WORKING GROUP FORM

Study Committee: B3 Substations

WG number: B3.34 **Name of Convener:** Johan Smit

Title: Expected impact of future grid concept on substation management

Terms of reference

Background:

It is expected that substations in future grids will be equipped to operate in a more complex ICT supported environment. At all aggregation levels T&D substation equipment will be required to address the demands of a deregulated electricity supply industry that includes network unbundling, distributed generation and renewable energy transmission, as well as – in many cases – an ageing infrastructure. With a future grid concept in mind, such as a smart grid*), many utilities are considering the introduction of a substation architecture with subsystems employing intelligent interface technologies. However, issues to be considered include the fact that the technologies being developed for sensors to interface with substation plant and related information systems are not yet mature. Similarly, interpretation tools and equipment ageing models have yet to be fully developed.

Declining reliability and temporary shortages in transmission capacity can be avoided by a strategy of timely replacements/extensions that will optimize utilization of old equipment. Applying characteristic and measured data to aging models, the actual condition or health state of a component can be assessed as input for advanced preventive maintenance methodologies like CBM, RCM or RBM. Health indices may be combined with operational parameters in the EMS/SCADA systems for preventive state estimation and dynamic control. However from the perspective of existing substations, the introduction of additional intelligence may not be feasible if costs of technical changes alone are considered. Other considerations such as environmental policy should be included also.

Scope:

In future substations real-time monitoring will require the embedding of sensors in primary plant together with the provision of associated intelligent hardware and ICT. The integration of secondary sensing/actuating technologies into primary equipment is still a big challenge particularly from the reliability point of view. Typically the secondary devices are less robust and have shorter lifetimes than primary equipment. An important consideration will be the feasibility to extend the lifetime of interface devices between the primary plant and modern digital secondary systems. In addition a model-based framework to optimize usage of power equipment should be implemented using a predictive health indexing model. Besides the issues relating to the normal flows of power and information the data management aspects are also of concern such as data security, data ownership, data storage, retention etc. The amount of data transfer at both local and central level will increase so rapidly that agent technologies will be required for processing the growing data streams in the autonomous grid sections. The working group should assess the benefits, if any, of introducing intelligence into the substation management methods.

The aim of the work is to:

- Establish how the future grid will impact on substation subsystem and component management
- Investigate the practical feasibility of applying these future grid concepts to substation equipment, including reliability/availability aspects and substation management issues to be tackled;
- Evaluate positive and negative aspects, such as technical, economical and environmental considerations;
- Assess the potential impact on substations and substation management when implementing a future grid concept and identify implications and requirements on e.g. ratings, functionality, location;
- Describe the impact of providing future grid intelligence in future substations and which requirements on ICT should be defined.

Deliverables and time schedule:
The work will be finalized with a brochure and a short report in ELECTRA.
After its approval and the WG constitution the WG will start working.
The final brochure can be available within approx. 3 years.

SCs /Target Groups concerned:

External: Asset managers / substation managers, original primary and secondary equipment manufacturers, research and development institutions, consultants, testing managers / staff, IEC and IEEE standard maintenance teams.
Internal: A2, A3, B5, C1, C4, D1, D2

Approval by TC Chairman Klaus Fröhlich **Date:** 03/05/2011

*) By definition a smart grid is an electricity network that can intelligently integrate the behaviour and actions of all users connected to it – from generators to consumers and vice versa, for those that do both – in order to efficiently ensure sustainable, economic and secure energy supply.