

The role of the human operator and of the Information and Communication Infrastructure under emergencies

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Abstract

Rapid technological developments have enabled advances in automation, monitoring, control and protection of power systems. However, an analysis of major disturbances of the last four decades highlights the importance of human operator's perception in preventing the propagation of an electrical event. Therefore, the system operators remain an integral part of the system in many situations, especially under emergencies. The Information and Communication Technologies (ICT) need to sufficiently support system operators to maintain a high level of situation awareness (SA) which enables effective decision-making and intervention when human reaction is required.

The development and maintenance of an adequate level of SA can be, however, a complicated process because a variety of factors may decrease operators SA. Since operators SA is of crucial importance, it is necessary to understand in more details the factors that can have an impact on SA formation, especially during electrical disturbances. This presentation identifies different factors in a power system control centre that can affect and possibly decrease operators SA and performance. Such knowledge would help achieve improvements in Situation Awareness, even under the most severe system conditions.

The main phases of the progression of a disturbance are used to demonstrate how the role of the operator and of the ICT infrastructure varies depending on the current system conditions. In the pre-cascading phase, the development of the disturbance is slow and the operators have time to implement the appropriate countermeasures to prevent the spreading of the failure and restore the system to the electrically secure state. Inability of the operators to react in an effective and timely manner, due to decreased SA, can lead to the deterioration of the power system state. The primary objective of the ICT systems in this phase is the provision of sufficient assistance to the operators to form a high level of SA. Failures, limitations or design flaws in the information infrastructure can result in an incomplete or inaccurate presentation of the actual state of the system. This would compromise the effectiveness of the operators' response. Once the system enters the cascading phase, series of system components may trip rapidly and consequently the operators will not have time to react. The integrity of the system relies heavily on the correct and timely implementation of automatic actions by the ICT systems. Failure of these systems to carry out these actions can result in a worsening of the situation and in an increased probability of failure propagation.