

The next step in the Central Western European electricity market: cross-border balancing

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Abstract

Following initiatives on the day-ahead and intra-day stage, a regional approach towards real-time balancing constitutes a logical next step in the process towards a single Central Western European electricity market. For the moment, balancing market designs still significantly differ between the countries of the region and a coordinated approach for cross-border exchange of balancing services is lacking. Further harmonisation and coordination efforts are consequently required to enable the implementation of a single cross-border balancing market in the region.

Samenvatting

Na de initiatieven met betrekking tot de day-ahead en intraday-markten, vormt een regionale benadering van het realtime-netevenwicht een logische volgende stap in de uitbouw van een Centraal-West-Europese elektriciteitsmarkt. Op dit ogenblik verschilt het ontwerp van de balancingmarkten nog aanzienlijk tussen de landen van de regio en ontbreekt een gecoördineerde aanpak voor grensoverschrijdende netevenwichtsdiensten. Er moet werk worden gemaakt van een verdere harmonisatie en coördinatie om een eengemaakte markt voor grensoverschrijdende netevenwichtsdiensten in de regio tot stand te brengen

Résumé

Après les initiatives prises dans le cadre de l'étape day-ahead et intra-day, une approche régionale vers un balancing en temps réel constitue la suite logique dans le processus de création d'un marché unique de l'électricité en Europe. Pour l'instant, les schémas de marché du balancing diffèrent nettement d'un pays de la région à l'autre et une approche coordonnée des échanges transfrontaliers de services de balancing fait défaut. Par conséquent, d'autres efforts d'harmonisation et de coordination sont nécessaires pour permettre la mise en oeuvre d'un marché transfrontalier unique de balancing dans la région.

Introduction

In February 2006, the European Regulator's Group for Electricity and Gas (EREG) launched its Electricity Regional Initiative, identifying seven European regional electricity markets (REMs), in which market integration has to be fostered [1]. In order to reach this objective, the regulators of the Central West REM – including CREG (Belgium), CRE (France), BNetzA (Germany), ILR (Luxemburg) and DTe (The Netherlands) – published an action plan in February 2007, indicating concrete steps to be taken during the next two years [2]. Regionalizing

the topics covered in earlier road maps for Belgo-Franco-Dutch and Franco-German cooperation, the action plan enumerates 9 priority areas, covering a regional approach to interconnection capacity investment and utilisation, an increasing regulatory cooperation and cross-border transparency and a regional operation of markets across different timescales. Concerning the latter, efforts were so far mainly focused on the day-ahead [3] and intraday stage [4]. A regional policy on real-time balancing trade therefore constitutes a logical next step in the process towards a single Central Western electricity market. The action plan requires

TSOs to submit an entirely regional solution for cross-border balancing by June 2008, which must allow implementation in March 2009. Note that the signature of a Memorandum of Understanding (MoU) in June 2007 by ministers, regulators, TSOs, power exchanges and other relevant stakeholders in the region, politically backs the realisation of the action plan [5]. Other key elements in the MoU concern the development of a regional flow-based market coupling system and measures for an increased security of electricity supply.

In view of the Central West region's cross-border balancing intentions, this paper aims to answer the question how far off we currently are from a single cross-border balancing market in the region and to give as such an idea of the implementation efforts still required from TSOs. Mostly quoted necessary conditions for a single cross-border balancing market are harmonized market designs and the possibility to exchange balancing services. Both aspects are respectively discussed in this paper.

Current status of balancing market design harmonisation

The design of a balancing market entails significantly other issues than those prevailing in the design of wholesale markets. Most balancing market design options either relate to the procurement of balancing services, either to their delivery and the involved settlement. In the following two paragraphs, main design aspects as well as the differences in their implementation between the countries of the Central West region are considered.

Market design aspects affecting procurement

TSOs are the single buyer of balancing services. Market design options related to their procurement can be classified into three categories as stated below.

Balancing services definitions

In order to ensure system security, TSOs should have access to appropriate balancing services. Major technical criteria distinguishing between different types of services are the response speed and the method of activation. Within UCTE – the association of continental European TSOs and amongst others in charge of establishing system security and reliability standards – 3 categories of necessary services are typically distinguished, known as primary, secondary and tertiary control services. As illustrated in [6], the relatively fast responding primary and secondary control services are technically rather similar across UCTE-countries, which can be attributed to the binding rules regarding the technical characteristics of both services, laid down in the UCTE

Operation Handbook [7]. Especially for primary control, whose performance is subject to multiple parameters (e.g. the droop of the generator and the insensitivity range of the controller) and whose provision is a shared obligation between all UCTE-members, similar reaction properties are of the utmost importance, in order to minimize dynamic interaction between control areas. Contrary to primary and secondary control, services falling under the relatively slower responding tertiary control rather vary between UCTE-countries, also between the countries belonging to the Central West region. Contrary to an overall uniformity of activation methods, i.e. manual activation, dissimilarities in number and names of services as well as variations in deployment times are recorded across the Central West region. Although all 4 countries dispose of one service fully responding within a time frame of 15 minutes, the 'full availability' of other services – equalling the time between the request for the service and a full 100 % delivery – as well as the 'deployment end' – defined as the time during which the service has to remain active starting from the time of the request – differ across the region. Furthermore, the involvement of load in the provision of tertiary control is implemented differently in all countries. Finally note that, besides primary, secondary and tertiary control services, all countries can appeal to additional services for emergency cases.

Times and methods of procurement

TSOs can choose between two major methods of procurement to obtain balancing services, notably bilateral contracts and auctions. Contrary to short term procurement via auctions, bilateral contracts and long term auctions are instruments to hedge TSOs against the risk of having insufficient balancing services at their disposal when needed. In the Central West Region, the most fast responding services (primary control) are usually procured via bilateral contracts or long term auctions while secondary and tertiary control services are obtained via long as well as short term procurement methods [8].

Methods of remuneration

TSOs can also opt for different remuneration structures. Providers of balan-



Fig. 1: The Central West REM (Source: ERGEG)

cing services are usually either paid only for availability (i.e. for holding balancing reserves), either only for utilisation (i.e. for the delivery of balancing services), or for both. Similar to the long term procurement methods mentioned above, availability payments reduce TSOs' risks. In the Central-West region, primary control services are contracted beforehand and usually only remunerated for availability (excluding primary control services in the Netherlands whose provision is not compensated for). Secondary and tertiary control on the contrary, are contracted beforehand and remunerated by both availability and utilisation, or offered without contract and merely remunerated for utilisation (the latter being only the case for tertiary control services in the Netherlands). Note that, while in the Netherlands utilisation payments are based on market clearing prices, utilisation in Belgium, France and Germany is priced pay-as-bid [9, 10, 11, 12].

Market design aspects affecting delivery and settlement

In order to constantly guarantee a secure system operation in their control area TSOs also discourage market parties to rely on the real-time delivery of balancing services. On that account, TSOs partially transfer the obligation to balance their control area to a number of market participants by making them responsible for keeping their own portfolio of injections and off-takes in a given time-frame in balance (via the so-called 'imbalance settlement'). As such,

each injection and off-take is designated to one of these market participants, usually denoted as 'balance responsible parties' (BRPs). Consequently, these BRPs try to match their injection and off-take portfolios to the best of their ability using their assets and the wholesale markets. Remaining short or long positions in real-time can only be handled by the TSO as a single buyer of balancing services. More specifically, a portfolio consists of generation, energy purchases and imports on the one hand (injections), and industrial and residential customers, energy sales and exports on the other hand (off-takes). At gate closure – the time at which wholesale trade between market participants ceases – each BRP is required to submit a schedule of at least its trading portfolio (consisting of imports, exports and power exchanges between BRPs and power exchanges), known as 'nominations'. Remaining short or long positions in real time are denoted as the BRP's imbalances. On the basis of the imbalances incurred, an imbalance charge is imposed on the BRPs concerned.

In consequence of this balance responsibility, the following four market design options related to the delivery and settlement can be identified.

Gate closure times

The timing of gate closure impacts BRPs' flexibility to follow up their energy imbalance. The shorter the delay between gate closure and real-time, the less uncertainty BRPs are confronted with when they have to nominate their portfolio. However, since all countries of the Central West Region calculate imbalances on the basis of the one step method (cf. infra), the timing of gate closure only affects BRPs with a portfolio consisting of either consumption or generation. BRPs with a portfolio including both consumption and generation can still carry out adjusting switches after gate closure. Gate closures significantly differ within the Central West Region. While gate closure times in the Netherlands and France respectively equal to 1 and 2 hours ahead of real-time, Belgium and Germany implemented a day-ahead gate closure combined with the possibility of trading imbalances until one day after delivery.

Settlement periods

Since imbalance volumes are calculated on a period basis (amounting to 1/4 h, 1/2 h or 1 h), BRPs being perfectly in balance over the whole settlement period may have been repeatedly out of balance within that period. Within the Central West Region, the settlement period of France is longer than the one implemented in the other countries. As meter readings in France are registered every 10', it opted for a settlement period of 30' – being the least common multiple of 10' and the settlement period of 15' as is implemented in the other countries of the Central West Region – to allow for cross-border exchange of balancing services with its neighbours.

Methods of imbalance volume calculation

The way in which imbalances volumes are calculated varies between control areas. Mostly – including all countries of the Central West region – imbalances are calculated using the one step method, according to which generation and consumption can be part of the same BRP. In few control areas – in Europe only the UK and Spain – imbalances are calculated in two steps. Contrary to the one step method, the two step method obliges generation and consumption to be unbundled in separate BRPs. That way, the two step method better incentivises generators and consumers to nominate as best they can, which is for instance highly valuable for TSOs in countries exhibiting a substantial amount of internal congestion.

Methods of imbalance pricing

TSOs set imbalance prices to recover balancing procurement costs. From the perspective of the market parties, the imbalance price is the real time price of energy. These prices therefore determine to what extent the balancing market is an alternative for the wholesale market. The imbalance prices are calculated either on the basis of a single-pricing system, in which the same imbalance price – be it with a different sign – is applied for remaining short and long positions, or by means of a double-pricing system, in which prices are differentiated according to the sign of the imbalance. Note that, contrary to single-pricing systems, double-pricing

systems typically give asymmetric incentives towards BRPs, i.e. they penalize short positions.

Within the category of single-pricing systems, the imbalance price usually corresponds to the price of the marginally accepted offer of balancing power. Amongst the countries of the Central-West region, only Germany has opted for a single-pricing system. Within the category of double-pricing systems, imbalance prices for short and long positions are either determined on the basis of the balancing power that was regulated upward ('incremental') and downward ('decremental'), either by relying on the corresponding day-ahead market (DAM) power exchange price or finally, by implementing a combination of both. Imbalance prices based on the accepted incremental and decremental offers of balancing power are usually calculated departing either from the price of the marginally accepted incremental or decremental offer or from the average price of all accepted incremental or decremental offers.

In Belgium and France, imbalance prices are computed on the basis of the accepted balancing offers or the DAM power exchange price, depending on the net activated balancing power. For instance, in case the net activated balancing volume is incremental, the price for a short position is determined on the basis of the total activated incremental balancing power, while the price for a long position is calculated relying on the relevant DAM power exchange price. In the Netherlands, a single-pricing system is altered for a double-pricing system depending on whether balancing power in one or both directions was activated during the time period concerned. In case of double-sided activation, imbalance prices for short and long positions equal the price of the marginally accepted offer for incremental and decremental regulation respectively.

Current status of balancing services exchange

Obviously, one can only speak of cross-border balancing on condition that services are exchanged across the borders. Within Europe, several approaches regarding the implementation of this

cross-border balancing trade have been put forward. This paragraph provides a short overview of all proposed approaches and their implementation so far in the Central Western European countries.

So far, ETSO [13, 14, 15], Frontier Economics and Consentec [16] and ERGEG [17] proposed four different approaches for the cross-border exchange of balancing services. Two groups of approaches are generally distinguished.

The first group or approach 1 consists in enabling providers of balancing services to contract for the provision of balancing services directly with the TSO of the neighbouring control zone (ETSO 2005, 2006 – Frontier Economics and Consentec, 2005 – ERGEG, 2006). This approach is currently applied by RTE (France) in its balancing arrangements with Germany, Spain and Switzerland; whenever transmission capacity is available, balancing service providers from these 4 countries are enabled to offer bids into the French balancing market. Note that under this approach, the TSOs of Germany, Spain and Switzerland are not aware of the balancing services offered by domestic market participants into the French balancing market. The TSOs concerned only get some indirect indications because of the related cross-border capacity nominations they are notified of. Consequently, balancing service providers in these countries could simultaneously offer the same balancing services in both the French and the domestic balancing market, without TSOs being aware of it.

The second group involves the exchange of balancing services between neighbouring TSOs. The group consists of three approaches, each assuming a different degree of balancing markets integration. They are arranged below in increasing order of integration.

According to approach 2 (ETSO, 2005, 2006 and 2007 – Frontier Economics and Consentec, 2005 – ERGEG, 2006), a TSO retains the full right to decide on the activation of the balancing services located in its control area. The TSO can offer – on a voluntary basis and depending on the actual situation – 0 – 100 % of its balancing services to a

neighbouring TSO. Consequently, TSOs can only procure services from external balancing service providers through the connecting TSO. Unlike approach 1, providers can not choose themselves into which balancing market they bid. The exchange of balancing services between the control areas of RTE and National Grid (UK) is currently organised according to this approach.

A third approach involves the sharing of a common balancing power reserve among neighbouring TSOs and the use of a common merit order (ETSO 2006 and 2007 - ERGEG, 2006). It includes the determination of required volumes on a regional basis and the supply of an agreed individual share to the common balancing power reserve by each of the TSOs concerned. TSOs do not have an exclusive right to use their own share of the common capacity. Within Germany, balancing services were until recently exchanged between its 4 control areas as described in approach 2. Meanwhile, a common reserve and merit order for primary, secondary as well as tertiary control services has been implemented in accordance with approach 3.

The potential benefits of approach 1 to 3 – although to a different extent – mainly consist in the reduction of overall balancing costs and the restriction of market power in the balancing markets concerned. Additional benefits, including optimal re-dispatching and opportunities to offset deficit and surplus generation positions, can only be achieved through the implementation of a fourth approach (ETSO - 2007). This approach involves the transition from several existing control areas to one overall control area. In fact, such a transition can be interpreted twofold. First, existing control areas could be joined into one overall control area while preserving balance responsibility per control area. Put it differently, each control area would become a BRP and imbalances of control areas would be cancelled out as far as possible. The remaining overall net imbalance would be compensated for by those countries whose imbalances are not yet completely levelled out. Second, existing control areas could be joined into one overall control area together with a transfer of balance responsibilities to one supervisory body, appointed for maintaining a balance at an overall regional level.

Note that the above approaches not always consider all balancing services. While most proposals (ETSO, 2005 and 2006 – Frontier Economics and Consentec, 2005 – ERGEG, 2006) focus on tertiary control services, ETSO's most recent Balance Management Report (ETSO, 2007) includes primary and secondary control services as well.

For primary control, the UCTE Operation Handbook [7] currently imposes reserve sharing. All countries of the Central-West region consequently contribute to the UCTE primary control reserve, based upon their relative annual generation. However, modifications to the Operation handbook are under consideration to enable a limited cross-border exchange of both primary and secondary control services. Following their implementation, UCTE countries will be allowed to increase their primary control reserve by maximally 30% (with a minimum of 90 MW to prevent small countries from being put at a disadvantage) with the aim of partly covering the primary control obligations of other countries. Furthermore, inter-area exchange of secondary control services will be allowed on condition that a fixed share of 2/3 of secondary control reserves needed inside the control area is kept inside the control area [18].

Conclusion

How far are we currently off from a single cross-border balancing market in the Central West region?

In terms of balancing market design harmonisation, substantial efforts are still required. Most balancing design aspects still significantly differ between the Central Western European countries. Even though it is not clear to what extent a single cross-border balancing market implies a standardized market design or a single price for balancing services and/or imbalances, a successful implementation will require the harmonisation of certain market design aspects.

Even though balancing services are already exchanged across borders in the Central Western European market, a coordinated approach is currently lacking. Balancing services from neighbouring countries are so far mainly considered as emergency services rather

than services that can compete on an equal footing with domestic balancing services.

To conclude, the implementation of a real cross-border balancing market within the Central West region will only take place conditionally to a further harmonisation and coordination of market rules and operations.

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