

What modelling tools (EMT or phasor-domain) and IBR dynamic modelling approaches (vendor-specific or generic models) have been used worldwide to develop forward looking dynamic models of years ahead power systems accounting for forthcoming network changes and emerging technologies?

The phasor-domain models have been used for many decades to evaluate the small signal and transient stability of large power systems with conventional generation. As the power electronic based devices get dominated in power systems, the bandwidth of the phasor-domain models used by the industry is not sufficient. Therefore, EMT simulations have been adapted for the evaluation of the power system stability. As we are all aware, EMT simulations are now used for large-scale power system studies of power electronics dominated power systems. Furthermore, the industry is trying to adapt more and more real-time digital simulation and hardware-in-the-loop testing for the evaluation of the device performance during planning and operation.

The recent announcement of energy island projects in Europe further highlights the need for coordinated modelling and study approaches because of the reasons such as 100% power electronic dominated system with zero or a very small amount of conventional loads, evolving system with multi-terminal HVDC and multi-vendor scenarios, and no prior experience. Recently we have developed simulation requirements for de-risking the North Sea Wind Power Hub concept [1] considering the aforementioned factors. The developed simulation requirements consider different availability of software models and hardware replicas. The model requirements for each phase of the project with and without the availability of the hardware replicas are shown in Figure 1. For both approaches, the validated software and real-time models shall be used. Also, as this project may involve multiple manufacturers, it is important some inputs and outputs, critical to the overall operation of the energy hub, are accessible to the user. Furthermore, if not visible in the model, detailed documentation of control structures shall be made available.

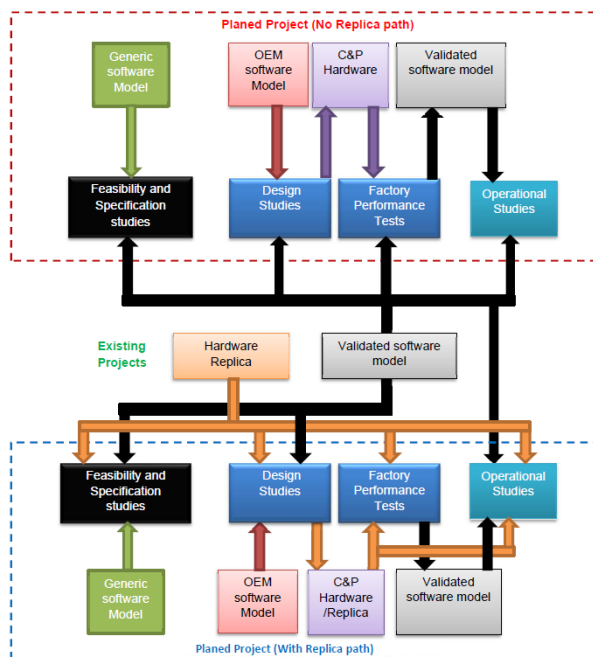


Figure-1: Model requirements with and without Hardware replica models

[1] <https://northseawindpowerhub.eu/knowledge>