SVENSKA KRAFTNÄT
SWEDISH NATIONAL GRID

2020-07-01 Svk 2020/1259

Request by Svenska kraftnät for a derogation from the minimum level of capacity to be made available for cross-zonal trade for 2021

In accordance with Article 16(9) of Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity

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Regulatory background

Article 16(8) of Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (hereinafter "Regulation 2019/943"), prescribes that TSOs shall not limit the volume of interconnection capacity to be made available to market participants as a means of solving congestion inside their own bidding zone, or as a means of managing flows resulting from transactions internal to bidding zones.

Article 16(8) also defines that this requirement is complied with if a minimum level of available capacity for cross-zonal trade is reached. This level, hereinafter referred to as the "CEP 70% requirement", is set to 70% of the capacity of internal and cross-zonal critical network elements respecting operational security limits (hereinafter "CNEs") considering contingencies (hereinafter referred to as "CNECs").

Article 16(4) of Regulation 2019/943 prescribes that counter-trading and redispatch, including cross-border redispatch, shall be used to reach the CEP 70% requirement. Article 16(4) stipulates that the application of cross-border measures is subject to the implementation of a redispatching and counter-trading cost sharing methodology.

The CEP 70% requirement to make available minimum cross-zonal capacity is applicable as of 1 January 2020. Transitory measures, i.e. action plans pursuant to Article 15 of Regulation 2019/943 or derogations pursuant to Article 16(9) of the same regulation, allow for this minimum capacity to be reached in a progressive way.

Article 16(8) of Regulation 2019/943 prescribes that the CEP 70% requirement entails respecting operational security limits on CNE as well as considering contingencies. Article 16(9) prescribes that relevant regulatory authorities may grant a derogation from paragraph 8 of article 16 where it is necessary on foreseeable grounds for maintaining operational security. The extent of such a derogation shall be strictly limited to what is necessary and to maintain operational security, avoid discrimination between internal and cross-zonal exchanges and not extend to more than one year at a time.

The Member State with identified structural congestion shall, in cooperation with its transmission system operators, decide within six months of receipt of the report;

- either to establish national or multinational action plans pursuant to Article 15 Regulation 2019/943,
- Alternatively in the bidding zone review pursuant this Article 14(7) or by one or more transmission system operators in their control areas in a report approved by the competent regulatory authority.

Article 15 of Regulation 2019/943 prescribes that following the adoption of a decision pursuant to Article 14(7), the Member State with identified structural congestion shall develop an action plan in cooperation with its regulatory authority. That action plan shall contain a concrete timetable for adopting measures to reduce the structural congestions. Irrespective of the concrete progress of the action plan, Member States shall ensure that without prejudice to derogations granted under Article 16(9) or deviations under Article 16(3), the cross-zonal trade capacity is increased on an annual basis until the minimum capacity provided for in Article 16(8) is reached.

The above provision also requires that minimum capacity compliant with Article 16(8) shall be reached by 31 December 2025, and that those annual increases shall be achieved by means of a linear trajectory.

Article 15 stipulates that it is for the Member State to decide on the establishment and implementation of the action plan. The Swedish authorities have considered this option. The conclusion was that Svenska kraftnät is to request a Derogation following the reason stated in Article 1.

If the requested derogation is granted Svenska kraftnät shall develop and publish a methodology and projects that shall provide a long-term solution to the issue that the derogation seeks to address. In Article 6. of this derogation request Svenska kraftnät describes a few of the measures included in the methodology and projects which will deliver a long-term solution to the issue.

Request for derogation is compliant with the relevant rules

Svenska kraftnät submits that the request for derogation is compliant with Regulation 2019/943, more specifically Article 16(9). In this connection, Svenska kraftnät notes the following:

- The request for a derogation is based on grounds that are foreseeable.
- The derogation is requested in order to maintain operational security.

- The extent of the requested derogation is strictly limited to what is necessary.
- The derogation avoids undue discrimination between internal and cross-zonal exchanges as Svenska kraftnät will maintain the available capacity above the CEP 70% requirement for as much of the time as possible.

Svenska kraftnät submits the following request for a derogation

Article 1. Subject matter and scope

This request for derogation on the implementation of the minimum margin available for cross-zonal trade is submitted by Svenska kraftnät in accordance with Article 16(9) of the Regulation 2019/943.

The request is based on foreseeable reasons to deviate from the CEP 70% requirement:

- The lack of downregulation volumes makes Svenska kraftnät unable to meet the CEP 70% requirement in 2021 without endangering operational security in a N-1 situation, cf. Article 4.
    - Congestion in the West Coast Corridor, inside bidding zone SE3, in combination with the lack of available downregulation implies a need to reduce capacity on six different interconnectors: SE3-NO1, DK1-SE3, DK2-SE4, DE-SE4, PL -SE4 and LT-SE4, cf. Article 3.

Svenska kraftnät commits to limiting the use of the derogation as much as possible. The minimum margin available for cross-zonal trade, as defined by the CEP 70% requirement, will be achieved to the maximum possible extent as long as operational security is guaranteed.

Svenska kraftnät also commits to report all deviations from CEP 70% requirement to the Swedish NRA along with a justification why the deviation was required to guarantee operational security.

Svenska kraftnät also commits to develop and publish a methodology and projects that provide a long-term solution to the issue for which the derogation is requested.

Article 2. Definitions and interpretations

For the purpose of this request for derogation, the terms used in this document shall have the meaning of the definitions included in Article 2 of Regulation 2019/943, Article 2 of commission regulation (EU) 2015/1222 of 24 July 2015

establishing a guideline on capacity allocation and congestion management (CACM Regulation), Article 2 of the ACER Recommendation No 01/2019.

In this request for derogation, unless the context requires otherwise:

- The table of contents, headings and examples are inserted for convenience only and do not affect the interpretation of this derogation request.
- Any reference to legislation, regulations, directive, order, instrument, code or any other enactment shall include any modification, extension or re-enactment of it then in force.

Article 3. The West Coast Corridor

The West Coast Corridor is a cross-section in the Swedish transmission network located within bidding zone SE3. It cuts through the 400 kV transmission lines between Strömma and Kilanda and between Horred and Kilanda in western Sweden near Gothenburg. The West Coast Corridor is one of four identified bottlenecks in the Swedish transmission network. The others cuts constitute bidding zone borders between Sweden's internal bidding zones. The West Coast Corridor is different from the other three as it cuts through two transmission lines near the Swedish West Coast and does not cut through the country from the eastern border to the western border.

The congestion problem at the West Coast Corridor occurs in hours with a northbound flow in the Swedish transmission system. For the problem to arise, the northbound flow from SE4, DK1, DK2, DE-LU, PL and LT, through the West Coast Corridor must exceed its maximum capacity of about 2,300 MW. These hours are generally characterised by a combination of four factors described in the following subsections.

1. **General reduction in demand relative to steady state load, for example during nights and weekends**

As the load decreases the power flows in the system changes. In the area close to the West Coast Corridor local load and generation are at an equilibrium during the day. As local load decreases local generation generally holds its output level and thus a new the equilibrium with increased flow is arises.

2. **High wind in-feed, especially in Denmark, Germany and Southern Sweden**

Wind in-feed located south of the West Coast Corridor pushes power through the Corridor. The normal south bound flow is replaced by northbound flow.

3. **Subsequent production reduction in the hydro plants in Norway**

As the flexible hydro plants decrease generation it generates a flow from south to north to meet the load in Norway.

4. Continued nuclear generation at the same level

First and foremost the Ringhals nuclear power plant located on the Swedish West Coast maintains its generation output. Other nuclear power plants in Sweden do the same as these are also relatively inflexible. Their output contributes to the northbound flow.

Current operational security management routines and impact

Currently Svenska kraftnät is constrained to maintain the operational security in the system in certain situations by restricting the capacity made available to the market on the six interconnectors in Southern Sweden (SE3 and SE4): SE3-NO1, DK1-SE3, DK2-SE4, DE-SE4, PL -SE4 and LT-SE4. A lower import capacity reduces the flow of power from interconnected countries into Southern Sweden. A lower export capacity, on SE3→NO1, reduces the transit of the imported power going via the West Coast Corridor to Norway.

Restrictions are only necessary to ensure that operational security can be maintained. If sufficient downregulation volumes would have been available, counter trade could be utilised in line with Article 16(4) of Regulation 2019/943. In Article 4. the lack of downregulation resources, and its relation to the congestions, is further elaborated on.

In Annex B the historical situation is described. The analysis in Annex B shows that historically, 2016-2019, the average capacity made available to the market on the relevant interconnectors is 67 % or higher considering all hours. There are however hours were zero MW is made available on the interconnectors.

West Coast Corridor as a bidding zone border

The properties of the West Coast Corridor, described previously in this article, are not ideal for creating a specific biding zone where it constitutes a border. A small bidding zone dedicated for just the West Coast Corridor would encompass small loads and virtually no generation. The resulting small bidding zone would often only be an extension of the adjacent bidding zones, not being able to function on its own.

Reconfiguring the Swedish bidding zones in a way that the West Coast Corridor would constitute a border is not feasible. A transmission line between Skogssäter to Stenkullen that elevates the congestion is planned to be in operation from 2023, see Article 6. The bidding zone would only be relevant until this time. There is currently an ongoing biding zone review in Sweden and ACER will provide its decision on the biding zone methodology in October of 2020.

Article 4. Lack of supply of downregulation volumes

The foreseeable ground to request a derogation is a lack of sufficient downregulation volumes that would enable Svenska kraftnät to meet the CEP 70%

requirement from 2021 without endangering operational security in a N-1 situation.

These situations occur due to the structural congestion described in Article 3. Svenska kraftnät would implement extensive use of remedial actions to solve the congestion, in accordance with Article 16(4) of Regulation 2019/943, if this was possible.

The lack of downregulations volumes has constrained Svenska kraftnät to reduce interconnector capacity to ensure operational security in relation to the West Coast Corridor certain situations, described in Article 3.

This measure used to ensure that operational security limits are not violated in the event of a contingency. As well as ensuring that the power system can be restored to a state of operational security. The measure is required in order for Svenska kraftnät to adhere to the requirements according to paragraph 4, chapter 5 of the targets for operational security established according to §1.a. of chapter 8 in the Swedish Electricity Act. When the need arises to reduce capacity encompasses six different interconnectors: SE3-NO1, DK1-SE3, DK2-SE4, DE-SE4, PL-SE4 and LT-SE4.

In situations where the West Coast Corridor is fully utilized, in general a volume of between 1 200 MW and 1 500 MW of downregulation resources would be required after a contingency to maintain operational security in line with the targets for operational security. The downregulations volumes need to be present south of the West Coast Corridor, in DK1, DK2 or SE4. It would also require corresponding upregulation volumes north of the West Coast Corridor; generally in Norway.

The 1 500 and 1 200 MW volumes mentioned above are theoretical. This needs to be taken into account in operational planning and capacity calculation as the required amount of downregulation to mitigate an overload. The actual downregulation volume available are not know until 45 minutes before the operational hour. Therefore, downregulation volumes are predicted which is associated with a risk level in the capacity calculation. The corresponding upregulation is also assessed in the capacity calculation. The availability of upregulation in Norway is not associated with the same risk level.

To depict the situation the special regulation market, through which counter trade is procured in the Nordic market design, has been analysed. The analysis also includes historic day ahead results and capacity allocation including limitations on interconnectors. In Annex A an in depth analysis of the situation of downregulation, and upregulation, in regards to the West Coast Corridor is presented.

During 2019 less than 1 500 MW of downregulation was available for a total of 4661 hours. Considering more favourable conditions there were 3 248 hours where less than 1 200 MW was available. Taking the history of the day head market, capacity allocation and interconnector limitation into account the results of the analysis show multiple occasions during 2019 where operational security targets cannot be met. For additional results of the analysis see Annex A.

In conclusion: Based on the analysis of the results from the analysis of available downregulation resources it is still Svenska kraftnät´s position that, in order to ensure operational security, situations may still occur where Svenska kraftnät´s only available tool is to reduce capacity on interconnectors to less than 70 % of maximum NTC. The current practice is that this involves six different interconnectors: SE3-NO1, DK1-SE3, DK2-SE4, DE-SE4, PL-SE4 and LT-SE4. Investigations are underway to see if this can be optimized and which new tools can be develop as well as their impact on reaching CEP 70% , this is elaborated more on in Article 6.

Article 5. Coordinated capacity allocation not implemented

Svenska kraftnät will continue to utilize the NTC approach for capacity calculation until the capacity calculation methodology according to article 20 if CACM entailing a flow-based approach for the Nordic Capacity Calculation Region is implemented. The implementation is planned to be finalized at the end of 2021 or the beginning of 2022. The level of capacity made available to the market when utilising NTC is not explicitly defined in CEP 70%.

Svenska kraftnät submits that until the method utilising a flow-based approach is implemented, regulatory authorities and ACER should recognize that, in some cases, the high uncertainties related to forecast cross-zonal exchanges outside coordination areas may impede Svenska kraftnät's ability to reach the CEP 70% requirement. In such cases, the temporary relaxation of the CEP 70% requirement through a derogation is an appropriate instrument.

Structural congestions have been identified by analysing historical capacities supplied to the power exchange, NordPool, for the six interconnectors in question during the period of 2016 to 2018. These capacities where compiled utilising the net transmission capacity method. To efficiently and precisely determine the capacity in relation to the requirement in Article 16(8) of Regulation 2019/943 the network needs to be analysed in flow-based representation as described in the recommendation no 01/2019 of the European Union Agency for the Cooperation of Energy Regulators of 8 august 2019.

During the period of the derogation Svenska kraftnät will gather data compiled in the external parallel run of the Flow-based approach capacity calculation presiding

its implementation. From this data Svenska kraftnät will precisely determine which network elements do not fulfil CEP 70% requirement. This data will additionally be utilised to improve and fine-tune the envisioned measures described in brief in Article 6. , and potentially to define the starting point in an action plan according to article 15 of Regulation 2019/943.

Article 6. Methodology and projects to reach CEP 70%

The structural problem will be alleviated with the decommissioning of the reactors Ringhals 1 and 2, in 2021 and 2020 respectively. With Ringhals nuclear power plant being located just south of the West Coast Corridor, this will reduce the need for capacity reductions on the six interconnectors in 2021 compared to the historic situation.

The structural problem is expected to be resolved from 2023 and onwards. Svenska kraftnät has committed to invest in a new transmission line from Skogssäter to Stenkullen. It will supplement the two North-South lines at the West Coast Corridor, and it will, according to simulations done by Svenska kraftnät, greatly reduce the congestion problem in the West Coast Corridor. Thereby, it will also eliminate the need for capacity reductions on the six interconnectors significantly.

However, Svenska kraftnät is considering several measures that will result in optimized capacity allocation with less capacity restrictions on the interconnectors and increased use of downregulation bids.

Some of the measures are aiming at adjusting the assumptions, which are used as the basis for the capacities allocated in relation to the West Coast Corridor. Since June 2019, Svenska kraftnät has gradually released more day-ahead capacities on the interconnectors and handle within the day imbalances through downregulation. Svenska kraftnät will continue to search for further optimisations and supplement with other measures that are aimed at developing the supply of downregulation in especially SE3, SE4 and DK2. For example through more comprehensive and targeted communication to the market participants about the opportunities.

The work in this area have already delivered progress in terms of available capacity on the interconnectors. Considering the DK2-SE4 interconnector the average allocated capacity was 1 000 MW (approximately 58% of the max NTC capacity) from 1 January 2019 to 31 May 2019. During the period 1 June 2019 to 31 October 2019, the average allocated capacity was 1 173 MW (approximately 68% of the max NTC capacity). Svenska kraftnät expects that the work with the measures will contribute to the fulfilment of the CEP 70% requirement.

Should the derogation be granted, Svenska kraftnät will further develop and publish a methodology regarding the management of the issue together with a description of additional measures.

Article 7. Extent and duration of derogation

This request for derogation is applicable for the duration of 2021 and to these six interconnectors: SE3-NO1, DK1-SE3, DK2-SE4, DE-SE4, PL-SE4 and LT-SE4.

However, since the foreseeable ground that the request for a derogation is based are reoccurring events, Svenska kraftnät may resubmit a request for derogation at the end of the 12 month period for the next period of maximal duration allowed by Regulation 2019/943.

Article 8. Language

The reference language for this derogation request shall be English.

Article 9. Confidentiality

The information provided by Svenska kraftnät for this derogation request does not have to be treated as confidential unless stated or agreed otherwise.

Annex A – Data presentation and analysis of the of day ahead, capacity allocation and special regulation market in the Nordics

In this Annex an in depth analysis of the situation of downregulation and upregulation bids in regards to the West Coast Corridor is presented. The analyses are based on historical market behaviour during 2019. The bidding history for the Nordic special regulation market is attained from NordPool's website. Bids are submitted to the Nordic TSO's per each bidding zone. The Nordic TSO´s publish the bids on NordPool's website.

In situations where the West Coast Corridor is fully utilized, in general a volume of between 1 200 MW and 1 500 MW of regulation resources would be required after a contingency to maintain operational security in line with the targets for operational security. These downregulation volumes need to be present south of the West Coast Corridor, in DK1, DK2 or SE4. The corresponding upregulation is required in the biding zones north of the West Coast Corridor; in NO1 to 5, SE2, SE1 and FI.

In the graph below, Figure 1 and Figure 2, the total amount of downregulation and upregulation resources available during 2019 are presented. Since available resources are not known until 45 minutes before the operation hour Svenska kraftnät has to base the capacity allocation on experience of available down-regulation resources. Looking at the historical data in the figures, it is clear that it is often the case that less than the required amount of downregulation resources are available.

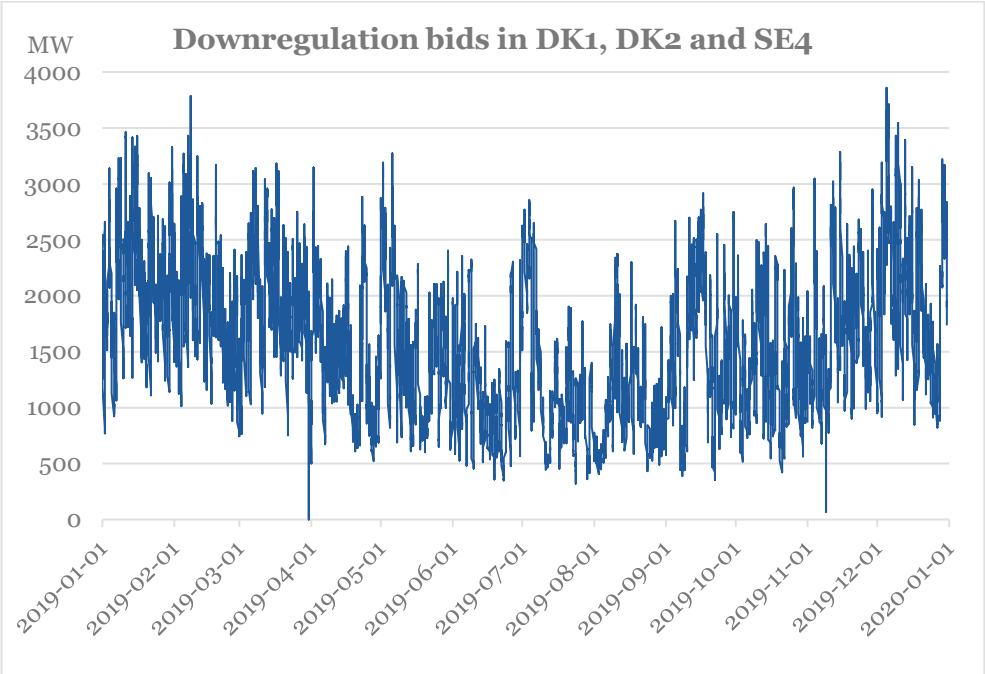

Figure 1: Available volume of downregulation in bidding zones south of the West Coast Corridor during 2019.

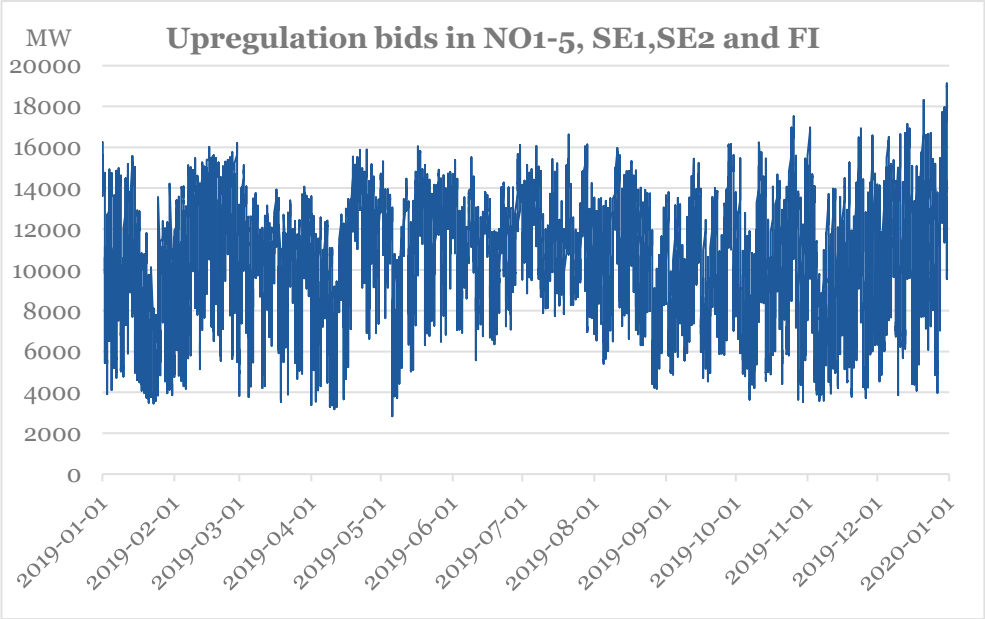

Figure 2: Available volume of upregulation in bidding zones north of the West Coast Corridor during 2019.

The level of available regulation volumes is different for up- and downregulation in the relevant biding zones. On average 10 127 MW and a minimum of 2 833 MW of upregulation is available. For downregulation the average is 1 613 but the minimum available volume is zero MW. The risk associated with assuming the available amount of regulations volumes therefore differs between up- and downregulation.

This analysis will focus on the downregulations volume as these levels are close to the required volumes, these are therefore the potential limiting factor.

1. Downregulation volumes

In Figure 3 the available downregulation resources in each bidding zone (DK1, DK2 and SE4) for each hour of 2019 are presented. Most of the downregulation resources are available in DK1.

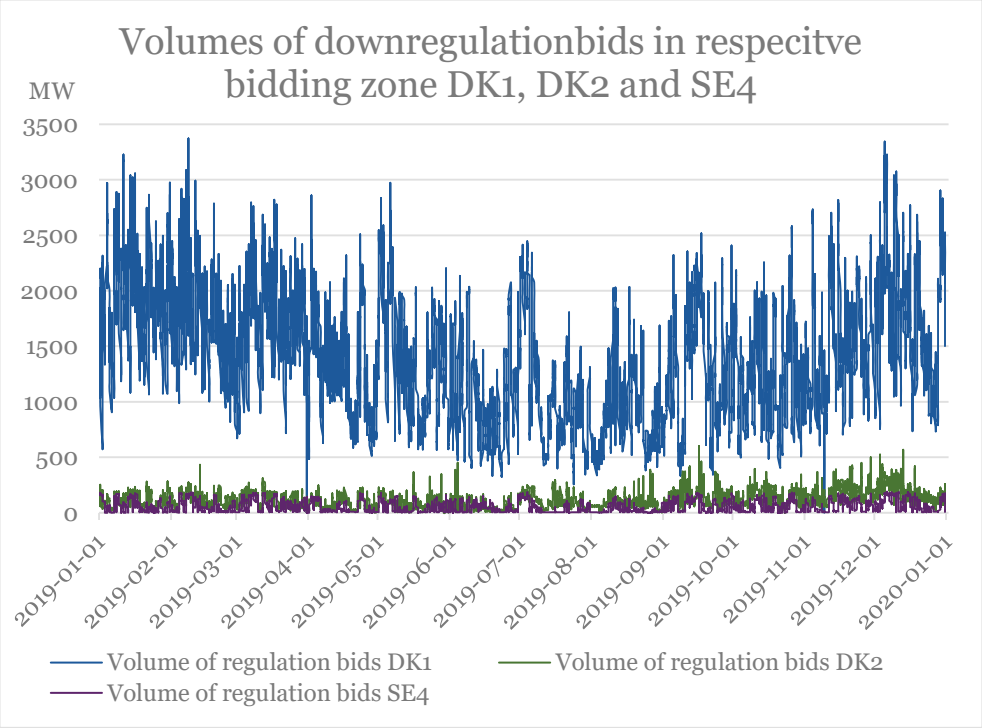

Figure 3: Volume of regulation bids in 2019 in DK1, DK2 and SE4, the vertical axis represents power in MW and the horizontal time and date which the specific volume is offered.

In Figure 4 remaining volumes that could be used for handling congestion problems in the West Coast Corridor are presented. During 2019 a total of 4 661 hours there is less than 1 500 MW of available downregulation. Considering more favourable conditions there were 3 248 hours where less than 1 200 MW was available.

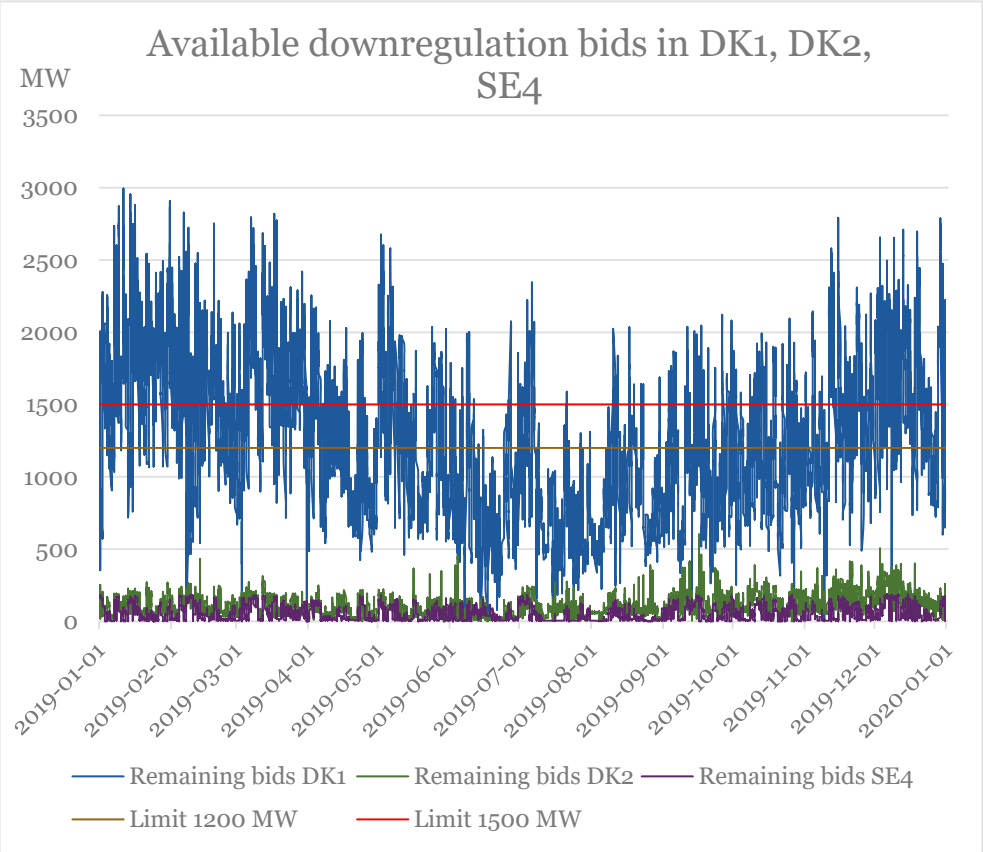

Figure 4: Available downregulation bids to solve congestion problems in the West Coast Corridor, taking into account volumes already used for balancing and special regulation (countertrade).

2. Interconnector capacity in combination with downregulation volumes

In Figure 5 the occasions where it was determined that there was a lack of downregulation resources during 2019 is presented. The graph also shows simulated results in terms of the number of occasions where there may have been a lack of downregulation resources if 70% of maximum NTC of interconnector capacity had been allocated. The historic results show that there were 87 hours where operational security targets could not be maintained and that this number would increase to 132 hours if 70% of maximum NTC was allocated on interconnectors for all hours. It should also be noted that on several occasions during 2019 too optimistic assumptions in Svenska kraftnät´s current capacity calculation method resulted in that 70% of maximum NTC or more was allocated and where the historic results subsequently showed a lack of resources. The best example of this is seen the 3rd of March 2019.

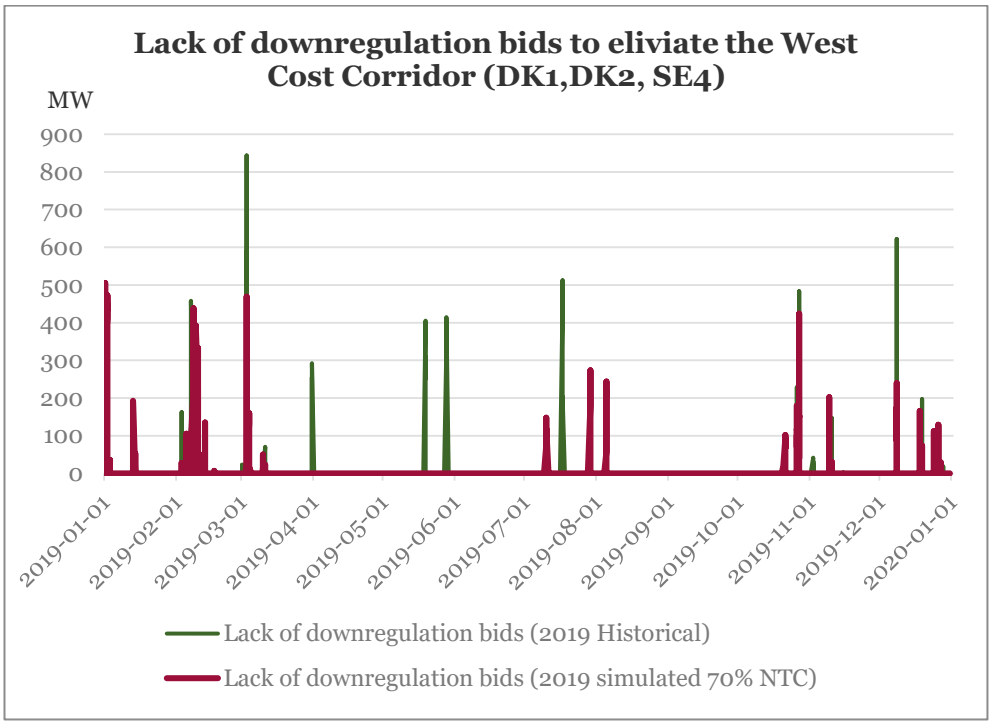

Figure 5: Available reserves for downregulation at times of congestion in the West Coast Corridor during 2019.

Annex B – Historical capacities on the borders effected by the congestion in the West Coast Corridor

This annex contains a summary of historical capacity data for the interconnectors effecting the West Coast Corridor significantly. The data is the same that has been published on NordPool prior to the to the Day Ahead auctions. The summary is comprised of three data sets to give both an overview and an in-depth description of the historical situation.

1. Data sets

In this section the data sets used in the analysis are described. The interconnectors with significant impact on flows through the West Cost Corridor are: NO1-SE3, DK1-SE3, DK2-SE4, DE-SE4, PL-SE4, LT-SE4.

The historical capacity data is divided into the three sets based on how Svenska kraftnät has categorised the capacity for each hour when it was originally published. The categorisation is done based on any contingent limitation of capacity. The market time unit, hours in this case, where there were limitations were tagged when they were published. The reason code, the tag, used to describe the limitation can be viewed on NordPool´s webpage[1]. The datasets used in the analyses include data with the following reason codes:

Dataset 1; All hours – all reason codes included

Dataset 2; Hours without outages - reason code 1010 and 1624. This shows how much curtailment that has been done due to internal congestions.

Dataset 3; West Coast Corridor restrictions - reason code 1624.

Data set 1: all hours

In Table 1 below is the total amount of hours for dataset 1 presented. This data set includes hours despite which reason code they are tagged with.

	NO1-SE3	DK1-SE3	DK2-SE4	DE-SE4	PL-SE4	LT-SE4
Hours 2016	8784	8784	8784	8784	8784	7632
Hours 2017	8760	8760	8760	8760	8760	8760
Hours 2018	8760	8760	8760	8760	8760	8760
Hours 2019	8760	8760	8760	8760	8760	8760

Table 1: The number of hours of capacity data included in data set 1.

[1] https://www.nordpoolgroup.com/globalassets/download-center/day-ahead/reason-codes-and-area-location-codes_1-dec-2015.pdf

Data set 2: Hours without outages

Dataset 2 includes data for all hours during 2016-2019 when there were no outages in the grid as well as the hours when there were restrictions due to congestion in the West Coast Corridor. These hours corresponds to the hours with reason code 1010 or 1624. This shows how much curtailment that has been done due to internal congestions. In Table 2 below is the total amount of hours for dataset 2 presented.

	NO1-SE3	DK1-SE3	DK2-SE4	DE-SE4	PL-SE4	LT-SE4
Hours 2016	8381	7741	8105	8458	8236	5159
Hours 2017	6053	7780	8378	7970	8350	7055
Hours 2018	8466	8176	7221	7310	8509	7143
Hours 2019	6282	6524	7072	8042	6924	7853

Table 2: The number of hours of capacity data included in data set 2.

Data set 3: Hours with restrictions due to West Coast Corridor

Dataset 3 includes data for the hours during 2016-2019 when there were restrictions due to congestion in the West Coast Corridor. These hours corresponds to the hours with reason code 1624. In Table 3 below the total amount of hours for dataset 3 is presented.

	NO1-SE3	DK1-SE3	DK2-SE4	DE-SE4	PL-SE4	LT-SE4
Hours 2016	1430	1391	1228	957	830	221
Hours 2017	3379	3634	3903	3451	3533	3098
Hours 2018	4183	3951	3817	2976	3754	3592
Hours 2019	3380	3320	3618	3351	3199	3462

Table 3: The number of hours of capacity data included in data set 3.

2. Results

In this section the results of the analysis is presented with load duration graphs, average values as well as the share of the time when the capacity was less than 70% of Max NTC.

Capacity load duration curves for dataset 1, all hours

Below is the capacity load duration curve for all six interconnections for year 2016, 2017, 2018 and 2019 which show the capacity (share of max NTC) for all market time units. The figures gives an illustration of how many hours each year the capacities have been reduced and how much.[2]

[2]The interconnect NordBalt SE4-LT was commissioned in February 2016 and included in the West Coast congestion management in November the same year.

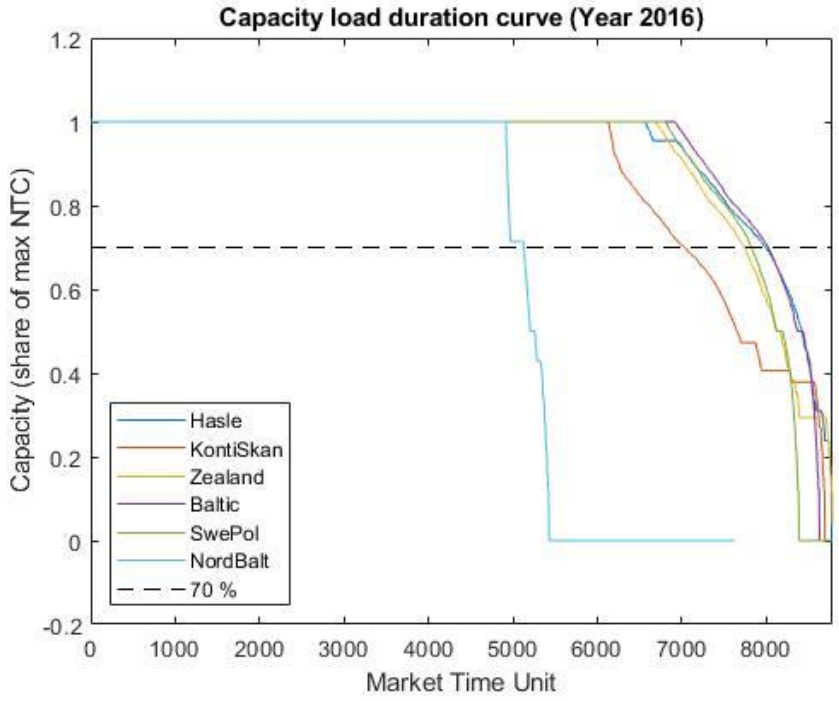

Figure 6. Capacity load duration curve for all six interconnections for 2016 for all market time units in dataset 1.

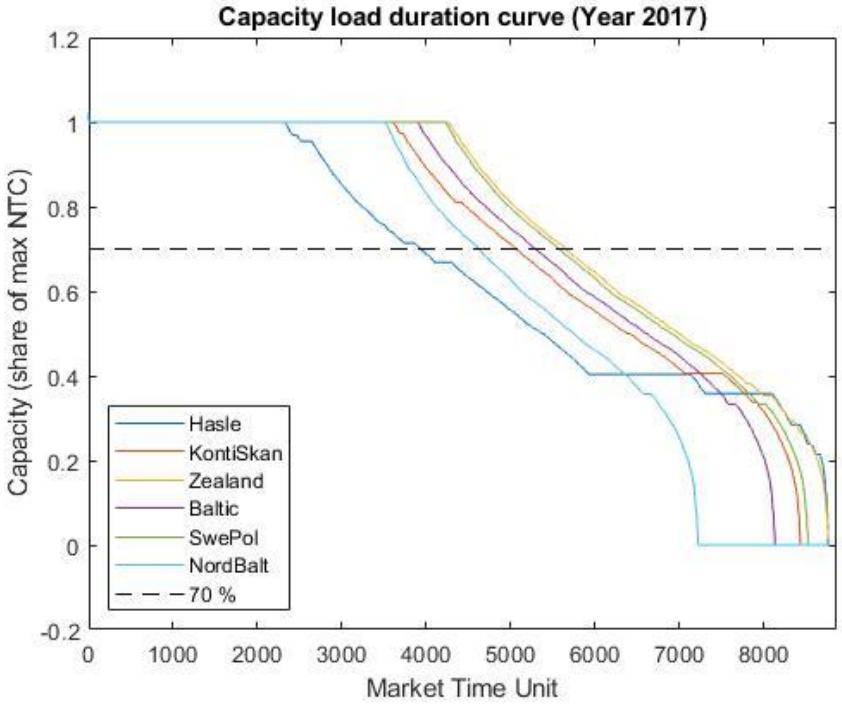

Figure 7. Capacity load duration curve for all six interconnections for 2017 for all market time units in dataset 1.

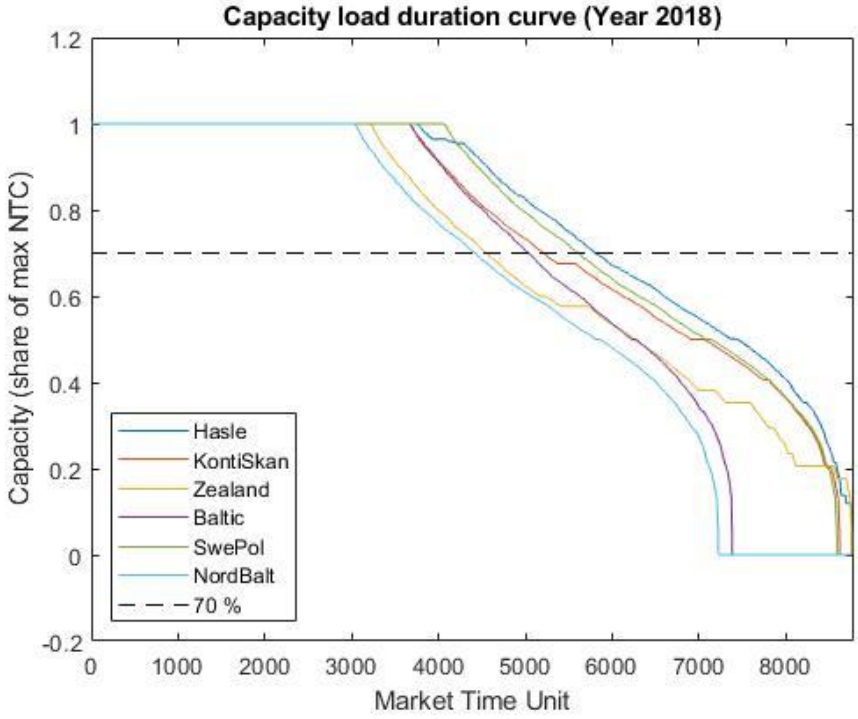

Figure 8. Capacity load duration curve for all six interconnections for 2018 for all market time units in dataset 1.

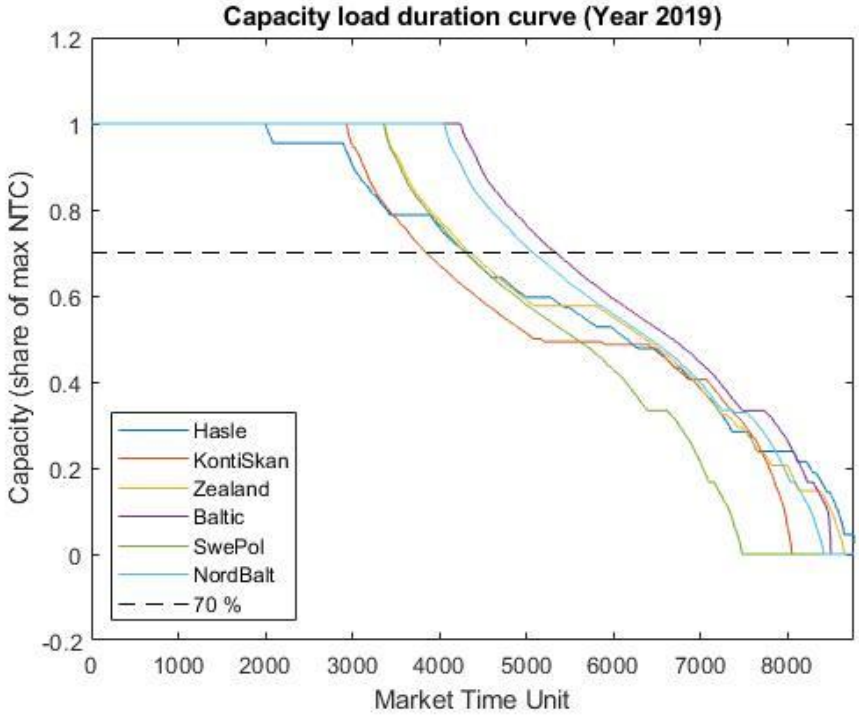

Figure 9. Capacity load duration curve for all six interconnections for 2019 for all market time units in dataset 1.

Capacity load duration curve for dataset 2, hours without outages

Below is the capacity load duration curve for all six interconnections for year 2016, 2017, 2018 and 2019, which show the capacity (share of max NTC) for all market time units.

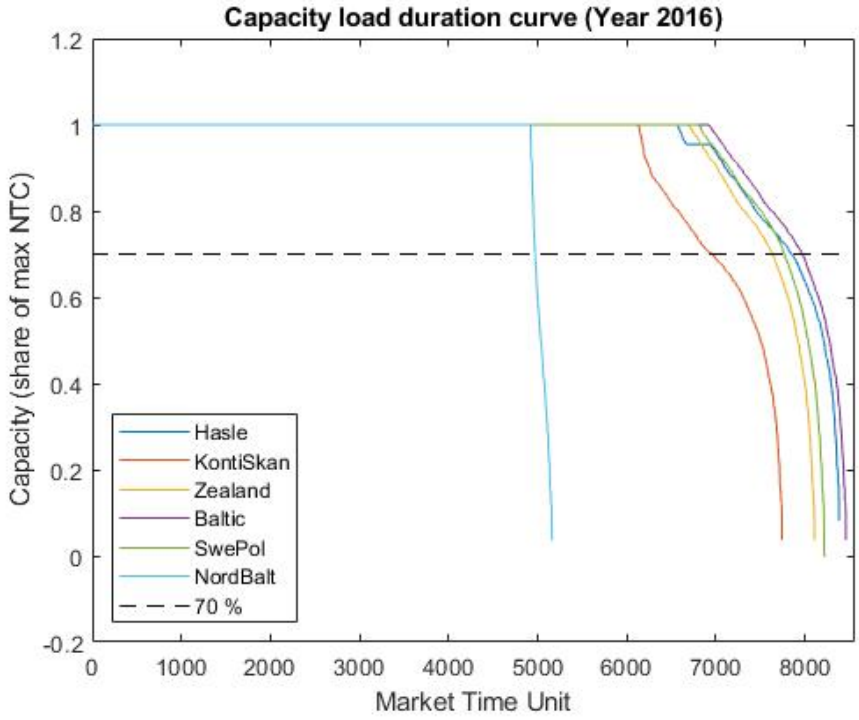

Figure 10. Capacity load duration curve for all six interconnections for 2016 for all market time units in dataset 2.

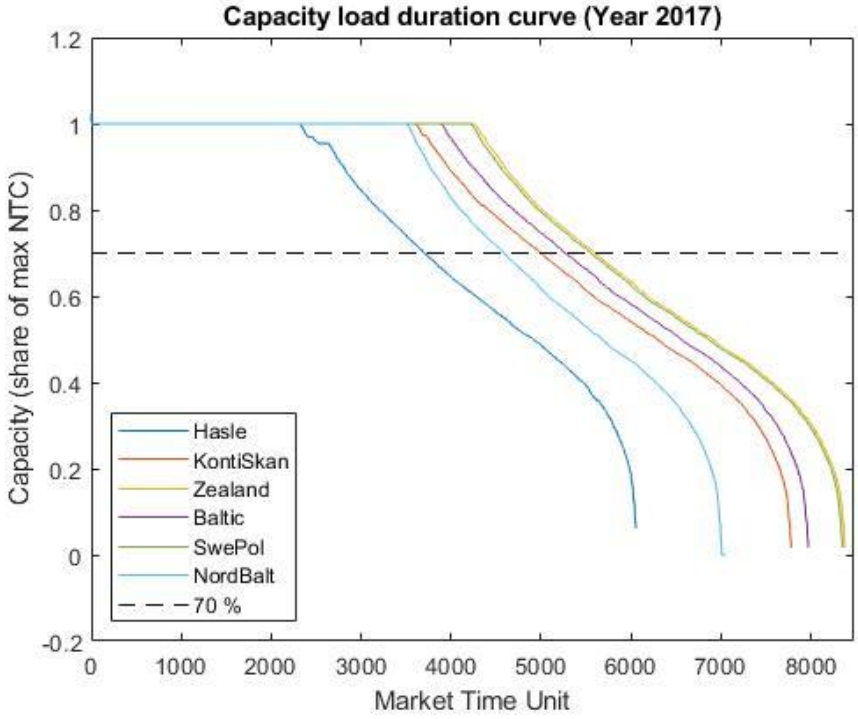

Figure 11. Capacity load duration curve for all six interconnections for 2017 for all market time units in dataset 2.

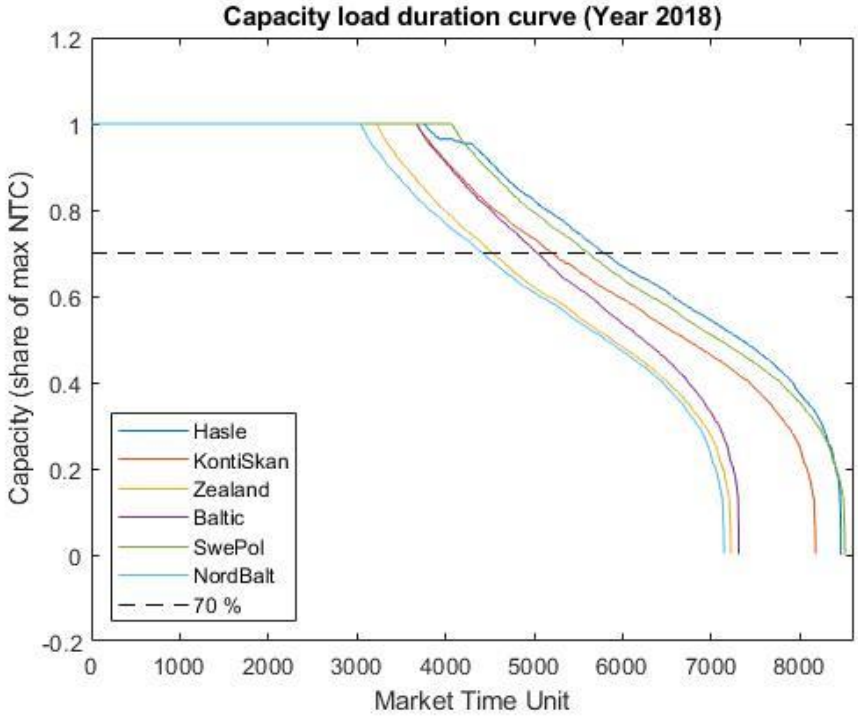

Figure 12. Capacity load duration curve for all six interconnections for 2018 for all market time units in dataset 2.

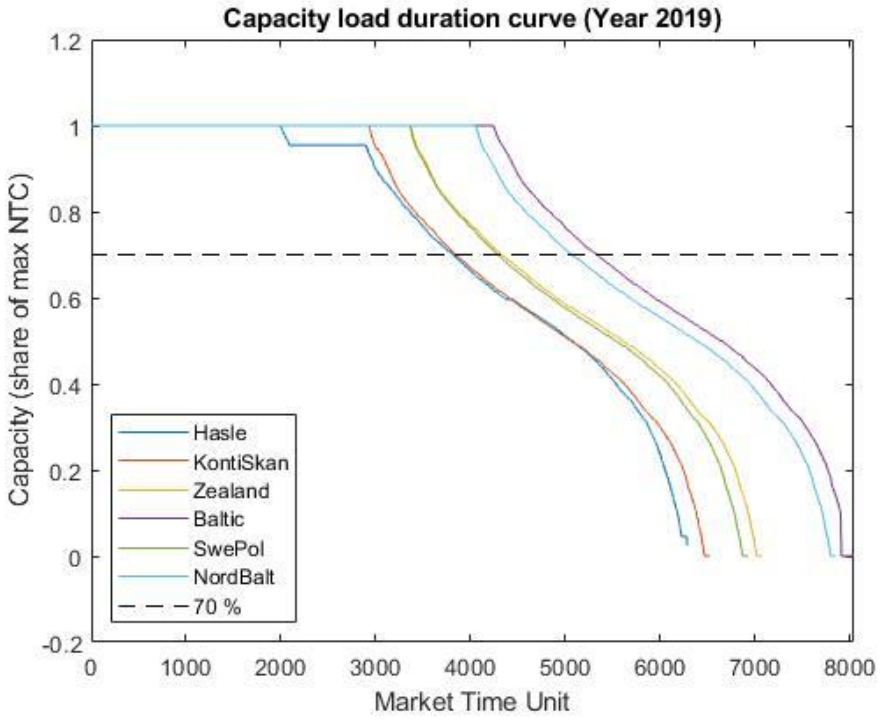

Figure 13. Capacity load duration curve for all six interconnections for 2019 for all market time units in dataset 2.

Capacity load duration curve for dataset 3, restrictions due to West Coast Corridor

Below is the capacity load duration curve for all six interconnections for year 2016, 2017, 2018 and 2019, which show the capacity (share of max NTC) for all market time units.

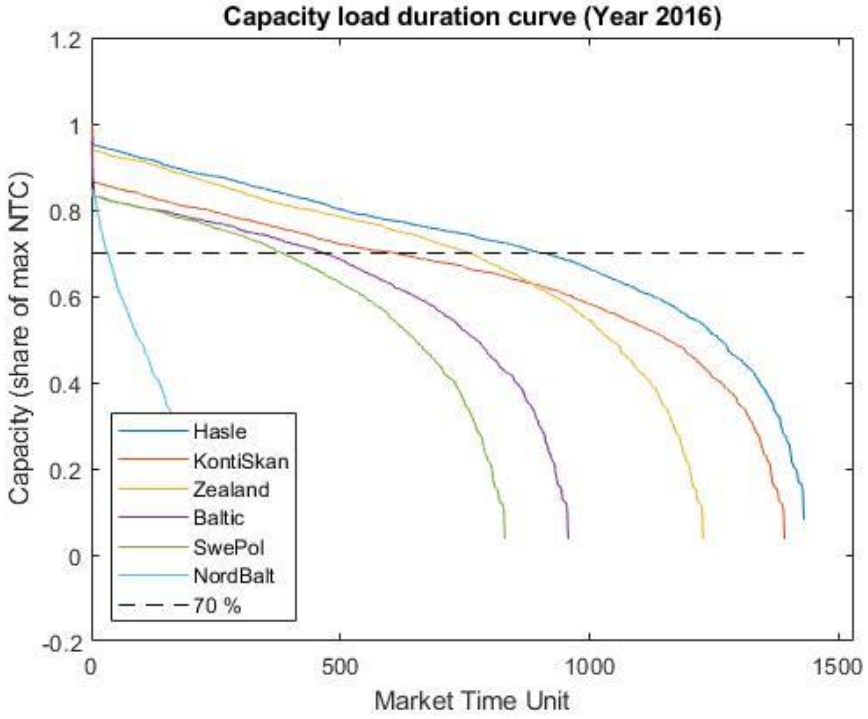

Figure 14. Capacity load duration curve for all six interconnections for 2016 for all market time units in dataset 3.

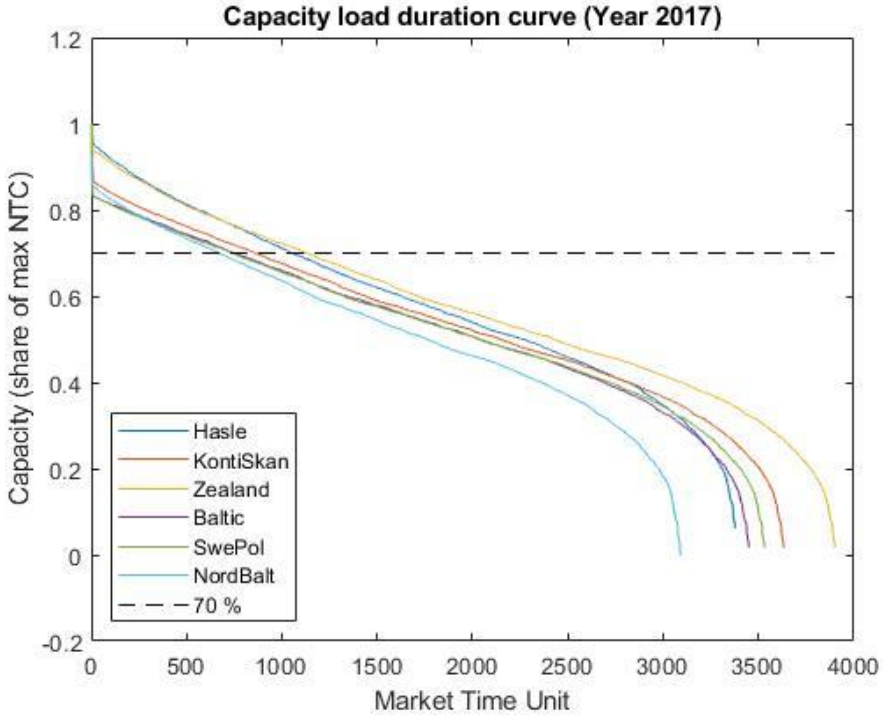

Figure 15. Capacity load duration curve for all six interconnections for 2017 for all market time units in dataset 3.

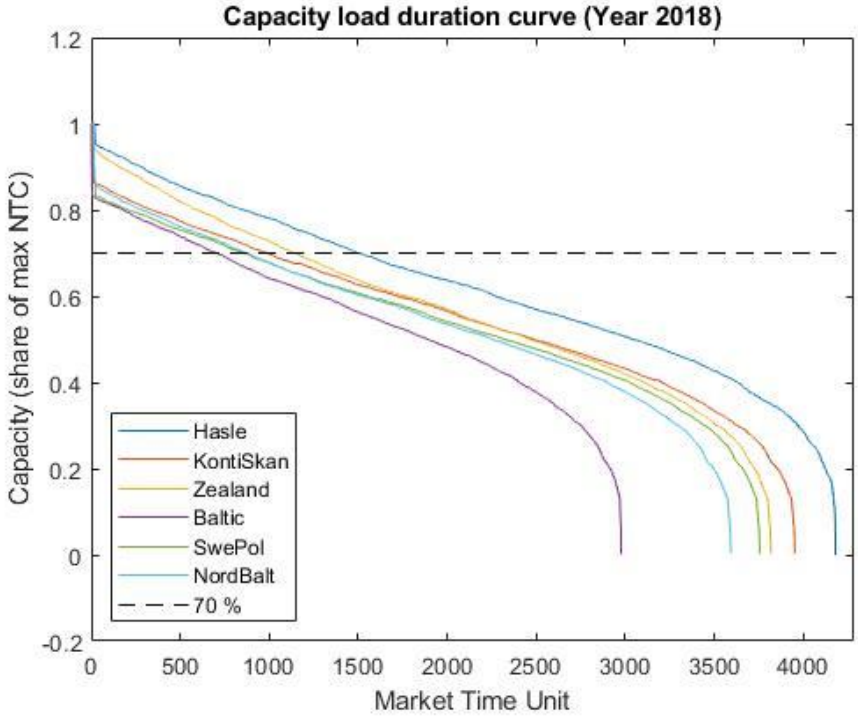

Figure 16. Capacity load duration curve for all six interconnections for 2018 for all market time units in dataset 3.

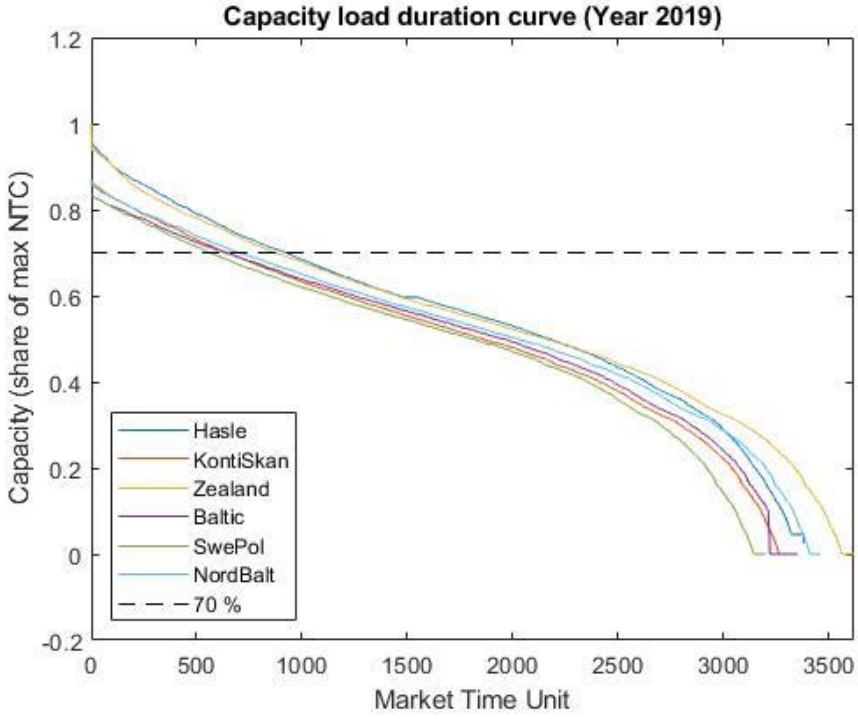

Figure 17. Capacity load duration curve for all six interconnections for 2019 for all market time units in dataset 3.

Average values

In the Figure 18 below the average values for dataset 1 (including all hours) are presented.

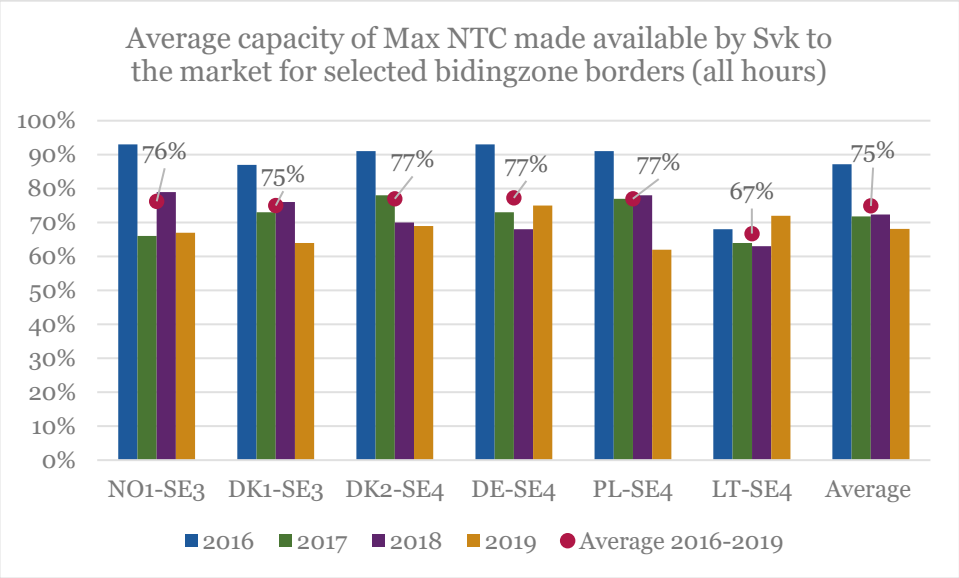

Figure 18: The average capacity made available to the market for the relevant interconnector considering all hours, dataset 1.

In the Figure 19 below the average values for dataset 2 (all hours without outages and with restrictions due to congestion in the WCC) are presented.

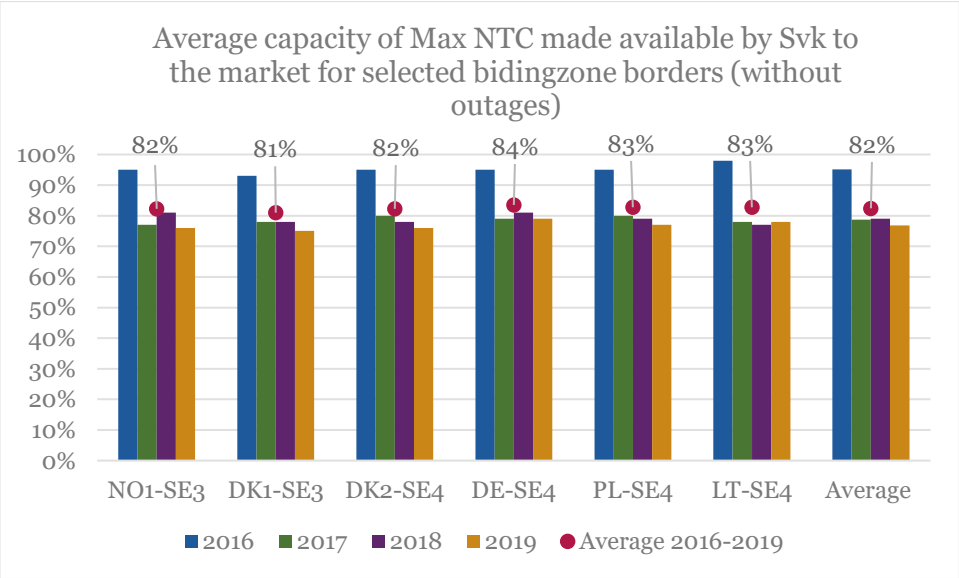

Figure 19: The average capacity made available to the market for the relevant interconnector considering hours with no outage and limitations due to the West Cost Corridor, dataset 2.

In the Figure 20 below the average values for dataset 3 (all hours with restrictions due to congestion in the WCC) are presented.

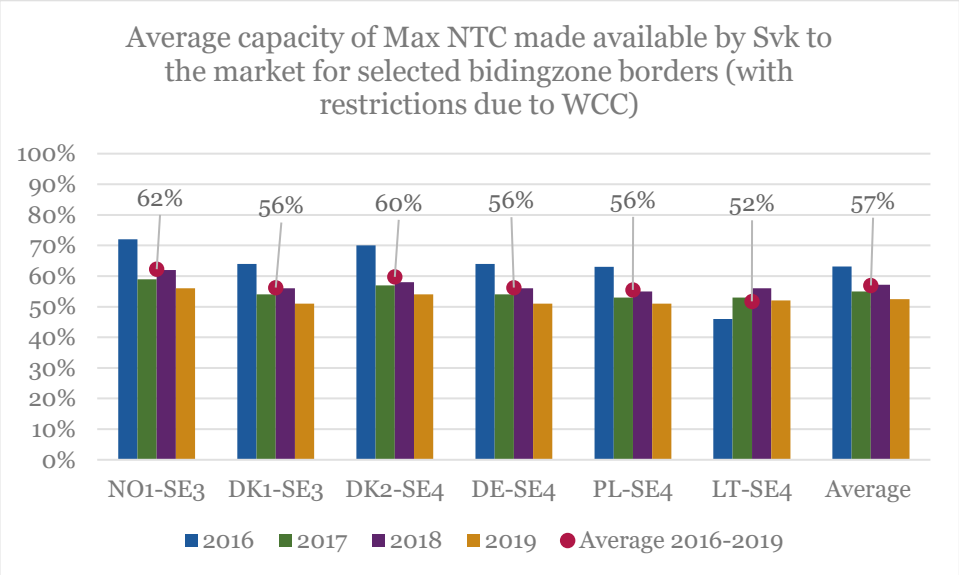

Figure 20: The average capacity made available to the market for the relevant interconnector considering hours with limitations due to the West Coast Corridor, dataset 3.

Share of hours under 70 percentage

The adoption of Regulation 2019/943 imposed a requirement for the TSO to make a minimum amount of the interconnector capacity available to the market. This minimum capacity requirement is 70%. In this section we present the result of the analysis regarding how Svenska kraftnät historically has met the requirement. The max NTC value which is used in the analysis is not equivalent to the 70%-requirement. However, this is the only comparable metric available. The results are therefore not definite, but give a good indication.

In Table 4 below the share of total hours where the capacity has been <70 % of max NTC is presented for 2016-2019 for dataset 1 (including all hours).

	NO1-SE3	DK1-SE3	DK2-SE4	DE-SE4	PL-SE4	LT-SE4
Share 2016	9 %	20 %	12 %	9 %	11 %	33 %
Share 2017	55 %	42 %	36 %	40 %	36 %	47 %
Share 2018	34 %	40 %	48 %	42 %	36 %	50 %
Share 2019	51 %	56 %	50 %	39 %	51 %	42 %
Share 2016-2019	33 %	34 %	32 %	30 %	28 %	43 %

Table 4. Share of total hours when the capacity has been <70 % of max NTC for dataset 1.

In Table 5 below the share of total hours where the capacity has been <70 % of max NTC is presented for 2016-2019 for dataset 2 (all hours without outages and with restrictions due to congestion in the WCC).

	NO1-SE3	DK1-SE3	DK2-SE4	DE-SE4	PL-SE4	LT-SE4
Share 2016	6 %	10 %	6 %	6 %	6 %	4 %
Share 2017	39 %	36 %	33 %	34 %	33 %	35 %
Share 2018	32 %	36 %	37 %	31 %	34 %	38 %
Share 2019	39 %	41 %	39 %	34 %	38 %	35 %
Share 2016-2019	26 %	27 %	25 %	24 %	24 %	26 %

Table 5. Share of total hours when the capacity has been <70 % of max NTC for dataset 2.

In Table 6 below the share of total hours where the capacity has been <70 % of max NTC is presented for 2016-2019 for dataset 3 (all hours with restrictions due to congestion in the WCC).

	NO1-SE3	DK1-SE3	DK2-SE4	DE-SE4	PL-SE4	LT-SE4
Share 2016	37 %	56 %	38 %	51 %	54 %	85 %
Share 2017	69 %	76 %	71 %	78 %	79 %	78 %

	NO1-SE3	DK1-SE3	DK2-SE4	DE-SE4	PL-SE4	LT-SE4
Share 2018	64 %	75 %	70 %	76 %	77 %	76 %
Share 2019	73 %	81 %	76 %	81 %	82 %	80 %
Share 2016-2019	57 %	69 %	60 %	68 %	70 %	80 %

Table 6. Share of total hours when the capacity has been <70 % of max NTC for dataset 3.

3. Summary

The analysis shows that on average the capacity made available to the market by Svenska kraftnät during 2016 to 2019 on the relevant interconnectors exceeds 67% considering all hours, see Figure 18. The average capacity metric doesn't give a comprehensive description of the situation.

For a large portion of the time Svenska kraftnät makes 100 % of the capacity available to the market for all interconnectors. However, for some hours no capacity is made available due to operational security reasons.

For 43 % of the hours the capacity on LT-SE4 interconnector is below 70% of Maximum NTC. For the remaining interconnectors there are fewer hours when capacity drops below 70% of Maximum NTC. For the PL-SE4 interconnector, which is the interconnector with most hours above 70%, the share of the time below 70% is 28%. To be able to reach the 70% threshold a combination of measures will be required to mitigate the operational security issue or as alternative tools to manage it.

The results of the analysis are therefore not definite, but give a good indication on the ability to meet the 70% requirement, defined in article 16(8) of regulation 2019/943.