

NUCLEAR ENERGY SERIES

Provisional Title	Reliability and Resilience of Electrical Grid for and with Nuclear Power Plant
--------------------------	---

1. RATIONALE

The establishment, operation, and maintenance of a nuclear generation in a country depends on the development of energy infrastructures, policies and regulations including the responsibilities and capabilities of the organisations involved and their interfaces. One of these infrastructures is the national or regional electrical grid and one of these interfaces is the interface between a nuclear power plant (NPP) and this system.

Whether it is a Member State's first NPP or a new NPP that is adding to existing nuclear generation, the interface between each new NPP and the electrical grid deserves careful attention as the electrical grid is essential for the safe and efficient operation of NPPs. A reliable and resilient electrical grid reduces the risk of reactor trips and the probability and duration of events of loss of off-site power (LOOP) and station blackout (SBO). During grid failures, the restoration of off-site power to the plant in a timely manner needs to be assured, by having an available electrical grid that would rapidly recover from such severe events.

Even if the availability of the off-site power is assured according to the operational requirements, the quality of the off-site power can also directly impact an NPP's safety, operability, and availability as it may result in service interruptions and damage to plant equipment.

The reliability of the electrical grid can also be directly impacted by the operation of nuclear power plants since they are typically the largest generating units in the system. An abrupt large change in electricity generation, such as an unexpected trip or disconnection of a nuclear power plant, can cause significant disturbance to the electrical grid. This, in turn, could affect the availability or power quality of off-site power supply to the nuclear power plant.

Therefore, for the safe and reliable operations of NPPs, it is essential to maintain reliability and resilience of the electrical grid compliant with the power quality requirements of the NPP.

The IAEA Nuclear Energy Series *Electric Grid Reliability and Interface with Nuclear Power Plants* aims to assist Member States that are considering the introduction of their first NPP to ensure that they analyse all the interactions between the electrical grid and the NPP. That document explains the need for the NPP to have a reliable interface with the electrical grid and the ways in which such a reliable connection can be assessed and implemented. Since its publication, it has become important to re-address the questions of the reliability and the resilience of the electrical grid due to events that have occurred, with an observed adverse trend.

In light of these issues, the IAEA Member States have requested from the IAEA Secretariat to assist them by providing an elaboration on the elements of a reliable interface between the electrical grid and NPPs that was discussed in earlier guidance - focusing on the electric grid, including its reliability and resilience - and sharing recent operating experience on the issues and solutions in maintaining a reliable and resilient grid system for safe and efficient operation of NPPs.

2. OBJECTIVE

This publication aims to review the needs, challenges, and solutions in Member States on the key areas of interfacing and operating electrical grids with NPPs, safely and effectively. The guidance intends to assist, in particular, with establishing and sustaining a reliable and resilient electrical grid in support of the safe and efficient operation of NPPs, and the contributions of NPPs to enhancing reliability and resilience of the grid system.

3. SCOPE

This publication provides information on the mutual interactions between the reliability and resilience of electrical grid and safe and efficient operation of nuclear power plants by investigating:

- The main physical, technical and administrative elements of electrical grid that are relevant to the safe and reliable design and operation of nuclear power plant.
- The reliability and resilience characteristics of the electrical grid that are needed by a nuclear power plant.
- The nuclear power plant's contributions and impacts on the reliability of the electric grid.

Maintaining and continuously improving reliability and resilience with evolving factors and conditions.