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HVDC Network Code – Update

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Sept 2013 JESG

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Current Progress

- Ist Draft for public consultation is being finalised (Sept – Oct)
- Outcome from 2nd User Group meeting (11 June)
  - Focus on onshore AC side requirements
  - Be cognisant of inherent technical capabilities
  - Alignment with RfG/DCC as far as possible
  - Agreement on Significant Grid Users
  - Technology neutrality should not be a barrier to development
- Some Initial Comments from 3rd User Group Meeting (12 Sept)
  - Important to get clear definitions
  - Conflicting requirements from both ends of “Relevant TSOs”
  - Reactive requirements – too much offshore; should be local issue
  - Some requirements are unnecessary and add to upfront costs
  - Unbalance Information exchange – too little from TSOs
  - Need an offshore code

HVDC Code Key Dates

- 29 April 2013 - Mandate received by ENTSO-E to draft code
- 7 May – 7 June – feedback requested from stakeholders on Preliminary Scope document and on the questions raised in the Call for Stakeholder Input document.
- 11 June – 2nd user group meeting
- 12 Sept - 3rd User Group Meeting

Going forwards:

- Publication of Draft Code in early November 2013
- Public consultation 7 Nov 2013 – 7 Jan 2014
- GB: 2 day stakeholder workshop to step through code and determine key issues
- 2nd Public workshop end Nov 2013 (TBC)
- 4th User Group meeting Jan 2014
- 5th User Group meeting Feb/Mar 2014
- 3rd Public workshop workshop early April 2014
- 1 May 2014 - Submission of code to ACER
- GB: May/June 2014 DECC/Ofgem stakeholder workshop to pass on to DECC key issues for comitology

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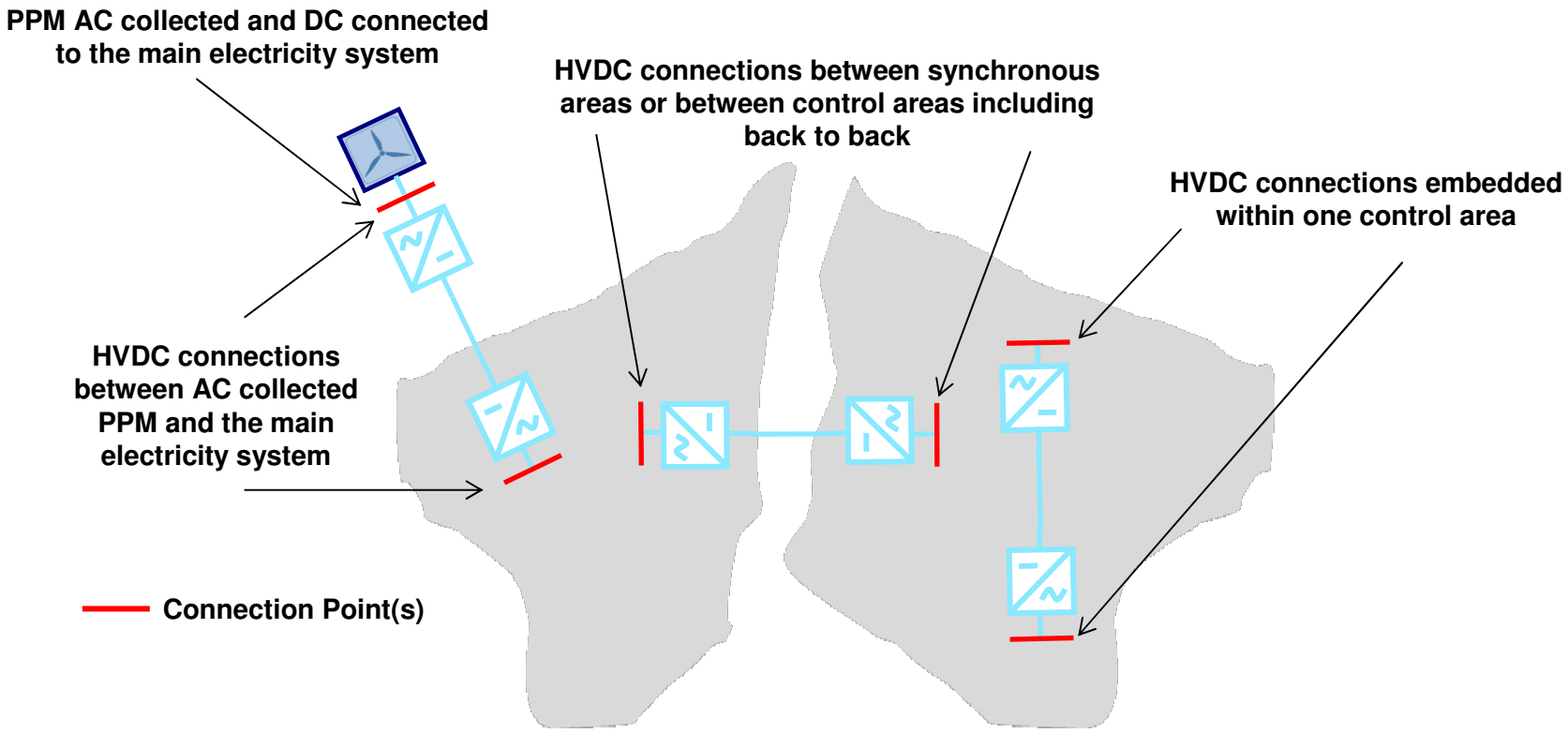
Significant Grid Users



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Requirements for HVDC and PPM

- At HVDC substation(s) at onshore AC end
  - Active power control and frequency support
  - Reactive power control and voltage support
  - Fault ride through
  - Control
  - Protection devices and settings
  - Power system restoration
- Requirements for PPM and HVDC substation
  - PPM – align with RfG if possible
- Information Exchange and Coordination
- Operational Notification Procedure
- Compliance
- Derogations

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Power Park Module Requirements

- As far as possible, align with RfG
- The HVDC substation at the PPM end shall meet the same requirements as the PPM if applicable
- Additionally, the HVDC substation at the PPM end shall also meet the requirements of the HVDC substation at the onshore end if applicable
- The PPM and HVDC connection need to be economically coordinated so as not to impair requirements at the onshore AC transmission connection point

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Impact on GB - system extension offshore

- Single to multi-terminal
  - If different vendors, control systems have to be compatible
- Initial AC connection of PPM, later addition of DC connection from PPM to a different onshore connection point, or vice versa
  - Is PPM subject to both RfG and HVDC codes?
- Multiple windfarms that are AC connected, extended to form a DC mesh, with DC connections to one or more synchronous areas
  - Does this form a separate offshore synchronous area?

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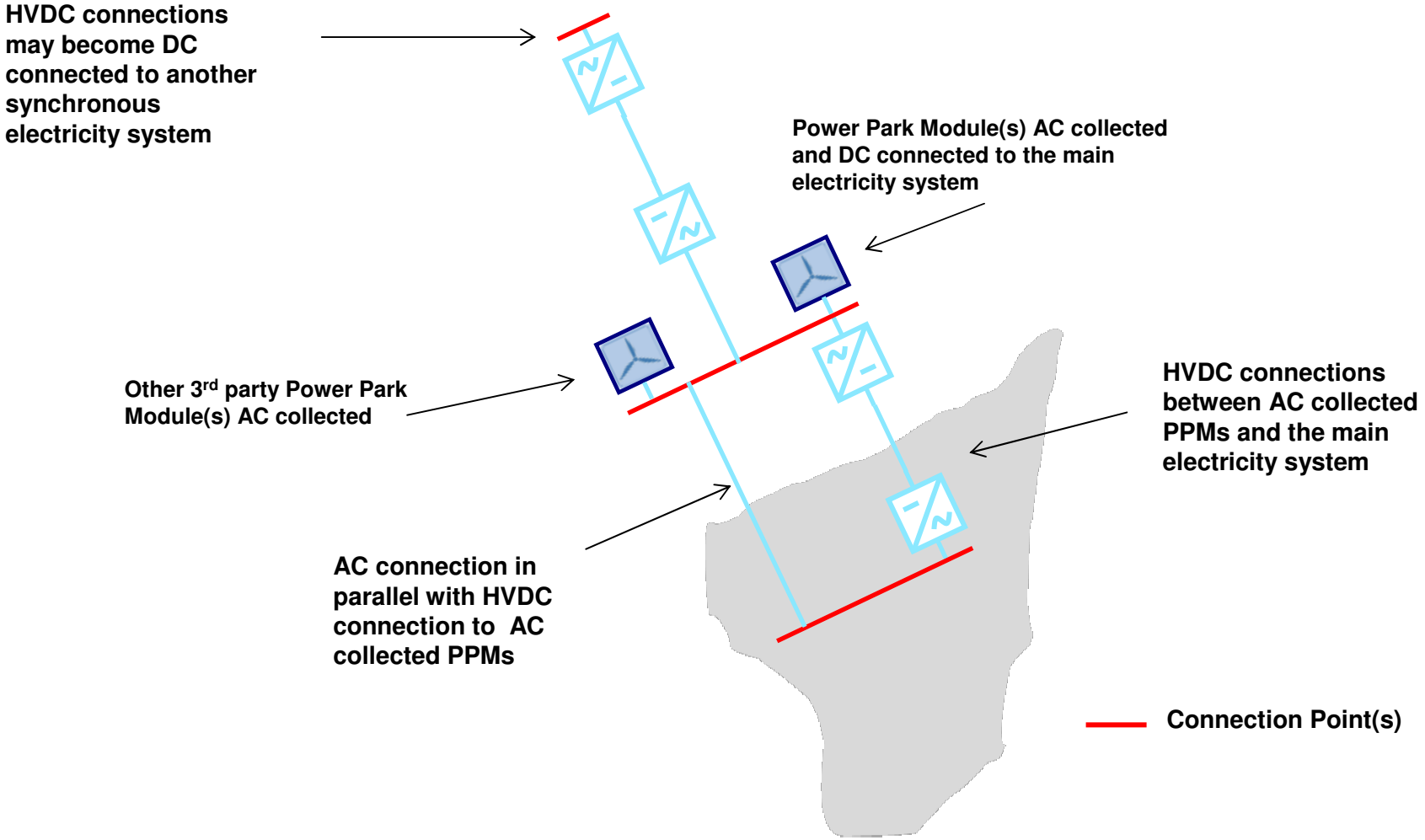
DC Connected PPMs



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Impact on GB – Compliance and derogation

- Compliance issues
  - Does ownership matter?
    - TSO (i.e, NGET, SPTL, etc)
    - OFTOs
    - Third parties (i.e Britned etc)
- Embedded HVDC systems(i.e within AC system)
  - Single TSO owned, in one control area
  - Multi-TSO owned, in one control area
  - Do these have x-border impact?
- Technical compliance not an issue for Relevant TSOs – necessary for the efficient and secure operation of the transmission system
  - Do TSOs compliance test themselves?

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Impact on GB – technical requirements

- OFTOs and PPMs
  - Coordination necessary between PPMs and OFTOs
  - Complexity increases with multi-vendor extensions of system
- Interconnectors
  - Technical requirements – not a major issue
  - Market operation, reserve capacity and firmness are major concerns – not within the scope of this code
- Relevant TSOs - Technical compliance not an issue for TSOs – necessary for the efficient and secure operation of the transmission system
  - Do TSOs have to subject themselves to their own compliance procedure?
- Retrospective Application
  - CBA required for existing systems
  - Likely to dictate limited scope of retrospective application, with only minor software/control system changes being viable