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Guideline for planning of HVDC systems

Part 1: HVDC systems with line-commutated converters

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Guideline for planning of HVDC systems – Part 1: HVDC systems with line-commutated converters

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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GUIDELINE FOR PLANNING OF HVDC SYSTEMS –

Part 1: HVDC systems with line-commutated converters

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IEC TR 63179-1, which is a Technical Report, has been prepared by IEC technical committee 115: High Voltage Direct Current (HVDC) transmission for DC voltages above 100 kV.

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

Draft TR	Report on voting
115/216/DTR	115/230/RVDTR

Full information on the voting for the approval of this Technical Report can be found in the report on voting indicated in the above table.

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This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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GUIDELINE FOR PLANNING OF HVDC SYSTEMS –

Part 1: HVDC systems with line-commutated converters

1 Scope

This document provides guidelines for the selection of a high-voltage directive current (HVDC) system with line-commutated converters (LCC), hereafter referred to as HVDC system, for the purposes of HVDC system planning. It covers the guidelines on the requirements for integrating HVDC systems in AC power networks, selection of rated voltage and power, overloads, circuit configuration, expandability, comparison of technical, economic, regulatory, political, social and environmental factors, etc. This document is applicable for planning an HVDC system.

This guideline is not exhaustive and it is possible that there will be other specific aspects, particular to a specific HVDC project, which will also need to be considered.

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 60633, *High-voltage direct current (HVDC) transmission – Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60633 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org
- ISO Online browsing platform: available at http://www.iso.org/obp

4 General

The HVDC system development and integration cycle may be described in terms of six phases, as shown in Figure 1.

The main task of HVDC system planning is to develop and select an HVDC scheme based on the conclusions of power network development planning where the network requirements are defined. HVDC system planning uses as a minimum the total transmission capacity and range of connection points previously determined by power network development planning, taking into account current and future conditions of the power system, environment, and other contributing factors.

There is a certain degree of repetition and iteration between HVDC system planning and system design (refer to Figure 1). For the purpose of project feasibility study and scheme comparison, some investigation would be carried out during the system planning phase, the detailed studies and final design would be accomplished during the system design phase.

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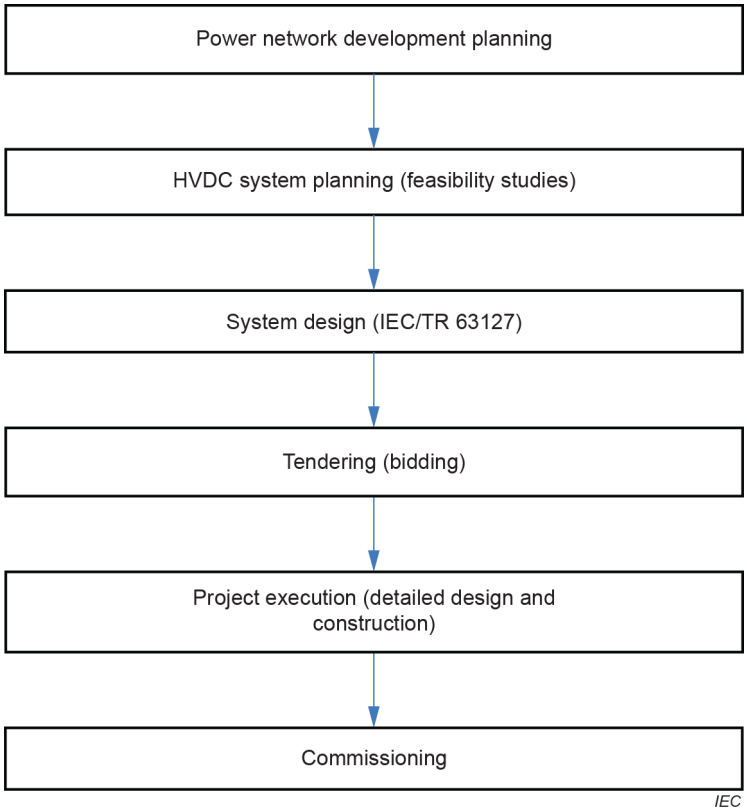

Figure 1 – Phases during integration of a new HVDC system into the power network

The work contents and procedure for planning of an HVDC system are as follows:

a) compare HVDC and AC solutions at high level according to the specific requirements (see Clause 5);

b) when HVDC is the only technically feasible solution, or the use of an HVDC scheme has overwhelming advantages, a number of alternative HVDC solutions could be investigated (see Clause 6). When both HVDC and AC alternatives are technically feasible and neither of them has overwhelming advantages, further analysis is required to confirm the preferred solution;

c) verify the security of supply and stability of each alternative (see Clause 7);

d) compare the economic efficiency of alternative solutions (see Clause 8);

e) present the recommended solution (see Clause 9).

The above steps in the planning of an HVDC system are shown in Figure 2.

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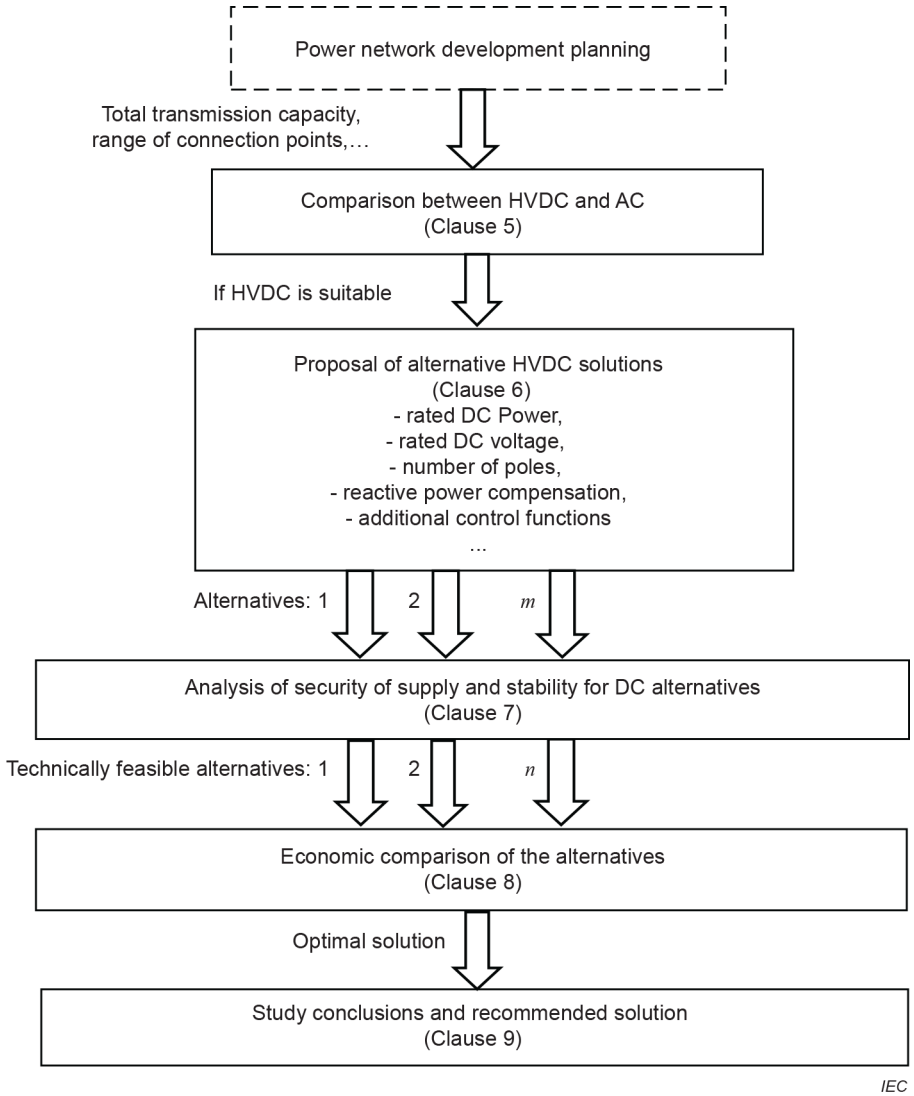

Figure 2 – Procedure for planning an HVDC system

5 Comparison between HVDC and AC alternatives

5.1 Consideration of overall network planning

5.1.1 Overall network planning

When a new line between two areas is planned, the solutions should consider all aspects of transmission planning, including the current and future power demand, line corridor conditions, operation and maintenance, energy dispatch and overall cost.

5.1.2 Connection topologies for HVDC systems

When an HVDC system is to be added to AC power networks, there are two typical connection topologies:

a) HVDC interconnection between two asynchronous AC power networks;

b) embedded HVDC system. An embedded HVDC system is an HVDC link between two parts of the same AC synchronous transmission system.

In addition, a multi-terminal HVDC link could also be considered both in a) and b) above.

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