European Network of Transmission System Operators for Electricity

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CAPACITY CALCULATION REGIONS ASSESSMENT REPORT

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Executive summary

This report addresses the ACER decision 04/2019 on the Amendment of the determination of CCRs from 1 April 2019. According to the amendment the TSOs shall analyse the optimal determination of CCRs with regard to Hansa and Channel CCRs. All TSOs shall submit a proposal for amendment of determination of those CCRs, accompanied by a document assessing the possible alternatives for the bidding zone borders of the Hansa and Channel CCR. If the analysis shows that no change of the Hansa and Channel CCRs is needed, all TSOs shall submit to the regulatory authorities the analysis without a proposal for amendment of the determination of the CCRs.

The analysis of the Hansa and Channel CCRs aims to:

1) Reassess whether assigning the DK1-NL and the DK1-DE/LU bidding zone borders to the CCR Core is indeed and optimal solution as ACER currently understands,
2) Assess the optimal determination of CCRs regarding other bidding zone borders of the Hansa and Channel CCRs, which are currently expected to create a significant level of unscheduled allocated flows in the Core CCR.

This report concludes that the current structure of CCR Hansa and CCR Channel are the most optimal structure for ensuring the progress in the current implementation of the flow-based methodologies and other regional methodologies in CCR Core and CCR Nordic in the short-term. The report concludes that any other CCR configuration will interfere with the implementation of the CCM(s) and other regional methodologies such as redispatching and countertrading, long-term capacity calculation etc.

On longer term, the development of the capacity calculation methodologies will give significant changes – both in terms of the calculations and in the coordination. It is expected that with the full implementation of the methodologies, the data quality and the coordination will improve. Evaluating the level of unscheduled flows should be done considering the implemented methodologies.

The TSOs cannot accurately demonstrate the impact of unscheduled flows in the adjacent regions caused by a shift of the borders in CCR Channel and CCR Hansa into either CCR Nordic or CCR Core. When feasible the appropriate solution is the implementation of AHC, as it provides a solution to the problem of unscheduled flows, but it's implementation should be investigated. The use of AHC is proposed in CCR Core methodology and implemented in CCR Nordic.

All TSOs suggest that the implementation of AHC is evaluated in CCR Core as indicated in ACERs decision (02/2019) within 18 months after the implementation of the day-ahead capacity calculation methodology. If AHC cannot reduce the unscheduled flows, then all-TSOs shall consider a possible CCR reconfiguration in the longer run.

1. Introduction

According to ACER Decision on the Amendment of the determination of CCRs from 1st April 2019: Annex I, Article 6:

"No later than 18 months after the entry into force of this Second Amendment, all TSOs shall analyse the optimal determination of CCRs with regard to Hansa and Channel CCRs and submit a proposal for the amendment of the determination of those CCRs in accordance with Article 9(13) of the CACM Regulation. This proposal shall be accompanied by a document assessing the possible alternatives for the bidding zone borders of the Hansa and Channel CCR. If this analysis shows that no change of the Hansa and Channel CCRs is needed, all TSOs shall submit to the regulatory authorities the analysis without a proposal for amendment of the determination of the CCRs.

The proposal shall include:

- *The reassignment of the Hansa bidding zone borders DK1-NL and DK1-DE/LU to the Core CCR, unless proven in the supporting document that placing these two borders in another CCR is more efficient;*
- *based on the analysis in the supporting document, the potential reassignment of the other Hansa and Channel CCR bidding zone borders to the Core or Nordic CCR without impacting other CCRs; and an implementation timeline for the proposed amendments."*

The scope of this project has a long-term perspective and does not interfere with the implementation of NC/GLs. According to ACERs decision, the proposal should consider the impact on the implementation of capacity calculation methodologies within the other CCRs.

2. Problem definition

As written in their decision from April 2019, ACER recognizes the main guiding principle for deciding on the assignment of borders in CCRs stems from point 3.1 of Annex I to Regulation (EC) No 714/2009, which states that;

"*in cases where commercial exchanges between two countries (TSOs) are expected to affect physical flow conditions in any third country (TSO) significantly, congestion-management methods shall be coordinated between all the TSOs so affected through a common congestion-management procedure*".

Further, ACER argues that this requirement from Regulation (EC) No 714/2009 necessitates that all bidding zone borders having significant mutual physical impact should be assigned to the same CCR while only a set of bidding zone border can be established in separate CCRs. For this, ACER argues that the principle is contribution to the objectives of optimizing the calculation and allocation of cross-zonal capacity (Article 3(d) of CACM regulation) and ensuring optimal use of the transmission infrastructure (Article 3(b) of the CACM regulation) since it ensures that the impact a bidding zone border will have on bidding zones outside a CCR to which is assigned, is minimized. This is because exchanges on bidding zone borders outside its CCR, which, in turn, reduce the optimality of cross-zonal capacity calculation and allocation and the efficient use of infrastructure.

Further to this key criterion for deciding on the optimal assignment of new bidding zone borders to CCRs, other considerations may also be considered, and ACER refers to a short-term consideration – the impact on existing implementation projects and initiatives that need to be implemented in such CCRs.

In this second proposal for amendment, ACER is of the opinion that the TSOs do not provide supporting evidence with regard to the assessment of the criteria above, i.e. effect on third-country physical flow (CCR Core), nor the impact of the alternative solution, e.g. to assign the new border to the Core CCR.

From here, ACER describes two problems:

- Physical impact on CCR Core
- Impact on existing implementation project and initiatives

2.2. Physical impact on CCR Core

ACER understands that a new interconnector between the Netherlands and Denmark establishes a strong interdependency of the following three bidding zone borders; DK1-DE/LU, DE/LU-NL and DK1-NL. The understanding is, that cross-zonal exchanges on the DK1-NL border may automatically create physical flow over the DK1-DE/LU and DE/LU-NL as they are connected via alternative current (AC) interconnectors and as they are part of the same synchronous area. Since DE/LU-NL is dependent on other bidding zone borders in CCR Core, ACER understands that the optimal solution would be to assign the three borders to CCR Core. In contrast it is not considered that the assignment of these three borders to CCR Hansa will have a significant impact on the bidding zone borders of the Hansa and Nordic CCRs.

Further in the Agency's understanding that alternatives to avoid negative impacts of unscheduled allocated flows could be either:

i) The reassignment of bidding zone borders, and
ii) The implementation of Advanced Hybrid Coupling (AHC).

2.3. Impact on existing implementation projects and initiatives

The assignment of the DK1-NL bidding zone border and the reassignment of the DK1-DE/LU border to CCR Core will, in ACERs opinion, interfere with the already ongoing implementation projects and initiatives and risk delaying these, since CCR Core aims to apply the flow-based capacity calculation approach. These projects are important for the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union (Article 3(g) of the CACM Regulation).

It is due this consideration, that ACER finds it reasonable that the new DK1-NL bidding zone border is assigned to CCR Hansa.

3. Task of the TSOs

ACER introduces a new Article 6 of the Second Amendment, which establishes a process for evaluating and establish an optimal solution for the determination of the CCRs. This process aims to:

1) Reassess whether assigning the DK1-NL and the DK1-DE/LU bidding zone borders to the CCR Core is indeed and optimal solution as ACER currently understands,
2) Assess the optimal determination of CCRs regarding other bidding zone borders of the Hansa and Channel CCRs, which are currently expected to create a significant level of unscheduled allocated flows in the Core CCR.

According to Article 6(1), no later than 18 months after the entry into force of the amendment, all TSOS shall analyse the optimal determination of CCRs regarding Hansa and Channel CCRs.

This article specifies that the TSOs shall, based on the analysis, access if changes to the Hansa and Channel CCR is needed, however if the analysis shows that no change of the two CCRs is needed, all TSOs shall submit the analysis without a proposal for amendments of the determination of the CCRs.

Further, Article 6(2) specifies that the analysis shall include:

a) a description of the possible alternatives for minimizing the unscheduled flows in the neighboring Core and Nordic CCRs due to the interconnectors in Hansa and Channel CCRs;
b) a qualitative assessment of the implementation time and effort of the described alternatives; and
c) a qualitative assessment of the operational efforts of the described alternatives; and
d) identification of changes needed to the determination of CCRs for minimizing the unscheduled allocated flows in the neighboring CCRs of the Core and Nordic CCR due to interconnectors in Hansa and Channel CCRs.

If the TSOs submits a proposal for amendments of the determination of the CCRs, article 6(3) specifies that this proposal shall include:

a) the reassignment of the Hansa bidding zone borders DK1-NL and DK1-DE/LU to the Core CCR, unless proven in the supporting document that placing these two borders in another CCR is more efficient;
b) based on the analysis in the supporting document, the potential reassignment of the other Hansa and Channel CCR bidding zone borders to the Core and Nordic CCR without impacting other CCRs; and
c) an implementation timeline for the proposed amendments.

To have a common understanding of the physical impact on CCR Core, the following sections provides a description of the unscheduled flows, the typology of the CCR Hansa and Channel borders, and how the unscheduled flows from adjacent regions are considered by the TSOs in each CCR.

4. Unscheduled flows

The main concern raised by ACER is the risk of unscheduled flows, and the concern that the commercial exchanges between two countries are expected to affect physical flow conditions in any third country significantly. Especially the NL-DE/LU border is mentioned to be physically impacted by the flows on DK1-DE/LU and DK1-NL, however the borders in CCR Channel are also considered by ACER to result in unscheduled flows.

The following describes the definition of different flows, and how the TSOs understands the unscheduled flows to be addressed by this analysis.

Firstly, it has to be recognized that there are transactions *within* a bidding zone and transaction *between* bidding zones. Inherently zonal markets models foresee different treatment of internal and cross-zonal transactions.

It is worthwhile to consider the implications of commercial transactions on different types of physical flows[1]:

[1] *Definitions are based on ACER-ENTSO-E,* Joint Task Force Cross Border Redispatch Flow Definitions, 2011

- Internal flows: Physical power flows observed on network elements within a bidding zone caused by commercial energy transaction within this zone.
- Import/export flows: Physical power flows in particular bidding zone caused by scheduled commercial energy export/import transaction from one bidding zone to neighboring bidding zone;
- Loop flows: physical power flows in one bidding zone caused by internal commercial energy transactions within another bidding zone;
- Transit flows: physical flows in one bidding zone caused by commercial energy exports and imports transactions between other bidding zones.

It is important to highlight, that all kinds of physical power flows occur at the same time. Every commercial energy transaction will be physically realized by power flows scattered over the interconnected power systems according to the physical laws.

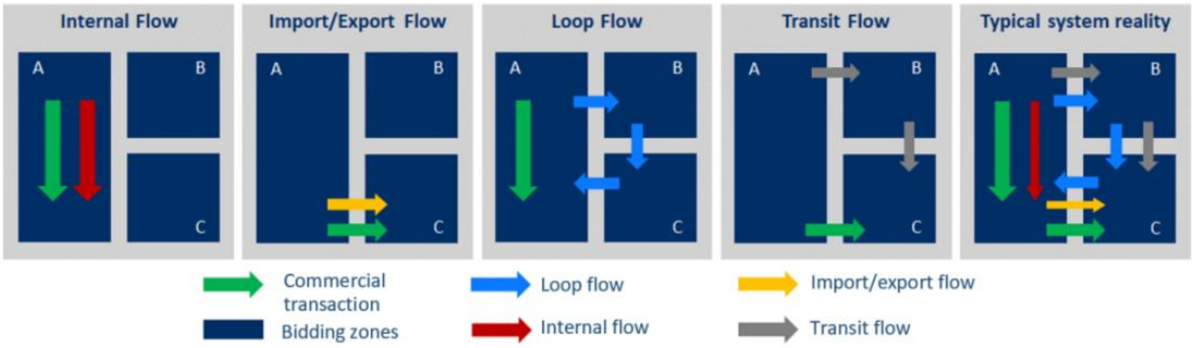

Figure 1 Physical power flow categories resulting from different commercial energy transactions.

Transit flows can be scheduled or unscheduled, where the difference is the level of coordination during capacity calculation and allocation. To diminish the level of unscheduled flow, higher level of coordination and the introduction of flow-based for several bidding zones can to a high degree limit the occurrence of these unscheduled transit flows.

It is critical to implement the flow-based capacity calculation methodologies proposed and approved by the CCRs for all of Europe in terms of handling the unscheduled flows and the loop-flows in the meshed AC-grid.

For the purpose of unscheduled flows in this analysis, a clear distinction between unscheduled flows at the border and in the AC-grid must be made. The below sections with the typologies of CCR Hansa and CCR Channel borders, these borders cannot lead to unscheduled flows between the bidding zones of their respective CCR.

For this analysis, it is understood that the unscheduled flows that needs to be addressed are the flows arising in the meshed AC-grid of CCR Core due to commercial flows from adjacent regions.

4.1. Typology of Channel borders

The Channel CCR interconnectors between Great Britain and continental Europe are HVDC, and are described in the following table:

Interconnector	Border	Connection	MW	In operation

		points		
IFA	GB-FR	Selingde – Les Mandarins	2000	Yes
IFA 2	GB-FR	Chilling – Tourbe	1000	From 2020
ElecLink	GB-FR	Sellingde – Les Mandarins	1000	From 2020
BritNed	GB-NL	Grain – Massvlaakte	1000	Yes
NemoLink	GB-BE	Richborough - Herdesbrug	1000	Yes

Table 1: CCR Channel HVDC interconnectors

Given that all borders in CCR Channel are HVDC, they can be considred as radial curcuits and are not leading to any unscheduled flows on the Channel bidding zone borders.

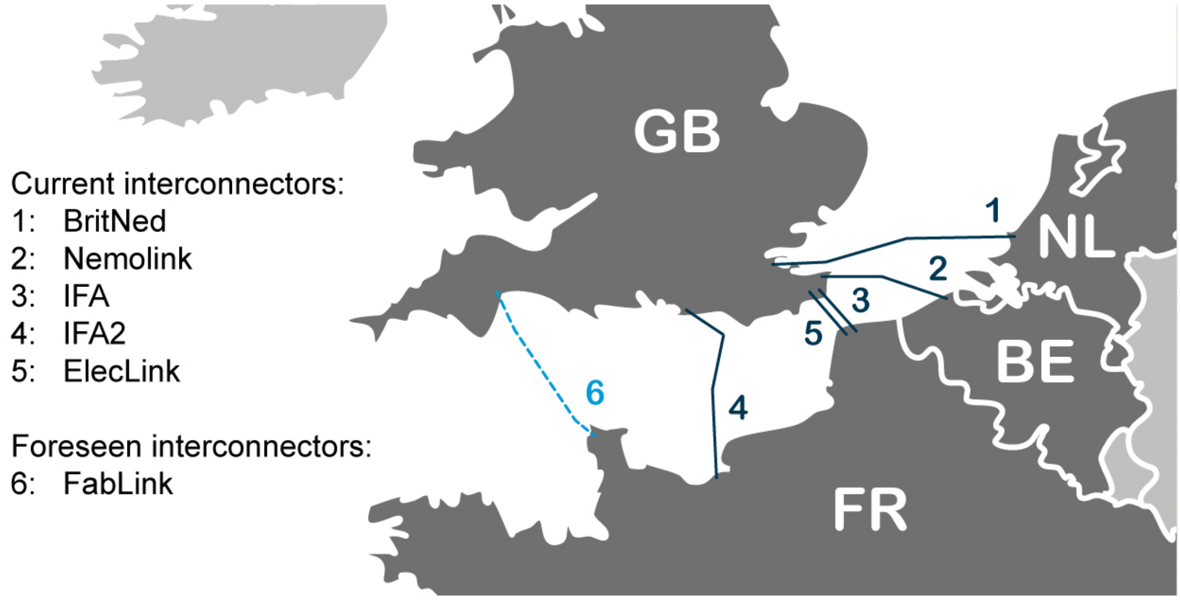

Figure 2: CCR Channel borders and interconnectors

4.2. Typology of Hansa borders

CCR Hansa represents the bidding zone borders connecting the Nordics to continental Europe. The borders are primarily operated by HVDC interconnectors, with two exceptions. The border DK2-DE/LU partly consists of the DC interconnector "Kontek" and partly by the Krigers Flak Combined Grid Solution. Additionally, the border DK1-DE/LU is an AC-border, however it is considered radial, as will be further described in section 4.2.1.

As all borders are considered radial, no unscheduled flows or loop flows can occur at the borders.

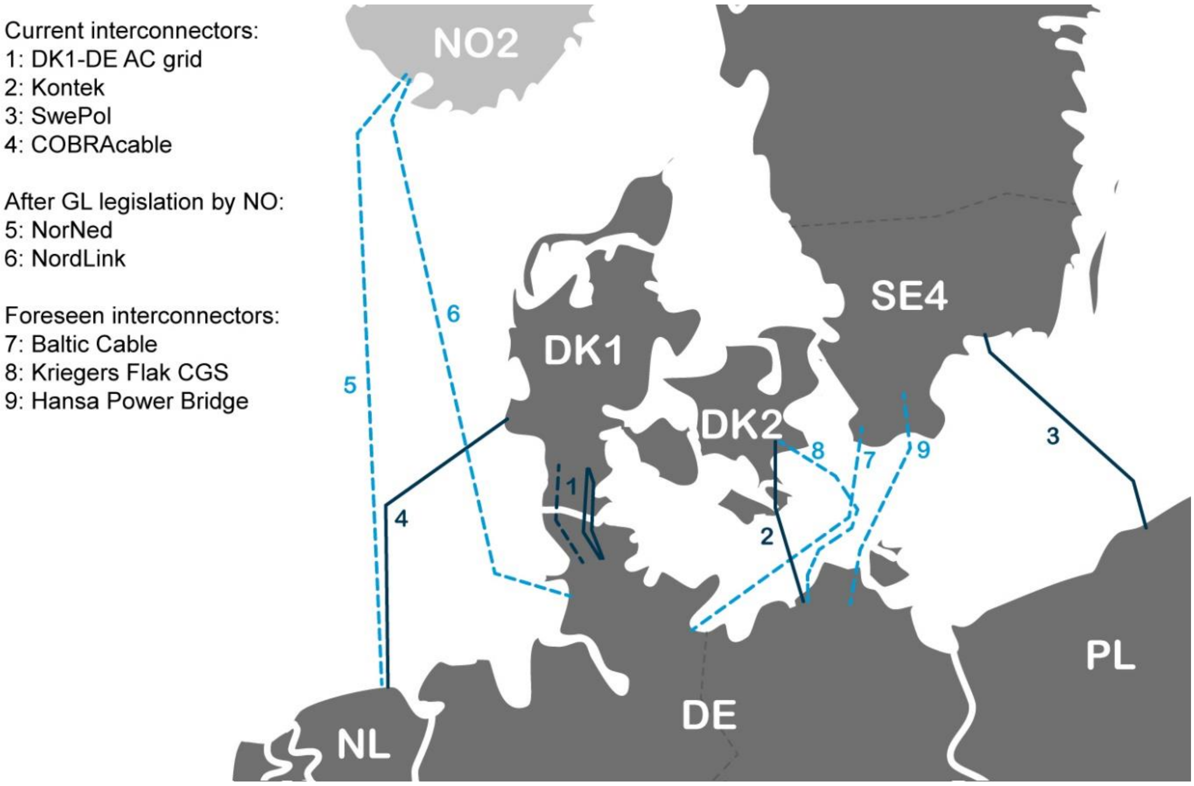

Figure 3: CCR Hansa borders and interconnectors

4.2.1. The DK1-DE/LU border

To understand the capacity calculation methodologies and the related regional methodologies for remedial actions, it is important to know the current topology of the AC border, which is shown in the below figure.

At present, there are two phase-shifting transformers placed in Denmark at the substations where the 220kV lines (green lines in map) connects. The aim of these is to equalize the distribution of flows between the 400 kV (red lines in map) and 220kV lines, to ensure the 220kV are not overloaded in operation. The 220kV lines will in 2020 be updated graded to 400kV and connect from "Kassø" instead of "Ensted", making the original 400kV and the 400Kv as replacement for the 220kV fully parallel (Eastcoast Project). The 150kV line from Ensted in Denmark and Flensburg in Germany is only a supply line, as there is no transfer capability between the bidding zones of DK1 and DE on this line.

Together with TenneT, Energinet expect to expand the trading capacity between Denmark and Germany by connecting the German and Danish part of the West Coast Line (not drafted in the map). On Danish side, Energinet will build a new double circuit 400kV overhead line from Endrup to the Danish-German border into Niebüll in Germany. The line is expected in operation in 2023.

Figure 4 Gridmap of the AC border between DK1 and DE/LU, ENTSO-E Grid Map 2019

There is no synchronous connection from DK1 to DK2 or Scandinavia. DK1 is only connected with AC lines to the German grid. This means that all exchanges between DK1 and DE have to flow from Kassø to Audorf.

Since both cross-border connections are connected to the substations Kassø in Denmark and Audorf in Germany, the DK1-DE/LU border is considered radial and no unscheduled flows can occur. A radial interconnection is to be understood as a direct connection from A to B with no alternative paths. In an electricity system this means there are no unscheduled flows across other parts of the grid.

Due to the typology of the border, no unscheduled flows can occur at the border, nor is it affected by the flows at the COBRA cable (DK1-NL). This implies that any unscheduled flows only can occur in the meshed AC grid in CCR Core.

4.3. Unscheduled flows in the AC-grid

As also written in section 4, the nature of the electricity grid is the physical flows, and the challenge is to correctly address the unscheduled flows. The higher level of coordination and the introduction of flow-based for several bidding zones can to a high degree limit the occurrence of these unscheduled transit flows.

Splitting of the AC grid capacity between CCRs has also been part of the TSOs implementation of the CCMs on bidding-zone borders, as also specified in CACM article 21(1)(b)(vii), which has already been incorporated by the TSOs in the methodologies. Following CACM article 21(1)(b)(vii), where the power flows on critical network elements are influenced by cross-zonal power exchanges in different CCRs, the CCRs shall establish rules for sharing power flow capabilities of critical network elements among different capacity calculation regions in order to accommodate these flows. In this methodology that correctly shall address the risk of unscheduled flow.

In the Nordic, flows from adjacent CCRs are managed using AHC. The CCM for CCR Nordic Article 10(7) states that:

"HVDC interconnections and AC interconnections between CCRs shall be managed by the advanced hybrid coupling, i.e. PTDF and RAM will be applied to the Nordic access mode of those connections, where the Nordic access node shall be a virtual bidding zone."

On April 20, 2020, the Nordic TSOs submitted an amended Nordic DA/ID CCM to the NRAs. The DA/ID CCM has been aligned to the ACER decision on the Nordic LT CCM (ACER decision 16-2019). The amended DA/ID CCM now mentions in Article 18 (Rules for sharing the power flow capabilities of CNECs among different CCRs):

"*1. To take into account the impact of exchanges in neighbouring CCRs on the CNECs and combined dynamic constraints within the Nordic CCR, the CCC shall calculate the cross-zonal exchanges or cross-zonal capacities on the bidding zone borders of these neighbouring CCRs by performing all steps in day-ahead and intraday calculation by assuming that bidding zone borders of neighbouring CCRs are part of the Nordic CCR and thereby the impact of exchanges on bidding zone borders outside the Nordic CCR on the CNECs within the Nordic CCR shall be calculated as well.*

2. The flow-based parameters calculated for bidding zone borders outside the Nordic CCR shall be part of the final flow-based parameters as referred to in Article 19(4).

3. The CCC shall submit flow-based parameters or the ATC values in case of the transitional solution pursuant to Article 20, calculated for bidding zone borders of neighbouring CCRs to the CCCs of these CCRs. The flow-based parameters or the ATC values may limit capacity allocation on the bidding zone borders of those CCRs if such limitations are allowed within the day-ahead and intraday CCM governing capacity calculation within those CCRs."

The introduction of AHC in CCR Core is subject to further analysis. In ACERs decision by the 02/2019 on the Core CCRs TSOs' proposal for the regional design of the day-ahead and intraday common capacity calculation methodology, article 13(1) it is stated that:

"Where critical network elements within the Core CCR are also impacted by electricity exchanges outside the Core CCR, the Core TSOs shall take such impact into account with a standard hybrid coupling (SHC) and where possible also with an "advanced hybrid coupling" (AHC)."

Further, article 13(4) states that:

"No later than eighteen months after the implementation of this methodology in accordance with Article 28(3), the Core TSOs shall jointly develop a proposal for the implementation of the AHC and submit it by the same deadline to all Core regulatory authorities as a proposal of this amendment of this methodology in accordance with Article 9(13) if the CACM regulation. The proposal for the implementation of AHC shall aim to reduce the volume of unscheduled allocated flows on the CNECs of the Core CCR resulting from electricity exchanges of the bidding zones borders of adjacent CCRs."

Lastly, article 14(5) states that:

"Until AHC is implemented, the Core TSOs shall monitor the accuracy of non-Core exchanges in the CGM. The Core TSOs shall report in the annual report to all Core regulatory authorities the accuracy of such forecast."

As also recognised in this requirement in the ACER decision on Core CCRs proposal, the TSOs will prepare an analysis of the introduction of the AHC. As also will be elaborated in section 5.1, the introduction of AHC in CCR Core will have practical implication, which will have to be reflected in the implementation timelines.

The CCR Hansa capacity calculation methodology for day-ahead and intraday article 17(1) suggest that only the interconnectors are taken into account. This implies that none of these elements or their power flow capabilities of Critical Network Elements, are shared between CCR Hansa bidding zone borders, following

CACM Regulation Article 21(1)(b)(vi), or between CCR Hansa and other CCR bidding zone borders in accordance with CACM regulation Article 21(1)(b)(vii).

In terms of the affected AC grid, all CCR configurations lead to risk of unscheduled flows if these are not correctly addressed in the capacity calculation methodology. This implies that merging the borders of CCR Hansa and CCR Channel, would shift the issue of unscheduled flows in the AC grid to other areas.

All TSOs recognise that any unscheduled flow in the meshed AC grid arising from adjacent CCRs shall firstly be addressed and diminished by the introduction of AHC. If this proves to be inefficient, then a possible CCR reconfiguration can be analysed.

4.4. Uncertainty about the level of unscheduled allocated flows

The transition of the capacity calculation methodologies will give significant changes – both in terms of the calculations and in the coordination. It is expected that with the full implementation of the methodologies, the data quality and the coordination will improve. Evaluating the level of unscheduled flows should be done considering the implemented methodologies.

It is perceived that the initial step of implementing SHC at CCR Core CCM can result in unscheduled flows in the AC-grid due to the prioritization of the flows form CCR Hansa and CCR Channel borders, however at present it is not possible to accurately assess the extent – qualitative nor quantitatively.

The risk exists as long as the CCR Core CCM implies the use of SHC, however as written in the above section, any CCR configuration leads to the risk of unscheduled flows until the implementation of AHC. This was also recognized by ACER in their decision 04/2019.

The TSOs are not of the same opinion as ACER about the magnitude of the unscheduled allocated flows in CCR Core, nor that the unscheduled flows will be less in CCR Nordic/CCR Hansa, if DK1-DE/LU and DK1-NL are reallocated to CCR Core, than if the borders are kept in CCR Hansa or moved to CCR Nordic. Especially keeping in mind that the DK1-DE/LU border, being a radial AC-interconnector, the problem of unscheduled flows in the adjacent grid in CCR Core, would be the same, but merely moved to the DK1 bidding zone, if DK1-DE/LU and DK1-NL are moved into CCR Core.

Currently, the NTC at the DK1-DE/LU and DK1-NL are respectively 1500/1780 MW and 700MW.

Compared, the CCR Core including DK1-DE/LU and DK1-NL would have to handle flows from DK1-DK2 (600MW), DK1-NO2 (1632MW), DK1-SE3 (715MW) all three HVDC interconnectors with combined 2947 MW, which all has to, with the introduction of CCR Core Flow based and standard hybrid coupling, be prioritized in the AC grid of DK1.

This would imply that, in order to manage the unscheduled flows possibly arising from these HVDCs in the limited AC grid of DK1, the capacity on the DK1-DE/LU and DK1-NL border will possibly be affected – just as also argued by ACER on the DE-NL border currently.

Hence, from this viewpoint, the reconfiguration does not lead the TSOs to consider a move from the DK1-DE/LU and DK1-NL borders into to CCR Core will cause less unscheduled flows, however, shift the issues of unscheduled flows from one border to another.

Figure 5: Gridmap of the border between DK1 and NL – the Cobra cable

Capacity Calculation Methodologies in CCRs will affect each other, and it is therefore more appropriate to address the issue with the introduction of Advanced Hybrid Coupling, even thus it is not being implemented in CCR Core CCM in the first step.

5. Alternative for minimising the unscheduled allocated flows

5.1. Advanced Hybrid Coupling

Hybrid coupling stands for the combined use of flow-based and Available Transmission Capacity (ATC) constraints in one single allocation mechanism[2]. There are two types of hybrid coupling: Standard Hybrid Coupling (SHC) and Advanced Hybrid Coupling (AHC).

Advanced Hybrid Coupling ensures that the bidding-zone borders within that CCR and in the adjacent CCRs are treated equally, implying that the power flows of the borders of CCR Hansa and CCR Channel are competing for the scarce capacity of the AC grid in CCR Core, like any other exchanges from any other Core bidding zone borders.

As the CCR reconfiguration will result in new unscheduled flows from adjacent CCRs, the optimal solution for addressing the problem is the implementation of AHC in each flow-based CCM. This is also proposed by the CCR Core and CCR Nordic, and the foreseen implementation timelines are described in the next section.

[2] *C. Müller, A. Hoffrichter, H. Barrios, A. Schwarz, A. Schnettler:* Integration of HVDC-Links into Flow-Based Market Coupling: Standard Hybrid Market Coupling versus Advanced Hybrid Market Coupling, *CIGRE Symposium Dublin, May/June 2017*

The application of AHC in Core CCR imposes the Core CCR constraints on bidding zone border which are not part of the capacity calculation process. Both Core and non-Core borders compete for the same capacity, hence there is no guarantee that non-Core borders will be allocated the maximum capacity. This does not only concern congestion close to the connection point of those interconnectors, but in principle any congestion in the Core CCR might reduce the allocated flow on the CCR Channel or CCR Hansa borders.

The application of AHC in one CCR also requires a re-evaluation of the different methodologies related to redispatching and countertrading and cost sharing, remedial action coordination and merging requirements. It also raises questions on how to deal with current flow based specific pre- and post-coupling processes (such as ATC for fall back determination).

Finally, there will be a non-negligible impact on the performance of the market coupling algorithm.

5.1.1. Implementation of day-ahead and intraday capacity calculation methodologies in CCR Nordic

The latest amendment to the CCR Nordic day-ahead and intraday Capacity Calculation Methodology was approved on the 19th of December 2019. A new amendment has been submitted to the NRAs on April 20, 2020.

The TSOs in the Nordic CCR will implement the flow-based methodology for the day-ahead market and intraday market. Until the single intraday coupling in accordance with Article 51 of the CACM Regulation is able to support the allocation of cross-zonal capacities based on flow-based parameters, the CCC shall transform the final flow-based parameters into available transmission capacity ('ATC') values on bidding zone borders of the Nordic CCR and bidding zone borders of neighbouring CCRs.

The solution will include the use of AHC on borders where Nordic bidding zones are connected through HVDC interconnectors from go-live of the day-ahead flow-based methodology. AHC will also be available for external borders from the same date.

The present implementation plan foresees start of internal parallel runs for Q3 2020, and external parallel runs from Q4 2020. Go-live is planned for Q4 2021.

5.1.2. Implementation of day-ahead and intraday capacity calculation methodologies in CCR Core

The Core CCR day-ahead and intraday CCM was decided on the 21st of February 2019 by ACER (ACER decision.

The TSOs in the Core CCR will implement a flow-based methodology for the day-ahead market and the intraday market and submit for intraday ATCs extracted from a flow-based domain, until the XBID system can handle flow-based parameters.

For the handling of internal HVDC interconnectors, the Core CCM will be using evolved flow-based[3], and SHC for external borders. However, as written in section 4.3, within 18 months the Core CCR TSOs will

[3] *Evolved Flow based is different from AHC. AHC imposes the capacity constraints of one CCR on the cross-zonal exchanges of another CCR by considering the impact of exchanges between two CCRs, e.g. the influence of exchanges of a bidding zone which is part of a CCR applying a CNTC approach is taken into account in a bidding*

develop a proposal for the implementation of the AHC, with the appropriate implementation plan. The proposal for the implementation of AHC will aim to reduce the volume of unscheduled allocated flows on the CNECs of the Core CCR resulting from electricity exchanges of the bidding zones borders of adjacent CCRs.

Until the implementation of AHC, the accuracy of the forecasting of adjacent regions affect Core.

The current project planning foresees an implementation of the day-ahead CCM by 30th of September 2021 including an internal and external parallel run. The implementation of the intraday CCM should follow one year later. The external parallel run is expected to have a duration of 6 months for both timeframes.

5.1.3. Implementation of day-ahead and intraday capacity calculation methodologies in CCR Hansa

The day-ahead and intraday capacity calculation methodology for CCR Hansa was approved by the regulators on the 16th of December 2018.

After the inclusion of DK1-NL, the day-ahead and intraday capacity calculation methodology has been submitted for approval at the Dutch regulator, ACM, and they have presently been granted a delay in the approval process until the 6th of September 2020.

The CCR Hansa TSOs will implement a CNTC methodology for both day-ahead and intraday capacity calculation methodologies.

The implementation of the CCR Hansa methodology, being a positioned between the flow-based methodology of CCR Core and CCR Nordic is highly affected by the implementation of these methodologies, and will continue to implement the methodology in a stepwise manner according to the implementation plan of CCR Nordic and CCR Core.

5.2. CCR reconfiguration

The main concern raised by the CCRs is the impact on the implementation projects of the flow-based methodologies being developed in CCR Core and CCR Nordic.

It has to be considered, that the inclusion of new bidding-zone border in a region would cause delays, firstly because of the perceived legal process of preparing an amendment to the already approved CCMs and for the approval by the relevant regulators.

As specified in CACM Article 20(2), the TSOs in the configured CCRs shall within 10 months submit a proposal for a common coordinated CCM within the respective region. Depending on the nature of the methodologies, the new TSOs in the respective CCRs will have to review the methodologies to secure that the methodology is compatible with the security operational limits and requirements from their system. A possible amendment will have to be prepared by the TSOs within 10 months.

Further to the preparation of a possible amendment, the approval process of the CCMs has to follow the requirements as specified in CACM Article 9. During this process, the TSOs will to the furthest extent continue the implementation, however, in case critical amendments have proposed, the TSOs will have to

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zone which is part of a CCR applying a flow-based approach. EFB takes into account commercial exchanges over the cross-border HVDC interconnector within a single CCR applying the flow-based method of that CCR.

await further implementation before a final decision of the amendment has been made – either by the relevant NRA or ACER.

Further to the possible delays caused by the legal process for the amendment to the methodology, the implementation of the methodology can also be delayed due to the IT-, and process implementation in the TSOs. It must be recognised, that even adopting the IT requirements and processes already prepared in the region, will require time for the newly added TSO to implemented. This is further critical, if all TSOs in the new region will have to adopt to new changes proposed in a possible amendment to the methodology.

It is the extent of the possible amendment to the methodology that will determine, if the implementation of the CCMs can be developed in step-wise and if some borders can go-live with the new CCM before other borders.

5.3. Optimal determination of CCRs

In terms of the physical impact, and as written in the above sections, it is not practically possible to make CCRs including all relevant borders and exclude others – the meshed AC grid will have to be divided between CCRs.

In the short-term, the TSOs suggest keeping the current structure of the CCRs to limit the effect on the ongoing implementation of the capacity calculation methodologies and other regional methodologies in the relevant CCRs, and as it cannot be proven that the inclusion of DK1-DE/LU, DK1-DE/LU and CCR Channel will lead to less unscheduled flows – the problem will simply move to another region.

As written in section 4.4, a CCR reconfiguration will lead to unscheduled flows, if the flows from adjacent regions, as required in CACM article 21(1)(b)(vii), are not considered by AHC.

The introduction of AHC is mentioned in the implementation of the day-ahead and intraday capacity calculation methodologies of CCR Core. The TSOs in CCR Core are required to develop a proposal for the implementation of the AHC, with the appropriate implementation plan, within 18 months and the proposal for the implementation of AHC will aim to reduce the volume of unscheduled allocated flows on the CNECs of the Core CCR resulting from electricity exchanges of the bidding zones borders of adjacent CCRs.

All TSOs suggest that in the medium-term, that the level of unscheduled flows, and if these can be correctly addressed by AHC, is addressed in CCR Core as indicated in ACERs decision (02/2019). If AHC cannot resolve the unscheduled flows, then the TSOs shall consider a possible CCR reconfiguration.

6. Fulfilment of objectives of CACM

As also written by the TSOs in the latest CCR amendment, the proposal for amendments of CCRs takes into account the general principles and goals set in the CACM Regulation as well as the Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity.

The TSOs suggestion will ensure optimal use of the transmission infrastructure, as it will not interfere with the current implementation of the day-ahead and intraday capacity calculation methodologies in CCR Core and CCR Nordic in the short-term. Further, the correct introduction of AHC is a prerequisite to limit the unscheduled flows from adjacent regions in the meshed AC grid. Both CCR Core and CCR Nordic considers the implementation of AHC. This will secure the principles of CACM Article 3(b) and 3(d).

The AHC will secure fair and non-discriminatory treatment of TSOs to the meshed AC grid in each CCR, according to CACM article 3(e) and 3(j).

Lastly, this approach will contribute to the efficient long-term operation and development of the electricity transmission system and electricity sector in the Union, according to CACM article 3(g), as the proposal by the TSOs ensure limited effect on the implementation projects of the regions, and a right way to address the unscheduled flows of the meshed AC grid from adjacent regions.

7. Conclusions

This is a common TSO report following the requirements of ACERs Decision on the Amendment of the determination of CCRs from 1st April 2019 ("No 04/2019") Annex I, Article 6. The article specifies that the TSOs shall analyse the optimal determination of CCRs regarding CCR Hansa and CCR Channel.

The analysis shall assess the possibility to minimize the unscheduled flows arising in the CCR Core internal grid due to flows at bidding zone borders in the adjacent CCRs – either by the means of CCR reconfiguration or by the implementation of Advanced Hybrid Coupling (AHC) in the CCR Core day-ahead and intraday capacity calculation methodology.

This report concludes that the current structure of CCR Hansa and CCR Channel is the most optimal structure for ensuring the progress in the current implementation of the flow-based methodologies and other regional methodologies in CCR Core and CCR Nordic in the short-term. The report concludes that any CCR reconfiguration today will interfere with the implementations of the CCM projects and other regional methodologies such as redispatching and countertrading, long-term capacity calculation etc. In the longer term, the TSOs cannot accurately demonstrate the impact of unscheduled flows in the adjacent regions caused by a shift of the borders in CCR Channel and CCR Hansa into either CCR Nordic or CCR Core. When feasible the appropriate solution is the implementation of AHC, as it provides a solution to the problem of unscheduled flows, but it's implementation should be investigated. The AHC is both proposed in the CCR Core methodology and implemented in CCR Nordic.

All TSOs suggest that the implementation of AHC is evaluated in CCR Core as indicated in ACERs decision (02/2019) within 18 months after the implementation of the day-ahead capacity calculation methodology. If AHC cannot reduce the unscheduled flows, then all-TSOs shall consider a possible CCR reconfiguration in the longer run.