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Long Term Flow-Based Capacity Calculation and Allocation Workshop

Thursday 27 January 2021, 9-12h

- please keep your mic muted when not speaking
- raise your hand when you want to provide a comment
- the slides will be shared
- the meeting has been recorded

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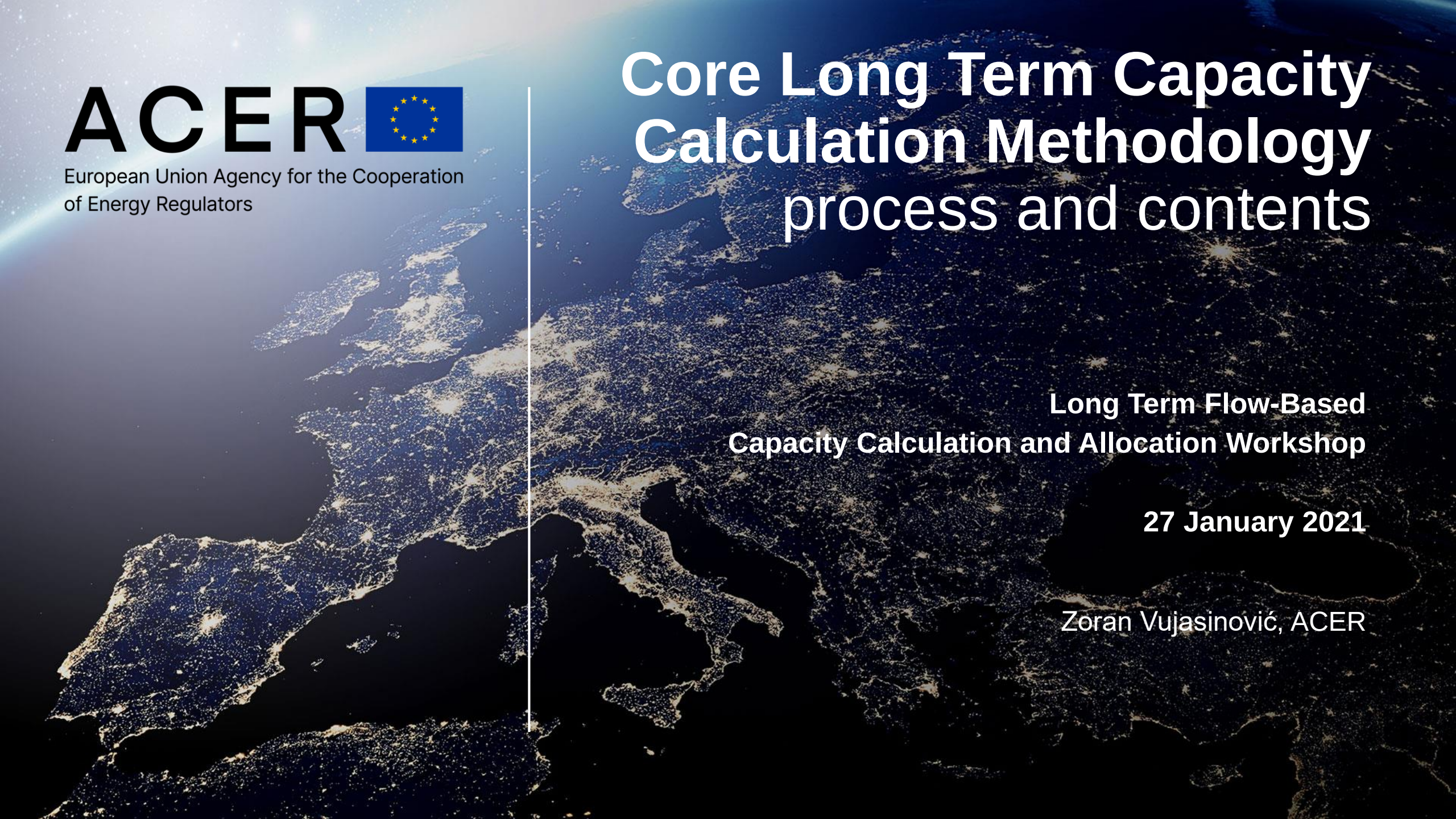
Long Term Flow-Based Capacity Calculation and Allocation Workshop

	AGENDA		
09.00	Introduction		Martin Povh, ACER
09:05	Core and Nordic LT FB: Capacity Calculation Methodology (CCM): process	Adoption processes and contents of the LT CCMs	Zoran Vujasinović, ACER Martin Viehhauser, ACER
09:25		Market Participants' (MPs) feedback Discussion	Helene Robaye, EFET&Eurelectric All
09:40	Core and Nordic LT FB: CCM Implementation	Core TSOs planning on the implementation of LT CCM	Bert Dobbelaere, ELIA
09:55		Core NRAs approach to regulatory oversight	Hrvoje Miličić, HERA
10:05		Nordic TSOs planning on the implementation of LT CCM	Trond Arnljot Jensen, Statnett
10:15		Market participants feedback and proposals Discussion	Helene Robaye, EFET&Eurelectric All
10:35	Core and Nordic LT FB: Allocation	Required amendments of LT methodologies	Zoran Vujasinović, ACER
10:40		High-level design of long-term FB allocation; Amendment process and timeline of LT methodologies	Harald Haider, APG
11:10		Market participants feedback and proposals	Helene Robaye, EFET&Eurelectric
11:40		Discussion	All
11:55-12:00	Wrap-up		Martin Povh, ACER All



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Core Long Term Capacity Calculation Methodology process and contents

Long Term Flow-Based Capacity Calculation and Allocation Workshop

27 January 2021

Zoran Vujasinović, ACER

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Core LT CCM: introduction

The Core Long Term CCM adopted in November 2021, shall:

- apply for the yearly and monthly time frame
- apply the flow-based (FB) approach

  ACER's experimentations have proven that FB approach provides improved economic efficiency under the same network security criteria as NTC-based (FCA 10(5) requirement)
- apply multiple scenarios (Common Grid Models) for calculation of FB parameters
- provide the FB parameters (PTDF/RAM) for explicit flow-based auctions with Options

- Implementation timeline: 3 years
  - Yearly auctions for 2025
  - Monthly auctions for January 2025

  a subsequent revision of the methodology 18 months after the go-live

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Core LT CCM process: iterations

- **Core LT CC: 1st iteration (2019)** (Public Consultation: Aug-2019)
  - Flow-based capacity calculation with allocation of coordinated NTCs converted from FB: failed as it was not possible to make an agreement how to split the interdependent cross-zonal capacities among Core borders
  - For flow-based approach such split is not necessary: FB allocation determines the volume of allocated capacities per each border based on maximisation of economic surplus
- **Core LT CC: 2nd iteration: (2020)** (Public Consultation: Nov-2020)
  - Flow-based approach for capacity calculation and allocation; Core TSOs' proposal
  - Not accepted by Core NRAs, requiring certain improvements and shorter deadline
- **Core LT CC: 3rd iteration: (2021):** (Public Consultation: Jul-2021)
  - Flow-based approach for capacity calculation and allocation; referral to ACER
  - The Core LT CCM has been issued by the joint efforts of Core stakeholders and ACER
  - ACER Decision 14/2021 on Core LT CCM (November 2021): Core LT CCM

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Core LT CCM process: timeline

As referred to ACER, 2021

- Procedure and timings pursuant to the FCA requirements
- All stakeholders publicly consulted during July 2021
- Further reports to market participants on MESC meetings & dedicated meeting (Sep, Oct, Dec)
- Further coordination and active involvement of MPs in the implementation is highly encouraged

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Critical Network Elements at input & output

- Critical Network Elements and Contingencies (CNEC) at input
  - The initial Long Term CNEC list shall be consistent with the initial DA CNEC list
  - During the calculation process, filtered to the final CNEC list, with applying the 5% PTDF threshold
- Capacity calculation output
  - Final flow-based parameters are PTDF/RAM values after validation
  - "Union" of CNECs from all scenarios (CGMs) shall be the set of constraints for the LT auction
  - Presolve function will remove redundant constraints

    (e.g: CNEC1 from Jan-peak "covers" CNEC1 in Jan-offpeak)

Scenario (Y)	CNEC	RAM	PTDFs			
1 Jan-peak	CNEC 1	950	0.06	0.5	0.2	...
	CNEC 2	900	0.07	0.44	0.22	...
	CNEC 3	500	0.33	0.06	0.3	...
	...	...	...	...	...	...
	CNEC N	1100	0.08	0.06	0.3	...
2 Jan-offpeak	CNEC 1	1100	0.055	0.44	0.22	...
	CNEC 2	910	0.07	0.44	0.22	...
	CNEC 3	520	0.33	0.06	0.3	...
	...	...	...	...	...	...
	CNEC N	1110	0.07	0.06	0.3	...
...	...	...	...	...	...	...
Dec-offpeak	CNEC 1	1000	0.06	0.48	0.21	...
	CNEC 2	880	0.07	0.45	0.22	...
	CNEC 3	550	0.23	0.06	0.3	...
	...	...	...	...	...	...
	CNEC N	1110	0.08	0.055	0.29	...

union of constraints from all scenarios at Y timeframe

Illustration: Union of RAM&PTDF parameters from all scenarios for Y timeframe

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Capacity calculation inputs

- Common Grid Models (Scenarios)
  - Common Grid Model methodology (CGMM) provides insufficient modelling resolution and outage planning
  - Temporary Core modelling procedure shall be implemented until the next CGMM amendment
    - 24 models/yearly auction
    - 8-10 models/monthly auction
- Operational Security Limits (Fmax) of Critical Network Elements
  - Fmax shall be calculated on the basis of AC load flow data $F_{max} = \sqrt{3} \cdot I_{max} \cdot U \cdot \cos \varphi$
- Flow Reliability Margin (FRM)
  - The FRM values on CNECs from the Day Ahead level shall be applied

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Capacity calculation inputs (2)

- Allocation (external) constraints
  - External constraints at LT shall be applied only where also applied at Day-ahead level (the Netherlands and Poland), to ensure compatibility
  - Strengthen monitoring of applied external constraints

- Remedial Actions (RA)
  - The coordinated optimisation of RA shall not be applied for LT CC, due to the uncertainty of RA forecasting at a long timeframe
- HVDCs at Core borders
  - The Evolved Flow Based (EFB) principles shall be applied for cross-border HVDCs, as in the Core DA

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PTDF and RAM: calculation and validation

	Calculation	Comment
PTDF calculation	$\mathrm{PTDF}_{\mathrm{zone-to-slack}} = \mathrm{PTDF}_{\mathrm{node-to-slack}} * \mathrm{GSK}_{\mathrm{node-to-zone}}$ $\mathrm{PTDF}_{\mathrm{zone1 \rightarrow zone2}} = \mathrm{PTDF}_{\mathrm{zone1-to-slack}} - \mathrm{PTDF}_{\mathrm{zone2-to-slack}}$	Linearized calculation of PTDFs; PTDF sensitivity threshold is <u>not</u> foreseen (to omit the small PTDFs during allocation)
Reference flows	$\mathrm{F}_{0,\mathrm{Core}} = \mathrm{F}_{\mathrm{ref}} - \mathrm{PTDF}_{\mathrm{z2h}} \ \mathrm{NP}_{\mathrm{ref,Core}}$	$\mathrm{F}_{\mathrm{ref}}$ shall be calculated with AC Load Flow by default
Already allocated flows	$\mathrm{F}_{\mathrm{AAC}} = \mathrm{pPTDF}_{\mathrm{z2z}} \cdot \mathrm{AAC}$	Yearly allocation (AAC) influencing flows at Monthly CC Only burdening flows taken into account (over pPTDF)
Remaining Available Margin (initial)	$\mathrm{RAM}_{\mathrm{initial}} = \mathrm{F}_{\mathrm{max}} - \mathrm{FRM} - \mathrm{F}_{0,\mathrm{Core}} - \mathrm{F}_{\mathrm{AAC}}$	Initial RAM before the minRAM implementation
minRAM	$\mathrm{RAM}_{\mathrm{initial}} + \mathrm{F}_{\mathrm{AAC}} \geq \mathrm{R}_{\mathrm{amr}} * \mathrm{F}_{\mathrm{max}} = \mathrm{AMR}$	AMR - Adjustment of Minimum RAM Minimal AMR: 20%$\mathrm{F}_{\mathrm{max}}$ (yearly), 10%$\mathrm{F}_{\mathrm{max}}$ (monthly)
Remaining Available Margin (before validation)	$\mathrm{RAM}_{\mathrm{bv}} = \mathrm{F}_{\mathrm{max}} - \mathrm{FRM} - \mathrm{F}_{0,\mathrm{Core}} - \mathrm{F}_{\mathrm{AAC}} + \mathrm{AMR}$	

Individual validation: Core TSOs can

- update the input data in case of inconsistencies
- correct RAM in case of security concerns where the data updates cannot reflect it (subject to justification)

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minimum RAM

- The future allocation outcomes of Core LT FB strongly depend on the minRAM approach
- ACER performed limited experimentation, to seek for the applicable “minimal” minRAM
- After consultations with Core NRAs and TSOs, these values have been set to:
  - **minRAM (yearly) = 20% Fmax,** possible increase up to 40%
  - **minRAM (monthly) = 10% Fmax,** possible increase up to 20%
- Such minRAM values are expected to provide somewhat lower allocated capacities when compared to actual (uncoordinated) NTC ones
- Further increase is not possible without detailed analyses by the Core TSOs

Flexibility given to Core TSOs to increase minRAM based on additional analyses during the implementation, thus providing higher LT capacities under secure network conditions

Economic efficiency of Flow Based?

FCA Article 10(5)(a):

All TSOs in each capacity calculation region may jointly apply the flow-based approach for long-term capacity calculation time frames on the following conditions:

(a) the flow-based approach leads to an increase of economic efficiency in the capacity calculation region with the same level of system security

ACER's experimentation performed in this respect:

- The outcomes of yearly NTC-based auctions from 2020 (data marked with 'ntc') were compared with the simulated flow-based yearly auctions (data marked with 'fb') with the same bids from the realised yearly auctions *(source: JAO)*.
- At the 'fb' auctions, the calculated FB parameters were adjusted with the minimum RAM which reflects the NTC values applied at the yearly auctions, thus providing the same level of system security for both the currently applied NTC approach and the proposed FB approach;

example:

						with minRAM 20% Fmax	with minRAM 30% Fmax	with minRAM 40% Fmax	**needed for NTCs Y2020**
CNE	Contingency	Direction	CGM	**Fmax**	RAM initial	RAM 20%	RAM 30%	RAM 40%	RAM ntc
MP____11_MS____11	MM____11_MP____11	Forward	Apr_2020	**1145**	**191.7**	228.9	343.4	457.9	**468.7**
					17%	20%	30%	40%	**41%**

applied at the **"fb"** auction

Range of min RAM "by NTCs" on congested CNECs was 20-80%, with the average of 43%

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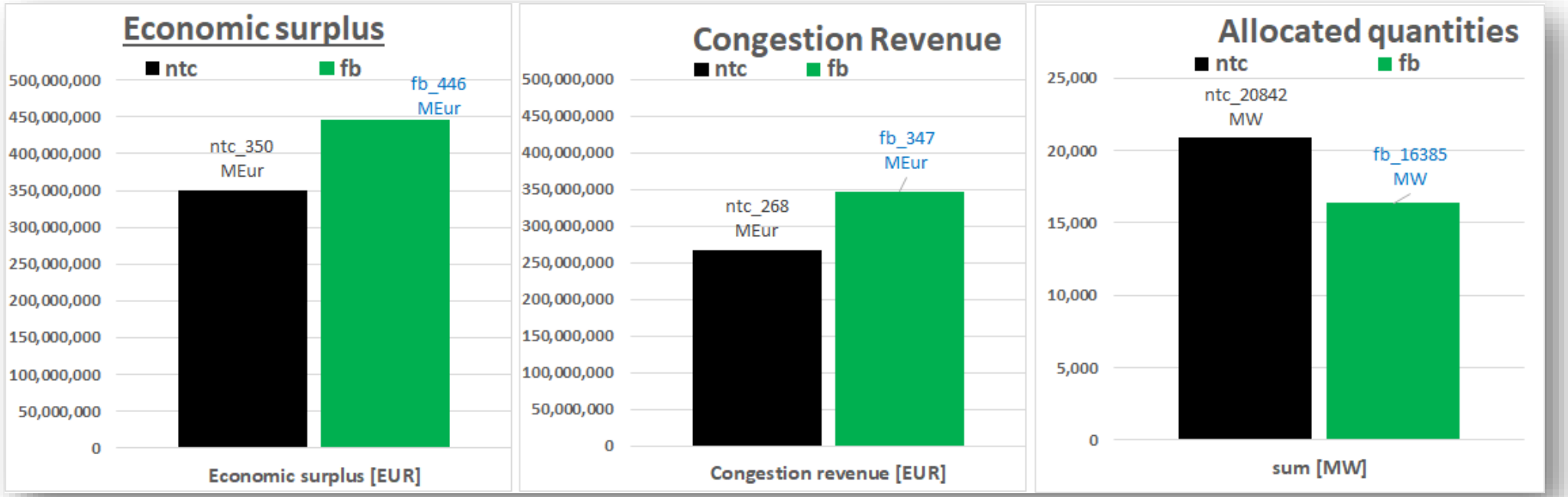
Economic efficiency of Flow Based?

Request of FCA Article 10(5)(a)



EconomicSurplus=$\sum$(AcceptedBids$_b$)*(OfferedPrices$_b$) CongRevenue = $\sum$[flow(cnec$_c$)*DualValue(cnec$_c$)]

FB approach increases economic efficiency in the Core CCR: with the same level of network security, the economic surplus (welfare) is 27% higher than with the NTC LT auctions

Allocated quantities are lower: this is an expected effect of the applied cross-regional optimisation, as it prioritises “more valuable” MWs to be allocated.

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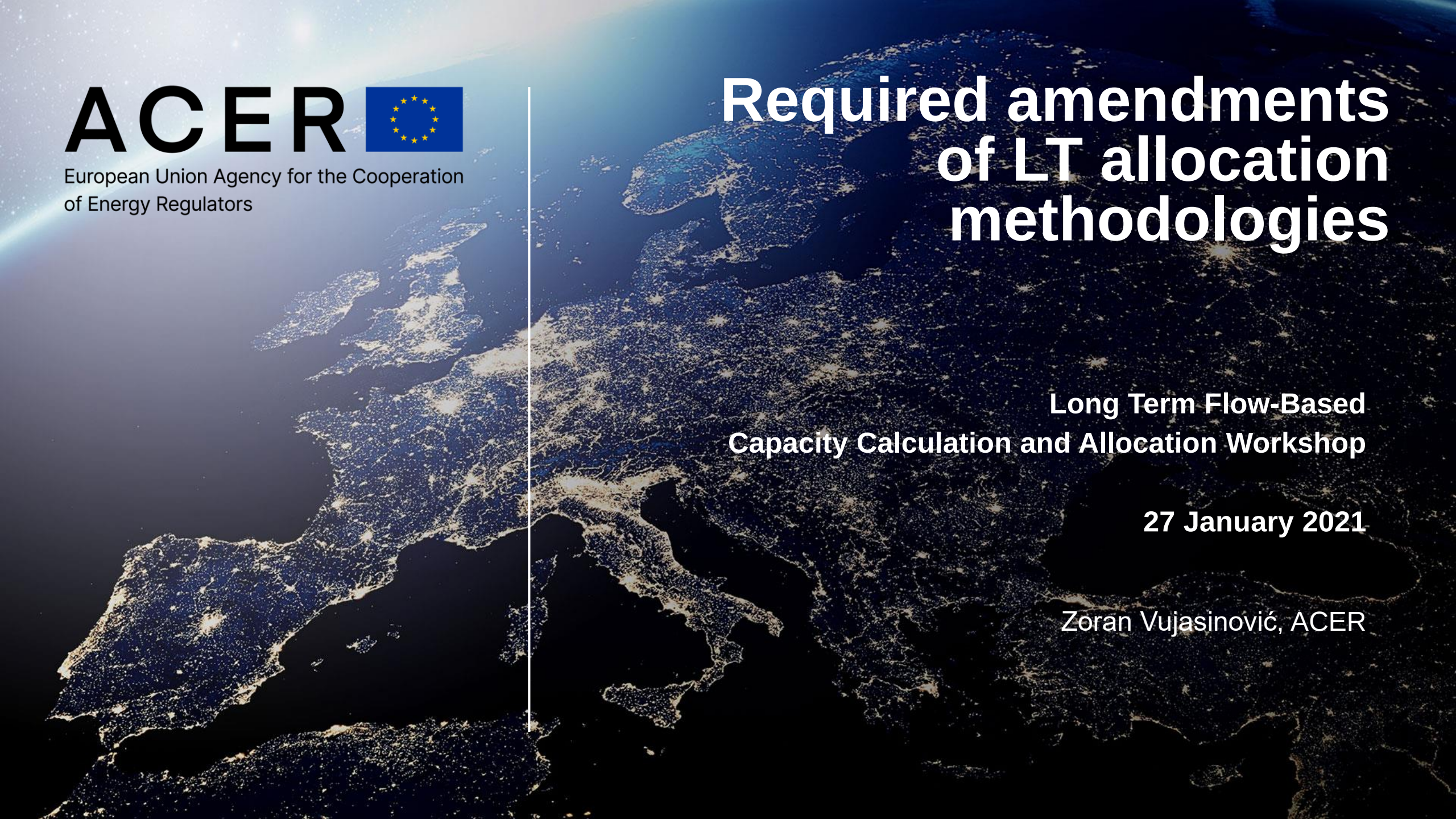
Core LT CCM: summary

Topic	Adopted solution
Critical Network Elements	LT Initial CNEC list for LT consistent with the one from DA
Operational security limits	Fmax with AC load flow values (U, cosφ)
Reliability margin	FRM from day-ahead
Allocation Constraints	Allow only as long as appplied at DA. Strict monitoring.
Scenarios (CGMs)	Temporary modelling procedure, until the CGMM amendment
Remedial actions	No application of RA for LT CC
HVDCs at Core borders	The Evolved Flow Based (EFB) principles
PTDF	No PTDF threshold for the allocation
RAM	Fref calculation with AC load flow
minRAM application	20%Fmax (Y) and 10%Fmax(M) as initial “minimal” minRAMs
Fallback	The last available long-term FB data
Validation	Individual validation by Core TSOs
CC outputs	Union of constraints from all scenarios, as FB auction input
Publication, reporting	Aligned with DA process
Implementation deadline	3 years (until Nov-2024); methodology update after 1.5 year



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Required amendments of LT allocation methodologies

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Amendment of LT allocation methodologies

- In order to enable the **Flow-based allocation on LT level** in Core and Nordic CCRs, ACER requested by all TSOs to **amend the methodologies** related to FCA Regulation
- TSOs, ENTSO-E ACER agreed on the following deadlines, assuming no endangering implementation timeline of Core and Nordic FB LT applications:
- **Until 1 October 2022:**
  - **SAP**: requirements for the single allocation platform (FCA49)
  - **CiD**: congestion income distribution methodology (FCA57)
  - **FRC**: methodology for sharing costs for firmness and remuneration of LTTR (FCA61)
- **Until 1 March 2023:**
  - **HAR**: harmonised allocation rules (FCA51)

More details on the timeline in general: in the next ENTSO-E presentation.

Thank you for your attention.

Backup slides →

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LT flow-based allocation principles

Objective is to maximize the economic surplus: *sum (bid_prices * accepted_bid_volumes)*

Constraints: 1) flow at each CNEC: *accepted_bid_volumes * PTDF^{+} ≤ RAM*

Options ⇒ no netting of counter flows ⇒ only burdening flows are summarized (via PTDF^{+})

2) total allocated capacity from/to zone ≤ Additional Constraint (if defined)

Clearing prices per border: *sum (DualValue * PTDF^{+})*

Dual Value, i.e. Shadow Price at a congested CNEC

Congestion revenue: *sum(clearing_prices * accepted_bid_volumes)*

FB LT CC Example (dummy values):

CongestionRevenue(2) = sum$_b$[ClearingPrice(b),LT*Accepted(b)]

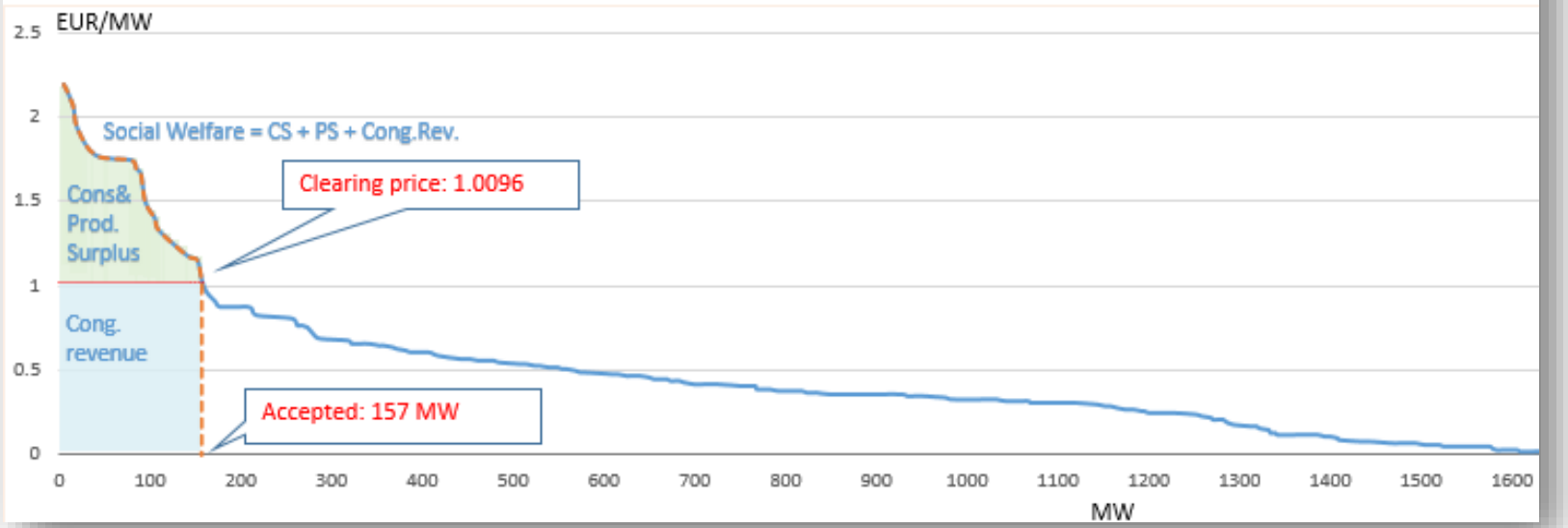
ClearingPrice(b),hourly = sum$_j$[pPTDF(b)*DualValue$_h$(cnec$_j$)]

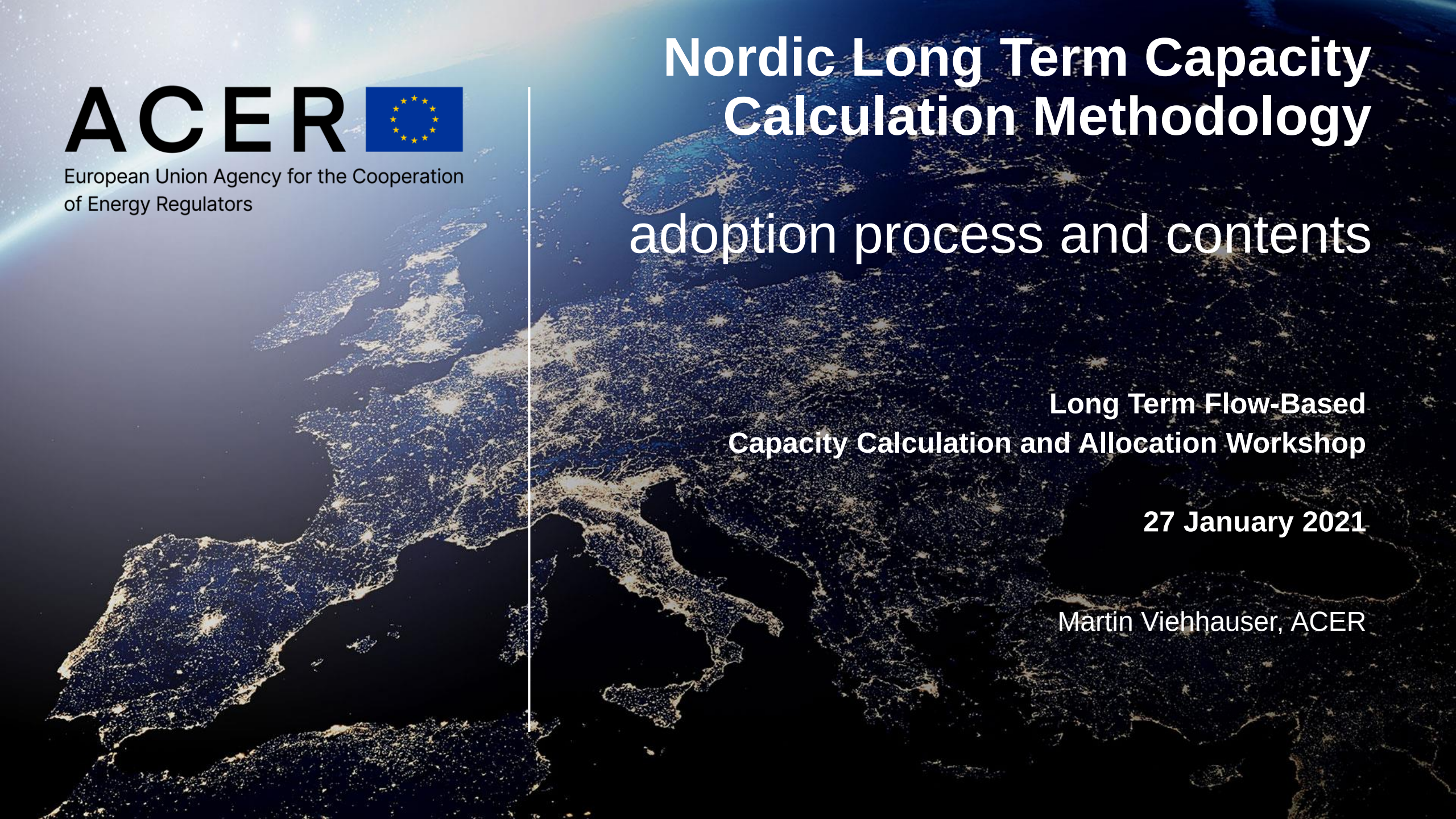
ClearingPrice(b),LT = ClearingPrice(b),hourly * No(hours)

													Marg. Price (h)		3.86	3.07	0.69	1.01	1.38	2.89	3.95	3.77
													Marg. Price (Y)		33788	26911	6041	8844	12090	25276	34581	33025
													Accepted bids per border:	**14,247**	0	70	0	157	1070	0	0	1294
													CONGESTION REVENUE_2	**274,655,769**	0	1883752	0	1388484	12936280	0	0	42729986
								(hourly)		(hourly)					PTDF:								
CGM	CB Name	From	To	CO Element Name	Fmax	FRM 12	FRM 21	Flow 12	DUAL12	Flow 21	DUAL21	Flow*Dual	RAM 12	RAM 21	ELIA_RTE	ELIA_TTN	CEPS_DE	CEPS_APG	CEPS_SEPS	CEPS_PSE	DE_CEPS	DE_RTE
Jan	MGY**********_CKT_1	MAVIR	SEPS	MGO**********_CKT_1	1433	138	138		0	979	3	3403	1612	979	-1%	0%	-5%	-15%	21%	3%	5%	-1%
Jan	QLE**********_CKT_1	SEPS	SEPS	QLE**********_CKT_1	1494	138	138		0	448	9	4240	2309	448	0%	0%	-3%	-2%	15%	-6%	3%	0%
Apr	MPA**********_CKT_1	MAVIR	MAVIR	MPA**********_CKT_1	1145	111	111	343	2		0	781	343	1968	0%	0%	0%	0%	0%	1%	0%	0%
Apr	RPA**********_CKT_1	Transele	Transele	RSI**********_CKT_1	318	30	30		0	95	3	329	562	95	0%	0%	0%	0%	0%	0%	0%	0%
Jul	BVA**********_CKT_2	ELIA	ELIA	BCO**********_CKT_1	1390	194	189		0	417	6	2499	2014	417	-16%	-31%	-4%	1%	1%	0%	4%	15%
Jul	BZA**********_CKT_1	ELIA	ELIA	BZA**********_CKT_1	1406	256	245	598	7		0	4156	598	1714	-14%	-47%	-6%	1%	1%	-1%	6%	18%
Oct	OTA**********_CKT_1	APG	APG	OTA**********_CKT_2	294	31	31	88	45		0	3975	88	715	0%	0%	-3%	-10%	1%	0%	3%	0%
Oct	BAU**********_CKT_4	ELIA	RTE	BAC**********_CKT_1	482	73	66	145	18		0	2622	145	679	15%	6%	-2%	1%	0%	0%	2%	5%
Oct	NLL**********_CKT_1	TTN	TTN	NEN**********_CKT_1	1701	121	121		0	510	11	5867	2812	510	6%	-2%	4%	-1%	0%	0%	-4%	-10%
Oct	ZMI**********_CKT_1	PSE	PSE	ZKR**********_CKT_1	532	54	54		0	160	22	3482	873	160	-1%	0%	7%	3%	-3%	-10%	-7%	-1%
												31,353										
									CONGESTION REVENUE_1			**274,655,769**	**CongestionRevenue(1) = sum$_j$[flow(cnec$_j$)*DualValue(cnec$_j$)]**									

Economic surplus (social welfare), example at 1 border:

Border:	**TSO 1 - TSO 2**	
Requested:	2619	MW
Accepted:	**157**	**MW**
Clearing price:	**1.0096**	**EUR/MW**
Congestion revenue:	$CR = \Sigma_{bids}(Accepted_{bids} * ClearingPrice)$	
Congestion revenue:	**158.5**	**EUR/h**
	1,388,484	EUR/y
Consumer&Producer surplus:	$CS\&PS = \Sigma_{bids}(Accepted_{bids} * (OfferedPrice_{bids} - ClearingPrice))$	
Consumer&Producer surplus:	**88.6**	**EUR/h**
	775,849	EUR/y
Economic surplus:	$ES = CS + PS + CR = \Sigma_{bids}(Accepted_{bids} * (OfferedPrice_{bids}))$	
Economic surplus:	**247.1**	**EUR/h**
	2,164,333	EUR/y





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Nordic Long Term Capacity Calculation Methodology

adoption process and contents

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Nordic LT CCM

- Nordic LT CCM
  - TSO proposal of January 2019
  - Referral to ACER by Nordic NRAs in May 2019 (disagreement on FB vs cNTC)
  - ACER Decision 16/2019 from October 2019

→ flow-based capacity calculation

- Implementation by 12 months after Nordic CCM for day-ahead and intraday is implemented (foreseen for March 2023 + 12 months)

- The flow-based LT CCM will provide flow-based parameters for the allocation of cross-zonal capacity
  - A transitional solution until long-term flow-based allocation is feasible will provide ATC long-term cross-zonal capacity values for the single allocation platform (Article 19 of Nordic LT CCM)

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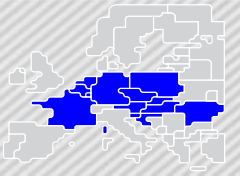
Nordic LT CCM – use of calculated CZC

- Allocation of long-term transmission rights on bidding zone borders of the Nordic CCR:
  - DK1-DK2 (HVDC)
  - Outstanding decision for FI-SE bidding zone borders (insufficient hedging opportunities could also be addressed by an alternative (non-LTTR) solution – i.e. FCA Article 30(5)(b))

- For remaining BZBs the CZC calculated in accordance with the Nordic LT CCM primarily serves as information provided to the forward markets



The Core LTCC methodology was decided by ACER in November 2021:

- Currently Core TSOs are drafting the HLBP and Requirements.
- Core TSOs want to engage in a dialogue with the market participants in defining the KPIs and EXT // run starting as of the next CCG meeting in March.

Roadmap, status and main milestones

	Key project milestones	Target due date
1	Prototype LTCC tool ready for testing and experimentation	Q2 2022
2	Offers for IT development approved	Q3 2022
3	Tooling ready for Int // Run	Q1 2024
4	Ext. // Run Start (6 months before Go-Live)	01/05/24
5	FB LTCC Go-Live	01/11/24

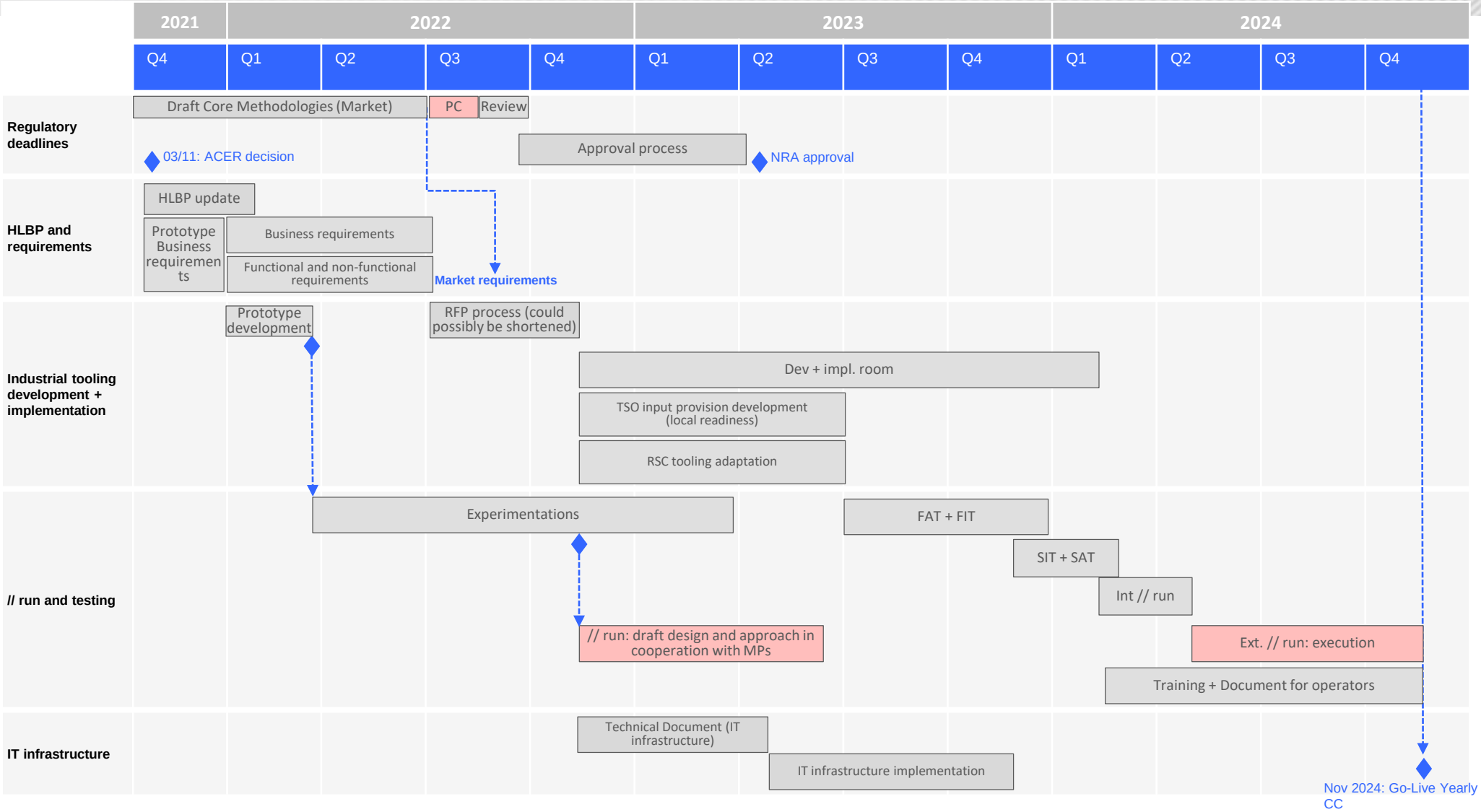
Core TSOs plan to be in regular contact with market participants during the dedicated meetings:

- CCG meetings
  - Dialogue with market participants to define KPIs and EXT // run
- MESC meetings
  - Reporting

Core Long Term CC

B.DOBBELAERE

LTCC implementation



Legend:

- MPs involvement

Core NRAs' approach to regulatory oversight of the LT CCM

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Monitoring and reporting

- Article 21 of the Core LT CCM defines that following data items shall be provided to NRAs:
  - On yearly and monthly basis: the information on non-anonymized names of CNECs
  - On demand: all needed information for adequate monitoring
  - Yearly monitoring report containing:
    - an assessment of the quality of the data published accompanied by a detailed analysis of a failure to achieve sufficient data quality standards
    - monitoring of the effects and performance of the application of the LT CCM
    - the monitoring of the accuracy of non-Core exchanges' forecasts in the CGM
    - validation monitoring
    - the pre-solved CNECs that were subject to minimum RAM adjustment
    - statistics on CNECs with minimum RAM applied pursuant to Article 14
- Most of the data **will be publicly available**
- Core NRAs trust that TSOs will continue to regularly and often involve market participants in their work and take into account their responses and concerns to enable to meet market participants needs and expectations regarding long term hedging opportunities

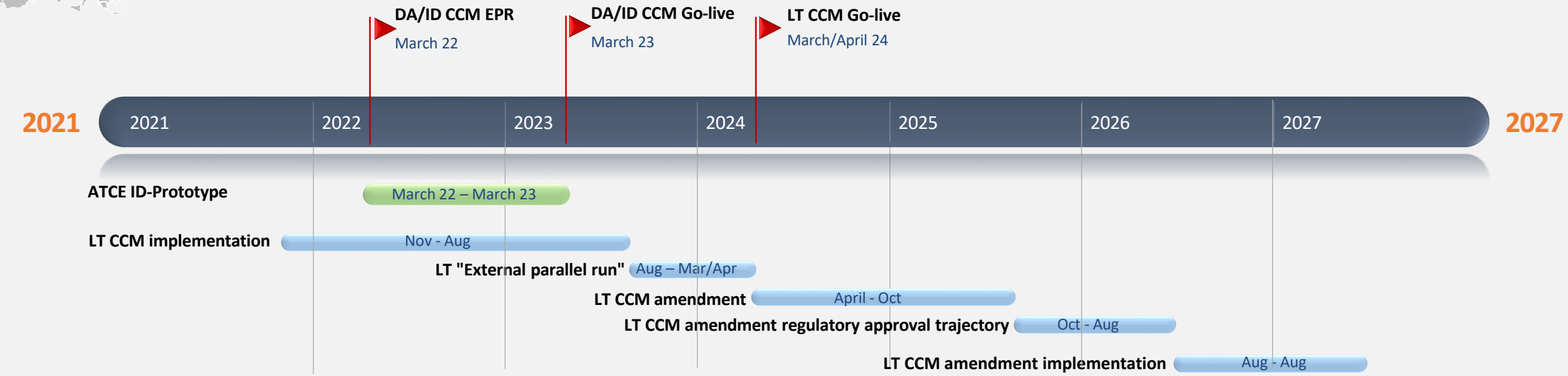
minRAM levels

- Minimum percentage of Fmax for RAM of the each CNEC shall be at least 20% of Fmax for the yearly time frame and 10% of Fmax for the monthly time frame
- Usage of multiple scenarios and application of outage topologies could limit the cross-zonal capacities
- Experimentation or dry-run of the Core LT CCM done by TSOs (and CCC and JAO) is the crucial step for defining adequate minRAM level
- In absence of identified network security constraints, minRAM level can be set with upper limits of minimum RAM of 40% of Fmax for the yearly time frame and 20% of the Fmax for the monthly time frame
- Prerequisite for higher levels of minRAM is the comprehensive analysis and consultation of the modified level with the Core regulatory authorities and stakeholders

Regulatory mechanism for minRAM

- Core NRAs expect good level of capacities to be ensured and provided to the market
- Basically, TSOs (Steering Committee of the representatives of Core TSOs) can raise the minRAM levels before go-live without approval of the all Core NRAs
- This is the obvious trade-off between the deadlines for implementation and smooth governance with the aim of timely implementation
- Core NRAs understand that timely implementation of the Core LT CCM will have great benefits for many other processes (end of current non-harmonized LT calculation, remuneration of the LT capacities, congestion income distribution, reduction of the loop flows, adequate DA domain, etc)
- In line with the FCA Regulation regulatory authorities responsible for their adoption may request amendments of these terms and conditions or methodologies

Nordic CCM HL timeline



- For now, the capacity calculation is for forecasting-purposes only
- The target model for the Nordic LT CC is an FB approach
- The intermediate Nordic LT CC is ATCE
  - LT CGM ⇒ LT FB-domains ⇒ Extracted LT ATC-domains
  - Both the FB and ATC-domain will be published
- Frequent SH meetings to discuss the approach and progress with stakeholders

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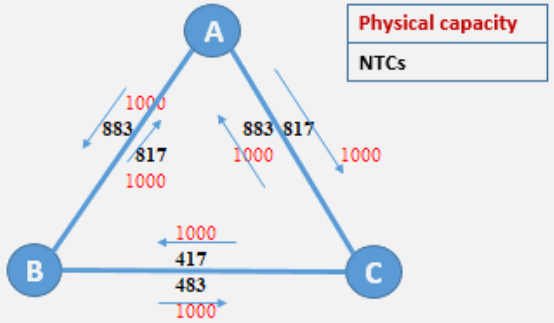
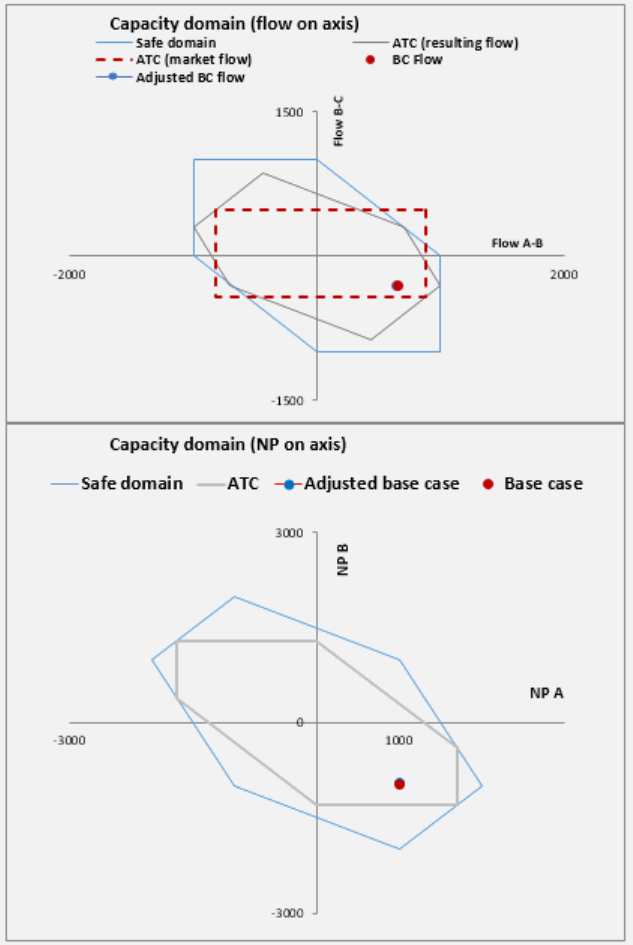
Nordic ATCE methodology

The intermediate ATCE approach:

- ❖Is based on optimization
- ❖Input data is a Nordic LT FB-domain and base case flows
- ❖The optimization algorithm finds a set of ATC-values that maximizes the ATC-volume, respects the FB constraints and includes the base case flows



	NTC
A>B	883
B>A	817
B>C	483
C>B	417
A>C	817
C>A	883



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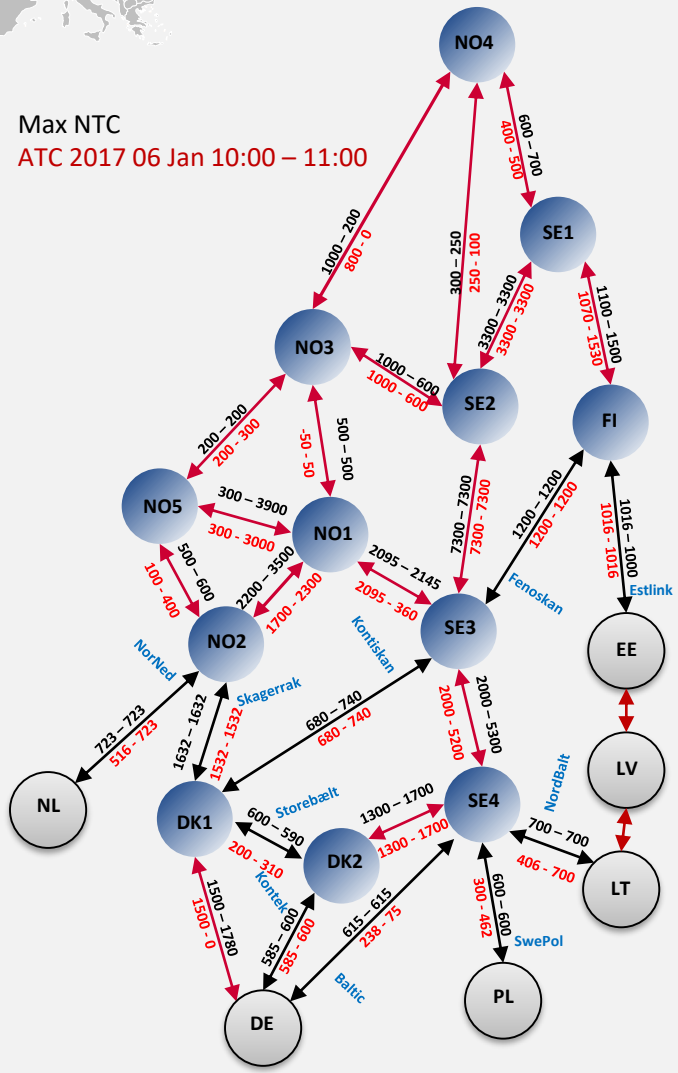
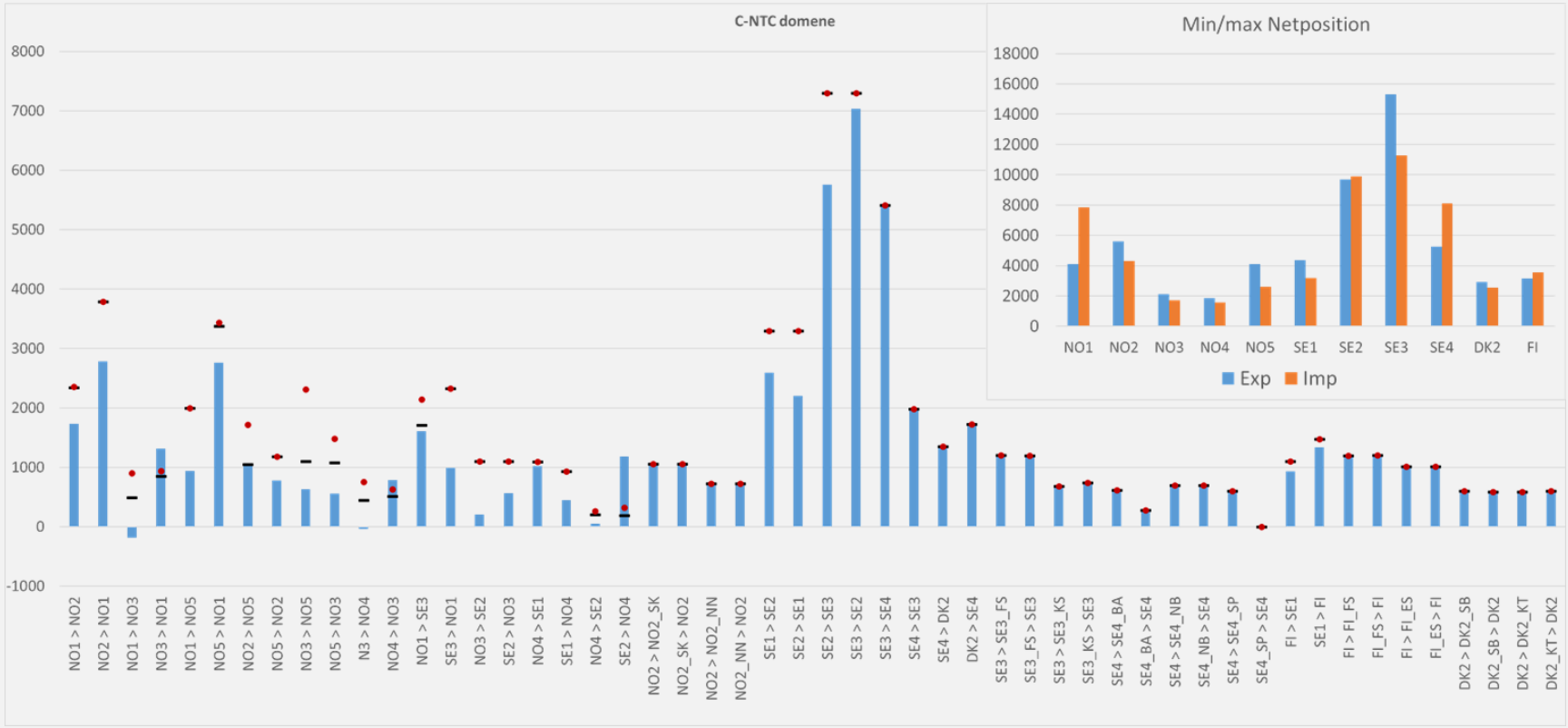
Example of ATCE in the Nordic power system

Max NTC
ATC 2017 06 Jan 10:00 – 11:00





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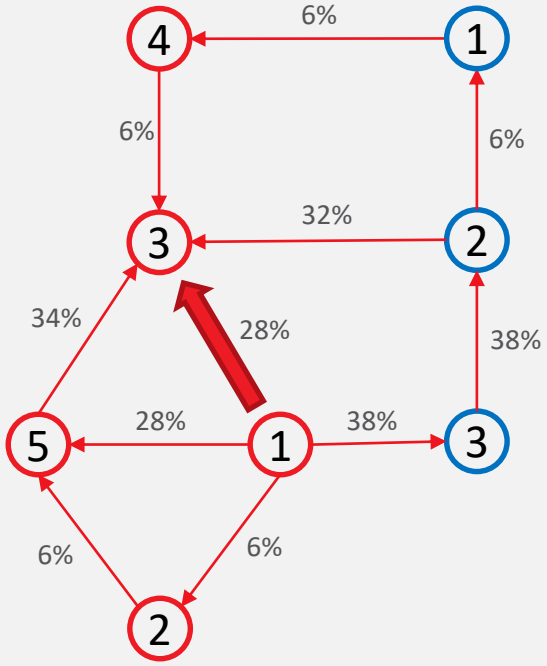
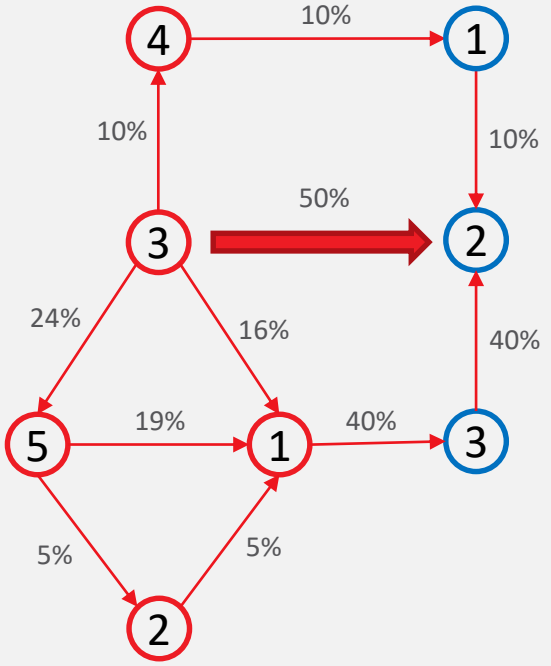
Bilateral exchange vs physical flow (20.03.2017 16:00)





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Long-Term Flow-Based Allocation

Workshop with market participants 27/01

entsoe

Reliable Sustainable Connected

Long-Term Flow-Based Allocation (LTFBA)

Introduction:

- The LTFBA task was launched after ACER's decision to implement Flow-Based approach **for Core and Nordic** Capacity Calculation Regions for the long-term timeframes.
- The Long-Term expert team (a team under ENTSO-E's Market Integration Working Group), is working on LTFBA on an **All-TSO's level together with JAO**, the Single Allocation Platform.
- After ACER's decisions, ACER shared a letter requesting the amendment of the following four All TSO methodologies to allow LTFBA:
  1. **'SAP proposal'** (FCA article 49)
  2. **'FCA CID'** (FCA article 57)
  3. **'FCA FRC'** (FCA article 61)
  4. **'HAR'** (FCA article 51)
- The Long-Term expert team has proposed an approach for the implementation of LTFBA in the Single Allocation Platform based on:
  - The finalized **gap-analysis** on the amendment of All TSO methodologies and Regional methodologies for LTFBA implementation.
  - A preliminary **implementation planning** built based on the outcomes of the gap-analysis.
- The overall design of LTFBA is described in the **High-Level Market Design document**
- As of January, the Long-Term expert team has started the **drafting of requirements and amendments** on ENTSO-E level.

Regular contact with market participants on the progress of LTFBA implementation will be ensured through **MESC meetings and public consultations or different workshops.**

**FCA: Forward Capacity Allocation ; SAP: Single Allocation Platform ; CID: Congestion Income Distribution ; FRC: Firmness and remuneration of long-term transmission rights ; HAR: Harmonised Allocation Rules*

LTFBA – Impacted All TSOs' methodologies – SAP Proposal

The SAP proposal following the **Article 49 of the FCA regulation** is the common all Transmission System Operators (TSOs) proposal:

- For a set of requirements and for the establishment of the Single Allocation Platform (SAP) in accordance with Article 49 of the FCA Regulation.

Please find the latest methodology dating 07/04/2017 on ENTSO-E's webpage:

- Methodology
- Explanatory Document

Main content of the methodology:

- The methodology describes the tasks of the SAP operator which includes being a single point of contact to market participants and operation of the auction procedures.
- The SAP operator also takes care of financial clearing and settlement of auctions as well as distribution of the auction incomes to the TSOs.

LTFBA – Impacted All TSOs' methodologies – FCA CID

The FCA CID proposal following the **Article 57 of the FCA regulation** is the common all Transmission System Operators (TSOs) proposal:

- For a Congestion Income Distribution (CID) methodology in accordance with Article 57 of FCA regulation

Please find the latest methodology dating 15/03/2019 on the ENTSO-E webpage

- Methodology
- Explanatory document

Main content of the methodology:

- The FCA CID methodology describes how process and calculation of long-term congestion in come takes place.
- The congestion income distribution is thereafter distributed per bidding zone border.

LTFBA – Impacted All TSOs' methodologies – FCA FRC

The FCA FRC proposal following the **Article 61 of the FCA regulation** is the common all Transmission System Operators (TSOs) proposal:

- For sharing costs incurred to ensure firmness and remuneration of long-term transmission rights in accordance with the Article 61 of the FCA regulation.

Please find the latest methodology dating 04/10/2021 on the ENTSO-E webpage

- Methodology

Main content of the methodology:

- In the FCA FRC methodology the sharing of remuneration costs among BZBz and among TSOs on BZB is described.
- The compensatoin of costs due to curtailment of long-term transmission rights is also described in this methodology.

LTFBA – Impacted All TSOs' methodologies – HAR

The EU HAR proposal following the **Article 51 of the FCA regulation** is the common all Transmission System Operators (TSOs) proposal:

- For **Harmonised Allocation Rules (HAR)** for long-term transmission rights in accordance with Article 51 of the FCA Regulation

Please find the latest methodology dating 29/11/2021 on the ENTSO-E webpage

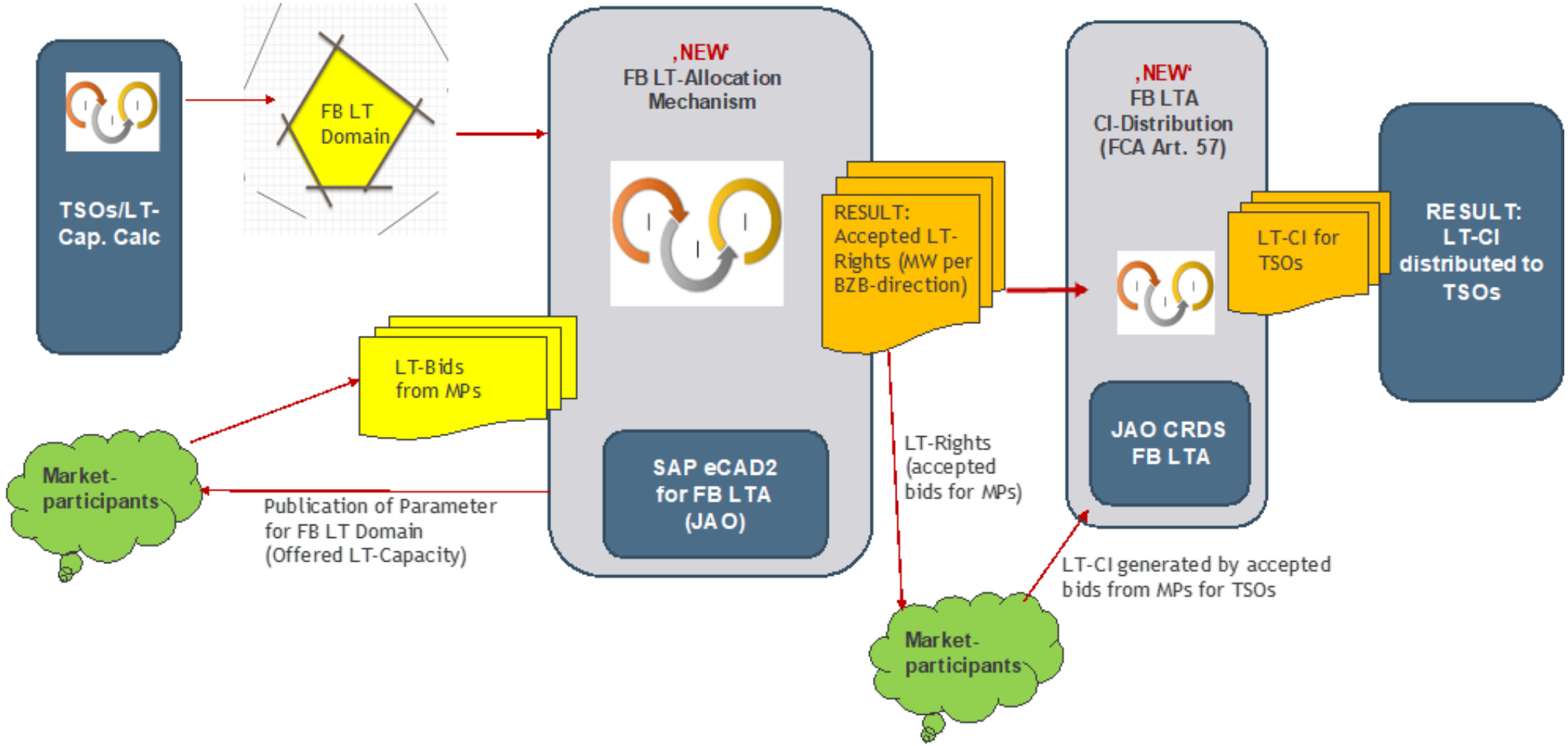
- Methodology

Main content of the methodology:

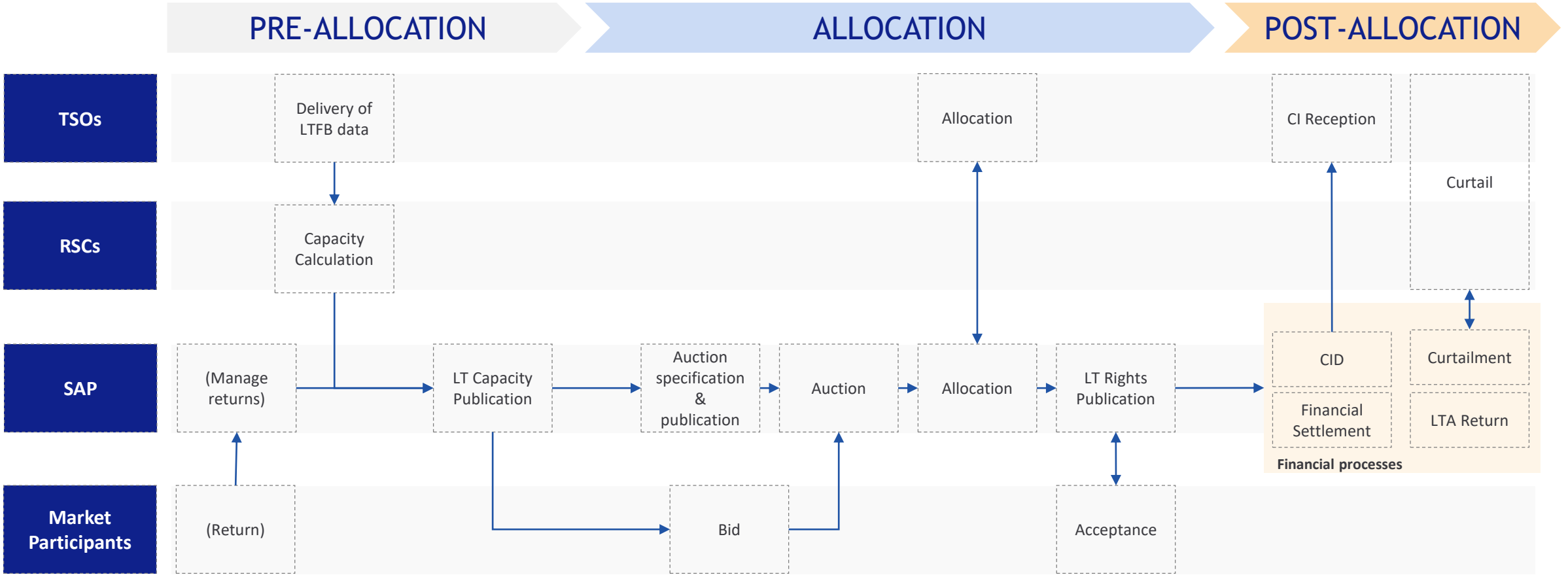
- The methodology on Harmonized Allocation Rules contain the terms and conditions for the allocation of Long-Term Transmission Rights on Bidding Zone borders.
- The registration and rules for market participants to trade on the Single Allocation Platform can be found in this methodology.

High-level market design of LTFBA (Core and Nordic CCRs)

LTFBA – Process overview



LTFBA – Process overview



LTFBA - User Experience (interface) JAO Tools

LTFBA will result in a **single LT auction for all BZ borders** within the given CCR **allocating all the LT capacity rights (product) for the given time period at once**.

This will result in **some changes for Market Participants compared to today where generally single border auctions are run**. Bidding and results will be treated per BZ border direction like today.

To facilitate the transition and to achieve a satisfactory user experience, JAO will involve Market Participants in the **design phase** to provide suggestions regarding elements such as:

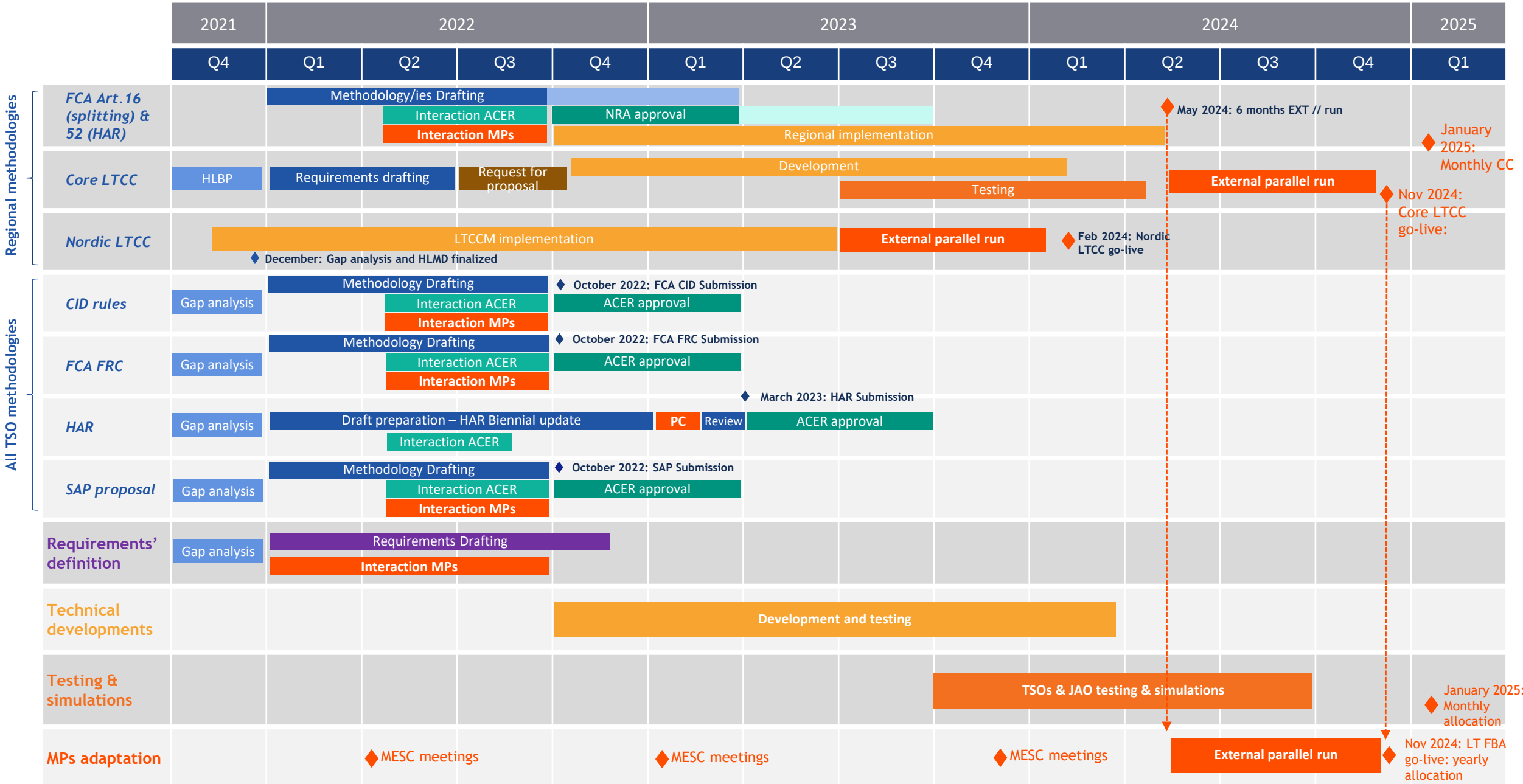
- **Auction Tool bidding interface** and **validation of bids** at bid submission
- **Visualization of available and allocated capacity** both in the auction tool and on the public website
- **Electronic data interfaces** impacted

Market participants will be invited to submit suggestions and review proposals **during Q1-Q3 2022**. Such involvement will be coordinated via a dedicated section of the JAO website.

LTFBA - High-level market design document - Overview

Content HLMD:

1. Introduction
2. Scope of the High-Level Market Design Document
3. **Design of the LT FBA**
   - *I. Allocation process and products supported*
   - *II. Roles in the allocation process under Flow-Based approach*
   - *III. Processes and interdependencies under Flow-Based approach*
   - *IV. Impact on credit limit verification and curtailment*
4. **LTFBA impact on the algorithms (HAR & other algorithms)**
5. **IT organization at SAP, RSCs, TSOs, Traders and Transparency**
6. **Rules and Contracts**
7. Costs for LTFBA
8. Implementation governance
9. Implementation timeline



*Timings may slightly vary from the planning above

LTFBA – Market participants' involvement

1.- Amendment of methodologies:

i. During **Q2 or Q3 2022** for SAP, FCA CID and FCA FRC, possible **public consultation or workshop** – *even though not required in the FCA*

ii. During **Q4 2022 or Q1 2023** for the HAR methodology, **regular public consultation** *(required in the FCA)* **and possible workshops**

iii. When relevant for regional methodologies, **regular public consultations**

2.- Development of requirements for the Single Allocation Platform (JAO):

i. During **Q1-Q3 2022** for Auction Tool bidding interface, visualization of allocated capacities, electronic interfaces, etc.

3.- Testing for the switch from NTC to LTFBA:

i. During **Q2 2024**

Annex

List of abbreviations:

- **CID:** Congestion Income Distribution
- **EXT:** External
- **FCA**: Forward Capacity Allocation
- **FAT:** Functional acceptance test
- **HAR:** Harmonized Allocation Rules
- **HLBP:** High-level business process
- **LT FBA:** Long-term Flow Based Allocation
- **MP:** Market Participants
- **PC:** Public Consultation
- **RSC:** Regional Security Coordinator
- **SAP:** Single Allocation Platform
- **SAT:** Site Acceptance Test
- **SIT:** Site Integration Test
- **TSO:** Transmission System Operator
- **UI:** User Interface

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SO YOU CAN RELY ON THE MARKET

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Market participants proposals with the allocation of LTTR

How/why do market participants use FTRs ?

- FTRs are options = hedging instruments used to protect against the variation of the spread (the price difference) between two bidding zones
  - An option gives the right to the owner to buy a certain product at a pre-determined price
  - FTR option gives the right to the buyer to receive a spread (= the price difference between two bidding zone) against the payment of a fix price (the result of the auction)
    - Eg: MP buys FTR A -> B at 3 €/MWh ➔ MP pays 3 €/MWh and will receive the price difference B-A (when B>A);
  - A market participant having a spread position (eg : long in A, short in B) can buy a FTR A->B to secure the spread risk (the price variation) of B versus A (not the absolute price level of A and B, but the **variation of this spread level)**

Absolute spreads vs. volatility – the example of foreign exchange trading

EUR to Japanese Yen:

- Absolute value of spread: 1 EUR=0,03% of average annual income

- Max variation of the spread over 10y: 13%

EUR to CFA Franc:

- Absolute value of spread: 1 EUR=0,19% of average annual income (Ivory Coast)

- Max variation of the spread over 10y: 0%

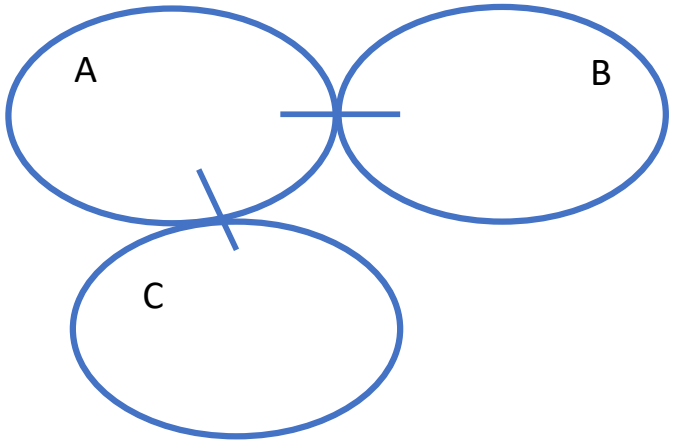
Source: XE converter and OECD data

Which currency would you seek to hedge?

Why FTRs are useful only if spread varies ?

- Illustrative example 1: without FTR

	Fwd price 2023 (@auction)	DA price 2023 (average)
A	50	52
B	60	62
C	51	59



- MP1:
  - FWD: today buys A, sells B => value = +10
  - Every day in 2023, sells A and buys B at DAMC (- 10)
  - Bottom line = 0
- MP2:
  - FWD: today buys A, sells C => value = +1
  - Every day in 2023, sells A and buys C at DAMC (-7)
  - Bottom line = -6

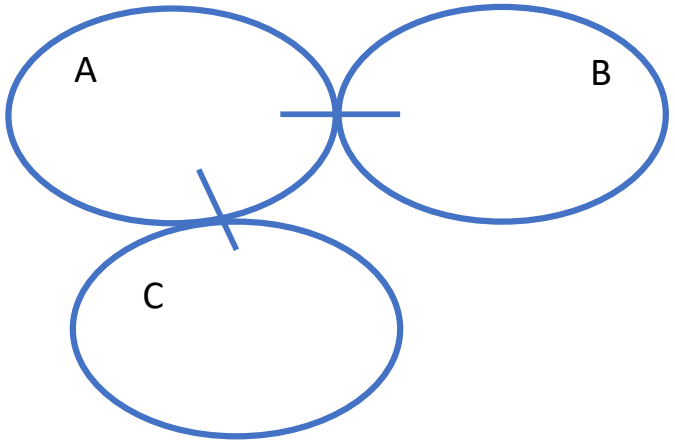
Conclusion: MP 2 is affected by the variation of the spread between A and C, while MP1 does not bear any loss given the fact that the spread is stable.

Why FTRs are useful only if spread varies ?

- Illustrative example 2: with FTR

	Fwd price 2023 (@auction)	DA price 2023 (average)
A	50	52
B	60	62
C	51	59

- MP1:
  - FWD: today buys A, sells B => value = +10
  - Buys FTR A->B at 10
  - Every day in 2023, sells A and buys B at DAMC (- 10)
  - FTR pays 10
  - Bottom line = 0
- MP2:
  - FWD: today buys A, sells C => value = +1
  - Buys FTR A->C at 1
  - Every day in 2023, sells A and buys C at DAMC (-7)
  - FTR pays 7
  - Bottom line = 0

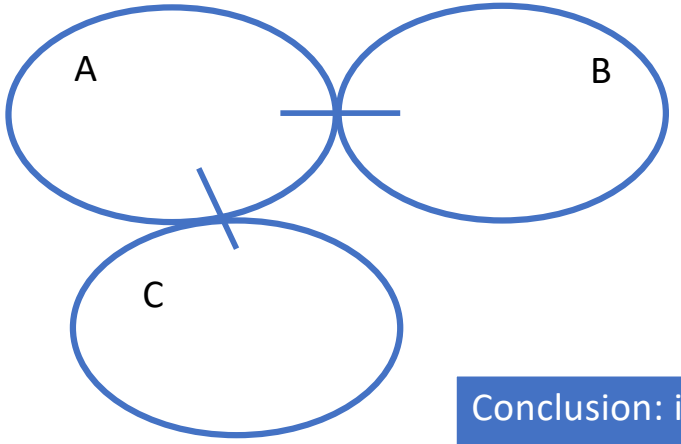


Conclusion: MPs are not affected by the variation of the spread when they own an FTR; however, compared to previous situation, only MP2 has had an added value with the FTR. MP1 had the same result without FTR.

How to measure the market appetite for FTR ?

- Illustrative example

	Fwd price 2023 (@auction)	DA price 2023 (average)
A	50	52
B	60	62
C	51	59



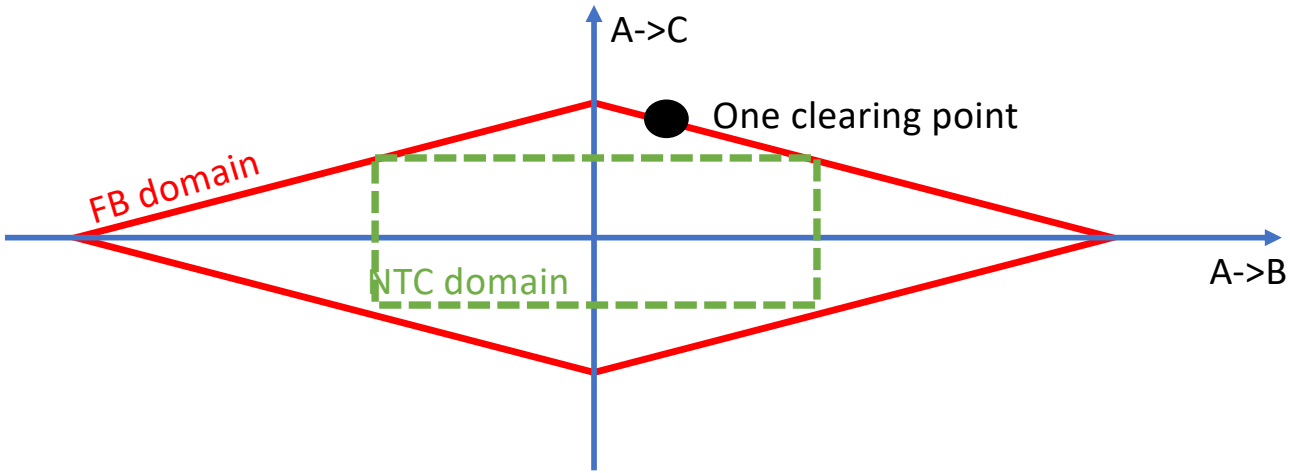
- MP1:
  - Low interest for the FTR (stable spread)
  - Value of the spread = 10
  - Total bid = **10,5**
  - **0,5 €** additional premium above current value
- MP2:
  - High interest for the FTR (volatile spread)
  - Value of the spread = 1
  - Total bid = **3**
  - **2€** additional premium above current value

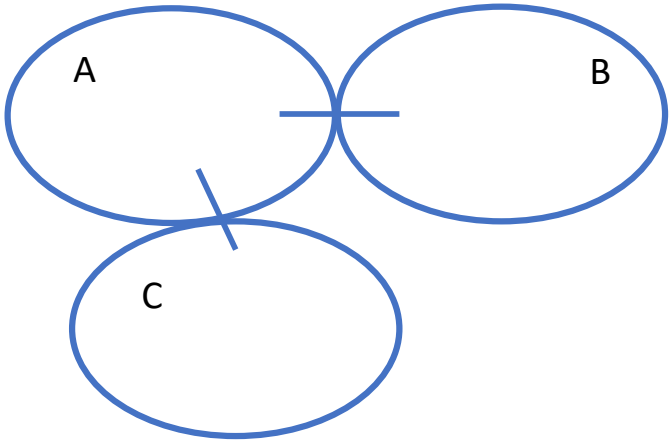
Conclusion: independently from the current value of the underlying product (the spread between the two bidding zone), the interest is translated into the additional premium proposed by the MP (= time value or extrinsic value). Time value translates the probability/hope that the underlying product (here the spread) will fluctuate with time.

How to measure the market appetite for FTR ?

- Independently from the current value of the underlying product (the spread between the two bidding zones) – the intrinsinc value, the interest is translated by the **additional premium proposed** by the MP (= extrinsic value).
  - P1 = 10 + RP1
  - P2 = 1 + RP2
  - Although P1>>P2, RP1<RP2
- Extinsic value (risk premium - rp) translates the probability/hope that the underlying product (here the spread) will fluctuate with time.
- Hedging strategies are driven by risk premium (cf. market appetite for FTR is due to the risk premium (rp) and not the option premium) and FTRs are used by market participants to hedge their exposure primarily to the volatility of the spreads, rather than their nominal value
- The rp of the options increase as volatilities of price spread increases and correlation between bz prices decreases. Hence lower correlated bz prices -> bigger risk premium -> higher interest in having FTR allocated

Flow based allocation of FTRs: arbitrage needed

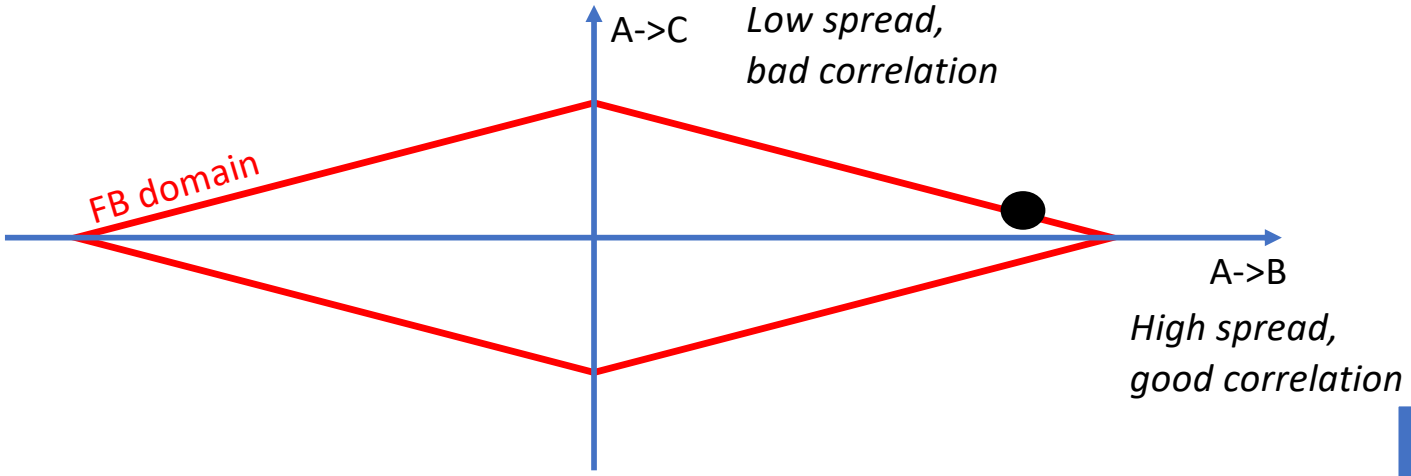


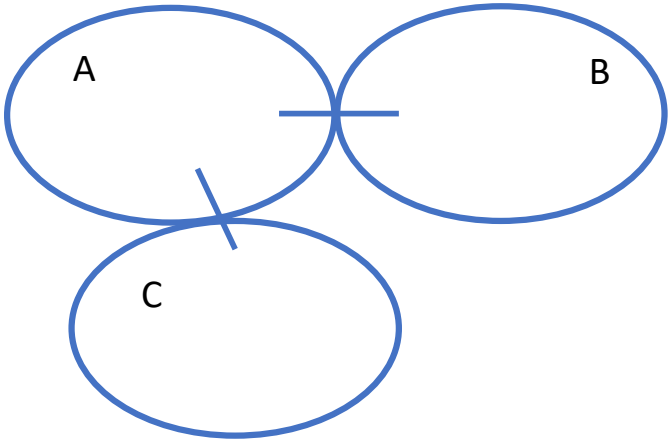


- NTC allocation is done for A-B and A-C independently. No “link” between quantity allocated at border AB versus AC
- FB allocation of FTR requires to determine both quantities allocated at the same time and there is a link/”arbitrage” between both => if the maximum quantity is allocated in AB, then, nothing can be allocated in AC (and vice versa)
- The choice to allocate more or less on each border depend **on the element one tries to optimize**.
- The optimization should focus on maximizing the welfare which should represent the overall benefit/added value brought by FTRs (ie: how to allocate FTR, while respecting grid security, in such a way that the overall welfare is maximized ?)

Flow based allocation of FTRs: using the MP bid to make the arbitrage

- Illustrative example





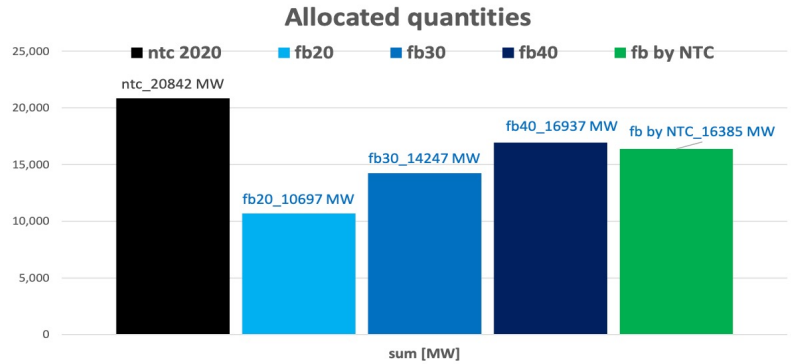
	Fwd price 2023 (@auction)	DA price 2023 (average)
A	50	52
B	60	62
C	51	59

	Fwd price 2023 (@auction)	MP bid	RP
A->B	10	10,5	0,5
A->C	1	3	2

Conclusion: if the auction income is the parameter to optimize in the FB allocation, borders with a high intrinsinc value (a high spread) will be favoured. Borders with low spread (even if volatile) will get low allocated volume (=> no/low hedging possibilities!!) .

Why using the total MP bid makes it inefficient ?

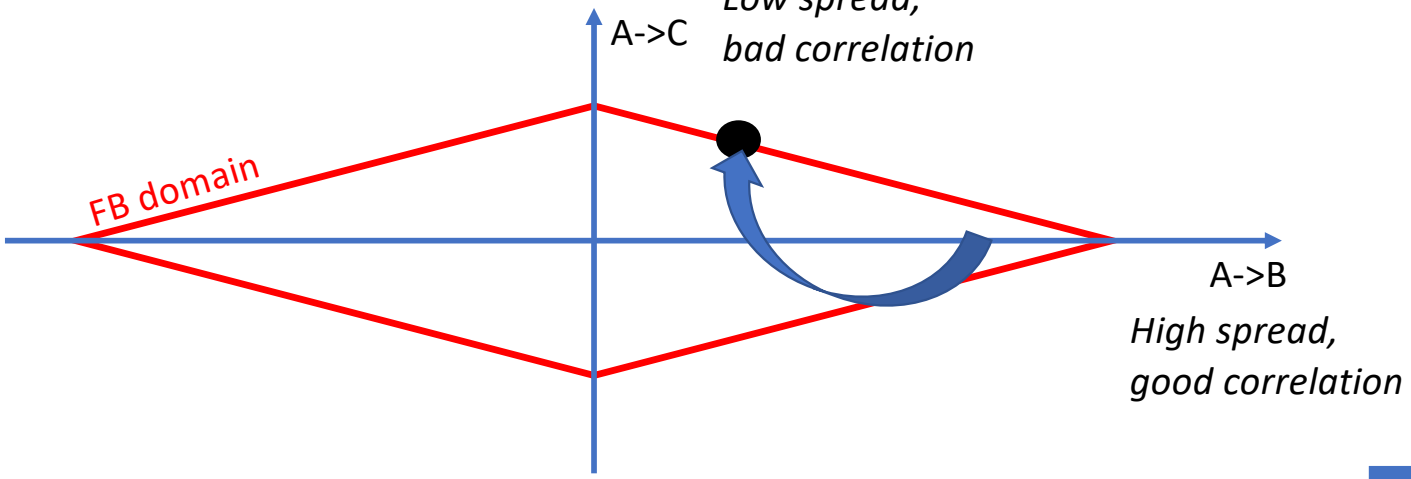
- Maximizing the auction income implies that borders with a low spread will get low/zero volumes allocated
- Having very low volumes allocated at some borders means that MP have no means to protect against variation of price spread – despite the potentiel high volatility of this spread => no hedging possibility => risk premium taken by market participants => higher prices for the consumer
- Absolute level of the spread does not mean that FTR have a strong added value – what matters is the variation of the spread (the lack of/low correlation between the two bidding zones)
- The network infrastructure should be allocated to the market in useful way, ie, where market participants have hedging needs; and this for the benefit of the customer

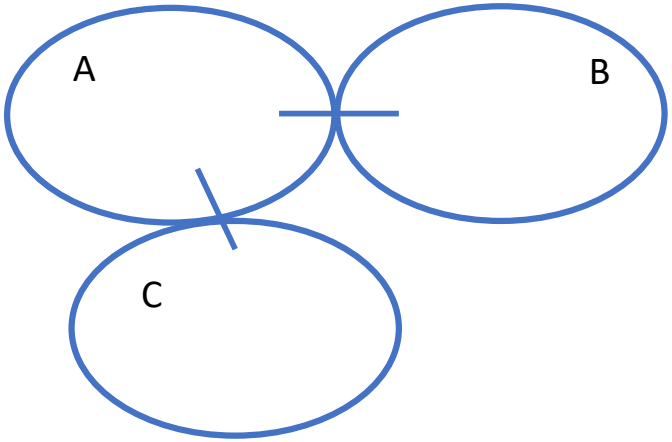


How to allocate while ensuring availability of hedging tools ?

Flow based allocation of FTRs: using the RP to make the arbitrage

- Illustrative example





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C	51	59

	Fwd price 2023 (@auction)	MP bid	RP
A->B	10	10,5	0,5
A->C	1	3	2

Conclusion: if the risk premium is the parameter to optimize in the FB allocation, borders with a high volatility will be favoured, which is precisely the goal of FTR !

Other considerations of Flow Based Allocation for FTRs

- Important operational impacts with a flow based allocation:
  - One big auction to allocate FTRs on all borders at the same time
  - What if it fails ? What will be the backup process ?
  - How/who will run the auction ?

Recommendations

- Concept: the optimization function performing the “arbitrage” for the allocation of FTR should consider
  - Not only the MP bid
  - But also put some weight (up to 100%) to the risk premium

- In practice:
  1. MP urge TSOs and ACER to make the technical design of future FTR FB auction in such a way that this feature is technically feasible
     - Further discussions with stakeholders and studies should be made to refine this concept and finetune the parameters
       - Reference fwd price
       - Weight for the consideration of the risk premium
  2. Integrate the description/concept in the upcoming EU HAR review

- Process: define backup/security processes for the “big” auction