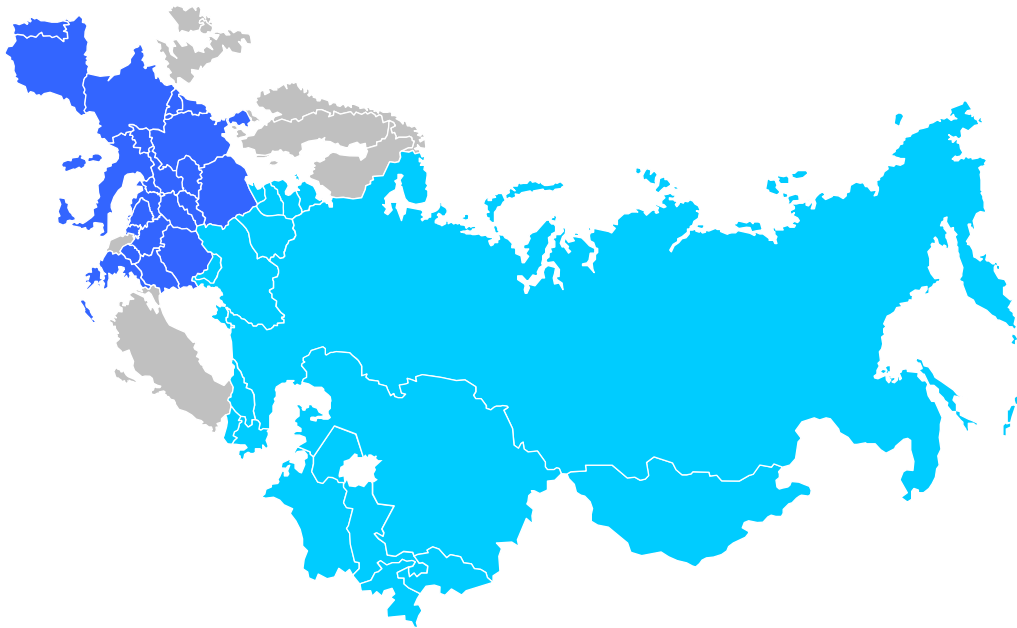


**Feasibility Study:
Synchronous Interconnection of the Power Systems
of IPS/UPS with UCTE**



**SUMMARY
OF PROJECT STATUS**

December 2006

In the beginning of 2002 the Electric Power Council of Commonwealth of Independent States (EPC CIS) expressed its interest in the synchronous interconnection of the power systems of the CIS countries and the Baltic States (IPS/UPS) with the power systems of the members of the Union for the Co-ordination of Transmission of Electricity (UCTE).

After the completion of a pre-feasibility study in 2003, dealing with steady state load-flow analysis, the UCTE and the Commission on Operational and Technological Coordination (COTC) of IPS/UPS agreed to launch a detailed feasibility study on the synchronous interconnection of the power systems concerned. The project is carried out in close co-operation between a group of companies from IPS/UPS and a UCTE consortium.

The study is unique in its ambitions and scope. Presently there is no existing electricity system in the world spanning more than 10 time zones with different load characteristics and various generation structures. More than 700 million people in two continents are served by the systems under investigation.

The main objectives of the study are to investigate the technical, operational, organisational and legal feasibility of an East-West synchronous interconnection of the transmission systems and to identify necessary measures and associated costs for implementation for all systems. The project work is comprised of a combination of analysis and power system simulation of two synchronously coupled systems without enforcing regulations and standards from one system to the other. The initial priority for the investigations is to maintain the system security and reliability level in the systems concerned.

The project is designed for a total duration of three years and was started in April 2005 by signing a *Cooperation Agreement* between both parties. The results of the project will be used as a basis for further decisions on system development on both sides.

As a part of the *EU-Russia Energy Dialogue* the project is of significant importance for the further progress on electricity issues. The European Commission, whose policy is to promote the creation of an open electricity market in Europe, also shows a great interest in the results of the study. The work of the UCTE consortium is co-financed by the Trans European Network (DG-TREN) programme of the European Commission.

The current summary provides an overview of the work done from the period April 2005 – December 2006 including the project status and first findings under the UCTE-IPS/UPS Feasibility Study.

The Terms of Reference (ToR) including a detailed description of the scope of work and the study procedure have been prepared before the actual start of the project. The project work is generally divided into three phases:

1. Data acquisition and system modelling;
2. Verification and simulation;
3. Assessment and results.

After the kick-off meeting in April 2005 first activities were comprised of the analysis of the present technical, organisational and legal status in IPS/UPS including data acquisition by a questionnaire. In June 2005 the *Questionnaire on Data Acquisition for IPS/UPS* was agreed among the parties. Due to the fact that the quality of simulation results closely depends on the quality of input data, providing the necessary data is a sine qua non condition for the successful completion of the study. The filling of the questionnaire ensures the necessary

quality level e.g. for load flow, probabilistic and dynamic data including the specification of their formats.

As a first basis for the technical and organisational investigation an *IPS/UPS System Survey* was finalised in February 2006. This report gives an overview about the principal structure, key figures and the global control behaviour of IPS/UPS.

In parallel to the data acquisition process, the installation of a Wide Area Measurement System (WAMS) – similar to the one operating in UCTE – has been performed. This transient measurement system is a pre-requisite for validation of the dynamic simulation models. At the end of 2006 24 measurement devices are installed and in operation in IPS/UPS and first recordings are available.

The operational, organisational and legal working tasks during the first phase focused on the determination of the actual status on both sides and the identification of major differences in UCTE and IPS/UPS, respectively. The organisational aspects (i.e. operation procedures at the technical interface, co-ordination strategies and procedures among the interface TSOs, etc.) are considered as a bridge between technical measures and their implementation and the necessary legal framework (i.e. to be implemented by interzonal and bilateral or multilateral agreements).

In order to define necessary technical specifications, which will serve as a communicational basis within the study a first version of the *Technical Glossary* was prepared.

A first common load flow study model reflecting a winter peak load scenario for the year 2008 has been prepared. The simulation model consists of about 4000 nodes, 6600 line and transformer branches with a total peak load of 580 GW. Based on this model first load flow calculations were performed in order to allocate possible transfer capacities across the interface and the most probable load flow pattern concerned for various power exchange scenarios.

The dynamic simulation models for both synchronous areas are under preparation. Since the dynamic investigations have been identified as the critical path within the project the verified models have to be available in early 2007 in order to fulfil the ambitious time schedule and timely finalise the study in 2008.

As a consequence from available data and models compared to the initial time schedule the data acquisition and modelling phase has been extended until the end of 2006. In order to catch up with the accumulated delay, the analysis and simulation phase has been – as far as possible – started in parallel. However, in order to compensate the delay from model preparation an urgent verification of dynamic models and a certain concentration of working resources is essential.

The preliminary conclusions from the project status at the end of 2006 are:

1. The current present status of work allows to precise and confirm in a more detailed way – compared to what was possible to pre-define in the ToR at the beginning of the study – the key issues in the final assessment of the feasibility of a possible synchronous interconnection.
2. In this regard, data compilations and models available at the end of 2006 and the results of first steady state load flow calculations already performed do not allow to identifying fundamental technical barriers to a positive assessment of the feasibility of a

synchronous operation between IPS/UPS and UCTE. Additionally, preliminary load flow simulations with a common model confirm by tendency the findings from earlier reference studies (i.e. TACIS EREG 9601: *Synchronous Interconnection of the TESIS and UPS Networks – Requirements and Feasibility –1999*, UCTE: *Load flow analysis with respect to a possible synchronous interconnection of networks of UCTE and IPS/UPS – 2003*).

3. The next essential step to be started in the beginning of 2007 will address the dynamic behaviour including the control performance of the common system model, once both systems would be synchronously interconnected. Due to the fact that dynamic stability may reveal the most limiting criteria for a synchronous system extension this analysis will be the first crucial stepping stone for the mere technical assessment of the feasibility of a possible synchronous interconnection. This investigation will point at the specific reliability standards to be used, the reasons for their potential adaptation, but also the reasons for embedding the operation of the coupled systems into a unique and, therefore, still to be created contractual and regulatory framework.
4. Besides the a.m. technical, operational and reliability standards including their legal and contractual framework, the study will deliver in 2008 a list of necessary investments and their associated costs to be made on both sides of the investigated electrical interface, most probably deep inside each of both systems.
5. Furthermore, in 2008 the study will present an open outlook on other non-synchronous system coupling possibilities with the aim at a global benchmark in terms of economic efficiency for the investigated system coupling.
6. The study results will be used as a basis for 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. Necessary decisions need to be made by stakeholders.