

Ex Post Control of availability reserves

Description of evaluation algorithm and report

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Revision

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1 Introduction

Aim of this document is to describe the main principles of the ex post evaluation algorithm and reporting.

Table 1 shows all acronyms used in the document.

Acronym	Definition
ASP	Ancillary Services Provider
PRL	Primary Control
SRL	Secondary Control
TRL	Tertiary Control
TRE	Tertiary Energy
SPPs	Shared Power Plant
ASP UOM	ASP undertaking the operational management of an SPP
MOL	Merit Order List
h	hour
min	minutes
sec	seconds
MWs	MWseconds
i	timestamp

Table 1. Acronyms, abbreviations and definitions

2 Main criteria

According to the Swissgrid monitoring requirements (as described in the document “Requirements on monitoring data”) every Ancillary Services Provider (ASP) has to fulfil two main criteria:

- As far as reserves availability is concerned, each ASP is obligated to have at least 99.9% of the awarded reserves capacity available for the entire delivery period of the product. Violation of this criterion results in penalties.
- Each ASP is obligated to have a 99.5% availability of valid online data. In other words, at least 99.5% of the online signals that are transmitted to Swissgrid must be of good quality. Violation of this criterion has also consequences for the ASP. For more details on this topic please refer to chapter 9.

3 General notes

An availability of 99.9% entails a 0.1% of violations that are not subject to penalization. This percentage is calculated based on the comparison of the online monitoring signals with the calculated limits.

The ex post evaluation of control reserves is performed on the below main principles:

- Only the signals representing the entire pool of an ASP are used. These signals are described in the document “Requirements on monitoring data”.
- All product reserves are evaluated on a 10 second resolution basis as this is the resolution of the online monitoring signals.
- For the calculation of the limits, the awarded bids and the activated reserves on each timestamp are taken into consideration.
- All delegations and reductions on each timestamp are taken into consideration. Especially for the Tertiary Control (TRL) calculation, the Tertiary Energy (TRE) reductions are also considered. For more information on that topic please refer to chapter 8.
- All Shared Power Plants (SPPs) are taken into consideration (tendering ASP or ASP undertaking the operational management or “ASP UOM”).

4 Consideration of SPPs, Reduction, Delegation

All market data (auction results, activations, reductions, delegations etc.) are adjusted to account for the SPPs. If an awarded bid, for example, refers to an SPP, the respective value will be considered in the evaluation of the ASP who is undertaking the operational management of the SPP or “ASP UOM” and not the tendering ASP.

If the tendering ASP submits a reduction for the above mentioned bid, this will also be accounted for, in the ex post evaluation of the ASP UOM. If an ASP delegates to an SPP the amount will be allocated to the ASP UOM.

The above also applies in the case of the Integrated Market (IM). All TRE offered capacity that is offered through an SPP or TRE reductions for an SPP are considered in the total TRE Merit Order List (MOL) of the ASP UOM and not the tendering ASP. **If a tendering ASP submits a TRE reduction that violates the reserve obligation of the SPPs, the effect will not be seen on the tendering ASP’s ex post evaluation but on the report of the ASP UOM as expected.** Please also refer chapter 8 for more information on IM.

5 Calculation of limits

5.1 PRL limits

For the calculation of the PRL limits, the frequency deviation is taken into consideration to account for the amount of activated PRL at each timestamp. The amount of activated PRL is calculated based on the following:

$$\Delta P_i = \frac{P_{\text{auction}_i} * \Delta f_i}{0.2}$$

where i is the timestamp and P_{auction_i} is the sum of awarded bids in the auction for this timestamp. The number 0.2 represents the 200 mHz which is the maximum steady state frequency deviation.

5.2 SRL limits

For the calculation of the SRL limits, the SRL Controller signal sent for activation of SRL reserves is taken into consideration together with the online monitoring signals of P_{sek}^{max} and P_{sek}^{min} .

5.3 TRL limits

The calculation of the TRL limits considers the total awarded reserves through the capacity auctions. Free bids are not considered as they do not represent an availability obligation.

Please note that in case of TRE reductions which result in a violation of the total amount of reserve obligation in TRL, this violation will not be shown in the ex post control. A separate penalization is implemented for these cases and therefore they are subtracted from this report.

6 Calculation of violation percentages

Each signal for each direction is compared with the respective calculated limit. When the signal is out of the limit bounds, a binary variable is set to 1 and the difference in MW between limit and signal is calculated.

There are two percentages that are being calculated based on the above comparison:

- Percentage of time when a violation occurred
- Percentage of reserves in MWs that were not available

Please note that only the percentage of MWs determines the size of the penalty imposed.

6.1 Calculation of time percentage

The total time range is one week. The calculation of the time percentage is based on the binary variable and it is the following:

$$time\ percentage = \frac{\sum violations}{\sum 10\ sec\ intervals\ of\ a\ week} = \frac{\sum violations}{\frac{(168\ h * 60\ min * 60\ sec)}{10\ sec}} = \frac{\sum violations}{60480_{timestamps}} \times 100\%$$

The above calculating method illustrates the amount of time where a violation occurred and does not take into account the amount of MW that were not reserved in each violation case.

6.2 Calculation of MWs percentage

For each timestamp that there is a violation, the difference of MW between the limit and the signal is calculated as:

$$\Delta MW = Limit - Signal$$

The resulting ΔMW is multiplied by 10 seconds in order to determine the amount of MWs that were not available/reserved.

$$\Delta MWs = \Delta MW \times 10\ sec$$

Therefore the amount of MWs per timestamp is determined. In order to calculate the MWs percentage of violations, the total awarded capacity in the various auctions for the respective delivery period is also taken into consideration:

$$MWs\ percentage = \frac{\sum_{week} MWs_{violations}}{\sum awarded\ capacity * 168\ h * 60\ min * 60\ sec} \times 100\%$$

The above percentage is calculated per product, per direction and per week and it has to be smaller than 0.1 %

Please note that in the above calculations it is assumed that there is no data loss occurring during the week therefore all data points are valid and the total evaluation time frame is an entire week or 604800 seconds (60480 timestamps of 10 sec intervals). When data loss occurs, Swissgrid is able to identify the exact timestamps affected. The affected timestamps are taken out of the evaluation meaning that the evaluation is then performed with less data points than the ones representing an entire week. For more information please refer to chapter 9.

7 Calculation of penalty

The calculation of the final penalty is based on:

- the sum of violations in MWs of the week,
- the weighted average price of all bids for the time range (one week),
- a factor of 10.

8 Integrated Market (IM) adaptation of TRL reserves control

IM implementation in Ex Post has led to the following changes:

- In case of a TRE reduction that violates the reserve obligation a separate penalization is implemented. Therefore this case is not considered in the present evaluation. In order to achieve that, the difference between the size of the entire MOL (awarded reserve capacity and free bids) and the TRE reductions is compared to the difference between TRL reserves and TRL reductions and the minimum of the two is considered.
- When the total size of the activations is higher than the reserves, the reserves are set to zero. The priority is in the favour of the ASP, meaning that it is assumed that the reserves are activated always before the free bids.

9 Data quality

A data quality check is implemented that checks all received signals per connection:

- PIA Network
- Swisscom LAN with IEC 104 protocol
- Swisscom LAN with TASE 2 protocol

This check is implemented at points on the internal data flow of Swissgrid taking into consideration the transmission quality of each connection path. The status of signals per connection is monitored and registered when invalid. An overview of all connection paths together is constructed.

Only timestamps with valid Data are considered in the ex post evaluation algorithm whereas timestamps with an invalid status are ignored. This affects the total number of timestamps in a week. As an example, in the case of 100% good data quality, a week is comprised by:

$$total\ number\ of\ timestamps = \frac{1}{10\ sec\ intervals} * \frac{60\ sec}{1\ min} * \frac{60\ min}{1\ h} * \frac{168\ h}{week} = 60480\ timestamps$$

In cases with invalid timestamps the total number is adjusted. If, for example, there is a data quality issue for 2 hours of Week 23, these 2 hours will be subtracted from the evaluation process resulting in a total number of data points as follows:

$$\frac{168 \frac{h}{week} * \frac{60 \frac{min}{h}} * \frac{60 \frac{sec}{min}} - \frac{2 \frac{h}{week} * \frac{60 \frac{min}{h}} * \frac{60 \frac{sec}{min}}}{10 \frac{sec}{intervals \ resolution}} = 60480 - 7200 = 53280 \text{ timestamps}$$

This adjusted total time frame is then taken into consideration in the calculation of the violation percentage. Please note that data quality is not specific to product.

9.1 Registration of data loss time ranges

In case of known data quality issues on the side of the ASP, there is the possibility to register the respective time ranges so that they are not considered in the ex post evaluation algorithm. Consideration of data loss in the algorithm is not per product. The time ranges will be taken out of the ex post evaluation algorithm for all products.

The ASP can send an email to sdl-ausschreibung@swissgrid.ch until Wednesday every week for the registration of data quality issues on the previous week. The necessary information that should be included in the email is the following:

- Time range of the data loss
- Reason for the data loss issues
- Product /signals affected

9.2 Penalties imposed due to data quality issues

When a time range with data quality issues is registered in advance it is always ignored in the ex post evaluation algorithm. Therefore it is **not** penalised with a factor of 10.

There is however a penalty for insufficient data quality. Swissgrid requires a data quality level of 99.5% for all ASPs. When the total number of registered time ranges in a week exceeds the percentage of 0.5%, the total registered time ranges are subject to a penalty. This penalty is calculated based on:

- the time range of the data loss,
- the weighted average price of all offered bids,
- a factor of 3.

In the case that the registered time ranges are below the 0.5% limit, no penalties apply.

10 Ex post report

The ex post report includes the following:

- An overview of all products (per direction) with the violation percentages, max violation in MWs and the total penalty to be imposed,
- Graphs for each product with the fluctuation of signal and limits for the entire week,
- Lists of timestamps where a violation occurred per product and direction.

Notes on the graphs:

- Online monitoring signals are represented always by bright colour.
- The calculated limits are always in grey colour.
- The signals are raw data transmitted by the ASPs and used for the evaluation. Table 2 presents all signals as specified in the document “Requirements on monitoring data” and the respective notation in the ex post report:

Signal name	Notation in the report
P _{pri_refpos}	Signal PRL ⁺
P _{pri_refneg}	Signal PRL ⁻
P _{sek_ist}	Signal SRL
P _{ter_up}	Signal TRL ⁺
P _{ter_down}	Signal TRL ⁻

Table 2. Monitoring signal and notation in ex post report

- For each product the comparison between signal and limits is illustrated together with the violations in MWs, for each direction.
- The time axis is separated by ticks of two different sizes representing every 12 hours and 4 hours respectively.

Notes on the list of violation timestamps:

- The last three pages of the report are used to show specific timestamps where a violation occurs. The number of timestamps shown is limited by a parameter set on the right hand side of the page. In case of violations smaller than this parameter, these violations will not be shown on the page.
- The number of timestamps shown is also limited by the size of the page in .pdf format and the use of email for the distribution of the reports. Inclusion of more pages with timestamps renders the file too big for sending via email therefore a limit of one page per product is set.

The above points refer to the current version of the report and will be adjusted in future releases.