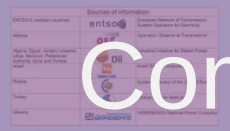


Common Grid Model Methodology
Generation and Load Data Provision Methodology

Dennis Stufkens

(on behalf of CGM Programme)

Stakeholder workshop

Brussels

18 February 2016

entsoe

Reliable Sustainable Connected

Disclaimer

The present set of slides does not aim to provide a summary of the Common Grid Model Methodology and the Generation and Load Data Provision Methodology; the slides were prepared merely in order to facilitate discussion at the public workshop on 18 February 2016. The content of these slides does not constitute approved final positions.

Abbreviations in use in the presentation - 01

CGM: Common Grid Model

CGMA: Common Grid Model Alignment

CGMM: Common Grid Model Methodology

CGMES: Common Grid Model Exchange Standard

CGMM: Common Grid Model Methodology

D-1: day-ahead (day before the day of delivery)

D-2: two days before the day of delivery

DLR: dynamic line rating

DSO: distribution system operator

FCR: Frequency Containment Reserve

Abbreviations in use in the presentation - 02

FRR: Frequency Restoration Reserve

GL CACM: Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management

GL FCA: Commission Regulation (EU) …/… of XXX establishing a guideline on forward capacity allocation

GL SO: Commission Regulation (EU) …/… of XXX establishing a guideline on transmission system operation

GLDPM: Generation and Load Data Provision Methodology

GLs/NCs: Guidelines / Network Codes

HVDC: High Voltage Direct Current

IGM: Individual Grid Model

MTU: market time unit

Abbreviations in use in the presentation - 03

MVA: Mega volt-ampere

NEMO: Nominated Electricity Market Operator

NRA: National Regulatory Authority

OPDE: Operational Planning Data Environment

P (as in Pmax, Pmin): active power

PNP: preliminary net position

PPD: pre-processing data

PST: phase-shifting transformer

Q (as in Qmax, Qmin): reactive power

R, X, B: Resistance, Reactance, Susceptance

Abbreviations in use in the presentation - 04

RES: Renewable Energy Sources

RfG: Commission Regulation (EU) …/… of XXX establishing a network code on requirements for grid connection of generators

RR: Replacement Reserve

RSCSP: Regional Security Coordination Service Provider; currently referred to in the Methodologies as "RSC". However, the term is expected to be corrected shortly.

SCADA: supervisory control and data acquisition

SGU: Significant Grid User

TSO: transmission system operator

Vsched: scheduled voltage

Y-1: year-ahead

WELCOME AND OVERVIEW OF THE CGM PROGRAMME

Dennis Stufkens

entsoe
Reliable Sustainable Connected

Welcome

Focus of workshop: methodologies

- CGMM: Common Grid Model Methodology (GL CACM Article 17 (1))
- GLDPM: Generation and Load Data Provision Methodology (GL CACM Article 16 (1))

Assumption: all participants have read the methodologies

Workshop does not aim to cover background; e.g., the following topics will not be covered:

- Network Codes / Guidelines in general
- Organisation of TSOs' work in CGM Programme
- Technical aspects of CGM implementation
- (...)

Not focus of workshop
However, questions are welcome

Context

This workshop: part of public consultation on Methodologies

- Consultation opened on 04 February and will close on 04 March
- Consultation documents and comments template available at: https://consultations.entsoe.eu/

Purposes of public consultation

- Improve the Methodologies before submission to regulatory authorities in the light of the comments received
- Meet legal requirement for public consultation

Today's workshop: opportunity to ask questions and discuss

Agenda

From	Until	Agenda item
10:00h	10:20h	Welcome & introduction
10:20h	11:45h	CGMM; chapters 1 to 3
11:45h	12:00h	Coffee break
12:00h	13:00h	CGMM; chapters 4 to 9
13:00h	13:40h	Lunch
13:45h	14:25h	Q&A on CGMM
14:30h	15:00h	GLDPM
15:00h	15:15h	Coffee break
15:15h	15:50h	Q&A on GLDPM
15:50h	16:00h	Next steps & farewell

BACKGROUND ON DRAFTING PROCESS

Benoît Jeanson

entsoe
Reliable Sustainable Connected

CGMM - CHAPTER 1
LEGAL REQUIREMENTS
SCOPE
GEOGRAPHICAL COVERAGE

Knut Eggenberger

entsoe
Reliable Sustainable Connected

Legal aspects

Aim of presentation: explain key legal considerations

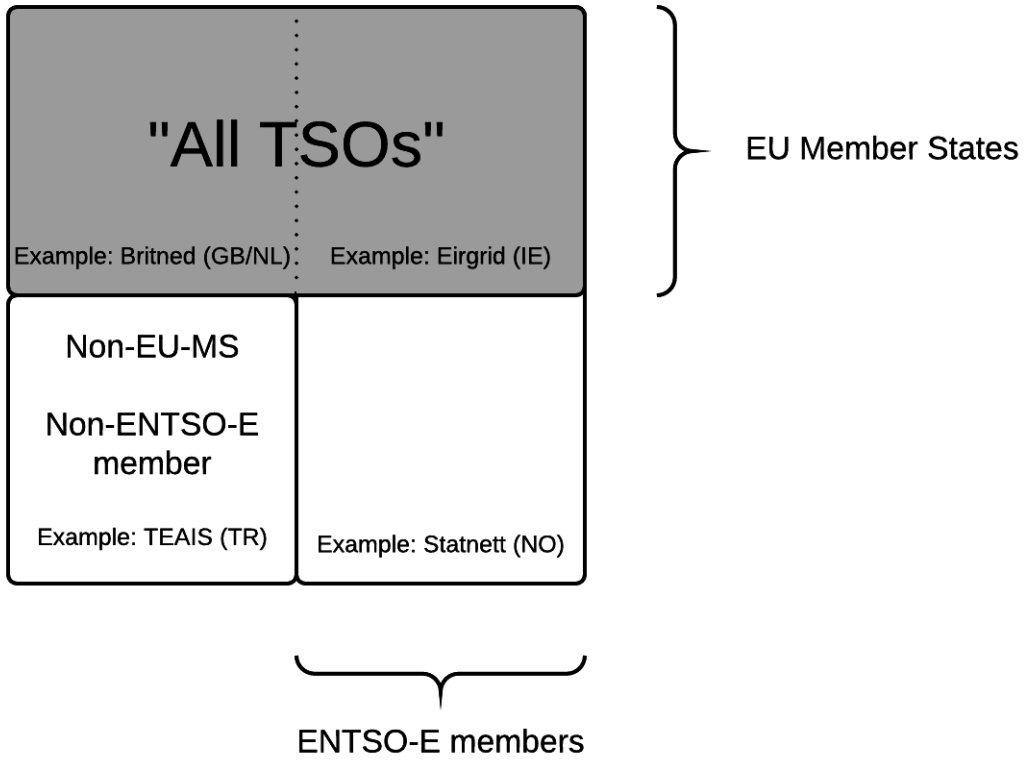
- Selective coverage of CGMM chapter 1 and annexes

"What is the role of non-EU TSOs in the CGM process?"

Confidentiality

"Why do the methodologies refer to GLs other than GL CACM?"

"What is the role of non-EU TSOs in the CGM process?" (1/2)



- "All TSOs" = all "certified TSOs" pursuant to Article 3 of 714/2009
- GLs / NCs (and thus the methodologies) binding in EU Member States
- Q.: Where does that leave non-EU TSOs?

"What is the role of non-EU TSOs in the CGM process?" (2/2)

A.: Non-EU TSOs are welcome to join the CGM process (i.e., contribute their IGM to the CGM and get access to the CGM) subject to conditions:

- Since methodologies are not automatically binding for non-EU TSOs, they shall agree to be bound by the methodologies.
- All organisations that make use of the common IT infrastructure shall, of course, pay for a share of the costs, obtain any additional licenses required, follow operational procedures (incl. use of common data formats) etc.

Legal considerations beyond the ones outlined above are beyond the scope of the Methodologies project.

Confidentiality

Both methodologies contain explicit obligations to ensure that data are kept confidential (pursuant to GL CACM Article 13).

However, all users of the IT infrastructure (notably the OPDE) shall sign a separate confidentiality agreement.

"Why do the methodologies refer to GLs other than GL CACM?"

The CGMM and the GLDPM are also required by other GLs.

CGMM

- GL SO - Articles 67 (1) (Y-1) and 70 (1) (D-1 / ID) of GL SO (2015-11-27)
- GL FCA - Article 18 (1) ("long-term timeframes") of GL FCA (2015-10-30)

GLDPM

- GL FCA - Article 17 (1) ("long-term timeframes") of GL FCA (2015-10-30)

Aim: prepare a single CGMM (not three) and a single GLDPM (not two)

Integrate all relevant requirements from all three / both GLs

However, GL FCA and GL SO are still at draft stage:

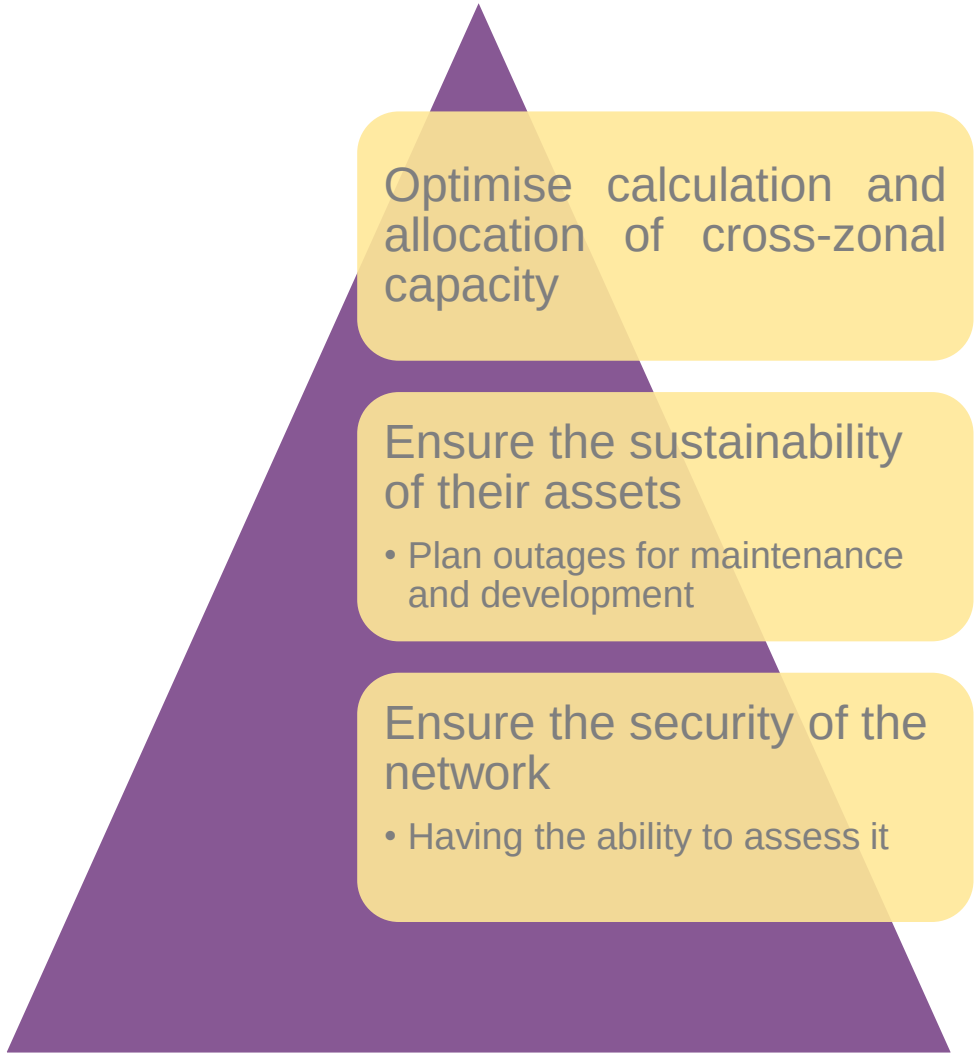
- Work with the current versions; update methodologies as drafts are finalised
- Resubmission, additional consultation of methodologies required

CGMM - CHAPTER 2
HIGH LEVEL OVERVIEW

Benoît Jeanson

entsoe
Reliable Sustainable Connected

Why is the CGM required?



Common need

Simulation of the **behaviour of the European Power System**

➔Perform reliable **calculation** to take operational **decisions** as to

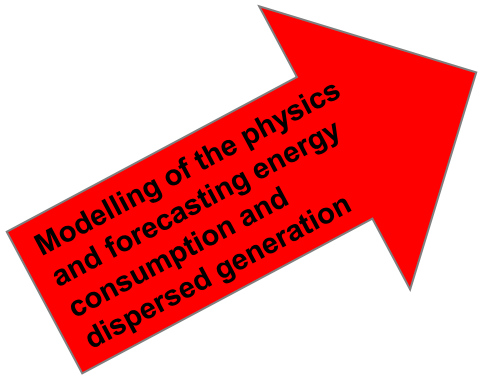
- ensuring optimal use of the transmission infrastructure
- ensuring operational security
- optimising the calculation and allocation of cross-zonal capacity

Common grid model problem statement

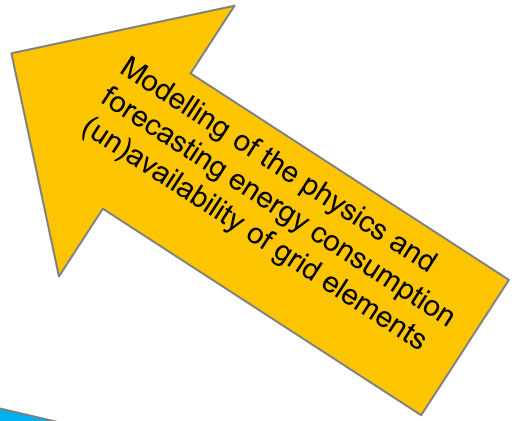
To forecast the behaviour of the European grid for a given point in time in order to

- assess the risks for operational security
- calculate the available transmission capacity for trading energy,
- you need to rely on data for which a lot of different parties are responsible – and exchange them in a harmonized manner based on international standards and European norms

Consumption of energy and the distribution of energy

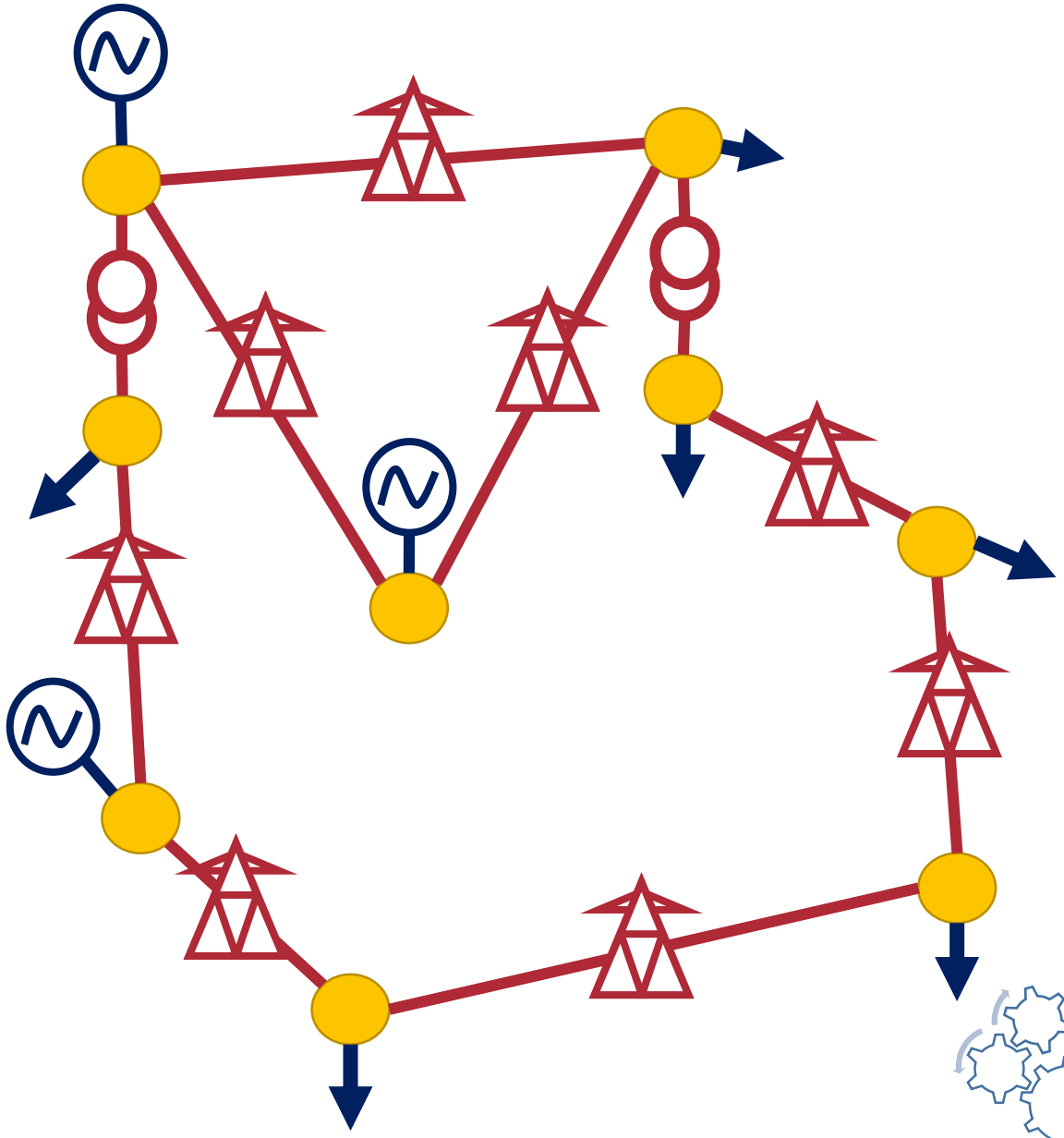


Transmission of energy over long distances and cross border



Production of energy

Principle of modelling the power system to perform calculation



- Set of nodes
  - (P,Q) Nodes (load behaviour)
  - (P,V) Nodes (Generation behaviour)

➔ **Hypothesis**: forecasts of load and generation

- Set of connecting devices
  - Transmission lines
  - Transformers

➔ **Equipment data**: physical parameters of the devices

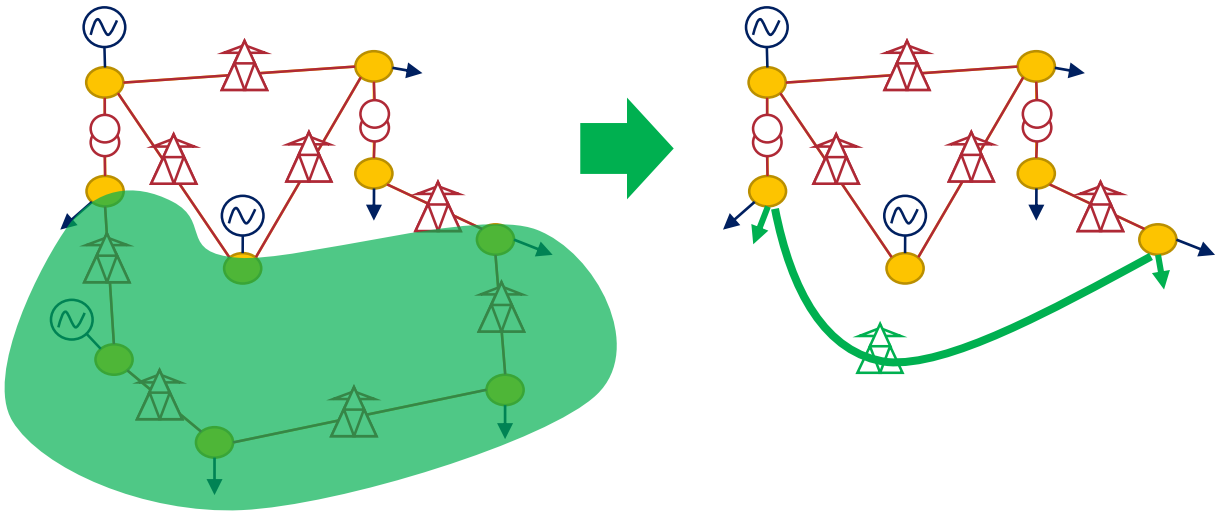
➔ **Calculation**: resulting flows and voltages for each element

Electricity does not know borders

Any element (from big generating units to single household consumption, whatever the location) of the power system has an impact on the resulting state (flows / voltages) of the grid

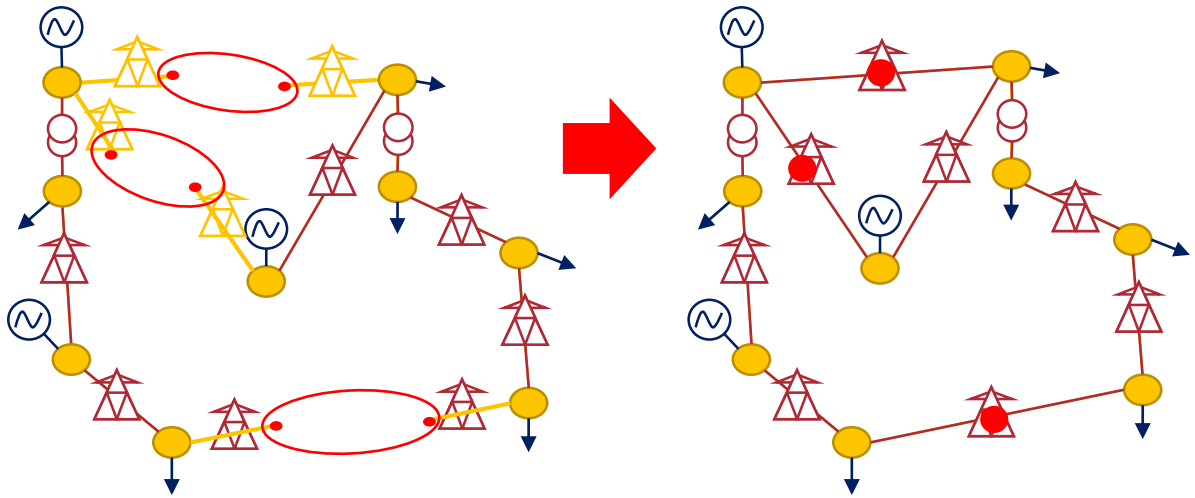
Some parts of the overall power grid shall be simplified / aggregated to reduce the size of the model

➔Network reduction



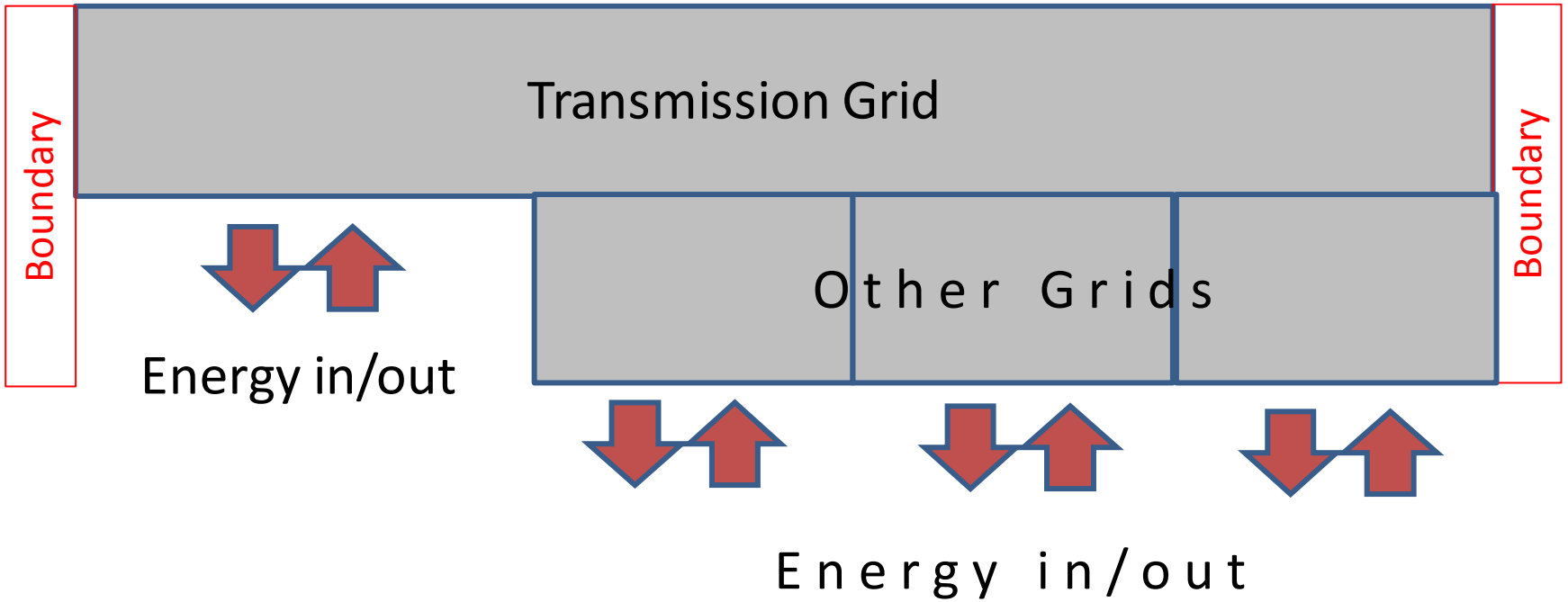
The model shall be extended to a wide area

➔ Merging subsets of the overall system



➔ Both approaches are to be combined to elaborate the CGM

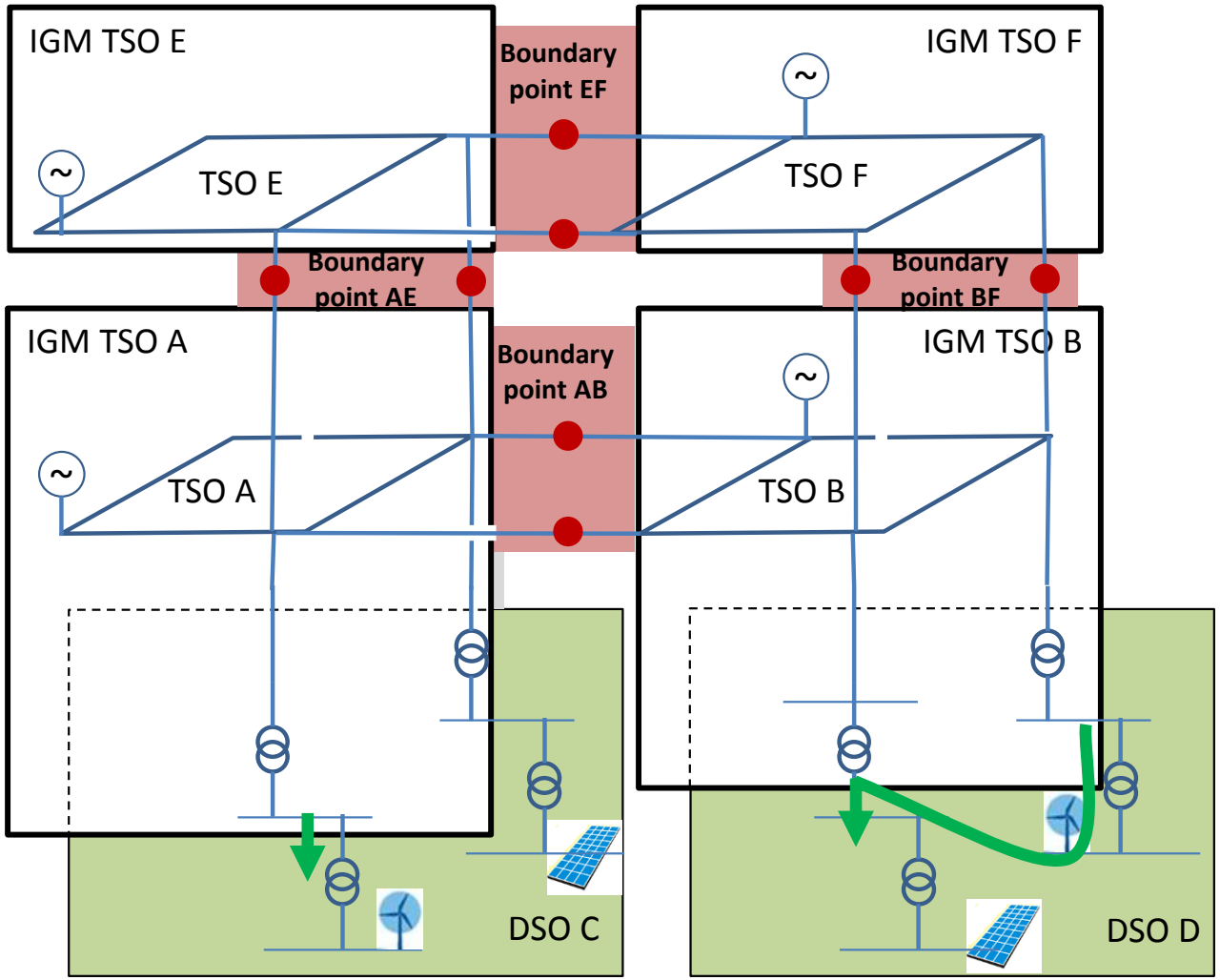
Every TSO gathers data and provides a piece of the puzzle: An Individual Grid Model (IGM)



Cross border commercial transactions do not reflect the actual flows of energy in the grid

entsoe
Reliable Sustainable Connected

The Common Grid Model (CGM) is the merging of all IGMs together



➔ The expected flow can be calculated

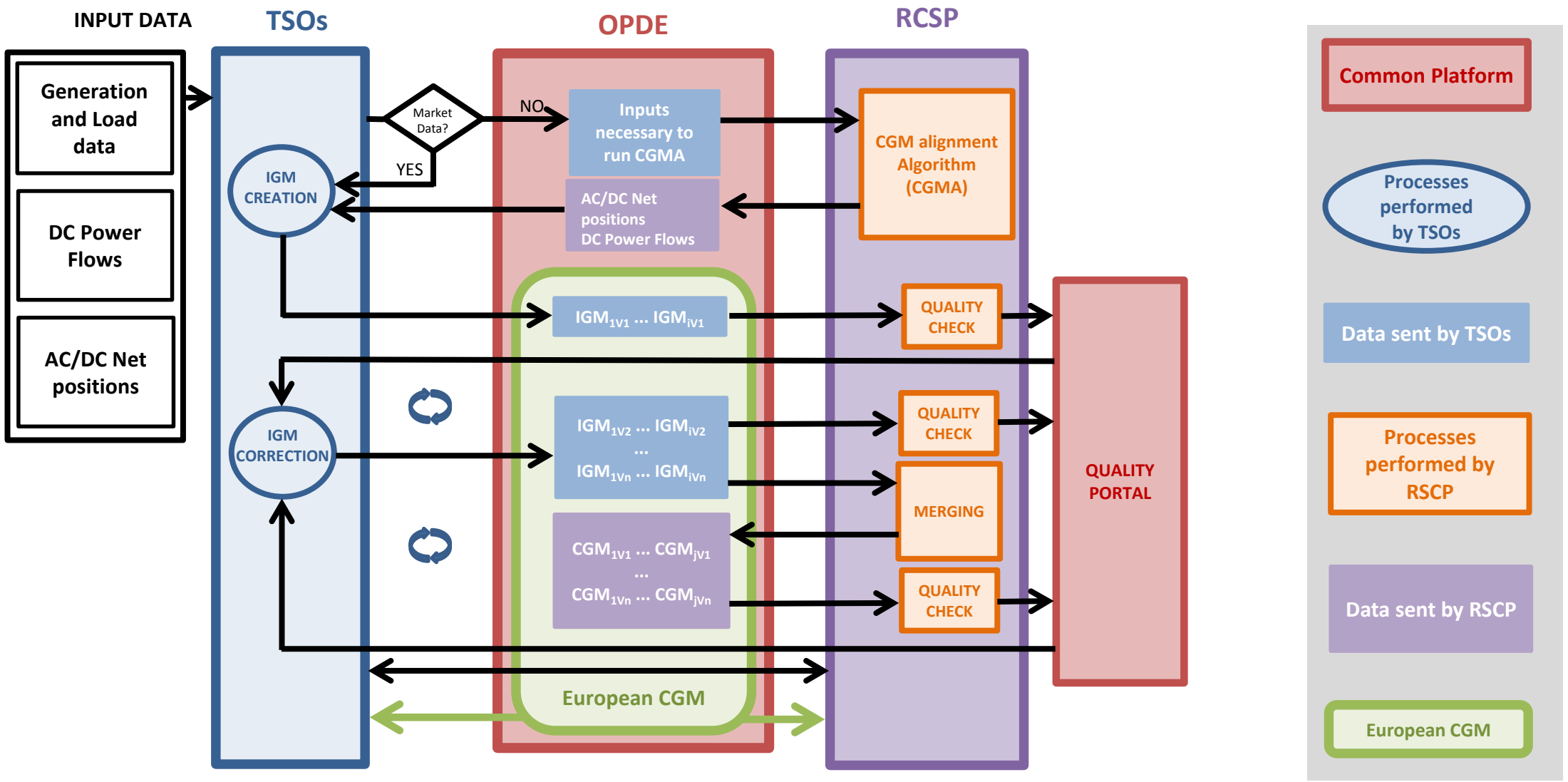
OUT OF SCOPE OF CGMM:

➔ Change in the hypothesis enables to:

- assess the security:
  - simulation of contingency and assess the efficiency of remedial action
  - Assess influence of different load level / generation plans …
- Assess the influence of outages
- Calculate the cross-border capacity

entsoe
Reliable Sustainable Connected

High level overview of the CGMM



Scenarios

Definition of scenarios are necessary:

- To harmonize the targeted reference case on which the TSO will align to elaborate their IGM

A scenario defines for its time horizons

- A targeted period
- A common way of aligning the net positions and flows on DC links
- A definition of the scope of the expected structural description
- The expected topology
- The Load pattern description
- The RES infeed hypothesis to be implemented
- The Generation infeed to be implemented

CGMM - CHAPTER 3
IGM CREATION

Charlie Mc Gee

entsoe
Reliable Sustainable Connected

Introduction

IGM Definition

TSO obligations under GLs

IGM Creation Process

IGM Content

Recap on IGM Creation Process

IGM Definition

Equipment Model – Structural Data

Operating Assumptions – Variable Data

"Associated Information" – IGM Modification / Analysis

Guideline Obligations

IGM creation/submission

IGMs shall represent the best possible forecast of transmission system conditions at their time of creation

The way in which IGMs are built shall be harmonised to the maximum possible extent

IGMs shall at least enable steady state load flow analyses to be performed

IGM Creation Process

- Create baseline equipment model
- Apply structural changes to the equipment model, if applicable
- Apply operating assumptions to the model
- Ensure supply/demand balance is consistent with boundary condition requirements
- Perform load flow solution and carry out internal quality checks
- Modify the model following quality checks, if necessary
- Carry out network reduction of other grids, if applicable
- Convert model to CGMES data exchange format
- Submit IGM to the OPDE for external quality assurance

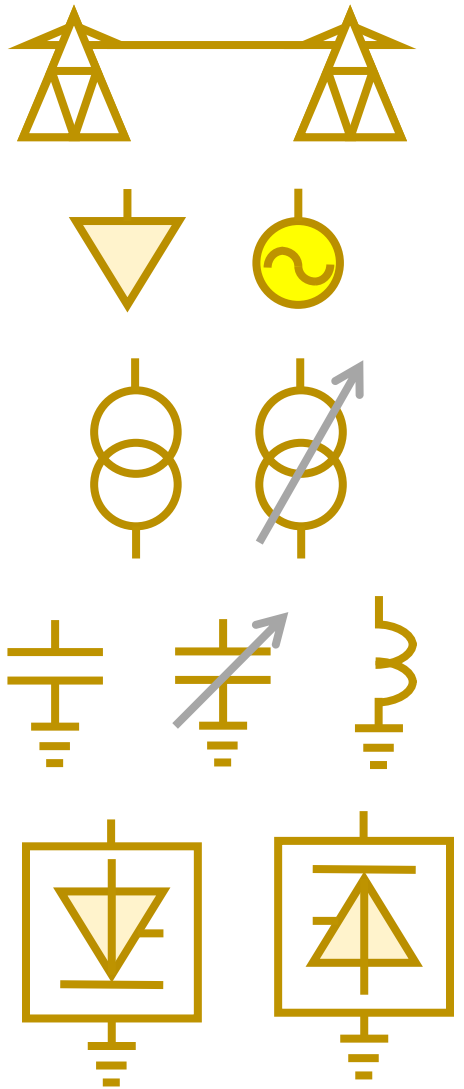
Baseline Equipment Model – Structural Data

Technical characteristics & connectivity of:

- Substations (busbars)
- Transmission lines/cables
- Transformers
- Reactive compensation devices
- Generators
- Loads
- HVDC equipment

Changes relatively infrequently

- Connection of new equipment
- Replacement/upgrade of existing equipment
- Decommissioning of equipment



Baseline Equipment Model

Example 1: data included for a transmission line

- Station identifiers
- Line identifier
- R, X, B
- Length

Example 2: data included for a generation unit

- Unit identifier
- Station identifier
- Qmax, Qmin
- Pmax, Pmin

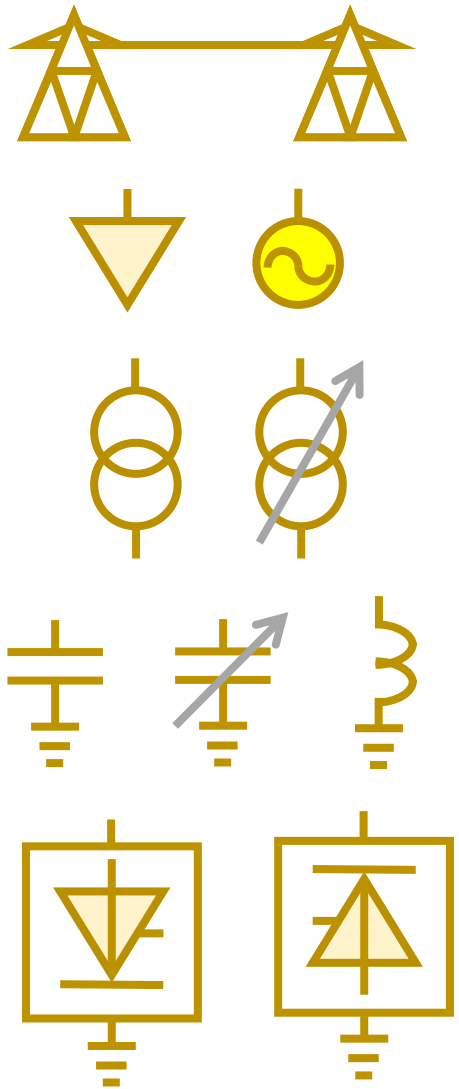
Baseline Equipment Model

Level of detail:

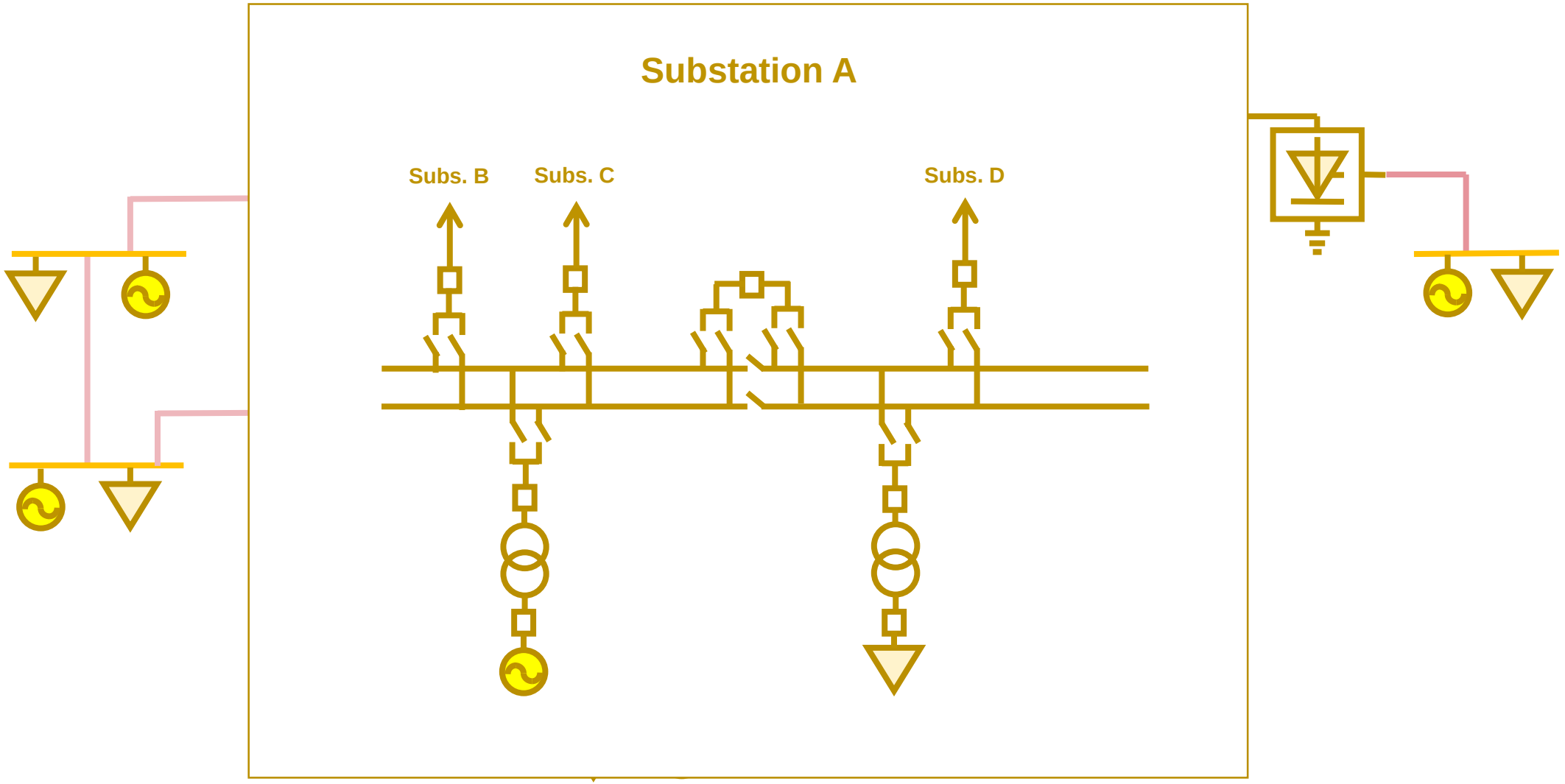
- At a minimum, explicit modelling of all 220 kV equipment and above
- Explicit modelling of all sub-220 kV equipment of cross-border relevance
- For sub-220 kV generating facilities, aggregation permitted only by type of primary energy source
- Notwithstanding the above, level of detail largely at discretion of each TSO

Bus Branch vs Node Breaker

- At the discretion of each TSO



Bus-Branch vs Node-Breaker



Operating Assumptions – Variable Data

- Topology
- Energy Injection & Loads
- Monitoring
- Control Settings
- Assumptions on Adjacent Grids

Operating Assumptions

Topology

- Switched status (open/closed) of all switching devices
- Initial transformer tap positions
- IGM topology shall reflect:
  - Planned/forced outages
  - Operational switching plans
  - Preventive remedial actions
- IGM topology shall be consistent with:
  - Scenario definition
  - Data exchanged between TSOs & SGUs in accordance with GL SO

Operating Assumptions

Energy Injections & Loads

- Scheduled or forecast injections of active & reactive power into the grid
- Scheduled or forecast withdrawals of active & reactive power from the grid
- Fictitious injections & withdrawals used to represent aggregated generation or demand in ‘reduced’ networks
- General requirement
  - Net sum of all energy injections, loads & losses in the IGM shall be consistent with the agreed boundary conditions (as per CGMA) or with scheduled exchanges to neighbouring TSOs

Operating Assumptions

Power Injections

- Generator active power injections shall be consistent with and/or based upon:
  - Scenario definition
  - Planned or forecast generator availability
  - Historical or forecast market data; market schedules
  - Best forecast of renewable generation as per available meteorological data
  - Applicable priority dispatch policies
  - Operating reserve requirements (FCR/FRR/RR)
  - Requirements to redispatch to alleviate internal structural congestion
  - Requirements to redispatch for the purposes of voltage management / system stability
  - Data exchanged between TSOs & SGUs in accordance with the GLDPM & GL SO

Operating Assumptions

Loads

- Nodal active & reactive power consumption associated with load shall be based upon:
  - Scenario definition
  - Historical reference data (season/day/time)
  - SCADA/metered data
  - Forecast demand reduction from demand units
  - Data exchanged between TSOs & SGUs in accordance with the GLDPM & GL SO

Operating Assumptions

Monitoring of operational limits such as

- Thermal ratings of lines/cables/transformers/DC equipment
  - Vary seasonally
  - May vary based on prevailing weather conditions (DLR schemes)

Control Settings

- Active or reactive power flow settings
  - Voltage regulation settings
  - DC equipment settings (active power targets, voltage targets, control mode, operating mode, etc.)

Operating Assumptions

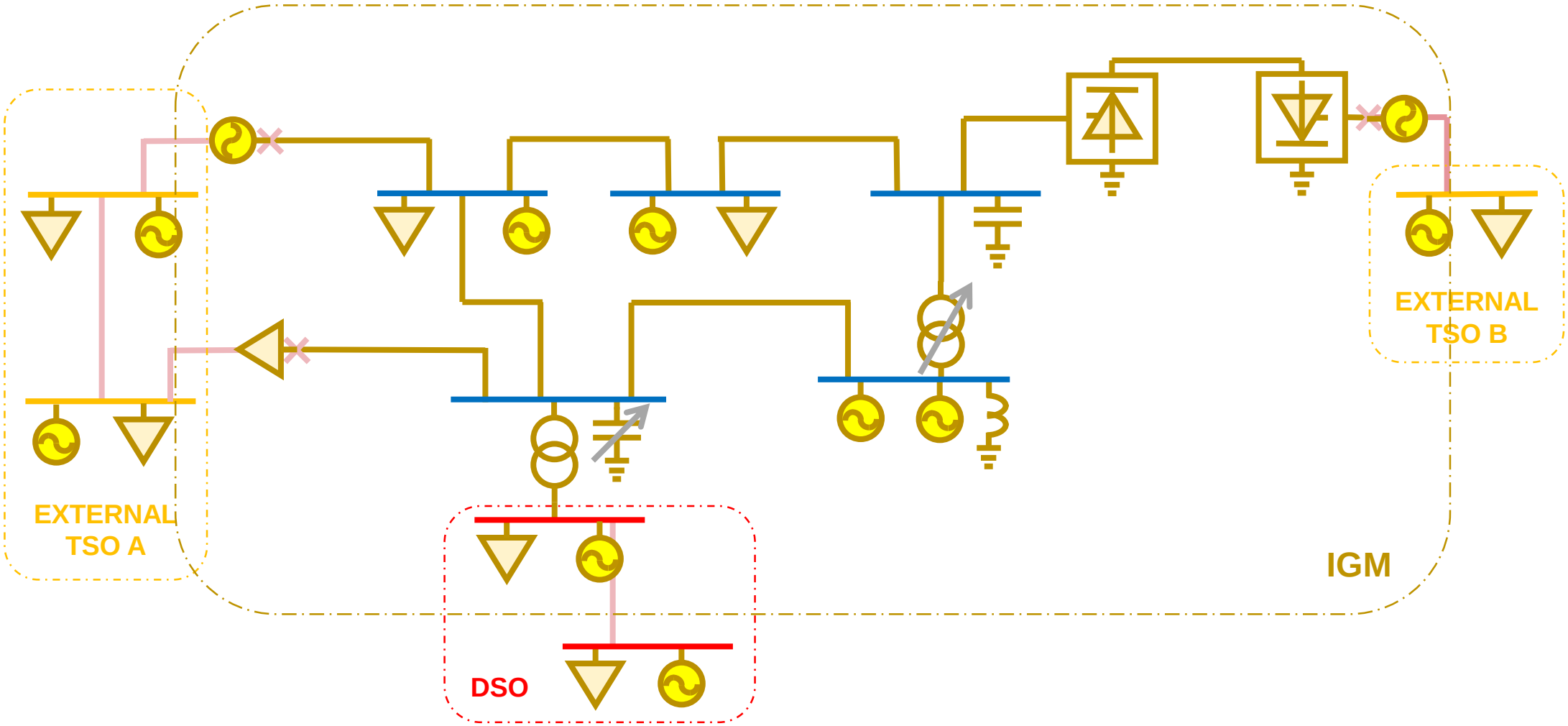
Example 1: data included for a transmission line

- Thermal ratings (MVA)

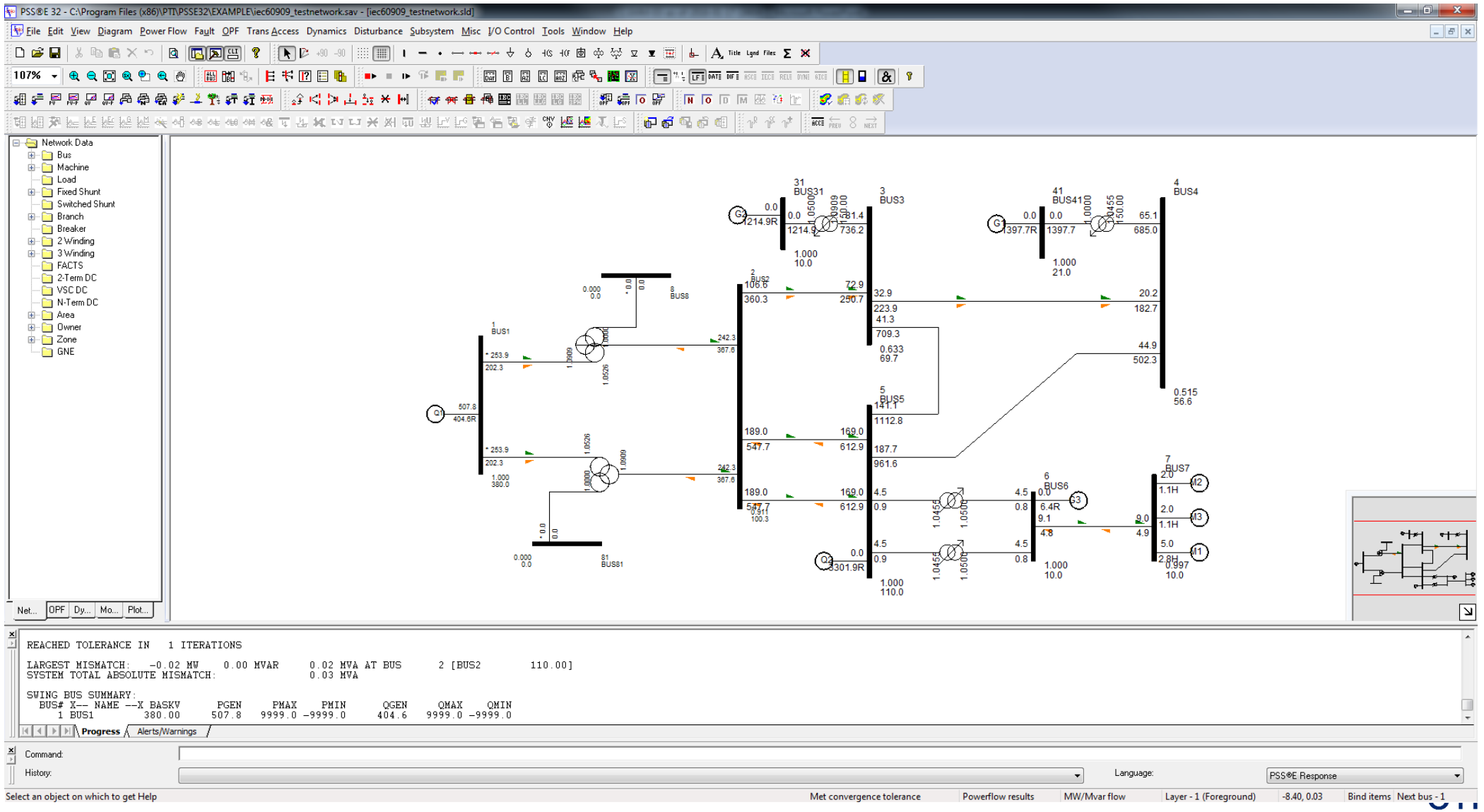
Example 2: data included for a generation unit

- Pgen
- Qgen
- Vsched
- Identifier of Regulated Node

Adjacent Grids / Network Reduction



Individual Grid Model – Loadflow Software



IGM Creation Process - Recap

Create baseline equipment model

Apply structural changes to the model, if applicable

Apply operating assumptions to the model

Ensure supply/demand balance is consistent with boundary condition requirements

Perform load flow solution and carry out internal quality checks

Modify the model following quality checks, if necessary

Carry out network reduction of other grids, if applicable

Convert model to CGMES data exchange format

Submit IGM to the OPDE for external quality assurance

COFFEE BREAK

CGMM - CHAPTER 4
CGM ALIGNEMENT

Bruno Lemetayer

entsoe
Reliable Sustainable Connected

CGM ALIGNMENT / INTRODUCTION

Requirements for CGM “Alignment”

- sum of aggregate AC/DC net positions shall equal the target aggregate AC/DC net position at the level of the CGM Area
- flows on DC interconnectors linking different synchronous areas shall be consistent with each other

See:
- GL CACM Article 18 (3)
- For Y-1, GL SO (2015-11-27) Article 66 (2)

Applied depending on time horizon

- time horizons for which market schedules are available (D-1, Intraday)
- no agreed schedules available for D-2 and previous horizons

CGM ALIGNMENT / OVERVIEW

Different data and processes are used

Model Horizon	AC/DC net positions/DC flows to be used
Year ahead	Based on **CGM**A Module
Month ahead	Methodology to be defined by relevant **TSO**s
Week ahead	Methodology to be defined by relevant **TSO**s
(D-2)	Based on **CGM**A Module
(D-1)	Based on agreed commercial trade schedules
Intraday	Based on agreed commercial trade schedules

A dedicated CGMA Methodology is applied for timeframes when no agreed commercial trade schedules are available (Y-1, D-2)

For time horizons for which market schedules are available (D-1, Intraday), aligned AC/DC net positions and consistent flows on DC interconnectors are derived from external commercial trade schedules

CGM ALIGNMENT / FROM Y-1 TO D-2 (1/2)

Rationale behind CGMA Methodology

- Goal: determine substitutes for "agreed commercial trade schedules"
- Defines processes and their harmonization on CGM Area level
- Defines the data to be provided by individual TSOs/sets corresponding quality standards

CGMA Methodology

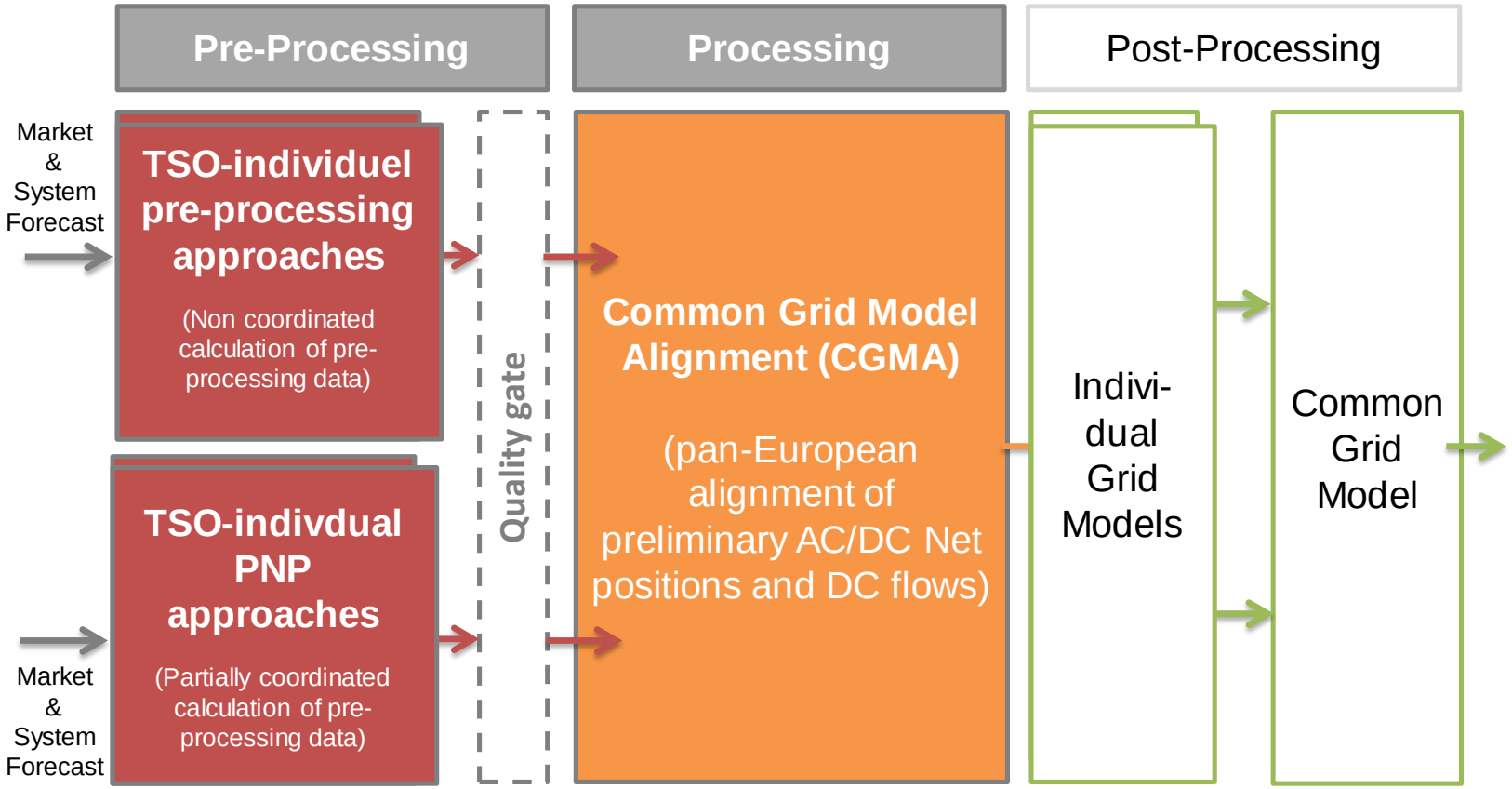
- Bottom-up rule-based process where TSOs provide input data to the central CGMA Algorithm
- Three steps: pre-process, process, post-process

Input data from TSOs are provided to the first step, and are refered to as « Pre-Processing Data » (PPD)

PPD are provided individually, but based on coordinated or individual best forecasts

CGM ALIGNMENT / FROM Y-1 TO D-2 (2/2)

Process overview



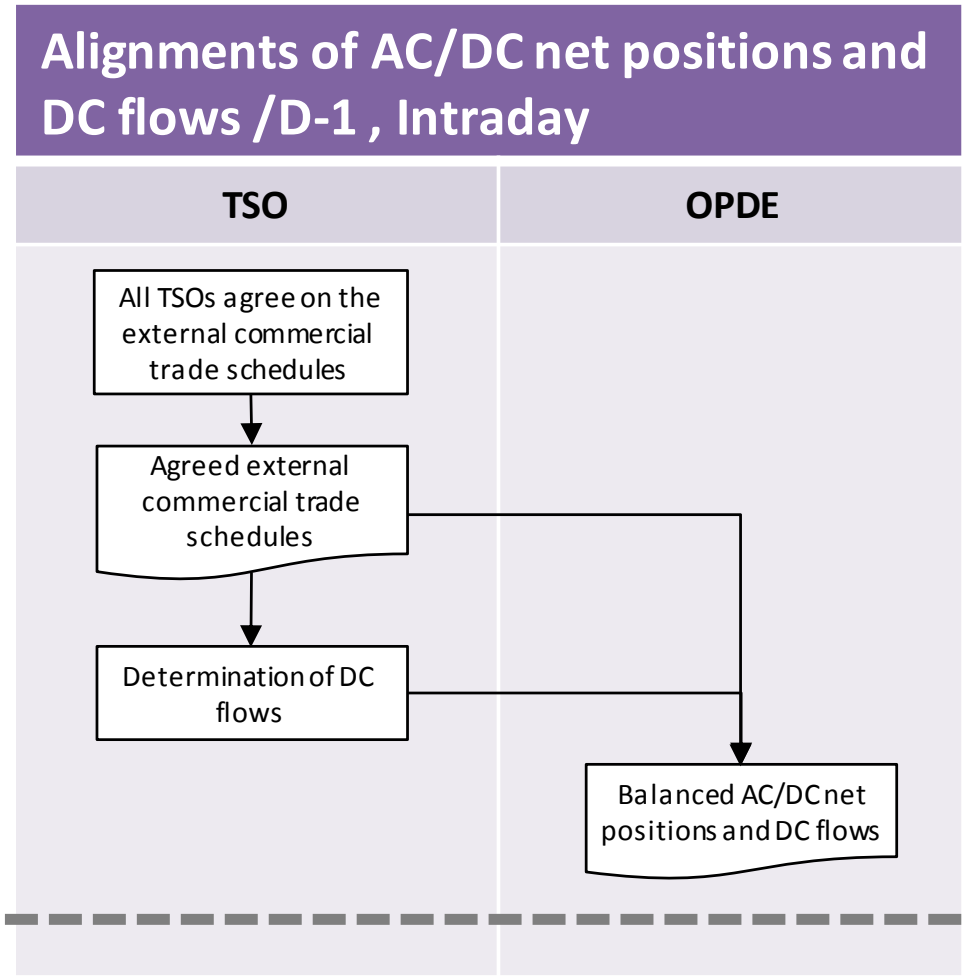
Objectives of Pre-Processing Data

- reflect best forecasts of AC/DC net positions and flows on DC interconnection/s (expected state of cross-border flows)
- specify how flexible these forecasted values are ("scalability parameters")

TSOs are advised to coordinate their pre-processing processes at least on the adjacent bidding zone "borders" and move gradually to a regional level. Coordinated approaches should be expected to lead to more accurate forecasts and should reduce the volume of adjustments required at the processing stage.

CGM ALIGNMENT / D-1 AND INTRADAY

Process overview



#04 Balanced AC/DC net positions and consistent flows on DC interconnectors available to TSOs for each relevant scenario via OPDE

Same version of external commercial trade schedules values are used by all TSOs: use the version of a defined point in time

Interconnectors only composed of several DC tie-lines need a specific calculation, since the market schedules are not defined per DC cable. To that end, TSOs may implement their own algorithm

CGMM - CHAPTER 5 MERGING

Benoît Jeanson

entsoe
Reliable Sustainable Connected

Merging process : Gathering the information

OPDE : Operational Planning Data Environment

- Is identified in the GL SO (2015-11-27) (focus on IGM / CGM in article 115)
- Is needed to gather all the information that is to be shared among the TSOs and RSCSPs* for the CGM process :
  - To be the single environment to put all the IGMs and CGMs at the disposal of all the TSOs and RSCSPs*
  - To provide access to services that are required for the process :
    - balanced AC/DC net positions and consistent DC-flows :
      - Via the CGMA when market data are not available
      - Via the verification platform when market data are available
    - Quality portal : that synthesizes the results of quality tests on the IGMs

* Regional Security Coordination Service Provider; currently referred to in the Methodologies as "RSC". However, the term is expected to be corrected shortly.

Merging process : Substitution rules

Merging of IGMs of different Market Time Units (MTUs)

- GL CACM requires merging per MTU, but the MTUs are not harmonized.

➔ Need correspondence between IGMs of different time granularity

Missing or poor quality IGMs

- for the time horizons that are not mandatory at the European level (e.g. in month ahead, use of IGM from Year ahead)
- In case a TSO is not able to provide a good quality IGM by the agreed deadline

➔ Harmonized rules for substitution

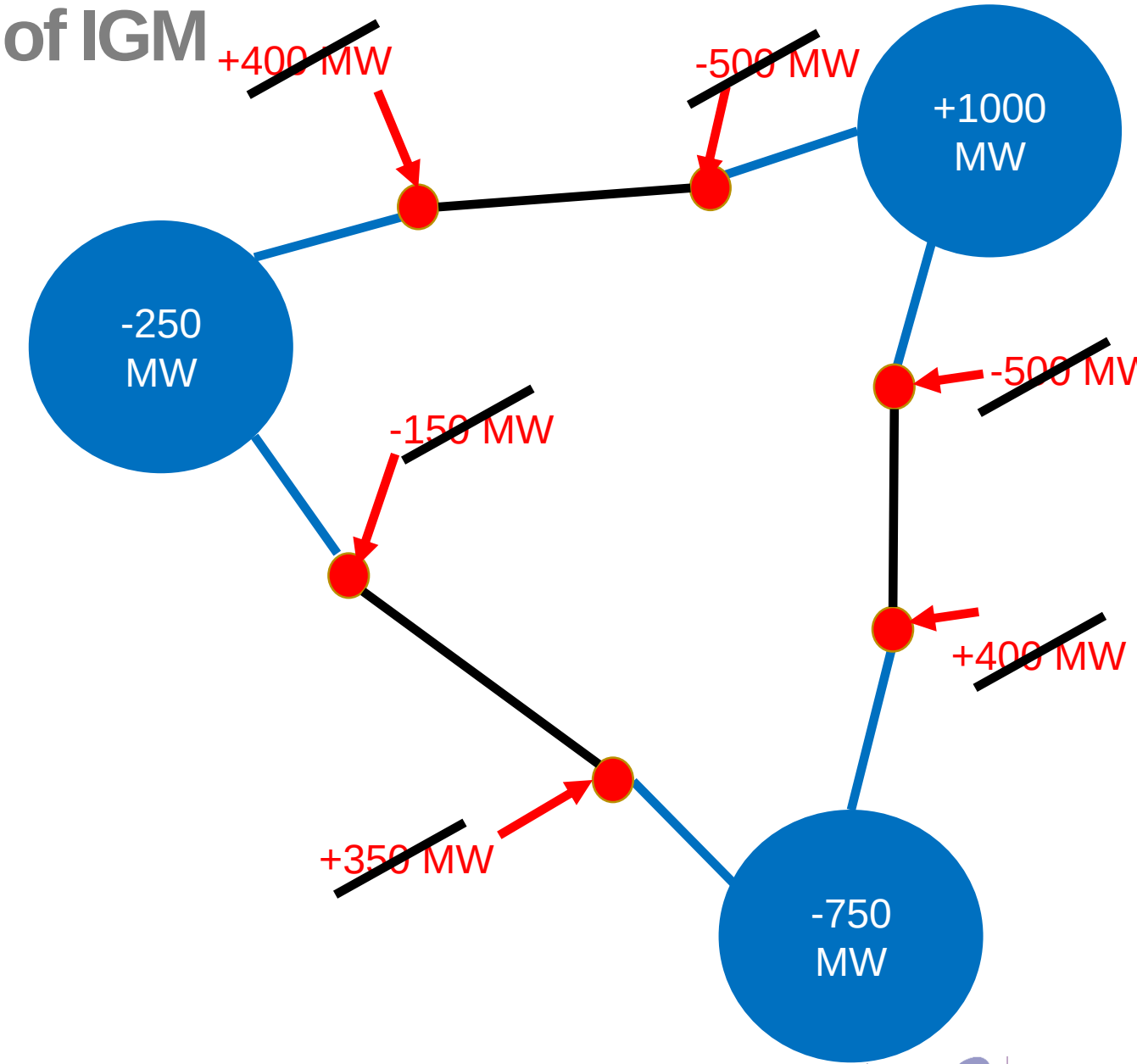
➔If the substitute IGM does not have exactly the targeted net position, the net position shall be adjusted.

- Use of Power Shift Key (or if unavailable proportional adjustment on generation and/or load)

Merging process : Assembling of IGM

Fictitious injection

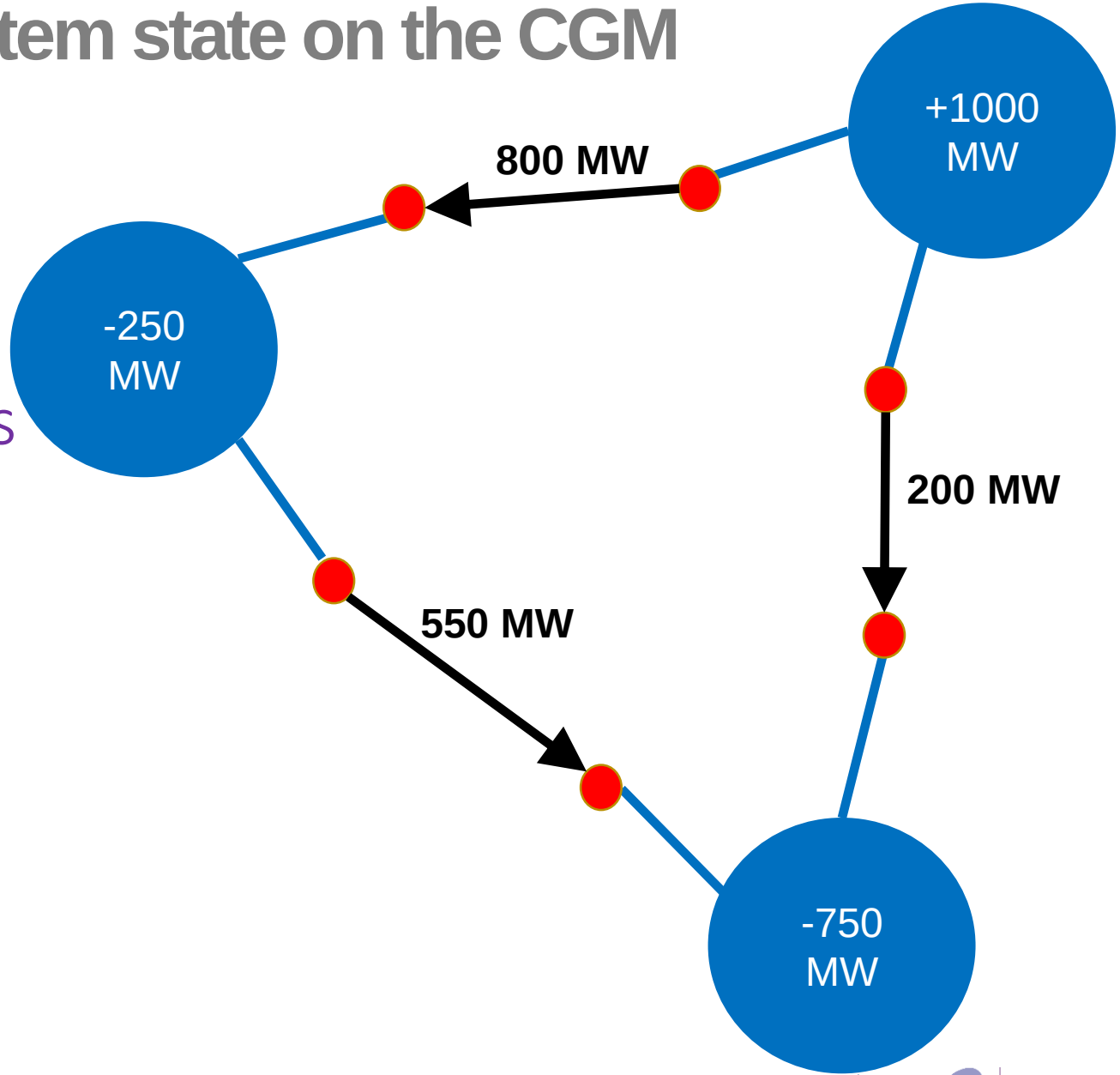
- IGM has fictitious injections on its boundary points (not consistent per interconnector) to enable calculation on IGM
- The sum of the fictitious injections is equal to the net position of the IGM.
- When assembling the IGMs, the fictitious injections shall be removed.



Merging process: Solve the system state on the CGM

Load flow results in:

- Consistent flows
- Consistent with laws of physics
- At a pan-European level

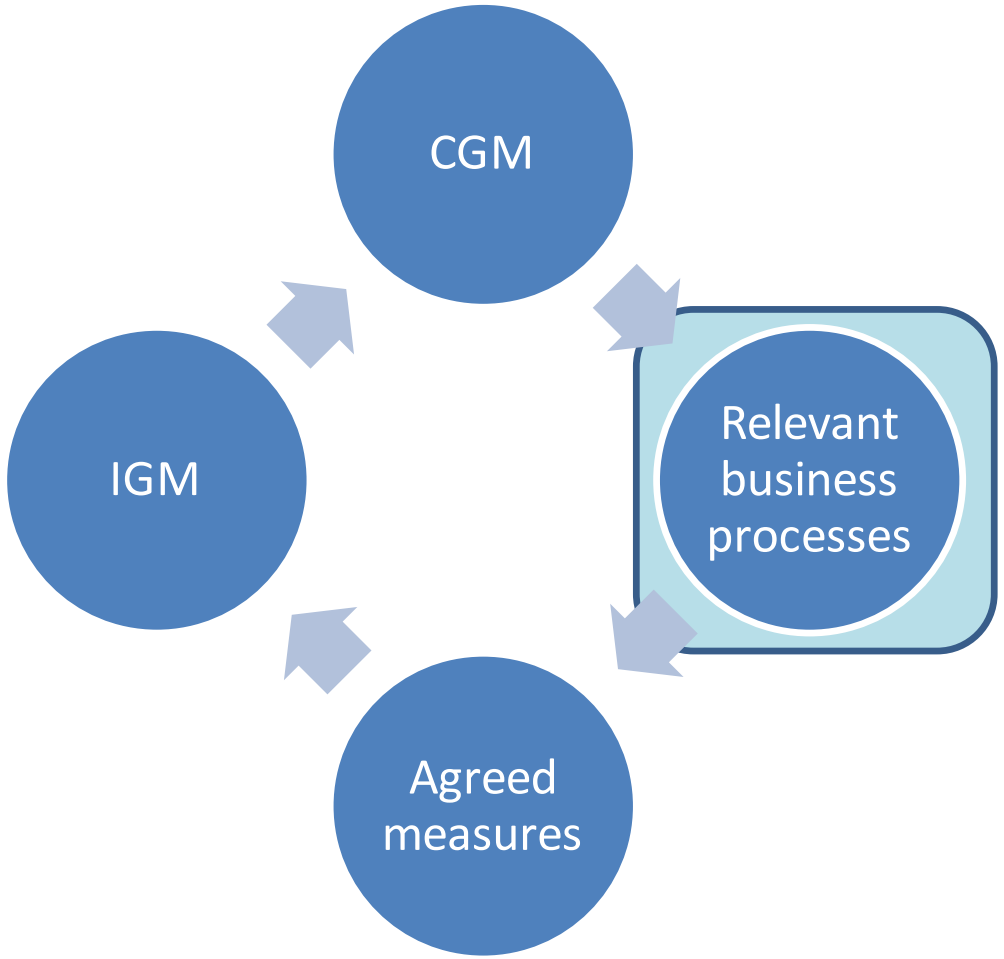


CGMM - CHAPTER 6 IMPLEMENTATION OF AGREED MESURES

Bruno Lemetayer

entsoe
Reliable Sustainable Connected

IMPLEMENTATION OF AGREED MEASURES



Once TSOs agree on modifications of the models following the coordination with RSCSPs* and other TSOs, TSOs shall then update their IGMs accordingly and provide a new version of the IGMs, if the grid situation described in the IGM requires it: this update constitutes the ”Agreed measures”

See: GL SO (2015-11-27) Article 70 (4).

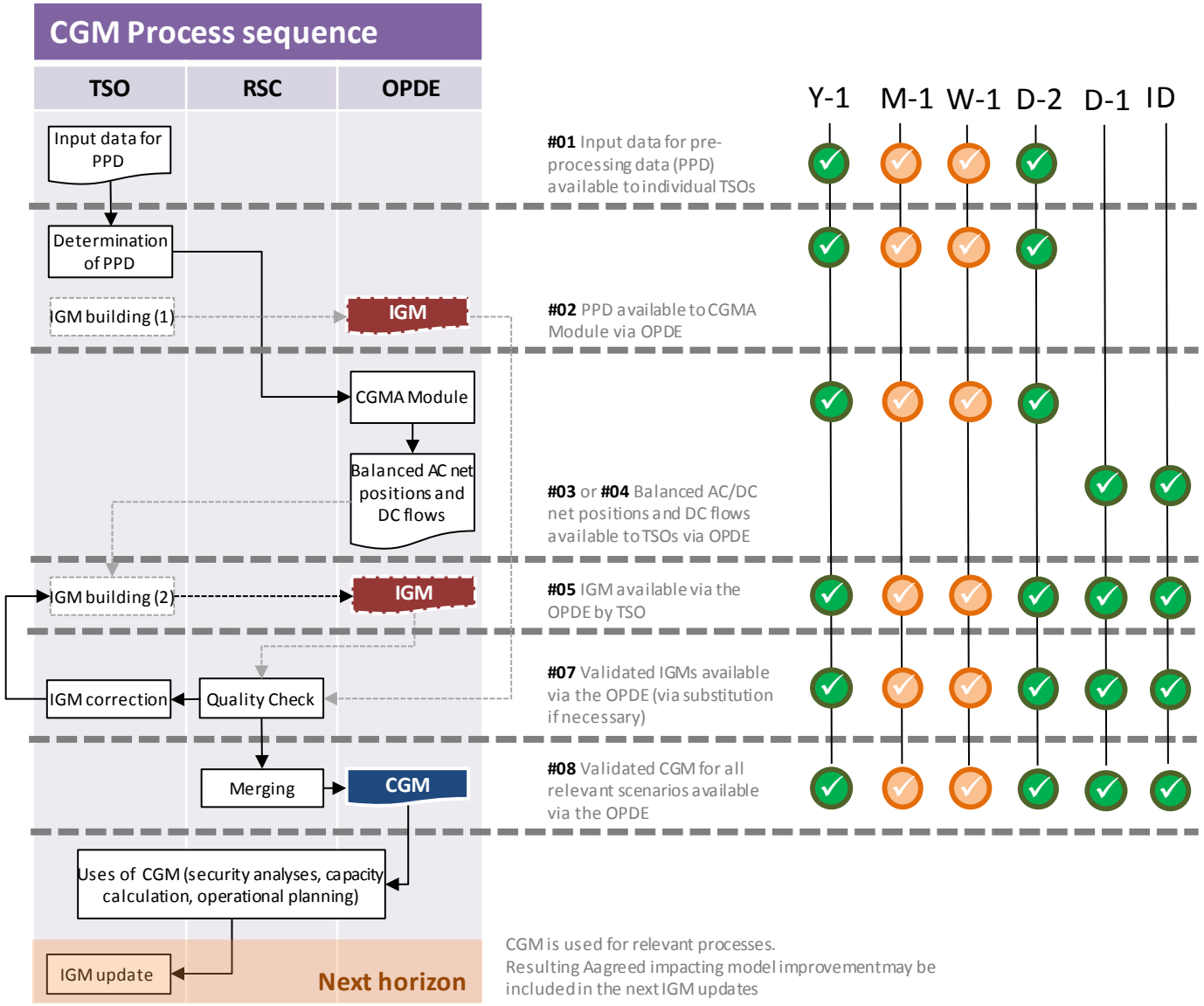
* Regional Security Coordination Service Provider; currently referred to in the Methodologies as "RSC". However, the term is expected to be corrected shortly.

CGMM - CHAPTER 7
TIMELINES / DEADLINES

Bruno Lemetayer

entsoe
Reliable Sustainable Connected

TIMELINES – DEADLINES / STANDARD STEPS



IGM building (1) — The TSO can provide its IGM and PPD at the same time (the IGM is available earlier), this is option 1 of step 05

IGM building (2) — The TSO can provide its IGM after taking into account the Balanced AC/DC net positions and consistent flows on DC interconnectors, this is option 2 of step 05

Applicable to all TSOs

Applicable to TSOs depending on their Capacity Calculation Regions

TIMELINES – DEADLINES / YEAR AHEAD

Step	End point	Deadline [CET / CEST]	Comments / References
02	**PPD** available to **CGM**A Module for each relevant scenario via **OPDE**	15 July minus 18 business days	Buffer of eighteen business days set to assess the **balanced AC/DC net positions and consistent flows on DC interconnectors**. Assessment of the **balanced AC/DC net positions and consistent flows on DC interconnectors** of higher complexity than D-2
03	**Balanced AC/DC net positions and consistent flows on DC interconnectors** available to **TSO**s for each relevant scenario via **OPDE** by **CGM**A Module	15 July minus 10 business days	Buffer of ten business days set before **GL SO** Article 60 (4) deadline to publish year-ahead scenarios.
05	**IGM** available via the **OPDE** by **TSO** for all relevant scenarios	01 September	Set at the soonest to allow creating the year ahead **CGM**s at the soonest before deadlines of outage planning provision as set in **GL SO** Article 92 (preliminary (**(Y-1)**) availability plans) and Article 94 (final (**(Y-1)**) availability plans).
07	Validated **IGM**s for all relevant scenarios available via the **OPDE** for all **TSO**s	01 September plus five business days	Fixed relative to the deadline for step 05.
08	Validated **CGM** for all relevant scenarios available via the **OPDE**	01 September plus ten business days	Fixed relative to the deadline for step 07.
After **CGM** creation	**CGM** is used for relevant processes. Resulting **agreed measures** may be included in the next **IGM** updates	During updates of year ahead models	**Agreed measures** to be included in the next **IGM** updates by the **TSO** if relevant in order to keep an up-to-date set of year ahead **CGM**s. In line with the provisions in **GL SO** Article 63 (1) and (2).

TIMELINES – DEADLINES / D-2

Step	End point	Deadline [CET / CEST]	Comments / References
02	**PPD** available to **CGM**A Module for each relevant scenario via **OPDE**	16:30, (D-2)	Takes also into account (D-2) exchanges forecast processes for each **TSO** that must be based on recent information as stipulated by **GL CACM** Article 14 (3). Set to grant **TSO**s sufficient time to build their **IGM** based on the **balanced AC/DC net positions and consistent flows on DC interconnectors** values calculated by the **CGM**A module at the next step.
03	**Balanced AC/DC net positions and consistent flows on DC interconnectors** available to **TSO**s for each relevant scenario via **OPDE** by **CGM**A module	17:15, (D-2)	Fixed so that a sufficient buffer is set to allow **CGM**A Module calculation.
05	**IGM** available via the **OPDE** by **TSO** for all relevant scenarios	19:00, (D-2)	Set so that provision of validated **CGM** allows executing coordinated capacity calculation before opening of the day ahead market. Takes also into account the operational constraints of **TSO**s.
07	Validated **IGM**s for all relevant scenarios available via the **OPDE** for all **TSO**s (via substitution if necessary)	19:50, (D-2)	50 min delay is introduced after previous step to ensure sufficient time for potential correction loops
08	Validated **CGM** for all relevant scenarios available via the **OPDE**	20:00, (D-2)	Set to harmonize the time when the **CGM** is available for all CCR
After **CGM** creation	**CGM** is used for relevant processes. Resulting **agreed measures** may be included in the next **IGM** updates	18:00, (D-1)	Following the direction chosen by the market a subset of the coordinated **agreed measures** during capacity calculation in (D-2) horizon shall be available for use in **IGM**s created in (D-1) horizon.

TIMELINES – DEADLINES / D-1

Step	End point	Deadline [CET / CEST]	Comments / References
04	**Balanced AC/DC net positions and consistent flows on DC interconnectors** available to **TSO**s for each relevant scenario via **OPDE** based on information in market schedules	16:30, (D-1)	Set as the soonest after (D-1) market results are available as 16:30h on (D-1) is the latest time for closing of explicit (D-1) Markets. Deadline also compliant with the timing of calculation of the scheduled exchanges resulting from day ahead market coupling as set out in **GL CACM** Article 43 (2).
05	**IGM** available via the **OPDE** by **TSO** for all relevant scenarios	18:00, (D-1)	Set so that TSOs can update their **IGM** with information from step 04.
07	Validated **IGM**s for all relevant scenarios available via the **OPDE** for all **TSO**s (via substitution if necessary)	18:50, (D-1)	
08	Validated **CGM** for all relevant scenarios available via the **OPDE**	19:00, (D-1)	
After **CGM** creation	**CGM** is used for relevant processes. Resulting **agreed measures** may be included in the next **IGM** updates	22:15, (D-1)	Set to ensure that **agreed measures** based on (D-1) models, if any, and if the situation requires it, are taken into account at least in a first update of the models at the very beginning of the intraday horizon.

TIMELINES – DEADLINES / INTRADAY (1/2)

Principles

- TSOs shall update their IGM at the latest one hour after significant changes take place
- IGM updates imply a CGM update (event based)
- automatic substitution rules are applied to non-updated IGM to create a consistent validated CGM

Issues for intraday CGM updates (when relevant)

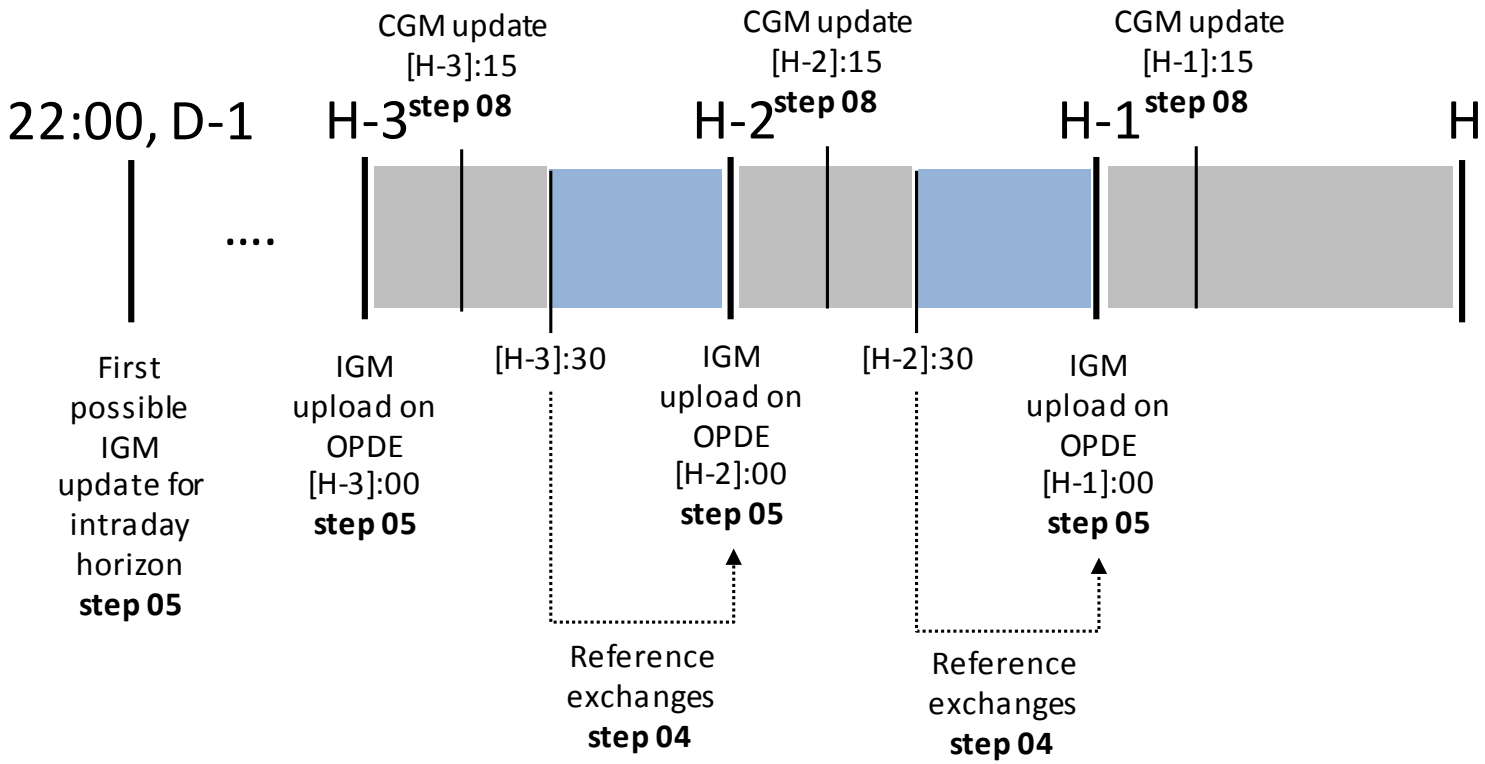
- ensure synchronism for AC/DC net positions and flows on DC interconnectors to be used as reference
- use latest market information
- make CGM updates ready for the subsequent TSO operational processes

TSOs shall send an update of their IGM at regionally agreed timestamps and one hour after occurrence of a significant change.

Significant changes :
- Change of AC/DC net position,
- Change of expected load profiles, production schedules (including RES), DC flows,
- Change of expected topology, including: unplanned outages, change of PST tap positions, modification of the standard automatic devices operation
- Updates/change of previously agreed coordinated remedial actions (including redispatching and countertrading).

TIMELINES – DEADLINES / INTRADAY (2/2)

For a given delivery Hour H



The next round hour after the moment the IGM is updated is defined as [H-n]:00.
The first possible update of the IGM can be sent until 22:00, D-1 when relevant; this thus allows a first update of the intraday IGM after 22:00, D-1.

Step #07 / Validated IGMs for all relevant scenarios available via the OPDE for all TSOs (via substitution if necessary)
The specificity of the intraday horizon is that automatic (and therefore faster) substitution rules have to be applied to validate IGMs within 5 min (between [H-n]:00 and [H-n]:05)

CGMM - CHAPTER 8
QUALITY ASSURANCE

Benoît Jeanson

entsoe
Reliable Sustainable Connected

Quality assurance

Performed at IGM and CGM level

- most of the checks are common to both

Check on

- Existence of the model for the considered timeframe
- Consistent connectivity of elements
- Physical plausibility (e.g. voltages within the allowed ranges)
- Consistent AC/DC net positions according to the target
- Inter-TSO consistency (e.g. operational limits, connection status …)
- Convergence of the load flow

CGMM - CHAPTER 9 TIMESCALE FOR IMPLEMENTATION

Benoît Jeanson

entsoe
Reliable Sustainable Connected

Main milestones according to Timescale for implementation

According to GL CACM :

- Starting point : submission of methodologies to NRAs : June 14th 2016
  - Decision on the methodologies by the NRAs : no longer than 6 months

  ➔ before December 14th 2016
  - TSOs shall organise the merging process (= who will do / what format / IT requirements …) : 6 months after decision on methodology

  ➔ before June 14th 2017

According to GL SO

- 6 months after entry into force : definition of the data format
- 24 months after entry into force : OPDE shall be implemented

  ➔ but some key functions shall be implemented beforehand to enable the CGM process : first blocks to be implemented in 2016

LUNCH

Q&A ON CGMM

GLDPM- CHAPTER 1 INTRODUCTION

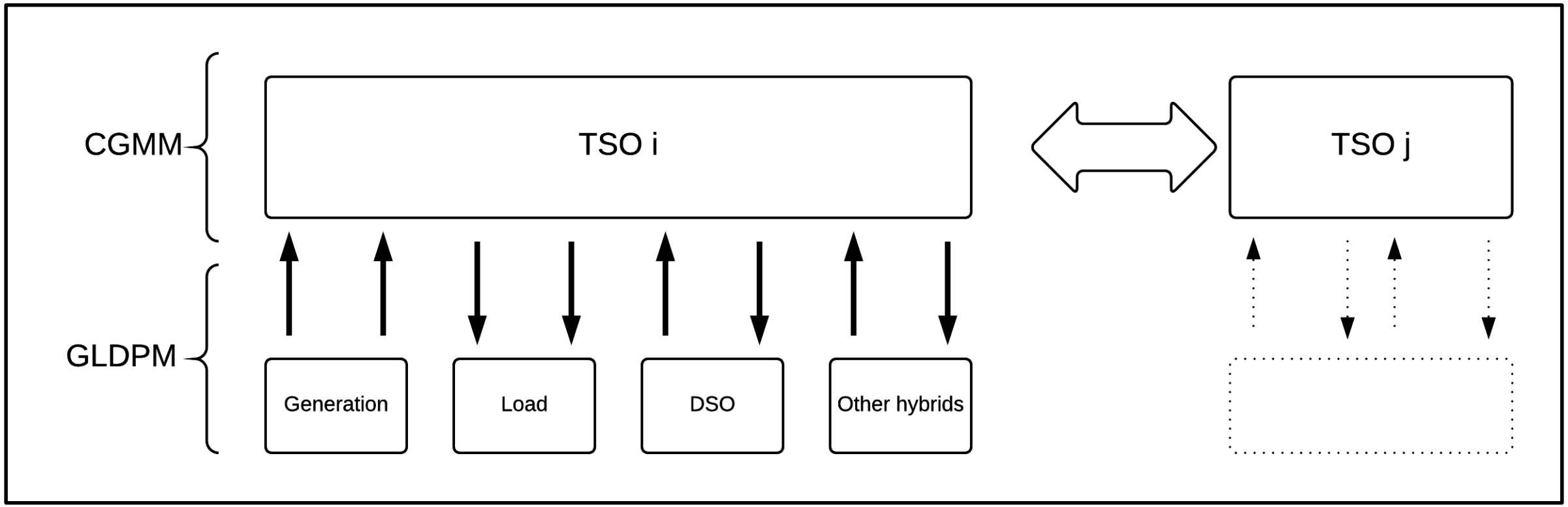
Knut Eggenberger

entsoe
Reliable Sustainable Connected

GLDPM - General Approach

Aim of presentation: explain general approach chosen for GLDPM

Selective coverage of GLDPM chapter 1



GLDPM - General Approach - categories of data providers

Generation

Existing and new power generating modules of type B, C and D in accordance with Article 5 of Commission Regulation No [000/2015 RfG] [GL SO (2015-11-27) Article 2 (1) (a)]

Load

Existing and new transmission connected demand facilities [GL SO (2015-11-27) Article 2 (1) (b)]

Existing and new demand facilities, regardless of whether these are connected to the transmission or distribution grid, if these are "relevant demand facilities" in the sense of GL SO (2015-11-27) Article 2 (88)

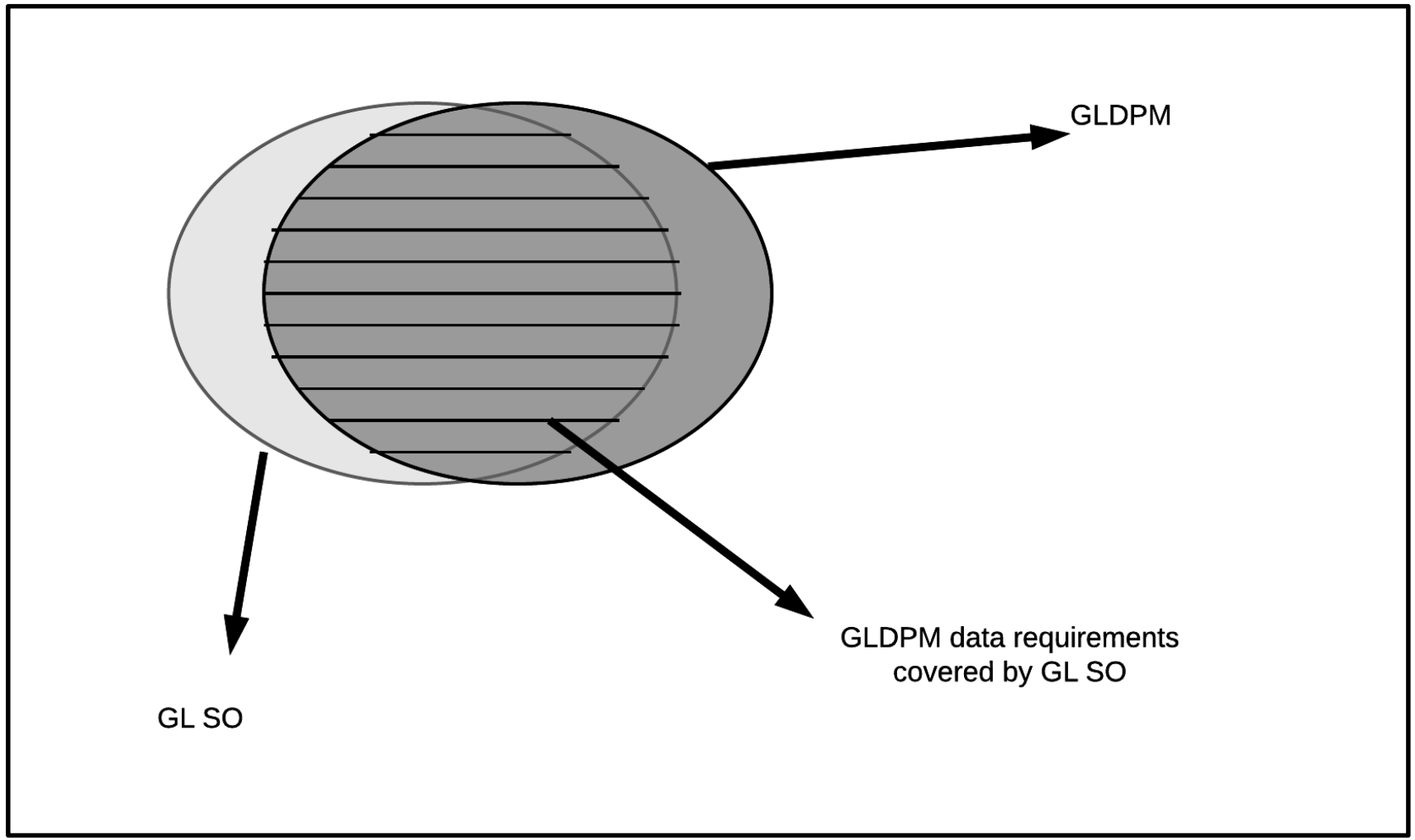
GLDPM - General Approach - categories of data providers

Hybrids

- Existing and new transmission connected closed distribution systems [GL SO (2015-11-27) Article 2 (1) (c)]
- Existing and new high voltage direct current ('HVDC') systems according to the criteria in Article 3(1) of Commission Regulation No [000/2015 HVDC] where these are also "interconnectors which are not operated by TSOs certified according to Article 3 of Regulation (EC) No 714/2009" pursuant to GL CACM Articles 45 and 57. [subset of GL SO (2015-11-27) Article 2 (1) (f)]
- Existing and new AC merchant interconnections specifically including "interconnectors which are not operated by TSOs certified according to Article 3 of Regulation (EC) No 714/2009" pursuant to GL CACM Article 45 and 57.
- Existing and new transmission connected distribution systems (i.e., specifically including non-closed distribution systems)
- NEMOs, brokers

GLDPM - General Approach

Minimize duplication: use data requirements set out in GL SO



GLDPM - General Approach

Implementation is to be a "local" task for each individual TSO

- Data shall be provided to the local TSO, not to a central platform
- TSOs shall make use of existing processes and interfaces as much as possible

The GLDPM provides a "maximum list" of data that TSOs may request

As a general rule, the obligation to provide the data is with the owner of the corresponding asset

Deadlines stated in the methodology relate to the CGM process and apply to TSOs

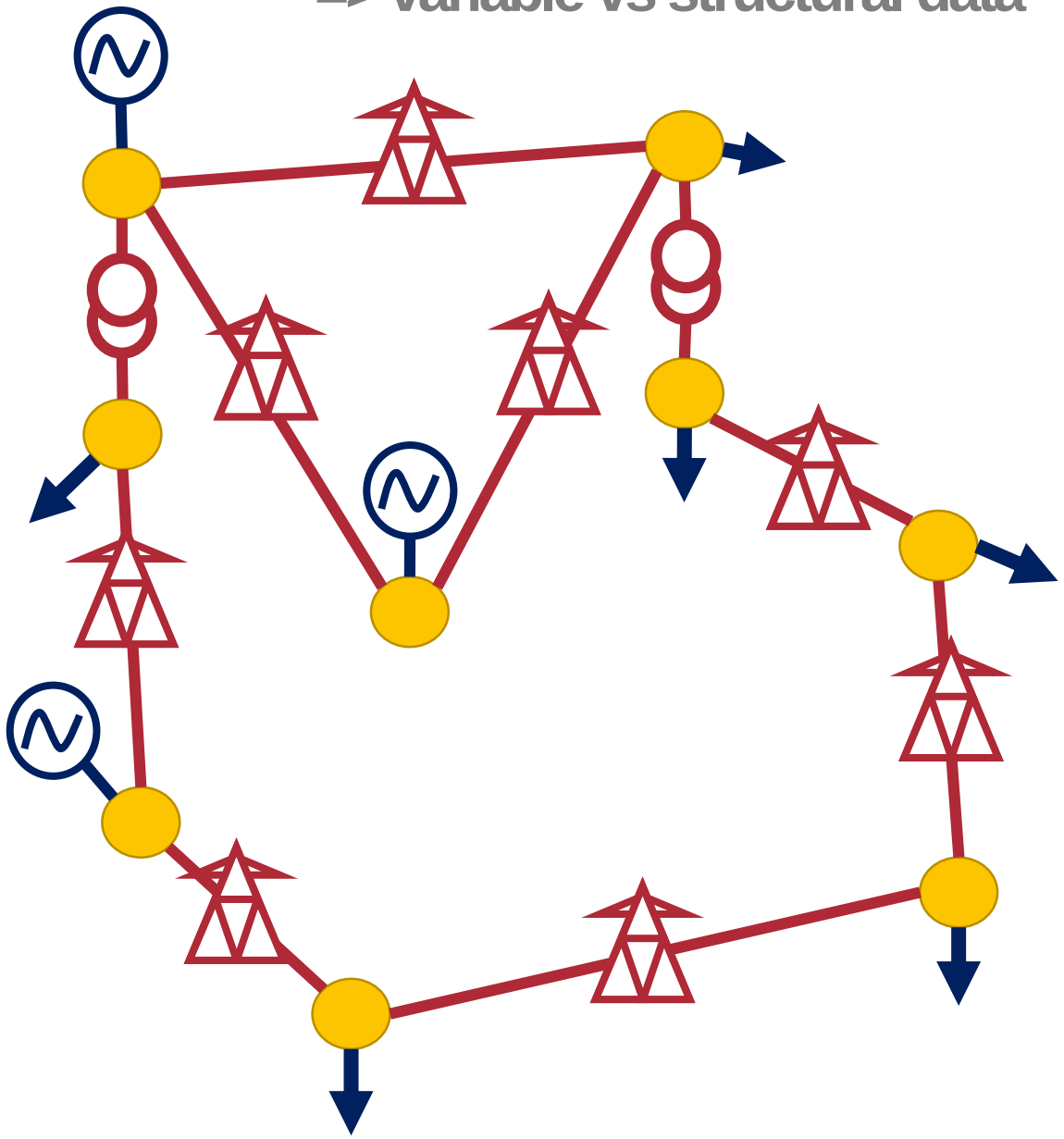
- TSOs will set their own "local" (and earlier) deadlines for data providers
- Deadlines of market rules apply (as the case may be)

GLDPM- CHAPTER 2 STRUCTURAL VS VARIABLE DATA

Benoît Jeanson

entsoe
Reliable Sustainable Connected

Principle of modelling the power system to perform calculation
=> variable vs structural data



Variable Data

that can evolve at any time (schedules / setpoints / state variables …)

➔ To be gathered on a regular basis

Structural Data

Physical parameters that derives from the technical design of the equipment

➔ To be gathered once

GLDPM- CHAPTER 3
DATA REQUIREMENTS

Benoît Jeanson

entsoe
Reliable Sustainable Connected

General requirements related to data provision

Timelines / deadlines for provision of data

- Shall enable the TSOs to meet their obligations regarding the different scenarios described in the CGMM
- Up to the TSOs to set the appropriate local deadline according to the local organisation.

The Methodology describes the data that are required for elaborating the CGM:

- It is up to the TSO to assess - based on the local organisation - which of them is to be provided by the external stakeholders, the expected level of details required in order to create its IGM in an accurate manner.

Data to be provided by DSOs

Structural data

- The TSO defines its observability area:
  - Relevant to determine the system state accurately and efficiently
  - Can concern DSOs that have no direct connection point to the TSO grid.

- Equipment to be modelled:
  - Substations by voltage
  - Lines and transformers that connect the substations
  - Reactors and capacitors
  - Significant Grid Users (SGU)
  - Aggregated generating capacities of type A per energy sources

/!\ This information needs to be up-to-date at any time

Variable data

- Applicable reference topology
- Outages of relevant DSO assets
- Tap positions / set-points of transformers
- Expected use of reactors and capacitors
- Forecasted consumption on a nodal level
- Forecast generation by type A power generating modules on a nodal level / per primary energy sources

Data to be provided by Power Generating Modules

Structural data

- For generating units that are SGUs (following GL SO Art 45 and 48)
- (Type B only: in bold – type connected to DSO only: in italic
- all (i.e. B, C and D and connected to DSO): normal
  - General data of the power generating module (installed capacity primary energy source)
  - **turbine and power generating facility data including time for cold and warm start**
  - data for short-circuit calculation
  - **power generating facility transformer data**
  - FCR data of power generating modules offering or providing this service
  - FRR data of power generating modules offering or providing that service
  - RR data for power generating modules that offer or provide that service
  - data necessary for restoration
  - data and models necessary for performing dynamic simulation
  - protection data
  - voltage and reactive power control capability.
  - Voltage level and location of each power generating module
  - Capability of remote access to the circuit breaker

Variable data

- active power output and active power reserves amount and availability, on a day ahead and intra-day basis;
- without any delay, any scheduled unavailability or active power capability restriction;
- as an exception to first 2 points, in regions with a central dispatch system, data requested by the TSO for the preparation of its active power output schedule.
- any forecast restriction in the reactive power control capability
- relevant available information relating to how generation units will be dispatched (D-2)
- Outage planning

Data to be provided by interconnectors

Structural data

- from **HVDC system owner or interconnector owner**:
  - name plate data of the installation
  - transformers data
  - data on filters and filter banks
  - reactive compensation data
  - active power control capability
  - reactive power and voltage control capability
  - active or reactive operational mode prioritization if exists
  - frequency response capability
  - dynamic models for dynamic simulation
  - protection data; and fault ride through capability
- From **AC interconnector owner:**
  - name plate data of the installation
  - electrical parameters
  - associated protections.

Variable data

- From **HVDC system operator:**
  - active power schedule on a day-ahead and intra-day basis;
  - without delay its scheduled unavailability or active power restriction
  - any forecast restriction in the reactive power or voltage control capability
- From **AC interconnector or line operator:**
  - scheduled unavailability
  - active power restriction data to the TSOs

Data to be provided by demand facilities

Structural data

- from transmission connected demand facility AND relevant demand facilities:
  - electrical data of the transformers connected to the transmission system
  - characteristics of the load of the demand facility
  - characteristics of the reactive power control.

Variable data

- scheduled active and forecast reactive consumption on a day-ahead and intraday basis
- by exception to previous point, in regions with a central dispatch system, the data requested by the TSO for the preparation of its active power output schedule.
- any forecasted restriction in the reactive power control capability
- in case of participation in demand side response, a schedule of its structural minimum and maximum power to be curtailed

Data to be provided by NEMOs and Brokers

Structural data

- None

Variable data

- From NEMOs : anonymised historical spot market order books (for the CGM Alignment process)
- From scheduling agent of a market coupling operator following schedules for all relevant time horizons:
  - net positions related to the scheduling area
  - external commercial trade schedules as
  - multilateral exchanges between the scheduling area and a group of other scheduling areas; or
  - bilateral exchanges between the scheduling area and another scheduling area;
  - internal commercial trade schedules between scheduling agents of market coupling operators and scheduling agents of nominated electricity market operators

GLDPM - CHAPTER 5 TIMESCALE FOR IMPLEMENTATION

Benoît Jeanson

Main milestones according to Timescale for implementation

According to GL CACM :

- Starting point : submission of methodologies to NRAs : June 14th 2016
  - Decision on the methodologies by the NRAs : no longer than 6 months

  ➔ before December 14th 2016
  - Publication of a list of entities required to provide information to the TSOs, a list of information to be provided, with the appropriate deadlines : 2 months after approval of the methodology by the NRAs

  ➔ before February 14th 2017

  ➔ At the same time as the methodologies are submitted to the NRAs, the TSOs to approach the entities addressed by the GLDPM to prepare the local implementation
  - Provision of the data according to the GLDPM : 12 months

  ➔ Before February 14th 2018

Q&A ON GLDPM

CONSULTATION
NEXT STEPS
FAREWELL

Thank you for your attention

Please provide your comments on the CGMM and GLDPM via the ENTSO-E Consultation Hub: https://consultations.entsoe.eu/

entsoe

Reliable Sustainable Connected