System Restoration and Black Start – System Operator Technical Session

Opportunity and impact

The International System Operator Network (ISON) met in November 2024 to discuss approaches to system restoration. Given the rapidly accelerating transition away from traditional synchronous generators, new and novel restoration strategies are being explored to help enable black start of power systems dominated by renewable, inverter-based resources across transmission and distribution networks.

System Operators engaged

The following System Operators (SOs) were involved:

- AEMO – Australia
- CAISO – United States (California)
- EirGrid – Ireland
- Energinet – Denmark
- ERCOT – United States (Texas)
- NESO – Great Britain.

SP Energy Networks (SPEN) – Southern Scotland, Merseyside and North Wales – also attended this meeting to share insights.

Key insights

Distributed ReStart project

SPEN, the distribution asset owner in Southern Scotland, Merseyside and North Wales, shared details of how it has successfully tested the Distributed ReStart project aimed at improving restoration following a partial or total power system shutdown through the use of distributed energy resources (DER).

The project proved successful in isolated trials[1] using hydro and biomass generators, and non-synchronous converter-connected battery energy storage systems (BESS), to act as anchor generators for a power island.

Trials showed that the block load pickup capacity of BESS is over five times greater than synchronous machines of the same capacity, and BESS restart capabilities were more reliable when Point on Wave switching was engaged. However, conventional synchronous generators are the preferred anchor generator type in larger power islands because they generally do not have the same fuel supply limitations, and can leverage fast acting BESS as a means of effectively balancing supply and demand.

[1] Please see https://www.neso.energy/document/271831/download for more information about the trials.

NESO restoration tools

NESO continues to work with the wider industry to ensure that necessary systems and processes are in place to support the implementation of the Electricity System Restoration Standard (ESRS) obligation. As part of this, NESO is planning to commission a Restoration Decision Support Tool to support its control room with recommendations regarding which routes to restore and real-time estimates of restoration times in each region, as well as a power island growth and synchronisation strategy. Inputs include network topology, demand forecasts, restoration contractors, Local Joint Restoration Plans and Distribution Restoration Zone Plans.

NESO is increasing industry-wide training with involvement of Transmission Operators for full simulations of restoration from a complete shutdown.

NESO now includes offshore wind generation (approximately 50 gigawatts [GW] in the next few years) in its restoration strategy.

NESO regularly tests Restoration Contractors with self-starting capabilities, on a suite of tests done annually, biennially, and triennially.

Recommendations

Based on the presentations in the technical session, it is recommended that SOs:

- Evaluate their system restoration strategies, including industry training and coordination
- Continue to share insights and learnings with other system operators, academics and subject matter experts (SMEs).

Contact

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