

# CONNECTION NETWORK CODES IMPLEMENTATION GUIDANCES

Survey outcomes and next steps



# The Stakeholder survey questions – 10 Dec'15 - 22 Jan '16

Please prioritise the following topics according to your own priority:

- (1) very important
- (2) important
- (3) less important
- (4) of no relevance

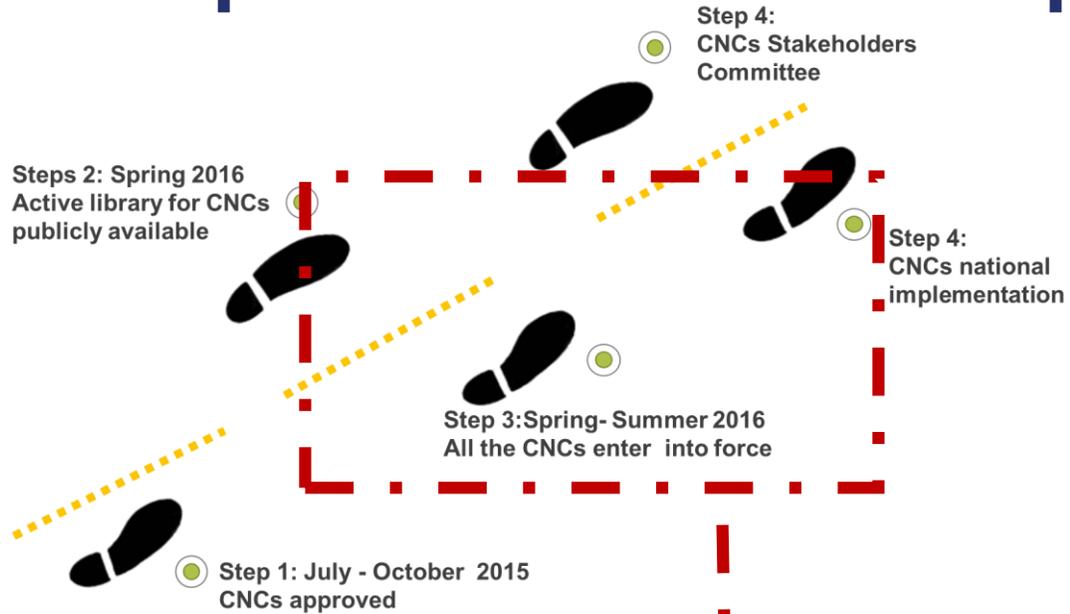
Other topics that are highly relevant to you and are suggested to be addressed in the ENTSO-E guidance documents?

Topic	Priority ranking
Rate-of-change-of-frequency withstand capability -	1
Guidance on compliance, test and monitoring -	2
General guidance on parameters for non-exhaustive requirements -	3
Post fault active power recovery -	4
Frequency related parameters for non-exhaustive requirements -	5
Determination of the thresholds for Types B, C & D power generating modules -	6
Voltage related parameters for non-exhaustive requirements -	7
Instruments, simulation, models & protection for non-exhaustive requirements -	8
Guidance on making non-mandatory requirements at European level mandatory at national level	9
General guidance on CBAs -	10
Need for Synthetic Inertia for frequency regulation -	11
System restoration requirements -	12
Reactive power requirement for PPMs & HVDC converters at low / zero active power -	13
Fault current contribution from PPMs & HVDC converters -	14
Reactive power on TSO-DSO interface -	15
Interactions between HVDC controllers -	16

# Additional implementation guidance documents

- Additional guidance topics selected in response to Stakeholders' requests:
  - Harmonisation
  - Real time data & communications including redundancy.
  - Special issues for Type A
- Topic added by ENTSO-E:
  - Voltage stability in a converter dominated system

# CNCs implementation - next step



**Dec '15–Jan '16**  
Survey on the guidances' topics

**29 Feb '16**  
'Define the content of each guidance document

**Mar– June '16**  
Draft the guidances

**June –July '16**  
Consultation of the implementation guidances

**Sept '16**  
Publication of the final implementation guidances

**ENTSO-E AT THE ENERGY  
COMMUNITY  
DISCUSSING NATIONAL  
IMPLEMENTATION OF THE CONNECTION  
NETWORK CODES**

**25 FEBRUARY 2016, VIENNA**

**Feedback from workshops**



# Purpose & outcomes

- **Meet with representatives from South East Europe involved in CNC national implementation.**
- **Cover legal issues (e.g. for non-EU countries), main content of 3 CNCs and share examples of national processes & plans.**
- **Outline current status and plans ahead, slides used are available on ECS web-site.**
- **Listen to hopes and concerns and status in each country.**
- **Encourage early involvement and engagement in implementation in all countries.**

# Countries represented in the workshop

**Albania, Austria,  
Czech Republic,  
Croatia, Georgia,  
Greece, Hungary,  
Italy, Kosovo,  
Montenegro, Poland,  
Slovakia, Spain,  
Serbia, Ukraine**

**Presenting own  
national processes &  
plans for their CNC  
implementation France  
& Romania**

# STAKEHOLDER WORKSHOP ON THE CONNECTION NETWORK CODES NATIONAL IMPLEMENTATION GUIDANCE DOCUMENTS

29 FEBRUARY 2016, BRUSSELS

Outcomes of all break-out group  
discussions



## Note

*The slides at the end represent the feedback received by ENTSO-E during the working sessions of the workshop on the contents of the CNC implementation guidance documents.*

*The participants worked in 5 groups and tackled 20 IGD topics (see the next slide). Here only a summary on 15 with full outcome for 5 topics.*

*ENTSO-E is looking closely at the full feedback received while currently drafting the implementation guidance documents, which are expected to be put forward for one month public consultation – possibly during June 2016.*

Group topics	Topics
1	Rate-of-change-of-frequency withstand capability -
	Frequency related parameters for non-exhaustive requirements -
	Need for Synthetic Inertia for frequency regulation -
	Interactions between HVDC controllers -
2	General guidance on parameters for non-exhaustive requirements -
	Determination of the thresholds for Types B, C & D power generating modules -
	Guidance on making non-mandatory requirements at European level mandatory at national level
	Special issues for Type A -
3	Voltage related parameters for non-exhaustive requirements -
	Reactive power requirement for PPMs & HVDC converters at low / zero active power -
	Reactive power on TSO-DSO interface -
	Voltage stability in a converter dominated system
4	Post fault active power recovery -
	System restoration requirements -
	Fault current contribution from PPMs & HVDC converters -
	Real time data & communications including redundancy.
5	Harmonisation
	Guidance on compliance, test and monitoring -
	General guidance on CBAs -
	Instruments, simulation, models & protection for non-exhaustive requirements -

# First set of IGDs - Overview

- **Rate-of-change-of-frequency withstand capability**
  - Its objective is to give advice on what considerations are appropriate before selecting a national value for RoCoF withstand for generators within scope of RfG. Consider also the relevance of the fully exhaustive withstand values in NC HVDC for both HVDC and for HVDC connected PPMs.
- **Frequency related parameters for non-exhaustive requirements**
  - Its objective is to give guidance on considerations on national choices for all frequency related non-exhaustive aspects. Including coordination within synchronous areas e.g. for FSM and LFSM parameters and maintaining P on falling f.
- **Need for Synthetic Inertia for frequency regulation**
  - The purpose of this IGD is to define under what system circumstances SI should be considered including considerations of forward needs, what are the alternatives, how could the functional requirements be defined and what is the readiness of technologies.
- **Interactions between HVDC controllers**
  - Its objective is to give guidance on how to manage potential interactions between controllers, responsibilities for providing data and for doing studies. Possible impact of future extreme levels of controller based sources (with link to guidance on voltage stability).

# First set of IGDs

## Rate-of-change-of-frequency withstand capability

Its objective is to give advice of what considerations are appropriate before selecting a national value for RoCoF withstand for RfG scope generators. Consider the relevance of the fully exhaustive withstand values in NC HVDC for both HVDC and for HVDC connected PPMs.

Specific guidance on related frequency issues are foreseen in other IGDs (e.g. Frequency parameters (general) and synthetic inertia (acting to reduce the RoCoF experienced)).

**Stakeholders have suggested that it contains:**

- Clear definition of ROCOF (robustness, trajectories) and how to measure it (df/dt, freq filtering, rolling window).
- Loss of mains protection scheme definition in the case of RfG
- State of art: References, ongoing studies
- Reference scenarios and disturbances for df/dt design
- Technology performance differences
- Machine protection and system protection
- Direct link to synthetic inertia rqm
- Coordination between TSOs of a S.A.
- Interaction with other NCs (Operation)

# Second set of IGDs - Overview

- **General guidance on parameters for non-exhaustive requirements**
  - Its objective is to give a general overview on the non-exhaustive parameters of the NC RfG, DCC and HVDC which will need a national choice and to provide a general guidance on these parameters. Specific guidelines on some technical issues are foreseen in other IGDs (e.g. Voltage issues, Frequency parameters, restoration issues).
- **General guidance making non-mandatory European Requirements Mandatory**
  - Its objective is to give guidance on how to proceed, when deciding if a non-mandatory requirement should be made mandatory in a specific country where the need for this requirement can be demonstrated.
- **Determination of the thresholds for Types B, C & D power generating modules**
  - The purpose of this IGD is to collate the main considerations in defining lower MW boundaries for the type B, C and D as defined in the NC RfG.
- **Special issues for Type A Generators**
  - Its objective is to give guidance on how to deal with small units largely “off the shelf” with less individual engineering and considerations but that could represent a significant share of the installation present in a country.

# Second set of IGDs

## Guidance on parameters for non-exhaustive requirements

Its objective is to give a general overview on the non-exhaustive parameters of the NC RfG, DCC and HVDC which will need a national choice and to provide a general guidance on these parameters.

Specific guidelines on some technical issues are foreseen in other IGDs (e.g. Voltage issues, Frequency parameters, restoration issues).

### Stakeholders have suggested that it contains:

- A list of the non-exhaustive parameters of the NC RfG, DCC and HVDC which will need a national choice. This list could then be categorized following different criteria (Frequency/Voltage/etc), (span of the needed coordination), ...
- A clarification of the overriding goals defining relation between coordination between countries and harmonized values
- An explanation of the origin of the ranges present in the different codes
- Guidance on possible processes to be followed for the design and justification of the non-exhaustive parameters
- Within the range defined in the code, a proposal of options/alternatives, as much as possible inline with standards, and including the typical drivers for and impact of these options
- A clarification of the expected role of the Stakeholder Group in the definition of the non-exhaustive parameters and their influence

# Third set of IGDs - Overview

- **Voltage related parameters for non-exhaustive requirements**
  - Its objective is to give guidance on considerations on the non-exhaustive voltage parameters of the NC RfG, DCC and HVDC needed to make the national choices.
- **Reactive power requirement for PPMs & HVDC converters at low / zero active power**
  - Its objective is to give guidance on considerations relevant to defining the need for reactive power at low active power operation, including impact of otherwise switching capability on and off whenever an active power is exceeded or gone below, as the power source (e.g. wind) or set-point varies.
- **Reactive power on TSO-DSO interface**
  - The purpose of this IGD is to collate the main considerations associated with the 3 requirements in NC DCC for reactive power exchange., including changing needs to regulate voltage as embedded RES capacity increases and availability of transmission based capacity reduces.
- **Voltage stability in a converter dominated system**
  - Its objective is to give guidance on how to deal with the emerging evidence that very high penetration of converter based power sources may lead to loss of stability. What are the considerations for defining the need or otherwise for mitigating actions (such as careful consideration of converter control strategy) and how could this be implemented at a national level in RfG and HVDC?

# Third set of IGDs

## Voltage stability in a converter dominated system

Its objective is to give guidance on how to deal with the emerging evidence that very high penetration of converter based power sources may lead to loss of stability. What are the considerations for defining the need or otherwise for mitigating actions (such as careful consideration of converter control strategy) and how could this be implemented at a national level in RfG and HVDC?

**Stakeholders have suggested that it contains:**

- **Analysis of the problem / characteristics of the problem**
- **Determine if TSO is affected**
  - Normal operation
  - System split
- **First functional requirements**
- **It might be partial knowledge**

# Fourth set of IGDs - Overview

- **Post Fault Active Power Recovery**
  - Its objective is to give guidance on the purpose of these requirements and on how to proceed when implementing the requirements on post-fault active power recovery for Type B Synchronous Power Generating Modules, Type B Power Park Modules and HVDC systems.
- **System Restoration Requirements**
  - Its objective is to give guidance on how to define the non exhaustive and non mandatory technical requirements necessary for system restoration. How to ensure consistency between the requirements for the generators, HVDC links and demand facility in order to have an efficient restoration plan.
- **Fault Current Contribution for PPMs and HVDC**
  - Its objective is to give guidance on the purpose of these requirements and on how to design these specific requirements for power park modules or HVDC systems connected to distribution or transmission networks to deliver an adequate reactive current injection during short circuits and after fault clearing when the voltage has not recovered.
- **Real-Time Data & Communications Including redundancy**
  - Its objective is to give a general overview of the different categories of information flows (e.g. DSO-TSO, DSO-DSO, DSO-Generating unit) and its purposes.

# Fourth set of IGDs

## Fault Current Contribution for PPMs and HVDC

**Its objective is to give guidance on**

- the purpose of these requirements and how to design these specific requirements for power park modules or HVDC systems connected to distribution or transmission networks to deliver an adequate reactive current injection during short circuits and after fault clearing when the voltage has not recovered.

**Stakeholders have suggested that it contains:**

- Justifications of why is this requirement needed and to explain the possible challenges related to correct operation of the protection systems (short circuit contribution, multi-directional flows in LV networks)
- Clear recommendation on required time delays, current levels and accuracy of the fast fault current injection.
- Current typical practices in other countries
- And provide advice on what can be expected in the future for this non-exhaustive requirement

# Fifth set of IGDs - Overview

- **Harmonisation**
  - Its objective is to give a general overview on further harmonisation via the national implementation process. Reflecting that cross border impact and associated coordination rather than harmonisation is driving this process. Could standards help to create desired further harmonisation?
- **Guidance on compliance, test and monitoring**
  - Its objective is to give guidance on appropriate considerations on how to proceed, when deciding on further details at national level for these requirements.
- **General guidance on CBAs**
  - The purpose of this IGD is to collate the main considerations when preparing national processes for implementing CBAs, including cooperation needed of parties to successfully complete CBAs.
- **Instruments, simulation, models & protection for non-exhaustive requirements**
  - Its objective is to give guidance on considerations for how to add practical details at national level on these aspects / processes.

# Fifth set of IGDs CBAs

The purpose of this IGD is to collate the main considerations when preparing national processes for implementing CBAs, including cooperation needed of parties to successfully complete CBAs.

**Stakeholders have suggested that it contains:**

- **Who does a CBA? Independent body. Look at existing European CBA process**

## **Scope of CBA**

- **Timeframe: how long are decisions made for? Clear universal criteria. Assessment method to establish**
- **Distinction between parties carrying out - TSO, DSO. Type of CBA - may determine scope/depth**

## **Methodology**

- **Guidance on quality, quantitative/qualitative analysis, impact screening, cost to consumers**

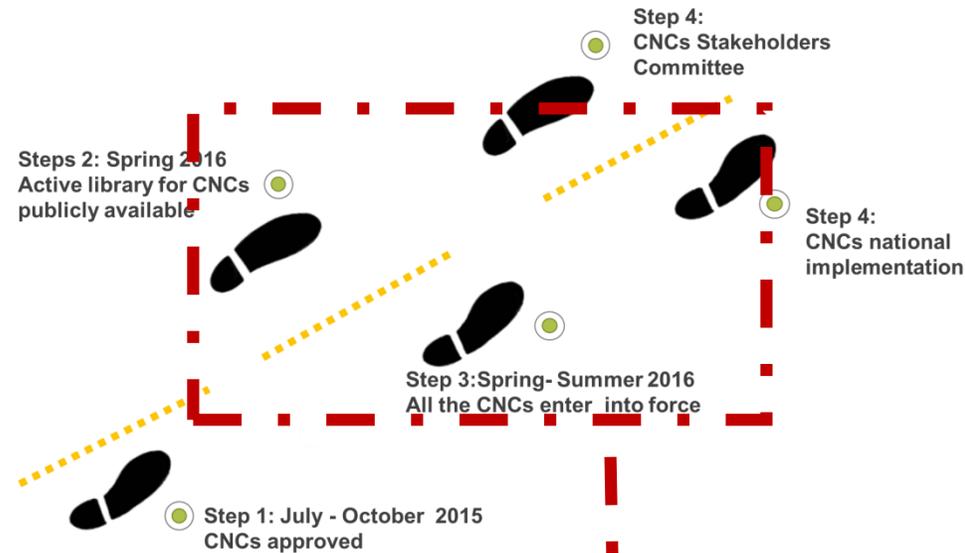
**Obligations to provide information - All parties need to have similar obligations to take part**

**Validation - Via consultation - Subject to NRA**

## **Outcomes**

- **Interpretation of outcome and justification for proposal**
- **Feeds in to NRA decision...and note cross border concerns**

# CNCs implementation – overview of the next step



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Survey on the guidances' topics

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Reliable Sustainable Connected

To access the whole outcomes of the workshop on  
CNC IGDs please click [here](#)