



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 second biennial report on balancing in accordance with Article 60 of electricity balancing Regulation (EU) 2017/2195.

This report covers the years 2020 and 2021 and reports on:

- the status of national implementation of requirements pursuant the EB Regulation, including:
 - accession to platforms
 - introduction of 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
- the development of physical and monetary parameters for TenneT NL.

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
LFDD	low frequency demand disconnection
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

1.1 introduction

The calendar years covered in the 2022 national report are 2020 and 2021; previous years are covered in the 2020 national report¹. The full 2022 national report will be published here².

TenneT TSO B.V. (hereinafter referred to as 'TenneT NL') is the Dutch TSO. TenneT NL is responsible for its single LFC block -with only one LFC area- as part of the Continental Europe (CE) synchronous area (SA).

TenneT NL is the single connecting TSO for the Bidding Zone NL, equal to the single imbalance price area and imbalance area.

The market, including the balancing market is organized according to self-dispatching model. For frequency restoration balancing energy from aFRR³ and mFRR⁴ is used, after reducing balancing energy demand by Imbalance Netting⁵. Balancing energy demand from mFRRda is supplementary to activation of aFRR. The non-mandatory reserve replacement process is not implemented.

National settlement principles⁶, in place since 2001, comply to Regulation (EU) 2017/2195:

- ISP is 15 minutes
- All imbalance prices comply to Art 55(4)(5) and (6) of Regulation (EU) 2017/2195
- 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
- Non-contracted balancing energy bids aFRR are allowed
- Value of avoided activation is defined at mid-price MOL FRR
- Balancing energy prices uniform per ISP, for all FRR balancing energy
- BRPs are allowed to notify position changes after IDGCT
- Finalization of imbalance settlement 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

Electricity consumption (including grid losses) is ca. 118 TWh/y; visibility of consumption is increasingly obscured by embedded generation of solar PV. There are currently ca. 25 BSPs accredited, and ca 100 BRPs, of which ca. 40 serve connections. The sharp increase in whole sale prices in Q4 2022 was reflected in an

¹ Source:

https://www.tennet.eu/fileadmin/user_upload/Company/Publications/Technical_Publications/Dutch/TenneT_TSO_BV_-_2020_Report_On_Balancing.pdf

² <https://www.tennet.eu/company/publications/technical-publications/>

³ aFRR: 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/Productinformation_mFRRda_incident_reserve.pdf

⁴ 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/Productinformation_mFRRda_incident_reserve.pdf

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

⁶ Imbalance Pricing System:

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

increase in balancing capacity, balancing energy and imbalance prices. A few bankruptcies of BRPs and of retail suppliers resulted because of these high energy prices on the whole sale market, that prevented them to close their positions satisfactorily in view of their retail commitments. There is considerable and increasing interest from market participants with vRES (mainly wind-farms), batteries to participate on FCR and aFRR markets.

1.2 Progress/timeline towards joining the European platforms and/or balancing capacity cooperations

The following information conforms to the ENTSO-E template for this executive summary.

European balancing platform for the activation of balancing energy	Accession timeline	Reasoning for derogation and status of the derogation (granted or not)
RR Platform	No Reserve Replacement process in place	
aFRR Platform	January 2022: Request for derogation until 24 July 2024 from the connection to MARI and PICASSO were sent	Replacement of current EMS/SCADA is prerequisite to implement adaptations to connect to European Platforms for aFRR and mFRR
mFRR Platform	January 2022: Request for derogation until 24 July 2024 from the connection to MARI and PICASSO were sent	Replacement of current EMS/SCADA is prerequisite to implement adaptations to connect to European Platforms for aFRR and mFRR
IN Platform	Accession to IGCC since Feb 2012	

Balancing capacity cooperations	Status (MoU, project, member, observer...)	Accession timeline
Name and objective of the cooperation		
FCR Cooperation, Platform for procurement and exchange of Frequency Containment Reserves⁷	Member	April 2015

⁷ TTN participates in FCR cooperation: https://www.entsoe.eu/network_codes/eb/fcr/

The following content is included in this Section 1.2 on a voluntary basis:

Question:	Please select an option:
Q1: Did you carry out regulatory and IT developments for allowing Demand, RES and Storage to participate at European balancing platforms	No
1.1. If response in Q1 is “no”, why?	TSO-TSO model. Standard product by definition eligible for European platforms
1.2. If response in Q1 is “yes”, what were the main results”?	-
Q2: Did you carry out regulatory and IT developments for adopting standard energy products (aFRR, mFRR, RR balancing energy products) in your system?	Yes
1.1. If response in Q2 is “no”, why?	-
1.2. If response in Q2 is “yes”, what were the main results?	A non-standard product mFRR (SA) has been abolished per Sep 2021
Q4: Do you procure a standard product for balancing capacity?	No
Q5: What are the main characteristics?	
Q6: Did you assess the potential for exchange of balancing capacities or sharing of reserve?	Yes, sharing of reserves with neighbouring TSOs within RG CE
6.1. If response in Q6 is “no”, why?	Open response.
6.2. If response in Q6 is “yes”, what were the main results?	<ol style="list-style-type: none"> 1. Sharing of capacity is possible since deterministic dimensioning parameter for FRR capacity > stochastic or probabilistic dimensioning parameter. 2. Unavailability of remaining CZC in flow based CZC allocation, prevents utilization of this sharing potential, and consequently there is no reduction of balancing capacity procurement.
Q7: Are you already involved in a BCC as a member or as an observer?	Not for Frequency restoration process

1.3 Evolutions of the terms and conditions for BRPs and BSPs

Evolution of the terms and conditions for BSP	
Content	Approved since 18 Dec 2018.
Evolution of the terms and conditions for BRP	
Content	Approved since 18 Dec 2018. Updated and approved by NRA on market suspension and restoration rules, and on settlement rules in case of market suspension per 08-12-2021: No separate imbalance settlement rules are foreseen during market suspension.

The evolution of the terms and conditions for BRPs related to the EB regulation implementation the following content as per the Articles 52, 53, 54 and 55 in the EB Regulation on settlement rules:

Question:	Please select an option:
Q1. Was 15-min Imbalance Settlement Period (ISP) implemented by 1 January 2022?	Implemented , since 1 January 2001
1.1. If response in Q1 is "derogation" or "exemption", until when was this derogation/exemption granted?	Date
Q2. Has your TSO made use of additional components pursuant ISH Methodology Art 9(6) as per 1 January 2022?	No
2.1. Scarcity component?	Not considered
2.2. Incentivizing component?	Not considered
2.3. Component related to financial neutrality of the TSO?	Not considered
Q3. Has your TSO made use of dual pricing as per 1 January 2022?	Yes
3.1. Condition (a)	Implemented; formal approval by relevant NRA on March 2, 2022
3.2. Condition (b)	Not considered
3.3. Condition (c)	Not considered
3.4. Condition (d)	Not considered
3.4. Condition (e)	Not considered

National GridCode⁸ was updated and approved by NRA on Low Frequency Demand Disconnect according to Reg 2017/2196, NCER, per 24-09-2020.

1.4 Summaries and main results of the analysis of Articles 60(2)(a-f):

Dimensioning and balancing capacity procurement in accordance with Articles 60(2)(b), 60(2)(c), 60(2)(e) and 60(2)(f): 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. Due to increasing volumes of vRES the stochastic/probabilistic criterion is expected to overtake the deterministic criterion shortly, thus effectively rendering sharing of reserves impossible. 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.

For the calendar years covered by this report no specific products for balancing capacity and balancing energy accordance with Articles 26(1) from (a) to (f) and 60(2)(a) and 60(2)(d) were defined by TenneT NL, and consequently no specific products were approved by the relevant NRA, nor used by TenneT NL.

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

⁸ Source national gridcode: <https://wetten.overheid.nl/BWBR0037940/2020-04-04>

3. Status update EB Regulation 2017/2195 implementation

See executive summary point 1.2

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 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.

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.

It is expected that the stochastic/probabilistic FRR dimensioning criterion will shortly overtake the deterministic criterion, thus preventing reserve sharing being an option.

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.

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 FRR balancing capacity demand 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 BRP imbalance reducing balancing energy demand 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 for 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.

Since 2018 the lack of opportunity due to congested borders after IDGCT became apparent after introduction of flow-based market coupling came into effect and effectively removed reserve sharing potential as option in fulfilling FRR dimensioning requirements. It is expected that the stochastic/probabilistic FRR dimensioning criterion will shortly overtake the deterministic criterion, thus preventing reserve sharing being an option.

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

The activation optimisation functions are but 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 suppletes 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 volumes of balancing energy required, the volumes activated by TenneT NL, and the financial results of settlements with BRPs, BSPs, and TSOs.

11. Monitoring results TTN

Metric/Indicator	2019	2020	2021	Unit
Demand NL	118.7	117.5	118.2	TWh/a
ΣTotal Balancing energy BSP	0.55	0.54	0.63	TWh /a
ΣNet Imbalance BRP	1.4	1.5	1.6	TWh /a
ΣNet Balancing energy	0.54	0.52	0.61	TWh /a
ΣNet Imbalance Netting	0.62	0.74	0.73	TWh /a
ΣPerfect ACE	0.24	0.24	0.24	TWh /a
ΣActual ACE	0.34	0.33	0.37	TWh /a
TSO-BRP Imbalance	-70.0	-95.0	-153.9	M€/a
TSO-BSP Balancing energy	40.0	44.8	86.4	M€/a
TSO-TSO Imbalance Netting	0.85	.3.4	1.2	M€/a
TSO-TSO compensation UE	0.63	-1.14	-1.01	M€/a
TSO-BSP Balancing capacity	85.2	80.2	302	M€/a
[1, 99] pctlile Net Imbalance	[-0.54, 0.49]	[-0.58, 0.55]	[-0.62, 0.58]	GW
[-/-, +/+] Largest Incidents	[-1.07, 1.3]	[-1.07, 1.3]	[-1.07, 1.3]	GW
Scaled Balancing energy cost	0,34	0,38	0,73	€/MWh
Scaled Balancing capacity cost	0,72	0,68	2,56	€/MWh
Incidence Imbalance price Dual	7.3	9.3	7.8	% ISPs
Incidence Imbalance price VoAA	12.7	13.4	12.7	% ISPs
Price BRP short/System short	60.0	62.2	160.5	€/MWh
Price BRP short/all ISP	42.6	36.3	103.5	€/MWh
Price BRP long/all ISP	40.4	32.8	96.3	€/MWh
Price BRP long/System long	20.1	4.4	44.5	€/MWh
Incidence System short	45.7	47.0	48.0	% ISPs
mFRRup	285.9	374.9	410	€/MWh
aFRRup	63.6	71.1	174.3	€/MWh
aFRdown	18.6	3.6	40	€/MWh
mFRR down	x	-278.1	-286	€/MWh
Day Ahead Whole Sale	41.23	32.4	102.9	€/MWh

Metric/Indicator	Unit	Derivation	Derivation & Data Source
Demand NL	TWh/a	Includes grid losses	CBS Statline; increasing underreporting embedded Solar PV on TTN website and TP
Total BE BSP	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) + Positive (BRP long)} $ ≈ 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) + 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 pctlies	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]