

RENEWABLE ENERGIES, CLEAN ENERGY GENERATION AND THEIR SUBSIDIES IN TURKEY AND EU COUNTRIES

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Abstract

Energy is a measurement for economical and social improvement and also it is a fundamental human requirement. Today all countries in the world are working hard to solve energy problems for example, depending energy importation, environmental pollution, global warming, increasing cost of energy and inefficiency in energy. The necessity of energy is increasing so rapidly to keep pace with technological developments. For feeding this hunger and our planet's future safety, it needs to generate clean energies. Therefore, the governments give huge amount of incentives for renewable energy productions.

In this study, the importance of renewable energy usage, recent incentives, renewable energy policies in Turkey and some EU countries are investigated and compared. It is aimed to show the real situation of renewables in Turkey, by comparing with some EU countries, so make contribution of future developments for these clean energies in Turkey. In this regard, some barriers and recommendations are submitted.

Keywords: Renewable energy, Renewable energy resources, Renewable energy policies, Renewable energy incentives, Energy in Turkey

1. Introduction

Turkey is the 17th largest economy of the World [1]. Turkey's economy has been developing strongly for the last decade. This fast industrialization, growing demand and urbanization require more energy production. The demand for electric energy in Turkey expected to be 580 billion kWh by the year 2020 [2]. Turkey mostly uses imported energy which costs very high for its economy. Thus, different types of renewable energies are seen as effective solutions for Turkey's energy problems and its sustainable development. Turkey has many renewable energy sources for extensive energy production and use. The country's main renewable energy resources are hydroelectric, solar, wind, biomass, and geothermal energy [3]. While hydro power accounts for most of the total renewable energy supply in Turkey; biomass increasingly has a good share in last few years. As for solar, geothermal and wind energy, they are expected to increase for near future [1].

Turkey is dependable primary energy consumes, such as oil, lignite, hard coal, and natural gas. This dependency is around 72% of total energy, at the end of 2009. Oil and natural gas have the biggest shares of imported energy. Total net imports in 2008 were 70.57 Mtoe, and it is expected as 151.76 Mtoe in 2020. Also total energy supply in 2008 was 98.55 TPES (total primary energy supply) and it is expected as 217.75 TPES in 2020 [1].

These numbers can demonstrate that Turkey must reduce the numbers of the energy importation bills. For this, it requires inexpensive, permanent, reliable and sustainable energy solutions like renewable energies. Also, Turkey should improve energy policies, strategies, and programmes. To take right steps for the

country's clean energy development, there is also a point to pay importance as acquisition of knowledge in renewable energies and their technologies [4].

Turkey needs important investments in renewable energies, particularly in the electricity generation. This requirement is not only for its people's welfare, but also for the continuation of its rapid economic growth. To attract new investments, energy production from renewable energies is supported by the government. At the end of 2010, the Turkish Government has enacted a new law that designs the new incentives for renewable energy productions [5]. With this new law, Turkey plans to increase energy production from alternative energy sources and make more emphasize to energy plans which are effective and applicable ones [6].

In this study, the evaluation of renewable energy and the importance of renewable energy use, the new incentives for renewable energy production, the renewable energy policies in Turkey and some EU countries are investigated and compared. In this regard, some barriers and recommendations are submitted for better understanding about the importance of the topic.

2. Current and next energy status of Turkey

In Turkey, electricity is mostly produced in thermal power plants (TPPs) by consuming coal, lignite, natural gas, fuel oil. The production of electricity from renewables has small amount. As for nuclear power, it is new and very limited. But, Russia and Turkey signed a \$20 billion agreement in May 2010 for the construction of a four-reactor power plant near the coastal city of Mersin (in Akkuyu). Although there are too many opposite ideas and environmental organizations' reactions to nuclear energy, Turkey wants to launch the nuclear power industry to diversify its energy mix and supply its soaring demand [7]. The demand for electricity is rising at a ratio of 8-10% annually in Turkey. That means, Turkey will need extra 5 billion US Dollars per year for investment of power generation, transmission and distribution by the year 2020. The Turkish Government encourages domestic and foreign private sectors to carry out the country's power generation projects on a built operate transfer basis [8].

For having the general point of view, it can be seen present and future total energy production and consumption in Turkey, in Table 1.a) and b), in turn. As it is shown in the tables, the total energy productions in Turkey are expected to be 58.20 Mtoe and 71.68 Mtoe by the years 2020 and 2030, respectively. On the other hand, total energy consumptions are expected to be 279.18 Mtoe and 463.24 Mtoe by the years 2020 and 2030, respectively. Turkey has large coal reserves and hopes to multiply their use over the next decade to provide electricity. Also, Turkey has been reforming tariffs in energy to increase energy production and competitions in energy since 2001 [9].

Table 1. a) Present and future (estimated) total energy production in Turkey (Mtoe) [9]

Energy Sources	1990	2000	2005	2010	2020	2030
Coal and Lignite	12.41	13.29	20.69	26.15	32.36	35.13
Oil	3.61	2.73	1.66	1.13	0.49	0.17
N. Gas	0.18	0.53	0.16	0.17	0.14	0.10
Com. Renewables and Wastes*	7.21	6.56	5.33	4.42	3.93	3.75
Nuclear	-	-	-	-	7.30	14.60
Hydropower	1.99	2.66	4.16	5.34	10.00	10.00
Geothermal	0.43	0.68	0.70	0.98	1.71	3.64
Solar/Wind/Other	0.03	0.27	0.22	1.05	2.27	4.28
Total energy production	25.86	26.71	34.12	39.22	58.20	71.68

*Comprises solid biomass, biogas, industrial waste and municipal waste.

Table 1. b) Present and future (estimated) total energy consumption in Turkey (Mtoe) [9]

Energy Sources	1990	2000	2005	2010	2020	2030
Coal and Lignite	16.94	23.32	35.46	39.70	107.57	198.34
Oil	23.61	31.08	40.01	51.17	71.89	102.38
N. Gas	2.86	12.63	42.21	49.58	74.51	126.25
Com. Renewables and Wastes*	7.21	6.56	5.33	4.42	3.93	3.75
Nuclear	-	-	-	-	7.30	14.60
Hydropower	1.99	2.66	4.16	5.34	10.00	10.00
Geothermal	0.43	0.68	1.89	0.97	1.71	3.64
Solar/Wind/Other	0.03	0.27	0.22	1.05	2.27	4.28
Total energy consumption	53.01	77.49	129.63	152.22	279.18	463.24

*Comprises solid biomass, biogas, industrial waste and municipal waste.

Table 2 [3] shows renewable energy potential in Turkey; including energy type, usage purpose, natural capacity, technical and economical values. Renewable sources represent the second-largest domestic energy source after coal in Turkey. As aforementioned, main renewable energy resources in Turkey are: hydro, biomass, wind, geothermal and solar. Hydropower has the biggest part of all. The Ministry of Energy and Natural Resources has declared recently that while Turkey’s installed power of the hydraulic power in 2002 was 12241 MW, it has now reached the number 16937 MW as of at the end of October 2011, with the increase of 39%. Total installed power capacity of the power plants that commissioned to produce electricity from renewable energy sources is 1554 MW and hydraulic power share of this amount is 1211,3 MW at the end of October 2011 [10].

Table 2. Renewable energy potential in Turkey [3]

Energy type	Usage purpose	Natural capacity	Technical	Economical
Solar energy	Electric (billion kWh)	977.000	6.105	305
	Thermal (Mtoe)	80.000	500	25
Hydropower	Electric (billion kWh)	430	215	124.5
Wind Direct energy-land	Electric (billion kWh)	400	110	50
	Electric (billion kWh)	-	180	-
Direct energy-off shore	(billion kWh)	150	18	-
Wave energy				
Geothermal energy	Electric (10 ⁹ kWh)	-	-	1.4
	Thermal (Mtoe)	31.500	7.500	2.843
Biomass energy	Total (Mtoe)	120	50	32

Turkey’s renewable energy potential can be seen as a great opportunity from an economic, environmental and national security perspective [11]. Turkey’s dependency on foreign resources for heating and electricity should be lessened. Developing and using domestic alternative energy resources enhances the country’s geopolitical safety. Moreover, renewable energy resources encourage economic growth [12].

One of the rising renewable energy supplies in Turkey is biomass. Total renewable energy supply declined from 1990 to 2004, due to a decrease in biomass supply [13]. But it has been taken some important steps in biomass and biogas production. For example, in Kocaeli, Metropolitan Municipality, TÜBİTAK MRC as a researcher institution and four universities have began the project “Biogas generation from vegetal and animal wastes and usage in integrated energy generation facilities”, established in IZAYDAS area. The construction of the facility was started on April 14th, 2007 and now is commissioned in 2011 to begin biogas production [14].

In recent years, the composition of renewable energy supply has changed with the wind power increases its market share. For example, Installed power of wind power was almost unavailable in 2002, which was 18.9 MW, now it has reached to 1600 MW, and also the wind electrical energy production is 325 MW as of at the end of October 2011 in Turkey [10].

Turkey is one of the leading countries in terms of potential for geothermal energy applications, but it has been relatively late for this renewable energy production and use, compared to the rest of the world. Yet, it is seen some important improvements in geothermal sector in the last few years, for example electricity generation from geothermal resources in Turkey is expecting to reach 550 MW (4 Billion kWh/year) by the year 2013 [15]. Turkey’s main geothermal areas are in Marmara and Aegean regions especially in Denizli, Yalova, Aydın, Çanakkale, Bursa, Kütahya, Balıkesir, Manisa and İzmir. Turkey’s primary energy production forecast 2000-2030 [16].

As to give another perspective of energy in Turkey, Fig. 1 shows domestic energy production forecast 2000-2030 [16]. The government forecasts both oil and gas production to decline owing to depletion of resources but coal production (mainly lignite) and renewable energy production to increase (see also Fig. 2). It can also be seen in Table 3, the largest share of the country’s total energy consumption comes from natural gas (31.8%), followed by oil (29.9%) and coal (27.3%). Renewable energy sources (with the exception of hydro) are currently small fractions of Turkey’s energy supply [17]. Fig. 3. (A) and (B) shows Turkey’s electricity generation mix in 2008 and economically feasible renewable energy potential, respectively.

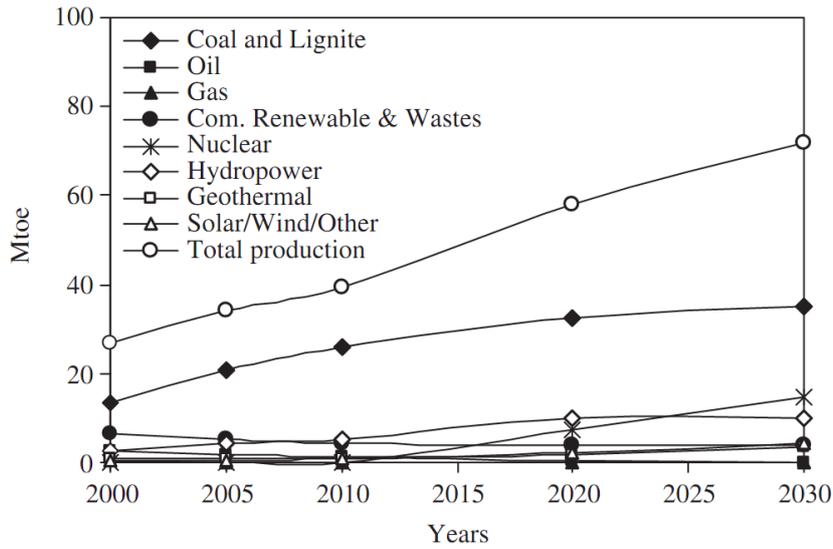


Figure 1. Turkey's primary energy production forecast 2000-2030 [16]

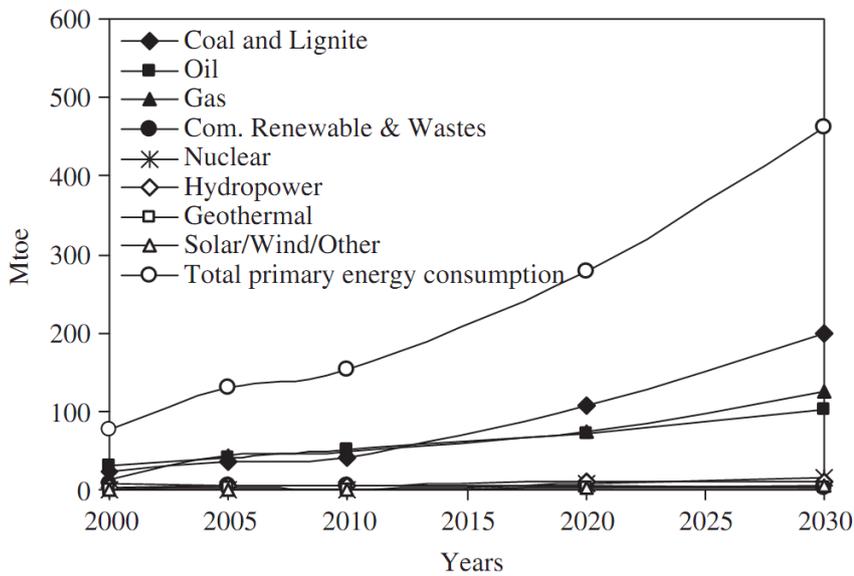
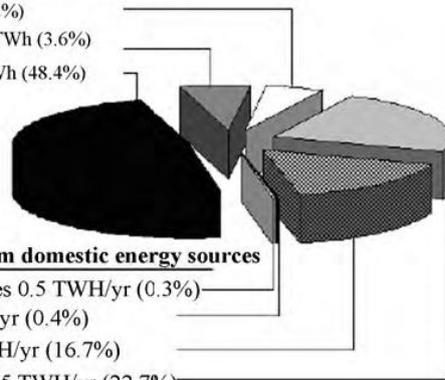


Figure 2. Turkey's primary energy consumption forecast 2000-2030 [16]

Generation from imported fossil fuels

Oil 10.3 TWh (5.2%)
 Import coal 12.5 TWh (3.6%)
 Natural gas 96 TWh (48.4%)

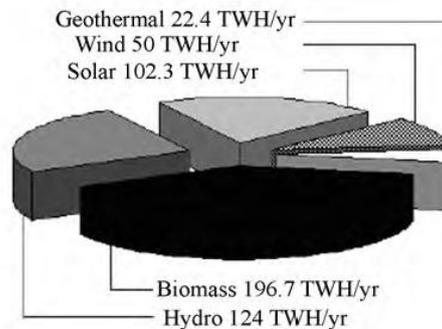


Generation from domestic energy sources

Other renewables 0.5 TWh/yr (0.3%)
 Wind 0.8 TWh/yr (0.4%)
 Hydro 33.1 TWh/yr (16.7%)
 Domestic coal 45 TWh/yr (22.7%)

(A)

Geothermal 22.4 TWh/yr
 Wind 50 TWh/yr
 Solar 102.3 TWh/yr



(B)

Figure 3. (A) Turkey's electricity generation mix in 2008 and (B) Turkey's economically feasible renewable energy potential [17].

Table 3. Comparison of fuel mix of total energy consumption between world and Turkey (%) [17].

	Oil	Natural Gas	Coal	Nuclear	Renewables (including hydropower)
World (2007)	34.0	20.9	26.5	5.9	12.7
Turkey (2008)	29.9	31.8	27.3	-	11.0

Turkey has progressed greatly in all areas of energy policy since the 2005 and there are obvious signs of a better future balance in energy policy goals [1]. Energy sustainability country index leaders by economic groupings can be seen in Table 4 [18]. Turkey has a powerhouse economy as growing at over 5% yearly. Considering geographic advantages, Turkey is perfectly positioned to benefit from renewables in a strong rate that would drive the country’s very fast development in renewable energy production. Also, with the help and encouragement of grant aids programs in Turkey [19-20] energy from renewable resources is supported by regional development agencies. Moreover, the country is well positioned to supply The European Grid.

Table 4. Energy sustainability country index leaders (by economic groupings) [18]

GDP/capita (USD)	> 33,500	14,300 – 33,500	6,000 – 14,300	< 6,000
Positioning				
1	Switzerland	Spain	Colombia*	Indonesia*
2	Sweden	Portugal	Argentina	Egypt
3	France	Slovenia	Brazil	Cameroon
4	Norway*	Italy	Mexico*	Philippines
5	Germany	New Zealand	Turkey	Swaziland

GDP: Gross Domestic Product. (*) = net energy exporters (Others) = net energy importers.

3. Renewable incentives in Turkey

There are some incentives and regulations related to renewable energy sources in Turkey. In our previous studies [3,6,11,21,22] these mechanisms have been investigated in depth. In his study, the changes in incentives according to the law of energy production from renewables have been examined. The detail of this regulation is given below in the sub topic.

3.1. Incentives for renewable energy in Turkey

At the end of 2010 Turkish Grand National Assembly (TBMM) passed a new renewable energy bill determining regulations and feed-in tariffs in the renewable energy sector [3]. Under the law, producers of renewable energy who started operation between May 18, 2005 and December 31, 2015 is guaranteed power purchase prices for a period of ten years. Wind and hydroelectric power is bought at USD 0.073 per kilowatt-hour (kWh), the price for geothermal energy is defined at USD 0.105 per kilowatt-hour (kWh), and biomass, including landfill gas, and solar energy is purchased at USD 0.133 per kilowatt-hour (kWh). Yet, the law limits the solar power capacity eligible for support to 600 MW until December 31, 2013 and entitles the Council of Ministers to determine the capacity after that. According to this new law, the renewable energy production incentives can be seen in Table 5 [5].

Table 5. Renewable energy (Law No:6094) subsidies [5]

The plant type of the generation of energy from renewable resources	The prices that will be applied (USD cent/kWh)
A hydroelectric power plant	7.3
A wind power plant (A wind farm)	7.3
A Geothermal energy plant	10.5
A biomass supplier (including landfill gas)	13.3
A solar energy plant	13.3

The Council of Ministers is also authorized to determine new purchase prices, which should not exceed the current prices, for facilities established after December 31, 2015. Renewable energy producers that got their operation license before December 31, 2015 are entitled to receive additional subsidy ranging from USD 0.004 to USD 0.035 per kWh for a period of five years if they use locally-produced equipment and technology for their plants, which can be seen in Table 6 [5]. License procedures will be handled by the

Energy Market Regulatory Authority (EPDK) in cooperation with the Energy Ministry, Interior Ministry and the State Waterworks Authority (DSI).

Table 6. Additional support amounts for companies with facilitates that use locally produced equipments and components [5]

Plant Type	Locally produced equipments and components	Domestic contribution supplement (USD cent/kWh)
A- Hydroelectric power plant	1.Turbine	1.3
	2.Generator and power electronics	1.0
B- A wind power plant (A wind farm)	1.Propeller	0.8
	2. Generator and power electronics	1.0
	3. Turbine Tower	0.6
	4. Rotor and all mechanical components in the nasel group (the exception of payments made for propeller group with generators and power electronics.)	1.3
C- Facilities of photovoltaic solar panels	1.Integration of PV panels and manufacture of the structural mechanics of the solar PV panels	0.8
	2.PV modules	1.3
	3. Cells that make up PV modules	3.5
	4.Inverter	0.6
	5 Beam materials that focusing solar energy on the solar PV module	0.5
D-The plants that based on concentrated solar power	1.Radiation pick-up tube	2.4
	2.Reflective surface plate	0.6
	3.Solar Tracking System	0.6
	4.The mechanical parts of the thermal energy storage system	1.3
	5.Mechanical parts of the steam production system by collecting the solar beam on the tower	2.4
	6. Sterling engine	1.3
	7. The panel integration and structural mechanics of the solar panel	0.6
E- Facilities that based on biomass energy	1. Fluidized-bed steam boiler	0.8
	2. Liquid or gas-fired steam boiler	0.4
	3. Gasification and gas cleaning group	0.6
	4. Steam or gas turbine	2.0
	5. Internal combustion engine, or Stirling engine	0.9
	6. Generator and power electronics	0.5
	7. Cogeneration system	0.4
F- Facilities that based on geothermal energy	1. Steam or gas turbine	1.3
	2. Generator and power electronics	0.7
	3. Steam injector or a vacuum compressor	0.7

4. Renewable energy subsidies in EU

Governments' energy policies play important roles to augment investments in renewable energies [23]. Increasing incentives, notably feed-in tariffs, direct subsidies, and tax credits can make the risk/revenue view of renewable energy investments more attractive. The proceeds from carbon and energy taxes or from phasing out fossil fuel subsidies could be used to uphold such incentives. As far as project financing is concerned, public finance mechanisms, which can range from simple grants to complex conditional funding structures, can be deployed to support R&D, technology transfer, and skill building. These can complement private capital, particularly in developing countries, or broaden the market for renewable energies. Thus, governments have increasingly been taking action; for early 2010, for example, 85 countries have set national targets for renewable energy, more than half of which are in developing countries like Turkey [24].

The European Commission in it's the Directive on renewable energy has set ambitious targets for all Member States, such that the EU will reach a 20% share of energy from renewable sources by 2020 and a 10% share of renewable energy specifically in the transport sector [25]. The 2005 share (measured in terms of gross final energy consumption) was 8.5% (9.2% in 2006), and the EU 2020 target is 20% [25]. In all European countries, production of electricity from renewable resources is supported. In many countries

minimum price system is used widely, which requires an electricity utility to purchase a portion of its electricity requirement, called as green energy, at a minimum price defined. Legally defined minimum prices change according to the country; some of them can be seen in Table 7 [26].

Table 7. Minimum price of renewable electricity in some European countries (Eurocent/kWh) [26]

Country	Price (Eurocent/kWh)
Netherlands	9.6-9.9
France	8.4
Austria	7.8
Portugal	7.5-7.9
Greece	6.4
Spain	6.3-7.5
Germany	6.2-8.5
Turkey*	5.0-5.5

* Turkey has changed the prices by new law at the end of in 2010, which is given in Table 5 and Table 6.

5. The analysis of current situation in Turkey and EU

There are many support mechanisms for dissemination of renewable energy usage in Turkey, but the most important and distinctive one has been enacted at the end of December, 2010, which has been given in this study, section 3.1 as Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy [5]. This law has long been waited. It has taken so much effort to be realized with some crucial modifications. For example, the most critical change in the tariff is the purchase price. The earlier version was “Euro cents” has changed into “Dollar cents” per kWh as unit prices, but the amount has almost remained the same. This is the main determining factor for the trend of future developments.

Incentive mechanisms in Turkey are presented in section 3 and applications of EU are presented in section 4. The following conclusions can be inferred if these two sections and references [28,29,30,31,32,33,34] are examined carefully,

* It can be seen that the unit purchase price of electricity which is generated from renewable energy sources (RES) are low when compared to EU countries. For example, while purchase price of biogas is approximately 10 EURO cent/kWh in Turkey, it can reach to 20 EURO cent/kWh in Germany, 29 EURO cent/kWh in Italy, 25 EURO cent/kWh in England. This effects affordability of the facility installation and can make difficult to find investment financing.

* The highest tariff purchase in Turkey is 13.3 Dollar cent/kWh (9 Euro cents/kWh), applied to the biomass and the sun. It is 8.5-20.00 Euro cent/kWh for biomass and 40-60.16 Euro cent/kWh for the sun in Germany [30].

* The implementation of procurement schedule of biomass energy is higher than other resources. The reason is that biomass production facilities have higher local installation potential than other facilities. Moreover, the incentives for biogas mean the indirect incentives for agricultural sector.

* This law in Turkey assures purchase guarantee only for the use of electricity, not for the heat, but in some EU Countries CHP applications that using renewable energy resources have additional bonus.

* While guaranteed purchase of electricity in Turkey is 10 years, this period is usually 20 years in EU countries.

* Using domestic products for the installation of the facility is encouraged by this law in Turkey. Renewable energy producers that got their operation license before 31 December 2015 are entitled to receive additional subsidy ranging from USD 0.004 to 0.035 per kWh for a period of five years if they use locally-produced mechanical, electromechanical and other equipment and technology for their plants. This is called “local contribution”.

* The law also limits the total production of licensed solar energy companies to 600MW annually until 31 December 2013, and then authorizes the cabinet to determine the limits afterwards in Turkey.

* The law in Turkey, purchase amounts for the renewable energies are determined by the resource, but the

size of plants is not taken into account.

* Although intense discussion has been made for the last decade to disseminate the usage of renewable energy resources in Turkey, there is not much progress can be seen especially in the employment of renewable energies. But, considering the employment in this sector in Germany, the numbers are quite high. For example in 2006 Germany has reached the employment of 235 000 in renewable energy sector, which was 160 500 in 2004 [31].

* The effect of the use of renewable energy resources is so important to reduce greenhouse gas emissions. Turkey's contribution to the reduction of greenhouse gases will be increased only with the expansion of the use of renewable energy resources [32].

* While the Turkish Parliament has approved a new renewable energy law that sets short-term standards, leave much about the renewable energy sector's long term prospects in the hands of nation's cabinet.

* It can also be thought that Turkey has great wind and solar energy potential, still needs important improvements.

6. Conclusion

In this study, the evaluation of renewable energy and the importance of renewable energy use, the incentives and subsidies, the renewable energy policies in Turkey and some EU countries are investigated and compared. Some EU countries are examined as examples whit regard to renewable energies and their usage.

With this study, the following items were identified or accomplished:

1) Turkey is an energy-importing country. In order to be less dependent on other countries, Turkey needs to use its sustainable sources. From this point of view, renewable power is a very attractive choice, since it is economical, sustainable, environmental friendly and a familiar energy source in Turkey. Furthermore, Turkey has several advantages for the use of renewable energy in terms of its geographical location. Although there has been an important progress last year in RES exploitation, there are still some barriers such as economic, lack of legislative and regulatory framework and poor infrastructure.

2) According to 2009 year's statistics Turkey in the tenth position among the 28 IEA countries, for comparison, renewable energy sources account for more than 40% of TPES in Norway which is basically hydropower, and around 1/3 in New Zealand and Sweden. Allowing for the electricity generation, in 2009, renewable sources provided 37.8 TWh of electricity, or 19.6% of the total power generation in Turkey, which is the 12th highest portion among the 28 IEA countries. Hydropower accounted for 95% (35.9 TWh) of this total and wind power for 4% (1.5 TWh). The remaining 1% came from biomass (0.3 TWh) and geothermal energy (0.5 TWh). Hydropower generation varies according to rainfall. The government outlines an overall target for renewable sources to provide at least 30% of electricity generation by the year 2023, in its Electricity Market and Security of Supply Strategy, approved on 18 May 2009 [1, 33].

3) As for heat, firewood is the largest source of heat from renewable sources in Turkey [34]. In 2008, 5.0 Mtoe of firewood was used for heating in rural areas. Other forms of biomass are negligible. The second-largest source of heat from renewable sources is geothermal, 0.9 Mtoe of which was used in 2008.

4) Turkey's greenhouse gas emissions are growing rapidly, and the energy sector is the major contributor, the government is therefore focusing on clean energy development, such as from domestic renewable resources. Incentives and the feed in tariffs have led to more investment in renewable energy generation and increased share of renewables in the electricity mix. It can be well known by all the sectors that the incentives can make the influence on starting renewable energies more rapid than any other policies. By enacting this new law, Turkey offers guarantied prices for power generated from renewable resources and pays more if the producers use locally-made equipment [3].

5) Current levels of investment in renewable energy are still below what is needed to. The major barriers and policy responses may be grouped as:

a) Risks and incentives associated with renewable energy investments, including fiscal policy instruments,

- b) Relative costs of renewable energy projects and financing,
- c) Electricity infrastructure and regulations,
- d) Sustainability criteria.

6) To achieve the required returns, incentive mechanisms such as feed-in tariffs need to be guaranteed for 15-20 years instead of 10 years.

7) Subsidies need to be judiciously designed and applied. Subsidies will most likely need to be adjusted over time in order to be efficient, and such changes are likely to be opposed by businesses or consumers who benefit from them. Such support also needs to take into account requirements of international agreements, in particular the rules and regulations of the World Trade Organization.

8) EU policy and legislation relevant to renewable energy resources should be more researched and summarized. These policies are believed to be the most developed in the world for this topic, and they serve as a solid base for development of recommendations for Turkish energy policy.

9) The importance of the role of the government in formulating and implementing favorable policies for renewable energy resources exploitation is stressed. It is also important for efficiency and effectiveness that communication and mechanisms for coordination/cooperation between ministries (i.e. energy, agricultural, and environmental) be improved. Successful policymaking and implementation can lead to an ultimately important outcome.

10) Since the private sector has the capacity to mobilize needed funds, development of incentives would motivate the private sector to become more involved in the advancement of renewable energy.

7. Disclaimer

Although some data taken from governmental document, this paper is not necessarily representative of the views of the government.

References

1. IEA, International Energy Agency. Energy policies of IEA countries, Turkey 2009 Review, IEA Publications, 9, Rue de la Fédération, 75739 Paris Cedex 15, printed in France by Soregraph, July 2010, (61 2009 06 1P1) ISBN : 978-92-64-06041-8.
2. Bilgen, S., Keles, S., Kaygusuz, A. Sarı A., Kaygusuz K. Global warming and renewable energy sources for sustainable development: A case study in Turkey. *Renewable and Sustainable Energy Reviews* 12 (2008) 372–396.
3. Çanka Kiliç, F. Recent renewable energy developments, studies, incentives in Turkey. *Energy Education Science and Technology Part A: Energy Science and Research*, 2011 Volume (Issue) 28 (1): pages 37-54.
4. Çiçek Bezir N., Öztürk, M., Özek, N. Renewable energy market conditions and barriers in Turkey. *Renewable and Sustainable Energy Reviews*, 13 (2009) 1428-1436.
5. The Republic of Turkey, Turkish Official Journal, No: 6094. 29th December 2010, Ankara.
6. Çanka Kiliç, F., Kaya, D. Energy production, consumption, policies, and recent developments in Turkey. *Renewable and Sustainable Energy Reviews*. (2007) 11: 1312-1320.
7. http://www.rferl.org/content/russia_turkey_to_build_nuclear_plant/2340411.html
8. Demirbaş, A., Bakıs, R. Energy from Renewable Sources in Turkey: Status and Future Direction. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, (2004) 26:5, 473-484, Taylor & Francis Inc. ISSN: 0090-8312 print/1521-0510 online, DOI: 10.1080/00908310490429759.
9. Koyun A. Energy Efficiency and Renewable Energy, Turkey-National Study's Summary. Mediterranean and National Strategies for Sustainable Development, Energy and Climate Change, Yıldız Technical University, Plan Bleu, Regional Activity Centre, Sophia Antipolis, March 2007.
10. The Presentation of The Ministry's Budget for The Year 2012 at The Plenary Session of The Turkish Grand National Assembly (TBMM), Republic of Turkey, Ministry of Energy and Natural Resources, December 2011.
11. Çanka Kılıç, F. Türkiye'deki Yenilenebilir Enerjilerde Mevcut Durum ve Teşviklerindeki Son Gelişmeler. Current renewable energy situation and renewable subsidies in Turkey. March 2011. TMMOB (Turkish Union of Chambers of Mechanical Engineers and Architects) Mühendis ve Makina Dergisi, ISSN:1300-3402, Volume: 52, Issue: 614, Pages: 103-115.

12. <http://greenbuildest.blogspot.com/2010/11/renewable-energy-opportunities-in.html>. Renewable energy opportunities in Turkey, 09 November 2010. Accessible in February, 22nd, 2011.
13. O. Ozyurt. Energy issues and renewables for sustainable development in Turkey. *Renewable and Sustainable Energy Reviews* 14 (2010) 2976–2985.
14. www.biyogaz.org.tr
15. Haklıdır, F. S. T. Türkiye’deki jeotermal alanlar ve bu alanlardaki farklı güncel uygulamalara bakış. VII. Ulusal Temiz Enerji Sempozyumu, UTES’ 2008, (Sf. 645-650), 17-19 Aralık 2008, İstanbul.
16. Kaygusuz K. Energy and environmental issues relating to green house gas emissions for sustainable development in Turkey *Renewable and Sustainable Energy Reviews* 13 (2009) 253–270.
17. Erdem, Z. B. The contribution of renewable resources in meeting Turkey’s energy-related challenges. *Renewable and Sustainable Energy Reviews* 14 (2010) 2710–2722.
18. Pursuing sustainability: 2010 Assessment of country energy and climate policies World Energy Council Report, 2010.
19. Demirbas A. High quality water supply for the production of algae. *Energy Education Science and Technology Part A* 2011;27:467-476.
20. Demirbas A. Energy issues in energy education. *Energy Education Science and Technology Part A* 2011;27:209-220.
21. Kaya, D. Renewable Energy policies in Turkey. *Renewable and Sustainable Energy Reviews*, (2006) 10: 152-163.
22. Kaya, D., Çanka Kılıç, F., Baban, A., Dikeç, S. Administrative, institutional and legislative issues on agricultural waste exploitation in Turkey. *Renewable and Sustainable Energy Reviews*, 12 (2008) 417-436.
23. IEA (International Energy Agency). In support of the G8 Plan of action, Deploying Renewables: Principles for effective policies. IEA Publications, 9, Rue de la Fédération, 75739 Paris Cedex 15, Printed in France By Stedi Media, (61 2008 06 1P1) ISBN: 978-92-64-04220-9-2008.
24. UNEP Green Economy Report, Part II, Chapter 1, Renewable energy Invest in energy and resource efficiency, United Nations Environment Programme, 2011.
25. http://ec.europa.eu/energy/renewables/targets_en.htm
26. Erdoğan E. On the wind energy in Turkey *Renewable and Sustainable Energy Reviews* 13 (2009) 1361–1371.
27. Saidur R., Islam M.R., Rahim N.A., Solangi K.H. A review on global wind energy policy *Renewable and Sustainable Energy Reviews* 14 (2010) 1744–1762.
28. <http://www.mayerbrown.com/publications/article.asp?id=11934>
29. <http://www.iea.org/textbase/pm/?mode=re&id=4910&action=detail>
30. <http://www.wind-works.org/FeedLaws/TableofRenewableTariffsorFeed-InTariffsWorldwide.html>
31. Renewable energy: Gross employment 2006, final report of the proposal, “Effect of increased use of renewable energies on the German labor market-Follow up” Version: September 2007.
32. Internet Update BMU- Brochure “Renewable energy sources in figures-national and international development” Version: November 2007; provisional figures.
33. Camadan, E., Erten, İ. E. An evaluation of the transitional Turkish electricity balancing and settlement market: Lessons for the future. *Renewable and Sustainable Energy Reviews* 15 (2011) 1325–1334.
34. Çanka Kılıç, F. Biyogaz, önemi, genel durumu ve Türkiye’deki yeri. General outlook of biogas, the importance of its usage and biogas in Turkey. June 2011. TMMOB (Turkish Union of Chambers of Mechanical Engineers and Architects) Mühendis ve Makina Dergisi, ISSN:1300-3402, Volume: 52, Issue: 617, Pages: 94-106.