



**Study Committee C6**  
**Distribution Systems and Dispersed Generation**

**Strategic plan for the period**  
**2002-2006**

# Introduction

## Reorganisation of CIGRE

New regulation principles, liberalisation and privatisation combined with increased attention to environmental and social factors are now strongly changing the world of the Electric Power Industry (EPI). New actors are appearing, some of which are conducting business in certain segments of the EPI, others representing financial interests and some having regulatory responsibilities. Their interest profile differ often considerably from the interests of the traditional actors, like utilities and manufacturers. In order to serve its existing members and to attract members from the new actors, CIGRE carried out a strong and wide transformation that resulted in a new Masterplan and in the adaptation of the governing bodies and of the principles for conducting work in CIGRE.

The main organisational building blocks of this transformation are:

- ✓ The scope shall be expanded from having been mainly technical to cover also other aspects of sustainable development; this means that economical and environmental aspects as well as the consideration of the impact of social drivers has to be added to the pure technical aspects.
- ✓ The field of activity shall include all aspects of “Electrical Systems”, just adding Generation and Demand to Transmission & Distribution
- ✓ The needs of all CIGRE Customers (i.e. the Target Groups) has to be satisfied, including new players, e.g.: Executives, financial bodies, regulators

In particular, as regards the field of activity the Master Plan concludes that CIGRE should look at the “Electrical System” as a whole, including all interconnected components whose role is the conversion of primary energy sources into electricity and the further transmission and distribution of electric energy to the end user. In particular it is noted that **Dispersed Generation** should be within CIGRE’s scope. Consequently a new SC was created on “**Distribution Systems and Dispersed Generation**” .

## Past history and motivation for the new SC

The subject of **Dispersed Generation (DG)** was initially included in the activity of the SC 37, “Power System Planning and Development” by the creation of a WG on the “Impact of increasing contribution of dispersed generation on the power system” who published on ELECTRA on Febr. 1999 a report on the same subject. The WG also stated a DG definition hereunder shown:

- ✓ *Not centrally planned*
- ✓ *Not centrally dispatched*
- ✓ *Connected to HV, MV, LV distribution networks*
- ✓ *Smaller than 50 - 100 MW*

In the recent years the concept of DG was continuously promoted by a number of Driving Forces deriving from some technological features the dispersed generators have and based on some function they may provide; these forces are:

- ✓ High efficiency in conversion from primary energy sources
- ✓ Low environmental impact (especially in the case of renewables)
- ✓ No transmission cost, low distribution costs (even though depending on DG location)

- ✓ The new generation technologies are intrinsically modular and have a low scale factor on the cost
- ✓ Participation to the open and competitive electric market
- ✓ Improve reliability and quality of power supply (even though depending on changes in design and operation of distribution networks)

Notwithstanding the above favourable factors, Dispersed Generation, apart from the case of some countries like Denmark and Germany, is less than 10% of installed generation capacity. This is due to the existence of barriers like:

- ✓ High technology cost (the development of some technology is still in progress)
- ✓ Existing distribution networks are not designed for DG integration (there is the need for additional investments)
- ✓ Criteria and rules to operate distribution networks have to be modified
- ✓ Contributions of DG to system requirements are currently not fully recognised

## **Mission, Scope, Targets**

The **Mission** of the SC is to facilitate and promote the progress and the exchange of knowledge in the field of system impact of distribution systems integrating dispersed generation, by synthesising state-of-the-art practices and developing recommendations.

The **Scope** of the SC is to assess the technical impacts and requirements which a more widespread adoption of DG and which a larger proportion of undispachable power generation could impose on the structure and operation of transmission and distribution systems. In parallel the SC also assesses the degree to which such solutions are likely to be adopted in the short, medium and long term and, consequently, the practical importance and timing of the technical impacts and requirements mentioned above. Rural electrification, demand side management methodologies and application of storage are within the scope of this SC.

The main **Targets** to be pursued are:

- ✓ Develop new (for CIGRE) know-how in the field of Distribution System and Dispersed Generation
- ✓ Identify the main needs of the SC Target Groups
- ✓ Develop technical analysis on the impact of DG to support National Bodies in developing policies
- ✓ Integrate in the SC new members who have no experience of the organisation and of the activity of CIGRE, also coming from professional areas before not considered in CIGRE (for instance, distribution utilities)
- ✓ Involve people from developing countries
- ✓ Promote the name of the SC in non-traditional (for CIGRE) areas
- ✓ Establish links with other bodies active in the field of the SC

## **SC Targets Groups**

Targets Groups are our customers; the activity of the SC has to be focused on the satisfaction of their needs in the field of action of the SC. Our Targets Groups are:

- ✓ Technical Groups: Network planners, Network engineers
- ✓ Operators: Distributors, Power System Operators
- ✓ Commercial Groups: Generators, Distributors, Consumers, Energy Traders, Representatives Bodies
- ✓ Science and Public Groups: Regulators, Universities
- ✓ Similar International Organisations: CIRED, EURELECTRIC, IEA, IEC, IEE, IEEE, etc.

## **Fields of activity**

### Preliminary remarks

- Under the pressure of the above said driving forces distribution utilities and TSOs are facing various problems posed by the demand to integrate at the various system levels a growing number of small - medium size generators. Especially in the case of the integration at the LV and MV level the development and the operation of the relevant networks will be radically changed; moreover the present trend existing in many countries to develop large plans of wind energy exploitation is also affecting the whole electric system. DG integration has many aspects to be studied depending on:
  - ✓ the technology used for generation and for interfacing with the network (synchronous or asynchronous generators, back-to-back systems),
  - ✓ the primary energy sources used (traditional fossil fuels, bio-masses, solar energy, wind),
  - ✓ the size of generators or of the cluster of generators and therefore the voltage level of the network where the generators are connected.

There are therefore several topics to be examined that should be of interest of the SC Targets groups, first the revision of the DG definition. Because of the time and resources are required to achieve significant results priorities has to be identified.
- Still to day about 2 billion of people living in developing countries, mostly in rural areas, have no access to electricity, due to many factors. The start of activities to:
  - ✓ identify the various technical, economical and organisational aspects,
  - ✓ carry out an inventory of the technological solutions now available (in some case already applied),
  - ✓ identify benefits and drawbacks and possible barriers to their implementation on a larger scale,
  - ✓ disseminate results, provide training and technical assistance to electric companies, local governmental organisations and communities, international financing bodies,

should be of great interest for developing countries, thus allowing CIGRE to involve new people, companies and countries.
- The SC actions have to be undertaken in a short term perspective just to meet the immediate expectation of our Targets Groups. Furthermore, considering the novelty and some revolutionary aspect of the above said subjects, the SC has also to investigate on problems whose solution may be envisaged in a longer term perspective.

## SC actions in a short term perspective

- ✓ Status of DG existing technologies (GT, diesel generators, wind turbines, wind farms, PV, CHP, Solar Thermal).
- ✓ DG economics (DG costs, transmission and distribution benefits).
- ✓ Energy management and trading.
- ✓ Integration of DG in distribution network (definition and harmonisation of connection rules, network interface, protections, quality of supply, stability of DG, safety of personnel).
- ✓ Contribution of DG to ancillary services.
- ✓ Rural electrification (extension of distribution networks, village power)
- ✓ Use of storage to improve the operation of distribution networks, and to support the exploitation of RES and DG
- ✓ DSM

## SC actions in a medium term perspective

- ✓ Expectation of performances of innovative DG system (high temperature fuel cells, fuel cells - GT combined cycles, multi-junction PV with concentration, PV thin films) and storage devices
- ✓ Study of active distribution networks with high penetration of DG (new MV and LV distribution structures, development of new operation criteria, use of storage and power electronics based devices)
- ✓ Dispersed automated control systems. Use of communication and information technology for DG.
- ✓ Impact of high penetration on planning and operation of generation + transmission systems. System security.

## **SC Organisation**

### Working forces and deliverables

The activity of the SC should be carried out by:

- ✓ Working Groups (WG) aimed to perform extensive activities on broad subjects of paramount importance for the SC. The activity should be ended in 3-4 years.
- ✓ Task Forces (TF) aimed to perform activities on subjects of specific and present interest where results are required in due time. The activity should be ended in 2 years

Participation to WG/TF is open. Deliverables are reports, technical brochures and summary for ELECTRA, papers for CIGRE conferences and symposia.

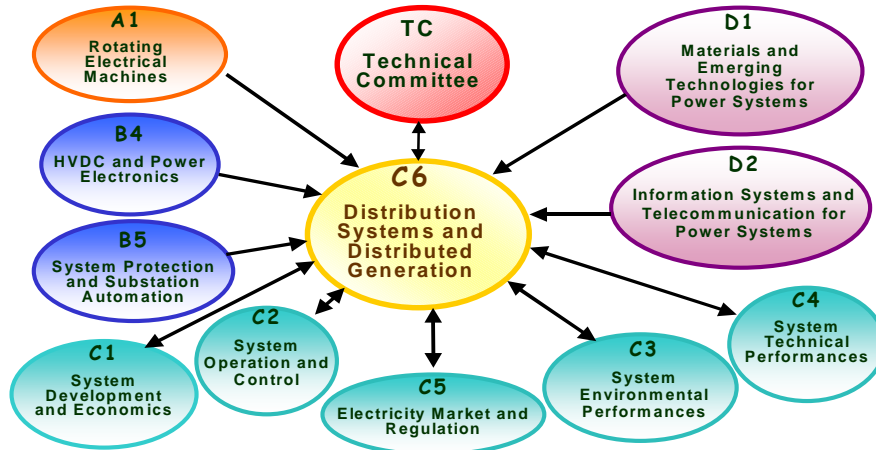
- ✓ Advisory Groups aimed to perform preliminary investigations on subjects of interest for the SC in view of possible future activities or to assist the SC Chairman to perform the mission and to pursue the scopes assigned by the TC. The activity could last one or more years.

Participation to AG is limited to SC members and experts. Deliverables are terms of reference for new WG/TFs, reports dealing with the management of the SC, proposals on strategies and organisation of the SC.

## Links with other CIGRE SC

The relations with the other SC of the Group C (System) are bi-directional (requirements are received, results are provided), while the relations with other SC are mostly unidirectional. The relations with the TC are of course continuous and in both directions.

## Relations with Other CIGRE SCs



## Links with other bodies external to CIGRE

*Technical/scientific associations.* The SC is interested in comparing activities in progress or planned; possible synergies may be envisaged

*Standardisation bodies:* The SC may provide requirements to develop new rules and standards, as well as technical assistance and background.

*Groups developing R&D projects financed by international bodies like EC, WB, ADB, etc.* The SC may provide to the involved experts an international forum where to:

- ✓ share experience,
- ✓ debate problems,
- ✓ compare and disseminate results,
- ✓ discuss future strategies,

relevant to the technical and economic aspects of the integration of Dispersed Generators within public distribution networks