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New markets for renewable industries: Developing countries – Turkey, its potential and policies

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Abstract
For today's world, energy is a huge requirement for economic, industrial and social life. The necessity of energy is increasing quite rapidly to keep pace with the technological and economical advancements and this brings about many energy problems like, dependence on energy importation, environmental pollution, global warming, increasing cost of energy expenses and inefficiency in energy use etc. Countries are working very hard to solve these problems. To supply the energy needs and protect our planet's future safety, it is very important to generate clean energies. In this context, governments give huge amounts of incentives for renewable energy generations and support related investments in many countries. In this study, the importance of renewable energy usage, recent incentives, renewable energy policies in Turkey and some developed countries are investigated and compared. It is also aimed to examine the real situation of renewables in Turkey by giving the latest numbers and make a contribution of future developments for these clean energies in Turkey. In this regard, some barriers and recommendations are also submitted.

Keywords: renewable energy, renewable energy resources, renewable energy policies, renewable energy incentives, Turkey

1. Introduction

Turkey is the 17th largest economy of the World (International Energy Agency, 2010). Considering total primary energy consumption in the world, Turkey was ranked 22nd according to a report published by the Ministry of Energy and Natural Resources of Turkey in 2012. As for Turkey's place in the energy sectors on a global scale, the country was ranked 20th in the world's electricity production list (Republic of Turkey, Ministry of Energy and Natural Resources, 2012).Turkey's economy has been developing strongly for the last twelve years. This fast industrialization, increasing energy demand and the needs of urbanization require more energy production. The demand for electrical energy in Turkey is expected to be 580 billion kWh by the year 2020 (Bilgen *et al*.,2008). Also, Turkey's primary energy demand reached the value of 119.5 million tons of oil equivalent (Mtoe) in 2012, the share of natural gas was 32 percent, coal was 31 percent, oil was 26 percent, hydropower was 4 percent, and other renewable energy sources were 7 percent in this total. When examining Turkey's primary energy demand by sectors, the usage distribution were 27 percent in the industrial sectors, 26 percent in residential and service sectors, 14 percent in transportation sectors and 24 percent in the conversion sectors (Republic of Turkey, Ministry of Energy and Natural Resources, 2013). Along with Turkey's economic development, its crude oil and natural gas consumption has increased over recent years, but Turkey has very limited domestic reserves; therefore, the country imports almost all of its oil and natural gas supplies, which costs are high for its economy. Despite all these, Turkey plays an increasingly crucial role in the transit of oil because the country is strategically located at the crossroads between Former Soviet Union countries, the Middle East, and the Europe. Also, Turkey has a strategic

role for distribution of natural gas between the world's second largest natural gas market, Europe, and the large gas reserves of the Caspian Basin and the Middle East.

In Turkey new investments and studies have been initiated to meet growing energy demand and needs. For this purpose, 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 (Kilic, 2011). While hydro power accounts for most of the total renewable energy supply in Turkey; biomass increasingly has a good share in the last few years. As for solar, geothermal and wind energy, they are expected to increase for the near future (International Energy Agency, 2010).

To reduce the amount of the cost of energy, it is necessary to generate renewable energy which is inexpensive, permanent, reliable, clean and sustainable and it is also the solution for the World's future of energy use. Therefore, Turkey has improving energy policies, strategies, and programs to take the right steps for the country's clean energy development. To realize the economic goals and energy targets, 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 for energy production from renewable energies are being 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 (The Republic of Turkey, Turkish Official Journal, No: 6094, 2010), thereby; Turkey plans to increase energy production from alternative energy sources.

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 developed countries are investigated and compared. In this regard, some barriers and recommendations are submitted for better understanding about the importance of the topic.

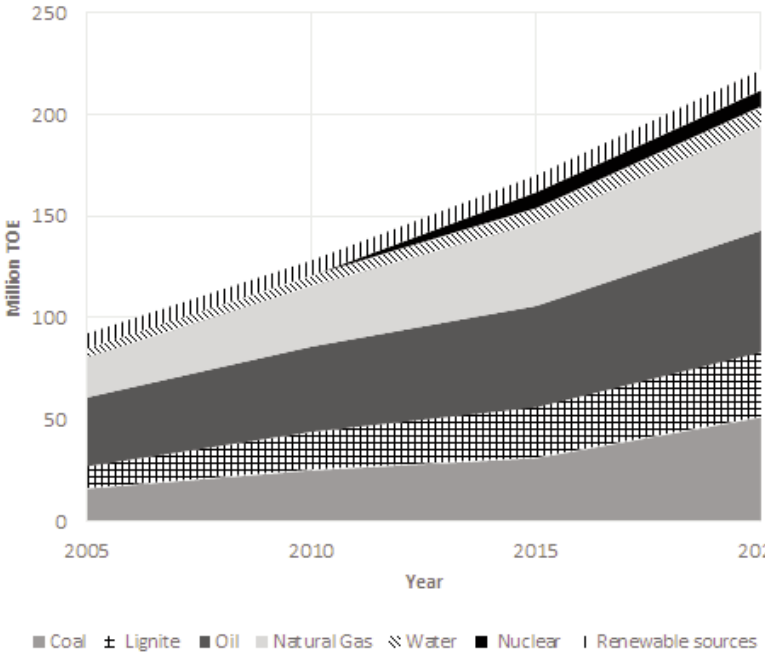

Figure 1: Turkey's Primary Energy Demand Projections by 2023
(Republic of Turkey, Ministry of Energy and Natural Resources, 2013)

2. Current and future energy status of Turkey

In Turkey, electricity is mostly produced in thermal power plants (TPPs) by using coal, lignite, natural gas and fuel oil. The production of electricity from renewables is small. As for nuclear power, it is new and very limited. On the other hand, Russia and Turkey signed a $20 billion agreement in May 2010 for the construction of a four-reactor Nuclear power plant near the coastal city of Mersin (in Akkuyu). Although there is opposition from environmental organizations to nuclear energy, Turkey wants to launch the nuclear power industry to diversify its energy mix and supply its soaring demand (www.rferl.org). The Turkish Government encourages domestic and foreign private sectors to carry out the country's power generation projects on a built operate transfer basis (Demirbas and Bakıs, 2004).

The distribution of electrical energy generation by primary energy sources in Turkey (in %, October 2013) is given in Table 1.

Table 1: Distribution of electrical energy generation by primary energy sources in Turkey (in %, October 2013)
(Republic of Turkey, Ministry of Energy and Natural Resources, 2013)

Geothermal	0.5%
Natural gas	41.3%
Hydraulic	29.2%
Wind	2.8%
Renewable and waste	0.4%
Coal	24.2%
Oil	1.6%

Primary energy demand in Turkey is expected to reach the value of 218 million tons of oil equivalent (Mtoe) with the increase of 90 percent by the year 2023. Also, the predictions for the share of coal will be 37 percent, the share of natural gas will be 23 percent, the share of oil will be 26 percent, the share of hydropower will be 4 percent, the share of

nuclear energy will be 4 percent, and the share of renewable and other energy sources will be 6 percent in primary energy demand by 2023. Turkey's primary energy demand projections by 2023 can be examined in Figure 1 (Republic of Turkey, Ministry of Energy and Natural Resources, 2013).

As it can be seen in Tables 2a and 2b, the total energy productions in Turkey is expected to be 58.20 Mtoe and 71.68 Mtoe by the years 2020 and 2030, respectively. On the other hand, total energy consumption is 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 generate electricity.

Table 3 (Kilic, 2011) shows renewable energy potential in Turkey; including energy type, usage purpose, natural capacity, technical and economical values.

One of the main energy goals of Turkey is to increase the share of renewable energy sources in the country's energy supply. Due to its geographical location and geological structure, Turkey is rich in renewable energy resources. Effective use of these resources will contribute to not only security of energy supply but also help the formation of new employment areas. While Turkey's installed capacity was 12,305 MW in renewable energy sources in 2002; this value has reached the number of 24,947 MW at the end of October in 2013. The electricity generation from renewable sources was 34 billion kWh in 2002, with an increase of 92 percent this number reached to 65.3 billion kWh in 2012.

The installed capacity of new commissioning power plants based on renewable energy sources in the first ten months of 2013 has been around 2,757 MW. The power plants that sharing this value can be listed as follows:

- 428.3 MW of wind,
- 2,114 MW of hydro power,
- 148.6 MW of geothermal,
- 65.5 MW of landfill gas, biomass and waste heat sourced electricity generation power plants.

Considering the power plants that were commissioned and put into service in the years of 2012 and 2013, have the power of 9085 MW, 64 percent of this value is coming from renewable, 36 percent is coming from thermal sources. These numbers demonstrate that renewable energy studies and applications for Turkey are improving and bringing

Table 2a: Present and future (estimated) total energy production in Turkey (Mtoe)
(Koyun, 2007)

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 2b: Present and future (estimated) total energy consumption in Turkey (Mtoe)
(Koyum, 2007)

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 3: Renewable energy potential in Turkey (annual)

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	Electric (billion kWh)	400	110	50
– land	Electric (billion kWh)	–	1801	–
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

to successful conclusions for the country's economy (Republic of Turkey, Ministry of Energy and Natural Resources, 2013).

Turkey gives great importance to the security of energy supply. To meet the increasing demand for energy, the country executes crucial projects and studies within the framework of policies for the security of energy supply. In this context, the studies for reducing the risks that result from the security of energy supply can be listed as follows:

1. To ensure diversification of sources by giving priority to domestic and renewable energy sources,
2. To enhance the investment and trade environment for businesses,
3. To diversify of energy sources, transport routes and energy technologies in order to ensure the sustainability of the energy sector,
4. To evaluate Turkey's underground and aboveground resources properly to gain and provide higher values to the country's national economy,
5. To increase the energy efficiency in the whole chain of energy supply and demand in the country,
6. To contribute to the security of electricity supply and provide interconnection to the neighbouring countries to assure the uninterrupted, qualified and adequate energy supply.
7. To integrate the nuclear energy to the whole system,
8. To reduce Turkey's dependence on foreign energy supply and decrease the energy costs in the country's economy and the current deficit (Republic of Turkey, Ministry of Energy and Natural Resources, 2013).

Turkey's renewable energy potential can be seen as a great opportunity from an economic, environmental and national security perspective (Kilic, 2011). Turkey's dependency on foreign energy resources for heating and electricity is planning to be lessened because of its high costs for the country. Developing and using domestic alternative energy resources will support security of energy.

Renewable energy sources in Turkey are the second largest source after coal in terms of energy production, and an important portion of the renewable energy production is met by biomass (Kilic, 2011). The annual biomass potential of Turkey is around 32 Mtoe. The current and projected biomass energy production in Turkey is presented in Table 4. Almost all of biomass energy is consumed in residences mostly for cooking and heating purposes. Wood is the main heating fuel for 6.5 million residences in Turkey. The Paper industry also uses wood wastes to provide 60% of needed energy for their production plants (Baris and Kucukali, 2012).

Table 4: Present and estimated biomass energy production of Turkey
(Baris and Kucukali, 2012)

Year	*Total biomass production (ktoe)*
2000	6982
2005	7260
2010	7414
2015	7320
2020	7520
2025	7810
2030	8205

The biomass sources of Turkey and corresponding potentials can be seen in Table 5.

Table 5: Biomass sources and their potentials
(WEC, 2007)[*]

Resource	*Raw material potential (million tons)*
Municipal solid wastes	25
Wood	3.52
Forestry/wood processing	3.56
Agricultural residues-straw+stalk	13.2
Agricultural residues-seed, shells, wood chips	4
Fertilizers	13.8

In Turkey, biomass has important potential to provide rural energy services based on forest and agricultural residues. Biomass has a significant place for Turkey because its share of total energy consumption is very high. Table 6 shows Turkey's annual biomass energy potential (Gokcol, 2009).

Table 6: Turkey's annual biomass energy potential
(Gokcol, 2009)

Type of biomass	*Energy potential (Mtoe)*	*Annual potential (Mt)*
Annual crops	14.9	55
Perennial crops	4.1	16
Animal wastes	1.5	7
Forest residues	5.4	18
Residues from agro industry	3.0	10
Residues from food industry	1.8	6
Other	1.3	5
Total	32.0	117

According to data received from the Energy Market Regulatory Authority (EMRA) in Turkey, operating capacity of power plants that generate electricity from biomass is around 138.7 MW in businesses. The capacity of power plants that are under construction for biomass energy generation is 13.4 MWe. Power plants capacity for biomass energy generation is 45.8 MWe, which in the form of projects. Turkey's energy generation plants from biomass can be grouped as follows:

- Energy production from waste gas,
- Power generation from organic waste through anaerobic fermentation,
- Energy production from biomass in the combustion plants,
- Energy production from organic wastes by using the method of gasification.

As for geothermal energy in Turkey, the country is one of the leading countries in terms of potential for geothermal energy applications. It has seen some important improvements in the geothermal sector in the last few years. The geothermal potential of Turkey is estimated as 31500 MW. This potential is around 77.9% and mainly takes place in Western Anatolia. With today's numbers, 13% of geothermal energy potential which is 4000 MW has been made available by General Directorate of Mineral Research and Exploration (MTA) under the management of Ministry of Energy and Natural Resources. In Turkey 55% of the total geothermal areas are suitable for heating applications (Kilic and and Kilic, 2013).

Since 2005, the rate of geothermal site exploration has been increased by the General Directorate of Mineral Research and Exploration (MTA). The number of discovered geothermal fields increased from 170 in 2005 to 187 in 2008 (Baris and Kucukali, 2012). As it can be seen in Table 7, geothermal usage in Turkey has reached the amount of 114.2 MWe at the end of 2012 (Kilic, 2013).

Table 7: Geothermal use in Turkey in 2012
(Kilic and Kilic, 2013)

Usage	*Capacity 2012 (MW)*
Electricity generation	114.2 MWe
Residence heating	805 MWt
Thermal tourism	402 MWt
Greenhouse heating	507 MWt

In addition to geothermal resources, there are 1 000 hot water and mineral water sources and wells available in Turkey. 170 of these wells have the temperature above 40 °C. 13 of these sources are considered the most valuable ones by the sector for the generation of electrical energy. The potentials of geothermal electricity generation and source temperatures of these regions are given in Table 8.

Table 8: Potentials of Turkey in electric energy generation form geothermal sources
(Kilic F and Kilic, 2013)

Geothermal region	*Temp. (°C)*	*Potential of electric energy generation (MW)*
Denizli Kızıldere	200-242	80
Aydın-Germencik	200-232	130
Manisa-Alaşehir-Kavaklıdere	213	15
Manisa-Salihli-Göbekli	182	15
Çanakkale-Tuzla	174	80
Aydın-Salavatlı	171	65
Kütahya-Simav	162	35
İzmir-Seferihisar	153	35
Manisa-Salihli-Caferbey	150	20
Aydın-Sultanhisar	145	20
Aydın-Yılmazköy	142	20
İzmir-Balçova	136	5
İzmir-Dikili	130	30
Total		**550**

The installed capacity of new commissioning power plants based on renewable energy sources in the first ten months of the year (2013) has been around 2 757 MW. The geothermal power plants sharing this total value can be defined as 148.6 MW of geothermal sourced electricity generation power plants (Republic of Turkey, Ministry of Energy and Natural Resources, 2013).

Currently, there are 13 geothermal power plants that are available based on geothermal energy

sources in Turkey. While geothermal installed capacity was only 17.5 MW in 2002, it has reached the value of 310 MW as at the current numbers.

On the other hand, in 2012 the applications of geothermal greenhouse heating have reached the value of 2 832 thousand square meters with an increase of 466 percent compared to 2002 and also the residential heating has reached a number of about 89 443 dwellings with an increase of 198 percent.

The private sector began to take part in geothermal studies in Turkey with the Law Number 5686: The Geothermal Resources and Natural Mineral Water Act came into force in 2007. Between the years 2008-2013, the geothermal 90 fields in total have been transferred to investors, 16 pieces of these fields are for electricity generation and 74 of them for heating and thermal tourism oriented. Thus, the total tender price of these geothermal fields is $547 million, brought to the country's economy (Republic of Turkey, Ministry of Energy and Natural Resources, 2013).

It can be seen in Table 9, 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 (Erdem, 2010).

Turkey has progressed well in all areas of energy policy since 2005 and there are obvious signs of a better future balance in energy policy goals (IEA, 2010). The Energy sustainability country index leaders by economic groupings can be seen in Table 10 (World Energy Council Report, 2010).

3. Renewable incentives in Turkey

There are some incentives and regulations related to renewable energy sources in Turkey. In our previous studies (Kilic, 2011; Kilic, and Kaya, 2007; Kilic, 2011; Kaya, 2006; Kaya *et al.,* 2008) these regulations have been investigated in depth. Law No. 5346 on the Use of Renewable Energy Sources for the Purpose of Electrical Power Generation dated 10 May 2005 ('Renewable Energy Law') has been amended by Law No. 6094 (Hence forward 'Amendments'). The Amendments were published in the Official Gazette for Promulgation of Law: 8 January 2011. In this study, the incentives according to Law No: 6094 have been examined in detail in the following sub topic.

3.1. Incentives for renewable energy in Turkey

At the end of 2010, the Turkish Grand National Assembly (TBMM) passed a new renewable energy bill determining regulations and feed-in tariffs in the renewable energy sector (Kilic, 2011). The New Law raises the guaranteed prices for the sale of electrical energy by renewable energy sources ('RES') certificate holders. According to law, producers of renewable energy who started operation between May 18, 2005 and December 31, 2015, are being guarantied for power purchase (purchasing of electricity that being produced is guaranteed) for a period of ten years. Such guaranteed prices for the incentives (Feed-in Tariffs) are determined in 'Dollar cents'. According to this new law, the renewable energy production incentives can be seen in Table 11 (Turkish Official Journal, 2010).

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 an additional subsidy ranging from USD 0.004 to USD

Table 9: Comparison of energy consumption amounts between the rorld and Turkey (%)
(*Erdem, 2010)*

	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

Table 10: Energy Sustainability: Country Index Leaders (by economic groupings)
***S**ource: Multiple (IEA, EIA, World Bank, IMF, WEF etc. 2007)*

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

* *Net energy exporters (others are net energy importers).*

Table 11: Renewable energy (Law No: 6094) subsidies
(Turkish Official Journal, 2010)

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

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 12. 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).

4. Renewable energy subsidies in EU

Governments' energy policies play important roles to augment investments in renewable energies (International Energy Agency, 2008). Increasing incentives, notably feed-in tariffs, direct subsidies, and tax credits can make the risk/revenue of renewable energy investments more attractive. The pro-

Table 12: Additional support amounts for companies with facilitates that use locally produced equipment and components
(Turkish Official Journal, 2010)

Plant type	*Locally produced equipment 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: Plants 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 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 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

ceeds 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; in early 2010, for example, 85 countries have set national targets for renewable energy, more than half of which are in developing countries like Turkey (UNEP Green Economy Report, 2011).

According to the European Commission's Brussels, 17.10.2012, COM (2012) 595 final 2012/0288 (COD), said in the section of Explanatory Memorandum that 'Directive 2009/28/EC1 on the promotion of the use of energy from renewable sources (the 'Renewable Energy Directive') established mandatory targets to be achieved by 2020 for a 20% overall share of renewable energy in the EU and a 10% share for renewable energy in the transport sector. At the same time, an amendment to Directive 98/70/EC2 ('the Fuel Quality Directive') introduced a mandatory target to achieve by 2020 a 6% reduction in the greenhouse gas intensity of fuels used in road transport and non-road mobile machinery'.

While 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% (European Commission, 2012). In all European countries, production of electricity from renewable resources is supported. In many countries and a minimum price system is used widely, which require an electricity utility to purchase a portion of its electricity requirement, 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 13 (Erdogdu, 2009).

Table 13: Minimum price of renewable electricity in some European countries (Eurocent/kWh) *(Erdogdu, 2009)*

Country	*Price (USD cents)*
Netherlands	11.9-12.27
France	10.41
Austria	9.66
Portugal	9.29-9.79
Greece	7.93
Spain	7.81-9.29
Germany	7.68-10.53
Turkey*	6.2-6.82

* *Turkey has changed the prices by new law at the end of 2010, which is given in Table 11 and Table 12.*

5. Analysis of the 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 (The Republic of Turkey, Turkish Official Journal, 2010). 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. 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 (Boewe 2012; Ghosh and Gangania, 2012; Gipe, 2010; Renewable energy: Gross employment 2006; BMU – Brochure, Internet Update, 2007; Camadan and Erten, 2011; Kilic, 2011) 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 other developed countries. For example, while purchase price of biogas is approximately 12.39 USD cent/kWh in Turkey, it can reach to 24.78 USD cent/kWh in Germany, 35.93 USD cent/kWh in Italy, and 30.97 USD cent/kWh in England. This effects affordability of the facility installation and can make it difficult to find investment financing.
- The highest tariff purchase in Turkey is 13.3 Dollar cent/kWh, applied to the biomass and solar. As of July 2014, feed-in tariffs for photovoltaic systems range from 15.95 USD cents per kWh for small roof-top system, down to 11.05 USD euro cents per kWh for large utility scaled solar parks. Feed-in tariffs are restricted to a maximum system capacity of 10 megawatts (MW). The feed-in tariff for solar PV is declining at a faster rate than for any other renewable technology in Germany (Feed-in tariffs in Germany, 2014).
- In Turkey, the implementation of a procurement schedule of biomass energy is higher than other resources' of energy production subsidies. The reason is that biomass production facilities have higher local installation potential than other facilities. Moreover, incentives for biogas mean the indirect incentives for agricultural sector.
- In Turkey, The Law No: 6094 for renewable energy production assures purchase guarantee for electrical energy generation, it does not comprise of heat or CHP (Combined Heat and Power) applications. However, some developed countries have additional subsidies for CHP applications that using RES (Renewable Energy Sources) as a source.

- While guaranteed purchase of electricity in Turkey is 10 years, this period is 20 years in countries like Germany, Greece, OECD countries and BRICS (Brazil, China, Russia and India) ((International Energy Agency, 2008).
- 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 an 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 600 MW annually until 31 December 2013, and then authorizes the cabinet to determine the limits afterwards in Turkey.
- Although intense discussion has been made for the last decade to disseminate the usage of renewable energy resources in Turkey, not much progress can be seen especially in the figures of the employment in renewable energies. But, considering the employment in this sector in Germany, the numbers are quite high. For example in 2006 Germany has reached the number of the employment in total of 235 000 people in the renewable energy sector, which was 160 500 in 2004 (Renewable energy: Gross employment, 2006).
- 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 by the expansion of the use of renewable energy resources (Internet Update BMU- Brochure, 2007).
- While the Turkish Parliament has approved a new renewable energy law that sets short-term standards, the renewable energy sector's long term prospects should be left in the hands of the nation's cabinet.
- It can also be said that Turkey has great wind and solar energy potential, and still needs important improvements.

6. Conclusion

In this paper, the evaluation of renewable energy and the importance of renewable energy usage, the feed in tariffs for renewable energy generation, the renewable energy policies in Turkey and some developed countries are investigated and compared. In this regard, some barriers and recommendations are submitted for better understanding about the importance of the subject. 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 in energy, Turkey needs to use its sustainable sources. From this point of view, renewable energy is a very attractive choice, since it is reliable, endless, domestic, sustainable and environmentally friendly. Furthermore, due to its geographical position, Turkey has many advantages having renewable energy resources; such as, hydraulic, solar, wind, geothermal and biomass. Although there has been an important progress recent years in RES exploitation, there are still some barriers; such as, economic, lack of legislative and regulatory framework and poor infrastructure.
2. According to the International Energy Agency (2009) Turkey Report, Turkey is tenth among the 28 IEA countries. To examine the renewable energy sources of Turkey by comparison, its renewable energy sources account for more than 40% of TPES (Total Primary Energy Supply) 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 Turkish government is planning to realize the target of electricity production from renewable energy sources as around 30% in the share of energy generation by 2023. (Turkish Republic Ministry of NR and Energy, 2014).
3. As for heat, firewood is the largest source of heat from renewable sources in Turkey (Kilic, 2011). 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. In Turkey, energy sectors are the main contributor to Turkey's greenhouse gas emissions, which increasing rapidly. The Turkish government is therefore focusing on clean energy development, such as from domestic renewable resources and introducing incentives and the feed in tariffs in energy production from RES, so it is aimed to increase the share of renewables in the electrical energy mix. By enacting this new law (Law No:6094), Turkey offers guaranteed prices for power generated from renewable resources and pays more if the producers use locally-made equipment (Kilic, 2011).
5. Current levels of investment in renewable energy are still lower than expected. The major bar-

riers and policy responses may be grouped as:

a) Some risks and incentives associated with renewable energy investments, including fiscal policy instruments. For example, the purchase prices specified in the 6094 Act (according to the renewable laws) will be valid until the end of 2015. The prices will be determined by the Council of Ministers for the investments that will be realized after 2015, and these new prices will not to exceed the price indicated in the law. This uncertainty poses risks for potential investments.
b) Relative costs of renewable energy projects and financing. For example, some of projects may not be feasible considering the region that the investment will be realized, the type and the quality of renewable energy sources and the amount of resources that will be used.
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. Feed in tariffs 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 favourable 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.

Disclaimer

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

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