



# SYSTEM EXTENSION STUDIES AND PROJECTS

## Introduction

Energy is today and for the years to come a priority topic the European Union's agenda at all levels (Council, Commission, and Parliament). It can be assumed that the foreseen developments of the primary energy dependency of the European Union will continue to impose to follow a balanced cooperation/integration course especially towards Russia (primary resources) and Ukraine (transit country)

In spite of market liberalization and changes in the sector, the electrical system integration is perceived by stakeholders as pre-requisites or pioneering elements of any European integration policy. This is why

UCTE, even if well recognized today by EC as "independent business association", is clearly expected to remain active as technical entity to assess the first of 3 EU-"pillars" (1-technical/operational feasibility, 2-reciprocity in market conditions and 3-compatibility in environmental standards) of the concrete implementation of such projects

UCTE has always pursued its efforts to develop the synchronous area while observing objective criteria and procedures in order to maintain the whole system at the present high level of reliability and stability.

## UCTE - History IV

### Mediterranean Ring

In the Barcelona Declaration adopted in 1995 the then 15 EU member states and the 12 Mediterranean countries Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, Palestine, Syria, Tunisia and Turkey agreed to form a free trade area that was also to include energy until 2010.

Presently, there are two synchronous areas in North Africa, the south-eastern bloc with Libya, Egypt, Jordan, Syria and Lebanon and the south-western bloc with Morocco, Algeria and Tunisia. UCTE is now synchronously connected to the south-western bloc via a 350 MW cable from Spain to Morocco.

### Towards the single market

Following the adoption of its new statutes effective January, 1 1997, UCPTÉ became the operational organization responsible for the definition of the technical rules to ensure the reliable operation of the interconnected systems of its member countries.

In 1999, UCPTÉ modified its Articles of Association in order to cope with the philosophy of the European Directive no. 92/96 EC. The name of the association changed into Union for the Coordination of Electricity Transmission UCTE to underline the unequivocal orientation towards Transmission System Operators' tasks. UCTE's activities are now centred around the creation of the prerequisites for reliable operation against the background of a competitive European electricity market.

## Feasibility Study for the Interconnection of Power Systems of IPS/UPS with UCTE

The Study analyzing the feasibility of a possible synchronous coupling of the power systems of the IPS/UPS with the UCTE was successfully closed.

Launched in 2004 the project was carried out by a UCTE consortium in close cooperation with a group of companies from the IPS/UPS. It is recognized by stakeholders as an important venture in the framework of the EU-Russia Energy Dialogue and co-financed by the TEN-Energy programme of the European Commission.

The Study, unique in its ambitions and scope, investigated all technical, organizational and legal aspects for a possible synchronous operation of both power systems, operated separately today. A synchronous coupling would create a transmission system serving more than 700 million customers on two continents and spanning ten time zones.

Combining analyses and power system simulations for two synchronously coupled systems the project work gave first priority to maintaining the current level of system security and reliability in the systems concerned. The Study, being unprecedented with regard to the resources employed and the advanced investigation methods and technologies applied, can be used as a basis for any further decision making by the stakeholders concerned in system development on either side.

During the closing session in Brussels on 5 December 2008 a public summary of the major findings and results was presented and endorsed by all study partners. This "Summary of Investigations and Conclusions" underlines the overall complexity of a synchronous coupling taking into consideration both system security and market aspects. Even if a synchronous coupling appears viable, it must be considered as a long-term option. In addition, non-synchronous system coupling by HVDC back-to-back links is also considered as an alternative to achieve a coupling of IPS/UPS with the UCTE transmission system in a medium-term perspective. This, however, will need separate investigations and the decisions by the stakeholders concerned.



## Interconnection of Turkey Power System with UCTE

The process for investigation of the Turkish Power System and the preparatory works for its synchronous interconnection to the UCTE network are progressing well under the coordination of the UCTE Project Group. A number of Reports on the Turkish Power System was finalized and approved. Besides the Reporting activities, Project Group progressed with performing unit tests at the power plants. The unit tests of a conventional type thermal Power plant were finalized and approved. Unit tests of a combined cycle natural gas type thermal Power plant were scheduled. The drafting of the Contractual Agreement by the Project Group is a significant step in the direction of the synchronous interconnection. The studies for finalization of the Contractual Agreement are still continuing.

### Technical Studies

The First Feasibility Study for investigation of the Turkish Power System was successfully completed in 2007. Although according to the study results interconnection of the Turkish Power System to UCTE system is found feasible but the necessity of the frequency control improvement in the Turkish Power System and the sufficient damping performance of the generation units regarding low inter-area oscillations was emphasized as a precondition for reliable synchronous operation.

In order to meet the UCTE requirements regarding the frequency control quality, TEIAS decided to launch in 2008 a Project named "Rehabilitation of the Frequency Control Performance of the Turkish Power System for Synchronous Operation with UCTE". The Project will be financed by the EC and will be carried out by the Consortium of TSO members of the UCTE. Besides to the UCTE member TSOs, which participate to the Project, experts from Technical Universities and manufacturers of the units control systems, turbine governors and excitation systems implemented in the Turkish power plants will also participate to the Project as sub-contractors. Besides EUAS (Turkey) and TEIAS (Turkey) which will have an important role in the Project as the owner of important power plants in Turkey and TSO, there are a set of UCTE member TSOs, which declared their interest to participate to the Project. Those TSOs are namely RWE TSO (Germany,) EMS (Serbia), ESO (Bulgaria), HTSO (Greece), RTE ( France ), SwissGrid ( Switzerland ) and TERNA ( Italy ). RWE TSO will be the Consortium leader of the Consortium which will perform the studies.

The main goal of the Project is to prepare the Turkish Power System for future synchronous operation with UCTE regarding power and frequency control, steady state and transient stability. The following topics are subject of the Project:

- Survey of the power plants.
- Investigation and elaboration of recommendations for the generating units' control systems improvement: settings and structure optimization of turbine governors.
- Secondary Control System improvement. Optimization on control parameters.
- Design and optimization of AVR and PSS.
- Emergency Control System on the interface with UCTE and Restoration Plan of the Turkish Power System .
- Staff training.

**Rehabilitations of the Control system at major Power Plants had already started under the UCTE Project Group coordination.**

## Thermal Power Plants

Some units of conventional type thermal power plants were under rehabilitation during 2008. Soma-B TPP (4 units out of 6), Catalagzı TPP (2 units), Seyitomer TPP (3 units out of 4), Tuncbilek-B TPP (2 units), Orhaneli TPP (1 unit), Kangal TPP (2 units out of 3). In total 13 units with 160 MW installed capacity each and one unit 210 MW are subject to the rehabilitation program. Part of the rehabilitation program was already completed in 2008.

## Hydro Power Plants

Rehabilitation of the control systems of Oymapinar HPP (4x135MW) have been finalized.

Ataturk and Karakaya Hydro Power Plants, 14 units x 300 MW, are under rehabilitation including:

- Modification and tuning on the existing control system.
- Studies related to the new replaced control system.

Based on the results of the studies performed in the "Rehabilitation of the Frequency Control Performance of the Turkish Power System for Synchronous Operation with UCTE" the requirements to the control systems of the major power plants will be defined and their implementation including parameter tuning and onsite tests will be done in close cooperation with the manufactures.



## Interconnection of Ukraine/Moldova Power Systems with UCTE

### BACKGROUND

- European Commission has clearly voiced its interest in including Ukraine in the framework of the external relations of European Union in the broader context of the future security of energy supply for Europe.
- In March 2006 the Ukrainian company NPC Ukren-ergo and the Moldovan Company Moldelectrica applied for a separate investigation of the full joint integration of the Ukrainian IPS and Power System of Moldova into UCTE synchronous area.
- On 23 November 2006, UCTE launched the Project Group with immediate task to work out the Terms of Reference of the Project and goals to assess all the technical, regulatory and operational requirements for the full integration of the Ukrainian and Moldavian electrical systems into UCTE electrical system.
- In January 2008 the Terms of reference were approved by UCTE Steering Committee.

The document was worked out around the following 4 main chapters:

1. Technical requirements and Operational Aspects
  2. System delimitation clause
  3. Congestion Management
  4. Legal / Regulatory Conditions
- Estimated cost of the Project: 4,446 mil €.
  - Estimated implementation period for the project (studies + implementation of recommendation + tests + trial operation) is 7.5 years, depending on the period for implementation of the UCTE recommendations by Requesting Parties.

The work of the PG will be structured in three phases as follows:

**Phase A**

Work-out of a proposal for a Contractual Agreement to be signed by Ukrenergo/Moldelectrica and UCTE or involved consortium parties, to be checked with statutes. Phase A closes with the 1st Intermediate Report to SC. Once approved by SC, the Agreement is signed by the Parties.

**Phase B**

Implementation of the Contractual Agreement statements by Ukrenergo and Moldelectrica, and the assessment of the results. Phase B closes with a 2nd Intermediate Report to SC about the compliance of the requesting Parties with the signed Contractual Agreement.

**Phase C**

Preparation and performing the tests in isolated operation and interconnection tests and the assessment of the results. Phase C closes with the Final Report to SC and with the request to start a longer test interconnection period or to go straight to a permanent interconnection.

## PROJECT FINANCING

After several meetings between UCTE, Ukrainian/Moldavian and European Commission, the financing solution was defined: Ukrainian Government and European Commission had agreed that part of the funds received under the Financial Support of the Ukrainian Power Strategy Implementation from the European Commission to be used for financing the UCTE Project.

## CURRENT STATUS AND NEXT STEPS

Actually the Project Group and the Requesting Parties are collaborating in order to finalize the Financing Contract between UCTE (as "Study Performer") and Ukrainian Government/CFCU (as "Contracting Authority" and "Funds Administrator").

Upon finalization of all contractual arrangements for project financing, the Consortium creation activities will start.

Considering the actual process of European Network of Transmission System Operators for Electricity (ENTSO-E) creation and the transfer of all UCTE activities and contractual commitments, the project will be transferred and will be fulfilled within the new association.



## Interconnection of Tunisia/Libya and LEJSL System with UCTE

At the request of Tunisia and Libya, the UCTE established a process for the closure of the Tunisia–Libya interconnection, which had its genesis of the previous studies carried out for both REE and HQI concerning this interconnection. The expansion request involves the closure of two existing 225 kV lines, between Tunisia and Libya which, if successful, would extend the UCTE synchronous zone from Spain to Syria involving in addition Libya, Egypt, Jordan and Lebanon.

The Tunisia–Libya interconnection, today out of service, is formed by two AC 220 kV overhead lines: a double circuit OHL between Medenine (Tunisia) and Abou Kamash (Libya), and a single circuit OHL between Tataouine (Tunisia) and Rowies (Libya). The total thermal transmission capacity (TTC) is 270 x 3 MVA. On November 21st 2005, at 12:00 (CET) the process of synchronization of the UCTE + TAM and LEJS power systems was initiated, according to the procedure agreed and closely followed by UCTE. A synchronization trial was therefore defined between the Maghreb and Mashrek, planned to last three days following the closure of the Libya and Tunisia interconnection. After 7 minutes, the defense plan opened up the lines between Libya and Tunisia, but lines were also triggered between Morocco and Algeria. Following consultations with the various utility companies, the test was interrupted.

The main conclusions of after-event analyses can be summarized as follows: being connected to a big system with a very large inertia as the UCTE is, any power deviation or load-generation unbalance are compensated by the bigger system, so normal daily load deviations can often activate the defense plans at international tie lines. In addition to this, the networks in North Africa and Near East were linked as a chain, not as a “spider-net” like the UCTE ones, so these power deviations at international tie lines increase the Transmission Reliability Margin (TRM) consuming an important part of the Total Transmission Capacity (TTC) at the international interconnections.

To prevent these problems and in order to take advantage of the exchange capacities among countries, it was agreed that the necessary actions to implement were in two main directions:

- Reduction of the power flow deviations.
- Increasing the settings of the defense plans/ network developments.

Last year developments have been oriented to achieve the two directions here listed; however some delays on the commissioning of critical 400 kV lines had happened. It is important to remark that important progress have been recorded regarding to the improvement of the National Control Centers, especially in Algeria and Libya. Too, the adaptation of the defence plans has been studied and agreed waiting for the readiness of the new transmission facilities.



## UCTE - Besides History II

Commedia dell'Arte in Europe's capital city

He is a big man, with his height of almost two metres and weighing more than 100 kilos, this expert from the UCTE secretariat. He used to boast during his night strolls through Brussels that he feared no-one, and on the contrary the others wondering through deserted places at night should fear him. And more over there is of course his experience from every possible poor country outside Europe.

On his way to work his acquaintance, a DG TREN dignitary who lived in the neighbourhood, would often overtake him on his bike. He would never forget to play a little prank on him - slap his back, pull off his hat and so on.

One evening after an exhausting day in the office, our UCTE expert is on the way home through the Cinquantenaire Park. He hears quickening footsteps behind him and thinks - aha, this will be yet another of those pranks. But then he is suddenly held from behind by someone's crushing arms. The grip however does not ease off and further two wrestlers are trying to push him to the ground. Obviously this is no prank this time. Finally he is down on the ground clutching his rucksack. The robbers are brutally hitting his head and he figures out: it is better to stay alive without the rucksack than to be beaten up like a dog - and thus without any further resistance he lets himself be robbed. The police arrive, and then an ambulance arrives and then follows a night at an intensive care unit with drip tubes plugged in. And in the morning he wilfully flees the hospital - surely he will not let his air ticket home lapse!

He was lucky, in spite the fact that his now badly bashed face bears no resemblance to the photo in his passport, the police again does nothing and let him graciously on the plane. They cannot but „expel“ such a person out of the Kingdom!

## Integration of Albania

During 2008 PG Albania continued the evaluation of the Albanian System , applied the UCTE Compliance process (CMP) to Albanian system and concluded to the measures that need to be taken by OST to achieve compliance to UCTE OH. OST progressively implements the measures and there is a definite plan to implement them within a period of two years. Special Protection Schemes were installed and additional procedures were put in place to ensure the interface to UCTE and as a result to protect the security in the neighbouring UCTE area.

A temporary agreement between UCTE and Albania is considered a necessary to cover the operational issues and to define compliance process , for the above period of about two years ,during which Albanian system will continue to operate connected to UCTE although not fully complying to UCTE OH and not having signed the MLA.

it is envisaged that OST In the end of the agreement period will have met full compliance to OH and be in position to be accepted as a UCTE member and sign the MLA. The agreement is scheduled to be signed in the first semester of 2009 and then transferred to ENTSO-E.