SUMMARY PROJECT FICHE
Project Number TR 0303.03

1. **Basic Information**

1.1 **Title:** Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System

1.2 **Sector:** Energy

1.3 **Location:** The Republic of Turkey, the Ministry of Energy and Natural Resources

2. **Objectives**

2.1 **Overall Objective**
The overall objective is to fully integrate the Turkish electricity market to the EU Internal Electricity Market.

2.2 **Purpose**
The project purpose is to determine the technical conditions under which the Turkish power system may be synchronised with the UCTE power system.

2.3 **Accession Partnership and NPAA Priority**
AP – Chapter 4 (Priorities)

Short term:
- Establish a programme for the adoption of the energy acquis, particularly that concerning issues other than the internal energy market.
- Ensure the establishment of a competitive internal energy market, in compliance with the electricity and gas directives.

Medium term:
- Remove restrictions on the cross-border trade in energy.
- Promote the implementation of projects in Turkey listed as projects of common interest in the European Community TEN-Energy Guidelines.

NPAA 4.15 (Energy)

d) Final Objective
Harmonization of Turkey’s national energy legislation with the related legislation of the European Union

2.4 **Contribution to National Development Plan**

Turkey has now begun preparation of its first National Development Plan. This is likely to be ready by the end of 2003.
2.5 Cross Border Impact

The connection of Turkey to the UCTE network may have impacts not only on the local power systems but also on the entire UCTE system. This project will determine these impacts and define necessary counter-measures to eliminate them.

This will allow Turkey to be interconnected to the UCTE system via tie lines between Turkey and Bulgaria in a first step and between Turkey and Greece in a second step without any negative impact on other power system. This is an essential step towards achieving the full integration of the Turkish market to the EU internal market.

3. Description

3.1 Background and Justification

The Helsinki European Council at the end of 1999 concluded that “Turkey is a candidate State destined to join the Union on the basis of the same criteria as applied to the other candidate States. Building on the existing European Strategy, Turkey, like other candidate States, will benefit from a pre-accession strategy to stimulate and support its reforms”.

The Turkish Electricity Market Law became effective on 3 March 2001 (Law 4628). The Law concentrates mainly on defining the sector’s new structure and the status of the power sector actors, including restructuring and unbundling of utilities. This is closely tied to the Constitutional Amendment of August 1999 (Law 4446), which for the first time explicitly permitted privatisation of state enterprises and assets including energy companies. Whilst the state will retain control over power transmission, generation and distribution activities are to be opened to competition and to private companies (the state will retain ownership of the hydropower generation assets).

In summary, the adopted electricity laws include the following key elements:

- An autonomous Energy Market Regulatory Authority, governed by the Board,
- A new licensing framework for market participants,
- An energy market, to be based on bilateral contracts between market participants,
- Eligible consumer concept, to ensure freedom for eligible consumers to choose their suppliers,
- A transition mechanism to be implemented over a two year program

Energy Market Regulatory Authority has started to work immediately after its appointment on 19 November 2001. The studies for the completion of necessary secondary regulation are at a very advanced stage through consultation with all the parties in the market.

Former TEAS, which had both transmission and generation functions, has been unbundled into three companies in October 2001: EUAS (Electricity Generation Company), TETAS (Turkish Electricity Trading Company) and TEIAS (Turkish Electricity Transmission Company). TEIAS is the owner and operator of the transmission network in Turkey. The restructuring of TEIAS to ensure its adaptation to the new market conditions are still underway.
The Ministry of Energy and Natural Resources is the main institution responsible for the formulation and implementation of energy policies and programmes in coordination with the relevant government institutions and other key sector actors. Coordination, supervision, assessment, execution and management of international relations regarding cross boundary energy transportation projects are among its functional duties.

The full integration of the Turkish electricity market to the Internal Electricity Market of the EU requires not only the alignment of the national legislation concerning the electricity market with the relevant EU acquis but also the synchronous physical connection of the Turkish power system with the European electricity transmission network, the UCTE (Union for the Co-ordination of Transmission of Electricity) network at full compatibility with the UCTE technical standards and requirements. The Ministry has the prime responsibility as regards the achievement of this goal.

As concerns synchronous electricity power system in the Continental Europe, there exist four main blocks. The NORDEL block covers the Nordic area while the CENTREL block involves four Central European countries. The IPS/UPS block includes the countries in the east of the CENTREL block, partly including Romania.

The UCTE block has the broadest coverage in continental Europe. The UCTE network currently operates in two synchronous zones, the 1st zone covering mostly the central and western part of Europe and the 2nd zone which includes power systems in the Balkan area. The two zones are expected to be reconnected by the year 2004. The CENTREL block is integrated to the UCTE block since 1999. First zone is currently connected by DC cable to the NORDEL block covers the Nordic countries, namely; Finland, Sweden, Norway and Denmark. It is connected to UK also by DC cable and further to Ireland. Also there is a synchronous connection by submarine AC cable from Spain to Africa connecting to Morocco, Algeria and Tunisia.

The UCTE (similar to other blocks) is an association comprising of the transmission system operators of the countries covered by the UCTE zone. It aims at providing a reliable market base through ensuring efficient and secure "power highways". 50 years of joint activities laid the basis for a leading position in the world which the UCTE holds in terms of the quality of synchronous operation of interconnected power systems. Through the networks of the UCTE, 400 million people are supplied with electricity energy; annual electricity consumption amounts to around 2100 TWh.

The connection of the Turkish power system with the former UCPTE (presently, UCTE) power system have 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 and used only for energy exchanges with island supply and directed generation methods.

In addition to the 400 kV link with Bulgaria which was commissioned in 1975, the second 400 kV link was completed in September 2002. A Memorandum of Understanding was signed on 28 March 2002, in Ankara, for the construction of Babaeski–Filippi 400 kV tie line between Greece and Turkey, which is projected to be completed by end-2006. The necessary funds for the construction of the Turkish segment (about 50 km) were secured through a World Bank loan.
Since the early 90’s, preliminary studies have been performed for various interconnection options between the networks of Greece, Turkey and Bulgaria. These studies revealed that the projects for the synchronous connection of the Turkish power system to the UCTE power system through Bulgaria and/or Greece is feasible and viable.

Most recently, in 2000-2001, an elaborate set of studies for investigating several scenarios for connecting Turkish power system to the UCTE power system through Bulgaria and Greece have been performed by a team of electricity utilities of the Balkans region, namely PPC (Greece), TEAS (Turkey), NEK (Bulgaria) and EKC (Yugoslavia), and financed by the European Commission within the framework of the TEN (Trans-European Networks) Programme. Furthermore, a second study was completed at the same time with the focus on the stability issues of the synchronously interconnected operation of the electricity network of UCTE / CENTREL and the second UCTE zone, with the networks of Romania and Bulgaria. Although this study was not related (at the time it was performed) to the connection of Turkey it presents a very important background for the investigation of this new connection.

On 21 March 2000, TEAS made an application to UCTE for membership. The UCTE Steering Committee took a decision on 26 April 2000 to consider and evaluate all possibilities for the synchronous interconnection of the Turkish power system to the UCTE power system.

In this connection, a subgroup was formed under the System Development Working Group to tackle with the issue of Turkey’s possible connection to UCTE.

This subgroup has already taken a number of steps concerning Turkey’s application for the connection to UCTE power system, building upon the previous relevant studies mentioned above; “Feasibility and Evaluation Study of the Electricity Interconnection Greece-Turkey” and “Stability of the Synchronously Interconnected Operation of the Electricity Networks of UCTE/CENTREL, Bulgaria–Romania”:

- Identified strategies, technical pre-requisites and sequence of operation
- Defined further studies and preliminary tests needed concerning the envisaged connection of Turkey to UCTE
- Prepared a draft terms of reference for the activities that must be concluded prior to taking a decision for the connection of the Turkish power system to the UCTE power system which includes;
  - Further studies complementing the previous ones (i.e. static and stability studies)
  - Preliminary monitoring and tests of the Turkish power system;
  - Reports concerning the status of the Turkish power system including power-energy balance, defence plans, restoration plans etc.;

The terms of reference in question was approved in principle by the UCTE Steering Committee (Bratislava meeting of April 2002). Afterwards, in its meeting of Vienna in June 2002, the Committee proposed that, with a view to speed up the process, in particular to overcome the difficulties for the funding of these studies:
• the Static Studies that will explore the impacts of Turkey’s interconnection at the regional level (i.e. on the network at the vicinity of Turkey) are to be performed by the local UCTE Transmission System Operators (TSO’s) in the region

• the Stability Studies that will analyse the impacts of Turkey’s interconnection on the entire UCTE system are to be performed by UCTE TSO’s with the leadership of RWE of Germany.

Similar stability studies for the connection of Romania and Bulgaria to UCTE was performed in 2000-2001 and the studies for the connection of Turkey will be an extension of these studies.

The results of these activities will constitute a basis for the decision to be taken by UCTE with regard to the connection of Turkish power system to UCTE power system.

3.2 Linked Activities

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

**EU Activities**

• Feasibility And Evaluation Study of the Electricity Interconnection Greece–Turkey; partially financed by TEN; completed.

• Stability Study for the Synchronously Interconnected Operation of the Electricity Networks of UCTE/CENTREL, Bulgaria and Romania”, financed by TEN; completed,

• Euro Mediterranean regional project “Euro Mediterranean Energy Forum - Support to the Ad Hoc Groups” financed through MEDA Programme; for supporting the three Ad Hoc groups, Energy policy, Economic Analysis and Interconnections which were created according to the action plan of Euro Mediterranean Energy Forum, to achieve their objectives; in progress.

• Euro Mediterranean regional project “MEDRING”, for the technical and economic assessment of the interconnection of the electricity transmission networks of the Mediterranean countries, financed through MEDA Programme; in progress.

• Southeast Europe Electricity Regulatory Forum (SEERF) Initiative for the creation of a regional electricity market in the South Eastern Europe for its further integration to the Internal Electricity Market (IEM) of the EU; in progress.

**World Bank Activities**

• National Transmission Grid Project. Financed from IBRD loan in the amount of USD 270 million. Covers restructuring of the sector and also the construction of transmission facilities, including the Turkish part of the 400 kV Turkey-Greece interconnection line; in progress.

3.3 Results

The activities which shall be carried out under the project and which are described in section 3.4 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.

3.4 Activities

The proposed project will consist of two components:

Component 1: Static (Load Flow) Studies

The purpose of the static studies is to calculate the maximum allowable total import-export capacity between UCTE power system and Turkish power system in accordance with the European Transmission System Operators (ETSO) definitions. The studies will focus on two time periods: Winter 2004 – Summer 2005 scenario and 2006 scenario.

Winter 2004 – Summer 2005 Scenario considers the synchronization of the Turkish power system with the UCTE power system via two existing 400 kV lines to Bulgaria, following the re-connection of UCTE first and second zones.

2006 Scenario considers:
  − the 400 kV interconnection between Turkey and Greece in operation and
  − availability of a second 400 kV interconnection between Greece and Bulgaria as a variant.

This component will include the following sub-tasks:

1.1: Data Collection: The necessary technical data will be collected and validated by each TSO to establish a database for the entire regional system to be studied.

1.2: Load Flow Solution with Zero Exchange: A load flow analysis will be performed with the Turkish power system in balance for the case of “no exchange with UCTE power system”.

1.3: Exchange Scenarios: The possible scenarios for the exchanges between Turkey and other countries within the context of static studies shall be defined.

1.4: Transfer Capacity Analysis: Maximum allowable exchange between UCTE and Turkey shall be determined on the basis of the static criteria.

1.5: Reporting: All the activities and results shall be reported.

Component 2: Stability Studies

The Stability Studies will be based upon the outcomes of:
  − the Static Studies under the component 1 and
the previous study concerning the synchronously interconnected operation of the electric network of UCTE/CENTREL and the second UCTE zone, with the networks of Romania and Bulgaria.

The same time intervals and scenarios of the component 1 shall also apply to the studies under this component.

This component will include the following sub-tasks:

2.1: Dynamic Data Collection: The necessary technical data will be collected and validated by TEIAS to be added to the existing database for the rest of the system.

2.2: Installation of Monitoring and Model Setup: The monitoring system (including a set of three data loggers with technical specifications in compliance with the UCTE standards and requirements) will be setup to monitor the behaviour of the Turkish power system regarding the quality of energy and stability.

2.3: Model tuning: The model set-up will be validated through making comparisons with the data collected from data logger devices (sub-component 2.2).

2.4: Verification (Evaluation) of Transfer Capacities: The transfer capacities calculated in Component 1.4 shall be evaluated and verified with the transient dynamic stability criteria including some relevant emergency conditions.

2.5: Analysis of Small Signal Stability: The issue of small signal stability will be investigated and possible counter-measures will be identified to improve damping (if needed).

3.5 Lessons Learnt

The past experience of the UCTE with previous system extensions (such as to CENTREL and former Yugoslavia) proved that, prior to any system extension, static and stability studies have to be conducted in order to eliminate possible negative impacts of the new interconnection on the security of the systems at 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.

4. Institutional Framework

The beneficiary of the Project is the Ministry of Energy and Natural Resources, which is responsible for, inter alia, the coordination, supervision, assessment, execution and management of cross boundary energy transportation projects.

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Phone: (90-312) 213-1124; Fax: (90-312) 213-2049; E-mail: etkbab@ttnet.net.tr
5. **Detailed Budget (€)**

<table>
<thead>
<tr>
<th></th>
<th>EU Support</th>
<th>National Co-financing</th>
<th>UCTE Co-financing</th>
<th>Total</th>
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<td>Institution Building</td>
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<tr>
<td><strong>Total</strong></td>
<td>37,000</td>
<td>1,300,000</td>
<td>13,000</td>
<td>150,000</td>
</tr>
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Co-financing will be in the form of joint co-financing.

6. **Implementation Arrangements**

6.1 **Implementing Agency**

The Implementing Agency for the proposed project will be the Central Finance and Contracts Unit (CFCU).

Responsibility for the administration related to the procedural aspects of procurement, contracting and accountancy will rest upon the CFCU. The tendering and contracting will be carried out by the CFCU and shall follow standard DIS rules.

6.2 **Non-standard Aspects**

The “Service” part of this Project, consisting of the conduct of Static and Stability studies in order to assess the impacts of Turkey’s interconnection on the regional systems as well as entire UCTE system, shall be directly contracted to UCTE supported by its member TSO’s it has assigned. The reasons for this are:

- UCTE has a long-standing and unique experience in conducting Static and Stability studies, such as 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 conduct of 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 to Romania and Bulgaria.

- Accordingly, the conduct of these studies is also required by UCTE for the case of Turkey’s application for connection to the UCTE power system. According to the outcome of these studies, the UCTE will determine the conditions under which the Turkish power system could be synchronously connected to the UCTE system.

The static studies shall be conducted by the TSO’s of the region assigned to conduct this study by the Decision of the UCTE Steering Committee (Vienna Meeting of June 2002), namely, TEIAS (Turkey), EKC (Serbia), HTSO (Greece), NEK (Bulgaria), HEP (Croatia).
The stability studies shall be conducted by the UCTE-member TSO’s assigned to conduct this study by the Decision of the UCTE Steering Committee (Vienna Meeting of June 2002), namely, RWE (Germany), EON (Germany), RTE (France), ELIA (Belgium), NEK (Bulgaria), HTSO (Greece) and TEIAS (Turkey).

6.3 Contracts
Service Contract 1,450,000 EUR
Supply Contract 50,000 EUR

7. Implementation Schedule

<table>
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<tr>
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<th>Start of Tendering</th>
<th>Start of project activities</th>
<th>Project completion</th>
</tr>
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<tr>
<td>Service</td>
<td>3rd quarter 2003</td>
<td>1st quarter 2004</td>
<td>2nd quarter 2005</td>
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<tr>
<td>Supply</td>
<td>3rd quarter 2003</td>
<td>1st quarter 2004</td>
<td>2nd quarter 2004</td>
</tr>
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</table>

8. 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.

9. Environment
Not applicable

10. Rates of return
Not applicable

11. Investment criteria
Not applicable

12. Conditionality and sequencing
The EU financing to this project is conditional upon:
- National co-financing for the equipment part to be ensured prior to signing of Supply contract;
- UCTE co-financing to be ensured prior to signing of Service contract.

ANNEXES TO THE PROJECT FICHÉ
1. Logical framework matrix in standard format
2. Detailed implementation chart
3. Contracting and disbursement schedule by quarter for full duration of programme (including disbursement period)
Annex 1 to Project Fiche

<table>
<thead>
<tr>
<th>LOGFRAME PLANNING MATRIX</th>
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<td>“Complementary Technical Studies for the Synchronization of the Turkish Power System with the UCTE Power System”</td>
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<td>Contracting period expires:</td>
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<th>Wider Objective</th>
<th>Indicators of Achievement</th>
<th>Sources of information</th>
<th>Assumptions and Risks</th>
</tr>
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<tbody>
<tr>
<td>To fully integrate the Turkish electricity market to the EU Internal Electricity Market</td>
<td>Commercial and physical electricity exchanges take place between Turkey and EU Member States within 2007</td>
<td>UCTE reports, IEA reports, Annual reports of EMRA, Annual reports of the concerned TSO’s</td>
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<table>
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<tr>
<th>Immediate Objective</th>
<th>Indicators of Achievement</th>
<th>Sources of information</th>
<th>Assumptions and Risks</th>
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<tbody>
<tr>
<td>To determine the technical conditions under which the Turkish power system may be synchronised with the power system of UCTE</td>
<td>A catalogue of measures prepared and approved by UCTE Steering Committee by the beginning of 2006.</td>
<td>UCTE correspondence with the Turkish Energy Ministry and/or TEIAS</td>
<td>Reconnection of UCTE first and second zones is secured. If required, sufficient investments are made on the Turkish system to fulfil the UCTE requirements.</td>
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</table>

<table>
<thead>
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<th>Results</th>
<th>Indicators of Achievement</th>
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<th>Assumptions and Risks</th>
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<tbody>
<tr>
<td>1. Conditions for system stability of the entire UCTE system in the event of contingencies determined</td>
<td>UCTE reported the technical conditions concerning the entire UCTE system’s stability in case of Turkey’s connection by mid-2005</td>
<td>Reports of the concerned TSO’s, Reports by UCTE, Correspondence between UCTE and the Turkish Energy Ministry and/or TEIAS, Reports by Energy Ministry and EMRA</td>
<td>Quality of data to be provided by the concerned TSO’s is good enough to make an accurate system simulation for the interconnection.</td>
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<tr>
<td>2. Power exchange capacity between Turkey and the UCTE system determined.</td>
<td>The simulation model yielded the maximum capacity for power exchange by mid-2005</td>
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<tr>
<td>3. Any technical risks and possible counter-measures</td>
<td>UCTE reported the technical conditions for</td>
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</table>
identified (if necessary). UCTE capable of monitoring the Turkish power system, as required by the UCTE procedures.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Means</th>
<th>Conditionality</th>
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| • Static studies  
  – Data collection  
  – Load flow simulation with zero exchange  
  – Exchange scenarios  
  – Transfer capacities analysis  
  – Documentation  
• Stability analysis  
  – Dynamic data collection  
  – Installation of monitoring and model set-up  
  – Model tuning  
  – Verification (evaluation) of transfer capacities  
  – Analysis of small signal stability | • Technical assistance  
  • Supply of 3 set of data loggers | • UCTE co-financing must be ensured prior to signing of Service contract  
• National co-financing must be ensured prior to signing of Supply contract |

Turkey’s connection by mid-2005  
• Necessary infrastructure is in place by mid-2005
## ANNEX No. 2
### DETAILED IMPLEMENTATION SCHEDULE OF ACTIVITIES

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<tr>
<td>1. Static Studies</td>
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<td>2. Stability Studies</td>
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### Tender
- Project Execution
# ANNEX No 3

**COMMITMENT AND DISBURSEMENT SCHEDULE (in €)**

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<td>Cumulated</td>
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<td>1.337.000</td>
<td>1.337.000</td>
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