JOINT DECLARATION MONITORING REPORT 2020

Date:
July 1, 2021

1. Introduction

The Danish Ministry of Energy, Utilities and Climate and the Federal Ministry of Economic Affairs and Energy of the Federal Republic of Germany together with the Danish Utility Regulator (DUR) and Bundesnetzagentur (BNetzA) have agreed on a Joint Declaration.

The Joint Declaration aims to gradually increase the capacity between Denmark West (DK1) and Germany (DE) available to the day-ahead market by securing a minimum of available hourly import and export capacity (referred to as minimum capacities) in each hour on the interconnector.

The Joint Declaration was launched on 3rd of July 2017 with a pilot phase lasting until the end of November 2017, and will until 2020 increase the minimum capacities in a stepwise approach, as figure 1 shows.

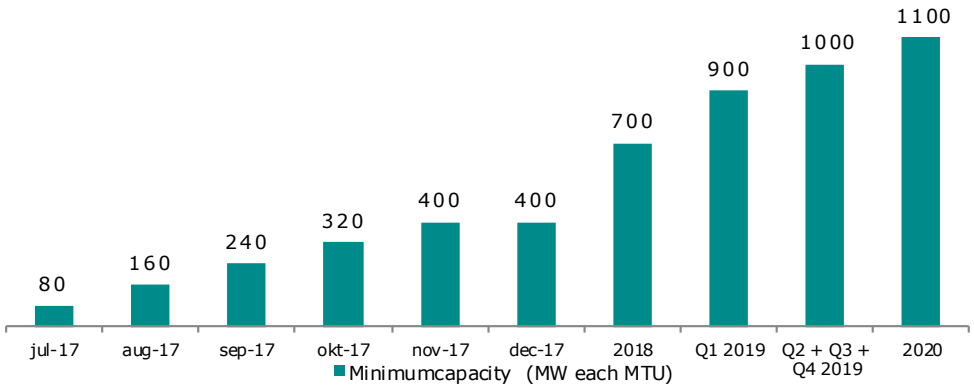

Figure 1: Minimum capacity (MW in every hour) following the Joint Declaration

Following the Joint Declaration, the TSOs Energinet and TenneT have sent their collected figures every quarter to the National Regulatory Authorities (NRAs) DUR and Bundesnetzagentur. The scope of this yearly monitoring report is to give an overview on the total costs incurred, deviations from the Joint Declaration, reasons for deviations, challenges during the operations and opportunities for improving the execution of this Agreement.

The report follows the outline of the monitoring report of 2019 and is supplemented with additional information requested by the NRAs as follows:

- Section 3: Describtion of the total level and cost of countertrade for 2020 and share of JD-countertrading.
- Section 4 and 5: Analysis of hourly level of countertrade assessing the sufficiency of supply for 2020.
- Section 6: Explaination of grid reenforcements and their effect on transmission capacity on the DK1-DE border in the coming years.

The Danish Ministry has on April 30th 2021 relieved Energinet of its legal obligations under the Joint Declaration, although it remains in effect as a political declaration. Due to this cost forecasts for 2021 has not been included in the report.

2. Scope of countertrade

For each hour TenneT and Energinet separately calculate the available Net Transfer Capacity (NTC) in both directions for the DK1-DE border. The capacity offered to the market is determined by whichever TSO calculates the lowest transmission capacity on its side. The TSOs have to respect a limitation set on capacity by each other, as the method is used to restrict the flow on the interconnector to a volume that does not endanger the other TSO's system security.

With the implementation of the minimum capacity requirements, the TSOs have to secure a day-ahead NTC at the same or at a higher level than the minimum capacity in each hour for both import and export capacities as specified in the Joint Declaration. The capacity to the day-ahead market is defined as the highest value of either the day-ahead NTC or the minimum capacity:

Day-ahead capacity = MAX(day-ahead NTC; minimum capacity)

Following this methodology, if one of the TSOs calculate an import and/or export NTC on the border for a given hour, which is lower than the level of minimum capacity specified in the Joint Declaration, the TSOs are obliged to disregard the calculated NTC value for the day-ahead market, and instead increase the capacity to the level specified in the Joint Declaration.

On the other hand, if the calculated NTC is higher than the level of minimum capacities, the Joint Declaration is disregarded, and the calculated higher NTC is released to the market.

The Joint Declaration covers both directions at the border, which implies that TenneT and Energinet will have to secure the minimum capacities in both the import and export direction.

The minimum capacity requirement applies only to the day-ahead market. Given the fact that minimum capacities are applied in situations where the internal grid cannot sustain the actual physical flow resulting from the day-ahead market, the minimum capacity flow cannot result in actual physical flow, but needs to be countertraded by the TSOs. The minimum capacities apply, when the reductions are caused by internal congestions, however, in hours with direct outages of the exact interconnectors between DK1-DE, the TSOs can disregard the minimum capacities.

Current measures used for countertrade are special regulation on the Danish side and trading on the continuous intraday market on the German side. These measures are described in detail in the report 'DK1-DE Countertrade Models Impact Assessment'[1]. The decision of Energinet to continue the use of special regulation beyond the pilot phase of the Joint Declaration has been based on a substantial stakeholder process and answers received as part of a public consultation in February/ March 2018.[2]

3. Amount of countertrade

The following figure shows the day-ahead capacity and day-ahead flow at the DK1-DE border.

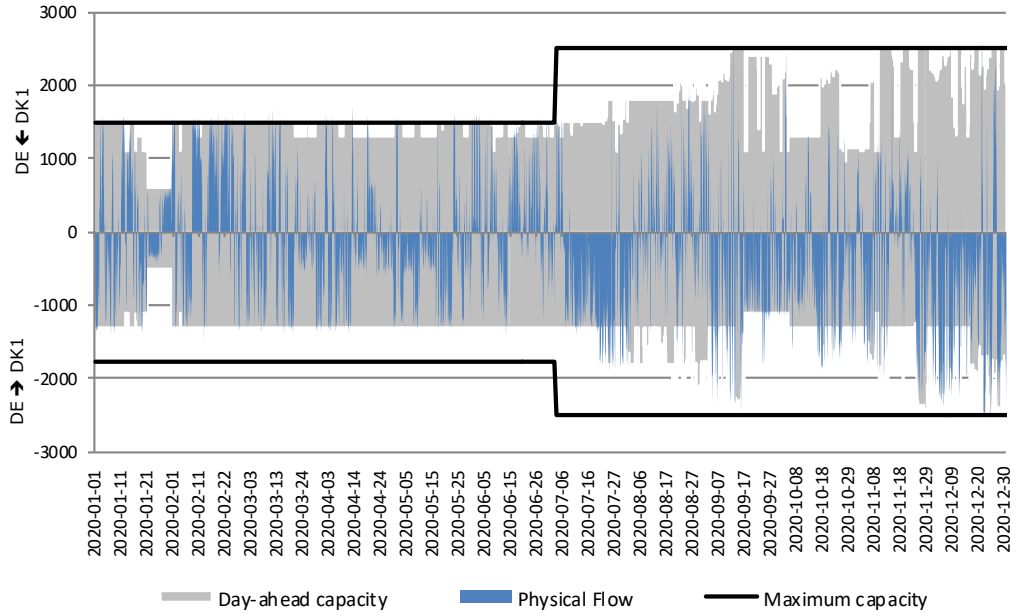

Figure 2: Day-ahead capacity and flow between Denmark West and Germany, MWh/h.

As can be seen in the figure there were a few hours where day-ahead capacity has been below the minimum capacity. This was due to maintenance on the exact interconnectors between DK1-DE:

- In 226 hours from the 22nd of January to the 31st of January 2020, Energinet reduced the day-ahead capacity below the minimum capacity, respectively to 500 and 600 MW in the import and export direction on the DK1-DE border. Further, on the 28th of October 2020 in 9 hours, Energinet reduced the export capacity to 960 MW. By approval of DUR, Energinet can limit the capacity below the minimum capacities specified in the Joint Declaration if the cross-border interconnectors on DK1-DE are out for maintenance, as decided by the Danish Energy Agency and Danish Utility Regulator. In the period with reduced capacity, Energinet was doing construction work on the 400 kV station in Kassoe[3]. Q2 and Q3 had no periods with reduced capacity below the minimum capacity.

[1] Available at: https://www.tennet.eu/news/detail/publication-of-dk1-de-countertrade-models-impact-assessment/ and https://en.energinet.dk/About-our-news/News/2017/12/01/Energinet-and-TenneT-publish-final-impact-assessment-of-different-countertrade-models-for-DK1-DE

[2] Available at: https://en.energinet.dk/About-our-news/News/2018/04/23/Published-consultation-report

[3] https://umm.nordpoolgroup.com/#/messages/08fcf4b8-7a8f-407c-9172-17284b946fa8/5 https://umm.nordpoolgroup.com/#/messages/286fc8c9-d256-474f-84a9-d0434d3aea9b/9

The following table shows the general overview of the use of countertrade according to the Joint Declaration in 2020.

2020	Hours with countertrade	Countertrade as of total hours per month	Countertrade following Joint Declaration (MWh)
Jan	516	69%	248,274
Feb	374	56%	268,579
Mar	346	47%	220,155
Apr	429	60%	291,982
May	329	44%	228,269
Jun	89	12%	41,153
Jul	219	29%	127,095
Aug	89	12%	55,659
Sep	66	9%	40,317
Oct	379	51%	178,029
Nov	291	40%	259,815
Dec	272	37%	193,426

Table 1: Overview of countertrade following Joint Declaration.

The following table shows the costs of the Joint Declaration by Energinet and TenneT for 2020.

2020	Costs in Denmark West (EUR)	Costs in TenneT area (EUR)	Total costs (EUR)
Jan	1,194,973	9,069,319	10,264,292
Feb	4,308,826	7,420,178	11,729,004
Mar	3,404,300	4,924,648	8,328,948
Apr	3,785,347	6,694,201	10,479,549
May	2,629,866	4,607,907	7,237,773
Jun	1,628,939	940,211	2,569,150
Jul	2,739,184	3,437,448	6,176,632
Aug	770,641	1,449,140	2,219,781
Sep	297,652	1,430,232	1,727,885
Oct	-115,623	6,240,651	6,125,028
Nov	6,996,853	8,723,350	15,720,203
Dec	2,338,518	8,629,624	10,968,142

Table 2: Countertrade following Joint Declaration costs for Energinet and TenneT (negative numbers indicate revenues).

The following table shows the total requested amounts from TenneT split according to netting, downward- and upward regulation. The costs of special regulation towards TenneT are included in the table as well.

2020	Requested volumes of downward regulation for special regulation (MWh)	Requested volumes for upward regulation for special regulation (MWh)	Imbalance netting (MWh)	Cost for downward regulation and netting towards TenneT (EUR)	Cost for upward regulation and netting towards TenneT (EUR)
Jan	*588,519*	*0*	*126,801*	*3,543,226*	*0*
Feb	*612,407*	*810*	*119,944*	*9,883,119*	*47,649*
Mar	*359,844*	*7,972*	*53,212*	*6,146,849*	*90,861*
Apr	*404,486*	*23,156*	*116,483*	*5,884,785*	*1,219,120*
May	*266,325*	*795*	*68,807*	*3,270,278*	*47,935*
Jun	*75,054*	*14,289*	*10,336*	*1,917,368*	*2,029,260*
Jul	*186,148*	*1,430*	*26,190*	*4,485,307*	*62,540*
Aug	*82,133*	*3,802*	*20,086*	*1,142,243*	*283,228*
Sep	*97,114*	*4,440*	*17,235*	*496,752*	*331,201*
Oct	*306,980*	*0*	*119,488*	*1,151,949*	*0*
Nov	*496,463*	*3,867*	*89,263*	*12,664,871*	*71,259*
Dec	*404,088*	*0*	*79,067*	*5,342,501*	*0*

Table 3: Requested volume, imbalance netting and cost for special regulation and netting towards TenneT

The total costs of TenneT's up- and downward regulation in Germany can only be determined based on additional assumptions since they are often embedded in (multilateral) redispatch measures. As such a direction relation between up- and downward regulation and attribution of costs is not directly possible. The total downward regulation requests of 3.9 TWh are part of nearly a thousand remedial actions of about 5.7 TWh. 2.9 TWh have a directly corresponding trade at the power exchange, while the rest is part of redispatch measures. In absence of a direct link between downward regulation in DK1 and the upward regulation of a power plant, a proportionate allocation of costs was applied to indicate the total costs of upward regulation in Germany corresponding to the 3.9 TWh downward regulations in DK1. The total costs of upward regulation in Germany of the year 2020 amount to 152 M Euro including 95.7 M Euro direct costs (exchange trades) and 56.6 M Euro indirect costs (proportionate share of redispatch measures). The total costs of downward regulation in Germany of the year 2020 amount to less than one millon Euro.

The following figure shows the total volumes of requested downward regulation from TenneT, split according to countertrade following Joint Declaration and other countertrade.

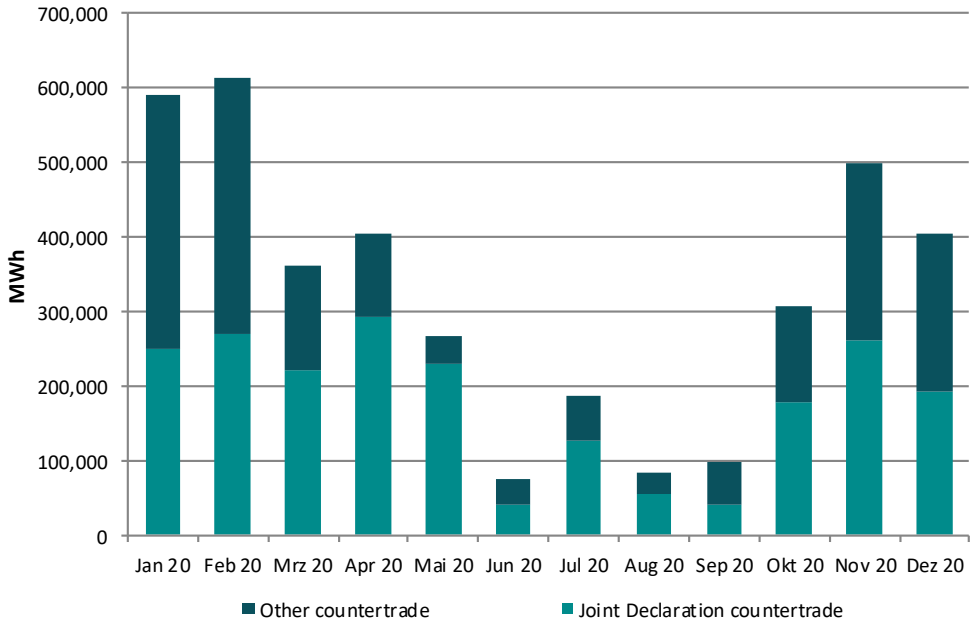

Figure 3: Total requested downward regulation (handled by netting or special downward regulation) for the purpose of Joint Declaration countertrade and other countertrades[4].

4. Impact of countertrading on the German intraday market

4.1 General

The German intraday market consists of two sub-markets, the opening auction and the subsequent continuous trading session. In the opening auction all bids are cleared in a single step. By contrast, continuous trading is a first come, first served market where, during a period of several hours, trades are executed as soon as a bid matching an existing bid is entered by a market participant. As TenneT performs trading for the above-mentioned purpose exclusively in the continuous trading session, and in order to avoid an underestimation of its impact on the intraday market, the present monitoring focuses on the continuous trading. Theoretically, it would be appealing to analyse the impact of TenneT's trades on the intraday market by comparing the actual historical market outcome with a fictitious alternative outcome that would have occurred without the countertrading activities. However, it is not feasible in practice to determine this counterfactual outcome, for reasons set out in the following.

Firstly, removing TenneT's activities from the continuous intraday market and simulating the then different fictitious market result would not be enough to describe the counterfactual situation. This is because market participants may have anticipated the need for countertrading and consequently adjusted their bidding behaviour on the earlier market stages, i.e. day-ahead and/or intraday opening auction. Yet it is not feasible to separate such potential adjustment activity from the overall bidding behaviour on these market stages.

[4] Other countertrades refer to any other requests from TenneT for up- or downward regulation besides the countertrading of Joint Declaration capacity. This includes countertrades over a German power exchange as well as redispatch measures for any other purpose than the Joint Declaration.

Secondly, even the isolated (and thus incomplete) simulation of the alternative outcome of the continuous intraday market without TenneT's trades is infeasible. This is not only because also in this market stage the bidding behaviour of other participants may have been influenced by their anticipation of the countertrading. Even more generally, the nature of continuous trading prevents such simulation: Since each pair of matching bids is cleared separately and instantly, the market situation and price evolve in the course of the trading session, as market participants learn about executed trades and about the evolution of the "external" situation (materialising of renewable injection forecast errors, unplanned power plant outages, etc.). There are neither sufficient data nor models available to simulate how the multitude of individual actions and decisions throughout the remaining trading session would have been altered if some bid (by TenneT) had not been placed.

On the backdrop of the above considerations, the following analysis is exclusively based on actual historical market data and abstains from simulating fictitious counterfactuals.

4.2 Observations for 2020

The following figure shows the volume of TenneT's trades in relation to the total continuous intraday trading volume in the German-Luxembourgian bidding zone in hourly resolution. TenneT conducted trades under the Joint Declaration (JD) in 38 % of all hours, with a maximum share in total volume of 43 %. The average share during hours with TenneT trades for the JD was 11.1 %, while the average share across all hours of the year was 4.2 %. Counting total TenneT trades between DE and DK1 for safeguarding transmission capacity (for the JD and beyond), 43 % of all hours were affected with a maximum share in total volume of 48 %. The average share during hours with TenneT trades for JD+other was 12.8 %, while the average share across all hours of the year was 5.5 %.

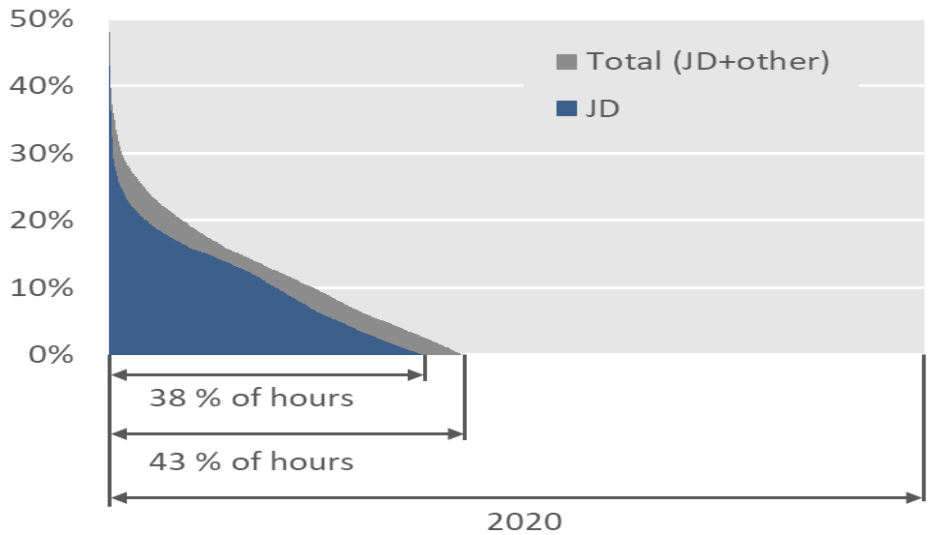

Figure 4: Hourly share of TenneT countertrading volume between DE and DK1 (insofar as applied for safeguarding cross-border transmission capacity) in continuous intraday trading volume (sorted)

The impact of TenneT's trades on the market prices is analysed by comparing day-ahead to intraday[5] prices and setting the difference between these in relation to the volume of TenneT's trades with DK1.

[5] Volume weighted prices of all successful trades per delivery hour; trades for 15 and 30 minutes periods weighted by ¼ and ½, respectively. Block bids are excluded, but believed to be of little significance (based on evaluation of 2019 data).

When focusing on trades under the Joint Declaration (JD), the analysis yields a positive correlation with a correlation coefficient of 0.10 across all hours with JD countertrading. This finding is underpinned by the – albeit moderate – positive slope of the red regression straight in the following figure: The more countertrading was conducted in direction from DE to DK1, i.e. the more energy TenneT bought in the German bidding zone, the higher the intraday price was relative to the day-ahead price for the same delivery hour.

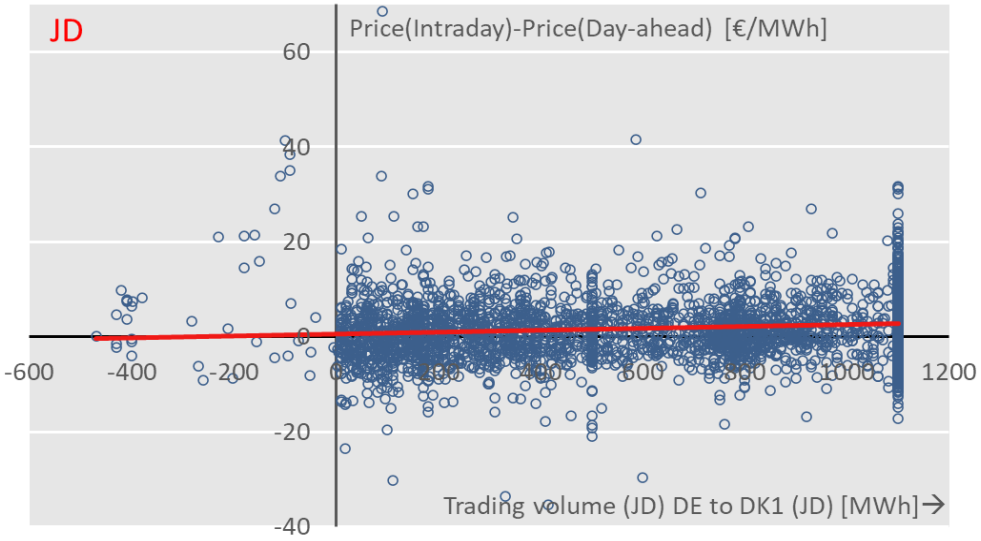

Figure 5: Relation between price difference (intraday vs. day-ahead) and countertrading volume (only for JD) for hours with such countertrading. Positive volume denotes buying in DE and selling in DK1.

The findings are accentuated even stronger when evaluating the total of trades for safeguarding cross-border transmission capacity (JD+other). The correlation coefficient rises to 0.15 across all hours of such countertrading, and in the following figure the slope of the red regression straight is higher than in the previous figure. This increase of the correlation between trade volumes and price difference is plausible because a larger share of trades with influence on the intraday price is taken into account.

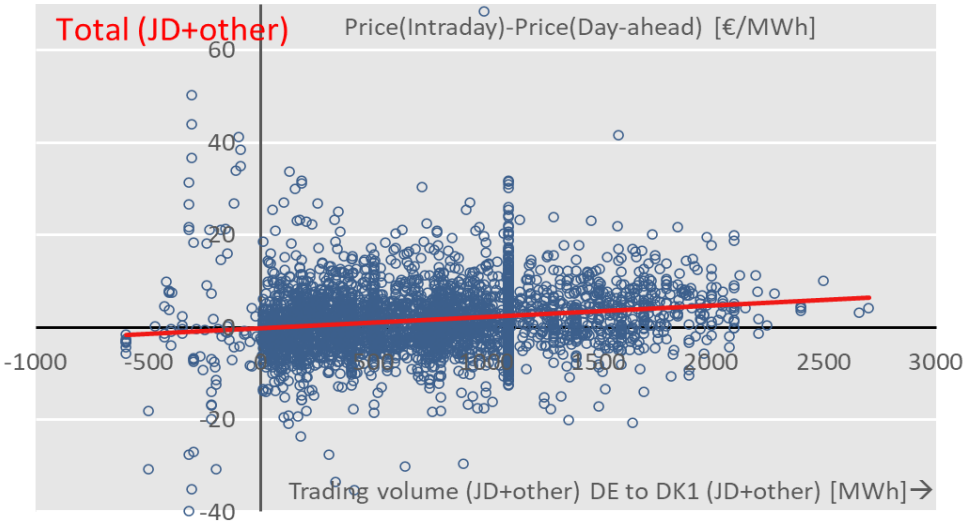

Figure 6: Relation between price difference (intraday vs. day-ahead) and trading volume (JD+other) for hours with countertrading. Positive volume denotes buying in DE and selling in DK1.

4.3 Comparison with 2018

Compared to 2018 and 2019, the frequency and, to a larger extent, the relative volume share of countertrading for safeguarding cross-border transmission capacity between DK1 and DE have further increased in 2020 (cf. Table 4). At the same time the correlation coefficient between countertrading volume and the difference between day-ahead (DA) and intraday (ID) prices has decreased as long as only trades related to the JD are considered. When taking into account total trades (JD+other), it is slightly higher than in 2019, but still significantly lower than in 2018.

	2018 (JD)	2019 (JD)	2020 (JD)	2020 (JD+other)
Frequency of countertrading for safeguarding transmission capacity [% of hours]	17.5 %	35 %	38 %	43 %
Average share of countertrading in continuous intraday trading volume [% during hours with countertrading]	6.5 %	8.4 %	11.1 %	12.8 %
Correlation coefficient between countertrading volume and DA-ID price difference	0.25	0.12	0.10	0.15

Table 4: Comparison of frequency and volume of countertrading between 2018, 2019 and 2020

Considering only static market conditions, one would tend to expect that a larger volume share of countertrading would yield an increase in the market price differences. However, the observed development is contrary to this. A possible explanation is that market participants over time have become more successful in their attempts to anticipate the TSOs' countertrading behaviour. This would support the rational expectation that market participants forecast the need for countertrade and make use of arbitrage between the day-ahead and intraday time frames. As a consequence, the day-ahead price spread between DK1 and DE would not be (solely) based on the transmission capacity available in the day-ahead market, but already tend to be related to the physical transmission capacity. The more this is the case, the less "surprising" the occurrence of countertrading is on any given day, and the less the intraday price differs from the day-ahead price. From 2019 to 2020 (regarding only JD for consistency) the development was smaller than the year before, which might indicate a saturation of the learning curve.

5. Special regulation in Denmark West

The following table provides an overview of the total volume of bids in the regulating power market in Denmark West. Please notice, that the volumes in the following table are not split according to countertrade conducted due to the Joint Declaration, regular countertrade towards TenneT or use of special regulation towards the Nordic, as Energinet is not able to make this split in the data.

2020	Offered bids of upward regulation (MWh)	Offered bids of downward regulation (MWh)	Activated bids of upward regulation for balancing (MWh)	Activated bids of downward regulation for balancing (MWh)	Requested volumes of down-ward regulation for special regulation towards TenneT (MWh)	Requested volumes for up-ward regulation for special regulation towards TenneT (MWh)
Jan	674,888	1,542,406	2,310	1,006	588,519	0
Feb	650,470	1,403,624	9,333	11,757	612,407	810
Mar	734,688	1,208,148	16,531	13,813	359,844	7,972
Apr	623,192	972,317	11,156	9,030	404,486	23,156
May	613,897	946,263	10,685	3,507	266,325	795
Jun	388,273	550,814	9,325	2,444	75,054	14,289
Jul	449,508	906,365	8,584	6,620	186,148	1,430
Aug	418,496	534,255	4,900	728	82,133	3,802
Sep	411,743	780,693	9,341	1,665	97,114	4,440
Oct	419,616	977,474	7,031	2,172	306,980	0
Nov	550,264	1,132,720	5,970	6,466	496,463	3,867
Dec	547,730	1,264,254	11,316	7,762	404,088	0

Table 5: Volume of offered and activated bids in the regulating power market in Denmark West. Note: Special regulation is total request MWh from TenneT.

The volume of bids is higher during the winter and spring season, as the demand for regulating power is higher these months, and more capacity is available due to higher heat production. The regulating volume bids are first and foremost reserved for balancing of the Nordic system, however if there are additional bids available, these can be used for special regulation towards TenneT.

The following duration curve shows the liquidity of the regulating power market in DK1, and the percentage use of offered upward and downward regulation. The curve is not split according to the use for special regulation or balancing.

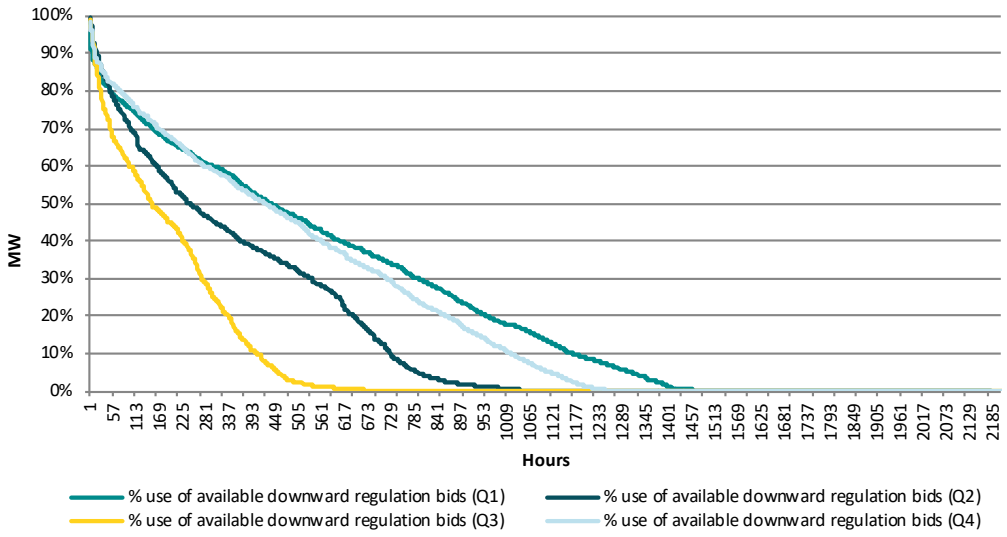

Figure 7: Duration curve of % use of offered downward regulation in DK1

The figure shows that in 49 hours in Q1, 47 hours in Q2, 25 hours in Q3 and 74 hours in Q4 Energinet activated over 80 % of all offered downward regulation in DK1, however the highest use of activated bids were 99,5 % in a single hour. The figure also shows that in almost 700 hours in Q1, more than 1100 hours in Q2, more than 1500 hours in Q3 and almost 1000 hours in Q4 none of the offered downward regulation in DK1 were used.

The following figure shows the duration curve for upward regulation in DK1.

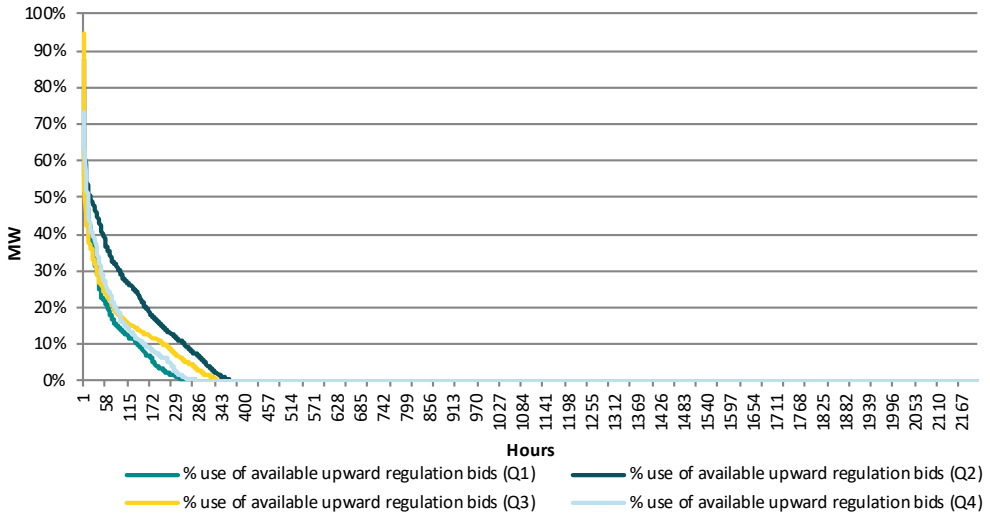

Figure 8: Duration curve of % use of offered upward regulation in DK1

From 3 July 2020 to 31 August 2020 Energinet was unable to assist Tennet with countertrade when upward regulation was needed in DK1. This was a result of many planned outages of thermal power plants and HVDC connection outages due to faults. Outages combined with the fact that countertrade is done in a national Danish special regulation market led to lack of generation adequacy, i.e. sufficient generation to cover consumption could not be ensured. During 2020 none of the downward regulation requests have been rejected.

The requested volumes of down- and upward regulation towards TenneT reflect the amount requested from TenneT, whereas the activated volumes might differ. This is due to the

imbalance netting procedure. Imbalance netting is the process agreed between TSOs that allow for the avoidance of simultaneous activation of balancing power, i.e. mFRR, in opposite directions by taking the respective and adjacent area control imbalances into account, in order to maximize social economic welfare[6].

The following table shows the activated volumes of special regulation in Denmark West, and specifies the source of the downward regulation, i.e. if the downward regulation is delivered by production, wind or consumption. Please notice, that the following volumes are not split according to countertrade conducted due to the Joint Declaration, regular countertrade towards Tennet or use of special regulation towards the Nordic, as Energinet is not able to make this split in the data.

2020	Activated volumes of downward regulation (MWh)	Delivered by			Activated volumes of upward regulation (MWh)	Delivered by		
		Wind	Consumption	Production		Wind	Consumption	Production
Jan	461,718	26%	21%	53%	1,972	0%	0%	100%
Feb	492,464	44%	20%	36%	2,789	0%	0%	100%
Mar	306,633	44%	18%	38%	3,501	0%	1,1%	98,9%
Apr	288,003	43%	19%	38%	18,143	0,1%	0,2%	99,7%
May	197,519	48%	12%	40%	2,474	1,5%	0%	98,5%
Jun	64,718	71%	7%	22%	14,615	0%	0%	100%
Jul	159,958	75%	10%	15%	1,004	0%	0%	100%
Aug	62,047	77%	13%	10%	7,711	0%	0%	100%
Sep	79,879	74%	10%	16%	1,440	0%	0%	100%
Oct	187,492	45%	18%	37%	1,097	0%	0%	100%
Nov	407,200	62%	11%	27%	4,361	0%	0%	100%
Dec	325,021	38%	20%	42%	1,321	0%	0%	100%

Table 6: Activated volumes of special regulation, split by source.

6. Status on grid development

Grid extensions directly related to the DK1-DE border include the Kassø-Dollern project (on Energinet's side called "Eastcoast Line" and on TenneT's side called "Middle Axis") and the Endrup-Brunsbüttel extension (called "West Coast Line"). The following two sections include a short description and progress for both project. Subsequently a general outlook on available transmission capacity is provided.

[6] See description in Energinet and TenneT common Impact Assessment

6.1 Kassø-Dollern (Energinet: Eastcoast Line; TenneT: Middle Axis)

The table below shows the different project sections, their size and status.

Section	Responsible TSO	Total route length [km]	Realised rout length [km]	Status/Planned commissioning
Dollern - Elbekreuzung	TenneT	10	10	In operation
Elbekreuzung – Hamburg/Nord	TenneT	35	30	In operation
Hamburg/Nord – Audorf	TenneT	70	70	In operation
Audorf - Flensburg-Handewitt	TenneT	70	70	In operation
Flensburg-Handewitt – DK/GER border	TenneT	10	10	In operation
DK/GER border – Kassø	Energinet	30	30	In operation

Table 7: Status of the project Kassø-Dollern.

The project Kassø-Dollern was successfully completed in 2020 with the commissioning of all sections in July 2020. After trial operation and some planned outages to allow for last ground works and decommissioning of the 220kV lines, the new setup is in full operation since October 2020. With the completion of the project the congestions within Schleswig-Holstein were mainly resolved.

6.2 Endrup-Brunsbüttel (West Coast Line)

The table below shows the different project sections, their size and status.

Section	Responsible TSO	Total route length [km]	Realised route length [km]	Status/Planned commissioning
Brunsbüttel - Süderdonn	TenneT	14	14	In operation
Süderdonn – Heide	TenneT	23	23	In operation
Heide – Husum	TenneT	46	39	2021
Husum – Klixbüll	TenneT	38	7	2022
Klixbüll – DK/GER border	TenneT	16	0	2023
DK/GER border – Endrup	Energinet	75	0	2023

Table 8: Status of the project Endrup-Brunsbüttel

The project is in the permitting phase in both Germany and Denmark. Overhead line construction work in Germany will commence from Q1 2022, while overhead line and underground cable construction work in Denmark will start in Q2 2022. Commissioning is planned for end of 2023.

6.3 Outlook on available net transmission capacity (NTC) of the border DE-DK1

With the commissioning of the East Coast Line and prospectively the West Coast Line in the year 2023 the minimum capacity requirements will further increase according to article 16 of regulation (EU) 2019/943 in conjunction with the German Action Plan and TenneT's Commitment until they will reach their maximum by the year 2026. Despite the decommissioning of the nuclear power plant Brokdorf, which will free-up transmission capacity to the south, temporary congestions might still occur at the meeting point of the flows from the norther interconnectors. Until a more substantial relief of the congestions will be achieved by the internal HVDC connections SüdLink and B-Korridor as well as other internal grid reinforcement measures after the year 2025.