



TenneT TSO BV (NL) biennial report on Balancing

in accordance with Article 60 of EB Regulation 2017/2195

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Preface

TenneT NL publishes this biennial report on balancing in accordance with Article 60 of Regulation (EU) 2017/2195 the EB Regulation on electricity balancing.

This report covers the years 2017 to 2019 and reports on:

- the status of national implementation of requirements pursuant the EB Regulation, including:
 - accession to platforms
 - introduction standard and specific balancing energy products
- the development of:
 - dimensioning of balancing capacity
 - provisioning of balancing capacity, including sharing of reserves
 - efficiency of frequency restoration process including FRR activation

AC	alternating current
ACE	area control error
ACEOL	area control error open loop
aFRR	frequency restoration reserves with automatic activation
BRP	balance responsible party
BSP	balancing service provider
CE	continental Europe
FCR	frequency containment reserves
FRR	frequency restoration reserves
HVDC	high voltage direct current
IDGCT	intraday gate closure time
IGCC	international grid control cooperation
ISP	imbalance settlement period
LFC	load frequency control
mFRR	frequency restoration reserves with manual activation
MOL	merit order list
NRA	national regulatory authority
RR	replacement reserves
SA	synchronous area
T&Cs	terms and conditions
TSO	transmission system operator
VRES	variable renewable energy sources

Table 1 List of abbreviations

1. Executive summary

TenneT TSO B.V (hereinafter referred to as 'TenneT NL') is the Dutch TSO. TenneT NL is the single connecting TSO for the Bidding Zone NL, which is equal to the NL imbalance price area¹. The balancing market is organized according to a self-dispatching model. TenneT NL is responsible for the Dutch part of the Continental Europe (CE) synchronous area.

TenneT NL publishes this biennial report on balancing in accordance with Article 60 of Regulation (EU) 2017/2195 ("EB regulation"). This report covers the years 2018 to 2019, with data from 2017 added as reference and covers the status of national implementation of requirements pursuant the EB Regulation, the development of balancing capacity and the efficiency of the frequency restoration process.

1. Status of national implementation of requirements pursuant the EB Regulation

The requirements of the EB regulation are implemented as follows:

- Terms and conditions for BSPs and BRPs:
The national Gridcode² ("Netcode") has been updated per 18/12/2018
- Market suspension and restoration rules, and settlement rules in case of market suspension:
An update of the national Gridcode to include these rules is in procedure³; no separate imbalance settlement rules are foreseen during market suspension
- Accession to the European platforms⁴:
Imbalance Netting: Yes, participating in IGCC⁵ as of February 2012;
Picasso (aFRR): Not yet applicable;
Mari (mFRR): Not yet applicable;
Terre (RR): Not applicable.
- Introduction of standard and specific balancing energy products:
No standard products have been introduced yet, prior to accession to the European platforms for the exchange of balancing energy. No specific products for balancing capacity and balancing energy were defined by TenneT NL, and consequently no specific products were approved by the relevant NRA, nor used by TenneT NL⁶.
- All settlement principles⁷, in place since 2001, comply to Regulation (EU) 2017/2195:
 - Single position BRPs [with 15 mins ISP]
 - Imbalance pricing single, with only specific ISPs with dual imbalance pricing
 - All imbalance prices comply to Art 55(4)(5) and (6) of Regulation (EU) 2017/2195

¹ The Dutch bidding zone / imbalance price area consist of only one imbalance area and only one LFC block / LFC area

² Source national gridcode: <https://wetten.overheid.nl/BWBR0037940/2020-04-04>

³ Source national gridcode current development: <https://www.acm.nl/sites/default/files/documents/2019-11/ontwerpbesluit-codewijziging-implementatie-er-verordening.pdf>

⁴ TTN participates in FCR cooperation, source: https://www.entsoe.eu/network_codes/eb/fcr/

⁵ Source to IGCC documentation: https://www.entsoe.eu/network_codes/eb/imbalance-netting/

⁶ Source to current aFRR and mFRRsa and mFRRda:

https://www.tennet.eu/fileadmin/user_upload/SO_NL/Product_information_aFRR_2018-12-18.pdf

https://www.tennet.eu/fileadmin/user_upload/SO_NL/EN_Productinformatie_mFRRsa_voor_balancing.pdf

https://www.tennet.eu/fileadmin/user_upload/SO_NL/Productinformatie_mFRRda_incident_reserve.pdf

⁷ Source to Imbalance pricing system TTN:

https://www.tennet.eu/fileadmin/user_upload/SO_NL/ALG_imbalance_pricing_system.doc.pdf

- Balancing energy bid prices are per ISP, and become firm 2 ISPs prior to ISP of delivery to allow bid price consistency with all previous whole sale markets
- Value of avoided activation is defined at mid-price MOL FRR
- Balancing energy prices uniform per ISP, for all FRR balancing energy
- Finalization within 10 working days, including procedure for BRPs and BSPs to challenge settlement volumes
- Financial neutralization TSO is guaranteed in national GridCode through Art 44(2) Regulation (EU) 2017/2195; No financial mechanism with BRPs, separate from imbalance settlement is implemented or considered.

2. Development of balancing capacity

- dimensioning of balancing capacity:
For the calendar years covered by this report the deterministic criterion exceeded the stochastic and probabilistic criteria for the minimally required volumes of frequency restoration reserves, allowing reserve sharing.
- provisioning of balancing capacity, including sharing of reserves:
Introduction of flow-based market coupling in May 2015 eventually removed the opportunity to use reserve sharing (under normal operating conditions) to fulfil FRR dimensioning requirements, resulting in a significant increase in balancing capacity (FRR) volumes and costs.

3. Efficiency of frequency restoration process including FRR activation

- The efficiency of the balancing market including activation optimisation functions for the balancing energy from frequency restoration reserves is manifest through the relatively low volumes of balancing energy required and low volumes activated by TenneT NL. The moderate financial settlements with BRPs, BSPs, and other TSOs are also indicators of an efficient balancing market in the Netherlands.

2. Legal background

In accordance with Article 60 of Regulation (EU) 2017/2195, TenneT NL shall publish at least once every two years a report on balancing covering at least the previous two calendar years, respecting the confidentiality in accordance with Article 11 of Regulation (EU) 2017/2195; the report shall:

- (a) include information concerning the volumes of available, procured and used specific products, as well as justification of specific products subject to conditions pursuant to Article 26;
- (b) provide the summary analysis of the dimensioning of reserve capacity including the justification and explanation for the calculated reserve capacity requirements;
- (c) provide the summary analysis of the optimal provision of reserve capacity including the justification of the volume of balancing capacity;
- (d) analyse the costs and benefits, and the possible inefficiencies and distortions of having specific products in terms of competition and market fragmentation, participation of demand response and renewable energy sources, integration of balancing markets and side-effects on other electricity markets;
- (e) analyse the opportunities for the exchange of balancing capacity and sharing of reserves;
- (f) provide an explanation and a justification for the procurement of balancing capacity without the exchange of balancing capacity or sharing of reserves;
- (g) analyse the efficiency of the activation optimisation functions for the balancing energy from frequency restoration reserves and, if applicable, for the balancing energy from replacement reserves.

Table 2 Legal content requirements Art 60 TSO balancing report

The calendar years covered in the 2020 report are 2017, 2018 and 2019.

3. Status update EB Regulation 2017/2195 implementation

3.1 General implementation

National Terms & Conditions: NL Gridcode ("Netcode") updated 18/12/2018

Accession TenneT NL to:

- Imbalance Netting: Yes (IGCC as of February 2012)
- Picasso (aFRR): Not yet applicable
- Mari (mFRR): Not yet applicable
- Terre (RR): Not applicable

Single imbalance pricing: Yes, specific ISPs with dual pricing

All imbalance prices compliant to Art 55(4)(5) and (6) Regulation (EU) 2017/2195

Value of avoided activation: Yes, at mid-price of the merit order list FRR

Balancing energy bid prices: per ISP, firm 2 ISPs prior to ISP of delivery

Balancing energy prices uniform per ISP, for all FRR balancing energy

Financial neutralization TSO: Art 44(2) Regulation (EU) 2017/2195

4. Information concerning the volumes of available, procured and used specific products, as well as justification of specific products

4.1 Specific products

Following the approval of the implementation frameworks for the European platforms pursuant to the Articles 19, 20 and 21 of Regulation (EU) 2017/2195, each TSO may develop a proposal for defining and using specific products for balancing energy and balancing capacity.

For the calendar years covered by this report no specific products for balancing capacity and balancing energy were defined by TenneT NL, and consequently no specific products were approved by the relevant NRA, nor used by TenneT NL.

4.2 Standard products

After the approval of each implementation framework and no later than the time when a TSO uses the respective European platform, the TSO shall use only standard and, where justified, specific balancing energy products, in order to maintain the system's balance in accordance with Article 127, Article 157 and Article 160 of Regulation (EU) 2017/1485.

The calendar years covered by this report are prior to the approval of the implementation frameworks for the exchange of balancing energy from frequency restoration reserves with manual respectively with automatic reserves.

The years covered by this report are prior to TenneT NL using these mandatory European platforms for frequency restoration, or using standard or specific balancing energy products pursuant Regulation (EU) 2017/2195, to maintain the system's balance in accordance with the Articles 127, 157 and 160 of Regulation (EU) 2017/1485.

5. Summary analysis of the dimensioning of reserve capacity, including the justification and explanation for the calculated reserve capacity requirements

5.1 Frequency containment reserves

For each calendar year covered by this report the frequency containment reserves volumes for TenneT NL were established by ENTSO-E according to, and justified by the agreements, rules and regulations applicable to the Synchronous Area Continental Europe. For the LFC Block (= Bidding Zone) operated by TenneT NL these volumes are its share in the joint SA CE 3000 MW frequency containment reserves.

5.2 Frequency restoration reserves

For each calendar year covered by this report the minimum compliance volumes of frequency restoration reserves for the LFC Block of TenneT NL were established according to the agreements and regulations applicable to the SA CE.

Minimum compliance targets were determined per direction (positive or negative) following a deterministic criterion, a stochastic, and a probabilistic approach in accordance with respectively Article 157(2)(d), Article 157(2)(h) and (i), and Article 157(2)(b) of Regulation (EU) 2017/1485.

5.2.1 Deterministic criterion

The deterministic criterion in a given direction is the largest imbalance that can result from an instantaneous change of active power of a single power generation module, single demand facility or single HVDC interconnector, or from a tripping of an AC line within the LFC block.

For the calendar years covered by this report the expected value of the largest potential imbalances were established bi-quarterly from 2018 on (in 2017: yearly).

5.2.2 Stochastic approach & criterion

For all the calendar years covered by this report the 1st and 99th percentiles of the distribution of net BRP imbalances constitute the boundary volumes for the minimally required volumes of frequency restoration reserves.

The net imbalances of all BRPs as published by TenneT NL are taken as the consecutive historical records comprising at least the historical TenneT NL LFC block imbalances per 15 minutes.

5.2.3 Probabilistic approach & criterion

In the probabilistic approach the expected impact of [changes in] installed capacity of Variable Renewable Energy Sources (VRES) in the distribution of net BRP imbalances is taken into account, before establishing the 1st and 99th percentiles as boundary volumes for the minimally required volumes of frequency restoration reserves.

5.2.4 Minimum targets for frequency restoration reserves provision

The largest values per direction from the listed methodologies constitute the minimum target for the provision of balancing energy reserves for frequency restoration reserves for each provision period.

For the calendar years covered by this report recommended symmetric minimum target volumes for

frequency restoration reserves with automatic activation were established per provision period according to Policy 1 of the Operational Handbook.

From the 2nd half of 2019 onward minimum target volumes for the provision of frequency restoration reserves with automatic activation were established per direction to national terms and conditions as the 0.5 respectively 99.5 percentile of the minute by minute difference between the minutely averaged ACE_{OL} and the 15 minute averaged ACE_{OL} .

6. Summary analysis of the optimal provision of reserve capacity including the justification of the volume of balancing capacity

6.1 Frequency containment reserves

For the calendar years covered by this report TenneT NL procured frequency containment reserves through the FCR Platform.

This platform allows the exchange of frequency containment reserves among the participating TSOs, in accordance with Article 163 of Regulation (EU) 2017/1485; sharing of frequency containment reserves is not allowed.

TenneT NL does not participate in any other frequency containment procurement schemes.

6.2 Frequency restoration reserves

The volume of balancing capacity for frequency restoration is established by reducing the minimum target volumes for frequency restoration reserves with the expected availability of non-contracted balancing energy bids, and with the opportunities for reserve sharing.

The resulting volumes of balancing capacity are procured in a joint tendering procedure among prequalified BSPs, that first satisfies the minimum target volume for frequency restoration reserves with automatic activation, and then complements the remaining volume requirement per direction by economic optimization between balancing capacity for automatic respectively directly activated balancing energy bids.

7. The costs and benefits, and the possible inefficiencies and distortions of having specific products

For the calendar years covered by this report no specific products for balancing capacity and balancing energy were defined by TenneT NL, and consequently no such specific products were approved by the relevant NRA, nor can any effects be attributed to the presence or absence of specific products for the calendar years covered by this report.

The currently used balancing capacity and balancing energy products are portfolio based and allow for aggregation of diverse sources including VRES and demand response.

Uniform pricing for balancing energy and imbalance allow for full integration and participation of imbalance as product on the (national) balancing market.

8. Analysis of the opportunities for the exchange of balancing capacity and sharing of reserves

8.1 Frequency containment reserves

For the calendar years covered by this report TenneT NL procured frequency containment reserves through the FCR Platform, a voluntary TSO cooperation, outside the scope of EB Regulation.

This platform allows the exchange of frequency containment reserves among the participating TSOs, in accordance with Article 163 of Regulation (EU) 2017/1485; sharing of frequency containment reserves is not allowed.

TenneT NL does not participate in any other frequency containment procurement schemes.

8.2 Frequency restoration reserves

For the calendar years covered by this report the deterministic criterion exceeded the stochastic and probabilistic criteria for the minimally required volumes of frequency restoration reserves.

This opportunity to reduce the minimally required volumes of frequency restoration reserves by sharing of reserves, in accordance with Article 157(2)(j) and (k) of Regulation (EU) 2017/1485 is seized by contractually securing frequency restoration reserves (positive and negative) with both ELIA and TenneT TSO GmbH, both with whom TenneT NL shares a border.

Prior to introduction of flow-based market coupling at least one of these borders was expected to be uncongested after IDGCT in each given direction, so the smallest of the contractually secured volumes were taken into account when procuring FRR capacity.

Introduction of flow-based market coupling in May 2015 resulted eventually in both borders being congested after IDGCT in both directions for a significant time, thus removing this opportunity to use reserve sharing under normal operating conditions to fulfil FRR dimensioning requirements without reservation of X-zonal capacity.

No X-zonal capacity has been reserved for the exchange of balancing energy, or imbalance netting.

9. Explanation and a justification for the procurement of balancing capacity without the exchange of balancing capacity or sharing of reserves

The opportunities for exchange and sharing of reserves are considered, and when and where possible are taken into account.

Per 2018 the lack of opportunity due to congested borders after IDGCT, apparent after introduction of flow-based market coupling came into effect in fulfilling FRR dimensioning requirements, resulting in a significant increase of FRR capacity volumes and cost per 2018.

10. Analysis of the efficiency of the activation optimisation functions for the balancing energy from frequency restoration reserves

The activation optimisation functions are part of the balancing market, other elements being the pricing of balancing energy and imbalance as incentives, real time transparency to convey such incentives, and the TSO's strategy for manual activating balancing energy.

In the sequence of processes on the balancing market the BRPs are collectively incentivised to minimize joint energy imbalance, with the TSO responsible for restoring the residual power imbalances.

Imbalance netting (IGCC) avoids substantial counter-activation of aFRR amongst participating TSOs.

Any residual power imbalance is restored through merit order list aFRR (control demand).

Frequency restoration by manual activation supplements and replaces activated aFRR.

The efficiency of the balancing market including activation optimisation functions for the balancing energy from frequency restoration reserves is manifest through the relatively low volumes of balancing energy required and low volumes activated by TenneT NL. The moderate financial settlements with BRPs, BSPs, and other TSOs are also indicators of an efficient balancing market in the Netherlands.

An overview of relevant data is given in chapter 11 Monitoring results.

11. Monitoring results

Metric/Indicator	2017	2018	2019	Unit
Demand NL	101 114	102 115	101 116?	TWh/a
Σ Total Imbalance	4.8	5.2	5.6	TWh /a
Σ Total Balancing energy	0.51	0.62	0.55	TWh /a
Σ Net Imbalance	1.28	1.39	1.38	TWh /a
Σ Net Balancing energy	0.49	0.60	0.53	TWh /a
Σ Net Imbalance Netting	0.60	0.58	0.62	TWh /a
Σ Perfect ACE	0.19	0.21	0.23	TWh /a
Σ Actual ACE	0.35	0.38	0.34	TWh /a
TSO-BRP Imbalance	-53.3	-73.2	-70.0	M€/a
TSO-BSP Balancing energy	29.4	45.7	40.0	M€/a
TSO-TSO Imbalance Netting	1.3	-3.4	0.85	M€/a
TSO-TSO compensation UE	-1.8	-1.95	-1.23	M€/a
TSO-User neutralization	-24.4	-32.9	-30.4	M€/a
TSO-BSP Balancing capacity	37.6	134	85.2	M€/a
[1, 99] pctl Net Imbalance	[-0.47, 0.47]	[-0.53, 0.49]	[-0.54, 0.49]	GW
[-/, +/+] Largest Incidents	[-1.13, 1.28]	[-1.03, 1.07]	[-1.03, 1.07]	GW
FRR capacity by sharing	[-0.35, 0.35]	[-0.35, 0.35]	[-0.35, 0.35]	GW
Scaled Balancing energy cost	0.29/0.26	0.44/0.40	0.39/0.34	€/MWh
Scaled Balancing capacity cost	0.37/0.33	1.31/1.17	0.84/0.73	€/MWh
Imbalance price Dual	8.2	7.1	7.4	% ISPs
Imbalance price VoAA	11.5	10.7	12.7	% ISPs

Metric/Indicator	Unit	Derivation	Derivation & Data Source
Demand NL	TWh/a	Includes grid losses TP resp. TTN website in resp. ex estimated auto-consumption	TTN website/ENTSO-E TP
Total Imbalance BRP	TWh /a	$\sum(\text{all ISP}) \text{Negative (BRP short)} + \text{Positive (BRP long)} $	TTN website
Total BE	TWh /a	$\sum(\text{all ISP}) \text{FRR-} + \sum\text{FRR+} $ Includes dummy energy	TTN website
Net Imbalance BRP	TWh /a	$\sum(\text{all ISP}) \text{Negative (BRP short)} + \text{Positive (BRP long)} $ \approx LFC Block imbalance	TTN website
Net BE	TWh /a	$\sum(\text{all ISP}) \sum\text{FRR-} + \sum\text{FRR+} $ TSO effort to TSO target; Total BE vs. Net BE: counter-activation	TTN website
Imbalance Netting	TWh /a	$\sum(\text{all ISP}) \text{Negative (Import)} + \text{Positive (Export)} $ avoided activation BE	IGCC settlement
Perfect ACE/ISP	TWh /a	Optimal result with given: TSO target, IN & TSO effort	Result
Actual ACE/ISP	TWh /a	Actual result given: TSO target, IN & TSO effort Actual ACE vs. Perfect ACE: effectivity TSO contribution	TTN data on ENTSO-E RG-CE SF website
TSO-BRP Imbalance	M€/a	Cash-flow element; $\sum(\text{all ISP, directions}) \text{Volume} * \text{relevant Price}$	Controller Report/TTN Website
TSO-BSP BE	M€/a	Cash-flow element; $\sum(\text{all ISP, directions, types}) \text{Volume} * \text{relevant Price}$	Controller Report/TTN Website
TSO-TSO IN	M€/a	Cash-flow element	Controller Report/IGCC settlement
TSO-TSO UE	M€/a	Cash-flow element	Controller Report
TSO User	M€/a	Cash-flow element (Neutralization TSO through user)	Result
TSO-BSP Capacity	M€/a	Cash-flow element; FCR, aFRR, mFRR	Procurement-tool, ENTSO-E TP
Net Imbalance pctiles	GW	[1, 99] Stochastic criteria FRR dimensioning	TTN website
Largest Incident	GW	[-/-, +/+] Deterministic criteria FRR dimensioning	TTN Procurement, "behoefte-raming"
Scaled BE cost	€/MWh	TSO Balancing capacity cost per unit of national demand	Result
Scaled capacity cost	€/MWh	TSO Balancing energy cost per unit of national demand	Result
Imbalance price Dual	% ISPs	Regulation state 2, including VoAA pricing under reverse dual pricing	TTN website [+2]
Imbalance price VoAA	% ISPs	Regulation state 0	TTN website [0]