TURKISH POWER SYSTEM OVERVIEW AND INTERCONNECTION WITH GEORGIAN POWER SYSTEM

TURKISH ELECTRICITY TRANSMISSION CORPORATION (TEIAS)
• MAIN FUNCTIONS OF TEIAS
• TURKISH POWER SYSTEM OVERVIEW
• EXISTING AND PLANNED INTERCONNECTIONS
• BLACK SEA REGION HPPs AND TRANSMISSION INFRASTRUCTURE
• AZERBAIJAN-GEORGIA-TURKEY(AGT) POWER BRIDGE PROJECT
• SPECIAL PROTECTION SYSTEM
• Responsible for the expansion of transmission network infrastructure, construction of new transmission facilities
• Operation & Maintenance of Turkish Electricity Network economically and reliable in compliance with international standards
• Monitoring real-time system reliability, purchase and provide ancillary services Through “Ancillary Service Agreements”
• Electrical Energy Generation Capacity Projection
• Operating the Market Financial Settlement Center (PMUM)
• Studies for the Interconnection Lines
- NUMBER OF SUBSTATIONS
  - 400 kV       86
  - 220 kV       1
  - 154 kV      547
  - 66 kV        14
  TOTAL:        648 (114.746 MVA)

- LENGTH OF TRANSMISSION LINES
  - 400 kV       16401 km
  - 154 kV      33539 km
  - 220 kV        85 km
  - 66 kV        508 km
  - 154 kV and 400 kV cable length 268 km
  TOTAL:        50.801 km
2012

Installed Capacity | 57.071 MW
Consumption       | 241.9 TWh
Peak Load         | 39.045 MW (27.07.2012 14:30)

2013, March

Installed Capacity | 57.794 MW
Consumption       | 60.5 TWh
Peak Load         | 36.135 MW (January, 2013)
## ENERGY CONSUMPTION

<table>
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<tr>
<th>Year</th>
<th>Consumption (TWh)</th>
<th>Increase (%)</th>
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<td>2012</td>
<td>241.9</td>
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INTERCONNECTIONS (Existing Situation)

- **BULGARIA**
  - 145 km 400kV
  - 136 km 400kV

- **GREECE**
  - 130 km 400kV

- **GEOGRIA**
  - 28 km 220kV
  - 160 km 400kV

- **ARMENIA**
  - 80.7 km 154kV

- **NAHCİVAN**
  - 87 km 154kV

- **IRAN**
  - 73 km 154kV
  - 100 km 400kV

- **IRAQ**
  - 42 km 400kV

- **SYRIA**
  - 124 km 400kV

- **TURKEY**
  - 15-30 MW
  - 400 kV Existing
  - 220 kV Existing
  - 154 kV Existing
  - 380 MW

- **cyprus**
  - 124 km 400kV

- **IR**
  - 0 MW
  - 150 MW
  - 40 MW
  - 40 MW

- **KKTC**
  - 42 MW
If ENTSO-E connection will be approved.
If ENTSO-E connection will be approved

**BULGARIA**
145 km 400kV
136 km 400kV

**GREECE**
130 km 400kV

**GEORGIA**
28 km 220kV
160 km 400kV

**ARMENIA**
80,7 km 154kV

**NAHCEVAN**
87 km 154kV

**IRAN**
73 km 154kV
100 km 400kV

**SYRIA**
124 km 400kV

**TÜRKİYE**

400 kV Existing
400 kV Under Construction
220 kV Existing
154 kV Existing

**ENTSO-E**

**TK**

**42 km 400kV**

**40 MW**

350 MW

700 MW

500 MW

600 MW

400 kW Existing

160 kW 400kV

**Turkey**

**Bursa**

**Ankara**

**Izmir**

**Adana**

**Gaziantep**

**Himş**

**Cyprus**

**KKTC**

**Türkiye Elektrik İletim A.Ş.**
Turkey – ENTSO/E CESA

- Trial Run period started with ENTSO-E on 18th of September 2010.
- The first phase system stability tests approved by ENTSO-E Planary Group on 8th of February.
- Without any trade Import-Export tests for the second phase found successfull by ENTSO-E.
- The third phase (import-export with limited trade) related with the synchronous parallel operation of Turkey with European Power System started on 1th of June 2011 and it will be ended on Autumn 2013.
- Trade is limited with 550 MW from Bulgaria and Greece to Turkey; 400 MW from Turkey to Europe via these countries.
HYDRAULIC POWER PLANT SITES IN TURKEY
400 kV ELECTRICITY CORRIDORS IN BLACK SEA REGION

- Existing 400 kV OHLs
- Planned 400 kV OHLs
On April 2009, Turkey, Georgia and Azerbaijan signed the memorandum of understanding to start the Power Bridge Project funded by US-AID from the USA. The project’s main objective is to develop interconnections between Turkey, Georgia and Azerbaijan. Phase I-II reports were prepared by TEIAS.

Regarding Phase-II studies, power quality, load flow, contingency analysis and stability issues are studied in the case of energy import from Azerbaijan and Georgia to Turkey. Also, feasibility of Turkey’s interconnection with Georgia through HVDC Back to Back is reported.

The last meeting of Phase III was held on February 2013 in Tbilisi. In this phase, Net Transfer Capacity calculations are in progress. For NTC calculations, principles of data sharing and data merging are determined. Every country is responsible to study NTC through a merged data. Results of studies done by Turkey, Georgia and Azerbaijan will be discussed in the next meeting on June 2013, in Istanbul.
400 kV OHL from Borcka to Turkey-Georgia border is under construction and will be in service within 2013. The asynchronous interconnection is expected to be in operation after the construction of Borcka-Border OHL. The capacity of Back-to-Back station is 700 MW; however, based on seasonal contingencies of Turkey and Georgia, NTC may below 700 MW.

Construction of 154kV Batumi-Muratlı transmission line together with a 350MW DC Back-to-back station at Georgian side are planned, tendering process for the construction of this line and relevant facilities are in the process. The interconnection is expected to be in operation in 2015.
There are two 400 kV electricity corridors from Borcka through central Anatolia. These two corridors constraint energy transfer. If one of two OHLs is tripped off, other OHL can be overloaded. Any failure on one of the OHLs may lead to regional blackout.

To avoid problems like regional blackout, Special Protection System is designed as a solution. SPCs will be constructed in:

- Altınkaya HPP
- Çarşamba SS
- OMW NGCC
- Borcka HPP
- Deriner HPP

SPSs will monitor power flows of critical OHLs and in case of emergency, units from power plants and import from Georgia will be decreased to specific amounts which will be calculated.
Thank you for your attention