

**Standard Summary Project Fiche**  
**IPA Decentralised National Programmes**  
**Project number: TR 07 02 05**

**1. Basic Information**

**1.1. CRIS Number:**

**1.2. Title:** Rehabilitation of the frequency control performance of Turkish Power System for Synchronous Operation with UCTE

**1.3. Sector:** Energy

**1.4. Location:** The Republic of Turkey

**Implementing arrangements:**

**1.5. Implementing Agency:**

The Implementing Agency for the project will be the Central Finance and Contracts Unit (CFCU). See Annex-3 for further information about the institutional framework.

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**1.6. Beneficiary:** The beneficiary of the Project is the Ministry of Energy and Natural Resources. Further information about the institutional framework could be found in Annex-3.

Detail information about the SPOs (Senior Program Officer) of the Project are given below.

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| <b>1.7. Overall Cost:</b>                           | 2,500,000 €                                    |
| <b>1.8. EU Contribution:</b>                        | 2,500,000 €                                    |
| <b>1.9. Final Date for Contracting:</b>             | 2 years after signature of Financial Agreement |
| <b>1.10. Final Date for Execution of Contracts:</b> | 4 years after signature of Financial Agreement |
| <b>1.11. Final Date for Disbursements:</b>          | 5 years after signature of Financial Agreement |

## **2. Overall Objective and Project Purpose**

### **2.1. Overall Objectives**

The overall objective is to fully integrate the Turkish Electricity Market to the EU Internal Electricity Market.

### **2.2. Purpose of the Project**

Turkish Power System is prepared for future parallel operation with UCTE regarding power and frequency control, steady state and transient stability.

### **2.3. Link with AP/NPAA/EP/SAA**

In the Accession Partnership Document “supporting the creation of a gradually integrated regional energy market as part of a wider European energy market and removal of restrictions on cross-border trade and third party access” is defined as a short-term priority.

In the 2003 NPAA (National Programme for the Adoption of the Acquis) of Turkey “The

removal of the restrictions on the cross-border trade in energy” in order to achieve the full alignment with the internal energy market and “promotion of the implementation of projects in Turkey listed as projects of common interest in the European Community TEN-Energy Guidelines” were set as objectives.

In order to remove the technical restrictions on cross-border trade in energy, the national electricity transmission system must operate in synchronous parallel with the European transmission system and the lack of transmission capacity must be addressed. As the purpose of the project is to prepare Turkish power system for a future parallel operation with UCTE (Union for the Co-ordination of Transmission of Electricity) regarding power and frequency control, steady state and transient stability; the Programme will simply implement the necessary counter-measures and will result in a secure synchronous parallel operation of Turkish power system with UCTE system which will result in the removal of the technical restrictions on cross-border trade in electricity.

NPAA sets these objectives in Chapter-14 “Energy” together with Task 14.1.2 of Priority 14.1 and Priority 14.3.

#### **2.4. Link with MIPD**

It is stated in the MIPD, under heading “Component I – Transition Assistance and Institution Building” and sub-heading “Main priorities and objectives”, that Institution Building support may also be provided in certain areas of the acquis. Energy (independence of regulatory authorities, third party access, cross border trade, promotion of energy efficiency and renewable energies, radioactive waste management) was also listed among those areas.

#### **2.5. Link with National Development Plan**

The Ninth Development Plan 2007-2013 was approved by Turkish Grand National Assembly on 28 June 2006 with Law No: 877. According to the Ninth Development Plan the necessary infrastructure for electricity trade with other countries, which will contribute to increasing supply security, will be created.

Synchronous operation with UCTE power system will allow the integration of the Turkish Power system with the Internal Electricity Market (IEM) where electricity trade between the market actors in the Turkish power sector and the market actors in the IEM will be continuously possible. The Ninth Development Plan addresses this issue under the paragraph 414 of section-7.1.5. “Improving the Energy and Transportation Infrastructure” within chapter 7 “Main Objectives: Development Axes”.

#### **2.6. Link with national/sectoral investment plans**

Not Applicable.

### **3. Description**

#### **3.1. Background and Justification**

The connection of the Turkish power system with the former UCPTE (since 30 June 1999 named as UCTE) power system has been on the agenda of Turkey since 1975. In the past, tie lines were

built with all neighbouring countries except Greece but the priority has always been given to the synchronous connection with the UCTE power system. None of these tie lines have been operated in synchronism but they were used only for energy exchanges with island supply and directed generation methods.

On 21 March 2000, on behalf of TEAS (Turkish Electricity Generation and Transmission Co.), PPC (Public Power Corporation-Greece) made an application to UCTE for TEIAS's (Turkish Electricity Transmission Corporation) membership and following this application a Sub-Group was formed under the System Development Working Group to tackle the issue of Turkey's possible connection to UCTE. The Sub-Group identified strategies, technical pre-requisites and sequence of operation, defined the further studies and preliminary tests needed and prepared a draft Terms of Reference for the activities that had to be concluded prior to taking a decision for the connection of the Turkish power system.

Based on the Terms of Reference prepared by the Sub-Group, the Project on "Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System" is currently being carried out. The purpose of the project is to determine the technical conditions under which the Turkish power system may be synchronized with the UCTE power system. This project is supported through the 2003 Pre-Accession Financial Cooperation Programme between Turkey and the EU (TR 0303.03).

Two Wide-Area Measurement Systems (WAMS) devices were installed at Babaeski and Keban Substations during the execution of the "Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System" Project. The Dynamic Group experts had remote access capability to those WAMS devices. The frequency oscillations and deviations beyond the admissible limits of the Turkish Power System were pointed out by the UCTE experts based on the investigation of the WAMS recordings and the Monthly Frequency Control Performance Reports, which were prepared by TEIAS since 2002 on a monthly basis. The existence of such frequency deviations and oscillation is not compliant with the UCTE requirements that are defined in UCTE Operational Handbook<sup>1</sup> (OH). Therefore it was stated by the UCTE experts in the Interim Report of the "Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System" Project that application of different methodologies and close cooperation with UCTE is required in the implementation of the project. It was also stated that the requirement was due to the necessity of the results of the "Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System" Project in the implementation of the "Improvement of the Frequency Performance of the Turkish Power System in accordance with the UCTE Criteria" Project and due to the characteristic of Turkish Power System being different when compared to UCTE System. The part of the Interim Report<sup>2</sup> where the comments of the UCTE experts are declared is given in Annex-6.

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<sup>1</sup> The "UCTE Operation Handbook" (OH) is an up-to-date collection of operation principles and rules for the transmission system operator in continental Europe.

<sup>2</sup> Interim Report "Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System", Part-C Stability Studies, page 28-29

When the inter-dependency and the sequencing of the Projects are considered, it must be mentioned that the Project of “Rehabilitation of the Frequency Control Performance of Turkish Power System for Synchronous Operation with UCTE” will be an investigation about the frequency control performance. Such an investigation was not within the scope of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project. The implementation of the results in control systems and power plants has to be coordinated among TEIAS, Electricity Generation Corporation (EUAS), manufacturers of the control systems of the power plants, UCTE experts and Space Technologies Research Institute of Turkish Scientific and Technological Research Council of Turkey (TUBITAK). It has to be noted that UCTE experts and TUBITAK experts who participated in the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project got experienced with the Turkish power system on the subject and their coordination is essential for the implementation of the results. In this Project the implementation of the results achieved in the Project of “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” regarding steady state and transient analysis will be coordinated.

Concerning the issues for synchronization of Turkish power system with UCTE system, on the basis of the UCTE Steering Committee decision regarding the new structure and new responsibilities of the Technical Committee and the Technical Committee Chairman, it was considered as suitable to rename the Technical Committee as UCTE Project Group (UCTE PG) for Interconnection of Turkey and the Technical Committee Chairman – as Project Manager, respectively. More information about the background, tasks and duties of UCTE PG could be found in the “Terms of reference of the project group for the connection of Turkey to the electrical system of UCTE” document which is available at TEIAS and UCTE.

In addition to the parties listed above whose participation to the Project is required for coordination, the Project Group for the Connection of Turkey to the Electrical System of UCTE has also a key role, not only in the implementation of the results but also during the whole process of Turkish power system’s connection to UCTE. As mentioned in the Terms of Reference of the Project Group, the Project Group will elaborate a comprehensive document entitled “Contractual Agreement”, which will include all technical, organizational and legal issues, needed as preconditions for the interconnection of the Turkish power system to the UCTE network. The Contractual Agreement will reflect the results and the recommendations of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project. After the Steering Committee approval and decision, the Project Group will monitor the implementation of the measures stated in the Contractual Agreement, the mandatory Final Tests of the Turkish power system and the trial parallel operation until the final interconnection to the UCTE Network.

Regarding the rehabilitation of the control systems which would be required as an implementation of the measures stated in the Contractual Agreement, it must be noted that first of all EUAS also participates to the Project, and secondly TEIAS as the transmission system operator has the authority to enforce the power plant operators (i.e. EUAS or private generation companies) to comply with the Grid Code requirements.

### **3.2. Assessment of project impact, catalytic effect, sustainability and cross border impact**

The connection of Turkish power system to the UCTE network may have impacts not only on the local power systems but also on the entire UCTE system. This project will provide a technical assistance for elimination of the probable negative impacts through the implementation of the necessary counter-measures and will result in a secure synchronous parallel operation of Turkish power system with UCTE system.

With the synchronisation of Turkish power system with UCTE, the parties will realize both technical and economical benefits of such an operation. After removing the technical restrictions on the cross-border trade in energy by the synchronisation of Turkish power system with UCTE through the existing Turkey-Bulgaria interconnection lines, and in the future additional Turkey-Greece interconnection line, the Turkish Electricity Market will have the possibility to integrate into the internal electricity market of EU. The removal of the technical restrictions will allow market participants on both sides of the border to have the opportunity for continuous energy exchanges.

It is stated in the Executive Summary of the Final Report (which is currently a draft as it is not yet approved by the Beneficiary) for the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project that; the synchronous interconnection of Turkey to UCTE is feasible provided that the frequency control problem is also resolved and the damping performance of the majority of the generation stations is improved by new Power System Stabilizers (PSS) and/or optimized parameter settings of the existing controllers.

As the outputs of the technical studies are positive in terms of both static and stability studies, it must be concluded that one of the important steps that have to be taken is the elimination of the frequency control problem of the Turkish power system and improvement of the new damping performance of the majority of the generation stations. So after achieving those requirements, technically there will not be any obstacle for the synchronisation of Turkish power system with UCTE system. Therefore the elimination of frequency control problem of the Turkish power system and improvement of the new damping performance of the majority of the generation stations will have a catalytic effect on the synchronisation of the Turkish power system with UCTE system.

### **3.3. Results and Measurable Indicators**

#### **Results and measurable indicators in relation with Activity-1:**

As a result of the Activity-1, the model of the control systems of power plants defined within this activity is further developed. It was discovered during the execution of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project that dynamic data of most of the old power plants in Turkey are unavailable. Due to this unavailability, their dynamic database was developed based on typical model/parameter approach which is not sufficient to solve the existing frequency control problem.

Therefore the model of the control system for power plants of which dynamic data is unavailable or insufficient has to be verified and updated for deeper analysis of the frequency control

performance within the first half of the Project.

**Results and measurable indicators in relation with Activity-2:**

As a result of Activity-2, the appropriate test procedures and methodologies for Turkish power system are available after the approval of the UCTE Project Group.

In fact the actual output of this activity will be the draft test procedures and methodologies, but based on the tasks and duties of the UCTE PG, such appropriate test procedures, methodologies and performance criteria will be approved by Project Group.

**Results and measurable indicators in relation with Activity-3:**

As a result of Activity-3, the tests of the control systems are finalized and reported in the second half of the Project.

**Results and measurable indicators in relation with Activity-4:**

As a result of Activity-4, compliance of the power plants, to the defined performance criteria, are determined, utilized and reported. Power plants are defined based on the results of the Activity-3.

**Results and measurable indicators in relation with Activity-5:**

As a result of Activity-5, Based on the results of the Activity-3, tuning of the relevant power plants are carried out and guidance provided for power plants which require rehabilitation. Besides, tuning of the AGC (Automatic Generation Control) system parameters are carried out and the Defence Plan and Restoration Plan are elaborated.

**Results and measurable indicators in relation with Activity-6:**

As a result of Activity-6, the knowledge and performance of the TEIAS and EUAS personnel are improved through a set of training sessions held. Two weeks theoretical training in Turkey and two weeks practical training in two different UCTE member TSOs Control Centers (one week each) will be received for 25 trainees.

### **3.4. Activities**

**All activities below will be carried out through a single direct grant contract.**

**Activity 1: Survey of the Power Plants, Data Verification and Stability Analysis of Control Systems**

Detailed input data for the existing power plants' control systems including power plant master controller, turbine governors, excitation systems, AVR (Automatic Voltage Regulator) and PSS are necessary, a survey of the Turkish power plants and onsite visits will be carried out.

It was discovered during the execution of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project that dynamic data of most of the old power plants in Turkey are unavailable. Due to this unavailability, their dynamic database was developed based on typical model/parameter approach which is not sufficient to solve the existing frequency control problem.

As the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project's output will be the results regarding steady state and transient stability, the “Rehabilitation of the Frequency Control Performance of Turkish Power

System for Synchronous Operation with UCTE” Project will focus on a more detailed modelling and analysis on frequency control and the implementation of the control systems at power plants. This requires a more detailed testing of the control systems of the units due to the lack/inconsistency of data gathered during the execution of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project. Based on the outputs of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project;

- This activity covers the controllers of the HPPs (Hydraulic power plant) of the Priority List which was defined in the mentioned Project.
- In Addition to the ones given in Priority List this Activity covers Keban HPP, Karakaya HPP, Atatürk HPP, Borçka HPP, Oymapinar HPP, Elbistan-B TPP (Thermal Power Plant) and Iskenderun TPP regarding their PSSs.

After an evaluation of the existing models of those power plant control models within this activity, the defined power plants will be subject to this activity and based on the findings review of input data for stability studies will be performed.

It has to be also noted that the power plant units, which have PSSs installed are subject to that activity. So as a summary, the listed power plants are the candidate power plants and a group of them will be investigated during this activity. The Priority List, which was introduced within the Interim Report of “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” as Annex-6 of the Part C: Stability Study, is given in Annex-7. Also the Section 6-7 “Damping measures located within the Turkish power system” part of the draft Final Report for the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project is given in Annex-8. In Section 6-7 of this report the best locations for most effective location for damping measures (i.e. the PSS locations) are introduced.

### **Activity 2: Determination of Test Procedures**

For the application of the UCTE rules to a system which exhibits fundamental differences (e.g. systems with a huge amount of HPP like the Turkish power system), the appropriate test procedures, methodologies and performance criteria have to be defined for the implementation of the Project.

Within Activity-2 an appropriate test procedures and methodologies will be drafted by the UCTE experts involved in the project and afterwards with the submission of this draft test procedure and methodologies to UCTE Project Group, it is expected to get the UCTE Project Group approval during the first half of the Project.

### **Activity 3: Tests of Control Systems**

Tests of the control systems will cover the power plant master controller, turbine governors, generator excitation system, AVR and PSS. As the Restoration Plan is also a subject of the Project, the black start capability and island mode of operation of the power plants, which are planned for participation in the Restoration Plan, will be tested as well.



#### **Activity 4: Evaluation of Tests Outputs**

Based on the evaluation of the tests performed within Activity-3, in compliance with the performance criteria defined the power plants will be evaluated and the result of this evaluation will be the base for the decision of the next actions for those power plants.

Based on the evaluation of the tests performed in compliance with the defined performance criteria within Activity-2, three outcomes are possible;

- Some of the units satisfy the defined performance criteria,
- Some of the generators' excitation system, AVR, governor and PSS have to be retuned,
- Some of the power plants' control systems may require to be rehabilitated.

#### **Activity 5: Implementation of the Findings**

Based on the findings of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project, detailed technical analysis and tests performed within the Project; power plant control systems and AGC system parameters will require some tuning and/or modifications for the synchronous operation of Turkish power system with UCTE and island operation of Turkish power system following the separation of the systems after a severe disturbance.

The Project also focuses on the implementation of Defence Plan and Restoration Plan results. Defence Plan and Restoration Plan Reports are the reports, which are in the scope of the UCTE Project Group “Interconnection of Turkey”. Further information about those reports is provided in Terms of Reference of the Project Group for the connection of Turkey to the electrical system of UCTE.

Therefore, Activity-5 is composed of four main sub-activities:

- i. Conceptional design of frequency control performance of Turkish power system
- ii. Tuning of Power Plant Controller Parameters
- iii. Tuning of AGC System Parameters
- iv. Defence Plan and Restoration Plan Elaboration

The required investments for rehabilitation of the power plants' control systems will be covered through the power plant operators' own resources.

Within this activity, the manufacturers of the control systems of the power plants defined in Activity-4 will provide an important input for the decision of the rehabilitation at power plants. The power plants, which will be rehabilitated, will be decided based on a cost-benefit analysis. If the required investment for the rehabilitation is high and its contribution to the overall system performance regarding the frequency control performance is relatively less for one power plant than another power plant, or several other power plants, which require a smaller budget for investments, can be chosen. The important condition to satisfy is the overall system performance regarding frequency control performance, but not the power plants' individual performance.

#### **Activity 6: Training**

TEIAS and EUAS personnel will participate in the theoretical study and in the practical training such as the field tests of the primary control, secondary control and PSS, in order to improve their knowledge and performance skills.

Practical training will be received during the last two months of the project. The training will be composed of two weeks theoretical training in Turkey and two weeks in UCTE member TSO's (Transmission System Operator) Control Center. 25 trainees from TEIAS and EUAS will participate for the training sessions and the workshops performed where appropriate documents will be supplied to the trainees. Electrical engineers working as system operators at TEIAS Dispatching Centers (National Dispatching Center and Regional Control Centers) and power plant operators working at EUAS will participate to those trainings. It is expected to have the trainees to be fluent in English language. After the finalisation of the training the successful trainees would be certified.

### **3.5. Conditionality and Sequencing**

Results of the "Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System" project are fully available and approved by the Beneficiary, namely Ministry of Energy and Natural Resources (MENR), before the signature of the contract and results will be used in this Project.

### **3.6. Linked Activities**

There are a number of linked activities supported by the European Commission and the World Bank completed, planned or underway:

#### **3.6.1. EU Activities**

##### **3.6.1.1. Completed Projects**

The projects listed below were performed with the support of EU to some extent and are already completed.

- Feasibility And Evaluation Study of the Electricity Interconnection Greece–Turkey  
In parallel with official application by Greece to UCTE (21<sup>st</sup> March 2000), the feasibility study of Greece-Turkey interconnection line has been started for the parallel operation of Turkish power system to UCTE network via Balkan Pool, as the Project of "Feasibility and Evaluation Study of the Electricity Interconnection Greece-Turkey". Fifty percent of the project was financed by the TEN (Trans-European Networks) Program, according to the financial assistance contract no: ENERGY/5.7100/Z/99-009 between the electricity utility of Greece (PPC) and the European Commission, and was performed by a team of electricity utilities of the Balkans region, namely PPC (Greece), TEAS (Turkey), NEK (Bulgaria) and EKC (Serbia Montenegro).

The Objective of the Project was,

- To examine the economic and technical feasibility of a 400kV interconnection line between Greece and Turkey for parallel and synchronous operation of Turkish power system with the interconnected South-Eastern European electric

power systems and then with UCTE after reconnection of 1st and 2nd Zone of UCTE,

- To identify system configuration enabling the secure, stable and reliable exchange of bulk amounts and necessary reinforcements.

The Feasibility Project elaborated a set of studies for investigating several scenarios for connecting Turkish power system to the UCTE power system through Bulgaria and Greece. The outputs of the feasibility project indicated that;

- There were no technical problems identified but the necessity of further investigations of dynamic security phenomena was pointed out,
- More opportunities for electricity trade in open market in region in accordance with EU's Electricity Directive (EC 96/92) would be realised, and
- An improvement of the reliability for the Greek power system and the voltage profile in the northern part of Greece,
- The possibility of bulk amounts of power exchange was discovered,
- The investment could be paid back in less than one year.

#### **3.6.1.2. Projects in Progress**

The projects listed below are being performed with the support of EU to some extent and are still in progress:

- Euro Mediterranean regional project “Euro Mediterranean Energy Forum - Support to the Ad Hoc Groups”

The project was financed through the MEDA Programme, for supporting the three Ad Hoc groups, namely Energy policy, Economic Analysis and Interconnections, which were created according to the action plan of the Euro Mediterranean Energy Forum, to achieve their objectives.

- Euro Mediterranean regional project “MEDRING”

The project aimed at the technical and economic assessment of the interconnection of the electricity transmission networks of the Mediterranean countries, and was financed through MEDA Programme.

- Southeast Europe Electricity Regulatory Forum (SEEERF) Initiative of EU

The project objective is the creation of a regional electricity market in the South Eastern Europe by the year 2005 and its further integration to the Internal Electricity Market (IEM) of the EU. Turkey participates as a member state in the Southeast Electricity Regulatory Forum (SEEERF) and signed the Memorandum of Understanding on 15 November 2002.

The project is sponsored by EC and Stability Pact and is supported by UCTE, CEER (Council of European Energy Regulators) and ETSO (European Transmission System Operators).

- “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” (TR 0303.03)

The project purpose is to determine the technical conditions under which the Turkish power system may be synchronized with the UCTE power system. The Project was supported within the 2003 Pre-Accession Financial Cooperation Programme between Turkey and the EU and has a budget of 1,500,000 €.

The activities of Project which are classified as Static Studies (Component 1) and Stability Studies (Component 2) are expected to lead to the following results:

- Conditions for system stability of the entire UCTE system in the event of contingencies determined,
- Power exchange capacity between the Turkish power system and the UCTE power system determined,
- Any technical risks and possible counter-measures identified (if necessary),
- UCTE capable of monitoring the Turkish power system, as required by the UCTE procedures.

The Project, consisting of static and stability studies, in order to assess the impacts of Turkey’s interconnection on the regional systems as well as on the entire UCTE system, was directly contracted to the UCTE by a Global Price Contract. An association of UCTE Member TSOs was involved in the execution of the activities. The reasons for such a Programme formulation were:

- UCTE has a long-standing and unique experience in conducting static and stability studies, e.g. studies for Romania and Bulgaria (Contract Nr. ENERGY/5.7100/Z/99-009 that is partially financed under TEN programme).
  - Prior to taking a decision concerning the extension of the UCTE system to cover new regions, UCTE asks for the static and stability studies in order to assess the possible impacts of new extension on the regional system as well as on the entire UCTE system. This is essential to ensure the continuity of the smooth functioning of the entire UCTE system.
  - In order to achieve consistent and reliable results out of these studies, UCTE requires such studies to be conducted by itself through some of its member TSO’s it assigns. This has been the case in the previous system extensions, such as Romania and Bulgaria.
  - Accordingly, these studies are required by UCTE also for the case of Turkey’s application for connection to the UCTE power system. According to the outcome of these studies, UCTE will determine the conditions under which the Turkish power system could be synchronously connected to the UCTE system.
- Improvement of the Conditions for Cross Border Electricity Trade in Turkey in Compliance with the Best Practice in EU

This is a Twinning Project with 18 months duration and will be financially supported by the EU within the 2006 Pre-Accession Financial Cooperation Programme between Turkey and the EU. The Twinning Contract and Work Plan are under preparation. The

purpose of the Project is to improve the conditions for the functioning of cross-border electricity trade in Turkey by removing technical, administrative and legislative obstacles. The Project consists of two tasks:

- “Improvement of the Operation and Maintenance Performance of Turkish Transmission System”. The purpose of this task is improving the technical performance of the Turkish transmission system regarding the existing infrastructure, operation and maintenance capabilities.
- “Development and/or Improvement of Legislative Framework and Administrative Capacity in Turkish Electricity Market Regarding the Cross Border Electricity Trade”. This task’s purpose is making new arrangements on the existing Turkish electricity market legislation, market operation and management structure to reach an appropriate level of services to be ensured for the whole regional market participants regarding the cross border electricity trade.

### **3.6.2. World Bank Activities**

The projects listed below are being performed with the support of World Bank and are still in progress:

- National Transmission Grid Project

The Project, which started in 2002 and will be finalized in 2007, is financed from an IBRD loan of USD 230 million. It covers the restructuring of the sector and also the construction of transmission facilities; including the Turkish part of the 400kV Turkey-Greece interconnection line.

### **3.7. Lessons Learned**

The past experience of the UCTE with previous system extensions proved that prior to any system extension necessary studies (i.e. studies, tests and reports) have to be conducted in order to eliminate possible negative impacts of the new interconnection on the security of the systems in the vicinity as well as the entire UCTE system. The investigation of system expansion, identification of possible risks and taking of proper counter-measures are essential pre-conditions to establish an effective interconnection.

During the implementation of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” two Wide-Area Measurement Systems (WAMS) devices were installed in Turkish power system. The Dynamic Group experts had remote access capability to those WAMS. Based on the investigation of the Monthly Frequency Control Performance Reports, which were prepared by TEIAS since 2004 on a monthly basis, and the WAMS recordings, the UCTE experts pointed out the frequency oscillations of the Turkish Power System. As the existence of such a frequency oscillation is not compliant with the UCTE requirements which are defined in UCTE Operational Handbook, it is essential that some further action has to be taken for the Turkish power system to operate synchronous parallel with the UCTE system.

Experience from the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project, indicated that a direct contract based on

global price was the best method to design the project. Therefore, the Service Contract of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project will be the base for the Service Contract of this Project.

#### 4. Indicative Budget (amounts in €)

The Project will be a Direct Grant Contract based on Global Price. In the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project, which was financed by EU through the 2003 Programme, UCTE made a contribution of 10 % of the total budget. The total budget of that Project was 1.5 million€. As the “Rehabilitation of the Frequency Control Performance of Turkish Power System for Synchronous Operation with UCTE” Project addresses the rehabilitation of the frequency control performance of Turkish power system, which is under the responsibility of Turkey, UCTE financial contribution is not considered in the Project. The incompliance of the frequency control performance of the Turkish power system and the observed frequency oscillation problems does not arise from connecting the Turkish power system with UCTE. But it has to be noted that as they are obstacles for getting the Turkish power system connected with UCTE system, they have to be eliminated by Turkey.

	TOTAL PUBLIC COST	SOURCES OF FUNDING										
		EU CONTRIBUTION				NATIONAL PUBLIC CONTRIBUTION						PRIVATE
		Total	%*	IB	INV	Total	Type of Cofinancing (J/P)**	%*	Central	Regional	IFIs	
Service	2,500,000	2,500,000	100	2,500,000								
TOTAL	2,500,000											

\*\* Compulsory for INV (minimum of 25 % of total EU + national public contribution); Joint cofinancing (J) as the rule, parallel cofinancing (P) per exception

\* Expressed in % of the Total Public Cost

#### 5. Indicative Implementation Schedule (period broken down per quarter)

Contracts	Start of Tendering	Signature of Contract	Contract Completion
Contract		1 <sup>st</sup> quarter of 2008	1 <sup>st</sup> quarter of 2009

Duration of the project: 14 months

The project completion is the final date for final disbursements under the contract and the project activities will be completed not later than 4 years after signing of the Financial Agreement.

## **6. Cross Cutting Issue (where applicable)**

### **6.1. Equal Opportunity**

Equal opportunity principles and practices in ensuring equitable gender participation in the project will be guaranteed. Male and female participation in the project will be based on the relevant standards of the EU. The main criteria for staff recruitment will be appropriate qualifications and experience in similar projects, not sex or age. Both men and women will have equal opportunities and salaries.

### **6.2. Environment**

Not applicable, since this project deals only with the technical assistance for the rehabilitation of the frequency control performance of Turkish Power System and not with construction of new power plants, substations and transmission lines. Tuning of the parameters and/or rehabilitation of the control system of existing power plants will not have an environmental impact.

### **6.3. Minority and Vulnerable Groups**

According to the Turkish Constitutional System, the word “minorities” encompasses only groups of persons defined and recognized as such on the basis of multilateral or bilateral instruments to which Turkey is a party. This project has no negative impact on minority and vulnerable groups

## **ANNEXES TO THE PROJECT FICHE**

1. Logical framework matrix in Standard Format
2. Amounts contracted and disbursed per Quarter over the full duration of Programme
3. Institutional Framework
4. Reference to laws, regulations and strategic documents
5. Details per EU funded contract (\*) where applicable
6. Reference to interim report of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project
7. Priority List introduced in the Interim Report of “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System”
8. Section 6-7 “Damping measures located within the Turkish power system” part of the draft Final Report for the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” Project



			Programme name and number:	
<b>LOGFRAME PLANNING MATRIX</b>				
<b>“Rehabilitation of the Frequency Control Performance of Turkish Power System for Synchronous Operation with UCTE”</b>			Contracting period expires: <b>2 Years after the signature of Financial Agreement</b>	Disbursement period expires: <b>5 Years after the signature of Financial Agreement</b>
<i>Project Number</i>			Total Budget: <b>€2,500,000</b>	EU contribution: <b>€2,500,000</b>
<b>Overall objective</b>	<b>Objectively Verifiable Indicators</b>	<b>Sources of Verification</b>		
The overall objective is to fully integrate the Turkish Electricity Market to the EU Internal Electricity Market.	<ul style="list-style-type: none"> <li>Commercial and physical electricity exchanges take place between Turkey and EU Member States</li> </ul>	<ul style="list-style-type: none"> <li>UCTE reports</li> <li>IEA reports</li> <li>Annual reports of EMRA</li> <li>Annual reports of the concerned Transmission System Operators</li> </ul>		
<b>Project purpose</b>	<b>Objectively Verifiable Indicators</b>	<b>Sources of Verification</b>	<b>Assumptions and Risks</b>	
Turkish Power System is prepared for future parallel operation with UCTE regarding power and frequency control, steady state and transient stability.	<ul style="list-style-type: none"> <li>It is reported by the UCTE Project Group for Interconnection of Turkish Power System that the frequency oscillation within the Turkish power system is eliminated and Turkish Power System meets the requirements</li> </ul>	<ul style="list-style-type: none"> <li>“Contractual Agreement” Prepared by UCTE Project Group for Interconnection of Turkish Power System</li> </ul>	<ul style="list-style-type: none"> <li>If required, sufficient investments were made on the Turkish system to fulfill the UCTE requirements.</li> </ul>	

<b>Results</b>	<b>Objectively Verifiable Indicators</b>	<b>Sources of Verification</b>	<b>Assumptions and Risks</b>
<ul style="list-style-type: none"> <li>• The model of the control systems of power plants is further developed</li>   <li>• Appropriate test procedures and methodologies for Turkish power system are available</li>   <li>• Tests of the Control Systems (turbine governor, generator excitation system and Automatic Voltage Regulators) together with the black start capability and island mode of operation of the power plants (which are part of the Restoration Plan) are finalized</li>   <li>• Compliance of the power plants to the defined performance criteria are determined and utilized</li>   <li>• Tuning of the relevant power plants are carried out, guidance provided for power plants which require rehabilitation, tuning of AGC (Automatic Generation Control) system parameters are carried out and the Defence Plan and Restoration Plan are</li> </ul>	<ul style="list-style-type: none"> <li>• Model of the control system for the required power plants' will be verified and updated for deeper analysis of the frequency control performance within the first half of the Project.</li>   <li>• The defined test procedures and methodologies approved by the UCTE Project Group for Interconnection of Turkey during the first half of the Project</li>   <li>• Tests results of the black start capability and island mode of operation of power plants (which are part of the Restoration Plan) and the frequency performance of the power plants will be reported in the second half of the project.</li>   <li>• Evaluation report of the control tests will be performed in the second half of the project.</li>   <li>• In the second half of the project, tuning of the control systems of the relevant power plants, AGC System parameters and elaboration of the Defence Plan and Restoration Plan will be performed.</li>   <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Monthly reports submitted by TEIAS to the UCTE Project Group</li>   <li>• Frequency measurements taken by the WAMS systems already installed at Turkish power system</li> </ul>	<ul style="list-style-type: none"> <li>• The willingness of the existing control system manufacturers to cooperate with the experts involved in the study</li>   <li>• Test procedures and methodologies defined for the Turkish power system by the Project Group/UCTE on time</li>   <li>• The required budget for the rehabilitation/tuning of the existing control systems is supplied on time by the required power system operators.</li>   <li>• Defence Plan and Restoration Plan Reports which are under the responsibility of the UCTE Project Group "Interconnection of Turkey"/UCTE is approved</li> </ul>

<p>elaborated</p> <ul style="list-style-type: none"> <li>The knowledge and performance of the TEIAS and EUAS personnel are improved through a set of training sessions</li> </ul>	<p>During the last two months of the project training composed of two weeks theoretical training in Turkey and two weeks in UCTE member TSOs Control Centers with appropriate documents are received for 25 trainees</p>		
<b>Activities</b>	<b>Means</b>		<b>Assumptions and Risks</b>
<ul style="list-style-type: none"> <li>Survey of the Power Plants, Data Verification and Stability Analysis of Control Systems</li> <li>Determination of Test Procedures</li> <li>Tests of Control Systems</li> <li>Evaluation of Test Outputs</li> <li>Implementation of the Findings <ul style="list-style-type: none"> <li>Conceptional design of frequency control performance of Turkish power system</li> <li>Tuning of power plant controller parameters</li> <li>Tuning of AGC system parameters</li> <li>Defence Plan and Restoration Plan elaboration</li> </ul> </li> <li>Training</li> </ul>	<ul style="list-style-type: none"> <li>1 x service contract (direct grant contract)</li> </ul>	<p>€2,500,000</p>	

	Pre-Condition
	Results of the “Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System” project are fully available and approved by the Beneficiary