
**Amended Nordic LFC block methodology for ramping restrictions
for active power output in accordance with Article 137(3) and (4) of
the Commission Regulation (EU) 2017/1485 of 2 August 2017
establishing a guideline on electricity transmission system operation**

29 January 2024

All TSOs of the Nordic LFC block, taking into account the following:

Whereas

- (1) This document is the common methodology developed by all Transmission System Operators within the Nordic LFC block (hereafter referred to as “TSOs”) for ramping restrictions for active power output in accordance with Article 137(3) and (4) of Commission Regulation (EU) 2017/1485 establishing a guideline on electricity transmission system operation (hereafter referred to as “SO Regulation”)¹. This methodology is hereafter referred to as “Methodology”. The Methodology is an amended version of the methodology *‘Amended Nordic LFC block methodology for ramping restrictions for active power output in accordance with Article 137(3) and (4) of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation’*. The amended methodology of 2 December 2021 has been approved by the NRAs in February 2022.
- (2) The Methodology takes into account the general principles and goals set in SO Regulation as well as Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on conditions for access to the network for cross-bidding-zone border exchanges in electricity (hereafter referred to as “Regulation (EU) 2019/943”). The goal of the SO Regulation/Regulation (EU) 2019/943 is the safeguarding of operational security, frequency quality and the efficient use of the interconnected system and resources. Article 119(1)(c) of the SO Regulation sets for this purpose requirements for the TSOs to “jointly develop common proposals for: [...] ramping restrictions for active power output in accordance with Article 137(3) and (4);”
- (3) Article 137(3) and (4) of the SO Regulation define the scope of this Methodology. Article 137(3) states that “All connecting TSOs of an HVDC interconnector shall have the right to determine [...] common restrictions for the active power output of that HVDC interconnector to limit its influence on the fulfilment of the FRCE target parameter of the connected LFC blocks [...]”. The TSOs will make use of this right. Article 137(4) states that “All TSOs of an LFC block shall have the right to determine in the LFC block operational agreement the [...] measures” related to “power generating modules and/or demand units [...]”. After implementation of 15 minutes MTU in the day-ahead, intraday and balancing markets, the TSOs will not make use of this right anymore.
- (4) The existing ramping restrictions for HVDC interconnectors and production and the existing possibilities for the TSOs to coordinate ramping between production plans limit FRCE and frequency deviations in such a way that the current target on frequency quality will be fulfilled.
- (5) This amendment to the methodology is required because of the change of the Market Time Units (MTU) in the day-ahead and intraday market from 60 to 15 minutes. The methodology also considers other developments in the power system that may affect the FRCE and frequency quality.

¹ As amended by Commission Implementing Regulation (EU) 2021/280 of 22 February 2021, amending Regulations (EU) 2015/1222, (EU) 2016/1719, (EU) 2017/2195 and (EU) 2017/1485 in order to align them with Regulation (EU) 2019/943.

- (6) The TSOs have studied in 2020 different measures² that mitigate the impact of ramping and the results confirm that ramping restrictions on HVDC interconnectors are the most efficient measure from a socioeconomic welfare perspective.
- (7) The TSOs have investigated the impact of the proposed ramping restrictions on individual HVDC interconnectors for 15 minute MTUs and conclude that the negative impact of ramping restrictions on the European Socio Economic Welfare (SEW) will be substantially reduced compared to the existing situation.
- (8) In response to the public consultation of previous ramping restriction proposals, many stakeholders suggested to increase the efficiency of ramping restrictions by replacing restrictions on individual HVDC interconnectors by a combined Nordic ramping restriction. The TSOs have investigated this scenario and concluded that it will not result in a significant increase of European SEW, compared to the situation after implementation of 15 min MTU and the proposed ramping restrictions. In addition, combined restrictions cannot completely replace restrictions on individual HVDC interconnectors and may require additional restrictions on bidding zone level, which increases the complexity. Furthermore, the implementation of combined Nordic ramping restrictions requires upgrades in market systems. For these reasons, a combined Nordic ramping restriction is not proposed in this amended methodology.
- (9) Article 6(3) of the SO Regulation states that this Methodology is subject to approval by the Nordic NRAs:
“The proposals for the following terms and conditions or methodologies shall be subject to approval by all regulatory authorities of the concerned region, on which a Member State may provide an opinion to the concerned regulatory authority: [...] (e) methodologies and conditions included in the LFC block operational agreements in Article 119, concerning: [...] (i) ramping restrictions for active power output in accordance with Article 137(3) and (4);”
- (10) According to Article 6(6) of the SO Regulation the expected impact of the Methodology on the objectives of the SO Regulation has to be described and is presented below.
- (11) The Methodology generally contributes to and does not in any way hamper the achievement of the objectives of Article 4 of the SO Regulation. In particular, the Methodology contributes to these objectives by specifying ramping restrictions. These ramping restrictions are required to maintain the operational security by reducing the risk for automatic frequency disconnection and for system blackouts due to under or over frequency. Furthermore, the ramping restrictions are required to maintain the frequency quality level of the Nordic synchronous area.
- (12) In conclusion, the Methodology contributes to the general objectives of the SO Regulation to the benefit of all market participants and electricity end consumers.

² Such as additional FRR, FCR or counter trading.

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SUBMIT THE FOLLOWING AMENDED METHODOLOGY TO ALL REGULATORY AUTHORITIES OF THE NORDIC LFC BLOCK:

Article 1 - Subject matter and scope

1. The ramping restrictions described in this Methodology are the common methodology of TSOs in accordance with article 137(3) and (4) of the SO Regulation. The Methodology applies solely to the Nordic LFC block.

The Nordic LFC block covers transmission systems of East-Denmark (DK2), Finland, Sweden and Norway.

This Methodology has been developed by Energinet, Fingrid Oyj, Kraftnät Åland AB, Svenska kraftnät and Statnett SF.

Article 2 - Definitions and interpretation

1. For the purposes of this Methodology, the terms used shall have the meaning of the definitions included in Article 3 of the SO Regulation and in Article 2 of Commission Regulation (EU) 2017/2195.
2. For the purpose of this Methodology,
 - a. a HVDC interconnector means all HVDC cables between a LFC area in the Nordic LFC block and a LFC area in another LFC block.
 - b. Deterministic Frequency Deviations (DFDs) mean frequency deviations around the transition from one Market Time Unit (MTU) to the next which are caused by momentary imbalances that result from differences in ramping from electricity demand, electricity production and HVDC exchange going from their market results from the first MTU to the scheduled value of the next.
 - c. Combined ramping restriction means a ramping restriction that applies to the sum of the exchanges on a defined group of HVDC interconnectors.
3. In this Methodology, unless the context requires otherwise:
 - a. the singular indicates the plural and vice versa;
 - b. the headings are inserted for convenience only and do not affect the interpretation of the Methodology; and
 - c. any reference to legislation, regulations, directives, orders, instruments, codes or any other enactment shall include any modification, extension or re-enactment of it when in force.

Article 3 – Ramping restrictions for the active power output of HVDC interconnectors

In order to fulfil the FRCE target parameters for the LFC block and LFC areas as referred to in Article 128 of the SO Regulation, the following ramping restrictions apply:

1. Each Nordic TSO shall apply ramping restrictions to each HVDC interconnector that connects its LFC area with another LFC area outside the Nordic LFC block and applies a 15 minutes Market Time Unit for intraday and/or day-ahead exchange:
 - a. The ramping period shall have a duration of 10 minutes and starts 5 minutes before each MTU;

- b. The initial value for the maximum ramping rate shall be 30 MW/min. The maximum ramping rate shall be regularly evaluated and if necessary updated in accordance with the procedure in Article 4. For LFC areas subject to a combined restriction in accordance with paragraph 2, the maximum ramping rate may be increased as described in Article 5;
2. One or more Nordic TSOs may apply a combined ramping restriction for HVDC interconnectors that connect one or more LFC area(s) in the Nordic LFC block with other LFC areas that participate in the Internal Energy Market (IEM). This shall be done in accordance with the following characteristics:
 - a. The ramping period shall have a duration of 10 minutes and starts 5 minutes before each MTU;
 - b. The initial value for the maximum combined ramping rate shall be:
 - i. at least the multiplication of 30 MW/min, and the number (n) of HVDC interconnectors subject to this sum restriction minus one (in formula: $30 \text{ MW/min} * (n-1)$); and
 - ii. not more than the multiplication of 30 MW/min, and the number (n) of HVDC interconnectors subject to this sum restriction (in formula: $30 \text{ MW/min} * n$);
 - iii. updated in accordance with the procedure in Article 4(2).
 - c. If technically feasible, the initial value for the maximum combined ramping rate shall be increased up to the maximum value specified in paragraph b)ii) for the MTU shifts at which less than full ramping takes place on HVDC interconnectors that connect the LFC area(s) that apply the combined ramping restriction to the LFC areas that do not participate in the IEM;
 - d. The TSOs shall include and keep updated the specifics of each combined restrictions in the Nordic System Operation Agreement, including:
 - i. the LFC areas and the HVDC interconnectors subject to the combined ramping restriction;
 - ii. the value for the maximum combined ramping rate in accordance with paragraph b);
 - iii. the requirement to increase maximum combined ramping rate in accordance with paragraph c).
3. The following ramping restrictions shall be applied to each HVDC interconnector that applies a Market Time Unit different from 15 minutes in both intraday and day-ahead exchange:
 - a. The total duration of the ramping periods per hour shall not exceed 20 minutes;
 - b. The initial value for the maximum ramping rate shall be 30 MW/min. The maximum ramping rate shall be regularly evaluated and if necessary updated in accordance with the procedure in Article 4.

Article 4 –Evaluation and update of ramping restrictions

1. Every year in quarter 1, the TSOs shall complete an evaluation of the ramping restrictions based on the following procedure:
 - a. The TSOs assess the number of minutes outside the standard frequency range and the deterministic frequency deviations;
 - b. If the number of minutes outside the standard frequency range is more than 20% below the Nordic aim for frequency deviations outside the standard frequency range³ and the assessment of the deterministic frequency deviations shows a significant decrease in deterministic frequency deviations, the maximum ramping rate (as referred to in Article 3(1)) shall be increased with exactly 10% (rounded to the nearest whole number);

³ as stipulated in the Nordic synchronous area methodology for the frequency quality defining parameters and the frequency quality target parameter in accordance with Article 127 of the Commission Regulation (EU) 2017/1485 of 2 August 2017 establishing a guideline on electricity transmission system operation.

- c. If the number of minutes outside the standard frequency range is more than 20% above the Nordic aim for frequency deviations outside the standard frequency range³ and the assessment of the deterministic frequency deviations shows a significant increase in deterministic frequency deviations, the maximum ramping rate (as referred to in Article 3(1)) may be decreased with exactly 10% (rounded to the nearest whole number). Alternatively other measures² shall be considered to improve the FRCE quality and frequency quality of the LFC block;
 - d. If the number of minutes outside the standard frequency range is within the 20% range around the Nordic aim for frequency deviations outside the standard frequency range³ and the assessment of the deterministic frequency deviations shows a significant decrease of deterministic frequency deviations in three consecutive years, the maximum ramping rate (as referred to in Article 3(1)) shall be increased with exactly 10% (rounded to the nearest whole number);
 - e. If the number of minutes outside the standard frequency range is within the 20% range around the Nordic aim for frequency deviations outside the standard frequency range³ and the assessment of the deterministic frequency deviations shows a significant increase in deterministic frequency deviations in three consecutive years, the maximum ramping rate (as referred to in Article 3(1)) may be decreased with exactly 10% (rounded to the nearest whole number). Alternatively other measures² shall be considered to improve the FRCE quality and frequency quality of the LFC block;
 - f. The conditions regarding deterministic frequency deviations in paragraph 1(b), 1(c), 1(d) and 1(e) shall only apply when a definition of deterministic frequency deviations is approved by the NRAs and definitions of "significant decrease" and "significant increase" are approved by the NRAs in accordance with Article 8(7).
2. Every year in quarter 1, the TSOs that apply a combined restriction shall complete an evaluation of the maximum combined ramping rates for each Nordic LFC area subject to a combined ramping restriction (as specified in Article 3(2)), based on the following procedure:
 - a. The TSOs assess the number of minutes outside the maximum FRCE limit for each LFC area;
 - b. If the number of minutes outside the maximum FRCE limit for the LFC area is larger than an agreed quality standard⁴, the relevant TSO shall inform the other TSOs if the maximum combined ramping rate for the relevant LFC area shall be changed or if other measures² shall be taken to improve FRCE quality for the LFC area(s);
 - c. The individual TSOs may also relax the combined ramping rate if agreed between TSOs of the Nordic LFC block.
 3. The TSOs apply the following process for their evaluation:
 - a. Every year in quarter 1, the TSOs shall evaluate the ramping restrictions based on the procedures in paragraph 1 and 2. The TSOs shall also make a cost-benefit analysis whenever there are significant changes in the operating environment but shall be done every 5 years at minimum, counting starting from the implementation of the Article 4. Cost-benefit analysis shall focus on alternative measures² compared to decreasing the ramping rate, to give more depth for the evaluation and conclusions.
 - b. If the procedures result in an update of the ramping restrictions, the TSOs shall agree on these updates with their cable partners in accordance with Article 6 not later than in quarter 2 of the same year.
 - c. Not later than in quarter 2, the TSOs shall publish and send to the NRAs their analysis, the results of their evaluation and their conclusions on the update of the maximum ramping rate. The publication shall be transparent and clearly describe the process, input data and the

⁴ The reference for the evaluation shall be the FRCE limit of the LFC area as to be included in appendix 1 of the LFCR Annex of the Nordic System Operation Agreement.

- variables used for the evaluation, an evaluation of alternative measures² and to determine whether the maximum ramping restriction should or should not be changed. The publication shall also describe the time of implementation of the new ramping restriction;
- d. Not later than in quarter 3, the TSOs shall implement the new ramping restrictions.

Article 5 – Increasing maximum ramping rate for HVDC interconnectors subject to a combined restriction

1. If the combined ramping restriction in Article 3(2) covers the concerned HVDC interconnector, the connecting Nordic TSO(s) may increase the maximum ramping rate as defined in Article 3(1) for this HVDC interconnectors if the following conditions apply:
 - a. The maximum ramping rate of the HVDC interconnector can be physically and operationally adapted to facilitate this change;
 - b. The change does not cause local network security problems;
 - c. The TSO connecting the other end of the HVDC interconnector approves the change.
2. The TSOs shall follow the process below when increasing the maximum ramping rate on HVDC interconnectors in accordance with paragraph 1:
 - a. The TSO confirms with the TSO on the other end of the HVDC interconnectors that all conditions in paragraph 1 have been fulfilled;
 - b. In coordination with the TSO on the other side of the HVDC interconnector, NEMOs and other relevant parties, the ramping restriction are changed in the day-ahead market systems, intraday market systems and internal TSO systems.
3. If one of the TSOs that connect the HVDC cable considers that the maximum ramping rate on HVDC interconnectors shall be reduced after they have been increased in accordance with paragraph 1, the TSOs shall follow the process below:
 - a. The TSOs connecting the HVDC interconnectors agree on a new restriction. It is noted that the Nordic TSOs shall not apply slower maximum ramping rate than indicated in Article 3(1);
 - b. In coordination with the TSO on the other side of the HVDC interconnector, NEMOs and other relevant parties, the ramping restriction are changed in the HVDC control systems, the day-ahead market systems, intraday market systems and internal TSO systems.

Article 6 – Coordination with cable partners

1. The Nordic TSOs are responsible for meeting the FRCE target parameters for the LFC block as referred to in Article 128 of the SO Regulation and accordingly need to set the ramping restrictions for their LFC block. TSOs of other LFC blocks and synchronous areas may set their ramping restrictions independently. In case the maximum ramping rates are set differently on each side of an HVDC interconnector or a combination of HVDC interconnectors, the lowest value shall prevail. This may result in a need to deviate from the resulting ramping rate according to the rules in this methodology.

Article 7 – Measures to support the fulfilment of the FRCE target parameter of the LFC block and to alleviate deterministic frequency deviations, taking into account the technological restrictions of power generating modules and demand units

1. In order to fulfil the FRCE target parameters for the LFC block as referred to in Article 128 of the SO Regulation, the following ramping restrictions apply:
 - a. When the hourly production plan of balance responsible parties representing power generating modules in Finland, Norway and Sweden changes more than 200 MW at hour shift, these balance responsible parties need to reschedule their plan with quarterly steps 15 minutes before hour shift, at hour shift and 15 minutes after hour shift in order to adjust the plans to better correspond to the consumption pattern. In Norway, the steps can be applied 30 minutes before the hour shift until 30 minutes after the hour shift. This obligation is not relevant in Denmark East due to the physical characteristics for production;
 - b. In case that planned production changes and planned HVDC exchanges around hour shift will impact the frequency in a way that cannot be entirely handled by control centres in the minutes before and after operating hour, the TSOs are allowed to request balance responsible parties that represent power generating modules to advance or delay parts of planned production steps at the hour shift. The power schedules may be changed from 30 minutes before hour shift till 30 minutes after the hour shift.
2. In order to fulfil the FRCE target parameters for the LFC block and LFC areas as referred to in Article 128 of the SO Regulation and the frequency targets as referred to in Article 127 of the SO Regulation:
 - a. Ramping rules should be considered by each TSO in order to minimise the activation of reserves, the FRCE of the LFC block and LFC area and the corresponding (deterministic) frequency deviation of the synchronous area. This could be reflected, for example, by financial incentives or operational requirements provided by TSO to balancing service providers, balance responsible parties that represent power generating modules and/or demand units.
 - b. Ideally, the Balance Responsible Parties (BRP's) ramp starts between 7.5 and 5 minutes before the start of an MTU and linearly ramps to the schedule for the next MTU which shall be reached between 5 and 7.5 minutes after the start of that MTU.

Article 8 – Publication and implementation

1. The relevant TSOs shall publish (in accordance with Article 8 of the SO Regulation) the Methodology without undue delay after the competent NRAs have approved the Methodology or a

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decision has been taken by the Agency for the Cooperation of Energy Regulators in accordance with Article 6 of the SO Regulation.

2. At the time of the changing to a 15 minutes MTU in the intraday market at the bidding zone border, Article 3 shall be implemented at this bidding zone border, except for Article 3(1)(a). Instead of the ramping period defined in Article 3(1)(a), a ramping period of up to 15 minutes may be applied, starting not earlier than 7.5 minutes before the start of the MTU and ending not later than 7.5 minutes after the start of the MTU. Article 3 shall be fully implemented when the Nordic TSOs have established the connection to the European platform for the exchange of mFRR in accordance with Article 20 of Commission Regulation (EU) 2017/2195 and 15 minutes MTU has been implemented in day-ahead and intraday markets.
3. Article 4 shall be implemented one year after the implementation of a 15 minutes MTU in the intraday market.
4. Article 5 and article 6 shall be implemented without undue delay after approval of this amended methodology by the NRAs.
5. At the time of implementation of the 15 minutes MTU in the day-ahead market, Article 7(1) becomes obsolete.
6. In case that the rules in this methodology cause a change to the combined ramping restrictions, the maximum ramping rates or ramping periods, the Nordic TSOs shall issue a market message as soon as new values are approved by the TSOs, with information of the reason for change and when new values will be implemented.
7. After fulfilling the conditions stated in Article 8(3), the TSOs shall deliver a new amended proposal for the NRAs approval no later than one year after fulfilling the conditions. The new proposal should include at least definition for ‘deterministic frequency deviation’ (DFD) and threshold value for the change of DFDs in Article 4(1)(b), (c), (d) and (e) (‘significant decrease’ and ‘significant increase’ respectively).

Article 9 – Language

The reference language for this Methodology shall be English. For the avoidance of doubt, where TSOs needs to translate this Methodology into national language(s), in the event of inconsistencies between the English version published by TSOs in Nordic LFC block in accordance with Article 8(1) of the SO Regulation and any version in another language the relevant TSOs shall, in accordance with national legislation, provide the relevant national regulatory authority with an updated translation of the Methodology.