

## C2 Power System Operation and Control

PS2 – Question 2.10 : Manual or automatic load shedding has often been a last resort mechanism to maintain Power System security under extreme operating conditions . With the 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?

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- One remedial measure to assure power system security is the implementation of Special Protection Schemes. Some of them command automatic load shedding in the distribution system.
- The power system operation under low inertia can reduce the system security, mainly in disturbances involving loss of generation. UFLS is an example.
- Remembering that the objective function of UFLS is to guarantee power system security. If after a disturbance, the power system remain 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.
- So, some points have to be mentioned:
  - regarding UFLS implementation. The load to be disconnected can be obtained by the opening of some radial distribution/subtransmission circuit. With the increase of RES, if some amount of RES is connected to the circuit to be disconnected, the “load” shed will be lower or, even negative, aggravating the frequency control, as a consequence of RES generation amount in the time of the circuit opening.

- Another aspect to be considered is the ROCOF increasing in case of system inertia reduction. In cases of high values of ROCOF, the UFLS tuning can be very difficult. This can be solved with the implementation of a SPS, whose operation provokes very fast load disconnection, based on the system's operation conditions, the type of disturbance and load (heavy, medium or light).

Detailed studies are necessary in order to evaluate system performance and to provide the total load to be shed for each credible disturbance.

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