TEMPLATE FOR THE TERMS OF REFERENCE FOR THE R&D PROJECTS

(*Refer to the Guidelines on R&D Projects issued vide note SCMD/R&D dated xx-09-23*)

1. Title of the Project: Inverter Duty Transformer Requirements for the Grid Connected Solar Photovoltaic Plants for Reliable and Efficient Operation

2. Background:

India embarked on a mission to develop 450 GW of Renewable Energy by 2030 to tackle the climate change problem by reducing CO_2 emissions. Even though Renewable Energy provides sustainable energy and security, it challenges power supply reliability and quality. Thus, it requires innovative and effective solutions using advanced power electronics technology. At the same time, one needs to address power quality and reliability due to the large-scale integration of Renewable Energy into the electric grid. National Grid Code addresses essential requirements for large-scale Solar and Wind Energy integration. India has an installed capacity of 71.145 GW of Solar PV on 31st July 2023, containing thousands of inverter duty transformers (IDT) and solar inverters. Many Solar PV plants recently experienced the failure of Solar Inverter Duty Transformers. These IDT failures go unreported due to an NDA signed by various parties involved in designing, commissioning, and operating solar PV plants. In addition, it also creates barriers to conducting root cause analysis to develop new guidelines and standards for Inverter Duty Transformers at the national level to avoid IDT failures at SPV Plants soon. This is an issue to be addressed and CIGRE has formed a working A2.68 in October 2022 to IDT Failure survey at SPV Plants and its findings will be available by October 2025.

3. Scope: Scope of the project

- Conduct PQ audit for the inverter duty transformer (i) string inverter (ii) central inverter at large grid connected solar PV plants above 1 MW.
- Provide necessary and essential guidelines for the PQ monitoring and audit at RE Plants both Solar and Wind Energy
- Specify necessary guidelines and specifications for the development of Inverter Duty Transformer for the Grid Connected Solar Photovoltaic Plants

4. Expected Deliverables: Following outcome of the project.

- Guidelines and SOP for power quality monitoring and audit at grid connected SPV plants
- Requirements and Guidelines for the IDT Transformer Standards Development

- SOP for conducting the forensic audit and diagnostic studies for IDT/VSB/Cable failures

5. Research Methodology:

- Conducting Solar Photovoltaic Plants online survey through CEA & Grid Controller of India (POSOCO)
- Conduct PQ Audit at IDT Failure SPV Site to collect relevant data
- Perform root cause analysis with relevant stakeholder to identify the problem
- Recommend relevant guidelines and best practices for the development of IDT Standards
- The study sample is limited by project span of 6 months, budget available and more importantly transparent cooperation from SPV plant operators and regulators.

6. Requirement for the CVs:

- Dr M V Chilukuri, SMIEEE PES/IAS/PELS/DIS, Member CIGRE India
  Associate Professor, Power Systems and Smart Grid, School of Electrical Engineering
  VIT Vellore 632014
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7. Timeline and Method of Progress Review:

Suggest the stagewise timelines including that for the submission of the first draft, final draft and the report and the mechanism for the review of the progress.

SPV Plant Failure Analysis Online Survey – 2 Months

SPV Plant Visit and PQ Audit at Failure Sites – 3 Months

Study Report & Recommendation on SPV Plant Failure Root Cause Analysis – 1 Month

8. Support BIS will Provide:

Indicate the support BIS may provide in terms of the standards, other publications, information regarding manufacturers and labs etc.

- BIS Relevant Resources for conducting the study
- BIS support and authorisation letter to conduct the SPV Plant Failure Analysis Survey and Site Audit at Grid Connected Solar Plants in India
- Research Funding INR 10 Lakhs and 6 Months to begin with