Ad hoc Group

"Geographical Distribution of Reserves"

Document 6:

Border – Crossing Exchange of

Schedule activated Tertiary Control Reserve

Limits and Constraints

Version 1.0 – July 2005

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0. Goal of the Document

This document gives an overview of the possibilities and the limitations on the cross-border exchange of SCHEDULE ACTIVATED TERTIARY CONTROL RESERVE. It also discusses the organisational aspects and requirements of such exchanges. Furthermore the operational risks associated with cross-border exchange of SCHEDULE ACTIVATED TERTIARY CONTROL RESERVE are analysed in detail. The document does not however take into account local regulations or provide an economical analysis of the subject, nor does it propose any market solutions, subjects which are out of scope of the document. Terms printed in CAPITAL FORMAT are defined within the separated document "Glossary of Terms".

1. Definition

According to the document "Basic Framework and Current State" it is essential to distinguish two different modes of TERTIARY CONTROL RESERVE activation.

- SCHEDULE ACTIVATED TERTIARY CONTROL RESERVE:
  The TERTIARY CONTROL RESERVE is activated with relation to a pre - defined time frame of exchange schedules, e.g. 15 min.
- DIRECTLY ACTIVATED TERTIARY CONTROL RESERVE:
  The TERTIARY CONTROL RESERVE can be activated at any time, independent from a time frame of to exchange schedules. The activation procedure results in a dynamically changing exchange pattern.

The figure 1 illustrates the different use of the "DIRECTLY ACTIVATED TERTIARY CONTROL RESERVE" and the "SCHEDULE ACTIVATED TERTIARY CONTROL RESERVE":

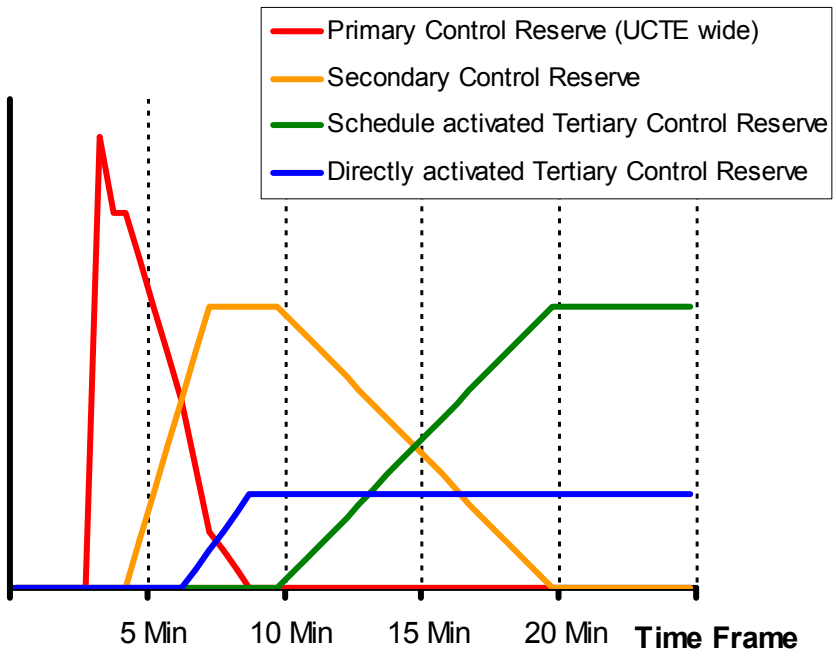

Fig. 1: Activation of different reserve types

The scope of this document is the analysis of limits for distribution of the SCHEDULE ACTIVATED TERTIARY CONTROL RESERVE. The limits for distribution of DIRECTLY ACTIVATED TERTIARY CONTROL RESERVE is treated in a separate report.

2. Physical Limits

2.1 Geographical Distribution of schedule activated Tertiary Control Reserves

According to the definition above the SCHEDULE ACTIVATED TERTIARY CONTROL RESERVE is regarded as a special kind of exchange schedule. To ensure sufficient monitoring and the reliability it is proposed to keep a fixed share of 1/2 of the total SECONDARY CONTROL RESERVES / TERTIARY CONTROL RESERVE needed inside the CONTROL AREA (see document 4 and 5). In addition, as a physical limit for the border – crossing exchange the availability of cross – border transfer capacity has to be taken into account. This applies not only for the RESERVE CONNECTING TSO and RESERVE RECEIVING TSO but also for all RESERVE TRANSITING TSOs involved. According to the analysis made in the document "Border – Crossing Exchange of Reserves – Use of Transmission Capacity" it can be concluded that a power flow resulting from SCHEDULE ACTIVATED TERTIARY CONTROL activation should use a part of NTC.

3. Technical Realisation of border – crossing exchange of schedule activated Tertiary Control Reserve

3.1 Concepts for Technical Realisation

According to the document "Basic Framework and Current State" the following three scenarios exist for the technical realisation of border – crossing exchange of SCHEDULE ACTIVATED TERTIARY CONTROL RESERVES:

1. Direct activation of the generation unit by the RESERVE RECEIVING TSO
    a) Adaptation of the LFC by the measurement value from the generation unit
    b) Adaptation of the LFC by the exchange schedule from the RESERVE RECEIVING TSO
2. Power request by the RESERVE RECEIVING TSO through the RESERVE CONNECTING TSO

3.1.1 Direct activation of the generation unit by the Reserve Receiving TSO

The direct activation of the generation unit fits to the contractual relation of border – crossing purchasing of TERTIARY CONTROL RESERVE from a GenCo.

a) Adaptation of the LFC by the measurement value from the generation unit

The on – line measurement value of active power is sent from the generation unit back to the LFC of both the RESERVE RECEIVING and the RESERVE CONNECTING TSO. If the generation unit produces according to an underlying schedule additionally to TERTIARY CONTROL RESERVE the schedule has to be subtracted from the measurement value accordingly. For the technical realisation a link must be set up from each generation unit which the RESERVE RECEIVING TSO has contracted for TERTIARY CONTROL RESERVE and the LFC of both the RESERVE RECEIVING and Reserve CONNECTING TSO. Though the order of the reserve through the RESERVE RECEIVING TSO could be time - frame related, the system results in an unpredictable interchange pattern and is therefore comparable to the time-frame independent TERTIARY CONTROL RESERVE activation.

b) Adaptation of the LFC by the exchange schedule from the Reserve Receiving TSO

The exchange schedule related to TERTIARY CONTROL RESERVE agreed between the RESERVE RECEIVING TSO, the RESERVE CONNECTING TSO and the generation unit is used for the adaptation of the LFC of both the RESERVE RECEIVING and the RESERVE CONNECTING TSO.

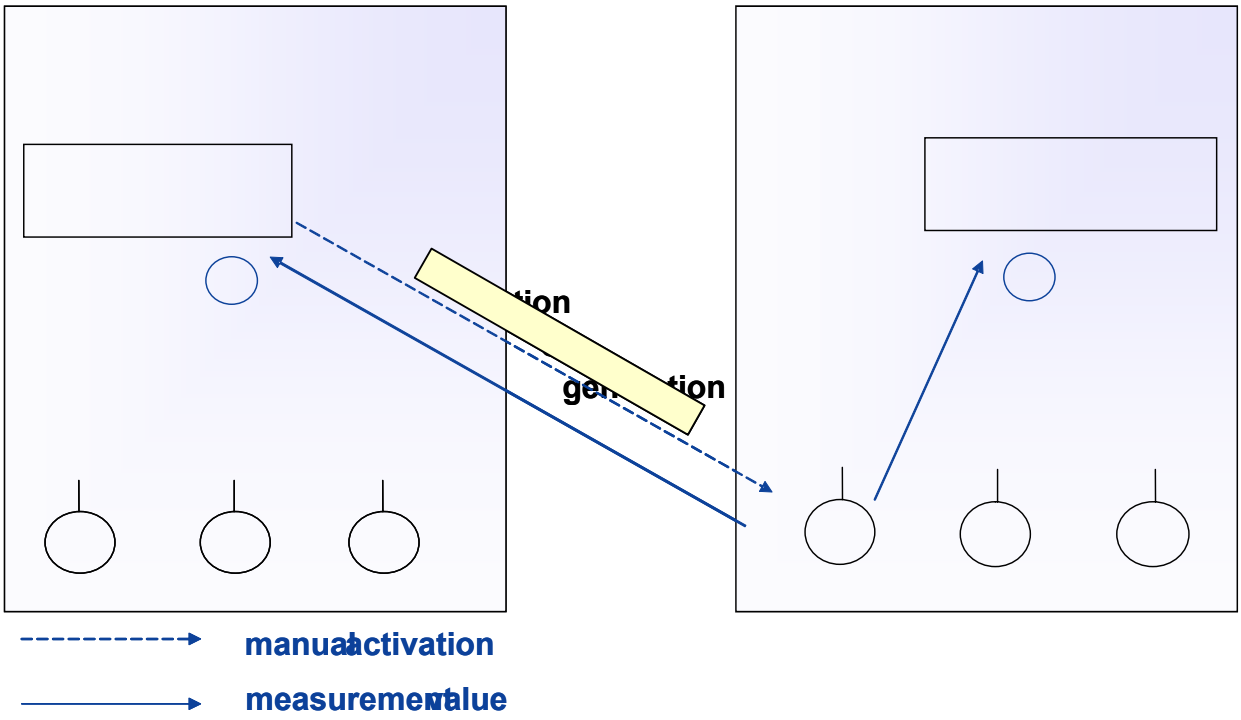

Fig. 3: Technical Realisation of TERTIARY CONTROL RESERVE across the Border: Scenario 1 a)

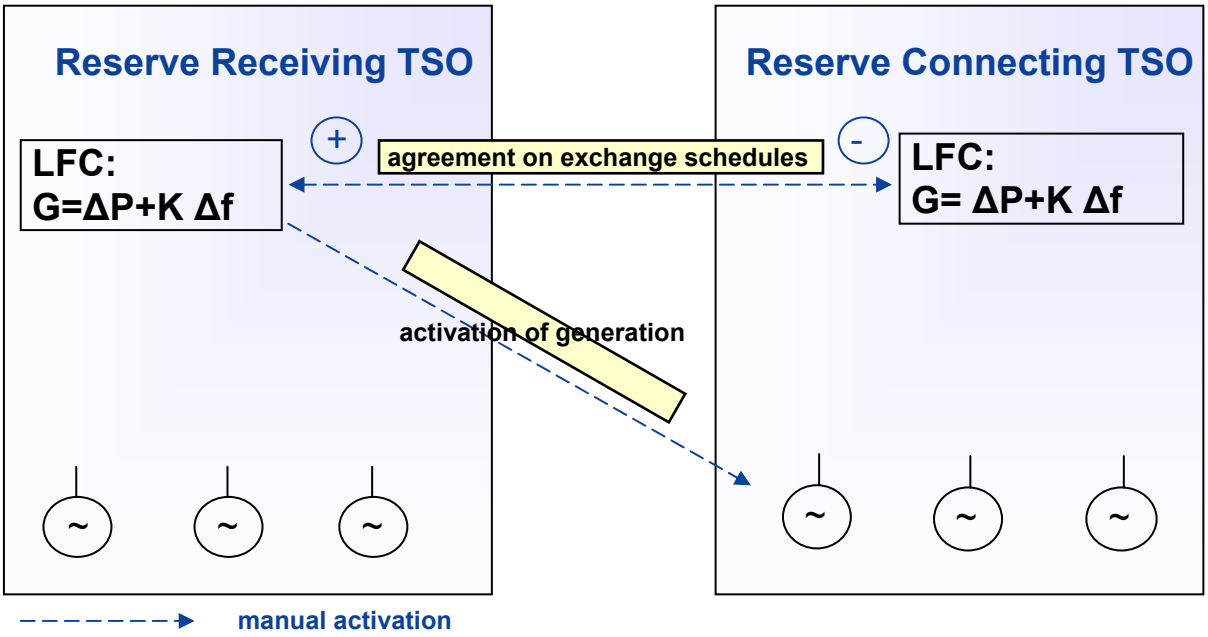

Fig. 4: Technical Realisation of TERTIARY CONTROL RESERVE across the Border: Scenario 1 b)

3.1.2 Power request by the Reserve Receiving TSO through the Reserve Connecting TSO

The RESERVE CONNECTING TSO provides TERTIARY CONTROL RESERVE to the RESERVE RECEIVING TSO. In this case the RESERVE RECEIVING TSO has to agree with the RESERVE CONNECTING TSO on an exchange schedule, which is used for the adaptation of the LFC of both the RESERVE RECEIVING and the RESERVE CONNECTING TSO. The RESERVE CONNECTING TSO activates the generation from either a set of units contracted by the RESERVE RECEIVING TSO or from a set of units contracted by the RESERVE CONNECTING TSO itself. Thus this technical solution fits to contractual relation of border – crossing purchasing of TERTIARY CONTROL RESERVES from a GenCo as well as from another TSO. In the second case no agreement between the RESERVE RECEIVING TSO and the Bidder is necessary.

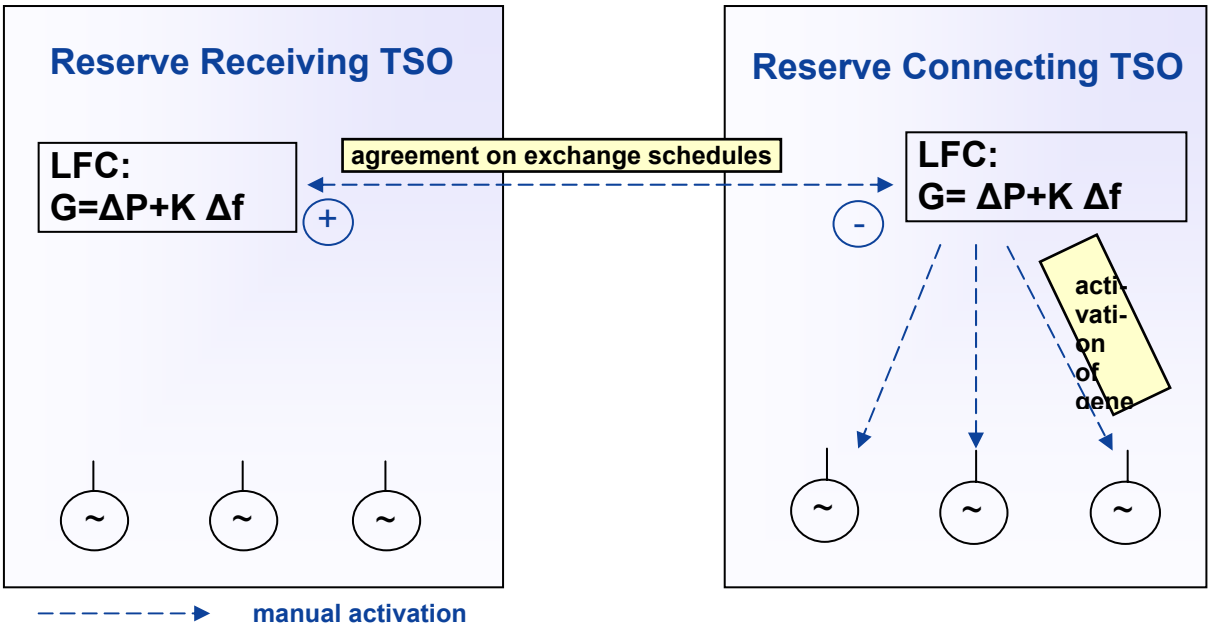

Fig. 5: Technical Realisation of TERTIARY CONTROL RESERVE across the Border: Scenario 2

3.2 Operational risks resulting from fault scenarios

To evaluate the different scenarios for technical realisation the operational risks resulting from fault scenarios are analysed. The following fault scenarios were taken into account:

1. Outage of the generation unit used for TERTIARY CONTROL
2. Tripping of tie lines and potential drop of interchange capacity on tie lines for TERTIARY CONTROL and
3. Transmission problems of data necessary for correct working of RESERVE CONNECTING TSO and RESERVE RECEIVING TSO load frequency control.
4. Wrong response of « outer » generation units to the load-frequency control of a RESERVE RECEIVING TSO (no respect of technical terms enclosed in the contract)

Analysis of Fault Scenario 1 (the outage of a generation unit):

- According to the scenarios for technical realisation the results differ:
  - Technical Scenario 1 a) - Adaptation of the LFC by the measurement value from the generator: In case of an outage of a generation unit, the measurement value of the TERTIARY CONTROL RESERVE participation for both TSO decreases to zero; thus from the point of view of the RESERVE RECEIVING TSO the generation unit is no longer available for TERTIARY CONTROL; since the measurement value decreases to zero, the adaptation of the LFC of RESERVE RECEIVING and RESERVE CONNECTING TSO vanishes
  - Technical Scenario 1 b) - Adaptation of the LFC by the exchange schedule from the RESERVE RECEIVING TSO: Obviously the exchange schedule agreed among the partners does not change in case of an outage of the generation unit; thus from the point of view of the RESERVE RECEIVING TSO the TERTIARY CONTROL RESERVE is still available for TERTIARY CONTROL; since the control signal is not changed, the adaptation of the LFC of RESERVE RECEIVING and RESERVE CONNECTING TSO still remains. As a result directly after an incident the risk of an outage of a generation unit for TERTIARY CONTROL RESERVE is shifted from the RESERVE RECEIVING TSO to the RESERVE CONNECTING TSO. To cope with this situation the RESERVE CONNECTING TSO should inform the RESERVE RECEIVING TSO as soon as possible about the non - availability of a generation unit providing TERTIARY CONTROL RESERVE. The affected generator has the duty to inform the RESERVE CONNECTING TSO and the RESERVE RECEIVING TSO about the outage as soon as possible. The exchange schedules have to be adapted accordingly at the beginning of the next schedule time frame possible.
  - Technical Scenario 2 - TERTIARY CONTROL RESERVE provided by the RESERVE CONNECTING TSO to the RESERVE RECEIVING TSO: Obviously the exchange schedule agreed among the partners does not change in case of an outage of the generation unit; thus from the point of view of the RESERVE RECEIVING TSO the TERTIARY CONTROL RESERVE is still available for TERTIARY CONTROL; since the control signal is not changed, the adaptation of the LFC of RESERVE RECEIVING and RESERVE CONNECTING TSO still remains. As a result directly after an incident the risk of an outage of a generation unit for TERTIARY CONTROL RESERVE is shifted from the RESERVE RECEIVING TSO to the RESERVE CONNECTING TSO. To cope with this situation the RESERVE CONNECTING TSO has to inform the RESERVE RECEIVING TSO as soon as possible about the non - availability of a generation unit providing TERTIARY CONTROL RESERVE and to activate a spare generation unit within the area of the RESERVE CONNECTING TSO (Consequently the affected generator has the duty to inform the RESERVE CONNECTING TSO about the outage as soon as possible). If the activation of a spare generation unit is not possible the exchange schedules have to be adapted accordingly at the beginning of the next schedule time frame.

Analysis of Fault Scenario 2 (drop of interchange capacity):

- The result is the same for all scenarios for technical realisation. This fault scenario may occur everywhere in the European network (and inside any national transmission grid), but in the scope of TERTIARY CONTROL RESERVE distribution, it deals with tie - lines of the RESERVE TRANSITING TSO with the RESERVE CONNECTING and the RESERVE RECEIVING TSO. A RESERVE TRANSITING TSO must study any N-1 scenario to check if it can transmit TERTIARY CONTROL RESERVE between all other affected TSOs, whatever commercial transit due to long term contracts or spot sales on its tie lines, without congestion problems and line tripping due to overload. It is reminded that transmission of TERTIARY CONTROL RESERVE must not use Transmission Reliability Margin. For these cases procedures for the short term congestion forecast and for the re-evaluation of the availability of the reserve have to be elaborated.

Analysis of Fault Scenario 3 (data transmission problems):

- This fault scenario is most relevant for the technical scenario 1 a) since the other technical scenarios do not have to transmit measurement values. The loss of data between a generation unit and the RESERVE RECEIVING resp. the RESERVE CONNECTING TSO is critical because it disturbs the correct working of both load frequency controls. In case of this failure, it becomes necessary to send corrections for measured interchanges manually, otherwise the LFC will have an incorrect response and the European frequency will be disturbed. The operational risk that results from this fact increases with the number of measurement values to be used.
- In addition to the case of malfunction of measurement value transmission every data transmission problem concerning exchange values could lead to a mismatch of set values of the load frequency controllers involved. Appropriate measures as e.g. confirmation procedures and adjustment / correction of wrong set values have to be elaborated. These measures should aim at reducing the risk for the RESERVE CONNECTING TSO as much as possible.

Analysis of Fault Scenario 4 (response quality):

- According to the scenarios for technical realisation the results differ:
  - <u>Technical Scenario 1 a) - Adaptation of the LFC by the measurement value from the generator:</u> In case of a wrong response of « outer » generation units to the load-frequency control of a RESERVE RECEIVING TSO the resulting deviation directly affects the LFC of the RESERVE RECEIVING TSO.
  - <u>Technical Scenario 1 b) - Adaptation of the LFC by the exchange schedule from the RESERVE RECEIVING TSO</u> / <u>Technical Scenario 2 - TERTIARY CONTROL RESERVE provided by the RESERVE CONNECTING TSO to the RESERVE RECEIVING TSO:</u>
    Obviously the exchange schedule agreed among the partners does not change in case of a wrong response of « outer » generation units; thus from the point of view of the RESERVE RECEIVING TSO the TERTIARY CONTROL RESERVE is available for TERTIARY CONTROL; since the control signal is not changed, the adaptation of the LFC of

RESERVE RECEIVING and RESERVE CONNECTING TSO still remains. As a result the risk of a wrong response of « outer » generation units is shifted from the RESERVE RECEIVING TSO to the RESERVE CONNECTING TSO.

Conclusion:
Specific rules for different fault scenarios have to be established to avoid longer periods of unbalance as well as "unfair" bearing of risks of the involved partners. It must be kept in mind for scenario 1 a), that a RESERVE RECEIVING TSO has to conclude a contract with a GenCo including direct contact concerning connection / measuring points for a probably limited contracted time which makes problems of data transmission and responsibility more complex. In addition the rules for handling problems of power transmission have to be determined carefully.

3.3 Technical Requirements

In the case of scenario 1 a), the adaptation of the LFC by the measurement value from the generator, a data exchange of the measurement value of the generation units to both the RESERVE RECEIVING TSO and the RESERVE CONNECTING TSO has to be set up. If border – crossing exchange between CONTROL AREAS / BLOCKS occurs the data exchange of the measurement value of the generation units has to be set up for all CONTROL AREAS / BLOCKS affected. The measurement values are used for the adaptation of all LFC involved. In case of the scenarios 1 b) and 2, no data exchange of the measurement values of the generation units is needed. The LFC involved are adapted on the basis of exchange schedules. For these solutions agreed and well defined procedures as well as appropriate equipment for the handling of fast data exchange including confirmation / reconfirmation is necessary (see also 3.2).

3.4 Recommended Technical Realisation

For the technical realisation the scenarios 1 b) and 2 are recommended, since no costly set – up of data exchange between every bidder for TERTIARY CONTROL RESERVE and both the RESERVE RECEIVING TSO and the RESERVE CONNECTING TSO is needed. The operational risk resulting from the loss of data transmission of a measurement values is excluded. The scenario 1 a) for technical realisation is not recommended due to the costly set – up of data exchange for every bidder. The operational risk of the TSO involved increases with number of measurement values to be used, i.e. with the number of bidders.

With the recommended scenarios 1 b) and 2 the responsibility for the reserve is shared among the RESERVE RECEIVING TSO and the RESERVE CONNECTING TSO. Considering the similarity with normal exchange schedules this can be accepted. The whole process is less time critical than in case of SECONDARY CONTROL RESERVE.

4. Organisational Constraints

4.1 Allocation of Transfer Capacity

As mentioned in Chapter 2 for the border – crossing exchange of TERTIARY CONTROL RESERVES the transfer capacity has to be available accordingly. With this the exchange of TERTIARY CONTROL RESERVES has to be taken into account in the process of transfer capacity assessment, allocation and nomination. If the TERTIARY CONTROL RESERVES are contracted on a daily basis, the transfer capacity has to be allocated short term (ST); in case of longer contracting periods for TERTIARY CONTROL RESERVES the capacity allocation has to be long term (LT) accordingly. The process needed for this purpose is described in detail in the document "Border – Crossing Exchange of Reserves – Use of Transmission Capacity".

4.2 Agreement on Exchange Schedules

TERTIARY CONTROL RESERVES are considered as energy reserves and cross border availability resembles the already practised exchange schedules between TSOs in the UCTE. Concerning organisational requirements, it has to be taken into account that the validation of exchange programs for TERTIARY CONTROL RESERVE has to be performed in very short time (i.e. some minutes) among the TSO involved. This process is more time critical than for normal exchange schedules, in particular if different hierarchical levels of schedule management co-ordination are involved (CONTROL AREA, CONTROL BLOCK, co-ordination centre). The use of fast and reliable data transmission and data processing systems exchange including confirmation / reconfirmation has to be applied and the application of more direct data validation procedures has to be developed.

4.3 Risk of Unavailability

In the case of a cross - border exchange for TERTIARY CONTROL RESERVE there is the risk that a TSO is not in the position to cover its needs, although enough reserve is available in its CONTROL AREA / BLOCK. This could occur when TERTIARY CONTROL RESERVE is sold to other TSOs and no more reserve is available in its CONTROL AREA / BLOCK. For this case local market rules are a possibility to assure that every TSO is in the position to cover its needs of TERTIARY CONTROL RESERVE. As an example reciprocity of access to TERTIARY CONTROL RESERVE among CONTROL AREAS / BLOCKS could be a prerequisite.

In addition, with increasing border –crossing exchange of SECONDARY CONTROL RESERVES the need is growing to verify that the market participants can ensure the supply. One risk is double selling of reserves by suppliers. To cope with this risk rules for monitoring will be necessary including complete information exchange among TSOs involved. The monitoring is a specific task of the Connecting TSO.

4.4 Data Exchange Bidder / TSO

A daily information process between Bidders and TSOs involved has to be set up. The RESERVE RECEIVING TSO has to inform the RESERVE CONNECTING TSO about the day – ahead share of each bidder in the area of the RESERVE CONNECTING TSO. The bidder has to inform the RESERVE CONNECTING TSO about the generation units planned for the next day provision of TERTIARY CONTROL RESERVES. Based on this information the Connecting TSO has to check that the bidder is in the position to fulfil his contractual duties. For example misuse by multiple bids of one share of reserve to different TSOs has to be excluded. In addition the RESERVE CONNECTING TSO has to be in the position to monitor the delivery of TERTIARY CONTROL RESERVE per generation unit.

4.5 Accounting

The accounting of the SCHEDULE ACTIVATED TERTIARY CONTROL RESERVES including any kind of penalty is up to the bilateral contract between the RESERVE CONNECTING TSO and the Bidder. In addition the following aspects have to be taken into account:

- The schedule for TERTIARY CONTROL RESERVES exchanged among TSOs has to be taken into account in the procedure for the UCTE accounting of unintentional deviations
- Any deviation between the physical delivery and the requested TERTIARY CONTROL RESERVES is treated according to the local rules of the balancing mechanism of the RESERVE CONNECTING TSO assuming the recommend solutions 1 b) or 2

5. Implementation Issues

Before the implementation of border – crossing exchange of TERTIARY CONTROL RESERVES the following topics have to be treated:

a) Contractual Issues
b) Technical Issues
c) Availability of Transmission Capacity
d) Related Market Rules

The main issues to be taken into account are given in the check lists below.

a) Contractual Issues:

Scenario1

- Contractual Agreement among TSO necessary:
  - Responsibility of TSO involved
  - Pre – Qualification of generation units
  - Accounting of Reserves
  - Information exchange for the monitoring of reserves
  - Treatment of error scenarios
    - Responsibility in the case of mistakes in exchange schedules between TSOs
    - Responsibility if the delivered reserve is not equal to the schedule activated reserve
- Contractual Agreement between each Receiving TSO and Supplier

Scenario 2

- Contractual Agreement among TSO necessary:
  - Responsibility of TSO involved
  - Pre – Qualification of generation units
  - Accounting of Reserves
  - Treatment of error scenarios
    - Responsibility in the case of mistakes in exchange schedules between TSOs
- Contractual Agreement between Connecting TSO and Supplier

b) Technical Issues

- Realisation of direct electronic data exchange procedures
- Change of the exchange programs in the LFC
- development of a system for checking inconsistencies in transactions
- Monitoring of the supply of reserves

c) Availability of Transmission Capacity

- Assessment / development of a day – ahead / intra - day estimation of available capacity (methods, procedures and tools)
- development of a system for allocation of the available capacity over all transactions and reserves (methods, procedures and tools)
- Usage of transmission capacity by activation of available TERTIARY RESERVE
- curtailment methods and congestion management (e.g. priority rules)

d) Related Market Rules

- adaptation of rules, laws or existing contracts in each country if needed (example: expansion of the bidding rules)
- Gate closures (time limits for offers)
- Activation periods
- Product Specifications (e.g. Lead time)

6. Summary

The SCHEDULE ACTIVATED TERTIARY CONTROL RESERVE can be exchanged border – crossing taking into account a number of constraints in the UCTE system.
The SCHEDULE ACTIVATED TERTIARY CONTROL RESERVE is regarded as a special kind of exchange schedule. To ensure sufficient monitoring and the reliability it is proposed to keep a fixed share of 1/2 of the total SECONDARY CONTROL RESERVE / TERTIARY CONTROL RESERVE needed inside the CONTROL AREA. In addition, as a physical limit for the border – crossing exchange the availability of cross – border transfer capacity has to be taken into account. Thus in case of limited transfer capacity it has to be decided how to share the transfer capacity between the market transactions and the TSO for SCHEDULE ACTIVATED TERTIARY CONTROL RESERVE. In any case the allocation of transfer capacity to the different kinds of transactions has to be organised accordingly.

The document recommends two technical solutions for border-crossing exchange of TERTIARY CONTROL RESERVES, points out the operational risks resulting from fault scenarios and summarises the implementation issues to be taken into account. One major point is the set up of faster and more secure data validation procedures for the agreement of exchange schedules.

The definitions found in this document make it necessary to eventually adapt the Policies 1 and 2 of the Operation Handbook. It is an open issue, which elements of realisation should become common UCTE rules, for example:

- general (UCTE) rule for the schedule for transfer capacity allocation and utilisation
- general (UCTE) solution for the set up of general data exchange and verification procedures among TSOs

As ETSO transfer capacity definitions are currently only available for adjacent CONTROL AREAS / BLOCKS it is recommended to allow only applications between neighbouring CONTROL AREAS / BLOCKS to gain additional experience on the implementation issues as a first phase. On the basis of this experience as a second phase the complete opening of the border – crossing exchange of TERTIARY CONTROL RESERVES can be decided. If necessary additional common UCTE rules will have to be introduced in combination with additional transfer capacity definitions for non-adjacent areas/blocks.