
GENERAL DIRECTORATE OF RENEWABLE ENERGY

**AN OVERVIEW OF
RENEWABLE ENERGY
SITUATION
IN TURKEY**

Sebahattin ÖZ

Yenilenebilir Enerji Kaynakları Daire Başkanı

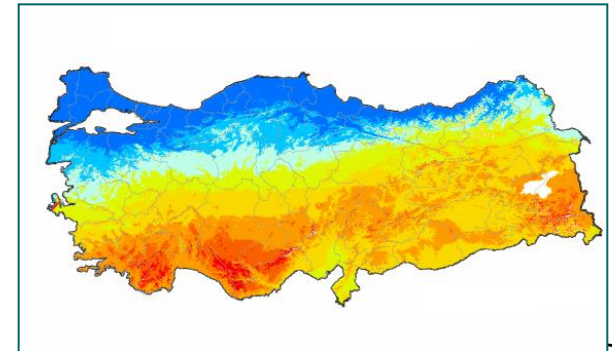
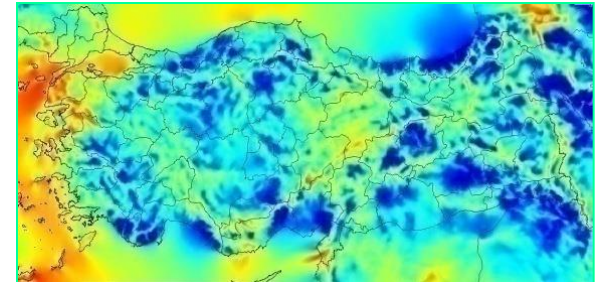
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RENEWABLE POTENTIAL OF TURKEY

Turkey has substantial amount of renewable energy potential and the utilization rates are growing. Hydro, wind and solar energy resources are the major portions of our renewable portfolio.

Turkey has at least;

- 160000 GWh/a. economic hydro,
- 48000 MW wind capacity
- 1.500 kWh/m²-year of average Global Solar Radiation
- 31500 MWt geothermal capacity
- 8,6 MTOE biomass
- 1,5-2 MTOE biogas



MAIN POLICY CONCERNS OF TURKEY

- **Energy security**
- **Sustainable energy supply**



Turkey attributes significant importance to;

- encouraging the **energy production from renewables** in a secure, economic and cost effective manner,
- expanding **the utilization of our renewable resources** for generating electrical energy,
- increasing **the diversification of energy resources**,
- **reducing greenhouse gas emissions**,
- making use of **waste products** and protecting the environment,
- developing the related **mechanical and/or electro-mechanical manufacturing** sector.

2023 TARGETS

According to Electricity Energy Market And Supply Security Strategy Paper (2009)

some targets defined related with
renewables until 2023 are as follow

- At least **30% of total electricity**
production from renewables,



2023 TARGETS

- **The whole economically feasible hydropower potential** of Turkey will be provided for generating electrical energy,
- **600 MWe geothermal** and **3000 MW** of **solar** energy will be implemented,
- **20,000 MW** capacity of wind power plant will be in operation.



LEGISLATION



Amendment to Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy (No. 6094)

(Official Gazette: January 08 , 2011,
No.27809)



LICENCES

Number of companies having the electricity market production license in the field of renewable energy sources :

- Hydroelectric : 927**
- Wind : 278**
- Biomass : 35**
- Geothermal : 25**

FEED IN TARIFFS

Schedule I **(Provision of the law dated 29/12/2010 and numbered 6094)**

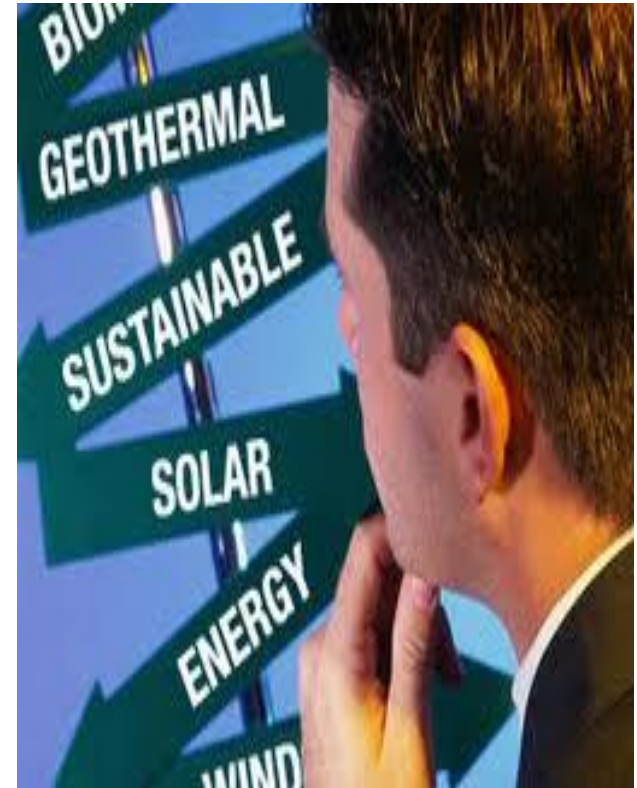
Type of Production Facility Based on Renewable Energy Resources	Prices Applicable (US Dollar cent/kWh)
a. Hydroelectric production facility	7,3
b. Wind power based production facility	7,3
c. Geothermal power based production facility	10,5
d. Biomass based production facility (including landfill gas)	13,3
e. Solar power based production facility	13,3

FEED IN TARIFFS

<u>Tariffs in \$cents/kWh;</u>	
Wind and Hydroelectric power plants	: 7.3
Geothermal power plants	:10.5
Solar and Biomass power plants	:13.3

- Licensed facilities producing electricity from renewables which will be in **operation before December 31, 2015** and also

- These prices will be given for a **maximum term of 10 years** from its operation date.





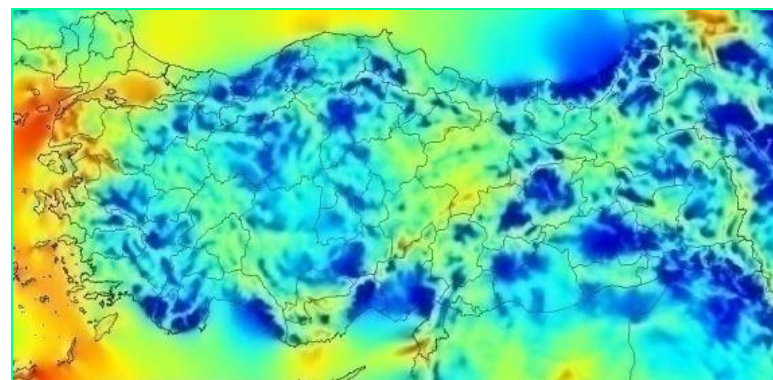
ADDITIONAL FEED IN TARIFFS

- The prices between 0.4 and 3.5 USD Cent/kWh will be added to the existing tariff in the case of usage of local content in the production of the electricity generated from renewables.
- The production facilities in the renewable energy sector, which are in operation before December 2015, can benefit from this application.
- This additional tariff is provided for a term of five years from the operation starting date of the production facility.

WIND ENERGY POTENTIAL

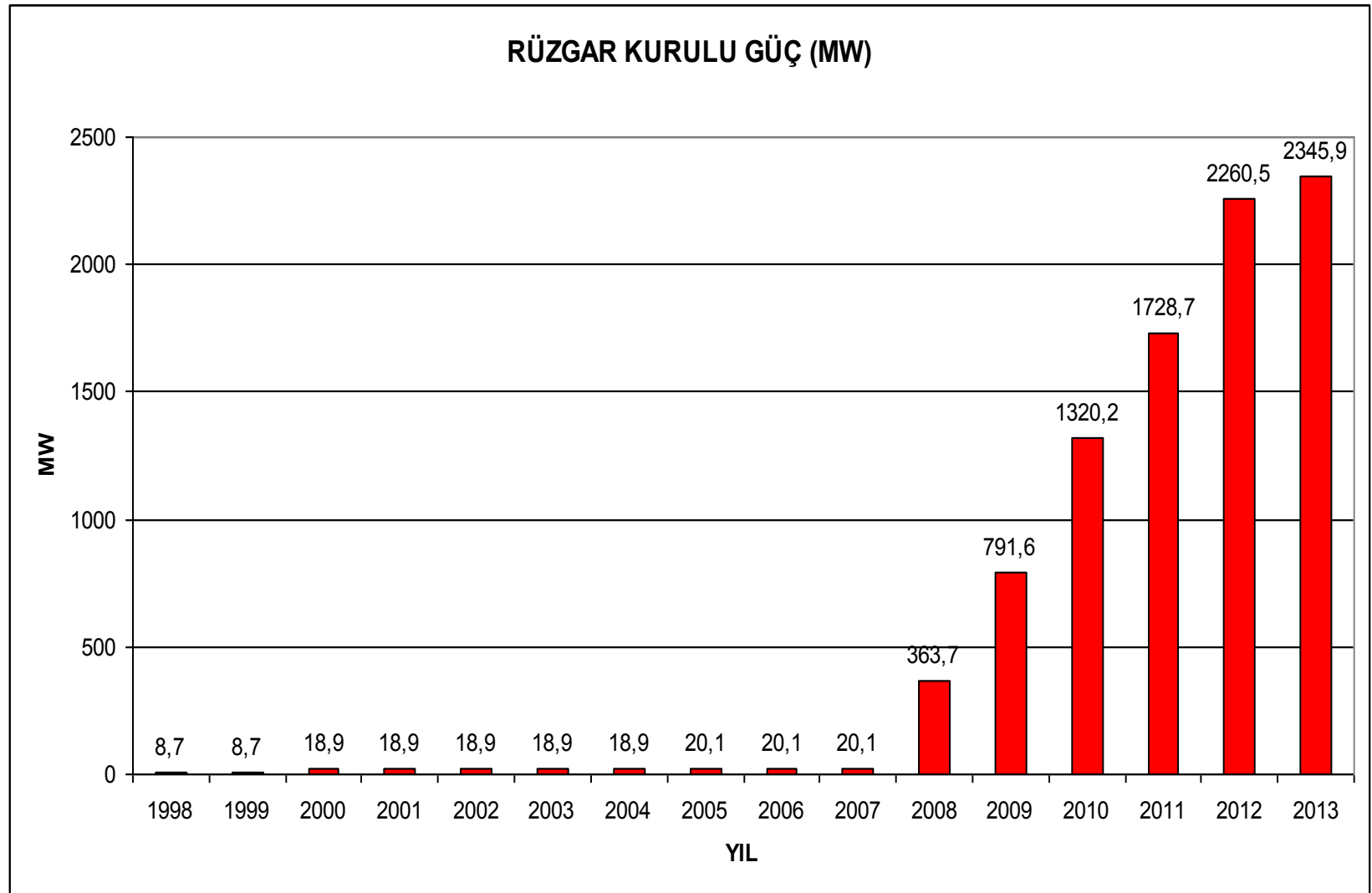
Resource potential	Wind class	Annual wind power density (W/m ²)	Annual wind speed (m/s)	Total capacity (MW)
Good	4	400 – 500	7,0 – 7,5	29.259,36
Excellent	5	500 – 600	7,5 – 8,0	12.994,32
Outstanding	6	600 – 800	8,0 – 9,0	5.399,92
Superb	7	> 800	> 9,0	195,84
TOTAL CAPACITY				47.849,44

ON-SHORE (MW)	OFF-SHORE (MW)
37.836	10.013

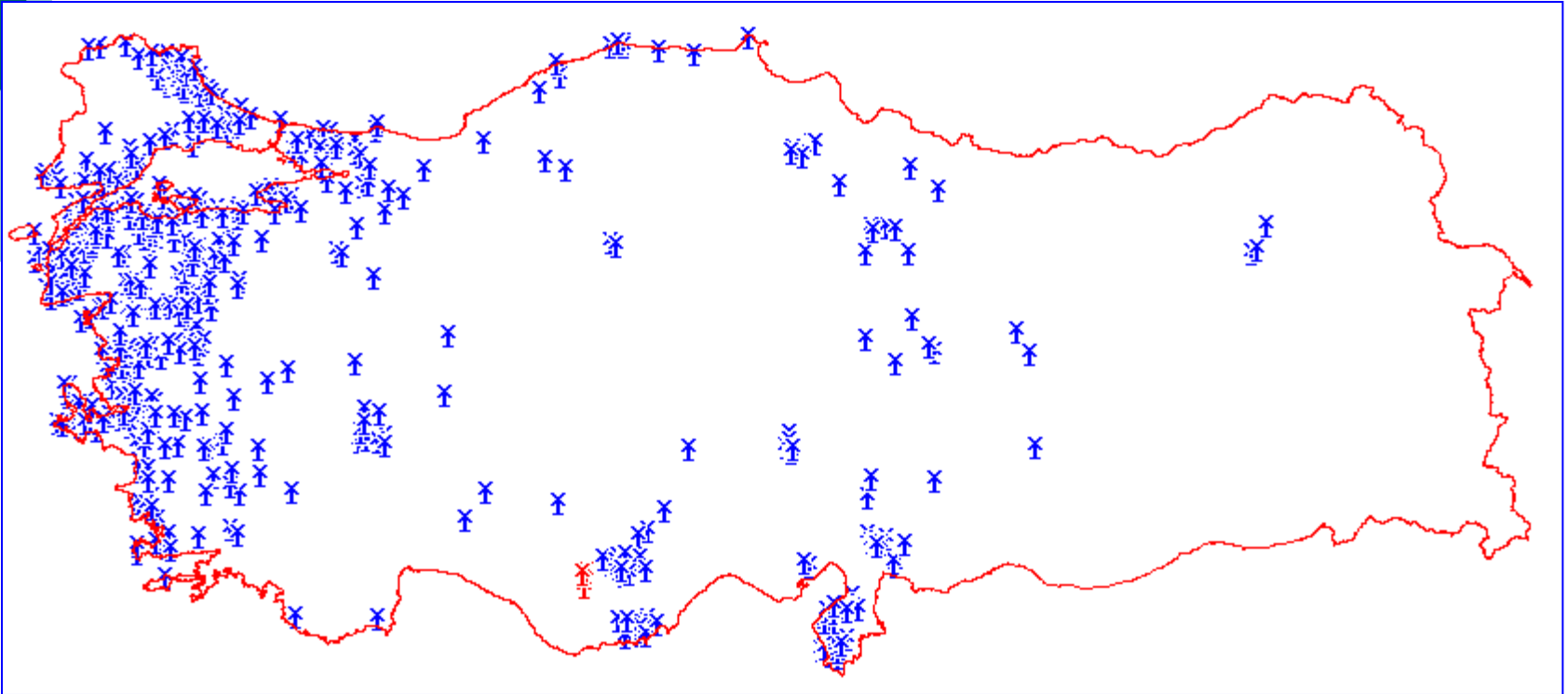


Wind energy potential (annual average wind speed > 7 m/s), 50 m a.g.l.

WIND ENERGY – WIND DEVELOPMENT

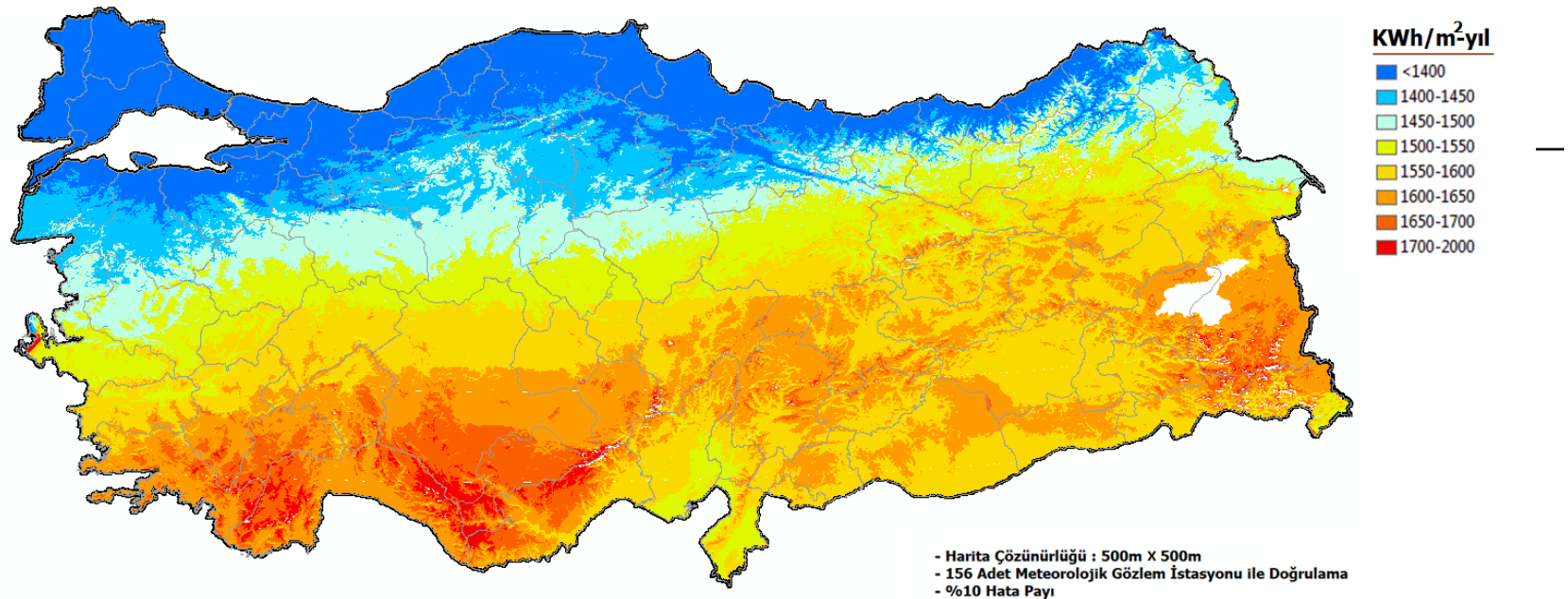


WIND ENERGY – WIND DEVELOPMENT



Location of wind license applications, March 2011

SOLAR ENERGY – SOLAR DEVELOPMENT



Average Global Solar Radiation: **1.500 kWh/m²-year**

Installed photovoltaic capacity:

- Estimated total installed capacity is **3 MW**.
- This technology is used only in forest fire watching towers, highways, communication towers and meteorological stations.

Equipment Production Capacity:

PV module manufacturing capacity is around **150 MW/year**.

SOLAR ENERGY

- In order to use the entire solar potential effectively, we are treating solar electricity generation in three aspects:
 - Off-grid
 - Without licence (up to 500 KW)
 - Licensed

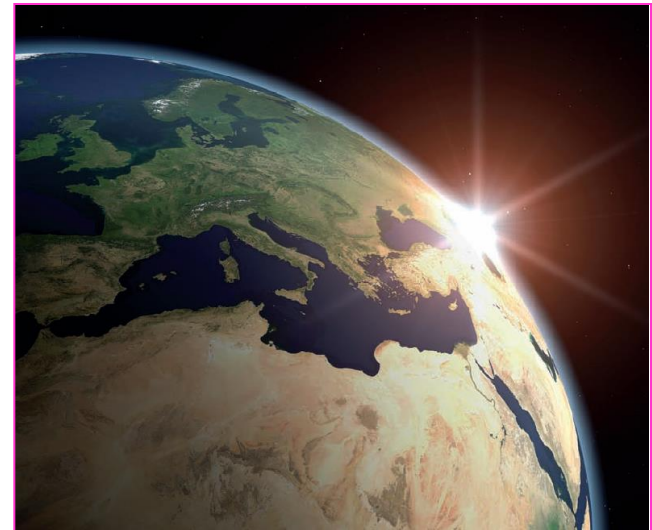
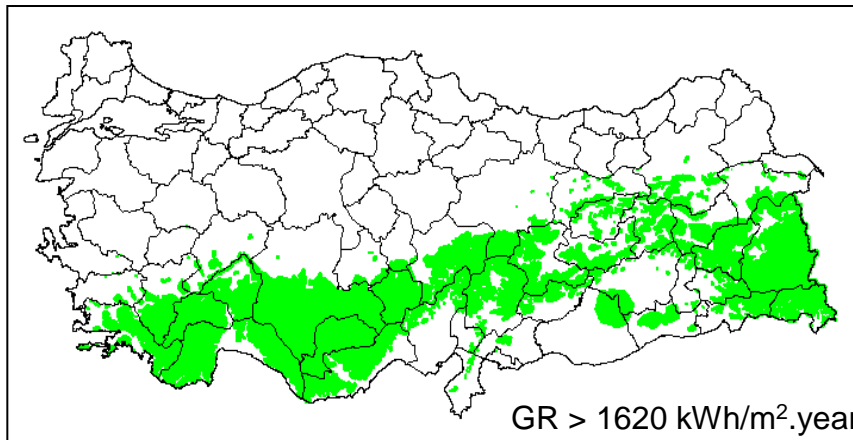
Under the Amendment Law - No. 6094

- A total installed capacity of **600 MW** can connect to the electricity **transmission systems before the end of 2013.**
(Applications will be accepted on **10-14 June 2013**)
- The Council of Ministers will determine the total installed capacities for the following years after 31.12.2013.

SOLAR ENERGY

(Under the Amendment Law - No. 6094)

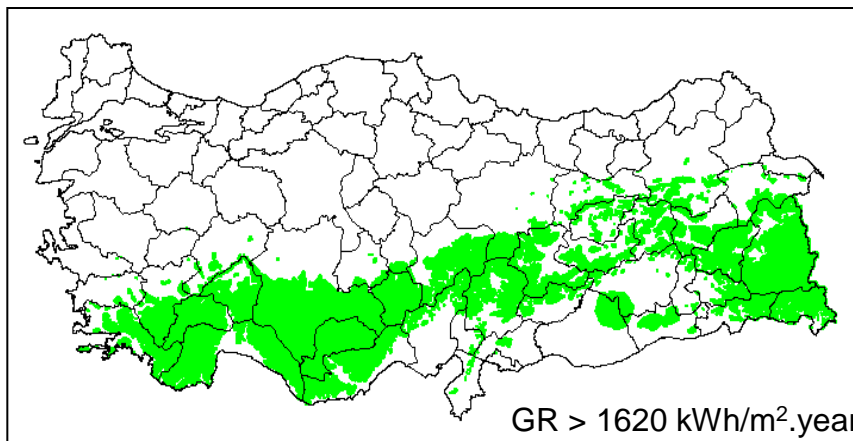
- To identify the promising areas, the regions where global horizontal radiation is more than **1620 kWh/m².year** were determined.
- Names and **connection capacities of 121 sub-stations** inside or near the promising areas were declared for license applications.
(This restriction is not valid for the systems up to 500 kW)



SOLAR ENERGY

(Under the Amendment Law - No. 6094)

- License applications based on solar energy must include a measurement data. A By-Law related to **solar measurement procedures** was issued (Official Gazette, 22/02/2012, No.28212).
- A By-Law was issued related to **standards and testing methods** of the equipment in electricity production facilities based on solar power (Official Gazette, 19/06/2011, No.27969).



SOLAR WATER HEATING SYSTEMS



Turkey is one of the biggest producers of the solar collectors in the world

- Annual flat-plate solar collector manufacturing capacity is about 0.5 - 1 million m²
- 18 million m² flat-plate solar collectors in use

BIOMASS-POTENTIAL

- 34 Biodiesel facilities received Processing License for biodiesel production (2012, February).
- Total biodiesel production capacity of all these facilities is 561.217 tons.
- Estimation at least
- 1,2 million ton/year biodiesel and
- 0,7 million ton/year bioethanol production capacity based on 2,7 million hectare agricultural land.

8,6 MTOE biomass
1,5-2 MTOE biogas



BIOFUELS

According to the decision by the Energy Market Regulatory Authority EMRA (27/09/2011)

- The ratio of domestically produced biodiesel (FAME) as an additive in the **fuel oil** will be at least;

1% from 01/01/2014

2% from 01/01/2015

3% from 01/01/2016

- The ratio of domestically produced **bioethanol** as an additive in the fuel oil will be at least;

2% from 01/01/2013

3% from 01/01/2014



BIOMASS-LICENCES

In the field of biofuels derived from renewable energy sources

Number of companies having Biodiesel Processing License: 23

Number of companies having Fuel Bioethanol producers License : 3

GEO THERMAL ENERGY - POTENTIAL



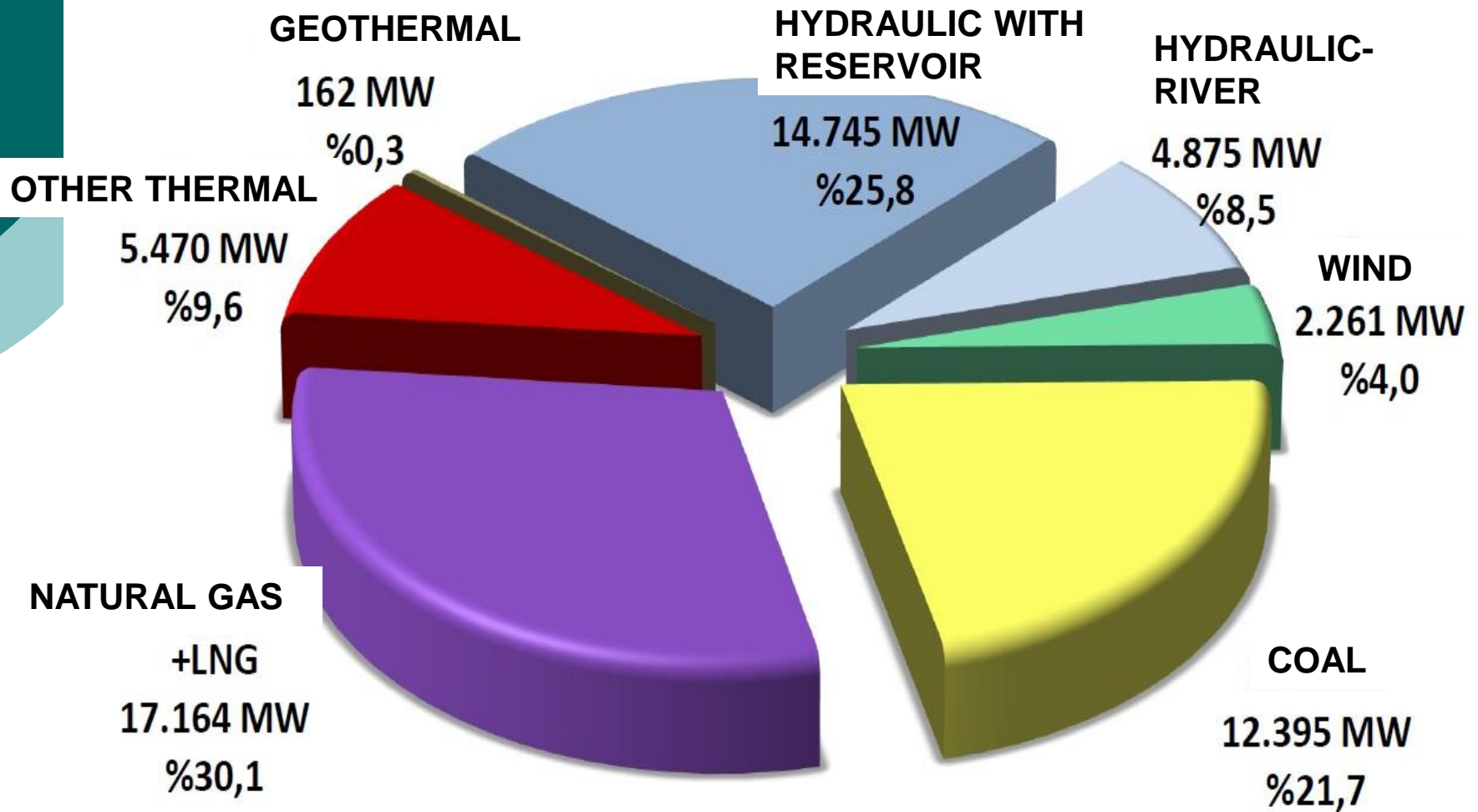
- Geothermal capacity of Turkey is **31.500 MWt.** % 77,9 of this potential is in Western Anatolia.
- Geothermal Electricity Potential: **1500 MWe.**

GEO THERMAL ENERGY - LICENCES



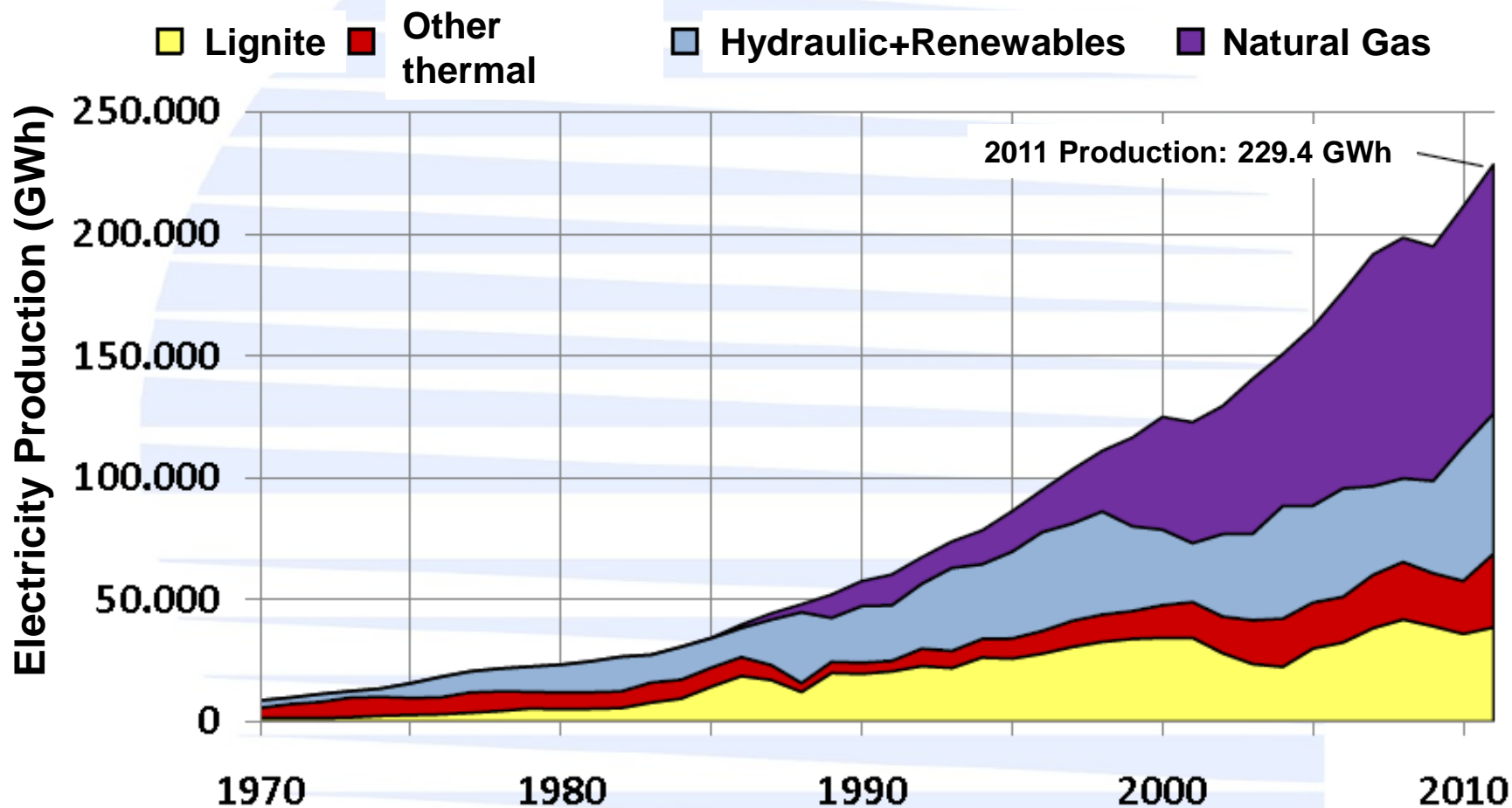
- Totally 25 projects of 634.67 MWe capacity are licensed
- 472.47 MWe (16 facilities) is under construction and
- 162.2 MWe (9 facilities) is under operation as of January, 2013
- Totally 17 applications with 330.95 MWe capacity under licensing procedure

INSTALLED POWER IN TURKEY (31.12.2012)



INSTALLED POWER: 57 072 MW

ELECTRICITY PRODUCTION IN TURKEY BY RESOURCES (1970-2011)



Thank you for your attention.