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TECHNICAL REPORT

Integrating distributed PV into LVDC systems and use cases

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INTEGRATING DISTRIBUTED PV INTO LVDC SYSTEMS AND USE CASES

FOREWORD

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IEC TR 63534 has been prepared by subcommittee SC 8A: Grid integration of renewable energy generation, of IEC technical committee TC 8: Systems aspects of electrical energy supply. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
8A/187/DTR	8A/191/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

During the 2019 IEC SC 8A plenary meeting in Shanghai, China, DECISION 2019/5, based on a proposition by the China National Committee, was approved and written into List of Decisions (see document 8A/61/DL): It consisted in a new Preliminary Work Item (PWI) called “Integrating distributed PV into LVDC systems and use cases”. It was approved to create a new WG led by SC 8A, with participation from SC 8B called “Integrating distributed PV into DC systems and use cases”. It was approved to nominate Prof. ZHU Miao from CN NC as the convenor.

The task is to develop a series of projects regarding integrating distributed PV into DC systems and use cases with emphasis on large-scale and high penetration of renewable energy (RE) via low voltage direct current (LVDC) system within the following scopes of operational behaviour and coordinated control between RE and DC system, for example including DC interface for RE integration, fault response and stability issues of LVDC integrated RE, etc.

It is increasingly important to optimize the performance and efficiency of renewable-enabled power systems by integrating DC power into various low voltage applications, such as buildings, vehicles, and electronic devices. DC power generated by PV systems is more compatible with the DC-based electronic devices used in these applications, making it more efficient and cost-effective.

Nonetheless, there lacks a standard or reference framework that would orient original equipment manufacturers (OEMs), engineering, procurement, and construction (EPC) as well as other RE system operators to provide continuous high-quality generation services to grids.

In this context, the intention of this document is to present necessary technical screening and then to offer profound insights to the formulation of relevant standards. It helps to deal with both the converter-level and grid-level requirements on PV integration via DC integration, to pave a way to further develop a series of standards/technical reports with emphasis on high penetration of PV via LVDC system.

INTEGRATING DISTRIBUTED PV INTO LVDC SYSTEMS AND USE CASES

1 Scope

This document reviews existing theoretical attempts and engineering applications in the area of solar PV systems coupled to LVDC systems. There are three aspects that are identified to be highly relevant to standard compilations:

- power converters and possible control mechanisms that are eligible for facilitating the interlinking between PV and LVDC networks;
- local PV system islanding detection algorithms and fault ride through in case of main grid faults;
- stability analysis of PV interacting with LVDC systems and corresponding stabilization methods;

An inventory of existing (mostly IEC and national) standards is also presented, based on which different sorts of PV integration scenarios are elaborated. Gaps between actual standards and future needs are analyzed and guidelines for evolution are presented.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62934, *Grid integration of renewable energy generation – Terms and definitions*