

Renewable Energy Support Mechanism in Turkey: Financial Analysis and Recommendations to Policymakers

Mustafa Gözen*

Electricity Market Department,
Energy Market Regulatory Authority, Ankara, Turkey.
Email: mgozen@gmail.com

ABSTRACT: The Turkish Grand National Parliament passed a renewable energy promotion law that provides feed-in tariffs for electricity generation from renewable energy sources in 2005. This law was not attractive to investors due to the low level of feed-in tariffs. Then, in 2011, the promotion law was amended and a new support scheme integrated in the day-ahead market was introduced. Therefore, the main purpose of this article is to explain the new support mechanism, analyze it from the financial perspective, and discuss the related key issues and challenges. In addition, to further improve the support mechanism, some recommendations have been made to policymakers.

Keywords: Feed-in tariff; RES support scheme; Turkish electricity market

Jel Classifications: E6; G39; H2; Q48

1. Introduction

Turkey made a radical decision in 2001 to liberalize its electricity sector, establishing a competitive market under the regulation and monitoring of an independent regulatory agency (*EMRA*). The market operates within the legal framework established by the Electricity Market Law No. 6446 (*Law No. 6446*). The main market law was the Law No. 4628 from March 2001 to March 2013. The Turkish Grand National Parliament (*TBMM*) introduced a new market law in March 2013 and the Law No. 4628 became an organizational law of *EMRA*. In the beginning, the main aim was to unbundle and liberalize electricity market activities, privatize state owned enterprises, and establish a competitive market. However, as the Turkish economy grew rapidly, policymakers became increasingly concerned about the country's security of electricity supply. In fact, the first strategy paper issued by the Turkish government covers mainly electricity sector reform and privatization issues (*MENR, 2013a*). However, the second strategy paper addresses the issues in the market from the security of supply perspective (*MENR, 2013b*). Later in 2008, the Law No. 4628 was amended to take into consideration security of supply issues and a transitional period was introduced to prepare the market for full competition. The transformation to a fully functioning free market is continuing. However, the security of electricity supply remains the main concern of the Turkish government, although this was not a problem in the early days of the market model.

Among other things in the electricity market, the country is now giving high importance to electricity generation from renewable energy resources (*RES*) in order to lower the country's import dependency on energy sources, and use own energy resources to minimize the current account deficit. In addition, the utilization of renewables for electricity generation appears to be one of the most efficient alternatives in meeting growing demand for electricity. Over the last ten years, Turkey's economic boom was accompanied by a rise in electricity demand. From 2003 to 2013, electricity demand grew by an average 6% per annum (*EMRA, 2014a*).

For the above reasons, in 2005, *TBMM* passed a renewable energy bill (*Law No.5346*) that provided a guaranteed, feed-in tariff (*FIT*) for electricity generation from *RES*. The promotion law envisioned *FIT* with upper and lower limits for a maximum 10 years of operation. These limits corresponded to 5.0 and 5.5 euro cents per kWh respectively. *FIT* was set at the same level as the

* The views and conclusions expressed in this article are those of the author and do not represent the views of the regulatory authority where the author is working, and of any other institutions.

Turkish average wholesale price calculated by EMRA every year. The same FIT is applied to all RES. However, market players preferred to sell their products in the balancing market where prices were relatively higher compared with FIT. That explains why no producer of renewable generation expressed an interest in the support mechanism offered under the initial terms of the law.

Moreover, market players were reluctant to invest in RES. The main argument was that the level of FIT was not enough to invest in renewable energy. In order to overcome this deficiency, the Turkish government decided to amend the existing Law No. 5346 in 2011 and introduced a new mechanism, which is linked to the day-ahead market. This linkage is the unique characteristic of the new mechanism. Therefore, the main purpose of this article is to introduce and explain the new support mechanism, make a financial analysis of the mechanism, and discuss the key issues and challenges that stakeholders may encounter during the implementation of the new mechanism.

This article is organized as follows. The second section outlines a brief history and basic features of the Turkish electricity market, including the legal framework, market design, and market opening. The third section summarizes renewable support mechanisms applicable by countries. The fourth section introduces the new support mechanism applied in Turkey and makes a comprehensive analysis of the new mechanism from a financial perspective. The fifth section provides recommendations to policymakers. The final section evaluates what has been covered and concludes the article.

2. Electricity Market in Turkey

2.1. A Brief History

Over the last 30 years, Turkey has made important efforts to transform its economy in line with those of European Union member states. This is not only for political but also for economic reasons. As a member of the European Economic Area, Turkey has been preparing to become a member of the European Union since the 1960s. As far as the electricity market is concerned, it is important to emphasize the challenges encountered so far ranging from rapid demand growth, limited financial resources for investments, and the burden placed on the central budget by state-owned utilities, which required new investments as well as cash for upgrading and maintenance (Erdogdu, 2007: 984-985). Recognizing these challenges, Turkey started to reform its electricity market and move more towards liberalization¹. For these aims, during 1980s and 1990s, BOT, ToOR, autoproducer and BOO models were introduced to reach the desired goals. Finally, seeking to become a full member of the European Union, Turkey took the initiative to open its electricity market to competition in 2001. A new era started in 2001 when TBMM passed the Law No. 4628 (EMRA, 2013a). The design and legal framework of the new market is adapted from that of the European Union. The electricity market model is designed especially in light of England's NETA model (Ozel & Atiyas, 2011: 64). TBMM decided to further improve the electricity market structure and introduced a new market law, the Law No. 6446, in March 2013. On the other hand, the Law No. 4628 became an organizational law of EMRA.

The year 2001 marked a turning point for Turkey. Previously, all electricity market activities had been carried out by TEK, a vertically integrated utility. In 1993, with a view to prepare TEK for privatization, the government divided TEK into two independent legal entities: The Turkish Electricity Generation Transmission Company and the Turkish Electricity Distribution Company (Atiyas & Dutz, 2004: 7).

Since 2001, there have been some major developments in the market. The Law No. 6446 stipulates that liberalization and privatization should progress in tandem. Thus, while the market is liberalizing further, the state owned generation and distribution facilities are being privatized. The government expects the privatization of the state owned generation plants to be completed by the end of 2014 (MENR, 2013a, 2013b)².

The balancing and settlement system began to operate as of August 2006. Since then, electricity spot prices have been established by market forces for the first time in the history of Turkey. From December 2003 to July 2006, as an interim solution, a financial settlement system

¹ For background information on Turkey's energy policy, see Yılmaz and Uslu (2007).

² There are 21 regional electricity distribution utilities in Turkey and the shares of all these utilities were sold to private investors as end of 2013.

regulated by EMRA was employed. During the interim period, state-owned generators acted as balancing units and their generation was used to balance the national energy supply and demand. The actual implementation of the balancing and settlement mechanism began on August 1, 2006. Since then, the price of electricity has been determined via market mechanisms. Results of this implementation have shown that there is a tendency for prices to increase because of increasing demand and extraordinary weather conditions (EMRA, 2013b). The final balancing and settlement system has been in operation since December 1, 2011³. The new system is based on day-ahead market and hourly settlement with the participation of the demand side as well. According to the new system, two system marginal prices are determined and published: one is for the day-ahead market while the other is for real time balancing⁴.

Although the legal framework and market design are in place and mainly comply with that of the European Union, Turkey is facing some difficulties in applying the legislation. Consequently, policymakers in Turkey have opted for a transitional period before the market structure as outlined in the Law No. 6446 is fully applied. Difficulties result from the dominant position of state-owned enterprises, the incompleteness of privatization of state-owned generation, high level of technical and commercial losses in the network, and the stranded liabilities of the previous period due to agreements of built-operate, built-operate-transfer, and transfer of operating rights signed between the Turkish government and private investors. As part of the transitional period in electricity retail sales, a national tariff system supported by a price equalization mechanism is applied all over Turkey until the end of 2015 (EMRA, 2013a). That is to say that the same customer group is charged with the same tariff, no matter where the customer group is located. By using the price equalization mechanism, cash flow deficiencies of some utilities due to high level of losses are balanced through a state-owned trading utility - TETAS - from the utilities with excess cash flows.

2.2. Legal Framework and Market Design

Law No. 6446 determines the framework of the Turkish electricity market. The electricity market is based on bilateral agreements complemented with the balancing and settlement market. The private sector may participate in all segments of the electricity market, except for transmission, by obtaining relevant licenses from EMRA. Third party access to the network without discrimination is in place under the supervision of EMRA. Under the provisions of Law No. 6446 market activities, except for network activities are open to competition under the supervision and regulation of EMRA.

In addition, Law No. 6446 foresees an independent transmission system operator. According to this law, the ownership, operation, and maintenance of investments in the national grid remain the remit of TEIAS, the transmission system operator. TEIAS also acts as the market operator. In addition, TEIAS will remain as the sole transmission system operator and asset owner.

On the other hand, Law No. 6446 makes distribution utilities responsible for distribution network planning, construction and operation, and assigns them the responsibility of '*supplier of last resort*'. The assigned suppliers⁵ are required to engage in retail business for consumers under the Law No. 6446 (EMRA, 2013a). Distribution utilities are required by the law to carry out generation and retail sale activities under separate legal entities, starting from January 1, 2013.

2.3. Market Opening and Full Retail Competition

The electricity market was launched on March 3, 2003. All customers directly connected to the transmission system as well as consumers with consumption of more than 4.500 kWh/year for 2014 are deemed eligible. The corresponding theoretical degree of market opening on the demand side is 85%⁶. Under the provisions of Law No. 4628 and 6446, EMRA lowered the eligibility limit from 9 million kWh/year in 2003 to 4.500 kWh/year in 2014. In order to enhance market openness on the consumption side, it is expected that the limit reach zero for all consumers by the beginning of 2015, meaning that all consumers will be free to select their own power suppliers from 2015 (MENR; 2013b,

³ The secondary regulation about its principles and rules was published in the Official Gazette on April 14, 2009.

⁴ Intraday market is planned to be introduced in 2014.

⁵ They are legally unbundled from electricity distribution utilities as of January 1, 2013. For the privatization method of distribution utilities, please see Privatization Administration of Republic of Turkey, (2014).

⁶ By definition, market opening is the percent of energy sold by bilateral agreements out of total sales volume in a given year. According to Law No. 4628, the board of EMRA has the authority to decide on reducing eligibility thresholds considering developments in the market.

2013b). It is anticipated that the Turkish electricity market will be opened to full retail competition at the beginning of 2016.

Even though the theoretical market opening is relatively high, in practice, the realized opening is as low as 23% because of the state's dominant position in the market (EMRA, 2013b). In addition, there is less energy that could be subject to bilateral agreements in the market. On the other hand, the price in the day-ahead market is quite high and almost all generators choose to sell their energy in the day-ahead market, instead of signing bilateral agreements with eligible customers. This is another reason for the low market opening in Turkey.

2.4. Some Statistical Information

At the end of December 2013, Turkey's total installed capacity reached 64.04 GW (TEIAS, 2014a). The share of hydro and thermal plants in the country's total installed capacity is 39.6% and 60.4% respectively. The breakdown of the installed capacity is given in Table 1. Renewables are the second largest contributor to the domestic production after coal. Renewable energy supply in Turkey is dominated mainly by hydropower. As seen from Table 1, the share of wind power increased to 4.3% while there was only 10.2 MW wind power capacity in operation in 2000 (Ilkilic, 2012: 1170).

Table 1. Breakdown of total installed capacity by primary fuel types (As of December 31, 2013)

Fuel / Source Types	Number of Power Plants	Installed Capacity	
		MW	%
Coal	27	12.427,8	19.4
Natural Gas	218	20.269,9	31.6
Hydro - Dam	74	16.142,5	25.2
Hydro - River	393	6.146,6	9.6
Wind	72	2.759,6	4.3
Geothermal	13	310,8	0.5
Other renewables	39	236,9	0.4
Other thermal plants	74	5.749,8	9.0
Total	910	64.044,0	100.0

Source: TEIAS (2014a)

In 2013, electricity generation in Turkey reached 239.3 TWh (TEIAS, 2014b). Out of this value, natural gas has a share of 43.8%. Renewables, except for hydraulic, have only minor shares in power generation: hydraulic accounts for 24.8%, wind generation represents an estimated 3.1% and waste and geothermal accounts for 0.4% (TEIAS, 2014a). Electricity consumption in Turkey was 245.5 TWh in 2013 (TEIAS, 2014b). Using the average electricity tariff for final customers for 2013, the monetary value of consumption is calculated as about 40 billion US\$. The demand for electrical energy is expected to increase between 6.5% and 7.5% per annum in the next 10 years (EMRA, 2014a). Economically feasible renewable energy potential in Turkey is given in Table 2.

Table 2. Renewable energy potential in Turkey

Source	Potential (MW)	Power plants with license (MW) ¹
Hydro	45.000	20.218
Wind	48.000	9.244
Geothermal	600	636
Solar	32.6 ²	- ³
Biomass	8.6 ²	53
Biogas	1.5 - 2 ²	189

Source: Adopted from TEIAS (2014a), EMRA (2014b), Keles & Bilgen (2012, 5205), Sirin & Ege (2012), Erdogdu (2011, 691), Topkaya (2012). This table includes only power plants with generation license issued by EMRA. ¹ Includes the capacity in operation and under construction as end of December 2013. ² It is given in mtoe. mtoe is the abbreviation for million tons of oil equivalents. ³ Currently, there is no solar power plant in operation in Turkey.

Currently, various state-owned enterprises continue to dominate sub-sectors of the electricity market, for example, EUAS' total installed capacity represents 37.1% of the country's total while TETAS accounts for 50% of the overall electricity trade, including import-export activities with

neighboring countries (TEIAS; 2014a, 2014b). Currently the state has no share in distribution activities through privatization procedures organized in 2012 and 2013 while it was more than 50% in 2011 (EMRA, 2013b; Privatization Administration of Republic of Turkey, 2014). In addition, at the end of 2013, around 43.8% of electricity generation came from natural gas fired power plants and this made Turkey an import dependent country with regard to both natural gas and oil (TEIAS, 2014b).

The operation of RES support mechanism began on December 1, 2011 and participants benefited from the support mechanism for only one month in 2011. The number of participants for 2011, 2012, and 2013 is given in Table 3.

Table 3. Number of participating power plants in RES support scheme

Type of Power Plant	2011 ¹		2012		2013	
	Number of Plants	Installed Capacity (MW)	Number of Plants	Installed Capacity (MW)	Number of Plants	Installed Capacity (MW)
Hydro	4	22.04	44	970.99	14	216.6
Wind	9	469.10	22	687.90	3	75.90
Geothermal	4	72.35	4	72.35	6	140.35
Biomass	3	46.43	8	75.32	15	101.09
Total	20	609.92	78	1806.56	38	546.56

Source: EMRA (2013c). ¹ The support mechanism started on December 1.

2.5. Definition of RES-Based Power Plants in the Legislation

According to Law No. 5346, mainly in compliance with the Directive 2009/72, renewables are defined as non-fossil energy resources and include hydraulic, wind, solar such as hydraulic, wind, solar, geothermal, biomass, gases derived from biomass⁷, wave, current, and tidal. On the other hand, renewables eligible for the renewable support mechanism under the scope of the Law No. 5346 are defined as wind, solar, geothermal, biomass, biogas, wave, current and tidal energy resources together with hydraulic generation plants, either canal or run-of-river type or with a reservoir area of less than 15 km². In other words, Law No. 5346 does not count all hydraulic power plants eligible for support mechanism and excludes hydraulic power plants with a reservoir area higher than 15 km². In addition, the board of EMRA has extended the definition of renewables eligible for the support mechanism in the secondary legislation⁸ by adding pumped storage power plants.

3. A Snapshot of Renewable Support Mechanisms

In today's world, it is commonly accepted that renewable generation should be supported and promoted through special government regulation, particularly in the first years of operation. In all countries, production of electrical energy from RES is supported (Kaygusuz, 2010: 2104-2106). The reason behind this thinking is that the renewable generation cannot compete with electricity generation from conventional fuels. As a result, various methods and policies have been used to promote renewable energy⁹. These instruments include pricing laws, quota requirements, production incentives, tax credits and trading systems (Saidur, 2010: 1747). However, two types of these policies have appeared as the major renewable energy support mechanisms: The feed-in tariff and quota mechanisms (Camadan, 2011: 4998). Both schemes run under purchase obligation, meaning that all generation is to be purchased by suppliers active in the market.

Under quantity based support schemes, a tender is implemented (Menanteau et al. 2003: 799-812). The bidder with the lowest price wins the contract and is given an exclusive right for renewable based generation. Alternatively, renewable electricity generator is issued a certain certificate in return for its generation. The certificates can be traded separately from the energy produced in the market. Renewable electricity generators sell the electricity at the market price, but can also sell green certificates and earn additional revenue (Commission of the European Communities, 2008). Suppliers

⁷ Including landfill gases.

⁸ This secondary legislation sets the rules and principles for the operation of the support mechanism. For additional information, see EMRA (2014c).

⁹ For a comprehensive reading, see World Bank (1997), Menanteau et al. (2003), Mitchell et al. (2006), Sawin (2004), del Rio and Gual (2007), Bunter and Neuhoff (2004), Dinica (2006).

are required to meet their obligation by buying green certificates in the market. Both schemes require a liquid market and a large number of market actors. Moreover, it is best applicable in fully liberalized markets. However, it provides little investment security because of the volatile market conditions.

The price-based support mechanism ensures a fixed payment to the generator of renewable generator. It is also known as feed in tariff (FIT). Unlike quantity-based mechanisms, FIT provides a high degree of investment security for the investors and the finance providers as well (Bhattacharyya, 2011: 263-267). If FIT is set correctly, it helps new actors to enter the market and brings more competition. In addition, it facilitates the realization of new investments. On the other hand, in the case of FIT that is set too high, this mechanism would result in uncontrolled market growth. The close monitoring is necessary if the technological developments are difficult to anticipate. On the other hand, the appropriate FIT could be calculated adding a reasonable rate of a return to technology specific generation costs. The reasonable rate of return can only be calculated depending on the capital structure, tax treatment, depreciation method, inflation, and other financial factors. It is known that the majority of countries have chosen to implement feed-in tariff regimes as the main support mechanism.

4. Support Schemes Applied in Turkey

When Law No. 4628 was in effect in 2001, there was no separate law to promote renewables in Turkey. The Law prompted the board of EMRA to take necessary measures to promote renewable generation. Later on, policymakers realized the need for a new law specific for renewable promotion. That was the main reason why TBMM passed a specific law related to the promotion of renewables in 2005. Currently, there are two main laws in Turkey promoting RES based power plants¹⁰. These are Law No. 4628 together with the related secondary legislation, and the Law No. 5346, which is the main promotion law.

4.1. Support Schemes in the Electricity Market Law

In order to encourage investments in Turkey and RES within the framework of the Law No. 6446 and the related secondary legislation, electricity generation plants based on renewables are supported by the following mechanisms¹¹ (Tukenmez & Demireli, 2012: 7; Topkaya, 2012: 3758-3759; EMRA, 2014d, 2014e).

- *Payment of only 10% of the total licensing fee*: According to By-Law on Electricity Market Licensing, legal entities applying for pre-licences and generation licenses for construction of facilities based on renewables are required to pay only 10% of the total licensing fee.

- *Exemption from payment of annual license fees for the first 8 years of operation*: Generation facilities based on renewables are exempted from paying annual license fees for the first 8 years following the facility completion date inserted in their respective licenses.

- *Priority for system connection*: Priority shall be given to RES based power plants by EMRA when forming the connection opinion.

- *Exemption from being a balancing mechanism unit*: Article 18 of By Law on Electricity Market Balancing and Settlement says that generation facilities listed below are exempted from the liability of being a balancing mechanism entity, but can be registered as a balancing mechanism entity, if requested by the market participant and agreed by National Load Dispatch Centre within TEIAS that the generation facility or unit can participate in the balancing mechanism:

- *Canal or river type hydroelectric generation facilities*
- *Wind power plants*
- *Solar power plants*
- *Power plants based on wave*
- *Power plants based on tidal energy*
- *Cogeneration facilities*
- *Generation facilities based on fluidized bed technology*

- *Purchasing electricity option*: All legal entities engaged in generation activity may purchase electricity from the market up to 40% of the annual average generation amounts indicated in their licenses in a calendar year in order to meet their contractual obligations.

¹⁰ For additional information, see Topkaya (2012).

¹¹ The exemptions from licensing and annual license fees and priority to system connection are also applied to electricity generation from domestic energy resources.

- *Exemption from licensing and establishing company*: In addition, power plants based on renewables with a maximum capacity of 1 MW are exempted from establishing a legal entity and obtaining the related license from EMRA to enter the electricity market.

4.2. Support Schemes in the Renewable Promotion Law

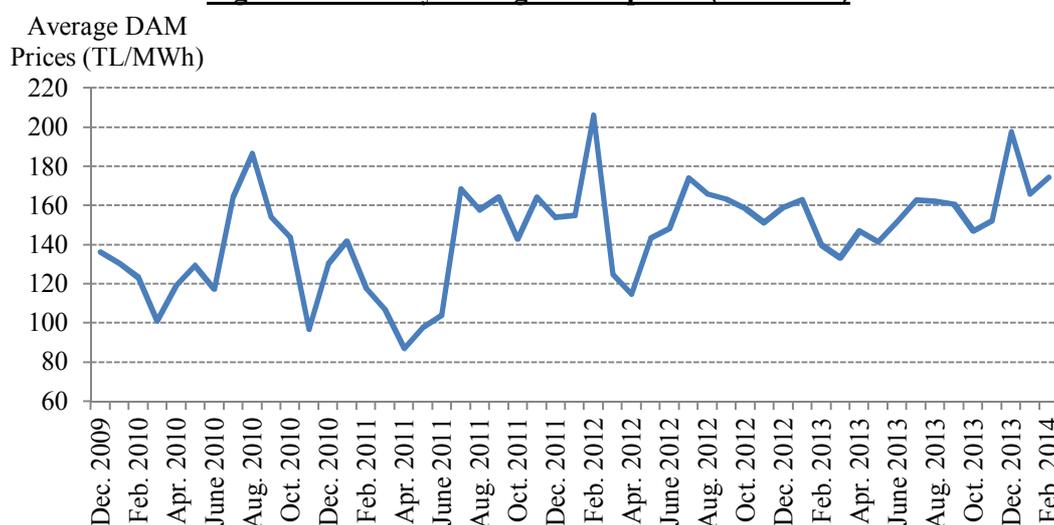
As stated earlier, the first law related to promotion of renewables - the Law No. 5346 - was introduced in 2005. However, this law failed to attract investors to benefit from the support mechanism. Then the Turkish government decided to change the Law No. 5346 by passing the amending Law No. 6094 in 2011. For this reason, it will be a better approach to divide the whole period into two periods as Period I (2005-2011) and Period II (After 2011), and analyze each period individually.

4.3. Support Scheme from 2005 to 2011 (Period I)

According to the Law No. 5346, RES-based generators were not required to participate in the support scheme. They were free to sell their energy in the market through bilateral contracts. Suppliers were obliged to purchase renewable generation in the market. Purchase obligation ratio equaled to, at least, the market share of each supplier for the previous year. In addition, this market share could not be less than 8% if there was enough energy in the market. The price for the RES certified electricity within each calendar year was formulated as the average wholesale electricity price in the previous year determined by EMRA. This price would be valid for the electricity produced from the RES-based power plants, commissioned before 2011 and for power plants with less than 10 years of operation. After maximum 10 years of support, the price for RES-based power plants would be formed through bilateral agreements in the electricity market, but the purchase obligation of the suppliers would continue.

The FIT was determined as 140.7 TL/MWh for 2011 (EMRA, 2014f)¹². There was a price band for the support price applied, which was between 50 and 55 euro/MWh to protect losses from currency exchange rate. That means that the support price is not allowed to be lower than the TL (Turkish Liras) equivalent of 50 euro/MWh and higher than the TL equivalent of 55 euro/MWh. The same FIT applied for all kinds of renewables. In order to give an idea about the comparative level of FIT, spot market prices¹³ in the balancing market in Turkey are given in Figure 1 below.

Figure 1. Monthly average DAM prices (TL/MWh)



Source: TEIAS (2014c).

¹² Per TL/MWh, the average wholesale electricity price determined by EMRA for the years of 2006, 2007, 2008, 2009, 2010, 2011, 2012, and 2013 is 83.6, 91.3, 96.7, 128.2, 133.2 140.7, 123.9 and 154.4 respectively. In addition, 1 TL/MWh is equal to (10 x Kr/kWh). The same applies to euro and 1 euro/MWh is equal to (10 x euro cents/kWh).

¹³ From December 2009 to December 2011, prices are formed in the balancing planning mechanism - a transitional period towards day-ahead market - operated by the market operator, TEIAS, but after December 2011, prices are DAM prices.

As seen in Figure 1, electricity prices for the last 2 years in the balancing market have been ranging between 120-200 TL/MWh (around 40-65 euro/MWh) and in general have been significantly higher than FIT. Due to these price differences, RES-based power plants cancelled their bilateral agreements with customers and focused their attention on selling electricity to the balancing market.

4.4. Support Scheme after 2011 (Period II)

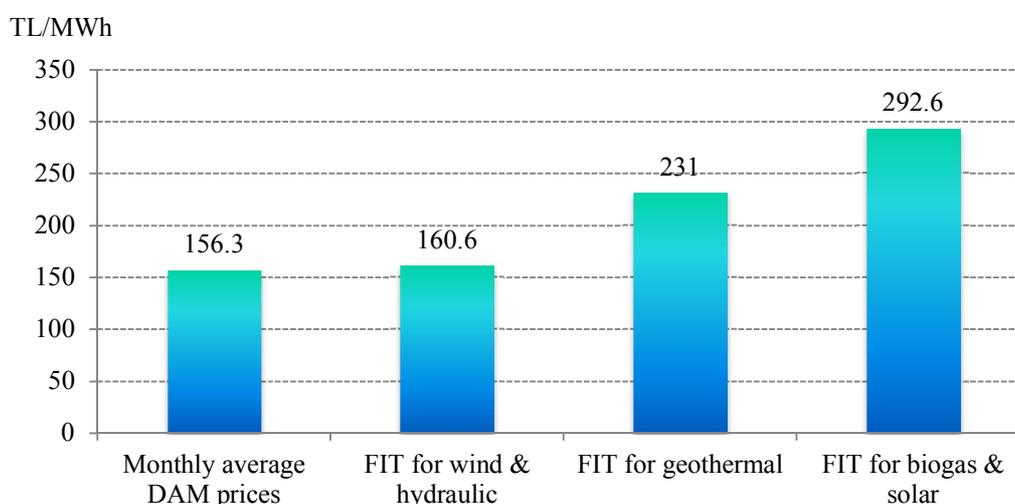
In 2011, Law No. 5346 was amended by Law No. 6094. The amendment brought a new support mechanism even though the feed-in price is used again. But, apart from earlier legislation, the new mechanism envisions different feed-in prices for different renewables. In addition, there is an extra support price for the use of domestic equipment in RES power plants. Table 4 shows the feed-in price for electricity generation from renewables and the maximum support price if the renewable based power plant is totally constructed from the local equipment and machinery. Turkey's FIT and spot market prices from December 2011 to 2014 January are compared in Figure 2 below.

Table 4. FIT for renewables

Power Plant Type	FIT for Electricity (1)	Maximum FIT for Use of Domestic Equipment (2)	Maximum Support Price (3) (3) = (1)+(2)	
	(US\$/MWh)	(US\$/MWh)	(US\$/MWh)	(TL/MWh)
Hydro	73	23	96	211.2
Wind	73	37	110	242
Geothermal	105	27	132	290.4
Biomass ¹	133	56	189	415.8
Solar - photovoltaic	133	67	200	440
Solar - concentrated	133	92	225	495

Note: 1 US\$ is assumed to be equal to 2.2 TL. ¹ Includes waste gas.

Figure 2. Comparison of FIT for electricity with average DAM prices from 2011 December to 2014 January



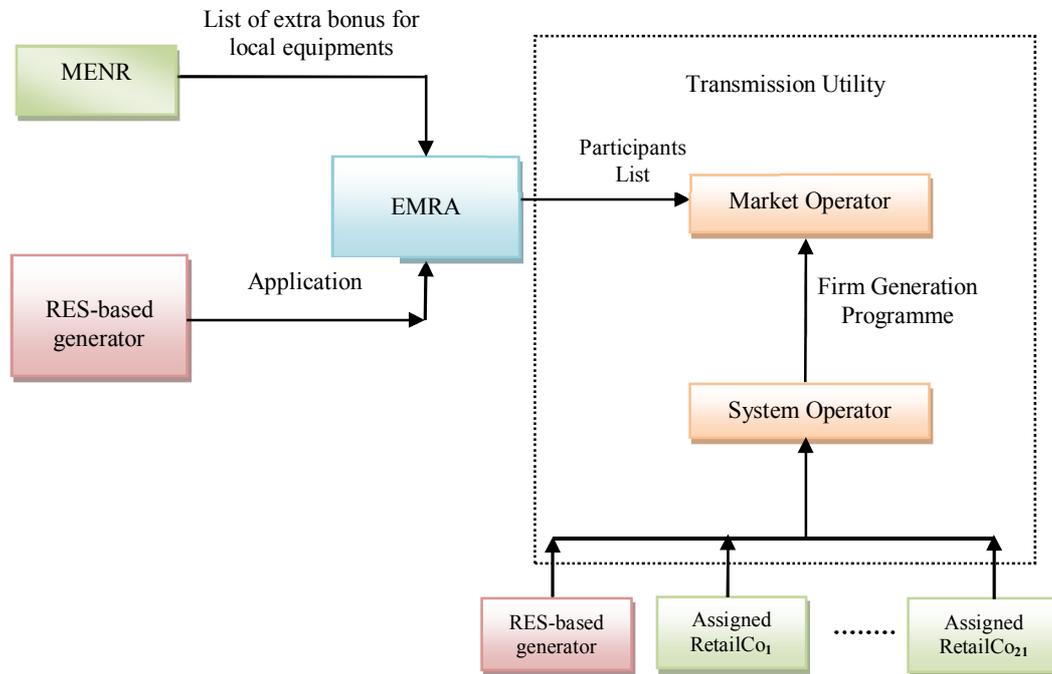
Note: To convert US\$ to TL, monthly average exchange rate published by Turkish Central Bank is used (Turkish Central Bank, 2014).

The support mechanism is run on a calendar year basis. Participation in the mechanism is voluntary. When a RES power plant participates in the mechanism, it must remain in the mechanism during the calendar year. It is important to note that the participating power plant is not allowed to sell its energy on a bilateral market or in any other mechanism.

All RES power plants constructed or to be constructed between May 18, 2005 and December 31, 2015 may participate in the support mechanism. However, the power plants can only benefit from the mechanism during their first 10 years of operation. The interested power plants will apply to EMRA by October 31 to join the support mechanism in the next calendar year. All generation from participating power plants is considered in the mechanism. In the case of hybrid plants, only the

generation from renewables is subject to the support. The operation of the support mechanism is shown schematically in Figure 3.

Figure 3. Information flow diagram of the support mechanism¹⁴

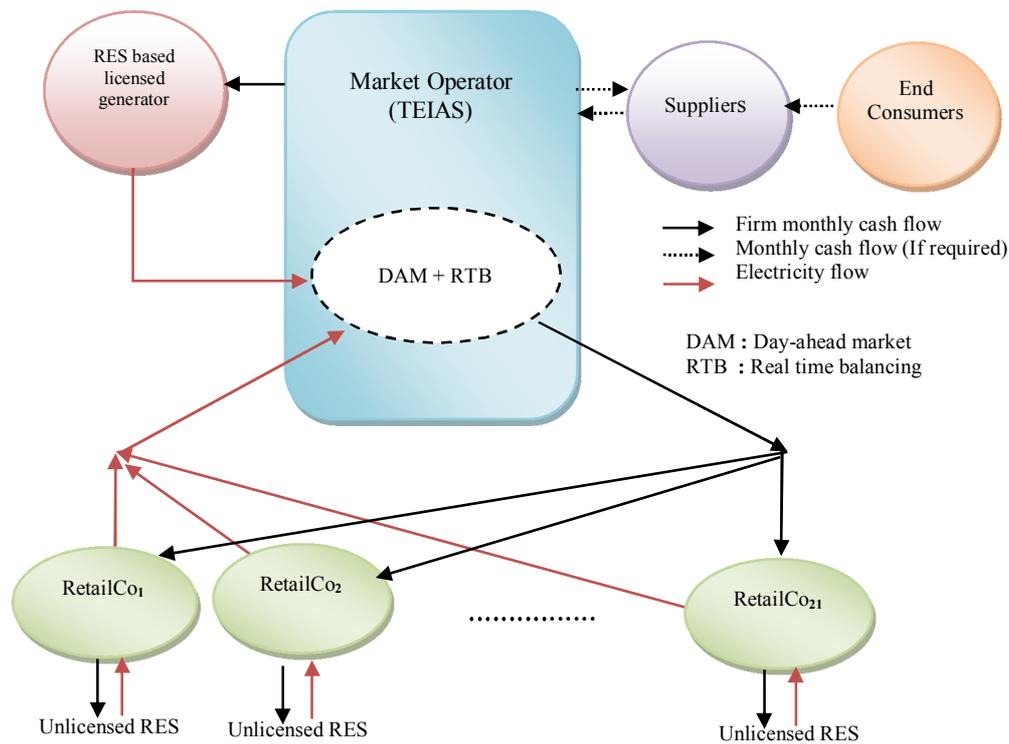


The system operator prepares a regional/national electricity generation forecast on hourly basis for every hour of the next day, using the data received from participant RES companies and assigned regional suppliers. The system operator inputs electronically these forecasted values in the market information system of the market operator by 10:30 a.m. Then the market operator announces these forecast values by 11:00 a.m. on its website. The forecast energy from participating RES generators and distribution utilities on behalf of distributed generation is sold in the day-ahead market without bidding a specific price on behalf of all suppliers under a portfolio opened and run by the market operator. For this purpose, only the forecast quantity is inputted to the market management system of the market operator by 11:30 a.m. The monetary value of the energy sold within RES portfolio is distributed to suppliers on a monthly basis according to their market shares. The cash flow among relevant parties is given below in Figure 4.

In the operation of the support mechanism, the system operator plays a critical role. What is expected is that the realized generation perfectly equals the forecast amount. In practice, this is a difficult task. Since the forecast involves different renewables, the deviation in the forecast amount has been expected to become smaller. Depending on the forecast performance of the system operator, the following three scenarios would occur in the support mechanism. The first is the scenario with no deviation. This refers to the fact that suppliers will be required to pay the monetary amount of RES-based generation during the specific month. The second is the scenario with positive generation, meaning that the realized generation is more than the forecast amount. In this case, a certain amount will be paid to suppliers. The third scenario is the one with negative deviation, meaning that the realized generation is less than the forecast amount. In this case, a certain amount will be collected from suppliers.

¹⁴ Renewable generators shown in the diagram refer to the generators with a generation license issued by EMRA.

Figure 4. Cash flow diagram of the support mechanism



Since the RES portfolio is run by the market operator, the market operator is authorized by EMRA to ask for a letter of bank guarantee to run the mechanism in an efficient way.

4.5. Advantages of the Support Scheme to Participants

Under the electricity market design and current market conditions, one could list the following possible benefits of participating in the support mechanism¹⁵.

- No need for marketing and sales activities
- No price competition
- No risk of imbalances in the balancing and settlement market
- An efficient and predictable cash flow management
- Easiness in finding project financing

Since the beneficiary company is required to sell all its generation under the support mechanism with the fixed price, the beneficiary will not need a marketing and sales department. In addition, it will not be under pressure to compete with other generators and suppliers in the market. Renewable-based generators are exempted from participating in the balancing market and they will not be subject to changes in their generation programs. Otherwise, they will be required to cover the cost of not meeting the demands of their customers in the bilateral market. Participation in the mechanism will provide a stable cash flow for the renewable based generators and this will make it easy to have access to better financing options.

5. Recommendations to Policymakers

For a better operation of the new support mechanism, the following points are given as recommendations for policymakers.

- *Amending FIT whenever needed*: The support price is set in the Law No. 5346 for 10 years. If inflation goes up and/or the exchange rate is highly volatile, then the level of the support price will have to be reviewed. On the other hand, the amendment of the Law No. 5346 would take some time to enforce considering developments in the market. In this regard, a flexible and foreseeable support mechanism would solve the problem.

¹⁵ For additional information, see Bhattacharyya (2011).

- *Changing FIT for some renewables*: The amending Law No. 6094 introduces the right support mechanism, which is a different FIT for each type of renewable. However, the FIT for some renewables is lower than, or roughly equal to the spot price in the market depending on the exchange rate. Particularly, the FIT for wind and hydro seems unattractive for investors. This negative feature would be solved by a reasonable increase in FIT or introducing a new FIT formula dependent on spot market prices. The average spot market price for the period 2011 December to 2014 January is 156.3 TL/MWh (TEIAS, 2014c). If a wind power or a hydraulic power plant is constructed totally by domestic means, then the difference between the total support price and the spot market price will be lower. On the other hand, the new support price is relatively higher and attractive for biomass and solar power plants. FIT for geothermal power plant seems reasonable. In addition, electricity prices in the balancing market are higher than FIT. FIT becomes unattractive for investors who benefit from the RES support scheme. Consequently, FIT needs to be modified to attract RES-based generators.

- *Monitoring the support mechanism*: The Law No. 5346 does not include any regulation with respect to monitoring. However, the progress in, and performance of the support mechanism should be assessed on a regular basis using some indicators. To this end, the effectiveness and efficiency of FIT is the key indicators to assess the success of the support mechanism. Another indicator, such as the average expected profit or annuity of the renewable investment, could be used. A monitoring scheme is required to follow the success of the support mechanism and change the FIT whenever needed.

- *Dealing with exchange rate risk*: The support is set in US cents in the amending law of 6094 while being given in euro cents in the main law 5346. This puts companies with projects loans and/or accounts payable in euro in exchange rate risk. Companies, which obtained financing or purchased equipment in euro, will be receiving the support revenue in US\$. This will bring an exchange rate risk for the companies. Even if there are financial instruments available to market participants to manage exchange rate risks, the key issue here is the regulatory uncertainty market players face. For the successful liberalization of the electricity market, policymakers and the energy regulator should be more sensitive to establish a foreseeable market environment.

- *The foreign relations aspect of the support mechanism*: Turkey has opened its economy since the 1980s and the extra support for the use of domestic machinery would negatively affect the country in foreign relations. In addition, due to lower level of domestic savings, Turkey needs foreign investment to secure electricity supply to meet its growing demand for electricity. Every year 5 billion US\$¹⁶ of investment is required to reach Turkey's 2023 targets in the electricity market. Therefore, a specific bonus for the use of domestic equipment should be reconsidered. A simple and reasonable FIT formula without extra bonus for domestic equipment usage, which allows generators to cover operating costs and realize a reasonable return on the investment, would be a better solution.

- *Renewables' contribution to security of supply*: On the other hand, the contribution of renewables to electricity security of supply seems to be limited if the high increase in demand for electricity is considered. The utilization of renewables will be a great asset, but for the security of supply concerns, other means should also be considered for the years ahead.

From above discussion, it could be concluded that Turkey's existing legislation regarding the RES promotion complies with that of the European Union, except for one issue that require harmonization before Turkey's accession to the European Union. This relates to monitoring the performance of the support mechanism. This is an issue that Turkey should correct in its legislation.

6. Summary and Concluding Remarks

Turkey is still on the way to liberalize its electricity market. The major issue is the mobilization of domestic energy sources to lower import dependency of the country and improve security of electricity supply. Renewable energy is one of the solutions to meet the country's target in the market. Electricity generation from renewable energy requires financial support and purchasing obligation in order to compete with that from classical energy sources, such as coal and natural gas. As in most countries, Turkey adopted FIT to support renewable-based generation. To implement this policy, Turkey first introduced the same FIT for all renewables in 2005, but eventually decided that the mechanism was unattractive to investors due to the low level of FIT compared with spot market

¹⁶ It is calculated by using information in the generation and capacity projection reports for the years 2003 to 2013. See EMRA (2014a).

prices. Then a new support scheme integrated to day-ahead market is introduced in 2011. The new mechanism is a unique scheme for Turkey in which renewable-based electricity is sold in the day-ahead market by TEIAS on behalf of all suppliers active in the market.

Even though it is too early to comment on the performance of the new support scheme, one could say that, when compared with spot market prices, the support mechanism is attractive for biogas, geothermal, and solar power plants. On the other hand, it is neutral for wind and hydraulic power plants. If wind and hydraulic power plants are installed by using only domestic equipment, then they are eligible for a bonus for domestic equipment usage. Power plants in this category would enjoy participating in the support mechanism because the overall support price is slightly higher than spot market prices.

There is no clear regulation how FIT is determined in Turkey. The support, in real terms, means that FIT is set relatively higher than spot market prices. Otherwise, the investor will prefer to sell its generation in the free market. Instead of the existing FIT in the Law No. 5346, a new FIT formula based on the addition of a certain premium to spot market prices, namely a day-ahead price would be a favorable alternative to all stakeholders in the market. The idea is that no matter whether there is a fixed FIT or a support price formula that takes in consideration spot market prices, the generator of renewable energy should be able to recover his operating costs and earn a reasonable rate of return on the investment. Then the revision of the existing FIT would be the right step to improve the investment in renewables.

On the other hand, the renewable promotion law lacks the monitoring aspect of the support mechanism. There is a strong need to monitor the performance on a regular basis whether the operation of the mechanism is in the right direction in line with the country's renewable energy policy. An efficient monitoring and assessment of the mechanism will help the lawmaker and the regulator to take the necessary corrective action in advance.

References

- Atiyas, I., Dutz, M. (2004), *Competition and regulatory reform in the Turkish electricity sector*, the Conference on EU Accession, May 10-11, 2003, Ankara, Turkey. Available at: <http://myweb.sabanciuniv.edu/izak/files/2008/10/atiyas-dutz-electricity-2004.pdf> (accessed 12 February 2014).
- Bhattacharyya, S.C. (2011), *Energy Economics: Concepts, Issues, Markets and Governance*. London: Springer.
- Bunter, L., Neuhoff, K. (2008), *Comparison of feed-in tariff, quota and auction mechanisms to support wind power development*. *Renewable Energy*, 33, 1854-1867.
- Camadan, E. (2011), *An assessment on the current status and future of wind energy in Turkish electricity industry*. *Renewable and Sustainable Energy Reviews*, 15, 4994-5002.
- Commission of the European Communities (2012), *The support of electricity from renewable energy sources, accompanying document to the Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources*, Commission Staff Working Document. Available at: http://ec.europa.eu/energy/climate_actions/doc/2008_res_working_document_en.pdf (accessed 8 November 2012).
- Del Rio, P., Gual, M. (2007), *An integrated assessment of the feed-in tariff system in Spain*. *Energy Policy*, 35, 994-1012.
- Dinica, V. (2006), *Support systems for the diffusion of renewable energy technologies - an investor perspective*, *Energy Policy*, 34, 461-80.
- EMRA, (2013a), *Elektrik Piyasası Kanunu*, in Turkish. Available at: <http://www.epdk.org.tr/english/regulations/electric/law/EML.doc> (accessed 20 July 2013).
- EMRA, (2013b), *EPDK'nın Yıllık Faaliyet Raporları*, in Turkish. Available at: http://www.epdk.gov.tr/yayin_rapor/yayinlar_raporlar.htm (accessed 25 July 2013).
- EMRA, (2013c), *2011, 2012 ve 2013 yılları Nihai YEKDEM Listeleri*, in Turkish. Available at: <http://www.epdk.org.tr/index.php/elektrik-piyasasi/yekdem> (accessed 22 December 2013).
- EMRA, (2014a), *Üretim kapasite projeksiyonları*, in Turkish. Available at: <http://www.epdk.org.tr/index.php/elektrik-piyasasi/yayinlar-raporlar> (accessed 11 February 2014).
- EMRA, (2014b), *Elektrik Piyasası Yürürlükte Olan Lisanslar*, in Turkish. Available at: <http://www.epdk.org.tr/index.php/elektrik-piyasasi/lisans?id=180> (accessed 10 February 2014).

- EMRA, (2014c), *Yenilenebilir Enerji Kaynaklarının Belgelendirilmesi ve Desteklenmesine İlişkin Yönetmelik*, in Turkish. Available at: <http://www.epdk.org.tr/index.php/elektrik-piyasasi/mevzuat?id=29> (accessed 7 February 2014).
- EMRA, (2014d), *Enerji Piyasası Lisans Yönetmeliği*, in Turkish. Available at: http://www.epdk.org.tr/documents/elektrik/mevzuat/yonetmelik/elektrik/lisans/Elk_Ynt_Lisans_Son_Hali.doc (accessed 12 February 2014).
- EMRA, (2014e), *Yenilenebilir Enerji Kaynaklarının Elektrik Enerjisi Üretimi Amaçlı Kullanımına İlişkin Kanun*, in Turkish. Available at: <http://www.epdk.org.tr/index.php/elektrik-piyasasi/mevzuat?id=143> (accessed 10 February 2014).
- EMRA, (2014f), *Enerji Piyasası Düzenleme Kurulu Kararları*, in Turkish. Available at: <http://www.epdk.gov.tr/mevzuat/kurul/elektrik.htm> (accessed 26 January 2014).
- Erdogdu, E. (2007), *Regulatory reform in Turkish energy industry: An analysis*. Energy Policy, 35, 984-993.
- Erdogdu, E. (2011), *An analysis of Turkish hydropower policy*, Renewable and Sustainable Energy Reviews, 15, 689-696.
- Ilkilic, C. (2012), *Wind energy and assessment of wind energy potential in Turkey*, Renewable and Sustainable Energy Reviews, 16, 1165-1173.
- Kaygusuz, K. (2010), *Wind energy status in renewable electrical energy production in Turkey*, Renewable and Sustainable Energy Reviews, 14, 2104-2112.
- Keles, S., Bilgen, S. (2012), *Renewable energy sources in Turkey for climate change mitigation and energy sustainability*, Renewable and Sustainable Energy Reviews, 16, 5199-5206.
- Menanteau, P., Finon, D., Lamy, M.L. (2003), *Prices-versus quantities: choosing policies for promoting the development of renewable energies*, Energy Policy, 31, 799-812.
- MENR, (2013a), *Electricity sector reform and privatization strategy paper*. March 17, 2004, No. 2004/3, Available at: http://www.enerji.gov.tr/yayinlar_raporlar_EN/Elektrik_Enerjisi_Sektoru_Reformu_ve_Ozelleştirme_Strateji_Belgesi_EN.pdf (accessed 16 July 2013).
- MENR, (2013b), *Electricity energy market and supply security strategy paper*. May 18, 2009, No. 2009/11, Available at: http://www.enerji.gov.tr/yayinlar_raporlar_EN/Arz_Guvenligi_Strateji_Belgesi_EN.pdf (accessed 16 July 2013).
- Mitchell, C., Bauknecht, D., Connor, P.M. (2006), *Effectiveness through risk reduction: a comparison of the renewable obligation in England and Wales and feed-in system in Germany*, Energy Policy, 34, 297-305.
- Ozel, I., Atiyas, I. (2011), *Regulatory diffusion in Turkey: A cross-sectoral assessment*, Cetin, T., Oguz, F., (Eds.) in *The Political Economy of Regulation in Turkey*, New York: Springer, 51-74.
- Privatization Administration of Republic of Turkey, (2014), *Privatization of electricity utilities*. Available at: http://www.oib.gov.tr/index_eng.htm (accessed 20 February 2014).
- Sawin, J.L. (2004), *National policy instruments, policy lessons for the advancement and diffusion of renewable energy technologies around the world*, Thematic background paper 3, the international conference for renewable energies, Bonn. Available at: http://wofuco.inet.de/fileadmin/user_upload/Miguel/Sawin_2004_National_policy_instruments.pdf (accessed 18 July 2012).
- Saidur, R., Islam, M.R., Rahim, N.A., Solangi, K.H., (2010), *A review on global wind energy policy*, Renewable and Sustainable Energy Reviews, 14, 1744-1762.
- Sirin, S.M., Ege, A. (2012), *Overcoming problems in Turkey's renewable energy policy: How can EU contribute?* Renewable and Sustainable Energy Reviews, 16, 4917-4926.
- TEIAS, (2014a), *Kuruluş ve yakıt cinslerine göre kurulu güç*, in Turkish. Available at: <http://www.teias.gov.tr/yukdagitim/kuruluguc.xls> (accessed 15 February 2014).
- TEIAS, (2014b), *Türkiye Tüketimi Karşılaştırma*, in Turkish. Available at: <http://www.teias.gov.tr/yukdagitim/2013Gecici.htm> (accessed 16 February 2014).
- TEIAS, (2014c), *SGÖF ve SMF Fiyatlarının Ağırlıklı Ortalamaları*, in Turkish. Available at: <https://dgpys.pmum.gov.tr/dgpys> (accessed 4 March 2014).
- Topkaya, S.O. (2012), *A discussion on recent developments in Turkey's emerging solar power market*, Renewable and Sustainable Energy Reviews, 16, 3754-3765.
- Turkish Central Bank, (2014), *Doviz kurlari*, in Turkish. Available at: http://www.tcmb.gov.tr/yeni/kurlar/kurlar_tr.php (accessed 10 February 2014).

- Tükenmez, M., Demireli, E. (2012), *Renewable energy policy in Turkey with the new legal regulations*, *Renewable Energy*, 39, 1-9.
- World Bank (1997), *Financial incentives for renewable energy development*, Discussion Paper No.391, Proceedings of an International Workshop, February 17-21, 1997, Amsterdam, Netherlands. Available at: <http://seg.fsu.edu/Library/financial%20incentives.pdf> (accessed 26 July 2012).
- Yılmaz, A.O., Uslu, T. (2007), *Energy policies of Turkey during the period 1923-2003*, *Energy Policy*, 35, 258-264.