FIELDS OF ACTIVITY OF STUDY COMMITTEES

A_1	**Rotating Electrical Machines** Economics, design, construction, test, behaviour and materials for turbine generators, hydro-generators, non conventional machines and large motors.
A_2	**Transformers** Design, construction, manufacture and operation for all kinds of power transformers including industrial,DC converters and phase-shift transformers and for all types of reactors and transformer components (bushing, tap-changer…)
A_3	**High Voltage Equipment** Theory, design, construction and operation for all devices for switching, interrupting and limiting currents, surges arresters, capacitors, busbars and equipment insulators and instrument transformers.
B_1	**Insulated Cables** Theory, design, applications, manufacture, installation, testing, operation, maintenance and diagnostic techniques for land and submarine AC and DC insulated cables systems.
B_2	**Overhead lines** Design, study of electrical and mechanical characteristics and performance, route selection, construction, operation, service life, maintenance, refurbishment uprating and upgrading of overhead lines and their components including : conductors, earth wires, insulators, towers, foundation and earthing systems.
B_3	**Substations** Design, construction, maintenance and ongoing management of substations and electrical installations in power stations, excluding generators.
B_4	**HVDC and Power Electronics** Economics, application, planning aspects, design, protection, control, construction and testing of HVDC links and the associated equipment. Power Electronics for AC systems and Power Quality Improvement and Advanced Power Electronics.
B_5	**Protection and Automation** Principles, design, application and management of power system protection, substation control, automation, monitoring and recording – including associated internal and external communications, substation metering systems and interfacing for remote control and monitoring.
C_1	**System Development and Economics** Economics and system analysis methods for the development of power systems : methods and tools for static and dynamic analysis, planning issues and methods in various context, assets management strategies.
C_2	**System Operation and Control** Technical and human resource aspects of operation of power systems : methods and tools for frequency, voltage and equipment control, operational planning and real time security assessment, fault and restoration management, performance evaluation, control centre functionalities and operators training.
C_3	**System Environmental Performance** Identification and assessment of the impacts on environment of electric power systems and methods used for assessing and managing the environmental impact of system equipment.
C_4	**System Technical Performance** Methods and tools for power system analysis in the following fields: power quality performance, electromagnetic compatibility, lightning characteristics and system interaction, insulation coordination, analytical assessment of system security.
C_5	**Electricity Markets and Regulation** Analysis of different approaches in the organisation of the Electric Supply Industry : different market structures and products, related techniques and tools, regulations aspects.
C_6	**Distribution Systems and Dispersed Generation** Assessment of technical impact and requirements which new distribution features impose on the structure and operation of the system : widespread development of dispersed generation, application of energy storage devices, demand side management ; rural electrification.
D_1	**Materials and Emerging Test Techniques** Monitoring and evaluation of new and existing materials for electrotechnology, diagnostic techniques and related knowledge rules, and emerging test techniques with expected impact in medium to long term.
D_2	**Information Systems and Telecommunications** Principles, economics, design, engineering, performance, operation and maintenance of telecommunication and information networks and services for Electric Power Industry; monitoring of related technologies.

CIGRE Technical Committee

Study Committee short descriptions

A1	Rotating Electrical Machines	· Life management · Machine monitoring and diagnosis · Renewable generation · Large generators · High efficient electrical machines
A2	Transformers	· Design and manufacture · Application of material · Utilization, e.g. maintenance and operation, condition monitoring, life management, repair and refurbishment, disposal · Safety and environmental aspects, e.g. noise, oil spill, fire hazard and explosion · Economic/commercial aspects · Quality assurance and testing
A3	High Voltage Equipment	· Design and development · New and improved test techniques · Maintenance, refurbishment and lifetime management · Reliability assessment and condition monitoring · Requirements presented by changing networks

B1	Insulated Cables	· Power cables in all phases of life · Submarine, underground, ducts, tunnels……. · HVDC and HVAC Cable Systems
B2	Overhead Lines	· Increase Acceptability of OHL · Increase Capacities of existing OHL · Increase Reliability and Availability of OHL
B3	Substations	· New substation concepts · Substation management issues · Life cycle management and maintenance · Impact of new communication standards and smart grids on existing and new substations
B4	HVDC and Power Electronics	· Responsible for HVDC systems and Power Electronics for AC systems · Its members are International Experts from Manufacturers, Operators, User Engineers, Consultants and Academics. · Provides unbiased and balanced documents concerning economical, technical and environmental matters associated with its area of responsibility. · The target audience includes engineers in the Electrical Supply Industry, Standardisation bodies, investors and regulators
B5	Protection and Automation	· Improved concepts of Substation Automation Systems · Technical recommendations for IEC 61850 · Application of numerical protections and substation automation systems · Methods to improve the performance of protection systems · Protection implications of new generation technologies.

C1	System Development and Economics	· Planning for rapid development, uncertain generation and desired reliability (newly and rapidly developing countries, system performance, contingency planning, mass penetration of renewables, a greenfield approach) · Investment drivers, decision processes and tools (investment drivers, planning criteria, grid codes and the role of new technology, new investment decision processes, new tools and methods for increasing uncertainty) · Asset management practices including risk assessment now and in the future (risk management, broad trends and practices, new solutions for changing power system designs)
C2	System Operation and Control	· Control and switching for reliability: voltage,frequency and capacity limits · Reserves and emergency strategies · Management of fault and restoration situations · Short term planning and coordination of system capacity needs · Requirements and use of power system analysis and security assessment functionalities · Requirements, methods, tools for training of operators · Impact on system operation from institutional structures: regulators,trading and contracted ancillary services.
C3	System Environmental Performance	· Environmental impacts of Power System development and operation; · Global environmental changes and Power System; · Public acceptance of Power System infrastructures; · Stakeholders engagement and communication; · Power System efficiency and environment.
C4	System Technical Performance	· Power Quality · Electromagnetic Compatibility/Electromagnetic Interference (EMC/EMI) · Insulation co-ordination · Lightning · Advanced Tools for the analysis of power system performance · Power systems dynamic/transient performance models and analysis.
C5	Electricity Markets and Regulation	· Consequences of regulatory changes for the electric power sector · Regulatory incentives for investment · System implications of new generation technologies · Markets design’s impact on transmission system operation · Market design for integration of intermittent generation

C6	Distribution Systems and Dispersed Generation	· Dispersed Energy Resources connection and integration · Dispersed Energy Resources concepts in distribution systems operation and planning (Microgrids and Active Distribution Networks) · Demand management and Active Customer Integration · Rural electrification.
D1	Materials and Emerging Test Techniques	· Electrical insulating materials · Electrical conducting materials · High voltage and current test and measuring techniques · Diagnostic tools
D2	Information Systems and Telecommunication	· ICT applied to the networks of the future. · Telecommunication networks in Electric Power utilities (architectures, media, protocols…) · New ICT architectures to control the bulk power systems (smart meter, smart grid, intelligent grid, control centres EMS, MMS etc…). · ICT governance within utilities – in-house versus outsourced. · Information security within the Electric Power Utilities

Scopes of Study Committees

Overview

A 1 Rotating Electrical Machines

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of rotating electrical machines. To add value to this information and knowledge by means of synthesising state-of-the-art practices and developing recommendations.

SCOPE

The activities of the Study Committee cover economics, design, construction, tests, behaviour and materials of turbine generators, hydro generators, non conventional machines and large motors. The relationship between electrical machines and the mechanical behavior of coupled prime movers behavior should be analyzed. In addition, behaviour of rotating machines as the part of power station and its performance in the power system will be covered in collaboration with other relevant Committees.

In order to respond to the future environment, different strategic directions will be followed. The long term goal of asset management is the most effective operation of machines to optimise performance, reliability and efficiency and to inform maintenance decisions through suitable diagnostics and understanding behaviour and signs of deterioration.

A 2 Transformers

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of transformers. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

The scope of the SC Transformers covers :

- all kinds of power transformers including industrial, DC converter and phase-shifting transformers
- all type of reactors (shunt, series , saturated, smoothing, ...)
- transformer components (bushings, tap changers, accessories)

The field of study includes :

- design, construction and manufacture, including in site erection;
- application of material;
- asset management (maintenance and operation, condition monitoring, techniques in service, repair and refurbishment, disposal, ...);
- safety and environmental aspects (noise, oil spill, fire, explosion, EMC, ...);
- quality assurance and testing;
- behaviour in and interaction with the system under normal and abnormal conditions;
- dependability (reliability, availability, maintainability, safety), risk management;
- economic aspects, decision making.

A 3 High Voltage Equipment

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of high voltage equipment. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

Responsible for the theory, design, construction, and application of high voltage equipment components, equipment, and equipment systems for both AC and DC systems. This includes the behaviour and interactions with, and duties imposed by the network and other system equipment under normal and abnormal conditions, testing and testing technologies, quality assurance, reliability, maintenance and asset management.

This equipment includes all devices for switching, interrupting, or limiting currents (circuit breakers, load switches, disconnect switches, earthing switches, fault current limiters, etc.) independent of technology. It also includes surge arresters, capacitors, busbar and equipment insulators, instrument transformers, bushings, and all other high voltage equipment not specifically covered under another equipment study committee's scopes. Emphasis is on function and interaction of high voltage equipment including air and gas-insulated equipment, solid insulation used in high voltage equipment, outdoor insulation, and equipment using other insulation systems and interrupting media.

B 1 Insulated Cables

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of insulated cables. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

The activities of CIGRE Study Committee B1 concern all types of AC and DC insulated cable systems for land and submarine connections and are focused mainly on high voltage applications. Whenever appropriate, however, lower voltage applications are also considered.

Within this field, the scope of work of the Study Committee covers design, manufacture, installation, service, quality assurance, tests and testing technology, behaviour in and interaction with the network, reliability, asset management, maintenance and diagnostic techniques in service.

B 2 Overhead Lines

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of overhead lines. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

The field of study includes:

- conductors, earth wires, optical cables, and their associated insulators, joints, hardware and accessories;
- towers including accessories;
- tower foundations and earthing systems.

The studies (electrical and mechanical) cover the individual items, the subsystems formed from those items, such as conductor bundles, and the interactions between the components comprising the subsystems.

The important parameters describing the environment experienced by overhead lines are covered, together with the effects of the environment on the line's components with regard to design specifications and loading, electrical and mechanical performance, service life and deterioration mechanisms. In addition, the Committee studies the effects of the line on the environment (including life cycle assessment) both in terms of its individual components, as well as the line as a whole. The scope includes the study of activities such as design, route selection, construction, operation, and asset management items such as : maintenance, refurbishment, uprating, upgrading, restoration and dismantling of the line.

B 3 Substations

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of substations. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

Responsible for the design, construction, maintenance and ongoing management of substations and for electrical installation in power stations excluding generators. Serves a broad range of target groups in the Electric Power Industry whose needs include the technical, economic, environmental and social aspects of this scope in varying degrees.

Major objectives include increased reliability and availability, asset management, environmental impact containment, and the adoption of appropriate technological advances in equipment and systems to achieve these objectives.

B 4 HVDC and Power Electronics

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of HVDC and power electronics. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations..

SCOPE

The work of the Study Committee addresses all the relevant Target Groups in Power Industry interested in Power Electronics. In addition to technical aspects also economical and environmental subjects of this technology and asset management are covered.

The Study Committee activities include following subjects:

HVDC: economics of HVDC, applications, planning aspects, design, performance, control, protection, control and testing of converter stations, i.e. the converting equipment itself and also the equipment associated with HVDC links.

Power Electronic for AC systems and Power Quality Improvement: economics, applications, planning, design, performance, control, protection, construction and testing.

Advanced Power Electronics: development of new converter technologies including controls, use of new semiconductor devices, applications of these technologies in HVDC, Power Electronics for AC systems and Power Quality Improvement. Power Electronics used in other fields of the Electric Power Industry , interesting for other Study Committees, will be covered by demand, this Committee being the Sponsoring Committee.

B 5 Protection and Automation

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of protection and automation. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations..

SCOPE

Study committee B5 covers principles, design, applications, coordination, performance and asset management of :

- System protection
- Substation control and automation
- Remote control systems and equipment
- Metering systems and equipment

All technical, organisational and economical aspects are considered including staff education and training. Emphasis is placed on design and application of digital technology and modern integrated system approach including hardware and software for the acquisition of system state information, local and remote data communication, and execution of control commands.

C 1 System Development and Economics

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of system development and economics. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

The scope of SC C1 is to study economic and system analysis methods important for the development of power systems and to assist utilities to find the best solutions in various evolving, competitive and unbundled conditions in the context of the overall energy supply system and with social and environmental considerations. .

The main areas of attention are:

- Methods and tools for power system static and dynamic analysis.
- Planning predicaments and methods in competitive and regulatory structures. Progress and new approaches in application of power system planning criteria and reliability (security and adequacy) assessment.
- Capacity enhancement by use of risk-based security assessment and advanced information, communication and power-electronics technology for improving system stability and dynamic performance.
- Future dependence, requirements and economy of ancillary services for frequency and voltage control and other system needs.
- The impact of pricing and tariff methods for transmission services on system development.
- Asset management strategies in the definition of optimal policies.
- Planning issues related to long distance transmission and international interconnections.
- System planning issues in newly industrialised and developing countries.
- Impact on system development of new solutions and technologies in fields such as generation and demand side management (DSM).

C 2 System Operation and Control

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of system operation and control. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

The scope of the SC covers the technical, human resource and institutional aspects and conditions needed for a secure and economic operation of existing power systems under security requirements against system disintegration, equipment damages and human injuries.

The main areas of attention are :

- Control and switching of objects, voltage control, frequency control by balancing generation vs. demand, monitoring of loading limits and actions to avoid capacity violations (congestion management). Reserves and emergency strategies, management of fault and restoration situations, interaction between the system and power plants. Short term planning and coordination of system capacity needs with maintenance of the physical assets.

- Evaluation and bench-marking of the system performance in terms of fault frequency, interruptions, operational and maintenance efficiency, both from the technical and economical points of view.

- Impact on system operation targets, methods and performance from new institutional structures of System Operators (TSO or ISO), regulators, market actors, trading mechanisms and contracted ancillary services.

- Requirements, methods, tools (simulators) and performance indices for training of operators.

- Development and use of power system analysis and security assessment functionalities within operational planning and the computer and telecommunication systems supporting the control centres and the operators.

C 3 System Environmental Performance

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of system environmental performance. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

Responsible for the identification and assessment of the various impacts on the natural environment arising in electric power systems, and the recommendation of appropriate monitoring, management and control measures.

Impacts addressed will include greenhouse gases, air and water pollution, electromagnetic fields, noise, visual, land use and flora and fauna impacts.

Major considerations will include: sustainable development vs. economic development; risk assessment and the economics of impact containment; effective communication with the public and regulatory authorities.

Tools and measures for quantifying, controlling and mitigating the environmental impact such as life-cycle assessment (LCA), environmental product declarations (EPD), global benchmarking, etc. are included in the scope.

The committee shall be well aware of the activities of global organisations in the environmental field and when necessary establish cooperations and/or liaisons.

Note :

The Study Committee shall support and work closely together with relevant equipment and systems committees within its field of responsibility.
Each Study Committee is responsible for environmental questions related to its scope of work.

C 4 System Technical Performance

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of system technical performance. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

This SC is responsible for methods and tools for analysis related to power systems in the following fields:

Power Quality Performance: Continuity of supply and voltage quality (magnitude, waveform, frequency, symmetry). Analysis covers measurement and simulation methods, identification of quality indices, monitoring techniques, emission from disturbing installations, immunity of sensitive installations, and mitigation techniques.

Electromagnetic Compatibility (EMC): High frequency disturbances on the electricity supply and all disturbances (HF or LF) reaching equipment other than through the electricity supply. Studies include measurement and simulation methods. Health effects related to low frequency EMF are however excluded.

Power System Security Assessment: development of new analytical techniques for assessment of power system security, design of controls and modelling of existing and new equipment, real time stability evaluation and control.

Lightning: Analysis of lightning characteristics and interactions of lightning with electric power systems and equipment, including protection in MV and LV networks against lightning, and their standardisation.

Insulation co-ordination: Methods and tools for insulation co-ordination in electric power systems and equipment, contributing to optimisation of their cost and reliability.

Study Committee C4 shall support and work closely together with relevant equipment and systems committees within its field of responsibility.

C 5 Electricity Markets and Regulation

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of electricity markets and regulation. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

In the worldwide process of restructuring the power supply industry, new structures, institutions and actors appear. Efficiency improvements are expected from introducing various combinations of competition and regulation.

The scope of the SC is to analyze the different approaches and solutions and their impact on the electricity supply industry in support of the traditional economists, planners and operators within the industry as well as new actors such as regulators, traders and independent power producers (IPPs). Close cooperation with C1 and C2 is expected.

In particular, areas to be covered are:

- Market structures and products such as physical and financial markets and the interaction between them, contracts, internationally integrated markets.
- Techniques and tools to support market actors such as demand and price forecasting profit estimation, financial risk management etc.
- Regulation and legislation such as regulation objectives, extension and limits, price regulation of transmission and ancillary services, international harmonization, environmental and reliability objectives etc.

C 6 Distribution Systems and Dispersed Generation

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of distribution systems and dispersed generation. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

The activities are principally concerned with the assessment of the technical impacts and requirements which a more widespread adoption of distributed/dispersed generation could impose on the structure and operation of the system.

In parallel, the Study Committee should assess the degree to which such solutions are likely to be adopted in the short, medium and long term. The practical importance and timing of the related technical impacts and requirements should also be assessed.

Rural electrification, demand side management methodologies and application of storage are within the scope of this Study Committee.

Through its work the Study Committee strives to objectively analyse the implications of distributed/dispersed generation and to become an internationally recognised forum on this evolving subject.

The SC shall co-operate with Study Committee D1 concerning emerging technologies for dispersed generation, and also with other System Study Committees.

D 1 Materials and Emerging Test Techniques

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of materials and emerging test techniques. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

The activities of CIGRE Study Committee D1 concern the monitoring and evaluation of:

- new and existing materials for electrotechnology,
- diagnostic techniques and related knowledge rules,
- emerging test techniques which may be expected to have a significant impact on power systems in the medium to long term.
- support of other study committees in their analysis of recently introduced and developing materials, emerging test techniques and diagnosis techniques

Said activities are focused mainly on transmission and distribution but emerging generation technologies will also be specifically considered. Within this scope the work of the Study Committee is principally scientific in nature and has as its main aim the provision of timely information on new developments and trends in the field of materials and emerging test techniques to other CIGRE Study Committees.
Through its work the Study Committee strives to keep CIGRE fully aware of the evolution of materials and emerging testing techniques relevant to its activities.
Where the scope of SC D1 work overlaps that of other study committees, SC D1 will strive for good communication and co-operation, the co-ordination of all activities, and, where appropriate, joint activities. Such interactions will extend to all study committees.

D 2 Information Systems and Telecommunication

MISSION

To facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of information systems and telecommunication. To add value to this information and knowledge by means of synthesizing state-of-the-art practices and developing recommendations.

SCOPE

To provide technical support and sound work for international standardisation activities.

To monitor the emerging technologies in its fields of activity, evaluating their possible impact on the EPI.

To continually adapt to present and evaluate future needs of systems, networks, customers and players inside the EPI in its fields of competence.

In a broad sense, the principles, design, specifications, engineering, commissioning, performance, operation and maintenance aspects on the following items are covered:

- Telecommunication and information needs and services in the EPI such as: all types of data transmission, from voice to video, specialised signalling for teleprotection, SCADA, DMS, EMS, measurement and billing systems.
- Information systems for both operational and business activities
- Best practices for delivery of TI and telecommunication services to the EPI.
- Data collection, validation and management.
- Telecommunication devices, media, networks and applications used in the EPI environment.
- Requirements on information systems and services: flow-control, security, economy, transparency, regulation, quality and security (including its management and implementation).
- Consideration of other related technologies which could pave the way towards an integrated enterprise.