STRATEGIC BUSINESS PLAN (SBP)

| IEC/TC OR SC: | SECRETARIAT: | DATE: |
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**A. STATE TITLE AND SCOPE OF TC**

**TC8: System aspects of electrical energy supply**

To prepare and coordinate, in co-operation with other TC/SCs, the development of international standards and other deliverables with emphasis on overall system aspects of electricity supply systems and acceptable balance between cost and quality for the users of electrical energy. Electricity supply system encompasses transmission and distribution networks, generators and loads with their network interfaces.
This scope includes, but is not limited to, standardization in the field of:

- Terminology for the electricity supply sector,
- Characteristics of electricity supplied by public networks,
- Network management from a system perspective,
- Connection of network users (generators and loads) and grid integration,
- Design and management of de-centralized electricity supply systems e.g. microgrids, systems for rural electrification,

While relying on efficient and secure data communication and exchange, TC8's scope does not include standards for communication with appliances and equipment connected to the electric grid or for communication infrastructure serving the electric grid.

TC8 is responsible for basic publications (horizontal standards) on standard voltages, currents and frequencies ensuring the consistency of the IEC publications in these fields.

TC8 cooperates also with several organizations active in the field of electricity supply such as CIGRE, CIRED, IEEE, AFSEC, IEA.

**SC 8A: Grid Integration of Renewable Energy Generation**

To prepare and coordinate, in co-operation with other TC/SCs, the development of international standards and other deliverables for grid integration of variable power generation from renewables such as PV, wind energy with emphasis on overall system aspects of electricity supply systems (grids) as defined in TC 8 scope, but not covering issues usually covered by regulation such as renewable energy policies e.g. infeed tariff schemes for renewables. SC 8A focuses on the impact of a high percentage of renewables connected to the grid, considering that their variability and predictability impact the functioning of the whole electricity grid. It covers grid integration standards for renewable energy, aggregating contributions of all grid users and prescribing interaction modes between the grid and power plants. This includes requirements for interconnection and related tests for grid code compliance, as well as standards or best practice documents for planning, modeling, forecasting, assessment, control and protection, scheduling and dispatching of renewables with a grid level perspective.

SC 8A deals with the grid level requirements enabling secure, non-discriminatory and cost effective operation of electricity supply systems with a significant share of renewable generation and cooperates with TC 82, TC 88, TC 95, TC 114, TC 115, TC 117, TC 120 and other product committees to ensure technical feasibility and verification of the implementation

of the grid level requirements.
SC 8A coordinates with TC 8 and SC8B which cover some topics related to Distributed Energy Resources (e.g. interconnection with the grid, design and operation of micro grids).

**SC 8B: Decentralized electrical energy systems**

To develop IEC publications enabling the development of secure, reliable and cost-effective systems with decentralized management for electrical energy supply, which are alternative, complement or precursor to traditional large interconnected and highly centralized systems. This includes but is not limited to AC, DC, AC/DC hybrid decentralized electrical energy system, such as distributed generation, distributed energy storage, virtual power plants and electrical energy systems having interaction with multiple types of distributed energy resources.

A popular concept is currently the “microgrid” defined as a group of interconnected loads and distributed energy resources with defined electrical boundaries that acts as a single controllable entity and is able to operate in both grid-connected and island mode.

Decentralized electrical energy systems have applications for developing countries (focussing on access to electricity) as well as for developed countries (focusing on high reliability, black-out recovery and services). Interactions within decentralized multi energy systems should also be considered.

Standardization activities in SC 8B will proceed with cooperation with concerned TCs, SCs and SyCs, including but not limited to IEC SyC Smart Energy, SyC LVDC, TC2, TC 22, TC57, TC64, TC82, TC88, TC 95, TC 99, TC114 and TC120. Also, SC8B will cooperate with organizations such as CIRED, CIGRE SC C6, …

## B. Management Structure of the TC

The list of Working Groups, Project Teams and Maintenance Teams is available at:
TC 8: http://www.iec.ch/dyn/www/f?p=103:29:0::::FSP_ORG_ID:1240#1
SC 8A: http://www.iec.ch/dyn/www/f?p=103:29:0::::FSP_ORG_ID:10072#1
SC 8B: http://www.iec.ch/dyn/www/f?p=103:29:0::::FSP_ORG_ID:20639#1

## C. Business Environment

The electricity supply market is undergoing rapid changes, with many new actors and fundamental changes in processes, replacing a market with vertically integrated monopolies.

The relations between various parties are increasing in complexity. In many parts of the world the infrastructures need to be renewed, and generally will grow to meet the demand and the fast growing phenomena of distributed generation. On the other hand developing countries need to invest a lot in order to provide electricity supply and build infrastructures for basic need and increasing demand.

In Europe, “Draft Grid connection codes” have been under development by ENTSO-E in view of being endorsed by the European Commission. At the same time, numerous pre-standardisation activities are conducted in CIGRE’s Study Committees.

By the end of 2016, many countries had started to develop wind power and the global installed capacity reached 486 GW, meanwhile, the global installed capacity of photovoltaic power reached 302 GW. RE generations will be expected to have a broad application and a booming market because of its clean, sustainable characteristics. The impact of a high percentage of renewables connected to the grid, will dramatically change the functioning of the whole electricity grid, and the variability, predictability and controllability of RE generation should be carefully considered in the period of time when the power grid

will be experiencing the transition to a high share of renewable energy.

By the end of 2016, more than 60 million households (approximately 300 million population) have benefited from islanded renewable energy resources (electric power system with dispersed management) (data resource: Renewable Energy Capacity Statistics 2017, IRENA). As an efficient way utilizing renewable energy resource on spot, distributed energy resource has become the common choice of handling energy crisis and environment challenge around the world. More than 150 countries have developed their own renewable energy goal and issued supportive policies.

Microgrid is one of the most common decentralized energy systems, according to the Microgrid Deployment Tracker 2Q15 issued by Navigant Research, by the end of the 2ndquarter, 2015, the capacity of microgrid worldwide under application, planning, construction and operation has exceeded 12,000 MW. Credited itself with the active role in promoting utilization of renewable energy resource, microgrid has been widely deployed in both developed and developing countries.

As illustrated in the IEC Whitepaper Grid integration of large-capacity renewable energy sources and use of large-capacity electrical energy storage, and Microgrids for disaster preparedness and recovery with electricity continuity and systems, published in 2012 and 2014, respectively, the decentralized energy system, including distributed energy resource and microgrid, is different from the large scale power plan or conventional power system. Specific standardization work from the aspect of decentralized energy system is in urgent need.

## D. MARKET DEMAND

There is a need for standards to support opening the market to new actors, for new forms of business and better conditions for consumers, but at the same time increase the quality and availability, and more generally the dependability of supply. Although a lot of standards are in place or under development, it is necessary to improve the coordination between the existing committees involved and ensure that all necessary system aspects are covered, and develop a flexible framework.

Regulation authorities are interested in consensus documents that assist them organizing and supervising the evolution of the market and allow comparing operators and countries.
TC8 develops standards that can be used to demonstrate compliance to Grid Codes or other applicable regulatory framework and guidelines for system designers or operators..
There is a general demand for publications and international standards that can be a reference for:

- implementation of harmonized rules in regulatory frameworks;
- specify and design flexible solutions that enable technical and commercial innovation;
- define the essential technical and economical characteristics, methods of assessment and measurement;
- clarify the conditions to be respected by the different involved parties for fair sharing of responsibilities, and proper operations (power producers, grid operators, distribution network operators, system and equipment manufacturers, suppliers, consumers, authorities, industrial and private users...).

RE generation is more and more often the power technology of choice as national governments, utilities, energy developers seek to diversify their energy mix and reduce CO2 emissions.

Experiences on managing with high share of renewables are already made in some parts of the world.
Standards for RE grid connection can help to share these experiences by defining terms, ways of implementation and listing best practices; standardized grid support functions with accurate terms and definitions are of great value to manufacturers.

The market is also exploring “non conventional” solutions. There is a need for standards enabling the development of secure, reliable and cost-effective decentralized systems for electrical energy supply, alternative/complement/precursor to traditional large interconnected and highly centralized systems. They have applications for developing countries (focussing on access to electricity) as well as for developed countries (focussing on high reliability, black-out recovery and/or services). Potential customers of the standards include but not limited to:

- Integrators and operators of decentralized energy system, research institutes, manufactures, test and certification bodies, grid operators, etc.
- Standards development organizations such as IEEE and NESL, and IEC TC/SCs such as TC 82, TC 69, TC 64 and SyC Smart Energy may also be interested.

## E. TRENDS IN TECHNOLOGY AND IN THE MARKET

Developments in information and communication technologies allowing a better connection of the end user to markets will allow new services and benefits. It will also allow new operating margins for example implementing demand response mechanisms, and enable energy efficiency to better respect the environment. Standardization will also foster markets of needed advanced commercial solutions for the benefits of users.

The transition from passive to active networks relies on the deployment of smart grid technologies including smart metering systems, as well as on the modification of existing roles and business processes of the EVH, HV and MV/LV System Operators. Such evolutions will also tend to modify the relations between EHV, HV and MV/LV System Operators as well as the other actors of the Electric Power System, such as Grid Users, Regulators, Balance Responsible Parties, Retailers, or Flexibility Operators.

New forms of generation, primarily based on renewable form of energy sources as well as electric energy storage, are being developed and introduced into the electricity networks. Incorporating more RE generation will bring additional variability and uncertainty into the grid. Worldwide studies and experiences in recent years have shown that new technical solutions are needed to address this new situation. The new solutions will include new technologies, methods and practices, applied in order to provide more flexibility and improve the efficiency of power systems, constantly balancing generation and load to make the power systems reliable and maintain security of supply, e.g. avoid any interruption in the supply of power.

Integration of RE generation technologies requires the following items to be considered:

- Advanced grid performance of RE generation,
- Testing and assessment of the grid performance of RE power plant,
- Centralized voltage control and power control of RE generation cluster,
- Smart operational state monitoring and maintenance of RE power plant,
- RE generation modelling improvements,
- More accurate RE power forecasts and better use of them in system operation,
- Enhancement of optimized dispatching & operation tools and practices.

Decentralized energy systems have applications for developing countries (focussing on access to electricity) as well as for developed countries (focussing on high reliability, black-out recovery and/or services).

Fast development of renewable energy generation, energy storage technology and integration with ICT, as well as the change of end-user consumption, will reshaped the power supply systems. The grid-friendly integration, safe and efficient operation of decentralized energy system have become the research focus. Related technologies include are not limited to:

- technologies enabling grid-friendly integration such as microgrid and virtual power plant;

- technologies enabling optimal control such as power electronic control and power control;
- technologies enabling operation monitoring, power forecast and optimal operation, such as advanced information process (data mining, cloud computing, etc.), communication and active distribution network;
- technologies enabling interaction between user of distributed energy resource and distribution network, such as demand response.

LVDC appears to be an option, again, for electricity distribution, inside buildings (e.g. in IT industry) and outside (e.g. for Energy access in developing countries). TC8 is first concerned with basic characteristics (standard voltages, currents) and then with potential application in decentralized supply systems (SC8B).

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

The object and scope of TC8 deals with general aspects of electricity supply and this influence many stakeholders. For this reason, several Technical Committees and international organizations have been requested to participate in TC 8 work.

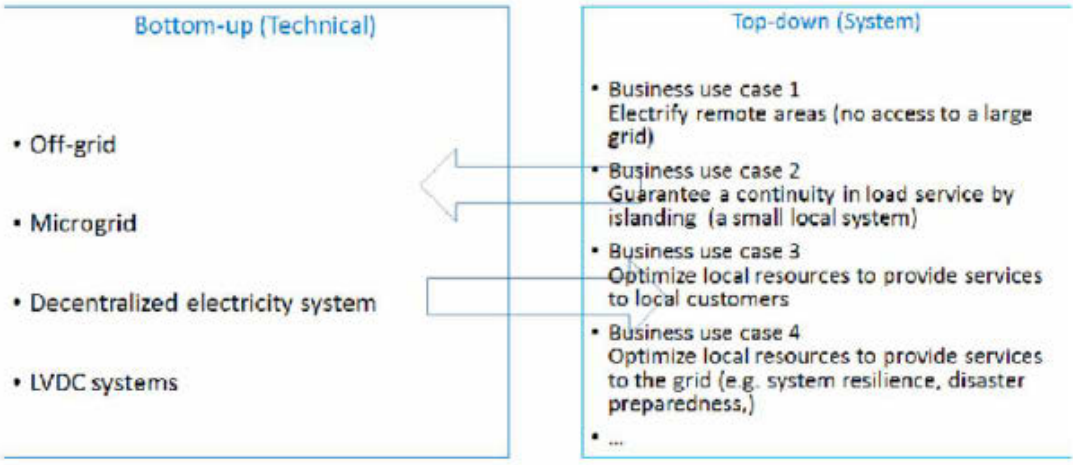
TC8 has liaisons with many Technical Committees such as TC 2, TC 13, TC14, TC17, TC38, TC57, TC59, TC64, TC69, SC77A, TC82, TC88, TC95, TC99, TC114, TC115, TC120, TC122 and new TC 123, to ensure technical feasibility and implementation of its system level requirements.

More effective cooperation is needed with several TCs

- TC8 (and SCs) participate in, or have established, Joint Working Groups
- Due to the number of common issues, TC8 (and SCs) and TC64 (LV Electrical Installations and protection against electric shocks) have established a Coordination Group (Decision 55 in 64/2212/DL, confirmed in Vladivostok on TC8 side). Joint projects should follow.

TC8 and SCs contributes to System Committees actions, especially Smart Energy and LVDC, by supporting the development of (Generic) requirements and by closing identified gaps within their scope.

SC8B is especially in charge of combining technologies and market in order to develop standards for developing countries (focussing on access to electricity) as well as for developed countries (focussing on high reliability, local optimization, black-out recovery and/or services).




System approach for decentralized electricity systems

## G. Conformity Assessment

TC8 currently doesn't have standards directly used by IEC CA Systems. Projects, e.g. projects on interconnection with the grid, might generate need for conformity assessment requirements in future, in relation to Grid Codes.

## 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 |
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| **TC8** | | |
| To develop and keep up to date the terms and definition of International Electrotechnical Vocabulary | WG 1 will contribute to the amendments of chapters of the IEV dealing with electricity supply system, namely 601-605 and 617 | 2020 |
| To maintain major reference standards (IEC 60038, IEC 60059 and IEC 60196) and technical specifications (TS 62749) | MT 1 will review IEC 60038 and Especially add a part dealing with LVDC voltages for supply systems (see also hereafter)<br><br>WG11 will maintain the TS62749 by collecting information from different region of the world and cooperate with IEC SC 77A for improving the consistency of power quality vs. compatibility levels. | 2020 |
| To develop/maintain, in cooperation with other TCs, requirements for the connection of distributed generation and standards permitting to demonstrate compliance with them, as a series of publications IEC 62786-x. | PT 62786 published the first edition of IEC TS62786 for distributed energy resources (DER) interconnection with the grid. In its activity, PT62786 has to duly take into consideration the practices of the different Countries and it has to be bound by laws and standards already developed driven by local Regulators, Authorities and Governments.<br><br>Further developments and maintenance are made in cooperation with other TCs and especially TC82 and 120 and the project will form a series of publications, current TS62786 becoming TS62786-1: General requirements. PT is changed in a JWG10 following decision taken in Vladivostok 2017.<br><br>NOTE: As most of distributed energy resources are RE generators, coordination with SC 8A is necessary. | 2020 |
| To define guidelines for the | WG 8 as published TS 63060: | 2018 |

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| management of electrical energy supply networks | general framework and procedures for maintenance of electrical energy supply networks.<br><br>Other aspects of network management will be considered by TC8, e.g based on the different aspects listed by SyC SE in project IEC 62913-2-1: Generic Smart Grid Requirements - Grid related Domains. | e.g. IEC/TS 63222 on power quality management: 2020 |
| To initiate technical work on LVDC systems | To develop, in cooperation with SyC LVDC, SC77A SC8B and others, a TR on “Assessment of standard voltages and power quality requirement for LVDC electricity supply systems”, preparing standardization work by TC8 MT1, WG11 and SC77A WG9 …, | 2020 |
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| **SC8A** | | |
| SC8A: To develop a roadmap report and a standard framework for grid integration of RE generation; | Collect the common market needs on international standards for grid integration of RE generation; collect information from regulatory context in different countries, e.g. network codes, renewable policies, and identify relevant issues for information sharing and standardization; work out a roadmap for the development of IEC standards and best practices concerning grid integration of RE generation by AHG 3.<br><br>Maintenance cycle of that document is intended to be every 2 years | 2019 |
| To finalize the WGs and JWGs projects tasks. | Finish the development of IS on definitions related to grid integration of RE, TS on grid compliance assessment and TR on RE power forecast. | 2019 |
| To develop some TRs concerning RE grid performances, weak AC grid connection to conclude the best practices in RE grid integration area. | Future projects cover the development of some TRs concerning grid performances of RE including fault ride through, fast frequency response, super and sub-synchronous control interaction, weak AC grid connection, as | 2020 |

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| | well as coordination, utilization and performance of electrical balance of plant equipment. New working groups should be established to start the relevant technical work. JWG5 has been established to carry these projects | |
| **SC8B** | | |
| *Maintain the SEG 6 final report to track the technology, market, and related policy development, and serve as resource for future SC 8B work.* | *A AHG has been established to:*<br>*1. review and transform SEG6 final report to SMB into a TR*<br>*2. develop a roadmap for SC 8B and publish as a TR* | *2019* |
| *To deliver guidelines on grid-connected AC microgrids planning and operation, taking into account new challenges from deregulated electrical market and new actors on the network.* | *JWG 1 will develop a series of technical specifications, complementing IEC TS 62898-1 and -2 with, e.g.:*<br>- *IEC TS 62898-3-1 Microgrids - Technical requirements – Protection*<br>- *IEC TS 62898-3-2 Microgrids – Technical requirements-EMS*<br>- *IEC TS 62898-3-3 Microgrids - Technical requirements - Self-regulation of dispatchable loads* | *2020* |
| *To develop and update terminologies related to decentralized energy system.* | *Develop terminologies related to decentralized energy system under the frame of TC 8/WG 1's work.* | *2019* |
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| Note: The progress on the actions should be reported in the RSMB. | | |