TÜRKİYE RÜZGAR ENERJİSİ BİRLİĞİ
TURKISH WIND ENERGY ASSOCIATION

TEİAŞ

# WIND POWER IN TURKISH POWER SYSTEM

HUSUM Wind
The German Wind Trade Fair and Congress
15–18 Sept. 2015
Husum, Germany


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**TURKISH ELECTRICITY TRANSMISSION CORPORATION (TEİAŞ)**


# TEİAŞ - MAIN RESPONSIBILITIES

- The sole owner of Electricity Transmission System
- Responsible for the expansion of transmission network infrastructure & construction of new transmission facilities
- Operating & Maintaining the Turkish Electricity Transmission Network economically and reliably in compliance with international standards
- Monitoring real-time system reliability, purchasing and providing Ancillary Services Through "Ancillary Service Agreements"
- Publishing 10-year *"Electrical Energy Generation Capacity Projection"*
- Carrying out studies for the Interconnection Lines with neighboring countries
- ~~Operating the Electricity Balancing-Settlement Market and Financial Reconciliation Center (PMUM)~~ [recently *unbundled as Exchange Market named EPİAŞ*]

# TRANSMISSION GRID

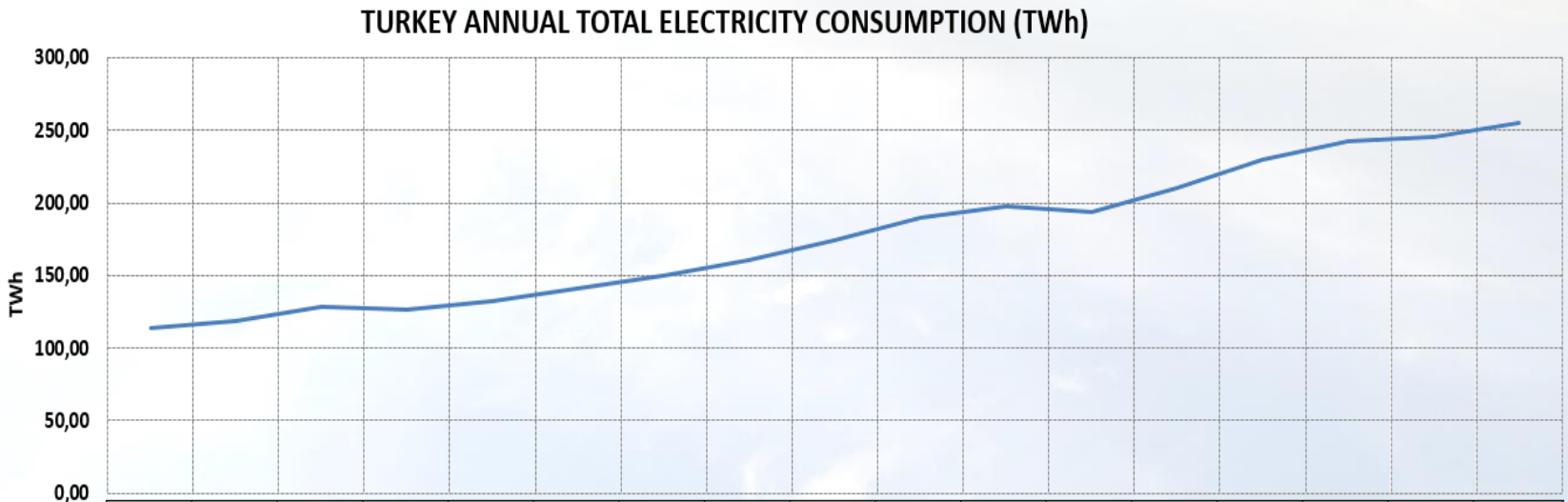

## SUBSTATIONS

400 kV : 92
220 kV : 1
154 kV : 568
66 kV : 14
Total : 675 Subs.
with 125.898 MVA capacity

## TRANSMISSION LINES

400 kV : 17.429 km
154 kV : 34.919 km
220 kV : 85 km
66 kV : 509 km
154 & 400 kV Cable: 296 km
Total : 53.238 km

# ENERGY CONSUMPTION



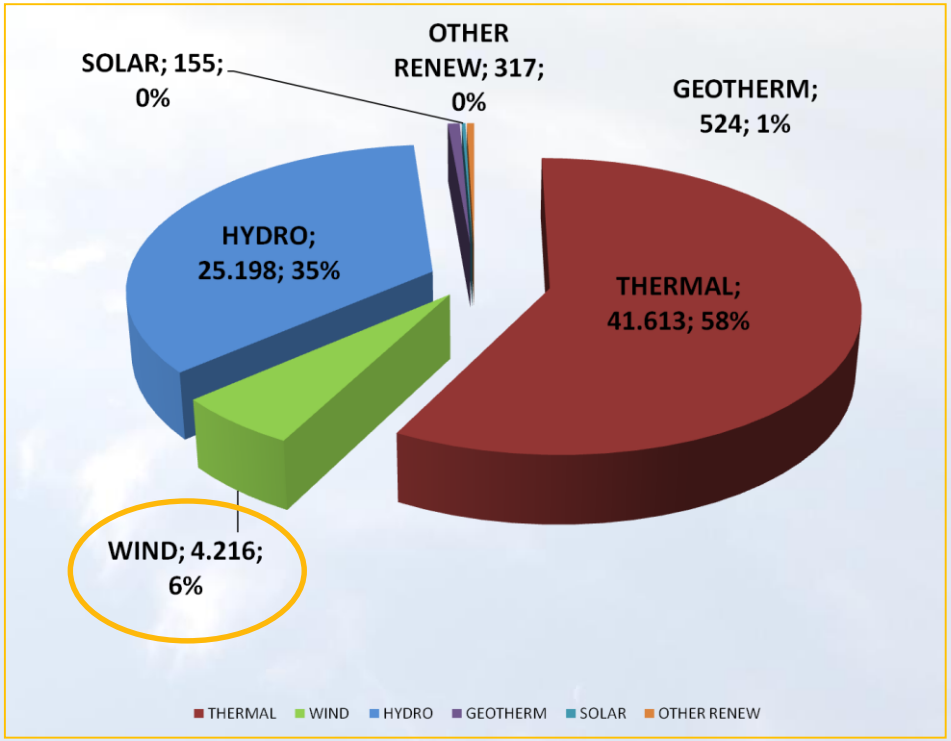

| | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONSUMPTION (TWh) | 114,00 | 118,50 | 128,30 | 126,90 | 132,60 | 141,20 | 150,00 | 160,80 | 174,60 | 190,00 | 198,10 | 194,10 | 210,40 | 230,30 | 242,37 | 245,48 | 255,54 |
| INCREASE (%) | 8,10 | 3,90 | 8,30 | -1,10 | 4,50 | 6,50 | 6,30 | 7,20 | 8,60 | 8,80 | 4,30 | -2,00 | 8,40 | 9,40 | 5,20 | 1,20 | 4,10 |

# INSTALLED CAPACITY & PEAK LOAD

| Year 2013 | |
|---|---|
| Installed Capacity: | 64.612MW |
| Annual Consumption | 245.48 TWh |
| Peak Load | 38,264 MW (29.08.2013 14:20) |

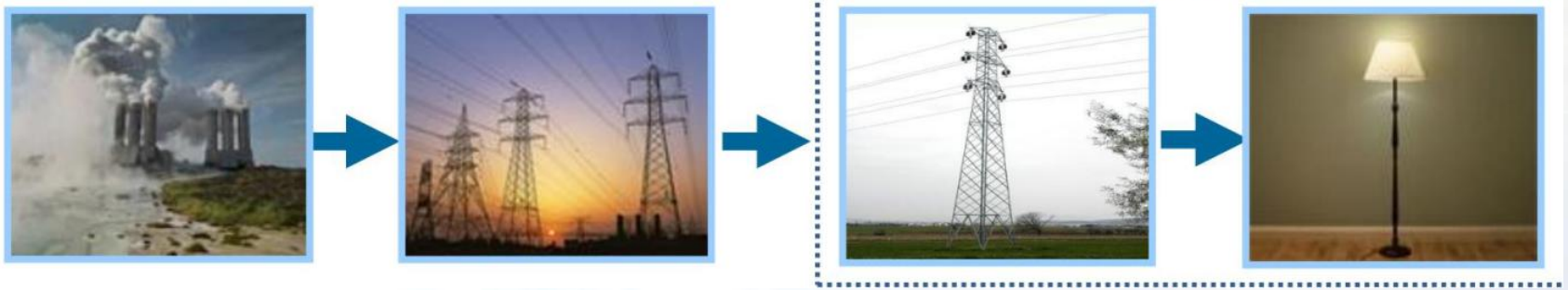
| Year 2014 | |
|---|---|
| Installed Capacity: | 69.516 MW |
| Annual Consumption | 255.55 TWh |
| Peak Load | 41.002 MW (14.08.2013 14:30) |

**Installed Capacity (Sept 2015)** (MW)




Total: 72,022 MW

# TURKISH ELECTRICITY MARKET STRUCTURE



| GENERATION | TRANSMISSION | DISTRIBUTION | TRADING |
|---|---|---|---|
| **EÜAŞ**<br><br>**Private Companies**<br>(- w/ License or -w/o License) | **TEİAŞ**<br>(Turkish Electricity Transmission Corp.) | **Private Distribution Companies**<br>(in 21 Regions) | **TETAŞ**<br><br>**Private Companies** |

**ENERGY AUTHORITY (EMRA)**

# ELECTRICITY GENERATION

Within the scope of the ***Electricity Market Law No.6446,*** generation activities are divided into two, according to license status.

**ELECTRICITY GENERATION**

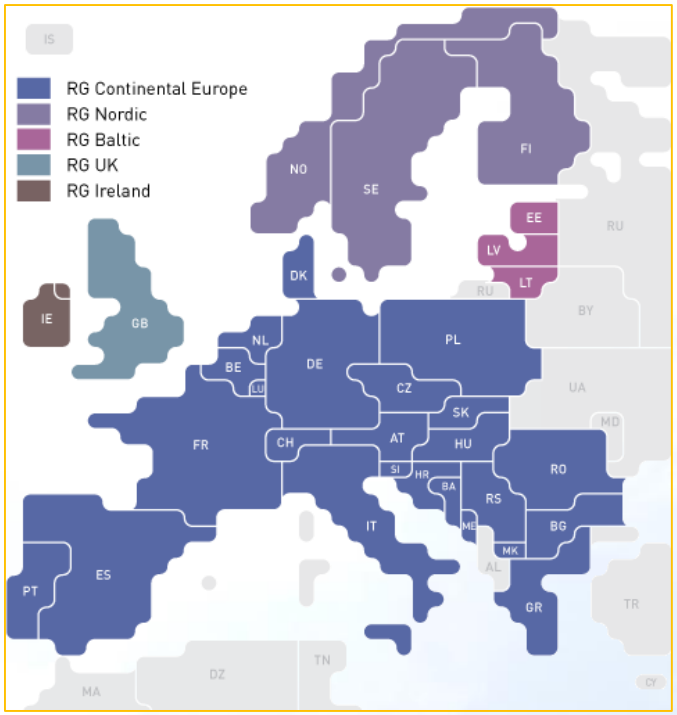
**WITH LICENSE**

- Conventional PP's
- Wind Power Plants
- Solar PP's

**WITHOUT LICENSE**

- Exempt defined in Article 14 of Law No. 6446
- The Regulation on Unlicensed Electricity Generation
- Communiqué on the Application of the Regulation on Unlicensed Electricity Generation
- mostly PV installations in distribution voltage level

# ENTSO-E CONNECTION OF TURKEY



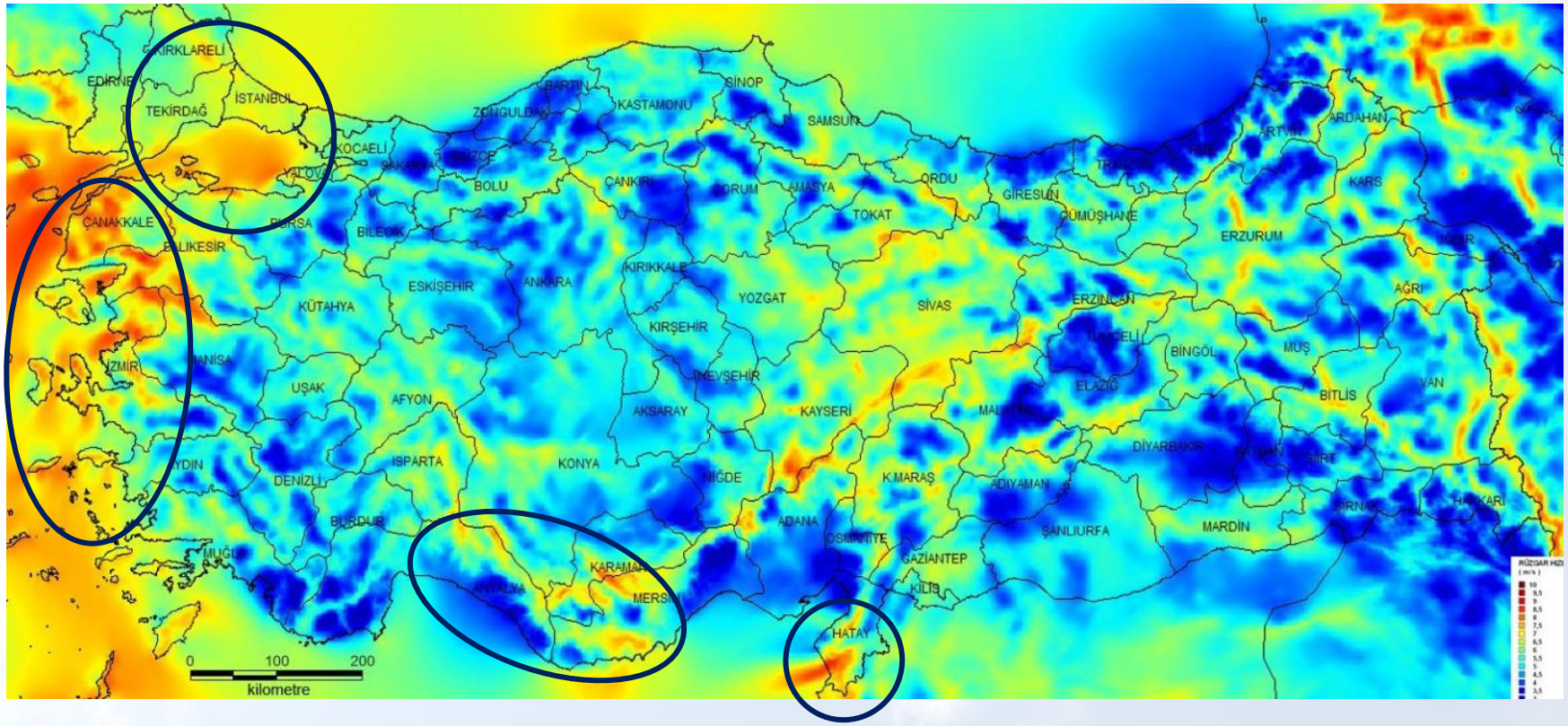

entsoe
Reliable Sustainable Connected

| Milestone | Date |
|---|---|
| Contractual Agreement between ENTSO-E & TEİAŞ | 18 December 2009 |
| Isolated Operation Test (Peak Load) | 11-24 January 2010 |
| Isolated Operation Test (Min. Load) | 22 March-5 April 2010 |
| Synchronous Parallel Operation Test Phase 1,2,3 | 2010 - 2011 |
| Increase of NTCs | 17 April 2013 |
| Decision for Permanent Synchronous Operation | 9 & 24 April 2014 |
| Signing of the Long Term Agreement | 15th April 2015 |
| Observer Membership process is initiated | 18th June 2015 |

# INTERCONNECTIONS

# WIND POWER IN TURKEY

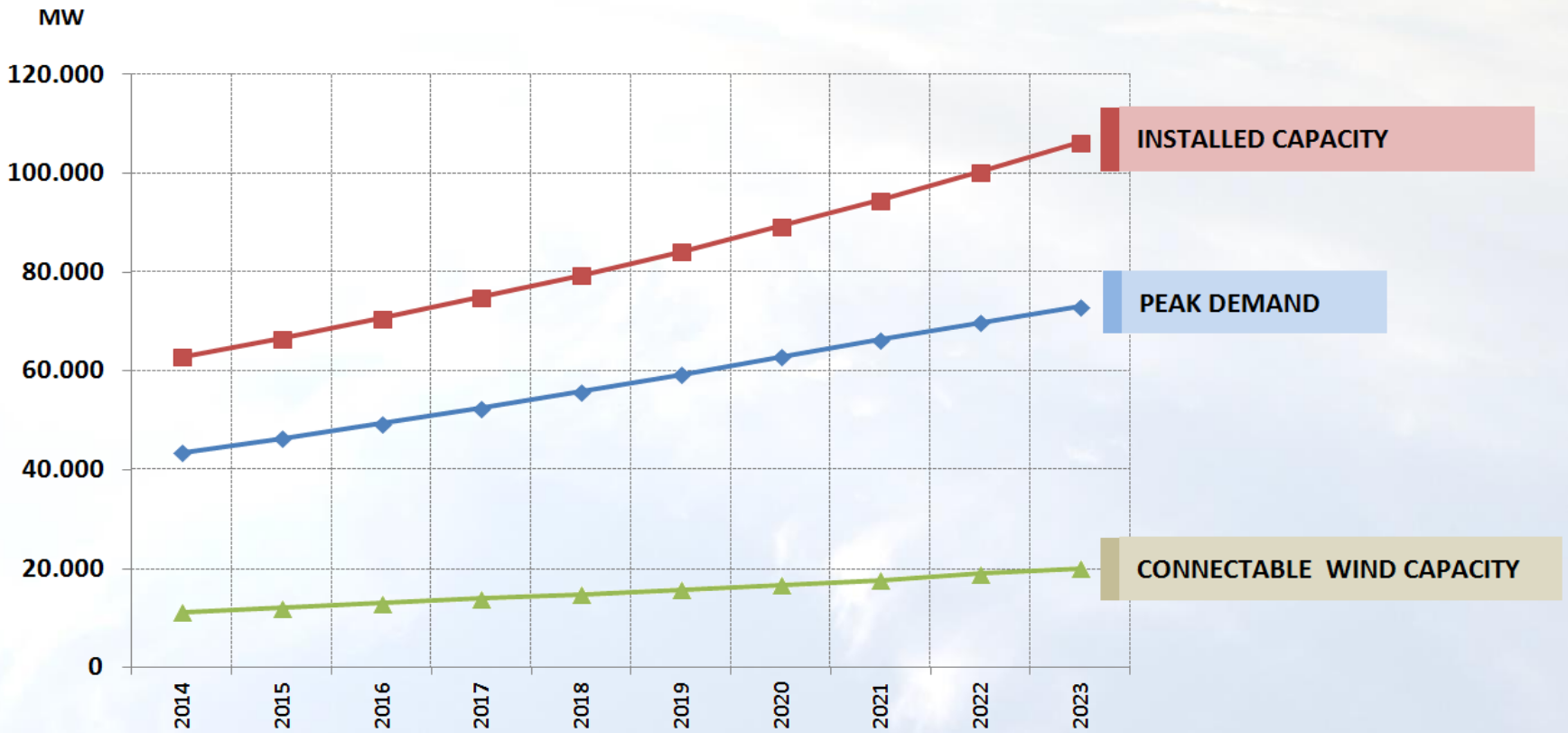
# TURKISH WIND POTENTIAL




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

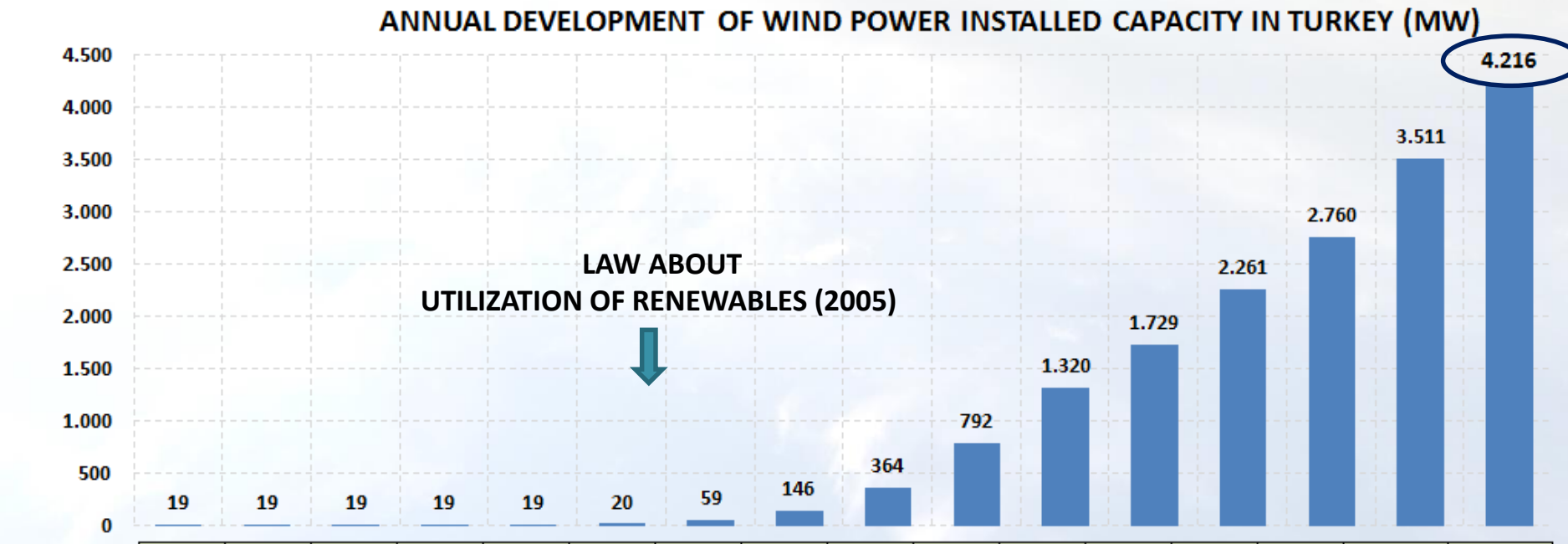
The locations with highest potential are in the Aegean, Marmara, and Eastern Mediterranean and Hatay.

# INSTALLED CAPACITY PROJECTIONS




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.

# WIND INSTALLED CAPACITY




| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INSTALLED CAPACITY (MW) | 19 | 19 | 19 | 19 | 19 | 20 | 59 | 146 | 364 | 792 | 1.320 | 1.729 | 2.261 | 2.760 | 3.511 | 4.216 |

# INSTALLED & PLANNED WPP's

## WPP STATUS

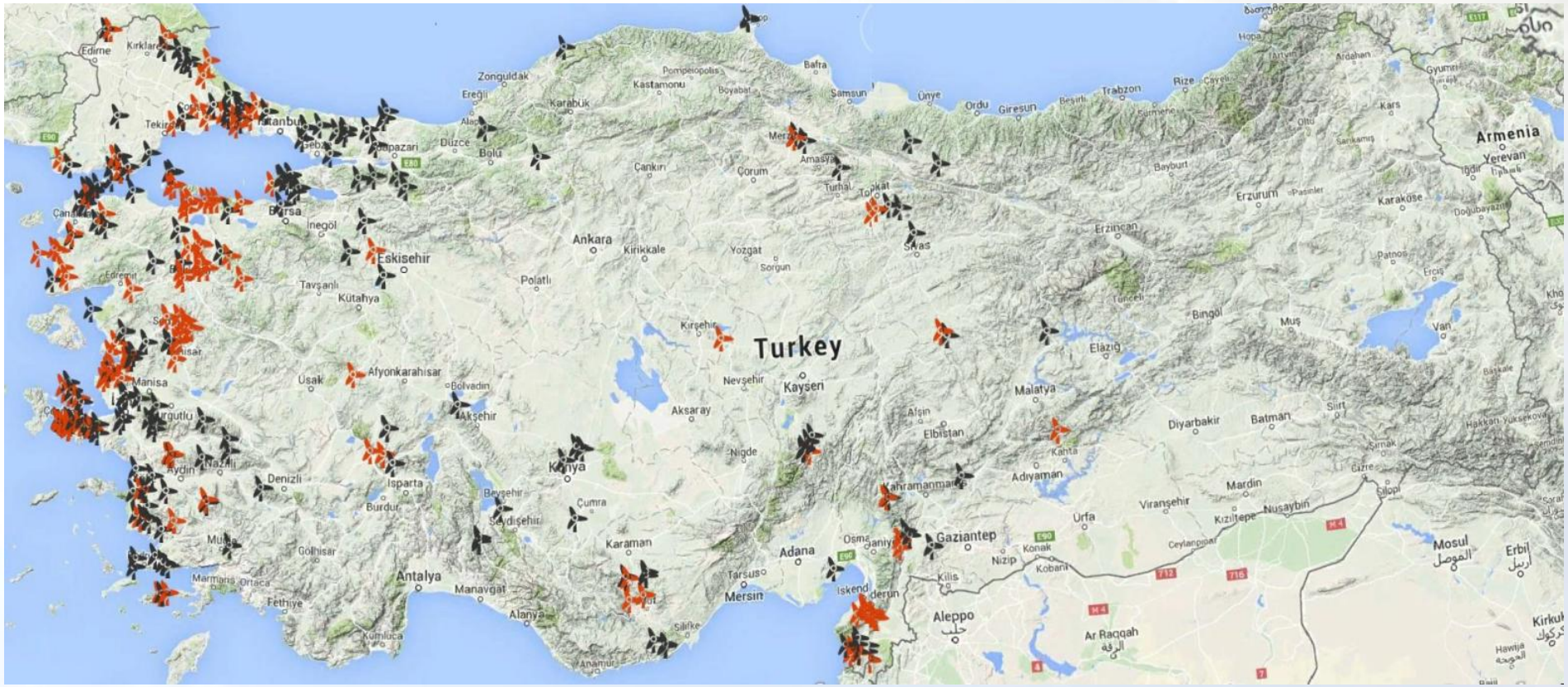
| | MW |
|---|---|
| IN OPERATION WPP's | 4,216 |
| EXTENSIONS APPROVED for IN OPERATION WPP's | 978 |
| *HAS* CONNECTION AGREEMENT with TEİAŞ | 3,278 |
| *IN* CONNECTION AGREEMENT PROCESSSS with TEİAŞ | 1,274 |
| LICENSED by EMRA | 780 |
| PERMITTED for CONNECTION | 1,157 |
| TOTAL | **11,682** |

## NEW CAPACITY AUCTIONS

| | MW |
|---|---|
| Year 2013 (Application are taken by EMRA in April 2015 ) | 3,000 |
| Year 2015 (Application will taken by EMRA in Oct. 2016 ) | 2,000 |

# INSTALLED & PLANNED WPP's

Distribution of Wind Power Plants in Turkey as of Sept. 2015




IN OPERATION

PLANNED

**PLANNED + INSTALLED**: ~12.000 MW

# MILESTONES FOR WIND IN TURKEY

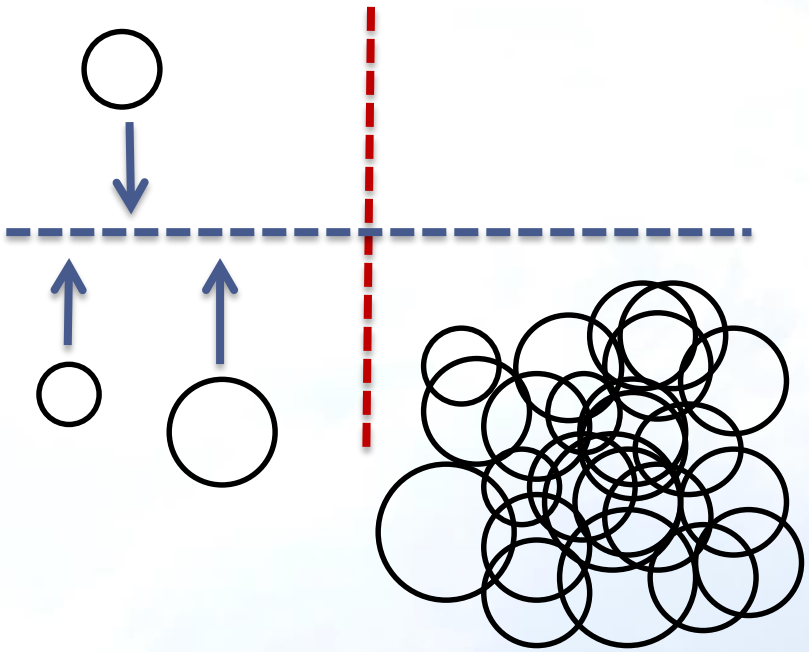
- The law on the Utilization of Renewable Energy Sources (RES) for the purpose of generating energy, (Law No. 5346 of 10/05/2005) is the first Renewable Energy Law of Turkey which was approved by the Turkish Parliament.
- In November 2007, the Turkish Energy Market Regulatory Authority (EMRA) accepted 751 WPP applications with total capacity of 78,000 MW.
- The Turkey's Parliament approved a new law related to feed-in tariff incentives that are applied for Renewables on 29 December 2010.

# INCENTIVES FOR WIND POWER

| Type | Feed-in Tariffs (USD Cent / kWh) | If Production Manufactured Domestically | Additional Feed-in Contribution (USD Cent / kWh) |
|---|---|---|---|
| **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 |

# 1st ROUND: NOVEMBER 1ST 2007 APPLICATIONS

**NOVEMBER 1ST 2007**



**Before Nov. 2007**
Singular WPP applications and licensed seperately

3500MW of Wind capacity allocated before 2007

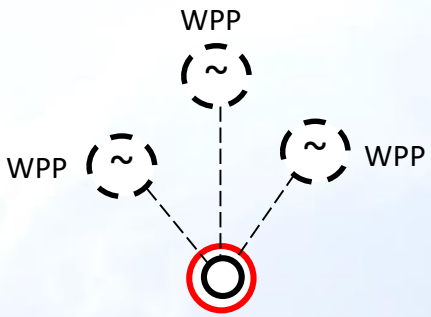
**Nov. 2007 Applications**
722 applications with 78.000 MW capacity Overlapping, or same region.

## ASSESMENT OF APPLICATIONS

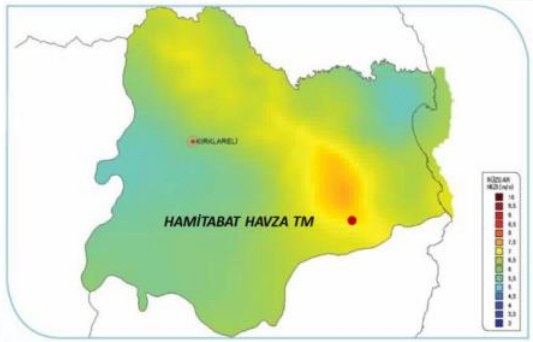
- Integration of wind capacity equal to 25% of maximum total demand is planned to be integrated. (48.0000/4=~12.000 MW)
- Wind Basin Substations are planned in region with high wind energy potential.
- WPP applications are directed to nearest substations.
- Maximum capacity connectable to a connection point is determined o be %5 of the Short Circuit MVA

# WPP BASIN (COLLECTOR) SUBSTATIONS

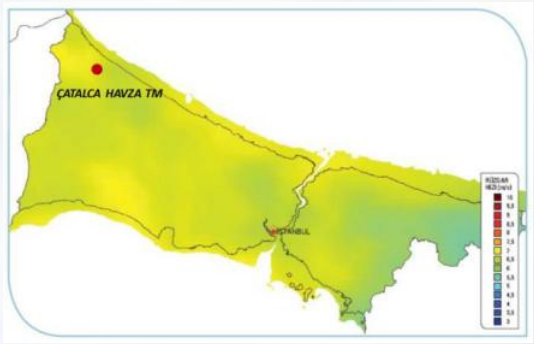
In region where wind potentials are high, Wind Basin Subs are planned to be established and connectable WPP capacities are announced by TEIAS to integrate WPP's.



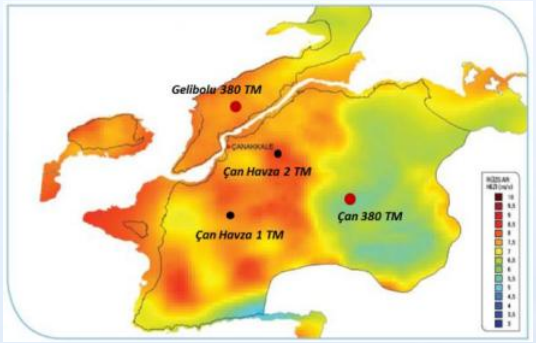

**400/154 kV Basin (Collector) Substation**



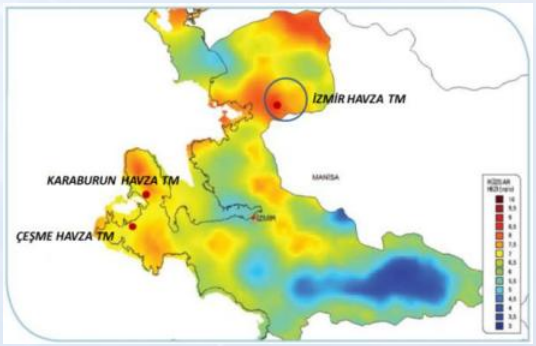

**KIRKLARELİ**
380/154 kV Basin Substation




**İSTANBUL**
380/154 kV Çatalca Basin TM



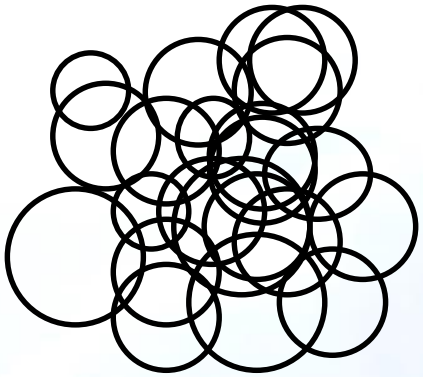

**ÇANAKKALE**
380/154 kV Çan TM
380/154 kV Gelibolu (Sütlüce) TM
154 kV Çan Basin 1 TM
154 kV Çan Basin 2 TM



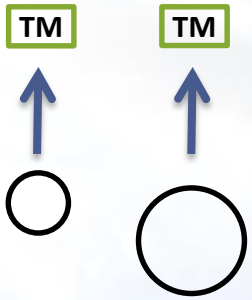

**İZMİR**
380/154 kV İzmir Basin TM

# WPP CONNECTION REQUESTS MANAGEMENT

**Nov. 2007**
**Applications**

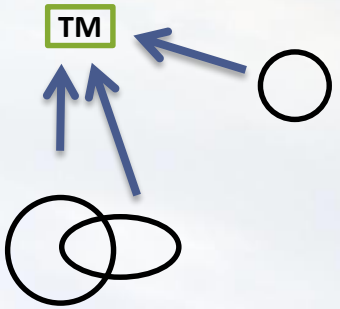


78.000 MW
is decreased to
7.500 MW




Non-overlapping applications to different substations are classified as singular application and connections approved.

No competition
2000 MW




Applications that are overlapping or/and have connection request to same substation are assessed via competitions (bidding process) according to contribution fees.

via competitions
5500 MW

## *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 Fee Wind and Solar Power Plant in the case of more than one power plant project application for the same region.

# PROCEDURE FOR WPP APPLICATIONS

*defined by Electricity Market Law*

Connection capacities on regional basis are announced by TEİAŞ.

**After 16 months** WPP Pre-licence applications are submitted to EMRA

The applications are reviewed by General Directorate of Renewable Energy and then assessed for connection points by TEİAŞ.

↓

The applications are listed by regions. In regions with application exceeding announced capacity, competition (tendering) is required.

# 2nd ROUND: WPP CAPACITIES, 2013


- 3,000 MW capacity was announced for wind power plants on regional basis on November 2013.
- Applications for that 3,000 MW capacity were taken by EMRA at end of the April 2015.
- Energy investors have installed 1,400 measurement stations for the capacity.
- Projects, total of 42.000 MW, applied for that capacity.
- Capacity competions (Auctions) are expected to be realized between end of 2015 and mid-2016.

# 3rd ROUND: WPP CAPACITIES 2015


•2000 MW capacity was announced for wind power plants in April 2015 on regional basis as 2013 capacities.

•Applications for that 2000 MW will be taken by EMRA in Oct. 2016 after necessary wind site measurements by applicants.

- 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

# NEW REGULATION - CONNECTABLE CAPACITY

- 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.

# Thank you!

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TEİAŞ