



IAEA

International Atomic Energy Agency
Atoms for Peace and Development

Technical Meeting on Electric Grid Reliability and Interface with Small Modular Reactors and Renewable Energy Sources

IAEA Headquarters, Vienna, Austria
and virtual participation via Microsoft Teams

19-22 November 2024

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Information Sheet

Introduction

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

Whether it is a Member State's first NPP or a new NPP being added to an existing nuclear fleet, the interface between each new NPP and the electrical power system deserves careful consideration. The power system is essential for the safe and efficient operation of all NPPs. A reliable and resilient electrical grid reduces the risk of reactor trips and the probability and duration of loss of off-site power and station blackout events. During grid failures, it is crucial to ensure the timely restoration of off-site power to the plant. Even if the availability of off-site power is guaranteed according to operational requirements, the quality of the off-site power can still directly impact an NPP's safety, operability, and availability. Poor quality off-site power may result in service interruptions and damage to plant equipment.

On the other hand, the reliability of the electrical grid can be directly impacted by the operation of NPPs, as they are typically the largest generating units in any electricity system. An abrupt, large change in electricity generation, such as an unexpected trip or disconnection of an NPP, can cause significant disturbances to the electrical grid. This, in turn, could affect the availability or quality of off-site power supply to other NPPs connected to the same grid.

The publication titled *Electric Grid Reliability and Interface with Nuclear Power Plants* (IAEA NES NG-T-3.8) addressed significant issues related to the grid interface with large-scale NPPs. Since its release in 2012, this publication has been widely recognized by Member States (MS) and has served as one of the major references in many IAEA events supporting MS capacity building on electrical grid development. However, the document did not consider Small Modular Reactors (SMRs) and renewable energy resources due to insufficient operating experience and information available at the time of publication.

Recently, MS's interest in SMRs has been increasing. The IAEA has received requests from MSs for consistent and comprehensive support related to all aspects of SMR development, deployment, and oversight. In response, the IAEA recently established an Agency-wide Platform on SMRs and their applications. As outlined in one of the fundamental documents for the SMR Platform, the *Medium-Term Strategy (2022-2029) for Agency Support to Member States in Small Modular Reactors and their Applications*, the Agency will support MS to become knowledgeable customers and make informed decisions on whether to embark on or expand nuclear power based on SMRs through various projects, activities, and initiatives. One of the actions is to review the major IAEA documents in the field of infrastructure development to consider the features of SMRs. Furthermore, while implementing activities to support electrical grid development for MSs, the IAEA has frequently received requests for guidance on the interface between future SMRs and the existing electrical grid.

The IAEA Safety Report Series on *Applicability of Safety Standards to Non-Water-Cooled Reactors and Small Modular Reactors* (SRS No. 123) describes some brief safety considerations regarding the interface between the electrical grid and SMRs. For example, Paragraph 6.15 recommends that a single transmission line for each off-site power supply may be acceptable if the safety analysis report shows that this arrangement achieves the technical safety objectives as defined in SSR-2/1 (Rev. 1). Specifically, a single off-site power supply might be acceptable for evolutionary and innovative designs employing passive engineered safety features, according to a graded approach.

In addition to the number of off-site power sources and the composition of the electrical switchyard, other unique features of SMRs regarding the interface with the electrical grid, in comparison to large-size reactors, deserve careful consideration as they may provide more flexibility when integrating into the grid. Such features include, but are not limited to, the impacts of passive safety systems on the requirements for electrical power supply systems, islanding mode, black start capability, battery capacity for power backup, and the connection of multiple modules.

Furthermore, besides electricity generation, the specific applications of SMRs (e.g., co-generation, hydrogen production, or other high-temperature process heat for chemical facilities) may require unique site- and mission-specific design considerations, which may also impact the interface with the electrical grid. However, currently, no IAEA Nuclear Energy publications provide practical examples or design considerations with technical details on this topic.

Additionally, to achieve the Net Zero Emission by 2050 goal, more renewable energy sources are being integrated into the electrical grids in Member States. The impact of renewable energy sources on grid reliability, and subsequently on the safe and reliable operation of NPPs, needs to be carefully considered.

Therefore, two IAEA consultancy meetings were planned: one was held in May, and another is scheduled for October 2024. These meetings enable discussion and revision of the IAEA NES NG-T-3.8 to support nuclear power infrastructure development, considering the features of SMRs and renewable energy sources.

Objectives

The purpose of the event is to serve as an international forum to share operating experiences and design considerations regarding electric grid reliability and the interface with SMRs and renewable energy sources. Additionally, it aims to collect feedback from Member States regarding the revision of a key Nuclear Energy Series publication entitled *Electric Grid Reliability and Interface with Nuclear Power Plants (NG-T-3.8)*.

Topics

1. Design Features of Electrical Power Systems at SMRs

- Impacts of passive systems on requirements for electrical power supply systems
- The preferred power supplies for SMRs
- Reliable Alternate Current power supply
- Use of batteries and emerging battery technologies for power backup
- Islanding in a SMR with multiple modules framework
- Load Following
- Black start capability
- Cogeneration
- Distributed control of multiunit

2. Special Considerations for SMRs in Siting

3. Connecting a Nuclear Power Plant to the Grid

- Requirements for off-site power systems
- Requirements for recovery from loss of off-site power
- Active systems vs passive systems
- Independence of electrical power supply at SMRs
- Multiple modules connection

4. Interactions Between Electrical Grid with Renewable Energy Sources

- Features of various types of Renewable Energy Sources
- Impacts of the Renewable Energy Sources to the Electrical Grid

Target Audience

The meeting targets senior managers and engineers with an electrical engineering background in design, engineering, and operating organizations for SMRs and renewable energy sources, who possess relevant experience in the listed topics.

Understanding the interface between the electrical grid and SMRs is crucial for formulating proper regulations and guidance, making this meeting beneficial for participants from regulatory bodies in both nuclear power and electrical grid sectors.

Additionally, senior managers and engineers with an electrical engineering background in Nuclear Energy Programme Implementing Organizations in newcomer countries, who are directly responsible for strategic and technical decision-making related to developing the electrical grid for future nuclear reactors, are encouraged to attend.

Nuclear industrial associations such as WANO, INPO, NEI, OECD/NEA, IEC, Nucleareurope, European Commission, and EPRI are also targeted due to their relevant activities supporting SMR operations.

Participants will discuss the listed topics and present their experiences, good practices, lessons learned, as well as their needs and challenges.

Working Language(s)

English.

Participation and Registration

All persons wishing to participate in the event have to be designated by an IAEA Member State or should be members of organizations that have been invited to attend.

In order to be designated by an IAEA Member State or invited organization, participants are requested to submit their application via the InTouch+ platform (<https://intouchplus.iaea.org>) to the competent national authority (Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or organization for onward transmission to the IAEA by **2 September 2024**, following the registration procedure in InTouch+:

1. Access the InTouch+ platform (<https://intouchplus.iaea.org>):
 - Persons with an existing NUCLEUS account can sign in to the platform with their username and password;
 - Persons without an existing NUCLEUS account can register [here](#).
2. Once signed in, prospective participants can use the InTouch+ platform to:
 - Complete or update their personal details under ‘Complete Profile’ and upload the relevant supporting documents;
 - Search for the relevant event under the ‘My Eligible Events’ tab;
 - Select the Member State or invited organization they want to represent from the drop-down

menu entitled 'Designating Authority' (if an invited organization is not listed, please contact InTouchPlus.Contact-Point@iaea.org);

- If applicable, indicate whether financial support is requested and complete the relevant information (this is not applicable to participants from invited organizations);
- Based on the data input, the InTouch+ platform will automatically generate the Participation Form (Form A) and/or the Grant Application Form (Form C);
- Submit their application.

Once submitted through the InTouch+ platform, the application, together with the auto-generated form(s), will be transmitted automatically to the required authority for approval. If approved, the application, together with the applicable form(s), will automatically be sent to the IAEA through the online platform.

NOTE: The application for financial support should be made, together with the submission of the application, by **16 September 2024**.

For additional information on how to apply for an event, please refer to the [InTouch+ Help](#) page. Any other issues or queries related to InTouch+ can be sent to InTouchPlus.Contact-Point@iaea.org.

Selected participants will be informed in due course on the procedures to be followed with regard to administrative and financial matters.

Participants are hereby informed that the personal data they submit will be processed in line with the [Agency's Personal Data and Privacy Policy](#) and is collected solely for the purpose(s) of reviewing and assessing the application and to complete logistical arrangements where required. The IAEA may also use the contact details of Applicants to inform them of the IAEA's scientific and technical publications, or the latest employment opportunities and current open vacancies at the IAEA. These secondary purposes are consistent with the IAEA's mandate. Further information can be found in the [Data Processing Notice](#) concerning the IAEA InTouch+ platform.

Expenditures and Grants

No registration fee is charged to participants.

The IAEA is generally not in a position to bear the travel and other costs of participants in the event. The IAEA has, however, limited funds at its disposal to help meet the cost of attendance of certain participants. Upon specific request, such assistance may be offered to normally one participant per country, provided that, in the IAEA's view, the participant will make an important contribution to the event.

The application for financial support should be made, together with the submission of the application, by **16 September 2024**.

Venue

The event will be held at the Vienna International Centre (VIC), where the IAEA's Headquarters are located. Participants must make their own travel and accommodation arrangements.

General information on the VIC and other practical details, such as a list of hotels offering a reduced rate for IAEA participants, are listed on the following IAEA web page:

www.iaea.org/events.

Participants are advised to arrive at Checkpoint 1/Gate 1 of the VIC one hour before the start of the event on the first day in order to allow for timely registration. Participants will need to present an official photo identification document in order to be admitted to the VIC premises.

The virtual component of the event will be held via Microsoft Teams from 19 to 22 November 2024.

Visas

Participants who require a visa to enter Austria should submit the necessary application to the nearest diplomatic or consular representative of Austria at least four weeks before they travel to Austria. Since Austria is a Schengen State, persons requiring a visa will have to apply for a Schengen visa. In States where Austria has no diplomatic mission, visas can be obtained from the consular authority of a Schengen Partner State representing Austria in the country in question.

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Subsequent correspondence on scientific matters should be sent to the Scientific Secretary and correspondence on other matters related to the event to the Administrative Secretary.