

TEİAŞ
TÜRKİYE ELEKTRİK İLETİM
ANONİM ŞİRKETİ



CONNECTION STAGES, PROCEDURES AND TERM OF POWER PLANTS & INTEGRATION OF RES IN LONG TERM PLANNING

TURKISH ELECTRICITY TRANSMISSION
CORPORATION

- THERMAL POWER PLANTS
- INCENTIVES ON RENEWABLE GENERATION
- GEOTHERMAL POWER IN TURKEY
- HYDRO POWER IN TURKEY
- GRID CONNECTION PLANNINGS OF HPPs
- WIND POWER IN TURKEY
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- GRID CONNECTION PLANNINGS OF WPPs
- SOLAR POWER IN TURKEY
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THERMAL POWER PLANTS



- Investors apply to EMRA (Energy Market Regulatory Authority) with relevant power plant data (location, technology, fuel, installed power ...)
- EMRA asks for connection assessment of power plant to TEİAŞ
- TEİAŞ constitutes connection assessment which includes voltage level, connection point, characteristics of connection line and system improvements
- EMRA accepts connection application according to connection assessment
- Investor makes environmental impact assessment for power plant
- License is given to power plant if environmental impact assessment is favorable
- Investor apply for connection agreement after licensing process

- TEİAŞ prepares a «Regional Connection Capacity Report» and in that report determines the capacity limits for natural gas and imported coal power plants on regional base.
- TEİAŞ does not give connection permission more than that capacity.
- Regional generation-consumption balance and load flow analysis are taken into account while determining limits.
- Within the limit, plant applications are assessed with power flow, short circuit and stability analysis.

INCENTIVES ON RENEWABLE GENERATION IN TURKEY



- The law on the Utilization of Renewable Energy Sources (RES) for the purpose of generating energy, (Law No. 5346 of 10/05/05) is the first Renewable Energy Law of Turkey which was approved in the year 2005 by the Turkish Parliament.
- The Turkey's Parliament approved a new law 29 December 2010, on regulating the renewable energy resources market in Turkey. The feed-in tariff incentives are applied for Renewable Power Plants.

Type	Feed-in Tariffs (USD Cent / kWh)	If Production Made Domestically	Additional Feed-in Contribution (USD Cent / kWh)
Hydro	7,3	Turbine	1,3
		Generator and power electronics	1,0
Wind	7,3	Blade	0,8
		Generator and power electronics	1,0
		Turbine tower	0,6
		Entire mechanical components within rotor and nacelle groups	1,3
Geothermal	10,5	Steam or gas turbine	1,3
		Generator and power electronics	0,7
		Steam injector or vacuum compressor	0,7

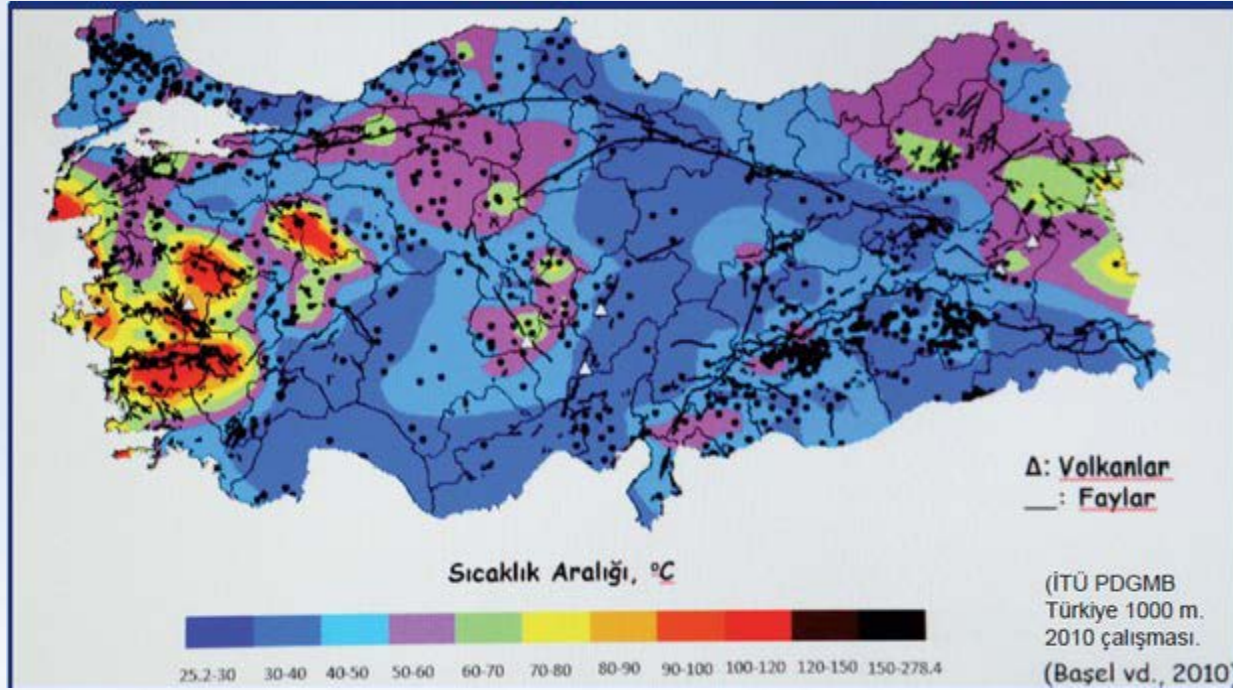
Type	Feed-in Tariffs (USD Cent / kWh)	If Production Made Domestically	Additional Feed-in Contribution (USD Cent / kWh)
Solar (PV)	13,3	Panel structural mechanics construction	0,8
		PV modules	1,3
		Cells forming PV module	3,5
		Inverter	0,6
		Material focusing solar irradiance onto PV module	0,5
Solar (CSP)	13,3	Radiation collection tube	2,4
		Reflector surface plate	0,6
		Solar tracking system	0,6
		Mechanical components of the heat storage	1,3
		Mechanical components steam generation	2,4
		Stirling engine	1,3
		Solar panel structural mechanics	0,6

Type	Feed-in Tariffs (USD Cent / kWh)	If Production Made Domestically	Additional Feed-in Contribution (USD Cent / kWh)
Biomass	13,3	Fluid bearing steam boiler	0,8
		Liquid or gas fuelled steam boiler	0,4
		Gassification and gas purging group	0,6
		Steam or gas turbine	2.0
		Internal combustion engine or Stirling Engine	0.9
		Generator and power electronics	0,5
		Cogeneration system	0,4

GEOTHERMAL POWER IN TURKEY



INSTALLED CAPACITY OF GEOTHERMAL POWER PLANTS



30.09.2015

IN SERVICE	581,4 MW
LICENCE	170,1 MW
PRE-LICENCE	451,3 MW
TOTAL	1200 MW

HYDRO POWER IN TURKEY

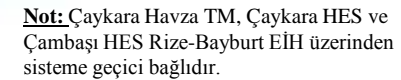


2014	
HYDRO – DAM INSTALLED CAPACITY	16.607 MW - %23,9
HYDRO – DAM GENERATION	28,5 TWh - %11,2
HYDRO – RUN OF RIVER INSTALLED CAPACITY	7.034 MW - %10,1
HYDRO – RUN OF RIVER GENERATION	11,9 TWh - %4,7

13.02.2015	
IN SERVICE	Dam – 18.126 MW RoR – 7.232 MW
LICENCE	12.556 MW
PRE-LICENCE	2.675 MW
TOTAL	40.589 MW

- All power plants below 50 MW are connected to distribution grid.
 - TEİAŞ collected all hydro power plant projects information such as coordination and installed capacity from State Hydraulic Works.
 - When a company applied for license, first of all TEİAŞ and Distribution Companies examined possible connection solutions under the existing grid.
 - If there is no solution in existing grid, distribution companies request TEİAŞ for a new substation for connection of new appliances.
 - With the information gained from State Hydraulic Works, TEİAŞ plans to construct a new Basin Substation on the center of Hydro Power Plants.
 - After the planning of new basin substation distribution Company decides medium voltage characteristics of project and gives connection agreement.
-
- Hydro plants above 50 MW, TEİAŞ decides high voltage connection characteristics with the information gained from SHW with same basin mentality in order to built minimum substation/overhead line.

06.08.2014



Dereköy Havza TM
~ 15 km 954 MCM

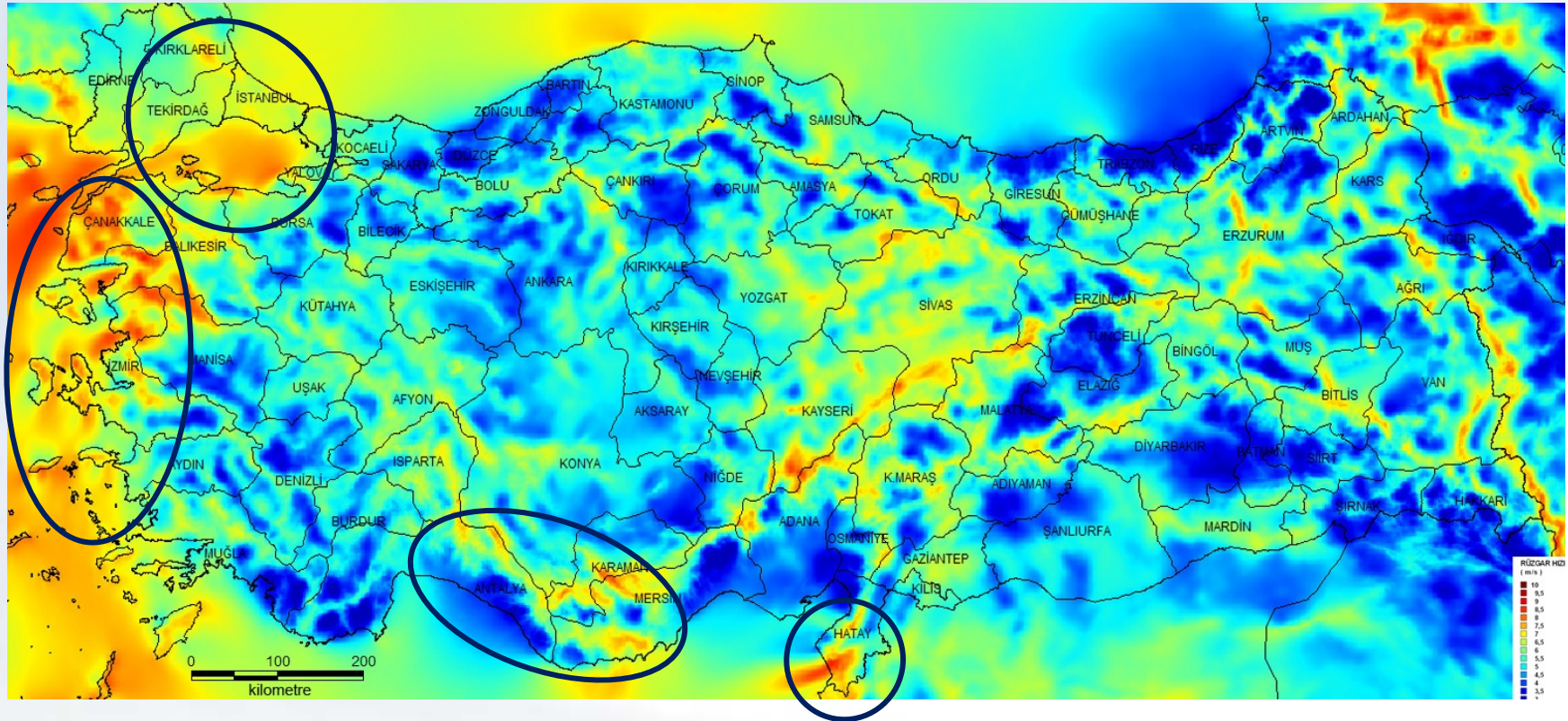
● Planlanan

- Cuniş HES - 8,41 MW
- Çağlayan HES - 6 MW
- Derindere HES - 4,03 MW
- Kemerçayır HES - 15,5 MW
- Üçharmanlar HES - 16,64 MW
- Üçanlar HES - 11,939 MW



- With planning of basin, transmission/distribution companies build minimum substation / overhead line.
- With building minimum grid extension, transmission/distribution loss will be minimum.
- With building minimum grid extension, minimum environmental affect occurs, because most of the regions where hydro plants are concentrated are the forestry areas.
- With bringing together all the companies it is easier to build new OHL/Substation by the help of much capital and effort from all companies.
- Medium voltage and high voltage of grid extension for the new connections, could be installed by the company of the project in the content of connection agreement. Company gets repayment from TEİAŞ/distribution company after finishing the grid extension.

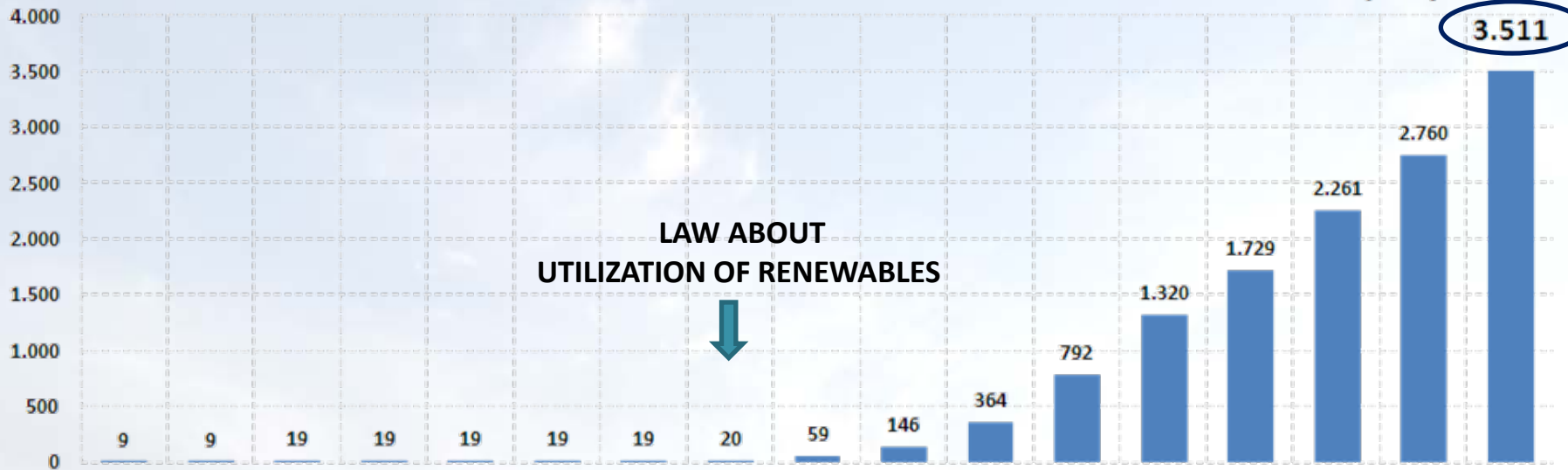
WIND POWER IN TURKEY



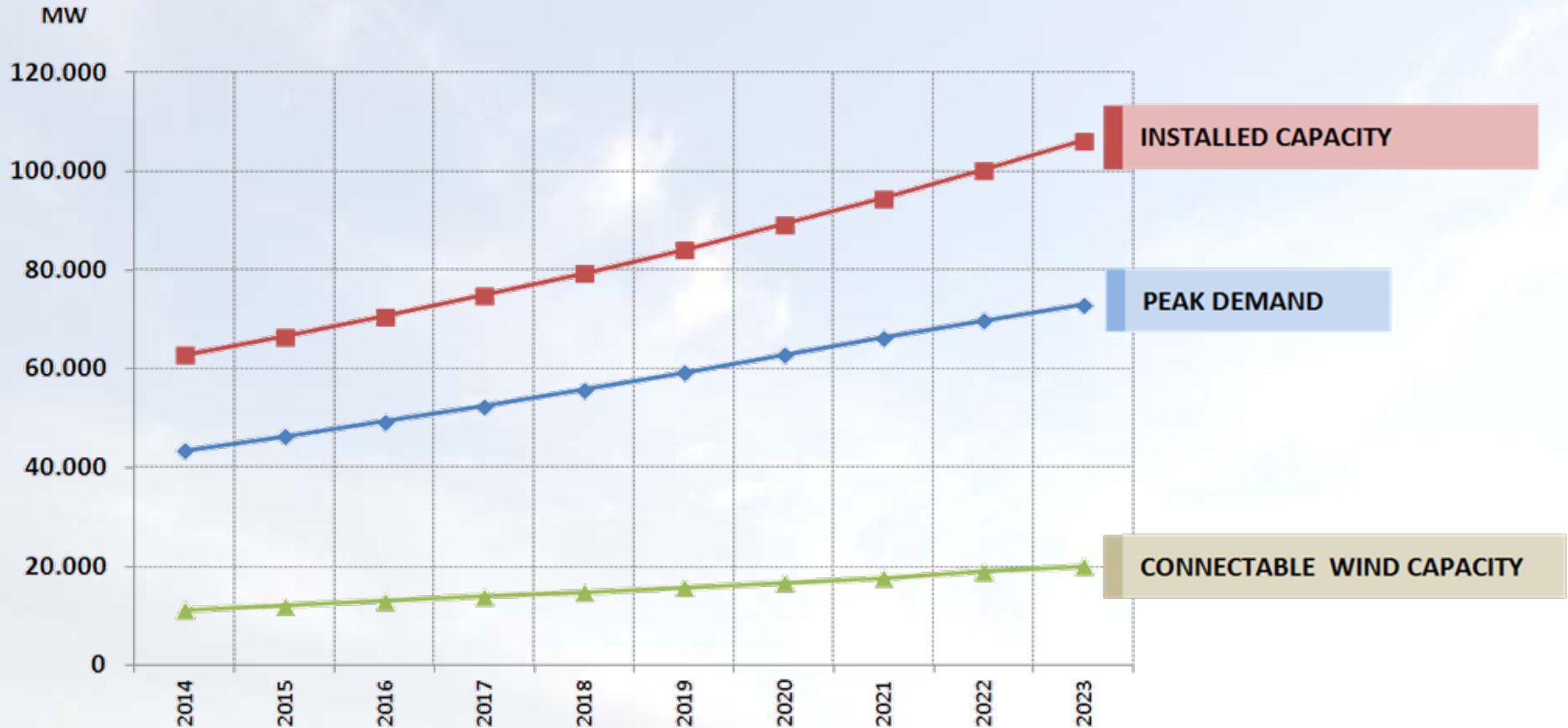
The techno-economic wind potential of Turkey is **48 GW**, according to General Directorate of Renewable Energy.

The locations with highest potential are in the Aegean, Marmara, and Eastern Mediterranean and Hatay.

ANNUAL DEVELOPMENT OF WIND POWER INSTALLED CAPACITY IN TURKEY (MW)



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
INSTALLED CAPACITY (MW)	9	9	19	19	19	19	19	20	59	146	364	792	1.320	1.729	2.261	2.760	3.511



In accordance with the Ministry of Energy's Strategic Plan, Turkey is targeting **20,000 MW** installed wind-power capacity by the end of 2023.

Distribution of Wind Power Plants in Turkey as of 2014



* Red: In Operation Blue: Planned

PLANNED + INSTALLED: ~12.000 MW

EXISTING LEGISLATION FOR WIND POWER PLANTS

- In the previous grid code, a capacity up to 5 % of the system short circuit MVA at the connection point is permitted.
- According to new regulation that has been published in **January 2013**, *IEC 61400 standard* is applied to determine wind power capacity that can be connected to busbar.

REGULATION REGARDING THE SELECTION PROCESS FOR MULTIPLE WIND PROJECT APPLICATIONS

- This regulation defines competition process, obligation of investors who will attend the competition and Contribution Rate of Wind and Solar Power Plant in the case of existence of more than one power plant application based on solar/wind energy for the same region.

1. Investors applies for license to Energy Authority (EMRA)



2. Applications are forwarded to TEİAŞ for grid assessment.



3. Attendees are listed according to connection area and/or connection point.



4. Investors who will attend to competition submit related documents to TEİAŞ.



5. Investor prepares bidding letter, letter of bank guarantee.



6. Investors attend to competition with the related documents.



7. Bids are ranked, bidders who submitted the highest Contribution Fee are permitted for grid connection.



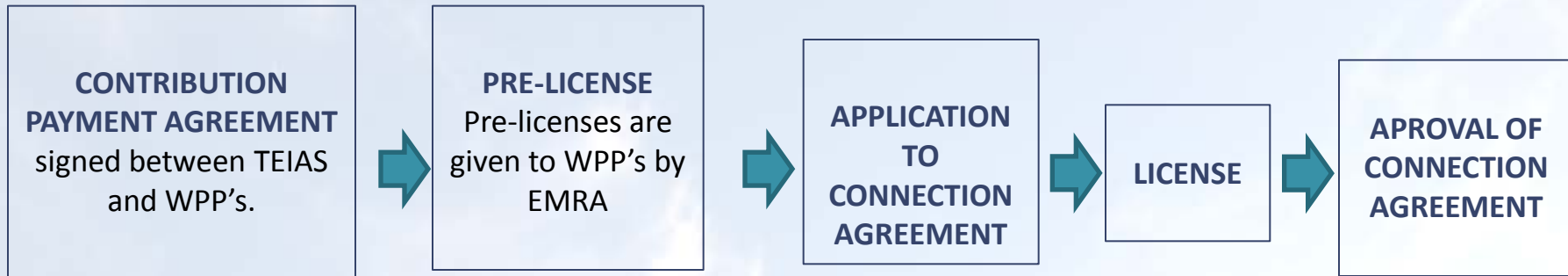
8. Results of the competition are forwarded to EMRA.



9. Contribution Fee Agreement is signed with succesfull bidders.



10. Pre-License is given by EMRA

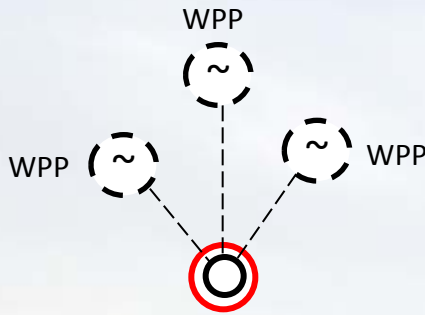


- If necessary connection investment is realized by investor on behalf of TEİAŞ in accordance with technical standards, total amount of expenditures of investment is paid back in 10 years.
- If necessary connection investment is agreed to be realized by TEİAŞ, connection lines are taken into TEİAŞ Investment Plan.
- After pre-licenses, other preliminary permit issues are covered by investors (ie. environmental). If all permits are obtained, projects are licensed by EMRA, then construction begins.

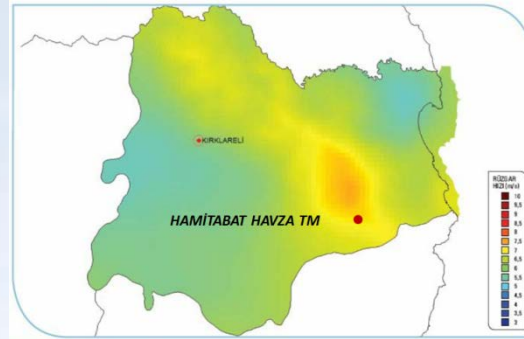
GRID CONNECTION PLANNINGS OF WPPs

- Connection requirements for Wind Power Generations are defined in the Appendix-18 of the Turkish Grid Code.
- Issues covered in **Appendix-18**:
 - Fault Ride Through Capability
 - Active Power Control
 - Frequency Contribution Of The Wind Power Plants
 - Reactive Power Capacity
 - Reactive Power Support
 - Monitoring Of Wind Power Plants

In region where wind potentials are high, Wind Basin Subs are planned to be established and connectable WPP capacities are announced by TEİAŞ to integrate WPP's.

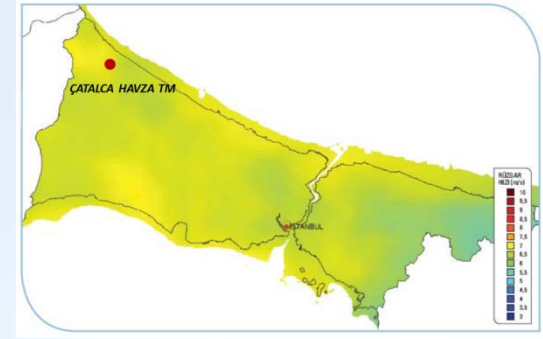


**400/154 kV
Basin (Collector)
Substation**



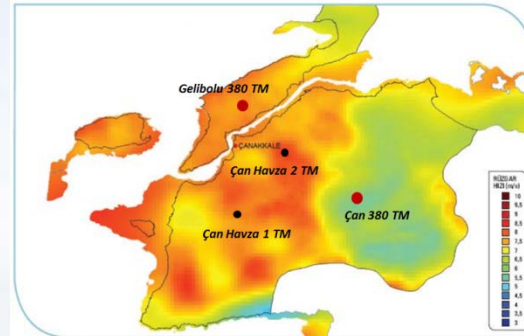
KIRKLARELI

380/154 kV Basin Substation



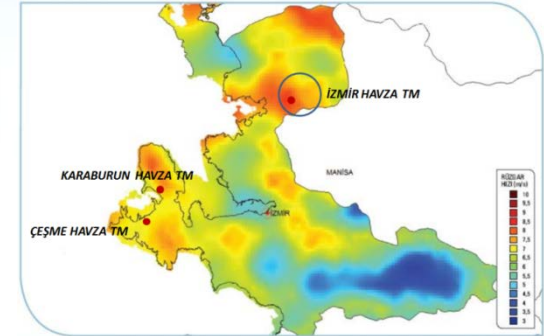
İSTANBUL

380/154 kV Çatalca Basin TM



ÇANAKKALE

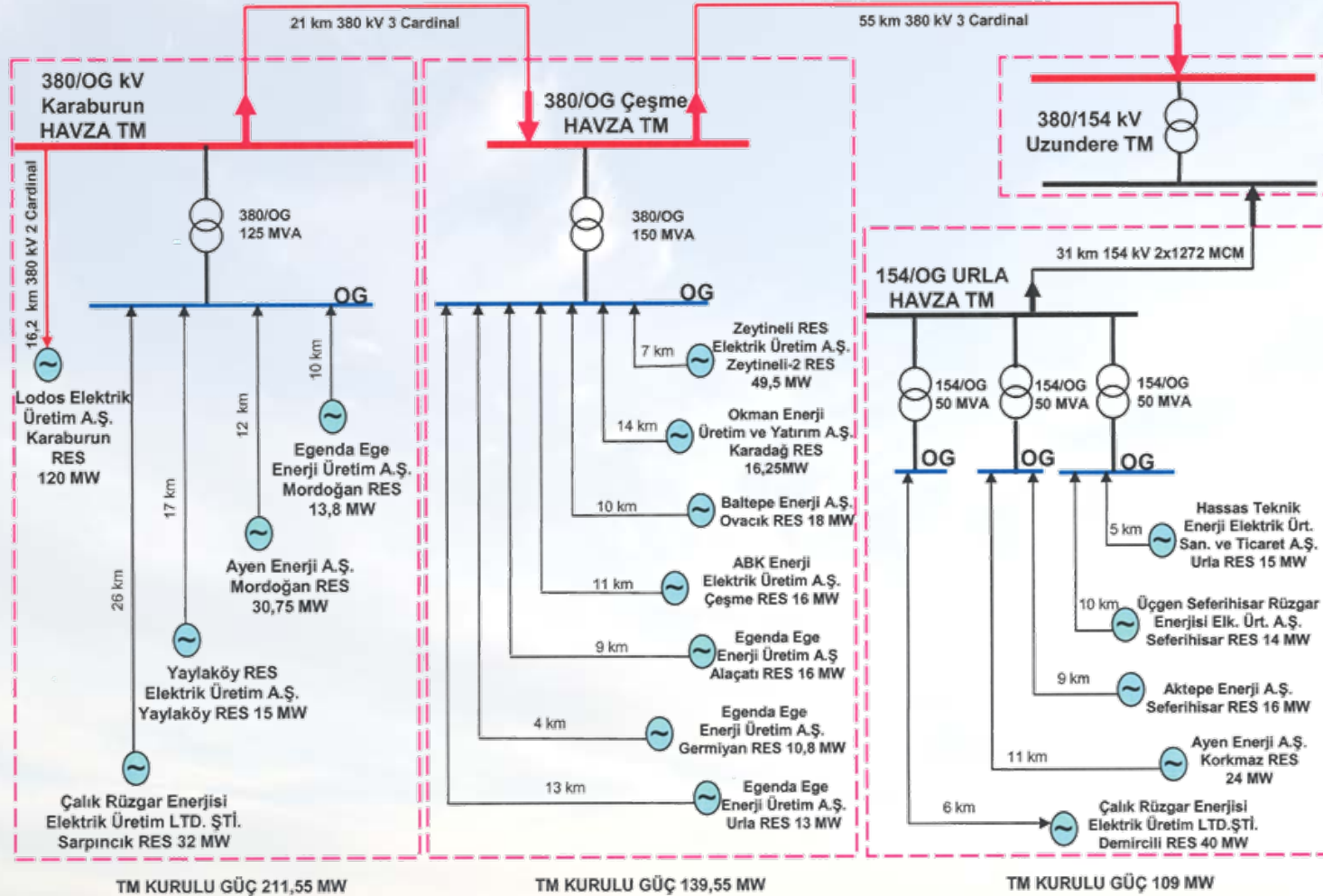
380/154 kV Çan TM
380/154 kV Gelibolu (Sütlüce) TM
154 kV Çan Basin 1 TM
154 kV Çan Basin 2 TM



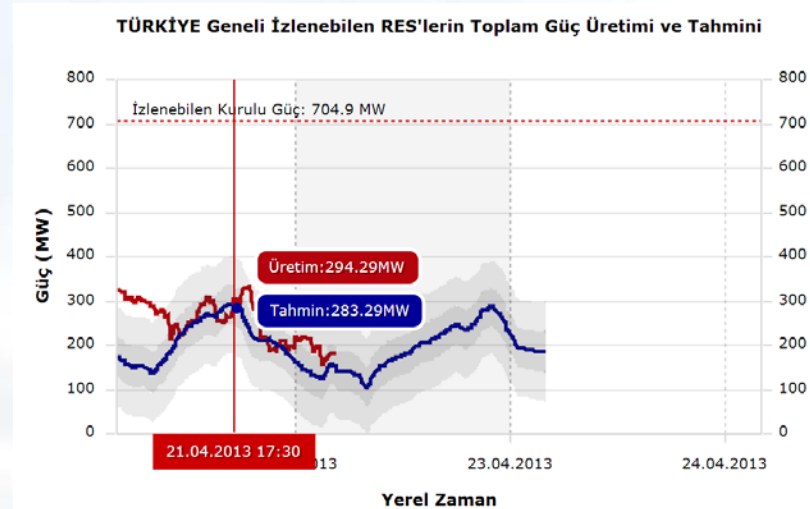
İZMİR

380/154 kV İzmir Basin TM

ÇEŞME HAVZASI BAĞLANTI ŞEMASI

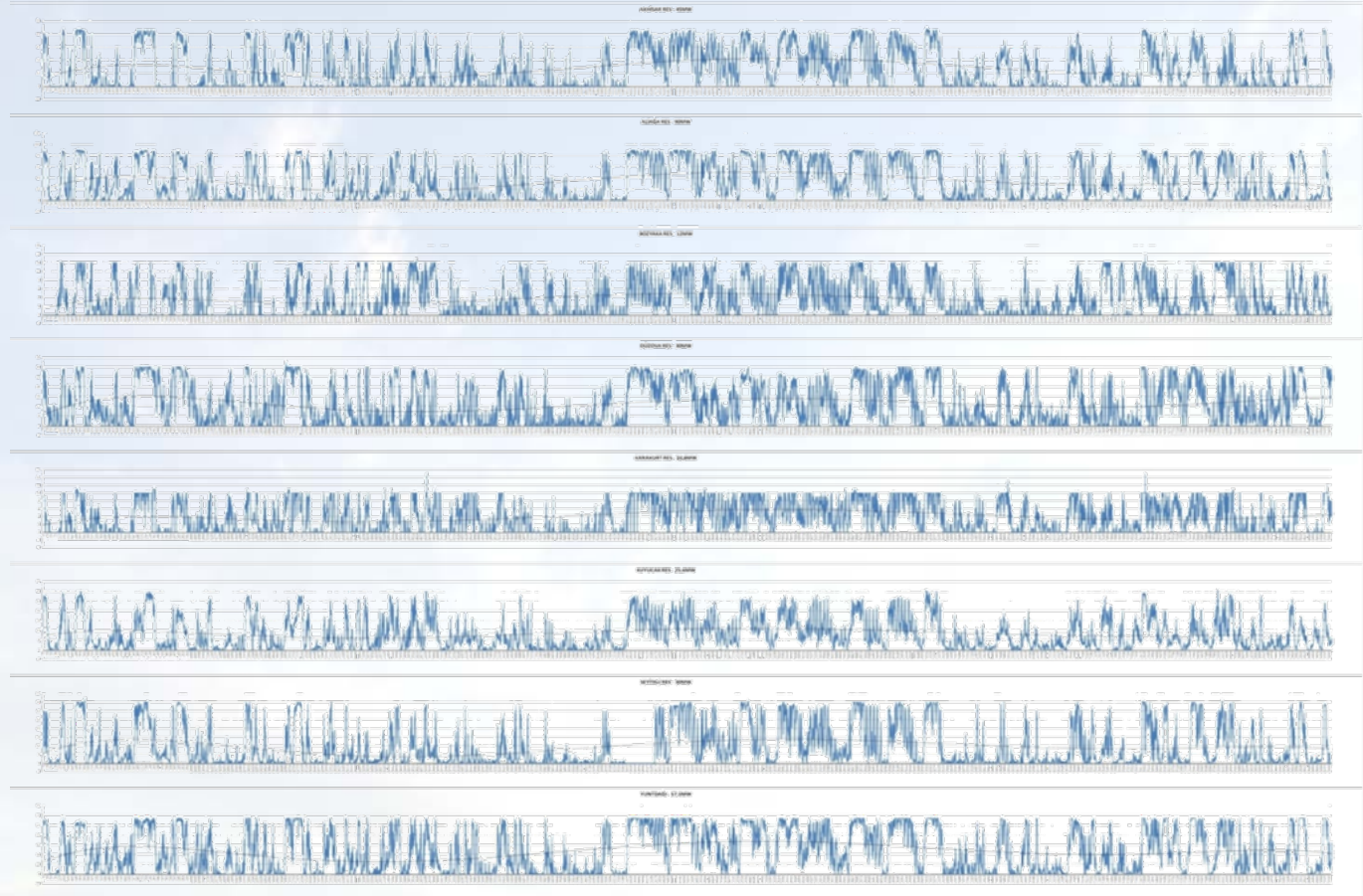


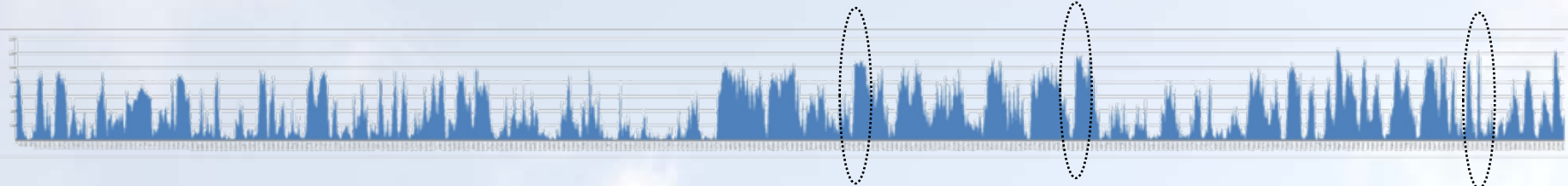
All the wind power plants shall establish the necessary infrastructure to provide the monitoring of the wind park from **Wind Power Monitoring and Forecast Center (RİTM)**, developed by General Directorate of Renewable Energy. WPP's will be monitored also from TEİAŞ Dispatch Centers for forecast and system operation.



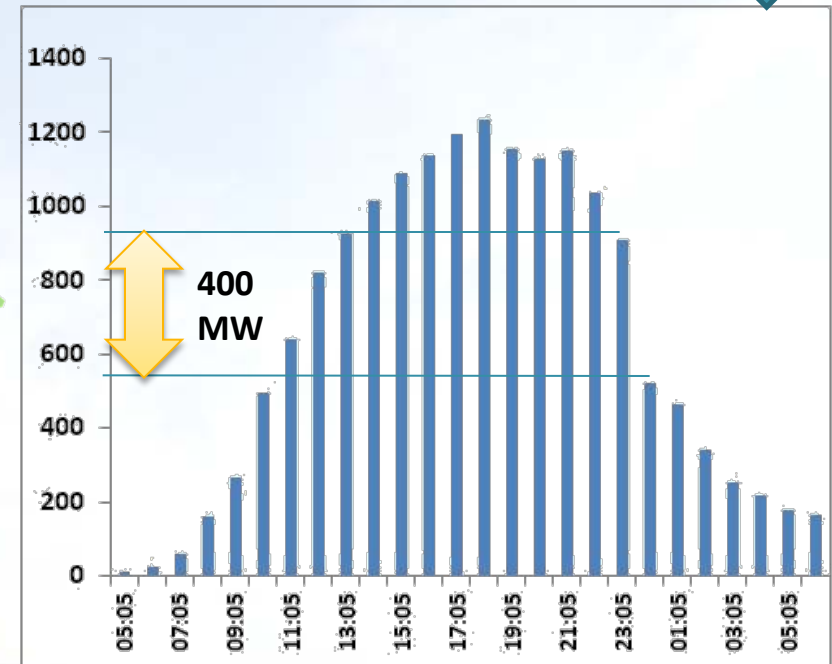
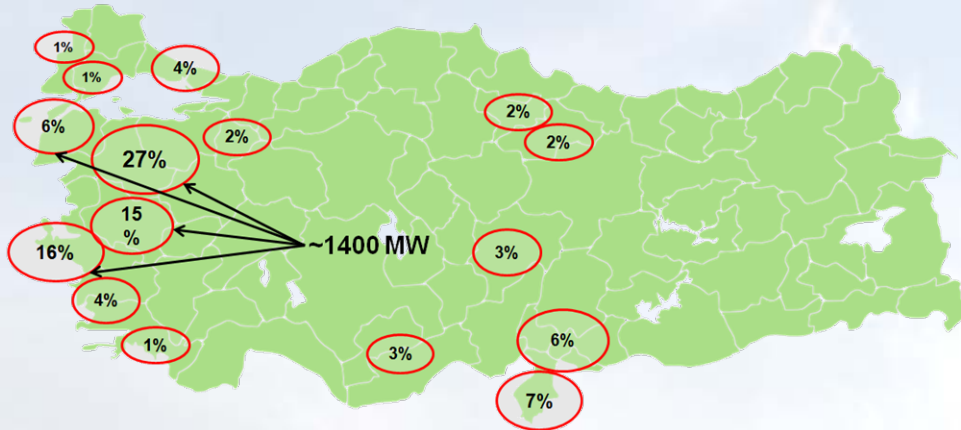
WPP's in the
(West) region in
Turkey have very
similar wind
characteristics.

Because of that,
regional WPP
behaviour is
studied together
for total impact,
total variation and
stability.





TOTAL INSTALLED WPP: ~2400 MW



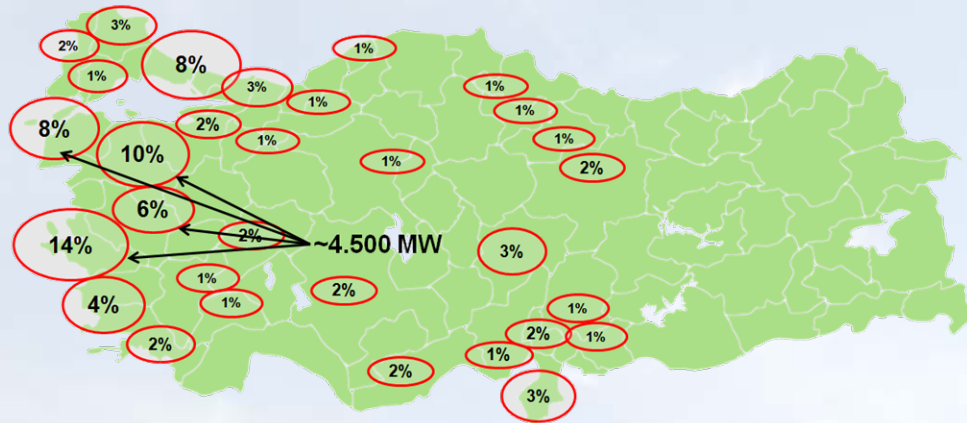
2012

1400 MW installed capacity.

Hourly variation: 400-500 MW

2-hourly variation: 700-800 MW

TOTAL PLANNED + INSTALLED WPP: ~12.000 MW



2018 – by correlation

4.500 MW installed capacity

~1500 MW hourly variation

~2000 MW 2-hourly variation

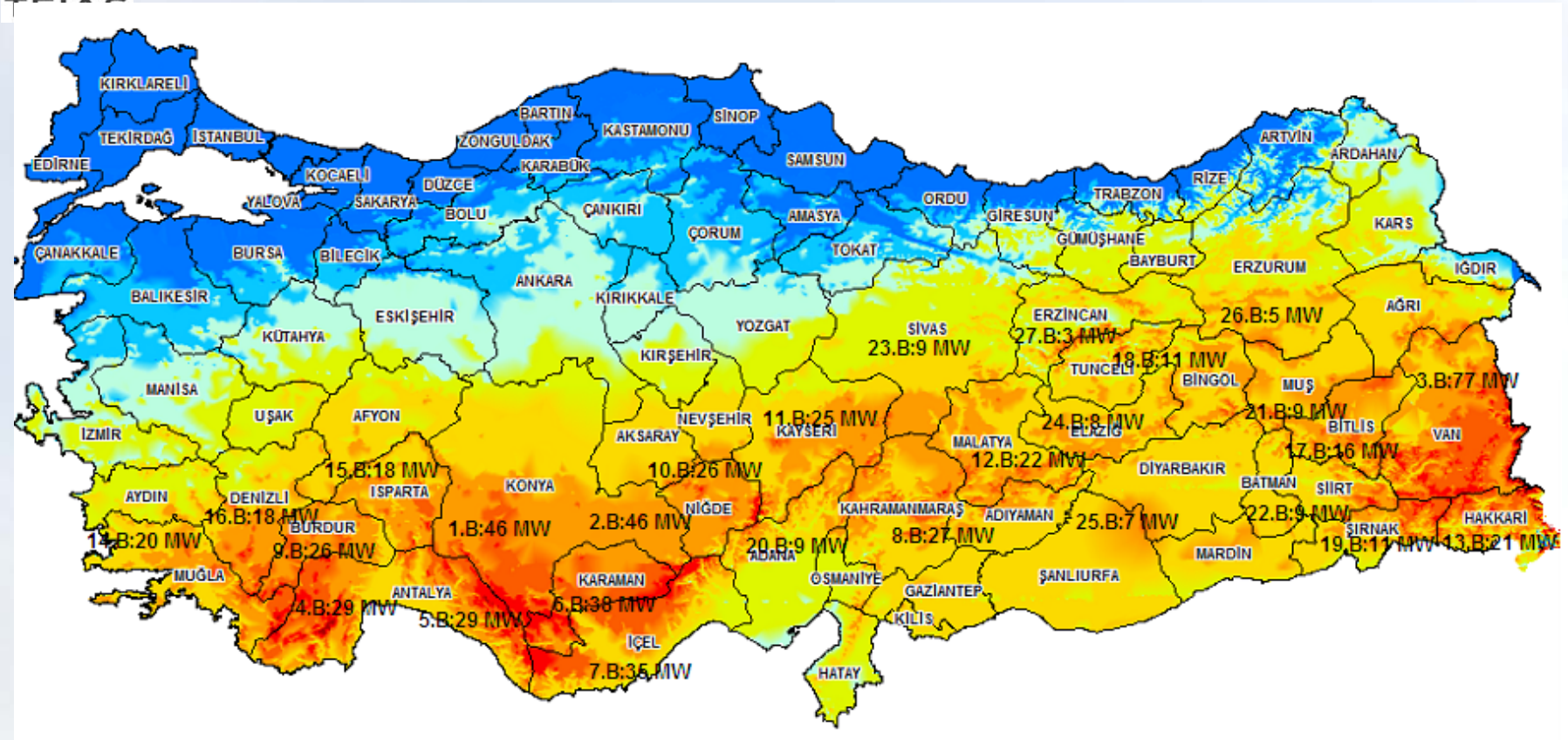
Concentrated WPP's that have similar characteristics may cause voltage fluctuations in the region.

Reactive Support from WPP's will gain much more importance than now.










It will be very important to forecast wind generation accurately to minimize daily-hourly deviations for dispatch and market.

- With higher wind penetration levels, the effects of wind generation on system increases, therefore Grid Code Compliance becomes much more critical.
- ie. *Fault Ride Through Capability* of Wind Farms will prevent loss of high wind generation due to system fault or generation loss
- Because of the similar wind variations, wind generation trips due to extreme weather conditions could occur and may result in regional collapse. To prevent this, better coordination between Dispatch Center and WPP Operators must be ensured.

SOLAR POWER IN TURKEY



- According to Strategy Paper of Energy Ministry, Turkey's aim in solar energy is to have 3.000 MW solar power plant integration by 2019.
- Installed capacity is ~ 200 MW by October 2015.

Toplam Güneş Radyasyonu		KWh/m ² · yıl	
	1400 - 1450		1650 - 1700
	1450 - 1500		1700 - 1750
	1500 - 1550		1750 - 1800
	1550 - 1600		1800 - 2000
	1600 - 1650		

- Capacity allocation and competition procedures are same with wind power plants.
- Grid code for solar plants is being prepared and will be published within this year. It will be similar with wpp's code because of the similar technology.
- As of today for total 600 MW capacity, licence competition was completed and projects are completing legal procedures such as environmental affect reports, expropriation, zoning plan etc.
- In addition to this licensed projects, Ministry of Energy and Natural Resources and Ministry of Science, Industry and Technology are planning to create a 'Renewable Energy Speciality Zone' for solar plants in order to support home production. 1000 MW of capacity was allocated to solar plants which will be built in that zones.

DISTRIBUTED GENERATION IN TURKEY

According to regulation published by Energy Market Regulatory Authority (EMRA), legal and natural personalities get right to construct power plants below 1 MW without license. Also from renewable sources, big consumers get right to construct plants without power limitation till the consumption value if the generation and consumption are at the same place.

For this purpose, TEİAŞ allocated 2 MW for wind and solar. However, in case this amount is exceeded, TEİAŞ will be asked to re-assessment for capacity increase and TEİAŞ will make a new assessment of the particular substation.

For solar plants, ~5500 MW capacity has given as of today and more than 2000 MW of them made connection agreement with distribution companies. Around 200 MW of them is in service.

Thank you for attention!