

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?

EirGrid uses the phasor-domain tool to perform dynamic studies (transient and frequency stability) in real-time and offline study applications in operational timeframes. We are using a combination of WECC 1st generation and WECC 2nd generation models for IBRs and user-defined positive-sequence models for HVDC interconnectors. We are in the process of converting all WECC 1st generation models to WECC 2nd generation models with site-specific parameters for existing connections, and for future connections generic parameters are used.

We are aware that a typical phasor-domain dynamic model might not be adequate to identify potential interactions and instabilities related to converters control in weak grids (low system strength). For example instability caused due to interaction of phase-locked loop (PLL) and inner current controller loop. We know that EMT simulations are recommended to identify these instabilities however EMT simulations are both modelling and computation-wise demanding and therefore not practical today for power system and operation analysis. As a result, EirGrid is trying to bridge the gap between the required modelling adequacy and analysis practicalities. A three-step process is under development, aimed to deal with low system strength scenarios and emerging new forms of instability.

Step 1: Screening scenarios using system strength metrics to identify potential risk of converter instabilities.

Step 2: Phasor-domain studies using enhanced dynamic models that include generic representation of fast acting controls such as PLL and current controller. This step is conducted in scenarios identified with high risk in step 1.

Step 3: Detailed EMT simulation: EMT simulations are both modelling and computation-wise demanding and perform EMT analysis when strictly necessary. This step is conducted in scenarios identified as high risk in step 2.