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Smart grid standardization roadmap

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SMART GRID STANDARDIZATION ROADMAP

FOREWORD

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The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 63097, which is a Technical Report, has been prepared by IEC Systems Committee: Smart energy.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
SyCSmartEnergy/50/DTR	SyCSmartEnergy/59/RVDTR

Full information on the voting for the approval of this Technical Report can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

0.1 Context

Smart Grid is a term which embraces an enhancement of the power grid to accommodate the immediate challenges of today (such as the integration of distributed energy resources) and provides a vision for the future power. Its main focus is on an increased efficiency, reliability, observability and controllability of the power grid and connected users, for the benefit of all concerned actors.

“Smart Grid” is one of the major trends and markets which involve the whole energy conversion chain from generation to consumer. The power flow will change from a unidirectional power flow (from centralized generation via the transmission grids and distribution grids to the customers) to a bidirectional power flow. Traditional energy architectures consisting of bulk generation, transmission and distribution will be impacted by these new technologies and will need to adapt to support new configurations with more distributed energy generation and storage.

Furthermore, the way a power system is operated changes from the hierarchical top-down approach to a distributed control.

Consumers too are leveraging smart technologies along with new options for local energy generation and storage to access new energy options.

This will then demand a higher level of syntactic and semantic interoperability of the various products, solutions and systems that build up a power system. Furthermore, specific requirements like long term investment security and legacy systems need to be considered. These two rationales – interoperability and investment security – make it absolutely necessary to base all developments and investment on a sound framework of standards.

Thus standardization plays a key role to enable the development of new applications for today and a future power system.

As a reminder, within the IEC, SMB Strategic Group 3 “Smart Grid” published a first release 1.0 of the IEC Smart Grid roadmap.

This original document has been reworked, and updated thanks to IEC Systems Evaluation Group (SEG) 2, which was formed with the mission of assessing the need for an IEC system committee on Smart Grids.

This work is now undertaken by IEC SyC Smart Energy, and its first mission is to finalize this work.

As a reminder IEC SyC Smart Energy has the mission:

- to provide systems level standardization, coordination and guidance in the areas of Smart Grid and Smart Energy, including interaction in the areas of heat and gas;
- to widely consult within the IEC community and the broader stakeholder community to provide overall systems level value, support and guidance to the technical committees and other standards development groups, both inside and outside the IEC;
- to liaise and cooperate with the SEG Smart Cities and future SEGs, as well as the future Systems Resource Group.

Several updates to the IEC Smart Grid roadmap have been brought to this document, especially by including the latest publications and upcoming standards. This document also

tries to take into account some of the relevant outcomes from other regions and countries, and among many sources, the work performed by the CEN-CENELEC-ETSI Smart Grid-Co-ordination Group [1][2][3][4][1] and the NIST SGIP roadmap [5][6].

At the current stage, the real scope considered in this approach remains the “Smart Grids”, meaning that the full Smart Energy scope has not been addressed yet (i.e. the consideration necessary to include the interactions with other energies such as gas, and heat).

Work is also underway within IEC SyC Smart Energy to progressively build a technical Smart Energy system framework. An alignment of this document with the IEC 62913[2] series will be performed as soon as these elements are available.

As a reminder, this document does not intend to present all standards which are applicable in the context of Smart Energy, but to highlight those which have been specifically designed and provide significant value to support a transition to a Smarter Energy, especially considering the need for an easier interoperability among devices and systems within the Smart Energy Domain.

This roadmap document is one element.

One other main element is the Smart Grid Standards Map (www.smartgridstandardsmap.com), a web tool presented in 5.4, and whose content will be aligned with this document.

Finally, IEC SyC Smart Energy also intends to create a specific relationship with user associations. The dissemination of the information included in this document will be one objective.

0.2 Overview

The aim of this document is to provide standards users with guidelines to select a most appropriate set of standards and specifications. These standards and specifications are either existing or planned, and are provided by IEC or other bodies also fulfilling use cases.

It also aims at creating a common set of guiding principles that can be referenced by end-users and integrators who are responsible for the specification, design, and implementation of Smart Energy Systems.

As a living document, this roadmap will be subject to future changes, modifications and additions, and will be incorporated into future editions.

At the current stage, the focus remains the “Smart Grids”. This means that the full Smart Energy scope has not been addressed yet (i.e. the consideration necessary to include the interactions with other energies such as gas, and heat) and will be considered in a future edition of this document.).

This roadmap presents an inventory of existing and future standards, and puts them into perspective regarding the different Smart Grid applications. The intention is to facilitate the choice of the relevant standards for all Smart Grid products, applications and systems, given the fact that such a scope is complex and moving.

The IEC, as the only international standardization organization in the field of electrotechnical standardization, is ideally positioned to provide such document. However, IEC is not the only

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[1] Numbers in square brackets refer to the Bibliography.

[2] Under preparation.

body contributing to to Smart Energy standardization; this document shows that IEC covers only 50 % of the used standards or specifications.

Based on this assessment, this document tries to not restrict the set of standards, except the fact that preference is given to International Standards (IEC, ISO, ITU). Regional specificities are also taken into account, especially when they fill gaps not yet realized at an international level.

Other bodies are also considered as long as they fulfil the “open specification” criteria defined in 5.2.5.

Gaps between actual standards and future requirements are listed and will lead to recommendations for evolution within IEC (the recommendations are included in a separate IEC publication). This framework will be then at the core of new developments and benefits reached through the implementation of Smart Grid.

As a roadmap this document also shows possible developments and future trends in Smart Energy technologies: Evolutions in communication, centralization, micro-grids, etc. are outlined in 5.7.

0.3 Purpose of the document

The importance of these standards will vary in their relation to Smart Energy applications and solutions. A number of standards form a core set of standards, which are valid or necessary for nearly all Smart Energy applications. These standards will be considered as IEC priority standards. Their further promotion and development will be a key for the IEC to provide support for Smart Energy solutions. (See also http://www.iec.ch/smartgrid/standards/).

Besides these IEC priority standards, the goal will also be to provide an overview of the IEC standards specifically capable of serving as a base for Smart Energy. The objective is that the collection should be comprehensive and also provide an overview of all the standardization involved.

Furthermore, not only does the roadmap consider the available standards but also the coming ones (see in 5.2.5 the triggers attached to these definitions “available” and “coming”). With this the IEC will provide a necessary precondition for Smart Energy to become widely accepted by the market. Since Smart Energy investments are long-term investments, it is absolutely necessary to provide the stakeholders with a needed vision as a basis for a sustainable future investment.

A specific focus is put on interoperability standards, which will help to reach the goal of increased observability and controllability of the power system. In this respect the IEC offers the absolute precondition for a further promotion of Smart Grid. It offers as well the conditions for profiling the usage of these standards and then improves the interoperability as explained in 5.6. On the other hand, the IEC refrains from standardization of solutions or applications itself. This would actually block innovation and the further development of Smart Energy.

Even if standards from other Standards Development Organizations (SDOs) are not the main focus of this roadmap, they are part of the complete story, and so need to be included.

The IEC acknowledges the vast literature and documentation which is already available on the Smart Grid topic and, to a far lesser extent, also on the standardization of Smart Energy (some documents are identified in Annex C and in the Bibliography [5][6][7][8]).

SMART GRID STANDARDIZATION ROADMAP

1 Scope

This document provides standards users with guidelines to select a most appropriate set of standards/specifications (either existing or coming, from IEC but possibly coming from other bodies) fulfilling the set of Smart Energy use cases, then relevant for Smart Energy project implementation.

It provides a summary of the core standards which form the pillars of the Smart Energy standards set.

Then the main areas of Smart Grid are investigated. The structure of this document has evolved in order to embrace the full scope of Smart Grids.

A new first area introduces the general IEC framework.

Then standards are presented, following these main guidelines:

– standards in relation with electrotechnics (planning the grid, integrating DER, coping with power electronics, coping with DC grids, and impact on the low voltage installations).
– standards related to communicating systems, divided into nineteen sections: generation management systems, FACTS, energy management systems, blackout prevention systems, advanced distribution management systems, distribution automation systems, smart substation automation systems, distributed energy resources operation systems, advanced meter infrastructure, meter-related back office systems, market place systems, demand response and load management systems, HBES/BACS systems, industrial automation systems, electrical storage management systems, electro-mobility systems, weather forecast systems, asset management and condition monitoring systems, micro-grid systems.
– standards which cover cross-cutting areas such as communication, data modelling, cyber-security, authentication, authorization, accounting, clock management, EMC, power quality, functional safety.

Annexes provide

– tables which indicate for each standard its main area of use;
– an overview of the core IEC standards;
– references to known Smart Grid/Smart Energy roadmaps provided by some regional bodies.

In total, this document identifies over 500 relevant standards/specifications and/or standard parts for the considered domain. Five electrotechnical domains, nineteen specific systems and nine cross-cutting topics have been analysed.

2 Normative references

There are no normative references in this document.