Renewable Energy Policies: A Comparison of Global and Turkish Perspectives

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Abstract
Sustainability concerns resulting from the consumption of natural resources, life-threatening levels of pollution, global warming, climate change and the ever increasing worldwide energy use have brought renewable energy sources to forefront. Given the possibility of depletion of fossil fuels in the near future; the utilization of clean and renewable energy sources have become inevitable. Consequently, countries have developed government policies and adopted respective regulations to ensure the production and use of renewable energy and promote the respective new investments. This has been realized both individually and also as a part of global organizations and networks some of which can be listed as the Organisation for Economic Co-operation and Development (OECD), European Union (EU), United Nations (UN) and International Energy Agency (IEA).

Turkey is a developing country with a substantial amount and wide range of renewable energy sources, and it is located in an advantageous geographical position that enables their effective utilization. However, because of the rapid increase in the energy consumption and the inefficient use of resources, it remains to be an energy importing country with more than half of its energy being met externally. Hence, a detailed review and evaluation is conducted in this study on the current literature, projects, binding regulations, incentives, and pricing mechanisms together with the respective energy statistics to analyze and compare the renewable energy policies in Turkey with those adopted worldwide. Ultimately, the goal is to make certain suggestions and lay out possible solutions regarding Turkey's energy problems.

Keywords: Renewable Energy, Renewable Energy Policies, Literature Survey, Turkish Renewable Energy Sector, Sustainability.

Introduction

Renewables have become the fastest growing source of world energy with their share of electric power generation increasing from 10 percent to 15 percent in 2010 while the fossil fuel sources grew 3 or 4 percent (EIA, 2012). The reason behind this is the concern for sustainability resulting from factors including but not limited to the depletion of natural resources, life-threatening levels of pollution, global warming, climate change and the ever increasing worldwide energy consumption (Komor and Bazilian, 2005; Apergis and Payne, 2010). The Renewable Energy Working Party of the International Energy Agency (IEA) has provided the following definition (IEA, 2013a):

"Renewable Energy is derived from natural processes that are replenished constantly. In its various forms, it derives directly or indirectly from the sun, or from heat generated deep within the earth. Included in the definition is energy generated from solar, wind, biofuels, geothermal, hydropower and ocean resources, and biofuels and hydrogen derived from renewable resources."

In line with the above definition, renewable energy sources can be classified under the following categories (IEA, 2013a):

- Hydro,
- Geothermal,
- Solar,
- Tide/Wave/Ocean,
- Wind,
- Solid biofuels, biogases, liquid biofuels, and
- Renewable municipal waste.

The effective utilization of the above-listed sources is critical across the world, where 1.3 billion people still do not have access to modern sources of energy (WEF, 2013). Societies have much to gain from the effective use of renewable energy with certain issues to consider while making this happen (see Table 1).

Advantages	**Disadvantages**
Provides low operating and maintaining costs	High up-front investment
Provides long life period	Entails long-term planning
Service cost is low	Entails long-term agreements
Reliable source	Entails multidisciplinary involvement
Induces technology development	Could involve resettlement
Fosters regional development	Entails new legal codes
Provides efficient energy production and safety	Excessive competition
Generates revenue and tax	
Creates new employment opportunities	
Protects environment and saves environmental protection costs	
Enhances living conditions	
It is waste-free	

Table 1: Advantages and disadvantages of renewable energy cont. (Gökmen and Temiz, 2015)

Advantages	**Disadvantages**
Improves air quality Preserves ecosystems Helps slow down climate change	

In order to make use of these advantages and to address the critical issues, countries have developed government policies and adopted respective regulations to ensure the production and use of renewable energy and promote the respective new investments. This has been realized both individually and also as a part of global organizations and networks such as the Organisation for Economic Co-operation and Development (OECD), European Union (EU), United Nations (UN) and IEA.

In the last decade, there has been a significant shift in the world toward emerging markets and consequently energy demand; in that, while the developed world used two thirds of world oil in 2000, by 2011 this was split about evenly between developed and developing countries (WEF, 2013). This shift is estimated to continue with virtually all growth from here on being expected in emerging market nations (WEF, 2013), and thus, the energy consumption and production in developing countries have become much more critical. Turkey is one of these developing countries with a substantial amount and wide range of renewable energy sources, and it is located in an advantageous geographical position that enables their effective utilization (Baris and Kucukali, 2012; Benli, 2013; Yuksel and Kaygusuz, 2011). However, because of the rapid increase in the energy consumption (Ozturk et al., 2009) and the inefficient use of resources, Turkey remains to be an energy importing country with more than half of its energy being met externally (Kaya, 2006; Yuksel and Kaygusuz, 2011; Benli, 2013). Figure 1 and Figure 2 clearly depict this situation.

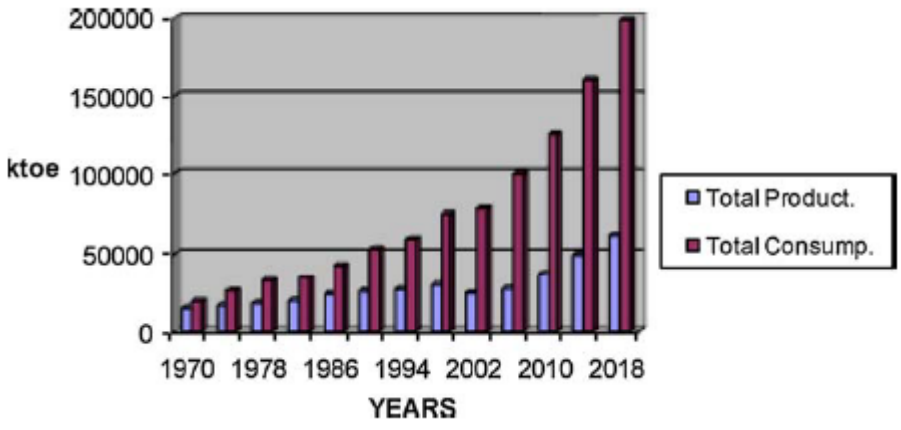
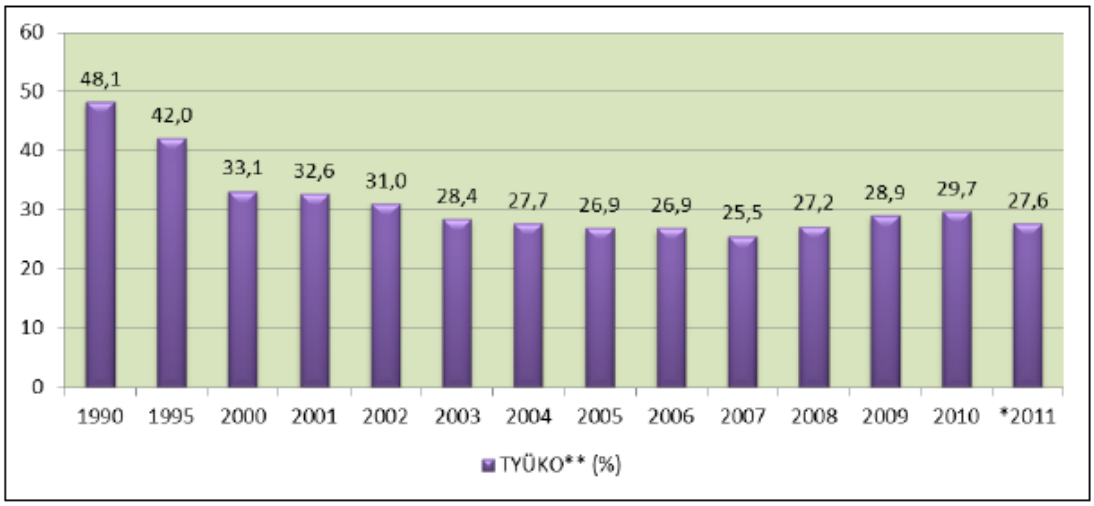


Figure 1: Total energy consumption and production in Turkey (Yuksel and Kaygusuz, 2011)



- An estimated value has been provided for 2011.

Figure 2: Percentage of energy demand met by indigenous production (MMO, 2012)

In order to form a general perspective on the energy situation in Turkey, the following numerical information has been provided (WWF-Türkiye, 2011; MMO, 2012):

- Turkey is Europe's 6th largest energy market,
- Projected annual growth of the electricity demand is 7%,
- Hydropower constitutes 98% of the renewable energy,
- In 2008, imported primary energy supply was 73%,
- In 2009, the energy generated from fossil fuels was 81%,
- As of 2009, the share of renewable energy in electricity generation was 19%,
- Between 2000 and 2010 Turkey's primary energy production has reached from 81.2 Mtoe to 109.3 Mtoe with an increase of 34.6%,
- In the period up to 2020, the annual average of Turkey's primary energy production is expected to increase by 4%,
- Between 2000 and 2010 Turkey's installed capacity of electricity has reached from 27,264 MW to 53,051 MW with an increase of 94.6%, and during the same period electricity consumption has reached from 128.3 billion kWh to 229.3 billion kWh with an increase of 78.8%.

The above-mentioned facts also prove that although there has been an increase in Turkey's primary energy production, this is far from meeting the accelerating demand. Thus, there is an urgent need to increase the quality, quantity and diversity of the renewable energy sources. This is only possible by effective renewable energy policies, which constitute a "highly complex policy subsystem that lies at the intersection between environmental policy, economic policy, and energy policy" (Yi and Feiock, 2014). Consequently, a detailed review and evaluation have been conducted in this study on the current literature, projects, binding regulations, incentives, and pricing mechanisms together with the respective energy statistics to analyze and compare the renewable energy policies in Turkey to those adopted worldwide. Ultimately, the goal is to make certain suggestions and lay out possible solutions regarding Turkey's energy problems. To this end, the second part of the study provides a comparative analysis of renewable energy use throughout the world. The third part summarizes the global energy policies under four headings, namely

those adopted in OECD countries, non-OECD countries, EU and Turkey. Finally, the possible solutions are suggested in the conclusions part.

Comparative Analysis of the Renewable Energy Use around the World

This section provides a brief analysis on the comparison of renewable energy use in Turkey with Africa, Asia, China, Latin America, Middle East, OECD and World Total. The purpose is to lay out the current situation of renewable energy use in Turkey on a general basis and also by source. To this end, Figure 3 and Figure 4 depict the renewable energy use throughout the years 2006 and 2010 and the corresponding five year averages of specific renewable energy categories, respectively. The analysis in this section is from a previous study carried out by the authors, wherein the data was taken from OECD sources.

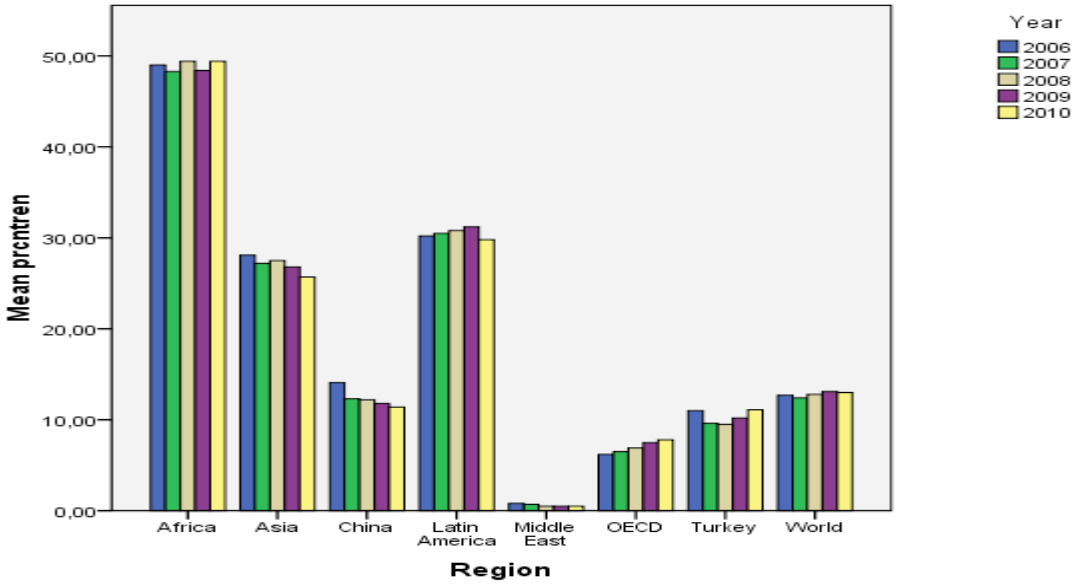


Figure 3: Renewable energy use throughout the world (Selam et al., 2014)

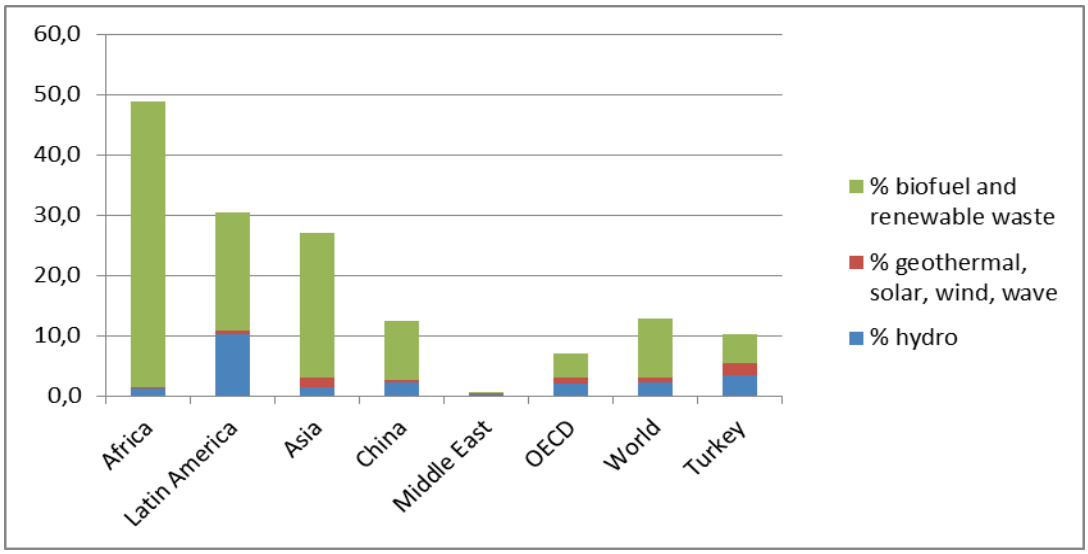


Figure 4: Worldwide Renewable Energy Use (five year averages by type) (Selam et al., 2014)

In Figure 3 and Figure 4, it can clearly be seen that the percentage of renewable energy use in Africa has reached up to 50%, which is significantly above the world average. This is due to the fact that mostly organic non-fossil fuels are used in African countries. The Middle East, which is the center of fossil fuels, is expectedly where renewable energy has the lowest share. As for the OECD countries, the renewable energy use is close to the world average with hydro; geothermal, solar, wind and wave; biofuels and renewable waste have almost equal shares. China has also caught up with the world average in terms of renewable energy use. As for Turkey, it approaches the world average in renewable energy use most of which is hydro, biofuels and waste. Selam et al. (2014) have also compared renewable energy use in Turkey with that of OECD and concluded that it is slightly above OECD Total, OECD Americas and OECD Asia Oceania and slightly below OECD Europe between the years 2006 and 2010. However, the renewable energy use excluding hydro is below the general average, which indicates that a significant amount of the energy production in Turkey is from hydroelectric sources. Considering the rich amount of renewable energy sources, it is clear that energy policies promoting the effective and efficient use of other renewable energy sources besides hydro are inevitable.

Energy Policies: Global and Turkish Perspectives

In this section, the renewable energy policies of certain selected countries have briefly been summarized. This evaluation has been presented under the main headings of OECD and non-OECD countries, EU and Turkey. The EU has especially been included in the analysis because Turkey is in the accession process to the EU. Thus, the energy policies should be compatible with those of the EU member countries.

Renewable Energy Policies of OECD

OECD has been established in 1961 with the aim of "promoting policies that will improve the economic and social well-being of people around the world" (OECD, 2014). Currently, there are 34 member countries spanning the globe, from North and South America to Europe and the Asia-Pasific region (OECD, 2014). Turkey is one of the founding members.

In 2010, 18% of the world population lived in the OECD with 74% of the world gross domestic product (GDP) being created in its 34 member countries. The TPES of the OECD in 2010 represented about 44% of global energy supply, while the total energy production constituted 30% of the global energy production (IEA, 2012a). Due to the reasons stated in Table 1, the OECD countries have adopted certain energy efficiency policies such that each government made its own decision regarding the measures to be taken and their implementation (Saidel and Alves, 2003). These measures fall under the following basic categories (Saidel and Alves, 2003):

- restrictive regulations,
- information to the public,
- creation of market asymmetries,
- funding/loans programs and
- state capital/private capital partnerships.

The evolution of the renewable energy policies in OECD countries can be viewed in Figure 5.

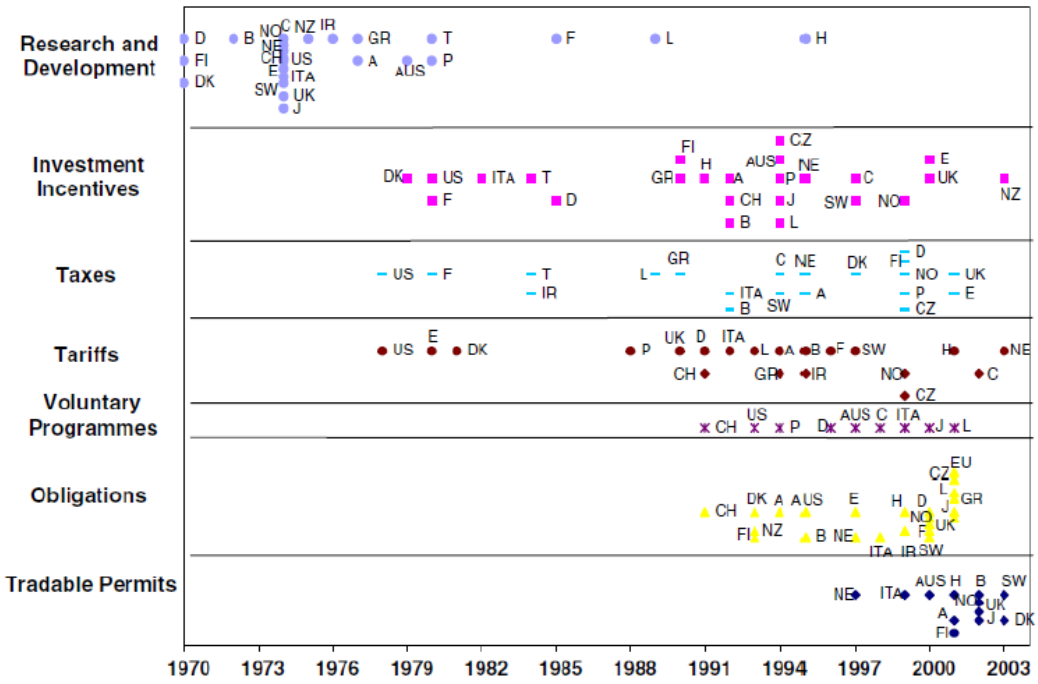


Figure 5: Patterns of policy adoption in selected OECD countries (Nicolli and Vona, 2012)

Renewable energy policies of some non-OECD countries

In 2007, OECD decided to invite some countries like Chile, Israel and Russia to open discussions for the membership of the organization and offered "enhanced engagement" program to Brazil, China, India, Indonesia and South Africa (OECD, 2014).

China is world's largest energy producer and emitter of greenhouse gases. Therefore, China focuses on efforts in energy conservation, efficiency in energy utilization and emission reduction. According to China's Energy Policy Report (2012) some of these efforts can be summarized as the following:

- Various energy-saving renovations are implemented;
- Efforts have been made to support new and renewable energy developments;
- Improvements have been made in civil energy use conditions (energy service level, access to natural gas and electricity, combined heat and power projects etc.);
- Environmental protection has been increased.

The country's energy consumption per-capita is low and decreasing every year. The energy consumption for every 10 000 yuan of GDP decreased by 20.7% from 2006 to 2011 (China's Energy Policy, 2012). China aims to increase the use of non-fossil fuels by developing new and renewable energy sources by the end of the 12th Five-Year Plan. It is the leading renewable energy producer in the world with the world's richest hydropower resources, and currently less than 30% of its resources have been utilized

(Liu, 2013; China's Energy Policy, 2012). These resources can help China to achieve the goal of increasing the non-fossil energy consumption share to 15% by 2020. Chinese government wants to provide hydropower development by using local resources and local employment, obtaining local economic development and protecting local environment. China is also the fastest growing wind power market in the world (Hanna, 2010). Thus, the aim is to encourage R&D studies in wind-power equipment production, improve the standards and control in the sector, optimize the wind power production and develop offshore wind farms. China has rich solar energy resources too. During the 12th Five-Year Plan, China will promote and encourage the solar-power development with the construction of power stations, solar power generation projects, efforts to generalize solar heating, cooling, water heaters and industrial applications of solar energy. Another energy policy of China is to make nuclear power plants safer and more efficient (China's Energy Policy Report, 2012). Especially after the nuclear disaster in 2011, there have been comprehensive safety controls and inspections for nuclear power plants in China. Finally, studies have been conducted to benefit from the biomass potential in rural areas, which is also one of the primary sources of renewable energy (Meisen and Hawkins, 2014).

Russia has rich oil and coal reserves, but the depletion danger leaded the country to the development of the renewable energy sector. Russia has wind, hydro, solar, geothermal and biomass energy sources in various regions. Current discussions emphasize the need for decentralized and smaller projects to develop renewable energy. There are several reasons for the low level of renewable energy in Russia, some of which are as follows (Bächtold, 2012):

- Traditional energy sources are easily available with low costs in Russia.
- The government imposes high export duties to keep the energy prices low in the country's market. Any increase in energy prices can deteriorate the life conditions of the people because of the severe climate in Russia.
- Scarce government subsidies and tax incentives cause an inconsistent legal base.
- The awareness of the population about renewable energy is weak.

India faces an emerging supply-demand imbalance situation with the increases in total electricity demand, which resulted from the economy, life conditions, urbanization and energy access in the country (MNRE, 2011). Thus, renewable energy has become a necessity for India and establishing a sustainable energy base has gained significance since early 1970s. According to the report of Ministry of New and Renewable Energy in India (MNRE, 2011), MNRE is the only ministry in this area in the world. In addition to the implementation of various comprehensive programs, MNRE supports research and development of new and renewable energy technologies, products and services.

Brazil is one of the countries that make use renewable energy effectively. Some highlights regarding renewable energy in Brazil are listed as the following (IEA, 2012b):

- Brazil and the United States are the largest biofuel producers. Brazil also aims to be the largest exporter of biofuels (mainly ethanol) in the world.

- 37% of the road transport demand in Brazil is expected to be met by biofuels by 2035.
- One of the targets of the ten-year plan for energy expansion is for renewables to account nearly 80% of the total installed capacity in 2020. It is expected to be met by mainly hydropower followed by wind power and biomass.

Renewable energy policies of the EU

Environmental concerns, supply security and competitiveness considerably affected the EU policies especially those related to the renewable energy sector, resulting in an effective renewable energy policy since 1997 (EWEA, 2011). The Renewable Energy Directive 2009/28/EC set forth a European framework for the promotion of renewable energy by 2020 through mandatory national renewable energy targets (EC, 2013a). Thus, the current policy of the EU for 2020 aims at 20% substitution of fossil fuels (coal, oil, gas and nuclear) by renewable energy resources that include biomass and waste, hydro-, geothermal-, solar-, and wind power (Krozer, 2013). The other targets for 2020 are greenhouse gas emission reductions of 20% relative to emissions in 1990 and 20% savings in energy consumption compared to projections (EC, 2013b). Consequently, 19.9% of the absolute European energy generation in the EU27 in 2009 was produced by renewables, with hydro-power taking the lead (11.6%), followed by wind (4.2%) (Fouquet, 2013).

Each member of the EU has decided on its own strategies to meet the above-stated energy targets and published these in Renewable Energy Action Plans (NREAP) between July 2010 and January 2011 as required by the EU (Directive 2009/28/EC) (Kitzing et al., 2012). The most common renewable energy sources (RES) support strategies implemented in the EU can be listed as the following (Kitzing et al., 2012):

- Feed-in tariffs; guaranteed prices (FIT)
- Feed-in premiums; production premiums (FIP)
- Tender schemes (TND)
- Quota obligations with tradeable green certificates (TGC)
- Investment grants (INV)
- Fiscal measures (tax incentives, etc.) (TAX)
- Financing support (loans, etc.) (FIN)

Recently, there have been efforts regarding an integrated policy framework for the period up to 2030 with the following targets (EC, 2014):

- reducing EU domestic greenhouse gas emissions by 40% below the 1990 level by 2030,
- increasing the share of renewable energy to at least 27% of the EU's energy consumption by 2030,
- realizing 30% energy savings,
- establishing a market stability reserve at the beginning of the next ETS (Emissions Trading System) trading period in 2021,
- developing a set of key indicators to assess progress over time and provide a factual basis for policy action as needed and

- establishing a new governance framework based on national plans for competitive, secure and sustainable energy.

Renewable energy policies of Turkey

The energy consumption in Turkey is constantly increasing due to the economic growth, increasing population, migration from rural regions to urban and/or tourism Regions (Kotcioğlu, 2011), and thus, it is in a position to import over 70% of its primary energy supply (with oil and natural gas having the biggest shares) (Kaya and Kılıç, 2012). The renewable energy potential (hydropower, solar, biomass and wind power) is sufficient enough to overcome the energy dependency (Kotcioğlu, 2011), but it has not been efficiently utilized, leaving the country with an urgent need for effective energy policies. Figure 6 depicts the renewable energy supply and projections for the future in Turkey.

Renewable energy sources	2000	2005	2010	2015	2020
Primary energy supply					
Hydropower (ktoe)	2656	4067	4903	7060	9419
Geothermal, solar and wind (ktoe)	978	1683	2896	4242	6397
Biomass and waste (ktoe)	6457	5325	4416	4001	3925
Renewable energy production (ktoe)	10,091	11,074	12,215	15,303	19,741
Share of total domestic production (%)	38	48	33	29	30
Share of TPES (%)	12	12	10	9	9
Generation					
Hydropower (GWh)	30,879	47,287	57,009	82,095	109,524
Geothermal, solar and wind (GWh)	109	490	5274	7020	8766
Renewable energy generation (GWh)	30,988	47,777	62,283	89,115	118,290
Share of total generation (%)	25	29	26	25	25
Total final consumption					
Geothermal, solar and wind (ktoe)	910	1385	2145	3341	5346
Biomass and waste (ktoe)	6457	5325	4416	4001	3925
Renewable total consumption (ktoe)	7367	6710	6561	7342	9271
Share of total final consumption (%)	12	10	7	6	6

Figure 6: Renewable energy supply and projections for the future in Turkey (Toklu, 2013)

Recently, energy efficiency has become a significant issue in the government's agenda, and Energy Efficiency Strategy Paper has been published in February 2012 (IEA, 2013b). This strategy and the Energy Efficiency Law (2007) are examples of the actions taken to form a legal and institutional framework to support energy efficiency with a predicted amount of 40 300 toe (involving total government support of TRY 8 900 000) total energy savings between the years 2009 and 2013 (IEA, 2013b). Some of the other significant legislative milestones are summarized as follows (Simsek and Simsek, 2013; Bölük, 2013; PwC, 2012):

- Law No. 4283 (Law on Building and Operating of Electricity Generation Plants by BOT Model and Regulation of Energy Marketing), wherein the participation of the private sector in building and operating energy plants was accepted;
- Electricity Market Law No. 4628 and electricity market licensing regulation (2001) (amended by Law no: 5784 in 2008), encouraging electricity generation from renewable energy sources;
- Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy-No. 5346 (2005), with the aim of expanding the use of renewable energy used to generate electrical energy and to ensure an increase and diversification in the use of renewable energy without disturbing free market conditions [amended by Law Regarding the Amendment in the Law of Utilization of Renewable Energy Resources for the Purpose of Generating Electricity (Law no: 6094) in December 2010, establishing Turkey's Renewable Energy Support (YEK) Mechanism];
- Law on Geothermal Resources and Natural Mineral waters-No. 5686 (2007), setting forth rules to protect and produce geothermal and natural mineral water resources;
- Strategy Plan 2010–2014 (2010), covering the period between 2010 and 2014, with the aim of ensuring that the share of renewable resources in electricity generation is increased by up to at least 30% by 2023; and
- Renewable Energy Law (2011), setting forth new incentives for renewable energy productions.

Figure 7 depicts the incentive mechanisms ruled out by the above-mentioned laws. Also, in order to make a comparison, the energy policies in the high income countries and those in the upper-middle income countries (including Turkey) can be viewed in Figure 8 and Figure 9, respectively.

<table>
<tr><td>Incentive Mechanism</td><td colspan="2">Incentives</td></tr>
<tr><td>Investment incentive</td><td colspan="2">Licensing
i) Installed capacity of 500 kW is exempted from licensing and setting up a company
ii) Only 1 % of licensing cost is paid by corporate entities applied to get a license and these entities do not pay annual licensing cost for the first eight years.
iii) Priority is ensured for system connection</td></tr>
<tr><td></td><td colspan="2">Land appropriation
i) Real properties either regarded as forest or private property of Treasury are leased or right of easement or usage permits are given to such properties
ii) 85 % of discount is given to rent, right of easement and usage permits and Forest Villagers Development Revenue, Forestation and Erosion Control Revenues are not demanded during the first 10 years</td></tr>
<tr><td>Feed-in Tariff</td><td colspan="2">Government guarantees to buy electricity generated for 10 years offering a feed-in Tariff.
Feed-in Tariff Amounts: USD $ cent</td></tr>
<tr><td></td><td>Hydropower</td><td>7.3</td></tr>
<tr><td></td><td>Wind Energy</td><td>7.3</td></tr>
<tr><td></td><td>Geothermal</td><td>10.5</td></tr>
<tr><td></td><td>Biomass</td><td>13.3</td></tr>
<tr><td></td><td>Solar Radiation</td><td>13.3</td></tr>
<tr><td>Tax exemptions and cuts</td><td colspan="2">Special consumption tax exemption is applied for 2% biodiesel blending.</td></tr>
<tr><td>Premium</td><td colspan="2">Premium is given for oil seeds.</td></tr>
</table>

Figure 7: Incentive mechanisms ruled out by Law No:4628, 5346, 6094 and 4760 (Bölük, 2013)

● indicates national level policy ○ indicates state/ provincial level policy	REGULATORY POLICIES AND TARGETS							FISCAL INCENTIVES				PUBLIC FINANCING	
	Renewable energy targets	Feed-in tariff/ premium payment	Electric utility quota obligation/ RPS	Net metering	Biofuels obligation/ mandate	Heat obligation/ mandate	Tradable REC	Capital subsidy, grant, or rebate	Investment or production tax credits	Reductions in sales, energy, CO_2, VAT, or other taxes	Energy production payment	Public investment, loans, or grants	Public competitive bidding/tendering
HIGH INCOME COUNTRIES $$$$													
Australia	●	○			○		●	●				●	
Austria	●	●			●		●	●	●			●	
Barbados	●			●								●	
Belgium	●		○	○	●		●		●			●	●
Canada	○	○	○	○	●			●	●	●		●	●
Croatia	●	●						●				●	
Cyprus	●	●			●			●					
Czech Republic	●	●			●		●	●	●	●		●	
Denmark	●	●		●	●		●	●		●		●	●
Estonia	●	●			●						●	●	
Finland	●	●			●		●	●		●	●		
France	●	●			●		●	●	●	●		●	●
Germany	●	●			●	●		●	●	●	●	●	
Greece	●	●			●			●	●	●		●	
Hungary	●	●			●			●		●		●	
Ireland	●	●			●	○	●						●
Israel	●	●	●			●				●		●	●
Italy	●	●	●	●	●	●	●	●	●	●		●	●
Japan	●	●	●	●			●	●	●			●	
Luxembourg	●	●			●			●		●			
Malta	●	●		●				●		●			
Netherlands	●	●		●	●		●	●	●	●	●	●	
New Zealand	●												
Norway	●				●		●	●		●		●	
Oman								●			●	●	●
Poland	●		●		●		●	●		●		●	●
Portugal	●	●	●	●	●	●		●	●	●		●	●
Singapore				●								●	●
Slovakia	●	●						●		●			
Slovenia	●	●						●					●
South Korea	●		●	●	●		●	●	●	●		●	
Spain[1]	●	●		●	●	●		●	●	●		●	
Sweden	●		●		●		●	●	●	●		●	
Switzerland	●	●						●		●			
Trinidad and Tobago	●								●	●			
United Arab Emirates	○		○			○					○	○	○
United Kingdom	●	●	●		●	●	●	●		●	●	●	
United States		○	○	○	●	○	○	●	●	●	●	●	●

Figure 8: Renewable Energy Support Policies (High Income Countries) (REN21, 2013)

The analysis of Figure 7, Figure 8 and Figure 9 clearly reveals that Turkey mostly has regulatory policies such feed-in tariff and biofuel obligations as opposed to some other countries (e.g. United States, China and the EU countries), where support tools including fiscal incentives (i.e. capital subsidy, grant or rebate, energy production payment) and public finances (i.e. public investment loans or grants and competitive public bidding) are also widely used to support renewable energy (PWC, 2012; Bölük, 2013).

● indicates national level policy ○ indicates state/ provincial level policy	REGULATORY POLICIES AND TARGETS							FISCAL INCENTIVES				PUBLIC FINANCING	
	Renewable energy targets	Feed-in tariff/ premium payment	Electric utility quota obligation/ RPS	Net metering	Biofuels obligation/ mandate	Heat obligation/ mandate	Tradable REC	Capital subsidy, grant, or rebate	Investment or production tax credits	Reductions in sales, energy, CO_2, VAT, or other taxes	Energy production payment	Public investment, loans, or grants	Public competitive bidding/tendering
UPPER-MIDDLE INCOME COUNTRIES $$$													
Algeria	●	●											●
Argentina	●	●			●			●	●	●	●	●	●
Belarus										●			
Bosnia and Herzegovina	●	●						●					●
Botswana	●							●		●			
Brazil	●			●	●	○			●	●		●	●
Bulgaria	●	●			●			●		●		●	
Chile	●		●	●		●		●		●		●	
China	●	●	●		●	●		●		●	●	●	●
Colombia	●				●					●			
Costa Rica	●			○									
Dominican Republic	●	●		●		●		●	●	●			●
Ecuador		●								●		●	
Grenada	●			●						●			
Iran		●							●		●		●
Jamaica	●			●	●				●	●			●
Jordan	●	●		●	●					●		●	●
Kazakhstan		●					●						
Latvia	●	●			●					●		●	●
Lebanon	●			●		●				●		●	
Libya	●									●			
Lithuania	●	●	●		●	●						●	
Macedonia	●	●											
Malaysia	●	●	●		●					●		●	●
Mauritius	●	●											
Mexico	●			●		●			●			●	●
Montenegro	●	●											
Palau	●		●										
Panama		●		●					●	●	●		●
Peru		●			●					●			●
Romania	●		●		●		●			●		●	
Russia	●							●					
Serbia	●	●						●					
South Africa	●							●		●	●	●	●
St. Lucia	●			●									
Thailand	●	●			●					●		●	
Tunisia	●			●				●		●		●	
Turkey	●	●			●			●				●	
Uruguay	●	●		●	●	●		●		●		●	●

Figure 9: Renewable Energy Support Policies (Upper-Middle Income Countries) (REN21, 2013)

Ozturk et al. (2009) summarize Turkey's energy policy as follows:

- Meeting long-term demand using public, private, and foreign capital,
- Accelerating privatization activities in the energy sector,
- Taking into consideration supply costs of energy imports,
- Meeting demand as much as possible through indigenous resources,
- Diversifying energy supplies and avoiding dependence on a single source or country,
- Adding new and renewable sources (geothermal heat, solar, wind, etc.) as soon as possible to the energy supply system,

- Ensuring sufficient, reliable and economic energy supplies on time,
- Ensuring energy security of supply,
- Implementing measures for energy efficiency,
- Planning energy research and development activities to meet requirements,
- Minimizing losses in energy production, transmission, distribution and consumption and
- Protecting the environment and public health in the production of energy.

The above-stated principles are also covered in the Strategy Plan 2010-2014, where the following targets are set for 2023-the 100th anniversary of Turkish Republic (the Vision 2023 Programme) (Kabakçı and Tanuğur, 2010; Yarbay et al., 2011; Erdal, 2012):

- To be able to make complete use of potential of indigenous coal and hydraulic resources,
- To make maximum use of renewable resources and increase their share to 30%,
- To incorporate nuclear energy into electricity generation within the period until 2020 and
- To secure rapid and continuous improvement in energy efficiency in a way that parallels EU countries.

In order to make maximum use of renewable resources as stated in the Strategic Plan, all the potential renewable energy types should be utilized. Renewable energy supply in Turkey is mostly hydropower and biomass, but air pollution concerns and deforestation have resulted in a decrease in the biomass use, changing the composition of the renewable energy supply in favor of wind energy (Kotcioğlu, 2011; Toklu, 2013). There is a significant potential for wind power development in Turkey (Kotcioğlu, 2011), which should effectively be utilized in the near future due to the fact that between 22.5TWh and 4 5.0TWh of electricity must be generated from renewable energy sources other than hydropower in the next decade to fill the demand gap (Melikoglu, 2013). It is estimated that this gap can be diminished by wind and solar energy if the investments are carried out as planned and the goals in Vision 2023 agenda can be achieved (Melikoglu, 2013). Consequently, the following causes of failure should be overcome for the renewable energy projects to be successful (Bezir et al., 2009):

- In many renewable energy projects, premature technologies which were still under research were used.
- The design of many projects did not allow sufficient, long-term maintenance.
- Many renewable energy projects were either demonstration projects, or for other reasons not replicated.
- Renewable energy technologies are often simply too expensive to be used in Turkey, where financial resources are limited.
- There is a lack of detailed renewable energy resource assessments and databanks particular to Turkey (Simsek and Simsek, 2013).
- Turkish bureaucracy is an important handicap for foreign investors (Toklu, 2013).

In its report on Turkish Renewable Energy Policies, IEA has made certain recommendations, which should be taken into consideration to address the above-stated issues. These are (IEA, 2009):

- Continue efforts to ensure a predictable and transparent support framework to attract investments, while creating technology-specific incentives that will decrease over time.
- Design the feed-in tariff to be as flexible and predictable as possible and assess the options to introduce further flexibility in support mechanisms, such as premium on wholesale price.
- Continue efforts to ensure smooth integration of new renewable electricity capacity into the grid.
- Continue efforts to remove non-economic barriers to renewable energy development.
- Consider stronger policy support for the wider use of solar and geothermal heat and biofuels for transport in a sustainable and cost-effective way.
- Expand the partnerships with the private sector through increased use of collaboration for energy R&D.

Conclusions

Turkey is a developing country with a substantial amount and wide range of renewable energy sources, but because of the rapid increase in the energy consumption and the inefficient use of resources, it remains to be an energy importing country with more than half of its energy being met externally. Thus, there is an urgent need for effective energy policies. To this end, a detailed review and evaluation has been conducted in this study on the current literature, projects, binding regulations, incentives, and pricing mechanisms together with the respective energy statistics to analyze and compare the renewable energy policies in Turkey with those adopted worldwide. As a result, the following suggestions and possible solutions have been reached:

- Binding legislation should be developed and taken into effect for all sources of renewable energy (as opposed to the current situation of the sole coverage of wind and geothermal in regulations).
- Licensed investments have to be finalized as soon as possible.
- Nuclear power plants should not be seen as a solution. (Due to the absence of basic laws, the lack of technical knowledge and experience etc.)
- R&D and technology investments should be valued (especially for converting energy resources into utilizable energy or into energy.
- Renewable energy investments should be supported by effective economic incentives.
- The necessary actions should be taken (such as the acceleration of exploration activities) for the utilization of geothermal energy potential.
- Development of regional renewable energy-related projects should be promoted as well as global ones and international collaborative efforts should be supported.
- Partnerships with the private sector should be expanded through increased use of public-private partnerships for energy R&D.

- Financial competitiveness of renewable energy sources must be enhanced.
- Simultaneous growth of renewable energy sources should be realized.
- The administrative process should be facilitated and technical difficulties should be removed for the efficient grid connection of these sources.
- The bureaucratic difficulties should be addressed to increase foreign investments.
- At the present the most significant renewable energy sources are biomass and hydropower in Turkey; however, this is expected to change in favor of solar and wind energy due to environmental concerns and resource scarcity.

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