ESMAP

Smart Energy Infrastructure Study Tour

South Korea
2024

TURKISH ELECTRICITY TRANSMISSION CORPORATION (TEİAŞ)

TEİAŞ TURKISH ELECTRICITY TRANSMISSION CORP.

ABOUT US

We have a deep-rooted history dating back to the Turkish Electricity Corporation (TEK), which was established in 1970, and since 2001, when we set out under the name of Turkish Electricity Transmission Corporation (TEİAŞ), we advance more determinedly towards bigger goals, with the pride of leaving behind the years full of success.

With our strong legacy from the past, we operate Türkiye's electricity transmission system and network at international standards, in a quality, economical and reliable manner. With our strong financial structure and qualified expert staff, we make a continuous contribution to the economy of our country.

Parallel to the developments in energy needs, we expand our electricity transmission infrastructure day by day, crossing insurmountable mountains and deep straits with our energy transmission lines, and we transmit Türkiye's energy 24/7 with our 17.000 employees, 22 regional directorates and 10 load dispatch centers to all corners of our country.

GENERAL STATUS AND DEVELOPMENT OF THE TRANSMISSION SYSTEM

The main activities of our company are;

- Preparing a transmission investment plan
- Establishing new transmission facilities
- Operate the electrical system
- Conducting international interconnection studies

Basic principles in transmission system development;

- Keeping the quality and continuity of energy supply at the highest level with minimum investment cost
- Designing a system that is economical, easy to operate and open to development
- To use existing facilities throughout their economic life.

GENERAL CONDITION OF THE TRANSMISSION SYSTEM			
	2010 YEAR	END OF 2023	2024 YEAR (JULY)
Power Transmission Line (km)	49.234	73.801	74.674
Cable (km)	211	640	657
Total Line Length (km)	49.445	74.442	75.331
Total Transformer Power (MWA)	99.852	225.055	228.556
Total Transformer Center (Custom)	602	793	802

INSTALLED CAPACITY OF TURKEY'S ELECTRICITY SYSTEM BY FUEL TYPES (2014-2024)

In 2014, the amount of resource-based installed power in our country was 69.518 MW. In the last 10 years it increased by 60% to 114.215 MW. In the same decade, the total capacity of renewable energy sources in installed capacity reached 67.396 MW from 28.006 MW, an increase of 240%.

INSTALLED CAPACITY OF TURKEY'S ELECTRICITY SYSTEM BY FUEL TYPES (2014-2024)

Unit:MW

INSTALLED POWER			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	* 2024
THERMAL	I. CAPACITY	MW	41.801,8	41.903,0	44.411,6	46.926,3	46.908,6	47.663,0	47.793,7	48.228,2	49.724,8	49.840,8	49.247,5
	Contribution	%	60,1	57,3	56,6	55,1	53,0	52,2	49,8	48,3	47,9	44,9	43,1
HYDRAULIC	I. CAPACITY	MW	23.643,2	25.867,8	26.681,1	27.273,1	28.291,4	28.503,0	30.983,9	31.492,6	31.571,5	31.962,4	32.194,5
	Contribution	%	34,0	35,4	34,0	32,0	31,9	31,2	32,3	31,5	30,4	28,8	28,2
WIND	I. CAPACITY	MW	3.629,7	4.503,2	5.751,3	6.516,2	7.005,4	7.591,2	8.832,4	10.607,0	11.396,2	11.806,1	12.369,4
	Contribution	%	5,2	6,2	7,3	7,6	7,9	8,3	9,2	10,6	11,0	10,6	10,8
GEOTHERMAL	I. CAPACITY	MW	404,9	623,9	820,9	1.063,7	1.282,5	1.514,7	1.613,2	1.676,2	1.691,3	1.691,3	1.691,3
	Contribution	%	0,6	0,9	1,0	1,2	1,4	1,7	1,7	1,7	1,6	1,5	1,5
SOLAR	I. CAPACITY	MW	40,2	248,8	832,5	3.420,7	5.062,8	5.995,2	6.667,4	7.815,6	9.425,4	15.613,4	18.712,4
	Contribution	%	0,1	0,3	1,1	4,0	5,7	6,6	7,0	7,8	9,1	14,1	16,4
TURKEY TOTAL	**I. CAPACITY**	**MW**	**69.519,8**	**73.146,7**	**78.497,4**	**85.200,0**	**88.550,8**	**91.267,0**	**95.890,6**	**99.819,6**	**103.809,3**	**110.914,0**	**114.215,1**
	Contribution	**%**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**
RENEWABLE ENERGY (HID+WIND+GEO+OTHER+WASTE+SOLAR)	I. CAPACITY	MW	28.006,1	31.606,1	34.574,5	38.907,9	42.453,3	44.767,4	49.581,6	53.626,8	56.393,2	63.473,4	67.396,4
	Contribution	%	40,3	43,2	44,0	45,7	47,9	49,1	51,7	53,7	54,3	57,2	59,0

Distribution of Produced Energy by Primary Sources

In the last 10 years, the electrical energy production obtained from renewable energy sources in our country was 52,978 GWh in 2014 and reached 125,800 GWh in 2024 with an increase of 237 percent.

Distribution of Produced Energy by Primary Sources

Unit : GWh

PRİMARY SOURCES			YEARS										
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	* 2024
THERMAL	Production	GWh	200.416,6	179.366,4	185.798,1	212.138,5	209.683,5	175.142,5	182.802,6	222.623,5	198.625,0	199.844,8	142.968,5
	Contribution	%	79,5	68,5	67,7	71,4	68,8	57,6	59,6	66,5	60,5	60,3	54,7
HYDRAULIC	Production	GWh	40.644,7	67.145,8	67.230,9	58.218,5	59.938,4	88.822,8	78.094,4	55.926,8	66.802,5	64.002,4	61.969,9
	Contribution	%	16,1	25,6	24,5	19,6	19,7	29,2	25,5	16,7	20,3	19,3	23,7
WIND	Production	GWh	8.520,1	11.652,5	15.517,1	17.903,8	19.949,2	21.730,7	24.828,2	31.436,7	34.945,4	34.109,0	27.167,9
	Contribution	%	3,4	4,5	5,7	6,0	6,5	7,2	8,1	9,4	10,6	10,3	10,4
GEOTHERMAL	Production	GWh	2.364,0	3.424,5	4.818,5	6.127,5	7.431,0	8.951,7	10.027,7	10.793,2	11.118,8	11.102,1	8.165,2
	Contribution	%	0,9	1,3	1,8	2,1	2,4	2,9	3,3	3,2	3,4	3,4	3,1
SOLAR	Production	GWh	17,4	194,1	1.043,1	2.867,4	7.738,0	9.047,9	10.457,6	12.228,8	13.892,4	17.705,6	16.565,1
	Contribution	%	0,0	0,1	0,4	1,0	2,5	3,0	3,4	3,7	4,2	5,3	6,3
TURKEY TOTAL	Production	GWh	251.962,8	261.783,3	274.407,7	297.277,5	304.801,9	303.897,6	306.703,1	334.723,1	328.379,3	331.148,9	261.533,2
	Contribution	%	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
RENEWABLE ENERGY (HID+WIND+GEO+OTHER+WASTE+SOLAR) TOTAL	Production	GWh	52.978,7	84.175,1	90.981,3	88.111,4	98.741,3	133.379,2	128.360,4	118.567,5	137.842,5	140.159,6	125.800,2
	Contribution	%	21,0	32,2	33,2	29,6	32,4	43,9	41,9	35,4	42,0	42,3	48,1

*OUR VALUES FOR 2023 ARE GROSS.
*OUR VALUES FOR 2024 ARE PROVISIONAL AND GROSS VALUES AS OF THE END OF SEPTEMBER.

INVESTMENTS

The 2024 Investment Program was prepared in order to supply for the energy demands of the future and to achieve a quality electricity transmission infrastructure for the Turkish power system, which reached 103.589 MW installed capacity in 2022. The investment budget of TEIAS for 2024 is TL 28 billion. A total of 584 projects are included in the 2024 Investment Program. Breakdown of the Investment Program into groups and information about the breakdown is given below:

Summary Of The 2024 Investment Programme	Number Of Projects	Amount Of Project (x Thousand TL's)	Investment Allowance (x Thousand TL's)
Transmission Facilities	534	101.041.300	16.052.038
Operation Group	34	23.008.310	11.068.482
Machinery And Equipments	3	226.000	87.000
Transmission System IT Infrastructure	4	1.549.000	707.000
Surveys	8	500.000	85.480
Sum Total	584	126.324.610	28.000.000

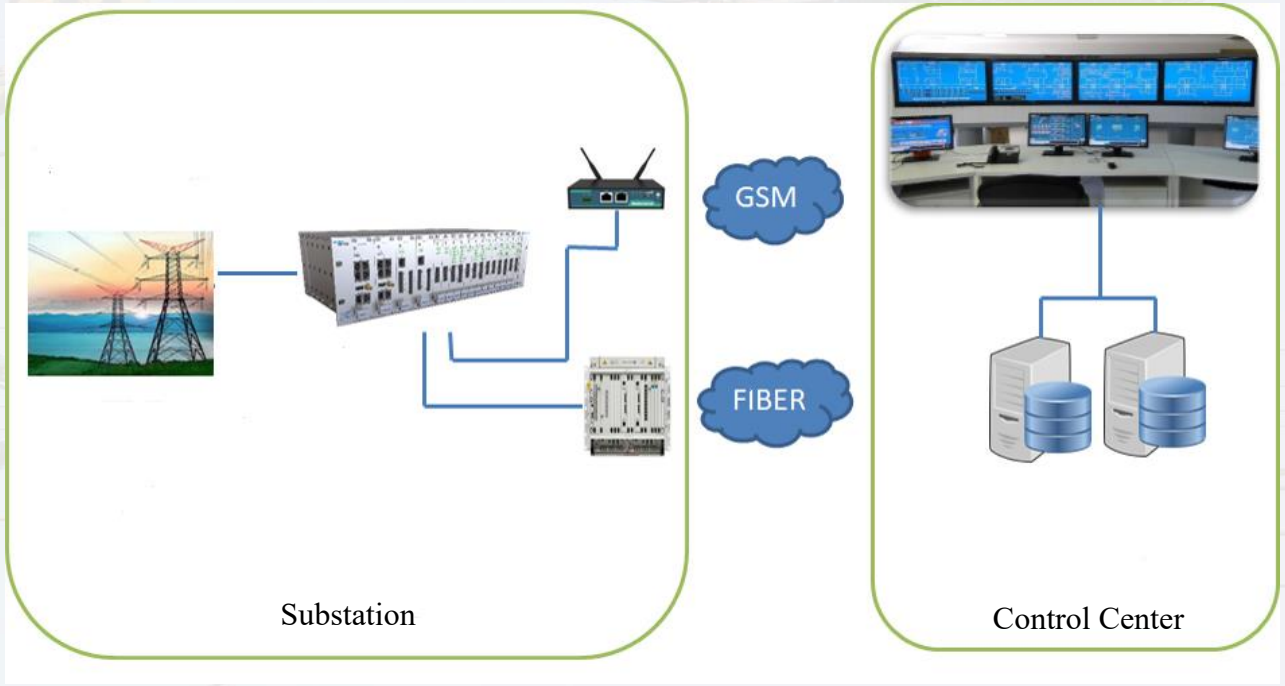
1. TEIAS SCADA/EMS SYSTEM

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

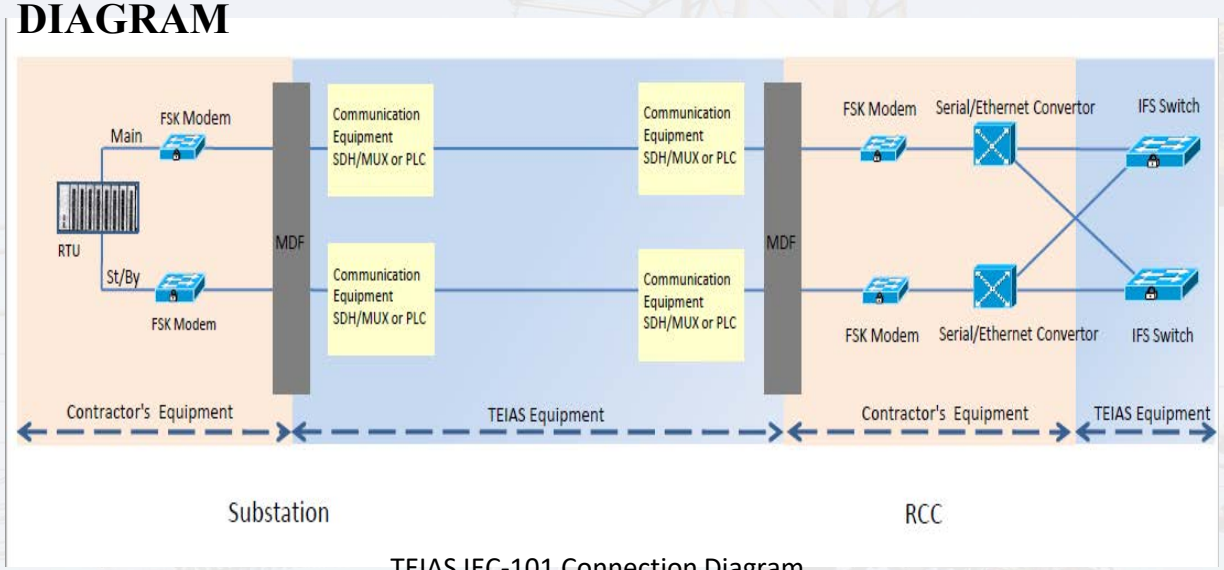
- National Control Center (General Management Building),
- Emergency National Control Center (Gölbaşı),
- 9 Regional Control Centers (Adapazarı, Erzurum, Gölbaşı, İkitelli, İzmir, Elazığ, Antalya, Samsun and Adana).

1. TEIAS SCADA/EMS SYSTEM

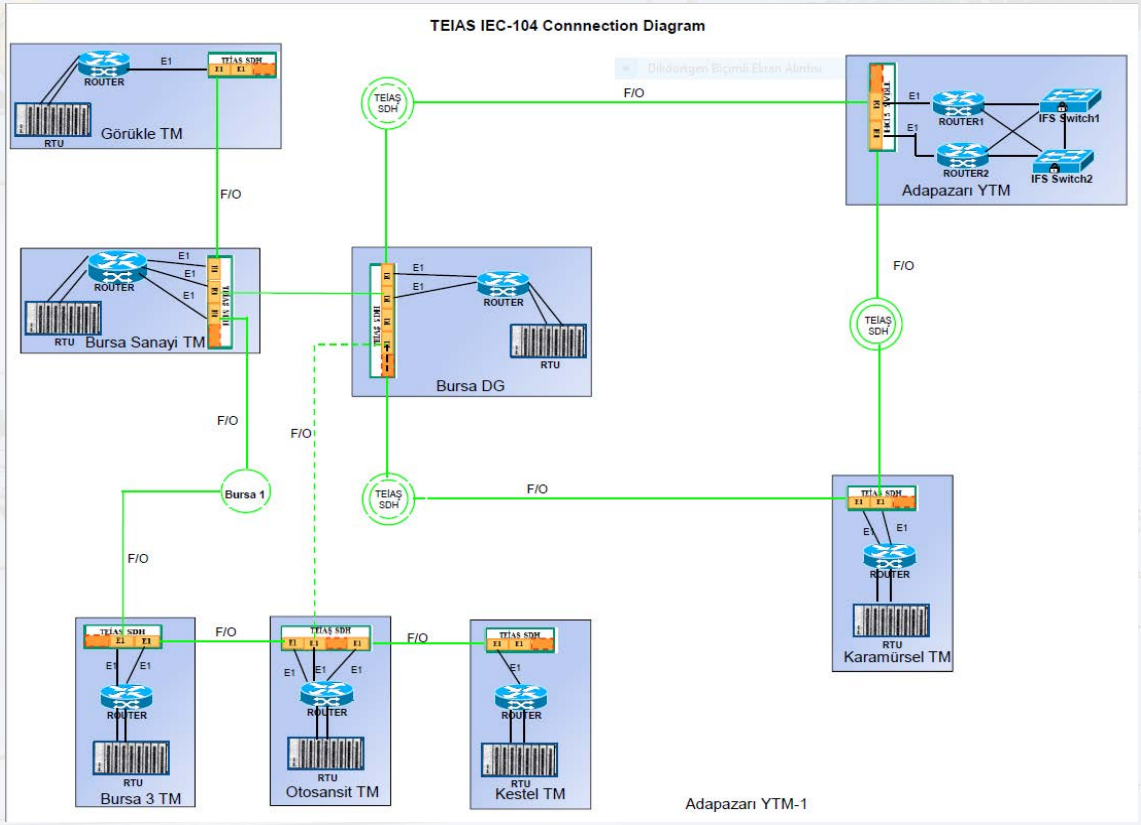
- SCADA / EMS System, has been established for a more safe, high quality and economical operation of National Interconnected Electrical Network.
- SCADA / EMS System collects data in real time through the Remote Terminal Units (RTU) at about 1450 centers connected from the transmission level.
- The information 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.



2. IEC-60870-5-101 and IEC-60870-5-104 CONNECTION DIAGRAM



TEIAS IEC-101 Connection Diagram



- IEC-60870-5-101 and IEC-60870-5-104 communication protocols are used for the communication between Regional Control Centers (RCC) and RTUs.

- RCCs and RTUs have redundant links/routes for the communication.

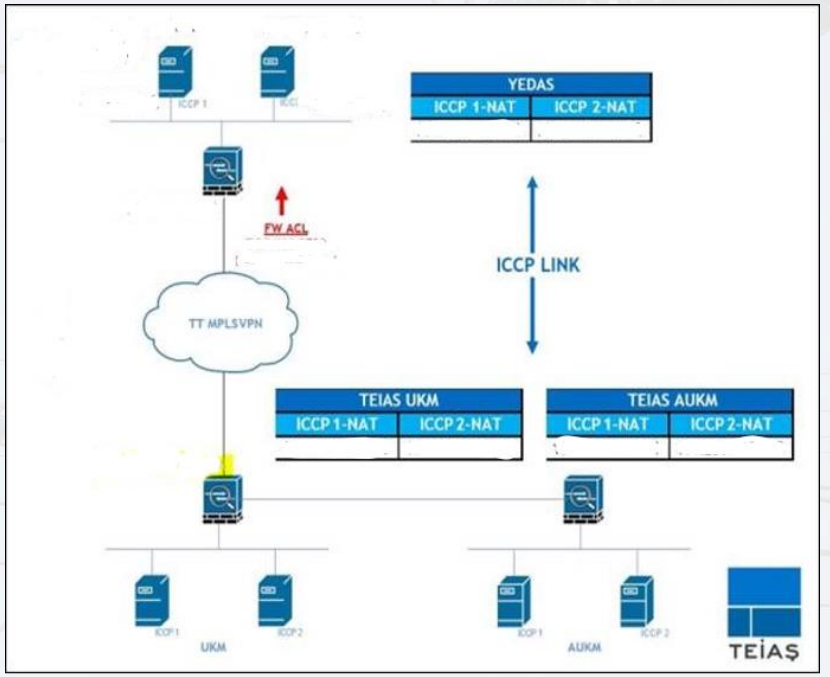
TEİAŞ SCADA/EMS Functions are as below:

- **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)**

EDC/OIZ ICCP Link Connection

- The data of the electricity generation facilities located in the distribution networks of Electricity Distribution Companies and Distribution License Holder Organized Industrial Zones is transferred to our SCADA system by using ICCP (IEC 60870-6/TASE.2) communication protocol through SCADA control centers.

- Within this scope 21 Electricity Distribution Companies and 132 Distribution License Holder Organized Industrial Zones which have electricity generation facilities in their distribution networks have been connected to TEİAŞ SCADA/EMS System.



EDC ICCP Link Connection Diagram

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.

THANK YOU FOR YOUR ATTENTION…

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