3rd NC HVDC User Group meeting

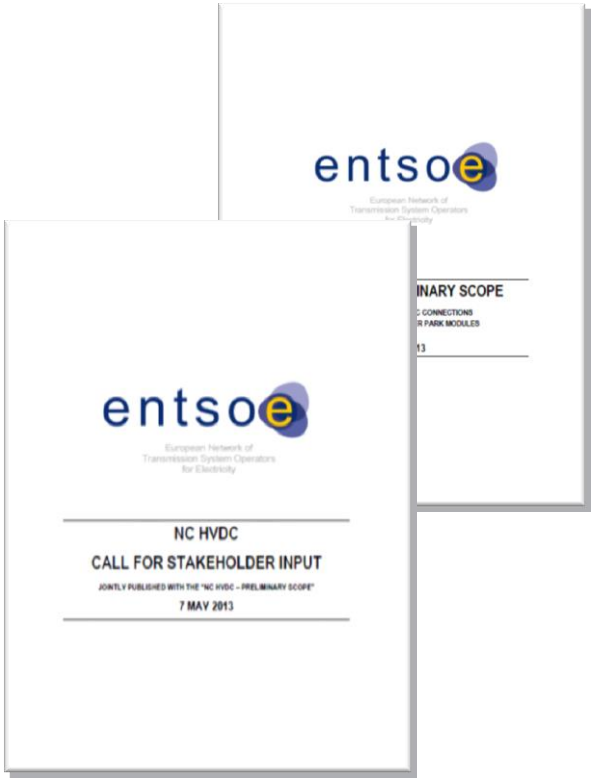
12 September 2013

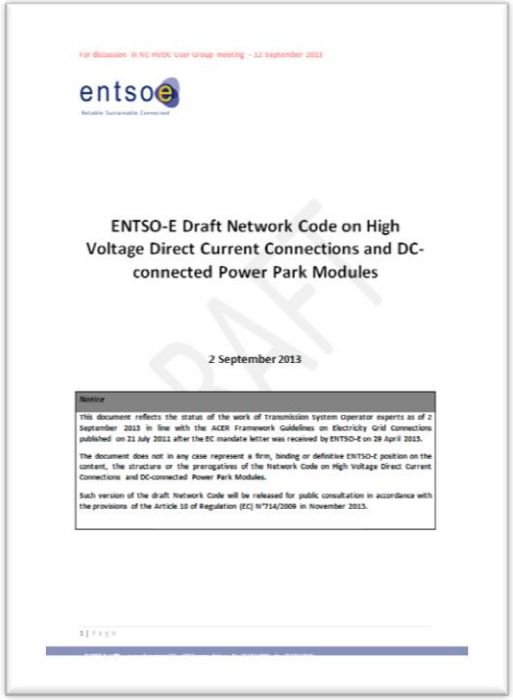
Brussels

12 September 2013

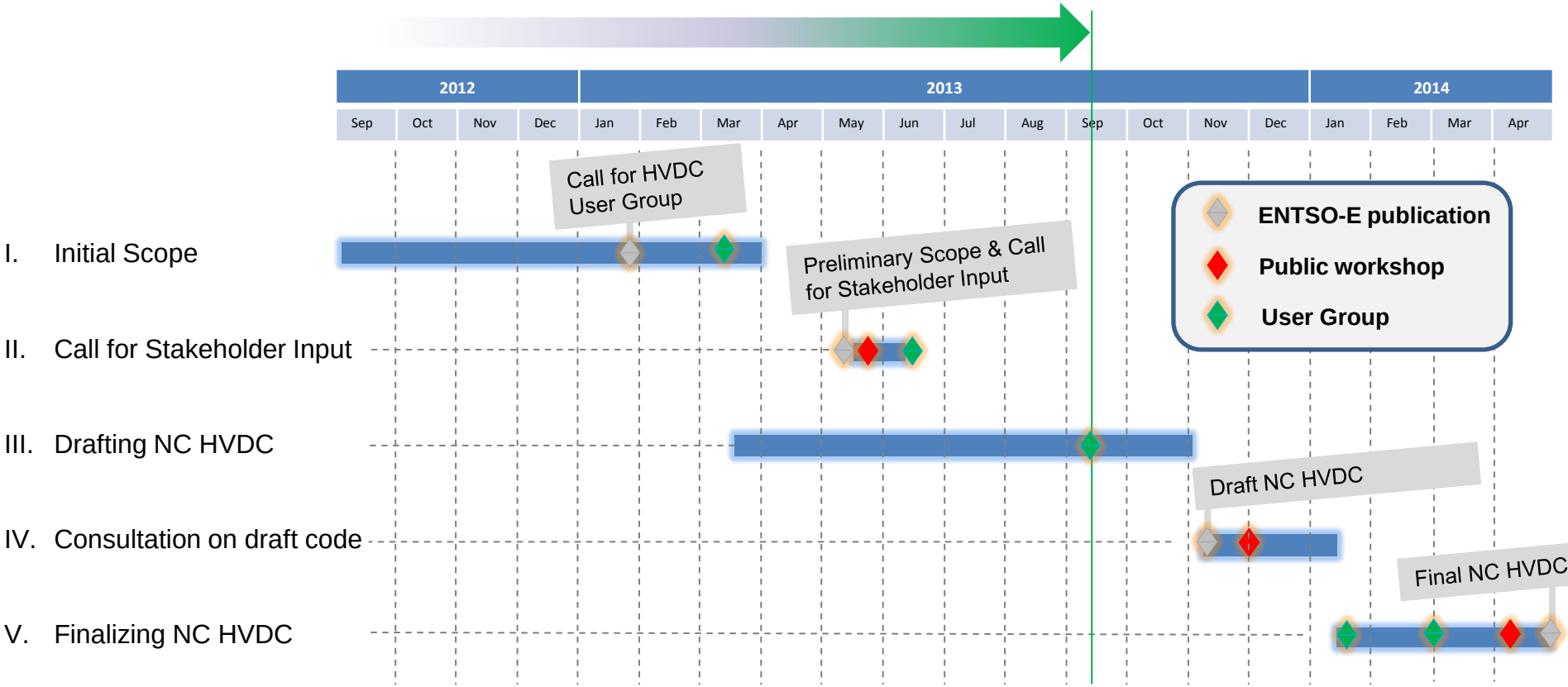
Reliable Sustainable Connected

From scope to draft requirements





General NC HVDC development



Outcome 2nd User Group meeting

NC RfG / DCC as reference point

- Be cognisant of inherent additional capabilities
- Clarify need for deviations

Agreement on 'Significant User' classification

- Dual objective of NC HVDC being forward looking and avoiding obstacles for future grid investments
- What is the exception? What should be mandatory for all? Where is flexibility for local conditions essential?

Focus on AC-side requirements for all configurations

- NC HVDC strengthens present best practices, reflects power system scenarios and enables grid development plans
- Complimentary with ongoing work in CIGRE/CENELEC

Technology-neutral approach of the code

- Further discussion based on draft requirements

Which expectations does this set for today?

1st User Group meeting

- general expectations for and benefits/opportunities of NC HVDC

2nd User Group meeting

- scope and key questions

3rd User Group meeting

- Walkthrough of draft requirements for DC Connected PPMs and HVDC connections

Towards public consultation

- Expectations for further involvement in the process?

Identify major points of attention from various sectors:

- ✓ ***How does it relate to connection criteria for other users?***
- ✓ ***Where does the requirement not fit with a vision of the future system?***
- ✓ ***Where can future developments be blocked?***

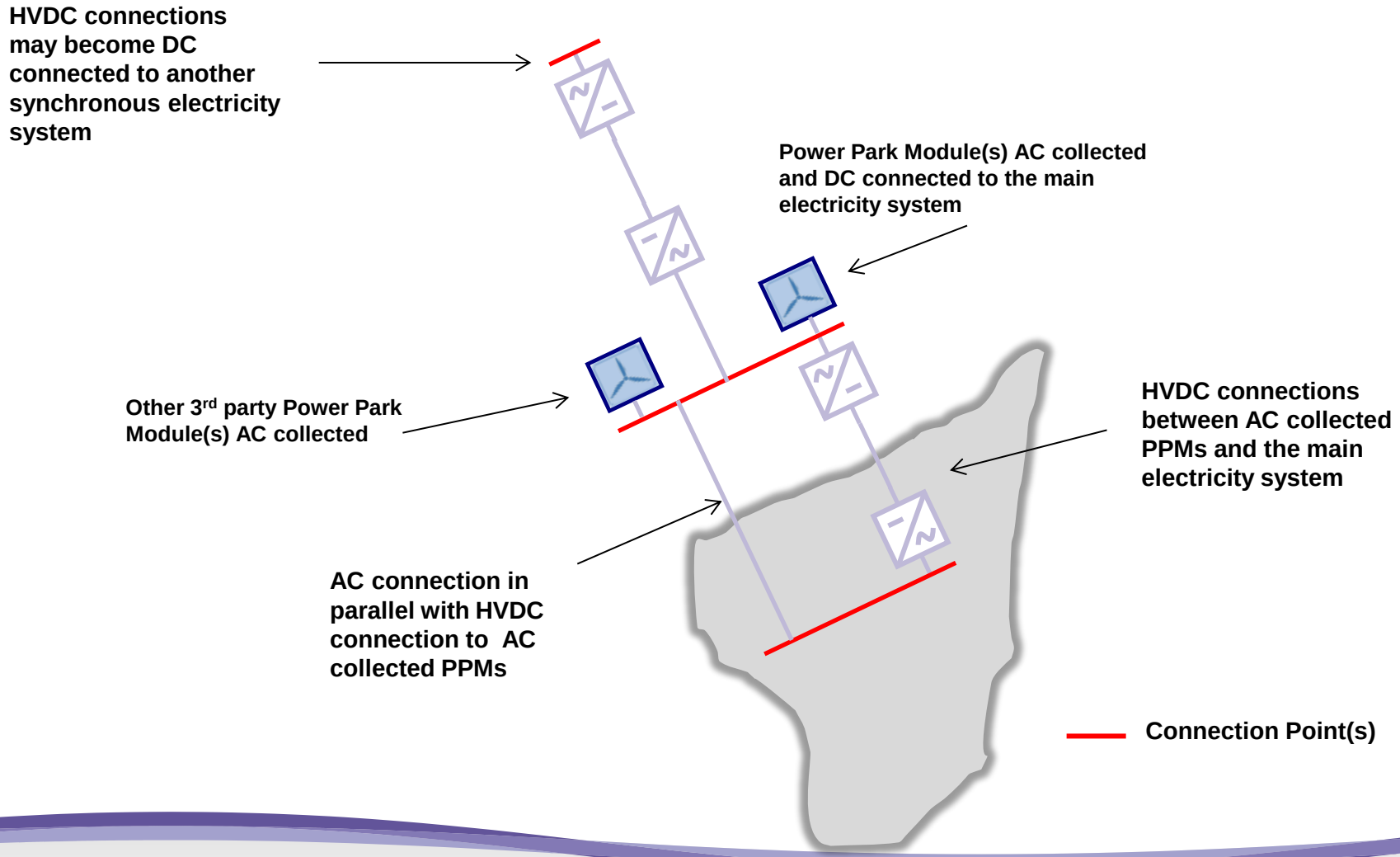
Draft agenda

10:30	***Welcome***	
10:30	Attendance and agenda	**ENTSO-E**
10:40	Status of the draft code and reflection on conclusions last meeting	**ENTSO-E**
11:00	General messages from User Group members (tbc) - Open discussion	**All participants**
12:00	Walkthrough of requirements for DC-connected Power Park Modules - Open discussion	**All participants**
12:45	***Lunch***	
13:45	Walkthrough of requirements for HVDC Systems - Open discussion	**All participants**
15:45	Summary & next steps	**ENTSO-E**
16:00	***End of Meeting***	

General views from the User Group

Requirements for DC Connected Power Park Modules

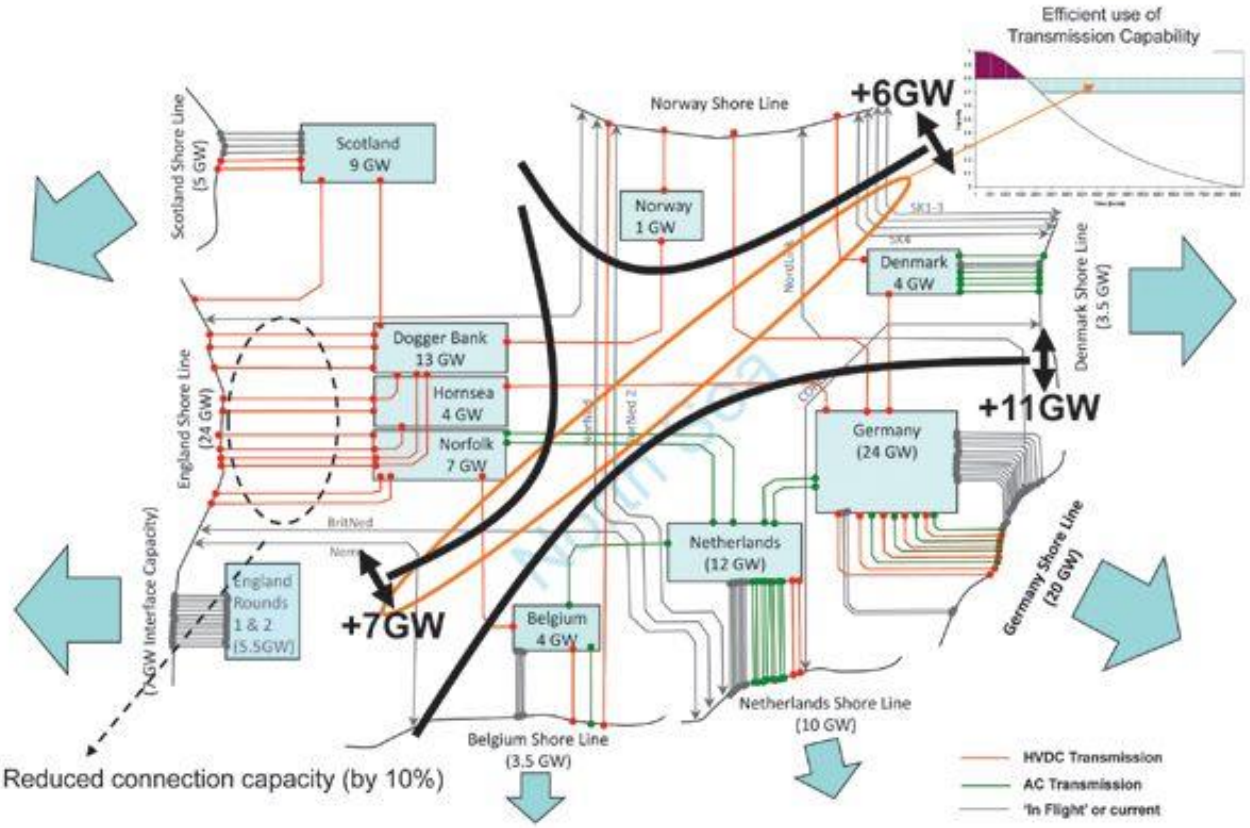
DC Connected PPMs



DC Connected PPMs

- AC connections may become DC and vice versa
- Offshore platform with DC Connected PPM may become a 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 with system services into the network which they are providing power to

DC Connected PPMs – towards large clusters of offshore wind, integrated in the European system



Offshore potential - configurations

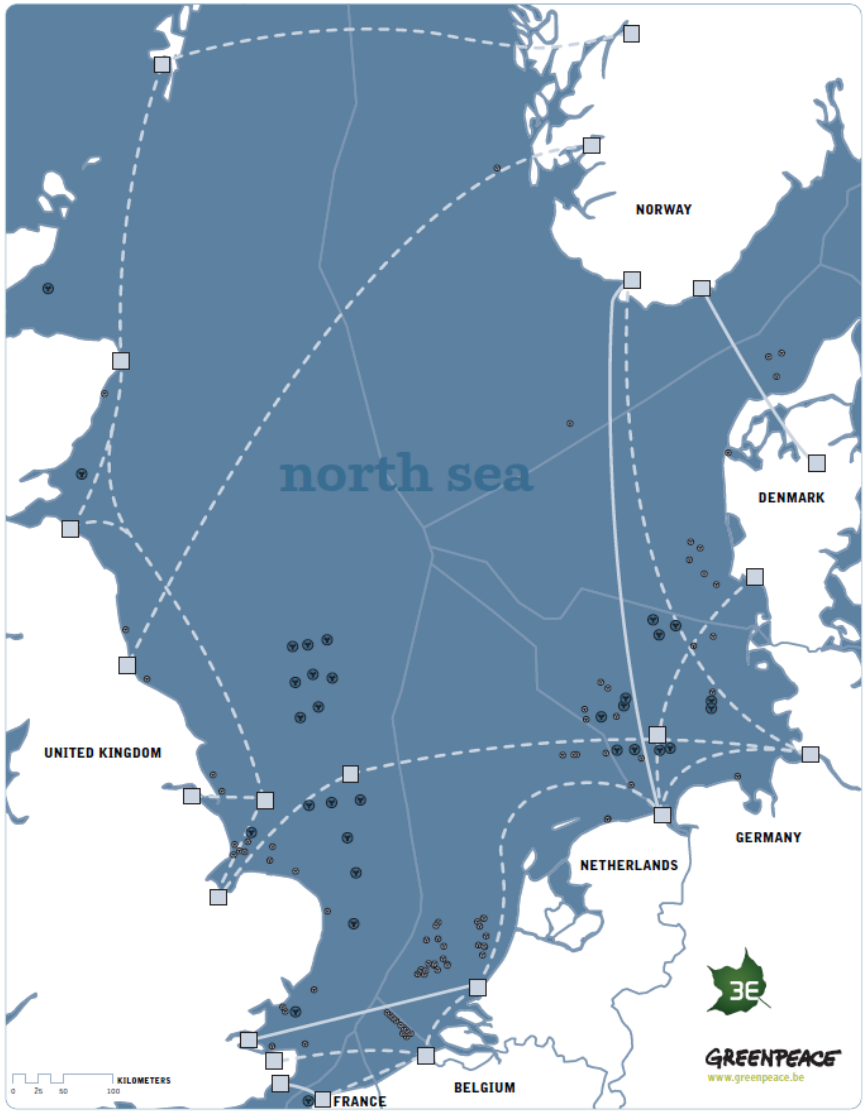


figure 9: connection of offshore wind farm cluster to shore for short distances (AC)

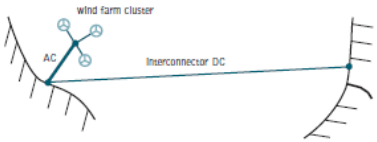
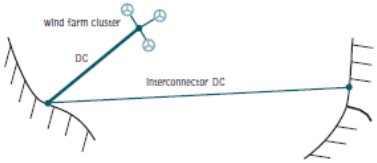


figure 10: connection of offhore wind farm cluster far from shore (DC)



LEGEND

- GRID: PROPOSED OR DISCUSSED IN THE PUBLIC DOMAIN
- GRID: IN OPERATION OR PLANNING
- PRINCIPLE HVDC SUBSTATIONS
- WIND FARMS: INSTALLED PLANNED CAPACITY < 1000 MW
- WIND FARMS: INSTALLED PLANNED CAPACITY > 1000 MW

figure 11: interconnector between onshore substations

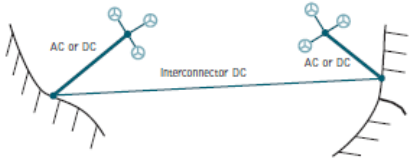


figure 12: interconnector drawn between two offshore converter stations

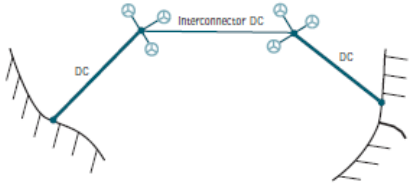
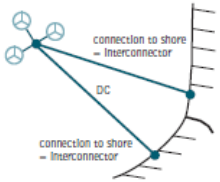


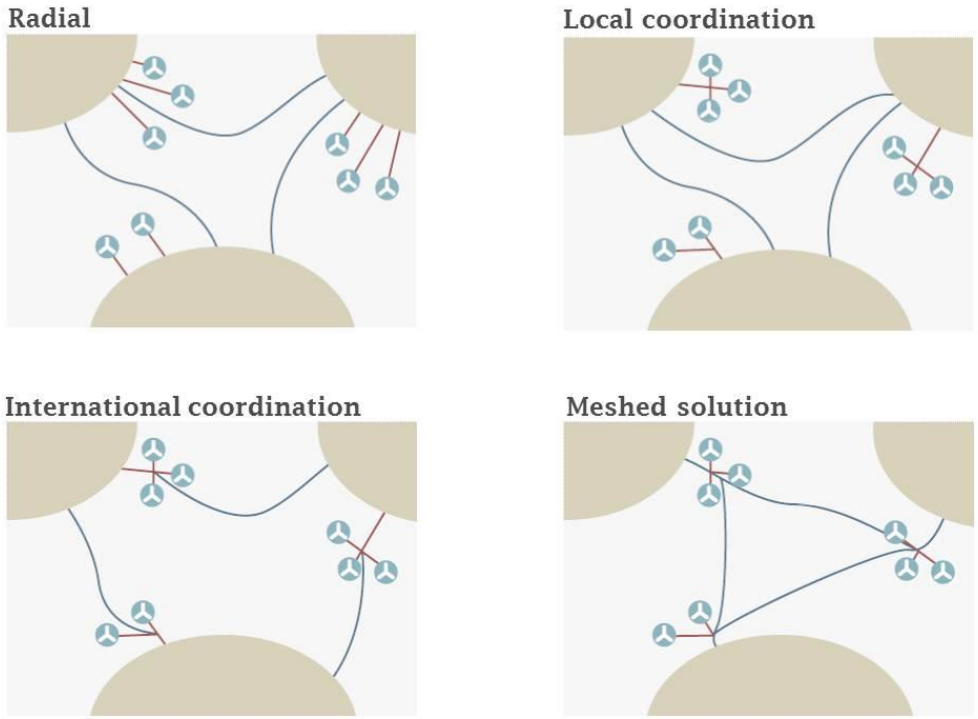
figure 13: split connection to shore with interconnector created at the same time



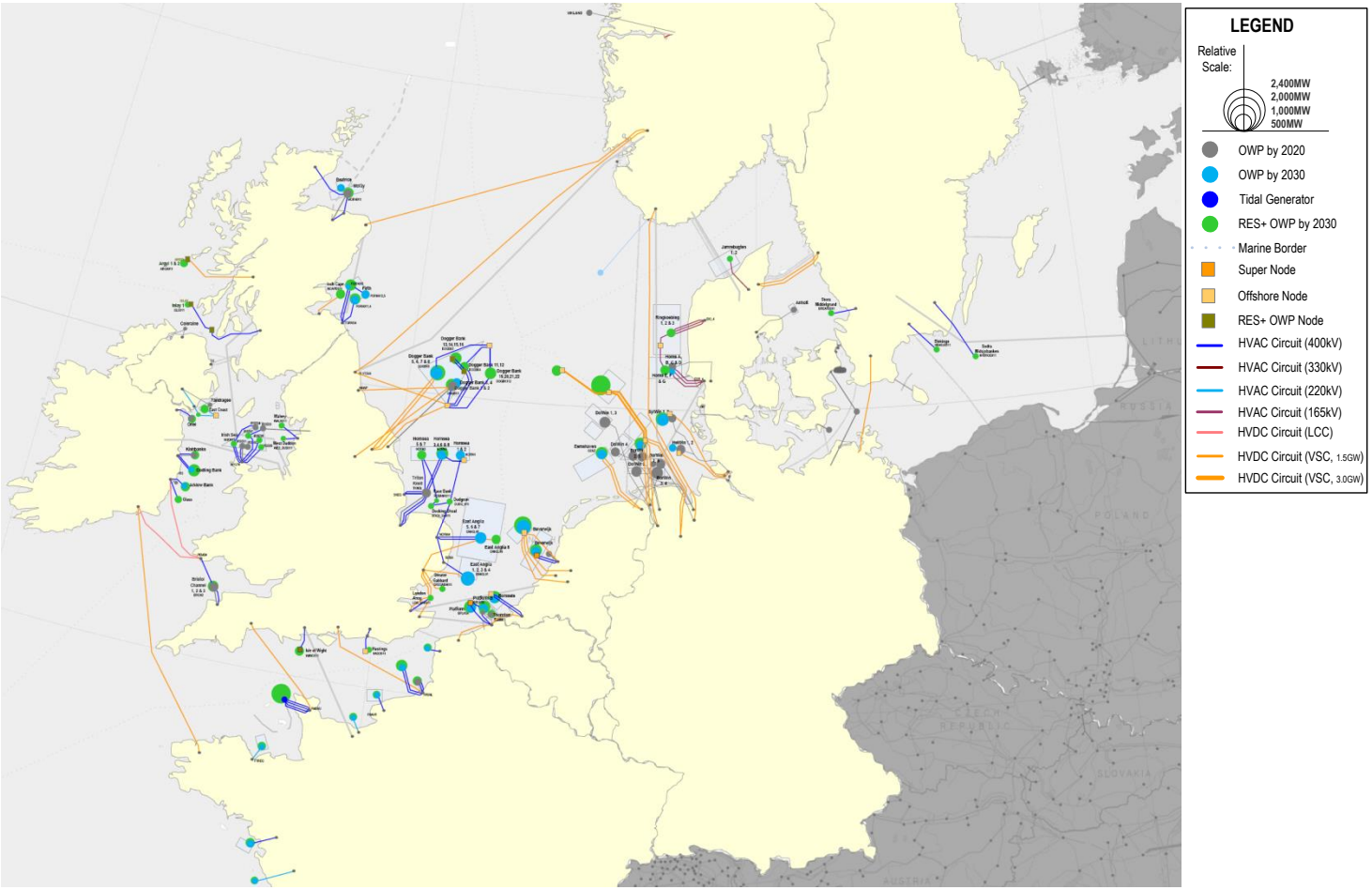
Ref: A north sea electricity grid [r]evolution ELECTRICITY OUTPUT OF INTERCONNECTED OFFSHORE WIND POWER [A VISION OF OFFSHORE WIND POWER INTEGRATION]

NSCOGI – Grid Configuration

Extreme edges of grid design strategies to capture most likely future grid configurations

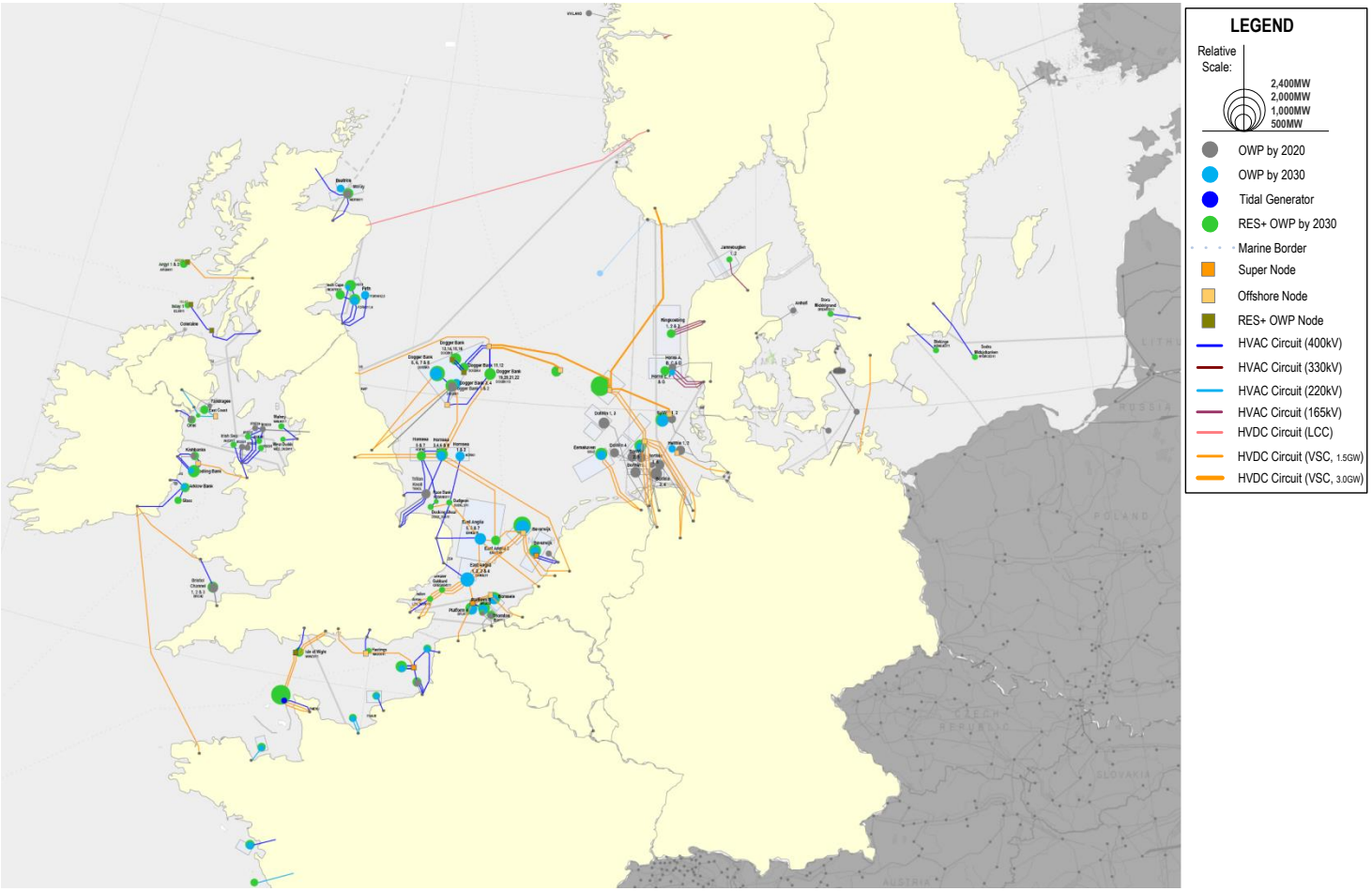


NSCOGI – Grid Configuration – radial design



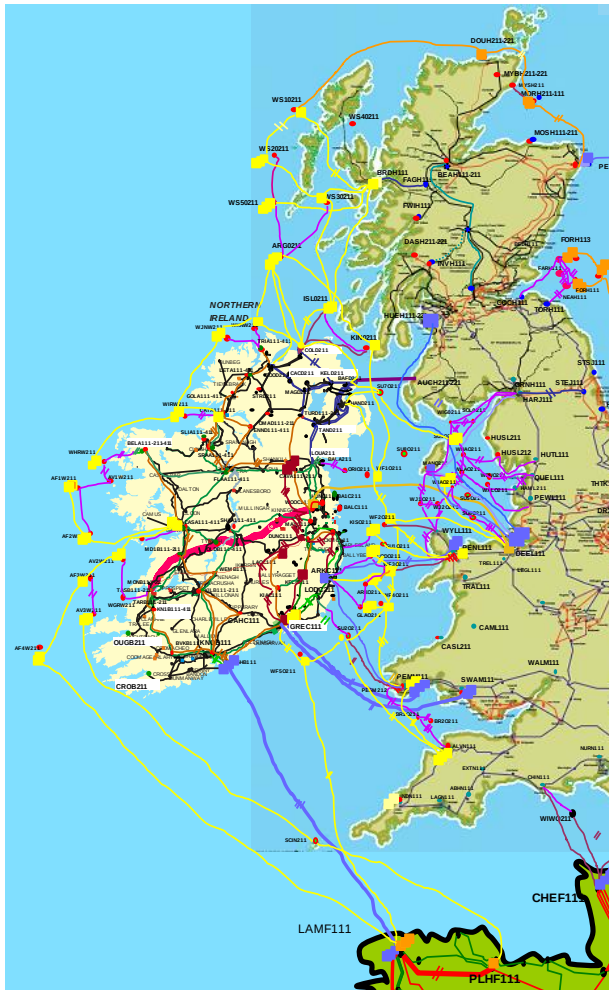
Map of radial grid design for RES+ sensitivity on the Reference Scenario

NSCOGI – Grid Configuration – meshed design



Map of meshed grid design for RES+ sensitivity on the Reference Scenario

Eirgrid offshore grid study



- 3 to 5GW offshore by 2030
- Incremental development: ensure that each step still allows to capture a wide range of scenarios
- Symbiotic nature of onshore and offshore grid
- Choice for AC, HVDC VSC or HVDC LCC depends on various parameters and project specific assessments
- Results eventually in meshed hybrid AC/DC connections

DC Connected PPMs

- Taking NC RfG requirements as starting point, specific consideration needs to be given mainly to
  - Frequency ranges: offshore system behaviour and dynamics differs from larger synchronous areas
  - Reactive power:
    - Economic optimization, based on HVDC System capabilities, in case link and generation are owned by the same party
    - RfG requirement provides flexibility with clear justifiable case to be demonstrated on a per project basis
  - Voltage support

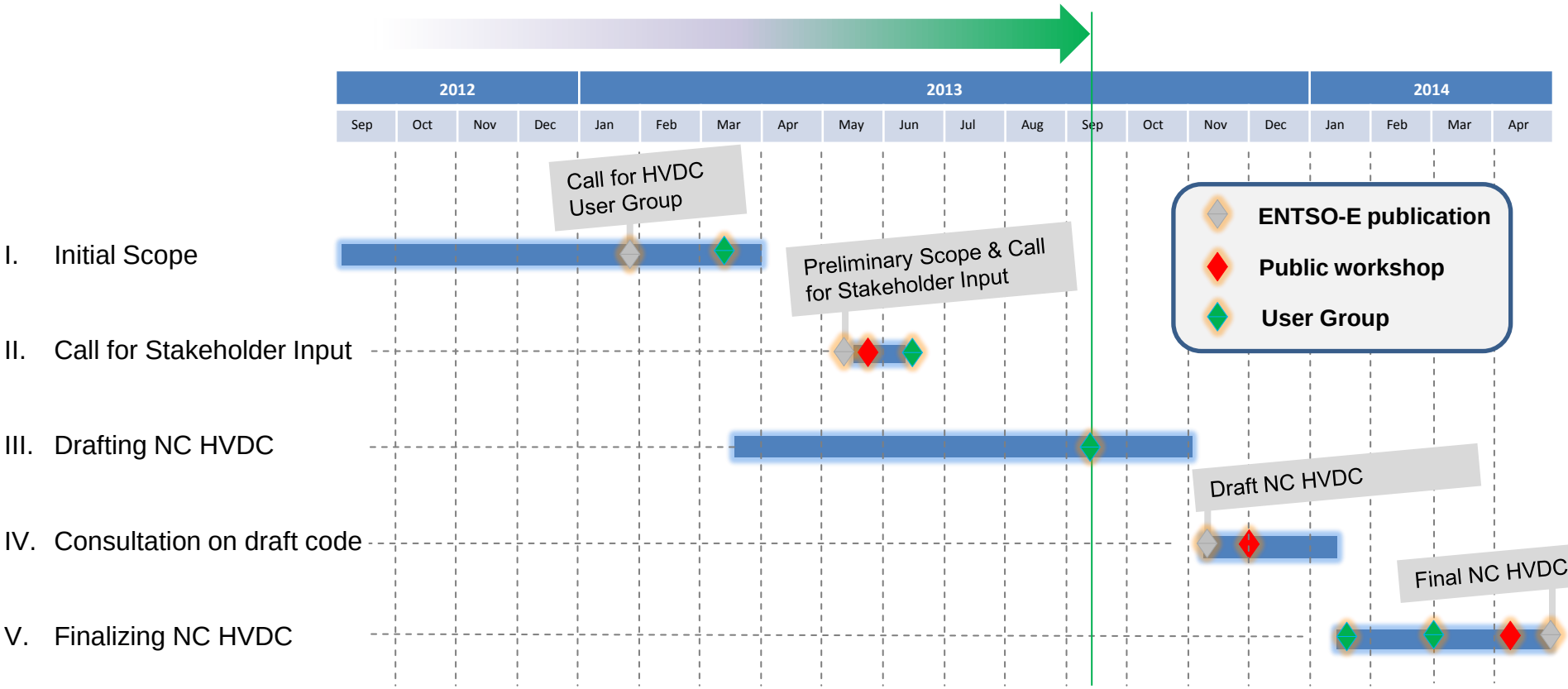
- PPM and HVDC System(s) need to have economic consistent coordinated requirements so as not to impair requirements at AC onshore transmission connection point
  - Frequency support service from PPM to onshore system

Requirements for HVDC Connections

General requirements for HVDC Connections

- **ACTIVE POWER CONTROL AND FREQUENCY SUPPORT**
  - Frequency ranges
  - Rate of change of frequency
  - Active power controllability and control range
  - Synthetic inertia
  - Frequency sensitive mode
  - Limited frequency sensitive mode (overfrequency)
  - Limited frequency sensitive mode (underfrequency
  - Frequency control
- **REACTIVE POWER CONTROL AND VOLTAGE SUPPORT**
  - Voltage ranges
  - Short circuit contribution during faults
  - Reactive power
  - Reactive power exchange
  - Reactive power control mode
  - Priority to active or reactive power contribution
  - Power quality
- **FAULT RIDE THROUGH**
  - Fault ride through capability
  - Post fault active power recovery
  - Auto-reclosure
- **CONTROL**
  - Converter energisation and synchronization
  - Interactions
  - Power oscillation damping
  - SSTI damping
  - Network characteristics
  - System robustness
- **PROTECTION DEVICES AND SETTINGS**
  - Re-connection
  - Electrical protection schemes and settings
  - Priority ranking of protection and control
  - Changes to the protection schemes and settings
- **POWER SYSTEM RESTORATION**
  - Power system restoration
  - Black start
  - Isolated network operation
- **INFORMATION EXCHANGE AND COORDINATION**
  - Operation
  - Parameter setting
  - Fault recording
  - Fault analysis
  - Simulation models

Next steps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I. Initial Scope
II. Call for Stakeholder Input
III. Drafting NC HVDC
IV. Consultation on draft code
V. Finalizing NC HVDC
Call for HVDC User Group
Preliminary Scope & Call for Stakeholder Input
Draft NC HVDC
Final NC HVDC
ENTSO-E publication
Public workshop
User Group

Feedback on scope	Feedback on draft proposals	Web based consultation mid November to mid January	Assessment of comments with the User Group
General views	**First proposals - Impact - Suggestions for improvement**	**Status of the code - general and in its details**	**Finalization**