Nordic ramping restrictions

Stakeholder webinar

28 January 2021

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Agenda

1. Welcome
2. Background for the current ramping restrictions
3. The new proposed methodology
4. Costs of proposed restrictions – simulation results
5. Closing

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Practical issues

- You will all be muted during the presentation. Please stay muted unless you shall ask a question during the Q/A sessions
- Please switch the camera off when not speaking – and on when speaking
- You can send in questions at all times by using the chat
- After each presenter is finished we will bring up questions from the chat – and ask for more questions. Use the "raised hand" function if you want to speak during these sessions

- The presentations in this webinar will be shared after the meeting

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Main questions from the previous consultation

1. Many questioned why not move to a Nordic Combined restriction instead of local restriction
   - This has been discussed between TSOs, and we agree to the rationale of going in that direction
   - Will be investigated further towards new update in 2023

2. Several market participants asked for a fast introduction of 15 minute ISP (Imbalance Settlement Period) to allow for more ramping
   - TSOs agree that this most likely will result in physics better reflected in the market results and thereby reducing the problem with deterministic frequency deviations.
   - 15 min ISP is scheduled for 2023 in the Nordics

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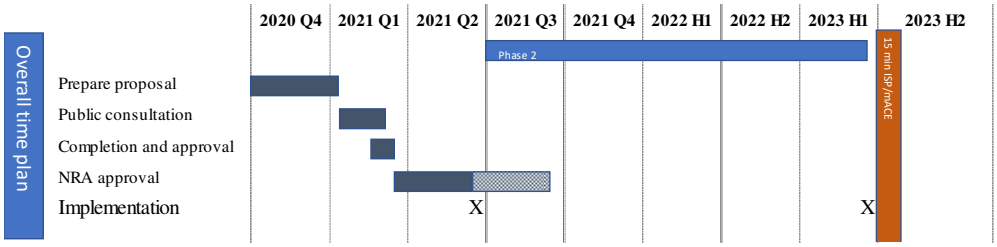
Overall plan ahead



- NRA approval not firm. Will request for decision by June, but NRAs have 6 months until Sept
- Phase 2 will lead to a new update in the methodology, taking into account the 15 minute Imbalance Settlement Period in the Nordics

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2. Background for the current ramping restrictions

- Initial restrictions and why is ramping restrictions needed
- Assessment of ramping restrictions
- Inclusion of NordLink

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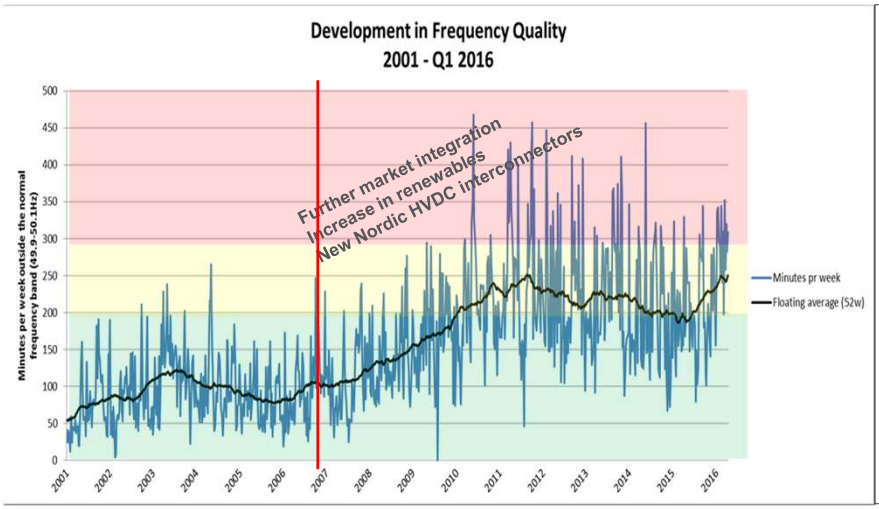
2007: TSOs worried about deteriorating Nordic frequency quality



Agreed mitigating measures (2007)

- **Ramping rules on HVDC interconnectors**
- A gate closure for binding production plans to the TSOs
- Quarterly (15 minute) resolution for production plans in some countries
- Minute based plans on some large production units in ramping hours to give needed production support for the frequency
- Introduction of automatic Load Frequency Control with aFRR also in the Nordic synchronous area

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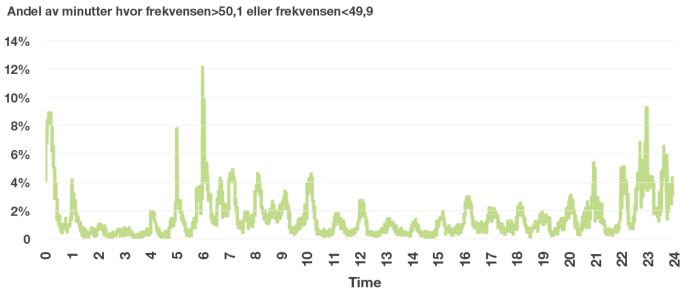
Deterministic Frequency Deviations (DfDs)



What happens in morning ramping hour shifts:

- Large increase in export on HVDC
- Large increase in consumption
- Large increase in production

To coordinate production changes with changes in consumption and HVDC ramping is challenging and imply risks for large frequency deviations / reduced system security due to:

- Large and quick changes in planned correlation between input and output in the system
- Potential failures in control equipment or advanced/delayed processes

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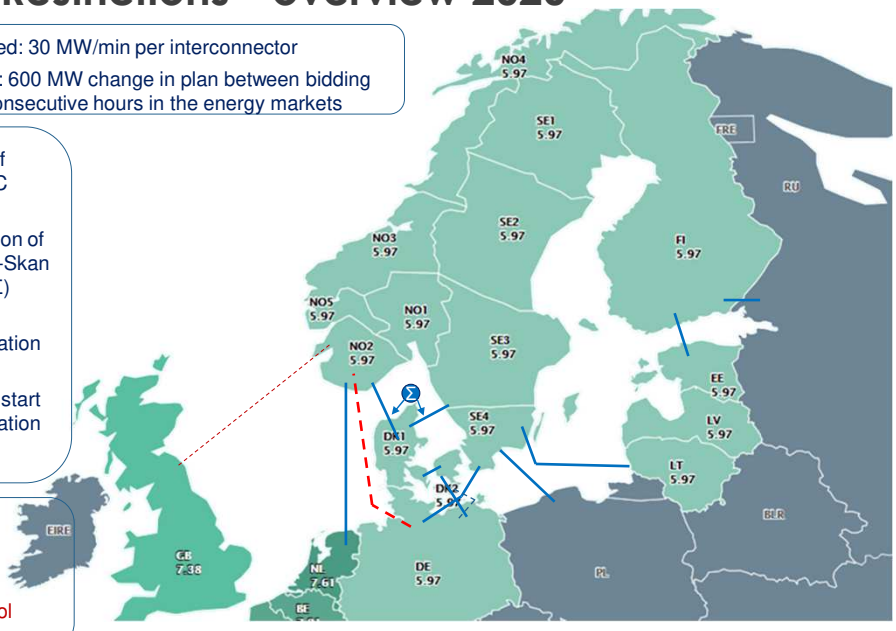
Ramping Restrictions - overview 2020

- Max ramping speed: 30 MW/min per interconnector
- Max ramping rate: 600 MW change in plan between bidding zones between consecutive hours in the energy markets

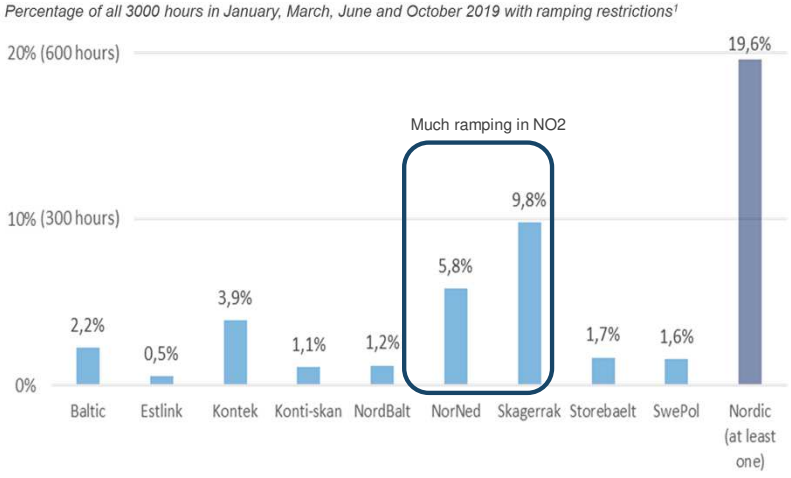
- Ten restrictions of 600MW on HVDC interconnectors
- One sum restriction of 600MW on Konti-Skan and Skagerrak (Σ)
- NordLink started commercial operation Dec 2020
- NSL expected to start commercial operation end of 2021

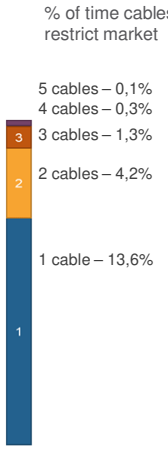
Challenges
1. Nordic frequency quality
2. Congestion control



Statistics for Nordic ramping in four chosen months 2019
(January, March, June and October) (1)

Percentage of all 3000 hours in January, March, June and October 2019 with ramping restrictions[1]

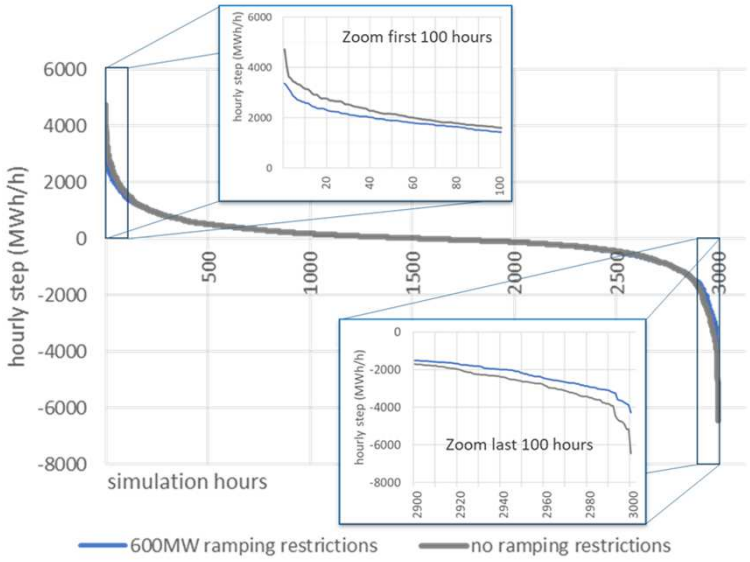




[1]The hours are counted if the difference in flow with the previous hour was equal or very close to the ramping restriction (i.e. in between 599 and 601 MWh/h).

Statistics for Nordic ramping in four chosen months 2019
(January, March, June and October)

Total hourly steps for the all Nordic HVDC interconnectors (except Vyborg), ordered from high to low for both scenarios



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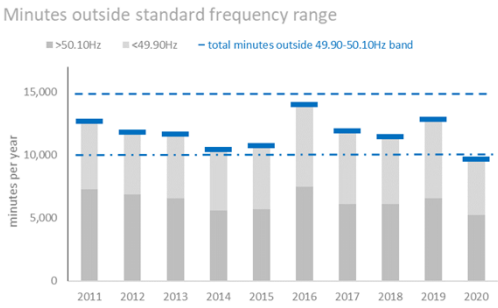
Why are Ramping Restrictions required?

Ramping restrictions keep imbalances controllable by automatic and manual reserves and the Nordic frequency quality within the 'frequency quality target parameter'

Allowing larger steps on all HVDC interconnectors would

1. increase momentary imbalances at hour shift
2. increase the need for very fast and costly balancing products and make the balancing job for the TSO much more difficult
3. increase excursions outside the standard frequency range
4. increased excursions of limits for flow in the grid and the voltage
5. Increase the risk for very large imbalances in case of inaccuracies in change control in production or malfunctions



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3. The new proposed methodology (2021)

3.1 The situation in NO2.

- New interconnectors, NSL in addition to NordLink
- Development frequency quality
- Network issues Norway south
- Specific network conditions NO2

3.2 The new proposal (2021)

- Introduction of a sum restriction and the possibility for higher ramp steps

Challenges and opportunities – TSO report (2016)

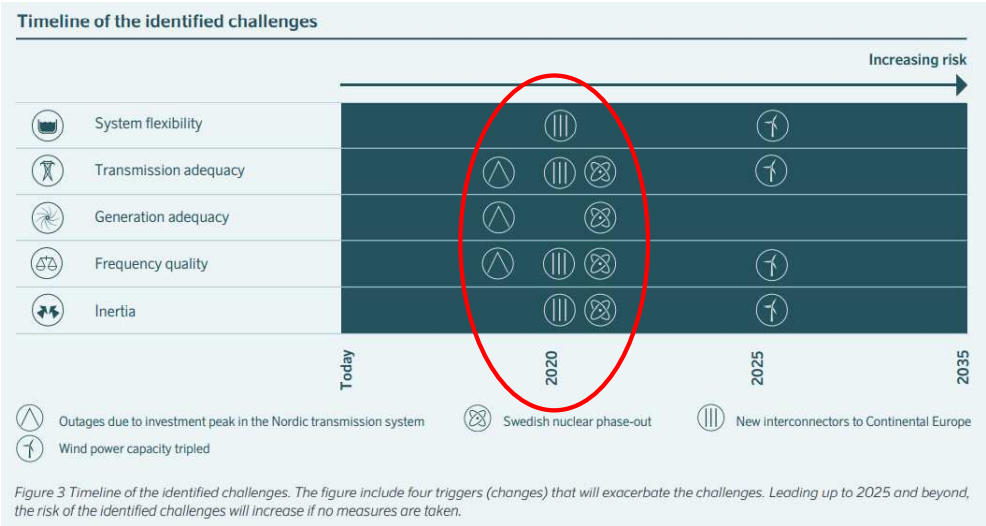

Figure 3 Timeline of the identified challenges. The figure include four triggers (changes) that will exacerbate the challenges. Leading up to 2025 and beyond, the risk of the identified challenges will increase if no measures are taken.

https://www.fingrid.fi/globalassets/dokumentit/fi/yhtio/tki-toiminta/report-challenges-and-opportunities-for-the-nordic-power-system.pdf

Ramping Restrictions - overview 2021

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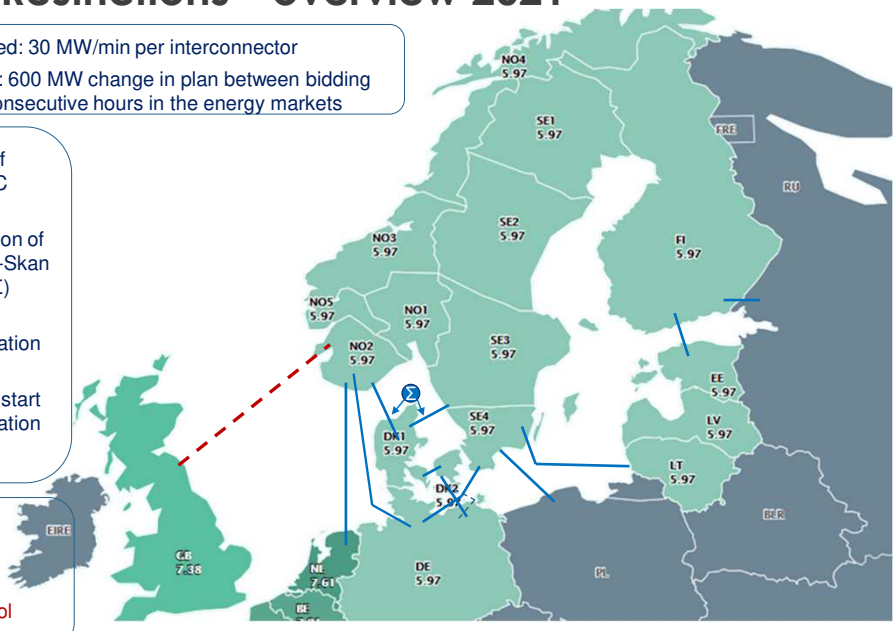

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Correlation Frequency Quality – HVDC capacity

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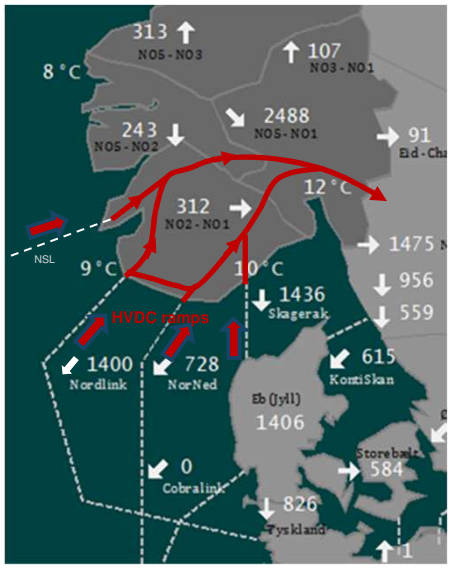
Network issues – Norway south



- Ramping in NO2 is currently restricted to 30 MW/min per HVDC interconnection
  20 min ramping period → 600 MW change in flow
- For 4 interconnectors this would mean 2400 MW change in 20 minutes → **120 MW/min change in flow** (correlated with change in local consumption in NO2 not included)
- Norwegian **TRMs between bidding zones are 50 – 150 MW** and there are many potential congestions between Norwegian terminal points and Sweden
- The flow in the grid may change so much and fast that it is impossible to plan and execute actions in time to avoid severe overloads and potentially blackouts with available tools
- **Consequence: The speed of flow changes needs to be reduced to safeguard system security**

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Specific network conditions in NO2

- Reinforcements of AC grid
  - The connection of the new HVDC interconnectors NordLink and NSL requires **reinforcements** in the AC grid in Southern Norway. Although these works are done in parallel to the completion of these HVDC lines, **the completion will take three more years**. During this time, some existing lines will need to be disconnected in outage periods and **reduction of ramping rates may be needed** in a similar way as reduction of ATC for the energy markets.
- Market message on NUCS:
  - In the period between 2020-2023, the ongoing upgrades of the transmission corridor, Western Corridor, will be completed. Until the re-construction is finalized, there may be need for capacity reductions on the HVDC corridors due to internal grid constraints, also in situations where there are no planned outages. This message describes the expected variations in these reductions. The affected HVDC-corridors will be NO2-DK1, NO2-NL and NO2-DE. In the period between 01.12.2020 until 31.12.2023 the need for total reductions may vary between 0-200 MW for both export and import. The reduction will vary based on the expected constraint and flow.
    The reductions will be placed on the corridor with the lowest expected socio-economic cost. For more information, see link: https://www.statnett.no/for-aktorer-i-kraftbransjen/nyhetsarkiv/reductions-on-hvdc-cables-in-the-re-construction-period-of-the-western-corridor-2020-2023
- Market will be informed in a timely manner about detailed figures for reduced capacity

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The new proposal

1. Keep the existing ramping restrictions as a starting point and make them applicable to new HVDC interconnectors
2. Introduce a combined ramping restriction for NorNed, NordLink and Skagerrak
   - Allow for increasing the individual ramping speed in MW/minute and the individual ramping rates in MW/hour on these three HVDC interconnectors
3. NSL will get the "standard" ramping restriction. NSL cannot be included in 2 because this interconnector is not part of the Internal Energy Market and its exchange is settled before the IEM
4. Make it possible for the TSOs to restrict the steps temporarily under specific network conditions
5. After implementation of the combined ramping restriction for NO2, the TSOs consider that the existing combined ramping restriction on Konti-Skan and Skagerrak is not required anymore

4. Costs of proposed restrictions – simulation results

Method

- Simulation Facility
- Euphemia algorithm

Period

- Feb/March 2019
- May/June 2019

Results

- Socio-economic surplus: Nordic
- Ramping: Combined ramping restriction NO2

Scenarios used

Name	New HVDC interconnectors	Socio-economic surplus	Combined ramping restrictions	Increase of individual ramping rates
Base	NordLink, NSL	(1)	Skagerrak + KontiSkan ≤ 600 MW/h	None
2019	-	(2)	Skagerrak + KontiSkan ≤ 600 MW/h	None
CRR (3)	NordLink, NSL	CRR – Base	Skagerrak + NordLink + NorNed ≤ 1200 MW/h	None
1000	NordLink, NSL	1000 – Base	Skagerrak + NordLink + NorNed ≤ 1200 MW/h	Skagerrak, NordLink, NorNed to 1000 MW/h

(1) 'Base' is used as a reference for the other scenarios.
(2) We only compare scenarios where NordLink and NSL are included. If we included the topology of 2019, the surplus of NordLink and NSL will overshadow the difference in combined ramping restriction.
(3) Combined Ramping Restriction on NO2

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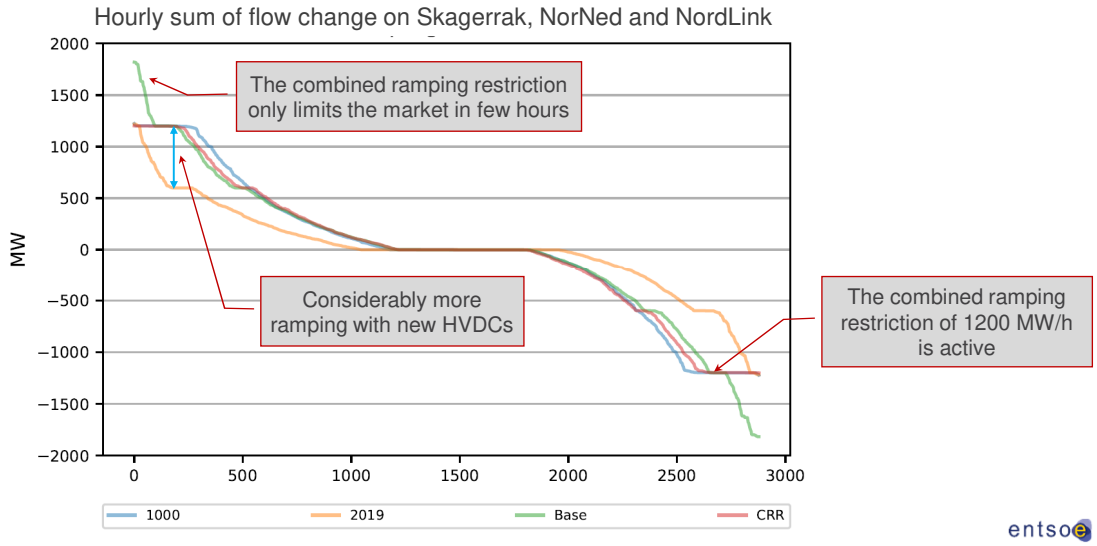
Simulation results - hourly flow change



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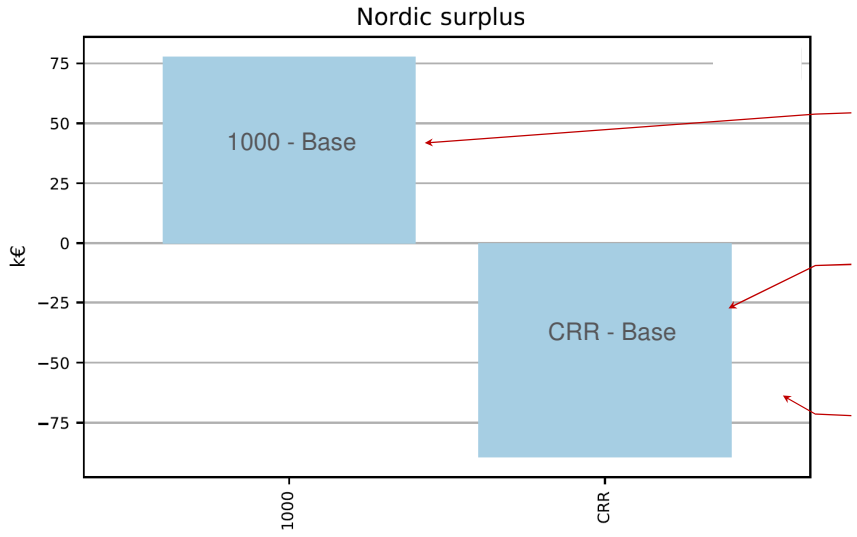
Simulation results - surplus



Increasing the individual ramping speed on HVDCs have a positive impact

The combined ramping restriction of 1200 MW/h in NO2 has a low impact

Simulation period is 4 months. Annual surplus will be about 3 times higher.

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Summary of simulation results

- Combined Ramping Restrictions (CRR) work
- CRR limit the market only in a few number of hours
- The cost of using CRR is low.
- The cost of using CRR can be offset by faster ramping on individual HVDCs

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