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-Question 2.10 : Manual or automatic load shedding has often been a last resort mechanism to maintain Power System security under extreme operating conditions . Which increasing penetration of distributed energy resources and power electronic interfaced resources what mechanisms can assist maintaining power systems security under load demand and/or inertia conditions?

To assure power system security under load demand and/or inertia conditions, it is vital to maintain an adequated control of the System Inertia as well as the Operative Reserve Requirements considering the system as a whole, as well as to all possible islanding areas, mainly in case of disturbances.

The main feature of Under Frequency Load Shedding - UFLS is to guarantee power system frequency control. If after a disturbance, the power system remains all integrated, without islanding, the load disconnected by UFLS can be reconnected in a few minutes. Otherwise, in case of system collapse, the load restoration time can take some hours.

Due to the new generation mix, frequency control has become more difficult. Load-shedding philosophy must be reviewed. In this scenario, it is better to anticipate UFLS actuation. This can avoid the automatic disconnection of some nuclear and thermal gas combined cycle generation units by their under-frequency operation protection.

One interesting point is related to SPS implementation. The load to be disconnected can be obtained by the opening of some radial distribution/subtransmission circuit. But now, some DER can be connected in the circuit to be opened. In this case, the "load" to be shed, depending on the DER generation value at the moment, can be lower or even negative, aggravating the frequency control.

Another aspect to be considered is the ROCOF increasing in case of system inertia reduction. In case of high values of ROCOF, UFLS tunning can be very difficult. This can be solved with the implementation of a new SPS, whose operation provokes very fast load disconnection based on the system’s operation conditions, the type of disturbance and load condition (heavy, medium, or light). Detailed studies are necessary in order to evaluate system performance to provide the total load to be shed for each credible disturbance.

-Example: in case of a generation block loss during medium a load period, some pre-defined load blocks are disconnected, right after the disturbance, reducing the ROCOF. This can allow UFLS tunning, in order to find an adequate frequency control.