

# Low-Inertia Very Large Grid Digital Twins using HYPERSIM EMT Simulator for Dynamic Transient Performance Evaluation

**Keynote Session B III**

**Date: Friday, Dec 17, 2021**

**Time: 11:30 AM-12:25 PM**

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## **Abstract:**

Governments and economics encourage to decommission nuclear and coal generation systems and to integrate the maximum quantities of renewable solar and wind energy generation to decrease CO2 emission. Modern electrical grid infrastructure has therefore evolved from systems with high-inertia rotating machines to low-inertia inverter-based systems. The increased use of large quantities of inverter-based generators as well as power-electronic-based HVDC interconnection systems have the effect of decreasing the total system inertia, which make the system more sensitive and responsive to faults or other systems events. Sophisticated and fast control and protection systems must therefore be installed to ensure that the grid will return to normal and stable conditions after the event.

It is therefore evident that the integration of large quantities of inverter-based distributed renewable energy generation over very large territories heavily relying on Ethernet-based communication systems has increased the overall system complexity and has created a new level of fragility. Unless advanced countermeasures are implemented it is also obvious that modern grids will be more vulnerable to natural communication system failures and cyberattack, which could lead to partial or complete system blackouts and equipment failure.

The evaluation of transient performance of these low-inertia systems using approximated phasor-type model is questionable and some experts and utilities now contemplate the use of detailed EMT models of the grid interface with <real-code> confidential black box model of Wind and solar plants.

This presentation will present advancements and challenges to achieve real-time or faster than real-time simulation of very large low-inertia grid in relation with the Australian AEMO grid.