Ad hoc Group

"Geographical Distribution of Reserves"

Document 2:

Use of Transmission Capacity

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1. Border – Crossing Exchange of Reserves: Use of Transfer Capacities

When talking about border crossing exchange of reserves between TSOs it has to be taken into account that there may be physical limitations, which restrict the exchange. Since any exchange of reserves requires transport between CONTROL AREAS, in case of activation sufficient interconnection capacity between these areas has to be available. Consequently any congestion may limit the potential exchange.

In general the question of sufficient available transfer capacity involves not only the RESERVE CONNECTING TSO and the RESERVE RECEIVING TSO but also all RESERVE TRANSITING TSOs affected.

1.1 ETSO Definitions of Transfer Capacities

Cross-border transfer capacities are the most important factors influencing technical possibilities of physical flows and thus international power and energy trade. Therefore ETSO has worked out general accepted transfer capacity definitions.
The **Total Transfer Capacity TTC** is the maximum exchange program between two areas compatible with operational security standards applicable at each system if future network conditions, generation and load patterns were perfectly known in advance.
The **Transmission Reliability Margin TRM** is a security margin that copes with uncertainties on the computed TTC values arising from:

- Unintended deviations of physical flows during operation due to the physical functioning of load-frequency control (and primary frequency control, consistent with the following paragraph)
- Emergency exchanges between TSOs to cope with unexpected unbalanced situations in real time
- Inaccuracies, e.g. in data collection and measurements

The **Net Transfer Capacity NTC** is defined as:
NTC = TTC – TRM
NTC is the maximum exchange program between two areas compatible with security standards applicable in both areas and taking into account the technical uncertainties on future network conditions.

The following chapters analyse the individual aspects with respect to the different reserve components.

1.2 Redistribution of Primary Control Reserve

PRIMARY CONTROL is organised as a commonly shared reserve. Since the location of a sudden imbalance - e.g. an outage of a power plant - , which automatically activates the PRIMARY CONTROL RESERVES all over the synchronised area, is not known in advance, no explicit border – crossing transfer capacity can be reserved. This was one of the arguments for introducing the TRM as defined in section 1.1.

The value of TRM is determined by each TSO on the basis of its analytical historical knowledge, in order to guarantee the operation security and the reliability of their power system and its co-operation with other power systems. The values of the TRM are discussed among the TSOs involved. The potential transmission of the PRIMARY CONTROL RESERVE plays an important role in calculating TRM.

After redistribution PRIMARY CONTROL RESERVE keeps its characteristic of uncertainty due to the unpredictable nature of real time events. Consequently the TRM has also to be used for **redistributed** PRIMARY CONTROL RESERVE. Since redistribution results in a physical shift of the PRIMARY CONTROL RESERVE sources, TRM may be affected. This issue is tackled in document 3 in more detail.

1.3 Border – Crossing Exchange of Secondary / Tertiary Control Reserve

In case of SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE exchanges between two CONTROL AREAS there is a necessity of having enough available transfer capacity (including all RESERVE TRANSITING TSO involved). Looking at the basic definitions of transfer capacities the question arises whether the TRM can be used for border – crossing exchange of SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVES or whether the NTC has to be used for it.

As mentioned in the previous chapter the TRM is defined as a security margin. It is based on the idea that unpredictable power flows have to be handled. The specific components of these unpredictable power flows were strictly defined (see section 1.1)

Considering the question whether the TRM could be used for the border – crossing exchange of SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVES a differentiation is made between border – crossing SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE and emergency power exchanges not connected to any market related contracts.

SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE is an agreement for power reserve delivery upon request between RESERVE RECEIVING TSO and market participant and all other TSOs involved. The agreement is fixed day – ahead at the latest. Thus the transfer capacity has to be free accordingly. Concerning emergency power exchanges only TSOs with complete knowledge about the actual conditions of their system and their available

transmission capacity (including the TRM value in both directions) are able to assess the possibility of such exchanges at short notice.

Taking the above into account, it can be concluded that a power flow resulting from SECONDARY CONTROL RESERVE / TERTIARY CONTROL activation should use a part of NTC and not affect TRM (thus competing with energy exchange based on contracts or spot bids).

2. Allocation of Transfer Capacity for Secondary / Tertiary Control Reserve

2.1 Recalculation of NTC at different stages in time

As mentioned in section 1.3 for the border – crossing exchange of SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE the transfer capacity has to be available accordingly. With that the exchange of SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE has to be taken into account in the process of transfer capacity assessment, allocation and nomination. If the SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE are contracted on a daily basis, the transfer capacity has to be allocated on a short term (ST) basis; in case of longer contracting periods for SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE the capacity allocation has to be part of the long term (LT) allocation accordingly.

Figure 1 shows an example of optimal use of available transfer capacity. The transfer capacity results from the assessment process, which usually is performed on a yearly, monthly and daily basis. Allocation means reserving a block of capacity for the possible use by a party, whilst nomination means the effective scheduling of the usage of capacity.

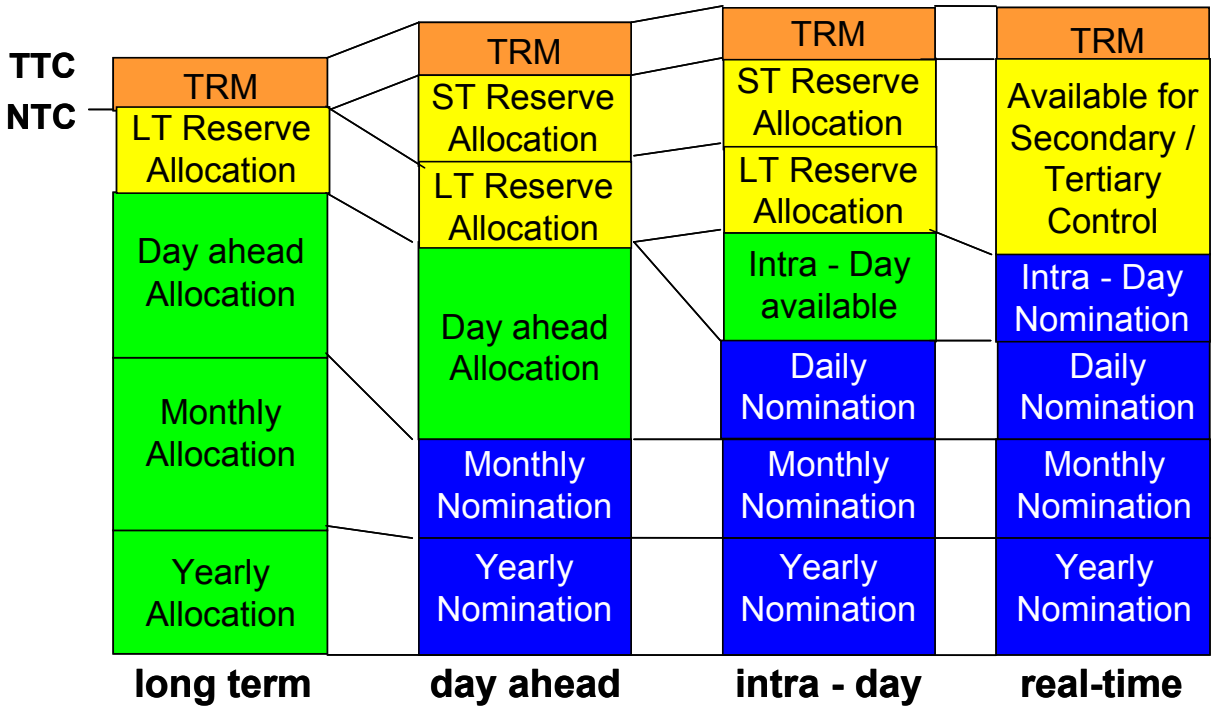

Fig. 1: Recalculation of NTC and TRM at different stages in time

The major difference between the allocation of reserves and other commercial contracts is the fact that the **use** of the capacity allocated for reserve can not be known in advance and thus this capacity can not be reallocated. Therefore it can not be used for any other exchange.

Current EU legislation aims at the maximisation of the NTC. The allocation of capacity needed for energy exchanges resulting from the SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE activation competes with energy exchange based on contracts or spot bids in the use of NTC. The regulatory questions related to these facts are out of scope of this analysis.

The total capacity of the interconnections is used as a basis to calculate the "long term" NTC by making provisions for probable (n-1) contingencies and planned outages using (pessimistic) suppositions about available production and taking into account the exchange of energy during emergency situations and during unbalances in the UCTE grid (TRM).

Day ahead some of the assumptions listed above can be more clearly delimited which could raise or lower provisions to be made on the total transfer capacity and thus lower or raise the NTC value for the day-ahead market. Since assumptions in the long term are generally pessimistic it is more likely that the adapted NTC value will be higher than the "long term" NTC.

Mostly, during day-ahead operations, market players have to specify which part of the reserved (allocated) capacity they will effectively use (nominate). It is customary to make the difference between allocation and nomination available to the market. After the day ahead nominations, some capacity could still be available cross-border. Once again, closer to real time in intraday the grid operator can re-evaluate the NTC value taking into account real time data and the firm day-ahead schedules. Most likely this estimation will once again raise the available capacity (NTC). Also the unused capacity from day-ahead is available in intraday / real-time.

2.2 Schedule for Transfer Capacity Allocation and Utilisation

The transfer capacities are available to the usage for:

- cross-border day - ahead transactions between market players
- cross-border intra - day transactions between market players
- cross-border exchange of reserves between TSO or between TSO and reserve providers

Thus in case of limited transfer capacity it has to be decided which share of transfer capacity is dedicated to market transactions and which share to TSO use. In any case the allocation of transfer capacity to the different kinds of transactions has to be organised according to a pre – defined schedule. Figure 2 shows an example of a schedule for the allocation of transfer capacities to the different types of transactions.

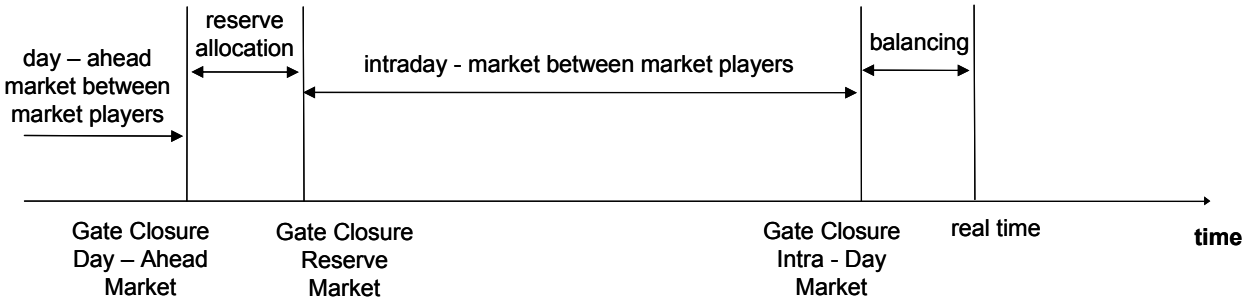

Fig. 2: Example of Schedule for the allocation of transfer capacities to the different types of transactions.

According to the example, the capacity allocation for SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE follows the day-ahead nominations and precedes any other intraday capacity allocation or usage, given the necessity of this reserve for grid security. At any "Gate Closure" point in time (Day – Ahead Market, Reserve Market, Intra - Day Market and Balance Market) the available transmission capacity is recalculated (see figure 1).

The following distinction has to be taken into account:

- the reservation of SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE and the allocation of transfer capacity
- the activation of reserves or execution of contracts and the utilisation of capacity

With regard to this distinction the handling of SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE and market transactions may differ. In the case of SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE the transfer capacity needed is allocated day – ahead. The transfer capacity is utilised only in the case the SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE is activated. This utilisation cannot be scheduled - there is no "nomination" like in the case of other commercial exchanges. In addition it has to be taken into account that due to security reasons curtailment of border – crossing SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE may not be possible in case of congestion. For the case of outages which result in a drop of interchange capacity pre – defined rules to secure the availability of border – crossing reserves have to be established (e.g. rules for curtailments, etc.).

2.3 Information Exchange

The introduction of border – crossing exchange of reserves will create an additional need of information exchange among TSO concerning transfer capacity allocation. The total amount of capacity for reserve exchange per border should be available to all TSO. This can be taken into account for the security analysis in addition to the information on exchange schedules.