Network Code Forum

30 October 2013

CACM & FCA Network Codes

Mark Lane

CACM update

- 29 October - Cross Border Committee meeting
- Still no text from EC
- Key Issues:
  - Enforceability
  - Timelines
  - Intraday
  - Governance
- ENTSO-E working on CACM Early Implementation (e.g. CCR, CGM, EMF, BZ)

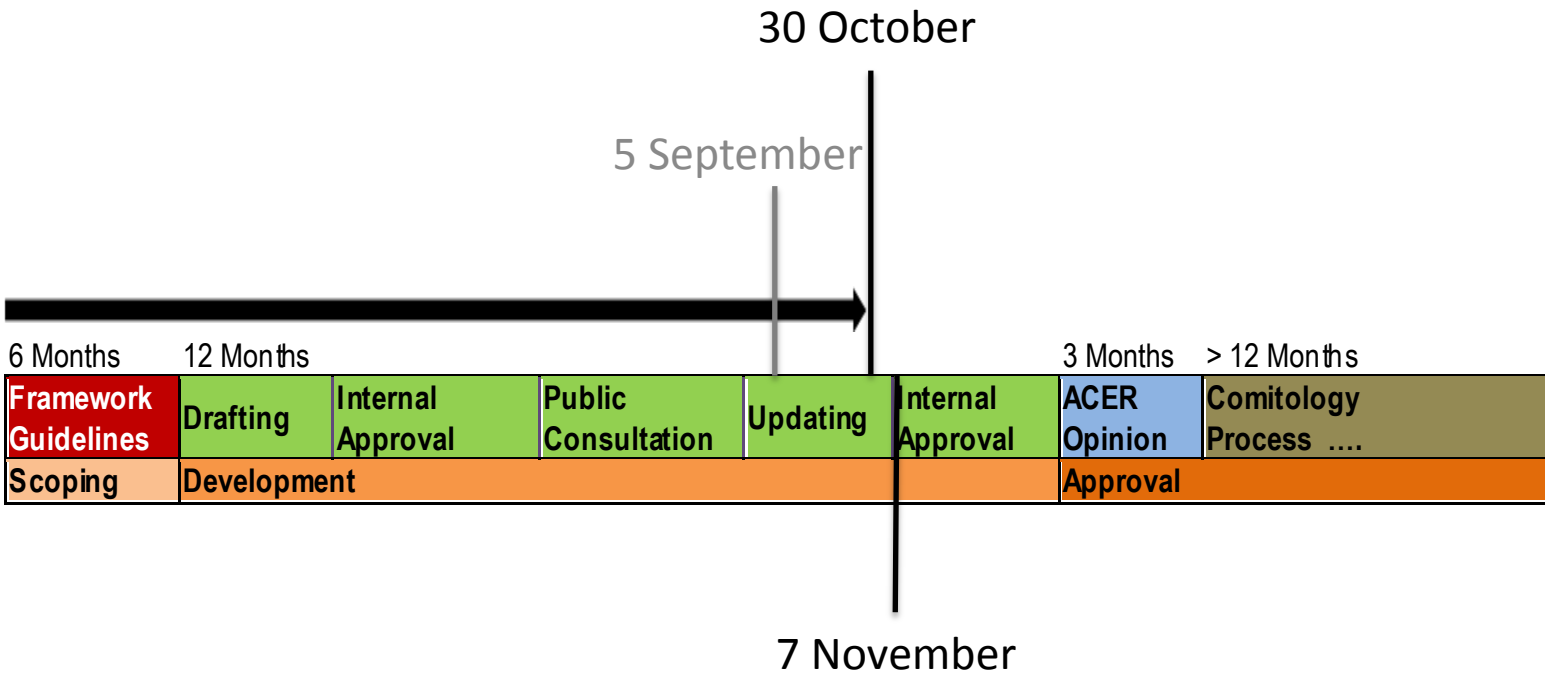
FCA update

- 1 October - Network Code submitted to ACER
- 28 October - ACER Workshop in Lubljana
- 8 November – Trilateral meeting
- Early December – ACER Opinion expected
- Key issues:
  - Firmness & Revenue Adequacy
  - Harmonised Allocation Rules & Single Allocation Platform
  - Capacity Calculation
- Other work: e.g. Firmness, HAR, Multiannual Products, Buyback

Electricity Balancing Network Code

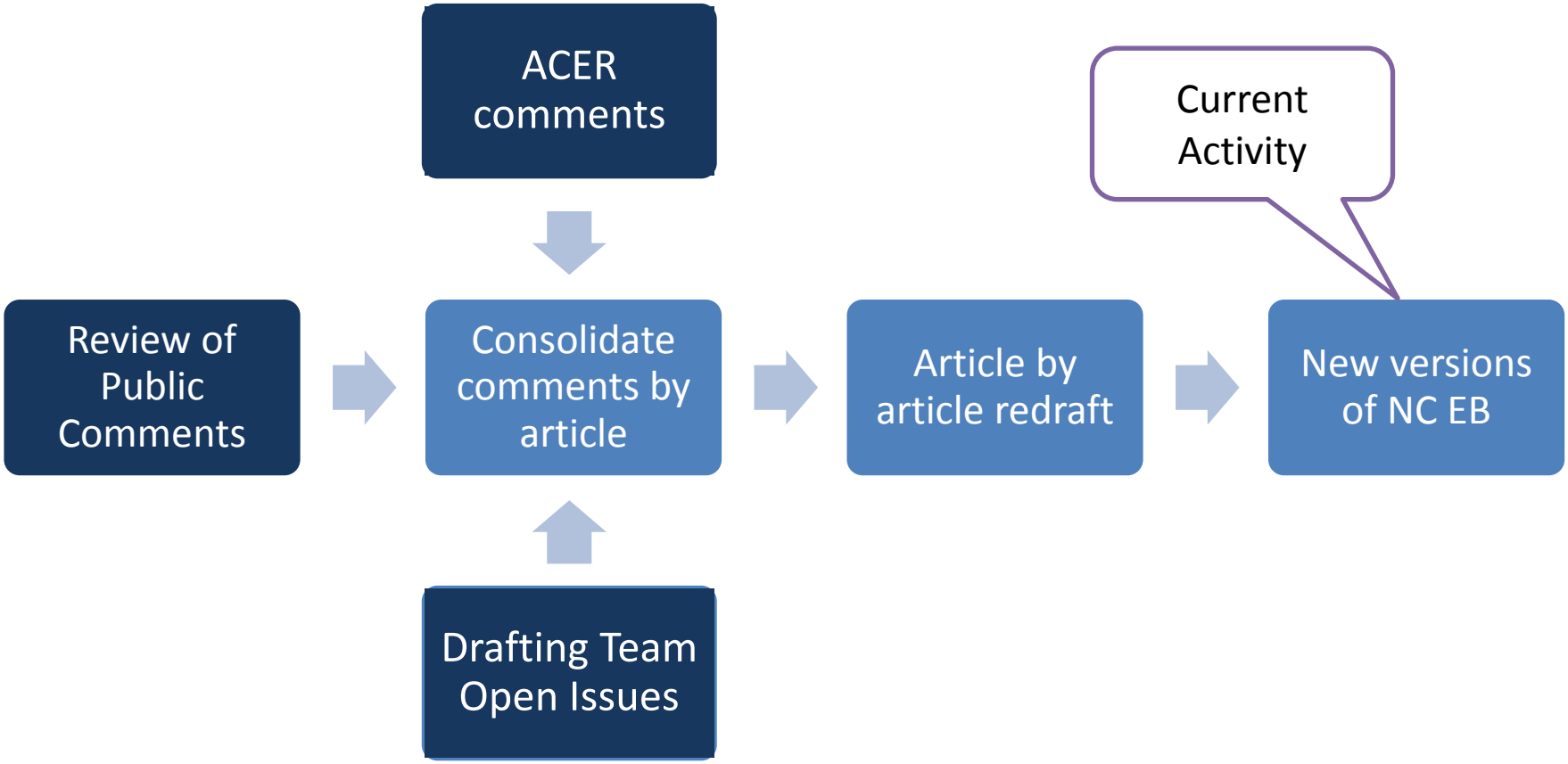
Conor Kavanagh

NC Electricity Balancing Timeline



Detailed Steps in the approval process

ENTSO-E Drafting Team Activity Post Consultation

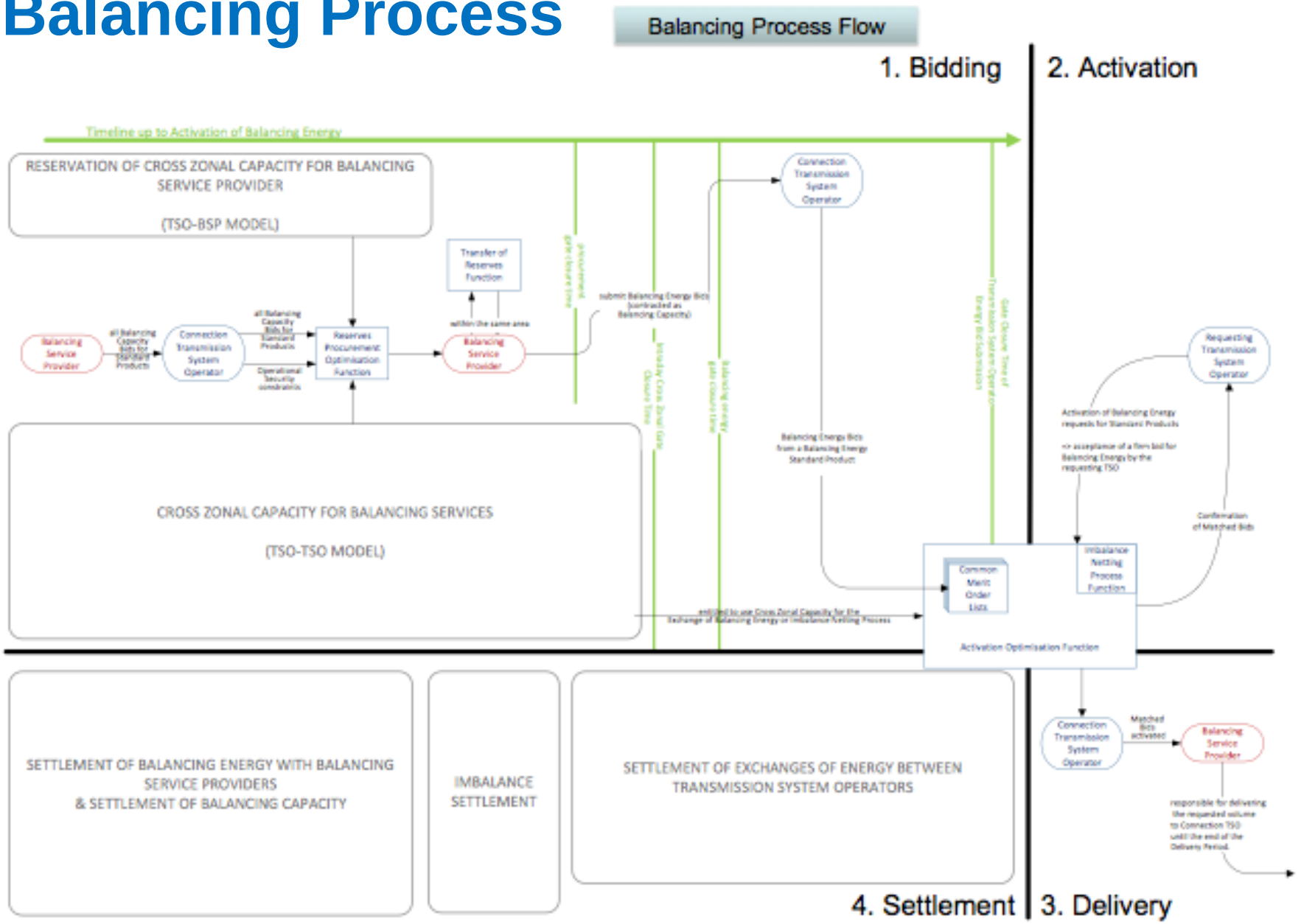


Information available

- Material from ENTSO-E Stakeholder workshop can be found on:

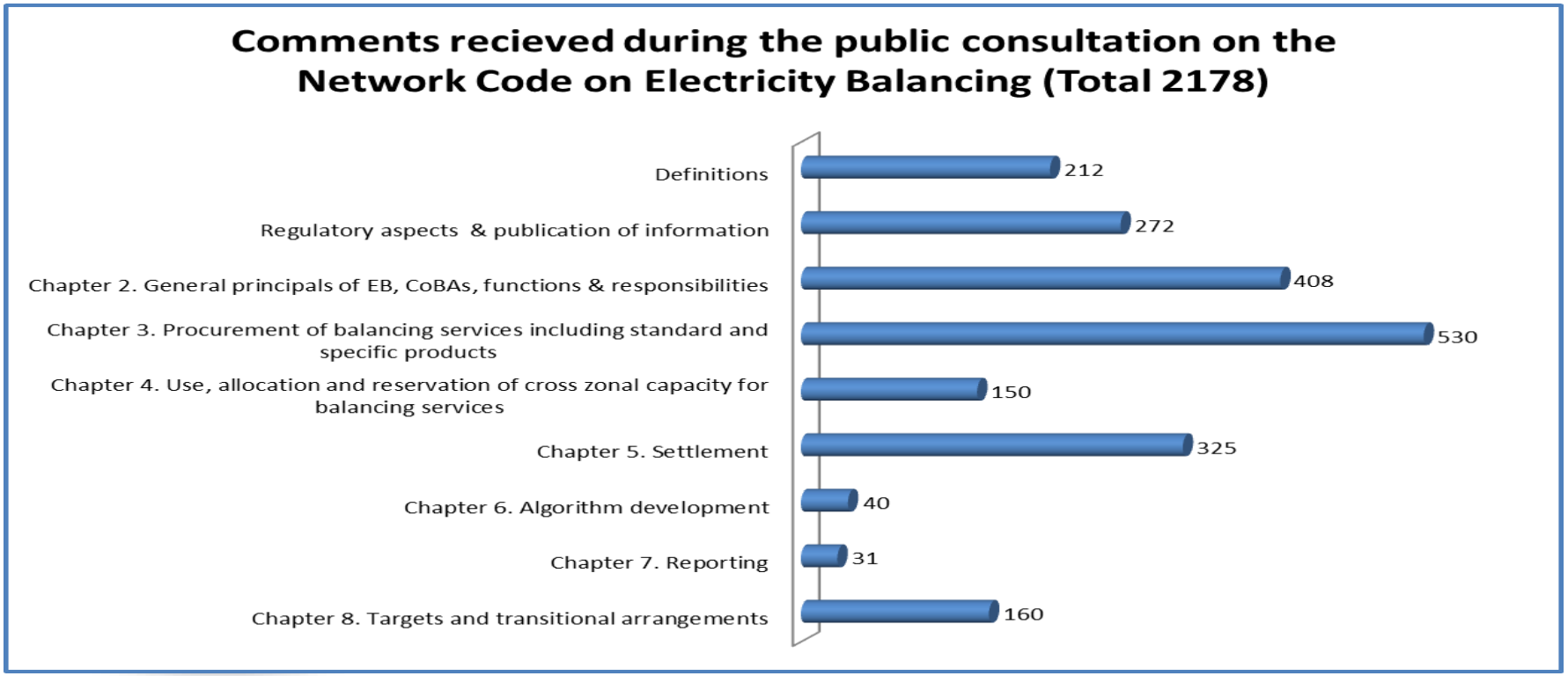
- https://www.entsoe.eu/major-projects/network-code-development/electricity-balancing/

Balancing Process



Public Consultation - Summary

- The Public Consultation on the draft Network Code on Electricity Balancing closed on 16 August.
- 2178 comments received
- ~144 All-island on 44 of 62 articles on 28 main topics
- Most public comments concerned Procurement of Balancing Services, Settlement and General Balancing Principles

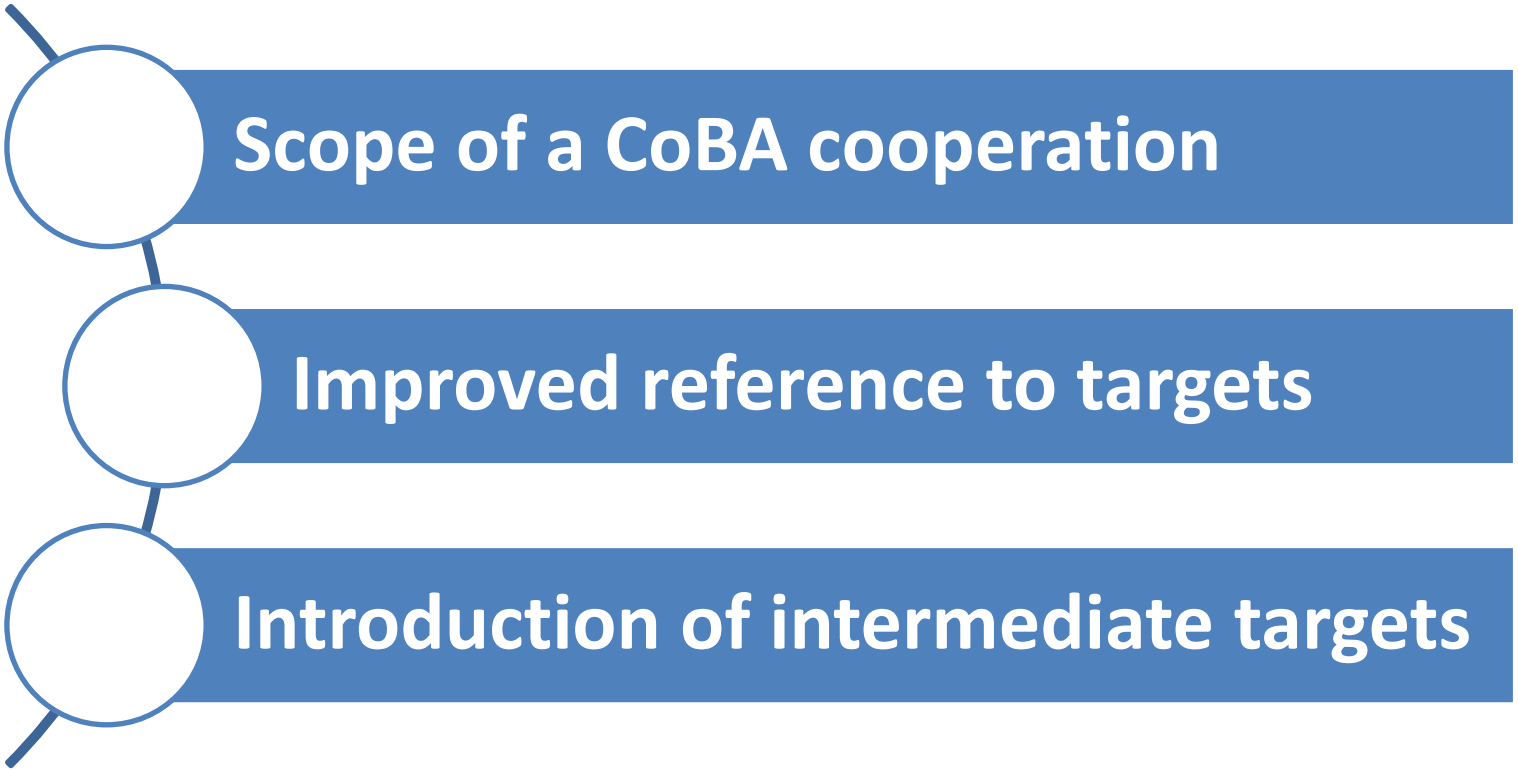


NC EB topics for round table discussions

Formation and Evolution of CoBAs and Targets	**Products and Gate Closure Times**	**Procurement and Activation of Energy and Reserves**
Cross Zonal Capacity Reservation	Settlement	Central Dispatch Systems

CoBAs & Targets

Main concerns were:



Coordinated Balancing Area (CoBA)

- FWGL gives a clear obligation to TSOs:

- “TSOs are responsible for organising balancing markets and shall strive for their integration […]”

- Obligation to cooperate in procurement of Balancing Energy, however, FGWL do not stipulate by who and how this is done before the target model is implemented, nor how cooperation is established for the Exchange of Reserves

  → Proposed solution: Coordinated Balancing Area

New structure for target (1 of 2)

- Applicability
- Deadline to implement the intermediate (regional) model
- Basics of the intermediate (regional) model
- Implementation plan for the intermediate (regional) model

Article 12
TARGETS FOR THE ACTIVATION OF BALANCING ENERGY BIDS USED IN CROSS-BORDER REPLACEMENT RESERVE ACTIVATION PROCESS

1. This Article applies to Transmission System Operators operating a Reserve Replacement Process as a part of the Load-Frequency-Control Structure as defined in the Synchronous Area Operational Agreement pursuant the Network Code on Load-Frequency Control and Reserves.

2. No later than two years after the entry into force of this Network Code, Transmission System Operator pursuant to paragraph 1 shall form together with other Transmission System Operator pursuant to paragraph 1 a Coordinated Balancing Area for activation of Balancing Energy Bids used in the Cross-Border Replacement Reserve Activation Process and implement the intermediate model pursuant to paragraph 3.

3. The intermediate model for activation of Balancing Energy Bids used in the Cross-Border Replacement Reserve Activation Process shall:
   (a) be based on a multilateral TSO-TSO Model with a Common Merit Order List;
   (b) allow Transmission System Operator not to share a certain amount of Balancing Energy Bids as defined in Article 36 ;
   (c) allow for the existence of more than one Coordinated Balancing Area.

4. No later than six months after the entry into force of this Network Code, Transmission System Operators pursuant to paragraph 2 shall develop and publish a common implementation framework to implement the intermediate model pursuant to paragraph 3. The implementation framework shall include a configuration of the Coordinated Balancing Area and the implementation timeline. Transmission System Operators shall have the right to modify the implementation framework during the implementation of the intermediate model.

New structure for targets (2 of 2)

- Possibility to modificate the target (European) model
- Basics of the target (European) model
- Implementation plan for the target (European) model
- Deadline to implement the target (European) model

5. No later than three years after the entry into force of this Network Code, all Transmission System Operators pursuant to paragraph 1 shall have right to propose:
   (a) a modification of the target model pursuant to paragraph 6; and
   (b) a modified configuration of Coordinated Balancing Areas for the target model for activation of Balancing Energy Bids used in the Cross-Border Replacement Reserve Activation Process which shall allow more than one Coordinated Balancing Area if it is demonstrated that it does not lead to reduced benefit compared to only one Coordinated Balancing Area.

The proposals pursuant to paragraph 5(a) and (b) shall be supported by a Cost-Benefit Analysis performed by all Transmission System Operators pursuant to paragraph 1and shall be subject to regulatory approval.

6. The target model for activation of Balancing Energy Bids used in the Cross-Border Replacement Reserve Activation Process shall:
   (a) be based on a multilateral TSO-TSO Model with a Common Merit Order List;
   (b) not allow Unshared Bids for Standard Products.

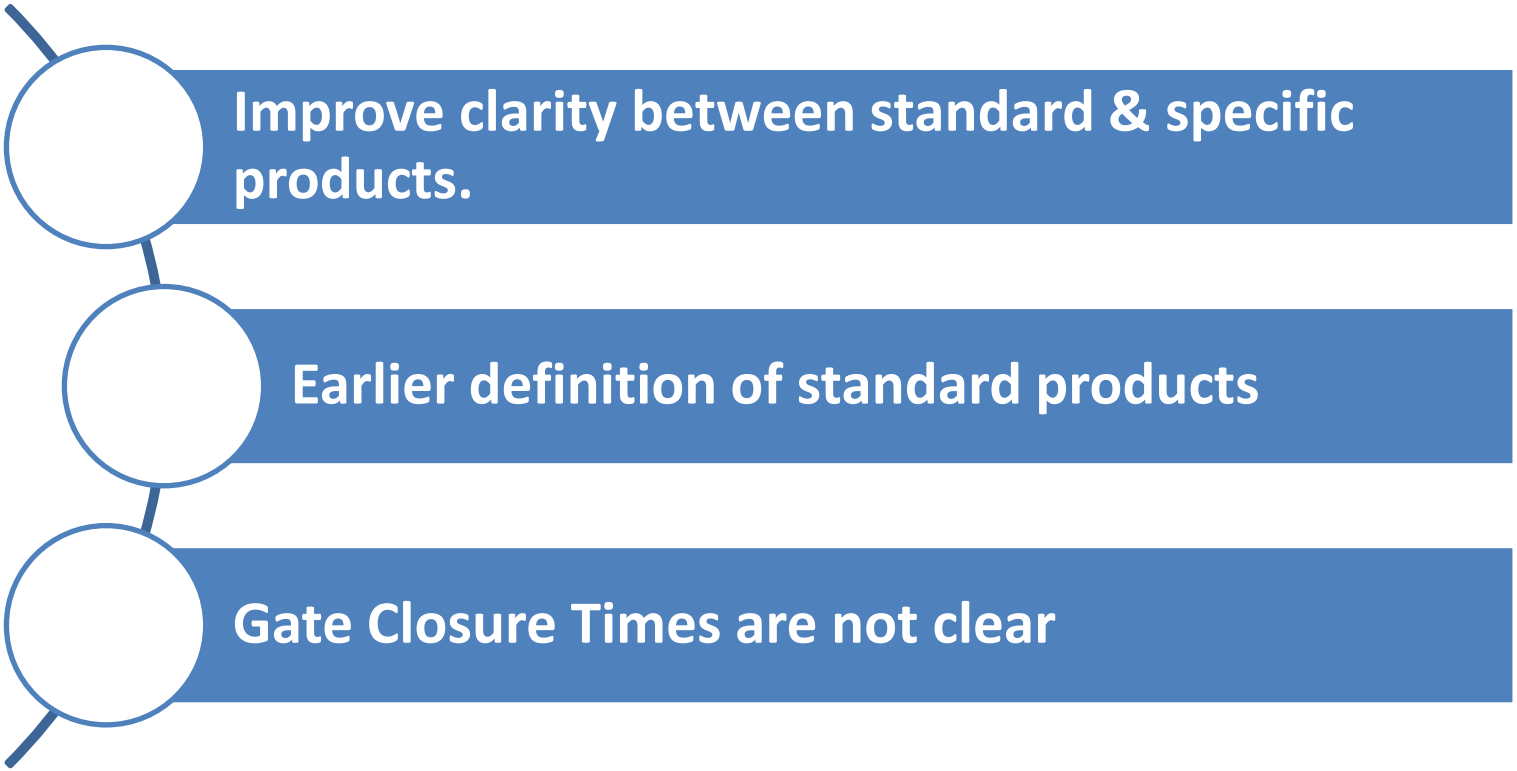
7. All Transmission System Operators pursuant to paragraph 1 shall develop and publish a common implementation framework to implement the target model for activation of Balancing Energy Bids used in the Cross-Border Replacement Reserve Activation Process. The implementation framework shall include an implementation timeline and a configuration of the Coordinated Balancing Areas pursuant to paragraph 5(b). The implementation framework shall be published:
   (a) in case the modification of the target model pursuant to paragraph 5(a) is requested, no later than 6 months after the regulatory approval of the modified target model;
   (b) in case no modification of the target model pursuant to paragraph 5(a) is requested, no later than one year after the regulatory approval of the modified configuration of Coordinated Balancing Areas.

Transmission System Operators shall have the right to modify the implementation framework during the implementation of the target model.

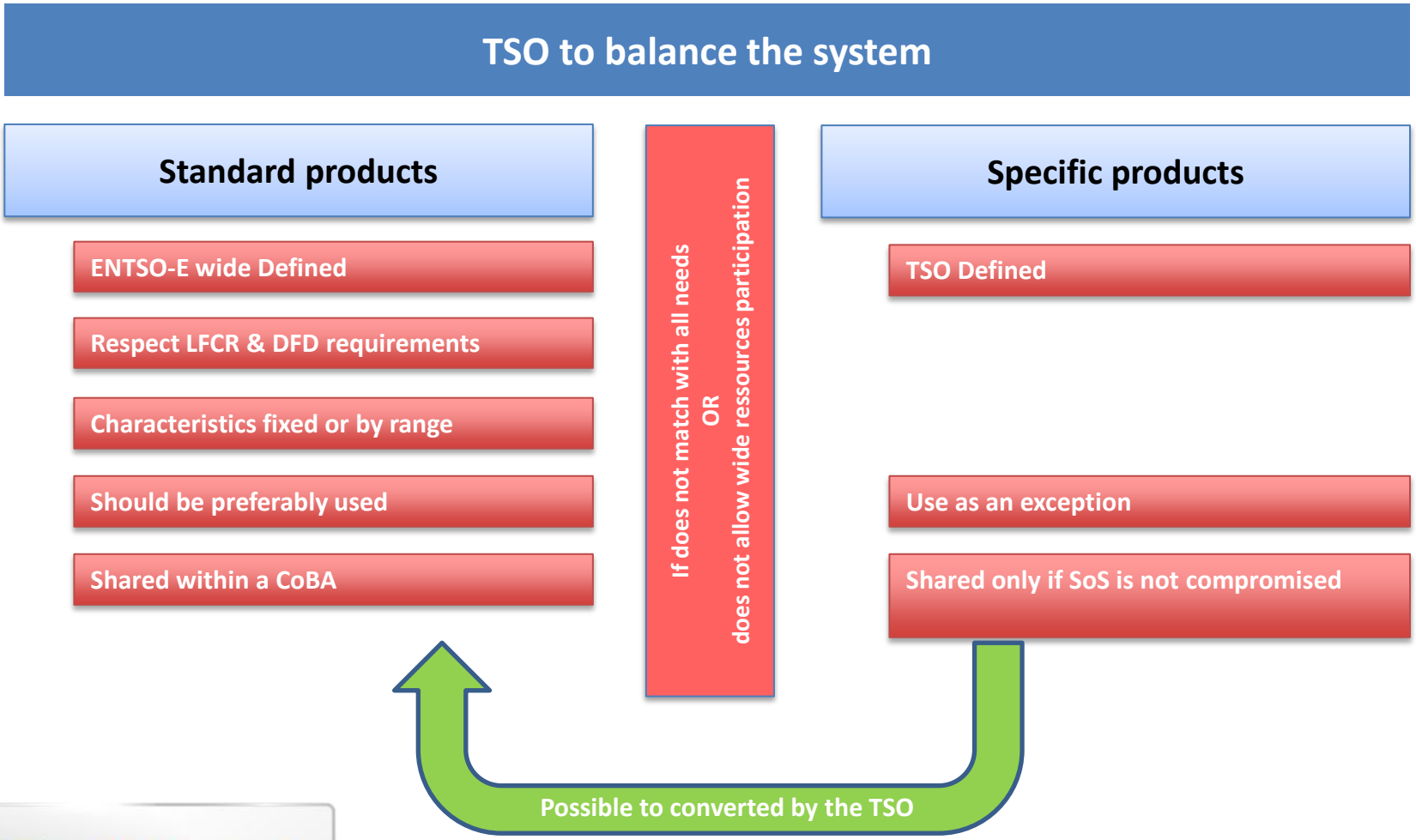
8. No later than six years after entry in to force of this Network Code, all Transmission System Operators pursuant to paragraph 1 shall implement the target model for activation of Balancing Energy Bids used in the Cross-Border Replacement Reserve Activation Process.

Products & Gate Closure Times

The main concerns were:

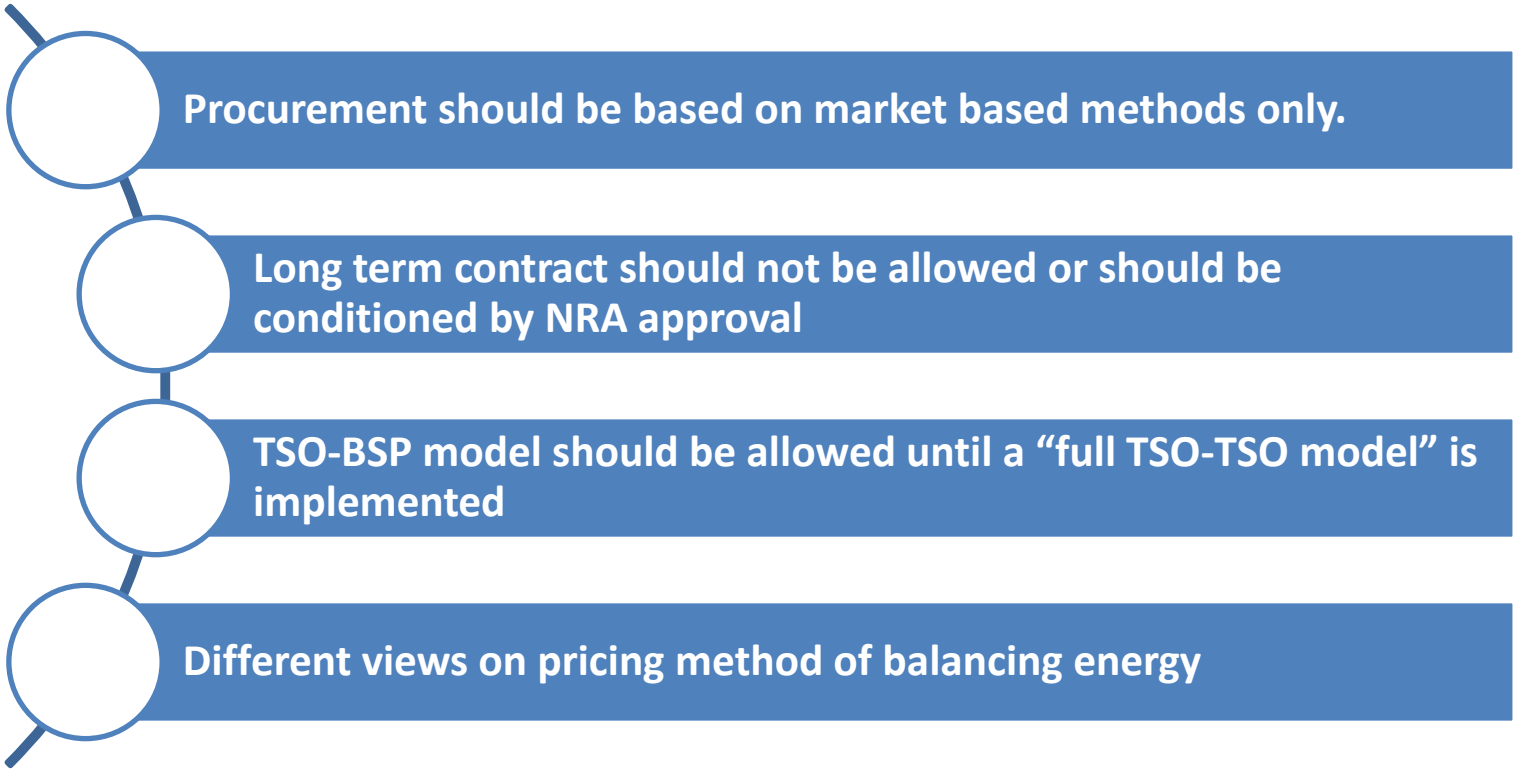


Standard vs Specific Products



Procurement & Activation

The main concerns were:



Overview of high-level changes

- **Differentiation between Procurement of Balancing Reserves**
  - within a Responsibility Area
  - within a Coordinated Balancing Area (CoBA)

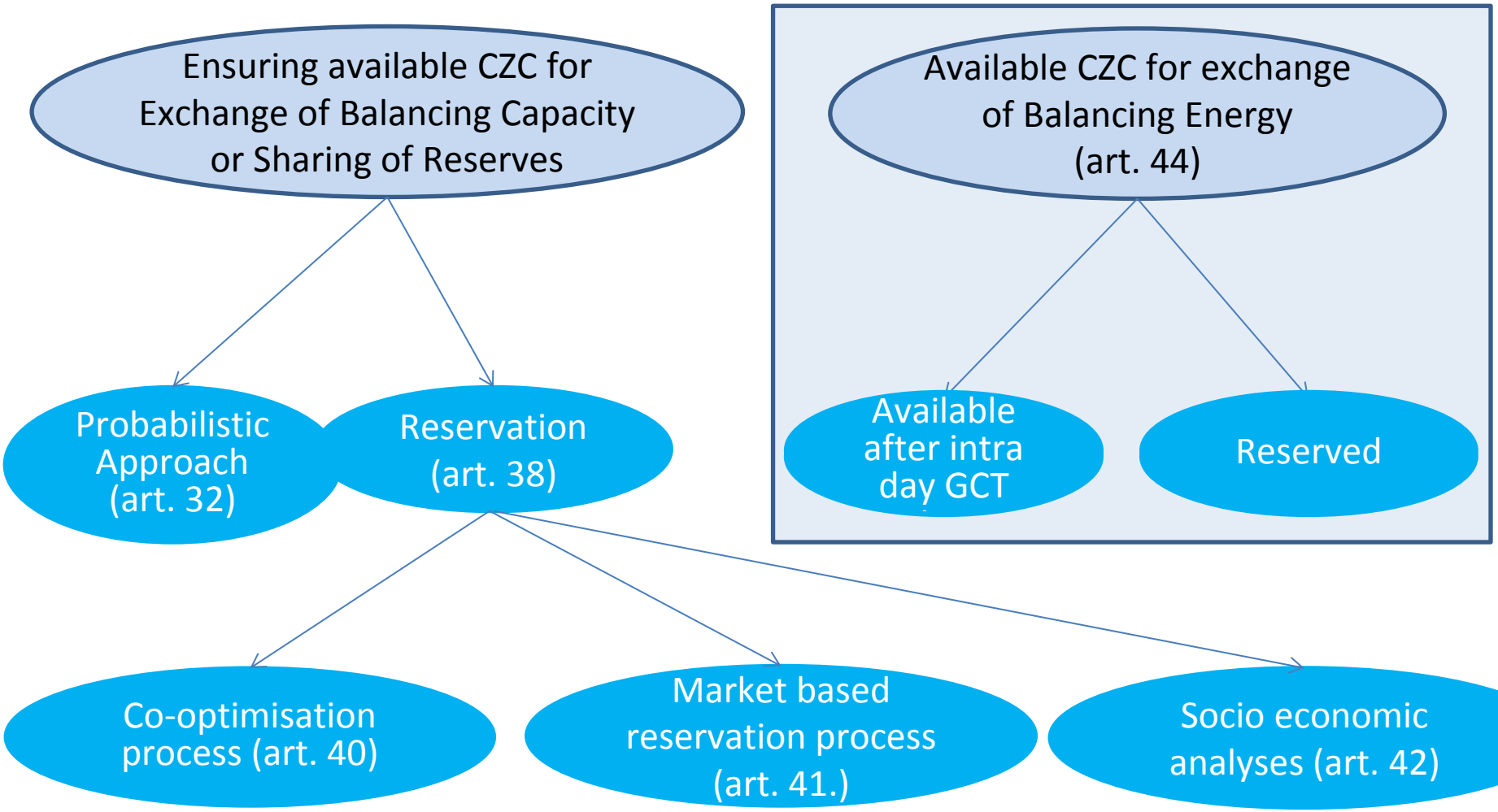
- **Rename: „Transfer of Obligation“ to „Transfer of a Balancing Capacity“**
- **Procurement period**
- **TSO-BSP model**

Cross Zonal Capacity

The main concerns were:

- Need for clarifications, improved definitions and better consistency with other codes
- Reservation of Cross Zonal Capacities should be prohibited
- Allocation of Cross Zonal Capacities should be prohibited

Exchange and Sharing of Balancing Services requires available Cross Zonal Capacity

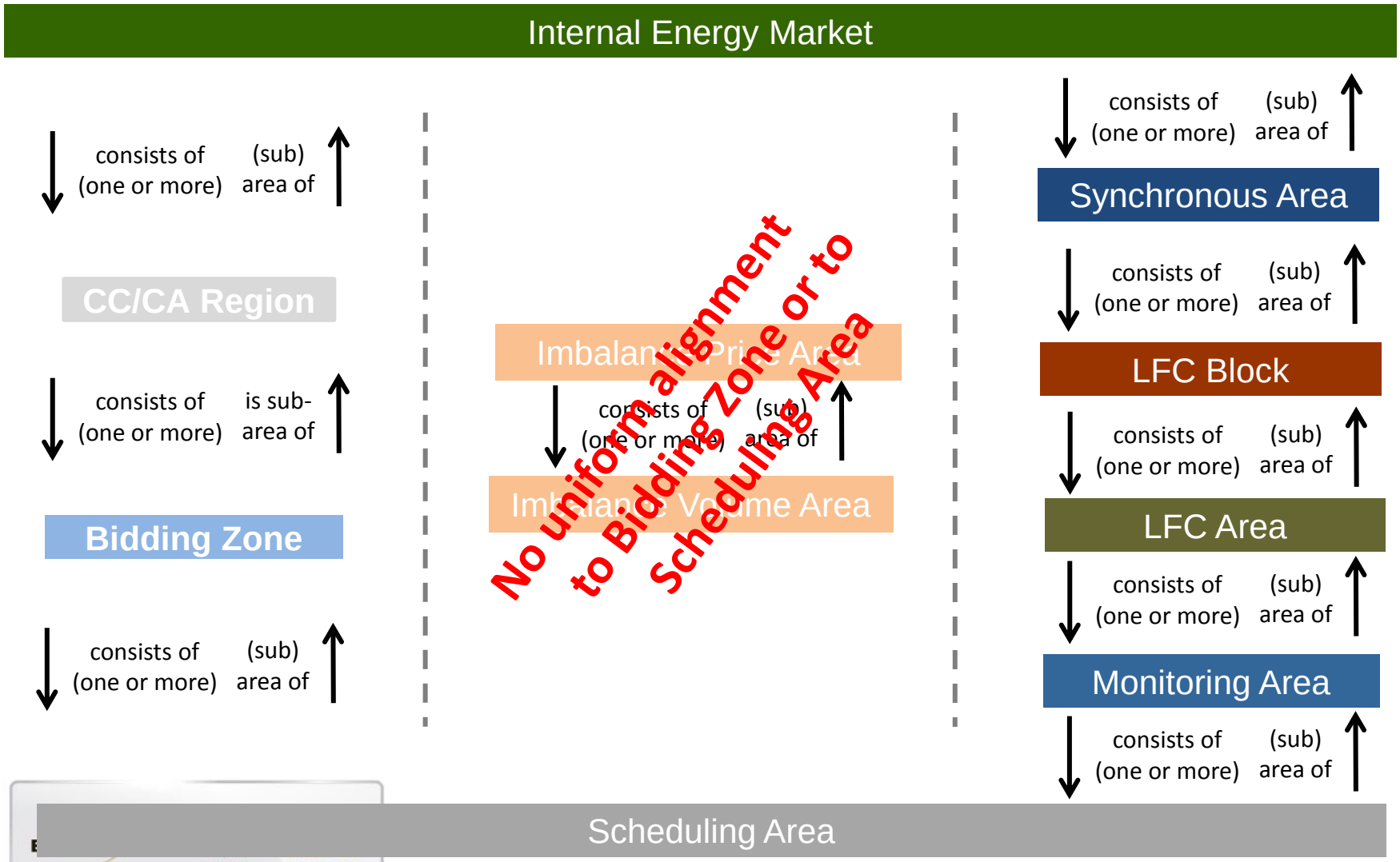


Settlement

The main concerns were:

- **Marginal Pricing. Some stakeholders want to enforce a single price system while others suggest a dual price system with reference to a day ahead price**
- **The use of the concept Relevant Area. Many stakeholders suggest to use Bidding Zones in line with NC CACM**
- **Settlement Responsibility. The possibility of delegation of Imbalance Settlement to another entity should be enlarged.**

Area Definitions



All-island Considerations

a) Synchronous Area Ireland reserve processes & product requirements.
b) Balancing after one hour Cross Zonal Intraday Gate Closure Time
c) All-island commercial & other aspects
d) Balancing in Central Dispatch Systems
e) Priority Dispatch
f) DS3 System Services
g) Ramp Rate Process and product definition with HVDC connection
h) BETTA market, Elexon and National Grid engagement.
i) DSOs coordination.

Next steps in the approval process

Operations Network Codes

Glen Flanagan (Operations Engineer, SONI)

OPS NC overview

- Data for Operational Security analysis in Operational Planning
- Operational Security Analysis in Operational Planning
- Outage Coordination
- Adequacy
- Ancillary Services
- Scheduling
- ENTSO-E Operational Planning Data Environment

Operational Planning and Scheduling, drafting up-date

- ENTSO-E received ACER's opinion on OPS NC 19th July
- Drafting team, Acer & EC to work together on re-draft
- Re-drafted by and resubmitted to Acer 24th Sept
- Acer's opinion expected soon.

Timelines for implementation of OPS NC

Article	Articles with extended implementation dates;	
Article 12	Year-Ahead Common Grid Models	(6 months after entering into force)
Article 19	Methodologies for coordinating Operational Security Analysis	(12 months after entering into force)
Article 21	Definition of Outage Coordination Regions	(15 months after entering into force)
Article 23	Methodology for assessing relevance of assets for the Outage Coordination Process	(12months after entering into force)
Article 24	List of Self-Planned Interconnectors, Relevant Power Generating Modules and Relevant Demand Facilities	(15months after entering into force)
Article 27	List of Relevant Grid Elements	(15months after entering into force)
Article 58	General provisions for ENTSO-E Operational Planning Data Environment	(24months after entering into force)

NC OS

- Stakeholder information session held on 16/9 in Brussels
- Internal ENTSOE approvals complete on 23/9
- Code resubmitted to ACER on 24/9
- EC Pre Comitology meeting on 29/10
- Time available to influence change is rapidly running out

at a minimum review

Data Exchange Chapter in NC OS

NC LFCR

- Positive ACER opinion with three recommendations:
  - Sharing of FCR between Synchronous Areas (currently only allowed between SAs IRE and GB)
  - The Recitals (7) with regard to National Scrutiny (corrected in the most recent version of the Recitals)
  - The minimum time period of 30 minutes for full activation of continuous FCR (not an issue for SAs IRE and GB)
- Code now goes to the EC for Comitology
- EC Pre Comitology meeting on 29/10
- Time available to influence change is rapidly running out

at a minimum review

"NC EB and NC LFCR All-Island Workshop 01-08-13 – Additional Info on NC LFCR"

At

www.eirgrid.com/europeanaffairs/networkcodes/

Connection Network Codes

Mark Norton

Update on Connection Codes

DT RfG

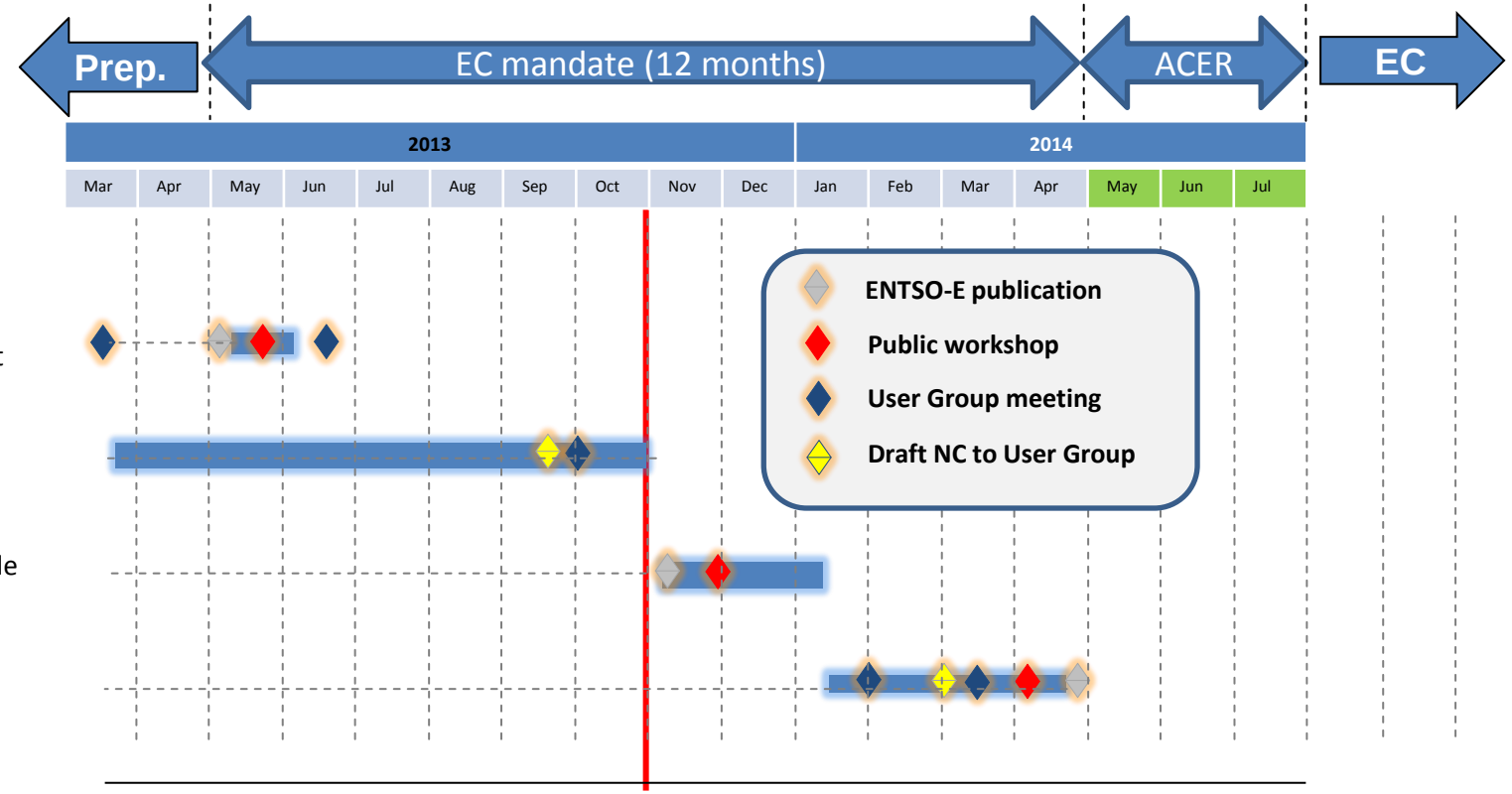
- Ongoing discussions with EC, driven by KEMA report recommendations
- Prepare response and changes for comitology in the coming months to reflect Kema report once fully reviewed
- Preparation of implementation guidelines of requirements into National Law

DCC

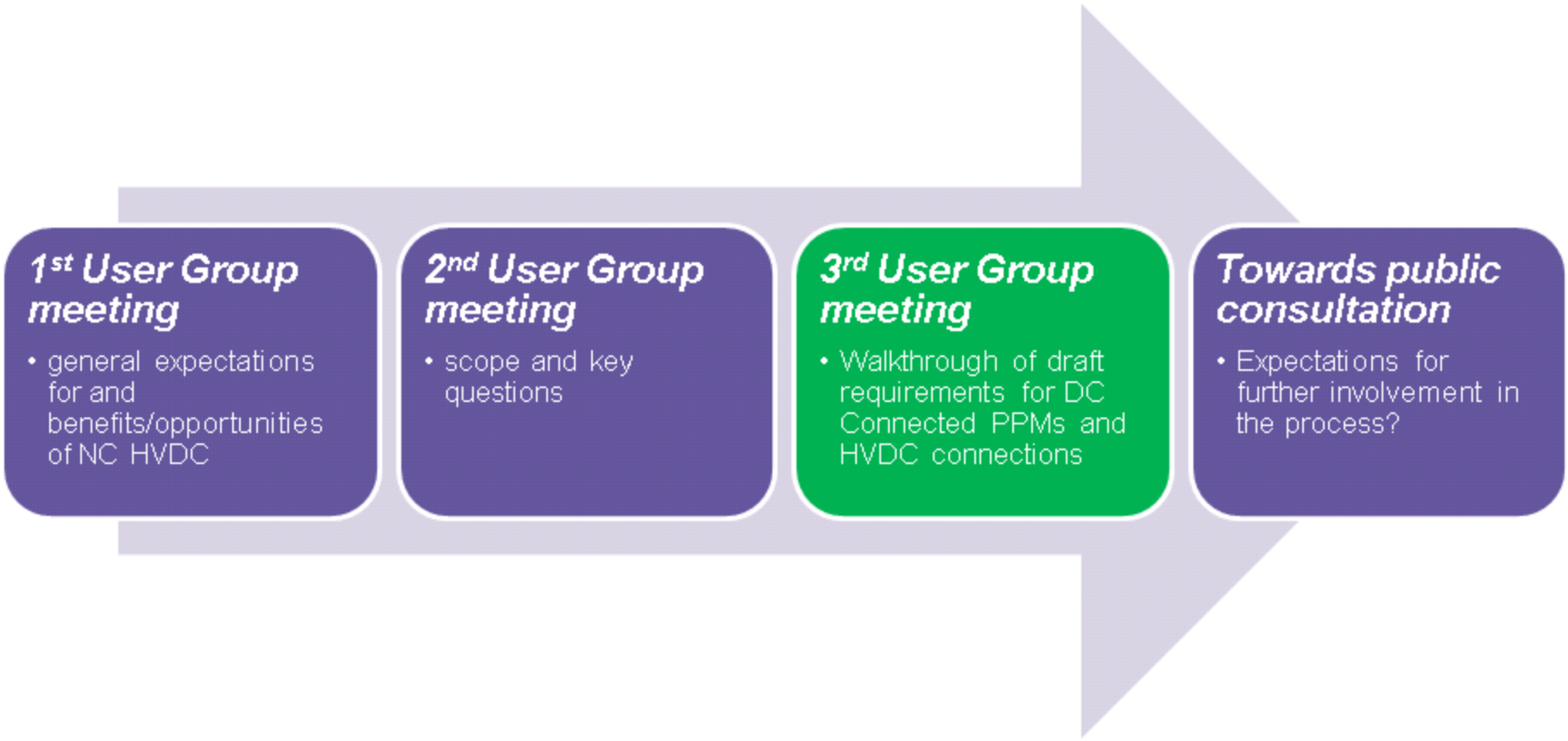
- Ongoing discussions with EC, no equivalent KEMA report for DCC
- Preparation of implementation guidelines of requirements into National Law
- Analysis of how and what Europe-wide DSR SFC implementation should be
- Continuing discussion with SEDC (European assoc. of demand aggregators) to come to a joint statement on Demand Side Response meeting Nov 7th 2013

DT HVDC – general planning

- Call for Stakeholder Input
- Drafting NC HVDC
- Consultation on draft code
- Finalizing NC HVDC

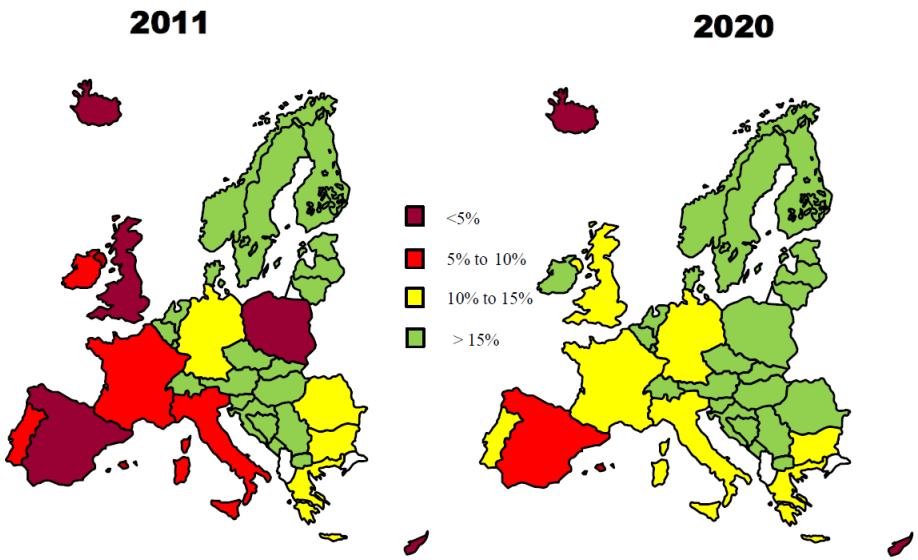


User Group meetings



HVDC Solutions in Europe

Global challenges and local system needs



Interconnection Ration reflects the % interconnection capability compared to installed power capacity for each country.

The interconnection with HVDC can be realized in three different ways:

- 1. To connect two or more Synchronous Areas (SA) to each other. The HVDC link is considered a significant grid user at all connection points.
- 2. To provide a transfer capability inside a single synchronous area, called embedded HVDC. The parallel operation of the HVDC with HVAC can encompassing a single TSO control area or 2 or more control areas.
- 3. To connect remote generations to the main AC network. The HVDC connection may or may not be part of the generation facility.

NC HVDC General Approach

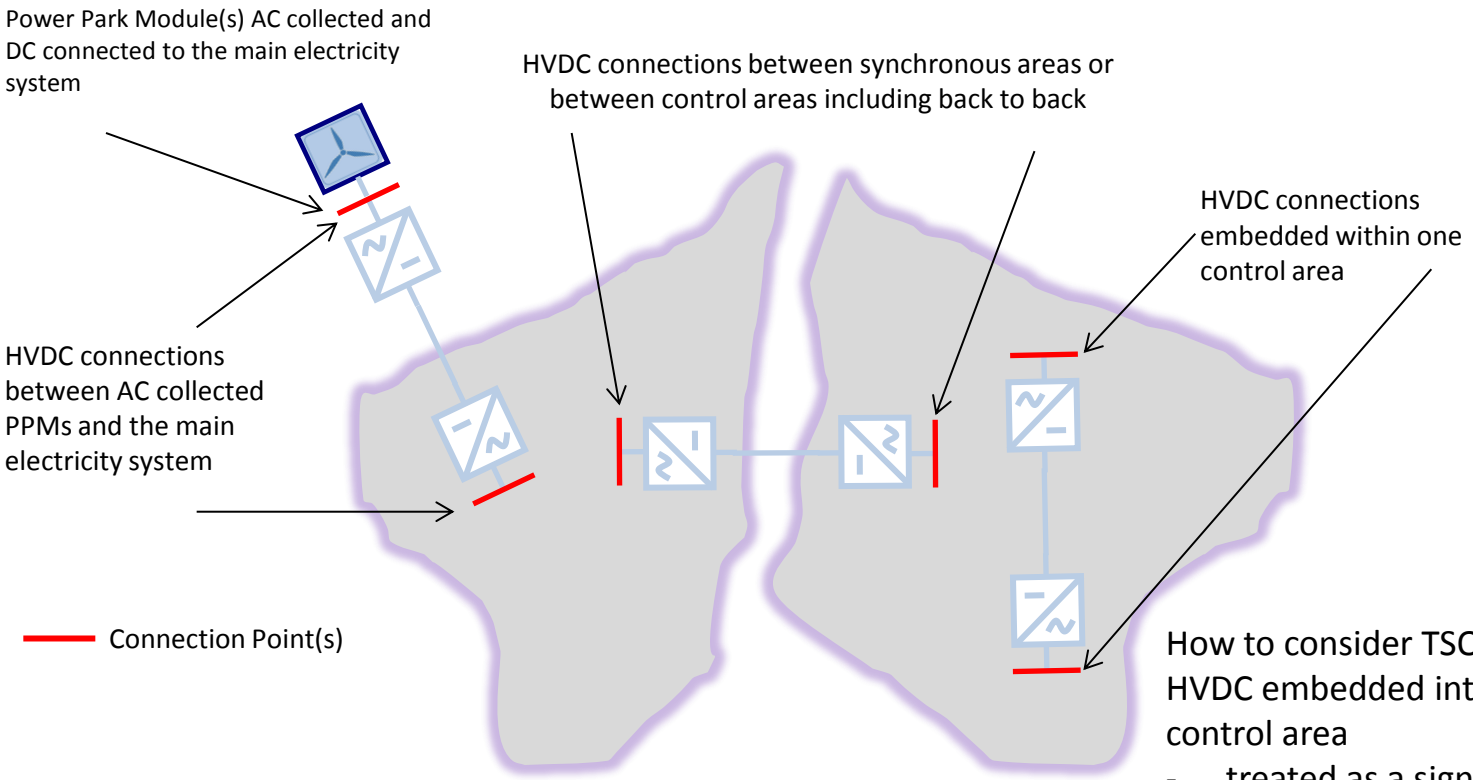
- **Capability of HVDC systems relevant for cross border system security**
  - Its inherent capabilities, e.g. fast active and reactive power control, supplementary control, etc…, support the EU's energy goals.
  - HVDC connected grid users complement those of generation and demand.

- **Capability of DC connected PPMs and remote end HVDC converter**
  - HVDC system in combination to PPMs could bring economic benefits
  - Coordination between capabilities of HVDC system and PPMs

- **Coping with different technologies**
  - Requirements should not favour a specific technology

- **Considering potential future DC grids**
  - Requirements for HVDC connections and DC connected PPMs should not be a barrier to future expansion into multi-terminal or meshed DC grids

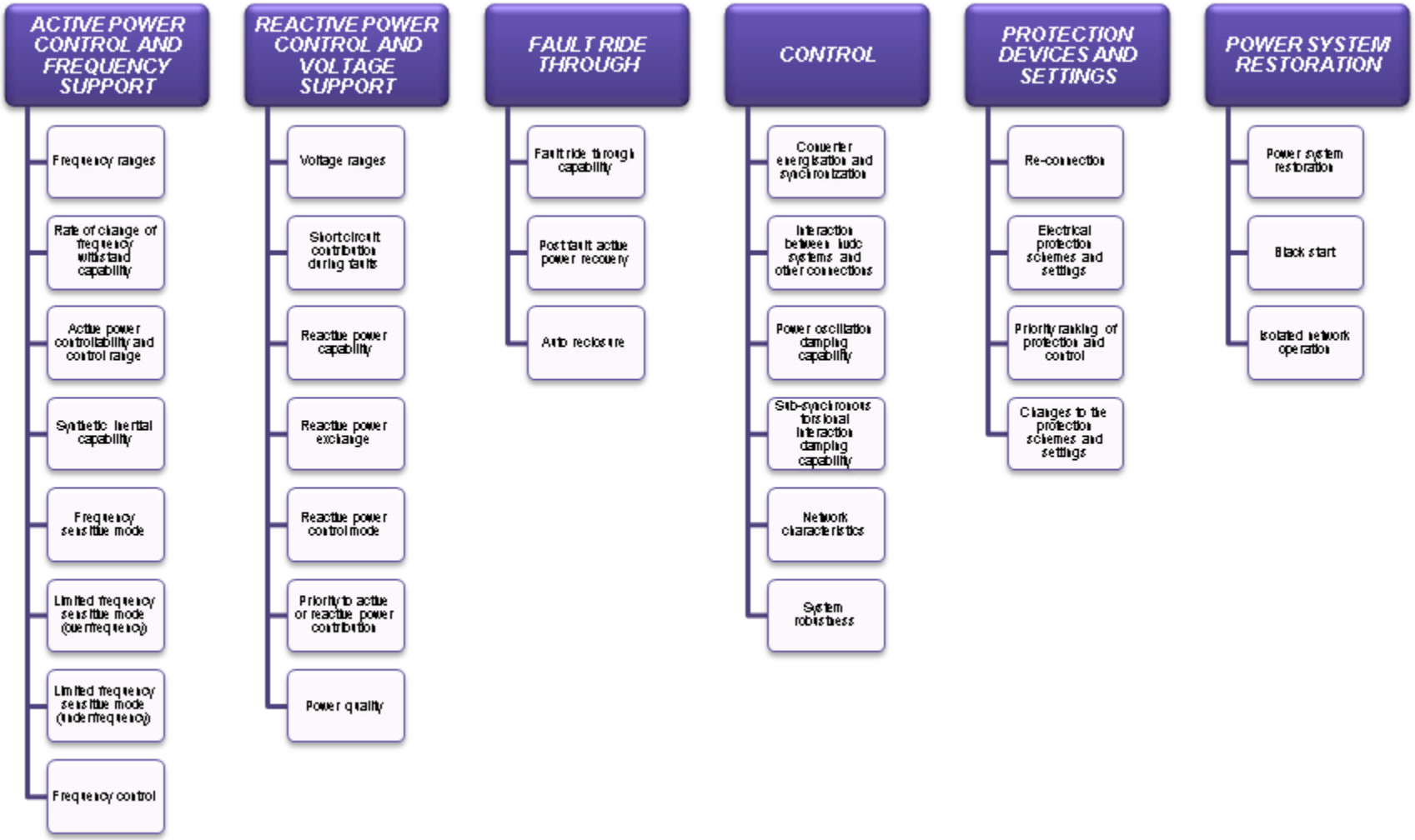
Applications of HVDC and DC connected PPMs



How to consider TSO-owned HVDC embedded into one control area

- treated as a significant grid user
- compliance to HVDC CC
- compliance simulation
- compliance testing

General requirements in HVDC code



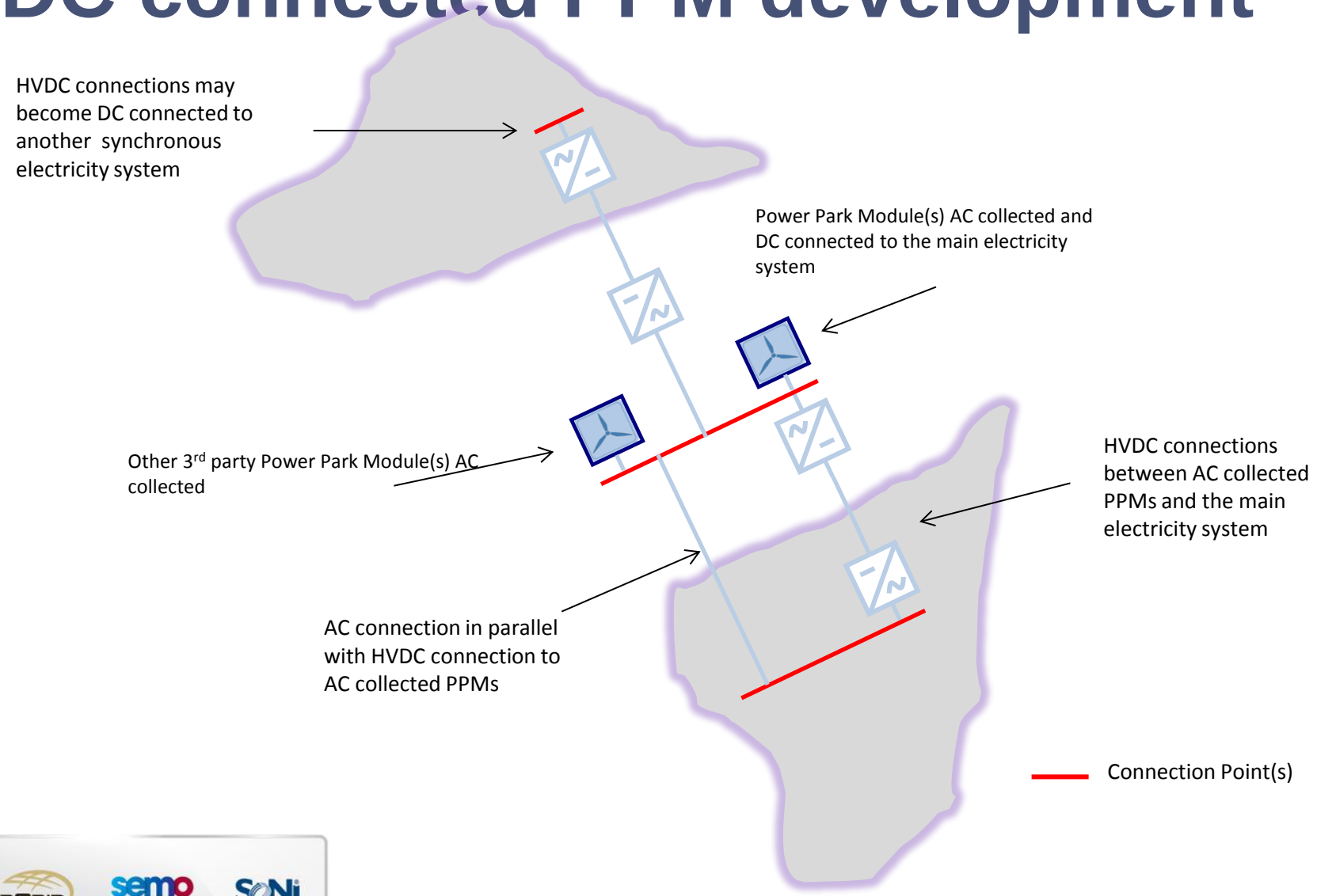
EIRGRID semo SONI

Requirements for DC connected PPMs and remote end HVDC converters

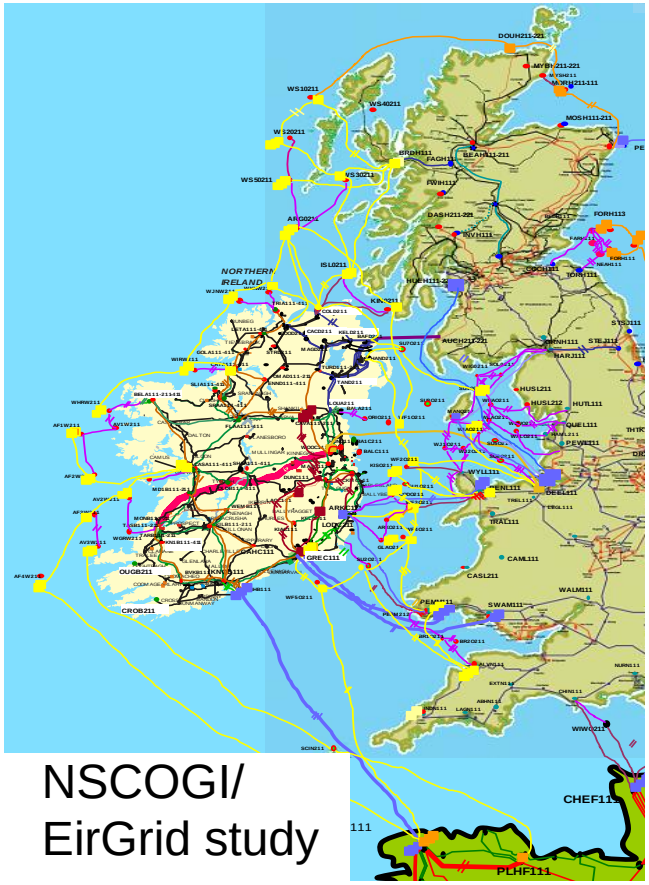
- DC connected PPMs and remote end HVDC converters need to have economic consistent coordinated requirements so as not to impair requirements at AC onshore transmission connection point
- Requirements cover the secure operation of such DC connected AC collection grids for critical situations inside the AC collection (changes in power flow as required by the mainland side, disturbances, disconnection of one ore more DC connections, …)

- DC connected PPMs
  - Reference to RfG with possible variation in ranges and settings
- Remote end HVDC converters
  - Reference to HVDC CC Art. 8 … 36 with possible variation in ranges and settings

DC connected PPM development

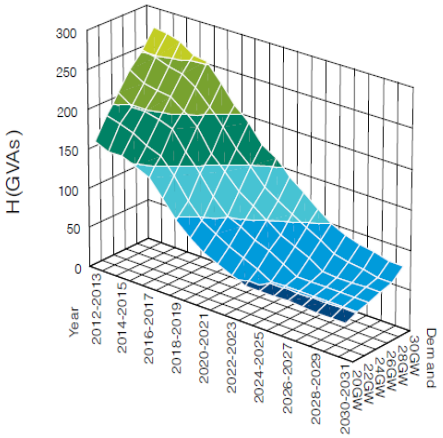


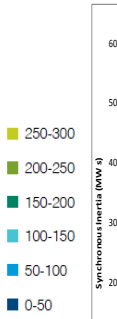
DC connected PPM development – Characteristics

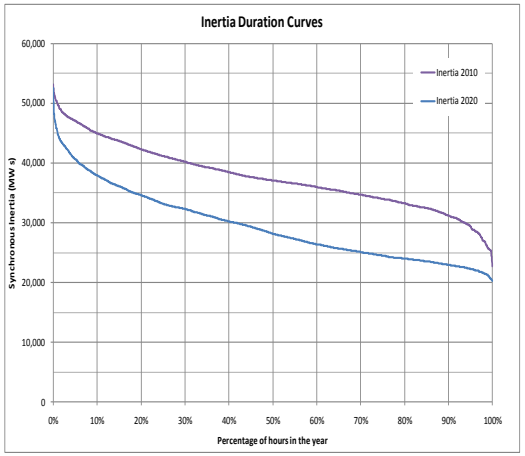


NSCOGI/
EirGrid study

- AC connections may become DC and vice versus
- DC connected PPMs may become node in interconnection between synchronous systems
- AC and DC connections should be interchangeable
- DC connected PPMs will have low inertia and be more volatile
- DC connected PPMs will be required to contribute system services into the network which they are providing power to

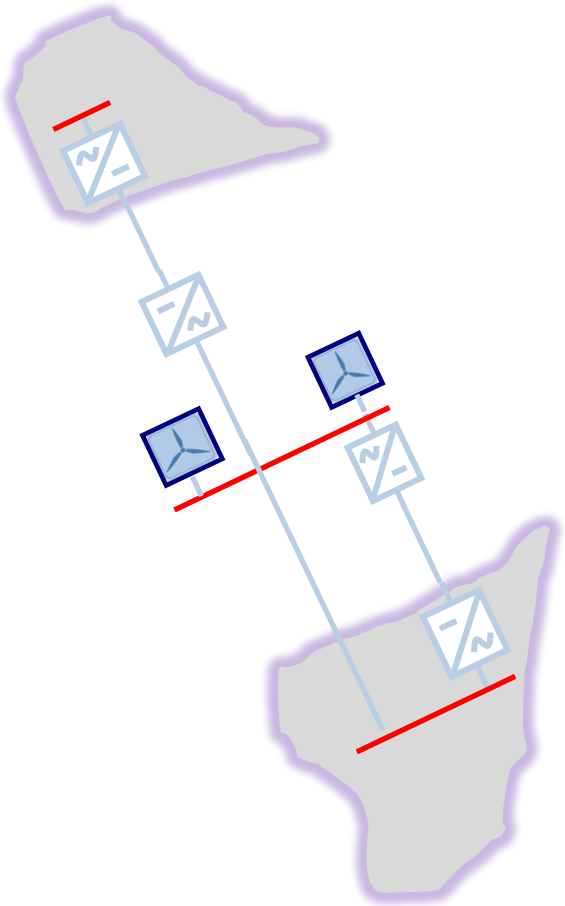






Thanks for your attention

Frequency requirements for DC connected PPMs and convertors



Why is it needed in the NC HVDC?

- PPMs/convertors to be relied upon must be resilient to reasonable frequency variations
- The PPM requirement is proposed to be in line with RFG as DC connected offshore generation may become AC connected

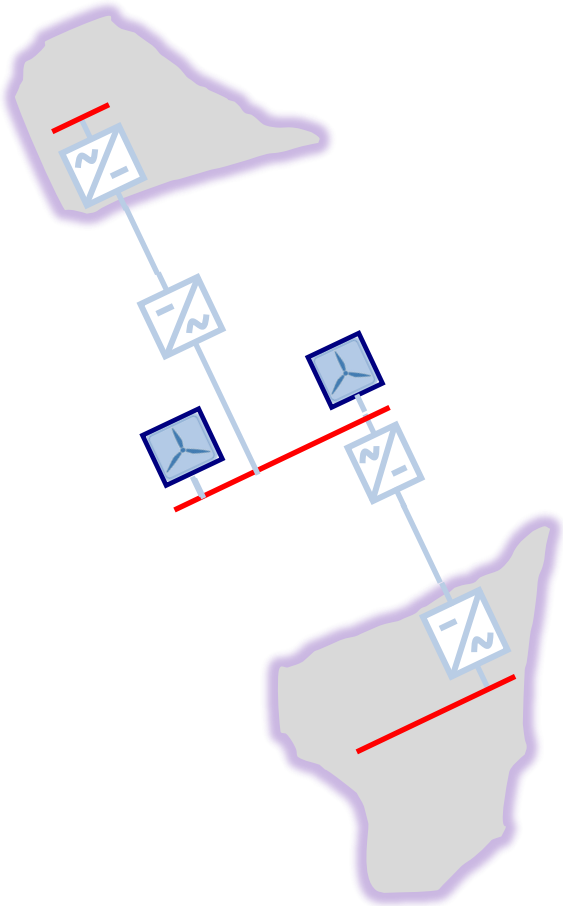
What does it aim to achieve?

- HVDC PPMs shall be capable of staying connected to the Network and operating within pre-defined frequency ranges and time periods compatible with AC connected as DC may become AC connected and retrofitting is practically impossible
- Network (Convertors) must be last to disconnect, proposed consistent with any other convertor requirements

Important to note:

- HVDC PPMs may become AC connected and if not DC connected AC connector network should at least be consistent with AC connected equivalents

ROCOF requirements for DC connected PPMs and convertors



Why is it needed in the NC HVDC?

- Offshore PPMs/convertors are small isolated networks which may experience high changes in ROCOF
- Reliance on generation requires reasonable resilience of offshore network
- Reliance of station as a link to other synchronous systems for system services and power transfer requires reasonable resilience of offshore network

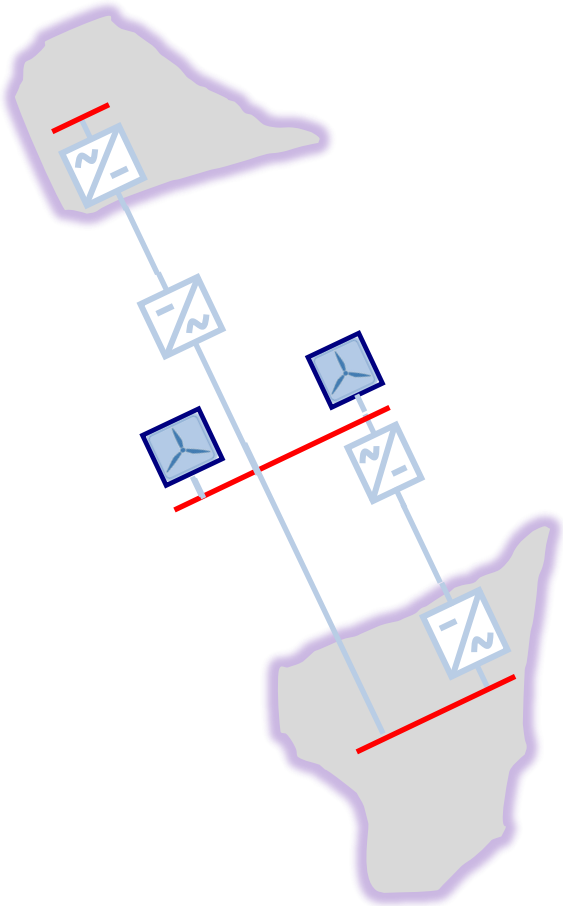
What does it aim to achieve?

- Retain AC collector networks, and PPMs for reasonable ROCOF

Important to note:

- ROCOF is averaged over 500mS time period not 500mS after fault
- PPM manufacturers believe 2Hz/sec for 500mS is achievable

FSM/LFSM requirements for DC connected PPMs and convertors



Why is it needed in the NC HVDC?

- FSM/LFSM strategy is for entire network not just synchronous connected
- Frequency response should be in sync with network which AC collector network is feeding into
- DC link should be capable of transferring power in this situation
- Fast communication of frequency response in less than 1 second

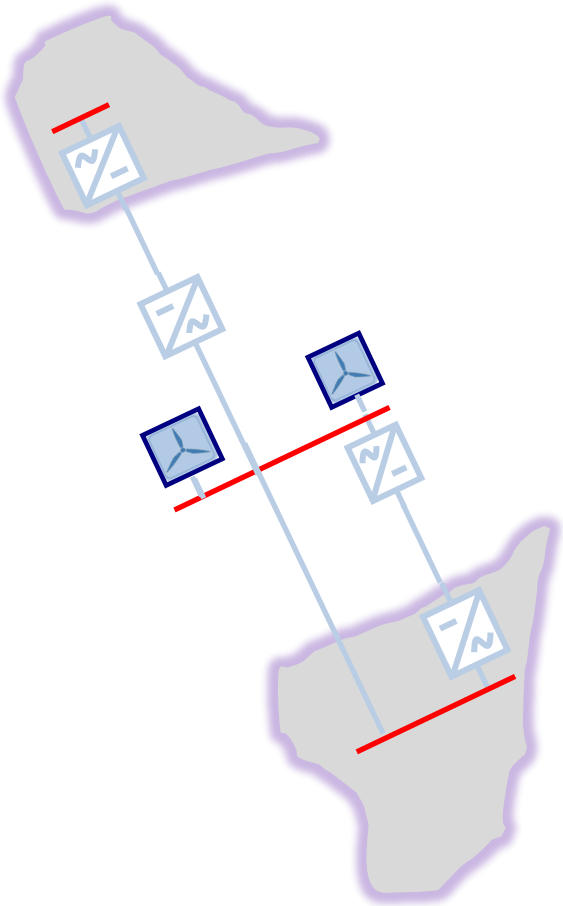
What does it aim to achieve?

- Ensure DC connected PPMs can contribute to entire network frequency response

Important to note:

- AC collector networks may be also transferring power from remote synchronous network via AC collector network
- DC connected PPMs could become AC connected

Voltage requirements for DC connected PPMs and convertors



Why is it needed in the NC HVDC?

- PPMs/convertors to be relied upon must be resilient to reasonable voltage variations
- The PPM requirement is proposed to be in line with RFG as DC connected offshore generation may become AC connected
- Convertor requirements will be in line with other AC connected convertors

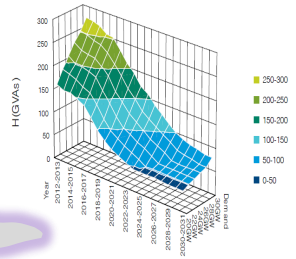
What does it aim to achieve?

- HVDC PPMs shall be capable of staying connected to the Network and operating within pre-defined voltage ranges and time periods compatible with AC connected as DC may become AC connected
- Network (Convertors) must be last to disconnect, proposed consistent with any other convertor requirements

Important to note:

- Voltage in DC connected PPMs is likely to be more volatile
- HVDC PPMs may become AC connected and if not DC connected AC connector network should at least be consistent with AC connected equivalents

Reactive power requirements for DC connected PPMs and convertors



Why is it needed in the NC HVDC?

- Reactive strategy is required for AC collector network
- As many parties maybe connected to offshore point , reactive requirements should be on all users not just convertor – non-discriminatory
- PPM reactive power range consistent with RfG due to possible future configurations
- Without PPMs the convertor[s] should be able to regulate voltage

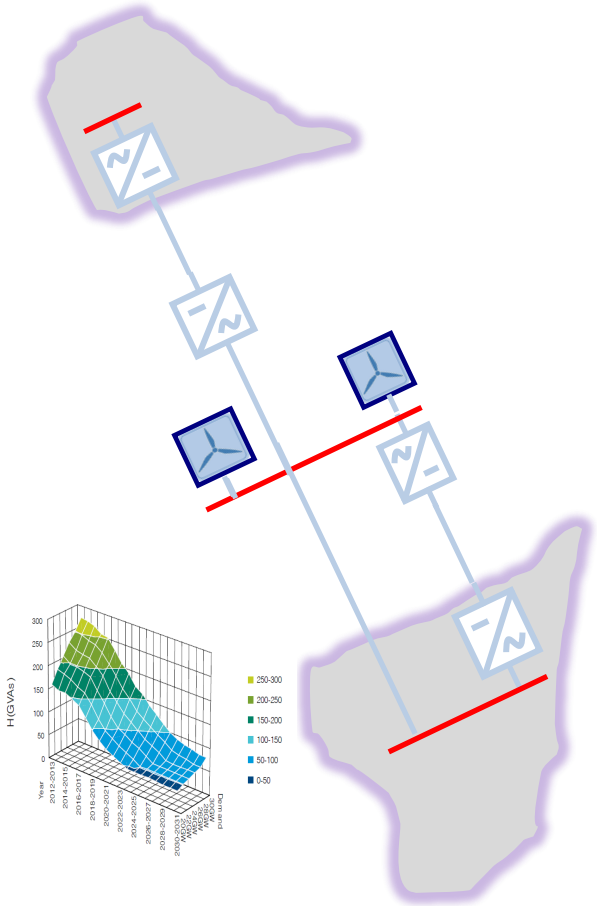
What does it aim to achieve?

- Ensure DC connected PPMs can contribute to regulate voltage for AC collector network
- Future proofed for network development and contingency

Important to note:

- DC connected PPMs could become AC connected
- A number of circuits maybe connected to one station
- Do we make an exception to 'dedicated' DC connections?

Synchronising requirements for DC connected PPMs and convertors



Why is it needed in the NC HVDC?

- Transient voltages are minimised during synchronising of convertors into a DC connection

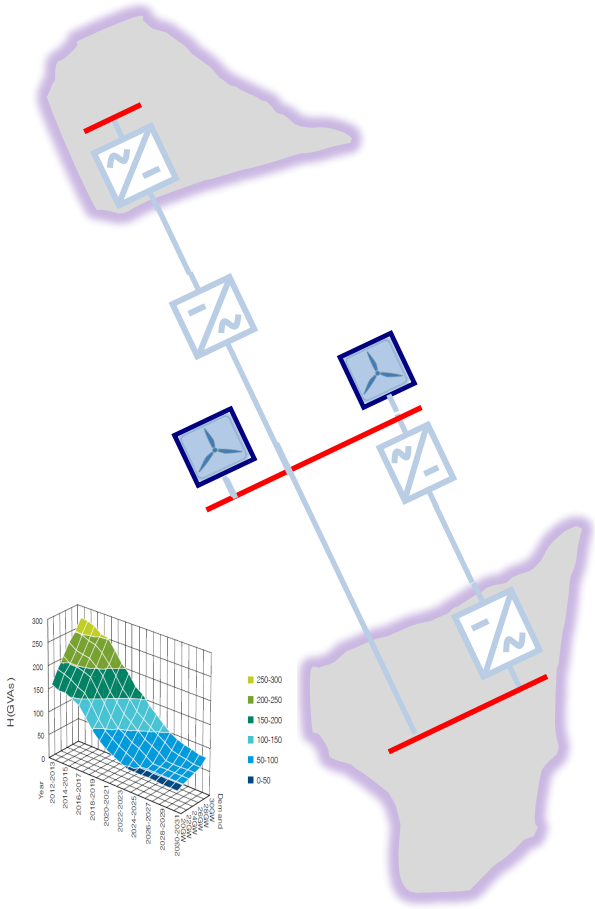
What does it aim to achieve?

- Connecting convertors into DC connected PPMs does not create voltage related disturbances or cascading outages

Important to note:

- DC connected PPMs could become AC connected
- A number of circuits maybe connected to one station
- DC connected AC collector networks are likely to be more volatile

Power Quality requirements for DC connected PPMs and convertors



Why is it needed in the NC HVDC?

- Power Quality must be maintained to avoid failure or accelerated aging of equipment

What does it aim to achieve?

- Manage power quality to avoid equipment stress, risk of temporary over voltages and provide users with a quality of supply

Important to note:

- Equipment offshore more difficult to repair/replace
- A number of circuits maybe connected to one station
- A number of users maybe connected to one station
- DC connected AC collector networks are likely to have a higher harmonic – low resistance, low strength, high risk of resonance conditions
- TSO defined power quality standard


EIRGRID
semo
Single Electricity
Market Operator
SONI
System Operator for Northern Ireland