



Study Committee C1

## Working Group Form

WG N°: C1-21

Name of convenor: **Andrea Mansoldo (Ireland)**

**Title of working group:** What advanced components and technologies are needed and which are available or under development to meet future network development requirements? What are the limits on their use?

### Background

Coming into the new century, the energy industry is facing a huge transformation. First the re-regulation process in most countries, has given rise to new issues such as uncertainties in generation dispatching and power flow patterns. Open market access for new power producers or energy retailers at any level had upset the traditional vertically-integrated approach on which the power system was based.

Exploitation of renewable resources is now completing the picture by adding further challenges to the Transmission Grid; at present onshore wind developments are raising some issues at planning and operating stages, but at the horizon, the expansion of the Transmission System offshore, which is pushing available technologies to extreme applications, may give rise new needs, further technology enhancement and technical challenges.

Increasing environmental sensitivity and public fear of alleged health effects of EMF emissions, are causing further problems for transmission companies in upgrading grid infrastructures. Often the traditional cost effective overhead line solutions cannot be pursued because of strong opposition, not only in populated areas but also in rural areas.

Transmission companies are therefore looking for solutions which enable them to better face uncertainties in power flows scenarios, to guarantee non-discriminatory market access, to increase and to fully exploit grid infrastructure capacity, while maintaining power system reliability to high standards. These solutions must be, adaptable, modular, flexible, environmentally friendly, reliable and cost effective.

To meet this wide range of challenges, many new approaches, including new technologies, are being proposed, developed, tested and/or introduced on a pilot basis:

- High Temperature conductors are being considered to maximise use of rights of way.
- HVDC technology is being considered not only for traditional long distance point to point transmission between separate networks, but also for multi-terminal applications where DC links are embedded in an AC grid.
- The use of XLPE based undergrounding technologies for EHV strategic links is being investigated even for lengths greater than 100 km .
- Dynamic Thermal Current Rating (DTCR) techniques are attracting greater interest from Grid Operators, for both underground and overhead applications.
- Control of EMF emissions both with passive or active technologies, is becoming viable where strict limits are enforced.

- The advances in power electronics are leading to new or upgraded products which can give increase flexibility to transmission companies in planning and operating the Transmission Grid in the changed Electric Industry.
- With the development of offshore 'Supergrids' new issues arise related to the feasibility of a DC meshed design, reflecting the structure of AC onshore network structure. Many AC components will require development and enhancements for use DC meshed networks.
- Offshore wind exploitation is raising new issues for cable technologies to connect floating platforms in deep sea.
- Superconducting technology, may offer some technical answer with recent pilot project applications, Cables, Fault Current Limiters, Storage Devices, especially in metropolitan areas where space occupancy must be matched with high power demands.

### **Objectives**

- To have transfer of knowledge, meeting point for TSOs and Technology Providers for a future Transmission Grid, giving a clear picture of available, near term and long term technology availability
- To identify and communicate the future technology needs in power systems
- To stress differences between barriers imposed by the technology and barriers imposed by the Grid characteristics, or requirements
- To study efficiency and technological feasibility of potential solutions and give some technical and economical examples of applications
- To define areas of application of different technologies, for example by power transfer, by voltage range, by length of connections

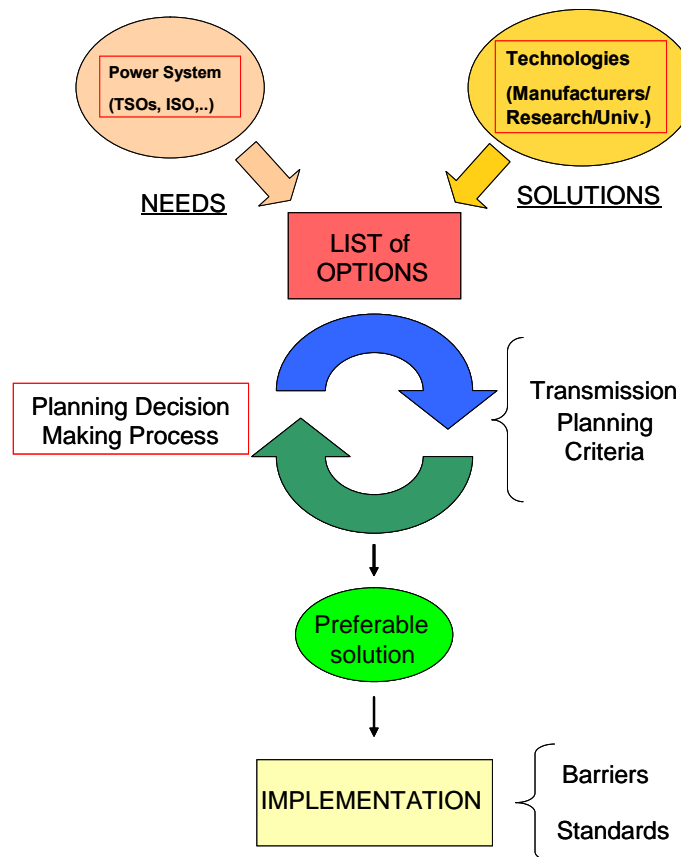
### **Scope of work**

The work will be carried out in two phases. The first phase will be a form of "brainstorming" involving power system owners and operators, manufacturers, researchers and others in developing a "long" list of candidate technologies. In particular a survey of views from other Study Committees will form a critical input.

From this list a small number of key technologies will then be selected for further examination in the second phase.

For each technology selected for the second phase the working group will consider:

- The state of maturity of the technology and when it is likely to be available for deployment
- The likely field of application for the technology
- The likely impact of the technology on power system performance
- Barriers to deployment and the means to overcome them.,
- Case studies and economics of alternatives
- Suitability and weaknesses of present standards, Transmission planning Criteria and Incentive schemes



Possible areas of investigation:

- HV and EHV Transmission System application AC and DC
- Benchmark of available and near future technologies for TSO operators taking account of recent and current CIGRE activities (see **Ref.** marked in yellow below)
- Availability of DC components, cables, circuit breaker, for a DC offshore meshed network
- Real Time Monitoring Systems and DTCR policy practice and experience
- Superconducting Technology solutions

**Deliverables/time schedule**

A technical brochure which lists a range of candidate technologies new or not yet widely adopted. For each technology:

- Description
- Status of the art and expected availability for widespread deployment
- Cost Indication
- Potential application, pilot projects or real examples
- Advantages and challenges
- Criteria to deem it suitable
- Cross Reference to other relevant CIGRE work

Two level of horizon are distinguished:

- a) Short term 0-10 years
- b) Long term > 10 years

WG establish in September 2009

List of technologies: 2009 SC meetings October 09 and October 2010, Complete April 2011

**Papers issued: TB, Summary in Electra**

**Comments from Chairmen of SCs concerned** : B4 requests to have two members on this new WG to cover AC and DC issues

**Approved by TC chairman: Klaus Fröhlich**

**Date: 07/09/2009**

## References

Working Group of interest with ongoing activities:

- A2/B4.28 HVDC converter Transformers end 2008
- A2.37 Transformer Reliability Survey 2011
- A3.06 Reliability of HV Equipments 2008
- A3.23 Application and feasibility of FCL 2011**
- B1.24 Test procedures for HV Joints 2009
- B1.27 Test recommendations on XLPE up to 500 kV 2010
- B1.29 Guidelines for maintaining XLPE accessories 2011
- B2.36 Monitoring system in Overhead lines 2010**
- B2.38 HSIL solution for reconducturing 2010**
- B2.40 Revision of IEC standards 2011
- B4.45 Technological assessment of HVDC over 800 kV 2008**
- B4.46 VSC HVDC Economic Comparisons with AC and LCC DC technologies 2009
- B4.48 Testing VSC 2009
- B4.49 review of TCSC control series compensation devices 2010
- B5.06 Maintenance Digital Substation automation 2010
- B5.37 Protection of Shunt reactors 2010
- B2/C1.19 Increasing capacity of OHL needs and solutions 2007**
- C1-C2-C6.18 Coping with limits for very high penetrations of renewables 2010
- C2.13 Voltage and Var support 2009
- C3.09 Corridor Management 2010**
- D1.18 Emerging technologies in Power Systems 2008**
- D1.12 HVDC Materials 2008