

# Preferential Subjects for the 2010 Session

## Study Committee A1

### PS1: Developments in Electrical Machine Design and Experience in Service

- New trends in design, materials, insulation, cooling and bearings technology, improvements in efficiency and maintenance.
- Impact of intermittent operation on the design of hydro and thermal machines.
- Improvements in excitation control systems to deal with electromechanical oscillations, load rejection, torsional interactions, transient torques, overfluxing, voltage / reactive power control, etc.

### PS2: Lifetime management

- Refurbishment, replacement, power uprating, efficiency improvement, economic evaluation of proposed alternatives.
- Risk analysis techniques for evaluating costs associated with increasing maintenance, failure rates and repairs, due to deferred capital expenditures.
- Use of on-line monitoring and diagnostics for risk mitigation - costs and benefits of their implementation.
- Development in commissioning and suppliers qualification of rotating machines.

## Study Committee A2

### PS1: Transformer incidents in service

- Fire prevention: new oils, new bushing technologies, avoidance of tank rupture, effectiveness of existing test standards (for equipment and material) in failure prevention, mitigation on urban underground substations, design factors and improvements.
- Fire mitigation: use of fluids with high fire point, fire wall, distances, sprinklers, risk assessment, modelling of internal overpressures by 3D methods
- Environment: oil spill containment, new types of oil, smoke

### PS2: Transformer Life

- Specification: technical and economical considerations for specification and design; experience with CIGRE TB 156
- Procurement process: design review, experience with CIGRE TB 204, life cost calculations under a procurement perspective, sustainability factors to be considered on transformer evaluation.
- Maintenance: maintenance practice, diagnostic, new technologies, life assessment, use of on-line monitoring system and expert system, reinvestment policy

### PS3: Transformer Modelling

- Transients: High frequency modelling, to determine stresses induced by transformer system interactions (inrush, switching, ferroresonance), new tests requirements, protection measures, relevant data collection for modelling etc.
- Thermal: Distribution of losses, operation profiles, application of Computational Fluid Dynamics (CFD), parameters affecting accuracy, comparison with direct temperature measurements during heat run tests and in operation, sustainable thermal uprates and life extension by advanced simulations etc.

## Study Committee A3

### **PS1 : Development in HV equipment to cater for increasing system demands**

- UHV
- Increasing load current requirements for equipment e.g. facilitation of renewable and large generation site connections
- Increasing fault current requirements for equipment
- Limitations and developments in test techniques
- Increased use of reactive compensation

### **PS2 : Lifetime management of HV equipment**

- Effective assessment of end of useful life – analysis, testing & monitoring
- Reliability assessment as a tool for lifetime management and as a driver for improved specification and design
- Management of potentially over-stressed equipment pending replacement
- Impact of environmental aspects

### **PS3 : Prospects for introduction of new HV technologies**

- Fault current limitation
- Vacuum for switching and/or isolation
- Non-conventional instrument transformers
- Prospects for application of new materials

## Study Committee B1

### **PS1 : Technical challenges that have been overcome in newly installed underground and submarine cable systems.**

- Current state-of-the-art in the design of AC and DC, submarine and underground traditional cable systems.
- Current state-of-the-art in cable systems installation techniques
- Experiences of operation of cable systems

### **PS2 : Key factors in current and foreseen development of cable systems.**

- Environmental impact
- Balancing capital costs (including costs for Right of ways) vs operational costs (including costs for Operation and Maintenance, social costs, losses, dismantling etc).
- Prospects of UHV cable systems.

### **PS3 : State-of-the-art and trends for cable system testing.**

- Qualification, type testing, routine, sample, after installation testing of cable systems.
- Representation of installation and operational stresses in testing of cable systems
- Diagnostic testing of cable systems.

## Study Committee B2

### **PS1 - Managing the environmental impact of new and existing overhead transmission lines**

- Methods of limiting visual impact (integration of OHL in the landscape, new tower designs,...), minimisation of audible noise, minimisation of environmental effects of the electric and magnetic fields.
- Methods for minimizing impact on land use, reduction of the construction, operation and maintenance impact
- Overhead line component material recycling.

### **PS2 - Increasing the power capacity of existing Overhead lines by conversion of AC to DC or by increasing the voltage level**

- Methods for AC to DC lines conversion (both conventional and innovative), combined AC/DC circuits on a common structure.
- Re-construction of tower top geometry to accommodate higher AC or DC voltage levels, modifications of insulator type and configuration, use of surge arrestors.

### **PS 3 - Assessment of overall electrical and mechanical availability of OHL**

- New methods for estimating residual life of line components (conductors, fittings, supports, foundations).
- Impact of component ageing, maintenance strategy, dynamic effects and climatic loading on mechanical line reliability.
- Data management of climatic conditions and revised risk assessment in view of climate change.
- Increasing overall line availability by adapting existing structures through the application of strategies such as anti-cascading devices.

## Study Committee B3

### **PS1 : New techniques/new design of substations:**

- Impact of stronger constraints with respect to footprint, severe climatic conditions and public amenity on substation design
- EHV/UHV substations
- Design and construction of substations for offshore wind farms
- Design of GIL for bulk power transmission

### **PS2 : Existing substations, new challenges :**

- Residual life estimation – Risk assessment, replacement or refurbishment options
- Uprating of substations and existing equipment to increase network capacity
- Technical solutions for extension of substations on already existing footprint
- Reducing the impact of substations on the environment and vice versa

### **PS3 : New secondary system challenges in substations :**

- Experience with the shorter lifetime of secondary equipment compared with primary equipment
- Impact of distributed generation on substation design
- Implication of IEC 61850 on substation design and performance

## Study Committee B4

### **PS1 : Developments in HVDC and FACTS technology.**

- HVDC transmission at 800 kVdc and above,
- New topologies and developments in VSC Transmission
- Multi-terminal and meshed HVDC configurations,
- HVDC and FACTS as a means to improve System Capacity, Performance and Efficiency.

### **PS2 : HVDC and FACTS –Operating Experience and New Projects.**

- Interconnections using land and/or submarine cables and/or overhead lines
- Embedding of HVDC and FACTS in AC Networks,
- Renewable Energy Applications

### **PS3 : HVDC and FACTS Project Development Issues**

- Environmental issues for HVDC and FACTS schemes, including visual impact, earth return, audible noise, EMF & Ions
- System performance with embedded HVDC links, including multi-infeed and ancillary services.
- Options Considered, Regulatory, Licensing, Project funding, and Technical Risks issues

## Study Committee B5

### **PS1 : Protection, Control and Monitoring for the next decade**

- New requirements for Substation Automation (SA) and Protection
- New concepts for SA and Protection
- Information recording and applications

### **PS2 : Impact of renewable generation and cogeneration on Substation automation and Protection**

- Protection coordination
- Connection & generator protection requirements
- Automation and restoration policies
- Islanding detection
- Future trends on protection and automation
- Consequences of using HVDC infeed from off shore wind farms

### **Common Session D2/B5 (see D2)**

## Study Committee C1

### PS 1: Solutions for planning power systems in a low carbon energy future

- System design
- New technologies
- Reliability, social and economic impacts

### PS 2: New business processes to support / facilitate power system design in a low carbon energy future

- Integrated transmission and distribution planning
- Multi-regional / multi-national planning
- Alternative reliability standards
- More grid operational flexibility taking into account different generation and load profiles and locations

### PS 3: Asset management challenges/strategies (replacement, refurbishment and maintenance) in a low carbon energy future.

- Future integration of large scale renewables
- Enhanced information needed
- Dealing with flatter load profiles, active distribution networks, uncertain generation, integration of new technology

## Study Committee C2

### PS 1 : Enhancement of Operational Reliability

- Impact of dynamic security assessment and dynamic ratings on real time system operations
- Decision making tools and methods, system visualization techniques. Common format and quality of data for wide area modeling and assessment.
- Balancing generation within transmission constraints, including distributed generation
- Impact of wind farm generation directly connected to the transmission system on the Grid code

### PS 2 : Consistency and Coordination of System Control and Operation

- Challenges/experiences/trends of coordinated operation among TSOs for interconnected system.
- Formulation and harmonization of operational reliability standards (criteria, performance indicators, compliance measures)
- *Impact of cross-border aspects for reliability and regulation* on system operation. Issues on shared responsibilities in system operation and control between real time actors

## Study Committee C3

### **PS1 : Innovative Environmental Studies for Power Transmission Corridors**

- Integration of Sustainable Development concepts throughout the life cycle
- Integrated environmental management of corridors (impacts identification, control measures, monitoring, cumulative impact evaluation and mitigation strategies)
- Stakeholders engagement and communication in the management of corridors
- Environmental Impact Assessment of joint corridors ( power transmission lines and other linear infrastructure uses –e.g. railways, highways, gas pipelines...-)

### **PS2 : External costs accounting of environmental and social impacts of Power Generation and Transmission**

- Assessment of environmental and social external costs in Power Generation and Transmission
- Experiences of assessment and integration of external costs on a project base for the Power Sector
- Country-based experiences about external cost assessment and their inclusion in the total cost for the Power Sector

## Study Committee C4

### **PS1 : EMC/EMF and PQ for future networks - compatibility requirements, assessment techniques/tools, and technical performance improvement programmes.**

- Management of PQ in networks with a high penetration of renewables, disturbing loads, and loads sensitive to PQ phenomena - technical and economical issues
- Extremely Low Frequency (ELF) field mitigation techniques for HV power systems
- Protection of the HV power network control electronics against intentional/unintentional Electromagnetic Interference
- Influence of power network on other installations

### **PS2 : Advances in insulation coordination and lightning knowledge for improved performance of electric power systems**

- UHV AC systems
- Lightning attachment to OH lines and to tall structures
- Earthing systems performance

### **PS3 : Techniques and Tools for Power balancing assessments and Risk-based security assessment**

- Modelling methods and tools for analyzing power balancing issues
- Risk based approaches.

## Study Committee C5

### **PS1 : Challenges of national or state regulations of transmission and system operators in regional markets**

- Multi-regional markets developed for enhanced competition

- State, Provincial or National regulations versus regional regulations (cross-border exchange, transmission capacity allocation, system expansion procedures, cost allocation – operation and expansion, congestion revenue allocation)
- Market designs – harmonization of grid codes and transmission tariffs

## **PS2 : Impact of intermittent resources or demand response on market designs**

- Market design aspects and coordinated procedures for day-ahead and intra-day markets
- Enhanced flexibility of intra day markets to facilitate intermittent resources and flexible demand
- Ancillary service markets to effectively cover system needs and impact of increased share of intermittent resources on ancillary service requirements
- Rules for simplified access to the market

## **PS3 : Interactions of environmental incentives and markets (e.g. carbon) with electricity markets**

- Impact of local/regional/national quotas on electricity market design and stability
- Challenges of different environmental incentives or support schemes within same market system
- Environmental market designs – impact on electricity market clearing procedures
- Return of experiences of environmental incentives.

## **Study Committee C6**

### **PS1 : Planning and operation of Distribution networks incorporating Dispersed Energy Resources (DER) and Renewables Energy Sources (RES)**

- Performance characteristics of distribution networks with high penetration of DER/RES, Operating experiences
- Effect of large scale integration on reliability
- Provision of ancillary services by DER/RES
- Regulatory schemes to support DER/RES

### **PS2 : Demand Side Integration**

- Load characteristics of appliances
- Practical experiences of demand side integration through pricing
- Impact of electrical vehicles connection to the Grid (challenges and opportunities)

### **PS3 : New concepts and technologies for the electrification of rural and remote areas**

- Microgrids
- Advanced grid based concepts and renewables
- Development of rural electrification projects including financial and commercial issues
- Practical experiences, including upgrading the local system and/or connection to the grid

## **Study Committee D1**

### **PS1 : New materials for improved efficiency and sustainability of AC&DC power equipment**

- Nanomaterials

- Biodegradable materials
- New gas compositions
- Recyclable materials
- Innovative polymers
- High Temperature Super Conductors (HTSC)

### **PS2 : Challenges for testing and diagnostics**

- New requirements for ultra high voltage
- Interpretation of diagnostic results for condition assessment
- New test and monitoring methods

### **PS3 : Endurance of materials especially in harsh electrical and physical environments**

- Off-shore applications
- Repetitive transients
- Load cycling
- Thermal overload
- Irradiated environment

## **Study Committee D2**

### **Common session with B5**

#### **PS1 : Practical implementation of IEC 61850 in electric power systems**

- Advantages for implementation outside the substation
- Impact on substation automation (security, WiFi, teleprotection requirements)
- Architecture and information technology aspects between substation automation and remote communication
- Communication needs for system protection schemes and wide area measurements (WAMS)

### **D2 Session**

#### **PS2 : Information and Information Technology (IT) security for electric power utilities**

- Convergence of physical and logical security
- Frameworks for management of information security
- Cyber security for Supervisory Control And Data Acquisition (SCADA) systems
- Assessment and management of the risk in information and IT security