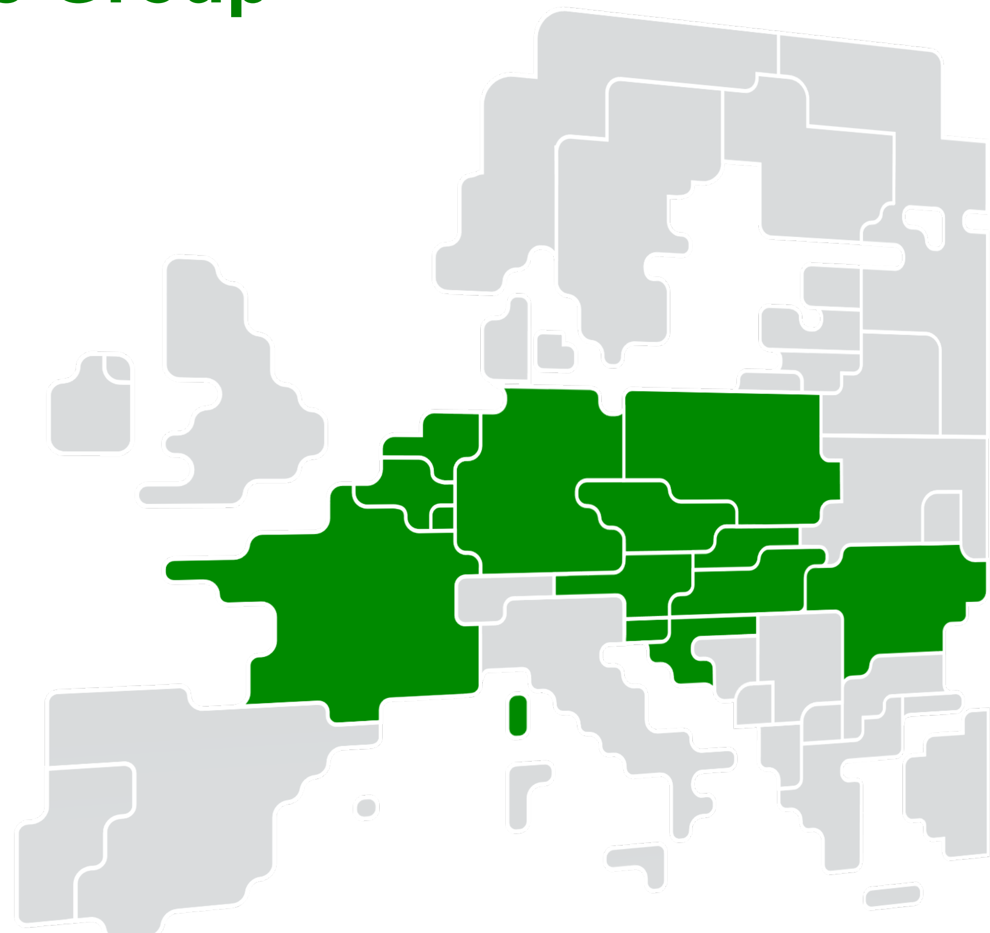
Core Consultative Group

28/03/2023

09:00 – 12:00 (CET)
Microsoft Teams meeting



1. Welcome and Introduction

Practicalities, announcements and reminders

Co-chairs

Hélène ROBAYE
Market Participants, Engie

Ruud OTTER
Core TSOs, Tennet BV

Steve Van Campenhout
Core TSOs, ELIA

Practicalities

- During meeting
  - Please use the **Q&A functionality** in Teams to address questions (not the chat). If you have a specific question on the slide, include the slide number in your question.
  - After each topic there will be a short Q&A section to see if all key questions have been addressed
- Follow up
  - Minutes and final meeting documents will be shared with CCG distribution list
  - JAO Q&A forum

1. Welcome and introduction

Agenda

H. ROBAYE

	SUBJECT	WHO	TIMING
1	**Welcome and introduction** • Announcements • Agenda for today	H. ROBAYE	09:00 – 09:15
2	**Individual validation** • Explanation on Core individual validation approaches • Outline of transparency and reporting: Core Quarterly Report • Feedback on BDs 20221206 and 20221217	STK manager, FB experts A. ANDOR L. VAN KESTEREN	09:15 – 10:30
			Break
3	**TSO response to MPs feedback on data publication & PuTo** • Introduction • CBCOs naming convention • Transmission outage publication • Static Grid Model • Publication Tool & JAO website	L. VAN KESTEREN V. BRAUSEN STK manager M. NEMY M. MIHAYLOVA / T. HURTIG	10:45 – 11:45
4	**AOB & closure** • Next CCG meeting	R. OTTER / S. VAN CAMPENHOUT	11:45 – 12:00
	APPENDIX • Glossary of common abbreviations • Core TSOs information on individual validation		

2. Individual validation

Explanation on Core individual validation approaches

L. VAN KESTEREN

Background

- During the Core Consultative Group meeting of November 15th, 2022, and in a note Core TSOs received from Market Participants (EFET, IFIEC, MPP) on December 22nd, 2022, Market Participants ask for more transparency on the Core TSO individual validation approaches.

Core TSOs have drafted an information deck to create the requested transparency on the Core FB DA CC individual validation approaches, containing the overview for:

- CEPS
- DAVinCy TSOs (50Hertz, APG, Amprion, TTN, TTG, TNG)
- Elia
- MAVIR
- SEPS, ELES, HOPS, TEL, PSE
- RTE
- Note: local fallbacks for individual validation are explained in the document Core FB MC – Ramr values, Local fallbacks.xls published on JAO: https://www.jao.eu/core-fb-mc

- Detailed information deck on the Core individual validation approaches can be found in the Annex

2. Individual validation

Core TSO Individual validation approaches: A high-level comparison

S. VAN CAMPENHOUT

- The following table gives an overview of the various individual validation approaches/tools applied by the Core TSOs, including outlooks on reaction to possible changes, e.g. of the PTDF threshold.

TSOs	Circumstances*	RAs	Operational security scope**	Application of IVA
DAVinCy (50Hertz, Amprion, APG, TNG, TTG, TTN)	8 vertices from FB and LTA domain, selected by distance and angle difference w.r.t. NPF	Redispatch (~15-40 GW), PSTs [topological RAs qualitatively, will be added to tool]	All own branches	All vertex CNECs, using substitute CNECs for foreign CNECs. Transpose non-CNEC overload to CNECs
ELES, PSE, HOPS, TEL	Depends on TSOs, can be chosen Closest vertex to RefProg or manually several vertices indicated by TSO from FB domain. PSE also checks LTA domain.	Topological RAs, Redispatch and PST	Own CNECs	Only CNECs
CEPS	Continuously increased transit from DE to SEE	PSTs, topological RAs	All own branches	On overloaded branches. Transpose non-CNEC overload to CNECs if PTDF<threshold
SEPS	Closest vertex to RefProg	Top. RAs	Own CNECs	Only CNECs
RTE	Vertices with overload on RTE CNEC(s)	Topological RAs	Own CNECs	On overloaded CNECs
Elia	2 Vertices per hour closest to the NPF, closes in the sense of weighted distance with the higher weight for hubs close to Belgium. Continuous monitoring in other to be capable to decide if other vertices should be chosen e.g. : max import + FR (see later slides)	Redispatch, PSTs *Future: topological RAs*	CNECs (as long as PTDF threshold not too high)	Only on overloaded CNECs
MAVIR	Define segments of FB + LTA domain where realistic market outcomes would overload and must be excluded.	With contingency analysis, the operator can decide on using topological RAs	All own branches	On overloaded branches. Transpose non-CNEC overload to CNECs.

*circumstances: net positions or exchanges analysed during individual validation

**operational security scope: flows on which branches are monitored during individual validation?

2. Individual validation

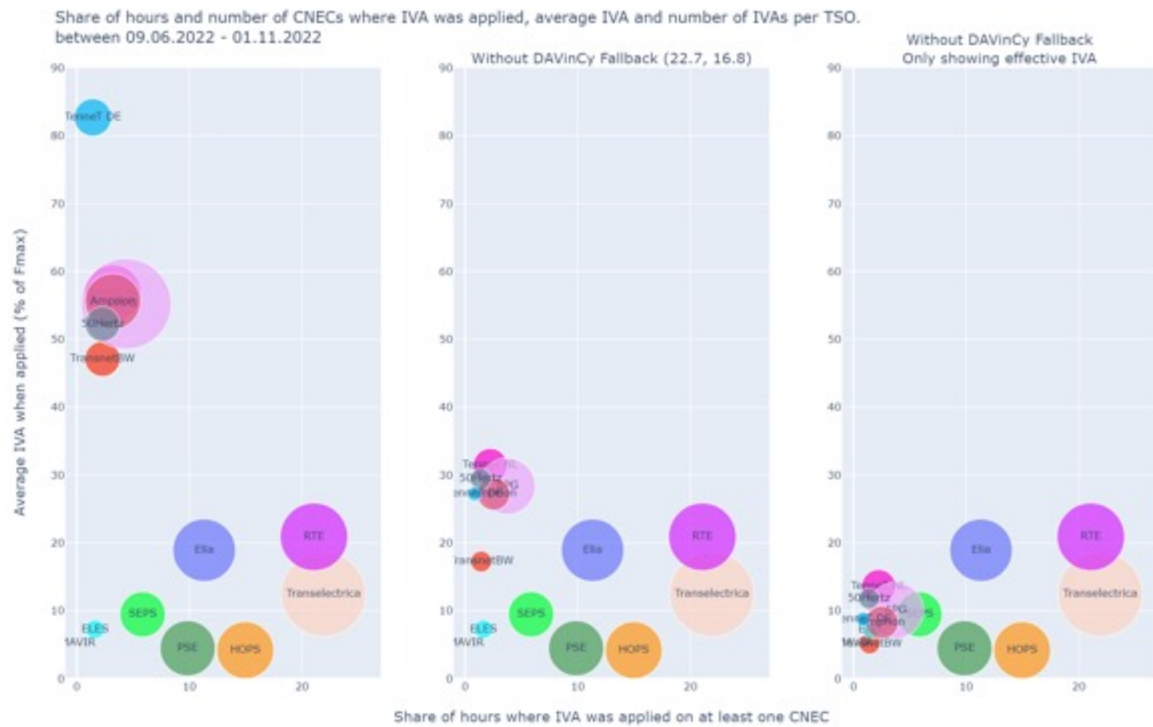
Core TSO Individual validation approaches: Overview of IVA application since Core DA CC Go-Live

- The average IVA application by DAVinCy TSOs is strongly linked to the formerly applied strict fallback application
  - 22.07.2022, 16.08.2022
  - Note: DAVinCy TSOs switched to light fallback (20% minRAM for Core) on 13.09.2022

- Normal IVA application (middle diagram; including instances of fallbacks for all TSOs, except for the no longer representative 2 BDs of strict DAVinCy fallback) shows slightly higher average relative IVAs at comparatively low frequency.

- Only depicting **effective**[*)] IVA for DAVinCy TSOs (right hand diagram), both relative IVA and frequency are below average.
  This is (in part) a success of the joint minimisation of IVA across 3 bidding zones

*) Some IVAs of DAVinCy TSOs and other TSOs consist of a part that moves the CNEC to the considered vertex and another part that effectively reduces the domain at the vertex (see detailed concepts), and only the second part is comparable with IVAs of other TSOs



The figure is derived from the Final Computation (F316) and IVA Justifications (F315) that includes effective IVA values and notification in case of fallback-application.

A. ANDOR

Outline of transparency and reporting: Core DA CCM Quarterly report - Introduction

As per Art 27(5) of the DA CCM, the quarterly report contains information on the following points:

1. External/allocation constraints
2. Flows resulting from Net Positions resulting from SDAC
3. **Capacity reductions**
   - Information per CNEC and MTU (Art. 20(13))
   - Aggregated information (Art. 20(14) and 20(15))

The report contains several xlsx files, as well as 2 Annexes and a reading guide, with the aim of introducing the reader to how all the reporting requirements are fulfilled and the location of each of the data item among the list of files attached

The reports are published on JAO website – LINK. Since the DA CC go-live, the Q2 2022 and Q3 2022 reports have been prepared and published

A high-level explanation of the contents related to capacity reductions is available on the next slides

2. Individual validation

Outline of transparency and reporting: Core DA CCM Quarterly report - Information per CNEC and MTU

Source file: QX_20XX_Reductions.xlsx

The worksheet Reductions_01 contains the information related to each specific reduction. Main points included:

- MTU, TSO, CNEC identification and volume of reduction (IVA) applied (*columns A, B, C-D and E*)
- Violated operational security limits (*columns G-W*) and circumstances (*columns X-AL*) for the reduction (relevant in case reduction was NOT applied as fallback – see *column AM*)
    - *Columns G-W* contain N/A if element with violated operational security limits coincides with element with IVA applied
- RAM in % of Fmax (*column AR*)

See below a few example entries from the Q3 2022 report.

Time Stamp	CNEC with IVA				Violated Operational Security Limits							
MTU (UTC)	TSO	CNEC name	CNEC ID	IVA [MW]	TSO (Option	element name (Optional if identi	Code (Opti	om Node (C	o Node (Op	ional if ider	e (Optional	(Optional i
2022-08-22T20:00Z	BE	[BE-BE] Y-Doel (-Lillo - Mercator) 380.52 [OPP]/N-1 Doel - Mercator 380.54	BE_CBCO_0	101	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2022-08-22T20:00Z	AT	[AT-AT] Ernsthofen 2 - Hausruck 203C [DIR] / N-1 St. Peter 2 - St. Peter 1 SPRHU43	AT_CBCO_0	23	NL	Eemshaven - Eemshaven het Hogel:	49T00000(	NEEM3810	NEHH3811	Eemshaven	NEEM381C	NMEE381I
2022-08-22T20:00Z	RO	[RO-RO] TR Rosiori 400/220 1 [DIR] + N-1 Rosiori - Gadalin	RO_CBCO_0	3.438907	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Circumstance														Fallback	
Core NP AT	Core NP BE	Core NP HR	Core NP CZ	Core NP FR	Core NP DE	Core NP HU	Core NP NL	Core NP PL	Core NP RO	Core NP SK	Core NP SI	Core NP BE_AL	Core NP DE_AL	Was Fallback applied?	RAM % of F_max
888.5	89.4	364.2	2199.1	-6225.7	2203.7	-1340.8	1377	1085.1	-121	214	-733.5	583.7	-583.7	FALSE	62.12121212
1568	610	-2472	5387	-4700	-3652	400	3977	-3134	2091	289	-363	-255	255	FALSE	25
1607	-711	-2216	1921	-5954	6676	-2119	3172	-430	-1719	-218	-9	1000	-1000	FALSE	50.39027327

2. Individual validation

Outline of transparency and reporting: Core DA CCM Quarterly report - Aggregated info. – statistics

Source file: QX_20XX_Reductions-statistics.xlsx

The file contains the following statistics:

- Overview of MTUs with/without reductions applied and TSO-specific overview of applied reductions and MTUs
- Number, causes (IVA applied as Fallback or not), volume and estimated loss of economic surplus of reductions
- Occurrences of CNECs and distinct MTUs with CNECs with RAM<20% of Fmax or RAM = 0

See below a few example entries from the Q3 2022 report.

TSO	Percentage of DA CC MTUs from analysed quarter where Core TSO has applied capacity reductions [%]
AT	4.211956522
BE	27.40036232
CZ	0
D2	1.811594203
D4	2.490942029
D7	3.713768116
D8	3.30615942
FR	19.56521739
HR	22.59963768
HU	0.135869565
NL	4.302536232
PL	16.21376812
RO	26.40398551
SI	2.173913043
SK	8.695652174

Reductions-statistics_02 | Reduction

TSO	Number of applied reductions	Number of distinct MTUs with applied reductions	Number of CNECs with RAM<20% Fmax + 3 MW	Number of distinct MTUs with CNECs with RAM<20% Fmax + 3 MW	Number of CNECs with 0 RAM	Number of distinct MTUs with CNECs with 0 RAM
AT	17333	93	8075	60	10	4
BE	18318	605	0	0	0	0
CZ	0	0	0	0	0	0
D2	11563	40	5631	33	0	0
D4	4585	55	2228	29	5	4
D7	143214	82	69383	37	1	1
D8	4696	73	2235	37	0	0
FR	500	432	0	0	0	0
HR	813	499	42	22	4	4
HU	3	3	0	0	0	0
NL	55244	95	26832	29	0	0
PL	4156	358	782	127	1	1
RO	4086	583	1192	199	109	36
SI	53	48	1	1	0	0
SK	920	192	0	0	0	0

Reductions-statistics_01 | Reductions-statistics_02 | Reductions-statistics_03 | Reductions-statistics_04_1

A. ANDOR

Source file: Annex II_QX_20XX_Core TSOs measures for reductions

According to Articles 20(14)(b) and 20(15) of the DA CCM, Core TSOs have the obligation to provide general measures and/or action plans in order to avoid cross-zonal capacity reductions in the future, as follows:

- As per Article 20(14)(b): *General measures to avoid cross-zonal capacity reductions in the future*
- As per Article 20(15): *When a given Core TSO reduces capacity for its CNECs in more than 1% of DA CC MTUs of the analysed quarter, the concerned TSO shall provide to the CCC a detailed report and action plan describing how such deviations are expected to be alleviated and solved in the future.*

This annex contains the required information described above for each Core TSO that has applied capacity reductions for at least 1 DA CC MTU of the analysed quarter.

2. Individual validation

Feedback on BDs 20221206 and 20221217 – root cause analysis & possible improvements 1/3

BDs 20221206 & 20221217 were characterised by comparably low capacities, for different reasons. Core TSOs analysed the issues that occurred and discussed possible improvements.

BD 20221206

Root cause: Congestions in TTN grid due to maintenance in the north, coinciding with input data issue

- There was a planned outage on one of two circuits of a critical line for several TSs during the day, and the simulated loss (N-1 contingency) of the second circuit resulted in high loadings on Meeden-Diele tie-line.
  - The planned outage was on an internal line close to high production area.
  - One of the two tie-line circuits from Meeden to Diele was also in outage.
- A large generator in NL north was fully restricted to run, but this was not represented on ENTSO-e Transparency Platform (ETP) as being unavailable, therefore this generator contributed to the high loadings in CGM and also in DAVinCy (for which TTN take information directly from the ETP).
- This combined with extraordinary grid situation, resulted in the single Meeden-Diele tie-line being loaded for 200% in the CGM, and ultimately causing IVA application by the individual validation with the DAVinCy tool.

Implemented short term mitigation measure (partly removing need for IVAs)

- Simulate cross-border RD between DE-NL in DAVinCy
  - DAVinCy TSOs recomputed the BD with the new measure which improved the situation but still IVA was applied by DAVinCy for the constraining hours
- Mitigations by TTN: ensured sanity check by operators & requested respective generator to ensure timely communication to ensure ETP reflects correct status of generator.

In general, application of (large) IVA reflects issues in the grid accurately, as these do not necessarily indicate a tool or process problem.

2. Individual validation

Feedback on BDs 20221206 and 20221217 – root cause analysis & possible improvements 2/3

BD 20221217

Description of operational observations & activities: DAVinCy process led to identification of merging issue

- DAVinCy operators had doubts on the validation results and triggered a DAVinCy operator-expert call. This triggered a check on input data.
- TTG expert detected unrealistic flows during CC process and investigation showed 1. discrepancy between CGM and RefProg, and 2. unrealistic RefProg and NPs in CGM.
  - DAVinCy TSOs contacted the Merging Operator to investigate issues in merging process
- DAVinCy operators decided to apply fallback during individual validation (20% minRAM) as DAVinCy results were not plausible.
- Core TSO Incident Committee call was initiated and merging issues were discussed. Core TSO operators analysed the impact on the CC process and decided DFPs were not needed considering the DAVinCy process fallback as sufficient (which could in any case not be changed at this moment in the process).
- More detailed ex-post analysis also point towards issues in merging and led to a mitigation in the merging process.

Origin of observed discrepancies: Merging issue, potentially due to replacement of configuration file for Italy North DA CC.

Short term mitigations for potential root cause have been implemented by the Merging Entity

- Warning for merging operator that configuration file was changed
- Cross-check implemented in merging tool to detect whether configuration file name is as expected. If not, error message is provided including actions to solve the issue and correct (and re-start) merging

2. Individual validation

Feedback on BDs 20221206 and 20221217 – root cause analysis & possible improvements 3/3

To avoid similar operational issues, Core TSOs are investigating and discussing possible improvement options

- Central operational monitoring such as a quality check (for merging results)
  - Could allow for adjustment of TSO input and re-run of merging or at least early awareness for the remaining process

- Possibly, include additional checks in TSOs' individual validation processes
  - Example of BD 20221217 shows that such checks (in this case in DAVinCy) can indicate central quality issues
  - Respective TSOs could inform other TSOs during operations via CCB or trigger a TIIC in case these additional checks would show a critical or implausible situation

3. TSO response to MPs feedback on data publication & PuTo

L. VAN KESTEREN

MPs feedback on data publication: Introduction

During the Core Consultative Group meeting on November 15th 2022, Market Participants presented feedback and requests regarding Core FB DA CC data publication & the Publication Tool (PuTo).

Core TSOs reviewed the feedback and requests from MPs regarding Core FB DA CC data publication & the PuTo and provide a response in the following slides, organised per topic (and including the feedback received from MPs):

1. CBCOs naming convention
    - Duplicates ID issue
2. Transmission outage publication
3. Static Grid Model
4. Publication Tool & JAO website
    - 'UID' parameters computation
    - Varia – JAO website
    - Varia – CBCO missing information

V. BRAUSEN

MPs feedback on data publication: 1. CBCO Naming Convention – Duplicates ID issue

Core TSO Feedback

- APG: local tool caused double CNECs. This should have been fixed beginning of September.
  - Duplicates with Imax=9999 applies are necessary for post-processing of data and do not impact capacities.
- Amprion: No duplicates in initial input file found.
  - The duplicates appear due to curative topological RA (PATL and TATL CNECs).
  - Duplicates with Imax = 9999 are necessary for post-processing of data and do not impact capacities.
- ELES: The duplicates appear due to curative topological RA (PATL and TATL CNECs)
- PSE: The duplicates appear due to curative (PST) RA (PATL and TATL CNECs)
- RTE: The duplicates appear due to curative topological RA (PATL and TATL CNECs)
- TNG: The duplicate of TNG was one time occurrence, already fixed since 02-07-2022
- TTN: TTN acknowledges some duplicate CNECs which are accidentally submitted and currently we are working on a fix

Core TSOs will include additional explanation in the PuTo Handbook [LINK] regarding duplicate IDs

- Proposed topics for explanations on next slide

3. TSO response to MPs feedback on data publication & PuTo

V. BRAUSEN

MPs feedback on data publication: 1. CBCO Naming Convention – Duplicates ID issue

Proposed explanation to be added to the PuTo handbook:

- What are PATL and TATL CNECs
  - PATL is the permanent admissible thermal limit of a network element
  - TATL is the temporary admissible thermal limit of a network element, higher than the PATL. For a short time PATL limit can be exceeded provided TATL is not exceeded
- Why duplicate IDs appear due to curative topological RA (PATL and TATL CNECs)
  - Depending on the used kind of RA, PATL or TATL is relevant for the CNEC. For example, RTE has a lot of curative topological RAs. The main principle is the availability to exceed the PATL provided 1) it doesn't exceed the TATL and 2) the current is back under the PATL after application of curative RA. If such a curative RA is applied during NRAO for a specific CNEC, two CNECs (instead of one) are represented in order to take into account those two constraints.
- The existence of the duplicates with Imax=9999
  - Already on the handbook: "Network elements with Imax = 9999 and that can appear at first sight as duplicates of CNECs. These CNECs relate to borders between Core and non-Core countries and are technically part of the dataset as they are needed to calculate the non-core exchanges KPI;"

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback 20221115

MPs feedback on data publication: 1. CBCO Naming Convention – Duplicates ID issue

- The following combination of identifiers should be unique but we often observe duplicates for the same hour with different FB parameters – which occurrence to choose ?
  'tso','cneName','cneEic','direction','hubFrom','hubTo','substationFrom','substationTo','elementType','fmaxType','contTso','contName','contingencies’

- Some observed duplicates since go live :

All duplicates found - raw

tso	Nb duplicates since go live
APG	2222
AMPRION	953
PSE	508
TENNETBV	246
RTE	184
ELES	36
TRANSNETBW	4

cneName	contName	tso	contTso	num_duplicated
Ternitz - Wien Suedost 225B	Kainachtal - Y_Mallach 476KT	APG	APG	204
	Kainachtal - Y_Mallach 475KT	APG	APG	204
	Suedburgenland - Y_Mallach 476SU	APG	APG	204
	Suedburgenland - Wien Suedost 478	APG	APG	204
	Oststeiermark - Y_Mallach 475SR	APG	APG	204
	Oststeiermark - Wien Suedost 477	APG	APG	204
Leupolz - Westtirol 412	Buers - Westtirol rt (421) Buers - Westtirol rt (422)	APG	TRANSNETBW	174
Buers - Meiningen gn (406A)	Buers - Walgau or (405B) Buers - Walgau or (405A)	APG	APG	174
Aschach - Hausruck 208B	_Simbach 234_230 Y-Altheim (-Simbach - St. Peter) 2	APG	APG	172
Walgau - Werben 405B	ers - Meiningen gn (406A) Buers - Meiningen gn (40	APG	TRANSNETBW	168
Westtirol 1 - Westtirol 2 WTRHU41	Buers - Westtirol ws (422) Buers - Westtirol ws (421)	APG	TRANSNETBW	166
Laufenburg - Tiengen ANDLSB	Alegro HVDC	AMPRION	ELIA	126
Beznau - Tiengen AARE W	Alegro HVDC	AMPRION	ELIA	119
Obernielach - Podlog 247	ainachtal - Maribor 474 400 kV Maribor - Kainachtal	APG	APG	72
	ainachtal - Maribor 473 400 kV Maribor - Kainachtal	APG	APG	72
Krimpen a/d IJssel - Bleiswijk 380 Wit	Crayestein-Geertruidenberg 380 2	TENNETBV	TENNETBV	36
Krimpen a/d IJssel - Bleiswijk 380 Zwart	Crayestein-Geertruidenberg 380 2	TENNETBV	TENNETBV	18
Y-Oberzier (-Dahlem - Niederstedem) SELHN W	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Mittelbexbach - Uchtelfangen BLIES N	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
PST Gronau TR 441 E	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Mittelbexbach - Uchtelfangen BLIES S	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Ensdorf - Vigy VIGY2 S	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Maasbracht - Van Eyck 380 Black/27	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	TENNETBV	ELIA	12
Doetinchem - Niederrhein 380 black	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
L 400kV NO 2 AVELIN - MASTAING	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	RTE	ELIA	12
Doetinchem - Niederrhein 380 white	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Y-Oberzier (-Dahlem - Niederstedem) SELHN O	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Y-Niederstedem (-Dahlem - Oberzier) SELHN W	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Niederstedem - Rommersheim NIMSTA O	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Paffendorf - Rommerskirchen PAFFEN N	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Ensdorf - Vigy VIGY1 N	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Rommerskirchen - Sechtem VILLE W	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Rommerskirchen - Sechtem VILLE O	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Rilland - Zandvliet 380 White/30	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	TENNETBV	ELIA	12
Ensdorf - Uchtelfangen TAUBNT S	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Maasbracht - Van Eyck 380 White/28	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	TENNETBV	ELIA	12
Ensdorf - Uchtelfangen TAUBNT N	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
L 400kV NO 1 AVELIN-MASTAING	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	RTE	ELIA	12
Knapsack - Sechtem WABERG W	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Brauweiler - Rommerskirchen BRAUWL W	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Brauweiler - Knapsack BURBAC O	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Paffendorf - Rommerskirchen PAFFEN S	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Avelgem - Avelin 380.80	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	RTE	ELIA	12
Y-Rommersheim (-Dahlem - Oberzier) SELHN O	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	12
Gronau - Hengelo 380 black	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	10
Y-Sechtem (-Oberzier - Paffendorf) SECHTM S	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	10
Y-Paffendorf (-Oberzier - Sechtem) SECHTM S	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	10
Hanekenfaehr - Doerpen West EMSLD WB	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	10
Buerstadt - Lambsheim BUERST W	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	10
Y-Oberzier (-Paffendorf - Sechtem) SECHTM S	velgem - Mastaing 380.79 Avelgem - Mastaing 380.7	AMPRION	ELIA	10

Recommendation :

- TSOs should clean their configuration to remove all current outstanding duplicates
- TSOs should set up systematic duplicate CNECs data checks that raise warnings in order to promptly correct the duplicates as they arise

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback on data publication: 2. Transmission outage publication

Core TSOs assessed the MPs feedback and suggestions on transmission outage publication and created an overview of the individual outage publication approaches

- Core TSOs have the legal obligation to publish “network outages” according to the Transparency Regulation and REMIT Regulation. The document issued by ACER provides guidance on how to do this.
- As there is no legal requirement which platform to use nor what scope to consider, Core TSOs apply different practices.

Core TSOs provide visibility on the different outage publication approaches, including information per TSO on:

- Scope of publication
- Timing of publication: outage planning cycle
- Location of publication (central platform: ENTSO-E TP, local platform)
- Publication of impact on cross-border capacities per timeframe (yearly-NTC, monthly-NTC, short-duration outage)
- The overview including detailed information per Core TSO on the individual outage publication approaches can be found enclosed.

Microsoft Excel Worksheet

To understand better MPs suggestions, Core TSOs would like to discuss the expectations and limitations of what can be done with centralised / daily publication of outages.

- Q: What would MPs like to assess with the outage publication information?
  - TSOs assume the main (only?) purpose is to assess the impact on cross-zonal capacities.
- The short-term visibility on capacities is provided by the daily publication of results
- The longer-term visibility on impact of outages was covered in SPAICs in CWE (a process that was defined jointly between MPs and CWE TSOs).
  - In Core, the CC process changed with NRAO, virtual capacity and validation. Consequently, Core TSOs are reworking the SPAICC approach for which an update will given in next Core CG (05/04).
    - Note: Core TSOs agree that assessing the impact on NTC is not relevant for the Core FB MC.

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback on data publication: 2. Transmission outage – 1

1. Platform and format:
   - not all TSOs publish data through ENTSOE
   - not all TSOs publish the data according to ACER guidances
   - Exotic platform non consistent with ACER guidances :
     - https://netztransparenz.tennet.eu/electricity-market/transparency-pages/urgent-market-messages-planned-maintenance-nl/
     - https://www.elia.be/en/grid-data/transmission/unavailability-of-grid-components-380-220-kv
     - https://www.sepsas.sk/en/control-centre/monthly-operational-data/plan-of-outages/
     - https://www.services-rte.com/en/view-data-published-by-rte/unavailibility-of-the-transmission-network-ntc-impact.html (ACER guidance ok on format but no API)
     - https://www.50hertz.com/en/Transparency/GridData/Congestionmanagement/OutageandPlanning (though seems to respect ACER guidances)
     - https://www.hops.hr/en/planned-disconnections-in-next-week
     - https://www.transelectrica.ro/documents/10179/91762/6functionare1a.xls/8cd2bfad-9361-4148-bb54-5613e32068be
     - GIIP (gasinsideinformationplatform.pl) (PSE)
   - **Recommendation :**
     - **Ideally all CORE TSOs should published outages in a single platform (ENTSOE TP could be a good candidate)**
     - **Independently of the publication platform, TSOs should respect ACER guidances : https://www.acer.europa.eu/sites/default/files/REMIT/REMIT%20Reporting%20Guidance/Manual%20of%20Procedures%20(MoP)%20on%20Data%20Reporting/ACER_REMIT_MoP-on-data-reporting.pdf**
     - **NORDIC TSOs current practice should be seen as a good example to follow (common platform NUCS / UMM format consistent with ACER guidances)**

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback 20221115

MPs feedback on data publication: 2. Transmission outage – 2

2. Scope of outage publication – which outages should be published?
   - We believe there are important CORE outages that are not published (especially internal lines)
   - Right table shows number of distinct EIC (network element) that has at least an outage that starts in that year on Entsoe Transparency Platform
   - Very few or no outages published on many borders/for many TSOs
   - **Recommendation :**
     - **We believe all outages on monitored CORE CNECs must be published as a minimum requirement**
     - **Ideally, all outages impacting the PTDF/RAM on CNECs should be published (as they are "likely to significantly affect the prices of wholesale energy products"*)**
     - **As it might be difficult to assess quantitively the previous point, an easier criteria would be to publish all outages on network element present in CORE static grid model**

TSO	2016	2017	2018	2019	2020	2021	2022	2023
TENNET NL	0	0	4	0	0	0	0	0
SK-UA	1	1	1	1	1	1	0	0
SEPS	1	3	0	2	1	1	0	0
BE-NL	4	2	4	4	0	0	0	0
HR-SI	0	0	0	0	0	1	0	0
ELES	0	0	0	0	0	1	1	0
RS-HR	1	1	1	1	1	1	1	0
RO-UA	1	1	1	1	1	0	1	0
RO-RS	1	1	1	1	1	1	1	0
PL-SE	1	1	1	1	1	1	1	1
NO-DE	0	0	0	0	0	1	1	0
IT-SI	1	1	1	1	1	2	1	0
HU-SR	1	1	1	1	1	1	1	0
HU-SK	2	2	2	2	2	2	1	0
TRANSNETBW	0	0	0	0	0	1	1	0
BG-RO	1	0	1	1	0	1	1	0
AT-IT	0	1	1	1	1	1	1	0
PL-SK	2	2	2	2	2	2	2	0
LT-PL	2	2	2	2	2	2	2	0
DE-DK	2	2	2	2	2	2	2	0
HU-UA	0	0	0	0	0	0	2	0
DE-NL	1	5	6	6	2	2	2	0
CEPS	1	1	1	1	3	1	2	0
RO-BG	3	0	3	3	0	3	3	0
FR-IT	3	3	3	3	3	3	3	0
ES-FR	4	4	4	4	4	4	3	0
DE-FR	4	3	2	4	4	4	3	0
AT-SI	3	3	3	3	3	3	3	0
AT-HU	4	4	4	2	4	2	4	0
AT-CZ	4	4	4	4	4	4	4	0
DE-PL	4	3	4	4	4	4	4	1
CZ-DE	4	4	4	4	4	4	4	0
AT-CH	4	4	3	4	4	4	4	2
CZ-PL	4	4	4	4	4	4	4	0
CZ-SK	5	5	5	5	5	5	5	0
BE-FR	6	5	5	5	6	5	6	0
Amprion GmbH	1	4	6	6	10	5	6	0
AT-DE	4	5	6	8	8	5	7	0
CH-DE	10	8	9	8	9	9	8	7
D2-D8	12	12	13	12	12	13	12	0
APG	24	27	22	20	22	20	26	0
PSE	45	49	38	50	53	59	30	0
ELIA	16	20	35	34	41	38	38	0
RTE	59	53	53	53	43	59	54	0
50HERTZ	51	94	91	93	102	100	95	0
TENNETGMBH	38	44	56	81	83	90	97	0

*https://documents.acer-remit.eu/wp-content/uploads/202105_5th-Edition-ACER-Guidance-Update2.pdf

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback 20221115

MPs feedback on data publication: 2. Transmission outage – 3

3. Outage Impact on cross border capacities
   - We see three possible ways of publishing impact of transmission outage :
     - 1. No impact published, just the network element outage start date / end date is published
     - 2. Legacy NTC impact of transmission outage on bilateral commercial borders
     - 3. Nordic flow-based proposal : publishing Reference full network FB domain vs reference FB domain with the outage : https://nordic-rcc.net/wp-content/uploads/2022/06/8.-NUCS_LT.pdf. Similar to the SPAIC process, but rendered systematic and with high standards for data quality /tooling
   - **Recommendation :**
     - **We think option 3 would be the best but is likely to take time to implement.
       In the meantime, options 2 (current) seems meaningless given we are in a FB world and create barrier for TSOs to publish required outages. As a result, temporarily, we are in favor of option 1 coupled with more outage published**

4. Transmission outage considered in D2CF
   - Even if all above recommendations are followed, it would still be impossible to know what outage TSOs have considered when building their D2CF. Indeed, TSOs might "freeze" their view of forward outage at a certain arbitrary time in D-2 that could change / be different for each TSOs
   - **Recommendation :**
     - **Extract from D2CF all considered outage in the D2CF per MTU and publish it as a new dataset on JAO Publication tool**

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback 20221115

MPs feedback on data publication: 2. Transmission outage – 4

5. Outage planning
   - We observed that barely any outage are published for Y+1 (cf Table on slide “Transmission outage – 2” / column 2023)
   - As a result, every year in Q4, we have almost no information on Q1 despite being only few months away.
   - This publication pattern seems to come from TSO yearly planning cycle which is generally finalized around end of the year
   - **Recommendation :**
     - **Each TSO should explain their outage planning cycle so that market parties can know whether the absence of outage means no outage or means outage planning not yet finalized**
     - **Even though outage planning is not yet finalized, it is better to publish approximate expected outages rather that publishing nothing.**
     - **TSOs should try to have outage published for all tradable horizons (i.e., at least up to end of Y+1)**

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback on data publication: 3. Static Grid Model

M. NĚMÝ

Core TSO feedback

1. Transmission lines and transformers completeness
   - All the lines that fulfil the criteria for publishing in the SGM were included in the latest version of the SGM
2. Substation standard topology description
   - The request for standard bus bas schema goes beyond the legal definition of the SGM
3. Voltage level coverage
   - The Core DA CCM defined the SGM in following way: a list of relevant grid elements of the transmission system, including their electrical parameters. In other words, aim of the SGM is not to create a copy of a D2CF model
   - Nevertheless, for every element published in the Core SGM a relevant voltage level is published. SGM Handbook [LINK] includes clear criteria, which elements are listed – these are tie-lines, internal lines, auto-transformer under-voltage level 380/220 kV and Phase Shifting Transformers under-voltage level 380kV or 220kV. Listed are only those assets which are strictly the property of the Core TSOs. The definition is as broad as possible taking into account technical and legal possibilities of the Core TSOs
4. Transformers
   - Correctness and completeness of data will be done in the next update of the SGM
5. Internal German tie-lines
   - These will be included in the tie-lines sheet of the next update of the SGM

In line with the DA CCM obligations, Core TSOs are preparing an update of their SGM every 6 months. The next update is foreseen by the end of Q1 2023 and this version will include above communicated TSO conclusions

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback 20221115

MPs feedback on data publication: 3. Static Grid Model

1. It seems that CORE static grid model is not complete in terms of transmission lines and transformers

	APG	50HZ	ELES	TNG	MAVIR	TEL	CEPS	SEPS	TTG	PSE	RTE	AMP
count_tfos_missing	2	3	3	3	4	4	5	5	5	7	9	17

Attached Full list of missing 400/220 TFOs:

possible missing tfos list

- We've also spotted some missing lines in the static grid model (there could be more…):
  - LIT 400kV N0 2 AVELIN – GAVRELLE
  - 220kV - Hausruck - St. Peter - 204A

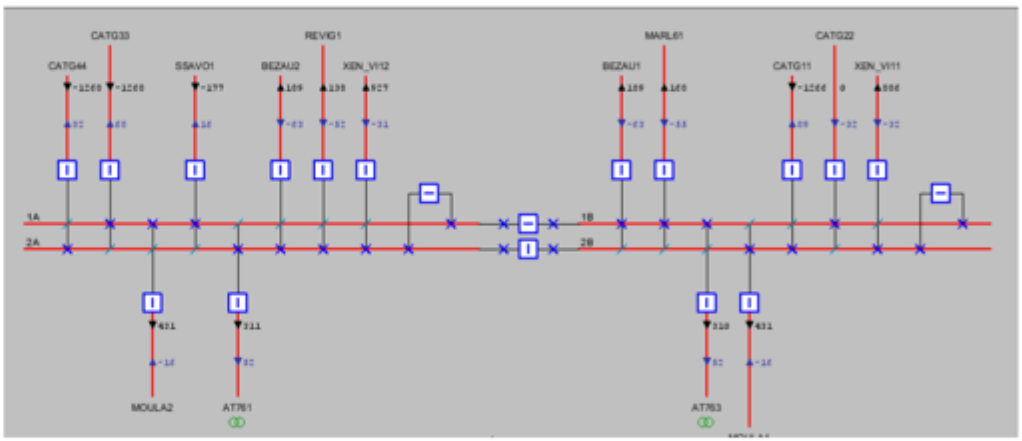
- **Recommendation :**
  - **TSOs should review that their static grid model are exhaustive for the voltage level they publish**

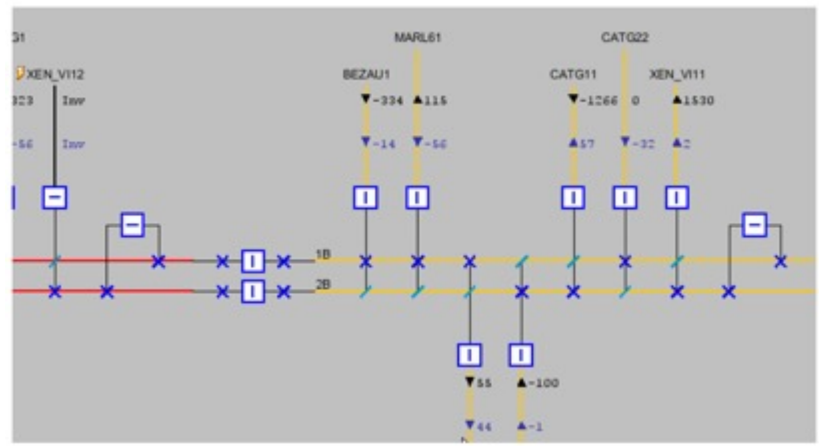
3. TSO response to MPs feedback on data publication & PuTo

MPs feedback on data publication: 3. Static Grid Model

2. Market players can't simulate 2 nodes topology nor model how PSTs are connected because of the lack of substation standard topology description.

- **Recommendation :**
    - **For each substation that contains PSTs or that can be operated under a 2 node topology in the RAO, a standard bus bar schema should be published as shown in the example bellow**



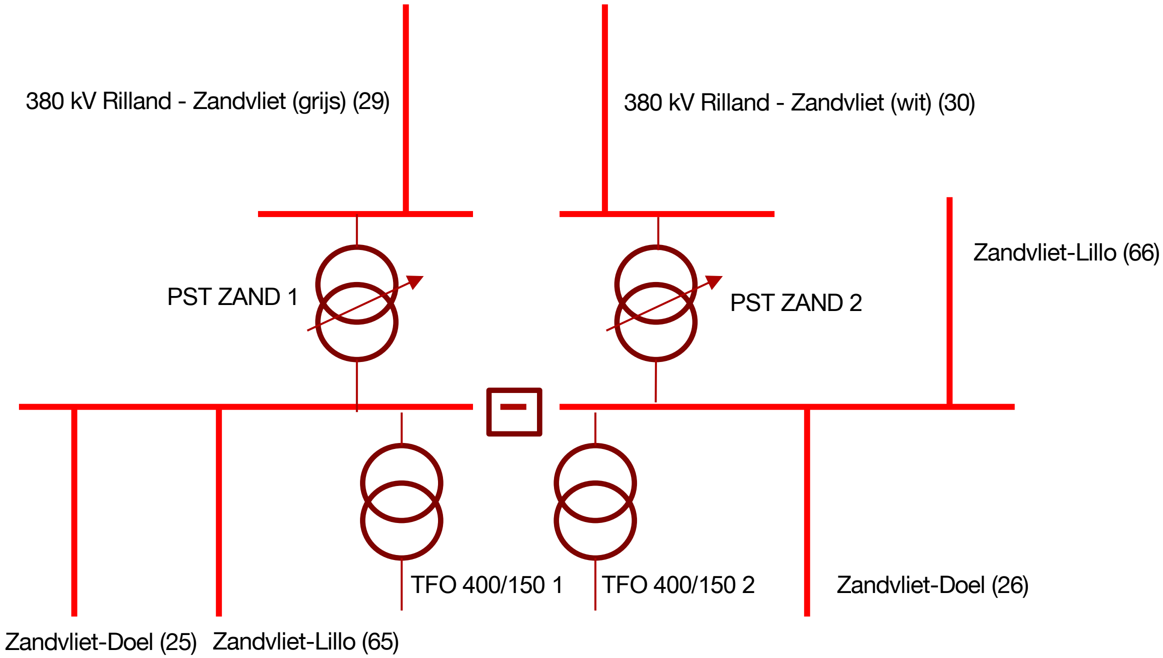


source : https://www.acm.nl/sites/default/files/old_publication/bijlagen/13001_annex-16-4-examples-remedial-actions.pdf

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback on data publication: 3. Static Grid Model

- Example substation topology Zandvliet 400kV



source : https://www.google.com/maps/@51.3695441,4.2476233,467m/data=!3m1!1e3

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback on data publication: 3. Static Grid Model

3. Voltage level coverage
   - It is not clear for market players what are the voltage levels that TSOs model in their D2CF
   - In particular the main uncertainty concerns the modelling of the 150/132/110kV voltage level
   - **Recommendation :**
     - **All TSOs should provide the list of the voltage level they model in their D2CF and whether these voltage levels are modelled through equivalent equipment or real equipment**
     - **All real or virtual equipment (line / transformer) that are modelled in the D2CF should be provided in the CORE static grid model**
   - (note that recommendation 1 is not needed anymore if recommendation 2 is followed)

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback on data publication: 3. Static Grid Model

4. Transformers
   - It seems that transformer parameters published in static grid model have a wide range of values.
   - For example bellow the distribution of parameters for all 400kV(Primary)-220kV(Secondary) transformers:

	count	mean	std	min	10%	20%	30%	40%	50%	60%	70%	80%	90%	max
Resistance_R(Ω)	405	0.4	0.3	0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.6	0.7	2.3
Reactance_X(Ω)	405	45.7	17.1	-11.7	22.9	39	42.4	42.8	45.2	45.7	47.5	63.2	70.4	86.4
Susceptance_B (µS)	170	-27.7	101	-669.6	-14.2	-9.4	-6.9	-6.3	-5	-3.5	-2.3	-1.4	-0.6	-0.1
Conductance_G (µS)	170	1	0.8	0	0	0.4	0.5	0.6	0.9	1	1.6	1.9	2	3.9

   - Susceptance and conductance not published for a large number of transformers
   - **Recommendation :**
     - **If the wide range of parameters is coming from different modelling of transformer (different conversion of 3 windings transformer to 2 windings transformer equivalent for example), TSOs should align the way they model transformer in the CORE static grid model so that those parameters can be used uniformly by standard load flow software**

4. Internal German tie lines
   - There are still some German TSOs that published internal tie line in the “lines” sheet, some in the “Tielines” sheet
   - **Recommendation : choose a convention and follow it consistently for all DE TSOs (preferably consider them in “tie-lines” sheet)**

F. NAGY

MPs feedback on data publication: 4. PuTo and JAO website - ‘UID’ parameters computation

A script is used to generate this data:

- The values for RAM_UID and LTA_UID parameters are correct.
- There seems to be indeed an issue with the RAM_f and LTA_f parameters.

This data publication is specific to the transitional phase we are in now until IDCC go-live. Once IDCC goes live, this data publication will be stopped.

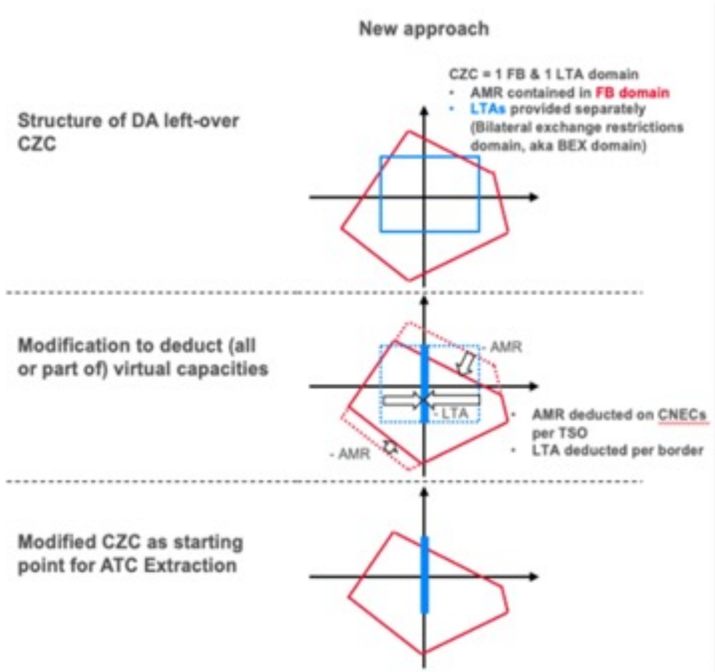
The following pragmatic approach is proposed:

- To fix the script for the future business days from the transitional period described in 1st amendment of ID CCM from Annex 5.
- MPs to use the RAM_UID and LTA_UID which are correct values for the business days from the past as well because these values are calculated by the CC tool to check the RAM used for the ID ATC extraction

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback on data publication: 4. PuTo and JAO website - Extraction process for the initial IntraDay ATC

- Reminder: **a new FB and LTA domain must be reconstructed** with ID-specific values prior to launching the ATC extraction for intraday (now done by optimization):



In brief:

1) **Recompute FB and LTA domains with new parameters**
2) **Launch extraction algorithm with these parameters**

- **The TSOs have started publishing on JAO the intermediary calculation steps** for the ID ATC extraction, e.g the LTA UID domain and the FB UID domain.

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback 20221115

MPs feedback on data publication: 4. PuTo and JAO website - It is not clear how the published ‘UID’ parameters are computed from the final DA values

RAM UID

- According to the public *Intra-Day Capacity Calculation Methodology*, the FB domain in ID is obtained from the following formula:

$$\boxed{\overrightarrow{RAM}_{UID}} = \max(0, \boxed{\overrightarrow{RAM}_f} - \boxed{\mathbf{PTDF}_f\, \overrightarrow{NP}_{AAC})}$$

Equation 3b

- However for some CNECs the UID value does not seem to follow that rule in the published files:

Time	TSO	NEC_ID	Contigency ID	branchStatus	f_ltn	F_SDAC	F_AAC	RAM_f_before_Adj	RAM_f_after_Adj	RAM_UID	Gap
2022-09-15 22:00:00+00:00	D2	D2_CBCO_00611	D7_CO_00025	OK	0.89509	93.80477	94.699861	252	109.6	158	142
2022-09-15 22:00:00+00:00	D2	D2_CBCO_00607	D2_CO_00023	OK	0.89509	93.80477	94.699861	252	113.6	158	138
2022-09-15 22:00:00+00:00	D2	D2_CBCO_00612	D2-D7_CO_00008	OK	0.89509	93.80477	94.699861	252	114.4	158	137
2022-09-15 22:00:00+00:00	D2	D2_CBCO_00610	D2-D7_CO_00005	OK	0.89509	93.80477	94.699861	252	128	158	124
2022-09-15 22:00:00+00:00	NL	NL_CBCO_00435	D7_CO_00018	OK	1.05104	117.70641	118.757456	209	122.6	91	86

LTA UID

- According to the public *Intra-Day Capacity Calculation Methodology*, the LTA domain in ID is obtained from the following formula:

$$\boxed{\overrightarrow{LTA}_{UID}} = \max(0, \boxed{\overrightarrow{LTA}_f} - \boxed{\overrightarrow{SEC}_{DA})}$$

Equation 3c

- However for some borders the UID value does not seem to follow that rule in the published files:

Time	Exchange	LTA_f_before_Adj	LTN	SEC_DA	LTA_f_after_Adj	LTA_UID	Gap
2022-09-15T22:00:00Z	AT-CZ	349	0	0	174.5	1684	-1510
2022-09-15T22:00:00Z	AT-DE	4819	0	0	963.8	2466	-1502
2022-09-15T22:00:00Z	AT-HU	400	0	393.8	80	0	0

NB: here some borders end up with much larger LTA in ID than in DA which is counter-intuitive

3. TSO response to MPs feedback on data publication & PuTo

M. MIHAYLOVA
T. HURTIG

MPs feedback on data publication: 4. PuTo and JAO website – Varia – JAO website 1/3

Core TSO feedback on MPs feedback on PuTo and JAO website:

- Filtering and showing page >10 has stopped working for (at least) Final on the website.
  - JAO is working on a solution to fix the issue before the end of Q2 2023

- The website and the API do not return the same headers (e.g. F0Core and FCore). On the website some could be swapped around and some are imprecise (MinRamTarget probably means MinRamTargetCore)
  - JAO is working on a solution to fix that before the end of Q2 2023

- Neither of the website and the API are consistent with the EU terminology of MACZT
  - Please refer to PuTo Handbook page 16 where explanations are provided:

    minRAM target Core %
    - Objective: describe the capacity for Core exchanges by deducing the non-Core exchanges from the R_amr
    - Currently implemented
      - In case AMR > 0: the value is correctly displaying minRAM_target_Core = R_amr – Fuaf
      - In case AMR = 0: the value shown is the RAM as percentage of Fmax → will be fixed in a future release so that it also represents R_amr – Fuaf

  - This issue will be fixed on the next release of CCCt before the end of Q1 2023

- Hub From/ Hub To in ShadowPrices is confusing – they are probably something related to the border generation welfare gains but the documentation says “The structure of the page is the same as for the initial/final Computation page cf. 5.14 with the exception that the column “pre-solved” is replaced with the shadow price the limiting CNEC has.” (leading to think it’s the geographical from/to)
  - This topic will be clarified in the PuTo Handbook before the end of Q1 2023
  - Proposed clarification: "The Hub From/Hub To columns refer to the maxZ2ZPtdf columns and indicates for which cross zonal exchange the binding CNEC has its maximum sensitivity."

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback on data publication: 4. PuTo and JAO website – Varia – JAO website 2/3

Overview of improvements planned for PuTo by Q1 2023.

1) Publication of the “alpha” parameter.
   - In the context of Ext LTA inclusion the cross-zonal capacities are described as the union of a FB domain and a LTA domain.
   - The “alpha” parameter indicates the share of the FB domain vs. the share of the LTA domain as applied by Euphemia during the allocation.
   - A separate page will be added to the PuTo with the value of this parameter per MTU

2) Fix of the “minRAM target Core %” parameter.
   - This parameter describes the capacity for Core exchanges by netting the non-Core exchanges to the R_amr
     - Reminder: R_amr is the target for the minimum amount of capacity to be made available for the totality of cross-zonal exchanges. This is 70% or the value applicable according to action plans / derogations.
   - Known limitation in PuTo: in case AMR = 0, the value shown is not the target but the actual RAM provided
   - The fix removes this limitation so that always the target is shown

Non-Core exchanges: 20 MW thus
20/360 = 5.6% of Fmax

RAM	Imax	U	F_max	FRM	F_(ref,init)	F_nrao	F_ref	F0core	F0all	F_uaf	AMR	R_amr %	R_amr_justification	minRAM_target_Core %
266	925	220	360	28	87	13	74	65	46	20	0	26.4		20.8 ~~74.4~~

3) Better structuring of the information on validation reductions

- BEFORE: all information is concatenated into the justification field; not all Core TSOs publish on daily basis in PuTo the information on the circumstances (scenario) that led to the application of capacity reduction
- AFTER: the data is structured into 4 parts
- TIMING: the functionality becomes centrally available with the next CCTool release (end Q1). Taking into account local implementation work, the switch is spread out from the moment when the functionality becomes available (DAVinCy TSOs, MAVIR, SEPS) over Q1 2023 (CEPS, ELIA, RTE) to begin Q2 2023 (HOPS, PSE, TEL)

CNEC with IVA							
Date	TSO	CNEC name	CNEC ID	Returned Branch	IVA [MW]	Share of IVA reducing the domain (Optional)	Justification

Violated Operational Security Limits									
Overloaded network element TSO (Optional if idential to CNEC with IVA)	Overloaded network element name (Optional if idential to CNEC with IVA)	Overloaded network element EIC Code (Optional if idential to CNEC with IVA)	Overloaded network element UCT From Node (Optional if idential to CNEC with IVA)	Overloaded network element UCT To Node (Optional if idential to CNEC with IVA)	#	Contingency element name (Optional if idential to CNEC with IVA)	Contingency TSO (Optional if idential to CNEC with IVA)	Contingency UCT From Node (Optional if idential to CNEC with IVA)	Contingency UCT To Node (Optional if idential to CNEC with IVA)

Indicates how much of the IVA was applied on the CNEC after it was brought from a non-pre-solved to a pre-solved state
– *optional as utilization depends on individual validation approach*

Indicates the element that is congested which can be different from the element upon which IVA is applied
– *optional as utilization depends on individual validation approach*

Circumstance															Fallback
Core NP ALBE	Core NP ALDE	Core NP AT	Core NP BE	Core NP CZ	Core NP DE	Core NP FR	Core NP HR	Core NP HU	Core NP NL	Core NP PL	Core NP RO	Core NP SI	Core NP SK	Comment	Was Fallback applied?

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback 20221115

MPs feedback on data publication: 4. PuTo and JAO website - Varia - JAO website

- Filtering and showing page >10 has stopped working for (at least) Final on the website.
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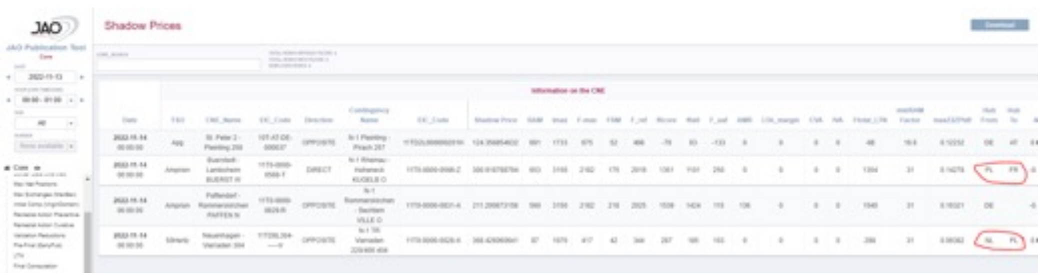
- Hub From/ Hub To in ShadowPrices is confusing – they are probably something related to the border generation welfare gains but the documentation says “The structure of the page is the same as for the initial/final Computation page cf. 5.14 with the exception that the column “pre-solved” is replaced with the shadow price the limiting CNEC has.” (leading to think it’s the geographical from/to):



3. TSO response to MPs feedback on data publication & PuTo

MPs feedback on data publication: 4. PuTo and JAO website - Varia – CBCO missing information

Core TSO Feedback

- APG: Zaya/Bisamberg – Sokolnice [AT-CZ]: This new line/substation went into operation last year and partly replaced old lines. There may have been an error regarding the EIC codes/names. This is currently under investigation and will be fixed as soon as possible
  Other AT / APG CNEs: It is not clear, which network elements are addressed here. If market parties could provide the CNEs and which information is missing, we would be happy to investigate and correct them if necessary
- CEPS: Zaya/Bisamberg – Sokolnice [AT-CZ]: This line went into operation last year. There may have been an error regarding the EIC codes/names. This is currently under investigation and will be fixed as soon as possible.
- ELIA: Issue description: the “Hub From” & “Hub To” fields are empty for 1 CNEC in the publication tool whilst they should have been filled in both with “BE” (as done in many other instances of this CNE).
  Feedback: the concerned CNE was subject to a topological change on BD 23/06/2022. The update to the publication names dictionary was overlooked. This gap was identified and corrected in the course of August 2022
- HOPS: [HR-SI] 400kV Zerjavinec – Cirkovce is a new tieline between Croatia and Slovenia from mid-2022, while we missed immediately to enter properly Publication Name details in the CCCt (HOPS and ELES party) at the beginning of its operation. We noticed this issue on 6.12. and both updated
- MAVIR: MAVIR – HOPS tieline, Zerjavinec – Heviz1, this tieline was included in the DA FB CC, during the first week of July 2022, in the CC tool publication database it was not defined at the time it was included in the DA FB CC. Therefore, it had missing information, e.g., EIC, border for 48 timestamps at that time
- TTG: The line in question is a tripod. Originally, it had only a single EIC, i.e., each leg of the tripod had the same EIC. This might have led to mapping issues. In the meantime, each leg of the tripod has been assigned a separate EIC, which has been reflected in the database in early January.

MPs are invited to provide the CNEs and which information is missing in order to properly investigate and correct them if necessary for the publication of future BDs

3. TSO response to MPs feedback on data publication & PuTo

MPs feedback 20221115

MPs feedback on data publication: 4. PuTo and JAO website - Varia – CBCO missing information

- According to regulations, every critical branch should contain information about the bidding zones it connects, as well as EIC of the CNE => this is not the case as explained in the analysis hereunder:
  'tso','cneName',**'cneEic'**,'direction',**'hubFrom','hubTo'**,'substationFrom','substationTo','elementType','fmaxType','contTso','contName','contingencies'

CNEs with missing information

1)Introduction

According to regulations, every critical branch should contain information about the bidding zones it connects, as well as EIC of the CNE.

The purpose of this report is to identify instances of missing information in published CNEs and to investigate whether missing information can reasonably be retrieved from other published instances of that or similar CNEs. The period investigated is *11th of June to 1st of August* inclusive.

To identify similar looking names, an algorithm scoring strings based on how human-similar they look and read was used. It identified at least 2 similar looking CNEs for every CNE which had unpublished data. From there, CNEs were looked on a case-by-case basis. We also compared EICs to make sure we don't miss information. Every reasonable attempt within the limit of the information contained within the dataset was made.

2)Results

A total of 19 CNEs and 11407 instances of missing information were detected (One instance is one CNE per timestamp. Note: if we looked at CNECs, they would be orders of magnitude more.) We will now look at them on a case-by-case basis.

2.1) Zaya/Bisamberg – Sokolnice [AT-CZ]

This CNE consists of a singe 2 circuit line, but it comes up under 8 different names (more if we include inconsistent hyphen and space placement), 6 of which have missing border and/or EIC information occasionally. It is monitored jointly by APG and CEPS. For a user to be able to understand where this CNE is located, they would need to both look for similar names and match by EIC.

2.2) Other AT / APG CNEs

There are another 9416 instances of 8 other APG monitored CNEs, spanning AT-SI, AT-DE, AT-AT and AT-CZ borders showing up without border information but with EIC. They could be matched using the EIC code to other instances of themselves.

2.3) Y-Mercator(-Doel-Lillo)380.52

This [BE-BE] CNE, monitored by ELIA shows up without border information sometimes (672 times), but often it also shows up under the same name with border information.

2.4) Zerjavinec -Heviz 1

This [HR-HU] CNE, monitored by MAVIR shows up 48 times without border and EIC information. It was matched to a very similar sounding CNE Zerjavinec-Heviz.

2.5) Plattling-Schwandorf 465

This [DE-DE] CNE, monitored by TENNETGMBH shows up 144 times without border information. Using the EIC, it was matched to Y Plattling-Pleinting 465.

2.6) 400kV Zerjavinec-Cirkovce

This was the hardest to identify CNE. It showed up 260 times and contained no border information, and no EIC information. By looking at CNEs containing these hubs as a start/end point it was identified as a [HR-SI] CNE, monitored by HOPS.

3)Summary

Below is a summary of how many instances of missing information each TSO had.

TSO	Instances
APG	10225
ELIA	672
HOPS	260
TENNETGMBH	144
CEPS	58
MAVIR	48

It's very clear that APG has the biggest problem with publishing information. However, with them it was relatively easy to identify another record with all the required information. On the other hand, while HOPS had only one problematic CNE, it was much harder to identify, since it contained virtually no useful information.

4. AOB & closure

Next meeting and communication channels

R.OTTER / S. VAN CAMPENHOUT

Proposal for next Core Consultative Group in 2023

- 05/04/2023 → Changed to 18/04/2023
- 04/10/2023

Existing Core communication channels

Core Consultative Group mailing list

- Register for future updates by subscribing to https://magnusenergypmo.hosted.phplist.com/lists/?p=subscribe

Core section on ENTSO-E website

- Upload of methodologies and reports on public consultations, current status of the Core CCR program, CG minutes
- Link: https://www.entsoe.eu/network_codes/ccr-regions/#core

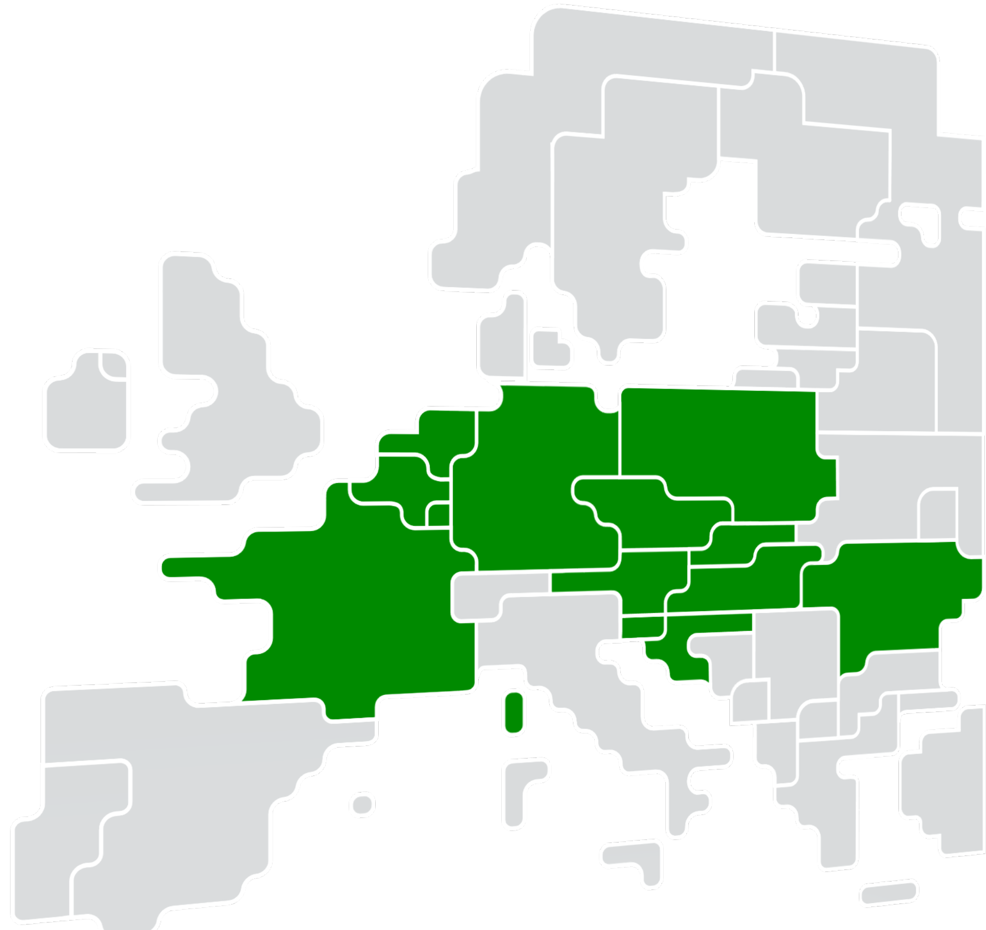
ENTSO-E newsletter

- Regular updates on the different CCRs (e.g., submitted methodologies, launch of public consultations)
- Subscription via https://www.entsoe.eu/contact/

Q&A forum on JAO website

- Provides space to Market Participants to ask questions about the External Parallel Run and other relevant topics:
- Link: http://coreforum.my-ems.net/

APPENDIX



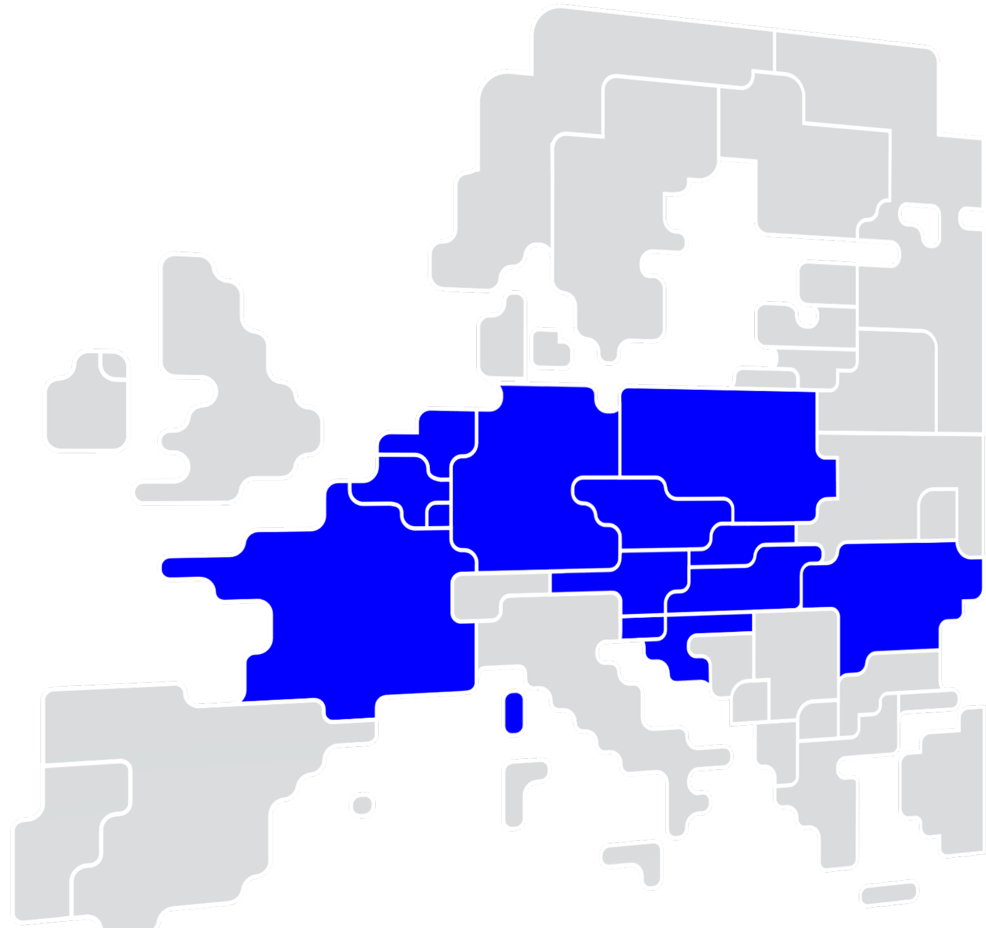
Appendix

Glossary

ACER	Agency for the Cooperation of Energy Regulators
AHC	Advanced Hybrid Coupling
BZ	Bidding Zone
CACM	Capacity Allocation and Congestion Management
CC	Capacity Calculation
CCR	Capacity Calculation Region
CGM	Common Grid Model
CGMES	Common Grid Model Exchange Standard
CNEC	Critical Network Element with a Contingency
CS	Cost Sharing
CSA	Coordinated Security Analysis
CSAM	Coordinated Security Analysis Methodology
CROSA	Coordinated Regional Operational Security Assessment
DA	Day-Ahead
ENTSO-E	European Network of Transmission System Operators for Electricity
FAT	Final Acceptance Test
FIT	Functional Integration Test
FB	Flow Based
GSK	Generation Shift Key
GLSK	Generation Load Shift Key
IDCC	Intraday Capacity Calculation
IGM	Individual Grid Model
IVA	Individual Validation Adjustment
KPI	Key Performance Indicator
LF-SA	Load Flow Security Analysis
NRA	National Regulatory Authority
NRAO	Non-costly Remedial Action Optimization
RA	Remedial Action
RAO	Remedial Action Optimizer
RFI	Request for Information
RFP	Request for Proposal
ROSC	Regional Operational Security Coordination
RD&CT	Redispatching and Countertrading
RSC	Regional System Operator
TSO	Transmission System Operator
SHC	Simple Hybrid Coupling
SO GL	System Operation Guideline
SAT	Site Acceptance Testing
SIT	System Integration Testing
V1/V2	Version 1/ Version 2
XNE	Cross-border element

Core TSOs information on individual validation

APPENDIX



Core TSOs information on individual validation

Introduction

To ensure consistency in the information provided per approach, Core TSOs used below table of content for the explanation of their respective individual validation approaches:

1. How are the circumstances selected?
2. How is operational security assessed for these circumstances?
3. Which RAs are used to avoid reductions, and how is their impact assessed?
4. How are identified operational security violations turned into IVAs?
5. Fallbacks: when do you apply it, which capacities result from it, how do you communicate about it
6. Show an example / case study / some figures (this to enhance understanding, as well as to demonstrate that RAs are being used)
7. Envisaged improvements: optional, in case you have further developments of your local tool planned

ČEPS Individual Validation Description

Philosophy of our approach

- Ensure that the Core Capacity Domain does not pose risk to the operational security
- Ensure efficient IVA application:
  - Minimize IVA application
  - Apply IVA directly on the overloaded grid elements
- Emphasis on quality of the validated CGM model

1) How are the circumstances selected?

- In ČEPS Individual Validation multiple scenarios (expected utilizations of the Capacity Domain) are analyzed:
  - The scenarios represent the best available forecast as well as deviation (surroundings) from the forecast towards the problematic constellations (based on the operational experience).

2) How is operational security assessed for these circumstances?

- The above-mentioned scenarios are applied to the Core CGM, which is then used to perform load flow calculation and analysis of potential operational security risks.
  - For every time stamp only the most critical scenario (most severe overloads) is chosen for further processing.
- An automatic Remedial Action Optimizer is run to find the optimal deployment of the available remedial actions or set of the actions that would ensure operational security if the scenario came true.
- Results of the automatic process is verified by experienced operator, who can decide on an alternative set of remedial actions.
- Proposed solution must ensure operational security limits such as maximal flow, voltage limits, short-circuit limits,…

ČEPS Individual Validation Description

ČEPS

3) Which RAs are used to avoid reductions, and how is their impact assessed?

- All expected available remedial actions in accordance with the Article 20(5) of the Core CCM (currently PSTs, topological RAs) are considered during the validation.
- Remedial Action optimizer applies the remedial actions to the Core CGM and then reperform the load-flow calculation.

4) How are identified operational security violations turned into IVAs?

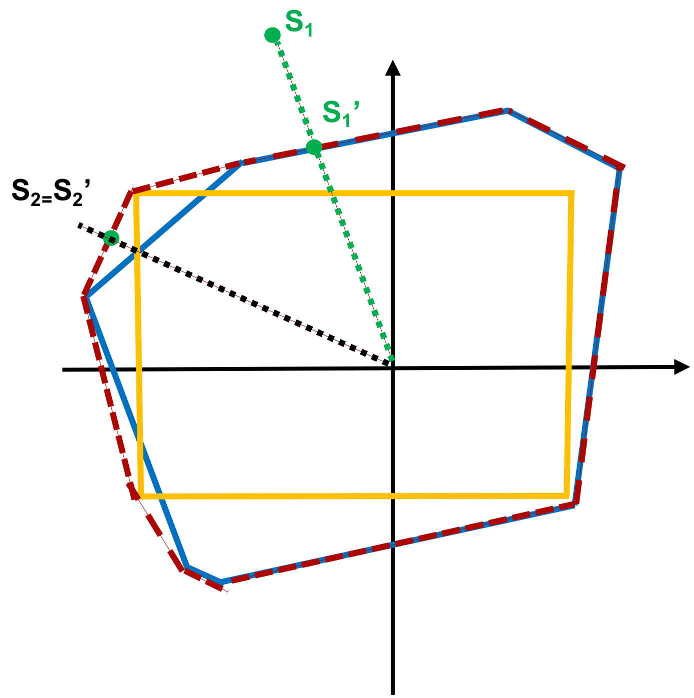
- In case, there is remaining overload on an element after the Remedial Actions optimization, RAM of the element is decreased by the value of overload effective to RAM.

5) Fallbacks: when do you apply it, which capacities result from it, how do you communicate about it

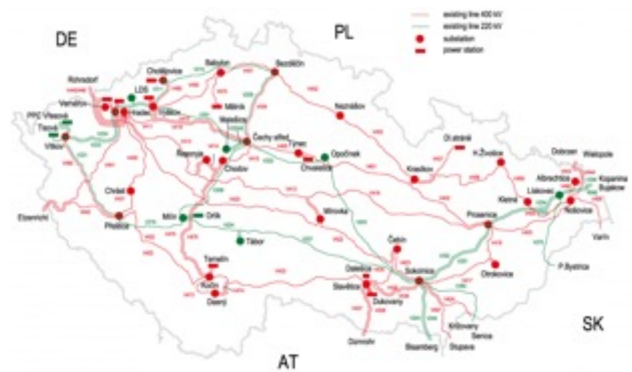
- In case ČEPS' individual validation tool is not available, there is no simple and at the same time precise way how to verify that the calculated cross-zonal capacity will not endanger operational security. Therefore a fallback calculation is triggered.
- Fallback calculation applies IVA on CNECs based on the statistical approach – statistics of applied IVA of the last 30 days, reflecting day of the week, time of the day.
- The fact that the fallback was applied is reported together with the resulting IVA values in the JAO Publication Tool.

6) Show an example / case study / some figures (this to enhance understanding, as well as to demonstrate that RAs are being used)

1) Various scenarios are created



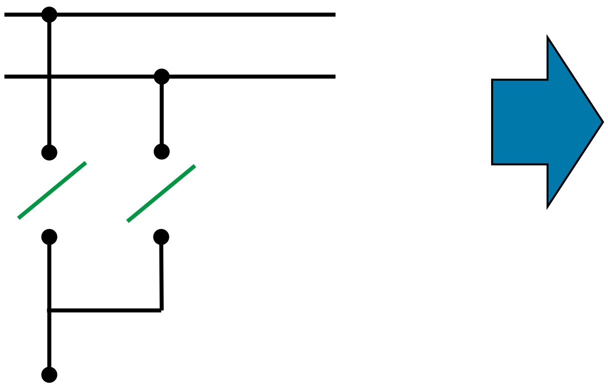
2) Scenarios are applied to the Core CGM and load flow calculation is performed (operational security is analyzed)



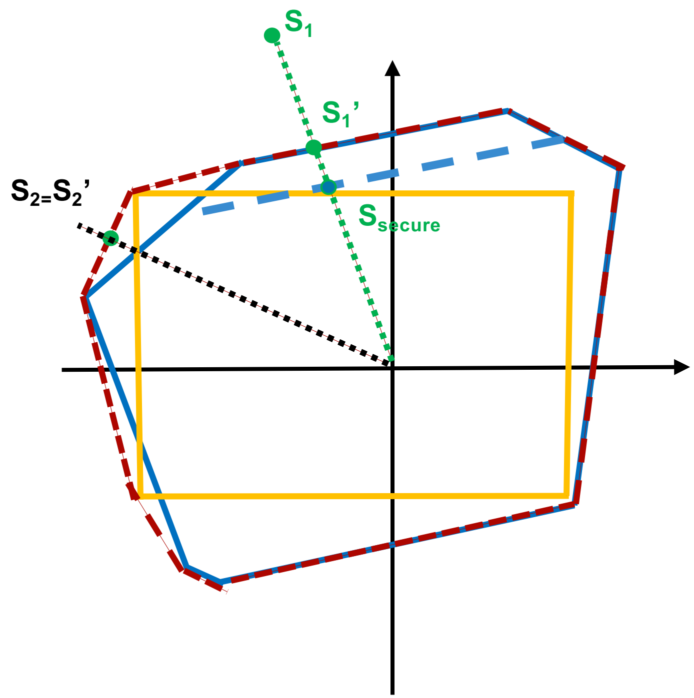
Flow-based domain
BEX restriction domain
Balas domain
S_x Validation scenario
S_x' Achievable validation scenario

6) Show an example / case study / some figures (this to enhance understanding, as well as to demonstrate that RAs are being used)

3) Remedial Actions are optimized to ensure operational security



4) IVA application to solve the remaining overloads



Explanation of selected DAVinCy aspects

Table of contents

DAVinCy TSOs

"DAVinCy" = Day-Ahead Validation of Capacity

DAVinCy is

1. an individual validation process operated jointly by the TSOs of AT, DE & NL as part of DA CC
2. a tool used for comprehensive computations during this process

Table of contents

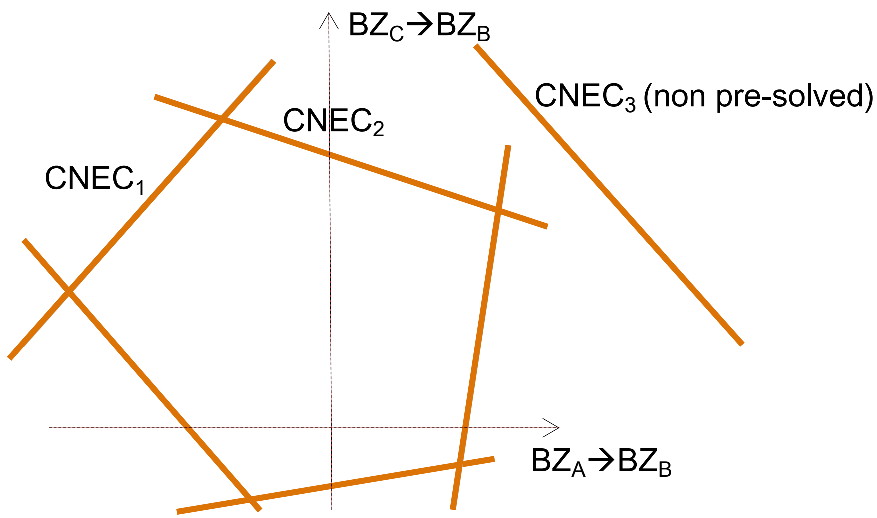
Explanation of selected DAVinCy aspects

Preface: Distinction between market domain and physical domain

- Market domain: **The model of grid capacity that is provided to the market (i.e. interface to SDAC)**
  - Describes range of potential market clearing points (MCPs) that are offered to the market (subject to individual validation)
  - Union of flow-based and BEX restrictions domains
  - CNECs with RAM and fixed PTDF: Simplified linear model of real network constraints
  - PTDFs are based on fixed GLSKs. They approximate the "trade-off" between different cross-zonal exchange directions with respect to the utilisation of the grid
  - RAM contains virtual part (AMR), expressing a lump assumption of the benefit of remedial actions (RAs)
  - Market domain has 14 dimensions (12 BZs and 2 virtual hubs for ALEGrO)

  ➔ **"Circumstances" (potential MCPs) to be validated are defined in the market domain**

  ➔ **Reductions (IVA) can only be imposed in the market domain.**
  "Only the market domain can limit the market."



Explanation of selected DAVinCy aspects

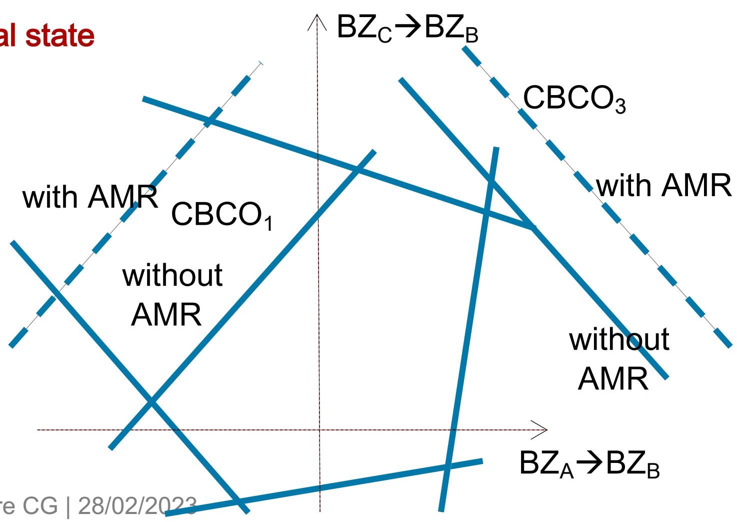
Preface: Distinction between market domain and physical domain

- **Physical domain: A more accurate model of the physical operational security limits**
  - Critical branches with outages (CBCOs) with physical RAM
  - The impact of RAs on the flows on CBCOs is explicitly modelled
  - The physical domain has hundreds of dimensions (14 for the net positions plus one for each RA)
  - Consideration of technical power limits of generators: If, for a given net position, the GLSK assumption leads to $P_i > P_{i,max}$ of generator i, P_i is kept at $P_{i,max}$ and the additional export is provided by some other generator(s) → This can be interpreted as superposition of the GLSK-based change of the dispatch and re-dispatch to respect technical limits → effectively, the GLSK evolves with the net position, and so do the PTDFs of the branches with respect to the cross-zonal exchanges
  - Consideration of physical CBCO RAM: If a potential MCP violates a CBCO limit, RAs can be activated (in the simulation) to relieve the CBCO. This RA activation changes the loading of all CBCOs (CNECs and non-CNECs)

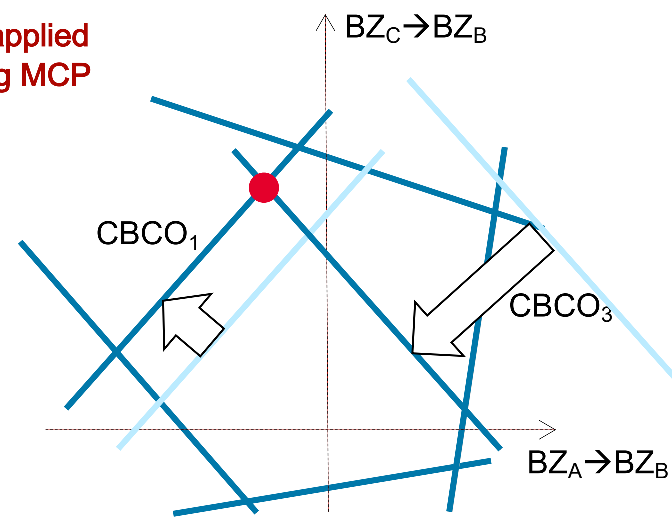
  ➔ **Overloaded branches can only be determined in the physical domain.**

  ➔ **Due to the impact of RAs (levelling of flows to allow more MCPs for the market) the overloaded CBCOs can differ from the CNECs of the market domain.**

Initial state



With RAs applied for securing MCP



Explanation of selected DAVinCy aspects

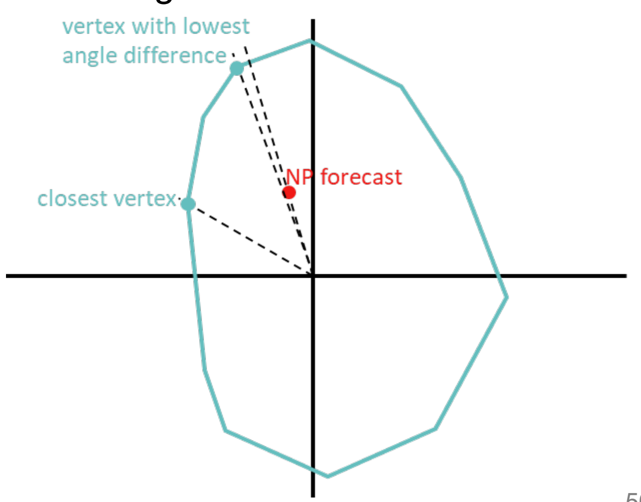
Selection of “circumstances”, i.e. potential market clearing points

- Only intermediate CZC Domain (market domain), but no market outcome is known at the time of individual validation

- Approach: Projection of the common Core Net Position Forecast (NPF) to the edge of the FB Domain to consider maximum possible exchange granted by CZC domains → analyse vertices of the domain
  - Vertices are realistic in terms of market direction. However, the extent of exchanges may be high compared to historical values. This is due to the size of the CZC domain.
  - In most MTUs, SDAC leads to at least one limiting CNEC → plausible to consider edge of domain
  - If edge of domain cannot be reached by entire generation capacity in the BZ, DAVinCy only goes as far as generators allow. No IVA is applied for the “gap” between this point and the edge of the domain.

- Determination of realistic maximum exchange: 2 parallel criteria (based on statistical assessment showing that none of them is systematically more accurate and/or sufficient)
  - “Closest vertex”: Lowest weighted Euclidian distance of NPs from NPF
    - Weighting reflects that large NP shifts are less realistic for small bidding zones
    - Priority on vertices with many BZ having same sign as NPF
  - “Angle difference”: Most similar angle compared to NPF

- Consideration of 8 vertices from FB and BEX restrictions domains
  - 4 vertices from FB domain (2 by distance, 2 by angle)
  - 4 vertices from BEX restrictions domain (2 by distance, 2 by angle)



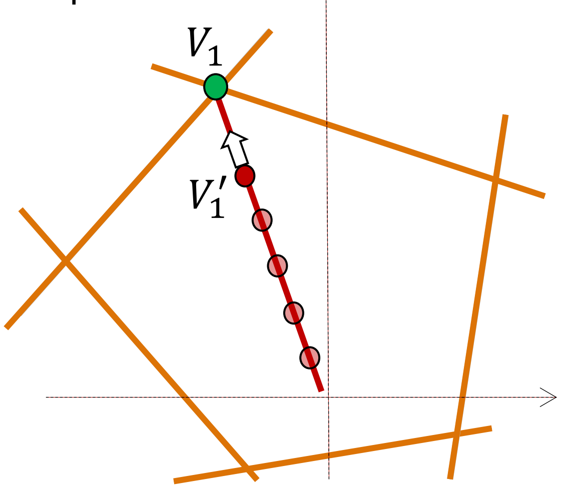
Explanation of selected DAVinCy aspects

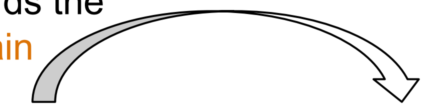
Consideration of remedial actions

- **Consideration of <u>all available RAs</u> to secure as much cross-zonal capacity as possible**
  - Redispatch potential (RDP) reflecting close-to-real-time operational processes
    - ca. 15-40 GW of RDP, depending on hourly load/RES/market dispatch
    - including cross-zonal redispatch AT←→DE, DK1←→DE, CH←→DE
    - including expected RDP in NL despite actual RDP not known yet (due to market-based RD process, which clears after individual validation)
  - PSTs (inside the tool), topological RAs (operators' assessment)

- **Determination of <u>minimum required capacity reduction</u>**

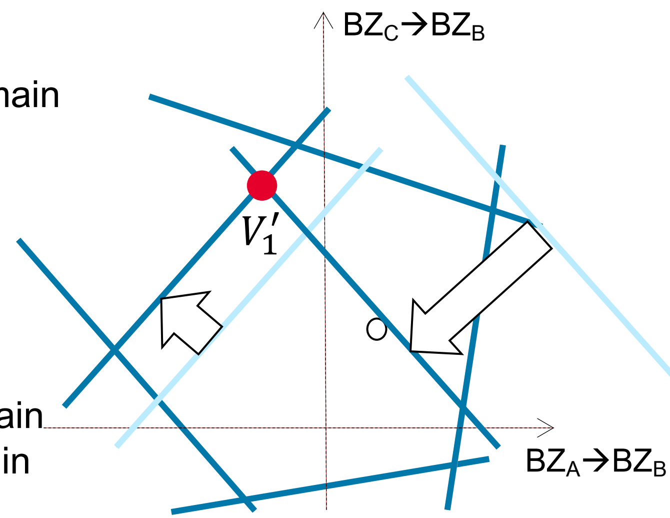
Approach: Maximise exchange towards the respective vertex of the market domain

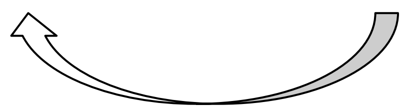




maximise exchanges using all available RAs → modelled in physical domain

The simulation algorithm continuously optimises RAs in the physical domain while shifting the MCP towards the vertex





limitations in physical domain determine feasible MCPs in the market domain

○ Net positions at zero balance

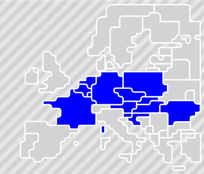
V_1 Analysed vertex (likely market outcome)

V_1' Maximisation of exchanges towards V_1

Explanation of selected DAVinCy aspects

Assessment of operational security

DAVinCy TSOs



- **Monitoring of operational security**
  - Load flow and contingency assessment based on the Common Grid Model (CGM)
  - Flows are monitored on all* branches (CBCOs) of DAVinCy TSOs
    - Consistent with the requirement to consider all available RAs
    - Required to capture the redistribution of flows due to the application of RAs
      - It is the consideration of all CBCOs which allows to harvest the benefit of RAs for the maximization of market options!
    - The CBCOs that would be overloaded in the vertex (if RAs are insufficient) can be CNECs or non-CNECs. But then, this distinction is void anyway, because CNEC selection is based on PTDFs from static GLSKs of the market domain, whereas the effective PTDFs in the physical domain dynamically evolve due to redispatch needed to avoid violations of generator and/or flow limits: The PTDF of a CBCO with respect to a marginal increase of a given cross-zonal exchange close to the edge of the physical domain can differ significantly from the static GLSK-based PTDF of the market domain
  - Special treatment of cross-zonal network elements to non-DAVinCy TSOs
    - No overloading allowed from applying RAs of DAVinCy TSOs. This avoids shift of congestion to non-DAVinCy grids
    - Overloading in the vertex (before applying RAs) is tolerated but not increased by RAs. This avoids undue capacity restrictions due to non-modelled cross-zonal redispatch with non-DAVinCy TSOs (→ will be introduced with coordinated validation)

*Some CBCOs are excluded to avoid unneeded reductions due to model limitations→ ”blacklist”

Explanation of selected DAVinCy aspects

Application of IVA

- **Approach: Proportional contraction of the market domain (CZC domain)**
  - Reminder: Only the market domain can limit the market!
  - When a vertex cannot be made safely available, DAVinCy seeks to apply IVA on all CNECs intersecting at the vertex ("vertex CNECs") → contract the domain safely towards zero balance

- **Consequence 1: Substitute CNECs needed for foreign vertex CNECs** → see details on next slide
  - Some vertex CNECs belong to foreign TSOs → DAVinCy TSOs cannot apply IVA on these
  - For each of these, DAVinCy looks up "substitute CNEC", which belongs to a DAVinCy TSO and has a similar angle as the foreign vertex CNEC
  - As the substitute CNEC is outside of the domain, some IVA is needed to move it to the vertex, and some more IVA for the required contraction effect of the domain
  - This leads to nominally high IVAs which might appear to cause a large reduction, whereas only a share of them actually reduces the size of the domain

  → **IVA as such cannot be interpreted if it is on a substitute CNEC.**

  → **The split of IVA among "move" and "contract" is transparently reported**

  → BTW: IVA can never be interpreted as is, because the impact on the domain depends on the PTDFs (cf. "relative RAM" approach in NRAO)

- **Consequence 2: CNECs with IVA can differ from overloaded CBCOs**
  - IVA can only be applied to CNECs → 5% threshold for z2z PTDF applies, regardless of whether CNEC is from intermediate domain or assigned during individual val. pursuant to Art. 20(6) DA CCM

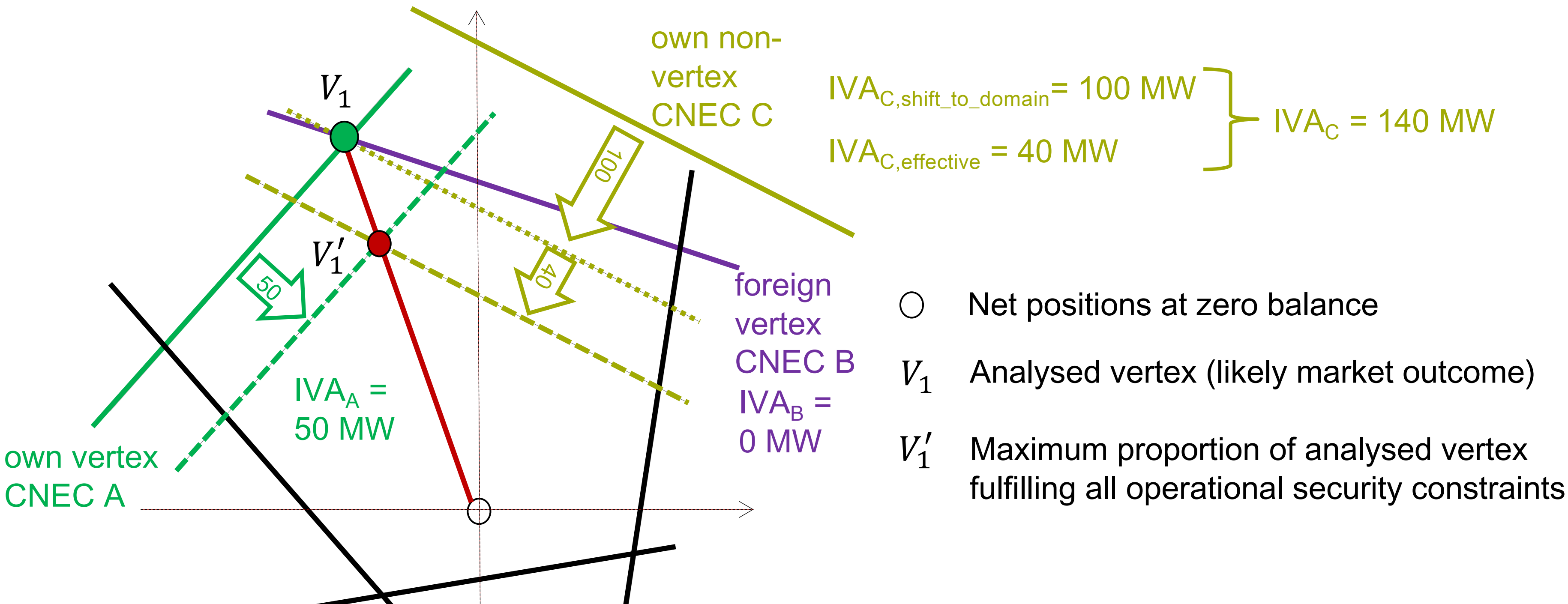
  → **DAVinCy applies IVA on a CNEC while the overloading was on another branch, regardless whether this is a CNEC or non-CNEC**

- **Consequences 1 and 2 are entirely independent from each other.** In particular, the first consequence (large nominal IVA due to the substitute CNEC approach) is in no way related to the location of the overloaded elements and whether these are CNECs or not.

Explanation of selected DAVinCy aspects

Application of IVA: IVAs on substitute CNECs

- In case operational security is endangered in vertex V_1, it can be maintained by shifting all vertex CNECs to a vector of net positions V_1' that can be securely operated.
- CNECs forming vertex V_1 which are not under control by a DAVinCy TSO (50Hertz, APG, Amprion, Tennet DE&NL, TransnetBW) cannot be used by DAVinCy to shift to a secure point.
    - **Note that this issue will not be present for Coordinated Validation, as it is allowed to apply CVA on any CNEC**
- For such foreign vertex CNECs DAVinCy uses own non-presolved CNECs with similar angle as a substitute. For these CNECs, only a share of the IVA is used to effectively move to another vector of net positions. The other part is used to shift the CNEC to Vertex V_1. This split is reported as a part of the justification field for IVAs. Example: “IVA applied due to results of joint security analysis by 50Hertz, Amprion, APG, TNG, TTG, TTN: 100MW of the IVA are needed to shift the non-presolved CNEC to the considered vertex of the intermediate domain ”



Overview of Core individual validation approaches/tools

DAVinCy relative to other individual validation processes

DAVinCy TSOs

- The DAVinCy process has been under relatively strong scrutiny by third parties
- However,
  - most of the aforementioned aspects of DAVinCy are not unique. The table in the main part of this slide deck gives an overview of the various individual validation approaches/tools applied by the Core TSOs, including outlooks on reaction to possible changes, e.g. of the PTDF threshold.

    -> See slide "Core TSO Individual validation approaches: A high-level comparison" in the main part of this slide deck
  - the resulting frequency and amount of IVAs, insofar as they effectively reduce the domains at the analysed vertices, are below average.

    -> See slide "Core TSO Individual validation approaches: Overview of IVA application since Core DA CC Go-Live" in the main part of this slide deck

The DAVinCy process contains a multi-step fallback approach

Fallback stage	Capacity provided	Communication
Scenario A Replacement for missing or corrupt input data (data not from CCCt), e.g. by using data from previous BD	Based on regular validation using the replaced data	None
Scenario B (Results implausible for subset of hours): Apply minRAM% for subset of hours, normal results for other hours	• RAM for Core exchanges: ≥20%·F_{max} & LTA inclusion in affected hours • based on regular validation for remaining hours	• Daily reporting pursuant to Art. 25(2)(d)(xi) DA CCM (Publication Tool) • Quarterly report pursuant to Art. 20(13) DA CCM
Scenario C (Tool failure or results implausible for all hours): Apply minRAM% for all hours	RAM for Core exchanges: ≥20%·F_{max} & LTA inclusion	• Daily reporting pursuant to Art. 25(2)(d)(xi) DA CCM (Publication Tool) • Quarterly report pursuant to Art. 20(13) DA CCM

Explanation of selected DAVinCy aspects

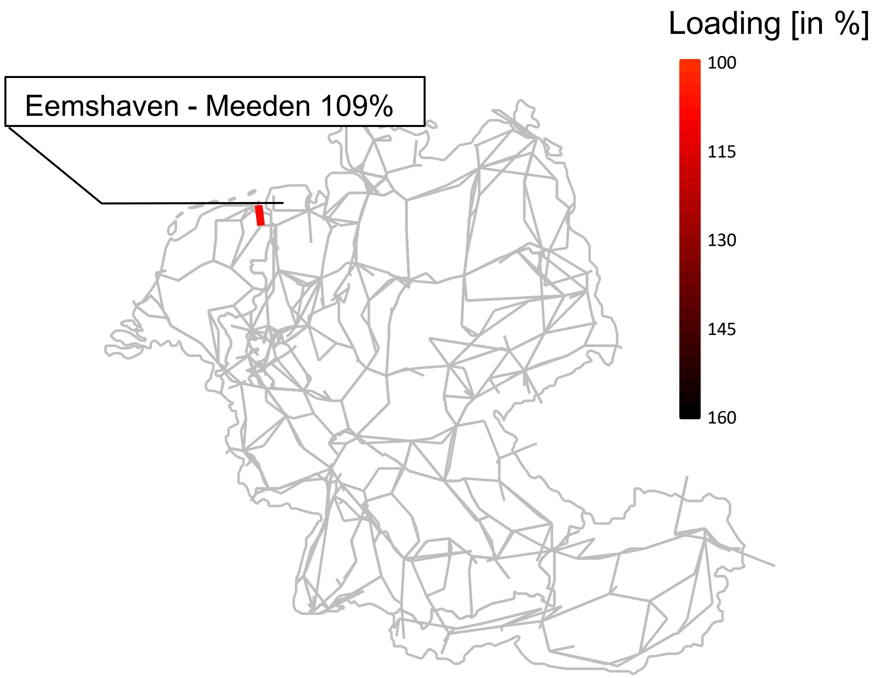
Case study

- **The following slides show a case study highlighting the following aspects**
  - Example showing how a large amount of redispatch is used to avoid IVA to the extent possible
  - Example showing the functioning of substitute CNECs and the split of IVA into the part for moving the CNEC to the vertex and the part that shifts the vertex towards zero balance
  - Some statistics about the magnitude of IVA

Explanation of selected DAVinCy aspects

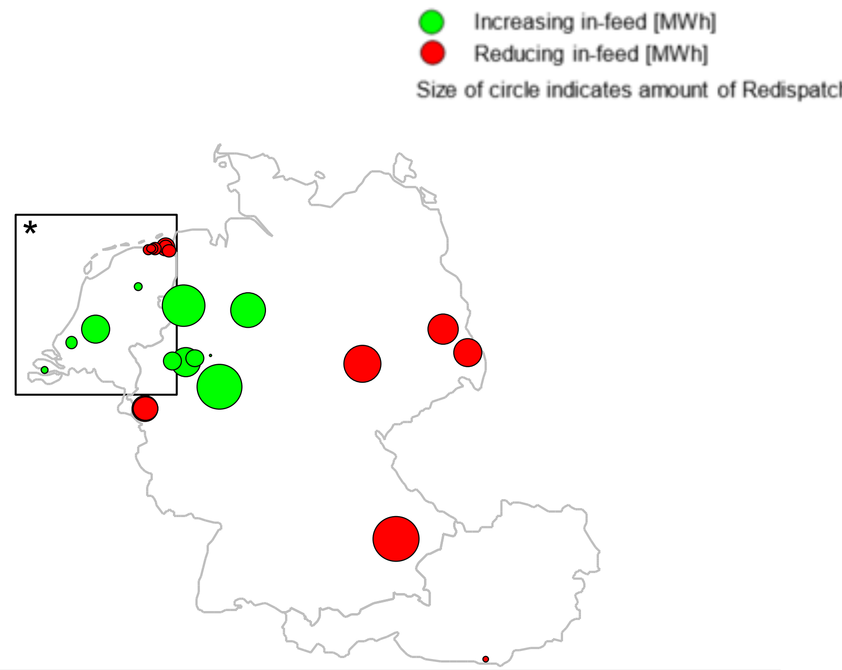
Case study BD20220830_H22

- Congestions before application of RAs in the most critical analysed vertex



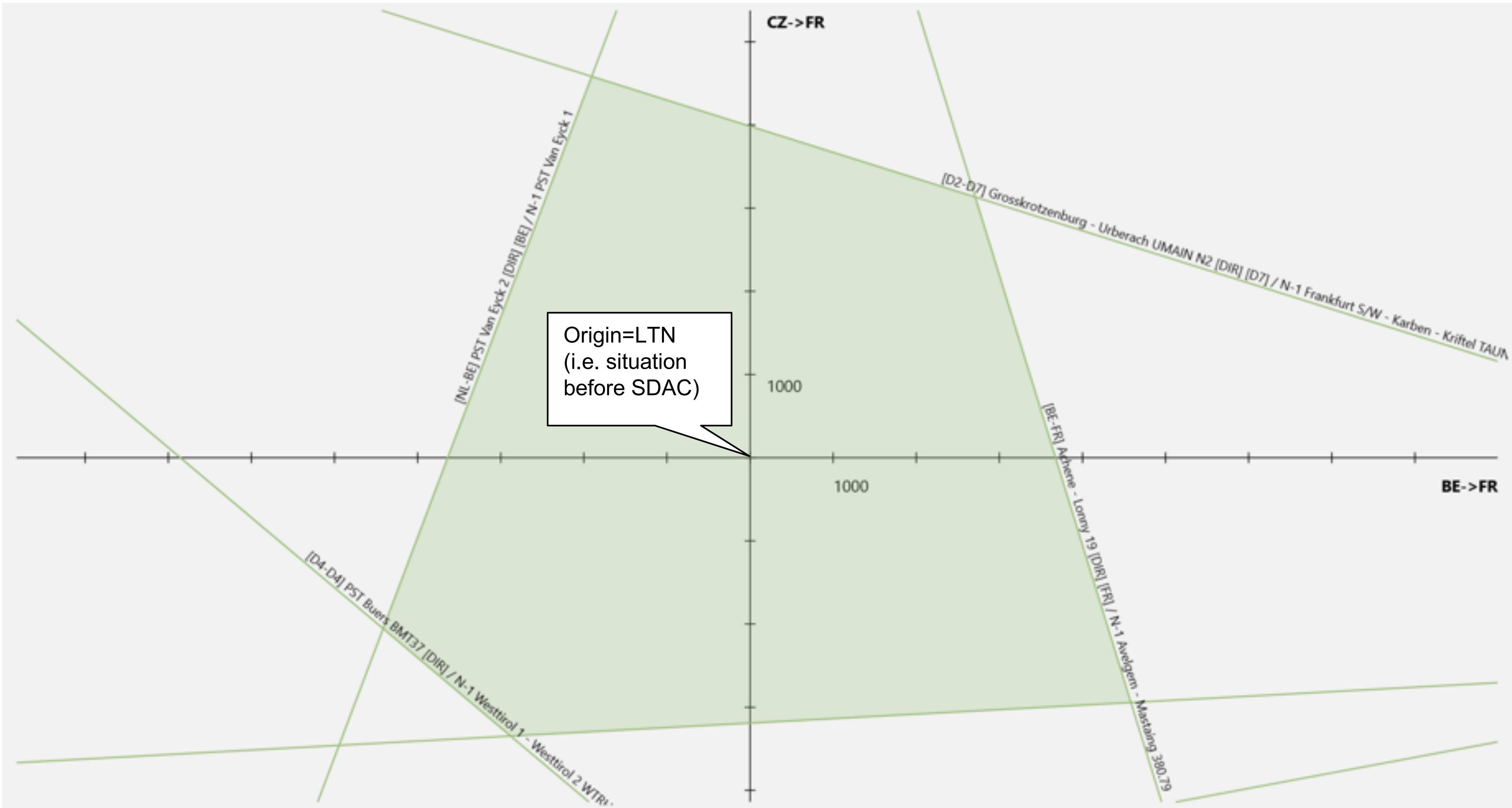
→ **Congestion can only be relieved by application of IVA**
→ **All available RAs with positive sensitivity on congested element (1500 MW of RD plus 11 PSTs) were applied in the simulation before capacity was reduced**

- Optimal redispatching in combination with capacity reduction to solve congestions



*
- No cross-border RD between NL and DE assumed, as there are currently no guaranteed processes for cross-border RD in place
- RD in Germany and Austria only determined to reduce loop-flows, which has a small sensitivity on the congestion in NL
- For initial situation in NL without application of IVA no potential of redispatching in NL at all, as all available power plants are at their maximum limit
- With application of IVA export of NL reduced which allows RD in NL to further relieve the congestion (next to effect of capacity reduction)

- Final FB domain without IVA from DAVinCy TSOs (2-dimensional cut CZ→FR / BE→FR)



Explanation of selected DAVinCy aspects

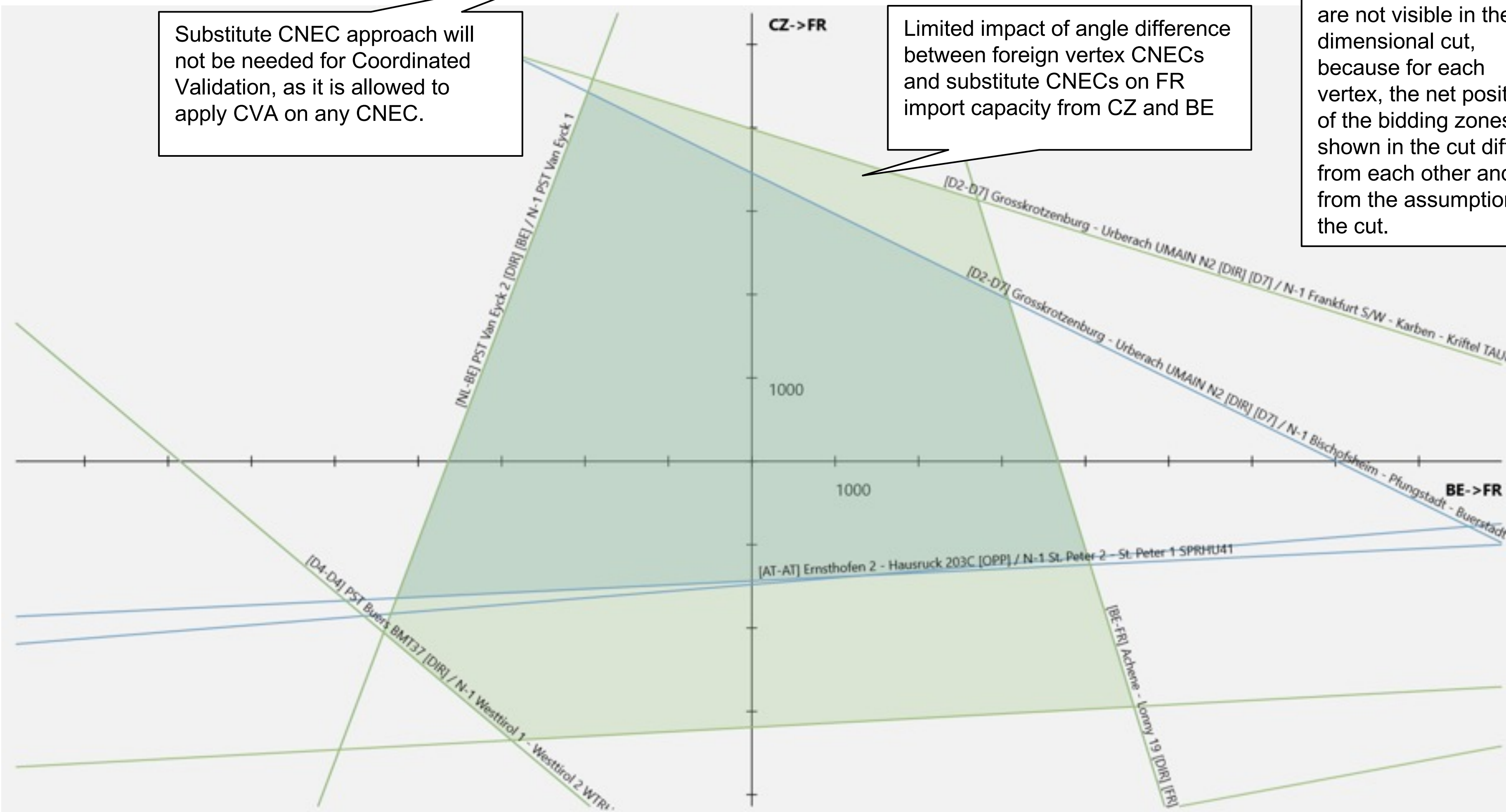
Case study BD20220830_H22

- Final FB domain with IVA share to shift substitute CNECs to the vertex

Substitute CNEC approach will not be needed for Coordinated Validation, as it is allowed to apply CVA on any CNEC.

Limited impact of angle difference between foreign vertex CNECs and substitute CNECs on FR import capacity from CZ and BE

Note: IVA applied due to several vertices of the domain. Vertices are not visible in the 2-dimensional cut, because for each vertex, the net positions of the bidding zones not shown in the cut differ from each other and from the assumptions in the cut.

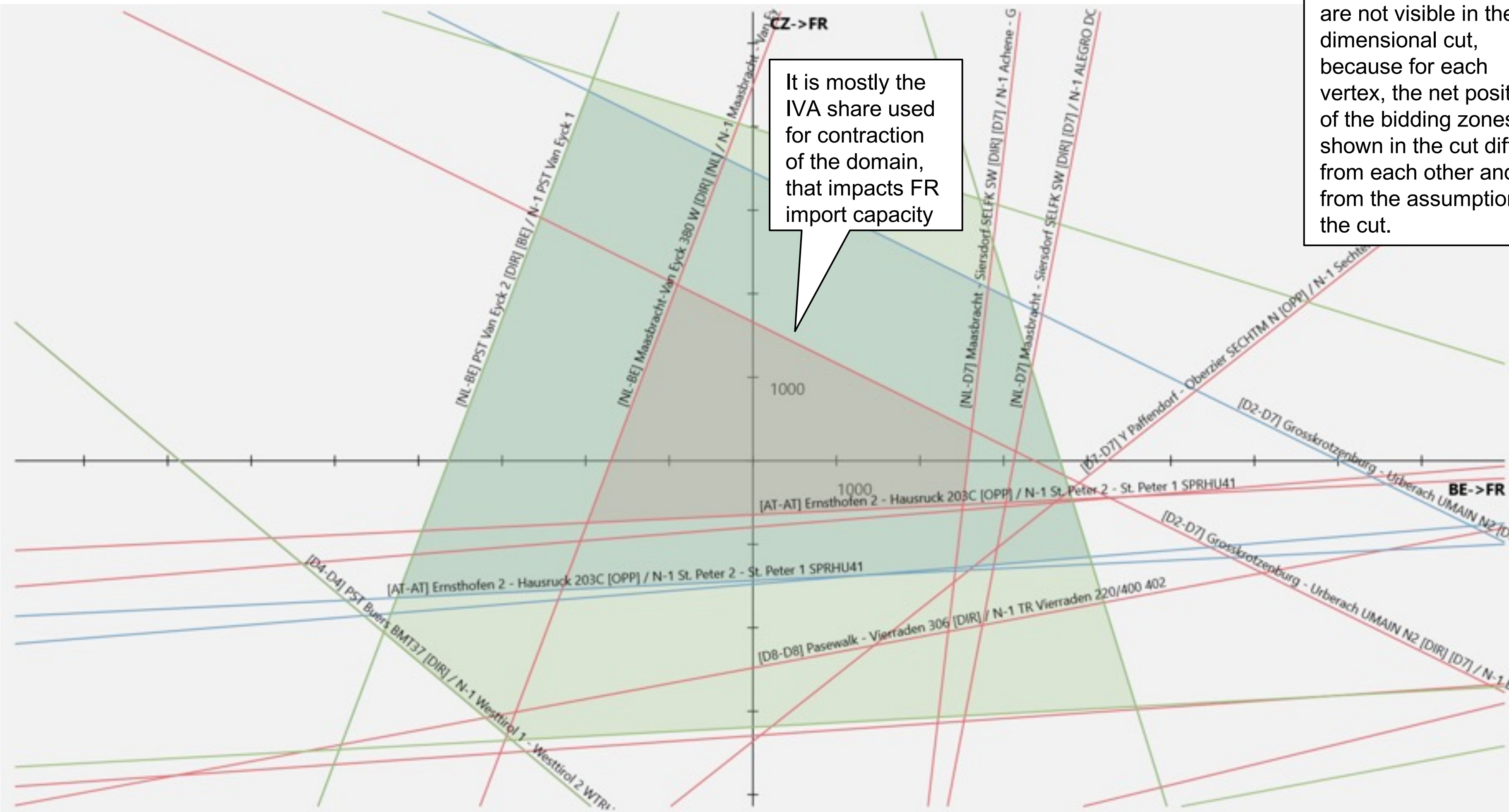


Explanation of selected DAVinCy aspects

Case study BD20220830_H22

- Final FB domain with complete IVA needed to avoid operational security violations

Note: IVA applied due to several vertices of the domain. Vertices are not visible in the 2-dimensional cut, because for each vertex, the net positions of the bidding zones not shown in the cut differ from each other and from the assumptions in the cut.



Explanation of selected DAVinCy aspects

Envisaged improvements

- **The DAVinCy TSOs are committed to performing Individual Validation in line with operational security requirements and all other stipulations of the DA CCM**
  - New features or modified parameters often imply a decision as to the balance of operational security and the goal to maximise capacity
  - The DAVinCy TSOs aim at a well-balanced parameterization
  - Requests for less reductions must always be weighed against the consequence of overlooking even just a single relevant threat to operational security
  - Cf. situation on BD 17/12/2022, when only the DAVinCy TSOs discovered a severe flaw in the DA CC inputs and stipulated reductions that afterwards were agreed to be necessary by all Core TSOs

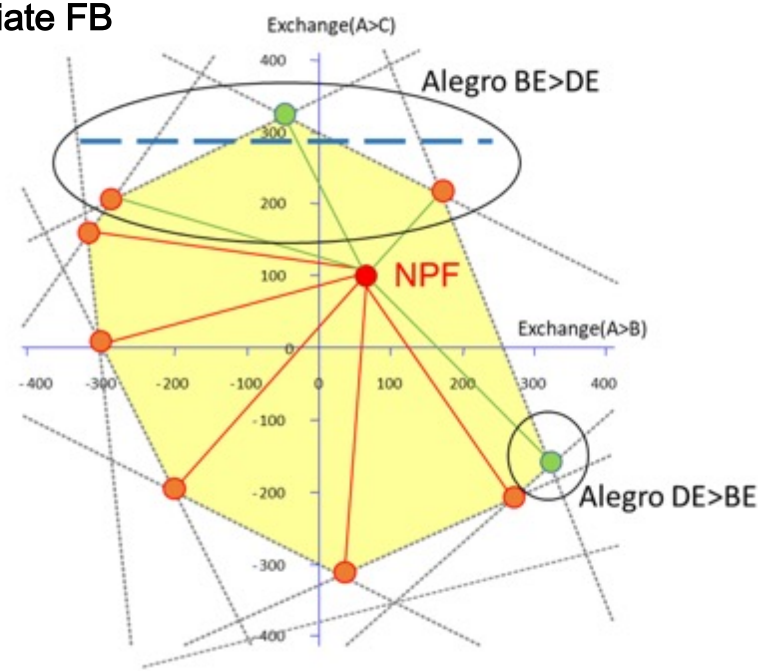
- **Recent improvements comprise, inter alia**
  - Introduction of lighter fallback (RAM ≥ 20 % · F_{max} & LTA inclusion)
  - Consideration of countertrading DK1-DE (non-Core border)
  - Consideration of cross-zonal redispatch with CH (non-Core border)
  - Avoidance or mitigation of IVA due to unrealistic vertices (implementation under review as of 23/01/2023, deploy expected soon)
    - Concept: When the market would need to dispatch (almost) all available generators in a DAVinCy bidding zone to reach the analysed vertex of the domain, the vertex is deemed unrealistic (in terms of the extent of cross-zonel exchange), and the assessment stops before reaching the vertex – unless the Core Net Position Forecast suggests a net position close to that of the vertex

- **Further improvements are under investigation**

Individual validation approach Elia

1. How are the circumstances selected?

Intermediate FB domain



Statistics

- **Pre-filtering:** filter from all vertices those closest to NPF with uncertainty interval P99. Closest = weighted Euclidian distance based on representative PTDFs.

$$d = \sqrt{\sum_{i=1}^{N} PTDF_i * (Vertex_i - NPF_i)^2}$$

- **ALEGrO:** create 2 groups in the pre-filtered vertices, using Min and Max NP of ALEGrO as key parameter
- **Adaptable scenario framework:** select from these 2 groups the vertices corresponding to the scenario's chosen for validation
  - Closest to NPF
  - Maximum import FR+BE (winter)
  - Maximum south > north exchanges (summer)

Individual validation approach Elia

1. How are the circumstances selected?

Input/Statistics

Source NPF = Coreso, which was improved with integration of ALEGrO

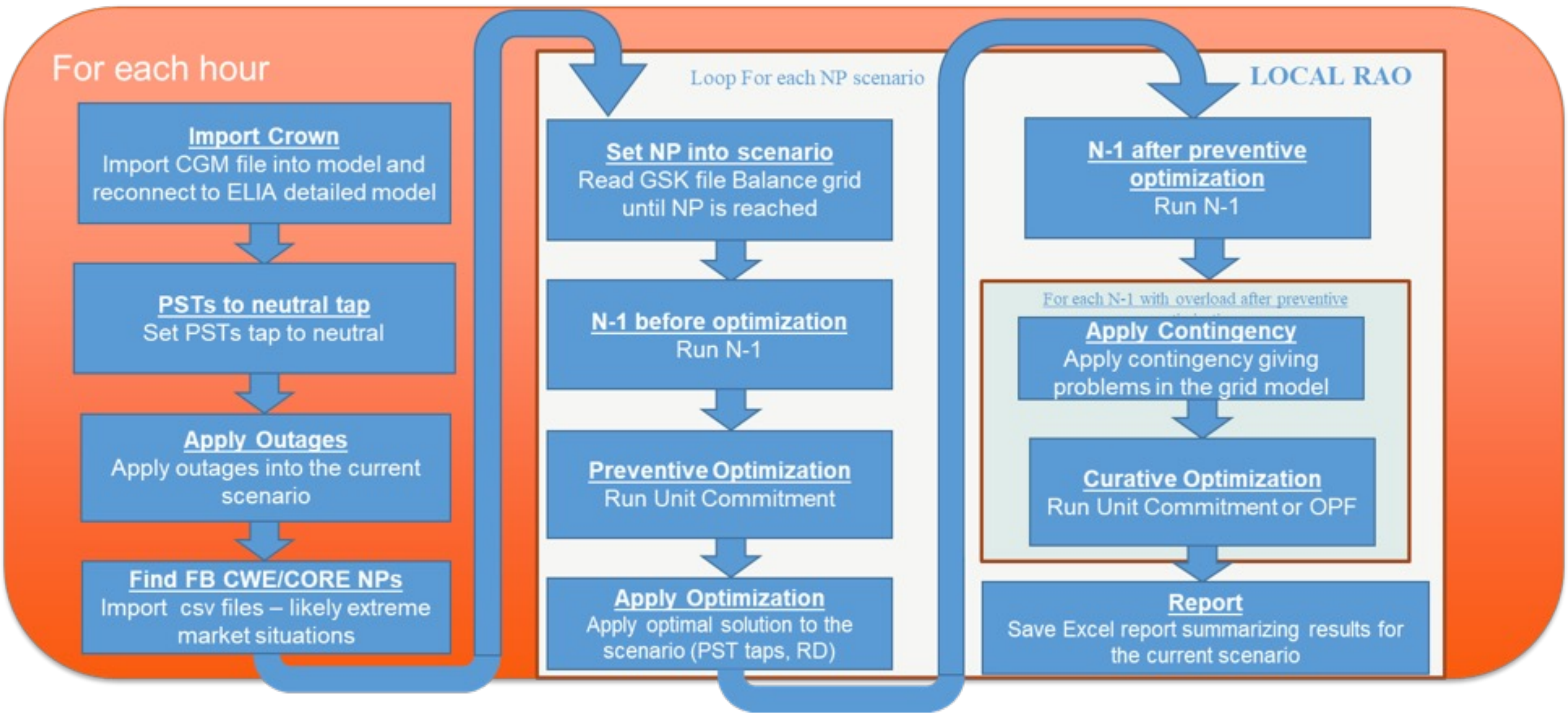
- Weighted distance to the NPF is weighted with P95 PTDFs (i.e. z2z with BE) over all presolved CNECs of previous month (rolling window; in fact no adaptation is made when it doesn't change a lot)

$$d = \sqrt{\sum_{i=1}^{N} PTDF_i * (MCP_i - NPF_i)^2}$$

→ In this way the distance favorizes bidding zones with a high impact (big PTDF) on Belgian CNECs but on which the forecast error might be bigger. **➔ Due to the too low PTDFs, the NPs of CZ, HR, HU PL, RO, SI, SK are excluded in the selection.**

Individual validation approach Elia

2. How is operational security assessed for these circumstances?



Individual validation approach Elia

Elia

2. How is operational security assessed for these circumstances?
3. Which RAs are used to avoid reductions, and how is their impact assessed?

- **Perform an AC loadflow in PowerFactory software on the selected vertices. In case of congestions, attempt to solve with remedial actions:**
  - PST taps:
    - Preventive: +8 / -8
    - Curative around preventive: additional 2 taps – proxy to ensure that temporary overload limits are not breached
  - National RD potential: CCGT & offshore wind
  - Topological: PowerFactory unit commitment module is not capable to process topological RAs. This is expected to be integrated into a future version of the software (1-2 years from now)
  - Cross-border RD potential: not applied as this is for the full coordinated validation phase

- **Local RAO minimizes the highest overload on CNECs. In case of remaining congestion, capacity reduction (IVA: individual validation adjustment) is applied. To minimize congestion, the RAO can shift congestion around between CNECs and therefore:**
  - IVA can occur on non pre-solved BE CNECs from the intermediate domain
  - IVA can occur on CNECs with no virtual RAM

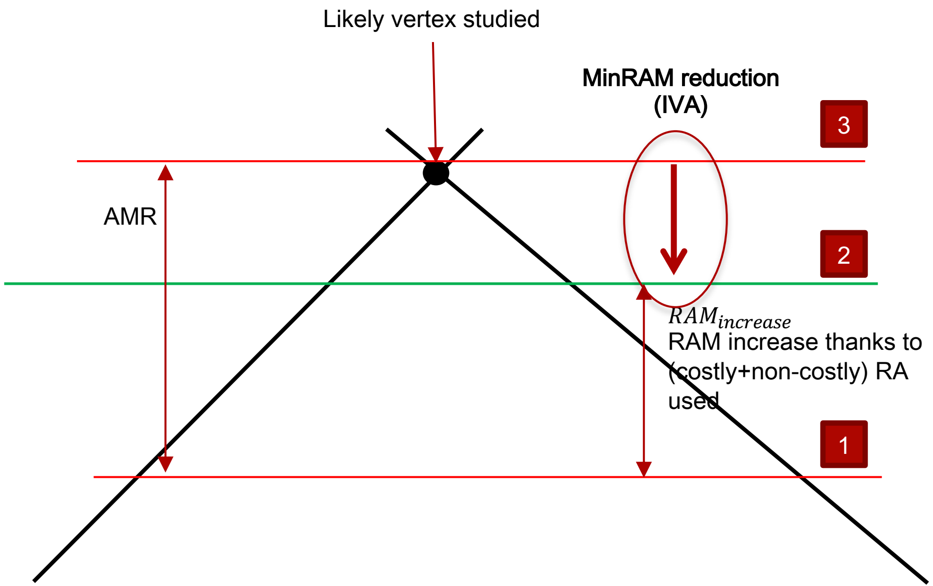
Assumptions on costly remedial actions

- **Criteria 0: local RAO thus only national RD potential**
- **Criteria 1: level of coordinability**
  - Include: coordinable units (example: CCGTs) & specific limited-coordinable units (offshore wind)
  - Exclude: limited-coordinable (example: nuclears, Zandvliet Power) & non-coordinable (historically these are units < 25 MW)
  - Justification: need ability for both upwards and downwards potential. Limited coordinable units typically only downwards potential
- **Criteria 2: size of production unit**
  - Include: production units >= 50 MW
  - Exclude: production units < 50 MW (example: turbojets, small WKKs, small GTs, onshore wind)
  - Justification: finding an efficient / doable solution. Using too many widespread small units increases quickly complexity (+ coordination on DSO level) whilst their contribution to reduce congestion in 380kV grid will be limited
- **Criteria 3: efficiency criterion:** Exclude during the costly RA optimisation in the local RAO, the tool assesses the efficiency of the possible RAs. In case it's efficiency is below 10%, the RD option will not be used. Example: if a change in setpoint of the considered unit of 10MW reduces the to-be solved overload with less than 1 MW, it will not be selected.
  - Justification: finding an efficient and doable solution.
- **Criteria 4: exclude pump-storage power plants (e.g. Coo & Plate Taille)**
  - Justification: RD bids are difficult to forecast as depending on energy level. Also the RAO works on per MTU basis as modeling temporal effects would make it too complex to run
- **Criteria 5: wind curtailment is limited to 420 MW as proxy for limit on upward RD potential**
  - Justification
    - In D-2 uncertainty on available upward RD potential
    - Setting a limit on RD potential that is locally decided upon makes sense as after market coupling such decision is to be taken through coordination

Individual validation approach Elia

4. How are identified operational security violations turned into IVAs?

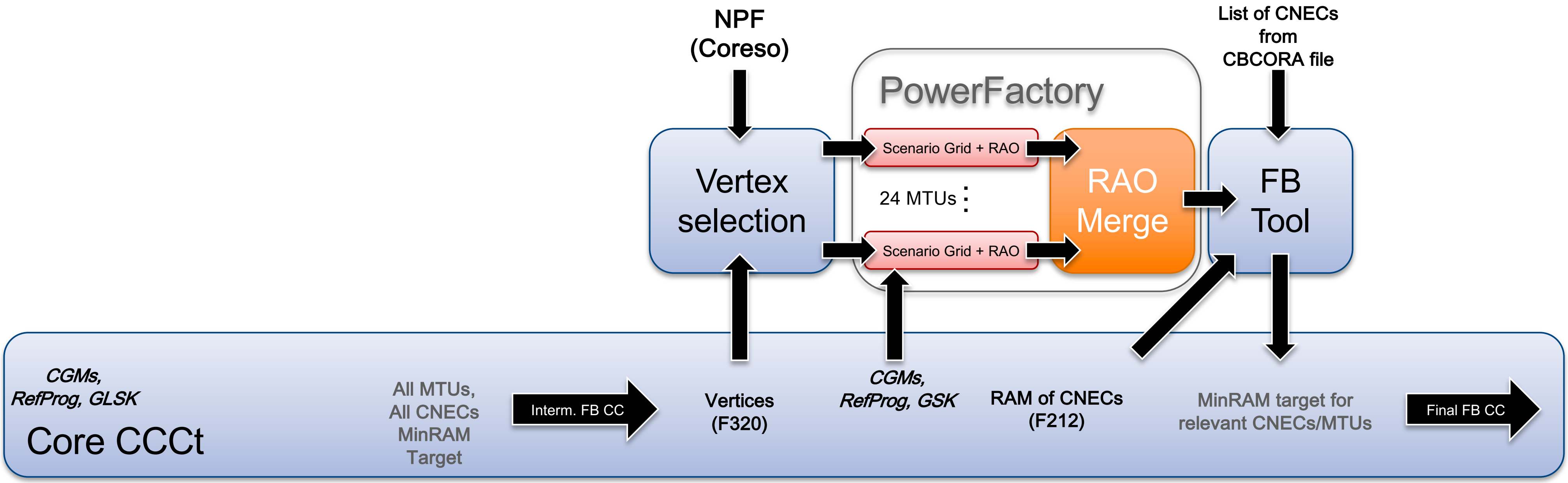
- **RAM to be finally reduced for a CNEC in case of remaining overloads**



1. Branch before 70% minRAM application RAM @vertex < 0
2. Branch secure following security analysis performed in validation process
3. Branch after 70% minRAM application RAM @vertex > 0
4. In case RAM for the branch would result after IVA application into <20%, IVA is capped so that 20% RAM is given

Individual validation approach Elia

5. Fallbacks: when do you apply it, which capacities result from it, how do you communicate about it



Vertex selection fails

- One or Multiple consecutive MTUs ➔ No RAO for concerned MTUs as no scenario's can be selected ➔ Concerned MTUs labelled as failed RAO (and processed like described below)

RAO fails

- In case of failure for 1 MTU ➔ spanning (same principle as for FD) for these CNECs
- In case of failure for multiple consecutive MTUs ➔ minRAM for Core exchanges adapted to 20% for the concerned MTUs
- In case of a CNEC missing in RAO merge results ➔ minRAM for Core exchanges adapted to 20% for the concerned CNEC

Communication

- Done via the justification field (PuTo Core CCR (jao.eu))

6. Show an example / case study / some figures (this to enhance understanding, as well as to demonstrate that RAs are being used)

Circumstance selection

Alegro creates 2 groups

Adaptable scenario framework

Relevant hub NPs as PTDFs on BE CNECs are biggest for those hubs

Pre-Filtering was implemented based on P99 distance

CEP Market Scenario Selection

Target Date: 24/01/2023 Version: 1 NPForecast File Version: 3 Vertices File Version: 1

Import Vertices & Calculate Market Scenarios

Minimum Distance to NP Forecast | Max Import BE | Max Import BE + FR | Max Exchange S>N

Max BE>DE

Hour	Dist.	BE	DE	BE_AL	DE_AL	FR	NL	AT	CZ	HR	HU	PL	RO	SI	SK
00:00	1164	-1037	4694	-1000	1000	-6878	-444	-3955	4044	-3438	6609	-4939	-1917	4048	3213
01:00	982	45	3911	-919	919	-7389	597	-95	7034	-5516	2640	1408	2629	-732	-4533
02:00	1233	-247	8549	-1000	1000	-6465	89	-3104	5198	-4991	-473	2091	-671	-798	823
03:00	1813	-1500	5011	-1000	1000	-6854	-1606	-974	4560	-5645	5146	3559	2546	1279	-5520
04:00	1332	602	6796	-1000	1000	-7289	663	-7487	5483	-3825	3256	3017	-1609	2348	-1958
05:00	2060	-1990	6088	-1000	1000	-6550	-1184	-3214	5075	1550	-3049	-4392	-2457	3189	6933
06:00	1850	-1000	-4874	-1000	1000	-3548	2600	-1215	5171	1229	5066	-4323	-354	3554	-2306
07:00	1358	-1316	618	-1000	1000	-3031	-860	-952	1479	-2842	3319	-2581	1826	1092	3247
08:00	2759	-3337	-574	-1000	1000	1591	-1065	894	6567	-4315	-3114	-4516	1746	696	5427
09:00	2811	783	2410	-1000	1000	-7277	-1684	-1362	3035	-4900	6012	-281	39	2324	902
10:00	1630	-2306	-585	-1000	1000	-726	-527	-1802	5074	-4133	4545	-4363	1760	3525	-463
11:00	2048	-2780	-1385	-1000	1000	110	-1046	-1422	6811	-1170	2502	372	-1220	6110	-6882
12:00	2273	235	1524	-1000	1000	-4399	-577	-1106	2168	3502	-5337	-4373	-1028	2866	6524
13:00	1956	-1954	505	-1000	1000	-1583	-607	724	2303	-3456	6573	2862	-1758	3060	-6669
14:00	1993	-1996	2407	-1000	1000	-2465	-359	-837	-567	-3620	7503	-3790	-1728	3897	1556
15:00	1233	-628	-2213	-1000	1000	-2802	1467	104	6691	-1115	4995	-4181	1710	-1225	-2803
16:00	1709	-2314	-1100	-1000	1000	-589	385	977	6822	-2748	-3256	-4520	1500	74	4771
17:00	1078	-1235	-1215	-1000	1000	-2400	32	6	5706	-2185	9083	-4105	-1656	349	-2379
18:00	1812	1522	-1580	-1000	1000	-4693	614	775	6707	115	-2905	-4211	321	-2934	6270
19:00	799	438	1739	-1000	1000	-5032	-498	-163	2356	-4932	7708	-4438	1224	2455	-857
20:00	858	-95	3024	-1000	1000	-4801	-787	-785	-3890	3300	-5906	1329	-134	2205	6541
21:00	1230	-465	96	-1000	1000	-5812	-326	-931	4675	1377	8037	-4240	-1646	743	-1509
22:00	1420	484	5885	-1000	1000	-7592	-940	978	6431	-4292	-3844	-1916	1269	986	2552
23:00	1458	-833	3082	-1000	1000	-6966	-637	-889	4731	821	8745	-4560	-2671	176	-999

Max DE>BE

Hour	Dist.	BE	DE	BE_AL	DE_AL	FR	NL	AT	CZ	HR	HU	PL
00:00	1329	-235	8581	1000	-1000	-8081	695	-7908	3582	2114	-3012	2623
01:00	1503	38	6320	1000	-1000	-8718	730	-1996	5848	-5637	-1862	3167
02:00	1495	195	5571	1000	-1000	-8603	969	-1447	5928	-5581	-2392	3301
03:00	1553	-397	10452	1000	-1000	-6013	1052	-7341	-4248	-4052	2629	1911
04:00	1372	-1048	8112	1000	-1000	-6550	633	-7894	5869	-5056	4354	1958
05:00	1104	-737	4366	1000	-1000	-7422	523	-489	5446	-206	-2560	3515
06:00	2334	3201	-713	1000	-1000	-3132	3794	3130	-4564	1458	-3717	1790
07:00	1876	-92	591	1000	-1000	-5773	-108	-952	-3104	1893	-4510	3572
08:00	1958	2146	338	1000	-1000	-3445	1517	1902	-7670	-4826	5089	1976
09:00	1791	-1714	1550	1000	-1000	-4006	-1429	-209	4753	-5311	7728	3517
10:00	2059	-1579	2345	1000	-1000	-4368	-1026	165	3504	-189	7118	3241
11:00	2146	2202	911	1000	-1000	-1266	3118	-3695	-5384	2413	-2983	1504
12:00	1590	1873	-3267	1000	-1000	-1291	3107	-4988	6183	-4048	4255	1778
13:00	1845	424	-4555	1000	-1000	1024	4373	1699	-8165	-3329	6722	1094
14:00	2101	1236	1902	1000	-1000	-5249	2246	1438	-819	-4529	7338	-1560
15:00	1676	1660	-1220	1000	-1000	-1003	3353	856	-2456	3586	-367	955
16:00	1375	47	-480	1000	-1000	822	2277	2527	-3180	1720	-308	887
17:00	1810	-346	-992	1000	-1000	-946	2571	2920	-2046	2948	-73	1481
18:00	1238	-1694	-648	1000	-1000	-3762	-739	-55	3206	-1431	-2787	4120
19:00	1511	1385	-81	1000	-1000	-5581	1121	824	-5106	-275	1155	3105
20:00	1056	1269	1668	1000	-1000	-5922	1070	-244	-6402	-3363	6569	2946
21:00	1485	-1439	1210	1000	-1000	-5839	-145	-1446	4668	1234	7183	-4301
22:00	771	1025	2609	1000	-1000	-6567	1292	-7931	4524	2283	6848	2925
23:00	886	95	6705	1000	-1000	-5759	1211	-9027	5941	1408	7298	-758

Export Options

Scenario 1 - Min Distance NPF: ☑ Max BE>DE ☑ Max DE>BE

Scenario 2 - Max Import BE: ☐ Max BE>DE ☐ Max DE>BE

Scenario 3 - Max Import BE+FR: ☐ Max BE>DE ☐ Max DE>BE

Scenario 4 - Max S>N Exchanges: ☐ Max BE>DE ☐ Max DE>BE

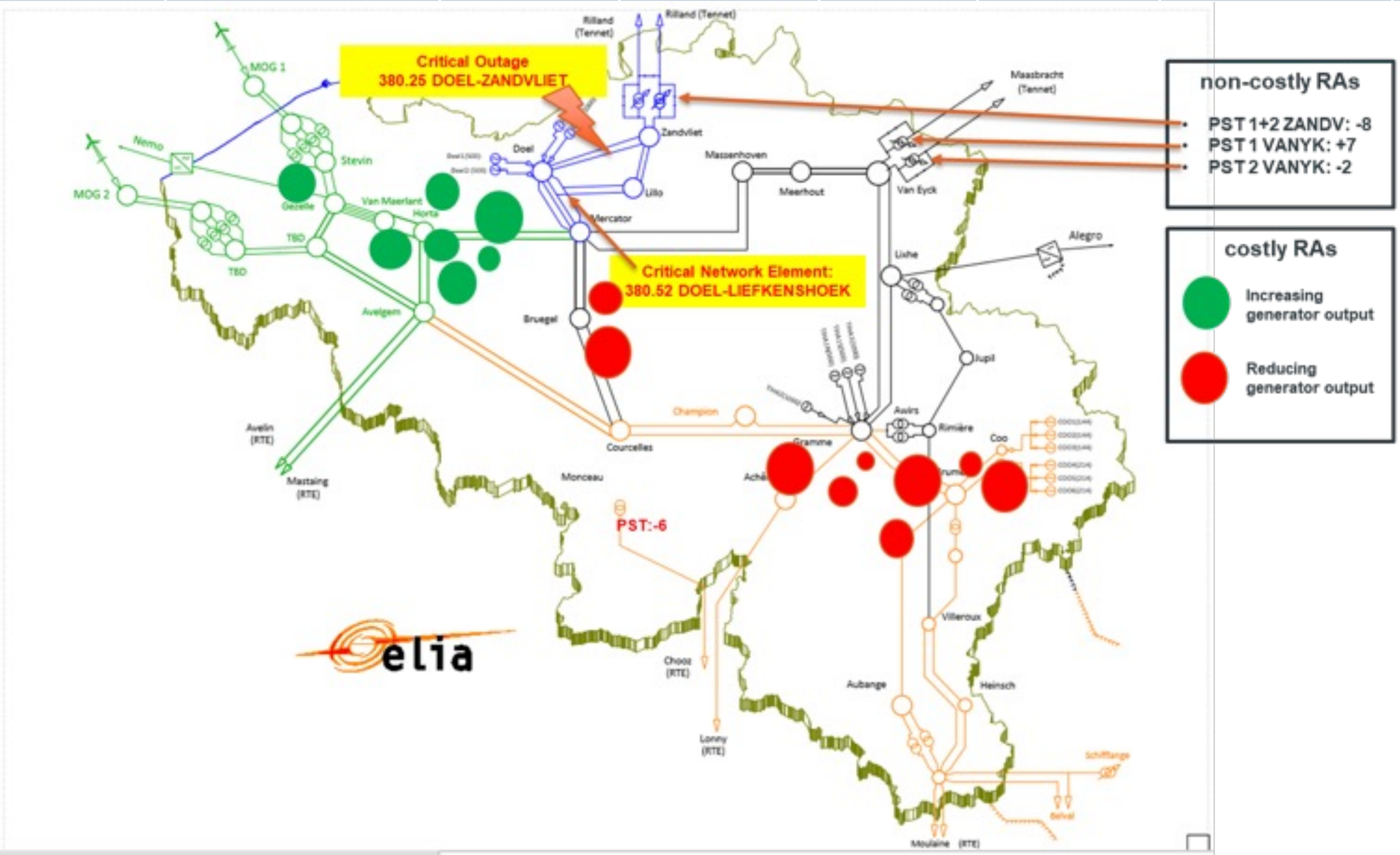
Excel Options: ☑ NP Forecast ☑ Settings ☐ All Vertices

Selection of the relevant scenario from the Adaptable scenario framework

Assessing operational security

Most critical scenario: DistanceNPF (Alegro: DE>BE)

Hour	CNE Element name	CO Base	Loading without RAs [%]	Overload without RAs [MW]	Loading with pRAs [%]	Overload with pRAs [MW]	Loading with pRAs+cRAs [%]	Overload with pRAs+cRAs [MW]
11.0	380.52 DOEL-LIEFKENSHOEK	380.25 DOEL-ZANDVLIET	152.1	808.4	108.5	132.7	103.4	53.4

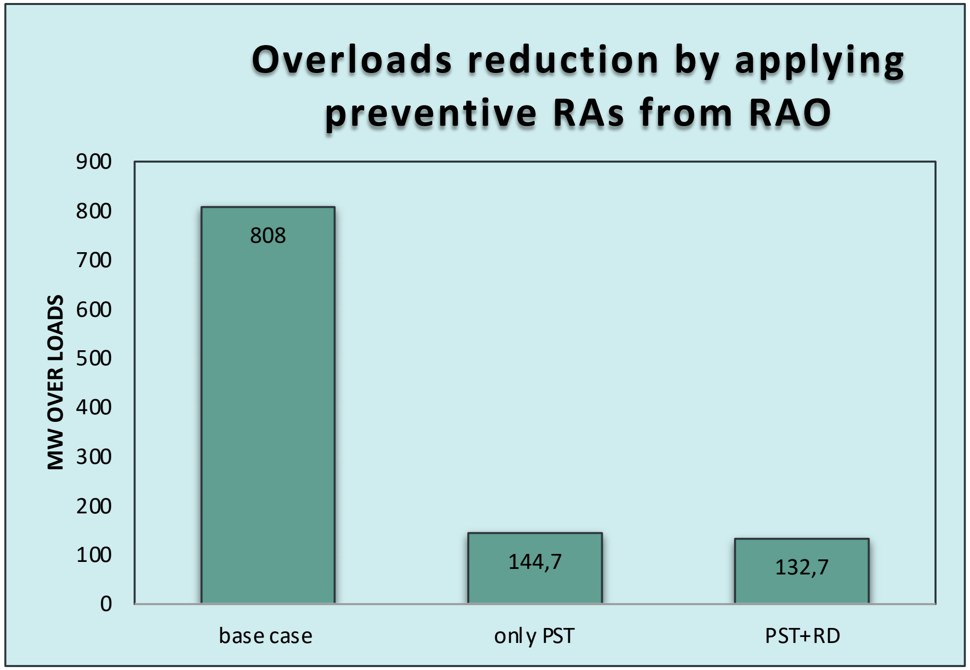


Assessing operational security

- RAs allow to reduce the initial overload seen
  - Costly (RD) and non-costly RAs (PSTs) are considered
  - Preventive and curative RAs are considered
- PST tap changes
  - allowed for reducing the initial overloads from 808MW to 144,7MW
  - this assumes that there is no impact X-border → risk on not being applicable in RT)
- Redispatch (RD)
  - allowed for further reducing overloads with 12MW when applying 576MW of RD
  - The congested grid element is in a grid area where internal RD (international RD cannot be applied in individual validation) is not efficient
  - Remark: grid elements close to offshore wind power generations seems to be much more relevant for internal RD

→ There is an added value for having a (more) coordinated validation

→ Overloads remain: in the end after preventive RAs applied there still remains **53,4MW**



Hour	CNE Element name	CO Base	Loading without RAs [%]	Overload without RAs [MW]	Loading with pRAs [%]	Overload with pRAs [MW]	Loading with pRAs+cRAs [%]	Overload with pRAs+cRAs [MW]
11.0	380.52 DOEL-LIEFKENSHOEK	380.25 DOEL-ZANDVLIET	152.1	808.4	108.5	132.7	103.4	53.4

Individual validation approach Elia

Elia

6. Show an example / case study / some figures (this to enhance understanding, as well as to demonstrate that RAs are being used)

Turning operational security violations into IVAs?

CNE(C) for which an overload seen is turned into IVA

CNE(C) out of service in the grid for that BD

Step 3B: IVA Creation | Step 3A: Market Scenario Selection

IVA Creation

Target Date: 24/01/2023 Version: 1

Import RAO Result

Overloads Overview | Overloads Details | KPI's

CB Name	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00
[BE-BE] Achene - Gramme 380.10 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Achene - Gramme 380.10 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Avelgem - Horta 380.101 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Avelgem - Horta 380.101 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Avelgem - Horta 380.102 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Avelgem - Horta 380.102 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Champion - Courcelles 380.56 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Champion - Courcelles 380.56 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Champion - Gramme 380.32 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Champion - Gramme 380.32 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Doel - Mercator 380.53 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Doel - Mercator 380.53 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Doel - Mercator 380.54 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Doel - Mercator 380.54 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Doel - Zandvliet 380.25 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Doel - Zandvliet 380.25 [OPP]	0	0	65	88	5	0	0	0	0	0	0	0	0	0	63	0	0	0	0	0
[BE-BE] Doel - Zandvliet 380.26 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Doel - Zandvliet 380.26 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Lixhe - Gramme 380.11 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Lixhe - Gramme 380.11 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Lixhe - Van Eyck 380.91 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Lixhe - Van Eyck 380.91 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0
[BE-BE] Y-Courcelles (-Gramme - Tergnee) 380.31 [DIR]	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	[illegible]	N/A	N/A	N/A	0	0	0	0
[BE-BE] Y-Courcelles (-Gramme - Tergnee) 380.31 [OPP]	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
[BE-BE] Y-Doel (-Lillo - Mercator) 380.52 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Y-Doel (-Lillo - Mercator) 380.52 [OPP]	90	136	148	146	175	73	29	12	44	56	36	53	114	28	112	42	28	63	52	47
[BE-BE] Y-Gramme (-Andre Dumont - Van Eyck) 380.12 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Y-Gramme (-Andre Dumont - Van Eyck) 380.12 [OPP]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
[BE-BE] Y-Gramme (-Courcelles - Tergnee) 380.31 [DIR]	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
[BE-BE] Y-Gramme (-Courcelles - Tergnee) 380.31 [OPP]	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
[BE-BE] Y-Horta (Mercator - Rodenhuize) 380.73 [DIR]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Export IVA XML | Export To Excel | Save & Send IVA XML

Turning operational security violations into IVAs?

PuTo Core CCR (jao.eu)

Date	CNEC Name	TSO Name	Returned Branch	CVA (MW)	IVA (MW)	Justification
2023-01-24 11:00:00	Y-DOEL (-LILLO - MERCATOR) 380.52 / DOEL - ZANDVLIET 380.25	Elia			0	IVA applied due to unsolvable overloads; RO = -1750 ; FR = -1266 ; NL = 3118 ; HU = -2983 ; BE = 2202 ; AT = -3695 ; CZ = -5384 ; SK = 5731 ; DE = 911 ; HR = 2413 ; SI = -803 ; DE_AL = -1000 ; BE_AL = 1000 ; PL = 1504

In case RAM for the branch would result after IVA application into <20%, IVA is capped so that 20% RAM is given
(when looking into PuTo, it's clear this was needed here)

See circumstance selection

Date	CNE_Name	Contingency Name	RAM	F_max	R_amr_justification	minRAM_target_Core %
2023-01-24 11:00:00	Y-Doel (-Lillo - Mercator) 380.52	Doel - Zandvliet 380.25	312	1552	LFcalc = 61,81% ; LFaccept = 12,65% ; MACZT(MCCC + MNCC) = 20,84% ; MNCC_UK = -0,36%	20.0

Explanation of MAVIR validation

Summary

1. How are the circumstances selected?

   For all CBCOs, MoPs are calculated meaning the most loading point in case of realistic market outcome. The CBCOs with overload (>90%) are selected. Realistic market outcomes are defined based on analysis of the historical reference program and MCP differences. Circumstances are domain parts in the validation procedure, not only selected vertices.

2. How is operational security assessed for these circumstances?

   Operational security is assessed by 90.5% limit for the Hungarian CBCOs, as FRM is always set to 10%. 0.5% extra margin is used to avoid numerical uncertainties coming from rounded data.

3. Which RAs are used to avoid reductions, and how is their impact assessed?

   RAs are considered indirectly by the operators. Operators have different tooling such as contingency analysis based on the uct-CGM-s in selected point of the domain, or visualisation.

4. How are identified operational security violations turned into IVAs?

   In the first step some parts (sections) of the domain are defined to be critical. IVAs are calculated to minimise Euclidean movement of the shifted CBCOs. Only one CBCO is shifted for a defined critical section.

5. Fallbacks: when do you apply it, which capacities result from it, how do you communicate about it?
   If any calculation procedure is failed, the following equations determine the IVA. The fallback is reported in the validation file.

$$IVA = F_{max} - FRM + AMR + LTA_{margin} - F_{ltamax}, \qquad if\ D(refprog, cbco) = \frac{\sum PTDF_z\, RP_z - (F_{max} - FRM - F_{0Core})}{\sqrt{\sum z2zPTDF_b^2}} \leq 500\ \mathrm{MW}$$

6. Show an example / case study / some figures (this to enhance understanding, as well as to demonstrate that RAs are being used)
   Next slides are prepared for explanation of the whole validation method in details, where equations are fully given and figures help the understanding.

7. Envisaged improvements: optional, in case you have further developments of your local tool planned
   The validation method are continuously improved based on the experiences. Four main branches are studied:
   1) considering redispatch and de facto GLSKs,
   2) improving the definition of market realistic environment,
   3) considering inner network elements,
   4) decrease the amount of applied IVA by avoiding redundant shifts.

Key elements of MAVIR IVA methodology

- Criticality assessment:
  - CBCOs are analysed and denoted to be critical (not the (clustered) vertices)
  - For each critical CBCOs, a market outcome is determined that results in its highest overload.
- IVA values are determined to minimise the Euclidean movement of shifted elements
  - Hence the volume of the domain remains the largest.
  - Segments of the domain are defined to be critical (for any CBCOs),
    algorithm excludes these domain-segments only and fully.
- Redispatch is not critical in Hungary, only manually applied by operators currently.
  - Still the automatic consideration of RD has been elaborated, and is currently under development.

Assumptions

- LTA domain can be also considered, but now only AMR domain is validated.
- Net position forecast gives proper reference program

Steps

1. Determine CBCOs that might be overloaded in domain (“seems to be critical”)
2. Select CBCOs that can be overloaded by a realistic market outcome (“proved to be critical”)
3. Define segments of domain where market outcomes would overload and must be excluded.
4. Calculate IVA resulting the least Euclidean movement of shifted elements but excluded all the defined critical segments.

CBCOs seems to be critical → CBCOs proved to be critical → Domain segments to exclude → IVA least decrease the size of domain

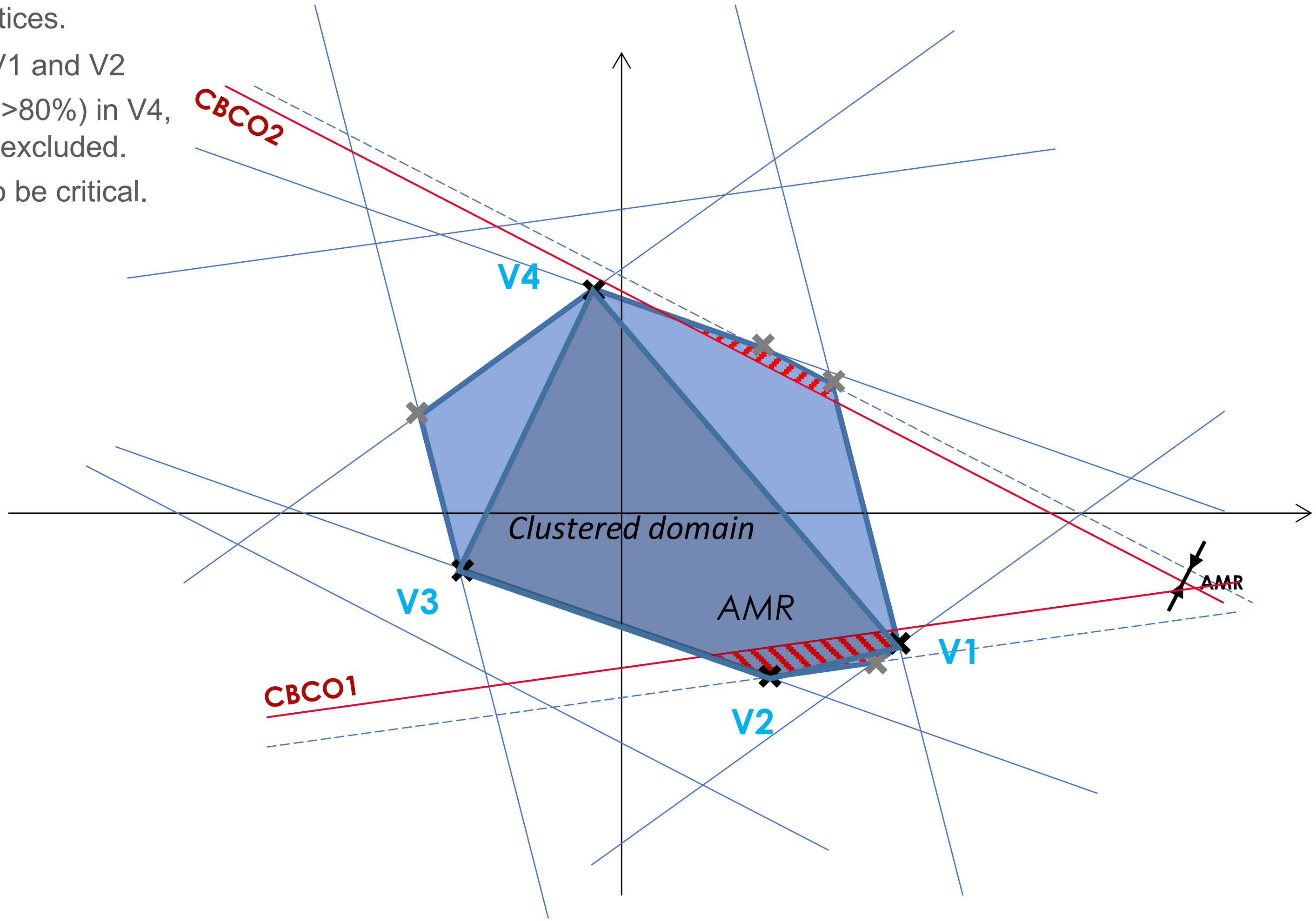
1. Determine CBCOs "seem to be critical"

MAVIR

CBCO seems to be critical, if there is a clustered vertex of the AMR domain where it is overloaded

Illustration

- Clustered domain is obviously smaller than the whole AMR domain.
- All CBCOs are checked in all vertices.
  - CBCO1 is critical (>90%) in V1 and V2
  - CBCO2 seems to be critical (>80%) in V4, it is critical in grey vertices excluded.
  - Other CBCOs do not seem to be critical.



CBCOs seems to be critical | CBCOs proved to be critical | Domain segments to exclude | IVA least decrease the size of domain

1. Determine CBCOs “seem to be critical”

MAVIR

CBCO seems to be critical, if there is a clustered vertex of the AMR domain where it is overloaded

Goal

- Application of fast procedures to decrease the number of CBCOs to check in the next step.
- Not all CBCOs that seem to be critical will be proved to be critical. It depends on the probability of the relevant market outcome.

Definition

- One CBCO seems to be critical, if:

$$\frac{F_{cnec,0core} + maxflow_{cnec}}{F_{max}} > 80\%$$

where

$$maxflow_{cnec} = \max_{v \in F320} \left(\sum_{z} PTDF_{crit,z} np_{v,z} \right)$$

Method

- Computational complexity is low, only matrix production and maximum search are used.

Notes

- Most of the CBCO do not seem to be critical, usually only 3-5% percent of them.
- None of the vertices are used in the later steps.
- For the sake of simplicity 10% FRM is supposed in the example for all CBCOs, therefore the normal criticality limit would be 90%. However 80% limit is applied to avoid the uncertainty coming from vertices being clustered.

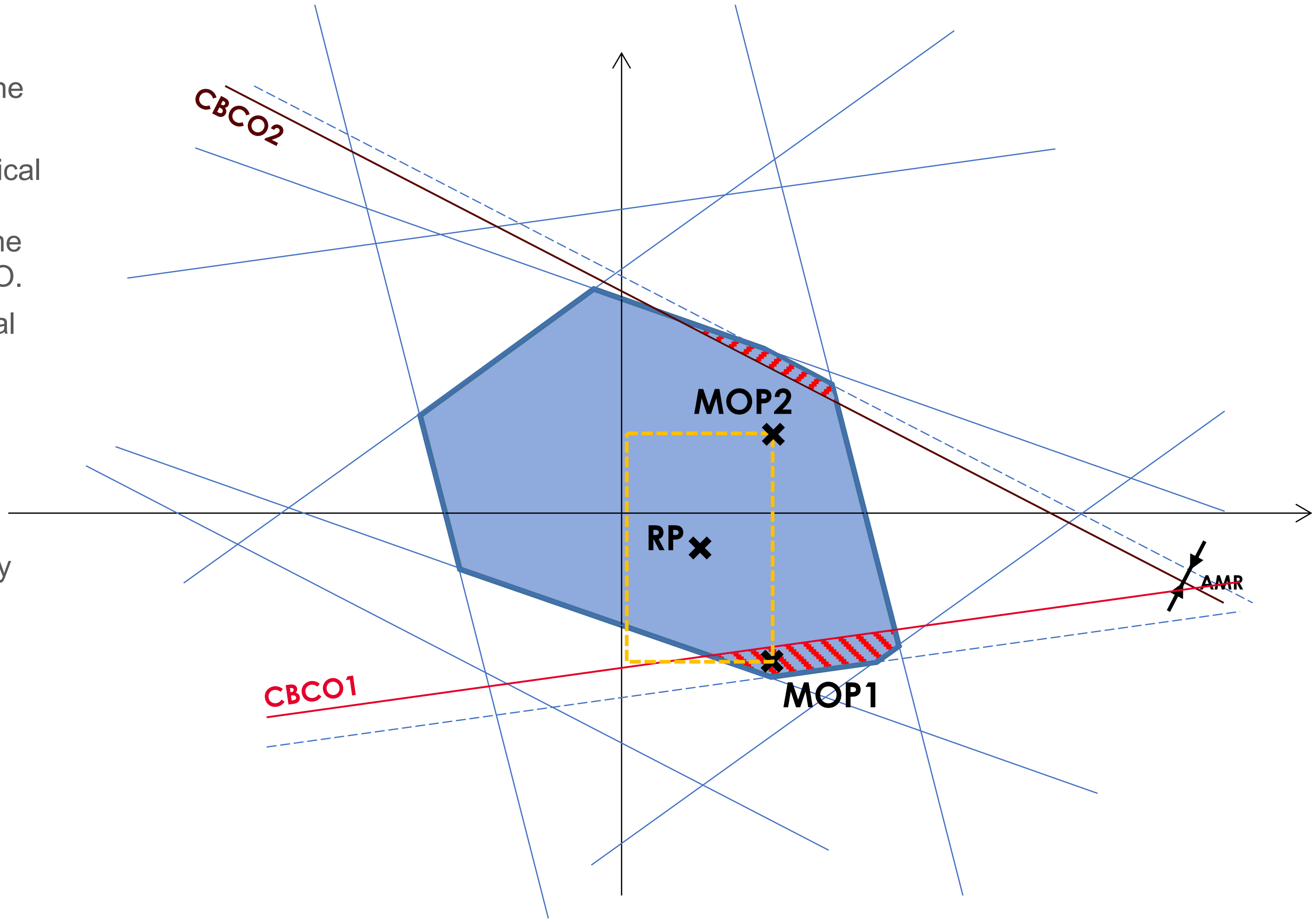
2. Determine CBCOs "proved to be critical"

MAVIR

CBCO is proved to be critical, if there is a realistic market outcome in which it is overloaded

Illustration

- Range of realistic market outcomes is only a part of the domain (orange dashed line)
- The realistic intervals of Core zone are different
- For each CBCO seems to be critical the MOP[1] is determined, that is a realistic market outcome and most overloading the CBCO.
  - CBCO1 is proved to be critical (>90%) in MOP1
  - CBCO2 is proved to be not critical (<90%) in MOP2.
- Redispatch potential can be also taken into consideration by using LSP[2] instead of MOP
  - LSP is similarly to MOP, but considering nodal capacity limits



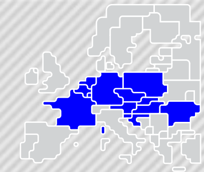
[1] most overloading point

[2] last safe point

CBCOs seems to be critical | CBCOs proved to be critical | Domain segments to exclude | IVA least decrease the size of domain

2. Determine CBCOs “proved to be critical”

MAVIR



CBCO is proved to be critical, if there is a realistic market outcome in which it is overloaded

Goal

- Applying precise procedure to evaluate the criticality of each CBCOs seem to be critical.
- Realistic market outcomes are determine on historical differences between reference program (RP) and MCP.

Definition

- One CBCO is proved to be critical, if:

$$\frac{F_{cnec,0core} + maxflow_{cnec}}{F_{max}} > 90\%$$

Where objective is

$$maxflow_{cnec} = \max\left(\sum_{z} PTDF_{cnec,z} np_z\right)$$

subject to

$$\forall p \in \{\text{presolved CBCOs}\}: \sum_{z} PTDF_{p,z} np_z \leq RAM_p + AMR_p, \qquad \sum_{z} np_z = 0, \qquad RP_z - \Delta D_z \leq np_z \leq RP_z + \Delta D_z$$

$$\text{in case of LSP:} \quad \sum_{n \in HU} ni_n = np_{HU}, \qquad P_{min,n} \leq ni_n \leq P_{max,n}$$

ΔD_z is the 95% percentile of historical absolute error of reference program in case of zone z:

AT	BE	CZ	DE	FR	HR	HU
1755	1901	1244	3765	3234	706	754
NL	PL	RO	SI	SK	BEAL	DEAL
2185	1405	1005	737	443	1000	1000

Method

- LP solver for each CBCO seems to be critical.

Notes

- IVA will be calculated only for CBCOs that are proved to be critical.

CBCOs seems to be critical → CBCOs proved to be critical → Domain segments to exclude → IVA least decrease the size of domain

3. Define segments to be excluded with IVA.

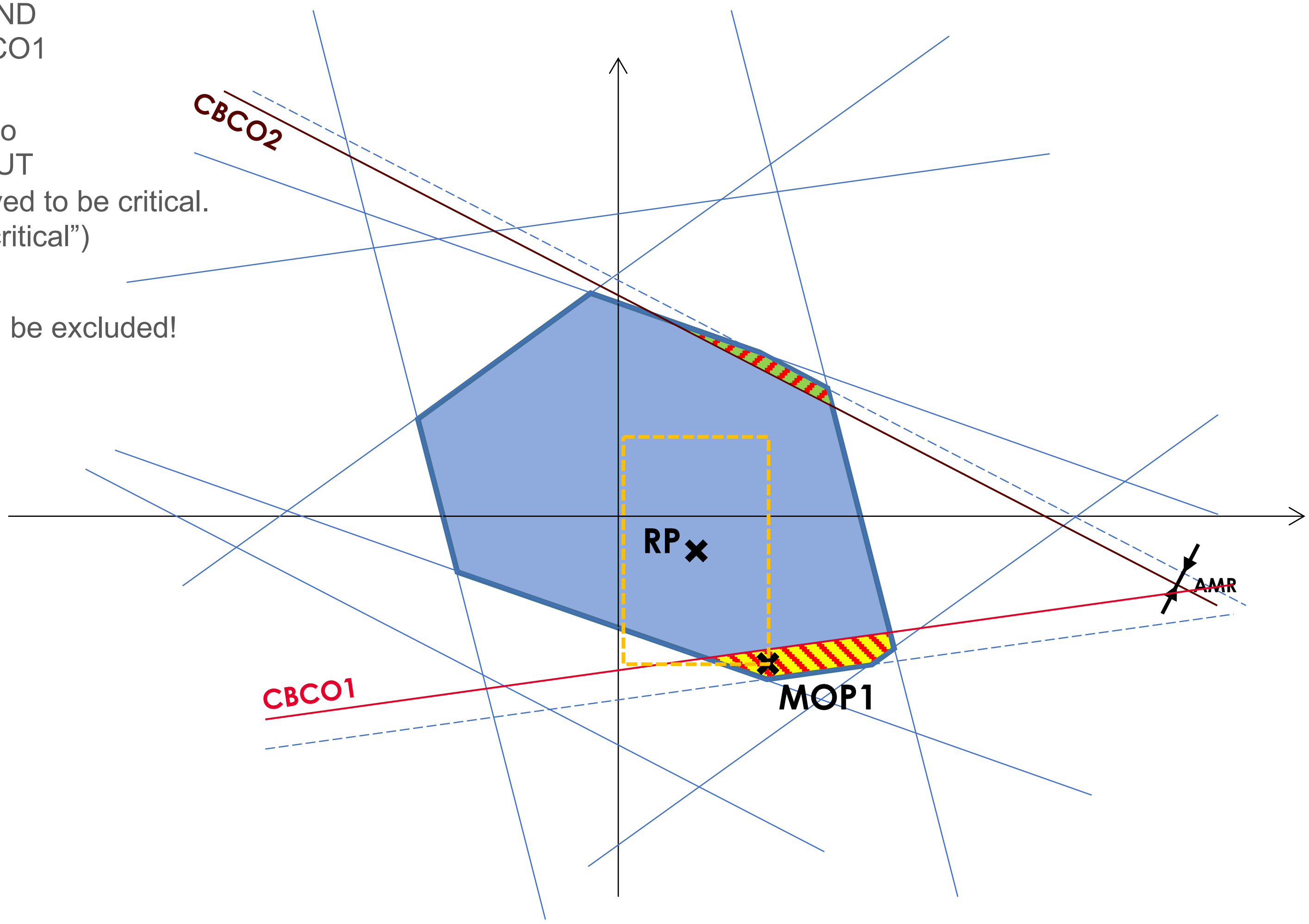
MAVIR

Segments contain all possible market outcomes that results overload on any CBCO proved to critical.

Illustration

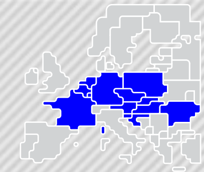
- Each point in the yellow area is
  inside the presolved CBCOs AND
  outside of the safe area of CBCO1
  proved to be critical.
- Each point in the green are is also
  inside the presolved CBCOs BUT
  not outside of any CBCOs proved to be critical.
  (CBCO2 is only “seems to be critical”)

- Only the yellow segments should be excluded!



CBCOs seems to be critical → CBCOs proved to be critical → Domain segments to exclude → IVA least decrease the size of domain

MAVIR



3. Define segments to be excluded with IVA.

Segments contain all possible market outcomes that results overload on any CBCO proved to critical.

Goal

- Define the smallest required parts of domain to exclude.

Definition

- Critical segments are actually domains defined as:

$$\left\{ np_z \;\middle|\; \begin{array}{c} \sum_z np_z = 0 \\ \forall p \in \{\text{presolved CBCOs}\}: \sum_z PTDF_{p,z} np_z \leq RAM_p + AMR_p \\ \exists c \in \{\text{CBCOs proved to be critical}\}: \sum_z PTDF_{c,z} np_z \geq RAM_c \end{array} \right\}$$

Notes

- Critical segments are defined per CBCO proved to be critical.
- In case of more CBCOs, critical segments may be overlapping.

CBCOs seems to be critical → CBCOs proved to be critical → Domain segments to exclude → IVA least decrease the size of domain

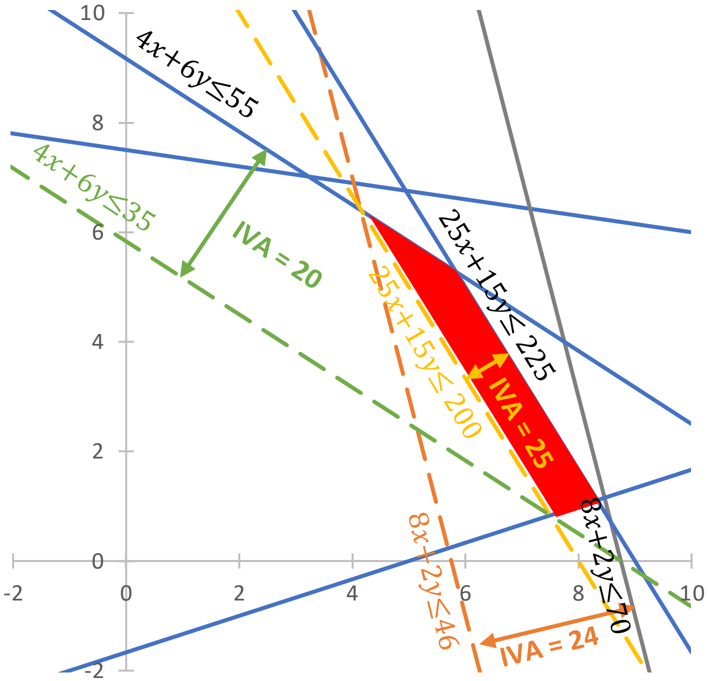
4. Calculate IVA resulting the least Euclidean movement

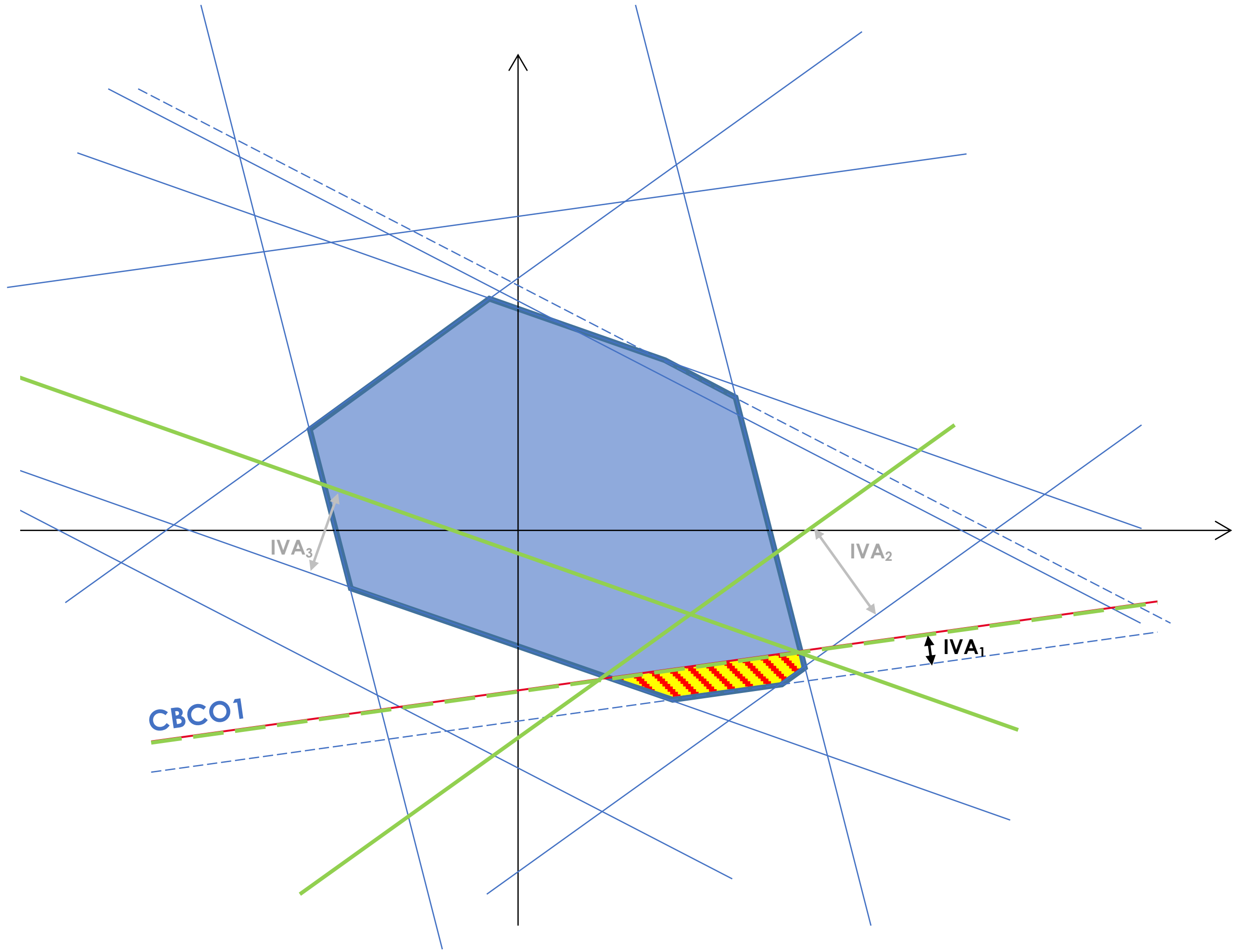
MAVIR

Objective is minimum of movements of shifted elements but exclude all the defined critical segments.

Illustration

- Three solutions exist to exclude the critical segments
  - IVA1: remove the AMR
  - IVA2, IVA3: need more IVA
- Minimising the Euclidean movement is not the same problem as minimising the sum of IVA
  - Minimum IVA: shift green CNEC
  - Minimum distance: shift yellow CNEC





CBCOs seems to be critical → CBCOs proved to be critical → Domain segments to exclude → IVA least decrease the size of domain

4. Calculate IVA resulting the least Euclidean movement

MAVIR

Objective is minimum of movements of shifted elements but exclude all the defined critical segments.

Goal

- Decrease the domain as less as required: find largest one that does not contain any critical segments.

Definition

- Solve the optimization problem:

$$\min\left(\sum_{s}\frac{IVA_s}{|PTDF_s|}\right)$$

subject to

$$\exists s \in \{\text{shiftable CBCOs}\}, \qquad \forall np \in \{\text{critical segments}\}:$$

$$\sum_{z} PTDF_{s,z}np_z \geq RAM_s + AMR_s - IVA_s$$

Method

- Robust optimization of MILP problem
- Shiftable CBCOs: where IVA is allowed to be applied.
  - All MAVIR CNECs with maxzone2zonePTDF > 5% (critical CNECs might be not shiftable, e.g. MNEC)
- As the problem easily becomes extreme large, it is always decomposed to subproblems
  - Not overlapping critical segments are solved separately
  - Only a few CBCOs nearly parallel to the critical CBCO are defined to be shiftable

Notes

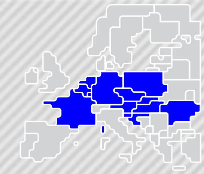
- Not the sum of IVA, but the Euclidean movements is minimised.
- Only one CNEC is shifted to exclude a critical segment

CBCOs seems to be critical → CBCOs proved to be critical → Domain segments to exclude → IVA least decrease the size of domain

Perun4V tool for Individual Validation

Individual Validation Tool introduction

SEPS, PSE, HOPS, TEL, ELES



SEPS, ELES, HOPS, TEL, PSE use PERUN4V validation tool developed by TSCNET

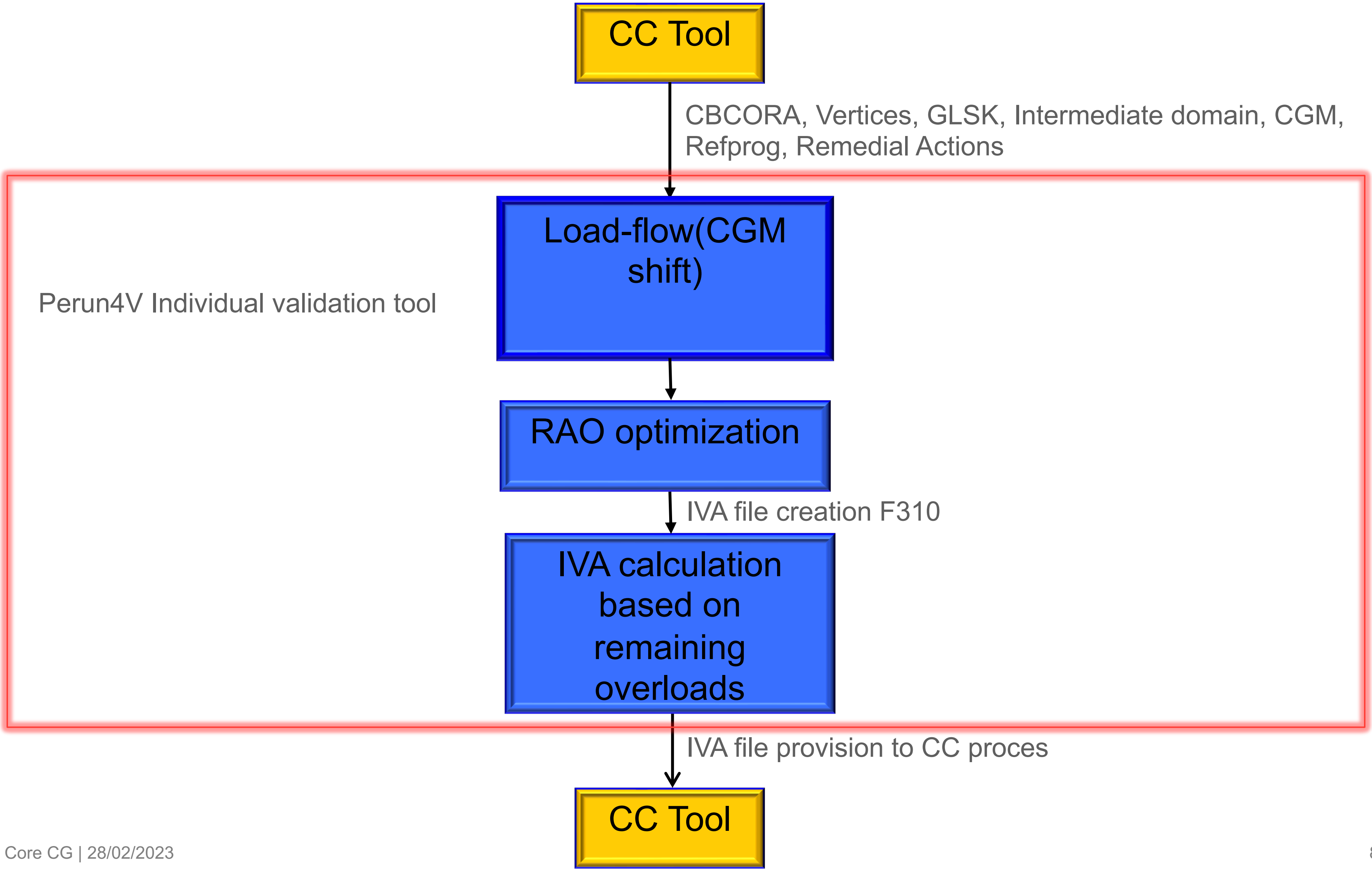
- The tool is used by five Core TSOs listed above. However, there is no common individual validation among Perun4V TSOs;
- The tool works with vertices and uses RAO optimization module (with costly & non-costly remedial actions available);
- Tool is fully automatized without any intervention from the operator’s side;
- Calculations are independently done by each TSO and options used can also differ from one TSO to another (e.g., operators can adjust setting before performing individual validation) .

General description of the approach

- The main goal is to ensure that selected scenario does not lead to overloadings of the CNECs considered in FB DA CC;
- In order to minimize application of IVA, available remedial actions are used;
- There are no additional elements considered in the local validation compared to the list provided for FB DA CC;
- IVA is applied purely in order to solve congestions on CNECs that are part of the CNEC list.
  - SEPS, PSE, HOPS, TEL do not apply IVA on substituted CNECs in order to solve congestions on other CNECs.

Perun4V tool for Individual Validation

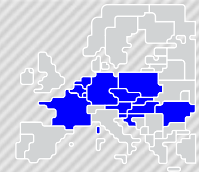
Grafical overview of the process



Perun4V tool for Individual Validation

Steps applied during the individual validation

SEPS, PSE, HOPS, TEL, ELES

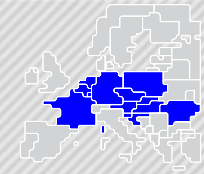


Data pre-processing

- Perun4V considers Intermediate FB domain and selected vertices as the main input for validation;
- CGM after NRAO optimization is used as an input for load-flow calculation;
- Rest of the inputs are either available in CC Tool or available locally at TSO side (e.g., file with potentially available remedial actions).

1. How are the circumstances selected?

- “Closest vertex”: Lowest weighted Euclidian distance of NPs from RefProg;
- Weighting factors are considered in order to asses the change of NP for BZs more realistically;
- One vertex is usually considered during validation, but multiple scenarios can be checked based on a selection of a subset of the vertices or by manually choosing the vertices to be assessed.
- TSOs are considering in the validation tool the following circumstances:
  - ELES: 1 vertex per TS, chosen as the “Closest vertex”, based on the Euclidian distance
  - HOPS: 1 vertex per TS, chosen as the “Closest vertex”, based on the Euclidian distance
  - PSE: 1 vertex per TS, chosen as the “Closest vertex”, based on the Euclidian distance
  - SEPS: Single “Closest vertex” chosen based on the Euclidian distance
  - TEL: 1 vertex per TS, chosen as the “Closest vertex”, based on the Euclidian distance



Perun4V tool for Individual Validation

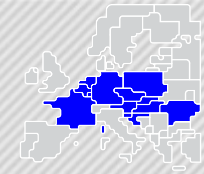
Steps applied during the individual validation

2. How is operational security assessed for these circumstances?

- Once the evaluated vertex is selected, the CGM is shifted to that particular vertex and potential operational security is evaluated;
- A load-flow computation is run to show potential congestions that are stemming from the selected vertex;
- Remedial actions are considered during this evaluation in order to minimize IVA application. Perun4V contains an automated RA optimizer similiar to the one used in DA CC, which also allows the usage of redispatch based on the availability of RAs;
- If available remedial actions are not sufficient to ensure grid security, IVA is calculated based on the observed remaining overloads only on CNECs.

3. Which RAs are used to avoid reductions, and how is their impact assessed?

- TSOs use the following types of RAs:
  - ELES: Topological measures (There is no redispacth nor PSTs in our grid)
  - HOPS: Topological measures (mainly), RD (if available, but mostly not used due to limited redispatching activation potential), no PSTs RA in the grid
  - PSE: PST (PSE full range, 50Hz range according to the F431), RD, topo RA
  - SEPS: Topological measures (There is no redispacth nor PSTs in our grid)
  - TEL: PST, Topological, RD



4. How are identified operational security violations turned into IVAs?

IVA calculation

- Perun4V offers three possible ways to calculate IVA values:
  1. IVA = max(-RAM_afterRAO_Vi + CC_val_threshold, 0)
  2. IVA = -RAM_afterRAO_Vn - RAM_afterRAO_Vi + CC_val_threshold
  3. IVA = -PTDF * (NP_Vn - Np_Vi) - RAM_afterRAO_Vi + CC_val_threshold

  where

  CC_val_threshold is a value by which the IVA is lowered and is configurable by each TSO (TSOs could accept in this case a certain level of overload)

  Vi is the selected vertex for validation

  Vn is the final secured vertex
- TSOs apply the following formulas and configurable threshold:
  - ELES: CC_val_threshold = -40 MW; IVA calculation - formula 3;
  - HOPS: CC_val_threshold = 0 (from 2023, 6MW); IVA calculation - formula 3;
  - PSE: CC_val_threshold = 0; IVA calculation - formula 1;
  - SEPS: CC_val_threshold = 50 MW; IVA calculation - formula 1;
  - TEL: CC_val_threshold = 0; IVA calculation – formula 1.

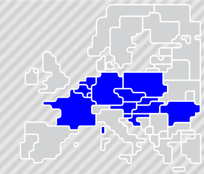
Theoretical example of IVA calculation using the 1st formula for a CNEC_i.

- RAM_beforeRAO_Vi = -80MW
- RAM_afterRAO_Vi = -30 MW
- IVA = max(- (-30) + 0, 0) = 30 MW (in this case CC_val_threshold is 0)

Perun4V tool for Individual Validation

Steps applied during the individual validation

SEPS, PSE, HOPS, TEL, ELES



5. Fallbacks: when do you apply it, which capacities result from it, how do you communicate about it

- Fallback is applied when there is an issue encountered in Perun4V and the tool does not provide any results or provides unfeasible results;
- In case an issue is encountered in the optimizer, TSOs have the possibility to not use it and assess the operational security without considering remedial actions.
- If tool does not work at all, TSOs apply the following fallbacks:
  - ELES: we reduce virtual capacity to zero: IVA = AMR – CVA
  - HOPS: uses a local fallback tool with 4 options that can by applied.HOPS mainly applies a statistical approach in necessar y cases;
  - PSE: 5%minRAM for Core exchanges
  - SEPS: 20%minRAM for Core exchanges;
  - TEL: 20%minRAM for Core exchanges.
- If fallbacks are applied, TSOs communicate this in the "justification" tab available in the IVA file. The justification are then available on the JAO Publication Tool under "Validation Reductions". TSOs communicate the following:
  - ELES: via justification used directly in the CCCt GUI as: *"Local validation tool failed. Fallback applied"*
  - HOPS: via justification created in the local fallback tool as: "*Fallback applied"*
  - PSE: via justification used directly in the CCCt GUI as: *"Individual Validation Tool failed. Applying bulk reductions"*
  - SEPS: via justification used directly in the CCCt GUI as: *"Local validation tool failed. Fallback applied"*
  - TEL: via justification used directly in the CCCt GUI as: *"Local validation tool failed. Applied fallback method for IVA.".* This is available on JAO Publication Tool under "Validation Reductions" tab.

6. Envisaged improvements:

- Tool is working as expected, improvements can be done usually for more flexibility in the validation step:
  - Improvement in formulas 2 and 3 for searching the minimum step of lowering the vertex;
  - Integration of newest IVA file format for justifications of applying IVA;

BD 20230201 TS 10:00

Extract from the reports resulting from running the local validation tool:

Name of the CNEC	Contingency	CBCO_ID	CO_ID	efore optimization @\ and Margin (Permane Margin (RAM)	fter optimization @\ nd Margin (Permane Margin (RAM)
[RO-RO] Resita - Timisoara c1 [DIR]	N-1 Resita - Timisoara c2	RO_CBCO_00104	RO_CO_00027	-42.8408462	-1.72229156
[RO-RO] Resita - Timisoara c2 [DIR]	N-1 Resita - Timisoara c1	RO_CBCO_00126	RO_CO_00026	-42.84009285	-1.721706146
[RO-RO] Portile de Fier - Resita c1 [DIR]	N-1 Portile de Fier - Resita c2	RO_CBCO_00169	RO_CO_00023	-32.13035343	-1.565341577
[RO-RO] Portile de Fier - Resita c2 [DIR]	N-1 Portile de Fier - Resita c1	RO_CBCO_00191	RO_CO_00022	-32.13022994	-1.565156988
[RO-RO] TR Portile de Fier 400/220 1 [OPP]	N-1 Portile de Fier - Resita	RO_CBCO_00254	RO_CO_00021	-0.315913567	-1.248830612
[RO-RO] TR Portile de Fier 400/220 2 [OPP]	N-1 Portile de Fier - Resita	RO_CBCO_00264	RO_CO_00021	-0.315913567	-1.248830612

Amount of RAs available for TS 10:00:

- 2 PSTs;
- RD RDP+: 760 MW;
- RD RDP-: 1454 MW.

TEL is mainly relying on RD potential to solve congestions on CNECs. On the next slide there is an example on the way RD used to manage congestions.

- In the end, the remaining overloads are translated into IVAs on CNECs.

IVA Calculation:

IVA = max(-RAM_afterRAO_Vi + CC_val_threshold, 0)

CC_val_threshold = 0

In the end: IVA = -RAM_afterRAO_Vi if this RAM<0


```
<AdjustmentValue name="[RO-RO] Resita - Timisoara c1 [DIR]" id="RO_CBCO_00104">
  <timeInterval v="2023-02-01T09:00Z/2023-02-01T10:00Z" />
  <IVA>1.7222916</IVA>
  <justification>IVA applied due to unsolvable overloads</justification>
</AdjustmentValue>
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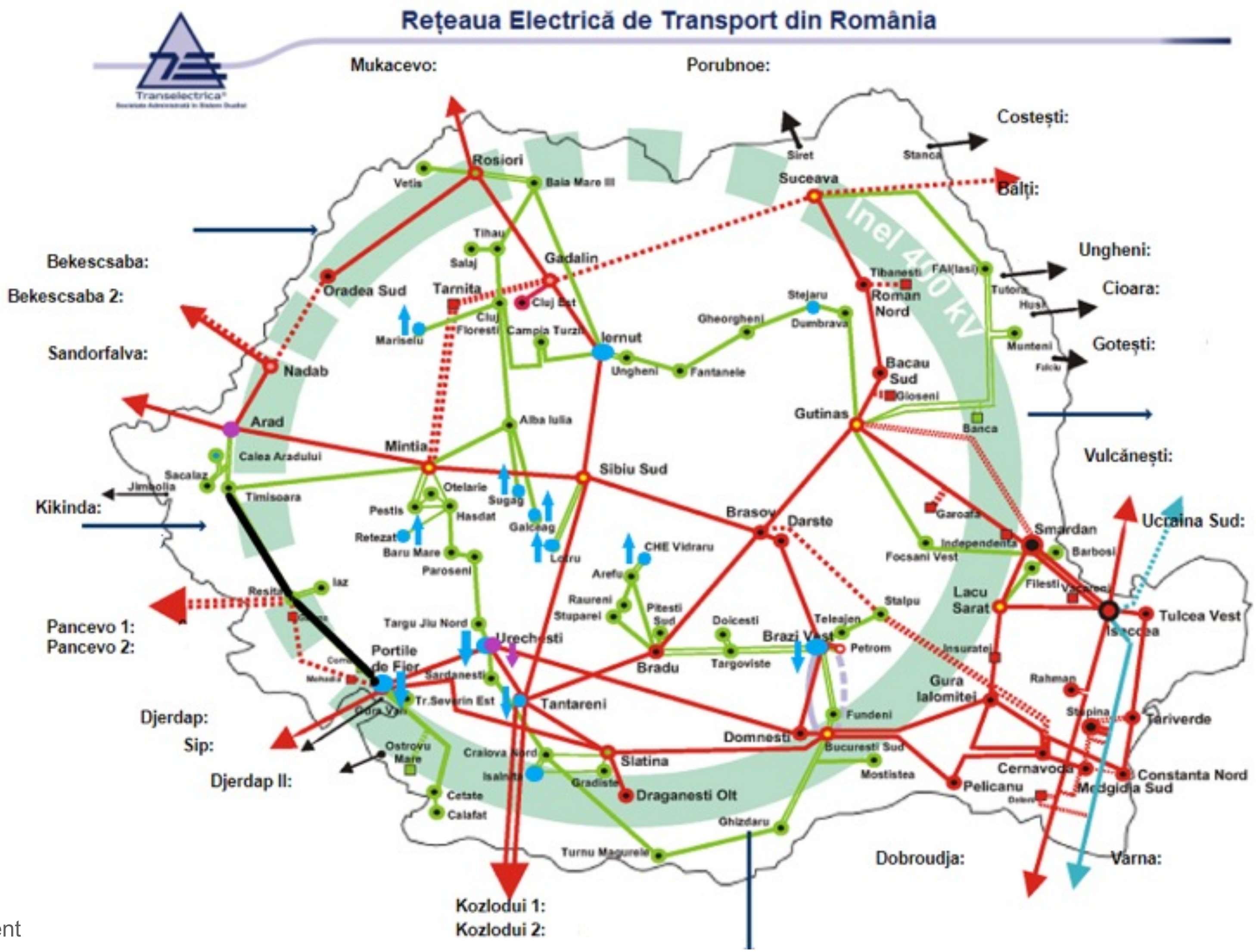
Perun4V tool for Individual Validation

Example of applying available RAs in TEL grid



- Congested element
- PST
- RD Potential

RTE individual validation

Introduction

RTE

This document explains how RTE validation process works, based on the set of questions described in the introduction of this document.

That being said, it is important to give some context about other aspects of the capacity calculation concepts, as they are tightly related to strategy made in individual validation. This is the purpose of the introduction slides.

RTE individual validation

RTE

Introduction

For RTE, the grid capacities rely mostly on the topological remedial actions. Those actions can be either:

- Preventive
- Curative
  - Those ones can be applied in case of N-1.
    - After N-1 and before application of CRA, the flow can exceed the PATL (Permanent Admissible Transmission Limit) for 10min max and up to the TATL (Transitory Admissible Transmission Limit)
    - After 10min and application of CRA, the flow shall be below the PATL.

The management of topological remedial actions is not taken into account to its full potential with the current Core framework

- Back in CWE, RTE operators were setting finely the association between each CNEC and RAs. As a result RTE branches were rarely limiting the market (16 timestamps in 2020).
- This is not the case anymore in Core, where only the Core NRAO defines those CNEC-RA associations, provided the CNEC is selected by the NRAO objective function. Unfortunately, as an order of magnitude the Core NRAO focuses on RTE's CNEC only 2% of TS (vs 100% in CWE especially for CRAs application thanks to a simple association between CNEC and CRA provided as an input by the operator).
- Nevertheless the 70%minRAM & the individual validation phases are then a chance to increase capacities, but it is much more complicated and less efficient to include the remedial actions at the latest stage of capacity calculation during the validation phase than natively.

As a result, RTE developed a 2-steps approach:

- Before validation phase: optimization of PRA during D2CF creation
- During validation phase: taking into account the PRA+CRA as best as possible to solve constraints

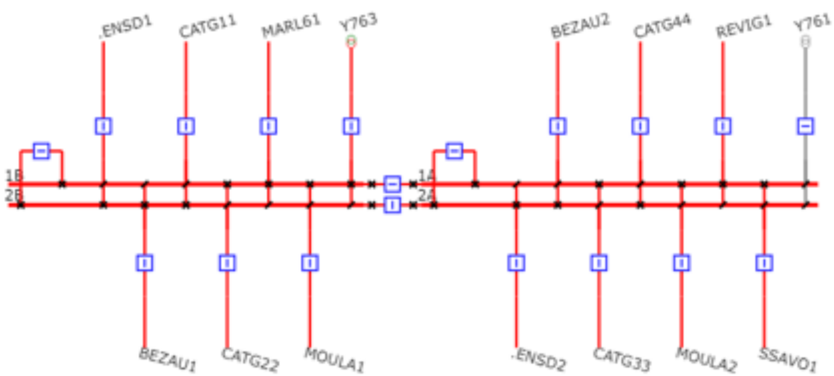
RTE individual validation

RTE

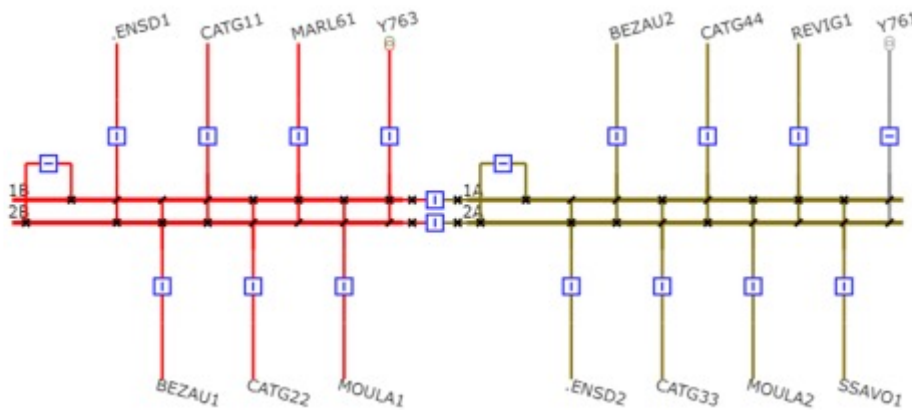
Introduction – action before validation phase

The IGM creation is an opportunity to increase capacities, setting topological PRAs based on market outcomes of the previous days (eg. limiting branches)

- The PRAs are set based on market outcomes of the previous days (eg. limiting branches)
- The CRAs must not be included into the grid model, because different N-1 can lead to concurrent CRAs



Day 1: no PRA in D2CF



Day 2: PRA (2 nodes) activated based on past MC outcome, which can reduce the flow by one hundred MW on a (tie)line

RTE individual validation

Validation phase

This slide focuses on how individual validation process works.

- How are the circumstances selected?
  - Circumstances selected are the vertices where the application of AMR can lead to an significant negative RAM on a CNEC
- How is operational security assessed for these circumstances?
  - Overloads on CNECs are assessed
- Which RAs are used to avoid reductions, and how is their impact assessed?
  - Based on choices made in IGM modelling (explained in the slides before), Preventive Remedial Actions have already been taken into account in the calculations. Only the Curative Remedial Actions that have not been already used by the common NRAO can be used to decrease the congestions; at the moment they are taken into account as a static contribution; as an improvement, RTE is working on introducing a RAO in the validation phase to assess more finely this contribution.
- How are identified operational security violations turned into IVAs?
  - If the branch is a N-1 branch where no CRA was found by the Core NRAO, IVA_init = AMR – staticCRA where staticCRA is a parameter defined statistically to take into account the additional margin relieved by CRA, as explained above
  - If the branch is a N-1 with a CRA applied by the Core NRAO, the CRA is deemed efficient, then there is no remaining available actions to unload the branch, thus IVA_init = AMR
  - N-state branches are deemed already optimized during the D2CF tuning (and eventually PRA enforcement by the Core NRAO), thus no more actions are available: IVA_init = AMR
  - Above values are then restricted to guarantee 20%minRAM(MCCC):
IVA_final=min(IVA_init, round(max(AMR-CVA-max(20%Fmax-(Fmax-FRM-F_0Core), 0), 0)))
- Fallbacks: when do you apply it, which capacities result from it, how do you communicate about it?
  - The fallback is used when there is an IT issue in the local validation tool.
  - The capacities resulting for Core are at least 20% of the Fmax of the network elements.
  - A message is published on the TSO message board of the JAO website

RTE individual validation

Validation phase - numerical example

RTE

- N-1 branch not impacted by the NRAO
- Fmax = 2000MW
- Min(RAM@circumstance) = - 60MW (on all selected circumstances inside the flowbased domain)
- AMR = 70MW
- F_0Core = 100MW
- FRM = 200MW

- Then, if staticCRA = 50MW, IVA = 20MW, which is smaller than the virtual margin applied on the branch (70MW), thanks to the assumption made on availability of CRA(s).