CROSS BORDER CAPACITY ALLOCATION FOR THE EXCHANGE OF ANCILLARY SERVICES

A POSITION PAPER BY THE ENTSO-E ANCILLARY SERVICES WORKING GROUP

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Purpose & objectives of the paper

This paper further develops and expands ENTSO-E’s view that it should be permissible to allocate cross border capacity to reserve markets to facilitate the exchange of ancillary services by proposing principles and methods for determining social welfare benefits of such allocations.

ENTSO-E position

ENTSO-E’s position is that it must be permissible to allocate cross border capacity to the exchange of Ancillary Services if it can be demonstrated that this allocation increases social welfare.

Consequently, the Framework Guideline (FWGL) should not prohibit the use of transfer capacity for exchanging reserves at any timeframe and should not limit the ways in which this can be achieved. In ENTSO-E’s view, the relevant TSOs should be tasked with demonstrating the effects on social welfare, including undertaking periodic reviews.

In this respect ENTSO-E highlights the following:

- ENTSO-E is committed to making balancing markets more efficient;
- The reserve element of balancing costs is significant (and in many cases expected to rise in future);
- The biggest savings can be realised by focusing on both elements of balancing costs (i.e. the balancing energy and reserve elements) – but this requires transfer capacity to be allocated to the reserves market;
- But we recognise allocating transfer capacity to the reserve market is controversial and needs careful assessment on a case by case basis;
- The burden should be on TSOs to prove, and on regulators to approve, that social welfare can be enhanced; and
- Examples exist which suggest this assessment is positive in specific cases.

The process of allocating transfer capacity to reserve markets should be open, transparent and subject to suitable regulatory oversight. It should also be organized in a way that is compatible with effective market functioning.

ENTSO-E considers that there are several possible methods of allocating transfer capacity to reserve markets. As an illustration, this paper describes three possible methods that may be used (ex-ante allocations, capacity auctions (explicit or implicit), and countertrading). In the description of each method the paper discusses how social welfare benefits could be demonstrated.

It should be noted that the allocation of transfer capacity for the exchange of reserves refers to the allocation of MWs on interconnectors to “non-energy” purposes (balancing energy is
however delivered if reserves are activated). This is required for exchange of reserves, but it is not required for the exchange of balancing energy only.

Furthermore, ENTSO-E recognises that there is not yet a large amount of experience of using cross border transfer capacities to facilitate the exchange of reserves. However, it will be an increasingly important topic that will need further exploration in line with the future development of the internal European market.

Introduction

More variable generation requires more flexibility, both in the Day-Ahead energy market and the intraday market when it comes to operational reserves. With an increasing part of energy production from variable renewable energy sources, the challenge and the cost of procurement of operational reserves is expected to increase in the future due to larger real time imbalances\(^1\) and changes in the running patterns of plant which has traditionally provided these services.

Efficient balancing is a key prerequisite for an efficient operation of the power system. It is likely that exchange of operational reserves between countries in some areas can be a part of an efficient reserve procurement strategy.

Key Concepts

The following key concepts are used throughout this document:

- **Reserves** refers to power capacity available to TSOs to balance the power system in real time, irrespective of whether TSOs contracts for the capacity or it is made available without payment. The TSOs secure reserves ahead of the operational hour.
- **Balancing energy** refers to energy delivered to balance the system in real time\(^2\). Balancing energy can be delivered from pre-contracted and non-contracted reserves, and is delivered upon automatic or manual request from TSOs.
- **Allocation of transfer capacity for exchange of reserves** refers to the allocation of MWs on interconnectors to “non-energy” purposes. This is required for exchanging reserves, but it is not required for exchange of balancing energy. The allocation is relevant for both manually and automatically activated reserves in different timeframes.

If transmission capacity is used to exchange several products across different timeframes it is necessary to establish methodologies that can define the optimal mix of these products in the different timeframes in a transparent way.

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1 For more information please refer to ENTSO-Es position paper on “Developing Balancing Systems to Facilitate the Achievement of Renewable Energy Goals” available from the ENTSO-E website.

2 “Real time” meaning the balancing timeframe. Balancing time frame meaning the timeframe where TSOs are single buyers of balancing services.
**Principles for social welfare calculations of cross border allocations**

In determining the social welfare of cross border allocations the costs and benefits of allocating transfer capacity to different purposes/markets must be calculated\(^3\). The following factors are likely to be relevant:

*On the benefit side*

- Efficient utilization of resources by accessing the desired reserves at the best price
- More flexible reserves and reserve markets, increased competition and liquidity
- It can enable sharing of reserves over a larger area (subject to case-by-case security analyses)

*On the cost side*

- Value of lost trade in other markets (forward, spot, intraday and reserve)

The cost/benefit analysis should cover the duration of the allocation.

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\(^3\) The specific sizing, geographical distribution and quality of reserves are not included in this task as it is considered a system operation issue.
below demonstrates that **at the margin the social welfare economic value of trade is equal to the price difference**

In the figure it is assumed that consumption in area A and area B is not price flexible.

Without trade marginal supply cost in area $A=A_1$ and area $B=B_1$, and with trade the prices are changed to $A_2$ and $B_2$.

Socioeconomic welfare gain =

+ net increase producer surplus in market A
+ net increase consumer surplus in market B
+ congestion rent
(and increased competition)

### Methods for demonstrating social welfare when allocating capacity to reserves

The paper now briefly discusses three potential methods for demonstrating the social welfare related to the allocation of cross border capacity for reserves:

- Ex-ante allocations;
- Capacity auctions; explicit auctions or implicit co-optimization; and
- Countertrading

ENTSO-E would like to point out that these methods should be viewed as possible solutions, each of which requires further assessment and development on a case-by-case basis. It should be noted however that for most of those methods, actual examples exist where such methods are being used.

In the social welfare calculations the effect of transferring capacity from one timeframe to the other must be taken into account, and in a multi-area environment the effect on all areas must be included when assessing the social welfare.

#### Ex-ante allocations

For this method, the ex-ante allocations are allocations taking place separately from existing markets. In the following, two versions of this method are discussed; ex-ante based on price assumptions and ex-ante based on market prices. The accuracy of these methods will depend on algorithm and available market prices, but these methods are expected to be reasonably easy to implement (under certain conditions).

**Ex-ante allocations based on price assumptions**

For the ex-ante based on price assumptions, the transfer capacity is allocated ex-ante (and typically long-term) between different purposes and timeframes based on assumed future
prices. This will be further illustrated by describing by the principles used in the Skagerak4 (SK4) case.

The expected energy market value has been calculated through an energy market model. The value of capacity is determined by analyses of future market prices in Denmark and actual prices in Norway.

The social welfare calculation has been based on prices and indices as follows:

- For the valuation of reserves exchange the following has been used:
  - Denmark: Existing monthly auctions for secondary reserves capacity – used as a basis for future price estimate
  - Norway: Existing market for primary reserves capacity – used as a basis for future price estimate and finally the resulting prices for a dedicated 5 year tender.

- For the valuation of the day-ahead exchanges, the price forecasts (prices of forward contracts on the Nordic power exchange) for the day-ahead prices in the Nordic market have been used combined with an energy market model.

Ex-ante allocations based on market prices

As allocations take place closer to real-time, more information such as market prices, are available. Consequently accuracy will improve compared to ex-ante allocation based on price assumptions. In the following, allocation based on market prices is further explained. This allocation can be viewed as a short-term, more dynamic version of the ex-ante allocation based on price assumptions, where the allocation (volume) is determined by market prices.

In a future dominated by variable production, prices will be volatile both on energy and reserves and the price differences between areas will be volatile as well. For most interconnectors it is likely to be important to have a dynamic solution during repetitive allocation of transmission capacity between products.

If two areas with liquid forward markets for day-ahead energy and repetitive capacity markets for reserves are linked the mix of products can be settled as follows:

- Finding expected area price difference in day-ahead energy market by using financial market prices and historic price structures.
- Compare capacity prices in the two areas. If for example area capacity auctions run weekly, actual prices can be used.
- The value of activation can be estimated.

If the required markets are in place this will be relatively easy to implement, and it will be a transparent way to simulate how much of the transmission capacity that should be used for

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4 HVDC cable between Denmark and Norway
reserves directly competes with the day-ahead energy value. It will as well be easy to adjust the algorithm if experiences show that it is valuable to do so.

**Capacity auctions: explicit auctions or implicit co-optimization**

The transfer capacity is allocated between different purposes and timeframes through a market pricing mechanism.

**Explicit capacity auctions**

Capacity is allocated explicitly in competition with other requests for cross border capacity, and thus the market mechanisms determine the social welfare of the allocation. The transfer capacity allocated for reserves should not be subject to Use-It-Or-Lose-It (UIOLI) or Use-It-Or-Sell-It (UIOSI), as it can only be used close to real-time (a non-energy product).

**Implicit capacity co-optimisation**

In this method cross border capacity is allocated for ancillary services and for day-ahead energy trading simultaneously. TSOs would bid for cross border capacities for ancillary services in competition with the day-ahead timeframe, and the market clearing algorithm would optimize the allocations of capacity between the two timeframes. This method can be relatively complex to implement, however, it could provide a more social welfare efficient allocation of transmission capacity.

**Counter trading**

In order to free up transfer capacity for reserve trading or sharing in real time TSOs can make use of counter trading. This allows for real time change of flows and, hence, the size of the transfer capacity available. In this case the TSO pays generators and/or loads to change schedules on both sides of the interconnector where available transfer capacity is needed in real time. The economic relevance of such actions is expected to be limited to very specific cases where certain reserves products are required and must be subject to system operations requirements. It should also be noted that this involves higher operational risk than the other methods. Therefore, this means that this method in all likelihood will not be widely used.

In addition, counter trading is possible if suitable markets exist for TSOs to trade in. What is needed is that the TSOs are able to trade upward and downward regulation on both sides of the relevant interconnector. To free up transfer capacity the TSOs trade counter to the flow on the interconnector (hence the term ‘counter trading’). The prices that TSOs pay and hence the costs, depend on energy price levels, the liquidity and the level of competition in the market. As an example counter trading is a possibility for Nordic TSOs due to the Nordic Balancing Market without direct impact to imbalance pricing. An example of this method can be found on the Finnish/Estonian border, where the respective TSOs have counter traded to free up capacity for the exchange of primary reserves.
Conclusion and recommendations

The cross border exchange and possibly (subject to case-by-case security analyses) sharing of reserves can increase social welfare and availability of sufficient transfer capacity is necessary to share/procure cross border reserves.

In this paper it has been shown that the availability of transfer capacity can be ensured in different ways ranging from ex ante allocations to market based mechanisms.

The choice of method has different implications for other markets and for the net-benefits of sharing and procurement of reserves. Therefore, the choice should rest on an evaluation of the effect on social welfare on a case-by-case basis.

The Framework Guideline (FWGL) should not prohibit the use of transfer capacity for the exchange of reserves and should not limit alternative ways of achieving this.

The applicable TSOs should be tasked with demonstrating the effects on social welfare, including periodically reviewing the calculation as required.