WORLD BANK GROUP | KOREA GREEN GROWTH TRUST FUND | Ministry of Economy and Finance | Jeju 제주특별자치도 Jeju Special Self-Governing Province

ENERGY TRANSITION OF TÜRKIYE

A GLIMPSE OF TURKISH POWER SYSTEM AND SMART GRIDS

Joint KGGTF-ESMAP
Energy Breakout Session

ESMAP
Energy Sector Management Assistance Program

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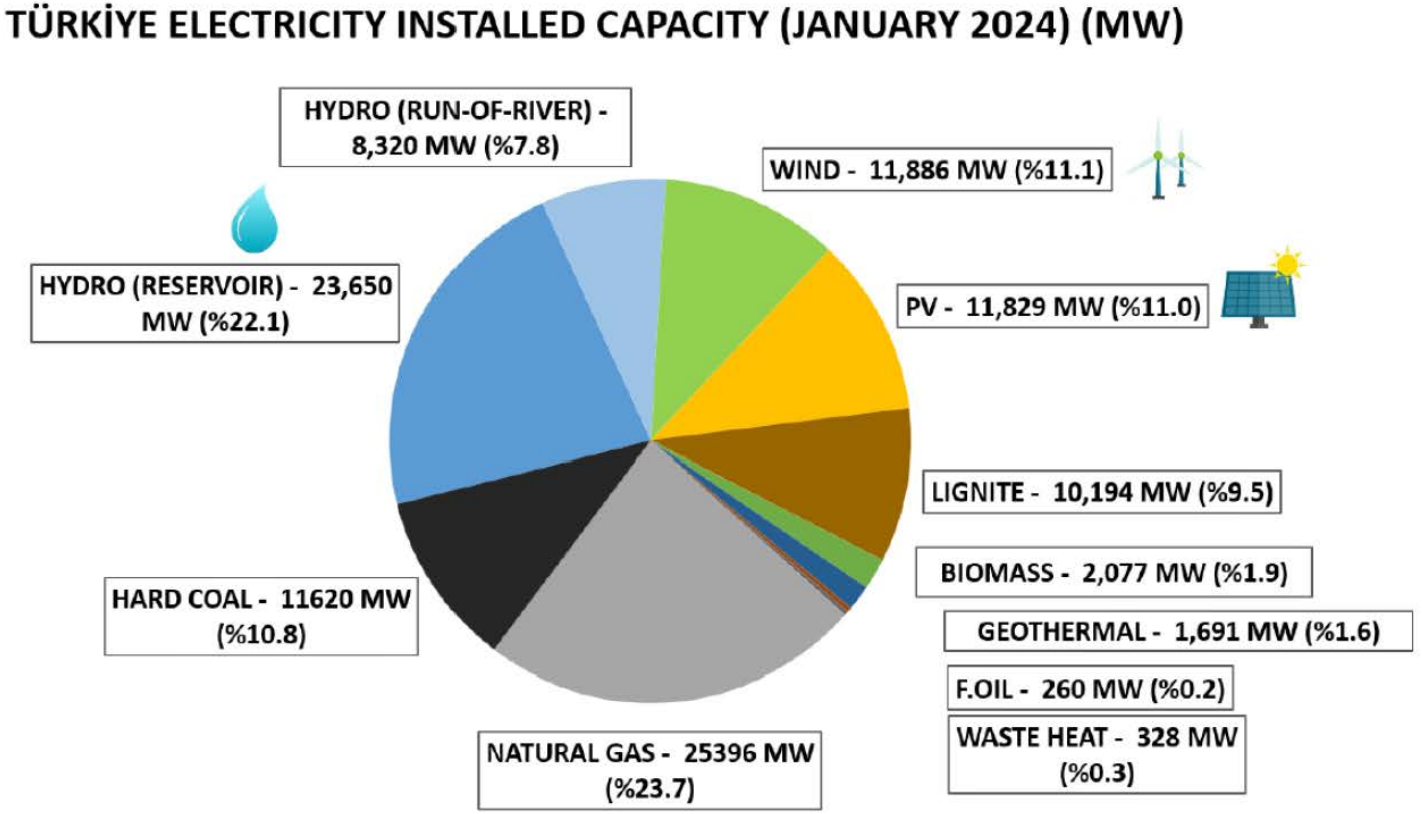
INSTALLED POWER OF TÜRKIYE

~ Renewables %56
~30% hydro
~11% wind
~11% pv
~4% other

~ Fossil Fueled % 44
~24% gas
~20% coal+lignite

TOTAL
~ 107 GW



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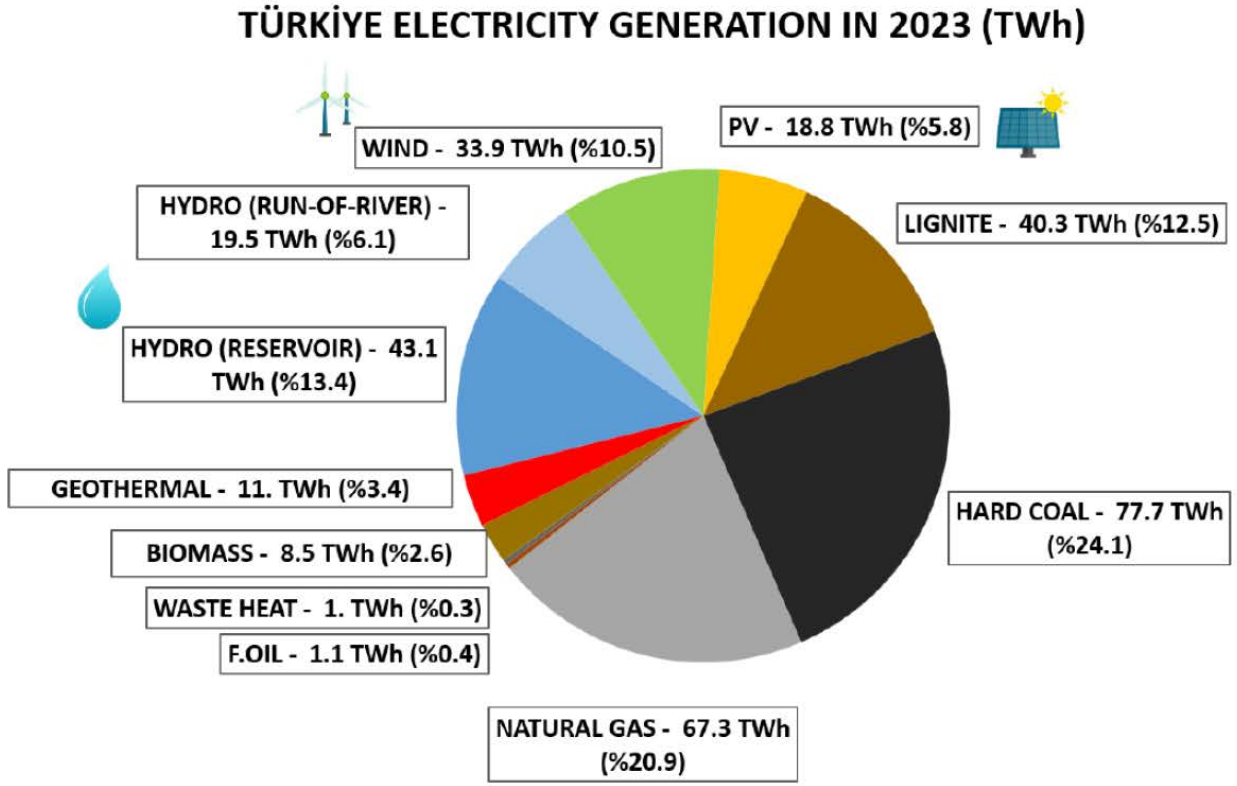
ELECTRICITY GENERATION OF TÜRKIYE

Renewable % 42
~20% hydro
~10.5% wind
~6% pv
~3.5% geothermal
~2.5% biomass

Fossil Fueled % 58
~21% gas
~36% coal+lignite

~1% other

TOTAL
~323 TWh



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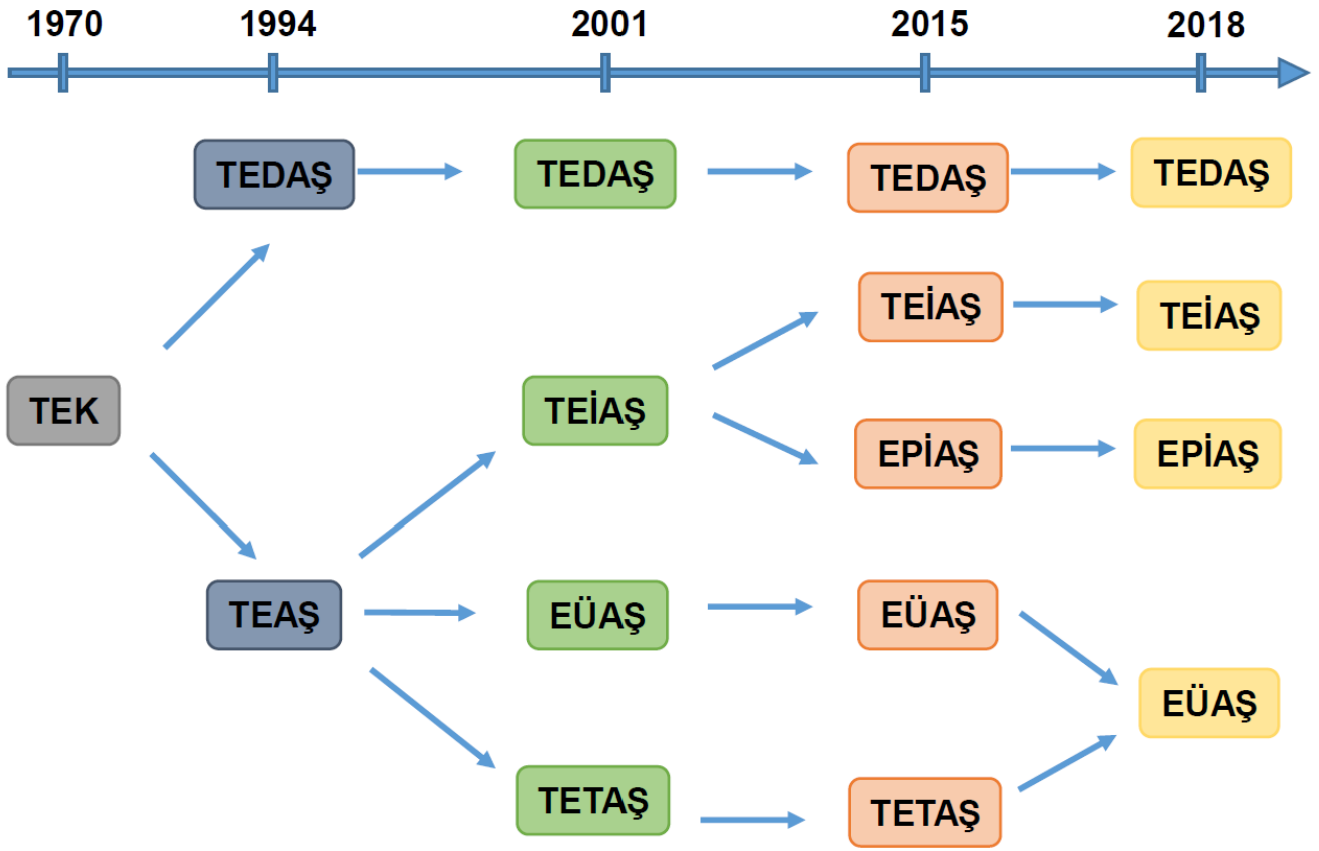
UNBUNDLING OF THE ELECTRICITY MARKET AND ESTABLISHMENT OF TEİAŞ



TEİAŞ, solely owner and operator of the transmission grid. TEİAŞ, is totally state owned company.

TEİAŞ IN TURKISH ELECTRICITY MARKET STRUCTURE

ELECTRICITY MARKET LAW (Law Nr. 6446)

ENERGY MARKET REGULATORY AUTHORITY (EMRA)

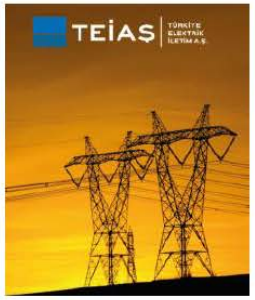
GENERATION

Private Companies
(-w/ License or -w/o License)

EÜAŞ
(State owned)

TRANSMISSION

TEİAŞ



DISTRIBUTION

Private Distribution Companies
(in 21 Regions)

TRADING

Private Companies

MARKET OPERATOR

EXIST (EPİAŞ)

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A BRIEF OVERVIEW OF THE SECTOR AND OUR POSITION IN THE SECTOR

TEIAS constitutes the interaction infrastructure between generation and consumption in the Turkish Electricity Sector

TEİAŞ, as the transmission system operator, plays a critical role in the electrical energy value chain:

- Network connection of generation/consumption facilities,
- Providing grid infrastructure suitable for renewable energy generation,
- Realization of investments that allows the increase in installed capacity,
- Balancing the system,
- Implementing new technologies for a more effective operation.

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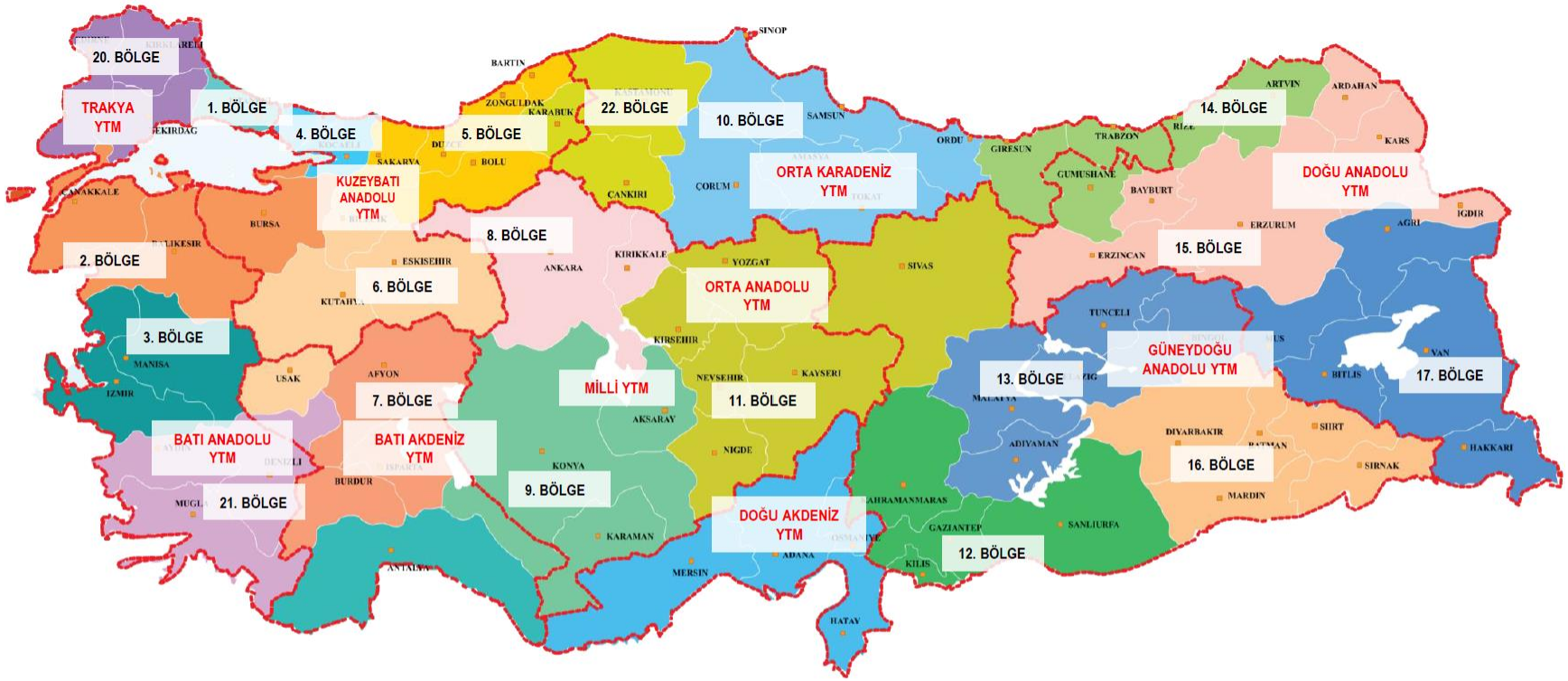
ORGANIZATION



- ❑ 22 Regional Directorates
- ❑ 9 Load Dispatch Operation Directorates
- ❑ 1 National Load Dispatch Center
- ❑ ~17.600 employee (TEİAŞ own ~ 8.200)

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ELECTRICITY TRANSMISSION IN TÜRKIYE BY THE END OF 2023

330,3 TWh
Total Consumption in 2023

55,119 GW
INSTANTANEOUS PEAK (July 2023)

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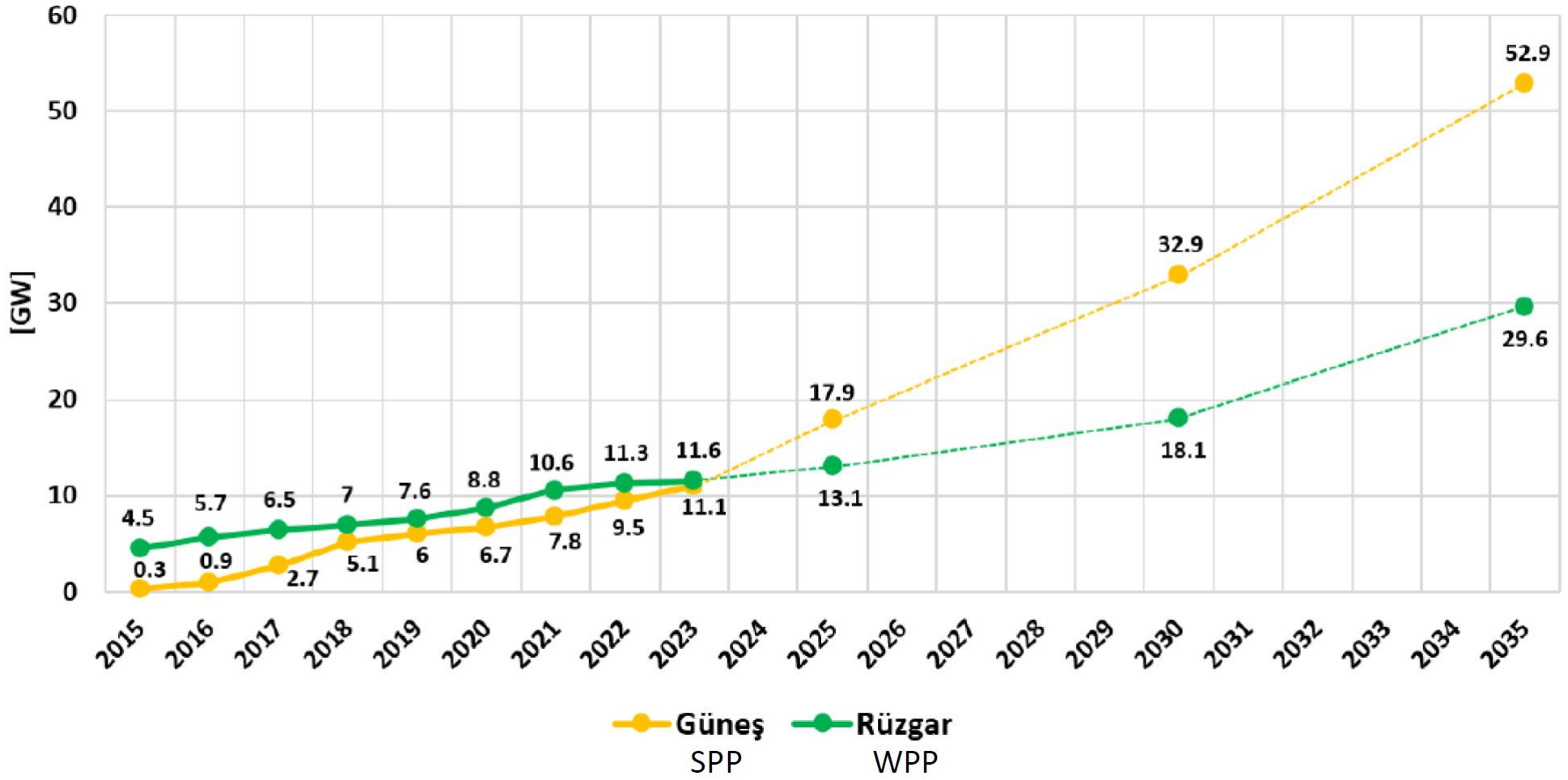
DEVELOPMENT OF WPP –SPP INSTALLED POWER



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IDENTIFIED PROBLEMS AND SOLUTIONS

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TEIAS SCADA/EMS SYSTEM

TEIAS SCADA/EMS SYSTEM

National Load Dispatch SCADA/EMS system which provides technical support for effective operation of transmission includes,

- National Control Center (General Management Building),
- Emergency National Control Center (Gölbaşı),
- 9 Regional Control Centers (Adapazarı, Erzurum, Gölbaşı, İkitelli, İzmir, Elazığ, Antalya, Samsun and Adana).

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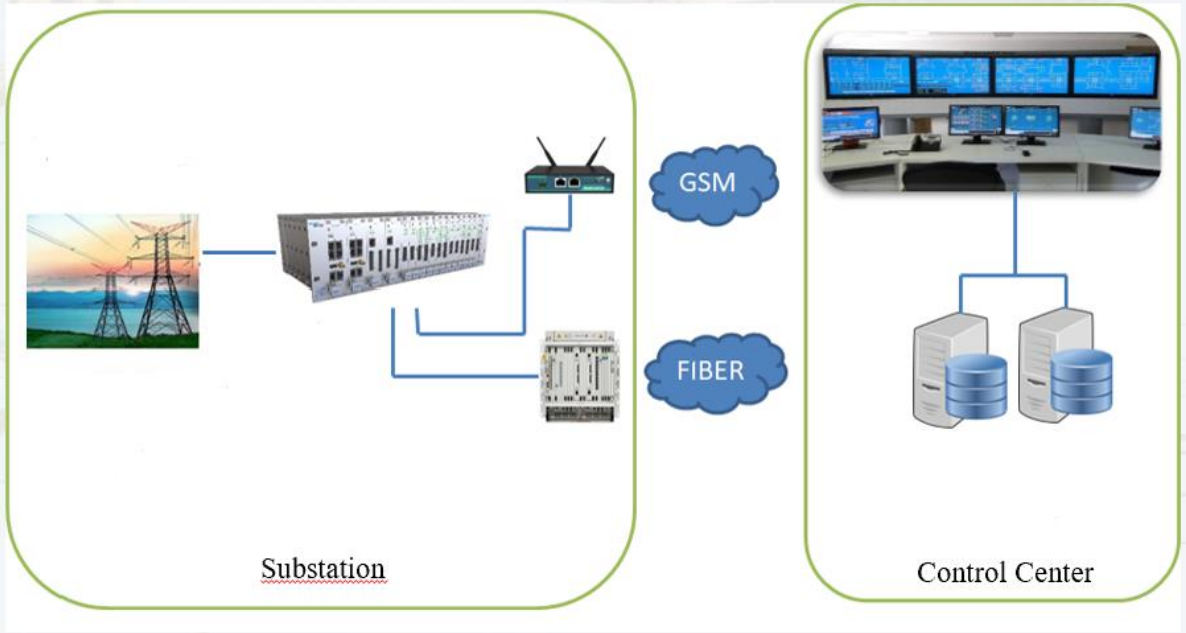
TEIAS SCADA/EMS SYSTEM

TEIAS SCADA/EMS SYSTEM

- SCADA / EMS System, has been established for a more safe, high quality and economical operation of National Interconnected Electrical Network.
- SCADA / EMS System collects data in real time through the Remote Terminal Units (RTU) at about 1450 centers connected from the transmission level.
- The information collected includes analog measurements, status information of switching equipment and alarm information.
- At the same time, thanks to two different archive system of SCADA / EMS System, all historical data can be accessed.



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TEIAS SCADA/EMS FUNCTIONS

TEİAŞ SCADA/EMS Functions are as below:

- **AUTOMATIC GENERATION CONTROL (AGC)**
- **NA (NETWORK ANALYSIS)**
    1. Bus Scheduler
    2. DPF (Dispatcher Power Flow)
    3. DSA (Dynamic System Analysis)
    4. DTS (Dispatcher Training Simulator)
    5. Contingency Analysis
    6. SE (State Estimator)
    7. Study Mode
- **STLF (Short Term Load Forecast)**
- **STWPF (Short Term Wind Power Forecast)**

TEIAS SCADA/EMS SYSTEM PROJECTS

1. *National SCADA Sysytem R&D Studies*

- In order to develop our country's electricity transmission infrastructure with national and domestic facilities, and in order to ensure the security of energy supply of our country, "National Smart Grid Management System" project was initiated and within this scope "National SCADA System R&D Studies" Project which is the first phase of the mentioned Project has been completed.

- Within the scope of the project 1 National Control Center (NCC), 1 Regional Control Center (RCC) and "National SCADA R&D Software" have been designed, supplied and installed, and communication have been provided between the Control Centers installed.

- Within the second phase of this Project 8 other RCCs and EMS Functions shall be included in National SCADA System.

2. *Renewal of Communication and Network Infrastructure of TEİAŞ SCADA/EMS System*

Within the scope of "Renewal of Communication and Network Infrastructure of TEİAŞ SCADA/EMS System" Project; Hardware, software and related systems have been supplied and established for safe operation of TEİAŞ SCADA/EMS so that end-to-end cyber security measures have been taken in Industrial Control Systems (ICS) from Control Centers up to substations.

- Communication protocols of 170 substations have been converted from IEC 101 to IEC 104.
- Data links of 2 Mbps between National Control Center (NCC), Emergency National Control Center (ENCC) and 9 Regional Control Centers (RCC) have been upgraded to data links of 100 Mbps.
- Firewalls and new generation Switches have been established in 110 substations for safe communication of TEİAŞ SCADA/EMS System.

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