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The Implications of Biofuel Policy in Turkey

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ABSTRACT: Turkish Energy Regulatory Agency (EMRA) announced in September 2011 that biofuel blending will be mandatory starting from 2013 and 2014 for bioethanol (2%) and biodiesel (1%) respectively. The blending ratio will be increased to 3 percent for bioethanol in 2014 and biodiesel in 2016. This study aims to evaluate the net trade impacts of the blending regulation. In Turkey, sugar beet based ethanol production seems feasible and sustainable. Mandatory blending ratio will increase the capacity utilization of existing plants. Bioethanol blending (2%) will reduce oil imports by 255.2 million US Dollar in 2013. Contribution impact of bioethanol production will be much greater by 2016. But, since Turkey is already a net importer of oilseeds biodiesel, blending implementation will deteriorate the foreign trade balance and 2 percent blending will bring around 488.5 million US Dollar extra import increase in 2015. Therefore, net trade impact of mandatory blending is expected to be negative.

Keywords: Sustainable biofuel production; biofuel policy impact; energy policy
JEL Classifications: Q16; Q4

1. Introduction

Turkey has faced a growing demand for energy during last two decades and furthermore primary energy demand is projected to reach 282.2 mtoe in 2020 which means almost 146 percent increase from current level of 114.5 mtoe (TUBITAK, 2008; DEKTMK, 2012). Energy sector has grown steadily with respect to per capita GDP growth, rapid industrial growth, expansion of service sector and increasing urbanization ratio. Total primary energy production reached 32.2 mtoe in 2011 and total electricity supply reached around 229.4 thousand Gwh in 2011 which was 84 percent higher than 2000 level (DEKTMK, 2012; TEIAS, 2011). Turkey has an economy challenging by a growing demand for energy while its self-sufficiency ratio in primary energy sources are very low. Total primary energy production met about 28 percent of the total primary energy demand in 2011. All of combined macroeconomic data indicate that energy will be one of the most important issues for Turkey's economic development in future.

Turkey is heavily dependent on energy import which imposes significant burden on the current account deficit and price stability. Fossil fuels constitute the bulk of energy production and consumption. For example coal and lignite generates 16 % of total energy production and 29 percent of final electricity consumption (MENR, 2011; TEIAS, 2011). In 2010, Turkey's greenhouse gas emissions (as CO_2 equivalent) increased 115 percent compared to 1990's emissions. Approximately 85 percent of total CO_2 emissions has emitted from energy sector (TurkStat, 2012a). As a result, GHG emissions have been causing severe environmental problems such as pollution in the country. Furthermore, to comply with Kyoto Protocol, consumption pattern needs to be modified which further require reducing share of coal in primary energy consumption. As a candidate country, Turkey will also have to adopt the bio-energy and biofuel directives of the EU in case of membership[1]. In this

[1] The Renewable Energy Directive (2009/28/EC) established mandatory targets to be achieved by 2020 for a 20 % overall share of renewable energy in the EU and 10 % share for renewable energy in transport sector. Moreover, based on published proposal by EC, the use of food based biofuels will be limited to 5 % towards the

regard, promoting renewable energy resources seem to be one of the effective energy policies in Turkey which also entails substantial investments. Hence, utilization of domestic renewable energy sources such as biofuels, hydro, wind is key issue for Turkey to reduce its dependence on import energy supplies, provide supply security and prevent the increase in greenhouse emissions.

Although Turkey has a high renewable energy potential to meet substantial part of its energy needs, this potential has not been exploited yet. Renewable energy is already the second major domestic energy source following the coal which constitutes 9 percent of primary energy supply with 9.94 mtep annually (MENR, 2011). According to Electricity Energy Market and Supply Safety Strategy Document, Turkey established a target to increase the share of renewable energy to 30 percent from current level 20 percent and drop share of natural gas in electricity production to 30 percent by 2023. Moreover, The Turkish Energy Regulatory Agency (EMRA) issued a new regulation for biofuel blending which will be mandatory starting from 2013 and 2014 respectively for bioethanol (2%) and biodiesel (1%). The blending ratio will be increased up to 3% respectively for bioethanol in 2014 and biodiesel in 2016 (EMRA, 2011).

Given current figure of high dependency of energy rapidly increasing CO_2 emission and energy import bill, renewable energy sources such as biofuel, solar, wind and hydro power are becoming a challenging alternative to substitute fossil fuels use for Turkey. The aim of this article is to examine the current situation and potential of biofuels and evaluate the impacts of biofuel blending mandate on energy import bill. The paper is organized as follows. In the second section, macroeconomic drivers of energy demand and national renewable energy policy are briefly presented. In the third section energy sector and biofuel energy potential are reviewed. In the fourth section implications of mandatory biofuel blending on import bill is analyzed. Paper ends with a conclusion.

2. Economic Profile and Renewable Energy Policy in Turkey

Turkey's has 779,452 km^2 land size and about 75.6 million populations as of 31 December 2012 (TurkStat, 2013a). Besides increasing population (1.2%), migration from rural regions to urban and/or rapidly growing tourism sector has been leading more energy consumption. Over the past decade Turkish Gross Domestic Product (GDP) has increased an exceptional rate compared to other OECD countries. According to the World Bank (2011), Turkey is one of the fastest growing country among emerging economies and 15th largest economy in the world with GDP of 1,259 billion international USD (in terms of GDP-PPP) and 17th largest economy in terms of Nominal GDP in the world (WB, 2011; WB, 2010). Turkey had experienced a 4.3 percent annual average growth rate during 2000-2010 (IEA, 2010). GDP per capita reached 10.5 thousand USD at current prices in 2012 (TurkStat, 2013b).

Table 1. Population, Economy and Energy in Turkey, 1973-2020

Year	Population (1000)*	Population Increase (%0)	GDP per capita ($**)	GDP, at current prices (billon USD)	Total Energy Consumption, (Mtoe)
1973	38,073	20.7	2,369.00	90.2	20.0
1990	55,120	17.0	3,859.52	202.38	40.6
1995	59,756	15.4	6,693.43	223.74	63.2
2000	64,259	13.8	7,750.35	265.18	82.2
2005	67,903	13,0	11,116.95	482.78	92.5
2010	73,722	15.0	13,577.10	729.05	97.3
2020	80,257	8.8	19,748.55	1,344.29	282.2

* Mid-year population data, ** IMF, International USD PPP equivalent
Source: TurkStat (2010), IMF (2011), TUBITAK (2008), Toklu et al., (2010) and IEA (2010).

Growth rate of GDP in Turkey was 8.5 percent in 2011 and GDP is expected to grow at a rate 4 percent in 2013 and 5 percent in 2014 and 2015 (SPO, 2012). The total energy consumption is

EU's 10 % target for renewable energy sources in the transport sector to restrict global land conversion for biofuel production and raise the climate benefits of biofuels (EC, 2012).

expected to reach 282.2 mtoe by the year 2023 (TUBITAK, 2008) which is almost 146 percent higher than current level of 114.5 mtoe.

There has been growing interest for biofuels such as biodiesel and ethanol during last two decades. Increasing oil prices, rising dependence on fossil fuels, global warming due to greenhouse emissions, control of the most of oil reserves by the politically unstable countries forced governments to take precautions to ensure energy safety. In this regard, renewable energy sources including biofuels are supported by the several countries (Ragauskas, 2006, p.484). Not only developed countries like European Union, Canada and the United States but also the developing countries are implementing support polices such as tax discounts and input subsidies. Successful PRO-ALCOOL ethanol program in Brazil constituted a very good example for other countries (Çağatay et al., 2012).

In Turkey, public investments including electricity investments have been gradually cut down to reduce the public share in the economy since 1980. In addition, privatization policies were not successful enough as planned and expected during early 1980s and late 1990s. Thus, Turkey adopted a radically different framework for the design of the energy markets during early 2000s. In 2003, Electricity Market Law (EML, No: 4628) came into force (Erdogdu 2007). The EML was designed to establish a competitive electricity market, to promote private participation and improve the efficiency in electricity supply (Ozkivrak, 2005). In parallel with the electricity market reform, some other reforms were also initiated in other segments of market. In 2001, Natural Gas Market Law (NGML, No: 4646) also came into force to achieve similar goals in natural gas industry. Turkey is candidate country for EU membership following the Helsinki European Council of December 1999 and the EU accession negotiations started in 2005 (EC, 2013). Therefore all candidate countries need to harmonize their policies with the European Union energy policies. Moreover all candidate countries should have adequate legislation and well functioning institutions. In this regard, Turkey adopted a strategy which consists of a privatization and integration into European and global economy. The EU energy policies essentially include the improvement of competitiveness, security of energy supply and protection of environment (Balat, 2010). Although fuel alcohol became an option to use during 1932-39 period in Turkey, first important promotion instrument for promoting renewable energy was the publication of Electricity Market Law in March 2001. In the context of this law, individual and corporate entities built electricity generation facilities from renewable energy sources having maximum installed capacity of 500 kW were exempted from licensing obligations and setting up a corporate entitles. The law on the Utilization of Renewable Energy Sources for Electricity Generation (Law No: 5346) in Turkey was released in 2005. Some incentive mechanisms such as licensing, land appropriation and purchase guarantee by a constant feed-in tariff were introduced (Kucukali and Baris, 2011). The Renewable Energy Law (REL, No: 6094) was enacted by the Turkish Grand National Assembly in December 28, 2010. According to the REL, unit electricity price for production facilities based on biomass (including waste gas) was determined to be 1.33 USD per KWs.

Table 2. Biofuel Mandatory Blending Ratio by EMRA (%)

Biofuel	2013	2014	2015	2016
Biodiesel	-	1	2	3
Bioethanol	2	3	3	3

EMRA announced that biofuel blending will be mandatory starting from 2013 and 2014 respectively for bioethanol (2%) and biodiesel (1%). The blending ratio will be increased to 3 percent respectively for bioethanol in 2014 and biodiesel in 2016 (EMRA, 2011) (Table 2).

3. Biofuel Potential of Turkey and Current Situation

According to the Ministry of Energy and Natural Resources (MENR) statistics (2011), petroleum products, natural gas and coal consist of the bulk of primary energy consumption in Turkey. Roughly 90 percent of oil supply and 98 percent of natural gas supply are imported. Although Turkey has high potential of renewable energy (Table 3), but only very small portion of this potential is being used. For example, Turkey has high technical hydro and wind power potential compared to many countries, but approximately 31 percent of existing hydro, 5.7 percent of geothermal, 3.1 percent of waste and 1.6 percent of wind energy potentials are utilized.

Table 3. The situation of renewable energy in Turkey, (the end of 2011)

Type of Energy	*Technical Potential (MW)*	*Economical Potential (MW)*	*Installed Capacity (MW)*
Hydropower	54,000	42,000	17,137
Wind	114,000	20,000	1,806
Geothermal	2,000	600	114.2
Wastes(Biogas+Biomass)	4,000	-	125.7
Solar	56,000	-	-

Source: Kucukali and Baris (2011), EWEA (2012), Topuz (2012), TEIAS (2011).

Government tries to foster the utilization of renewable energy sources due to the fuel import dependency, growing energy demand and increasing greenhouse emissions[2]. Turkish government aims to increase the share of renewable energy sources in electricity generation to at least 30 percent while decreasing the share of natural gas below 30 percent from 45.3 percent (TEAIS, 2011). In this context, biofuel initiatives were started since 2000. There were more than 100 small scale biodiesel facilities in 2010 but most of them were repealed. Currently, there are 23 biodiesel facilities with processing license and 15 facilities with distribution license (EMRA, 2013). Moreover Alternative Energy and Biodiesel Producers Association (ALBIYOBIR) continue to produce biodiesel from waste oil. Currently, 231 firms have been licensed by Ministry of Environment and Urban Planning to transport waste oil (MOTAT, 2013). In addition, there are 9 biofuel facilities with 230 thousand tones annual capacity from waste cooking oil (Hatunoglu, 2010). It is estimated that capacity of the installed biodiesel plant is around 1.5 million tones.

Biodiesel blended with oil produced from domestic crops production has exempted from the Specific Consumption Tax (OTV in Turkish). Despite this opportunity, existing production capacity in biodiesel has not been fully utilized. Moreover, Turkey has foreign trade deficit in oilseed sector and imported oilseed use for biodiesel was not found feasible compare to fossil fuel (Boluk and Koç, 2008). Hence due to unfavorable changes in the regulatory environment and related tax laws, development of the biofuels sector in Turkey has been blocked by bureaucratic procedures and high tax rates and many factories have closed down (Ar et al., 2010; EMRA, 2011). Although Turkey has an annual capacity of 1.5 million MT, only 7,000 MT biodiesel was produced in 2009 (Erkut, 2010). Some R&D activities are being carried out by universities (for example Ege University) and by the TUBITAK, however second generation biofuels are not commercialized yet. There is one commercial plant carrying out researches on microalge biodiesel in Turkey but the product is not being sold yet (TUPRAS, 2012; Erkut, 2010).

As seen in Table 4, bioethanol production surpassed 50 million liters in Turkey. About 35 per cent of bioethanol is being exported (Erkut, 2010).

In contrast to biodiesel production, bioethanol market has been more stable since 2000 as foreseen by Boluk and Koç (2008). Bioethanol can be supplied to fuel market in E2 form (including 2% bioethanol) as three trade mark since 2004 (Ar et al., 2010). The established production capacity of bioethanol reached 184 million m3 as of 2010, of which around 46 percent is run by a sugar beet producer cooperative union (Pankobirlik) (Table 5).

[2] According to the TURKSTAT (2012a), the highest growth of CO_2 emission between 1990 and 2010 was observed in energy industries with 115 percent in 2010. Second major part of GHG emissions was emitted from industrial process. Share of the energy, industrial process, waste and agricultural activities were 70.9 percent, 13.4 percent, 8.9 percent and 6.7 percent in GHG emission respectively as of 2010.

Table 4. Biofuel for Heat and Power, million liters

	2006	2007	2008	2009	2010	2011
Bioethanol						
Production	38	38	50.6	50.6	50.6	50.6
Export	N/A	N/A	N/A	17.7	17.7	17.7
Consumption	38	38	50.6	32.9	32.9	32.9
Production Capacity						
Number of bio-refineries	0	1	3	4	4	4
Capacity	N/A	N/A	N/A	202	202	202
Biodiesel						
Production	56.8	56.8	28.4	7.9	7.9	11.3
Export	0	0	0	0	0	0
Consumption	56.8	56.8	28.4	7.9	7.9	11.3
Production Capacity						
Number of biorefineries	48	48	48	33	33	33
Capacity	N/A	N/A	N/A	1.7	1.7	1.7

Source: Erkut, (2010, p.5).
Note: N/A means data is not available

Table 5. Ethanol Production Capacity in Turkey

Facility/Plant	**Raw Material Used**	**Annual Capacity (million m^3)**
PANKOBIRLIK	Sugar beet syrup and molasses	84
Tarkim	Corn and wheat	40
Tezkim	Corn and wheat	40
Eskisehir	Sugar beet molasses	20
TOTAL		184

Source: Ar et al. (2010).

4. Implications of Biofuel Policies on Economy

Transportation sector in Turkey rapidly developed during the 1990s and the number of motor vehicles increased from 8.3 million (2000) to 17.1 million in 20133 (TurkStat, 2013c). Motor vehicles use diesel, gasoline and Liquefied Petroleum Gas (LPG) as fuel, but diesel constitutes major part of fuel consumption. According to the Turkish Petroleum Industry Association (PETDER, 2012), share of the diesel, LPG and gasoline were 70, 19 and 11 percent in 2011, respectively. Increase in fuel consumption is expected to continue in near future in Turkey.

Table 6. Mandatory Blending Application and Biofuel Requirement*

Fuel type	Consumption (million tons in 2012)	Blending ratio (%)		Biofuel quantity (thousand tones)
Gasoline	2.54	**2**	(2013)	50.8 (bioethanol)
		3	(2014)	76.2 (bioethanol)
		10	(EU Membership)	254 (bioethanol)
Diesel	16.5	**2**	(2015)	330 (biodiesel)
		3	(2016)	495 (biodiesel)
		10	(EU Membership)	1,650 (biodiesel)

*; Based on the PETDER fuel consumption statistics calculated by the authors.

As mentioned before, blending ratio for bioethanol is 2 % and 3 % in 2013 and 2014, respectively. Taking into account the blending ratios and PETDER (2012) fuel consumption data, bioethanol requirement is calculated to be 50.8 thousand tons in 2013 and 76.2 thousand tons in 2014. Accordingly, biodiesel requirement is calculated to be 330 thousand tons in 2015 and 495 thousand tons in 2016. When the EU criteria are implemented, 254 thousand tons bioethanol and 1,650 thousand tons biodiesel will be required (Table 6).

[3] As of January 2013 (TurkStat, 2013b).

The requirement of oilseed based biodiesel will be 495 thousand tones if biodiesel blending ratio is applied for 16.5 million tones diesel consumption in 2012. Therefore, roughly 1,089 thousand metric tons oilseed will be required if the biodiesel is produced from rapeseed. Oilseed requirement will be much more if other raw materials such as sunflower or soybean are used for biodiesel (Table 7). Biodiesel production based on rapeseed will roughly increase oilseed import bill 733 million USD if the required rapeseed quantity (1,089 thousand tons) is multiplied by import unit value (673 USD per ton) as of 2011. Oilseed complex trade deficit has been growing and reached 2.5 billion USD in 2011 (TurkStat, 2011). Furthermore cost price of oilseed based fuel production in comparison with fossil fuel pre-tax wholesale price was not found feasible alternative in Turkey (Boluk and Koç, 2008).

Table 7. Agricultural Feedstock Necessity of Mandatory Blending*

Biofuel	Biofuel consumption quantity (million liter)			Crop	Harvest yield of biofuel feedstock (kg per liter biofuel)	Production Necessity (1000 tones)		
	2 %	3%	10 %			2 %	3%	10 %
Bioethanol	50.8	76.2	254	Maize	2.4	122	183	610
				Wheat	2.9	147	221	737
				Sugar beet	10.5	533	800	2667
Biodiesel	330	495	1,650	Rapeseed	2.2	726	1089	3630
				Sunflower	2.5	825	1238	4125
				Safflower	3.3	1089	1634	5445
				Soybean	5.0	1650	2475	8445

*Table was prepared by authors using conversion ratios of oilseeds.

On the other hand, ethanol production from sugar beet seems more feasible and might be sustainable in Turkey. Sugar beet is cultivated on 315 thousand hectares of land average of 2007-2011 and sugar beet production area can be increased up to at least 500 thousand hectares in the short-run. However, 500 thousand hectare arable land cultivated for sugar beet production in 1998, the highest rate in history (TurkStat, 2012b). Therefore the ethanol requirement quantity for mandatory blending ratio (3 percent) can be obtained from sugar beet if additional land area around 14.8 thousand hectare is allocated for sugar beet production. This calculation is based on roughly 54 tons per hectare sugar beet yield with an average conversion ratio of 95 liters per metric ton and 76.2 thousand liters ethanol requirement with 3 percent blending ratio for 2.54 million tons gasoline consumption (Table 4). Thus, Turkey has enough potential land area to meet the mandatory blending ratio of EMRA with sugar beet based ethanol for gasoline.

Taking into consideration of the established bioethanol production capacity of Turkey (Table 5), it can be predicted that out of 50.8 million liters of bioethanol, 29 million liters will be produced from sugar beet, 10.9 million liters will be produced from wheat and 10.9 million liters will be produced from maize. If installed bioethanol capacity is considered, approximately 304.5 thousand tons of sugar beet will be needed. In order to produce this quantity, around 5.6 thousand hectare land will be used for sugar beet production. As mentioned before, Turkey has enough land to allocate this quantity of sugar beet production.

According to the TurkStat (2012c), Turkey's total energy import has increased nearly ten folds during the last 16 years and reached to 48,281 million US Dollar in 2008 and 60,112 million US Dollar in 2012. Energy import bill has nearly grown with 18 percent annual average except for 2009. The energy import share in total import constituted about 25.4 percent of the total import in 2012. The import of Turkey's petroleum and petroleum products import was 16,175.5 million USD in 2012. Based on the mandatory blending ratio 2 percent which will be implemented in 2013, 50.8 million liters of bioethanol blending will result roughly 307.4 thousand cubic meters of oil replacement and this means a US$ 255.2 million reduction in oil imports[4] . According to the USDA (2012), extra sugar beet production will mean employment possibilities for over 3,000 people. In case of implementation of 3 percent blending ratio, contribution of bioethanol production will be much greater in 2014

[4] The unit value of petrol import might be calculated roughly as 830 USD in 2012. The value of petrol import was 16.2 billion USD and 19,47 million tonnes oil was imported in Turkey (TurkStat, 2012c).

(roughly 380 million USD). As mentioned before, biodiesel on the other hand is obtained from oilseeds and Turkey already a net importer of oilseeds. Therefore biodiesel will be claimed that it would deteriorate the import bill. For example, if the biodiesel blending (2%) is met by rapeseed, 726 thousand tones rapeseed will be needed and this will bring 488.6 million USD import bill in 2015[5].

Mandatory blending ratio will increase the agricultural production and might lead to increase agricultural commodity prices. Hence, income level of farmers would increase. Moreover, sugar beet production for ethanol would create job opportunity in agriculture sector. Bioethanol production process would also create additional job opportunities. As a result bioethanol production would contribute the local economic development in Turkey if it is based on sustainable agricultural production such as crops rotations. But, net trade impact will be negative in terms of import value.

5. Conclusion

Turkey has faced with growing demand for energy during last decades and increasing import dependency which imposes heavy burden on the national economy. Some efforts for sustainable energy, energy efficiency and environmental issues have been observed in Turkey since 2000s. A renewable energy source including biofuel has become a challenging alternative to fossil fuels for Turkey.

Turkey has an installed capacity of around 1.5 million tones biodiesel plant but this capacity could not utilized because of the low oilseed self-sufficiency ratio and increasing trade deficit in this sector. Biodiesel production based on imported oilseed is not sustainable but ethanol production from sugar beet seems rather sustainable. Implementation of mandatory blending would increase the capacity utilization and decrease import dependency. For example, 2 percent bioethanol blending can lead roughly 255.2 million USD reductions in oil import. Furthermore, biofuel production will contribute to the local economic development by increasing income level of farmers and creating new job opportunities in Turkey if agricultural production is realized a sustainable manner or comply with cross compliance rules. It was estimated that bioethanol blending can create over 3,000 people employment in 2013. On the other hand mandatory blending ratio of biodiesel would increase oilseed import bill roughly 488.5 million USD burden in Turkey's import bill in 2015. So, net economic impact of the regulation is expected to be negative.

References

Ar, F., Karaosmanoğlu, F., Koç, A.A., Acaroğlu, M., Sarsu, F., Özsöyler, Y., Bölük, G., İşler, A., Aygün, Ö.M. (2010), *Biofuels Report*, (In Turkish), World Energy Council, Turkish National Committee Publication, Ankara.

Balat, M. (2010), Security of energy supply in Turkey: Challenges and solutions, 51, 1998-2011.

Boluk, G., Koç, A.A. (2008). "Biofuels in the World and Turkey: Production, polices, cost and impacts", İktisat İsletme ve Finans, 23(269), 25-50 (In Turkish with extended English abstract).

Çağatay, S., Kıymaz, T., Koç, A.A., Bölük, G., Bilgin, D. (2012), Modeling the Impact of Developments and Potential Changes in the World and Turkey's Bio-energy Markets on Turkey's Agricultural and Livestock Sectors and Developing Alternative Bio-energy Policies for Turkey, (In Turkish), Agricultural Economics and Policy Development Institute (TEPGE) Publications, No: 204, Ankara.

DEKTMK, (2012), Turkey's Energy Facts and Figures 2012, World Energy Council Turkish National Committee (DEKTMK), http://dektmk.org.tr/upresimler/ TURKEYSENERGYFACTSANDFIGURES2012.pdf, (4/02/2013).

EC, (2012), European Commission, Renewable Energy Targets by 2020, http://ec.europa.eu/energy/renewables/targets_en.htm, (3/02/2013).

EC, (2013), EU-Turkey Relations, European Commission (EC), http://ec.europa.eu/enlargement/candidate-countries/turkey/eu_turkey_relations_en.htm, (10/03/2013).

[5] The unit value of rapeseed was calculated as 673 USD per tons in 2011 based on TurkStat data (TurkStat, 2011b).

EMRA, (2011), Energy Market Regulatory Agency, 2011, www.epdk.gov.tr (5/03/2012).
EMRA, (2013), Oil market license statistics, www.epdk.gov.tr (10/04/2013).
Erdogdu, E. (2007), "Regulatory reform in Turkish energy industry: An analysis", Energy Policy, 35, 984-993
Erkut, Y. (2010), 2010 Turkey Biofuels Annual, Report, USDA Foreign Agricultural Information Network, http://gain.fas.usda.gov/Recent% 20GAIN%20Publications /Biofuels %20Annual_Ankara_Turkey_8-13-2010.pdf, (02/01/2013).
EWEA, (2012), Wind in power 2011, European Statistics, http://www.ewea.org/fileadmin/files/library/publications/statistics/Wind_in_power_2011_European_statistics.pdf, (6/02/2013).
Hatunoglu, E.E. (2010), Effects of Biofuel Policies on Agricultural Sector, Publication of State Planning Organization, (in Turkish), Ankara.
IEA, (2010), Energy Policies of IEA Countries: Turkey 2009 Review, OECD/IEA 2010, France, 2010.
IMF, (2011), Country Information: Turkey, 2011, www.imf.org.tr, (24/10/2011).
Kucukali, S., Baris, K. (2011), Renewable energy policy in Turkey, World Renewable Energy Congress 2011, 8-13 May 2011, Linköping, Sweden, http://www.ep.liu.se/ecp/057/vol10/023/ecp57vol10_023.pdf (10/09/2012).
MENR, (2011), Ministry of Energy and Natural Resources, Energy Statistics, www.enerji.gov.tr, (15/09/2012).
MOTAT, (2013), Mobile Hazardous Waste Tracking System, Ministry of Environment and Urban Planning, http://cbs.cevre.gov.tr/Motat/Tumlisanslar.zul, (12/04/2013).
Ozkivrak, O. (2005), "Electricity restructuring in Turkey", Energy Policy, 33(10), 1339-1350.
PETDER, (2012), Sector Report 2011, Petroleum Industry Association (PETDER) http://www.petder.org.tr/admin/my_documents/my_files/CC3_PETDERSektorRaporu2011.pdf, (13/03/2013).
Ragauskas, A.J., Williams, C.K., Davison, B.H., Britovsek, G., Cairney, J., Eckert, C.A., Frererick, jr., W.J., Hallet, J.P. Leak, D.J., Liotta, C.L., Mielenz, J.R., Murphy, R., Templer, R., Tschaplinki, T. (2006), "The Path Forward for Biofuels and Biomaterials", Science, 311, 484-489.
SPO, (2012), State Planning Organization (SPO), Medium Term Program (2013-2015), Main Macroeconomic and Fiscal Targets, Turkey, www.dpt.gov.tr, (04/03/2012).
TEIAS, (2011), Electricity Generation&Transmission Statistics of Turkey 2011, Turkish Electricity Transmission Company (TEIAS), http://www.teias.gov.tr/ Türkiye Elektrik İstatistikleri/istatistik2011/istatistik%202011.htm, (07/09/2012)).
Toklu E., Guney M.S., Isık, M., Comakli O., and Kaygusuz K. (2010), "Energy Production, consumption, policies and recent developments in Turkey", Renewable and Sustainable Energy Reviews, 14, 1172-1186.
Topuz, G. (2012), Renewable Energy Investments, Rising Star in Fast Developing Market Turkey, The Union of Chambers and Commodity Exchanges of Turkey, 17 April 2012, http://www.hollandturkey.com/2012/presentation/workshop8/8-GokmenTOPUZ-Nederland-17042012.pdf, (6/02/2013).
TUBITAK, (2008), The Scientific and Technological Research Council of Turkey (TUBİTAK), Vision 2023 Technology Foresight Project, Panel of Energy and Natural Resources, 24 July, Supplements of Report, Supplement A, Turkey, World and OECD Data, (In Turkish) http://www.tubitak.gov.tr/tubitak_content_files/vizyon2023/edk/ekler.pdf (4/9/2012).
TUPRAS, (2012), 2012 Annual Report, http://www.tupras.com.tr/uploads/TUP2011ING.pdf, (17/04/2013).
TurkStat, (2013a), Results of Address Based Population Registration System, Bulletin of Turkish Statistical Institute 2012, No: 13425, 28 January 2013, http://www.tuik.gov.tr/PreHaberBultenleri.do?id=13425, (6/02/2013).
TurkStat, (2013b), Gross Domestic Product, Fourth Quarter, Bulletin of Turkish Statistical Institute 2012, No:13471, 1 April 2013, www.tuik.gov.tr , (10/04/2013).
TurkStat, (2013c), Road Motor Vehicles Statistics, Bulletin of Turkish Statistical Institute, No: 13465, (19/03/2013).
TurkStat, (2012a), Greenhouse Gases Emission Inventory Period 1990-2011, http://www.turkstat.gov.tr/PreHaberBultenleri.do?id=10829, (01/10/2012)

TurkStat, (2012b), Crop Production Statistics, www.tuik.gov.tr.
TurkStat, (2012c), Foreign Trade by Standard International Trade Classification,, www.tuik.gov.tr.
TurkStat, (2011), Crop Production Statistics, www.tuik.gov.tr.
Turkstat, (2010), Population Statistics, www.tuik.gov.tr.
USDA, (2012), Turkey Sugar Annual, Global Agricultural Information Network (GAIN) Report, 4/15/2012, USDA Foreign Agricultural Service, http://www.thefarmsite.com/reports/contents/turksugapril12.pdf, (5/02/2012).
WB, (2012), Gross domestic product 2011, PPP, http://databank.worldbank.org/databank/download/GDP_PPP.pdf , (02/01/2013)
WB, (2011), Gross domestic product 2010, http://siteresources.worldbank.org/DATASTATISTICS/Resources/GDP.pdf, (02/01/2013).