ACER

European Union Agency for the Cooperation of Energy Regulators

Workshop on the study by
Engie Impact and Janson

Technical and legal definitions of congestions in electricity networks

Thursday, 9 November 2023 | 14:00 - 15:30

Housekeeping rules

Questions shall be posed using the Slido tool within Microsoft Teams

Use direct link: https://app.sli.do/event/rPpQ2Y9psetv5M7gFUZPkS

Your microphone is muted unless the chair gives you the floor

Questions from other participants can be 'liked' to increase their visibility

Slides from this webinar will be uploaded to ACER website

Substance-related questions will be addressed during the relevant Q&A session; although they can be posed at any point

The workshop has been recorded

Introductory remarks

- The 4th Energy Package (2019) provides different definitions of **congestion**

Electricity Regulation, Article 2:

(4) **'congestion'** means a situation in which all requests from market participants to trade between network areas cannot be accommodated because they would significantly affect the physical flows on network elements which cannot accommodate those flows;

(6) **'structural congestion'** means congestion in the transmission system that is capable of being unambiguously defined, is predictable, is geographically stable over time, and frequently reoccurs under normal electricity system conditions;

CACM Regulation, Article 2:

(17) **'market congestion'** means a situation in which the economic surplus for single day-ahead or intraday coupling has been limited by cross-zonal capacity or allocation constraints;

(18) **'physical congestion'** means any network situation where forecasted or realised power flows violate the thermal limits of the elements of the grid and voltage stability or the angle stability limits of the power system;

(19) **'structural congestion'** means congestion in the transmission system that can be unambiguously defined, is predictable, is geographically stable over time and is frequently reoccurring under normal power system conditions;

The links between the definitions are subject to interpretation

The definition of **congestion** implicitly refers to **physical congestion:**
significant impact of **congestion** → **physical congestion**, without specifying any threshold

The definition of **structural congestion**
- lacks clearer definitions of frequency, predictability and stability; and
- lacks clarity whether it applies separately to '**congestion**' or '**physical congestion**'

CACM: Capacity Allocation and Congestion Management

Introductory remarks

- In order to:
  - clarify concepts related to congestions in power systems, and their interdependences
  - define clear boundaries between structural and non-structural congestions
  - provide advice on legal/regulatory changes required to clearly identify various kinds of congestions

- ACER has engaged a consultant *Engie Impact and Janson*
  - to conduct a study aimed to provide clearer and simpler definitions of different types of congestion in electricity networks (physical, areal, structural)

- The primary goal of this workshop: present the study's outcomes and engage in discussions with stakeholders

- ACER intends to use the study's results and the insights gained from the workshop as input to the upcoming revisions to the CACM Regulation and associated methodologies

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Introductory remarks

13:45 - 14:00	**Workshop open for log-in**	Starts promptly at 14:00
14:00 - 14:05	**Introductory Remarks** Zoran VUJASINOVIC, ACER	
14:05-14:15	**Review of existing definitions in EU legislation** Marina PETRELLI, Tractebel (formerly Engie Impact)	
14:15 - 14:35	**Proposition of improved definitions** Marina PETRELLI, Tractebel (formerly Engie Impact)	
14:35 - 14:45	**Legal & regulatory changes** Guy BLOCK, Janson	
14:45 - 14:55	**Stakeholder survey results** **Conclusions and perspectives** Pierre HENNEAUX, Tractebel (formerly Engie Impact)	
14:55 - 15:25	**Q&A**	
15:25 - 15:30	**Closing Remarks** Martin POVH, ACER	

Definitions of electricity networks congestions

ACER workshop

09/10/2023

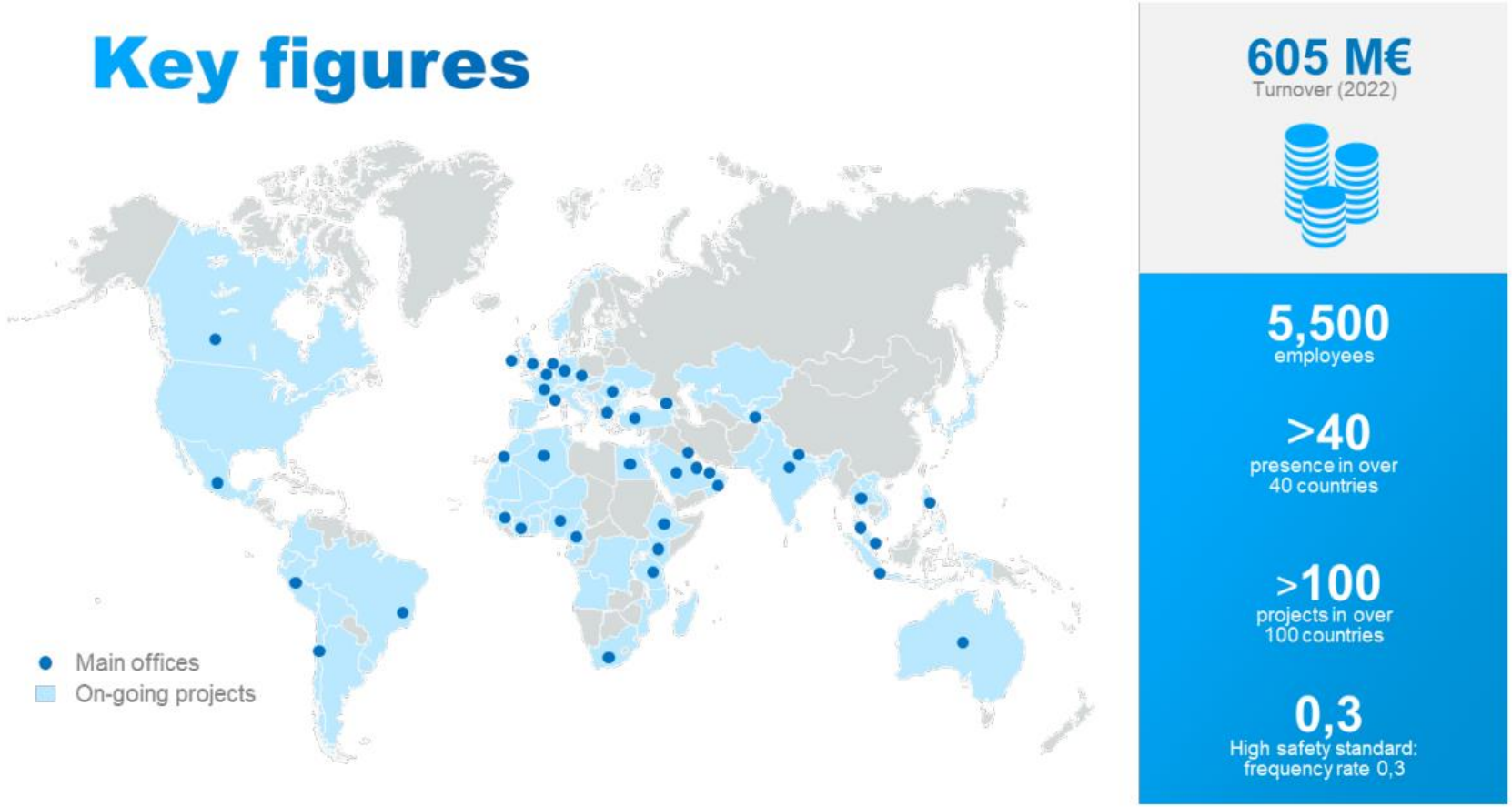
Internal | Restricted | Secret

Introduction

ENGIE Impact

About the Consultant

Formerly Engie Impact, next assignments under **Tractebel**



This study represents the individual opinion of the Consultants (Engie Impact and Janson) and does not represent the position of the Engie group.

Janson

ENGIE Impact

Context

CACM and Electricity Regulation provide multiple **congestion** definitions with **unclear boundaries and interdependencies**.

This can lead to issues and controversies when dealing with key aspects and programs, like the **Bidding Zone Review** (BZR).

Objectives of the project

1. **Identify** types of **congestions and their interdependences**.
2. Define clear **boundaries between structural and non-structural** congestion.
3. Provide **advice on legal definitions** for structural and non-structural and physical, areal and market congestion.

Review of existing definitions

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Physical congestion

Constraints not directly considered for capacity allocation

CACM Regulation Article 2(17): **‘physical congestion’** means any network situation where forecasted or realised power flows violate the thermal limits of the elements of the grid and voltage stability or the angle stability limits of the power system;

No reference to the market step in which the forecast of power flows would lead to identification of physical congestions

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Market congestion

Grid constraints directly considered at the level of market coupling

CACM Regulation Article 2(17): '**market congestion**' means a situation in which the economic surplus for single day-ahead or intraday coupling has been limited by cross-zonal capacity or allocation constraints;

No explicit relationship with physical congestions

Janson

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Congestion

Does not distinguish congestions managed at the level of the market coupling algorithm and congestions managed ex-post through redispatch

Electricity Regulation Article 2(4): '**congestion**' means a situation in which all requests from market participants to trade between network areas cannot be accommodated because they would significantly affect the physical flows on network elements which cannot accommodate those flows;

No geographical and/or technical boundary

No explicit relationship with physical and market congestions

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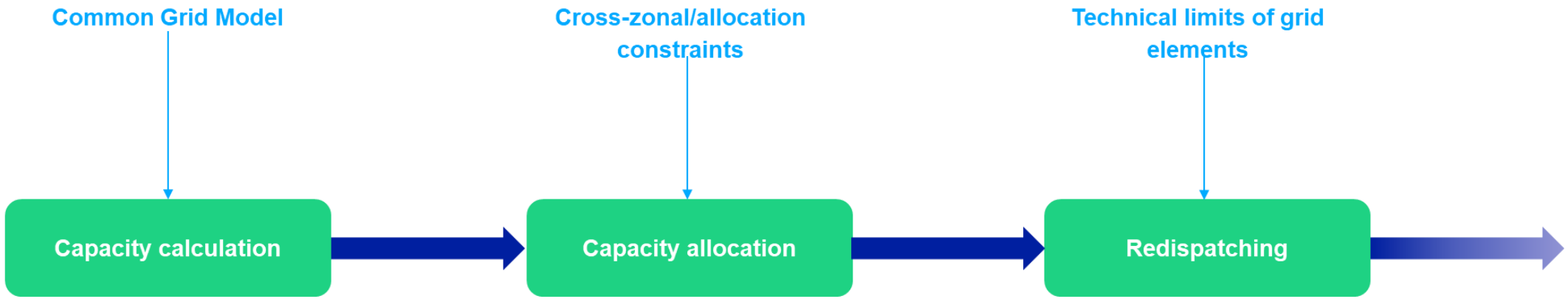
Structural congestion

No exact threshold

Electricity Regulation Article 2(6) '**structural congestion**' means congestion in the transmission system that is capable of being unambiguously defined, is predictable, is geographically stable over time, and frequently reoccurs under normal electricity system conditions;

No reference to the type of congestion it refers to nor to the market step in which structural congestion should be identified

Overall interpretation



Post capacity calculation

Pre-identification of physical congestions

Post capacity allocation

Acknowledged market congestions

Identification of forecasted physical congestions

Real time (Post redispatching)

Solved forecasted physical congestions

Identification of realized physical congestions

Arising of congestions

New proposed definitions

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Requirements

Limited room for interpretation

Straightforward application

Clear relationships between definitions

Physical congestion

Two main ways to clarify the definition:

Approach 1. Focus on impact of **accommodating all requests** from market participants

→ detected through unconstrained market run

Approach 2. Focus on impact on **incremental impact on economic surplus**

→ detected through Security-Constrained Optimal Power Flow or zonal market + redispatch

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Physical congestion

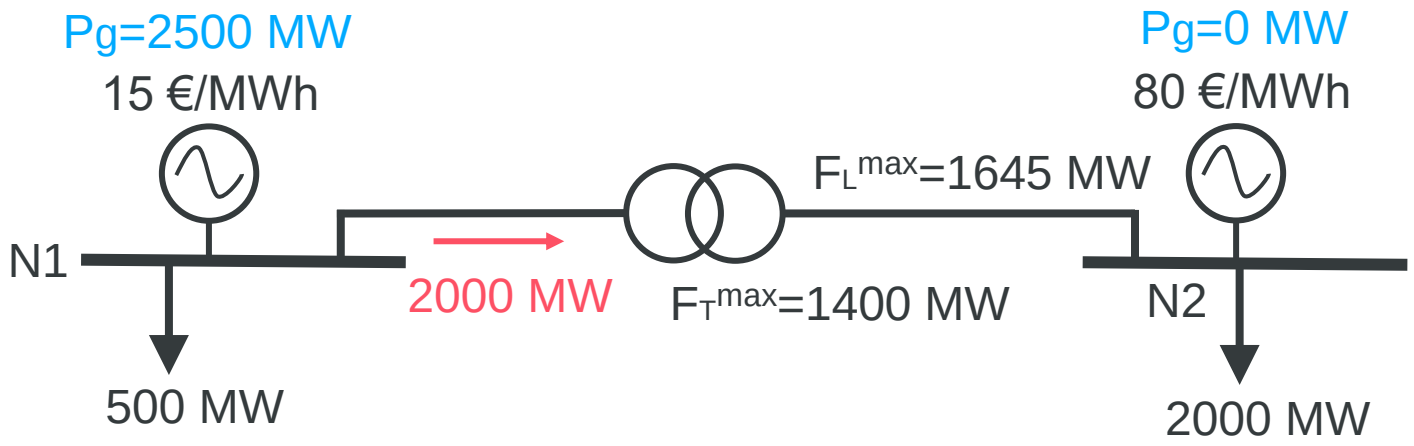
Two main ways to clarify the definition:

Approach 1. Focus on impact of **accommodating all requests** from market participants

→ physical congestion on transformer and line

Approach 2. Focus on impact on **incremental impact on economic surplus**

→ physical congestion on transformer



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Physical congestion

Two main ways to clarify the definition:

Approach 1. Focus on impact of **accommodating all requests** from market participants

→ physical congestion on transformer and line

Approach 2. Focus on impact on **incremental impact on economic surplus**

→ physical congestion on transformer

Approach 1 interesting for grid planning

Approach 2 more relevant for BZR

Physical congestion

Clarified the meaning of ‘situation’

‘physical congestion’ means a~~ny~~ network situation on one or several network elements simultaneously where ~~forecasted or realised power flows~~ violate ~~the thermal limits of the elements of the grid and voltage stability or the angle stability limits of the power system~~ a further increase of power flows on this network element(s) would lead to, or increase, the violation of operational security limits;

Removed reference to forecasts
→ open door to step for identification

Approach 2
→ focus on incremental increase

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Market congestion

"market congestion" means a situation in which the economic surplus ~~for single day-ahead or intraday coupling~~ during capacity allocation has been limited by cross-zonal capacity or allocation constraints.

Broadened the scope beyond day-ahead and intraday market coupling

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Areal congestion

Introduced and specified the type of congestion

Removed unclear reference to impact on physical flows

"areal congestion" means a situation in which all requests from market participants to trade between two network areas cannot be accommodated simultaneously because they would significantly ~~affect the physical flows on network elements which cannot accommodate those flows~~ contribute to a physical congestion on at least one network element;

Clarified relationship with physical congestion

"network area" means a group of nodes.

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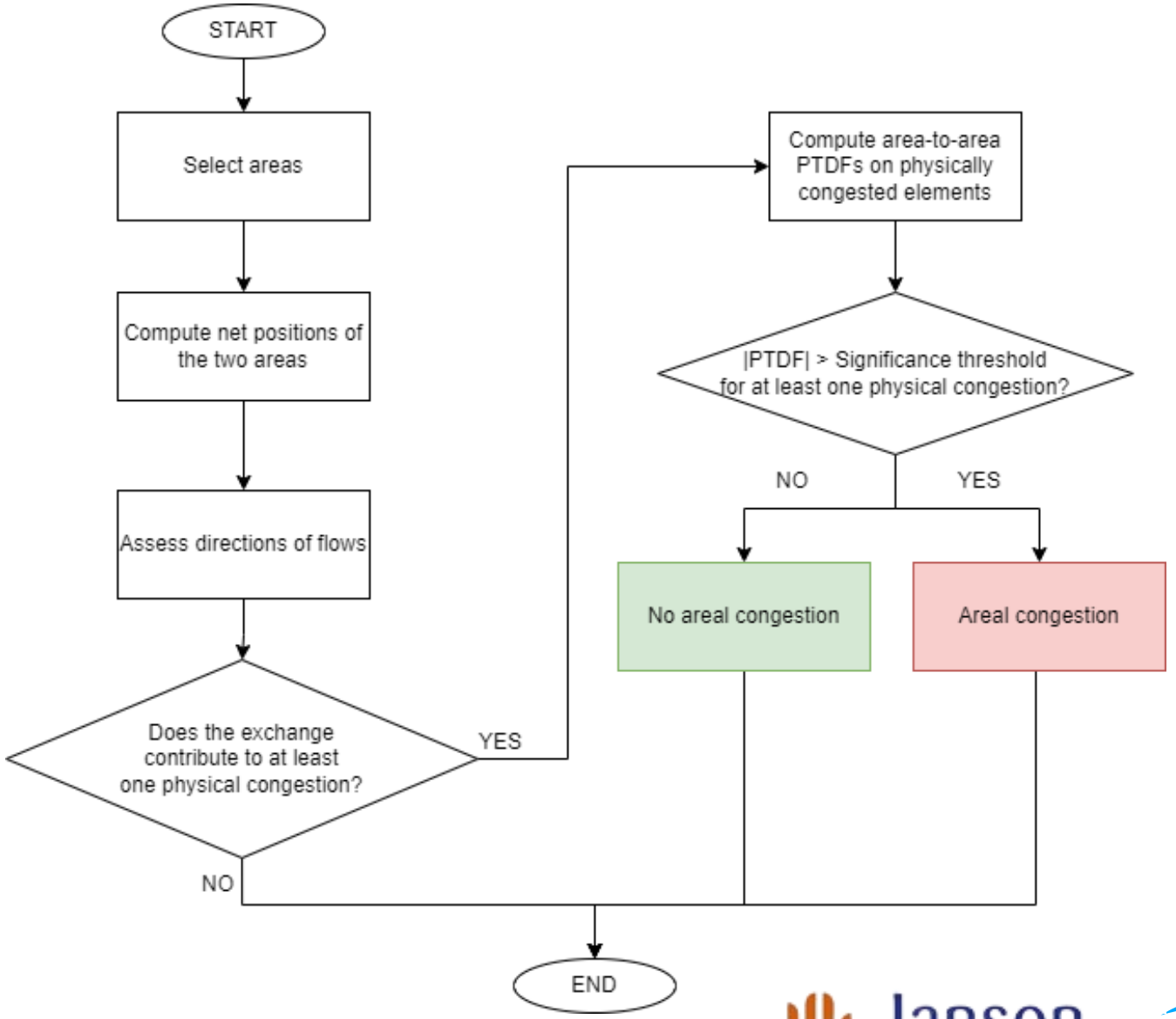
Areal congestion

[…] significantly contribute to a physical congestion […]



*significance threshold set to 5% in accordance with Article 5 of the Core capacity calculation methodology

Structural congestion

When is it relevant to assess the structurality of a congestion?

- **Physical congestion:** not relevant, would not convey useful information on market structure
- **Market congestion:** not relevant as it points at congestions on specific network elements, not on trades generating them
- **Areal congestion:** relevant as it looks at trades between groups of nodes (often presenting a recurring pattern)

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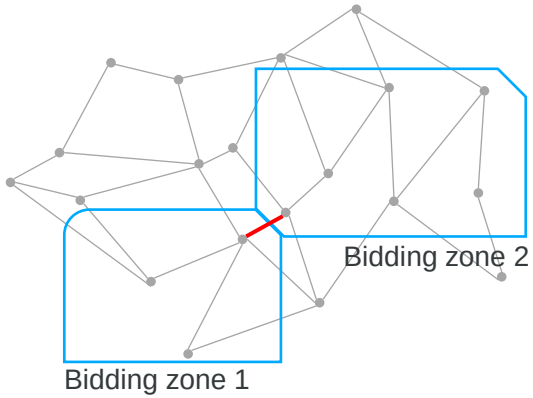
Structural congestion

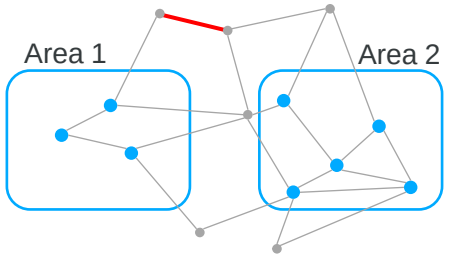
Clarified relationship with other types of congestion

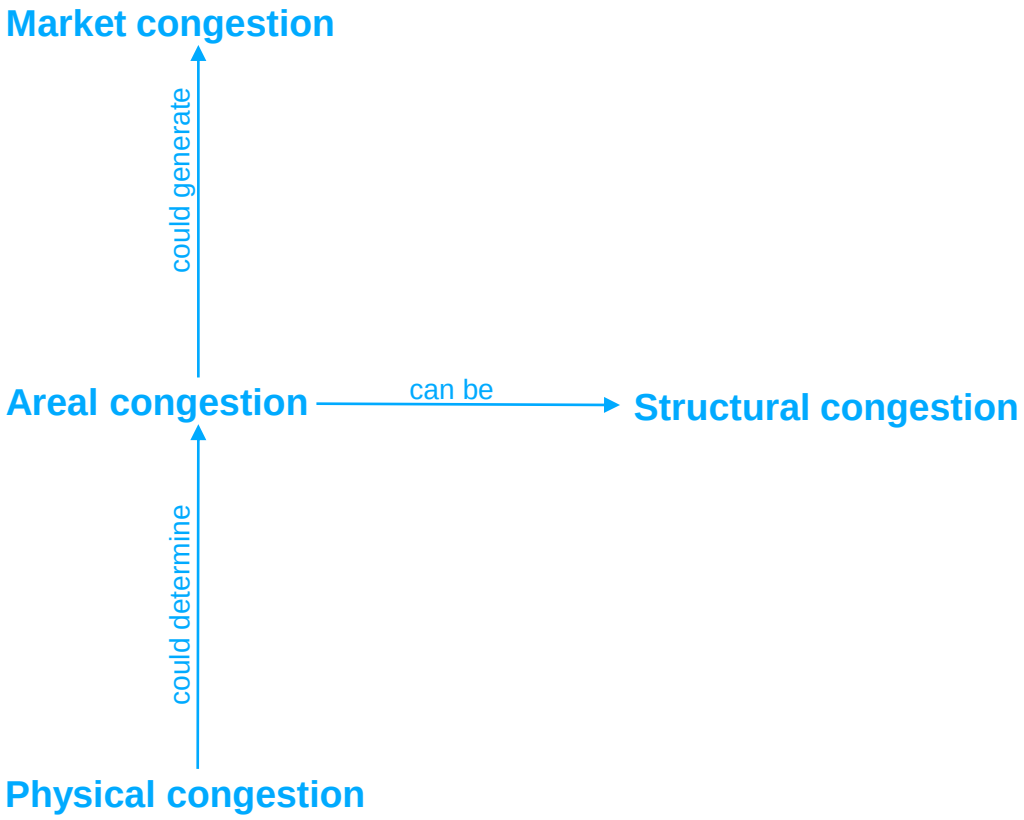
“structural congestion” means an areal congestion that is capable of being unambiguously defined, is predictable, is geographically stable over time, and is frequently reoccurring under normal electricity system conditions.

Extremely complex to define threshold
→ Issues survey to collect experts’ opinions

Interdependencies







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Legal & regulatory changes

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Proposed Regulatory Changes for New Definitions

Proposed Set of Definitions

- A new set of definitions for improved clarity and accuracy in the regulatory framework was proposed.
- Methods to identify and characterize the new set of definitions have been discussed.

Proposed Amendments to **Electricity Regulation**

- Amend Article 2 to include definitions of "areal congestion," and "physical congestion."
- Modify the definition of "structural congestion" to align with the new set of definitions.

Proposed Amendments to **CACM Regulation**

- Modification of the definitions in Article 2, including "market congestion," "physical congestion," and "structural congestion." Introduce definitions for "areal congestion," “network area,“
- Introduction of a new article explaining how to identify physical and areal congestion in the CACM Regulation.

Proposed amendments to the Electricity Regulation

Current definitions

Article 2

Definitions

(4)‘congestion’ means a situation in which all requests from market participants to trade between network areas cannot be accommodated because they would significantly affect the physical flows on network elements which cannot accommodate those flows;

(5)‘new interconnector’ means an interconnector not completed by 4 August 2003;

(6)‘structural congestion’ means congestion in the transmission system that is capable of being unambiguously defined, is predictable, is geographically stable over time, and frequently reoccurs under normal electricity system conditions;

Proposal

1. Introduction of "Areal Congestion” to address exchanges contributing to congestion between network areas and explicitly references "physical congestion.“
2. Reinterpretation of "Structural Congestion“ to align with Article 14 of EU Regulation 2019/943, which states that bidding zones must not contain structural congestions, by associating the proposed definition with the concept of "areal congestion”.

Proposed amendments to the Electricity Regulation – New definitions

Article 2

Definitions

(4) 'congestion' means a situation in which all requests from market participants to trade between network areas cannot be accommodated because they would significantly affect the physical flows on network elements which cannot accommodate those flows;

(5) 'new interconnector' means an interconnector not completed by 4 August 2003;

(6) "physical congestion" means a network situation on one or several grid elements simultaneously where a further increase of power flows on this network element(s) would lead to, or increase, the violation of operational security limits.

(7) "areal congestion" means a situation in which all requests to exchange electricity between two network areas cannot be accommodated simultaneously because they would significantly contribute to a physical congestion on at least one network element.

(~~7~~8) 'structural congestion' means ~~congestion in the transmission system that is capable of being~~ an areal congestion that is capable of being unambiguously defined, is predictable, is geographically stable over time, and ~~frequently reoccurs~~ is frequently reoccurring under normal electricity system ~~e~~ conditions."

Proposed amendments to the CACM Regulation

Current definitions

Article 2

Definitions

17. ‘market congestion’ means a situation in which the economic surplus for single day-ahead or intraday coupling has been limited by cross-zonal capacity or allocation constraints;

18. ‘physical congestion’ means any network situation where forecasted or realised power flows violate the thermal limits of the elements of the grid and voltage stability or the angle stability limits of the power system;

19. ‘structural congestion’ means congestion in the transmission system that can be unambiguously defined, is predictable, is geographically stable over time and is frequently reoccurring under normal power system conditions;

Proposal

1. Refined "Market Congestion" Definition by expanding its the scope beyond day-ahead and intra-day market coupling and emphasizing its interdependence with "areal congestion" and cross-zonal capacity constraints.
2. Clarified "Physical Congestion" by focusing on its impact on overall economic well-being and operational security.
3. Reinterpretation of "Structural Congestion“ to align with Article 14 of EU Regulation 2019/943, which states that bidding zones must not contain structural congestions, by associating the proposed definition with the concept of "areal congestion”.
4. Introduction of "Areal Congestion“ to address exchanges contributing to congestion between network areas. Introduces the concept of "network areas" and "area" as a group of nodes. Implements a new article with significance threshold for identifying areal congestion.

Proposed amendments to the CACM Regulation – New definitions

Article 2

Definitions

17. 'areal congestion' means a situation in which all requests to exchange electricity between two network areas cannot be accommodated simultaneously because they would significantly contribute to a physical congestion on at least one network element.

18. 'network area' means a group of nodes.

1~~7~~9. 'market congestion' means a situation in which the economic surplus ~~for single day-ahead or intraday coupling~~ during capacity allocation has been limited by cross-zonal capacity or allocation constraints;

~~18~~20. 'physical congestion' means ~~any~~ a network situation ~~where forecasted or 36~~ealized ~~power flows violate the thermal limits of the elements of the grid and voltage stability or the angle stability limits of the power system;~~ on one or several grid elements simultaneously where a further increase of power flows on this network element(s) would lead to, or increase, the violation of operational security limits.

21. 'structural congestion' means ~~congestion in the transmission system~~ an areal congestion that can be unambiguously defined, is predictable, is geographically stable over time and is frequently reoccurring under normal power system conditions;

Methodology for the identification of physical and areal congestion: Methodology in the CACM or developed by the TSOs

- **Option 1: Methodology in the CACM Regulation (New article 34)**
  - Contains the steps for identifying areal congestion:

a) Identification of two network areas area between which areal congestion is being tested;

b) Identification of requested exchange between two areas;

c) Identification of physical congestions;

d) Identification of impact of requested exchange on physical congestions; and

e) Identification of the significance of the impact of requested exchange on physical congestions.

f) And others… see report

Methodology for the identification of physical and areal congestion: Methodology in the CACM or developed by the TSOs

- **Option 2: The TSOs develop the methodology**

  - The TSOs must propose a Methodology for clarification of congestion definitions.
  - The methodology developed by TSOs should cover steps to identify physical, areal, and market congestion and determine whether areal congestion is structural or not.
  - Methodology addresses both past and future congestions and defines necessary data requirements.

By no later than [X] months after entry into force of this Regulation, all TSOs shall develop a proposal for a Methodology for clarification of definitions of congestions. The methodology shall clarify practical steps to identify physical congestion, areal congestion, market congestion and whether areal congestion is structural or not. The methodology shall also distinguish how these congestions are identified for congestions occurred in the past as well as congestions expected in the future. The methodology shall also define the data required for such an assessment and identification.

Stakeholder survey results

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Stakeholder survey

- Experts were invited in May/June to give their views on how structural congestion should be defined quantitatively (i.e., threshold)
- 31 responses, originating not only from individual experts but also from institutional stakeholders
- Numerous comments on the concepts and the definitions
  - Comments considered to shape the proposed definitions
  - No formal answer to each comment
- 11 respondents suggested a value for the threshold

Quantitative criterion for structural congestion

- Input of experts/stakeholders + internal assessment → recommended threshold in the range 5-10%
- An areal congestion should be considered as structural if it happens more than 5-10% of the market time units
- Value to refine based on analyses for the European power system

Conclusions & perspectives

ENGIE Impact

Contributions of this study

- Proposition of a consistent approach to identify structural congestions
  - Structural congestions should correspond to areal congestions and not to physical congestions
  - In particular, BZ borders should not necessarily be on physical congestions
- Proposition to adapt congestion definitions in the relevant EU regulations
- Demonstration of the applicability of the approach

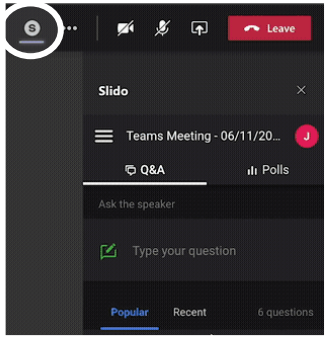
Concluding comments

- Not the only possible approach
- More an “academic study” at this point
- Should be seen as starting point for an agreement on the methodology at the European level
- Open questions remain, especially for the ex-post assessment of structural congestions

Q&A session

Connect to Slido

- **Directly in MS Teams**
- Through www.slido.com #electricity
- Scan QR code
- Use direct link:
  https://app.sli.do/event/rPpQ2Y9psetv5M7gFUZPkS



Closing remarks

Thank you.