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Korea Electric Power Corporation (KEPCO) is constructing the 'Local Renewable Management System (LRMS)' in Korea's southwest local power system to monitor and regulate local RESs. The LRMS is a software that monitors and controls the RESs connected to the high voltage distribution system in real time. The LRMS receives real time power system and meteorological information as input. Using this information, the LRMS evaluates the power system's stability and calculates the maximum amount of RES that system can held without violating system stability requirements by calculating system non-synchronous penetration (SNSP).

The LRMS is connected to other components for information sharing in order to anticipate, monitor, and operate the local power system. Korean Power Exchange (KPX), established the central Energy Management System (EMS), which regulates and monitors the RESs that are connected at the transmission voltage level. The Supervisory Control and Data Acquisition (SCADA) system, which also exchanges information with LRMS, receives data from the central EMS. If necessary, the central EMS issues a curtailment order to LRMS.

The LRMS consist of three major modules: state estimation DB construction module, on-line dynamic stability assessment module, and local power system control module.

The power system is separated into two parts to create the local power system database. The first power system is the local power system, which is the target power system to be analyzed and controlled. The second system is the non-target power system. The purpose of building a local power system database is to compress the non-target power system while keeping its inertia and dynamic properties.

Generic RES models are used to collect and model data from the RES connected to the target power system. The point of interconnection (POI), interconnection transmission line, station transformer, collector system equivalent, equivalent pad-mounted transformer, RES equivalent, and power factor are all taken into account while static modeling the RES. For dynamic modeling, the generic models are utilized to create equivalent wind and PV generators.

When the data set up is complete, the state estimation databases with RES generation in the. pfb format are inputted with 15-minute timestep intervals. The DSA Manager allows the operator to run PSAT, VSAT, and TSAT, simultaneously. For each timestep, the simulations are conducted according to the input data. The 0hr database represents the present power system, which is expected to have no significant difference from the actual power system. However, the 1hr and 6hr databases represents the estimated future power system, and the actual power systems may differ. Therefore, the margin should be placed into account considering these differences. Once the simulations are complete for one timestep, the set of results are then sent to local power system control module.

During the on-line dynamic stability assessment, the LRMS increases the RES generation while decreasing the conventional power generation during the simulation. The LRMS system acquires the maximum RES generation without violating the system stability. The database file with the maximum RES output is also saved and sent to the local power system control module as an output of the on-line dynamic system assessment module.

The LRMS use SNSP to determine the requirement for the RES control. The SNSP is a measure of the non-synchronous generation such as RES on the system at an instant in time. The SNSP is a percentage that indicates the ratio of non-synchronous generation to total power demand.

The basic SNSP and the maximum SNSP are the two types of SNSP that are calculated. The base SNSP is determined using a database with estimated RES output, whereas the maximum SNSP is determined using a database with maximum RES output.

The SNSP margin was established to identify the requirement for RES regulation. The SNSP margin is a needed headroom. Local power system control is essential if the SNSP margin is breached. The approach for determining an acceptable SNSP margin for each database is under development.

If it is decided that local power system control is not required, this operation is skipped and the following time step is conducted. If local power system control is required, preventative control is carried out before curtailment is implemented. To adjust the voltage profile, preventive control requires changing the tap on the switched shunt. More preventative control approaches are in development. The database is applied with preventive control and kept for re-evaluation of the local power system's stability.

After implementing preventative control, the database must be re-evaluated to ensure its stability and SNSP margin. The signal to apply preventive control is transmitted and the next timestep of LRMS is conducted if the instability is addressed and the SNSP margin criterion is fulfilled owing to preventative control. If the instability or SNSP margin persists after preventative interventions, the LRMS calculates and implements curtailment.

The LRMS detects the generators that are responsible for the instability in order to compute the amount of curtailment. The database must be re-evaluated after applying preventive control to assure its stability and SNSP margin. If the instability is treated and the SNSP margin criterion is fulfilled as a result of preventative control, the signal to apply preventive control is delivered, and the next timestep of LRMS is performed. The LRMS calculates and performs curtailment if the instability or SNSP margin remain after preventive actions.

After evaluating the appropriate amount of curtailment, the amount of curtailment for each RES must be calculated. Depending on the curtailment strategy, the mechanism for determining the amount of curtailment for each RES differs. Currently, the local power system of Jeju, Korea, employs the pro rata method, in which all renewable energy sources are curtailed based on the ratio of available capacity.

When the curtailment process is complete, the results and the amount of curtailment for each RESs are applied to the database. This database is re-evaluated to confirm the stability and the SNSP margin. After stability and SNSP margin are confirmed, the LRMS send signal to each RESs to apply the curtailment.