SMB/6014/R

STRATEGIC BUSINESS PLAN (SBP)

IEC/TC OR SC:	SECRETARIAT:	DATE:
122	**JP**	**2016-10-14**

Please ensure this form is annexed to the Report to the Standardization Management Board if it has been prepared during a meeting, or sent to the Central Office promptly after its contents have been agreed by the committee.

A. STATE TITLE AND SCOPE OF TC

Are there any new or emerging trends in technology that will impact the scope and work activities of the TC? Please describe briefly.

Do you need to update your scope to reflect new and emerging technologies? If yes, will these changes impact another TC's scope or work activities?

If yes, describe how these will impact another TC(s) and list the TC(s) it would impact

TITLE

UHV AC TRANSMISSION SYSTEMS

SCOPE

Standardization in the field of AC transmission technology for highest voltage of the system exceeding 800 kV, particularly the preparation of systems-oriented specifications such as those for planning, design, technical requirements, construction, commissioning, reliability, availability, operation and maintenance. Development of processes for specifying requirements and demonstrating whether the required performance of UHV systems is assured.

Responsibility for equipment standards remains with product TCs, except for specific equipment which is not within the scope of an existing TC but is nevertheless essential for the UHV transmission system. The UHV AC Transmission TC will consult and coordinate with the product TCs in all systems-related aspects of equipment standards.

BACKGROUND

Ultra High Voltage (UHV) AC transmission systems were developed in Italy, Russia, USA and Japan in the 1970s and 1980s, to increase the bulk power transmission capability over long distances. The first commercial UHV transmission line, Ekibastuz – Kokchetav (1 150 kV, 500 km), was put into operation in the USSR in September 1985. In August 1988 it was prolonged by 410 km from Kokchetav to Kustanai, i.e. the full length became 910 km. The transmission line operated at 1 150 kV until January 1992 and then the voltage was reduced to 500 kV because there was no need to transmit the full power. As this line was unique it was not relevant to begin a standardization procedure in the IEC.

On 6 January 2009 the 1 100 kV UHV AC pilot project in China was put into commercial operation, which further proved the functioning of this technology for future applications. The extension of this UHV AC pilot project with the installation of series capacitors has allowed the project to transmit power up to 5 GW since the end of 2011, and it operates stably and securely.

In 2012, India has also put into trial operation a 1 200 kV test station consisting of 1 200 kV bays and 1 200 kV test lines at Bina, Madhya Pradesh. Test station is presently charged at 1 200 kV voltage level. Further to completion of interconnection works of 1 200 kV test station with grid by this FY 2016, power flow through the 1 200 kV equipment's will be accomplished.

B. MANAGEMENT STRUCTURE OF THE TC

Describe the management structure of the TC (use of an organizational chart is acceptable) (should be integrated by CO automatically) and, if relevant (for example an unusual structure is used), provide the rationale as to why this structure is used.

Note: Check if the information on the IEC website is complete.

When was the last time the TC reviewed its management structure? Describe any changes made. When does the TC intend to review its current management structure? In the future, will the TC change the current structure, for example due to new and emerging technologies, product withdrawal, change in regulations etc. Please describe.

Make sure the overview includes:

- any joint working groups with other committees,
- any special groups like advisory groups, editing groups, etc.

- **Chair: Dr Liangzhong Yao (CN)**
- **Secretary: Dr Eiichi Zaima (JP)**
- **Assistant Secretary: Mr Yukiyasu Shirasaka (JP)**
- **Assistant Secretary: Mr Kyoichi Uehara (JP)**
- **Technical Officer: Ms Suzanne Yap Geok Sim**
- **P-members:**

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Russian Federation	RU
Sweden	SE
Switzerland	CH
United Kingdom	GB

- **Liaisons**

  TC 8, TC 14, TC 28, TC 99

- **Working Groups**

  WG 1: System design

  WG 2: Substation and Transmission Line Design

  WG 3: Commissioning

C. BUSINESS ENVIRONMENT

Provide the rationale for the market relevance of the future standards being produced in the TC.

If readily available, provide an indication of global or regional sales of products or services related to the TC/SC work and state the source of the data.

Specify if standards will be significantly effective for assessing regulatory compliance.

GENERAL

The second 1 100 kV UHV AC project is under construction in China and several projects are in planning. Besides China, several other projects for 1 200 kV in India are also in planning and construction today.

In Brazil and South Africa planning has been started to consider the potential use of UHV DC and UHV AC systems, and it can be expected that in Europe and North America UHV AC systems may also be introduced, with the change in the power supply to a mix with large quantities of renewable power generation. In all these cases, the resources from wind, large hydro and solar will be located far away from the end users and bulk power transmission systems such as UHV will be required to connect the sources to existing power grids.

UHV in AC can be seen as an additional technical solution to long-distance UHV DC and HVDC bulk power transmission, potentially in a combined power network.

ECOLOGICAL ENVIRONMENT

The ecological impact of electric power transmission at UHV AC is low in general. The most critical impact is visibility of overhead lines which can have tower heights of 80 m to 140 m. Not all regions will accept such high towers for aesthetic reasons. AC underground systems are needed to offer solutions for UHV AC lines where such high towers cannot be built. Technical solutions are available and rules need to be set up for when undergrounding is needed.

Electromagnetic fields along lines may also be critical and a reason to go underground with a fully earth system.

The noise of overhead lines or substations is another system aspect of UHV AC transmission which needs normative rules.

Also, there is a need for a consistent process to specify countermeasures to deal with ecological and environmental issues, and to verify them in a consistent manner.

D. MARKET DEMAND

Provide a list of likely customers of the standards (suppliers, specifiers, testing bodies, regulators, installers, other TC/SC's etc.). Do not specify company names, only categories of customers.

The increase in electric power consumption world-wide and the concentration of electric load in megacities and industrial areas require higher capacities in power transmission lines. The required electric current in existing transmission lines in several locations of the world has reached rated current levels of up to 4 000 A, and is reaching its technical limit at EHV. The only way to increase the bulk power transmission capacity in an AC system is to use higher transmission voltages (at the UHV level).

Using renewable energy sources on a large scale, in sites far away from the main load centres, e.g. in offshore wind farms, large hydro power plants or large photovoltaic installations in deserts, is also a driving force to introduce higher transmission voltages with acceptably low transmission losses, leading to a better economic balance.

Interconnecting existing AC transmission systems of 400 kV or 500 kV in various regions—Europe, Asia of the ASEAN countries, Africa south of the Sahara, North and South America and India—will also need the higher AC transmission voltage of UHV.

Furthermore, the number of countries to install UHV systems will grow and UHV AC

interconnections between countries may be realized in future, which needs a globally agreed process to manage UHV AC systems at international level.

The Institute of Electrical and Electronic Engineers (IEEE) has already started standardization of UHV AC systems. CIGRÉ has also started technical work on UHV AC systems.

E. TRENDS IN TECHNOLOGY AND IN THE MARKET

If any, indicate the current or expected trends in the technology or in the market covered by the products of your TC/SC.

TREND IN TECHNOLOGY

The equipment technology of circuit breakers, disconnectors, earth switches, current and voltage transformers, bushings, power transformers, gas-insulated switchgear (GIS) and transmission lines has already started to extend product standards to UHV AC. For underground cables and gas-insulated transmission lines the development of product standards for UHV AC is under way.

The successful application of all these products to UHV AC systems will need UHV AC system standards to give rules for interconnecting UHV AC lines on a world-wide standardized basis. This is important for equipment manufacturers to be able to standard-design and manufacture of products, since the development costs are very high. A standardized market and systems requirement is the most efficient way to reduce costs.

Also, in order to initiate and maintain a stable power supply, standards to define appropriate processes to verify the required performance of UHV AC systems are needed, in addition to individual system-related standards.

New challenges to be solved by international standardization are:

1. interoperability of equipment following standardized testing requirements;

2. environmental impact of UHV AC systems: since this can be considerable, normative rules are needed for noise, electromagnetic fields and visual impact;

3. control and protection of UHV AC, which require rules for high power reliability and network stability;

4. efficient operation of AC UHV systems, which needs normative rules for power factor compensation;

5. handling of network failures such as earth or line faults;

6. interaction of UHV AC lines with regional power transmission, which requires grid connection codes;

7. proper management of a UHV power system from concept planning to decommissioning, to ensure that required performance is achieved and maintained through its lifecycle.

The main activity is seen in the following areas:

1. general system-related specifications for the design of substations and transmission lines;

2. harmonizing of system-related aspects for on-site acceptance tests of electrical equipment and system commissioning of UHV AC;

3. reviewing all the phases of UHV power systems and developing a consistent approach to specifying their requirements, to demonstrate that proper performance is properly fulfilled and maintained.

To introduce UHV AC on a world-wide basis will need new system-oriented international standards. This is the only way to reduce the high system cost, achieve the necessary

reliability/availability requirements and tackle expensive product development.

TREND IN THE MARKET

The biggest market trend for UHV AC is towards long-distance bulk power transmission and interconnection with existing power systems; there is also a trend towards building strong power reception grids to receive more large-scale power feed-in. The grid changes are driven by fast-growing power consumption in load centres of emerging countries and by structural changes of coal, gas and nuclear power generation towards full renewable power generation with wind, solar, large hydro and others at far-away generation locations.

With increasing renewable power generation, mainly from wind, large hydro and solar, electrical energy will be competitive with oil, gas and coal sources, but it will need new AC transportation systems to cope with the needs foreseen.

AC transmission lines or corridors of 5 GW to 10 GW will be needed, which is more than double today's 3 GW to 4 GW at 400 kV or 500 kV. Doubling the AC transmission voltage to 1000 kV can solve this in an efficient and economic way. UHV AC provides reliable, safe and efficient bulk power transmission over long distances to get energy into load centres or to interconnect regions to balance load and generation.

On the other hand, the characteristics, such as its large power flow mentioned above, of UHV AC system may have a serious impact on existing power grids and their operation if, for example, severe transmission faults occur on the UHV AC lines built without the proper consideration and evaluation.

F. SYSTEM APPROACH ASPECTS (REFERENCE - AC/33/2013)

Does your TC/SC have a need for a systems approach?

If so:

- Will the Systems work be in a single TC or in multiple TCs?
- Will a Systems Evaluation Group (SEG), Systems Committee (SyC), or Systems Resource Group be required?
- Is your TC/SC work of relevance to ISO?
- Is or are there fora or consortia working in parallel to IEC? Is there a chance to integrate this work in your TC/SC?

This should not only be restricted to the customer/supplier relationships with other TC/SCs indicating types of co-operation (e.g. liaisons, joint working groups) but be of a more generic nature.

If there is no need for a systems approach as outlined in AC/33/2013, is it intended a TC would not be requested to report on general systems approach considerations such as customer/supplier relationships, liaisons, joint WGs, etc. as referenced in the system approach matrix illustrated in slide 14 of the presentation attached to AC/37/2006?

This newly established TC on UHV AC systems will mainly act as a coordinator of systems aspects in connection with the relevant product and horizontal committees.

The focus of standards to be developed by this TC will be purely system-related and they will be established in coordination with related product standards and horizontal standards.

In this TC, based on the communication with relevant TC/SCs, all the stages in a UHV project from concept planning to design, installation, operation, maintenance and others will be reviewed to provide an appropriate management approach through its life.

The related TCs and SCs could be:

TC 7	Overhead electrical conductors
TC 8	Systems aspects for electrical energy supply
TC 11	Overhead lines
TC 14	Power transformers

SC 17A	HV switchgear and control gear
SC 17C	HV switchgear and control gear assemblies
TC 20	Electric cables
SC 22F	Power electronics for electrical transmission and distribution systems
TC 28	Insulation co-ordination
TC 33	Power capacitors
TC 36	Insulators
SC 36A	Bushings
SC 36B	Insulators for overhead lines
TC 37	Surge arresters
TC 38	Instrument transformers
TC 42	High-voltage and high-current test techniques
TC 73	Short-circuit currents
TC 77	Electromagnetic compatibility
TC 85	Measuring equipment for electrical and electromagnetic quantities
TC 95	Measuring relays and protection equipment
TC 99	System engineering and erection of electrical power installations in systems with nominal voltages above 1kV a.c. and 1.5kV d.c.
CISPR	International special committee on radio interference

Additionally this TC will cooperate with ISO and related groups in IEEE and CIGRÉ.

G. CONFORMITY ASSESSMENT

With reference to clause 6.7 of Part 2 of the ISO/IEC directives, are all you publications in line with the requirements related to conformity assessment aspects?

Will the TC/SC publications be used for IEC Conformity Assessment Systems (IECEE, IECEx, IECQ, IECRE)?

Will any of your standards include test specifications, reproducible test requirements, and test methods?

Are there likely to be special conformity assessment requirements generated by any standards projects? If yes, list which projects.

TC 122 being a new technical committee does not have any publications to be used for IEC Conformity Assessment Systems yet.

H. 3-5 YEAR PROJECTED STRATEGIC OBJECTIVES, ACTIONS, TARGET DATES

STRATEGIC OBJECTIVES 3-5 YEARS	ACTIONS TO SUPPORT THE STRATEGIC OBJECTIVES	TARGET DATE(S) TO COMPLETE THE ACTIONS
1. To develop Standards, Technical Specifications and Technical Reports for planning, design, technical requirements, construction, commissioning, reliability, availability, operation and maintenance.	– To define and establish standards for UHV AC systems through analysis of the demand of end users and manufacturers;	
	a) To publish a Technical Report on “The basic document for UHV AC transmission systems”	2016 - Done -

	b) Proposed new work on System design circulated as PNW 122-17 Ed.1.0	2018
	c) Proposed new work on Substation and transmission line design circulated as PNW 122-18 Ed.1.0	2018
	d) Proposed new work on Commissioning circulated as PNW 122-19 Ed.1.0	2018
2. To develop standardized processes to specify necessary requirements and verify performance given the documents in the IEC and relevant organizations.	– To define the positioning of the IEC towards other organizations such as CIGRÉ and IEEE.	Done TC122 agreed to establish liaison with CIGRE SC A2.
3. To establish cooperative relationships with the relevant product committees as required by the standardization work.	– To work out a time schedule for UHV AC system-relevant standards in coordination with the activities of related IEC product and horizontal TCs.	Done TC 122 secretary will contact officially the secretary of TC 42 for making the liaison relationship
Note: The progress on the actions should be reported in the RSMB.		