



**STUDY COMMITTEE B1
“INSULATED CABLES”**

2008 - 2018 STRATEGIC PLAN

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1. FRAMEWORK

1.1 Purpose and time horizon of the Strategic Plan

to define the mid to long term goals of the SC and to provide a global framework on which to base its activities. It takes into account the CIGRÉ Master Plan 1999 - 2009, the CIGRÉ Technical Committee Strategic Plan 1998 – 2008 (update 2004 – 2008), the CIGRÉ organisation as introduced during the 2002 Paris Session and the former SC B1 Strategic Plan 2002 - 2012. Furthermore it takes into consideration the general trends in the Electric Power Industry (EPI), which are affecting or are expected to affect the field of insulated cable systems.

In keeping with the indications of the Technical Committee, the Strategic Plan spans a ten years period. It is however anticipated that it will need to be updated at least once during its validity period to ensure it remains closely connected to ongoing trends.

1.2 Field of activity of the Study Committee

The field of activities of SC B1 concerns the development and operation of all types of AC and DC insulated cable systems for land and submarine power transmission. It is focused mainly on high (HV) and extra high voltage (EHV) applications, however lower voltage (preferably medium voltage (MV)) cable applications for power distribution are also considered, when deemed to be of a more general cable interest.

Within this field, the scope of work of SC B1 covers theory, design, applications, manufacture, installation, testing, operation, maintenance and diagnostic techniques of insulated cables.

Accordingly, the core technologies of SC B1 can be defined as insulated components and equipment (preferably HV and EHV cables and accessories) for power transmission. Supporting technologies are materials and operational and environmental management.

1.3 Mission of the Study Committee

Paraphrasing the mission statement contained in the CIGRÉ Master Plan, the mission of SC B1 can be summarised as follows:

- to facilitate and develop the exchange of engineering knowledge and information between engineering personnel and technical specialists in the field of insulated cables,
- to add value to the knowledge and information exchanged by synthesising state-of-the-art and world practices,
- to make EPI managers, decision-makers and regulators aware of the syntheses of SC B1's work in the field of insulated cables.

1.4 Goals of the Study Committee

The main goals of the SC B1 are the following:

- to contribute effectively to the progress in insulated cable systems technology,
- to facilitate the integration of insulated cable systems in electric power networks and in the environment, covering the complete life cycle of cables,
- to maintain its leading position in the field of power cables by providing unbiased and neutral information on all essential cable aspects,
- to be recognised by the Electric Power Industry as a leading and reliable partner with competence in all engineering issues related to insulated cable systems, i.e. technical, economical, ecological and social,
- to monitor and assess current trends in cable technology,
- to promote advancements in cable technology.

1.5 Organisation of the Study Committee

SC B1 currently consists of a Chairman, a Secretary, Regular Members (to a maximum number of 24 persons) and Observer Members to a maximum of 12 persons).

The details of the current composition can be seen on www.cigre-b1.org.

The present organisation of the Study Committee is attached hereto.

2. INTERNAL FACTORS

2.1 Engineering competence

The knowledge, experience and commitment of its Members, Working Groups and Task Forces have made the SC, since its establishment in 1927, an internationally recognised forum on all technical matters related to HV cable systems and a major contributor to the advancement of the associated technologies. It is an important target for SC B1 over the forthcoming years to safeguard not only its technical competence but, in addition, to extend its competence to the other engineering aspects, i.e. economic and environmental, in the field of insulated cables.

SC B1 strives for maintaining and enhancing its role as the world-wide leading organisation on power cables and for the acknowledgement by its customers for covering all their engineering needs.

2.2 Advisory Groups

To improve the efficiency of the SC and to cope e.g. with the extended non-technical requirements according to the new CIGRÉ strategy, Advisory Groups (AGs) are set up to analyse items of strategic character such as customer's relations, target groups, tutorials etc. Based on their analyses, AGs will prepare proposals for the management of these items within the SC.

2.3. Interactions with other Study Committees

SC B1 will maintain close and open relations with other Study Committees, in order to coordinate issues that interface, and to promote a homogeneous presentation to the various target groups.

Whenever appropriate, Joint WGs will be established, in agreement with the other SCs concerned, in order to study interdisciplinary subjects of common interest.

3. EXTERNAL FACTORS

3.1 Evolution of the Electric Power Industry (EPI)

The operational environment of the EPI has changed remarkably in recent years and the evolution of the EPI will probably continue in the future. The basic need of customers is the supply of electric power with a satisfactory level of availability, reliability, quality and cost.

The following configurations are typical for different areas:

- In industrialised countries load growth is small and slow. Technology and expansion are no longer the main drivers for the EPI. Privatisation, de- and re-regulation have led to extensive restructuring of traditional power supply networks. Competition amongst new players resulted in increased emphasis on the cost effectiveness of products and systems. Shorter payback terms of investment are hampering larger projects. Utilities are suffering a remarkable loss of expertise and competence due to splitting of former organisations and reduction of personnel. In addition, the manufacturing area is also losing expertise due to continued rationalisation and closing of manufacturing/research facilities with many of the world-wide suppliers.
- In newly industrialised and developing countries needs of utilities and customers are characterised from first electrification to bulk power transmission. Trends towards high load growth due to large-scale industrialisation and urbanisation are combined with financial constraints and growing environmental concerns. Small local projects and dispersed generation are evolving at the same time as long distance interconnections. Often there is a lack of skilled and well-educated people.

The structural changes in the EPI will result in an evolution towards functional requirements and specifications and, for cable manufacturers, in a shift from being mainly component suppliers to being principally solution providers. On the other side there are tendencies at higher voltage levels, too, with customers towards “shopping” of single components and building their own HV systems, (as is practice yet in the MV cable market).

The growth of distributed generation will probably have an effect on the architecture of the network and will lead to a more widespread use of lower voltage (MV) cable systems. In this context, SC B1 will look into the issue of distribution cables, too.

More electricity trading across large geographical areas will require increasing number of interconnections, affecting DC and submarine cables.

Better operation and utilisation of existing assets (longer lifetime, up-rating, upgrading) will find growing attention of network owners and operators and will require adequate means (monitoring and diagnostics) for condition assessments, data based maintenance and operation management. Availability, reliability and quality of transmission systems, on the other hand, will remain of paramount importance.

3.2 Environmental factors

Environmental constraints and social aspects have become of prime importance for the EPI in most developed countries and will be gaining increasing importance in developing ones, too. Typical environmentally relevant issues related to electric power transmission systems are influence on nature and natural resources, consumption of materials and energy, emission of green house gases, occupation of land and visual impact on landscape, disturbances of social and biological structures during construction and operation, materials waste, pollution and end-of-life disposal.

- Overhead lines (OHL) have been and will remain the dominating means for bulk power transmission in the HV and EHV ranges. However, during the past years public concern regarding overhead transmission lines has grown and there are indications suggesting that this trend may continue in the future. It is therefore anticipated that undergrounding may become a requirement not limited any more to specific and localised areas as was the case until the very recent past.
- Some overhead lines as well as cable links will have in the near future to be replaced as they reached their end of life or as they need a bigger ampacity. The concern about environment will lead to a more frequent use of cables than in the past giving importance to their integration in the network and their installation.
- Subsoil congestion in urban areas, difficulties concerning the availability of rights of way and constraints in the use of open trenches will require the application of appropriate product and installation solutions. Furthermore,

the possible use of multi-purpose structures such as tunnels for the transport of electricity, communications, gas and water will require careful study of the different factors of influence.

- Environmental Impact Assessments (EIA) and Life Cycle Assessments (LCA) are increasingly adopted by EPI decision-makers. End-of-life and general material related environmental issues are expected to gain growing influence on product and system evolutions in the field of insulated cables.
- In addition, it is anticipated that concerns regarding Electro-Magnetic Fields (EMF) levels will have a growing effect on both overhead lines and underground cables.
- Security of persons living or working along the cable lines is also an issue of general concern. Thus, the demand of cables and accessories with reduced risk of pollution, explosion or fire will accelerate in the future.
- As new generation plants based on renewables are constructed, the requirements on the transmission and distribution systems will change.

3.3 Technological factors

From a technological point of view it is expected that the drivers for technical innovations, improvements and adaptations will preferably be economical, ecological and operational requirements rather than purely technical ones.

- The trend towards dry solutions with reduced environmental risks (pollution, explosion, fire) will continue for AC and DC cables systems. This will include extruded cable designs for all voltage classes and their relevant accessories, which will preferably be prefabricated, pre-tested and easy to install.
- Needs for cost savings at erection of new transmission systems will encourage tendencies to minimise the dimensions of connecting plants and equipment. This will affect dimensions of cables and accessories, too, i.e. diameters and weights of cables, lengths of terminations, sizes of manholes etc.
- As expenses for construction work, installation and jointing are gaining increasing importance, cable and accessories designs will have to be adjusted to comply with the requirements of the most economic procedures. Whenever appropriate, relevant experiences from MV cable technologies might be adopted for higher voltages, too.
- Further advances in HVDC technology (e.g. VSC converters and extruded DC cables) are likely to lead to a wider application of DC cables for land and submarine installations (i.e. for lower voltages and shorter links, too).

- Development efforts related to innovative transmission media such as Gas Insulated Lines (GIL) and High Temperature Superconducting (HTS) cable systems may begin to find practical applications in customer's networks. A precondition is that not only the present technical challenges but also the economical constraints (investment and regular cost) and the operational requirements (availability, maintenance, reliability) will be solved satisfactorily.
- Work concerning the integration of cable systems in the network, e.g. the evaluation of over-voltages and related protection devices as well as the insulation co-ordination of cable systems, will continue to be required. In addition, the possible impact on cable systems by the application of Flexible AC Transmission Systems (FACTS) to control power flows in the network may need to be studied.

4. STRATEGIES

4.1 Administrative Strategies

The administrative strategies of SC B1 will focus on three main targets:

4.1.1 Maintenance of technical competence:

- To safeguard the technical competence and excellence of the SC, i.e. to ensure that the quality of the technical experts participating in the work of the SC is such as to provide both continuity and the ability to face new technical developments and challenges.
- To encourage young experts to participate in the work of SC B1.
- To encourage, whenever appropriate, the addition of new Observer Members, thus enhancing the participation of newly industrialising or developing countries in the work of SC B1.
- To appropriately communicate to the relevant public its expertise in the cable field via high-quality CIGRÉ reports, symposia, tutorials etc.

4.1.2 Alignment of SC B1 activities with needs of target groups

- To systematically analyse, map and review the needs of customers and target groups, respectively, and to align the activities of the SC with their requirements
- To promote the active participation of Regular and Observer Members as interfaces to local target groups, mainly with regard to non-technical issues.
- Whenever appropriate and possible, to incorporate within the working programme of SC B1 non-technical activities, (i.e. to develop new competence) to satisfy the respective needs of target groups.
- To strive for acquisition of experts from target groups with other than technical, i.e. system related expertise (operational, economical, ecological). If possible these should preferably be members of those target groups the needs of which will be investigated. This aspect is particularly

important and Members should be very attentive to it when proposing experts for participation in WGs or TFs.

- To make managers and decision makers in the Electric Power Industry (EPI) aware of the syntheses and options of our work by communicating the outcome in an appropriate way to customers and target groups.

4.1.3 Interaction with partners

- To interact effectively with other CIGRÉ SCs in connection with interdisciplinary subjects of common interest.
- To maintain the close cooperation with IEC TC 20 and the well-established links with IEEE PES/ICC.
- To develop relations to CIGRE to co-ordinate activities, if any, in the field of distribution (MV) cables.

4.2 Engineering strategies

The engineering, i.e. technical, economical and ecological strategies of SC B1 will focus on two main targets:

4.2.1 Maintenance and Improvements of core technologies

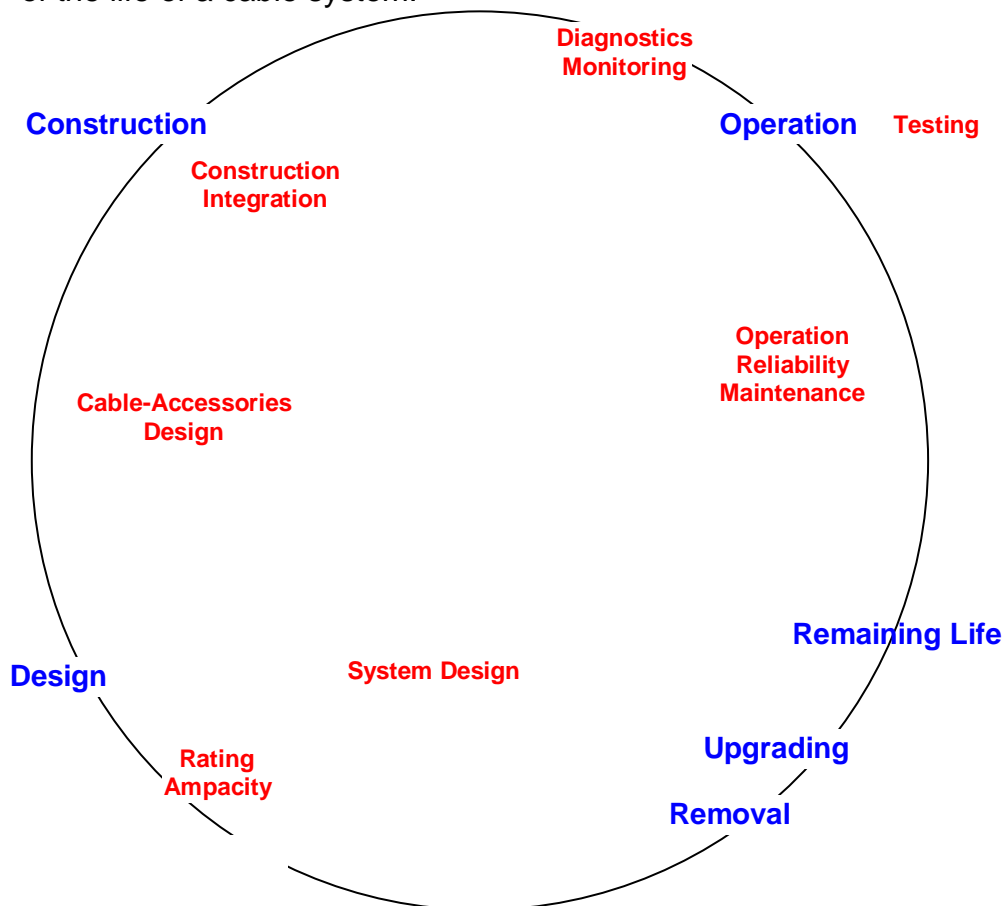
- Extruded AC cables for EHV applications have become more widespread and electric stresses are considerably increasing even in HV cable systems, where trends towards reducing insulation wall thicknesses are widely growing. Long-term service performance of such highly-stressed cables and their accessories, however, has been demonstrated so far only to a limited extent. It is therefore important to study their ageing mechanisms by means of suitable diagnostic and condition assessment methods. Such methods could be of interest, too, for lower voltage classes (HV) under the aspect of up-rating or upgrading of existent cable systems.
- The implementation of monitoring, diagnostic and maintenance techniques shall contribute to the improvement of systems on-line operational management and better exploitation of existing assets. Monitoring and diagnostic systems using optical fibres will be kept under steady attention by SC B1 as they are continuously improving with practical experience and are supposed to become valuable and indispensable tools for operators and network owners.
- Developments concerning AC/DC conversion have made DC transmission viable for lower power/voltage levels and shorter distances. Progress in the field of polymeric materials will make extruded DC cables become an interesting alternative to conventional submarine cables with lapped insulation, providing attractive options for extremely long lengths and increased transmission capacities. These estimations will cause SC B1 to spend ongoing attention to application and performance of DC cable systems.
- Progress in the development and application of new bulk power transmission media such as Gas Insulated Lines (GIL) and High

Temperature Superconducting (HTS) cable systems will be kept under ongoing observation by SC B1.

- Test procedures for extruded HV and EHV cable systems have been comprehensively studied by SC 21 in the past, but attention will be placed on the possible evolution of these tests in the light of growing service experience.

In addition, increasing tendencies to specify products and systems by their functional characteristics rather than by dimensions or other design features, (e.g. current ampacities instead of conductor cross sections, electrical stresses instead of nominal voltages etc.) might need special considerations with regard to appropriate test specifications.

- The development of new materials and their possible impact on cable related applications will be kept under close attention by SC B1 in cooperation with SC D1.
- The work by SC B1 shall strive to cover all aspects of the different phases of the life of a cable system:



4.2.2 Cables in the changing operational environment

- To keep under review the evolution of world-wide practices concerning HV and EHV transmission cable systems with emphasis not only on products

but also on operational, economical and ecological aspects of complete cable systems in their actual network environment. Whenever appropriate, distribution (MV) cable systems will be equally included in the field of activities of SC B1.

- In view of the increasing importance of undergrounding SC B1 will study the technical, economical and environmental issues associated with a more widespread presence of underground cable systems in the network. Aspects of reliability and availability and effects of integration of cable systems in and interaction with the networks under normal and abnormal conditions will be considered.
- Work aimed at increasing the competitiveness of underground cable systems will be pursued, including in particular the optimisation of product designs and of systems operational performance with regard to current carrying capacities, overvoltages, transients and losses.

CIGRE SC B1

Chairman : Fredrik Rüter (SE)

Secretary : Yves Maugain (FR)

