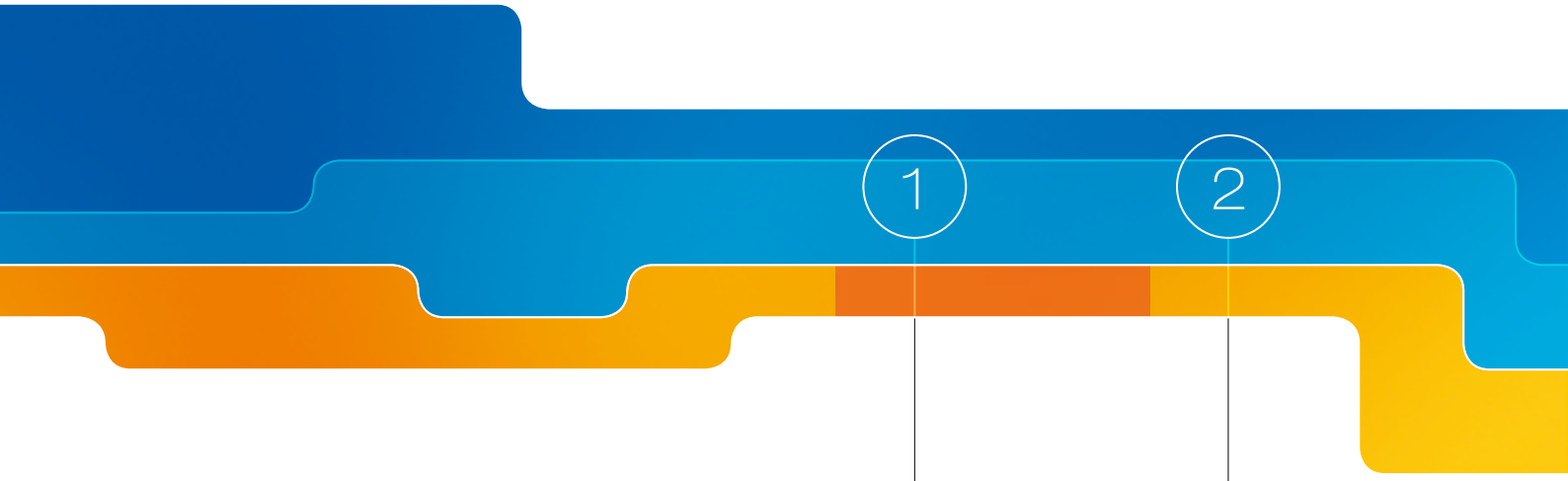
UCTE

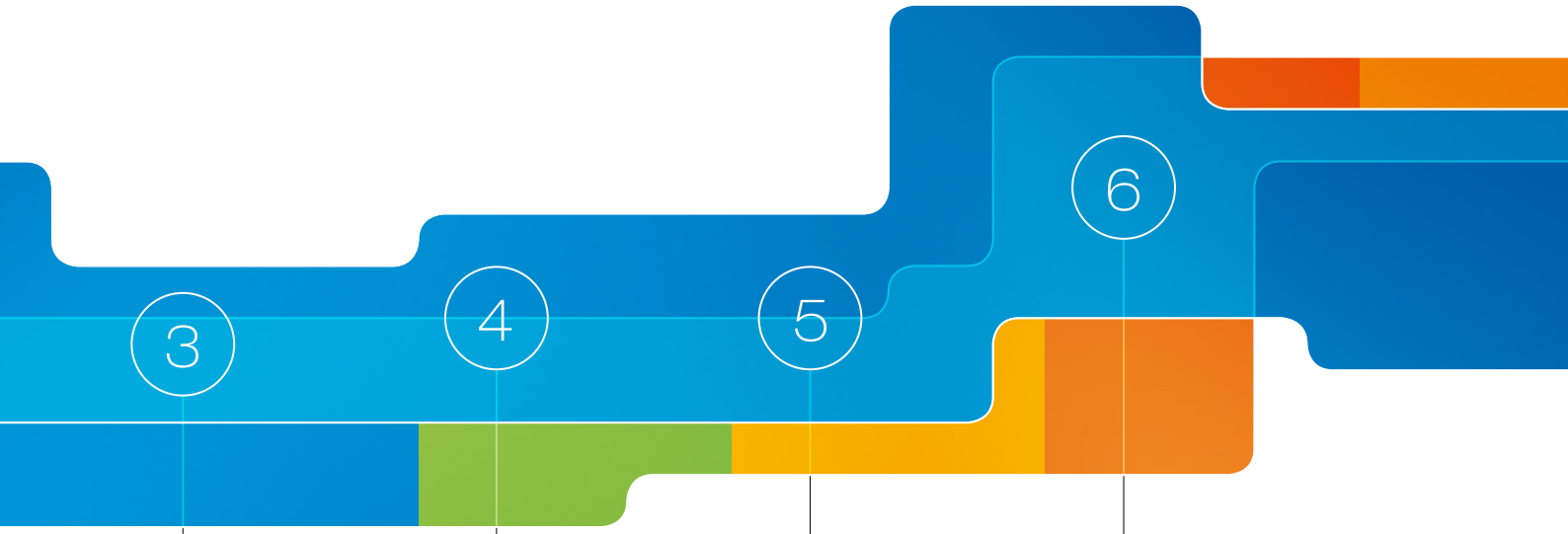
Annual Report 2006

union for the co-ordination of transmission of electricity

A visit to UCTE in 2007

union for the co-ordination of transmission of electricity





1 PRESIDENT'S FOREWORD

Time has come to face the fundamental challenges of system reliability

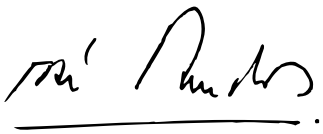
UCTE is the Association of Transmission System Operators in the European mainland comprising 23 countries, both EU and non EU. Its main mission is the coordination of TSO operational issues in the largest synchronously interconnected system in Europe with a view to pursuing the objectives of system reliability and thus security of supply for the benefit of 500 million people.

UCTE is therefore at the source of the sine qua non condition for developing electricity markets in Europe: a reliable physical interconnection. But UCTE is also concerned about the present lack of an adequate political response to the changes undergone in the transmission sector that should soon result in feasible measures enabling TSO responsibilities and TSO means of action to be reconciled.

An apparent contradiction? On the one hand, electricity supply products did not change much over the past decades. What did change is that markets are requesting more trading and transmission capacity and an ever increasing possibility to modify programs, and shorter gate-closure times. On the other hand, while no serious system-wide incidents happened over the last 50 years in Europe, the continent is facing more severe regional supply disturbances with a looming risk of global blackout in Europe with TSOs regularly warning about operating their systems at their respective limits.

Nowadays, various types of market participants (generators, distributors, traders) use the system primarily for trading purposes claiming »thinner« security margins which already led to a substantial increase of cross border transits with changes in operational patterns, intermittent flows, long-distance exchanges and several congested areas / borders. The role of TSOs and their respective means of actions – as defined in the still primarily binding national legislations – differ widely even among EU member states as well as the requirements set to grid users in the countries participating in a given system: In recent years, this started to cause severe system disturbances and induced severe limits of enforceability of reliability standards. And, last but not least, all these changes in the environment of TSOs occur in the light of growing difficulties for building new lines and substations, including interconnection facilities. A new approach to technological improvements is thus required especially for protecting the grids against disturbances due to decentralized generation injected into the system and cross-border flows.

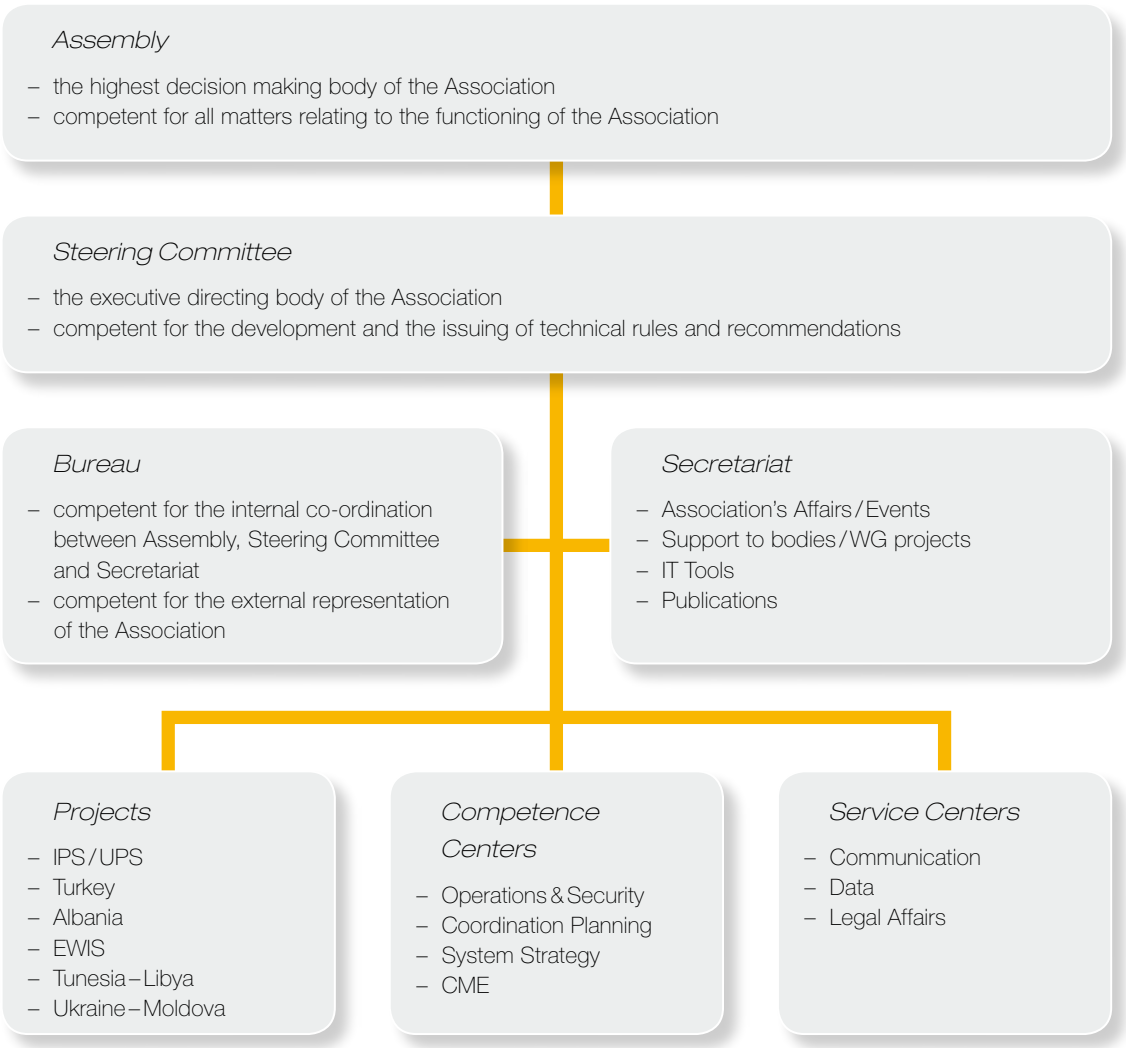
It is imperative to develop first and as soon as possible political awareness of the fact that the modalities of grid use provide benefits to markets, but that also risks are a key issue, while successful management of these operational risks remains also today an essential role of TSOs. Now this role definitely calls for improved TSO services but most urgently for adapted mechanisms and ultimately, new structures based on a new politically endorsed legitimacy for actions on reliability. This also includes a clear delimitation between the individual and the collective TSO responsibilities and competences for running their respective synchronously interconnected system. Finally, efficient and effective mechanisms of legal enforcement towards both TSOs and grid users on essential reliability targets must be put in place.

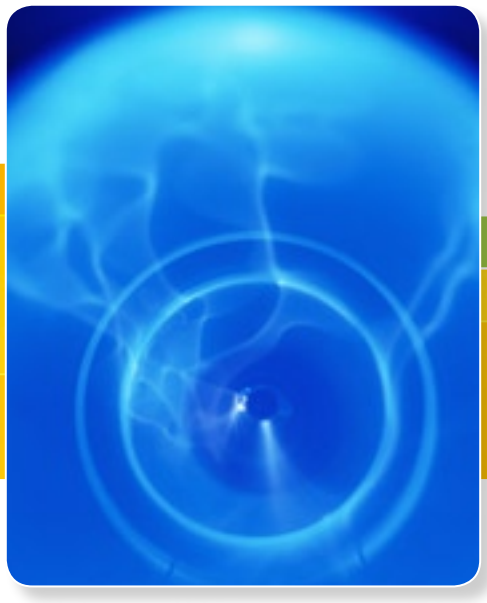


José Rodrigues Pereira Dos Penedos
UCTE President

2 A NEW APPROACH TO NEW CHALLENGES

A new orientation





Recent European events on networks are triggers to look for common services to be provided in order to significantly increase the security of the UCTE power systems and to ease the functioning of the electricity market. E. g. the related UCTE coordination is expected to be urgently improved and better structured by European stakeholders like EC / ERGEG and CEER. That underlined TSOs have to make proposals in terms of improvements for both operation and planning coordination throughout a wide system.

The year 2006 was a crucial one in the history of UCTE, since major new orientations were given to the Association to meet the challenges of the coming years. UCTE has decided to implement a new working structure on 22 June 2006 calling for a stronger interaction between the UCTE bodies and groups. Besides, new members of the Extended Bureau and new Project Managers were on 22 September 2006.

The new structure (see figure on the left) shall help to meet the challenges of the coming years.

A new support function to Working Groups and Projects has been set up in the UCTE Secretariat with the hiring of two data experts to further ensure a consistent data handling and raise synergies in data management across the TSO community while sharing common knowledge. <<<

New core competences

Compliance Monitoring and Enforcement

The main purpose of the UCTE is to promote the reliable and efficient operation of the interconnected power systems in Europe through the establishment of commonly agreed standards for system operation. Besides the definition and regular review of these standards, this implies a procedure to monitor the compliance of the standards in order to ensure that the TSO community keeps credible in its commitment to reliable operation of the interconnected system.

WG CME aims at establishing the process and procedures for monitoring the compliance of TSOs with the Operation Handbook and increasing the credibility of the TSO community through promoting the concept of self-regulation. This process should fulfill the needs of TSOs and meet the expectations of the stakeholders. It provides a forum in which TSOs can discuss and advise the WG on the existing problems with reaching compliance with OH rules and propose instruments and methods for the compliance assessment. In addition, WG CME will recommend improvements of the OH by the use of the compliance monitoring feedback information. <<<

Coordinated Planning

The need for reinforced coordination at international level also includes planning activities. At the beginning of 2006, WG System Development tackled the first steps regarding the investigation of benefits and implications of a coordinated planning activity and the necessary evolution of network planning principles. A list of »harmonized« guidelines was drawn up and UCTE decided to go one significant step further while creating a new dedicated WG which has been in charge of coordinated planning since September 2006.

The new WG builds up a common vision of UCTE priorities for development of transmission infrastructures and creates a framework to exchange TSOs' information on their individual development plans and to initiate joint planning studies. The WG Coordinated Planning looks into planning principles and processes and makes proposals for improvement for internal and external use. A common data basis for medium and long-term network studies shall be shared by TSOs. In addition, TSOs and the market players get a global view of present and future levels of system adequacy including both generation adequacy and transmission adequacy based on an appropriate methodology. This improved product becomes a basis for sound EC initiatives towards an integration of the IEM and for investment decision-making. <<<

Towards an Integrated System Strategy

Furthermore, UCTE has contributed to building one of the largest synchronously interconnected power systems in the world, supplying half a billion customers in a safe and reliable way. However, in the recent past power outages have been experienced around the world and, in the UCTE system as well which had important consequences. This confirms that the main focus of the work of UCTE is, must be and will remain the security and the reliability of the interconnected system. In particular, the set up of a European coordination centre, European reliability standards and a formal Group of TSOs are likely to be discussed within EC to improve the reliability of the interconnected system. These issues become more complex under liberalized market conditions. UCTE is focusing on the assessment of the technical feasibility and the related legal/regulatory boundary conditions of interconnections.

In order to help UCTE define its future strategy, the newly created System Strategy WG identifies all topics (organizational, technical) having an impact on UCTE TSOs, proposes a priority list and for each topic a clear UCTE strategy, and finally puts forward a global strategic vision to be shared by the other electricity stakeholders.

One of those topics is an improved coordination at the European level which can be sought to improve the reliability of the power system, with an increasingly significant awareness by TSOs of common risks for the interconnected operation, the development of wider exchanges of power system information on operation and balancing reserves. The increased coordination shall help to comply as far as possible with operational rules and grid codes, and to be transparent in case of provisory faulty situations, with a credible self-assessment of non-compliance. <<<

New services: Communication

Through active communication and public affairs activities, WG Communication strengthens the image of the UCTE as Reference Centre for reliability and technical consultancy towards European institutions and market parties. It has to establish and live a new UCTE Communication Policy fostering the UCTE vision. Efficient internal communication methods enable UCTE members to work together in an effective and sustainable way. WG Communication sets up effective and efficient communication and information processes between UCTE member companies and the Association, conveys UCTE positions on energy policy issues to the relevant European Institutions in a professional and convincing way, actively manages issues by monitoring regulatory statements and media on UCTE topics, directs the knowledge to appropriate UCTE bodies and prepares position papers and statements. <<<

Towards a global data management in UCTE

On the one hand, the WG Data inherited tasks from the former WG Statistics around the collection, control, processing and publication of statistics. In addition, its mission has been enlarged to become the gatekeeper of the data gathering and processing competence within UCTE. It shall define a data policy covering also areas that are under the responsibility of other WGs and closely interact with WGs and Project WGs to allow an effective and efficient cooperation in the field of data management. <<<

Managing the change

Besides the decision on the new working structure dated 22 June 2006 with an increased importance of interactions between the UCTE bodies and groups, new members of the Extended Bureau and new Project Managers have been appointed. In addition, external solicitations increased significantly in 2006 (external extension requests, projects such as CMEP, EWIS, CIP …) and lead to an extension of the scope of UCTE activities. This brings UCTE at limits and calls for a change.

In order to accompany professionally all those important developments, the UCTE Bureau launched the Change project CUTE (acronym for Conduct UCTE Towards Excellence and synonym of »smart«) to channel the implementation of changes, clarify interfaces, core processes and develop recommendations to increase the performance of the Association in a consistent way.

It accompanies the changes in working structure and the designation of the new leading team. The project run by Olivier Feix and involving Convenors, Project Managers and the Bureau shall

- analyse the present missions, the expected deliverables and used working methods of the different bodies of the association,
- work out a common vision, consistent missions and approaches of all bodies of the Association,
- develop practical solutions for handling efficient and effective interaction between WGs, Projects, Secretariat and SC,
- propose clearer interfaces, working processes, methods and tools to be used by WGs, Project Groups, Secretariat and SC.

At the end of 2006, CUTE has worked out and communicated a new mission to the members, aiming at positioning UCTE as the Association »recognized by European institutions and market parties as the Reference Centre for the reliability of the synchronously interconnected system and for technical consultancy for UHV (Ultra High Voltage) system performance and development in order to make the electricity market happen.«

A clear split of responsibilities is defined, the systematic support given by the Secretariat to Working Groups is defined, and a Bureau Program 2007 focusing on 5 key issues is approved. All Working Groups and Projects developed Mission Plans that are all consistent with each other and provide a precise description of objectives, tasks, interfaces, processes and responsibilities. <<<

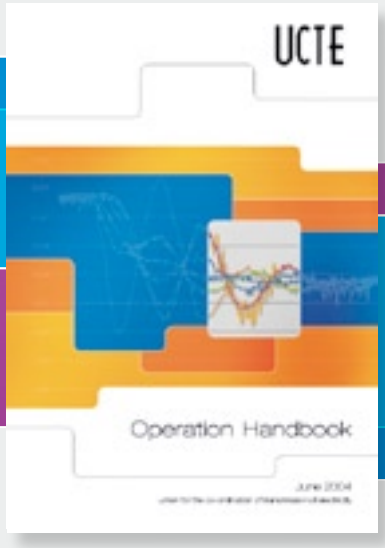
UCTE is recognized by European institutions and market parties as the Reference Centre for the reliability of the synchronously interconnected system and for technical consultancy for UHV (Ultra High Voltage) system performance and development in order to make the electricity market happen.

3 SECURITY OF THE UCTE SYNCHRONOUS AREA

Security Package

In 2006, UCTE continued to develop its Security Package consisting of three main elements:

- *Operation Handbook*
  setting the standards for the secure operation of the interconnected system,
- *Multilateral Agreement*
  ensuring the legal obligation for application of the OH standards and
- *Compliance Monitoring and Enforcement Process*
  monitoring the current status of OH standards implementation.



The Operation Handbook was extended to 4 further Policies:

Policy 4 – »Coordinated Operational Planning« covers the issues related to TSOs' planning activities including outages planning, cross-border capacity calculation, procedures for Day-Ahead Congestion Forecast.

Policy 5 – »Emergency Operations« covers TSOs activities during alert and emergency states as well as restoration phase after the blackout.

Policy 6 – »Communication Infrastructure« specifies standards and requirements for communication links between TSOs.

Policy 7 – »Data Exchanges« provides a »code of conduct« for the exchange of data.

These Policies were developed as a second step of the whole development process where the old recommendations were updated to current best practices and new rules were developed including the areas not covered in former UCTE recommendations.

These four Policies came into force after their approval by the Steering Committee in June 2005 and were included into the Multilateral Agreement in August 2005.

Additionally, UCTE continued the development of Policy 8 »Operational Training«. This Policy will address the standards on inter-TSO training which is critical in the context of day-to-day TSOs' cooperation.

The year 2006 was also marked by the very first approach to the Compliance Monitoring and Enforcement Process. In January 2006, the Steering Committee approved the launch of the trial pilot compliance monitoring program for the first three (approved at this time) Policies of the Operation Handbook.

The program was based on TSOs' self-assessment where TSOs evaluated systematically their own level of compliance with selected rules of the Operation Handbook. The trial process was concluded with a Compliance Oversight Report (available on the UCTE website). It shows that compliance with the rules was rather the norm than exception. Nevertheless, non-compliances were also identified and action plans to retrieve these situations were proposed. The experiences gained during the 2006 exercise give valuable input for strengthening the rules and improvement of compliance monitoring in 2007.

Compliance monitoring on the European continent has become a new core competence of UCTE aiming at increasing transparency and mutual trust among the community of TSOs and between TSOs and their stakeholders. Furthermore, compliance activities are aiming at recognizing UCTE as a credible self-regulated organization. <<<

Studies aiming at preserving the security of the UCTE synchronous area

European Wind Integration Study (EWIS) – towards a successful integration of wind power into european electricity grids

The EWIS study was launched in April 2006. First results were available at the end of 2006. The final report (phase I) was published in February on the ETSO/UCTE homepage. The EWIS study is a joint investigation for the system integration of wind power, initiated by the European Transmission System Operators and supported by the EU. The study is focused on the extra-high voltage grid and comprises extended steady state and stability investigations in the European synchronous areas (ATSOI, NORDEL, UKTSOA and UCTE) for the installed wind capacities expected in Europe in 2008 and 2015 based on common Europe-wide scenarios.

In 2006, necessary requirements for the further increase of wind power in the national/regional generation mix were analysed on the basis of the developed scenarios. The measures to counteract identified limitations of integration of wind power and the costs of such measures are also analysed. Interactions between operational/technical/technological constraints, market designs and energy policies for synchronous areas in Europe are analysed. Consequences for the existing, medium and long-term issues related to the integration of wind power are discussed.

The final results which will be available in 2009 will also comprise stability impacts for the time horizon of 2015 and give recommendations for harmonised grid code requirements for wind turbines necessary for successful integration of wind power into European electricity grids. EWIS phase II is totally funded by the European Commission.

The EWIS study covered all relevant technical, operational and market aspects related to the integration of large-scale wind power in Europe for the time horizon 2008. In order to determine the major impact of the expected wind power on the operation and security of the European transmission network, two Europe-wide realistic scenarios for the year 2008 were developed. With most European countries planning to increase the installed wind power, it is expected that installed wind power in Europe will grow from 41 GW in 2005 to nearly 67 GW in 2008. The highest amount of wind power is concentrated in Germany, where approximately 40 % of the total installed capacity is likely to be represented by wind power in 2008. Spain and Great Britain are ranking second. These 3 countries will represent more than 70 % of the total installed wind capacity within Europe. The expansion of variable wind power generation has significant effects on the European electricity system as a whole.

Investigation results showed that the high concentration of wind power in northern Germany is producing large power flows through Germany and the neighbouring transmission systems in Benelux and Central Eastern Europe, increasingly affecting system stability and trading capacities. Detailed analysis of the scenarios reveals overloads on transmission lines in normal operation as well as under N-1 conditions.

Experience showed that the disconnection of old wind turbine technology in case of disturbances can lead to serious outages with a risk to endanger the entire UCTE system. The identified risks should be reduced by risk mitigation methods within the scope of both medium-term system planning and system operation.

For the time horizon 2008, the fundamental medium-term measures comprise installation of additional phase-shifters and reactive power compensators and the realisation of network extensions and reinforcements as planned. Operational measures are grid-related load flow control such as corrective switching and changing of settings of phase-shifters.

In countries with a high concentration of wind power, additional countermeasures, such as security management measures, i.e. the reduction of wind power generation in emergency cases or the adaptation of old wind turbine technology due to fault ride through behaviour have to be taken. Based upon the final results, recommendations will be given as to harmonised grid code requirements for wind turbines to ensure a successful integration of wind power into European electricity grids while maintaining system security and stability. <<<

4 THE ATTRACTIVENESS OF THE UCTE SYNCHRONOUS AREA

The UCTE synchronous system ranks among the biggest and most complex systems in the world, integrating the whole western and central part of the European mainland and three Maghreb countries. The expansion of this system since the first interconnection to the present status has been a success story. Today UCTE coordinates the operation and development of the electricity transmission grid from Portugal to Poland and from the Netherlands to Romania and Greece providing a reliable market platform to all participants of the Internal Electricity Market (IEM) and beyond.

Nevertheless, the evolution of the UCTE system never stops. Currently, UCTE faces the challenge of expansion requests towards the the following geographical directions:

– To the Southeast with the request for the synchronous interconnection of Turkey.

– Further eastward in Northern Africa which involves the interconnection of Tunisia – Libya that would bring the UCTE frequency up to Syria and Lebanon.

– And, most significantly, to the East which involves the connection of two very large systems, the one of UCTE and the one of IPS/UPS. Such interconnection would lead to a huge electrical system spreading from Lisbon to Vladivostok.

The major challenge for the aforementioned enlargements is to make them possible in a smooth and technically sound manner, as happened in the past, while maintaining the quality of the UCTE system at the present high level of safety. This will allow to provide a sound basis for electricity markets in broader Europe and their enlargement to the benefit of all market players and consumers. <<<

Facts about current extension activities

However, today's tasks are much more complex than in the past. In some cases, the systems requesting interconnection with the UCTE system do not share the same operational philosophy, the same rules and/or standards, and some of the systems examined for interconnection present inherent technical problems. The fact that vertically integrated utilities have been recently replaced by unbundled enterprises also adds to the complexity of the situation and makes the security and the sharing of responsibilities issues more critical than in the past. Also the countries making a request for interconnection already have interconnections further beyond, which might give rise to more requests.

The precondition for any extension of the synchronous area beyond the borders of UCTE is to keep the reliability of the system at the current high level. <<<

Current projects

1. Feasibility Study on synchronous interconnection of the Power Systems of IPS/UPS with UCTE

In January 2002, RAO UES Russia acting on behalf of EPC CIS* and Baltic States requested UCTE to study possibilities of synchronous interconnection of the European power grid – UCTE with the transmission systems of IPS-UPS**. The study with a direct support of the EC was launched in 2005 and is performed as a joint project under the responsibility of UCTE.

Presently, there is no example of a system in the world which operates in synchronous mode to this extent.

The feasibility study will give an answer to the main questions:

- Is a synchronous interconnection of IPS/UPS and UCTE possible?
- What measures (technical, operational and organizational and legal) and investments have to be taken on both sides?
- What are the associated costs?
- What would be a non-synchronous solution both from the technical and economic point of view?

The request for UCTE-IPS/UPS interconnection is quite different from all former requests for system interconnections. It implies the electrical interconnection of two large power systems with different rules and standards for each of them.

Therefore, the feasibility of the synchronous interconnection has not only to be defined in terms of compatibility of technical performance, but also of organization and management in order to ensure a secure and reliable interconnection. A mandatory set of technical requirements needs to be determined in order to avoid any negative influence of one system on the other although the technical standards and internal rules of each system will, as far as possible, remain unchanged provided they do not have any negative impact on system security.

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* EPC CIS: Electric Power Council of Commonwealth of Independent States

** IPS/UPS: Comprises the Power Systems of the Baltic States (Latvia, Lithuania, and Estonia), Armenia, Azerbaijan, Belarus, Georgia, Moldova, Mongolia, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Ukraine and Uzbekistan.

>>> Meanwhile, important milestones have been reached. Initially, a load-flow study model of the transmission systems spanning a geographical extension from Portugal to the Bering Sea was jointly prepared by experts from both parties. The simulation model reflects a peak load case with a time horizon of 2008 and a total load of 530 GW. The first simulations performed until now are solely dedicated to the steady-state load flow and do not allow to identify fundamental technical barriers to a positive assessment of the feasibility of a synchronous operation between IPS/UPS and UCTE.

The study results will be used as a basis for taking decisions on the further developments of the systems concerned. All this may result in a timeline for the possible industrial implementation of the study results. Further decisions need to be made by stakeholders taking into account further fundamental boundary conditions of the East-West cooperation in Europe in the field of electricity. <<<

2 Interconnection of the Turkish Power System to UCTE

The discussions for the connection of Turkey to UCTE have started in 2000, following a relevant request to UCTE for connection and membership. The »Service Contract« for the Execution of the Studies was signed between UCTE and the EC Central Finance and Contracts Unit (CFCU) for Turkey at the end of September 2005. The work was performed by a consortium of TSOs, members of UCTE with the support of TEIAS, the Transmission System Operator in Turkey. Financing was provided mainly (90 %) by CFCU with a 10 % contribution from UCTE own funds.

The latest scenario considered will enable the connection of Turkey to the UCTE grid via three single-circuit 400 kV lines (two 400 kV lines between Turkey and Bulgaria and one 400 kV line between Turkey and Greece). The planned 400 kV 3-circuit connection and the configuration of 400 – 220 kV systems in the Balkan countries and Hungary will ensure a reliable interconnection with Central Europe, which is adequate to the capacity of the Turkish power system. The interconnection of Turkey with the UCTE grid is also a pre-requisite for the feasibility of the prospective Mediterranean Synchronous Ring. However, given the UCTE technical requirement, the synchronization of the Turkish power system with its Eastern and South-Eastern neighbours needs further substantial efforts. <<<

3. Interconnection of Tunisia – Libya and LEJSL System with UCTE

Morocco, Algeria and Tunisia are already synchronously interconnected with UCTE via two 400 kV AC submarine cables to Spain. Said countries though synchronously operating with UCTE are not members of the Union, therefore they do not share the same technical operating rules and the same obligations.

At the request of Tunisia and Libya, UCTE investigates whether an extension of the European frequency does not endanger the reliable operation within UCTE. A possible future closure of the Tunisia – Libya interconnection originates from previous studies carried out with the Spanish UCTE member REE.

The expansion would involve the closure of two existing 225 kV lines between Tunisia and Libya which, in case of success, would extend the synchronism from Spain to Syria involving in addition Libya, Egypt, Jordan and Lebanon.

The conclusion of the investigations so far is that the system needs the following substantial improvements before being connected to UCTE:

- Power System Stabilisers in Egypt
- defence plans to be adapted

Based on the conclusions of the study, UCTE asked for:

- the assessment on all the conclusions and recommendations by all countries
- a description of measures executed against stability problems
- a description of measures executed regarding defence plans

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4. Interconnection of Ukraine and Moldova with the Electrical System of UCTE

On March 2006, an official request of Ukrenergo/UA and Moldelectrica/MD was submitted to UCTE via Transelectrica (as »Supporting Party«) for synchronous interconnection with the UCTE grid. Both systems requested to be considered as a single control area.

On 26 June 2006, the UCTE Steering Committee recognized the case as »Type B extension« according to the UCTE Internal Regulations Art.32 (»each synchronous interconnection between a Control Area which is part of the Synchronous Area and a Control Area which is not yet part of the Synchronous Area«). Further to the request on 23 November 2006, the Ukraine/Moldova Project Group was launched.

This new request is different from the IPS/UPS study since Ukraine and Moldova together with the connection request are seeking also full integration and membership with UCTE after achieving full compliance with the provisions of the UCTE Operation Handbook. UCTE has decided to treat the two projects, namely Ukraine/Moldova and IPS/UPS, separately and independently.

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5. Integration of Albania

The Albanian power system has been already connected and operated synchronously with the UCTE network in the late 80ies.

As a result of the reconnection of two UCTE zones, the question of compliance with operational rules has become a matter of priority. The issue of compliance with operational rules was investigated and discussed with the Albanian Power System Operator ATSO which has expressed its strong commitment to proceed to the necessary system upgrade in order to comply in due time with UCTE standards. It was decided that:

- the Albanian System is to remain interconnected with the UCTE power system
- ATSO has to organize the Load-Frequency Control function forming its own control block under the coordination of the »UCTE Co-ordination Centre South« run by swissgrid in Laufenburg.
- UCTE appoints an »Albania« Project Group charged to give to Albania the necessary information on how to proceed in the improvement process and how to perform the monitoring of the entire process.

The UCTE »Albania« Project Group has already prepared the »Albanian System Status Report« that reflects the status of the Albanian System at the end of 2005 and the system development plans. Moreover, the PG »Albania« has started the preparation of the catalogue of measures needed for the Albanian System to comply with the UCTE Operational Handbook. <<<

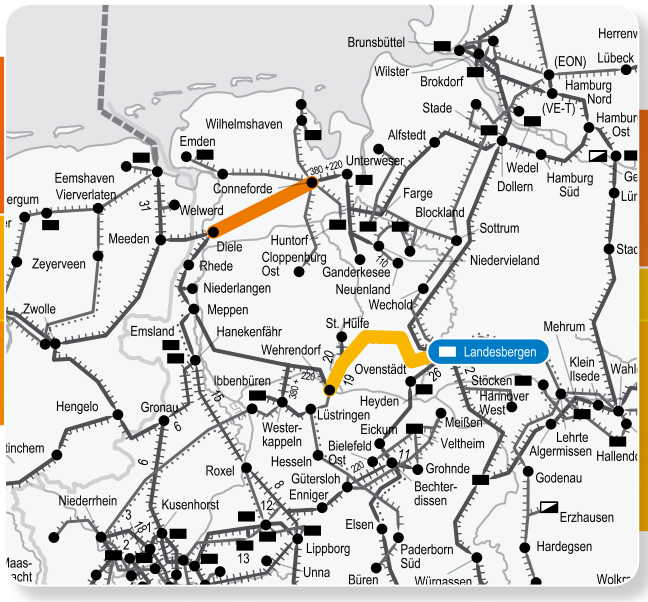
5 LESSONS LEARNT FROM THE DISTURBANCE ON 4 NOVEMBER 2006

Background

In the evening of 4 November 2006, at around 22:10 h, the UCTE interconnected grid was affected by a serious incident originating from the North German transmission grid that led to power supply disruptions for more than 15 million European households and a splitting of the UCTE synchronously interconnected network into three areas.

The immediate action taken by all Transmission System Operators (TSOs) according to the UCTE security standards prevented this disturbance to turn into a Europe-wide blackout. However, this event ranks among the most severe and largest disturbances in Europe.

Immediately after the disturbance, UCTE decided to set up a UCTE Investigation Committee charged to find out the root causes of the disturbance and propose recommendations to avoid a recurrence of such events. The UCTE Investigation Committee was led by Gerard Maas as Chairman of the UCTE Steering Committee assisted by three convenors (corresponding to the 3-fold split in the system).



21:38 h – double circuit line switched off by E.ON Netz (due to ship crossing)

21:38 h till 22:10 h – heavy loaded line between RWE TSO and E.ON Netz

22:10 h – manoeuvre in Landesbergen substation

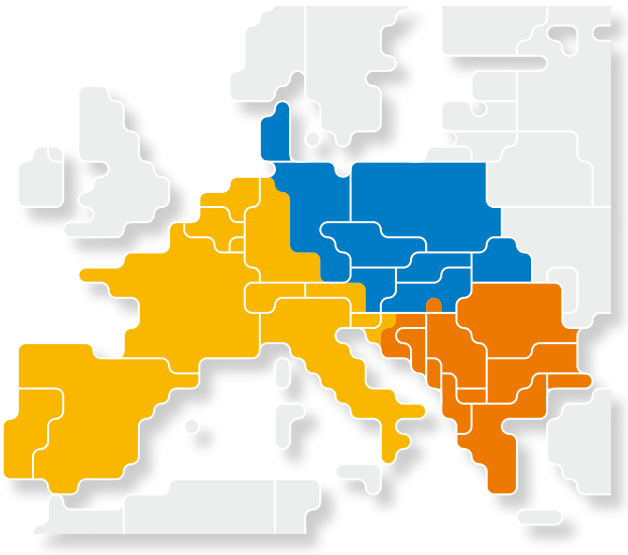
Sequence of events

In the evening of November 4, significant East – West power flows in the UCTE system resulted from international power trade and the obligatory exchange of wind feed-in inside Germany. At around 22:00 h, the consumption in the control area of E.ON Netz was about 13 500 MW with the injected wind power amounting to 3 300 MW. This situation was in itself normal.

At 21:38 h, both circuits of the 380-kV-line Conneforde-Diele were switched off in order to secure the passing of the Ems river by a ship. A routine simulation of the switching-off of the aforementioned line was computed in advance and did not bring up concerns about this switching manœuver. Following the switching-off of the said line, the energy flow was transferred to other lines in the South and this situation was still stable.

Between 22:05 h and 22:07 h, the load on the 380 kV line Landesbergen-Wehrendorf increased by 100 MW exceeding the warning value. E.ON Netz expected that coupling of the busbars in the substation of Landesbergen would end in a reduction of the current, however this manoeuvre implemented at 22:10 h resulted in immediate tripping of the line and consequent cascading line tripping throughout the UCTE area.

This led to a split of the European UCTE interconnected network into 3 separate islands. About 9 000 MW which came from the Eastern to the Western area was cut and those areas could not ensure the balance any more. Therefore, the frequency sharply dropped to about 49 Hz in the Western area due to the sudden lack of power. On the contrary, the North-Eastern area faced a surplus of generating power of the same magnitude which induced a high over-frequency reaching about 51.4 Hz in the peak. Just after the splitting, the South-Eastern area was missing an amount of power of around 750 MW which induced a slight under-frequency of about 49.7 Hz. <<<



Area 1 – under-frequency: 49.00 Hz

Area 2 – over-frequency: 51.40 Hz

Area 3 – under-frequency: 49.70 Hz

System status and defense actions in individual areas

In the Western area, the imbalance between supply and demand resulting from the splitting was further increased in the first moment due to a significant amount of tripped generation connected to the distribution grid (mainly windmills). The frequency drop activated defence plans in each TSO area and led to an automatic load shedding (meant as cut of the power to customers) and pump storage units' tripping. Finally, a total of about 17 000 MW of consumption and 1 600 MW of pumps was shed. All these actions occurred in a very short time (8 seconds during the frequency drop) and prevented the system collapse. The frequency was restored close to its nominal value in relatively short time upon manual starting of generation units (mainly hydro ones) by TSOs.

The North-Eastern area faced severe generation surplus leading to a situation of high over-frequency peaking up to about 51.4 Hz and then being reduced to the range of about 50.3 Hz by automatic pre-defined actions. In the first minutes after the disturbance the windmills, which tripped at 22:10 h, started being automatically reconnected to the power systems, thus gradually increasing generation resulting in slow but steady further frequency increase. Manual actions to decrease output of thermal units led in turn to significant changes in power flows within area 2. At that time, there was a real danger of further splitting of UCTE power systems. Fortunately, the cooperation between the control centres of involved TSOs allowed first to relieve the overload for some minutes, and then finally the successful resynchronization at 22:47 h decreased the flows in the region to acceptable levels within half an hour.

In the South-Eastern area, the frequency dropped down to 49.79 Hz, which was still significantly above the first threshold for load shedding. Thus, no other automatic actions or load shedding took place during the event. The area was N-1 secure during the whole event.

As a first step of a resynchronization process, the Western area was synchronized with the North-Eastern area in Germany and Austria and as a second step, the South-Eastern area was synchronized with those already interconnected areas through the tie-line between Romania and West Ukraine. Upon several unsuccessful attempts, the first successful reconnection of the tie-line between the Western and the North-Eastern area was carried out at 22:47 h, and the first tie-line between already connected areas and the South-Eastern area was switched on at 22:49 h. The TSOs were able to re-establish a normal situation in all European countries in less than 2 hours. <<<

Analysis of main causes and recommendations

The investigations identified two main causes of the disturbance as well as some critical factors which had significant influence on its course.

Two main causes

Non fulfilment of the N-1 criterion

After manual disconnection of the double-circuit 380 kV Conneforde-Diele line (E.ON Netz), the N-1 criterion was not fulfilled in the E.ON Netz grid and on some of its tie-lines to the neighbouring TSOs. Moreover, the resulting physical flow on the 380 kV Landesbergen (E.ON Netz) – Wehrendorf (RWE TSO) line – being in operation – was so close to the protection settings at the Wehrendorf substation (RWE TSO) that even a relatively small power flow deviation triggered the cascade of line tripping. This occurred when E.ON Netz did not undertake proper countermeasures to reduce the flow on this line.

Insufficient inter-TSO co-ordination

The initial planning for switching-off the double-circuit 380 kV Conneforde – Diele line scheduled for 5 November from 01:00 h to 5:00 h was duly prepared by the directly involved TSOs (E.ON Netz, RWE TSO and TenneT).

However, the change of the time for this switching manoeuver was communicated by E.ON Netz to the other directly involved TSOs at a very late moment; it was also not sufficiently prepared and checked in order to ensure the secure operation of the system in this area after the switching-off. No specific attention was given by E.ON Netz to the fact that the protection devices have different settings on both sides of the Landesbergen – Wehrendorf line although this information was critical due to the very high flow on this line. <<<

Critical factors

Generator-related issues

During the disturbance, a significant amount of generation units tripped due to the frequency drop in the Western area of the UCTE system. This contributed to the deterioration of system conditions and to the delay for restoring secure normal conditions. In addition, most of the TSOs do not have access to the real-time data of the power units connected to the distribution grids. This prevented them from performing a better evaluation of the system conditions. Furthermore, in the North-Eastern area, the uncontrolled reconnection of generation units induced very severe conditions and the need for additional time to recover secure system operation.

Limited range of action available to dispatchers for handling grid congestions

In Germany, TSOs have to take different kinds of measures during congestions and emergency situations as stated in the Energy Industry Act and transposed into internal procedures: grid-related measures, market-related measures and other adjustments for the management of emergency situations. The adequacy and effectiveness of such measures are not always supporting an adequate management of such specific conditions like the one on 4 November 2006.

TSO/DSO co-ordination in the context of defence and restoration plans

In some control areas, re-energization of customers was started by DSOs without proper knowledge of the situation in the overall UCTE system; some of them started reconnecting customers without coordination with their TSOs. This worsened the conditions for TSOs' action to restore normal system conditions in a controllable way.

Resynchronization process

Actions taken by TSOs during the resynchronization process were not fully coordinated. There have been several unsuccessful attempts to put tie-lines back into operation and to resynchronize the three different areas with only a partial view of the status of the whole grid.

Training of dispatchers

Although training of dispatchers has been well developed for a couple of years for situations related to TSOs' internal control area conditions, incidents originating from external networks and affecting a TSO's own grid are not always trained. Joint simulation training with neighbouring TSOs is not yet a common practice.

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In terms of security standards, the Investigation Committee proposed the following recommendations:

Recommendation #1

The application of the N-1 criterion in Policy 3 of the UCTE Operation Handbook has to be reviewed in terms of the following aspects:

- Definition of the relevant part and specific conditions in the adjacent systems which have to be taken into account in TSOs' security analyses.
- Simulation of contingencies (tripping of power system elements) located outside the TSO's own control area.
- Mandatory and regular online contingency analysis (N-1 simulations) connected to the alarm processing system.
- Preparation and regular check of the efficiency of remedial actions through numerical simulations.

Recommendation #2

Policy 5 (»Emergency Operations«) has to be extended to a »Master Plan« defining principles of operation and TSOs' responsibilities to manage UCTE-wide or regional disturbances. Additionally the following aspects have to be considered:

- TSOs have to reconsider their defence plans and load-shedding philosophy and rating taking into account significant amounts of generation tripped during disturbances with large frequency deviation.
- The restoration and re-energization process has to be explicitly coordinated by TSOs regarding DSOs actions, and the related responsibilities and duties of the parties involved must be clarified within a national framework.

Recommendation #3

UCTE has to develop standard criteria for regional and inter-regional TSOs' co-ordination approach aiming at regional security management, from operational planning to real time, in terms of joint training, enhancement of exchanges of data, results of security analyses and foreseen remedial actions.

Recommendation #4

UCTE has to set up an information platform allowing TSOs to observe in real time the actual state of the whole UCTE system in order to quickly react during large disturbances.

Recommendation #5

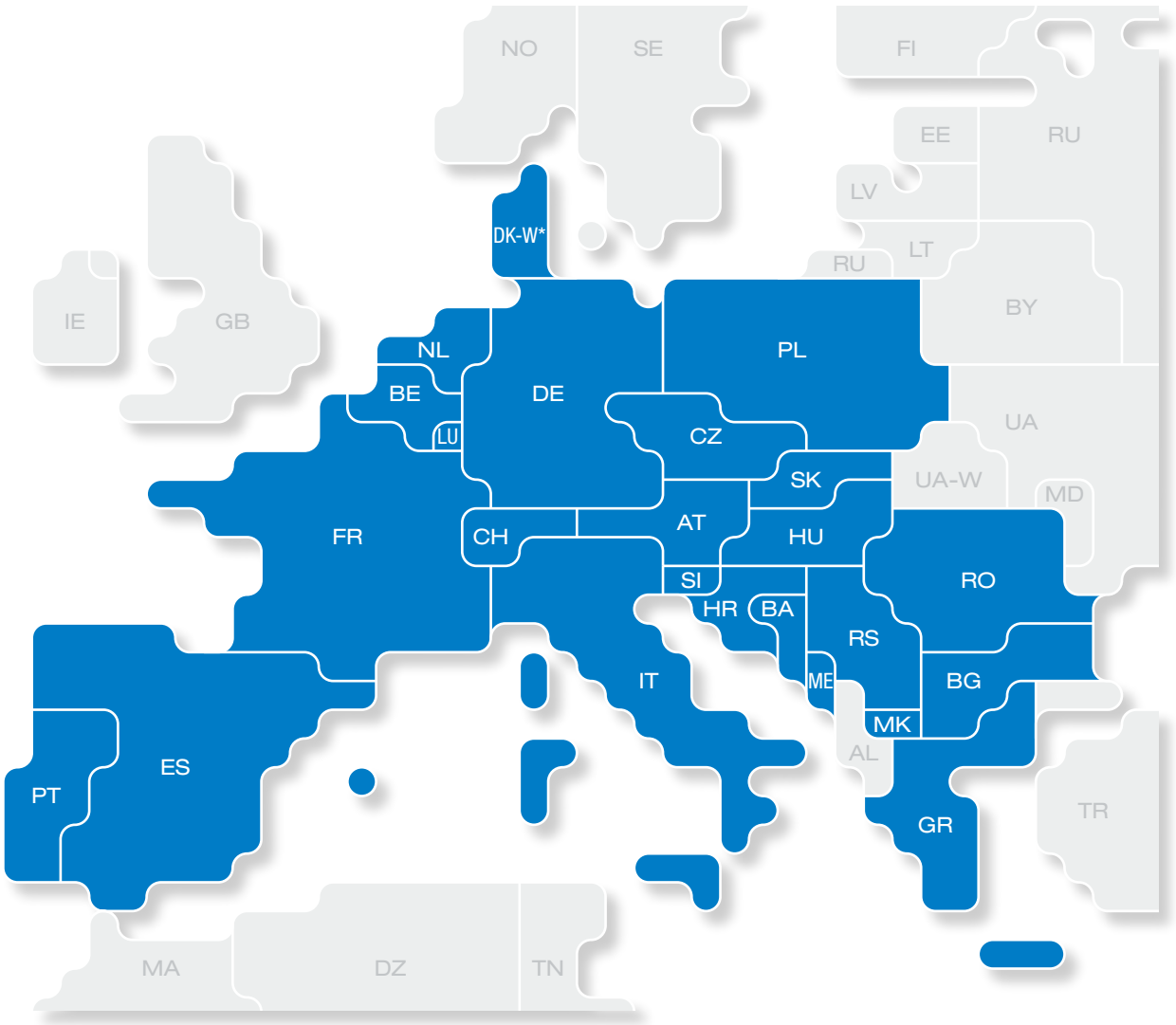
The regulatory or legal framework has to be adapted in terms of the following aspects:

- TSOs should have the control over generation output (changes of schedules, ability to start/stop the units).
- Requirements to be fulfilled by generation units connected to the distribution grid should be the same in terms of behaviour during frequency and voltage variations as for the units connected to the transmission network. These requirements should be applied also to units already connected to transmission and distribution grids.
- Operators of generation units connected to the transmission grid must be obliged to inform the TSO about their generation schedules and intra-day changes of programs prior to their implementation.
- TSOs should receive on-line data of generation connected to DSOs grids (at least 1-minute data).

The final report of the Investigation Committee on the disturbances of 4 November 2006 is available on the UCTE website.

6 INSIDE UCTE

The European area covered by UCTE



Member companies in UCTE as of 1st January 2006

Austria	APG TIWAG-Netz AG VKW-Netz AG	*VERBUND – Austrian Power Grid AG* *TIWAG-Netz AG* *VKW-Netz AG*
Belgium	Elia	*Elia System Operator SA / NV*
Bosnia Herzegovina	ISO BiH	*Nezavisni operator sustava u Bosni i Hercegovini*
Bulgaria	ESO EAD	*Electroenergien Sistemen Operator EAD*
Croatia	HEP-OPS	*HEP-Operator prijenosnog sustav d.o.o.*
Czech Republic	CEPS	*CEPS, a.s.*
Denmark West	Energinet.dk*	*Energinet.dk*
France	RTE	*RTE EDF Transport S.A.*
FYROM	MEPSO	*Macedonian Electricity Transmission Company*
Germany	EnBW Transportnetze E.ON Netz RWE Transportnetz Strom VE Transmission	*EnBW Transportnetze AG* *E.ON Netz GmbH* *RWE Transportnetz Strom GmbH* *Vattenfall Europe Transmission GmbH*
Greece	HTSO / DESMIE	*Hellenic Transmission System Operator/* *Diachiristis Elinikou Sistimatos Metaforas* *Ilectrikis Energias*
Hungary	MAVIR ZRt.	*MAVIR Magyar Villamosenergia-ipari Rendszerirányító* *Zártkörúen Múködó Részvénytársaság*
Italy	Terna S.p.A.	*Terna – Rete Elettrica Nazionale SpA*
Luxembourg	CEGEDEL Net S.A.	*Compagnie Grand Ducale* *d'Electricité du Luxembourg*
Montenegro	EPCG	*Elektroprivreda Crne Gore*
Netherlands	TenneT	*TenneT TSO B.V.*
Poland	PSE-Operator S.A.	*Operator Systemu Przesylowego*
Portugal	REN	*Rede Eléctrica Nacional, S.A.*
Romania	Transelectrica	*C.N. Transelectrica S.A.*
Serbia	JP EMS	*JP Elektromreža Srbije*
Slovak Republik	SEPS	*Slovenská elektrizačná prenosová sústava, a.s.*
Slovenia	ELES	*Elektro Slovenij*
Spain	REE	*Red Eléctrica de España S.A.*
Switzerland	swissgrid	*swissgrid ag*

* Associate member

The Bureau, from left to right:
Jose Penedos, Malgorzata Klawe,
Gerard Maas, Marcel Bial

Bodies

The decision-making bodies of UCTE are the Assembly consisting of all 28 members of UCTE and one associated member, and the Steering Committee with one representative from each of the 23 member countries represented in UCTE.

Within the Bureau that represents the Association externally, the President José Penedos (Portugal) served as President from 1 January 2006 on. Vice-President Malgorzata Klawe (Poland), the Chairman of the Steering Committee, Gerard Maas (The Netherlands), and the Secretary General, Marcel Bial were re-elected and re-appointed in their positions.

Working Groups

UCTE changed its working structure to better meet the requirements and expectations from its members and external stakeholders.

The Working Groups (4 Competence Centre Working Groups and 3 Service Centre Working Groups) are composed of experts from the member companies.

They focus their activities on operations and security, system strategy, co-ordinated planning, compliance monitoring and enforcement, communication, data management and legal affairs. They are installed and entrusted with specific missions by the Steering Committee to which they report according to the Articles of Association and Internal Regulations.

Secretariat

The Secretariat is led by Marcel Bial. The premises of the Secretariat are located in Brussels,

Boulevard Saint-Michel 15, B-1040 Brussels
Tel. +32 2 741 69 40, Fax +32 2 741 69 49
info@ucte.org, media@ucte.org
www.ucte.org

The Secretariat is responsible for the assistance and the support to the bodies of the association.

Furthermore, it provides support with data management expertise and is responsible for the UCTE web site, the information system, all kinds of publication and the implementation of all the statistical and communication measures decided by the Steering Committee.

National representatives in the Steering Committee as of 1 January 2007

All member countries are represented in the Steering Committee, which is the executive body of the association.

AT	*Heinz Kaupa*
BA	*Omer Hadzic*
BE	*Hubert Lemmens*
BG	*Mitiu Christozov*
CH	*Hans Peter Aebi*
CZ	*Petr Zeman*
DE	*Wolfgang Neldner*
ES	*Luis Imaz Monforte*
FR	*Jean-Pierre Desbrosses*
GR	*Ioannis Theodorakopoulos*
HU	*Lajos Oroszki*

HR	*Ivica Toljan*
IT	*Carlo Sabelli*
LU	*Carlo Bartocci*
ME	*Branko Stojkovic*
MK	*Blagojce Trpovski*
NL	*Ben Voorhorst*
PL	*Jerzy Dudzik*
PT	*Jorge Liça*
RO	*Octavian Lohan*
RS	*Dusco Tubic*
SK	*Vladimir Jendryscik*
SI	*Pavel Omahen*

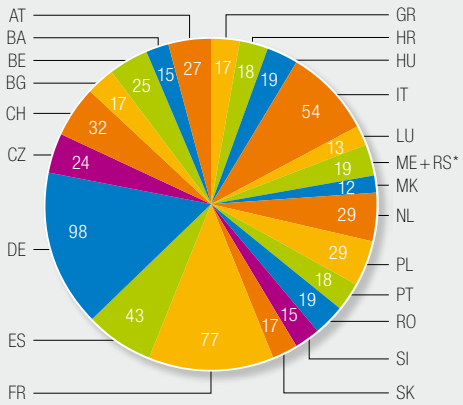
Organizational chart as of 1st January 2007

Assembly

29 TSOs from 24 countries

– Chairman: José Penedos (PT)

Voting rights as of May 2006:



TSO from DK as Assembly guest without voting rights

* Formerly CS

Steering Committee

1 representative per country

– Chairman: Gerard Maas (NL)

Bureau

- President:
  Jose Penedos (PT)
- Vice-President:
  Malgorzata Klawe (PL)
- Chairman SC:
  Gerard Maas (NL)
- Secretary General:
  Marcel Bial

Secretariat

- Secretary General:
  Marcel Bial

Working Groups

- *Operations and Security*
  Convenor: Klaus Kleinekorte (DE)
- *System Strategy*
  Convenor: Georges de Montravel (FR)
- *Compliance Monitoring and Enforcement*
  Convenor: Jacek Ratz (PL)

Technical Committees / Studies

- *UCTE-IPS / UPS Study*
  Project Manager: Matthias Luther
- *EWIS**
  (European Wind Integration Study)
  Project Manager: Wilhelm Winter (BE)
- *PG Albania*
  Convenor: Ioannis Blanas (GR)
- *PG Turkey*
  Convenor: Bozhidar Pavlov (GR)
- *SYSTINT***
  Convenor: Georges de Montravel (FR)

* together with ETSO, NORDEL, UKTSO, ATSOI
** joint Task Force UCTE / EURELECTRIC

IN MEMORIAM ANTONIO SERRANI

UCTE Vice-President Antonio Serrani †

Antonio Serrani, UCTE Vice-President, was victim of a tragic accident on 14 March 2006. Antonio was 64. The electricity sector and UCTE have lost both an outstanding expert and personality and also a dear friend whose entire career was closely linked to the development of the sector.

Antonio Serrani has been Grid Director of the Italian Independent System Operator, since 2001 till 2005. In his role he was responsible of Grid Planning, Environment Relationship, Grid Engineering, Grid Rules and Power System Statistics and, subsequently, Antonio became the expert of TERNA for the businesses in South East Europe

In 2004 Antonio was elected Vice President of the Union for the Co-ordination of the Transmission of Electricity in Europe (UCTE) and confirmed in this function for a 2nd term 2006 – 2007. He was also President of SUDEL, the Regional TSOs Association in South East Europe, during the period 1999 – 2001. He represented the Italian power sector in many Associations (UCTE, CIGRE, UNIPEDE, MEDELEC, ETSO) and in many events worldwide. He also was chairman of the UCTE Technical Committee preparing the integration of the Albanian TSO in UCTE.

Antonio received several public and honorary distinctions, as among others Chevalier of the Italian Republic Order of Merit.

Abbreviations used

ATSO	*Albanian TSO*
ATSOI	*Association of the TSOs in Ireland and Northern Ireland*
CEER	*Council of European Energy Regulators*
CFCU	*EC Central Finance and Contracts Unit*
CIP	*Critical Infrastructure Protection*
CMEP	*Compliance Monitoring and Enforcement Process*
CUTE	*Conduct UCTE Towards Excellence*
DACF	*Day Ahead Congestion Forecast*
EPC-CIS	*Electric Power Council of the Commonwealth of Independent States*
EWIS	*European Wind Integration Study*
IEM	*Internal Electricity Market*
KOTK	*Commission on Operational and Technological Coordination for the Joint Operation of Power Systems of the CIS and Baltic States*
NORDEL	*Association of the TSOs in Northern Europe*
OH	*Operation Handbook*
SC	*Steering Committee*
TSO	*Transmission System Operator*
UCTE	*Union for the Co-ordination of Transmission of Electricity*
UKTSOA	*Association of the TSOs in Great Britain*
UPS / IPS	*Unified Power System/Interconnected Power Systems (of CIS and Baltic Countries)*

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