

**TURKEY**



## TURKEY

### 1. GENERAL INFORMATION

#### 1.1. General Overview

As of its geographical situation Turkey connects Europe to Asia. Turkey is an important candidate to be the “Energy Corridor”, for the transmission of the Middle Asia Country’s rich oil and natural gas resources to the West Market. Turkey has borders with Greece, Bulgaria, Romania, Georgia, Armenia, Azerbaijan, Iran, Iraq and Syria. Turkey’s total area is 779 452 km<sup>2</sup>, about 97% of which is situated in Asia and 3% in Europe. Four seas, the Marmara, the Aegean, the Mediterranean and the Black Sea surround Turkey.

Turkey's strategic location makes it a natural "energy bridge" between major oil producing areas in the Middle East and Caspian Sea regions on the one hand, and consumer markets in Europe on the other. Turkey's port of Ceyhan is an important outlet both for current Iraqi oil exports as well as for potential future Caspian oil exports. Turkey's Bosphorus Straits are a major shipping "choke point" between the Black and Mediterranean Seas.

In 2001, the population was almost 68 million and the population density reached 87 inhabitants per km<sup>2</sup> (see Table 1). The average annual population growth rate was 1.5 %.

TABLE 1. POPULATION INFORMATION

	1960	1970	1980	1990	1999	2000	2001	Annual av. growth rate (%)
								1980 to 2001
Population (millions)	27.5	35.3	44.4	56.1	65.6	66.7	67.8	2
Population density (inhabitants/km <sup>2</sup> )	35.3	45.3	57	72	84.1	85.5	86.9	
Urban population as percent of total					74	N/A		
Area (1000 km <sup>2</sup> )	779.5							

Source: IAEA Energy and Economic Database, Data & Statistics/The World Bank, Country Information.

#### 1.2. Economic Indicators

The Gross Domestic Product (GDP) in 1999 was 208.7 billion US\$ and grew 3.1% since the year before. Table 2 presents the statistical GDP data. The GDP per capita was 3221 US\$.

TABLE 2. GROSS DOMESTIC PRODUCT (GDP)

	1970	1980	1990	2000	2001	Growth rate (%)
						1980 To 2001
<b>GDP (millions of current US\$)</b>		68,795	150,676	190,265	192,805	5.0
<b>GDP (millions of constant 1990 US\$)</b>	60,864	90,677	150,676	213,743	220,723	4
<b>GDP per capita (current US\$/capita)</b>		1,541	2,686	2,854	2,851	3.0

Source: IAEA Energy and Economic Database.

### 1.3 Energy Situation

The five main energy reserves from EEDB are given in Table 3, whilst Table 4 gives more detailed national data. The energy consumption per capita in 2001 was 1.150 toe. Tables 5 and 6 show national provided data on primary and final energy consumption and Table 7 the EEDB statistical data.

TABLE 3. ESTIMATED ENERGY RESERVES

	Estimated energy reserves in 1999 (Exajoule)					
	Solid	Liquid	Gas	Uranium (1)	Hydro (2)	Total
<b>Total amount in place</b>	93.29	1.81	0.27	4.97	39.81	140.14

(1) This total represents essentially recoverable reserves.

(2) For comparison purposes a rough attempt is made to convert hydro capacity to energy by multiplying the gross theoretical annual capability (World Energy Council - 2002) by a factor of 10.

Source: IAEA Energy and Economic Database.

TABLE 4. PRIMARY ENERGY RESOURCES AND RESERVES

Reserves	Unit	Proven	Probable	Possible	Total
Hard Coal	Mt	428	456	245	1,129
Lignite	Mt	7,339	626	110	8,075
Asphaltite	Mt	45	29	8	82
Bituminous Shale	Mt	555	1,086		1,641
Hydro	GW·h/a	125,328			125,328
	MW/a	35,310			35,310
Crude Oil	Mt	41			41
Natural Gas	bcm	8.6			8.6
Nuclear	t Uranium	9,129			9,129
	t Thorium	380,000			380,000
Geothermal	MW/a electricity	200		4,300	4,500
	MW/a heat	2,250		28,850	31,100
Solar	MW/a electricity				8.8
	MW/a heat				26.4

Source: National Data

TABLE 5. PRIMARY ENERGY CONSUMPTION

	Mtoe					
	1996	1997	1998	1999	2000	2001
Demand	70.77	74.75	75.81	78.51	82.23	77.98
Production	28.29	29.18	28.82	28.8	27.93	27.41
Import	44.33	47.52	48.63	52.50	55.88	52.31
Export	1.88	1.63	2.40	2.79	1.58	2.40
Bunkers	0.46	0.62	0.63	0.59	0.47	0.62
Net Import	41.99	45.27	45.61	49.13	53.75	49.29
Production/Demand (%)	40.0	39.0	38.0	36.7	34.0	35.2

Source: National Data

TABLE 6. TOTAL FINAL CONSUMPTION BY SECTOR IN 2001

Sector	Mtoe	%
Industry	20.06	26
Residential	19.92	25
Transportation	11.91	15
Agriculture	2.95	4
Non Energy	1.64	2
Conversion sector	21.50	28
TPES	77.98	100

Source: National Data

#### 1.4. Energy Policy

The Turkish energy policy is mainly concentrated on assurance of energy supply in a reliable manner and sufficiently in time, under economic and clean terms and in a way to support and orientate the target growth and social developments.

TABLE 7. ENERGY STATISTICS

	1960	1970	1980	1990	1999	2000	2001	Exajoule	
								Average annual growth rate (%)	
	1960	1970	1980	1990	1999	2000	2001	1960 to 1980	1980 to 2000
Energy consumption									
- Total <sup>(1)</sup>	0.20	0.81	1.20	2.09	3.34	3.58	3.28	9.42	5.63
- Solids <sup>(2)</sup>	0.12	0.46	0.44	0.76	1.10	1.20	1.17	6.53	5.15
- Liquids	0.06	0.32	0.64	0.98	1.26	1.27	1.29	12.16	3.53
- Gases				0.13	0.49	0.58	0.63		38.43
- Primary electricity <sup>(3)</sup>	0.01	0.03	0.12	0.22	0.49	0.53	0.19	13.53	7.64
Energy production									
- Total	0.14	0.64	0.64	0.98	1.31	1.39	1.15	7.77	3.94
- Solids	0.12	0.46	0.43	0.59	0.71	0.74	0.85	6.71	2.74
- Liquids	0.02	0.15	0.10	0.16	0.13	0.13	0.11	9.56	1.31
- Gases				0.01	0.03	0.04	0.01		21.79
- Primary electricity <sup>(3)</sup>	0.01	0.03	0.11	0.22	0.44	0.47	0.18	12.90	7.59
Net import (import - export)									
- Total	0.05	0.17	0.57	1.13	2.01	2.17	2.07	12.89	6.87
- Solids	0.00	-0.01	0.02	0.16	0.39	0.47	0.28	-16.33	17.95
- Liquids	0.05	0.17	0.56	0.85	1.16	1.16	1.16	12.62	3.73
- Gases				0.12	0.47	0.54	0.62		

<sup>(1)</sup> Energy consumption = Primary energy consumption + Net import (Import - Export) of secondary energy.

<sup>(2)</sup> Solid fuels include coal, lignite and commercial wood.

<sup>(3)</sup> Primary electricity = Hydro + Geothermal + Nuclear + Wind.

Source: IAEA Energy and Economic Database, National Data.

Although almost all conventional resources exist in Turkey, these resources are not sufficient to meet the energy demand, except for lignite and hydro. More than half of the energy demand has been met through imports. Energy planning studies show that energy demand of the country will increase parallel with its development and industrialization. In order to meet its demand reliably, a significant increase is expected both in energy production and in supply during the coming years.

The Turkish environmental policy considers that energy policy should take into account environmental problems and that a balance should be found between increases in energy demand which are required for economic development, and environmental concerns. Some of the main criteria, which are stated in the Seventh Five-Year Development Plan, are given below:

- A dynamic and feasible master plan which accomplishes the optimum planning of resources in an economical and reliable way and which minimises the environmental problems taking place during the production and consumption of energy has been prepared;
- For Turkey, it is necessary to meet energy requirement with national resources as much as possible and to use new technologies, which eliminate and the adverse effects of energy production on the environment;
- According to the development plans, “energy saving” is one of the basic principles.

With respect to global environmental issues, although Turkey’s (CO<sub>2</sub>) emissions are still the lowest among Organization for Economic Cooperation and Development (OECD) countries in terms of per capita emissions, these emissions too have been growing rapidly at an average annual rate of 4.3 percent since 1990. In the previous position Turkey was classified as a developed country in the United Nations Framework Convention on Climate Change (UNFCCC) and she was included in Annex I and Annex II to the Convention, together with the developed countries. Therefore, Turkey has not signed the UNFCCC, regarding the national economic circumstances and the development level of the country and in accordance with the “Common but differentiated responsibilities” principle of the Convention.

In the process of the Convention, Turkey proposed to be deleted from Annex I and Annex II to the Convention. However, during the 6<sup>th</sup>. Conference of the Parties (COP-6) held in the Hauge-Holland, on 13-24 November 2000, Turkey has made a proposal. This proposal was on remaining in Annex I, but enjoying a certain degree of flexibility, within the “common but differentiated responsibilities”, regarding the Turkey’s difficulties stemming from the fact that she is still in the process of industrialization, but deleting of her name from Annex II.

The new approach of Turkey was discussed and the Conference agreed that the subject proposal should be referred to the Subsidiary Body for Implementation (SBI) at its next session for consideration.

The concerned intention of Turkey has negotiated by SBI, the definitive action has taken in COP-7 held on 29 October-9 November 2001 in Marrakesh, upon the related proposal of SBI. According to the decision taken during COP-7, the name of Turkey will be deleted from Annex II and, after becoming a party, she will remain in Annex I in a situation different from that of other parties included, by recognizing the special circumstances of the country.

## 2. ELECTRICITY SECTOR

### 2.1. Structure of the Electricity Sector

The Ministry of Energy and Natural Resources is the main body of the Turkish energy sector and is responsible for the preparation and implementation of energy policies, plans and programmes in co-ordination with its dependent and related institutions and other public and private entities.

The Turkish Electricity Generation and Transmission Corporation (TEAS) is in charge of planning, building (only thermal power plants), operation and maintenance of electricity generation and transmission installations in the framework of general energy planning studies. Transfer of Operating Rights of main thermal and some hydro plants are being carried out. TEAS separated into three entities on 4 April 2000. The Turkish Electricity Transmission Company (TEİAŞ) is responsible for electricity transmission and load dispatch activities. The Electricity Generation Company (EÜAŞ) is responsible for operation of existing power plants owned by the public. The Turkish Electricity Trading and Contracting Company (TETAŞ) is responsible for electricity wholesale sales and purchases.

The Turkish Electricity Distribution Corporation (TEDAS) is responsible for carrying out electricity distribution activities. Related to these activities are activities such as necessary construction, operation and maintenance of installations, buying electricity from generating utilities and selling electricity to purchaser, which are also under TEDAS responsibility. Privatization, under the scope of the privatization of the 20 regions through the Transfer of Operating Rights formula, is at an advanced stage.

The State Water Works (DSI) is in charge of the planning, design and building of hydro plants as well as flood protection, irrigation, water supply to big cities and land drainage works.

## **2.2. Decision Making Process**

The “Electricity Market Law” no: 4628, published in the Official Gazette dated 3 March 2001, is enacted to unbundle electricity market activities, enable progress into a liberalized electricity market and provide for fair and transparent market regulation.

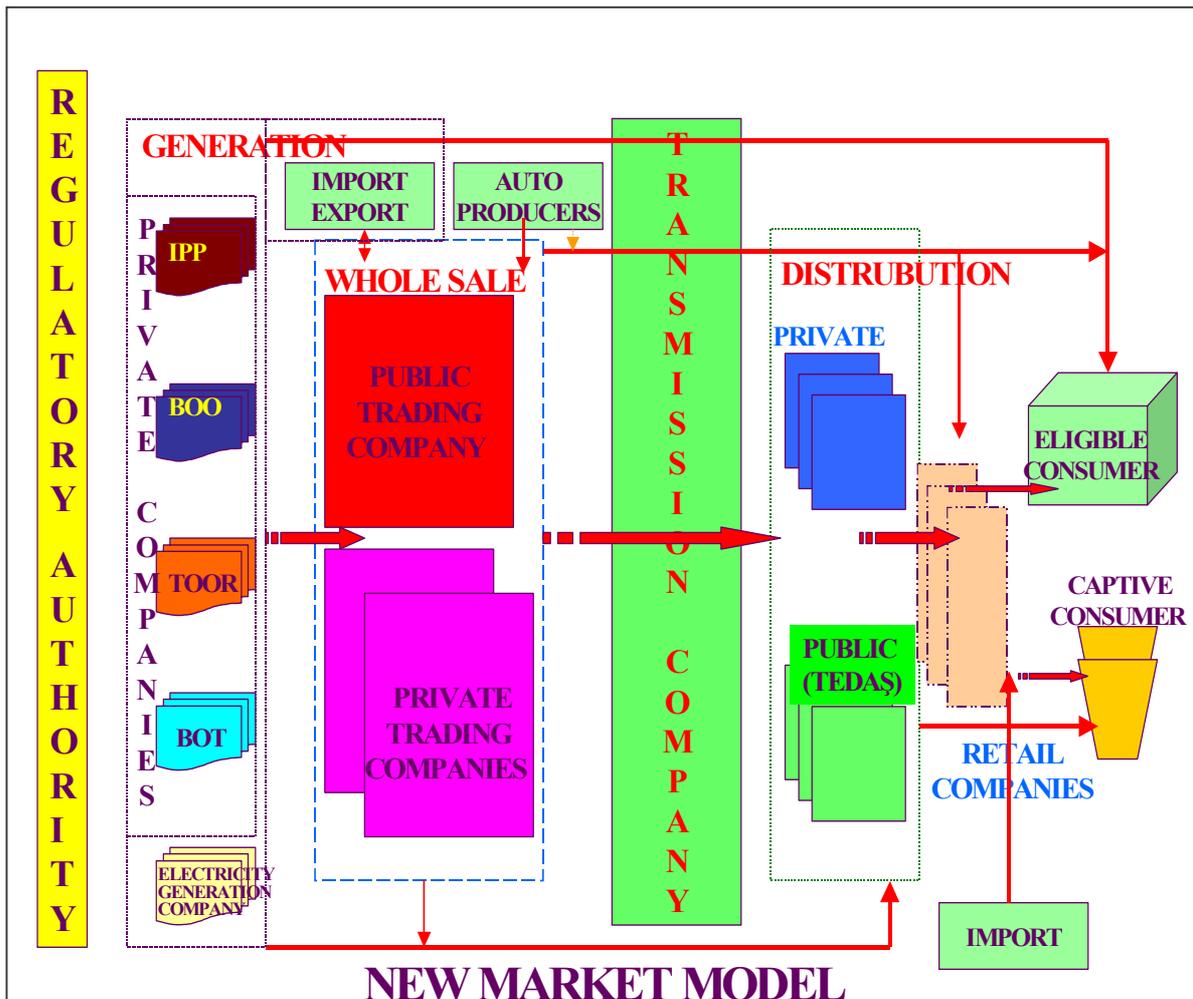
In summary, the new laws include the following key elements:

- An autonomous Energy Market Regulatory Authority, governed by a Board;
- A new licensing framework for market participants;
- An energy market, to comprised bilateral contracts between market participants;
- Eligible consumer concept, eligible consumers to be free to choose their suppliers;
- A transition mechanism to be implemented over a two year programme for electricity and 1.5 year programme for gas.

In addition, all over the world energy sector investments are gradually being undertaken by the private sector and Turkey is following this global trend as well. It is important to ensure that this transition smooth and effective. The purpose of this law is to ensure the formation of an electricity market which is financially strong, transparent and operates in accordance with provisions of private law in a competitive environment, to achieve a stable supply of adequate, low-cost, and environment-friendly electricity of good quality, and to ensure autonomous regulation and supervision of this market.

The main objective of this law is to create a competitive electricity market with the great majority of the participants in this market being private firms and most of the assets used to supply electricity being privately owned (see Figure 1). The role of the State would be greatly reduced. The law has a number of provisions. These are:

- First it creates a framework in which there will be privately owned generation companies, privately owned retail and wholesale companies, and Government owned transmission company. The private generation companies will sell electricity to the supplier companies with the transmission company transmitting the electricity. All participants must obtain license to perform activities in the market.
- Second, the law allows larger electricity consumers (eligible consumer) to buy power from any source rather than just from the local distribution company. This is designed to introduce competition and to meet the requirement of the European Electricity Directive.
- Third, it establishes a Regulatory Body to issue licenses and oversee the market; especially the transmission and distribution charges and the tariffs for captive consumers.
- Fourth, the law limits monopoly in the sector.
- Fifth, the law allows the privatization of electricity assets according to the Privatization Law (Law no:4046).
- Sixth, the law allows all those TOORs which cannot be finalized by June 30, 2001 to lapse.
- Seventh, the law limits Treasury Guarantees for new BOT's and BOO's to certain plants which have already been agreed between Treasury, State Planning Organization (SPO) and Ministry and even then the guarantee applies only if these plants can be in operation before the end of 2002.



BOO: Build Own Operate  
 BOT: Build Operate Transfer

IPP: Independent Power Producers  
 TOOR: Transfer of Operating Rights

FIG. 1 Schematic view of the new market model

Generation, transmission, distribution, wholesale, retail-sale and retailing services, import, export of electricity and the establishment of the Energy Market Regulatory Authority and rules and principles related to its operations, is the subject of the law.

The Electricity Generation Company and private sector generation companies may sell electricity and/or capacity to customers in accordance with their licenses. The Electricity Generation Co. Inc. may build, lease and operate new generation facilities on behalf of the State where deemed necessary in accordance with the Board-approved generation capacity projection, taking into account private sector generation investments. The total market share of a private sector generation company, which it may acquire through the generation facilities it operates together with its affiliates, may not exceed twenty percent of the published figure for the total actual installed electricity generation capacity in Turkey in the preceding year. Generation companies may enter into affiliate relationship with distribution companies without having controlling power over them. Generation companies may not engage in any market activities other than those described above. =

An Auto-producer and Auto-producer Group can sell within a competitive environment, a certain percentage (not exceeding twenty percent in any case) to be determined by the Board of the electricity it has generated in a calendar year. The Board, under exceptional circumstances, can increase this percentage by half. Obtaining a generation license is required in case the amount of the electricity sold in a calendar year exceeds this percentage.

The Turkish Electricity Transmission Co. Inc. is empowered to take over all transmission facilities owned by the public and plan the transmission investments for the proposed new transmission facilities and to build and operate these new transmission facilities. The Turkish Electricity Transmission Co. Inc. will perform international interconnection activities in line with the decision of the Ministry and will provide transmission and connection services to all system users including eligible consumers connected and/or to be connected to the transmission system, without discrimination, in accordance with provisions of grid code and transmission license. The Turkish Electricity Transmission Company may not engage in any activity in the market other than the transmission activity.

Distribution companies in areas specified in their respective licenses shall conduct the electricity distribution activities. Distribution companies by obtaining a retail sale license can sell electricity to consumers in their respective areas on a retail basis and/or can provide retail sale services even if there are other retail companies in their designated regions. Apart from distribution and retail sale operations, private sector distribution companies are allowed to establish a generation facility in the region specified in their licenses, provided that they have obtained a generation license and that the amount of the annual electricity then generate does not exceed 20 percent of the total amount of electricity offered for sale in this region during the previous year.

Distribution companies may not purchase more than 20 percent of the electricity that they have distributed during the previous year in the area defined in their license from generation companies that they own or are affiliated with.

The Turkish Electricity Trading and Contracting Co. Inc. and private sector wholesale companies shall conduct wholesale activities. The total market share of any private sector wholesale company together with its affiliates may not exceed ten percent of the total electricity consumed in the market during the preceding year.

Retail sale companies shall conduct activities involving retail sale of electricity and/or capacity and of retail sale services. Retail sale companies are allowed to engage in retail sale or retail sale service activities without being subject to any regional limitation.

Any distribution company having a retail sale license may sell electricity and/or capacity to any eligible consumer in another distribution company's area provided that its retail sale license includes such a provision.

Import or export of electricity with the Board approval from or to countries that fulfil the requirement of international interconnection in accordance with the Ministry's policy, may be conducted by the Turkish Electricity Trading and Contracting Co., Inc. and private sector wholesale companies and retail companies in accordance with provisions of this Law, applicable regulations, their respective licenses, grid code and distribution code.

This law defines the framework, but requires a large number of secondary regulations and procedures to make it work properly. This is standard since Laws should not establish detailed regulations and procedures as this can be done better by experts in the field and by independent regulators. Also these regulations and procedures will need to be changed over time and it is difficult to do this if the regulations and procedures are part of a law.

### **2.3. Main Indicators**

Tables 8 – 12 show characteristic electricity data.

TABLE 8. INSTALLED GENERATION CAPACITY AND PRODUCTION BY ENERGY SOURCE IN 2001

Energy source	Capacity (MW)	Production (GW·h)
Hard coal	700	4,046
Lignite	6,412	34,372
Oil	2,245	10,366
Natural Gas	7,242	49,549
Geothermal	18	90
Others*	42	292
Total Thermal	16,659	98,715
Total Hydro	11,673	24,010
TOTAL	28,332	122,725

\* Includes wood, wood wastes, liquid sulphur, sulphur cake, wind, multi-fuel fired etc.

TABLE 9. THE DISTRIBUTION OF INSTALLED CAPACITY AND GROSS ELECTRICITY GENERATION BY THE TURKISH ELECTRICITY UTILITIES IN 2001

	EÜAŞ	Affiliated Partnerships of EÜAŞ	Concessionary Companies	Production Companies	Auto-producer	Mobile Power Plants	Toor*	TOTAL
Installed capacity (MW)	17,779	3,284	610	2,338	3,374	297	650	28,332
Gross electricity generation (GW·h)	67,468	18,894	1,346	13,278	17,914	1,117	2,707	122,725

\* Transfer of operating rights

TABLE 10. NATIONAL ELECTRICITY DATA FOR 2001

Total Electricity Production	122,725	GW·h
Total Electricity Consumption	126,872	GW·h
Per capita Consumption (Net)	1,476	kW·h
Share of electricity in total energy consumption	15	%

Source: National Data

TABLE 11. HISTORICAL ELECTRICITY PRODUCTION AND INSTALLED CAPACITY

	1960	1970	1980	1990	1999	2000	2001	Average ann. growth rate (%)	
								1960 to 1980	1980 to 2000
Electricity production (TW·h)									
- Total <sup>(1)</sup>	2.82	8.62	23.28	57.54	116.44	124.92	122.72	11.14	9.06
- Thermal	1.81	5.58	11.93	34.32	81.66	93.93	98.56	9.88	10.18
- Hydro	1	3.04	11.35	23.15	34.64	30.88	24.01	12.9	7.58
- Geothermal + Wind				0.08	0.10	0.11	0.15		
Capacity of electrical plants (GW(e))									
- Total	1.67	2.31	5.59	16.32	26.12	27.26	28.33	6.22	7.76
- Thermal	1.26	1.59	3.21	9.54	15.56	16.05	16.62	4.79	7.76
- Hydro	0.41	0.72	2.38	6.77	10.54	11.18	11.67	9.16	7.74
- Geothermal +Wind				0.02	0.02	0.04	0.04		

<sup>(1)</sup> Electricity losses are not deducted.

Source: IAEA Energy and Economic Database, National Data.

TABLE 12. ENERGY RELATED RATIOS

	1960	1970	1980	1990	2000	2001
Energy consumption per capita (GJ/capita)	7	23	27	37	45	46
Electricity per capita (kW.h/capita)	102	233	523	954	2,338	2,360
Electricity production/Energy production (%)	19	13	35	57	137	151
Nuclear/Total electricity (%)						
Ratio of external dependency (%) (1)	26	21	48	54	64	72
Load factor of electricity plants						
- Total (%)	19	43	48	40	72	77
- Thermal	16	40	42	41	97	105
- Hydro	28	48	54	39	37	37
- Nuclear						

(1) Net import / Total energy consumption.

Source: IAEA Energy and Economic Database.

## 2.4. Impact of Open Electricity Market in the Nuclear Sector:

The “Electricity Market Law” was published in the Official Gazette and enacted by 3 March 2001. The purpose of this Law is to establish an electricity market, which is financially strong and transparent that operates in accordance with provisions of the private law in a competitive market with the objectives of supplying sufficient, stable, cheap and environment-friendly electricity with good quality, and to ensure autonomous regulation and supervision of this market. With this new Law; private companies will be able to build independent power plants (IPP) and produce electricity with fewer bureaucratic procedures, the freedom of market participants will be able to choose their electricity from suppliers or customers and as of March 2003, eligible consumers which consume more than 9 GW·h, can receive power from their choice of electricity suppliers.

## 3. NUCLEAR POWER SITUATION

### 3.1. Historical Development

Studies to build a nuclear power plant in Turkey were started in 1965. Later, between 1967 and 1970, a feasibility study was made by a foreign consultant company to build a 300-400 MW NPP. The NPP would have been in operation in 1977. Unfortunately, because of the problems relating the site selection and other issues the project could not come into life.

In 1973, Turkish Electricity Authority (TEK) decided to build an 80 MWe prototype plant. However, in 1974 the project was cancelled due to reason that this project could delay the construction of a greater capacity nuclear power plant. Instead of this prototype plant, TEK has decided to build a 600 MWe NPP in southern Turkey.

Site selection studies have been made in 1974 and 1975 and the Gülnar-Akkuyu location was found suitable for the construction of first NPP. In 1976, the Atomic Energy Commission granted a site license for Akkuyu. In 1977, a bid was prepared and ASEA-ATOM and STAL-LAVAL companies were awarded as the best bidders. Contract negotiations continued until 1980. However, in September 1980, due to Swedish Government’s decision to withdraw the loan guarantee, the project was cancelled.

The third attempt was made in 1980. Three companies were awarded to build four nuclear power plants (1 CANDU unit by AECL and 1 PWR unit by KWU in Akkuyu and 2 BWR units by GE in Sinop). Due to Turkey’s request to apply the BOT model, KWU resigned from the bid. Although AECL accepted the BOT model, it insisted upon the governmental guarantee on the BOT credit. The Turkish government refused to give the guarantee and as a consequence the project was cancelled.

In 1992, the Ministry of Energy and Natural Resources stated in a report submitted to the Government that without the installation of new energy resources before 2010, the country would face an energy crisis, suggesting that nuclear energy generation should be considered as an option.

In 1993, the High Council of Science and Technology identified nuclear electricity generation as the 3<sup>rd</sup> highest priority project of the country. In view of this decision, the Turkish Electricity Generation and Transmission Company (TEAŞ) included a NPP project in its 1993 investment programme. In 1995, TEAŞ selected the Korean KAERI as the consultant for the preparation of the bid specifications. The bid process started in 1996. Three companies offered proposals in 1997: AECL, NPI and Westinghouse. After a series of delays, the Government decided to postpone the project in July 2000.

### **3.2. Status and Trends of Nuclear Power**

There is no nuclear power plants in operation, under construction and closed down. According to the long term energy planning studies in Turkey, nuclear power plant will be projected after 2010.

### **3.3. Current Policy Issues**

During the period of 1996-2000, the primary energy consumption in Turkey increased by 4.5 % per year and reached to 78.8 Mtoe by the year 2000. During the same period, the electricity demand increased about 8.2 % per year, and reached to about 125 TW·h at the end of this period. The primary energy consumption per capita is about 1.2 toe and the electricity consumption per capita is about 1,416 kW·h in 2000. Electricity production has been rising steadily; it grew from 111 TW·h in 1998 to 116 TW·h in 1999. The installed capacity, during the same period, increased from 23,352 MW<sub>e</sub> to 26,117 MW<sub>e</sub>. The projected installed capacity and electricity production rate are expected to grown annually by about 8 % - 10 % till 2010. The projected electricity consumption for 2010 is about 290 TW·h. Thus nuclear energy is the most important alternative to fossil resources when diversity and energy supply security are taken into consideration. Today, the electricity generation composition is about 70 % thermal (coal, gas, oil, geothermal) and 30 % hydro.

It is well known that the fossil fuel utilization is dominant over other energy types and its share in the global electricity generation is around 65 %. The main draw back of fossil fuel utilization is the environmental pollution, especially the CO<sub>2</sub> emission. Today, the total CO<sub>2</sub> emission reached about 22,000 Mtonne (about 3800 kg/capita) and the share of power generation is about 8,000 Mtonne. The nuclear energy is an important option and alternative to fossil fuels provided that the economical aspect of a NPP is improved, so as to become more competitive in a deregulated market and the problem of public acceptance is solved. The economic aspect of nuclear power is highly significant for industrializing countries like Turkey, since the capital cost share of nuclear electricity generation is about 60 - 70%, contrary to that of fossil fuel plants, i.e. 20 - 40%. This fact endangers the NPP projects in developing countries, since external credits are necessary and credit guarantees and reimbursement of credit play a central role in the decision making process on NPP.

In spite of the fact that nuclear energy contribution was planned to be 2,000 MW<sub>e</sub> by the year 2015 (2.34 % share of total electricity generation) and that there was a strong intention of the Government to install the first NPP in Akkuyu, the Government had decided to postpone the Akkuyu NPP project, following the meeting of the Cabinet held on 25 July 2000. The Government's statement on this decision made it clear that the reasons were not related to safety issues. Since Turkey needed to concentrate on a programme of economic stability aiming to reduce inflation rates at considerable amounts, under supervision of the IMF, the government could not afford the estimated three to four billion US dollars needed for construction of the country's first nuclear power plant. The Government declared also that the cancellation of the Akkuyu NPP project did not mean that Turkey will refrain from using nuclear energy in the future. The Cabinet's announcement also included the need of contributing to the technological improvements of new generation nuclear power plants.

## 4. NUCLEAR POWER INDUSTRY

There is no nuclear power industry in Turkey.

### 4.4. Research and Development Activities

Nuclear Policy of the country includes research and development activities in the application of nuclear energy sectors, including nuclear power, and programmes associated to each sector which also includes innovative designs and small and medium sized reactors (SMRs). Research and development activities in the nuclear field in Turkey are performed by the following organizations:

The Turkish Atomic Energy Authority (TAEA) is responsible for the research and development studies in atomic energy and authorised to license and inspect facilities that use radioactive material and equipment and giving authorisations for site selection, construction and operation of nuclear facilities including NPPs.

The Mineral Exploration and Research Directorate is responsible for the systematic investigation and research on all kinds of resource including thorium and uranium.

The Hacettepe University, Nuclear Energy Engineering Department educate students in the field of nuclear engineering.

### 4.5. International Co-operation in the Field of Nuclear Power Development and Implementation

Co-operation with international/national groups on theoretical and experimental projects concerning SMRs and innovative technologies would lead to an increase of staff capabilities and experience on nuclear technology in Turkey. To achieve this goal, TAEA has been participating in the “International Project on Innovative Nuclear Reactor Technologies and Fuel Cycles” coordinated by the IAEA.

There is an IAEA TC project to enlighten the public with bare facts of nuclear technology to develop an unbiased understanding in nuclear field in Turkey.

## 5. REGULATORY FRAMEWORK

### 5.1. Safety Authority and the Licensing Process

The authority responsible from the enforcing nuclear safety is the Turkish Atomic Energy Authority (TAEK), a governmental body directly under the supervision of the Prime Minister. TAEK is the main driving force for enhancing and broadening of all nuclear related activities in Turkey. Besides her other duties such as promoting peaceful use of nuclear energy and research and development in nuclear field, TAEK undertakes all established regulatory activities over the special nuclear materials, radioactive materials and nuclear facilities, including licensing, issuing regulations, inspections, etc.

The bodies of TAEK are:

- The Atomic Energy Commission,
- The Advisory Committee,
- The Specialized Departments, and
- The Affiliated Centres.

The licensing activities for nuclear facilities are primarily the responsibility of Nuclear Safety Department (NGD) of TAEK. Review, assessment and evaluation activities are performed by NGD.

Issuing licence, on the other hand, depends on the decision making body of TAEK, the Atomic Energy Commission, and the signature of the Prime Minister. The Vice President for Nuclear Power and Safety co-ordinates and supervises the licensing activities of the Authority. In order to support the Nuclear Safety Department for review, assessment and evaluation activities during licensing, a new structure has been established utilizing all human resources of TAEK.

Licensing of nuclear facilities has three main steps. The first step is the site licence. The Nuclear Safety Department prepares an evaluation report and submits it to the Vice President. The Vice President conveys this report to the President, adding a report of his/her own. The President brings these reports to the Atomic Energy Commission meeting for adoption. If adopted, the site licence is issued after the signature of the Prime Minister. The second stage is the limited work permit and the construction licence. The same procedure is followed for both permit and licence after evaluation of preliminary safety analysis report of the nuclear facility. The final stage of the licensing activity is composed of commissioning permit, fuel loading and start up tests permit and operating licence. Licensing activities are completed after evaluation of the final safety analysis report of the facility. The report prepared by NGD follows the same procedure for issuing the operating licence.

## 5.2. Main National Laws and Regulations

The 1982 Act (No. 2690, published in Official Gazette No. 17753 on 13 July 1982) established TAEK and superseded the former organization - the Atomic Energy Commission. The Act defines the structure of the TAEK, the duties, responsibilities and jurisdiction of each unit. According to the Act, TAEK is the judicial organization for preparing the regulatory framework concerning radiation protection, nuclear safety.

Beside the Act mentioned above, TAEK issued two decrees concerning the licensing procedures of nuclear installations and radiation safety. "Decree on Licensing of Nuclear Installations" (OG No.18256, 19 December 1983) regulates the licensing procedures and necessary documents for application of a licence.

There are thirteen Codes of Practice issued by TAEK to cover more detailed issues like licensing of radioactive devices, quality assurance for nuclear installations and site selection for nuclear power plants. A few more Codes of Practice are ready to be issued. Guides and recommendations of the Atomic Energy Commission serve only for advisory purposes.

Finally, a new set of regulatory documents called the TAEK Nuclear Safety Series is under preparation. A regulation for drafting, changing and issuing documents in these series has been drafted, approved by Atomic Energy Commission and sent for approval of the Prime Ministry. Meanwhile, a few documents from these series has been drafted and are waiting for issuance of the above mentioned regulation. More documents are expected to be drafted after the regulation enters into force.

The list of issued regulations is as follows:

- Regulations on General Project and Safety Criteria for Design and Construction of Nuclear Power Plants  
03.09.1975, *RG<sup>1</sup>(under revision)*
- Regulations on Physical Protection of Special Nuclear Materials  
RG No:16702 of 20.07.1979
- Decree Pertaining to Issue of Licenses for Nuclear Installations

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<sup>1</sup> RG : Official Gazette

RG No: 18256 of 19.12.1983

- Decree on Radiation Safety  
RG No: 18861 of 7.9.1985
- A Guide on the Earthquake Related Subject Requested in the Issuance of Limited Work Permit and Site License, 1989.
- Regulations on Radiation Safety  
RG No: 23999 of 24.03.2000
- Regulation on Licensing Procedures and Determination of Responsibilities and Authorities for the Research Reactor Operators  
RG No: 20255 of 17.09.1989
- Regulation on Preparation and Enactment of Safety Guides Determining Safety Principles of Nuclear Installations  
RG No: 18572 of 11.11.1984
- A Guide on Seismic Design and Qualification of Nuclear Plant Facilities.  
Approved by AEC on 29.5.1996
- Regulations on Quality Assurance and Inspection of Nuclear Installations  
RG No: 22932 of 13.3.1997
- Regulations on Nuclear Materials Accounting and Control  
RG No: 23106 of 10.9.1997
- Regulations on Safe Transport of Radioactive Materials  
RG No: 23106 of 10.9.1997
- Regulations on the Establishment and Working Procedures of Nuclear Safety Advisory Committee  
RG No: 23106 of 10.09.97
- Regulation on Quality Assurance Criteria in Scope of PSAR  
RG No: 23965 of 15.02.2000
- Regulation on General Safety Rules Related to the Siting Activities of Nuclear Power Plants  
RG No: 23975 of 25.02.2000
- Regulation on Quality Assurance for Studies on Survey and Evaluation Concerning Site Selection of Nuclear Power Plants  
RG No: 24766 of 26.05.2002
- Regulation on Fundamental Criteria of Quality Assurance Program for Nuclear Installations  
RG No: 23991 of 12.03.2000

Regulations Approved by AEC (waiting for approval of Prime Ministry) and Regulations under Discussion (not submitted to AEC):

- A Guide on Fire Protection in Nuclear Power Plants  
Approved by AEC
- A Guide on External Man-Induced Events in Relation to Nuclear Power Plant Design

Approved by AEC

- Regulation on Principles for Preparing, Adopting, Enforcing and Amending of Nuclear Safety Series Documents  
Waiting for approval by AEC
- Regulations Related to Quality Assurance in the Procurement, Design and Manufacture of Nuclear Assemblies  
Under Discussion
- Regulations for Design Basis Flood for Nuclear Power Plants on Coastal Sites  
Under Discussion
  
- A guide on Quality Assurance for Studies on Survey and Evaluation Concerning Site Selection of Nuclear Power Plants  
  
To be submitted to AEC
- A guide on Site Survey for Nuclear Power Plants  
  
Under discussion
- A guide on Design Basis Flood for Nuclear Power Plants on River Side  
  
Under discussion
- Regulations related to Handling and Storage of Nuclear Fuels in Nuclear Power Plants  
Under Discussion
- Objectives for the Safety of Nuclear Installations  
Approved by AEC
- Basic Principles for the Safety of Nuclear Installations  
Approved by AEC
- Specific Principles for the Safety of Nuclear Power Plants  
Under Discussion
- Nuclear Safety Series AR-1, Unusual Event Reporting in Research Reactors  
Waiting for approval by AEC
- Nuclear Safety Series AR-2, Records and Reports in Research Reactors  
Under Discussion
- Nuclear Safety Series AR-3, Inspection of Research Reactors  
Under Discussion

### **5.3. International, Multilateral and Bilateral Agreements**

#### *AGREEMENTS WITH THE IAEA*

- |   |                   |                  |
|---|-------------------|------------------|
| • NPT related Agreement<br>INFCIRC/295                            | Entry into force: | 1 September 1981 |
| • Additional protocol   | Entry into force: | 17 July 2001     |
| • Improved procedures for designation<br>of safeguards inspectors | Accepted on:      | 18 January 1989  |

- Supplementary agreement on provision of technical assistance by the IAEA      Entry into force:      11 November 1980
- EURATOM      Entry into force:      September 1984
- RCA      Non-Party
- Agreement on privileges and immunities      Entry into force:      26 June 1978

*MAIN INTERNATIONAL TREATIES etc.*

- NPT      Entry into force:      17 April 1980
- Convention on physical protection of nuclear material      Entry into force:      6 February 1987
- Convention on early notification of a nuclear accident      Entry into force:      3 February 1991
- Convention on assistance in the case of a nuclear accident or radiological emergency      Entry into force:      3 February 1991
- Paris convention on civil liability for nuclear damage      Entry into force:      10 October 1961
- Joint protocol relating to the application of the Vienna and the Paris conventions      Signature:      21 September 1988
- Protocol to amend the Vienna convention on civil liability for nuclear damage      Not signed
- Convention on supplementary compensation for nuclear damage      Not signed
- Convention on nuclear safety      Entry into force:      24 October 1996
- Joint convention on the safety of spent fuel management and on the safety of radioactive waste management      Not signed

*OTHER RELEVANT INTERNATIONAL AGREEMENTS*

- ZANGGER Committee      Member      21 October 1999
- Nuclear Export Guidelines (INFCIRC/254)      Not adopted
- Acceptance of NUSS Codes      Summary: Codes are used as reference  
In preparing national nuclear legislation  
and regulations. S1 and S2 are used as  
safety guides. Letter of:      31 October 1988

- |   |                             |                                      |
|---|-----------------------------|--------------------------------------|
| • Nuclear Suppliers Group   | Member                      | 20 April 2000                        |
| • International convention No: 42 on the compensation of professional disease   | Ratification:               | 16 February 1946                     |
| • Convention on the co-operation in the atomic energy field between the NATO members and its amendment  | Signature:<br>Ratification: | 22 June 1955<br>1 September 1956     |
| • Convention on the establishment of a security control in the field of nuclear energy, protocol on the establishment of a court and convention on the European company for the chemical separation of radioactive fuel (EUROCHIME) | Signature:<br>Ratification: | 20 December 1957<br>25 May 1959      |
| • Treaty banning nuclear weapons tests in the atmosphere, in outer space and under water  | Signature:<br>Ratification: | 5 August 1963<br>13 May 1965         |
| • International labour conference convention number 115 concerning the protection of workers against ionizing radiations  | Ratification:               | 7 March 1968                         |
| • Treaty on the prohibition of the emplacement of nuclear weapons and other weapons of mass destruction on the seabed and ocean floor and in the subsoil thereof  | ratification:               | 27 April 1972                        |
| • Convention for the protection of the Mediterranean sea against pollution  | Signature:<br>Ratification: | 16 February 1976<br>RG: 12 June 1981 |
| • Protocol for the protection of the Mediterranean sea against pollution from land originated sources   | Ratification:               | 18 March 1987                        |
| • The international convention on railway transportation  | Ratification:               | 21 March 1985                        |
| • Convention on the protection of the Black Sea against pollution   | Ratification:               | 7 December 1993                      |
| • Comprehensive test ban treaty   | Signature:                  | 1996                                 |

#### *BILATERAL CO-OPERATION AGREEMENTS*

- Agreement For Cooperation Concerning Civil Uses of Atomic Energy Between the Government of Turkey and the USA  
Signature: 10 June 1955  
Ratification date: 4 December 1956  
Several amendments and revisions (1956-1981)  
Extension (1981-1985)  
Termination: 1985

- Agreement Between The Government of Canada and The Government of Turkey for Cooperation in The Peaceful Uses of Nuclear Energy  
Signature: 18 June 1985  
Ratification: 23 February 1986
- Agreement Between The Government of Argentina and The Government of Turkey for Cooperation in The Peaceful Uses of Nuclear Energy  
Signature: 3 May 1988  
Ratification date: 21 May 1991
- Agreement Between The Government of South Korea and The Government of Turkey for Cooperation in The Peaceful Uses of Nuclear Energy  
Signature: 26 October 1998
- Agreement Between The Government of Germany and The Government of Turkey for Cooperation in The Peaceful Uses of Nuclear Energy  
Initialled: 14 January 1998
- Agreement Between The Government of France and The Government of Turkey for Cooperation in The Peaceful Uses of Nuclear Energy  
Signature: 21 September 1999
- Agreement Between The Government of USA and The Government of Turkey for Cooperation in The Peaceful Uses of Nuclear Energy  
Initialled: 26 July 2000
- Agreement Between USNRC and TAEA for Thermal-hydraulic Computer Code Application and Maintenance Program (CAMP)  
Initiated: 9 February 1998 (to be extended in 2002 for five years period)

#### *BILATERAL AGREEMENTS ON EARLY NOTIFICATION*

- Agreement Between The Government of Republic of Bulgaria and The Government of Republic of Turkey on Early Notification of a Nuclear Accident and on Exchange of Information on Nuclear Facilities  
Signature: 28 July 97  
Ratification: 11 Sept. 1997
- Agreement Between The cabinet of ministries of Ukraine and The Government of Republic of Turkey on Early Notification of a Nuclear Accident and on Exchange of Information on Nuclear Facilities  
Signature: 23 November 2000
- Agreement Between The Government of Russia and The Government of Republic of Turkey on Early Notification of a Nuclear Accident And on Exchange of Information on Nuclear Facilities  
Initialled: 29 July 1988
- Agreement Between The Government of Romania and The Government of Republic of Turkey on Early Notification of a Nuclear Accident And on Exchange of Information on Nuclear Facilities and for Cooperation in The Peaceful Uses of Nuclear Energy.  
Initialled: 14 September 1993

## REFERENCES

- [1] IAEA Energy and Economic Data Base.
- [2] Data & Statistics, the World Bank, [www.worldbank.org/data](http://www.worldbank.org/data).

## Appendix

### DIRECTORY OF THE MAIN ORGANIZATIONS, INSTITUTIONS AND COMPANIES INVOLVED IN NUCLEAR POWER RELATED ACTIVITIES

#### *NATIONAL ENERGY AUTHORITY*

Turkish Ministry of  
Energy and Natural Resources  
İnönü Bulvarı, No:27 Bahçelievler  
Ankara

Tel: (312) 212 69 15  
Fax: (312) 286 47 69  
<http://www.enerji.gov.tr/>

Turkish Atomic Energy Authority  
Eskisehir Yolu  
Lodumlu, TR-06530  
Ankara

<http://www.atom.gov.tr/>

#### *OTHER ORGANIZATIONS*

Nuclear Engineering Department  
Hacettepe University  
06532 Beytepe, Ankara

<http://www.nuke.hun.edu.tr/>

Nuclear Engineers Society

<http://www.nuke.hun.edu.tr/dernek/dernek.html>

Institute for Nuclear energy  
Technical University of Istanbul  
Ayazaga Kampusu  
TR- 80626 Istanbul