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STRATEGIC PLAN FOR 2012 TO 2018 APPROVED BY TC IN OCTOBER 2013

MINOR REVISIONS – APRIL 4, 2016¹

¹ Only change was in contact address of chairman.

1. INTRODUCTION

1.1 Purpose

The purpose of the strategic plan is to describe mid- to long-term objectives and goals of Study Committee (SC) C4. It is intended to be a living document, enabling the planning and organization of future activities. The document will be routinely reviewed by the Advisory Group (AG) C4.1, and revised as necessary and circulated among the SC C4 members through the SC C4 website.

1.2 Time Period

The time period of the current strategic plan is six years (2012-2018).

1.3 Relationship to the CIGRE Strategic Plan and other Study Committees

The CIGRE Technical Committee has prepared a Strategic Plan, which has been adopted by the CIGRE Administrative Council and that is the basis for the preparation of the various Study Committee Strategic Plans. The goal of SC C4 is thus to carry out or to take part in the development of working groups (WG) and other related activities (e.g. tutorial, colloquia, symposia, etc.) that will investigate the latest methods and tools for the analysis of power systems performance, with particular attention to the study of the transmission and distribution system as a whole, to the solutions for maintaining the quality and security of electric power supply, to the consolidation of unbiased technical information useful to assist decision makers and stakeholders, to the analysis of the system implications of new generation technologies, and other similar topics. Study Committee C4 cooperates with other Study Committees in joint working groups where joint participation is beneficial and/or where areas of responsibility overlap.

1.4 Approval

The last CIGRE SC C4 Strategic Plan was approved in October, 2013. This document has minor revisions from that document simply updating the latest active WGs etc. under SC C4.

2. Goals

2.1 Mission Statement for SC C4

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

2.2 Scope for SC C4

SC C4 deals with methods and tools for analysis related to power systems, with particular reference to dynamic and transient conditions and to the interaction between the power system and its apparatus/sub-systems, between the power system and external causes of stress and between the power system and other installations. Specific issues related to the design and manufacturing of components and apparatus are not in the scopes of SC C4, as well as those specifically related to planning, operation and control, apart from those cases in which a component, apparatus, or subsystem behavior depends on, or significantly interacts with, the performance of the nearby power system.

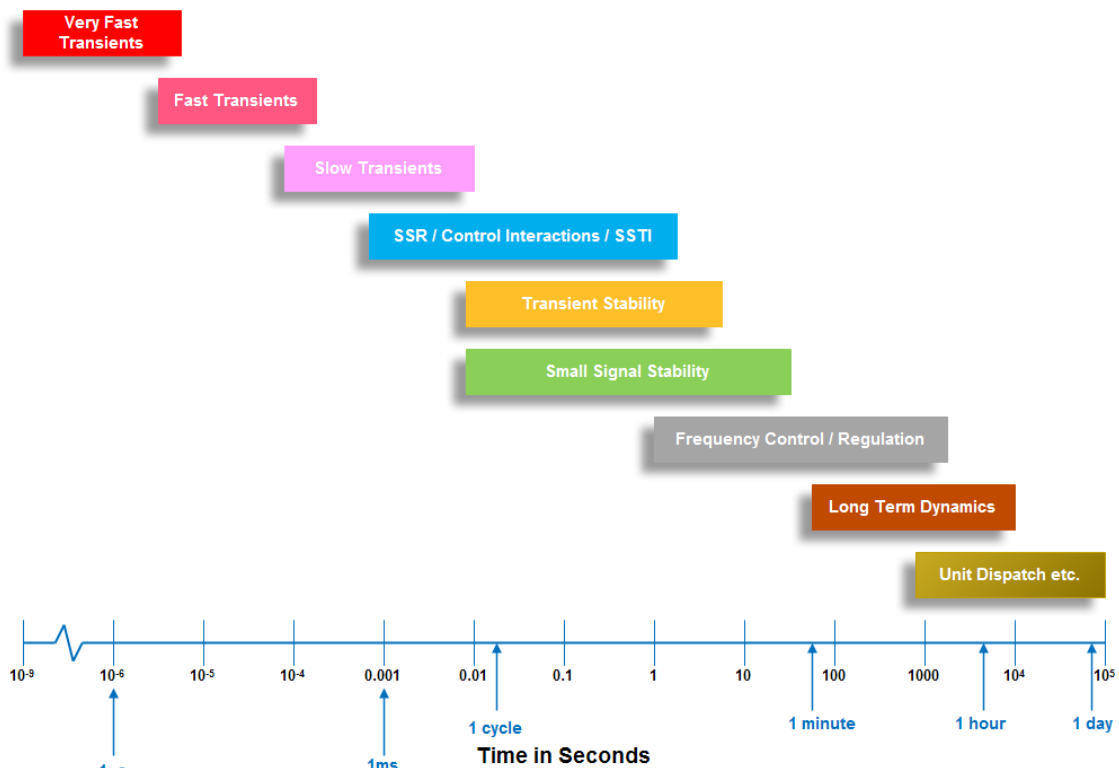


Figure 1: Time frame of various system phenomena of interest in power system studies.

Figure 1 shows the time frame of the various system phenomena of interest in power system studies. The scope of SC C4 is focused on system technical performance issues across this entire range of phenomena and time frames. To better define these activities, the following broad topics of interest are defined: Power Quality, Electromagnetic Compatibility and Electromagnetic Interference (EMC/EMI), Insulation Co-ordination, Lightning, and Power systems performance models and numerical analysis. Inherent in all these activities is the investigation of the development of new tools, models, methods and techniques for the assessment and analysis of such phenomena. In terms of modelling, models are needed and developed both at the equipment and system level, with the focus

being on modelling for the purpose of analyzing the system and equipment interaction. The above points certainly relate also to the emerging Smart Grid technologies, with particular emphasis concerning Power Quality and Advanced Tools for the analysis of power system transients and dynamic performance.

For each of the five (5) areas mentioned above, the topics of interest include, but are not limited to, the following points:

- **Power Quality:** Benchmarking of PQ performance; Compatibility levels and Indices; Measuring and monitoring; Correlation between lightning and voltage dips; Emissions from disturbing installations (e.g. HVDC, SVC, arc furnaces); Immunity of installations.
- **Electromagnetic Compatibility and Electromagnetic Interference (EMC/EMI):** EM vulnerability; EMC in vicinity of power systems; Requirements and solutions for HV substations and generating stations; Effects of intentional EMI on the power system; Understanding geomagnetic phenomena and their impacts on the power system. Health effects related to low frequency EMF are covered by SC C3, but when needed, technical topics (measurement, calculations, mitigation, etc.) will be covered by SC C4.
- **Insulation Co-ordination:** Critical review of existing practice; UHV systems; HVDC systems; Interaction between system and transformers, with reference to transformer energization studies; Resonance and ferroresonance; interaction between long AC cables and the system; influence of system conditions and characteristics on CBs operation, such as TRVs; Insulator pollution influence on the system performance.
- **Lightning:** Critical review parameter statistics; Attachment process; Lightning performance of distribution and transmission lines with reference to the application of line arresters; Low Voltage lines protection; Protection of wind generators; lightning location systems data application.
- **Power systems performance models and numerical analysis:** Power balancing assessments; Influence of power converters and HVDC transmission on system security and AC network performances; Methods for modelling and aggregation of loads in active power networks; dynamic interaction between generation and transmission equipment; methods and tools for the analysis and assessment of power balancing; modelling of renewable energy systems and inverter based technologies; numerical EM analysis for surge propagation studies; Numerical techniques for the computation from steady-state to very fast front transients; modelling unsymmetrical conditions of power systems. Electrical transient interactions between the power system and equipment

(e.g. between power transformers and the power system, performance issues related to the application of long HVAC cables, etc.)

2.3 Strategic Direction

The strategic direction of SC C4 is to initiate and coordinate technical activities related to the above five fields related to power system technical performance. This will be achieved through maximizing the potential of the links that exist with external organizations, such as CIGRE, IEC, Eurelectric and IEEE, as well as through internal coordination with the other CIGRE Study Committees. As an example, presently SC C4 has several joint WGs with CIGRE and other CIGRE SCs. A key focus for the next six-year period is on the technical challenges related to the networks of the future and what is nowadays generally called 'smart grid', with no distinction between transmission and distribution level.

In organizing the SC C4 activities and workforce, it is important to recognize the following key features of its scope:

- It brings together all activities related to the system "technical" performance under one study committee, thus providing for the coordination and integration of these activities.
- The study of the phenomena considered requires a high degree of specialist knowledge and experience related to characteristics and performance of individual components as well as the integrated power system.

The SC C4 strategy to fulfil its mission and scope is expected to be accomplished by focusing on the following main targets:

1. interaction with other committees and organizations;
2. dissemination of the technical achievements;
3. meaningful interaction with target groups;
4. promoting electrical power engineering education (EPEE).

For the first two bullets the relevant AGs have been established (see Appendix). Concerning points 3 and 4, some elements are given in what follows.

2.4 Interaction with Target Groups and meeting their needs

The following is a preliminary list of Target Groups identified by SC-C4:

- Technical Groups: equipment suppliers, consultants, grid planners
- Operations: system operators, distributors, asset managers
- Science and Public Groups: universities, research institutes
- International Technical Organizations: CIGRE, IEEE, IEC
- Other stakeholders: regulators, distributors, consumers

One of the main strategic thrusts of SC C4 is to identify the needs of the target groups, develop useful technical information, and promote trends beneficial to them.

2.5 Promotion of EPEE Activities

A key priority for SC C4 will be to promote power engineering education and research as a means of facilitating progress in engineering and advancing knowledge in the field of System Technical Performance. Active participation of universities and students in SC C4 activities will be encouraged. Technical assistance and support will be provided for developing good power engineering courses. Industry/university collaborative research in the fields of interest to SC C4 will be promoted.

3. Contribution to CIGRE Master Plan 2006-2011

The strategic plan for SC C4 takes into consideration the CIGRE Master Plan 2006-2011, which sets out four major objectives. These are listed below highlighting the contribution from SC C4:

Objective 1: Increase CIGRE's value to members and society

Endorsement of the worldwide focus of CIGRE is an important aspect of the SC C4 strategic plan: this is expected to result in the desired increase of CIGRE value to members and society. The interchange of technical knowledge and information between stakeholders and organizations in different parts of the world will be promoted by SC C4, as done in the past.

Objective 2: Fully engage all stakeholders in the electricity enterprise

SC C4 can effectively promote engagements of all stakeholders of the electricity enterprise, in view of its 'system' connotation. 'Ad-hoc' symposia and colloquia will be one of the major ways for such an accomplishment.

Objective 3: Increase the recognition of CIGRE

Among its roles CIGRE has the fundamental mission of providing the technical-scientific basis for the development of new standards. SC C4 has a consolidated tradition of cooperation with international organizations, such as IEC, CIREN, CENELEC, IEEE, ITU-T, EURELECTRIC, and UIE, which is expected to keep increasing the recognition of CIGRE.

Objective 4: Strengthen support and cooperation between National Committees and Central Offices

All members of SC C4 will be warmly encouraged to act also in this respect, as well as in the recruitment of new members.

Objective 5: Strengthen support and cooperation among Study Committees dealing with power systems performance issues

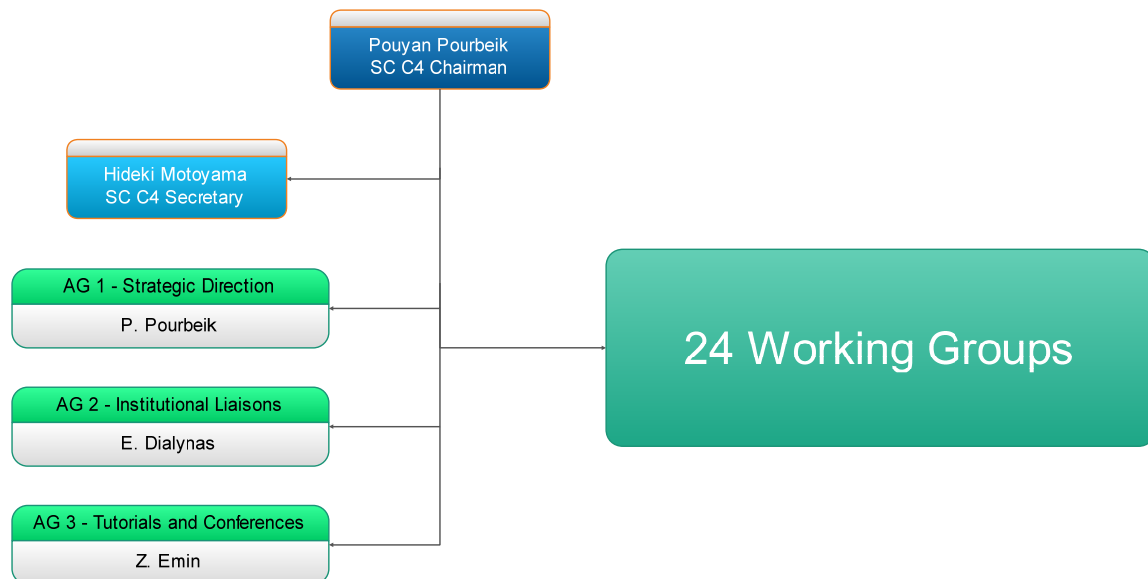
All members of SC C4 will be warmly encouraged to act also in this respect

4. STUDY COMMITTEE STRUCTURE AND MANAGEMENT

4.1. General

At present the Study Committee C4 consists of a Chairman, a Secretary, 24 Regular Members and 14 Observer Members representing 38 countries. Among the 40 constituent members, 16 are from Research Organizations and Universities, 15 from Utilities, and 9 from Regulators, Manufacturers or other entities.

The present overall organization of SC C4, including the Advisory Groups, Working Groups, is illustrated in the following Figure. The structure of SC C4 will be periodically reviewed and modified as necessary as the technical problems it has to address change or the needs of the stakeholders change. The number of active working groups (WGs) is constantly changing as WGs complete their tasks and are disbanded and new WGs are formed. For the most up-to-date list of WGs please consult the SC C4 website (<http://c4.cigre.org/WG-Area>).



4.2. Management

The following Advisory Groups have been set up to assist in the planning and steering of SC C4 activities:

- AG C4.1 Strategic directions
- AG C4.2 Institutional Liaisons
- AG C4.3 Tutorials and Conferences

The AGs are primarily composed of SC members, however, at the discretion of the SC Chairman other industry experts may be asked to join AG C4.1. The AGs are purposefully small groups focused on discussing the strategic direction of the SC, needed tutorials and conferences and identifying where liaison activities may be

needed. The results of the AG discussions are then formulated into recommendations which are brought to the SC C4 main meetings (or disseminated to SC C4 members by email) for review and execution as appropriate. Details of the AGs are reported in the Appendix.

Appendix – STRATEGIC PLANS FOR SC C4 ADVISORY GROUPS

A.1 Strategic directions (AG C4.1)

AG C4.1 has the purpose of

- Assisting the Chairman in coordinating the SC activities; facilitate the interaction among AGs and WGs and promote active participation of experts in WGs.
- Routinely reviewing the SC C4 strategic direction and current activities and thus suggesting relevant SC actions, for example, initiation of new WGs, to address gaps in the SC activities and revising the SC strategic plan as needed to address emerging industry and stakeholder issues.
- Identify the need for any new standards, in the scope of interest of SC C4, and thus whether a WG should be established to develop the technical background needed for such a standard to be developed by other organizations such as IEC, IEEE, etc.
- Suggest the creation of Ad hoc Groups, when necessary, with a particular scope and time-frame to accomplish the needed task.

AG C4.1 will be composed on no more than roughly 16 members:

- a. The SC chairman, who will act as the AG convener
- b. The SC secretary
- c. Up to three (3) expert advisors for each of the five (5) SC C4 areas of interest; these experts will be selected by the SC chairman and will be primarily members of the SC but may also be other CIGRE members who are not SC C4 members.

A.2 Institutional Liaisons (AG C4.2)

Interaction with other technical organizations is essential for identifying and effectively dealing with emerging system performance problems. Additionally, CIGRE has the important role of providing the scientific and technical knowledge base on which new standards are developed by international organizations such as IEC. In this context, SC C4 intends to work collaboratively as appropriate with the following organizations:

- **International Electrotechnical Commission (IEC)**, in the area of conducted and radiated interferences (at industrial and high frequencies), insulation coordination, power quality. The main committees concerned are IEC 65, IEC TC 77, IEC SC77A/WG8, IEC77A/WG9, IEC TC 8 and CISPR.
- **Cenelec (CLC)**, in the same fields of activities as for IEC but in the framework of European mandates in order to achieve the requirements of the European Directives.
- **International Telecommunications Union (ITU-T)** on induction effects on telecommunications lines, potential rise above ground etc.

- **International Conference on Electricity Distribution (CIRED)** as regards Power Quality and EMC in distribution systems and at the interface between transmission and distribution.
- **Institute of Electrical and Electronics Engineers (IEEE)**, in dealing with specific problems related to all technical areas dealt with in C4. The intent is to pool resources when appropriate and to avoid duplication as well as conflicting reports.
- **Union of the Electricity Industry (EURELECTRIC)**, in relation to Power Quality and EMC.
- **International Union for Electrotechnology (UIE)** for power-quality problems caused or experienced by industrial installations using electrotechnologies.
- **Liaisons, as needed, with other CIGRE SCs**

A.2 Tutorials and Conferences (AG C4.3)

Communication with the members of CIGRE as well as with the “outside world” is an important aspect of this Strategic Plan. The traditional methods of communication have been ELECTRA, biennial sessions, the symposiums and colloquiums. However, other means with a view to complementing the traditional methods and improving dissemination of the technical achievements are:

- More effective use of the SC C4 internet home page, e-mail and other electronic means. The SC C4 website is maintained by the SC C4 webmaster – the SC C4 secretary typically assumes the role of webmaster.
- Joint sessions on special subjects with two or more study committees participating.
- Panel sessions on topical issues, possibly with more than one study committee involved.
- Organizing short courses and tutorials on subjects of topical interest in different parts of the world.
- Organizing symposiums, colloquiums, SC and WG meetings in developing countries and in Eastern European countries.
- Increased study committee participation in Regional Meetings of CIGRE.

SC C4 has a membership representing 38 countries; as far as possible, advantage will be taken of this large representation to promote the worldwide focus of CIGRE. The function of this AG is to help promote and formulate ideas for tutorials, colloquia, and other conferences supported by SC C4.