

*Reliability, Sustainability, LCA:
New challenges for the International World of
Cables*

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June 20 th, 2011



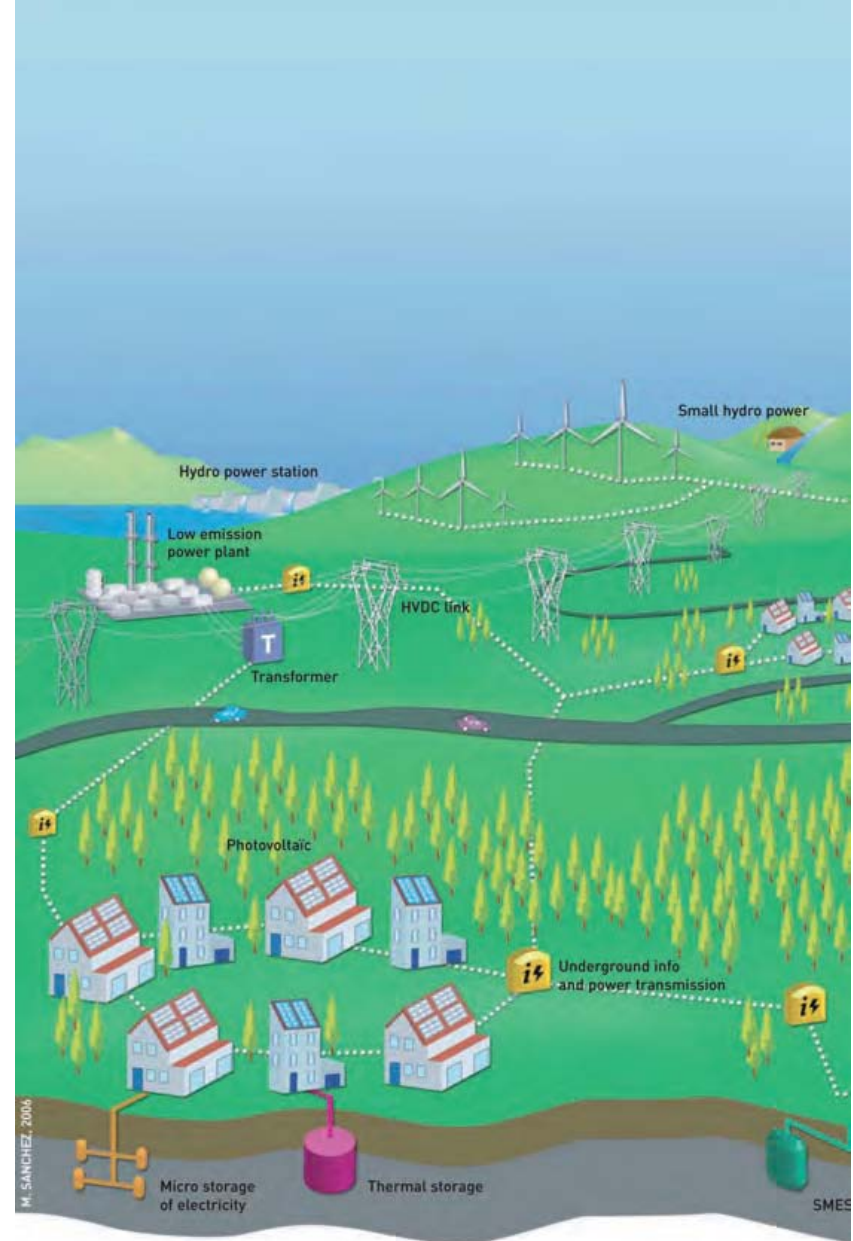
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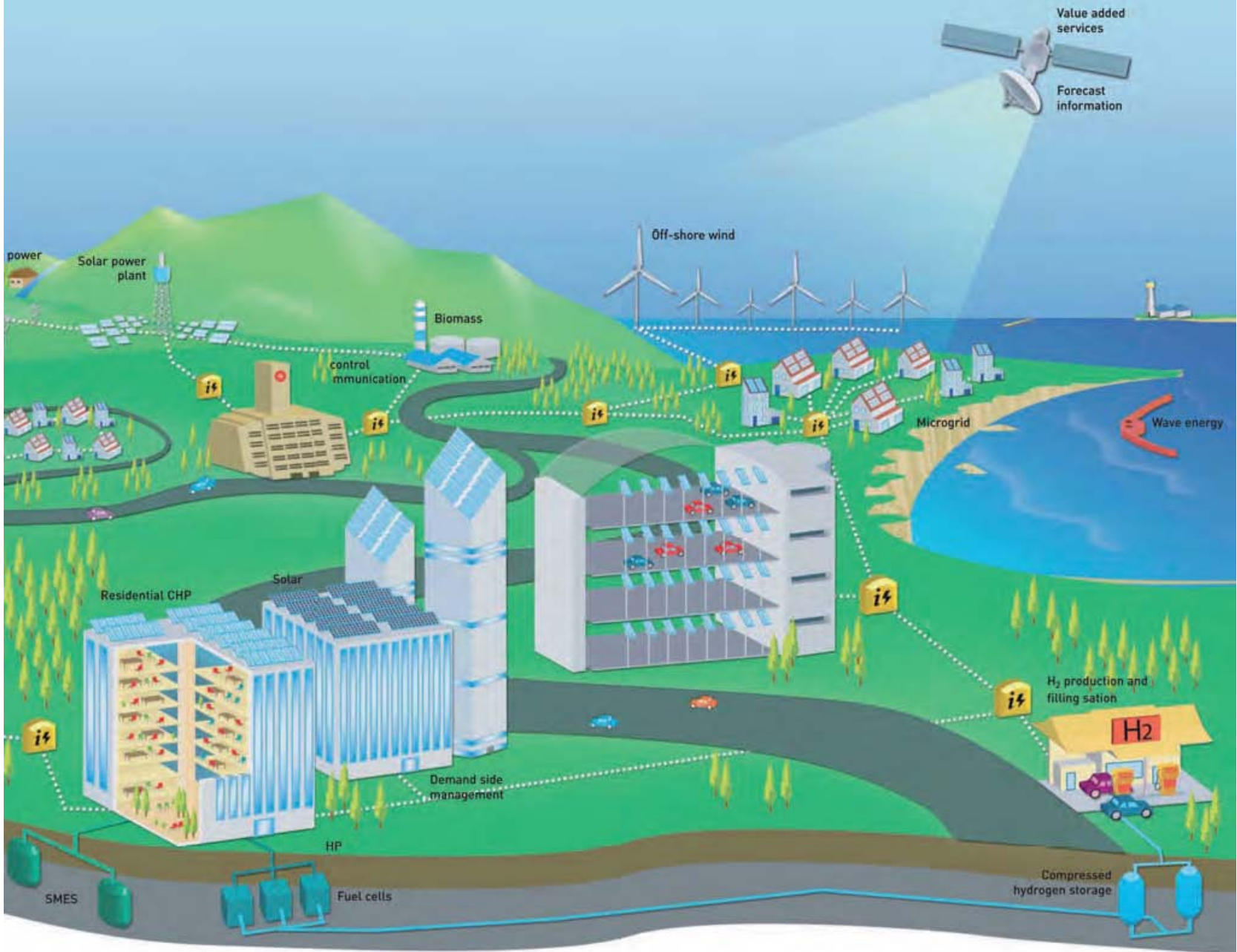


Future Network Vision

- Energy efficiency will have to be improved at each level, which involves generation, transmission, distribution and consumption of electric energy.
- In addition, the further development of wholesale and retail power markets and simultaneously increasingly stringent environmental regulations will significantly govern the future development of the power system.

As a consequence the electrical power system of tomorrow will be different.



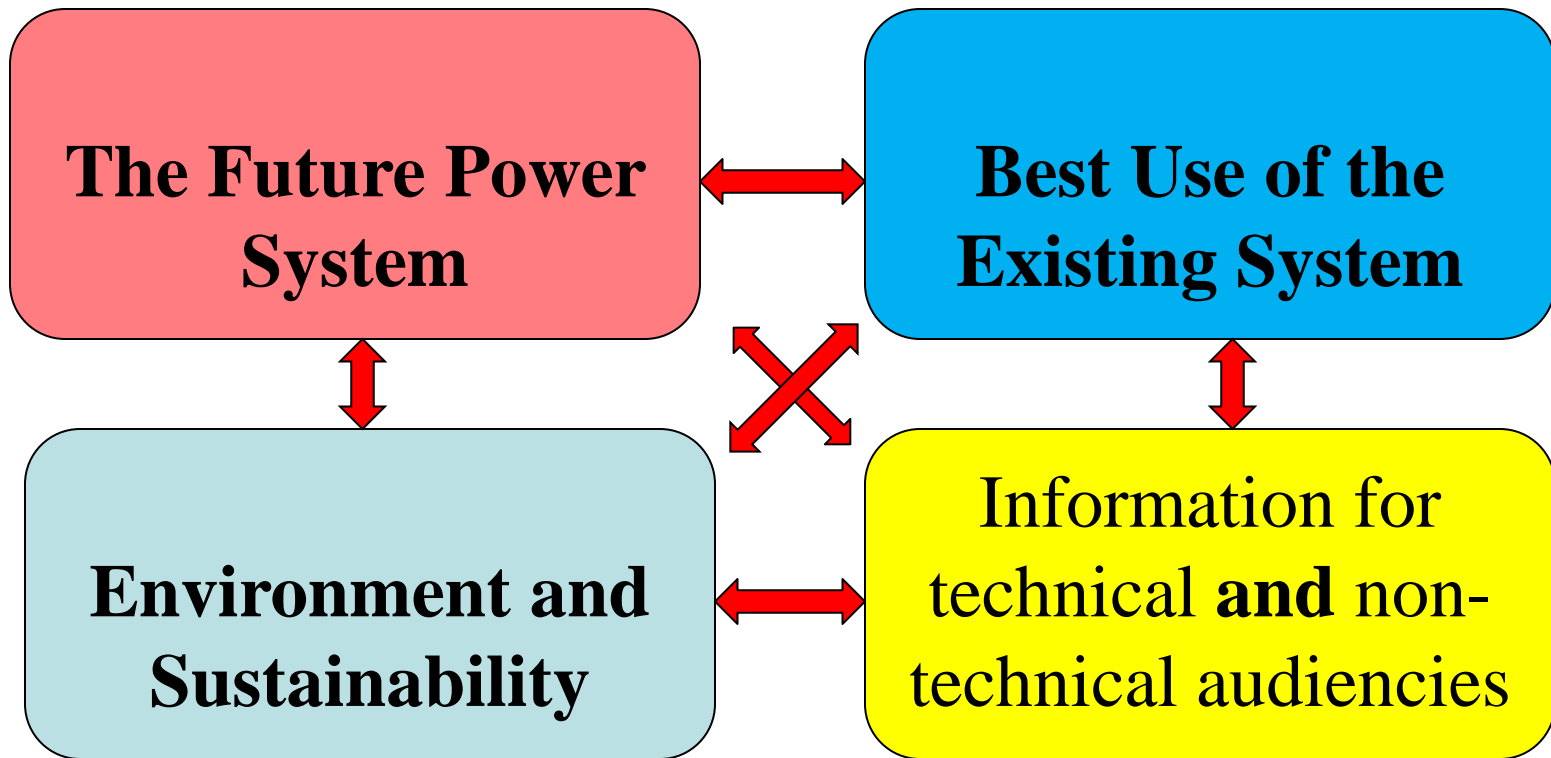


Key factors shaping the Electric Power Sector

The future of power systems is shaped by some important factors:

- the need to serve a growing demand of electricity
- the climate change and the development of carbon free generation
- the dearth and cost of energy
- the acceptability of power infrastructure.

Four Strategic Directions adopted by TC of CIGRE



D1: The Future Power system

Drivers for a future (electric) power system

- Climate change and fuel independence
 - De-carbonisation of the energy sector to reduce dependence on fossil fuels
 - Increase of renewable energy sources
 - Increased customer participation
 - Power efficiency
- Need for investment in end-of-life grid renewal (ageing assets)
- Fast grow in developing countries
- Progress in technology (primary, secondary)

Requirements for a future power electric system

- Highly efficient, flexible and reliable
- Economic: best value through innovation, efficient energy management
- Able to exploit any type of sustainable generation, any size and any technology
- Able to support the interactivity of generators (at any voltage level) and end users through the liberalised market - including energy storage

Requirements for a future power electric system

- Able to incorporate transparency: the information flow should be designed so users (in general) may take their decisions based on accurate and reliable information – smart metering
- Able to provide interoperability at a continental, maybe intercontinental level
- Able to securing long term strategic investments co-ordinated with investments on existing networks

Key Technical Areas

- Intermittent bulk power feed in (Wind, Solar)
- Remote production

Millions of small energy sources
Feeding in on LV- and MV level

Requires enforcement of TS:

- Network architecture (overlay grid, HVDC grid)
- Bulk power transmission over long distances (AC, DC)
- Increase of pump storage

Changes in System Architecture
Distributed energy storage
Interaction between load and system

Enablers

- The intelligent system
- New Technology and Methods

Enablers for the Future Network

- **Equipment technology**
 - Energy storage
 - Power electronics (converters, HVDC, Facts)
 - Generation sources
 - New devices (fault current limiters, ...)
- **Information and Communication technology (ICT)**
- **System automation, control, metering**
- **Environmental technologies**

D2: Best use of the existing power system

- **Management and best use of assets (life extension, diagnostics)**
- **Improvement of system operation, stability and recovery (demand side /congestion management)**
- **Best use of ROW (Hybrid lines, HVDC,UHV)**
- **Use of new technology/principles/materials**
- **New testing- diagnosis methods**

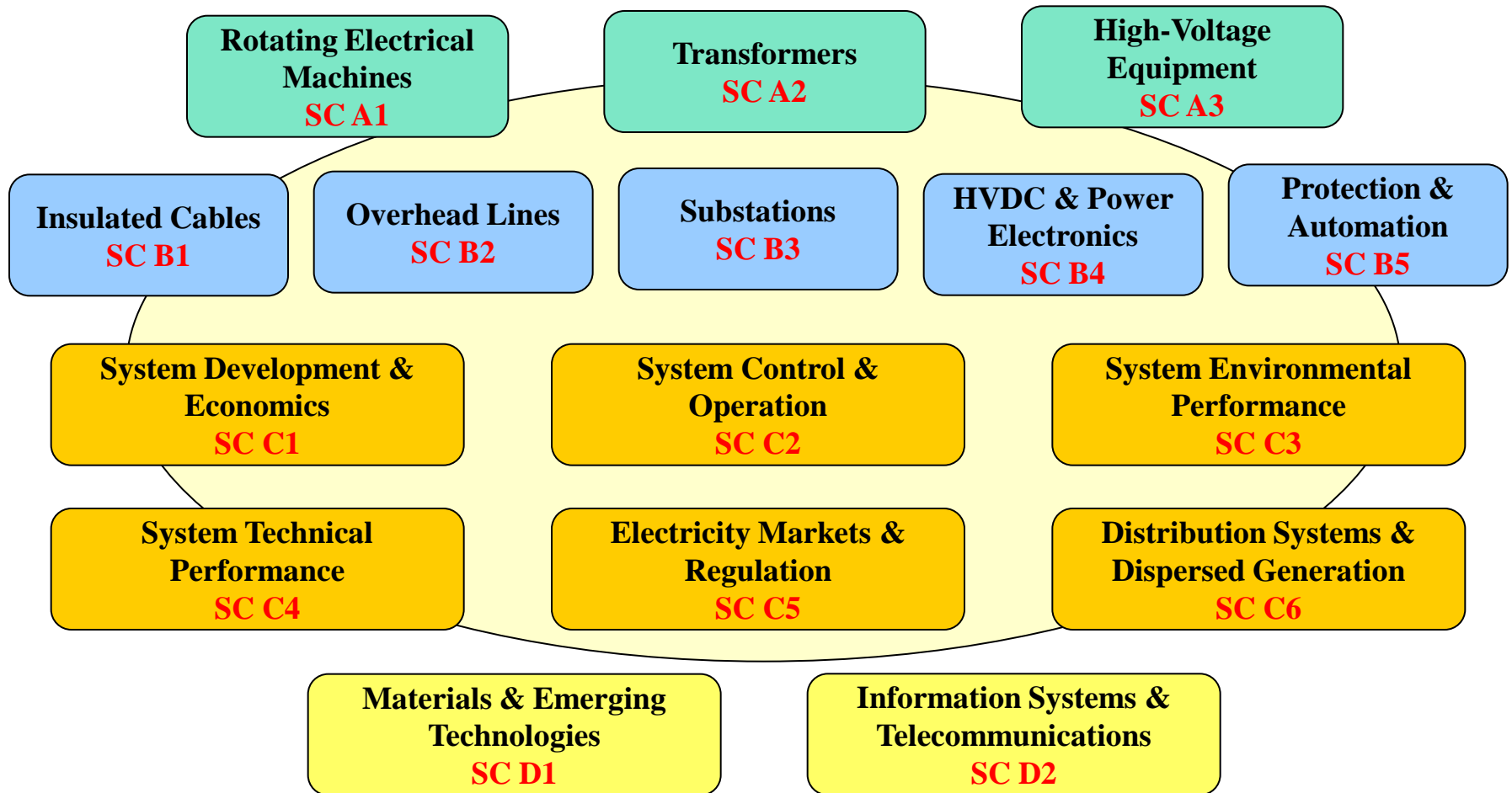
D3: Environment and sustainability

- **New environmentally friendly materials (e.g. replacement of SF6, mineral oil)**
- **Power system efficiency**
- **Severe climatic conditions**
- **Security of the system**

D4:Develop and publish unbiased and objective technical information

- **Preparation of documents for use by CIGRE's stakeholders**
- **Easy to understand by both technical and non-technical audiences**
- **Aim: To enable CIGRE members to inform other industry stakeholders on Power System technology issues**

CIGRÉ Study Committees

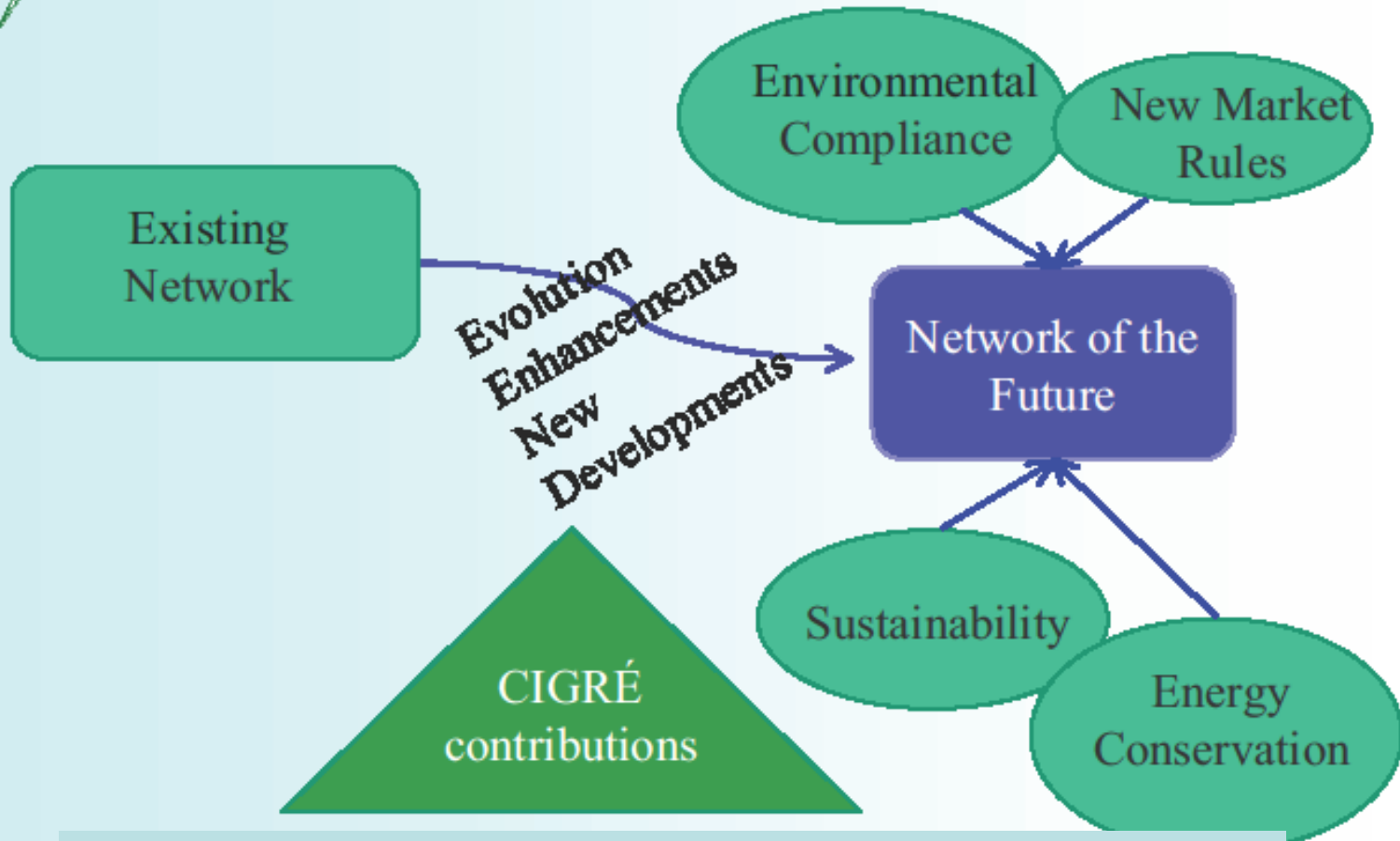


SC = Study Committee

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The role of CIGRE



From the existing network to the Network of the Future

The Cable in the Future

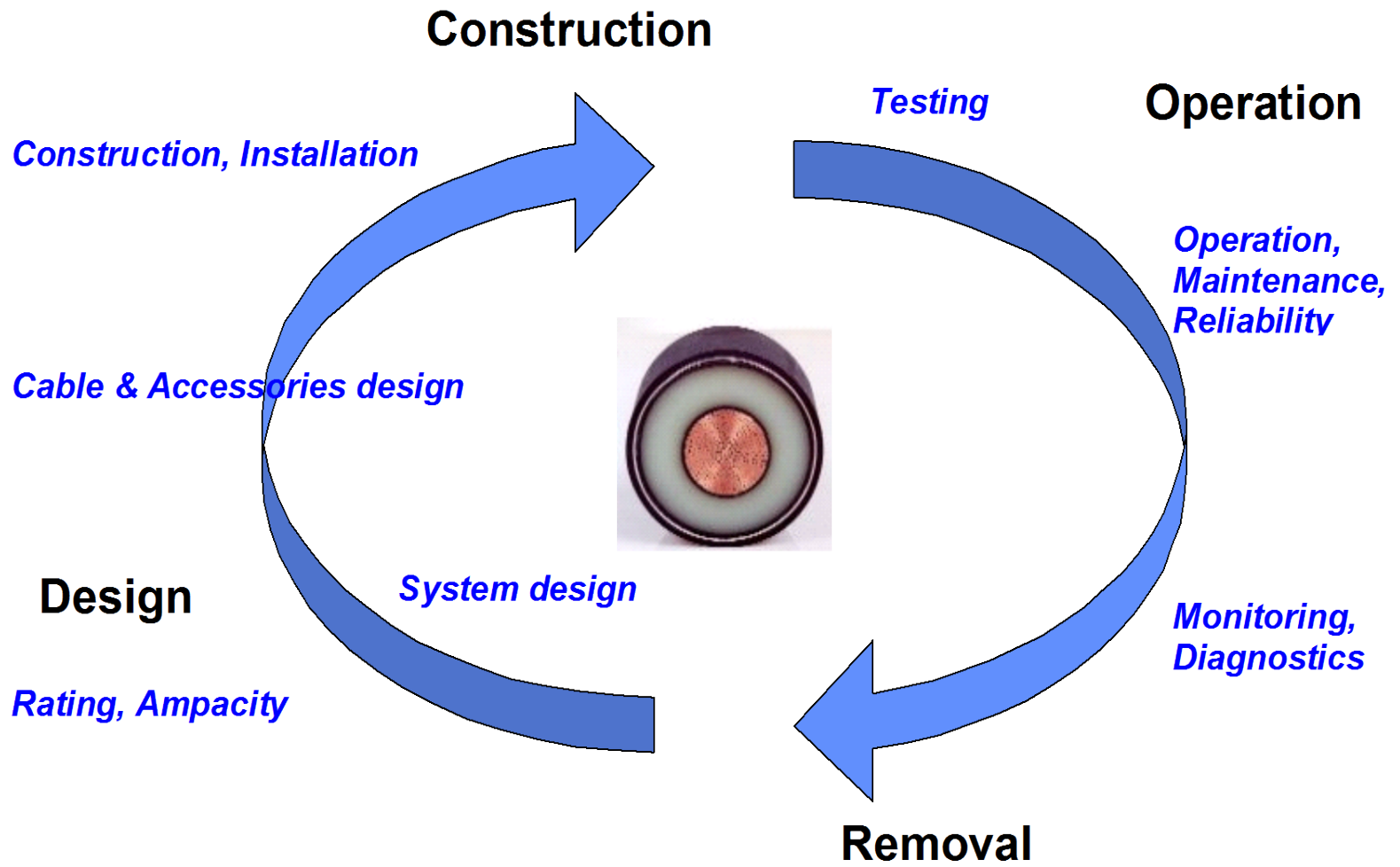
- **More transmission.**
- **Larger share will be cables.**
- **Larger share of extruded cables.**
- **Longer cable circuits.**
- **Increased focus on asset management.**

Cables within CIGRE: SC B1 (Insulated Cables)

- **Founded in 1927 (84 years old)**
- **34 SC Members**
- **200 experts in the Working Bodies**
- **169 publications since 1969**

Fields of Activity of SC B1

- Power cables in all phases of life**
- Submarine, underground, ducts, tunnels...**
- HVDC and HVAC Cable Systems but also distribution cables if necessary.**
- To write the state of the art and recommendations for further input to IEC**



Some Recent Publications of SCB1

Year	TB No	Title
2004	247	Optimization of power transmission capability of UG cable systems using thermal monitoring
2004	250	Technical and environmental issues regarding the integration of a new HV UG cable system in the network
2005	279	Maintenance of HVAC UG cable and accessories
2006	303	Revision of qualification procedures for HV and EHV AC extruded UG cable systems
2007	338	Statistics on UG cable in transmission networks
2008	358	Remaining life management of existing HV AC underground lines
2008	351	Application of long high capacity GIL in structures
2009	379	Update of Service experience on UG and submarine cables
2009	398	Third party damages on UG and submarine cables
2010	403	Cable systems in multipurpose or shared structures
2010	415	Test Procedures for HV Transition Joints for Rated Voltages 30kV up to 500kV
2011	446	Advanced design of laminated metallic coverings

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Publications to come

2011		Cable accessories workmanship
2011		Upgrading and upgrading of existing cable systems
2011		Impact of EMF on current ratings and cable systems
2011		Recommendations for testing of long AC submarine cables with extruded insulation for system voltage above 30 (36) kV to 500 (550) kV

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Active Working Bodies in SCB1

WG	B1.22	Cable accessories workmanship
WG	B1.23	Impact of EMF on current ratings and cable systems
WG	B1.27	Test Recommendations on XLPE AC Submarine Cables from 170 kV to 500 kV
WG	B1.28	On site Partial Discharge Assessment
WG	B1.29	Guidelines for maintaining the integrity of XLPE transmission cable accessories
WG	B1.30	Cable system electrical characteristics
WG	B1.31	Testing of HTSC cable systems
WG	B1.32	Testing extruded DC cables up to 500 kV
JWG	B1/B3.33	Feasibility of a common dry type interface for GIS terminations above 52 kV
WG	B1.34	Mechanical forces in large cross section cable systems
WG	B1.35	Guide for cable rating calculations
WG	B1.37	Guide for operation of fluid filled cable systems
JWG	B3/B1.27	Factors for Investment decision GIL vs Cables for AC Transmission
JWG	C3/B1/B2.13	Environmental concerns, procedures, impacts and mitigation issues of HV transmission lines for rural and urban areas.

Proposed New Items for Future Work

- **New Techniques for After Installation Testing (VLF)**
- **Offshore cables, static and floating platforms**
- **LCA and Environmental Impact of Cable Systems**
- **Generation Leads**
- **Recommendations for mechanical testing of submarine cables**

Conclusion

HV and EHV cable systems are reliable and well established components of electric power transmission networks. The goal of SC B1 is to prepare in its field of activity the Network of the Future:

- The first Technical Direction is to ease the development of new techniques by making recommendations and guidelines for design, testing and installation.
- The second Technical Direction of SC B1 is to make the best use of this existing equipment and system by producing guidelines for operation, maintenance and diagnostics, as well as statistics.
- The third Technical Direction is to make sure that the Environment is preserved.
- The fourth Technical Direction is to develop Technical Information through Technical Brochures and Tutorials.

At present almost 200 cable experts are participating to this task.

Many high technical value publications (around 170) are available.

Tutorials sessions have been organised to disseminate this information in several countries.

Any further information is currently available on SC B1's website **www.cigre-b1.org**.

THANK YOU FOR YOUR ATTENTION!