(Smart) regulation for far and large offshore wind integration

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22 January 2014

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General Considerations

- Unlike the meshed onshore systems, the North Sea Grid does not yet exist except for a hand full of point-to-point interconnectors…
- …Which gives us free dimensions in applied technology, regulation and design.
- (it is assumed) a grid brings economic benefits:
  - Better use of existing electricity generation resources
  - Higher security of supply ad reserve power
  - Integration of a higher share of renewable energy generation (mainly hydropower).

Focus of Previous Studies

Study	Focus
European Offshore Supergrid Proposal (2006)	Pilot project with 10GW of wind generation in the North Sea connected to GB, Germany and NL.
Zeekracht Masterplan (2009)	"Offshore energy super ring" in the North Sea.
Oceans of Opportunity (2009)	Integration of 40 GW offshore wind generation capacity into European network by 2020 and 150 GW by 2030.
NSCOGI (2012)	Identify regulatory barriers and opportunities in general market design (support systems consistency, cost allocation).
ENTSO-E (TYNDP 2012-2022)	Scenarios (2020 and B)

What is not being investigated

- What institutions support the integration of offshore grids?
- What are the (current and potential) roles and responsibilities of the different stakeholders that participate in the OWE transmission grid?
- Who is responsible for the power quality, under which conditions and who pays for it? (Even beyond national boundaries).
- How can reliability in the system be safeguarded?
- Can regulation support the design and management of an offshore grid, and if so, how?

Point of Departure (Bauer, Herder, 2009).

Design possibilities	Social subsystem	Technical subsystem
Embeddedness (mostly emergent)	Tacit conventions and prior decisions	Tacit conventions and prior decisions
Institutional environment (emergent/deliberate)	Division of powers; assignment of jurisdiction; legal framework; general definition of property rights	Selection of standards, technology selection, architecture
Governance (deliberate/emergent)	Ownership; form, organisation, and methods of regulation; market design (entry, contracts)	Design of specific technical artefacts, protocols and routines to govern operational decisions
Operation and management (deliberate)	Regulation of prices and conditions, antitrust enforcement, social regulation	Execution of operational decisions

Objectives of the Research

- **What?**
  - To design institutional arrangements that safeguard the reliable operation of OWE in The Netherlands.
  - To design the regulatory framework that supports the functioning of the institutional arrangements.

- **What for?**
  - Inform interested stakeholders about the possibilities of their roles and responsibilities under different institutional arrangements scenarios.
  - Contribute on risk reduction (by safeguarding reliability).

Why Reliability

- Infrastructures are "balky systems":
  - Highly diverse, networked components;
  - High performance variations among components;
  - Few modal behaviours that characterize infrastructures as whole systems.
- Current focus on "hardened" designs and less on their governance!
- Reliability as a reality check of what is or not an error.

Outlook and Conclusions

- Focus on reliability.

- Case studies:

  - For the given institutional environment, analysis of current and consented developments in Germany, the UK, Belgium, Denmark and The Netherlands.
  - For current institutional arrangements, analysis of two specific (consented) cases in each country, one with stand-alone lines and one with meshed technology.
  - Adaptation of the framework for alignment (Scholten 2009, 2012, 2013) to the case of OWE (together with 3 stakeholders).