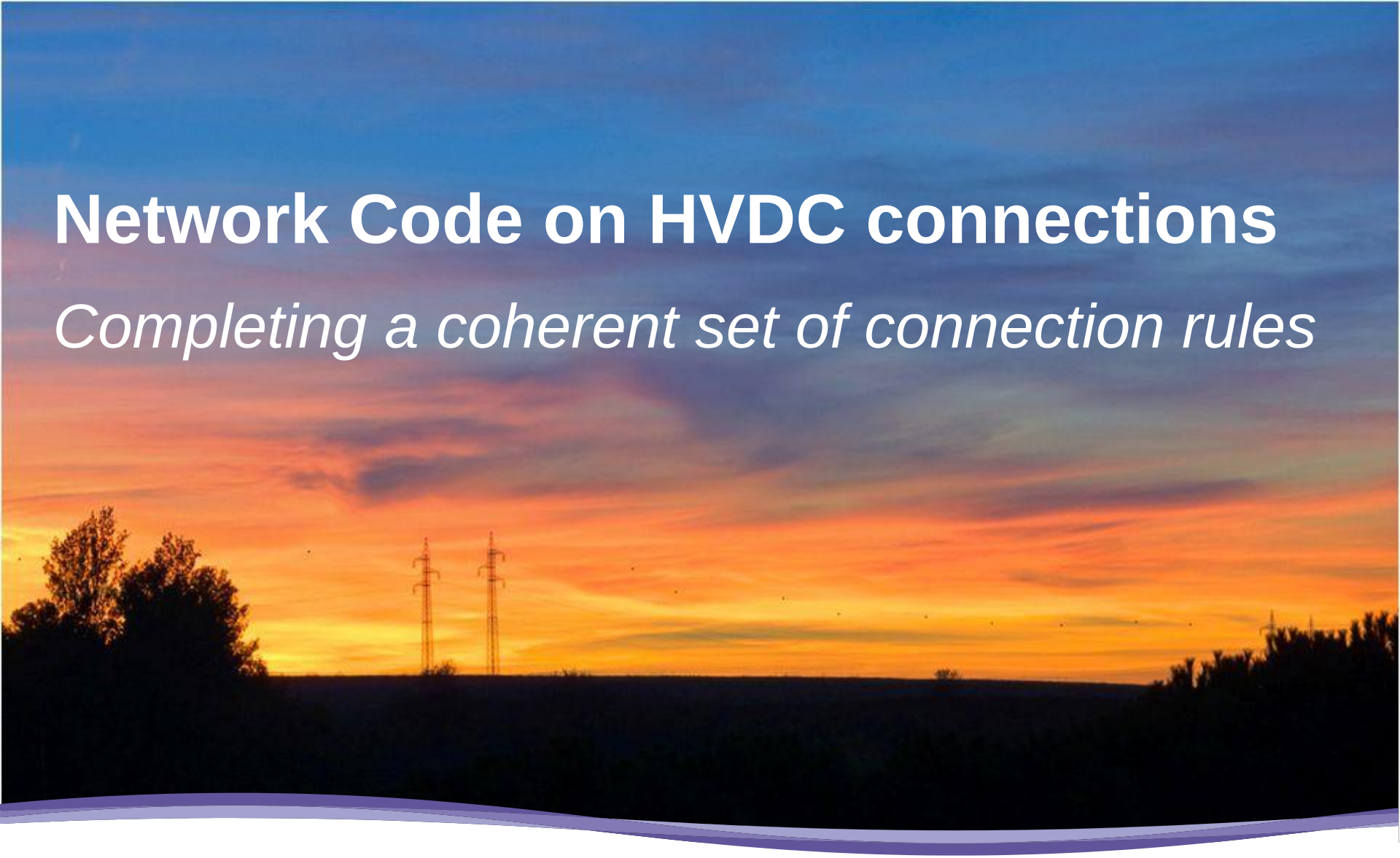


Network Code on HVDC connections

Completing a coherent set of connection rules

Edwin Haesen, ENTSO-E Senior Advisor

19 May 2014

ACER public workshop, Ljubljana

entsoe

Reliable Sustainable Connected

The 9th NC on electricity

Connection Codes

NC RfG

- From smallest generation
- To largest plants

DCC

- Industrial demand
- T/D interface
- Demand Side Response

NC HVDC

- HVDC connections
- Offshore wind

Operational Codes

Market Codes

Why does the European power system need a NC HVDC?

HVDC technology has a large potential, and is increasingly used in Europe's grid planning.

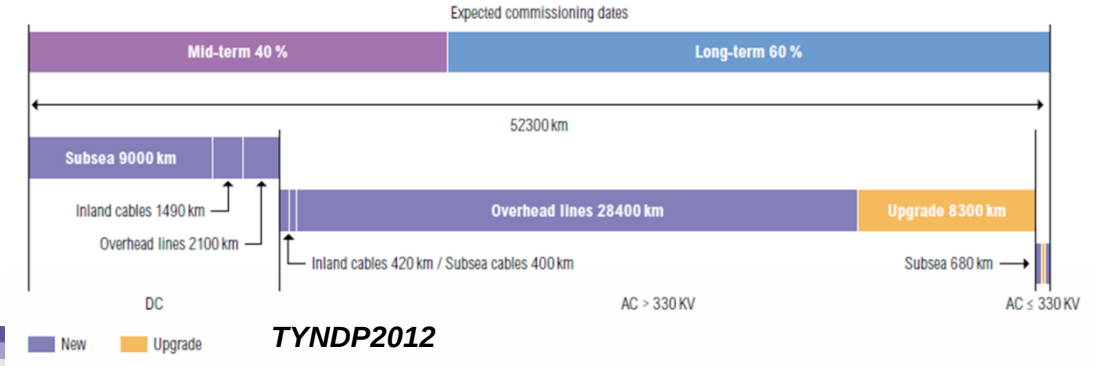
An ***integrated system vision*** is crucial at European level.

Application is based often on national best practices. Also standards are still under development.

A NC HVDC gives a clear framework for future ***project specifications*** and ***technical standards.***

A level playing field is needed for all generation (including offshore wind), for all DC links (including 3rd parties), regardless of ownership.

The NC HVDC ***completes*** the trio of connection codes.



TYNDP2012

Almost two years of European code development

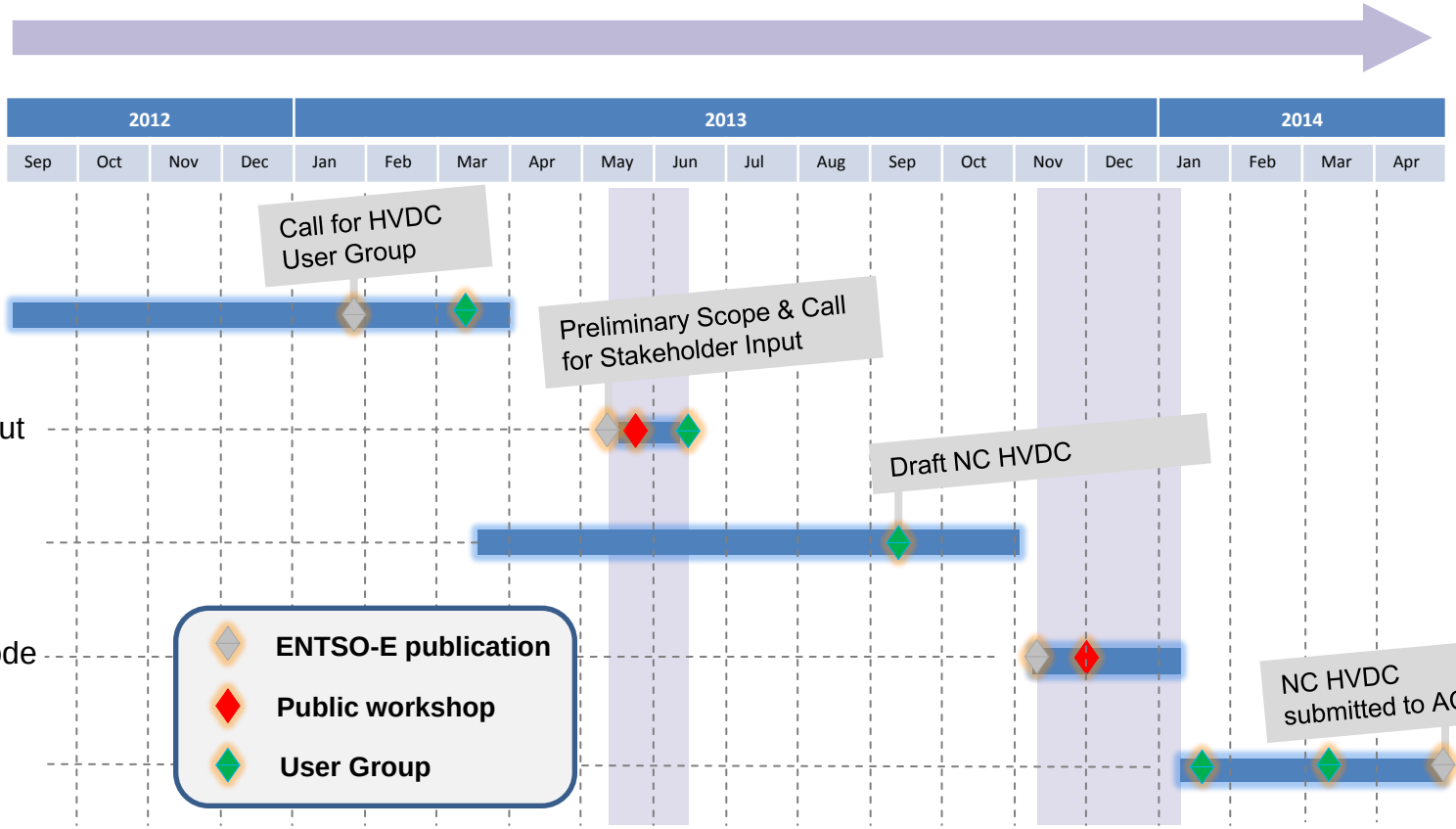
I. Initial Scope

II. Call for Stakeholder Input

III. Drafting NC HVDC

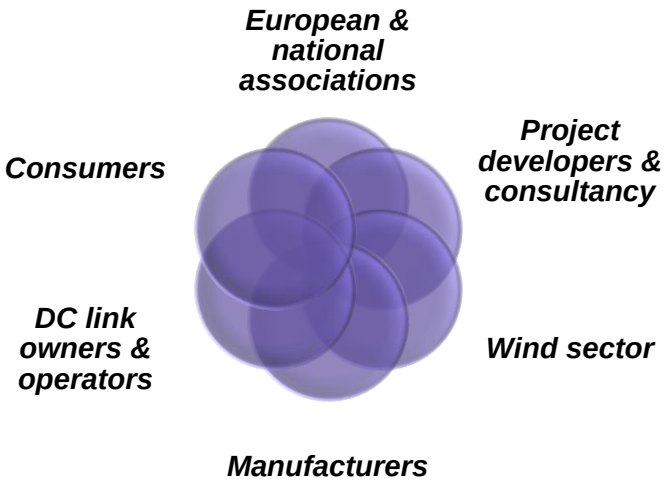
IV. Consultation on draft code

V. Finalizing NC HVDC



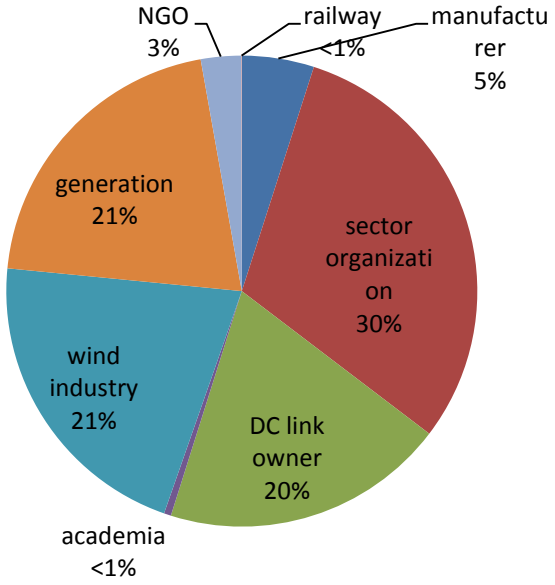
All pushing for continuing improvements of the code

Written consultation on preliminary scope and key questions (15 responses)



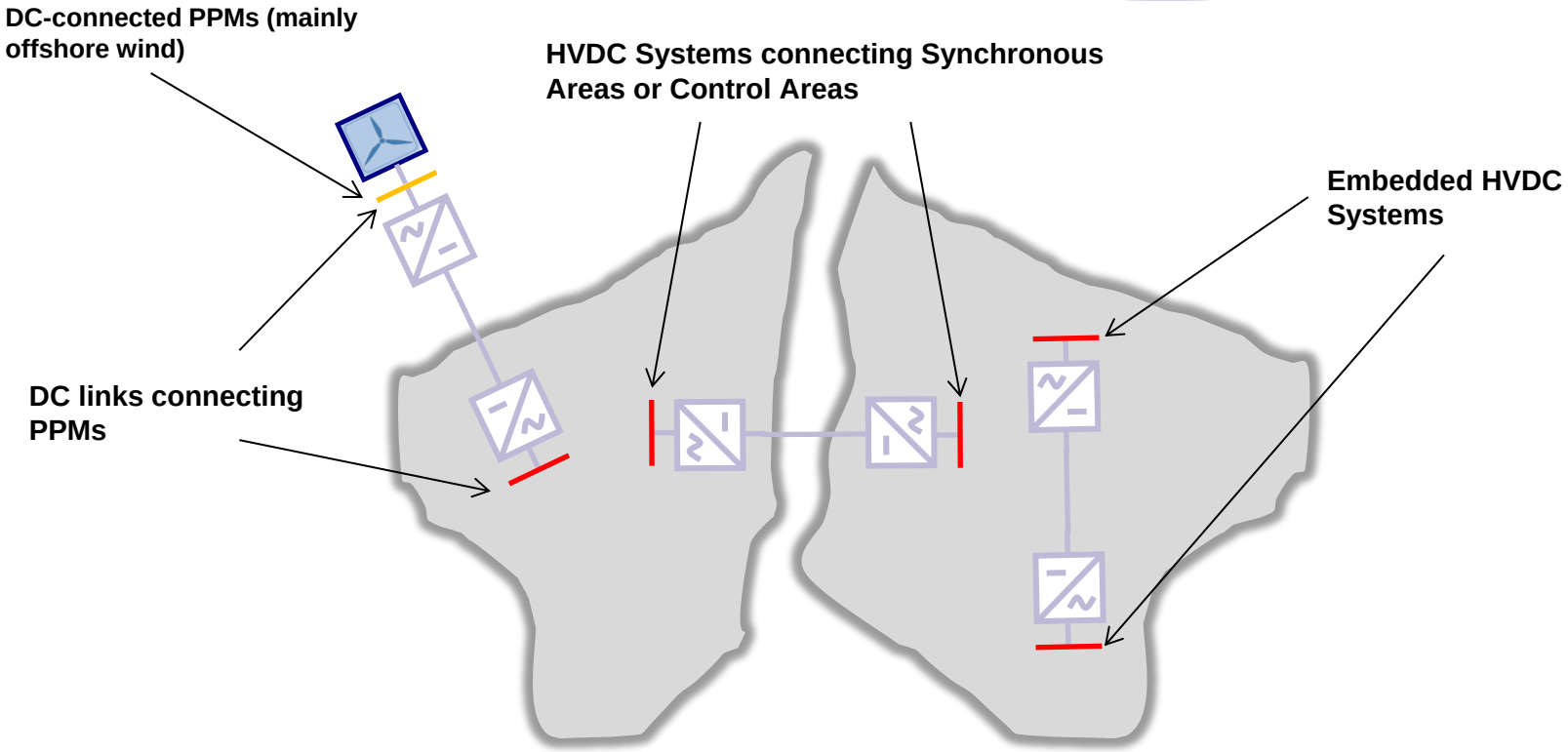
NC HVDC User Group (> 20 organizations / 5 meetings)

Written consultation on draft code (33 organizations / 2500 comments)



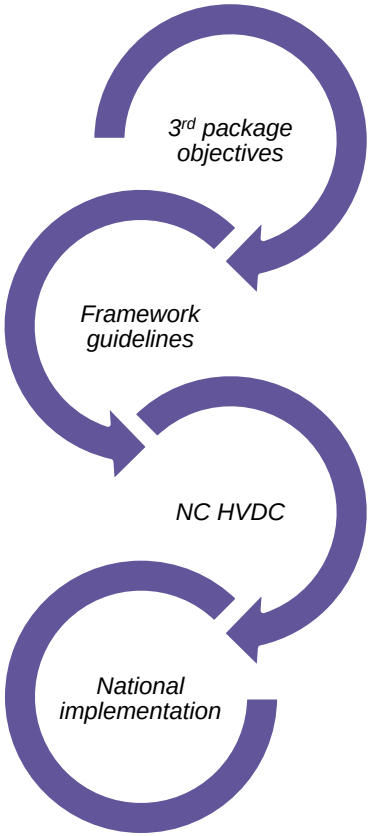
Survey to HVDC equipment manufacturers (confidential)

NC HVDC Scope



- **Focus on new connections**

NC HVDC in light of ACER's framework guidelines



HVDC general requirements

- covers all relevant technical provisions mentioned in the framework guidelines.
- complements other NCs, notably NC RfG and DCC, in requirements and procedures

Criteria for significant user

- clarity on system needs by capturing all transmission-connected links

  ensuring coherency of national practices, e.g. planning standards, for embedded links

  pragmatic approach for distribution-connected links and PPMs

Relationship with present practices

- described in supporting documents, and often discussed with other industry actors
- feedback pursued in Call for Stakeholder Input - supported by manufacturer/TSO survey
- NC HVDC is broadly in line with existing practices where applicable, and in itself does not create a significant cost increase for new projects.

Often discussed topics

- **Clarity** of a network code: aligned definitions and clear interpretation
- **Equitable and proportional** treatment of all network operators and grid users across the three connection codes
- **Avoid barriers** for future offshore developments: clear need for requirements offshore, but allowing pragmatic and efficient solutions (e.g. non-50 Hz systems, reactive power compensation, etc.)
- **Rights and obligations** of HVDC owners, network operators and other grid users
  (Power quality and mitigated interaction of controllers)
- **Costs and benefits** of NC HVDC: Survey to manufacturers and options in the code to relax requirements
- **Technology neutrality**: requirements compatible with both LCC and VSC
- Applicability at the **AC connection point**: Present code does not look at meshed DC grids or additional DC-side capabilities

Summary and next steps

- NC HVDC provides the instruments for network operators to cope with future challenges of RES integration onshore/offshore and to maintain security of supply in converter dominated power systems with large transit flows.

- Extensive stakeholder feedback throughout the entire NC development process, significantly improved the code and a common understanding of its rationale and benefits.

- ACERs current task to assess that the Network Code complies with the principles and objectives of the framework guidelines, is key for the successful further implementation of the code.