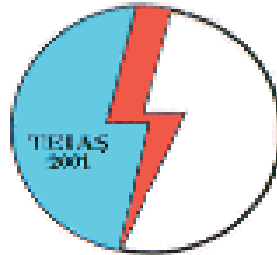


# Connection of Turkish Power System to UCTE

Turkish Electricity Transmission Corporation





# Objective

---

- In order to get the maximum benefit of international interconnections; the targeted method is synchronous parallel operation
- In this respect; the priority of Turkey is connection to UCTE System
- Integration of the Turkish Electricity Market into “Internal Electricity Market of EU”



# Background

---

- Studies have been performed for the energy exchange alternatives via GR, TR and BG since 1970's.
- None of the tie lines with these countries have been operated in synchronization.
- The studies performed in 1990's proved that synchronous connection of the Turkish power system through BG and GR to UCTE is feasible and viable.



## Background-2

---

- Following the request of TEAŞ for synchronous connection and membership, relevant application made by PPC to UCTE
- Decision of UCTE Steering Committee:
  - Consider all possibilities of synchronously interconnecting the Electric Power System of Turkey to the UCTE Network
- A subgroup was formed in order to carry on the studies, preliminary tests and identify strategies related with the connection of Turkey



## Projects Developed

---

1. Complementary Studies for the Synchronization of Turkish Power System with UCTE System (Project-1)
2. Rehabilitation of the Frequency Control Performance of Turkish Power System for Synchronous Operation with UCTE (Project-2)



## Project-1 “Complementary Studies for the Synchronization of Turkish Power System with UCTE System”

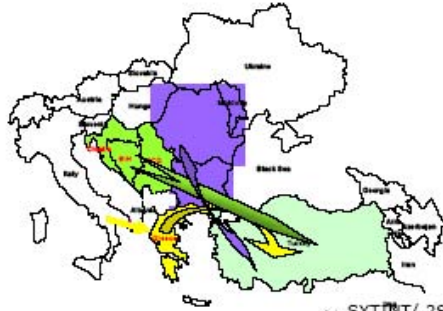
---

Studies performed under the project-1 are:

- Static Studies by local TSO's in the Balkans
- Stability studies by central UCTE TSO's under the leadership of RWE-Germany

# Exchange patterns

	FROM		TO
<b>IMPORT TO TR</b>	ROMANIA	<b>EXPORT FROM TR</b>	GREECE
	BULGARIA		B&H AND CROATIA
	ITALY (THROUGH THE DC CABLE LINK)		ITALY (THROUGH THE DC INTERCONNECTION CABLE GREECE-ITALY)
	GREECE (50%) + SERBIA/MONTENEGRO (25%) AND B&H (25%)		



SYNTIN/ 29 April 2008, Brussels



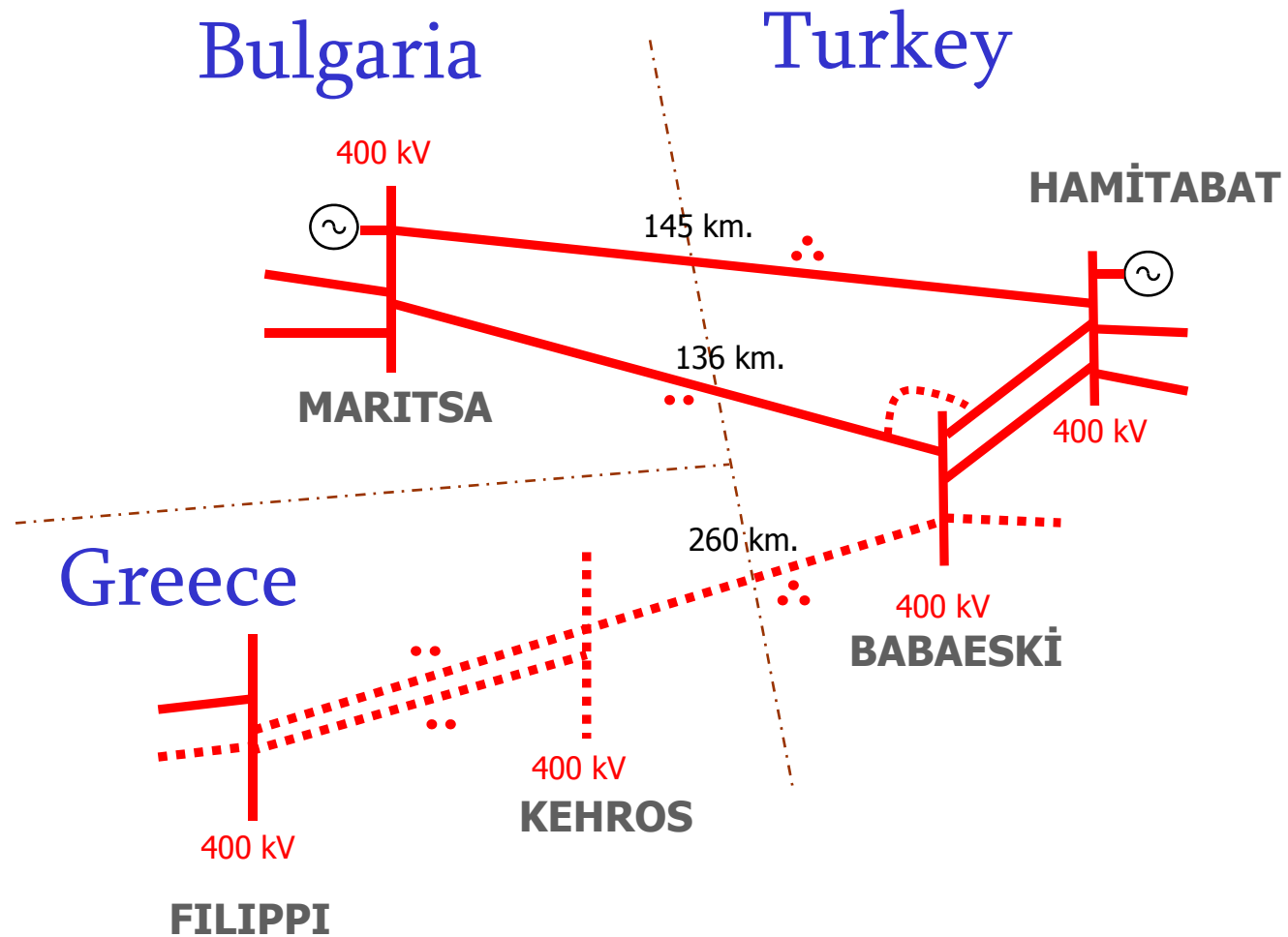


# limiting factors

---

- Two main limiting factors were identified for exchange patterns:
  - between Turkey and Northeast Europe the transfer capability is limited by:
    - the thermal limit of lines in the Serbia-Romania interconnection area
  - between Turkey and Southeast Europe the transfer capability is limited by:
    - contingencies in the Bulgaria 400 kV ring
    - contingencies in the 400 kV interconnection lines between Bosnia and Serbia

# Connection to UCTE





# Summary Results of Static Studies

---

The interconnection of the Turkish EPS with the UCTE system is technically feasible from the static security point of view.

The connection of Turkish EPS to UCTE by three lines provides the necessary technical conditions for import/export of significant amount of electricity:

- NTC for the import to Turkey is within the range of 800-1300 MW
- NTC for the export from Turkey is within the range of 1000-1100 MW



# Summary Results of Damping Measures

---

- can be achieved by modern Power System Stabilizers-PSS (it is measured that positive (small) damping effect for 0,15 Hz. oscillations)
- results confirmed by manufactures for selected generation units
- positive damping effect of Automatic Voltage Regulator (AVR) of the majority of units has to be assured by
  - new parameter settings of existing voltage controllers and/or
  - implementation of new PSS
  - adjustment of turbine governors



## Conclusions:

---

- The system interconnection of Turkey to UCTE is feasible under following conditions that:
  - the existing inherent frequency control problem is resolved
  - positive damping effect of AVR for the 0,15 Hz. inter-area oscillations is assured in the majority of generation units (new PSS)
- A System Protection Scheme at the interface is necessary to manage extreme contingencies
- The power transfer from Turkey to UCTE must not exceed 500 MW during the trial operation



## Project-2 “Rehabilitation of the Frequency Control Performance of Turkish Power System for Synchronous Operation with UCTE”

The reasons for the improvement of project-2 are:

- Results of the test which were performed at
  - Atatürk HPP and Birecik HPP
    - In isolated region operation, stability can not be realized
  
- Results of project-1 are:
  - Need for removing the periodical frequency oscillations
  - Damping of inter-area oscillations
  - Need for taking precautions for special system protection

So, in order to make available for operating Turkish Power System in synchronous parallel with UCTE, reliability must be approved on power and frequency control, steady state and transient stability aspects.



## Tasks under the project-2

---

- TASK 1 (%20): Survey of the power plants field tests
  - Task leader: TEIAS
  
- TASK 2 (%25): Design of governor control and parameter optimization
  - Task leader: RWE
  
- TASK 3 (%10): Secondary Control
  - Task leader: HTSO
  
- TASK 4 (%20): Design and Optimization of AVR/PSS
  - Task leader: Swiss Grid
  
- TASK 5 (%15): Special Protection Scheme Restoration Plan
  - Task leader: ESO
  
- TASK 6 (%10): Training
  - Task leader: RTE



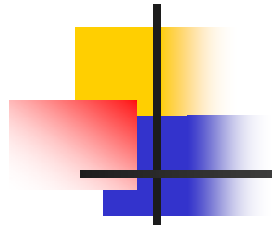
## Next Steps

---

- Since signing of the Service Contract the period will be the pre-project phase to have a clear picture to start the project
  - Task Share, Budget ✓
  - Identification of the Power Plants to be considered in the Project ✓
  
- Draft Contracts will be finalized
  - Association Agreement ✓
  - Service Contract (Meeting with CFCU organized)
  
- Studies in Task 1, 2, 3, 4 and 5 will continue meanwhile

## Prospective Timetable

Stage	Date	Status
Finalization of Technical Analysis (18 months)	April 2007	✓
Completion and Approval of Reports	March 16, 2007	✓
Improvement of the frequency control performance of the Turkish Power System	Mid. of June 2007-2009	
Taking Necessary Measures and Isolated Tests	2007-2009	
Trial Parallel Operation	2009	



Thank you for your attention...

