TERMS OF REFERENCE FOR R&D PROJECT

1. **Title of the project:** Comprehensive study of interconnection and interoperability of Distributed Energy Resources with associated Electric Power Systems (EPSs) interfaces

2. **Background:**

   a. The subject area focuses on the technical specifications for testing of the interconnection and interoperability between utility electric power systems (EPSs) and Distributes Energy Resources (DER).
   b. International standards outline the requirements relevant to the performance, operation, testing, safety considerations, and maintenance of the smart inverters at the point of interconnection/ connection to the grid.
   c. It is essential to standardize the technical and functional requirements, recommended practices, interconnection and interoperability guidelines and, testing and evaluation procedures for the safe operation of DERs and reliable operation of the grid. Currently there is no standard compliance is required for DER integration in India.
   d. This research will focus to evaluate the suitability of international standard in India and will identify the country specific changes.

3. **Scope for R&D:**

   The research and development project will focus on assessing the suitability of the international standards for grid-connected distributed energy resources (DERs) in the context of India. These international standards are widely recognized and adopted internationally for the interconnection of DERs to the grid. However, India's unique energy landscape, grid infrastructure, and regulatory environment may necessitate specific modifications or adaptations to ensure the effective and safe integration of DERs

   The scope of the R&D project encompasses the following:

   a. **Literature Review**: Conduct a comprehensive review of existing literature, standards, and relevant research to understand the global applicability of international standards and identify potential issues or gaps when applied in the Indian context.
   b. **Grid Analysis:** Analyze the existing Indian grid infrastructure, voltage profiles, grid reliability, and other technical parameters to determine the compatibility.
   c. **Stakeholder Engagement:** Engage with key stakeholders, including government agencies, utilities, DER manufacturers, and industry experts to gather insights, feedback, and recommendations.
   d. **Modifications and Recommendations:** Based on the research findings, propose specific modifications, additions, or adaptations to the international standards that align with the Indian energy landscape and regulatory requirements.

e. **Documentation and Reporting:** Create detailed documentation of the research process, findings, and recommendations in the form of a comprehensive report.

4. Research Methodology:

The project will involve the following research methodologies:

a. Undertake literature review in respect of performance/ safety parameters, test methods and other requirements through desktop study, books, magazines, national and international standards/regulation, technical information available or any other source.
b. Identifying the key stakeholders, including government agencies, utilities, DER manufacturers, and industry experts and the following activities shall be carried out and report prepared and collect the information on the following data:
    - Indian grid infrastructure
    - Voltage profiles
    - Testing methods used
    - Standards being followed
    - Key deviations from international standard
    - Any other relevant information

c. Detailed documentation encompassing specific modifications, additions, or adaptations to the international standards that align with the Indian energy landscape and regulatory requirements.
d. Detailed test methods for confirming compliance with safety, performance, and energy efficiency requirements
e. A comprehensive report documenting the research methodology, findings and recommendations.

5. Expected Deliverables:

a. Analytical report on the applicability and effectiveness of the international standards in the Indian energy context.
b. Detailed report to identify and recommend specific modifications or enhancements to the international standards to suit the Indian grid infrastructure, environmental conditions, and regulatory framework.
c. To ensure the safe and efficient integration of renewable energy sources and other DERs into the Indian power grid.

6. Criteria for Identification of Proposer to conduct Research work:

a. Proposer shall be a technologist with experience power systems, grid integration, and standards development and should have a comprehensive understanding of the Indian energy sector, including the grid infrastructure, regulatory framework, environmental conditions, and unique challenges.

7. **Timeline and Method of Progress Review:**

    a. The review will be carried out in each month along with consultation of other experts if required. Testing and verification after 3 months, the first draft report after 2 months and the final report at the end of 6 months.

8. **Support BIS will Provide:**

    a. BIS will provide access to latest editions of standards required for the project.