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Energy Outlook of Turkey

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ABSTRACT

In Turkey, energy sector is mainly state-owned. In the recent years, the private sector is been encouraged to invest in energy business by developing liberalization and privatization in the energy market.

Lignite is one of the most promising indigenous resources of the country and its production, which has been supported by the Government, has increased gradually since the beginning of the 1980s and reached 51 Mt in 2002.

The import of the hard coal has been increasing every year owing to the inadequacy of its production to meet the demand of the country.

Because of its geopolitical location, Turkey is an important candidate to be "Eurasia Energy Corridor" by offering a great potential to transport the rich oil and natural gas resources of the Caspian Region to the western Energy Markets. In this endeavor, a particular attention is given to realize the relevant oil and natural gas projects.

Natural gas consumption in Turkey has started towards the end of the 1970s and has increased rapidly with high amounts of imports because of its small production in the country.

Renewable energy resources have a high share in energy supply in rural areas, in particular, owing to the extensive use of wood by households. Hydro-power generation reached from 23.15 TWh in1990 to 33.68 TWh in 2002. It is expected that hydro and geothermal energy use will increase substantially.

Electricity demand of the country has grown rapidly. It was 56.8 TWh in 1990 and reached 132.6 TWh in 2002. Installed power was 16.3 GW and 31.8 Gw in the years 1990 and 2002, respectively.

1. INTRODUCTION

Turkey has common borders with Greece, Bulgaria, Romania, Georgia, Armenia, Azerbaijan, Iran, Iraq and Syria. Its total area is about 779 452 km2. Turkey is surrounded by the Mediterranean, Black Sea, Marmara and Aegean Sea with total coastlines of 8 333 km.

Owing to its geographical location, Turkey is a strong candidate to be an "Energy Corridor" for the transit of rich oil and natural gas resources of the Central Asian countries to the Western Energy Markets.

Total population of Turkey is 69. 645 million, the annual growth rate of population is 1.63 %, GDP per capital is around 3058 US$, as of 2002.

2. ENERGY POLICY OF TURKEY

The Ministry of Energy and Natural Resources is the main body of the Turkish energy sector and is in charge of setting out and implementation of energy policies, plans and programs in coordination with its dependent and related institutions and other public and private entities.

The main principles of Turkish energy policy are to:

- to liberalize the energy sector by creating competitive energy market with a view to improve efficiency in the sector as well as to provide transparency;
- to meet the energy demand, mainly by the limited indigenous energy resources of the country to the extend possible, in a rational way and by minimizing the adverse impacts on the environment and human health;
- to diversify the energy services by alternative energy resources and new technologies;
- to undertake the role of "Energy Corridor" to transit the rich energy resources of the East into the Western Energy Markets;
- to give priority to the activities related to energy supply security of the country with growing concerns in meeting rapidly increasing energy demand;

To establish a competitive energy market, the Electricity Market Law, which was in compliance with EU Directive on Internal Electricity Market, was enacted by the Turkish Parliament in March 2001. The purpose of the Law is to ensure the development of a financially sound and transparent electricity market operating in a competitive, transparent environment under provisions of civil law and to ensure the autonomous regulation and supervision of the market. The Electricity Market Law also aims the implementation of incentives for the electricity production from the indigenous and renewable resources. The Natural Gas Market Law and the Petroleum Products Market Law with similar purposes were made effective subsequently.

The Energy Market Regulatory Authority was established in year 2001. The objective of the Authority is to establish a financially viable, stable, transparent and competitive energy market, which will function as per the provisions of private law and ensure independent regulation and supervision of the market in order to provide adequate electricity, natural gas and petroleum products of good quality to the consumers, at low cost, in a reliable and environmentally friendly manner.

Due to its geopolitical situation, Turkey has the potential of being the most important energy terminal for oil and gas exports. In this respect, the Government gives a high priority to realize that Turkey would be the **"Eurasia Energy Corridor"** of the 21st Century.

It is projected that World energy consumption will increase 50% over the next 20 years and a great part of the demand will be met by the oil and gas reserves of Eurasia. Caspian

region does not have an access to the sea and has limited possibilities to export its rich hydrocarbon energy resources to the international markets. From geographical point of view, Turkey is on the point of cross-roads to connect Central Asia and Middle East to Mediterranean region and Europe and in compliance with the national energy policy, the transit projects are being prioritized aiming at transportation of Caspian hydrocarbon to the global energy markets in a secure, stable, economic and environmentally friendly way.

"Baku-Tbilisi-Ceyhan Crude Oil Pipeline Project" is one of these above mentioned- projects and it has a great importance. The pipeline from Sangachal Terminal (near Baku) to the Turkish Mediterranean port of Ceyhan will pass through Georgia. The maximum capacity of the pipeline will be 50 million ton per annum (1 million barrel per day).

All Intergovernmental Agreements related to "Baku-Tbilisi-Ceyhan (BTC) Crude Oil Pipeline Project" were signed. Detailed engineering studies were completed. As from 10 September 2002, construction phase has started. The target date for the commissioning of the Project is 2005 and its economic life is estimated approximately 40 years.

Another oil transport project, from Kazakhstan to global energy markets through Turkey is being developed. In parallel to these projects, "Caspian Region-Turkey-Europe Natural Gas Pipeline Project" which has the target of transporting natural gas to be produced by the Caspian countries to Europe, will be an important step to achieve the goal of East-West Energy Corridor.

Moreover, the studies are continuing on "Southern Europe Gas Ring Project" to meet the growing natural gas demand of European Union by transporting the gas from Caspian Region, Russian Federation, Middle East, South Mediterranean countries and other international resources to Europe. In this context, the relevant Intergovernmental Agreement was signed on 23 February 2003 to interconnect the natural gas pipeline systems of Turkey and Greece with a view to export natural gas from Turkey to Greece. The Interconnection of Natural Gas Systems of Turkey and Greece is expected to be completed and put into service by the end of 2005.

The environmental protection from the related emissions of the production and use of energy is an important issue on the agenda of the Turkish energy sector, which is under consideration in setting out our energy policies, as in the other countries of the World. More particularly, a special attention is given to the clean coal technologies in the framework of sustainable development, as well as the new and renewable energy resources, more particularly hydro and wind energy.

3. ENERGY SUPPLY AND DEMAND

Reserves of the primary energy resources of Turkey and the primary energy production rates are shown in Tables 1 and 2.

As compared with the global energy reserve; coal, geothermal and hydro energy resources of Turkey represents about 1% of the World energy reserves; while oil and natural gas reserves are negligible. As for thorium, Turkey has large reserves accounting for 54% of the World thorium reserves. However, its use in nuclear power generation depends on the development of thorium cycle power plants, which are presently at development stage.

Table 1: Primary Energy Reserves of Turkey-2002

RESERVES	PROVEN	PROBABLE	POSSIBLE	TOTAL
Hard Coal (Mt)	428(*)	456	245	1129
Lignite (Mt)				
Elbistan	3357			3357
Others	3982	626	110	4718
Total	7339	626	110	8075(**)
Asphaltite (Mt)	45	29	8	82
Bituminous Shale (Mt)	555	1086		1641
Hydro				
GWh/Year	126109			126109
MW/Year	35539			35539
Crude oil (Mt)	39,0			39,0
Natural gas (bcm)	10,2			10,2
Nuclear Energy Resources (Ton)				
Uranium	9129			9129
Thorium	380000			380000
Geothermal (MW/Year)				
Electricity	200		4300	4500
Thermal	2250		28850	31100
Solar (Mtoe)				
Electricity				8,8
Thermal				26,4

(*) Including available reserves (**) including identified and potential sources of 300 million tons

Concerning the share of energy resources in the primary energy production in 2002, coal had the highest part by 47.4%; while together oil and natural gas share was 11.8%. Hydro and geothermal accounts for 12.2%; other renewables had the lowest share by 4,3%. Non-commercial fuels' share was 24.3%.

Table 2- Primary Energy Production

	1990	1995	1999	2000	2001	2002
Hard Coal (Kt)	2745	2248	1990	2259	2357	2245
Lignite (Kt)	44407	52758	65019	60854	59572	51048
Asphaltite (Kt)	276	67	29	22	31	5
Oil (Kt)	3717	3516	2940	2749	2551	2420
Natural Gas (Million m³)	212	182	731	639	312	407
Hydro (GWh)	23148	35541	34678	30879	24010	33684
Geothermal- Elec. (GWh)	80	86	81	76	90	105
Geothermal- Heat (Ktoe)	364	437	618	648	687	730
Wind (GWh)			21	33	62	48
Solar (Ktoe)	28	143	236	262	287	318
Wood (Kt)	17870	18374	17642	16938	16263	15614
Dung (Kt)	8030	6765	6184	5981	5790	5609
TOTAL (Kt)	**25478**	**26719**	**27659**	**26855**	**25173**	**24569**
Growth rate (%)		**1,0**	**0,9**	**-2,9**	**-6,3**	**-2,0**

Table 3- General Energy Consumption

	1990	1995	1999	2000	2001	2002
Hard Coal (Kt)	8191	8548	11362	15393	11039	13756
Lignite (Kt)	45891	52405	64049	64384	61010	51446
Asphaltite (Kt)	287	66	29	22	31	5
Oil (Kt)	22700	27918	28862	31072	29661	29624
Natural Gas (mcm)	3418	6937	12902	15086	16339	17723
Hydro (GWh)	23148	35541	34678	30879	24010	33684
Geothermal- Elec.(GWh)	80	86	81	76	90	105
Geothermal- Heat (Ktoe)	364	437	618	648	687	730
Wind (GWh)			21	33	62	48
Solar (Ktoe)	28	143	236	262	287	318
Wood (Kt)	17870	18374	17642	16938	16263	15614
Dung (Kt)	8030	6765	6184	5981	5790	5609
Electricity Import (GWh)	-731	-696	2045	3354	4147	3153
Secondary Coal Import (Ktoe)	453	1024	2075	2184	1949	2310
TOTAL (Kt)	**52987**	**63679**	**74275**	**81251**	**75952**	**78403**
Growth rate (%)		**3,7**	**3,9**	**9,4**	**-6,5**	**3,2**
Per Capita Consumption (Koe)	**944**	**1031**	**1120**	**1205**	**1108**	**1126**

As of 2002, consumption of oil had the highest share in general energy consumption by 39.3%; and it was followed by natural gas and lignite by 20.6% and 13.5%, respectively, (Table 3). In the same year, hydro energy accounted for 3.7%, while the share of non-commercial resources was observed as 7.6%. In the same year, renewable energy (excluding hydro) consumption was 7.1 Mtoe, including wood (4.7 Mtoe), dung (1.3 Mtoe), geothermal (0.8 Mtoe), and solar energy (0.3Mtoe).

3. ENERGY IMPORT AND EXPORT

Due to slow increase in the energy production against high demand growth in the country, net energy imports have increased by average annual rate of 5.5% and almost doubled by increasing from 28.5 Mtoe to 53.9 Mtoe between 1990 and 2002 (Table 4).

As in the past years, in 2002 energy imports have continued and realized as: coal and coal products 9.6 Mtoe (16.5%), crude oil and oil products 32.6 Mtoe (56%), natural gas 15.8 Mtoe (27%) and electricity 0.3 Mtoe (0.5%).

The ratio of domestic production to meet the energy demand which was 48.1% in 1990 decreased to 31.3% in 2002.

In 2002, total energy export, including marine bunkers, was 4.4 Mtoe of which the largest part was petroleum products (99.2%), while the rest was electricity.

Table 4- Development of Energy Demand-Production Import and Export (Ktoe)

	1990	1995	1999	2000	2001	2002
Demand	52987	63679	74275	81251	75952	78403
Production	25478	26719	27659	26855	25173	24569
Import	30936	39779	49406	56280	52702	58335
Export	2104	1947	2791	1584	2620	3162
Bunkers	355	464	587	467	624	1233
Net Import	28477	37368	46028	54229	49458	53940
Growth Rate (%)		5,6	5,3	17,8	-8,8	8,9
Production/Demand (%)	48,1	42,0	37,2	33,1	33,1	31,3

4. ELECTRICAL ENERGY

Electrical energy has a vital role in the development of countries and its demand is increasing even in energy saturated industrialized countries. Development of electricity installed capacity, generation and consumption in Turkey is shown in Table 5.

Table 5- Electricity Installed Capacity, Generation and Consumption

	1990	1995	1999	2000	2001	2002
Installed Capacity (MW)	**16318**	**20954**	**26119**	**27264**	**28332**	**31846**
Generation (GWh)	**57543**	**86247**	**116440**	**124922**	**122725**	**129400**
Import (GWh)	176		2330	3791	4579	3588
Export (GWh)	907	696	285	437	433	435
Gross Supply (GWh)	56812	85551	118485	128276	126871	132553
Growth Rate (%)		8,5	8,5	8,3	-1,1	4,5
Net Consumption (GWh)	**46820**	**67394**	**91202**	**98296**	**97070**	**102800**
Growth Rate (%)		7,6	7,9	7,8	-1,2	5,9
Net Consumption Per Capita (kWh)	**834**	**1092**	**1376**	**1458**	**1416**	**1476**
Gross Consumption Per Capita (kWh)	**1012**	**1386**	**1787**	**1903**	**1851**	**1903**

Turkey had been an electricity exporting country between the years 1990-1996; it has started to import electricity, afterwards, due to the higher increase rate of demand than the growth rate of the supply capacity. On the other hand, in 1990, net electricity consumption was 46 820 GWh with the reflection The net and gross consumption per capita almost doubled in the period 1990-2002.

Development of electricity generation by energy resources between 1990-2002 is shown in Table 6.

Table 6- Electricity Generation by Energy Resources (GWh)

	1990	%	1995	%	2000	%	2001	%	2002	%
HARDCOAL	621	1	2232	3	3819	3	4046	3	4092	3
LIGNITE	19560	34	25815	30	34367	28	34372	28	28056	22
OIL	3942	7	5772	7	9311	7	10366	8	10744	8
NATURAL GAS	10192	18	16579	19	46217	37	49549	40	52497	41
OTHER(*)			222		220		230		174	
TOTAL THERMAL	**34315**	**60**	**50620**	**59**	**93934**	**75**	**98563**	**80**	**95563**	**74**
GEOTERMAL	**80**		**86**		**76**		**90**		**105**	
WIND					**33**		**62**		**48**	
TOT. HYDRO	**23148**	**40**	**35541**	**41**	**30879**	**25**	**24010**	**20**	**33684**	**26**
TOTAL	**57543**	**100**	**86247**	**100**	**124922**	**100**	**122725**	**100**	**129400**	**100**

*Includes liquid sulphur, sulphur cake, waste plants, etc.

5. ENERGY CONSERVATION AND EFFICIENCY

The Ministry of Energy and Natural Resources is the main body, which is responsible for the formulation and implementation of the energy efficiency policies. In order to ensure these policy objectives, Directorate General of Electrical Power Resources Survey and Development Administration was assigned by the Ministry to function as the National Energy Conservation Center to enhance the activities related to the improvement and promotion of energy efficiency in all end-use sectors.

Moreover, the Energy Conservation Coordinating Board that was initially established under the auspices of the Ministry has carried out activities to increase the dialogue and cooperation with the related private and governmental institutions and public awareness, especially among the students of primary to high schools on energy efficiency .it has organizes energy conservation week every year.

In order to increase the energy efficiency in industrial sectors, Energy Conservation Regulation was issued in 1995, which urges the factories consuming energy over 2000 toe to appoint an Energy Manager in their plants. More than 500 technical persons were trained as Energy Managers and certified by the National Energy Conservation Center.

6. DEVELOPMENT OF ENERGY RESOURCES

Almost all kinds of conventional energy resources exist in Turkey. However, the potential of indigenous resources, except coal and hydro, does not have an adequate share in meeting the energy requirements. Both coal and hydropower contribute to indigenous energy production considerably; while oil and coal have a long standing importance in the energy consumption. On the other hand, in the recent years, the share of natural gas has started to increase rapidly in the consumption. After 1980's significant increase has been recorded in electricity generation and consumption. It is estimated that the energy demand of the country would rise in parallel with its development and industrialization in the coming years. In the context of meeting the growing demand in a reliable manner, significant increases are expected in both primary and secondary energy production and supply.

6.1 Coal

In Turkey, hard coal, lignite and asphaltite are domestically produced for consumption.

The largest coal reserves of Turkey are in Zonguldak basins which is the area on the coast of Black Sea between Ereğli and Amasra. Additionally, 20 million tons of coal reserves are estimated in Toros Mountains and Diyarbakır regions. Total hard coal reserves are estimated approximately 1.1 billion tons in the end of 2002.

Lignite is one of the most important domestic resources of the country and it has large and widespread deposits, mainly in Afşin-Elbistan, Muğla, Soma, Tunçbilek, Konya, Beypazarı and Sivas regions.

The country has estimated 8.4 billion tones of proven lignite reserves (end of 2002) of which 68% is low-calorific value (average 1100 kcal/kg) and its largest part, which 3.4 billion tons, is in the Afşin-Elbistan region. Calorific value of the remaining reserves is: 23.5% 2000-3000 kcal/kg; 5.1% 3000-4000kcal/kg and 3.4% 4000 kcal/kg and over. Government has been encouraging domestic coal production as

important indigenous source of the country for reliable energy supply.

In 2002, total coal import encompassed 7.8 million toe (11.7 million ton) hard coal. Rest of the coal import was secondary coal in the form of coke and petro-coke. The iron and steel sectors consumed about 30% of the imported coal. In the recent years, because of rapid increase in natural gas consumption in the residential sector, the amount of the imported hard coal for heating has decreased significantly. The cement sector is the main consumer of imported petro-coke and 1.7 million tons of petro-coke was imported in 2002.

6.2 Oil

In accordance with theoretical calculations, 954 million tons of oil reserves exist in Turkey and 156 million tons of this reserve is extractable. As of end of 2002, 117 million tons of oil reserve was extracted. With the current available reserve of extractable oil, that is 39 million tons, remaining reserve could be exploited in the next coming 16 years. In 2002, crude oil production was realized as 2.4 million tons which constitutes 8% of oil demand of the country. Most of the production has been realized in the southeast of Turkey. Additionally, some amount of oil supply was obtained from the production of Thrace Region.

In 2002, oil-fired power plants produced 8.3 % of the electricity production. Similar to the previous years, in this year transportation sector used oil intensively. Oil consumption of this sector reached from 8.3 million tons in 1990 to 10.7 million tons in 2002, by increasing at an average annual growth rate of 2.1%.In Turkey, there are five refineries with 32 million tons of total capacity.

Since Turkey has limited oil reserves, approximately 90% of oil requirement of the country is being imported by pipelines, tanker ship or tanker trucks. In 2002 , 27.3 million tons of oil was imported from Saudi Arabia (16.4 %), Iraq (9.7 %), Iran (19.0 %), Libya (16.4 %), Russia (16.4), Syria (10.2 %) and other countries (11.9 %). 30 million tons of crude oil was transported in 2002 through 4 pipelines (Batman-Dörtyol, Şelmo-Batman, Ceyhan-Kırıkkale and Turkey-Iraq pipelines).

6.3 Natural Gas

Natural gas is produced in 14 fields in Thrace region of Turkey. Off shore natural gas is produced from North Marmara Sea since. Total natural gas reserve in place of Turkey is 22.1 billion cubic meter (bcm) and recoverable total gas is 15.8 bcm. As of 2002, cumulative production of natural gas was 5.6 bcm and remaining recoverable gas is 10.2 bcm.

Production and consumption of natural gas began in 1976 in Turkey. By mid 80's consumption and shares of gas in electricity production and primary energy consumptions have grown rapidly. In 2002, primary gas supply amounted to 17.7 billion cubic meters that was 20.5% of primary energy supply. The 59% of gas supply was used in electricity generation. In the same year, 407 million cubic meter of gas was produced which met only 2.3 % of domestic consumption. The rest was imported either by pipelines or as liquefied natural gas (LNG). Total imported gas amounted to 17.3 billion cubic meters. The largest share of Turkey's imported natural gas came from Russia (66 %) in 2002, the rest from Algeria (23%), Nigeria (8%) and Iran (3 %).

Presently, the Russian Gas is transported to Turkey, through Bulgaria, by a pipeline of 842 km from Bulgarian border to Ankara which supplied gas to the power plants, several large industrial plants and cities of İstanbul, İzmit, Adapazarı, Bursa, Eskişehir and Ankara. In 1996 the main line was extended to West Black Sea Region by the İzmit -Karadeniz Ereğli Pipeline (209 km) and to Çan by Bursa-Çan Pipeline (208 km).

East Anatolia Pipeline, was constructed between Iranian border and Ankara, later was extended to Konya-Seydişehir Following these developments, Karacabey-İzmir Line and Turkish part of Blue Stream Pipeline between Samsun and Ankara have been in operation since 2002 and February 2003, respectively. Presently, length of the natural gas transmission pipeline system reached to 4500 km.

In Turkey, storage of natural gas has a great importance in order to ensure the supply security against the daily and seasonal demand fluctuations, in this scope, an LNG import and gasification plant in Marmara Region was constructed. An underground storage plant will be constructed and put in to operation in short term.

6.4 Renewable Energy

Renewable energy production and use accounted for 10 mtoe in 2002 with a share of 12.8 % of total primary energy resources. Renewable energy production has the second highest rank in indigenous energy resources, after coal production. More than two thirds of renewable energy supply is biomass, mostly wood and animal wastes that are almost exclusively non-commercial fuels. They are mainly used in the residential sector for heating. The remaining one-third of renewable energy supply is predominantly hydropower which had a share of 26 % in electricity production in 2002. Ministry of Energy and Natural Resources estimated that energy production from renewables would continue to increase. Yearly production and consumption rates of Renewable Energy Sources are shown in Table 7.

Hydro-power generation reached from 23 148 GWh (2 mtoe) in 1990 to 33 684 GWh (2.9 mtoe) in 2002 by an annual average growth rate of 3.2% It is projected that this growing trend will continue in the future. Regarding the end of 2002, the technically feasible hydro-power potential of Turkey is 216 TWh/year while economically feasible potential is estimated approximately 126 TWh/year. About 34 % of the economically feasible hydro potential has been exploited, based on average annual generation.

Table 7- Production and Consumption of Renewable Energy Sources

	1990	1995	1999	2000	2001	2002
TOTAL PRODUCTION (Ktoe)	**9660**	**10779**	**10623**	**10091**	**9332**	**10013**
Hydro	1991	3057	2982	2656	2065	2897
Geothermal, Solar and Wind	461	654	926	978	1056	1142
Biomass	7208	7068	6715	6457	6211	5974
Renewable / Total Primary Energy Production (%)	38	40	38	38	37	41
Renewable / Total Primary Energy Supply (%)	18	17	14	12	12	13
RENEWABLE ELECTRICITY PRODUCTION (GWh)	**23228**	**35627**	**34780**	**39899**	**24162**	**33837**
Hydro	23148	35541	34678	30988	24010	33684
Geothermal, Solar and Wind	80	86	102	109	152	153
Renewable / Total Electricity Production (%)	40	41	30	25	20	26
RENEWABLE ENERGY END-USE CONSUMPTION (Ktoe)	**7600**	**7648**	**7569**	**7367**	**7185**	**7022**
Geothermal, Solar and Wind	392	580	854	910	974	1048
Biomass	7208	7068	6715	6457	6211	5974
Renewable NET/Total NET (%)	18	15	14	12	13	12

At present, there are 130 Hydro-electric Power Plants (HEPP) in operation, of total 12 241 MW installed capacity; 31 HEPP of total 3 346 MW power are under construction; 405 HEPP of total 19 952 MW capacity are being planned.

Geothermal energy is widely used in district heating, green house applications; etc. Total used capacity for heating is around 665 MW_t .Denizli-Kızıldere Geothermal Power Plant has 17.5 MW_e, installed capacity. In 2002, contribution of geothermal energy to total primary energy is around 820 mtoe, including 105 GWh electricity generation.

Geothermal Energy in Turkey is extensively covered in other papers presented in WGC2005

Turkey is geographically well located with respect to solar energy potential. Studies carried out by using meteorological data for the time span between 1966-1982 showed that Turkey has an average 2,640 sunshine hours (daily total 7.2 hour) annually, with an average solar intensity of 3,6 kWh/m^2 per day, (1311kWh/m^2 annual total) with higher peaks at certain locations.

Accordingly, in Turkey, annual technical solar thermal and technical solar electrical energy potentials are estimated as 26.5 mtoe thermal and 8.8 mtoe electricity, respectively. The highest potential is in southeast of Turkey, followed by Mediterranean region.

The main solar energy utilization in Turkey is for domestic hot water, especially in the southern and western regions (290 000 mtoe).

Studies related to the use of wind energy in electricity generation, are initially focused on the determination of its potential-by detailed survey and analyses. For this purpose, distribution of natural wind energy has been determined by the evaluation of all wind data recorded by State Meteorological Service between 1970-1980., However, further detailed studies and measurements are required to identify favorable locations for electricity generation from wind energy. Potential for wind power is especially high at the Aegean, Marmara and south Mediterranean coasts. It is estimated the current technical and economic potential of wind energy is 88,000 MW_e and 10,000 MW_e respectively. There are only 2 grid connected wind power plants of 18.9 MW_e installed capacity each and they generated 48 GWh energy in 2002.

CONCLUSIONS

Energy is a vital issue for the sustainable economical and social development of Turkey. The energy policy of Turkey can be summarized as: liberalization of the energy sector by creating competitive energy market, meeting the energy demand by the limited indigenous energy resources of the country to the extend possible, minimizing the adverse impacts of energy conversion on the environment and human health, undertaking the role of “Energy Corridor” to transit the rich energy resources of the East into the Western Energy Markets.

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ABBREVIATIONS

bcm: billion cubic meters

EU: European Union

GWh: giga watt hour

kcal: kilo calorie

kt: kilo ton

ktoe: kilo ton oil equivalent

kWh: kilo watt hour

Mt : million ton

Mtoe: million ton oil equivalent

MW: mega watt

TWh: tera watt hour

REFERENCES

Altas.M., Fikret.H., and Celebi.E., Energy Statistics, *Proceedings*, 8th Energy Congress of Turkey, World Energy Council Turkish National Committee, 1998.

World Energy Council Turkish National Committee: Turkey Energy Report 2002, Ankara.

World Energy Council Turkish National Committee: Turkey Energy Report 1999, Ankara.

Research, Planning and Coordination Department of the Ministry of Energy and Natural Resources of Turkey: Planning and Financing Statistics, 2002, Ankara.

General Directorate of Petroleum Affairs: Official Statistics

General Directorate of State Water Works: Official Statistics

Turkish Electricity Transmission Co.Inc. : Website “teias.gov.tr “

Turkish Electricity Distribution Co.Inc. : Website “tedas.gov.tr “

Turkish Pipeline Co.Inc. : Website “botas.gov.tr “