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INTERNATIONAL ELECTROTECHNICAL COMMISSION

STANDARDIZATION MANAGEMENT BOARD

SUBJECT

Report of SG3, Smart Grid after the meeting held on **2009-11-19/20** in Denver, US

BACKGROUND

SG3 held a meeting on **2009-11-19/20**; its next meeting is planned for **2009-04-08/09** in Geneva.

Part A – SG3 Decisions submitted to the SMB for formal approval.
The Strategic Group recommends that the SMB endorse and approve the 10 high-impact decisions listed in this report.

ACTION

A. The SMB is invited to discuss the recommendations submitted in Part A of the report at the February SMB meeting in Geneva.

B. The Standardisation Management Board is invited to endorse a formal liaison of SMB SG3 with NIST SGIP. (see “Decision 0” in Part A)

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Part A: recommendations for approval

IEC SMB – Smart Grid Strategic Group
Denver– November 19/20, 2009

1. Progress update

SG3 Framework 1

In April (Paris), SG3 identified **24 IEC TCs** with published International Standards playing a role in the Smart Grid; then pinpointed how these standards address the priorities of Stakeholders.
SG3 agreed on a basic set of standards representing cross cutting needs for: Interoperability, Transmission, Distribution, Metering, Connecting the consumers, Cyber Security
In order to coordinate Smart Grid standardization within IEC, a detailed technical reference document (a.k.a. IEC SG3 roadmap) has been drafted, following the logical sequence:

- First a description of the individual parts and applications of the Smart Grid system is given.
- New requirements are derived from this description.
- Then existing standards are mapped to the requirements.
- New gaps are identified.
- Recommendations for IEC actions are formulated.

SG3 Roadmap and Framework 2

A detailed survey has identified over 100 relevant standards and standard parts relevant for Smart Grid. Involved TC/SCs are TC3, TC8, TC13, TC21, SC22F, SC23F, TC38, TC57, TC64, TC65, TC69, TC77, TC82, TC88, TC95, TC105, and CISPR.
Approximately 55 detailed technical findings have been documented. These include new issues, general recommendations and already ongoing work.
The following topics have been investigated in detail:

- Communication
- Security
- HVDC/FACTS
- Blackout Prevention/EMS
- Advanced Distribution Management
- Distribution Automation
- Smart Substation Automation
- Distributed Energy Resources
- Advanced Meter Infrastructure
- Demand Response and Load Management
- Smart Home and Building Automation
- Electric Storage
- Electric transportation
- Condition Monitoring
- General Topics: EMC, LV Installation, Object Identification, PPC, Engineering / Planning, Use Cases

IEC can already display an **impressive collection of standards** relevant to Smart Grid.
Some of these standards are considered to be **core standards** of any implementation of Smart Grid now and in the future.

- **IEC/TR 62357** – Framework of power automation standards and description of the Service Oriented Architecture (SOA) concept
- **IEC 61850** – Substation automation and beyond
- **IEC 61970** – Energy Management System - **CIM** and GID definitions
- **IEC 61968** – Distribution Management System – **CIM** and CIS definitions
- **IEC 62351** – Security

SG3 has decided and implemented the following Plan:

- Monitor worldwide Smart Grid standards initiatives to leverage and synchronize at best the efforts of: (USA-NIST, China, EU…..)
- Isolate gaps and overlaps within IEC standards related to Smart Grid.

- Engage and provide stakeholders, (Vendors, Utilities, and Regulators) with a fixed set of Standards to use immediately.
- Launch IEC web portal: www.iec.ch/smartgrid

Denver meeting
The following topics have been addressed at the Denver meeting in order to set up a concrete plan **involving relevant TCs to**:

1. **Document the « usability »** of their existing standards
2. **Interact** with each other, **close gaps and reduce overlaps** of identified standards;
3. **Incorporate** Smart Grid design in their current and future planning;
4. Encourage the **use of the PAS process** to jumpstart missing standards process and buy time.
5. Investigate a conformity assessment type system for testing and certification of how standards are implemented in Smart Grid devices and projects.

Coordination with NIST
IEC SMB SG3 and NIST met during the Denver meeting in order to review mutually their plans. IEC expects to make available Smart Grids standards, many of whom will be compatible with NIST needs.

It should also be noted that the SMB Chairman, Mr. Frank Kitzantides, attended the joint meeting with NIST and also part of the SG 3 meeting

SG3 DECISION 0: To put in place a formal liaison between NIST SGIP and SMB SG3
Following the meeting discussion, an appropriate liaison between NIST and IEC SG3 will be in the best interest of both parties.

SG3 RECOMMENDATION 0: That the SMB endorse SG3 Decision 0

2. Findings and discussion

At its Denver meeting SG3 further discussed the 150-pages detailed technical reference document (a.k.a. SG3 Smart Grid roadmap document), which was developed between the 1st and 2nd SG3 meetings. The group discussed at length the 55 documented findings, and the comments and proposals submitted by SG3 members, in order to formulate **10 high impact decisions proposals which are presented in this report**. The technical reference document together with the comments received is a supporting working document. at this stage.

2.1 IEC Smart Grid framework: a One Stop Shop now

The IEC Smart Grid standard framework is already offered on the web as a one stop shop for industrial project managers. It is therefore urgent to increase the usability of this framework by providing the minimum guidance on how to use at best those existing standards. Meanwhile it is necessary to close the gaps so that a project manager is able to find all the standards he needs in the IEC framework. This will avoid that the project managers start to patchwork standards from different SDOs, which would create a real interoperability challenge. Finally, it is also necessary to put in place a process to collect feedback from the users in order to improve the IEC framework and its usability.

2.1.1 Increase usability of existing standards

SG3 DECISION 1: TCs will provide practical guidelines to increase current usability of standards

There is a need to develop a set of guidelines to help the industry implement the standards of the IEC Smart Grid framework. In a very short time, a series of individual guidelines for each existing standard should be published which urgently covers the known challenges, and provides very practical hints and tips.

- This set of guidelines should include:
  - A collection of challenges encountered by users;

- A list of proposals and directions that can be put in place;
- A communication toolkit and solutions suite with hints and tips.

SG3 will further promote the work in the Smart Grid area requesting contributions and involvement of the TC's through white papers, web portals, promotions and workshops; **This promotion must be done collectively for the framework and not individually for bits and pieces by the TCs.**

In addition, the Central Office should put extra effort in further designing the IEC Smart Grid web portal to be used as the one stop shop for Smart Grid.

SG3 Decision 1 Responsibility: All relevant TCs/SC's in charge of standards identified in the IEC Smart Grid Framework (current version on line), for the guidelines and communications toolkit; IEC CO for web portal

SG3 Decision 1 Timeframe: Immediately

SG3 RECOMMENDATION 1: That the SMB endorse SG3 Decision 1

2.1.2 New standards to close the gaps

For the sake of speed and optimization of the global expertise resources, it is far preferable to attempt to leverage preexisting or ongoing efforts, rather than starting from scratch to develop a new standard

SG3 DECISION 2: Fast-track new standards to close the gaps

Before starting any work on new standards for Smart Grid (NWIPs), TC's must **perform a survey of what exists or is under development** in other SDO's and then make decisions to adopt / harmonize or develop that standard. The "candidate standard" from the other SDO can come from anywhere, providing that enough consensus has been embedded in it to increase the chances that it will pass the NC vote.

SG3 suggests a revision of the IEC NP-form to include a check box indicating that the proposed standard is applicable to the Smart Grid Framework; as well as a check box to indicate if the NWIP is based on preexisting work

Additionally, the individual TC's shall inventory the other SDO standards in their area of expertise to further identify major Smart Grid related standards, and **report it in their Strategic Business Plan within 60 days and thereafter on a yearly basis**. Moreover TC/SCs should consider decisions to adopt / harmonize that standard, and make the maximum use of the Publicly Available Specification (PAS) process.

SG3 Decision 2 Responsibility: All relevant TCs/SC's in charge of standards identified in the IEC Smart Grid Framework (current version on-line),

SG3 Decision 2 Timeframe: Immediately

SG3 RECOMMENDATION 2: That the SMB endorse SG3 Decision 2.

2.1.3 Feedback for improvement

For the long run, a feedback process is an important means to manage the evolution and the maintenance of the IEC Smart Grid standards Framework.

SG3 DECISION 3: Set up a Feedback process for continuous improvement

For the long term, a process is needed that allows TC's to collect and share experiences of users of the framework, in order to

- Close the loop: sharing and inter-vision should improve existing standards
- Check consistency and completeness with World and National efforts (US NIST, China, ...)

The IEC CO shall add a wiki to the IEC Smart Grid web portal to collect and share experiences of users of the IEC Smart Grid standards framework in order to document problems that can be processed.

SG3 Decision 3 Responsibility: SG3, IEC CO
SG3 Decision 3 Timeframe: Immediately

SG3 RECOMMENDATION 3: That the SMB endorse SG3 decision 3

2.2 Improve the IEC organization for Smart Grid

IEC has detected the new area of Smart Grid for a long time. The topic has been discussed at the SMB meeting in Copenhagen on May 10th of 2006. A call for Publicly Available Specifications candidates has been formulated but didn't receive proposals. Then several avenues have been pursued considering coordinating and developing the standards for Smart Grid within existing TCs, or creating ad'hoc Working Groups, or a Sub Committee or even a new TC. But none of these happened to be appropriate due to the very nature of this new area. Based on this experience the Smart Grid Strategic Group has been incepted, and for the first time is providing an overall view and articulate tactical paths. Definitely, the needs for Standards cannot be fulfilled by one entity, otherwise this would have been already resolved within the IEC. The solution will come only by building upon and articulating further the power of the existing "horizontal" and "vertical" TCs. This leads to consider some adjustments in the current organization and practices. But of course, in any evolution of that nature, closing win / win deals for each existing TC is an important goal ("local optimum"), it is also necessary to accept adjustments for the collective interest of the industry ("global optimum").

2.2.1 Issues inhibiting the development of optimal IEC Standards for Smart Grid

Each IEC TC is very efficient in producing sharp standards for electrical equipment in their application domain. The challenge with smart grid is that large quantities of equipment must interact intimately. This is why the interoperability of smart grid has been identified as a high priority challenge. Most of the standards projects are crafted through a bottom up approach, one NWIP at a time. Standards developed separately by independent TCs cannot naturally ensure interoperability.
IEC's current structure was established when each component of automation technology was relatively isolated and the distinction between device protocols and information technology systems integration was more apparent. Over time, as substantial consolidation has occurred with advancing technology, the distinction between distributed computing and intelligent devices should have made it possible to have a much more seamless flow of information and control. This ability is especially critical for building safe and reliable smart grids incrementally with many disparate components. However, existing IEC TCs are operating as functional silos, and even with the best of intentions, are often hindering progress toward the achievement of seamless information flow. Examples of issues hindering progress include:

- Organization issues:
  - Separate object models being required between the meter and the meter head end system (TC13) and between the meter head end system and the utility enterprise (TC57).
  - Separate object models for inter-application integration (61970 and 61968) and inter-device communication (61850).
  - Protocols being developed for electric vehicles by ISO/IEC JWG V2G CI which do not take into consideration CIM and /or 61850 object models
- Architectural issues:
  - Lack of a common flexible architecture enabling the same object models to be used over multiple transports
  - Being too tied to the OSI 7 layer stack
  - Lack of the same vocabulary being used across standard interfaces, resulting in the need for data transformation, which drives up costs and increases the likelihood of errors.

It is critically important that the IEC adopt a top-down design which provides a context for Technical Committees and Working Groups **to be able to work effectively in parallel**. A key aspect is to have an architecture that minimizes the need for data transformation at component interfaces. This can only be done when all interface standards are derived from the same common architecture. As the IEC Smart Grid architecture is formulated, it then becomes possible to determine an ideal organizational structure for accomplishing the necessary standards.

Furthermore, System Engineering may be a mature industrial area, but its level of complexity is unprecedented. In the first place, the electrical system is in continuous operation. At the same time, it is evolving constantly while incorporating a huge legacy. Second, different stakeholders are responsible for different parts of the system. Independently, each may make different choices about evolution and use. This is where standards make a major enabling difference.
Experience gained from the application of System Engineering in industry demonstrates the importance of **separating out requirements from any kind of solution**. Very often there's not enough separation between the two and the picture becomes blurred.

2.2.2 Solutions recommended by SG3

Requirements versus Specifications

Increasingly, there is a need for standards that provide building blocks on two different fronts. On the one hand, ***standards need to address requirements***. This allows utilities, retailers, distribution and transmission operators to document their needs. On the other hand, ***standard's that apply to technical design and specification*** allow system architects and integrators to implement devices that not only speak the same language but also behave synergistically and could be interchangeable.
Requirements can even be built from building blocks. There are generic requirements – in metering, for example, utilities could reuse 80 % of the same requirements. It helps utilities not to reinvent the wheel. Vendors can then recognize standard 'bricks' and manufacturers can see where the market goes. It's cheaper for the user and it also allows fruitful competition.

Writing standards for ***requirements*** is a new concept. Producing these standards successfully demands that utilities, retail entities, regulators and distribution and transmission system operators discuss what they use today, how they process the information and to whom they send it.

Technical specification standards are necessary for the development of standardized devices.
But today, if anything, there are too many specification standards on the same issue, resulting in a somewhat piecemeal approach, and still gaps to fill.

Organization, culture, processes

On an organizational point of view, it is always possible to organize an ad hoc group or a liaison each time a new interoperability issue is discovered. This can provide an efficient quick fix, but this cannot be replicated indefinitely. Sound basic management principles dictate that each organization should focus on its core competencies and application domain. It is obviously necessary to add some top down directions, and to put in place some simple processes.

The partner TCs identified for the smart grid framework are in fact of two different types:

- "Horizontal" TCs: TC8 - System aspects for energy delivery; TC 57 - Power systems management and associated information exchange; TC 56 - Dependability; and TC 65 - Industrial processes.

- Application Domain TCs: TC3, TC13, TC21, SC22F, SC23F, TC38, TC64, TC65, TC69, TC77, TC82, TC88, TC95, TC105, CISPR.

SG3 DECISION 4: Across the IEC Smart Grid Framework, the Application Domain TCs must use the methods delivered by the "horizontal" TCs included in the Framework.

To make mandatory use of the concepts/methods/tools delivered by the "horizontal" TCs:

> **From TC 57**: IEC 61850 and CIM suite of solutions across the entire portfolio framework. IEC 61850 (existing and extended) will be used for all communications to field equipment and systems, while the IEC 61970 and IEC 61968 will be used within control centers for managing information exchanges among enterprise systems.
> **From TC 8:** Generic use cases
> **From TC77:** EMF guidelines
> **From TC 56:** Method and tools for Dependability

In the unlikely event that these cannot be used, an exception must be submitted for SMB SG3 approval.

SG3 Decision 4 Responsibility: All Application Domain TC's
SG3 Decision 4 Timeframe: Immediately

RECOMMENDATION 4: That the SMB endorse SG3 Decision 4

SG3 DECISION 5: The Application Domain TCs must develop their own Data Models and Test Cases

The application domain TC must develop the data models relevant to their own domains. An Application Domain TC also has the responsibility to develop the complete test case, including application aspects and communication aspects. IEC 61850 and Common Information Model (CIM) must be used across the board for these data models. The unlikely exceptions must be submitted for SMB SG3 approval.

A. For the communication aspects, the application domain TC can seek appropriate support from TC57.
B. TC57 shall provide support if requested, and is empowered to check and validate the communication part of the test case for each project
C. TC57 must validate the implementation of its standard suite by the application domain TC's.

SG3 Decision 5 Responsibility: Application Domain TCs, TC57
SG3 Decision 5 Timeframe: Immediately

RECOMMENDATION 5: That the SMB endorse SG3 decision 5

General recommendation for interoperability: *It is essential everywhere in the development of standards to de-couple the application from communication technology. This allows protecting the investment in application development while benefiting from the never-ending technology evolution. This enables efficient migration and supports interoperability.*

SG3 DECISION 6: Accelerate the harmonization of IEC 61850 and CIM

As the top priority, TC57 must accelerate the harmonization of IEC 61850 and CIM, and describe its action plan.
It must also provide ASAP a practical guideline how the industry can design today, projects heavily relying on IEC61850 and CIM that will be able to evolve seamlessly to benefit from the new versions that will be released.

SG3 Decision 6 Responsibility: TC57
SG3 Decision 6 Timeframe: TBD urgently by TC57

RECOMMENDATION 6: That the SMB endorse SG3 Decision 6

SG3 DECISION 7: Deliver generic Use Cases

TC8 is mostly composed of experts representing the Utilities, the Regulators, and the Users, more than of technical designers, vendors or integrators.

TC8 should promote the system view and system approach based on Use Cases. Most Use Cases cut across the Application Domain TCs fields. The Application Domain TCs need those Use Cases to further develop their Data Models.

TC8 must urgently provide the generic Use Cases for all applications associated with electrical energy supply, and make the best use of the PAS process if strong technical references can be identified.

Decision 7 Responsibility: TC8, SG3
Decision 7 Timeframe: 2010-06

RECOMMENDATION 7: That the SMB endorse SG3 Decision 7

2.3 Closing an organizational gap to develop "connecting the consumer" standards (Consumer applications, Smart Home and Buildings, PHEV)

From recent efforts, there appears to be a new area of focus crossing the boundaries between a few TCs, and not covered really by anyone of them. Therefore there is a need for a new TC with a scope addressing consumer domain applications like:

- Smart Appliances
- Thermostats
- Load Control Devices
- Sub-meters
- Plug-in Electric Vehicles
- Distributed Energy Resources (consumer connected)
- Demand Response
- Energy Storage Devices (consumer connected)
- Building Energy Management Systems
- Building Automation

Wherever possible the new TC can reuse data models and specifications that have already been established, such as the IEC TC57 CIM. Specific technical committees that would need to participate include: TC 13 – Metering, TC 69 – Automotive, TC 57 – DER, Metering System Integration, Energy Markets, TC72 - Automatic controls for household use

Some of the specific projects that could be undertaken within a new TC would potentially include:

- Definition of standard interfaces for the access of consumer energy usage information (NIST PAP 10), in collaboration with OASIS efforts
- Definition of models and standard interfaces as needed for communication between utilities, ISOs, service providers and consumers using the internet
- Standardization of the ZigBee/HomePlug 'Smart Energy Profile' (SEP). This would define interfaces to 'home' or 'premise' area networks. These interfaces could be direct (via internet) or through AMI

SG3 DECISION 8: Establish a new TC or SC on "connecting the consumer applications"

There is an urgent need to create one new TC to cover the connection of all the consumer applications in Smart Home and Buildings, Vehicle and Storage.
This could be in fact an SC within a close application domain TC like TC69 (Electric road vehicles and electric industrial trucks) or TC72 for example (TC72, Automatic controls for household use)

Smart Home and Buildings:

- There is an urgent need for new standards for Smart Homes and Buildings as the application domain in which to create these standards currently does not exist in the IEC. The situation is complex with the combination of efforts from the telecom industry and entertainment sector, as well as the grid becoming smarter. A standard already exists in CEN 247 (KNX) Home and Building Control). In the meantime a new TC or subcommittee is required immediately.

PEV's:

- This application domain must be covered in the IEC SG framework. There is an urgent need for new standards in the application domain for Electromobility. Responsibilities should be re-adjusted between ISO and IEC in the light of this new development. There is a question whether to import standards or to have them developed in an application domain or the recommended new domain TC mentioned for Home Building, Vehicle and Storage.

SG3 Decision 8 Responsibility: SMB
SG3 Decision 8 Timeframe: Immediately

RECOMMENDATION 8: That the SMB endorse SG3 Decision 8

2.4 Conformity Assessment

SG3 DECISION 9: Add a Smart Grid certification process to the IEC System family

One Standard, One Test, One Mark: SG3 recognizes the importance of the role that the three IEC multilateral Conformity Assessment Systems currently play in international trade and commerce. Conformity Assessment allows it to close the loop with the initial requirements of any project. SG3 further acknowledges that interoperability is a major feat in the integration of smart grids worldwide and therefore recommends that **a certification of the processes for smart grid be added to the IEC System family.**

A list of questions still remains and need further discussion by the SMB, the IEC Conformity Assessment Board (CAB) which has the responsibility for all IEC conformity assessment programs, present and future. It should be noted that the CAB is already proposing a survey to national committees on conformity assessment needs for Smart Grid,.and also within SG3.

Some points to consider are:

- Agreement on Mutual Recognition in Relation to Conformity Assessment?
- Are there independent sources able to analyze smart grid design?
- Will there be tests or certificates for the design? For equipment?
- Will the Owner of Smart Grid (or the integrator) asks for certificate?
- Should the IEC system allow for self certification of Smart Grid?
- Risk assessment and mitigation and the management of the complexity of the Smart Grid design.
- Should there be different levels of assessment?
- Give different dimensions to lowering risk and guarantee that systems can evolve with a long life cycle (this is achieved by interoperability and can be completed by using standards).
- Accreditation - formal attestation that a model or simulation is acceptable for use for a specific purpose. Accreditation is conferred by the organization best positioned to make the judgment that the model or simulation in question is acceptable. That organization may be an operational user, the program office, or a contractor, depending upon the purposes intended. Is this possible?

SG3 Decision 9 Responsibility: SMB, CAB, SG3
SG3 Decision 9 Timeframe: TBD

RECOMMENDATION 9: That the SMB endorse SG3 Decision 9

2.5 For the long term, a permanent organization for sustainability

The SMB strategic group is proposing a series of high impact decisions for a new area which appears to present unique aspects and needs within the IEC family. Beyond proposing decisions to pave the way, there is a need for **a more operational management role** that can be a resource to the SMB in order to help and monitor the implementation of the decisions, create the conditions for the collective success, as well as keep adapting the IEC posture to the rapid evolution of the sector.

In order to efficiently manage the long term on the IEC Smart Grid standard Framework, there is a need also to develop a **common Reference Architecture** within the IEC for Smart Grids standards. A process that starts with a standardized view of the space (i.e., conceptual view) could be tremendously beneficial for organizational direction and standards work management. The model/architecture view would show that normal technology convergence is straining IEC's solid organizational structure (i.e., we would see the same information has to flow through multiple standards domains).

This would be focused - initially used to show the dysfunction of the organizational structure (e.g., the same piece of data passes through several different TC's domain or a device can exist in several domains and still needs standard interfaces).
The next step would be to use the model to organize and assign work. Same as an organization would do when building a large and complex system.SG3 could commission a study, organize a workshop with architects and organize a workshop with asset owners (utilities).

A workshop open to industry is in order to produce a necessary "IEC Reference Architecture". This reference architecture is very technical to produce but will create a stronger basis to be followed by all the TCs

SG3 DECISION 10: Add operational management of the IEC Smart Grid Framework

For sustainability, the IEC must put in place an organization and processes to ensure the implementation of the decisions to be taken here. SG3 proposes to evolve in order to fulfill this role in the future.

For good manageability, SG3 has been limited to about 13 members from the beginning. The SMB should invite its members to review the effectiveness of their current representation within SG3, and call for participation from parts of the world that are very active like Australia, India, etc. Therefore the first step would be to extend and expand SG3 with committed NC representatives. Moreover, there is a need for a increased operational role in order to have the decisions taken to be fully implemented, as well as creating the new needed "culture".

SG3 Decision 10 Responsibility: SG3
SG3 Decision 10 Timeframe: 2010-06

RECOMMENDATION 10: That the SMB endorse SG3 Decision 10

Annex A - List of attendees in Denver:

Convenor:	Mr. Richard Schomberg
Secretary:	Mr. Peter Lanctot (IEC CO)
Brazil:	Absent
Canada:	Absent
China:	Mr. Bai Xiaomin
France:	Mr. Serge Volut
Germany:	Mr. Heiko Englert
Great Britain:	Absent with apology
Italy:	Absent with apology
Japan:	Dr. Tadahiro Goda
Korea:	Mr. Il-Keun Song
Netherlands:	Mr. Teus de Zwart
Sweden:	Mr. Karl Elfstadius
Switzerland:	Absent with apology
United States:	Mr. Gary Rackliffe
Invited Guest:	Mr. Frank Kitzantides, SMB Chairman