

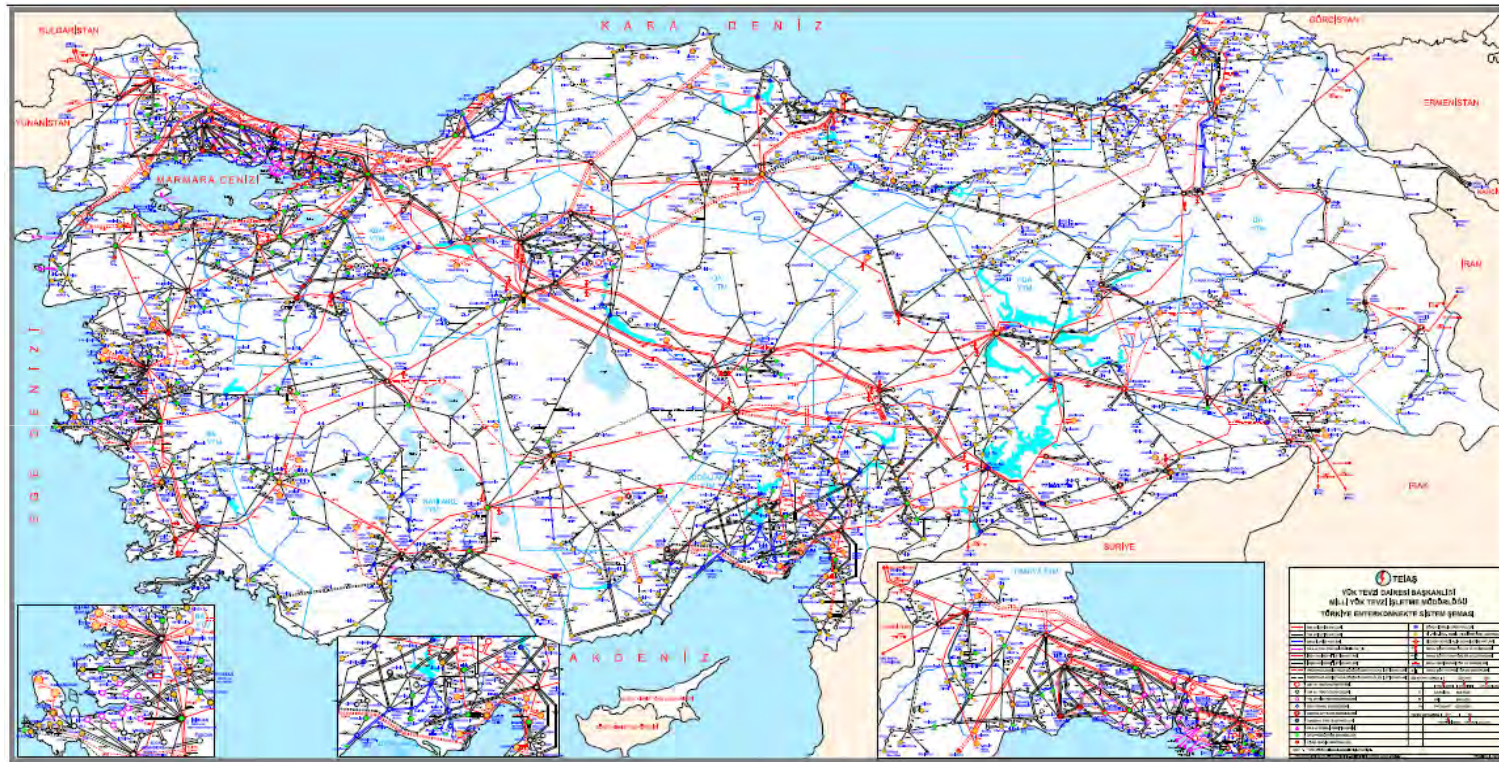


TÜRKİYE ELEKTRİK
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TURKISH POWER SYSTEM

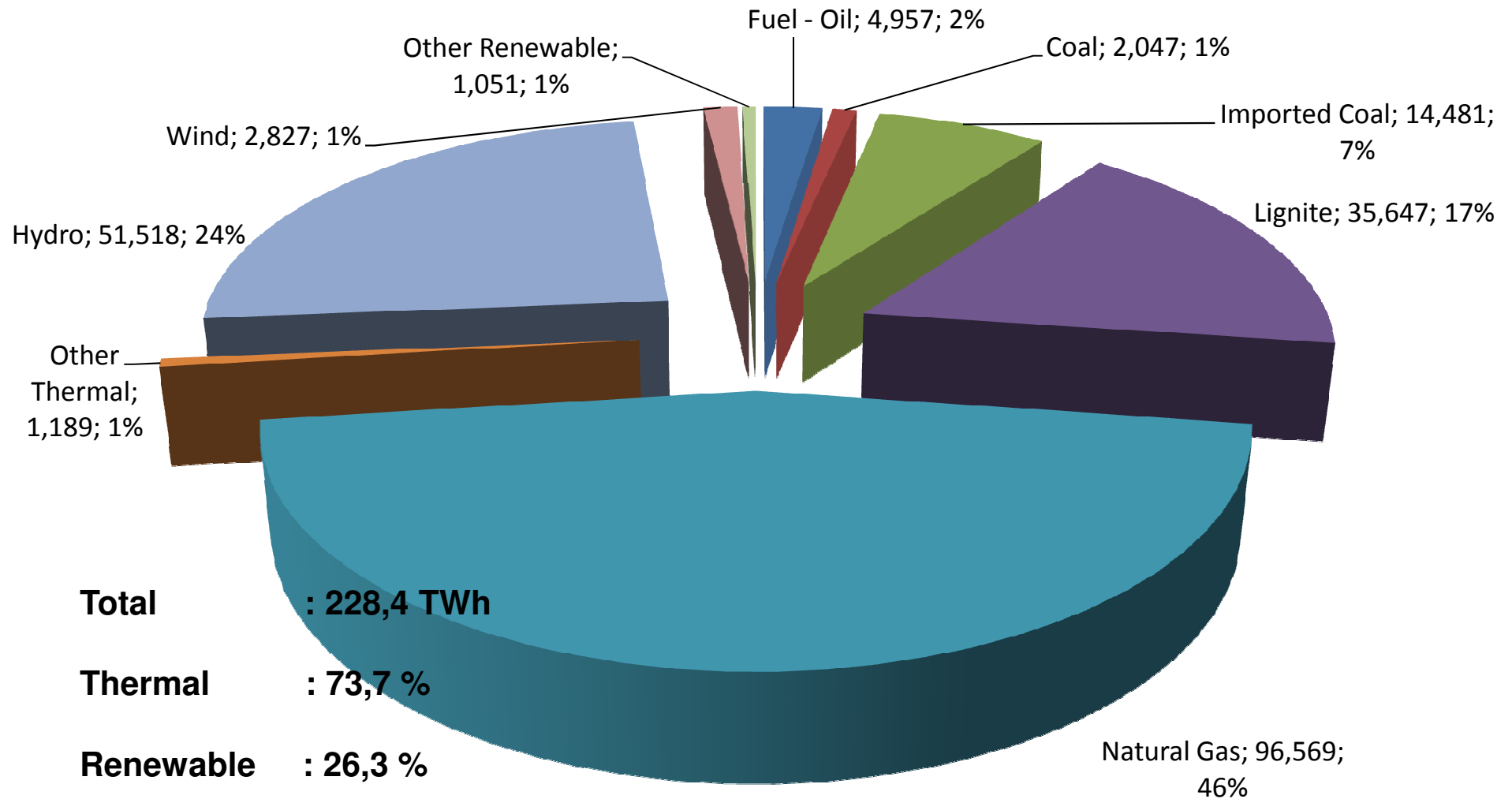
TURKISH ELECTRICITY TRANSMISSION CORPORATION
(TEIAS)

30 May 2012



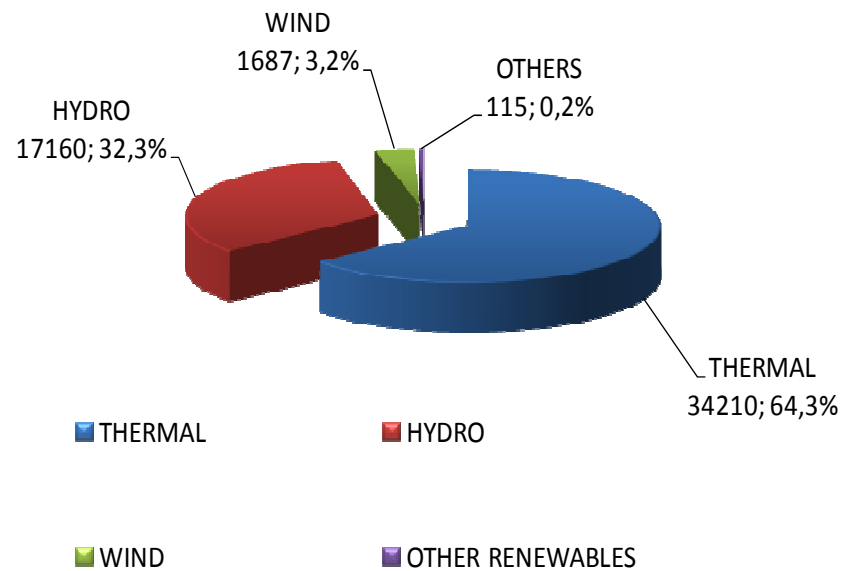
- NUMBER OF SUBSTATIONS	
- 400 kV	78
- 220 kV	2
- 154 kV	526
- 66 kV	13
TOTAL:	619 (105.226 MVA)

LENGTH OF TRANSMISSION LINES	
- 400 kV	16027 km
- 154 kV	32920 km
- 220 kV	85 km
- 66 kV	509 km
- 154 kV and 400 kV cable length	240 km
- TOTAL	49.541 km





INSTALLED CAPACITY (DECEMBER 2011)



Installed Capacity : 53.235 MW

Renewable(hydro,wind,jeo.) : 36 %

Thermal : 64%

Peak Load (2010) : 33.392 MW

Peak Load (2011 July) : 36.122 MW



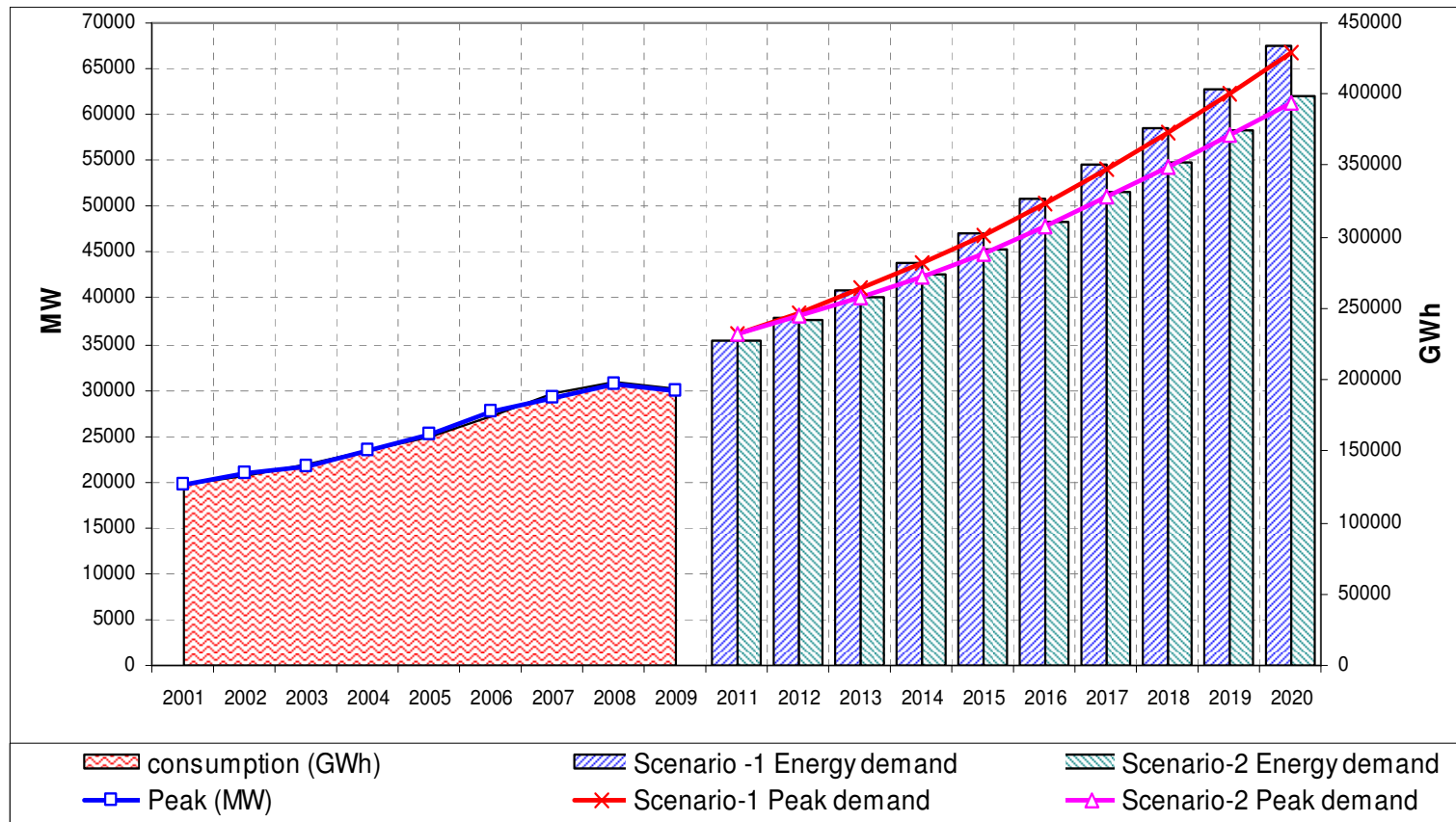
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CONSUMPTION

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Consumption (TWh)	114,0	118,5	128,3	126,9	132,6	141,2	150,0	160,8	174,6	190,0	198,1	194,1	210,4	229,3
Increase (%)	8,1	3,9	8,3	-1,1	4,5	6,5	6,3	7,2	8,6	8,8	4,3	-2,0	8,4	9,0



PEAK LOAD AND ELECTRICITY CONSUMPTION 2001-2020





INTERCONNECTIONS





Country	Voltage Level (kV)	Line	(MW)	Expected Commissioning Year
Georgia	400	Akhaltsikhe(Georgia)- Borçka(Turkey)	700	2012
	154	Batumi(Georgia)- Muratlı(Turkey)	350	2013
Syria	400	Birecik (Turkey)- Aleppo(Syria)	600	under study
Iraq	400	Cizre(Turkey)- Mosul(Iraq)	-	2013
Iran	400	Van(Turkey)- Khoy(Iran)	600	-



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Restructuring and Reforming the Electricity Sector in Turkey



- Sweeping programme of economic reforms and restructuring, supported by European Union, IMF and World Bank, fully extending to energy sector
- In compliance with the EU's "Electricity Directive" (EC 96/92)
- To align the industry with the principles applicable to the EU member states and Internal Market for Electricity within EU
- To establish a favourable environment for private investments



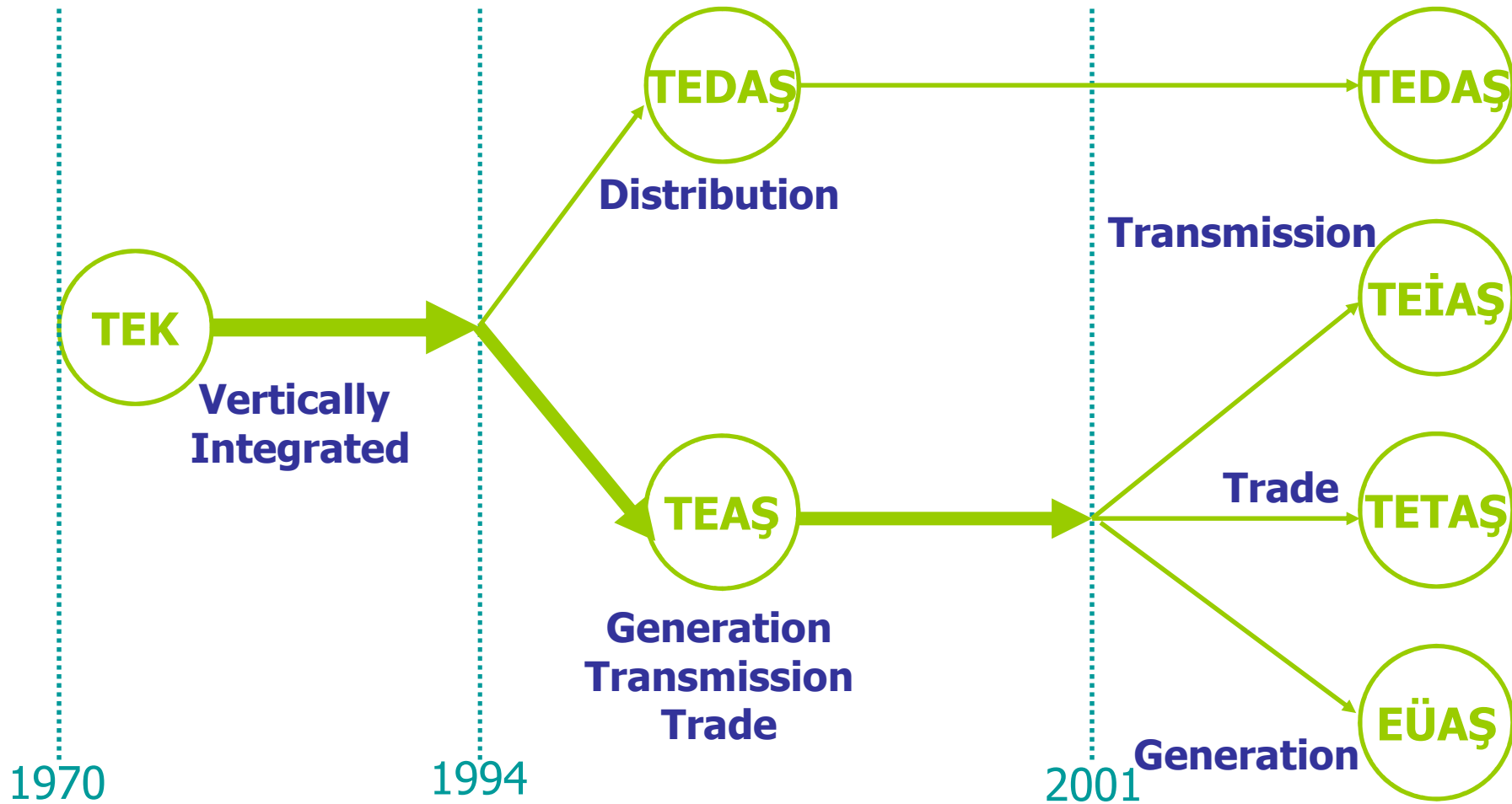
- The arbitration issue solved through the amendments to the constitution under the Law No:4446 of August 1999.
- By this law, local and international arbitration became applicable to the private power investment contracts.
- Electricity Market Law (3 March 2001)



- An autonomous Energy Market Regulatory Authority governed by the Board
- Licensing framework for market participants
- An energy market based on bilateral contracts between market participants and a balancing market
 - Balancing and Settlement mechanism started its operation on 1st August 2006
- Eligible consumer concept to ensure freedom for eligible consumers to choose their suppliers
- Regulated Third Party Access
- A transition mechanism to be implemented over a two year program



- Turkish Electricity Transmission Co.
 - Transmission system owner & operator (TSO)
 - Balancing Market Operator
- Market Opening (3 March 2003)
 - For eligible consumption the limit was 480 MWh / year in 2009 but this limit decreased to 100 MWh/year in 2010 and to 30 MWh/year in 2011.
 - Distribution Co.s eligible
- Import & Export by
 - Turkish Electricity Trading & Contracting Co.
 - Private wholesale companies
 - Retailers (Also Dist. Co.s with retailer license)





- Transmission system owner and operator (TSO)
- Responsible from the Electricity Market Balancing and Settlement
- Provision of connection to and use of transmission system services to all users without discrimination
 - Through “Connection and Use of System Agreements”
- Monitoring real-time system reliability, purchase and provide ancillary services
 - Through “Ancillary Service Agreements”
- International interconnection activities
 - Development of infrastructure
- Perform the capacity projection of Turkish Power System



- No responsibility for trade of electricity
 - By Law and transmission license
- Revenue from charges for provision of transmission services
 - Use of system
 - Connection
 - System Operation
- Revenue regulation by EMRA
 - Revenue cap: the annual revenue cannot exceed the limit set by EMRA which is defined for every year.



- Use of Transmission System (TUoS) Tariff
 - Related to the cost of installing, operating and maintaining transmission system for the bulk transfer of electricity and system security and quality of supply
 - Paid by all users based on their capacity
 - 50 % of revenue from Generation
 - 50 % of revenue from Demand
 - Revenue regulated by EMRA (revenue cap)

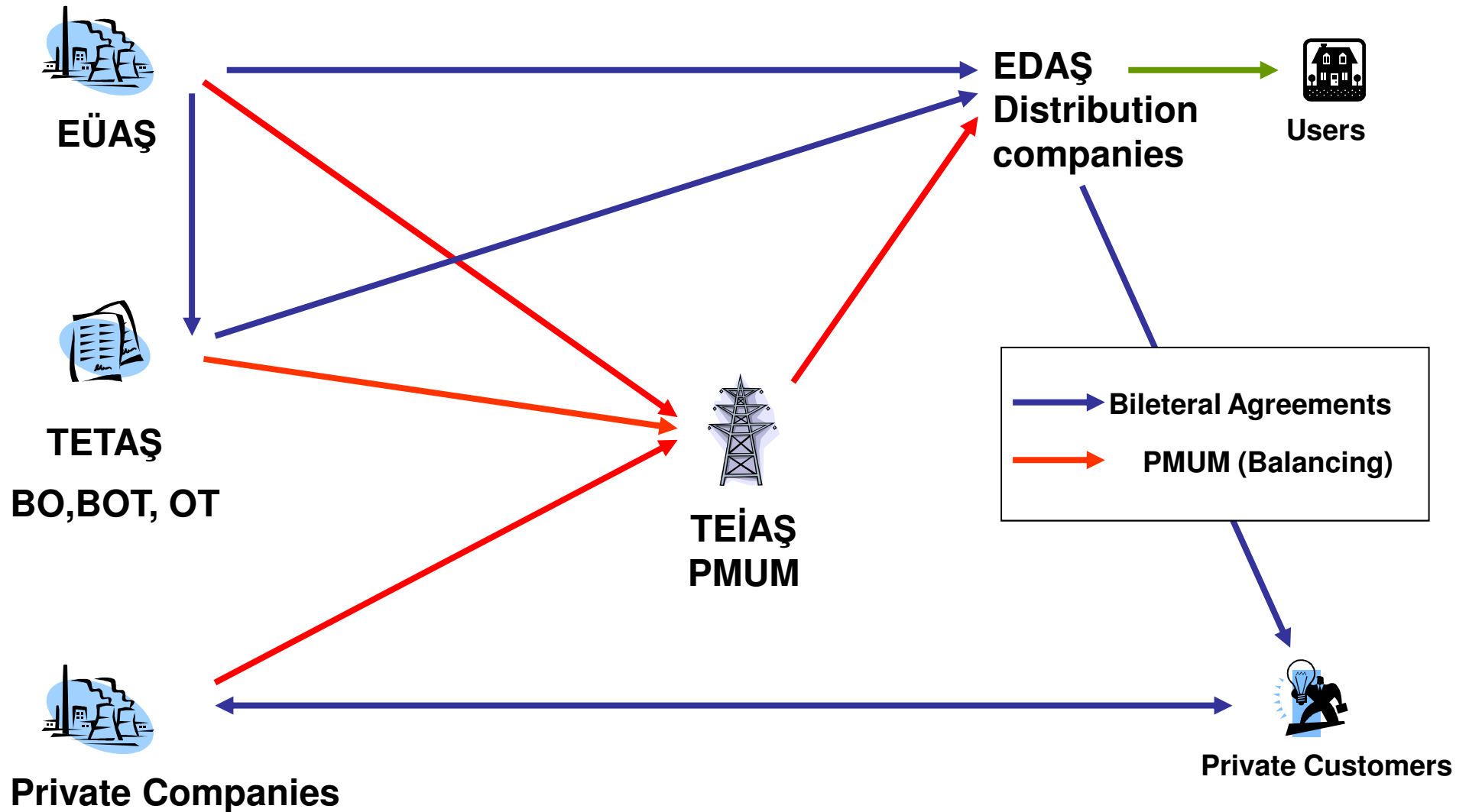


- Based on the Long Run Marginal Costs
 - Investment Cost Related Pricing (ICRP) methodology
- Zonal
 - 22 Generation & Distribution Zones
 - For Generation: 0 – 10 \$ / kW-year



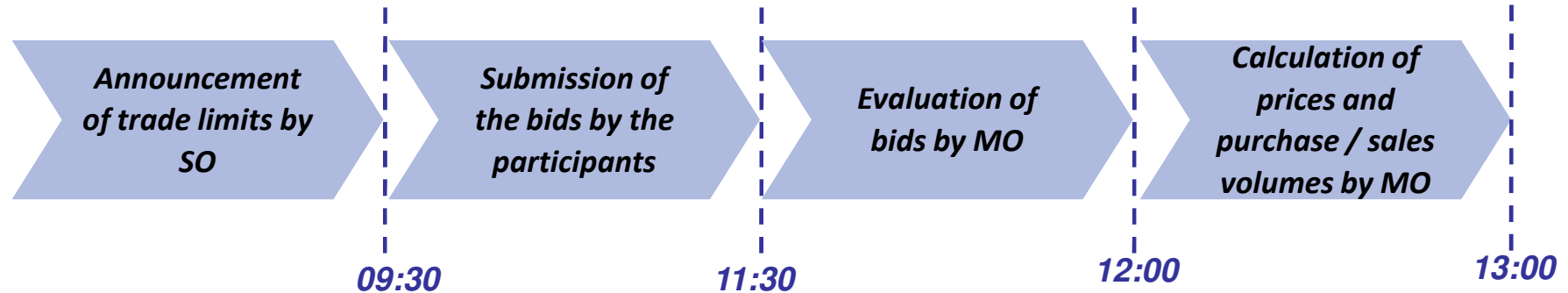
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Electricity Market





- **Balancing and Settlement Mechanism started its operation on 1st August 2006**
- **Day ahead planning and Balancing Power Market started its operation on 1 st December 2009**
- **Day ahead market was started operation in 01 DEC 2011.**
- **Together with the day ahead market;**
 - **Market participants have the opportunity to balance their generations or/and consumptions and bilateral contract obligations,**
 - **Reference price for electricity raises**
 - **Balanced system to the system operator at day ahead stage is provided**
 - **A tool to the System Operator to carry out congestion management at day ahead stage is provided by means of market splitting**
- **In day ahead market, participants submit their bids in portfolio basis.**
- **Both consumption and generation facilities submit energy sales or purchase bids, and demand side participation is more active then.**



- Each day until 09:30; *System Operator* determines hourly transmission capacity between trade zones and market participants are notified about it.
- *Market Participants* submit their bids for each hour for the following day until 11:30.
- *Market Operator*
 - checks the consistency of bids together with the collateral amount of that participant until 12:00.
 - Calculates the day ahead market price for each hour and for each trade zone and notifies the market participants regarding their energy sales and purchase volumes until 13:00
 - Published sales and volumes with price at hours 14:00



Balancing Power Market

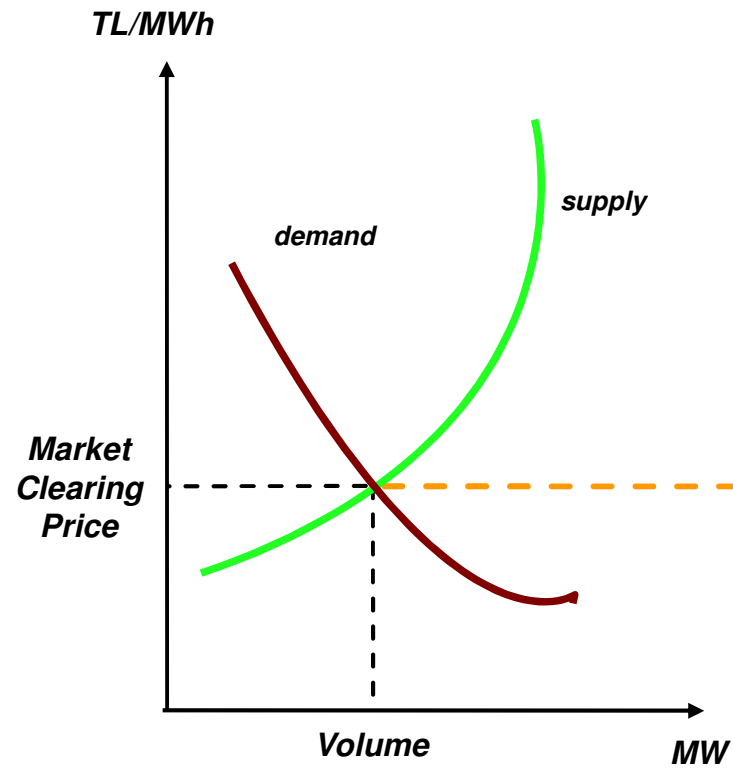


- Balancing Power Market is the organized wholesale electricity market, which is operated by the SO and where the reserve capacity, obtained by the change in output power within 15 minutes, is sold or purchased, to serve the purpose of real-time balancing of demand and supply,
- Market participants who own balancing entity registered under their own account are obliged to participate in BPM,
- Instructions regarding BPM can be notified at any moment starting from the end of the bid submission period until the end of the relevant hour,
- The system marginal prices for each hour, is determined after four hours following the related hour and is announced to market participants by the SO.

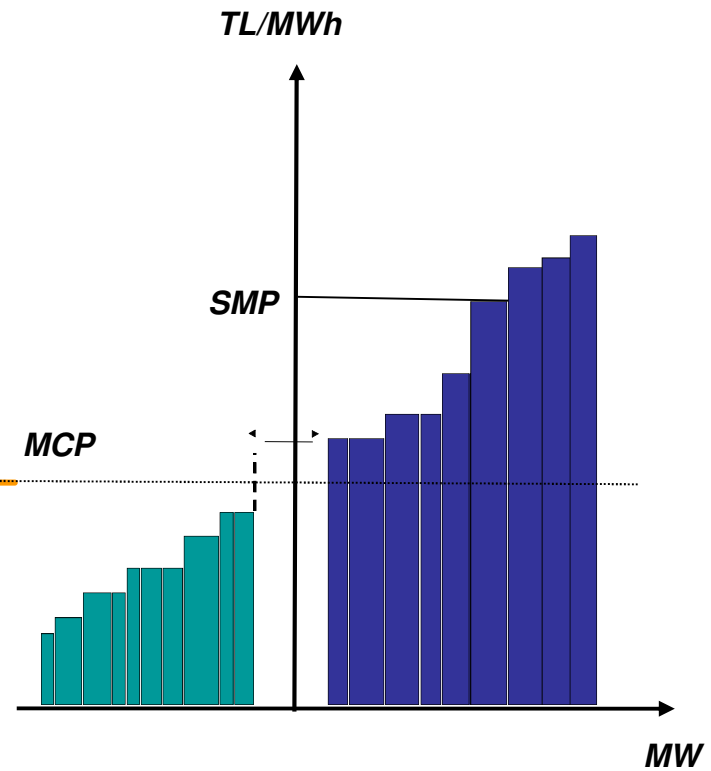


Price Relationship between DAM and BPM

Day Ahead Market
Price Determination



Balancing Power Market
Price Determination





Settlement of Day Ahead Market

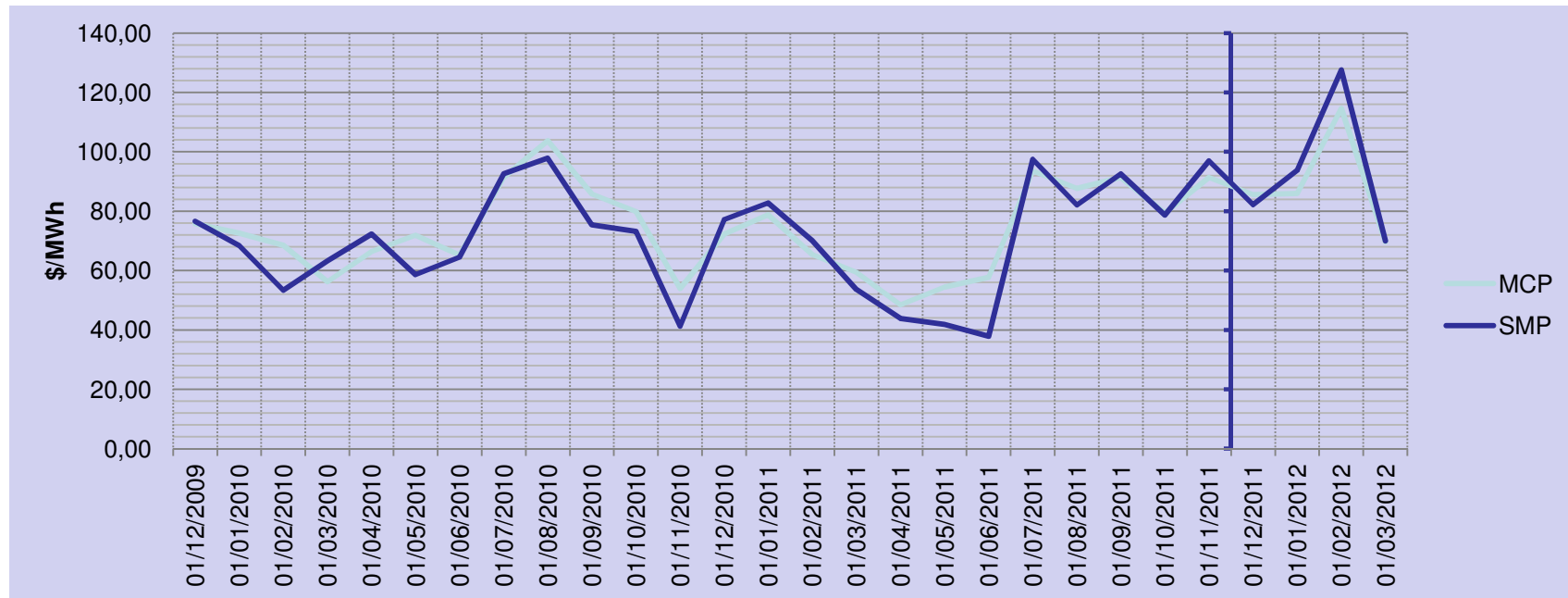
Receivable / payable of each participant is calculated as a result of multiplication of day-ahead price of related hour and sales / purchasing volume that occurred in day ahead market, and daily advance payments is done in the delivery day.

Settlement of Balancing Power Market

Accepted offers and bid volumes, issued for balancing purposes, are settled by multiplying the actual energy sales / purchase by the hourly marginal price.

Settlement of Imbalances

Energy deficit / surplus are settled by a two prices mechanism. Imbalances are settled by multiplying the energy imbalance volumes by the MCP or SMP, which is worst for that market participant.

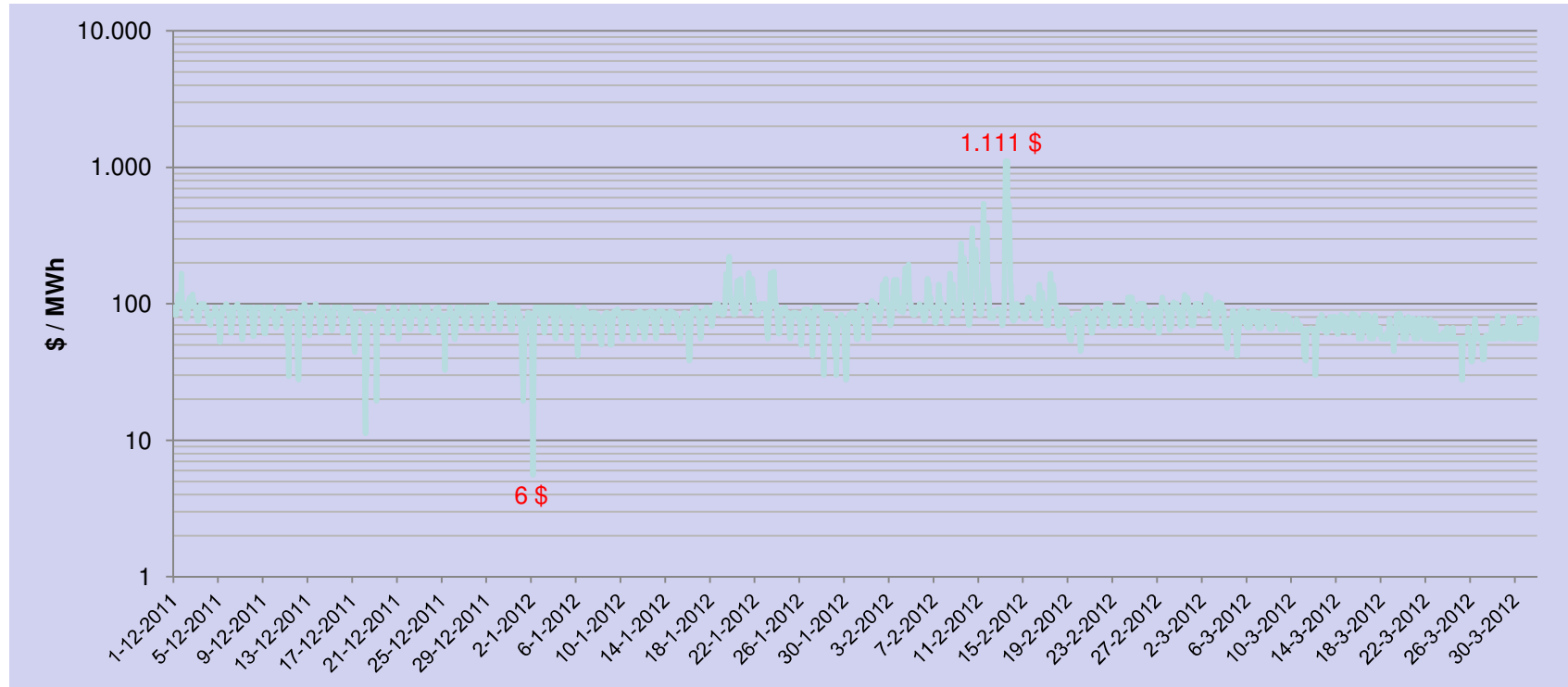


- Demand is increasing 8-10% each year. Although demand is higher than before, due to hydro generation, prices are sometimes lower than before.
- Average prices since December, 2011, when the Day Ahead Market has commenced, to the end of March, 2012 is 160 º/MWh (around \$89) .
- Realized average of SDAP in 2010 is 133 º/MWh and 134 º/MWh for the 2011 (around \$74) .



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Market Clearing Prices Since DAM Opening



- We don't have price limits but we have technical price limits. The lower is "0" and the upper is "2,000" (about 1,111\$).
- We faced 3 times on same day, 13th of March 2012 since DAM commence. Due to insufficient gas pressure in pipe lines.



The Turkish transmission system is operated by the National Control Centre (NCC) and 9 Regional Control Centers (RCCs).

NCC → Ankara

Regional Control Centers

- ❖ **Thrace RCC** → Istanbul
- ❖ **North West Anatolia RCC** → Adapazari
- ❖ **North East Anatolia RCC** → Samsun
- ❖ **West Anatolia RCC** → İzmir
- ❖ **West Mediterranean RCC** → Antalya
- ❖ **Central Anatolia RCC** → Ankara
- ❖ **East Anatolia RCC** → Erzurum
- ❖ **South East Anatolia RCC** → Elazığ
- ❖ **Cukurova RCC** → Adana



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NATIONAL CONTROL CENTER





TÜRKİYE ELEKTRİK
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REGIONAL CONTROL CENTERS





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RECENT DEVELOPMENTS IN TURKISH POWER SYSTEM AND INTERCONNECTIONS



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Hydraulic Power Plant Applications





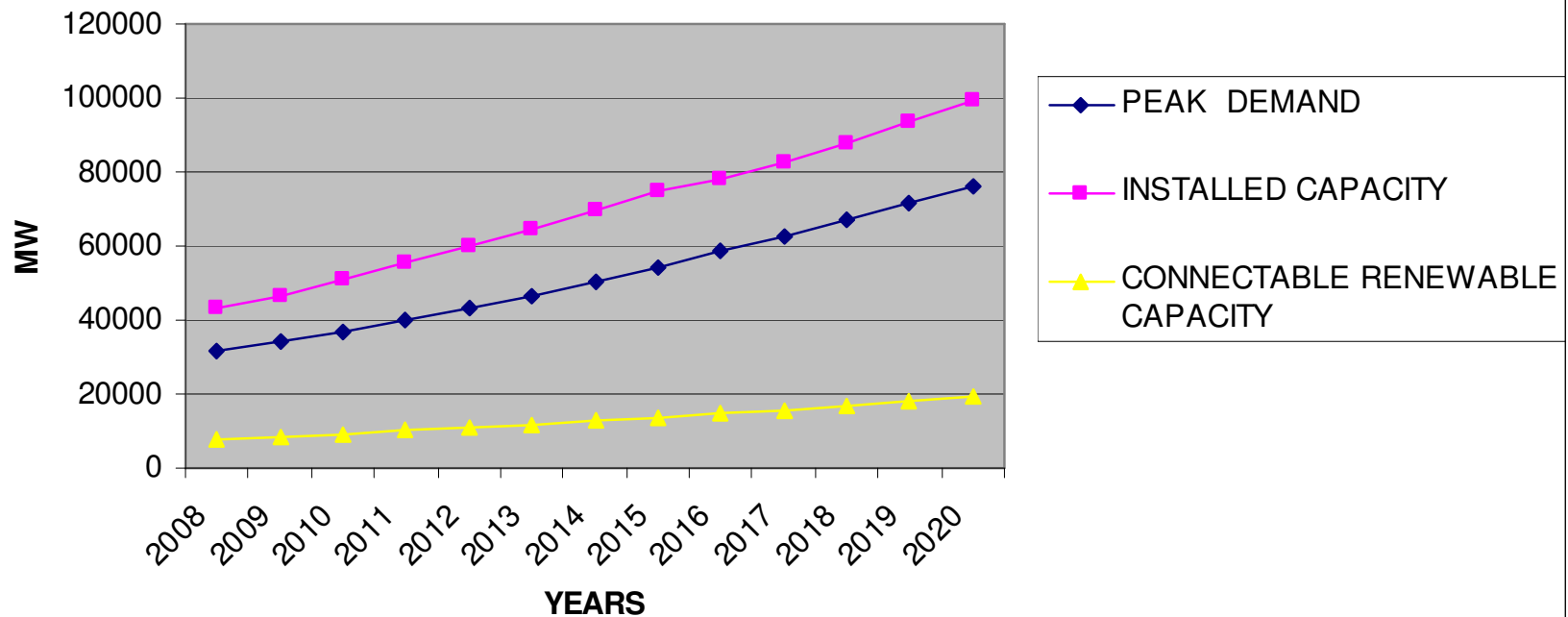
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Wind Power Plant Application Areas





INSTALLED CAPACITY AND PEAK LOAD OF TURKEY ACCORDING TO THE YEARS AND AVAILABLE RENEWABLE CAPACITY CAN BE CONNECTED TO THE SYSTEM





Incentive System for Windfarm Projects in Turkey

~ Investment Incentive Certificate by Republic of Turkey Prime Ministry Undersecretariat of Treasury

Exemption of corporate income taxes, VAT

Exemption of custom expenses for im- and exportation of materials

~ Electricity Sale-Price Guarantee (for 10 years)

Nominal 7,3 USD-ct/kWh

~ Electricity Sale-Price Guarantee additional for Local Content (for 5 years)

0,6 USD-ct/kWh for towers

0,8 USD-ct/kWh for rotor blades

1,0 USD-ct/kWh for generator and power electronic

1,3 USD-ct/kWh for mechanical part / nacelle

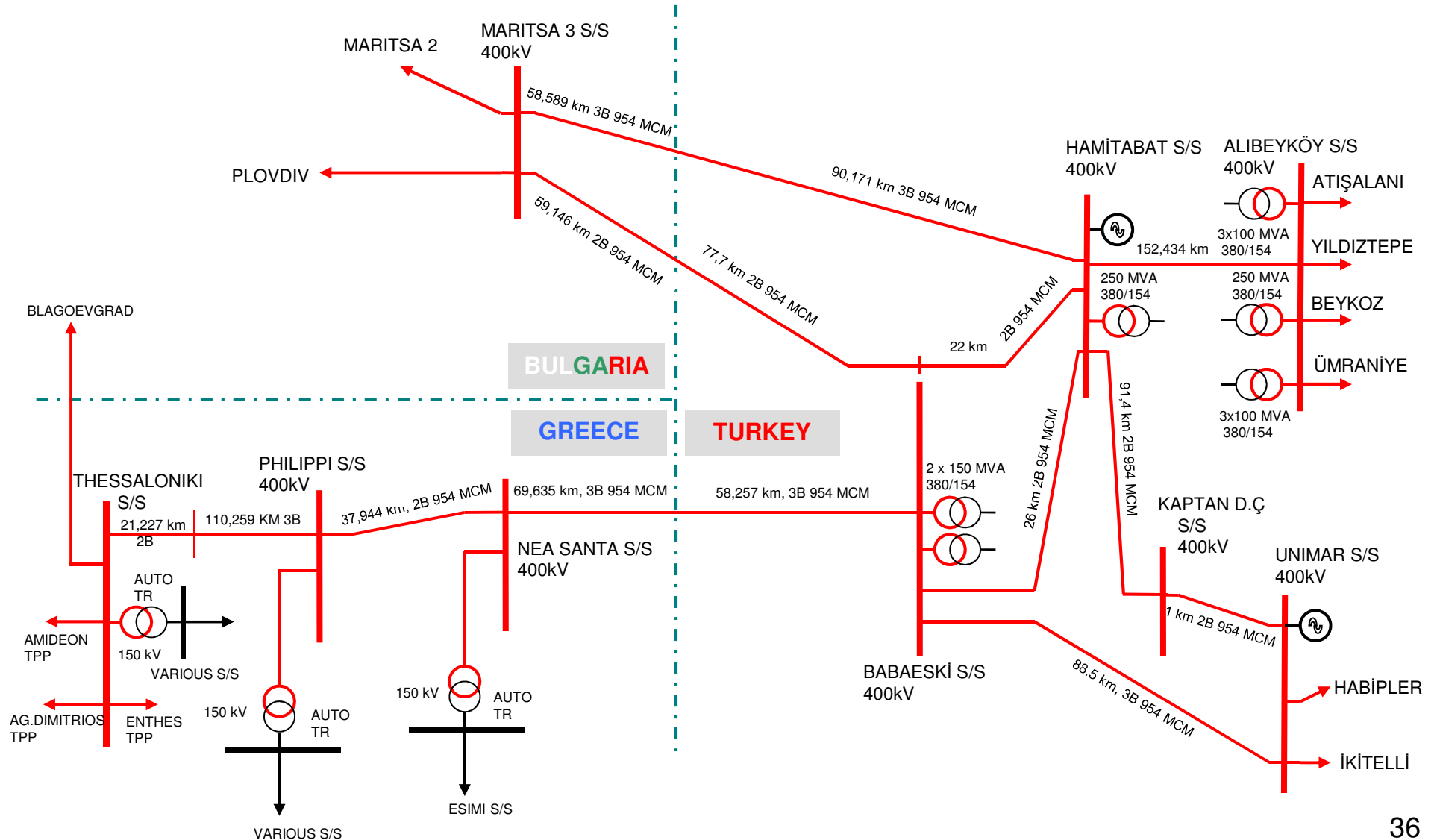
~ Electricity Sale on Market Operator (Piyasa Mali Uzlaştırma Merkezi (PMUM))*

System Marginal Price, which depends on the demanded electricity and the electricity production have to be predicted 24 hours before.



Amendment to Renewables Law (No:6094)

- Law includes regulations regarding the promotion of renewable based electricity generation. In addition, it covers the procedures and principles for the conservation of the renewable energy resource areas, certification of the energy generated from these resources and utilization of these resources.
- Amendment to Law in 2011;
 - A new support scheme is introduced. Different feed-in prices for different renewable based electricity generation.
 - 7.3 US cents per kWh for hydro and wind
 - 10,5 US cents per kWh for geothermal
 - 13.3 US cents per kWh for solar and biomass (including waste gases)
 - In addition, a certain support of 0.4 to 3.5 US cents per kWh is also given to the plants for the utilisation of domestically manufactured technical equipments.
 - The implementation period of the incentive mechanism covers the power plants to be commissioned before 31.12.2015 with the Law (previously: 31.12.2011).





Turkey-UCTE (ENTSO-E) Connection:

1. **Complementary Technical Studies for the Synchronization of Turkish Power System with the UCTE System** (2003 Programming - finalized with success in April 2007). Within this project, required technical conditions for Turkish Power System was determined, for synchronization with the ENTSO-E Continental Europe Power System.

The system interconnection of Turkey to UCTE is feasible under following conditions:

- 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
2. **Rehabilitation of the Frequency Control Performance of Turkish Power System for Synchronous Operation with UCTE** (2007 Programming - 2010). Within the scope of the project, Turkish Power System is prepared for parallel operation with ENTSO-E.



Turkey-UCTE (ENTSO-E) Connection:

With positive results of these projects, an agreement was signed between HTSO of Greece, Electricity System Operator EAD of Bulgaria, Amprion GmbH and Transpower of Germany and TEİAŞ of Turkey on December, 18th, 2009 on the Procedure Steps and Measures to Achieve the Interconnection of the Turkish Power System with the Continental Europe Synchronous Area of ENTSO-E.

- Tests in Island Mode of Operation were successfully performed under maximum load conditions in January 2010 and under minimum load conditions in March 2010.
- Trial synchronous operation with ENTSO-E Continental Europe System is started at 18 September 2010.
- Commercial exchanges started with +/- 400 MW import, +/- 300 MW export.



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STATCOM





- 2 pieces SPS PLC unit,
 - main unit is at Hamitabat substation,
 - slave unit is at Babaeski substation.
- Equipment have been installed in the Atatürk, Keban and Birecik hydro electric power plants (HPP), and in the Bursa, Adapazarı and Temelli Natural Gas Combined Cycle Thermal Power Plants (NGCCTPP) for GD if needed



Load Shedding:

- B. Çekmece
- İkitelli
- Bağcılar
- Davutpaşa
- Habibler
- Yıldıztepe
- Yenibosna
- Babaeski
- Tepeören
- Paşaköy

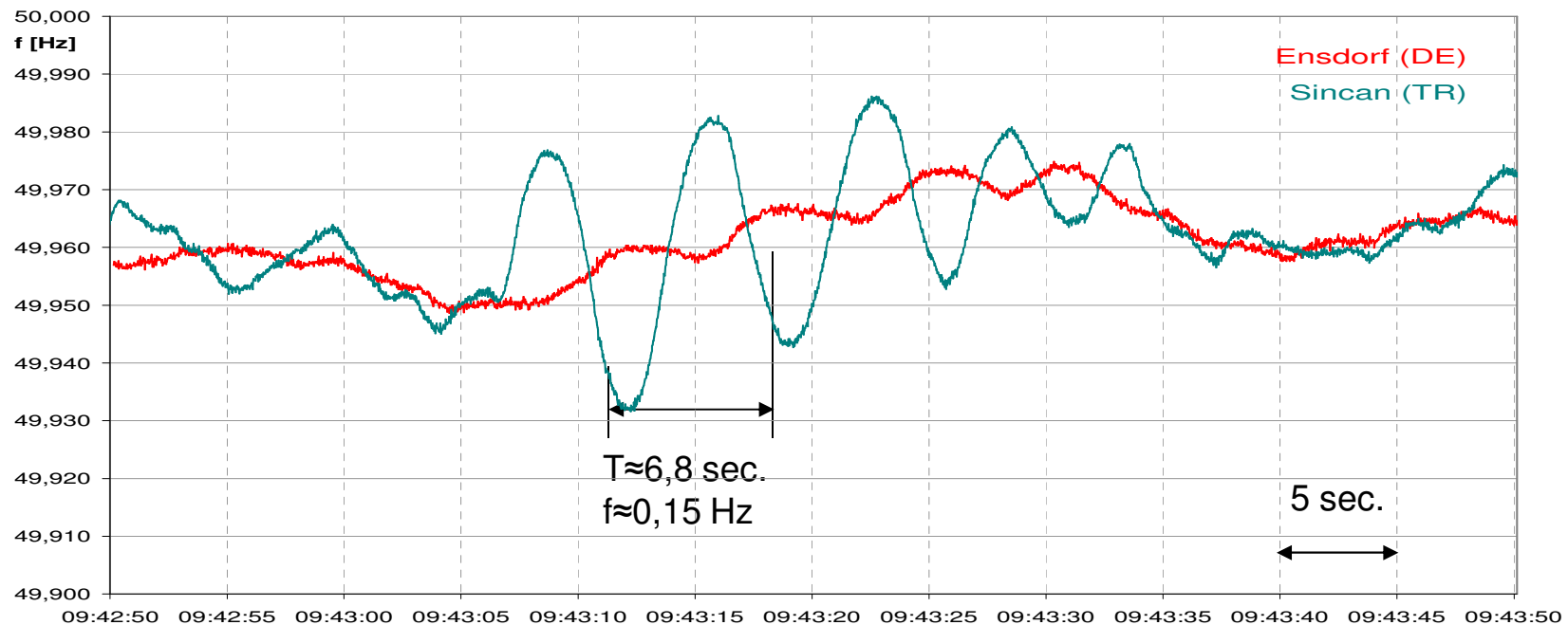
Generation Dropping:

- Atatürk HPP
- Karakaya HPP
- Birecik HPP
- Bursa NGCCTPP
- Adapazarı NGCCTPP
- Temelli NGCCTPP





On 18 September 2010 at 9h25 (CET) the Turkish power system was synchronized with the interconnected power systems of Continental Europe.



•WAMS recordings - Synchronisation TR-ENTSO-E CE - 18.09.2010 frequency DE | TR (1 min.)



- $IACEI \geq 175\text{MW}$ of 4sec duration, less than 11% of the total number of samples
- or
- $IACEI \geq 100\text{MW}$ of 4sec duration, less than 33% of the total number of samples over the hour
 - $IACEI \geq 100\text{MW}$ of 15 minute duration, less than 10% of the total number of intervals



- Started since June 2011
 - ENTSO-E -> TR **400 MW**
 - TR -> ENTSO-E **300 MW**
- BG,GR
 - Monthly and Daily Auctions
- TR
 - Monthly Auctions
- TCAT (TEIAS CAPACITY ALLOCATION TOOL)
 - <https://tcat.teias.gov.tr>
 - Auction, Secondary Market, Nomination



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İLETİM A.Ş.

Thank you for your attention

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