The Strategic Role and Challenge of EHV Power Grid in the New Context of the European Energy Policy

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WHAT IS CIGRE?
How CIGRE works

- **Conferences**
  - *Session, every other year*
  - *Symposium: 2 in between*
  - *Other meetings – National, Regional, Colloquium…*

- **Study Committees and WGs**
  - *Permanent structures*
  - *Scopes cover all the issues concerning Power*

- **Dissemination**
  - *Publication, Tutorials…*
  - *Technical library: e-cigre*
CIGRE OBJECT

- Produce engineering knowledge
- Facilitate exchange of information
- Deliver high quality publications
- Its domain: Power Electric Systems
  *Starting on electric side of generation; excluding usages*
  *Covering all issues: technical, environmental, markets...*
Why CIGRE is different?

- More technical than scientific
- Collective work and added value through permanent structures – SCs & WGs
- All profiles of the ESI: unbiased information
- Really worldwide -> 80 countries
- Not produce standards
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SC organisation

A1 ROTATING ELECTRICAL MACHINES
A2 TRANSFORMERS
A3 HIGH VOLTAGE EQUIPMENT

B1 INSULATED CABLES
B2 OVERHEAD LINES
B3 SUBSTATIONS
B4 HVDC & POWER ELECTRONICS
B5 PROTECTION & AUTOMATION

C1 SYSTEM DEVELOPMENT & ECONOMICS
C2 SYSTEM OPERATION & CONTROL
C3 SYSTEM ENVIRONMENTAL PERFORMANCE
C4 SYSTEM TECHNICAL PERFORMANCE
C5 ELECTRICITY MARKETS & REGULATION
C6 DISTRIBUTION SYSTEMS & DISPERSED GENERATION

D1 MATERIALS & EMERGING TEST TECHNIQUES
D2 INFORMATION SYSTEMS & TELECOMMUNICATIONS
Electricity will play a more and more important role in order to achieve the three main goals of the EU Energy Policy:

- Reduction of the CO2 emissions
- Increase of security of supply
- More competitiveness of EU economy
- In the demand side, it allows a high energy efficiency
- In the supply side it allows a strong development of low carbon energy sources (wind, hydro, geothermal, nuclear)
Europe of electricity

29 interconnected countries (22 EU Member states)

Four synchronous blocks:
- Nordic countries, United kingdom, Ireland and Continental Europe.

Installed Capacity: more than 650 GW,

Annual electricity demand: around 3000 TWh

Physical flows exchange between countries: around 300 TWh
<table>
<thead>
<tr>
<th>Energy Source</th>
<th>2005 (TWh)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>940</td>
<td>28.4%</td>
</tr>
<tr>
<td>Oil</td>
<td>139</td>
<td>4.2%</td>
</tr>
<tr>
<td>Gas</td>
<td>694</td>
<td>21.0%</td>
</tr>
<tr>
<td>Others</td>
<td>40</td>
<td>1.2%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>998</td>
<td>30.2%</td>
</tr>
<tr>
<td>Hydro</td>
<td>341</td>
<td>10.4%</td>
</tr>
<tr>
<td>Renewables</td>
<td>157</td>
<td>4.8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3309</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
EU 27 GROSS ELECTRICITY GENERATION IN 2020

- 2/3 of the generation from low carbon sources
- 1/3 from nuclear
- 1/3 from renewables
  Wind energy could share 13% (1.9% in 2005)
13% of electricity mix in 2020 will represent more than 500 TWh out of a total of 4 000 TWh.

- To generate such an output, between 200 and 250 GW of wind capacity should be connected to the European grid out of a total of 1 000 GW installed capacity.
IN 2050

- WHEN CARBON CAPTURE AND SEQUESTRATION WILL BE AVAILABLE, IT IS POSSIBLE TO IMAGINE AN ALMOST CO2 FREE EU POWER SYSTEM
Such a drastic change in power systems will need a strong evolution of power grids.
Why such a need?

- To allow integration of large quantity of intermittent renewable energy (wind and later on solar)
- To increase the security of supply for mutual back-up of neighbouring member state power grids and regional neighbouring systems
- To achieve a better integration of the EU electricity market
What does it mean for the EU high voltage grid?

- A strong increase of the interconnections within the EU grid
- An extension of the interconnections beyond the present EU grid limit (around the Mediterranean sea, with the Russian IPS UPS system)
- A better efficiency of the operation of the EU grid
Some available technologies to meet these challenges

- Hybrid high voltage grids (AC+DC)
- Underground and submarine EHV synthetic cables (AC+DC)
- AC gas insulated link
- More intelligence in the grid (from a European control centre to the end users)
4 priority development plans for the EU electricity grid *

- A Baltic interconnection plan
- A Mediterranean power ring plan
- A North South power interconnection plan within Central and South East Europe
- A North sea offshore grid plan

*Second strategic energy review of the European Commission (October 2008)