INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries

TURKEY

2005 Review

OECD

INTERNATIONAL ENERGY AGENCY

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- to maintain and improve systems for coping with oil supply disruptions;
- to promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations;
- to operate a permanent information system on the international oil market;
- to improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use;
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ORGANISATIONS VISITED

The team consulted with the following organisations:

- Adgas (a private gas distribution company)
- Association of Electricity Distributors and Retailers (ELDER)
- Association of Oil Distribution Companies (ADER)
- Association of Electricity Industrialists and Businessmen (ELSİAD)
- Autoproducers and Electricity Generation Association (EÜD)
- CorumGas (a private gas distribution company)
- Electricity Producers Association
- Energy Market Regulatory Authority (EMRA)
- EÜAŞ (a state-owned electricity generation company)
- Federation of Consumer Associations (TÜDEF)
- Gas Distributors Union Association (GAZBİR)
- Geothermal Association
- Hydroelectricity Power Plant Industrialists and Businessmen Association (HESİAD)
- INGAZ (a private natural gas distribution company)
- IZODER (Association of thermal and sound insulation, waterproofing materials producers and suppliers)
- Ministry of Energy and Natural Resources (MENR)
- Ministry of Environment and Forestry
- Ministry of Foreign Affairs
- Ministry of Transport
- Petroleum Pipeline Corporation (BOTAŞ)
- Petroleum Platform Association (PETFORM)
- Petrol Ofisi (POAŞ)
- Privatisation Authority
- Small and Medium Industry Development Organisation (KOSGEB)
- Solar Energy Association

- State Planning Organisation (DPT)
- The Electrical Power Resources Survey and Development Administration (EİE)
- The Scientific and Technical Research Council of Turkey (TÜBİTAK)
- The Union of Chambers and Commodity Exchanges of Turkey (TOBB)
- Trade Union of Petroleum Products Employees (PÜİS)
- Trade Union of Turkish Petroleum and Gas Employees (TABGİS)
- Turkish Atomic Energy Authority (TAEK)
- Turkish Electricity Distribution Company (TEDAŞ)
- Turkish Electricity Transmission Company (TEİAŞ)
- Turkish Electricity Wholesale and Trading Company (TETAŞ, a state-owned electricity wholesale company)
- Turkish Hard Coal Enterprise (TTK)
- Turkish Coal Enterprises (TKİ, a state-owned lignite producer company)
- Turkish Co-generation Association
- Turkish Petroleum Corporation (TPAO)
- Turkish Petrol Industrialists' Association (PETDER)
- Wind Energy Power Plants Investors Association (RESYAD)
- Wind Power Plant Industrialists and Businessmen Association (RESSİAD)
- World Bank
- World Energy Council Turkish National Committee
- Yaman Enerji (private company)
- Young Businessmen Association of Turkey (TÜGIAD)

The assistance and co-operation of all participants in the review are gratefully acknowledged.

REVIEW CRITERIA

The IEA *Shared Goals*, which were adopted by IEA Ministers at their 4 June 1993 meeting in Paris, provide the evaluation criteria for in-depth reviews conducted by the Agency. The IEA *Shared Goals* are set out in Annex B.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Turkey has made impressive progress since the last IEA in-depth review in 2001. The government has made considerable efforts to address the "3 Es", namely energy security, economic efficiency and environmental protection, in a sustainable manner. New legislation will reduce the role of the government in energy markets and strengthen market forces in the sector. An independent regulator (EMRA) has been established, an ambitious privatisation programme has been announced, the United Nations Framework Convention on Climate Change (UNFCCC) has been ratified and the country is preparing legislation to address energy efficiency. A renewable energy law has been submitted to the Parliament for approval. Some important oil and gas transit pipeline projects are under way or nearing completion, which will improve the security of supply in Turkey and make it an important "energy corridor" between East and West. Investments have been made to extend domestic gas infrastructures and upgrade refineries. Nevertheless, Turkey still faces many challenges in all areas of energy policy.

Forecasts serving as a basis for the government's energy policy and energy enterprises' investment plans have been overestimating demand growth in Turkey, mainly owing to the previous overly optimistic assumptions of gross domestic product (GDP) growth and the effect of the economic crisis in 2001. While it is encouraging that most recent forecasts appear to be more realistic, the government needs to continue such efforts taking into account the effects of market liberalisation and privatisation.

Despite significant efforts to liberalise the energy markets, Turkey continues to rely on its state-owned companies. Although privatisation is not a prerequisite for market reform, it is necessary to restructure the state-owned enterprises into a corporate form operating under market competition and to prevent the Treasury from requesting annual income for the state budget. This would allow them to act as a player in the liberalised markets without government intervention, thus creating a level playing field. The already announced privatisation of the generation company EÜAŞ into several parts would bring immediate competition to the market and enhance efficiency within the company. The government is determined to create a *domaine réservé* for state enterprises for security of supply, including keeping large parts of the hydro generation facilities. Lack of transparent criteria for the level of government intervention could create uncertainties for market entrants and potential investors.

It is positive that the Energy Market Regulatory Authority (EMRA) has been given considerable powers such as setting the third-party access (TPA) tariffs, providing licences and making decisions not to be overruled by the

government. At the same time, it is important that EMRA consults the different stakeholders and benefits from their experience in energy markets when preparing regulations.

Turkey has made significant progress with regard to environmental protection but more still needs to be done. The UNFCCC entered into force in May 2004. The country is in the process of developing its Climate Change Strategy and first national communication to the UNFCCC. The government should strive to monitor the effectiveness of the chosen policies and measures, both in terms of costs and emissions reductions. It should also consider defining an emissions target based on the momentum of the UNFCCC ratification. Co-ordination among the various government bodies will be key to the success of the strategy. Turkey has made significant progress in reducing local air pollution, particularly in large cities, but work remains to be done to ensure existing standards are met and to prepare for further reductions in air pollution. In this respect, it will be important to ensure that all market operators, including those owned by the State, comply with the existing air quality and emissions legislation. While investments have been made to increase security in the congested tanker traffic through the Turkish Straits, further action, such as seeking alternative transport routes, continued co-operation with other Black Sea nations and increased involvement of large oil and gas importing countries, appears necessary.

The general approach of Turkey's energy policy has been highly supply-oriented, with emphasis placed on ensuring additional energy supply to meet the growing demand, while energy efficiency has been a lower priority. Consistently high energy intensity and its imminent increase, partly attributable to the improving living standards, are matters of concern. To realise an energy savings potential of 25-30%, an Energy Efficiency Strategy was developed in 2004 and the government is preparing an Energy Efficiency Law. These positive developments lift the status of energy efficiency and conservation as part of the government's energy policy but stronger policies beyond those in the law are still needed. The evident lack of a comprehensive and co-ordinated energy efficiency policy for the transport sector is of particular concern.

The oil sector has gone through a profound reform. The 2003 Petroleum Market Law liberalised oil market activities, lifted price ceilings and removed import quotas on petroleum products at the beginning of 2005. EMRA has been assigned the responsibility to issue secondary regulations and licences, approve certain tariffs and carry out investigations concerning market activities. While its role in, for example, licensing is indispensable, it appears that there has been some level of over-regulation in other areas, possibly owing to a stated lack of consultation with the oil industry. Large-scale fuel smuggling in Turkey is a problem that degenerates the operating conditions for the legitimate market operators and reduces state revenues. The recent introduction of a national chemical oil marker will help.

Natural gas accounts for 23% of total primary energy supply (TPES) in Turkey. Gas demand has been growing rapidly but the overestimated demand forecasts, caused principally by the 2000-2001 economic crisis, have led to some risk of oversupply because most of the imports are based on long-term take-or-pay contracts. The domestic gas network is being extended quickly to allow more consumers to access gas. The new gas storage facilities can help to meet peak demand but decisions to build storage facilities to cover seasonal peak supply should be made on the basis of economic criteria taking into account alternative approaches, namely more flexible supply contracts, interruptible consumers and multi-firing in power plants. Large-scale gas transmission projects will enhance supply diversity, security of supply and competition in Europe and Turkey. However, their success will depend on the regulatory systems, including pricing, for gas transit, which will affect the viability of transit routes. It will also depend on the gas market reform given the large share of domestic consumption out of the total volumes of new pipelines.

The full implementation of the 2001 Natural Gas Market Law will substantially modify the gas market by transforming the monopolistic market structure into a competitive one through encouragement of new market entry and investments. While most of the necessary secondary regulation has been issued by EMRA and, in principle, 80% of the market is free to choose suppliers, competition has not developed because of the Petroleum Pipeline Corporation's (BOTAŞ's) *de facto* monopoly in imports. Other factors hampering competition are the lack of an independent transmission system operator (TSO) and incentives for eligible consumers to change suppliers owing to TPA tariff structures in the distribution networks. A flat price cap on all consumers constitutes cross-subsidies both between different consumer groups, notably from industrial consumers to residential consumers, and between different geographical areas.

The government wishes to maintain hard coal production to enhance fuel diversity, and consequently security of supply, but the policy is also closely related to social, regional and employment policies. Given its poor competitiveness, Turkish hard coal receives high and increasing subsidies per tonne. The International Energy Agency (IEA) considers that these indefinite subsidies are not justified because the international market in hard coal is well established and offers secure and reliable sources of fuel at prices, both now and in the future, that Turkish national production cannot match. Furthermore, Turkey has large lignite resources, which make a far bigger contribution to its security of supply and are much more competitively priced (without subsidies) than its hard coal resources ever could be. Nonetheless, there is a need for vigorous pursuit of productivity so that coal can compete as a fuel on equal grounds, even in the face of costs associated with tightening environmental requirements.

Turkey's use of hydropower, geothermal and solar thermal energy has increased since 1990. However, the total share of renewables in TPES has

declined, owing to the declining use of non-commercial biomass and the growing role of natural gas in the system. The fixed feed-in tariffs and purchase obligation for distribution companies under the proposed new Renewable Energy Law can encourage investments. The maximum level, 6 eurocents per kWh, is moderate as compared to the levels given, for example, to wind power in some other IEA member countries. While the scheme may not become excessively expensive for consumers, which is a common risk in feed-in tariffs, careful monitoring and adjustment of the cost of the scheme will be necessary until it is fully replaced by the purchase obligation in 2011. Given the diverse availability of resources among different distribution areas, it needs to be ensured that distribution companies can buy renewable electricity from certified producers located in other distribution regions to be able to fulfil their obligation at minimum cost. Despite a large potential for use of heat from renewables (geothermal, solar thermal and biomass), there are no specific policies in place for heat production from renewables.

Turkey has recently announced that it will reopen its nuclear programme in order to respond to the growing electricity demand while avoiding increasing dependence on energy imports. The competitiveness of nuclear power in a liberalised electricity market in Turkey needs to be clarified. Investment decisions should be made on the basis of efficient and transparent price signals regardless of whether power plants are being built by private or public companies. Furthermore, waste disposal options need to be defined from the outset of launching a nuclear power project.

Despite a high reserve margin of 40%, Turkey will need more capacity in the mid-term because electricity demand will continue to grow rapidly. The recently launched rehabilitation programme for the thermal power plants to increase their efficiency is a prudent approach as it postpones the need to invest in new capacity. Nonetheless, new capacity will be needed in the next decade, which requires a good investment climate. Despite some reductions in distribution losses during the last couple of years, both technical and non-technical losses (totalling about 18% in 2004) are still a concern. One notable development is the progress in the project to interconnect with the European Union for the Co-ordination of Transmission of Electricity (UCTE) network, which is scheduled for 2006.

To date, there have been cross-subsidies in electricity prices both between different consumer groups, notably from industrial consumers to residential consumers, and between different geographical areas. It is positive that the government has announced that energy prices for each consumer group will be based on cost and that transparent tariff calculation rules have been established by the regulator. However, regional cross-subsidies will remain at least for the next five years.

The government should be highly commended for the initiative to create competitive electricity markets. The steps taken so far have created a window

of opportunity to implement successful reform with clear and significant benefits. Now, decisive action will need to be taken to see the process through to a successful conclusion.

The adoption of the 2001 Electricity Market Law was a major milestone. It established EMRA, which has issued most of the necessary secondary legislation. The legislation has been supplemented by the 2004 Electricity Strategy. Despite the good legislative and regulatory framework, not much competition has developed for a number of reasons. There is a lack of consumer choice caused by the small number of market players; new entrants have difficulties competing with the state-owned incumbent who owns competitive depreciated generation units, including hydropower. Furthermore, the current generation overcapacity and lack of cost-reflective prices have made new investment unattractive. In addition, the Build-Own-Operate (BOO) and Build-Operate-Transfer (BOT) schemes have a relatively high market share (with high guaranteed price) and only 29% of the market has been made eligible to choose suppliers. The Electricity Strategy contains the key elements for tackling these issues, including the privatisation of EÜAŞ and handling the stranded cost issues caused by the BOO and BOT schemes. However, it will also be important to consider if the share of the liberalised market can be increased sooner than planned and to ensure that the transmission system and market operator (TEİAŞ) is independent from government control in its normal operation. Establishment of an electricity exchange would facilitate trade and introduce more competition. Cost-reflective pricing will be vital.

Given that Turkey is facing significant energy and environment policy challenges, the government needs to explore all possible means to respond to these challenges, including formulating a coherent energy research and development (R&D) policy. To implement such a policy, a coherent energy R&D strategy with adequate financing as well as good co-operation among the different ministries is necessary. This could be done by building on the work done for the National Research and Technology Foresight Programme (Vision 2023 Programme).

RECOMMENDATIONS

The Government of Turkey should:

General Energy Policy

- *Take into account the effects of liberalisation in the energy forecasts. Continue to revise forecasts regularly to enable the creation of a robust long-term energy policy framework in light of the sharp demand growth.*

- *Increase focus on the demand side (energy efficiency) in energy policy planning and implementation.*

- *Continue the process of liberalisation and privatisation of the energy sector in a transparent way. Specifically:*
  - *Determine clearly the role of the involved parties,* i.e. *the government, the regulator, state companies and other energy industries.*
  - *Create a level playing field for market entrants and avoid giving state enterprises a special role in competitive areas of the market beyond the predefined transition period.*
  - *Ensure that the interests of the final consumers remain in the central focus of the liberalisation process.*
  - *Ensure that privatisation is implemented in a way that contributes to the creation of competitive markets.*

- *While avoiding interfering with the work of the energy market regulator, ensure that it follows the appropriate consultation processes when formulating regulations.*

- *Improve co-ordination among government agencies in all areas related to energy. Involve all stakeholders, in particular consumers, in developing energy policies.*

- *Ensure that energy prices are cost-reflective.*

Energy and the Environment

- *Complete the national climate change mitigation strategy and first national communication to the UNFCCC as soon as possible.*

- *Define a framework to monitor and evaluate, in terms of costs and carbon emissions, the effectiveness of the policies and measures included in the national climate change mitigation strategy.*

- *Build on the momentum created by the ratification of the UNFCCC to consider defining an emissions target.*

- *Clearly define the roles of the different ministries and agencies involved in air quality monitoring and enforcement.*

- *Ensure the Ministry of Environment and Forestry has adequate resources to monitor and enforce environmental legislation.*

- *Ensure that all market operators, including those owned by the State, comply with the existing air quality and emissions legislation.*

- *Put in place a clear investment schedule to complete the retrofitting of flue gas desulphurisation equipment on all old power plants.*

- *Clearly define a schedule for the introduction of the new legislation on air quality standards giving clear signals to market participants.*

- *Clearly define how responsibilities are shared among ministries and municipalities with regard to transport-related air pollution and encourage co-operation.*

- *Continue efforts to reduce the risk of marine pollution in the Black Sea and Marmara Sea, notably through enhanced co-operation with countries bordering the Black Sea and with large fossil fuel-importing countries.*

- *Consider the reintroduction of tax benefits for liquefied petroleum gas.*

Energy Demand and End-use Efficiency

- *Promptly enact the Energy Efficiency Law, implement the measures in the Energy Efficiency Strategy and carefully monitor and evaluate their impacts, including the cost-effectiveness.*

- *Strengthen energy efficiency measures in the industrial sector by:*
  - *Introducing specific fiscal and financial incentives and third-party financing.*
  - *Expanding energy audit and energy manager obligations beyond large enterprises.*
  - *Exploring the possibility of voluntary agreements with industries with quantitative targets.*

- *Encourage energy efficiency in buildings by:*
  - *Demonstrating leadership by improving energy efficiency in public buildings.*
  - *Strongly enforcing the building standards for new buildings.*
  - *Introducing mechanisms to improve energy efficiency in existing buildings.*
  - *Setting high efficiency standards for air-conditioning equipment and other appliances.*

- *Integrate energy efficiency objectives in developing transport policy by, for example, promoting public transport, fostering inter-modal changes away from road transport and improving the energy efficiency of the vehicle fleet through economic and regulatory incentives. Improve transport statistics.*

Oil

- *Solve the problem of fuel smuggling.*
- *Encourage the industry to develop a Turkish Straits bypass, which is commercially feasible and is located far enough from the environmentally sensitive zones of the Black Sea, the Strait of İstanbul and the Marmara Sea.*
- *Ensure that the regulator focuses on the monitoring of competition in the downstream oil market and takes a light-handed regulatory approach.*
- *Complete the privatisation of the Turkish Petroleum Refinery Corporation (TÜPRAŞ) in a way that reduces its dominant role in the refining market.*
- *Corporatise the Turkish Petroleum Corporation (TPAO) and consider its privatisation. Give TPAO the possibility to integrate vertically in the downstream oil market.*
- *Establish clear and precise oil stockholding arrangements to define the obligation for each type of oil market operator.*

Coal

- *Promote the advantages of domestic coal reserves as a fuel and continue reforms of the coal industry to ensure it can compete on equal and competitive terms in an open electricity market, but refrain from intervention (such as providing subsidies for coal or allowing exemption from environmental regulations), which would distort the market.*
- *Rapidly step up efforts to increase productivity in coal mining, including through possible privatisation of state-owned operations, or accelerating current moves to lease and contract mining operations.*
- *Reduce coal subsidies with the aim of eliminating them, and set a clear deadline for this abolition. Replace the subsidies by restructuring programmes to address social impacts.*

Natural Gas

- *Encourage the expansion of the gas distribution networks to new cities for the environmental benefits and to enable imports by new entrants from any supplier, thereby reducing BOTAŞ's market power.*
- *Continue to promote gas transit routes and establish the necessary regulatory framework.*
- *Make natural gas prices cost-reflective for all consumer groups. Eliminate cross-subsidies between different customers.*

- *Develop and support mechanisms to divest existing imports, in accordance with a defined schedule, to provide a fair chance for new entrants. Clarify the role of the government and BOTAŞ in this process.*
- *Lift the restrictions on sources of natural gas imports by other parties from countries where BOTAŞ is importing, while paying due attention to diversification of supply sources.*
- *Monitor the market power of external gas suppliers.*
- *Define the exact steps to be taken to establish a fair and transparent open market as envisaged in the Gas Market Law. Closely monitor the progress.*
- *Establish an independent gas transmission system and storage operator by effective unbundling of BOTAŞ. Corporatise BOTAŞ.*
- *Review third-party access tariffs to the distribution networks and storage to enhance the possibilities of eligible consumers to switch suppliers.*

Renewables

- *Consider steps to accelerate economic hydropower projects, including refurbishment, consistent with the protection of the environment, to utilise the remaining hydropower potential.*
- *Enact the Renewable Energy Law as envisaged and monitor and evaluate its cost and effectiveness.*
- *Share information and experience with other countries introducing quota- and certificate-based promotional schemes for renewables.*
- *Assess the impact on the network reliability and stability resulting from increased penetration of intermittent wind power and explore ways to minimise such an impact. Consider a combination of wind power and pumped storage hydro for this purpose. Share information and experience with other countries on technical and regulatory approaches to intermittency.*
- *Investigate the extent to which policies and measures are needed to promote the use of renewables in heat production, co-generation and transport.*

Electricity, Nuclear Power and Co-generation

- *Encourage the rehabilitation of the thermal power plants to increase their efficiency where economically feasible.*
- *Allow the market participants to decide when and what kind of new power capacity will be built. Clarify the level of intervention which is considered necessary for security of supply and environmental reasons, and clearly specify the criteria under which such interventions should occur.*

- *Continue the efforts for synchronisation of the Turkish power system with the European grid of the Union for the Co-ordination of Transmission of Electricity (UCTE).*
- *Ensure that effective regulation creates incentives for distribution companies to continue decreasing technical and non-technical losses.*
- *Make sure that the transmission system and market operator (TEİAŞ) is independent from government control in its normal operation, including the development of the network.*
- *Encourage the establishment of an electricity exchange to facilitate trade and to introduce more competition.*
- *Carefully consider the sequence of market reform. In particular, ensure that the legal and regulatory framework, independent transmission system operator and spot market are fully implemented before proceeding with privatisation.*
- *Ensure that the privatisation programme can be efficiently implemented without delays.*
- *Create a sound legal framework for the use of nuclear power. Clarify the role of nuclear power in the future in terms of economic competitiveness. Define nuclear technology choices and waste disposal options before building nuclear power plants.*
- *Evaluate the potential for co-generation and pay due attention to the cost-effectiveness of future policies.*

Research and Development

- *Build on the work done within the Vision 2023 Programme to prepare a coherent energy R&D strategy. It should have adequate financing and efficient allocation in line with energy policy objectives to maximise energy R&D's contribution to the significant energy policy challenges in coming years.*
- *Concentrate on the adaptation of existing technologies and their early deployment, particularly in areas where there is a clear competitive advantage and need.*
- *Improve the collection of data on governmental R&D funding.*
- *Actively encourage the formation of private-public partnerships and, as appropriate, provide incentives for energy companies to increase R&D expenditures.*
- *Facilitate adequate R&D investment by the state-owned entities and ensure that incentives are provided post privatisation.*

OVERVIEW

GEOGRAPHY AND POPULATION

The Republic of Turkey (hereafter Turkey) is located between Europe and Asia (see Figure 1). Its surface area is 781 000 km^2 of which approximately 97% is in Asia and 3% is in Europe. Turkey's coastlines (the Mediterranean, Aegean and Black Seas) total more than 8 333 km.

Turkey's geographical location makes it a natural land bridge connecting Europe to Asia. Therefore, it has an increasingly important role to play as an "energy corridor" between the major oil and natural gas producing countries in the Middle East and Caspian Sea and the Western energy markets.

Turkey is one of the most earthquake-prone areas in the world. The last major earthquake occurred in 1999 in the northern Marmara and Bolu areas claiming nearly 20 000 lives, causing injuries, destroying homes and bringing about havoc to important energy infrastructures.

In 2003, the population of Turkey was 70.8 million, 26% over the 1990 level. The average population growth rate was 1.8% per year between 1990 and 2002, the highest among the IEA member countries. Population growth is envisaged to gradually slow down to 1.6% in 2005, 1.4% in 2010 and 1.1% in 2020. With these growth rates, the population would reach almost 88 million by 2020. Turkey is experiencing high domestic migration rates towards cities.

ECONOMY

The economy has undergone a significant shift from agriculture towards the service sector and to some extent industry, although some 30% (43% in 1993) of the active population was still employed in agriculture in 2003. The unemployment rate was 9% in mid-2004, three percentage points above the 2000 level. However, the employment rate is only 46% of the labour force, the lowest in OECD member countries and labour productivity is around 35% of the OECD average.

Turkey suffered from the most severe economic difficulties of its recent history in 2001 caused by a banking crisis resulting from a widening current account deficit and fragile foreign confidence. The gross domestic product (GDP) declined by 7.5% in 2001 but recovered by 8% in 2002 and 6% in 2003. The Turkish economy is currently among the fastest growing economies in the

Figure 1

Map of Turkey

OECD. It is driven by strong productivity gains and by robust growing private consumption, investments and exports, and has not been hindered by cuts in government consumption and investment. Nevertheless, Turkey still has the lowest GDP per capita among the OECD member countries. In 2003, GDP per capita in Turkey, measured using current purchasing power parities, was US$ 6 800[1], which is 26% of the OECD average. A major problem is the significant extent of unregistered activities that account for more than 50% of total employment and lead to a narrowing of the tax base.

Tight macroeconomic policies based on a high primary surplus and on strict monetary conditions have kept inflation on a steep downward path, have significantly improved confidence and have proved to be expansionary. Inflation could fall to a single digit annual rate in 2005, for the first time in three decades. Turkey implemented a monetary reform on 1 January 2005 by introducing the Yeni Turkish Lira (YTL), the new currency that deletes six zeroes from the old Turkish lira (TL).

The reform agenda following the 2001 crisis, based on the National Convergence Programme to the European Union (EU) *acquis* and on the Stand-By Agreement with the International Monetary Fund and later reinforced by the Urgent Action Plan of the current government, has aimed to address the former problems of low confidence, weak governance and high informality, which undermined economic growth. This agenda has included ambitious macro-stabilisation and institutional reforms and has been endorsed by two successive governments.

EU ACCESSION

Turkey applied for EU membership in 1987 and was declared a candidate for accession to the EU in 1999. Thereafter, it has had the possibility to benefit from a pre-accession strategy and the possibility to participate in EU programmes and agencies. The new reform agenda is perceived as a prerequisite for the opening of accession negotiations with the EU and enjoys wide public support. On 3 October 2005, accession negotiations are scheduled to be opened with Turkey, which has been an associate member of the EU since 1963 and an official candidate since 1999. The December 2004 decision by the European Council has also called on the European Commission (EC) to present a proposal for a framework for negotiations.

PRIVATISATION

Infrastructure services, including energy, have for a long time been offered at comparatively high costs in Turkey, particularly for business users. One major reason for this is that competition and private investment have remained

1. On average in 2004, TL 1 000 = US$ 0.0007.

underdeveloped. In response to these problems, market liberalisation efforts in accordance with EU rules have been launched since 2001. To further enhance efficiency in the energy sector and to bring private investments, the government has announced the privatisation of many state-owned energy companies. More details of the existing privatisation programme, as well as recommendations to corporatise state-owned companies, can be found in several chapters of this review, namely Chapter 6 (Oil), Chapter 7 (Coal), Chapter 8 (Gas) and Chapter 10 (Electricity).

ENERGY MARKET

As shown in Figure 2, in 2003, TPES in Turkey was 83.7 million tonnes of oil equivalent (Mtoe), up by 58% from the 1990 level, growing in phase with GDP. Dependence on oil has declined from 51% in 1973 to 38% in 2003, which is slightly lower than the IEA average. Natural gas demand has grown almost sevenfold since 1990, gaining a 23% share in TPES. The share of coal in TPES is 27%, down from 32% in 1990 and the share of combustible renewables and wastes 7%, down from 14% in 1990. Given hydropower production's dependence on weather conditions, annual variations tend to be large; however, the longer-term trend has been increasing supply owing to new capacities. Production of geothermal energy has almost doubled since 1990 reaching 0.86 Mtoe. Solar and wind contributed 0.36 Mtoe (0.4% of TPES) in 2003.

As seen in Figure 3, domestic energy production was 23.8 Mtoe in 2003 (28 % of TPES) and comprised coal (10.8 Mtoe), renewables (10 Mtoe), oil (2.5 Mtoe) and gas (0.5 Mtoe). The government forecasts both oil and gas production to decline owing to depletion of resources but coal production (principally lignite) and renewable energy production to increase.

The trends in total final energy consumption (TFC) and energy end-use efficiency are discussed in Chapter 5.

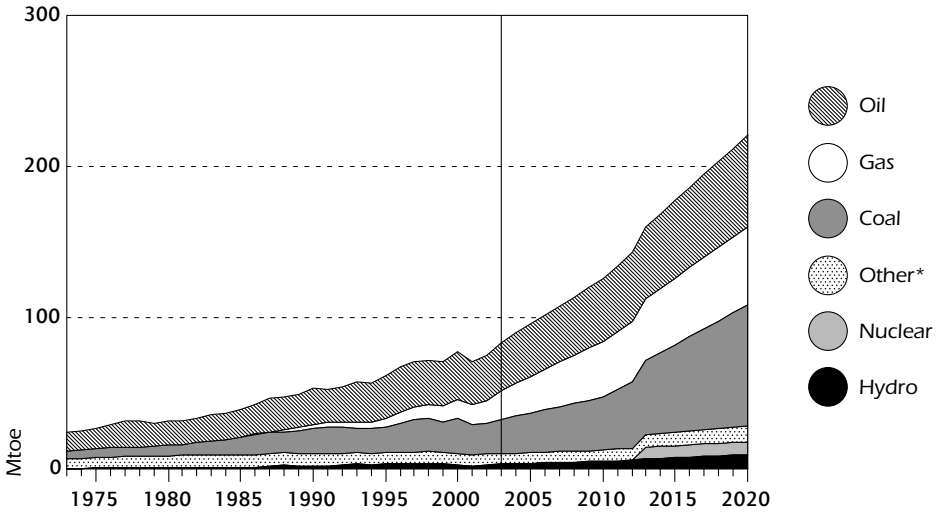
ENERGY POLICY ADMINISTRATION

The Ministry of Energy and Natural Resources (MENR) 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. It reports directly to the Prime Minister. The MENR has the following tasks and objectives:

- To determine and implement national energy policy objectives.
- To co-ordinate between the dependent and related institutions and other public and private entities.

Figure 2

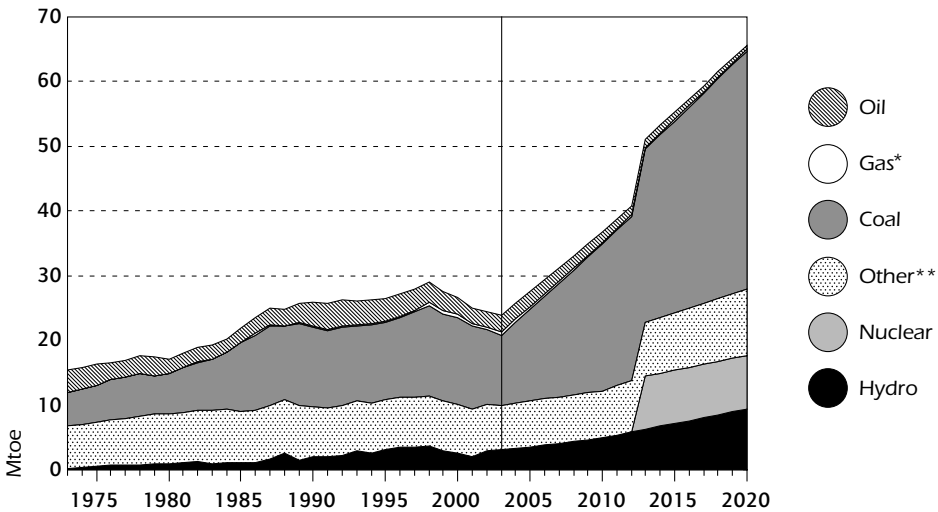
Total Primary Energy Supply, 1973 to 2020



* includes geothermal, solar, wind, combustible renewables and waste.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; and country submission.

Figure 3

Energy Production by Source, 1973 to 2020



* negligible.
** includes geothermal, solar, wind, combustible renewables and waste.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; and country submission.

- To prepare and/or supervise programmes in conformity with the energy policy.
- To ensure the implementation of the programmes.
- To supervise and control all exploration, development, production and distribution activities for energy and natural resources.

The Research, Planning and Coordination Board (APK) of MENR co-ordinates the activities of the dependent and related institutions and executes national energy policy. It conducts long-term energy planning and develops different policy scenarios to support this work.

The General Directorate of Energy Affairs (EİGM) is the main policy-making body within the MENR. The EİGM is responsible for the co-ordination of the natural gas and electricity sector reform programmes, including the consequences of past efforts to bring private investments to the electricity sector (see Chapter 10). It also carries out studies on general energy and environmental policies, renewables and energy efficiency.

The General Directorate of Petroleum Affairs (PIGM) of MENR licenses oil exploration, production and refining. Since the abolition of the automatic pricing mechanism (APM) in the beginning of 2005, it no longer sets or controls oil prices.

The Electrical Power Resources Survey and Development Administration (EİE) of MENR is assigned to identify the energy potential of water resources and to prepare dam and hydropower plant projects. The EİE carries out various activities in relation to energy efficiency and renewable energy resources. The National Energy Conservation Centre (NECC) within the EİE is responsible for energy efficiency.

State Hydraulic Works (DSI) is the state water agency responsible for the development of all water resources in the country. DSI implements surface and ground water projects and plans, designs, constructs and operates dams and hydroelectric power plants for multi-purpose use.

The Turkish Atomic Energy Authority (TAEK) is the regulatory body responsible for the licensing of the activities related to the site selection, construction, operation and decommissioning of nuclear installations and other activities involving nuclear or radioactive materials. It also executes and supports nuclear R&D. The regulatory and R&D activities of TAEK will be separated in 2005 by creating an independent nuclear regulator.

The Energy Market Regulatory Authority (EMRA) was established as the independent regulatory authority for electricity by the Electricity Market Law in February 2001. After the enactment of the Natural Gas Market Law (May 2001) and the Petroleum Market Law (December 2003), EMRA was also given responsibilities in the natural gas and oil sectors. Its tasks in each energy sub-sector are given in Chapter 6 (Oil), Chapter 8 (Natural Gas) and Chapter 10

(Electricity). EMRA's decision-making body is its board. EMRA's board assumed duty in the third quarter of 2001. It is composed of nine members, including a chairperson and a vice chairperson.

EMRA has administrative and financial autonomy; it receives no financing from the state budget. Its total number of staff in September 2004 was 303 of whom 65 worked in the electricity department, 44 in the natural gas department, 32 in the petroleum department and 162 in other departments. EMRA collects its revenues principally from electricity and gas licensing fees and from a surcharge on electricity TPA tariff (maximum 1%).

In addition, the Turkish Competition Authority has rights to issue the authorisations with respect to any merger or acquisition to be carried out in the market under the scope of Article 7 of the Law on Protection of Fair Competition No. 4054.

The State Planning Organisation (DPT) is an advisory body of the Prime Minister. It assists the government in determining economic and social objectives and the policies to be adopted. In practice, its major activities concerning the energy sector are the preparation of the five-year development plans together with the MENR and industry and preparing demand projections.

ENERGY POLICY OBJECTIVES

Every five years the State Planning Organisation, with the assistance of different ministries and expert organisations from all sectors, including the energy sector, prepares a Development Plan. The most recent one is the Eighth Five-Year Development Plan for the period 2001-2005. The energy policy objectives of this plan, largely unchanged from the previous plans, are as follows:

- To ensure sufficient, reliable and economic energy supplies in order to support economic and social development.
- To maintain security of energy supply.
- To encourage sufficient investments to meet growing energy demand.

In parallel to the above primary goals, Turkish energy policy has the following additional objectives:

- Prioritising energy security activities to cope with the increasing demand and import dependence.
- Taking into account the environmental concerns in all stages of the energy chain within the framework of sustainable development.
- Reforming and liberalising the energy sector to increase productivity and efficiency and to enhance transparency.

- Intensifying R&D on energy technologies.
- Facilitating projects for the transportation of hydrocarbons from the East to Western Europe in the context of the "East-West Energy Corridor" concept.

ENERGY SECURITY

Turkey has been able to keep supply up with the country's increasing demand. The government emphasises the importance of ensuring energy security and improvement of environmental quality while encouraging investments in the energy sector. The MENR considers energy security to continue to be a high priority issue for the following reasons:

- The limited domestic energy sources and the (still) limited production capacity of these resources.
- The growing energy demand.
- The high level of dependence on energy imports, primarily oil and gas.

Net energy imports have been increasing considerably and import dependence is becoming an important issue for Turkey. On average, net energy imports increased by 6% per year in 1990-2003, climbing from 28 Mtoe in 1990 to 60.5 Mtoe in 2003. The share of imports in TPES has increased significantly, from 51% in 1990 to 72% in 2003. In terms of energy, natural gas imports have increased most (by 16.3 Mtoe) but there has also been notable growth in oil (by 8.2 Mtoe) and coal (by 7.9 Mtoe) imports. To reduce the supply risks caused by increasing imports, encouraging the use of domestic energy resources is a high priority on the government's agenda. Another priority is diversification in import sources, both in terms of type of energy and its origin.

Turkey has diversified oil import sources. Crude oil was imported from Iraq, Iran, Libya, Saudi Arabia, Russia, Syria, Algeria, Egypt, Tunisia, Azerbaijan, Kazakhstan and Italy in 2003. Attempts have been made to diversify gas imports but the share from Russia was 61% in 2003 because many of the recent contracts with other suppliers have not become active owing to oversupply concerns. Coal, principally hard coal, is imported from diversified sources while domestic production, particularly of lignite, makes a significant contribution to total coal supply. More details about import sources of fossil fuels can be found in the sectoral chapters.

Turkey is actively participating in initiatives to establish regional markets, such as the Energy Community of South East Europe and the Med-Ring Project. These initiatives are expected to increase cross-border electricity and gas trading.

Synchronisation of the Turkish electricity grid with UCTE is expected in 2006 (see Chapter 10). With regard to interconnections with the neighbouring gas markets, the Turkey-Greece interconnector will also be commissioned in 2006.

Fuel switching in power generation has been significant over the past two decades as coal-fired plants are increasingly replaced by gas-fired ones. The gas transmission and distribution infrastructure is being improved and extended to new areas, which enables industry and households to progressively switch from oil and coal to gas. Natural gas storage is being developed to ensure supply during the winter season and peak hours; at present, the major flexibility mechanism is the interruptible consumers (see Chapter 8).

Ensuring a secure electricity supply requires adequate and timely investments in electricity infrastructures and generating capacity. The government emphasises the importance of having sufficient reserve margins when preparing forecasts and estimating needs for generation expansion. According to the most recent electricity demand projections, a supply shortfall could occur after the last quarter of 2008 if new power plants are not built. Therefore, the government is taking an active role in maintaining a supply and demand balance. Some measures already taken are the refurbishment of some coal-fired power plants and the reduction of technical and non-technical losses in the distribution networks. The reformed electricity market is expected to attract new investments in generating capacity ensuring sustainability. Energy efficiency policies and measures will also play a role. Transmission infrastructure will be improved to allow for the expansion of distributed and intermitted generation such as renewables.

The Petroleum Market Law stipulates that Turkey must keep oil emergency stocks corresponding to 90 days of oil consumption based on the previous year's average consumption. The legislation conforms to EU requirements without being completely compatible with IEA requirements, which are based on historical net import levels.

ENERGY TAXATION

Turkey's main tax on oil products is the fuel consumption tax (FTC). The FTC rates for various oil products are given in Table 1. To alleviate the effects of oil price fluctuations and the pronounced exchange rate fluctuations of the Turkish lira against the dollar on domestic oil prices, the government linked the FTC to a pre-existing mechanism called the Fuel Stabilisation Fund (FPSF) in 2000. The FPSF was financed through a compensatory FPSF tax. The tax fluctuated and was inversely proportional to developments in the international oil prices and the exchange rate of the Turkish lira against the dollar. The tax did not apply to fuels used in generating electricity. While this tax was abolished and replaced with the Automatic Pricing Mechanism (APM), the APM was also abolished at the beginning of 2005. Oil products are also subject to a value-added tax (VAT) of 18%.

In January 1996 Turkey signed the Customs Union Agreement with the EU, whereafter customs duties are applied only to oil product imports from non-EU countries.

The FTC is applied also for natural gas. As of March 2004 it was TL 6 750 per m^3. VAT rate for natural gas is 18%.

Electricity prices are subject to several taxes and levies. Although the Electricity Market Law prohibits inclusion of any costs on electricity prices that are not directly related to electricity market activities, with the exception of EMRA's surcharge on electricity TPA tariffs, a 2% levy for Turkish Radio and Television Corporation is imposed on end-user electricity prices. Electricity prices are subject to the municipality consumption tax, which is 1% for industry and 4% for household consumers. The VAT rate for electricity is 18%.

No excise taxes are applied for coal. The only tax is the VAT of 18%.

Table 1

Taxes on Oil Products and Natural Gas in Turkey, 30 April 2004

	Excise tax (TL)	*VAT (%)*
Premium gasoline (per litre)	1 005 000	18
Unleaded gasoline (per litre)	990 000	18
Naphtha	–	18
Kerosene (per litre)	634 000	18
Jet fuel (per litre)	–	18
Diesel oil (2% sulphur, per litre)	706 000	18
Diesel oil (other qualities)	706 000	18
Heating oil (per kg)	360 500	18
Fuel oil (1% sulphur, per kg)	158 500	18
Fuel oil (3.5% sulphur, per kg)	115 500	18
LPG (bottled), propane, butane (per kg)	699 000	18
LPG (automotive, per kg)	770 500	18
LPG (heating, per kg)	699 000	18
Propane (fuel, per kg)	699 000	17
Natural gas (per m^3)	6 750	18

Source: MENR.

FORECASTS

MENR prepares energy demand forecasts approximately every four years using a detailed bottom-up methodology that relies on projections of a range of economic and demographic variables and relationships. The inputs are a

combination of energy forecasts from the DPT and projections of other parameters using available data and the judgement of MENR staff. General energy planning studies are carried out by MENR.

According to the Electricity Market Law of 2001, distribution companies are obliged to prepare their demand forecasts and submit them to the TSO, the Turkish Electricity Transmission Company (TEİAŞ). TEİAŞ will prepare its transmission planning on the basis of these demand forecasts and submit it to the regulator for approval.

MENR published its latest updated energy forecasts in September 2004; their summary is shown in Annex A of this report. These forecasts indicate lower future total energy demand as well as lower demand for all fossil fuels and electricity than the last forecasts prepared in 2000 and 1996, which some parties, including the DPT and the World Bank, criticised for being too high, particularly for electricity. The new forecasts are based on lower estimates of economic growth (3.1% per year by 2005, 5.5% in 2005-2010 and 6.4% in 2010-2020) than the previous ones. On the other hand, the World Bank ESMAP report (Report 273/03) published forecasts which exceed the 2002 MENR forecast basing on the assumption that energy intensity will not peak until per-capita income reaches approximately US$ 11 000 (at 1990 prices).

CRITIQUE

Turkey has made impressive progress since the last IEA in-depth review. The government is making considerable efforts to address the "3 Es", namely energy security, economic efficiency and environmental protection, in a sustainable manner. New legislation will reduce the role of the government in energy markets and strengthen market forces in the sector. An independent regulator (EMRA) has been established, an ambitious privatisation programme has been announced, the UNFCCC has been ratified and the country is preparing legislation to address energy efficiency. A renewable energy law has been submitted to the Parliament for approval. Some important oil and gas transit pipeline projects are under way or nearing completion, which will improve the security of supply in Turkey making it an "energy corridor" between East and West. Investments have been made to extend domestic gas infrastructures and upgrade refineries.

However, Turkey is facing many challenges in all areas of energy policy. Despite a favourable legislative framework, the bulk of the work for the effective implementation of the electricity and gas market reforms still lies ahead. Security of supply remains a concern as local power cuts continue to occur and oil stock levels have occasionally declined under the 90-day level. Energy efficiency, environmental protection and the exploitation of Turkey's large renewable energy resources all warrant additional attention. These issues are discussed in more detail in the following chapters.

Forecasts are very important for effective implementation of energy policies. Through reasonably accurate forecasts, the government can anticipate possible problems in coming years and take the necessary actions to address them. Accurate forecasts of energy demand are also vital, since they drive decisions on capital-intensive investments. Forecasts also guide energy ministries to take necessary actions concerning supply security, environmental quality and other important aspects of the energy policy. This is particularly important when demand is growing relatively quickly, as is the case for Turkey. Furthermore, given heavy government involvement in Turkey's energy sector, the forecasts could even include the future investment plans of state-owned companies. This is very different from many other IEA countries where investment decisions are left to private companies.

In this context, it is a concern that projections of supply and demand balance have been overestimating demand growth in Turkey. Overestimation of demand tends to cause overinvestment or oversupply, which could reduce overall economic efficiency of the energy system. The stated reasons for the past overestimates are the overly optimistic expectations of GDP growth and the 2001 economic crisis. However, it should be noted that slower periods of growth have occurred in the economy, caused by various internal and external factors. Examples can be found in Turkey's recent history: 1994 (resulting from a declining current account, loss of investor confidence and a banking crisis) and 1998-1999 (a major earthquake). On the other hand, according to the latest OECD forecasts, Turkey has the potential for high growth rates (up to 7% per year) provided that the ongoing structural reforms are fully implemented. It is encouraging that the most recent forecasts appear more realistic compared with the previous ones. The government should continue its efforts towards forecasts that are as realistic as possible. It is a challenging task because the predictability of investment could be reduced with the growing role of the private sector under market liberalisation and privatisation. Close monitoring and periodic revision are essential to make the forecasts as relevant as possible. It will also be important to make a distinction between policy objectives (such as increased use of lignite for reasons of security of supply) and likely developments in the liberalised markets (such as generators preferring gas over lignite). One way to handle such different expectations, as well as the difficulty to accurately estimate economic growth, could be to prepare alternative scenarios.

The general approach of the energy policy has been highly supply-oriented. Emphasis has been placed on ensuring additional energy supply to meet the growing demand while energy efficiency has been a lower priority. Although more activities have recently been launched to enhance energy efficiency, the focus on energy efficiency needs to be clearly increased. Chapter 5 gives several detailed recommendations for possible additional policies and measures and for maximising the impact of the existing ones.

Significant efforts have been made to liberalise the energy market in conformity with the EU *acquis*. Nevertheless, Turkey keeps relying on the state-owned companies owing to postponements in privatisation. Although this influence is to be reduced after a transition period, government involvement will remain. One example of continued government involvement is in electricity generation, where the government seems determined to create a *domaine réservé* for state enterprises, including keeping large parts of the hydro generating facilities, for reasons of security of supply and optimal operation of the transmission system. In addition, financial support for hard coal mining may continue. Well-established liberalised energy markets have generally encouraged adequate investment to meet security requirements. The lack of transparent criteria for, as well as the level of, future government intervention creates uncertainty for market entrants and expected investors. This could distort the level playing field in the liberalised energy market, discourage private investment and reduce overall efficiency of the energy system. Also, the delays in defining the privatisation methodology and implementation have had this effect. These issues are discussed more extensively in Chapter 10.

Although privatisation is not a prerequisite for market reform, it is necessary to restructure the state enterprises into a corporate form operating under market competition and to prevent the Treasury from requesting annual income for the state budget. This allows them to act as a player in the liberalised markets without government intervention, thus creating a level playing field. However, privatisation of the electricity generation company (EÜAŞ) into several parts would bring immediate competition to the market and enhance efficiency in the company.

In the process of market opening, the division of authority between MENR, EMRA and the state enterprises should be clearer in order to avoid inconsistencies, which could hamper the effective realisation of the process and the removal of "burdens from the past". It is positive that EMRA has been given considerable powers, such as setting the TPA tariffs to energy grids and providing licences, and that its decisions cannot be overruled by the government. This increases the transparency of regulation. However, oil and gas industries have expressed concern about the competence of EMRA regarding its understanding of the regulated industries and its consultation process in preparing regulations. While maintaining independence, it is important that EMRA consults the relevant stakeholders and benefits from their experience of the market when preparing regulations.

In shaping energy policy and a liberalised energy market, it appears necessary to improve communication, co-ordination and consultation between the relevant government agencies as well as with the main stakeholders. In particular, consumers need to be fully involved in the policy-making process, especially market liberalisation, energy efficiency and environmental

protection, and the relevant information must be disseminated. Although formal participation in the law-making process is ensured among governmental agencies, for example by intergovernmental commissions, there seems to be a lack of co-ordination on matters of substance. A good example of a more co-ordinated approach is the recent Strategy Paper, which outlined the major steps to be taken towards a fully competitive electricity market based on the consensus of and in co-operation with MENR, EMRA, DPT, the Privatisation Administration and the Treasury.

Cost-reflective pricing is a prerequisite for effective energy policies such as market reform and energy efficiency. Despite vows to eliminate all cross-subsidies and indirect subsidies, it remains to be seen how cost-reflective pricing can be assured in a transparent way.

There is not sufficient emphasis on market instruments in pursuing energy policy objectives. Energy taxes primarily serve fiscal needs, which is not uncommon among the IEA member countries. Nevertheless, while many IEA countries are, to varying degrees, also using energy taxation for certain energy policy objectives, such an approach is almost non-existent in Turkey. Tax incentives and differentiation can play a useful role in promoting energy policy and environmental goals.

RECOMMENDATIONS

The Government of Turkey should:

- *Take into account the effects of liberalisation in the energy forecasts. Continue to revise forecasts regularly to enable the creation of a robust long-term energy policy framework in light of the sharp demand growth.*
- *Increase focus on the demand side (energy efficiency) in energy policy planning and implementation.*
- *Continue the process of liberalisation and privatisation of the energy sector in a transparent way. Specifically:*
  - *Determine clearly the role of the involved parties,* i.e. *the government, the regulator, state companies and other energy industries.*
  - *Create a level playing field for market entrants and avoid giving state enterprises a special role in competitive areas of the market beyond the predefined transition period.*
  - *Ensure that the interests of the final consumers remain in the central focus of the liberalisation process.*

- *Ensure that privatisation is implemented in a way that contributes to the creation of competitive markets.*

- *While avoiding interfering with the work of the energy market regulator, ensure that it follows the appropriate consultation processes when formulating regulations.*

- *Improve co-ordination among government agencies in all areas related to energy. Involve all stakeholders, in particular consumers, in developing energy policies.*

- *Ensure that energy prices are cost-reflective.*

CLIMATE CHANGE

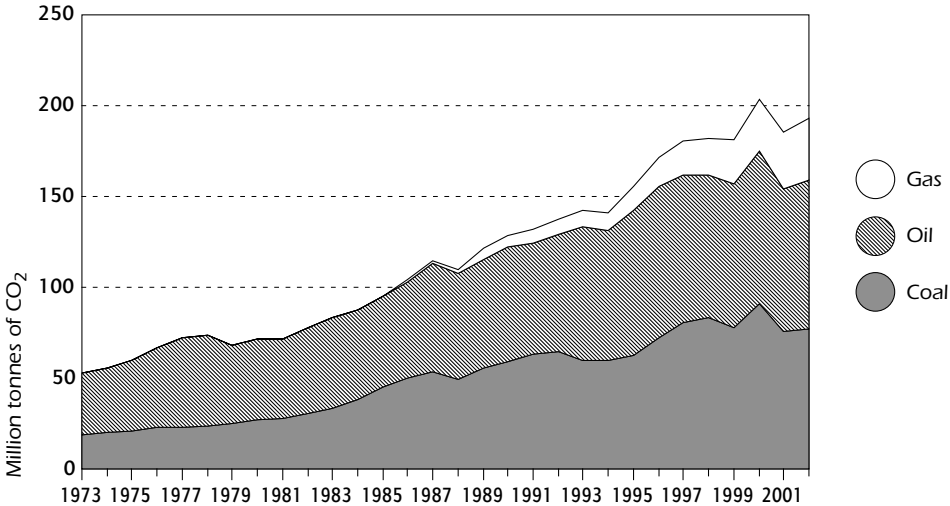
CO_2 EMISSIONS

Turkey's total carbon dioxide (CO_2) emissions amounted to 193 million tonnes (Mt) in 2002 (see Figure 4). Emissions grew by 4% compared to 2001 levels and by just over 50% compared to 1990 levels. Oil has historically been the most important source of emissions, followed by coal and gas. Oil represented 42% of total emissions in 2002, while coal represented 40% and gas 18%. The contribution of each fuel has however changed significantly owing to the increasingly important role of gas in the country's fuel mix starting from the mid-1980s.

According to recent projections, TPES will almost double between 2002 and 2020, with coal accounting for an increasingly important share, rising from 26% in 2002 to 36% in 2020, principally replacing oil, which is expected to drop from 40% to 27%. Such trends will lead to a significant rise in CO_2 emissions, which are projected to reach nearly 600 Mt in 2020, over three times 2002 levels.

Figure 4

CO_2 Emissions by Fuel*, 1973 to 2002



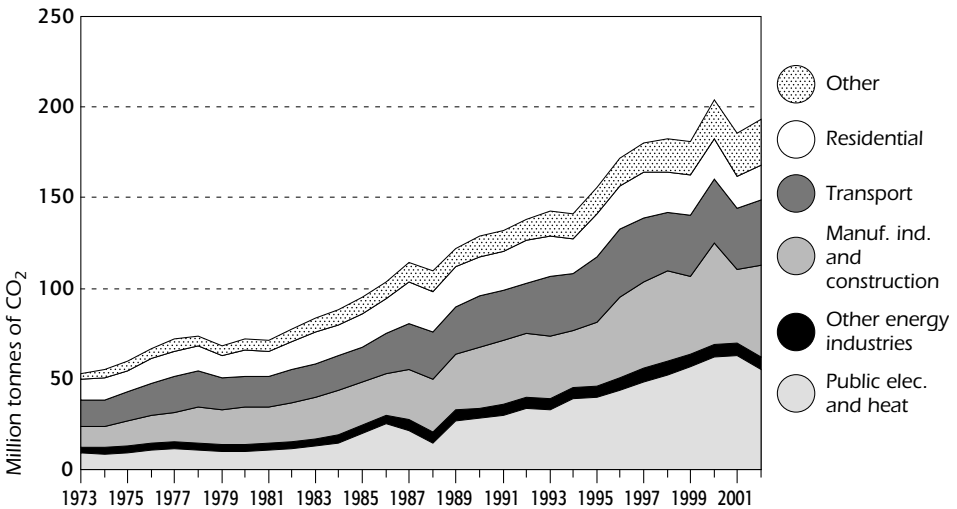
* estimated using the IPCC Sectoral Approach.

Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2004.

In 2002, public electricity and heat production were the largest contributors of CO_2 emissions, accounting for 28% of the country's total (see Figure 5). The industry sector was the second largest, representing 26% of total emissions, followed by transport, which represented 19% and direct fossil fuel use in the residential sector with 10%. Other sectors, including other energy industries, account for 17% of total emissions. Since 1990, emissions from public electricity and heat production have grown more rapidly than in other sectors, increasing by 6%. Simultaneously, the shares of emissions from the residential and transport sectors both dropped by 7% and 3% respectively while the share of emissions from the manufacturing industries and construction sector remained stable.

Figure 5

CO_2 Emissions by Sector*, 1973 to 2002



* estimated using the IPCC Sectoral Approach.

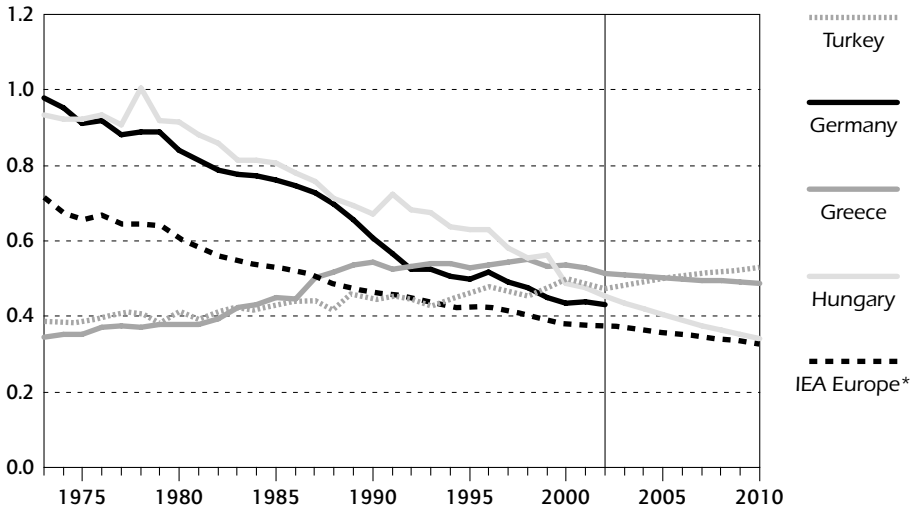
Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2004.

Per capita CO_2 emissions were at 2.8 tonnes in 2002, much lower than the OECD average of 11.0 tonnes. Between 1990 and 2002, per capita emissions in Turkey grew by 21% while on average they grew by only 4% at the OECD level and dropped by 3% in the IEA Europe region. Turkey's CO_2 emissions per unit of GDP are shown in Figure 6. Historically these emissions have been much lower than the OECD average. However, owing to the important growth in emissions that took place over the 1990s, by 2002 CO_2 emissions per unit of GDP were only marginally lower than the OECD average.

Figure 6

Energy-related CO_2 Emissions per GDP in Turkey and in Other Selected IEA Countries, 1973 to 2010

(tonnes of CO_2 emissions per thousand US$ GDP using 1995 prices and purchasing power parities)



* excluding Belgium, Germany and Norway from 2003 to 2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; *National Accounts of OECD Countries*, OECD Paris, 2004; and country submissions.

CLIMATE CHANGE MITIGATION POLICIES

Turkey was a member of the OECD when the UNFCCC was adopted in 1992, and was therefore included among the so-called Annex I and Annex II countries. Under the convention, Annex I countries have to take steps to reduce emissions and Annex II countries have to take steps to provide financial and technical assistance to developing countries. However, in comparison to other countries included in these annexes, Turkey was at a relatively early stage of industrialisation and had a lower level of economic development as well as a lower means to assist developing countries. Turkey was not given a quantified emissions reduction or limitation objective in the Kyoto Protocol. Following a number of negotiations, in 2001 Turkey was finally removed from the list of Annex II countries but remained on the list of Annex I countries with an accompanying footnote specifying that Turkey should enjoy favourable conditions considering differentiated responsibilities. This led to an official acceptance of the UNFCCC by the Turkish Grand National Assembly in October 2003, followed by its enactment in May 2004. Turkey has not yet signed the Kyoto Protocol.

Throughout this process, the government carried out a number of studies on the implications of climate change and its mitigation. The first efforts were undertaken by the National Climate Coordination Group in preparation for the 1992 Rio Earth Summit. Following this, a National Climate Programme was developed in the scope of the UNFCCC. In 1999, a specialised Commission on Climate Change was established by DPT in preparation of the Eighth Five-Year Development Plan (2001-2005). The Five-Year Development Plan was the first planning document to contain proposals for national policies and measures to reduce greenhouse gas (GHG) emissions, and funding for climate-friendly technologies.

Following the ratification of the UNFCCC, a number of working groups were set up with the objective to define a climate change mitigation strategy and compile the country's first national communication to the UNFCCC. These included a working group on mitigation in the energy sector and a working group on mitigation in the transport sector. However, it remains unclear as to when the strategy and national communication will be completed. The strategy aims to reduce GHG emissions through the implementation of appropriate measures and the development of climate-friendly technologies. Energy efficiency and the development of renewable energy sources are two important components of the strategy. However, the strategy will not include any policies that directly target GHG emissions, such as carbon taxation or emissions trading. It also does not include a specific target for emissions reductions.

Nevertheless, Turkey has formally been accepted as an applicant to join the European Union and has begun a process of screening and "approximation", where domestic legislation is aligned with that of the EU but without full compliance. The Kyoto Protocol is a part of the EU's *acquis communautaire* and as such may lead Turkey to consider some form of emissions reduction requirement in the foreseeable future.

AIR POLLUTION

POLLUTION TRENDS

The main air pollutants related to the production and use of energy are sulphur oxides (SO_x) – in particular sulphur dioxide (SO_2), – nitrogen oxides (NO_x) and suspended particulates. These emissions come mostly from the combustion of solid and liquid fuels. The use of high-sulphur lignite in particular is an important source of air pollution.

As a consequence of efforts to move away from high-sulphur lignite to either imported coal or gas, air pollution concentration levels have reduced significantly in most large cities since the early 1990s. Table 2 shows total suspended particulates (TSP) and SO_2 levels in many Turkish cities since 1990.

However, concentration levels remain significantly higher than in cities in most other OECD countries[2] as well as, in most cases, above World Heath Organization (WHO) long-term standards (see Table 3). It is also likely that concentration levels in smaller cities where gas distribution networks have not yet been built are higher than in larger cities. In addition to this, even in cities where average air quality has improved, air quality mapping reveals that high concentration hot spots exist around heavily used roads, particularly to the west of the country, owing to higher vehicle-ownership density[3].

Table 2

Winter Season Air Pollution Trends in Turkish Cities

City	TSP (average μg/m³)				SO_2 (average μg/m³)			
	1990-1991	1999-2000	2002-2003	% change 1990/1-2002/3	1990-1991	1999-2000	2002-2003	% change 1990/1-2002/3
Ankara	107	84	76	–29%	218	66	56	–74%
İstanbul	151	63	..	..	315	57	..	..
İzmir	82	55	44	–46%	112	71	48	–57%
Bursa	139	58	68	–51%	329	76	68	–79%
Yozgat	75	31	24	–68%	186	145	138	–26%
Kütahya	111	118	148	33%	283	347	211	–25%
Erzurum	141	..	95	–33%	262	..	207	–21%
Zonguldak	130	126	114	–12%	89	81	121	36%
Afyon	111	113	67	–40%	114	119	69	–39%
Diyarbakır	201	111	132	–34%	285	110	125	–56%

Source: Ministry of Environment and Forestry.

In 2001, Turkey emitted a total of 2.08 Mt of SO_2, equivalent to 30.4 kg per capita. This is slightly below the OECD average, which at the end of the 1990s was 32.9 kg per capita. In terms of emissions per unit of GDP, Turkey emitted 5.5 kg per US$ 1 000 in 2001, among the highest levels in OECD countries where the average was approximately 1.5 kg per US$ 1 000. Electricity generation and industry are by far the largest contributors to SO_2 emissions in the country, representing respectively 65% and 21% of total emissions in 2001.

2. OECD: *Environmental Data Compendium*, 2002.
3. UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP): *Turkey Energy and Environment Review: Synthesis Report*, December 2003.

Emissions of NO_x totalled approximately 0.90 Mt in 2003, slightly below 2000 levels of 0.92 Mt. NO_x emissions have nevertheless been rising over the past decades. According to the OECD, over the 1990s only, NO_x emissions grew by 48%. On a per capita level, emissions were of 12.8 kg in 2003, substantially below the OECD average of approximately 40 kg at the end of the 1990s. On the other hand, emissions per unit of GDP were at 2.1 kg per US$ 1 000 in 2003, above the OECD average, which at the end of the 1990s was around 1.9 kg per US$ 1 000. Transportation, and predominantly road-based transport, is the largest source of NO_x emissions, representing 36% of total emissions. Electricity generation and industry represent over 20% each.

Under a reference scenario prepared for the World Bank[4], particulate matter and SO_2 emissions are expected to grow at about 2.2% per year, reaching in the case of SO_2 over 3.8 Mt in 2025. NO_x emissions are projected to grow at 3.5% per year.

ABATEMENT POLICIES

Air quality standards for four pollutants, namely SO_2, nitrogen dioxide (NO_2), particulate matter (PM) and ozone (O_3) are set under the 1986 Air Quality Protection regulation. As shown in Table 3, these standards are much less stringent than those set by the WHO. The monitoring of ambient air pollution has improved over recent years but remains a problem, particularly with regards to NO_2 and O_3.

Until recently, the 1986 regulation was also responsible for setting air pollution standards for combustion plants. It was amended in October 2004 by the new Industrial Air Pollution Control Regulation.

The regulation sets standards for the emissions of NO_x, SO_2, carbon monoxide (CO) and PM. NO_x and SO_2 standards have not changed compared to 1986 standards, while PM and CO standards have been lowered for both solid and liquid fuel-fired plants. In the case of PM, standards have been lowered from 150 mg/m^3 to 100 mg/m^3 for solid fuel-fired power plants. For CO, standards have been lowered from 250 mg/m^3 to 200 mg/m^3 in the case of solid fuel-fired plants and from 175 mg/m^3 to 150 mg/m^3 in the case of liquid fuel-fired plants.

Given the high sulphur content of domestic lignite, new lignite-fired power plants have been equipped with flue gas desulphurisation (FGD) technology in order to comply with the regulation. To reduce emissions from pre-1986

4. World Bank: *Turkey Energy and Environmental Review: Task 7: Energy Sector Modeling: Executive Summary*, prepared by Argonne National Laboratory, August 2002.

Table 3

Turkish and WHO Air Quality Standards

($\mu g/m^3$)

	Turkish standards		*WHO standards*	
	LTS	*STS*	*LTS*	*STS*
SO_2	150	400[a]	50	125
NO_2	100	300	–	150
PM_{10}	150	300	50	120
O_3		240[b]	100-200	–

$\mu g/m^3$: micrograms per cubic metre.

LTS: long-term standards (maximum annual average).

STS: short-term standards (maximum daily average).

PM_{10}: particulate matter with particles less than or equal to 10 micrometres (μm) in diameter.

– : not applicable.

[a] Turkey's ambient air quality standard for SO_2 on an hourly basis is 900 $\mu g/m^3$.

[b] This represents the maximum value allowable in any one-hour period. As Turkey does not have an LTS for O_3, this value can be compared to the WHO LTS.

Source: Ministry of Environment and Forestry.

lignite-fired power plants, these plants are progressively being retrofitted with FGD technology. At present, six out of eleven lignite power plants have been retrofitted. No schedule has been defined for the five remaining plants. As regards particulate emissions, both new and old power plants have been fitted with electrostatic precipitators (ESP). However, owing to technical problems, not all ESPs are working at maximum efficiency.

The Industrial Air Pollution Control Regulation sets limits and penalties for non-compliance with emissions standards for power plants and gives the Ministry of Environment and Forestry responsibility for plant authorisation and enforcement. Under the new regulation, the plant operators are responsible for continuous monitoring of stack emissions. Plant operators are also responsible for contracting with an independent authorised laboratory to provide compliance monitoring and plant-vicinity air quality assessments. This is a notable difference from the 1986 regulation where the Ministry of Health and the Ministry of Environment and Forestry shared monitoring responsibilities. The dual role of the government as owner and operator of most power plants on the one hand and as the air quality enforcement authority on the other has historically made the enforcement of air quality standards difficult. It is unclear whether giving plant operators emissions monitoring responsibilities, as well as the responsibility for contracting for compliance monitoring and air quality assessment, will provide sufficient independence to improve this situation. In addition, the enforcement capacity of the Ministry of Environment and Forestry is limited owing to resource constraints.

Table 4

Emissions Standards for Combustion Plants in Turkey 1986/2004 regulation

1986 regulation (mg/Nm³)									
	PM		*CO*	*NO_x*		*SO_2*			
						< 300 MW_{th}		> 300 MW_{th}	
	Old plants	New plants		Old plants	New plants	Remaining operating hours > 20 000	New plants	Remaining operating hours 20 000-50 000	Remaining operating hours > 50 000 and new plants
Solid fuel-fired plants	250	150	250	1 000	800	3 200	2 000	3 200	1 000
Liquid fuel-fired plants	110	110	175	1 000	800	3 200	1 700	1 700	800
Gas-fired plants	10	10	100	500	500	60	60	60	60

2004 regulation (mg/Nm³)					
	PM	*CO*	*NO_x*	*SO_2*	
Solid fuel-fired plants	100	200	800	2 000 (< 100 MW_{th}) 1 300 (100 MW_{th}-300 MW_{th})	1 000 (≥ 300 MW_{th})
Liquid fuel-fired plants	110-170 (≥ 15 MW_{th})	150	800	1 700 (%1 S[a]) and 2 400 (%1.5 S[a]) (< 100 MW_{th}); 1 700 (100 MW_{th}-200 MW_{th}h)	800 (≥ 300 MW_{th})
Gas-fired plants	10	100	500	60	

[a] Sulphur content (mass percentage) of the fuel used.

Note: "Old plants" and "New plants" refer to power plants built before and after the Air Quality Protection regulation came into force in 1986.

Source: Ministry of Environment and Forestry.

The emissions standards for power plants remain significantly less stringent than those currently in force at the EU level as defined by the revised Large Combustion Plants (LCP) Directive[5]. For example, for new solid fuel-fired power plants (authorised after 27 November 2003) with a thermal input greater than 300 MW, the NO_x emissions limit is set at 200 mg/Nm^3 at the EU level, while the NO_x emissions limit is 800 mg/Nm^3 in Turkey (see Table 4). The "approximation" process with EU legislation has important implications for the energy sector, particularly as regards the LCP directive and the Integrated Pollution Prevention and Control Directive[6]. A number of studies on how to comply with the EU LCP directive are under way. First estimates show that achieving the standards defined under the LCP directive would entail investments of over US$ 1 billion. This would include investments in the retrofitting of installed FGD and ESP equipment and the adoption of advanced and environment-friendly coal technologies. The 2004 Industrial Air Pollution Control Regulation is an important step towards aligning air quality standards with EU regulations, but more efforts will be needed.

Construction of one power plant based on circulating fluidised bed technology has recently been completed. The plant is the first application of advanced coal technology in Turkey and has been designed to use low-quality lignite with high sulphur content.

The industry and residential sectors are also responsible for significant air pollution, mainly as a result of lignite consumption. In order to reduce emissions from these sectors, the state-owned Turkish Coal Enterprises (TKİ) has developed significant lignite washing capacity. By the end of 2003, total washing capacity was approximately 10 Mt, equivalent to current coal demand from both sectors. In addition, the use of high-sulphur coal in residential heating is prohibited. Lastly, the substitution of gas as distribution networks are expanded in urban areas should further contribute to reduce air pollution.

In the transport sector "the Gasoline and Diesel Oil Quality Regulation" was enacted in June 2004. It provides the necessary arrangements for harmonisation of the gasoline and diesel oil standards with the most recent EU standards (Euro 5)[7]. While the directive specifies a transitional period between 2005 and 2009 for full compliance with the new standards, in the Turkish regulation the transitional period only starts in 2007.

5. Directive 2001/80/EC of the European Parliament and of the Council on the Limits of Emissions of Certain Pollutants into the Air from Large Combustion Plants.
6. Council Directive 96/61/EC of 24 September 1996 Concerning Integrated Pollution Prevention and Control.
7. As set out in Directive 2003/17/EC further amending Directive 98/70/EC on the quality of petrol and diesel fuels.

In the first half of 2004, unleaded gasoline represented 73% of total gasoline sold while the share was only 63% in 2003. This reflects the increasing proportion of the car fleet being fitted with catalytic converters. It is forecasted that by 2012, the entire car fleet will be fitted with such converters. Since 2000, all imported and domestically produced new automobiles are equipped with catalytic converters and Euro 2 standards are in place. The government also promotes the use of unleaded gasoline through a preferential pricing policy. Finally, the government is in the process of upgrading İzmit and İzmir refineries through the construction of hydro cracking and isomerisation units. The rehabilitation project is planned to be concluded by the end of 2007. Kırıkkale refinery already complies with current and post-2005 EU regulations on petroleum quality for both leaded and unleaded gasoline.

As regards diesel, new desulphurisation units are under construction and are planned to be operational in three major refineries so as to comply with the EU standards by 2007, as envisaged in the 2004 regulation.

In parallel, the Ministry of Industry and Trade has issued regulations in 2003 in order to transpose into national law the EU directives related to vehicle standards for emissions of gaseous pollutants.

MARINE POLLUTION

Marine pollution in the Black Sea and the Marmara Sea caused by the transport of oil and gas is a serious issue for Turkey. The Strait of İstanbul is a particularly sensitive zone. It is 32 km long, with İstanbul, a city with a population of approximately 13 million people, situated on both sides of it. It is less than one kilometre wide at the narrowest point and is characterised by numerous sharp bends. Commercial shipping through the Turkish Straits (namely, the Strait of İstanbul and the Strait of Çanakkale; see Figure 1) is regulated by the 1936 Treaty of Montreux, which guarantees free navigation. Total traffic through the Straits has increased steadily, reaching on average 20 000 vessels per year between 1970 and 1996. Traffic increased significantly, however, after the opening of the Main-Danube canal reaching the current level of approximately 50 000 vessels per year, of which around one-tenth are oil and liquefied natural gas (LNG) tankers. This led to a rise in the number of accidents. One of the most significant took place in 1994 and led to the death of 30 people and the spilling of 20 000 tonnes of oil into the Turkish Straits. Following the accident, Turkey tightened safety regulations on ships passing through the Turkish Straits. This includes requiring ships carrying hazardous materials to report to the Ministry of Environment and Forestry with 24 hours advance notice as well as retaining the right to close the waterways to other traffic when large vessels are passing through or during bad weather conditions. In addition, a modern vessel-tracking system has recently been installed.

In 1992, the Convention on the Protection of the Black Sea against Pollution was signed and by early 1994 was ratified by all six Black Sea countries. The convention has a number of specific protocols, including one on the control of land-based sources of pollution, one on the dumping of waste and another on joint action in the case of accidents (such as oil spills). In addition, a protocol on the protection of biodiversity and marine living resources has been signed by Turkey, Romania and Bulgaria. An annual Black Sea Pollution Monitoring Project was launched in 2004 and the Environmental Master Plan and Investment Strategy for the Marmara Sea Basin Project is currently being developed with the support of the European Investment Bank.

ALTERNATIVE TRANSPORT FUELS

The government considers alternative transport fuels to be an important option in the longer term to mitigate energy security concerns and reduce GHG emissions. However, it deems current technologies to be expensive and a risky investment, while not offering significant life cycle GHG reduction benefits, especially if the fuel is derived from fossil fuels.

Liquefied petroleum gas (LPG) demand in transport increased between 1998 and 2000 owing to a government subsidy and a zero-taxation policy. The trend was subsequently reversed in 2001 with an increase in taxation and the removal of the subsidy. Nevertheless, LPG remains an important transport fuel as its share was 8.9% of the total oil product demand in the transport sector in 2002. LPG is used, for example, in taxis in the major cities.

In Ankara, there are 30 buses operating with hybrid fuels (diesel and natural gas) and in İstanbul about 100 buses run on natural gas. Two demonstration projects are under way by the İstanbul Technical University (İTÜ) and Marmara University on the use of compressed natural gas (CNG) in public buses. The İTÜ project demonstrates the use of hybrid vehicles and the Marmara University project the conversion of engines for the use of natural gas.

The government is in the process of drafting an energy efficiency law, which will include provisions for the use and promotion of biofuels; the draft renewable energy law does not cover biofuels. The government is considering the introduction of tax benefits to promote biofuels. Another promotional provision will be a 1% biofuel supply obligation, which will be introduced for the oil distribution licence holders.

Biofuels as well as fuel cells and hydrogen technologies are among the priority areas of government-funded energy R&D (see Chapter 11).

CRITIQUE

CLIMATE CHANGE

Turkey has actively followed developments in the international climate change mitigation process since its inception and the country's ratification of the UNFCCC in 2004 is a positive step.

The government is in the process of developing its Climate Change Strategy and first national communication to the UNFCCC. In this context, the government should strive to define a sound framework to monitor the effectiveness of the policies and measures defined in the strategy, both in terms of costs and emissions reductions. Co-ordination among the various government bodies, and in particular between the Ministry of Environment and Forestry and the Ministry of Energy and Natural Resources, will be key to the success of the strategy.

The strategy and first national communication are important elements in defining the position of the country with regard to future steps. Turkey may reject adopting a binding emissions reduction target in the near term on the grounds of relatively low levels of economic development and emissions per capita compared to other OECD countries. On the other hand, the government could adopt a more proactive stance and decide to define an emissions target. The latter could take a number of forms. Turkey could officially join the Kyoto Protocol process for the second commitment period. Turkey could also choose to define a non-binding target, either in terms of absolute emissions or relative to economic activity. This would also contribute to managing the rapid growth of energy demand, which could become a security concern in coming years. In any case, adopting an emissions target in the near term would send a strong signal to the international community, reflecting Turkey's leadership in moving countries which have previously rejected an emissions target on economic grounds to take some form of commitment.

AIR POLLUTION

Turkey has made significant progress in reducing local air pollution, particularly in large cities. Nevertheless, significant efforts still need to be made to ensure existing standards are met and to prepare for further reductions in air pollution.

Monitoring and enforcement of pollution standards remains a problem in Turkey. Responsibilities between the Ministry of Environment and Forestry and the Ministry of Energy and Natural Resources need to be clarified to ensure an efficient enforcement process. Resources, in terms of staff, equipment and training may need to be increased. In the case of the power generation sector, the Ministry of Energy and Natural Resources should affirm its position in

making the enforcement of existing pollution standards for power plants an absolute priority. In the transport sector, the role of the Ministry of Transport with regard to air pollution should be clarified.

Turkey has made progress since the last in-depth review to retrofit old (pre-1986) coal power plants with FGD and ESP technologies. Nevertheless five power plants still need to be retrofitted. The government should make the retrofitting of these power plants a priority and define a precise schedule to complete this process as soon as possible, taking into account the remaining lifetime of the power plants.

Efforts to align air pollution regulation with EU standards are commendable. However, the correlation between this process and efforts to liberalise the power generation sector should be assessed carefully. The potential long-term impacts of the liberalisation process on air pollution and on GHG emissions should be investigated and monitored in order to optimise policy outcomes. For example, one likely effect of the liberalisation of the gas and power sectors is the accelerated uptake of gas in power generation and in the residential sector, which would have significant positive implications for both air pollution and GHG emissions. However, the extent of this uptake remains uncertain and depends on a number of factors such as the extension of the gas distribution network and developments in the coal industry.

The recent construction of a power plant based on fluidised bed combustion technology is laudable. Further adoption of such cleaner coal plants and more efficient technologies would help Turkey meet more stringent air pollution standards.

Turkey has made significant efforts to accelerate the penetration of unleaded gasoline in the transport fuel mix, define regulations in line with the latest EU fuel and vehicle standards and upgrade existing refineries. The smooth transition to the higher fuel/vehicle quality standards between 2007 and 2009 as planned in the regulation will depend on the completion of the refinery rehabilitation works and the progressive upgrade of the country's vehicle fleet. The government should continue to carefully monitor developments on both fronts and define contingency measures in case of unforeseen developments.

MARINE POLLUTION

The tanker traffic through the Turkish Straits has increased to unsustainable levels over the past decade and efforts from Turkey to enhance the security and better manage associated risks are positive. The government should continue to co-operate with other Black Sea countries and increase the involvement of large oil and gas-importing countries. The country should also continue to seek alternative transportation routes.

ALTERNATIVE TRANSPORT FUELS

The tax benefit and subsidies given to LPG in 1998-2001 proved successful while lifting them led to the decline of LPG use in the transport sector. Given the environmental benefits of LPG as compared to, for example, diesel in local air pollution, the possibility of re-introduction of the tax benefit warrants attention. It is positive that the government is considering promotional measures, such as tax benefits, to promote biofuels in the transport sector.

RECOMMENDATIONS

The Government of Turkey should:

- *Complete the national climate change mitigation strategy and first national communication to the UNFCCC as soon as possible.*
- *Define a framework to monitor and evaluate, in terms of costs and carbon emissions, the effectiveness of the policies and measures included in the national climate change mitigation strategy.*
- *Build on the momentum created by the ratification of the UNFCCC to consider defining an emissions target.*
- *Clearly define the roles of the different ministries and agencies involved in air quality monitoring and enforcement.*
- *Ensure the Ministry of Environment and Forestry has adequate resources to monitor and enforce environmental legislation.*
- *Ensure that all market operators, including those owned by the State, comply with the existing air quality and emissions legislation.*
- *Put in place a clear investment schedule to complete the retrofitting of FGD equipment on all old power plants.*
- *Clearly define a schedule for the introduction of the new legislation on air quality standards giving clear signals to market participants.*
- *Clearly define how responsibilities are shared among ministries and municipalities with regard to transport-related air pollution and encourage co-operation.*
- *Continue efforts to reduce the risk of marine pollution in the Black Sea and Marmara Sea, notably through enhanced co-operation with countries bordering the Black Sea and with large fossil fuel-importing countries.*
- *Consider the reintroduction of tax benefits for LPG.*

ENERGY DEMAND AND END-USE EFFICIENCY

DEMAND TRENDS

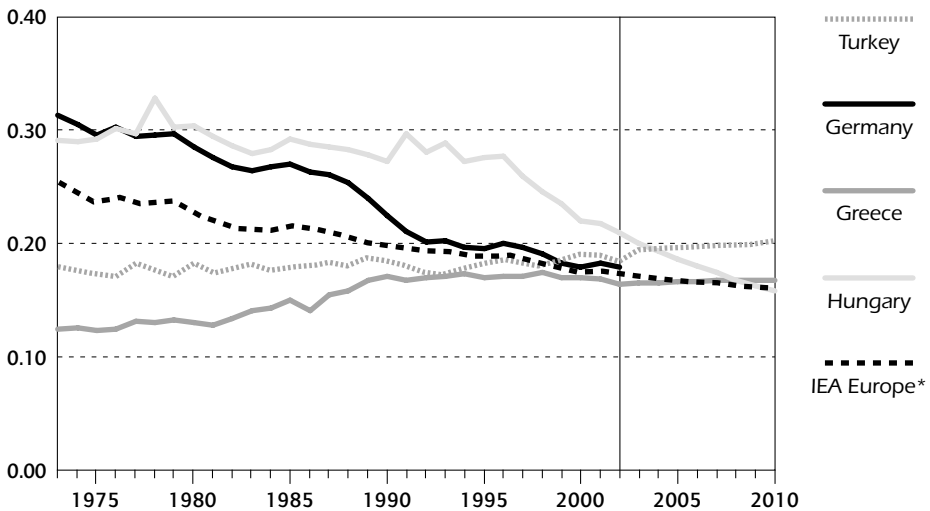
In Turkey, energy intensity has been relatively steady for the last two decades (see Figure 7). At 1.18 tonnes of oil equivalent (toe), the per capita TPES is much lower than the average among IEA member countries (5.09 toe in 2003) but it is projected to continue its growth while the IEA average declines.

Total final consumption (TFC) was 64 Mtoe in 2003, up by 54% from the 1990 level. In 2003, oil accounted for 41% of TFC, electricity 15%, coal 21%, combustible renewables and wastes 9%, natural gas 12%, geothermal 1.2% and solar and wind 0.5%, as shown in Figure 8. The share of oil and the combustible renewables and waste (largely non-commercial energies) has declined since 1990 whereas the use of gas, electricity and to a smaller extent coal has increased.

Figure 7

Energy Intensity in Turkey and in Other Selected IEA Countries, 1973 to 2010

(toe per thousand US$ at 1995 prices and purchasing power parities)



* excluding Belgium, Germany and Norway from 2003 to 2010.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; *National Accounts of OECD Countries*, OECD Paris, 2004; and country submissions.

As shown in Figure 9, in 2003, the industry (including non-energy use of 2 Mtoe) was the largest energy-consuming sector (45%), followed by the residential sector (31%), transport (19%), and "other" sectors, namely commercial, public service and agricultural sectors (4.8%). Since 1990, the share of industry in TFC has increased while the share of transport, residential and "other" sectors has declined.

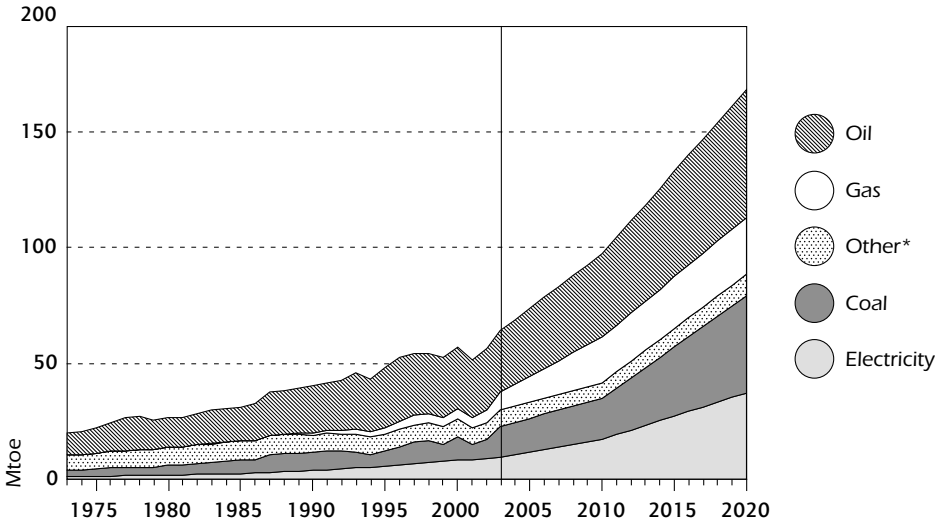
The structure of industry in Turkey is energy-intensive. The iron and steel sector is the biggest energy consumer among the industrial sectors (3.3 Mtoe in 2003), textile and leather industries (1.5 Mtoe) and chemicals and petrochemicals (2.2 Mtoe excluding feedstock); the cement industry is also among the largest industrial energy consumers. Industrial energy consumption (including non-energy use) more than doubled between 1990 and 2003 reaching 29 Mtoe (see top chart in Figure 10). Industrial production grew over the same period by 49.5%. The government estimates that industrial energy consumption will increase by 53% from 2003 to 2010. The sector consumes large amounts of coal (39.5% of sectoral demand) and oil (29.6%) followed by electricity (15.4%), gas (15.1%) and other fuels (0.4%).

Energy consumption in the transport sector grew by 29% between 1990 and 2003, reaching 12.4 Mtoe (see bottom chart in Figure 10). For the period from 2003 to 2010, the government expects a 61% increase in energy use in this sector. There are about 67 cars per 1 000 inhabitants in Turkey but regional variations are large; whereas, for example, in the Marmara Region the car density is 90 per 1 000 people, in Eastern and South-Eastern Anatolia the density is only 20 per 1 000 people. Road has been the dominant means of transport for decades; during 1996-2000 about 96% of passenger transport occurred on roads. The share of road in freight transport is about 90% and rail 5%. Freight transport volumes have been increasing by almost 8% per year. Detailed statistics and trends for the number of vehicles, mileage and the share of different modes of transport are not available because statistics in the transport sector are not carried out regularly. The last statistics on the transport sector were issued in 1998 but the quality was so poor that they were not published.

Between 1990 and 2003, energy consumption in the other sectors (residential and commercial) increased by 31% reaching 22.6 Mtoe (see middle chart in Figure 10). There are several reasons for the growth, including rising living standards and the 5% annual growth rate in the building stock. Households use various fuels for heating, including coal (both indigenous and imported), natural gas, oil and geothermal, but biomass is still the dominant fuel. The government is encouraging switching to natural gas where it is available. Solar energy is used increasingly for hot water supply in households. As living standards rise, the use of electrical appliances is climbing fast and driving electricity demand up rapidly. Energy demand is increasing particularly quickly in the services sector. In 2002, it increased 4.5-fold compared to 1990. In the

Figure 8

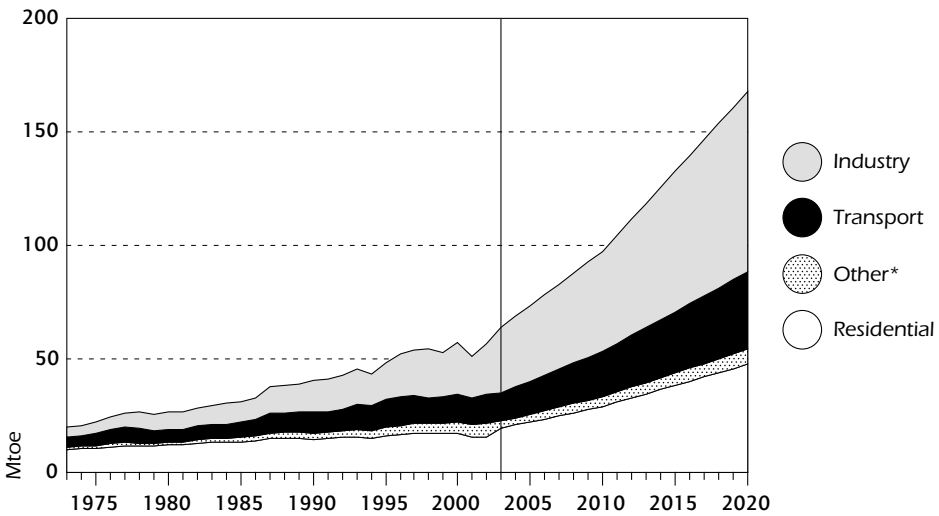
Total Final Consumption by Source, 1973 to 2020



* includes geothermal, solar, wind, combustible renewables and waste.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; and country submission.

Figure 9

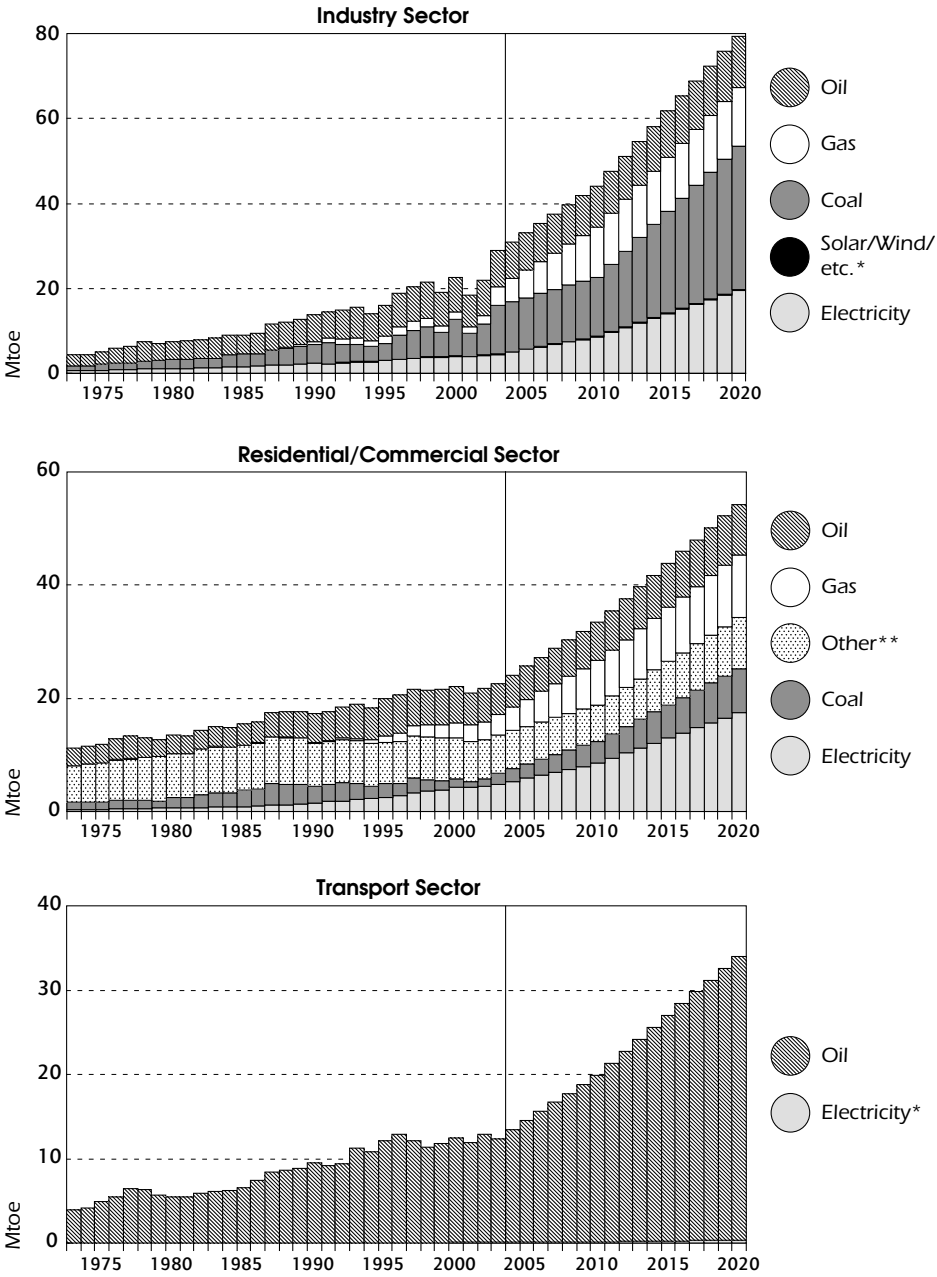
Total Final Consumption by Sector, 1973 to 2020



* includes commercial, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; and country submission.

Figure 10

Total Final Consumption by Sector and by Source, 1973 to 2020



* negligible.

** includes geothermal, solar, wind, combustible renewables and waste.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; and country submission.

residential and services sectors, more than 80% of the energy consumed is used for heating. For the period from 2003 to 2010, the government expects 48% growth in energy demand by the "other" sectors.

ENERGY EFFICIENCY POLICY

CROSS-CUTTING ACTIVITIES

The government recognises the potential of energy efficiency in meeting its goal of satisfying demand while not hampering economic growth and protecting the environment. The government's studies have demonstrated that Turkey has a 25-30% energy conservation potential.

The Energy Resources Survey Department of the EİE, which is part of MENR, was nominated as the National Energy Conservation Centre (NECC) in 1992. In addition to energy efficiency, it also works in the area of renewables. NECC has a total staff of about 870 of which about 640 work in the central office and about 230 in local offices. The EİE/NECC's budget for energy efficiency activities was US$ 0.6 million in 2003. These activities include the following:

- Training consumers on energy conservation measures and raising consumer awareness on energy efficiency.
- Preparing energy efficiency publications for all sectors.
- Conducting energy audits in industry.
- Consultation process with the industrial and building sectors in the formulation of energy efficiency measures.
- Maintaining energy manager databases and energy consumption statistics for the industrial sector and public buildings.
- Co-ordination of the dialogue and co-operation with the related governmental institutions, private sectors, universities, research institutes and manufacturing associations within the Energy Conservation Coordination Board.

MENR recognises that it is not sufficient that only the EİE/NECC deals actively with energy efficiency policies and measures because energy efficiency has horizontal aspects in many sectors that are the responsibilities of other ministries. It has therefore concluded that co-operation and co-ordination of energy efficiency measures between the main stakeholders and institutions have not developed adequately and are hampering the establishment of an efficient policy. MENR considered it necessary to develop a comprehensive energy efficiency strategy to address these problems. The Energy Efficiency Strategy was adopted by the Minister of Energy and Natural Resources in June 2004.

MENR is preparing new legislation to set a framework for the development and implementation of the Energy Efficiency Strategy, and the new Energy Efficiency Law is planned to be issued in early 2005 (see the box). Prior to the introduction of the new law, Turkey has had no general legal framework for energy efficiency matters and the current activities are carried out in accordance with a few regulations issued by MENR and the EİE/NECC.

Draft Energy Efficiency Law

The objective of the law is to increase the efficient use of energy and energy resources to reduce the burden of energy cost on the economy and to protect the environment.

The main strategies of the law are:

- **Increasing energy efficiency awareness.** The EİE/NECC and universities will provide training for energy managers and the staff of future energy service companies (ESCOs). Later on, energy manager courses could be organised by the ESCOs. Public organisations will be obliged to provide training for their own personnel. The general public will be informed about energy efficiency through professional associations, chambers, unions, manufacturing associations, state and private primary and high schools and the media.
- **Improving administrative structures for energy efficiency services.** An Energy Efficiency Coordination Board (EECB) will be established to carry out energy efficiency activities nationally and to monitor the results. The EECB will include representatives from all the relevant ministries and the EİE/NECC will work as its secretariat. To increase energy efficiency in industry and residential buildings, a wide network of public and private organisations will be engaged to conduct site surveys, audits and training for energy managers. Third-party financing will be introduced for all sectors and voluntary agreements will be introduced for industrial plants. It is planned to set up the financial sources mechanisms for the energy efficiency investments.
- **Promotion of renewable energies, including biofuels.** This addresses the government energy policy objectives to increase the use of domestic energy resources.

The law will include several specific policies and measures:

- Energy manager obligation will be extended to non-industrial establishments, including public and commercial buildings exceeding a certain size.

- Industries, buildings and public organisations whose energy consumption or size exceeds a certain threshold must report their energy consumption annually to the EİE/NECC to facilitate its preparation of energy efficiency analysis and forecasts.
- Public awareness will be increased through the channels described above.
- Electricity and natural gas distribution companies will be obliged to provide more informative invoices for the consumers as well as information on energy efficiency organisations they can consult to improve their energy efficiency.
- Tax incentives, subsidies and soft loans will be given to industry for energy efficiency investments; VAT exemptions will be provided for energy-efficient household appliances and equipment used in buildings; and subsidies will be provided for biomass-based co-generation.

Source: MENR.

One of the strategy's main objectives is to provide a roadmap for harmonisation of Turkish legislation and regulation with the relevant EU *acquis*. It also focuses strongly on supporting the governmental and local administrations in defining and implementing rational energy policies and assisting final consumers in achieving better energy efficiency. The strategy does not yet include specific quantitative targets for energy efficiency in the different end-use sectors. However, the EİE/NECC has been assigned to further develop and update the strategy under the supervision of MENR.

Following on from the strategy, the Improvement of Energy Efficiency in Turkey project has started. Under this project, twinning activities, which will start with France's Agency for the Environment and Energy Management (ADEME) and the Netherlands Agency for Energy and the Environment (NOVEM) at the beginning of 2005, will continue for almost two years. Twinning will concentrate mainly on three topics, namely strengthening of the legal and institutional framework, assessing energy saving potential and identifying barriers, while planning support to implementation.

Turkey ratified the Energy Charter Treaty and the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects in February 2000. Some of the main objectives of these international agreements are to maximise energy efficiency and to protect the environment. In this context, efforts have been made to develop policies and programmes to increase energy efficiency and establish an appropriate legal framework; the development of the new Energy Efficiency Law is part of this process. In 2003, the Energy Charter Secretariat reviewed Turkey's energy efficiency policies[8].

8. Energy Charter Secretariat: *In-depth Review of Energy Efficiency Policies and Programmes*, 2003, http://www.encharter.org/upload/9/191168308480105864820197165782059864745101358879f1662v1.pdf.

Various donors, such as the United Nations Industrial Development Organization (UNIDO), the World Bank, the EU, the GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) and the Japan International Cooperation Agency (JICA) have provided financing for energy efficiency projects and programmes in Turkey (see sections on Industry and the Residential and Services Sectors). These activities were mostly technical in nature and focused on energy audits, staff training and energy efficiency policy development. Turkey has been eligible to receive EU financing only since 2002 and the financial assistance from EU sources has so far been limited with the exception of financing the Energy Efficiency Strategy.

There are no direct tax incentives to encourage end-use energy efficiency, nor any other kind of direct financial incentives. There exists, however, an Investment Encouraging Programme that encourages investments, especially in less developed regions, and a regime of aid to small and medium-size enterprises. Energy saving is not covered specifically by these initiatives, which aim to encourage productive investment, but they do have an indirect positive impact on energy efficiency through, for example, manufacturing of energy-efficient equipment.

INDUSTRY

In November 1995, MENR issued a regulation in order to increase energy efficiency in industry. Consequently, all industrial establishments consuming more than 2 000 toe per year must establish an energy management system. The regulation affects some 600 industrial establishments, which represent 70% of total industrial energy consumption in Turkey. These facilities must also do audits to determine their energy saving potential. The regulation will be updated in 2005 to align it better with the EU legislation.

The EİE/NECC has been performing energy audits itself and through two certified companies in various industrial plants since 1990. The audits have usually been carried out by a team of engineers over a period of one or two weeks. To date, approximately 100 detailed audits and pre-audits have been conducted in different industrial sectors, partly financed by JICA. However, there have been some difficulties, causing delays in the implementation of the audit results by industrial companies. A good monitoring system to overcome this problem does not yet exist; however the EİE/NECC does maintain a close relationship with industries on an informal basis.

Industrial energy manager courses began in 1997 and are now provided by four organisations in different parts of the country. The government expects training, together with effective energy management systems in factories, to save about 10% in industrial energy use. JICA is supporting this activity until 2005. Among other things, this project has involved technical assistance on

industrial energy efficiency, equipment donations, the establishment of an Energy Efficiency Training Centre, building a model plant[9] and improving the energy manager courses. The US$ 2.1 million model plant was opened in October 2001. Eighteen energy manager courses have been organised in this training centre and 282 engineers were trained in the 2002-2004 period, in addition to the several hundred engineers trained before the JICA project. Engineers from other countries in the region also come to the training centre with financing from international organisations, including JICA.

The EİE/NECC has a number of activities for raising awareness on energy efficiency in industry. These include operating a training bus, providing free publications, preparing technical manuals for energy managers, organisation of national and international conferences, seminars and workshops, and granting energy conservation awards to companies.

ESCOs are not active in Turkey. The main problems appear to be a lack of appropriate regulation and Turkey's high inflation. Industrial co-generation is common in Turkey (see Chapter 10).

RESIDENTIAL AND SERVICES SECTORS

Approximately 10% of buildings have roof insulation and/or double-glazing; however, 70% of new buildings have double glazing. The first mandatory standards for heat insulation for buildings were adopted in Turkey in 1985. In 1998, the standards were strengthened and in June 2000, their implementation was made mandatory. Heat loss limits from the building envelope have been reduced by half compared with old standards. The standards divide Turkey into four climatic zones and must be implemented if large-scale renovations are carried out in existing buildings. In May 2000, the standards were complemented by the Regulation on Heat Insulation in Buildings, which sets limits for annual heating energy requirements of buildings – also differentiated according to the climatic zones. This regulation also obliges new buildings to possess an energy certificate that shows its energy consumption per square metre and cubic metre.

In accordance with the circular entitled "Measures to be taken by governmental organisations and institutions in order to reduce their energy consumption" issued by the Prime Minister in 1997, all governmental organisations have prepared annual reports on energy consumption in their buildings. These reports are evaluated by the EİE/NECC. In 1999, information concerning 2 037 governmental buildings were evaluated and the reporting activity continues. According to the evaluation results, the energy

9. This small model factory includes industrial equipment such as a boiler, a furnace, an air pressure system, fan and pump systems and lighting.

consumption in these buildings was high, exceeding 250 kWh per m^2. While 48% of public buildings had double glazing, 40% roof insulation and 17% automatic heating control systems, the energy efficiency improvement potential in public buildings was estimated at 30%. In order to analyse incoming data more efficiently and to enhance monitoring, a software programme is being developed within a project conducted by the German company GTZ.

Energy efficiency labels for consumer appliances have been introduced by the Ministry of Industry and Trade within the harmonisation programme for EU directives. They cover refrigerators and freezers and their combinations, washing machines and dryers and their combinations, dishwashers and lamps. A labelling system for air-conditioning has been proposed by the ministry but it is awaiting parliamentary approval. Energy efficiency regulations are in place for new hot water boilers, refrigerators and freezers and their combinations and are being prepared for street lighting

Boilers and stoves using wood, coal or fuel oil must have a certificate based on a test of heat efficiency. The certificates are issued jointly by the Ministry of Industry and Trade and the Turkish Standards Institute.

A three-year technical co-operation project, "Efficient Use of Energy in the Building Sector", with the German government was launched in November 2002. The project aims to establish an energy efficiency unit in the Erzurum municipality (Eastern Anatolian region) and will include training programmes, energy efficiency policy studies for cities, preparation of standards and regulations for energy efficiency and reduction of local pollution. Pilot demonstration projects will be carried out to provide the necessary input for developing the related legal arrangements for heat insulation and efficient use of energy.

TRANSPORT

The development of a transport master plan was initiated in 2003 as mandated by the Eighth Five-Year Development Plan (2001-2005). The objective of the master plan will be to improve the balance among the different transport modes and to establish a transport infrastructure in harmony with the needs of the national economy and social life. The master plan will develop laws, regulations and standards for energy use and emissions in the transport sector and improve inter-ministerial co-operation and co-ordination. The plan will be completed by March 2005.

In order to reduce local air pollution, traffic congestion and energy consumption, new projects have been implemented by the large municipalities at their own financing. These include improving the public bus transport

service and extending the subway, light rail and light tram networks. At present, Ankara and İstanbul have subways and İstanbul is extending its tramway system.

The Regulation for Protecting Air Quality was issued in 1992 to reduce air pollution from road transport by mandating annual emissions inspections for all motor vehicles and in connection with the sale of used vehicles. (See Chapter 4 for information on EU standards for vehicles.)

The high maintenance cost and fuel consumption of old vehicles makes them uneconomical to use. In order to decrease the use of old cars with non-efficient engines, a new law to provide incentives for scrapping old cars was passed in July 2003. By July 2004, 120 000 vehicles had been scrapped and tax deductions of US$ 250 million had been given away as incentives. The programme ended in 2004.

The government plans to increase the number of modern locomotives and the length of electrified rails. The government foresees that the share of rail will increase to 13% for freight transportation and to 7% for passenger transportation between 2005 and 2009 through 18 new railway construction projects, such as the İstanbul tube transit pass and the Ankara-İstanbul rehabilitation project. It also plans to increase the service efficiency of the public railway company and to reduce its losses.

MONITORING AND ASSESSMENT

Monitoring of energy efficiency policies in Turkey is weak because of a lack of expertise. Turkey has therefore been keen to benefit from international co-operation in this field, in particular participating in related EU programmes.

Although a regular or systematic nationwide energy efficiency monitoring system does not yet exist in Turkey, certain statistical studies have been carried out by the EİE/ENCC and the State Statistical Institute to analyse energy consumption patterns in the different sectors. Surveys in the late 1990s in the industrial sector indicated that the energy savings potential in this sector was almost 24% of the sectoral demand. The cost of achieving this potential was estimated at US$ 2.3 billion while the monetary benefit was estimated at US$ 1 billion in 1996 prices. The EİE/NECC has developed an Energy Managers Database to follow up energy management activities in the industry. According to the database, since 1997 almost all industrial facilities have adopted energy conservation measures.

Household surveys among 11.5 million residential buildings in 1998-2000 showed that 10% of buildings had roof insulation and 9% double glazing; information was collected also on fuel and electricity consumption and heating systems. The results were used in the updating of the new building standards.

CRITIQUE

Energy intensity in Turkey has been stagnant and above the IEA average. Furthermore, it is estimated to increase whereas the IEA average is declining. While this is partly attributable to increasing living standards, and similar trends can be observed in other countries in the same stage of development, this is a matter of concern which requires constant monitoring and the introduction of strong policies and measures. To date, Turkey has used a relatively limited portfolio of measures to pursue energy efficiency because the main emphasis has been in ensuring adequate supply.

The government has estimated Turkey's energy saving potential at 25-30% of its energy consumption. To exploit this potential, an Energy Efficiency Strategy was developed in 2004 and the government is preparing an Energy Efficiency Law. These are positive developments, which can lift the status of energy efficiency and conservation as part of the government's energy policy. It is important that the new law is introduced without delay and that adequate resources are provided to support its implementation. While the strategy includes many important measures in all the sectors for the improved co-ordination and collaboration between the different stakeholders, it does not include quantitative targets at the national or sectoral levels. Such targets would help in monitoring and evaluating the effectiveness of the policies and measures. Furthermore, while some analysis on the cost-effectiveness of energy efficiency improvements has been conducted in the industrial sector, comprehensive consideration of the cost-effectiveness of policies and measures had not yet been included in the strategy.

Most of the relevant EU *acquis* for energy efficiency in the residential and services sector (energy standards and labelling for electrical appliances, standards for boilers, building codes for new buildings, etc.) have already been transposed to the domestic legislation and the strategy provides the implementation schedule for finalising the process. In the transport sector, the EU's car efficiency labels and fuel economy targets remain to be adopted and a competent agency needs to be assigned to establish the standards and monitor compliance.

Although there are currently no specific financial or fiscal incentives to promote energy efficiency, the draft Energy Efficiency Law does include tax reductions, soft loans and grants for various purposes and promotes third-party financing and voluntary agreements. These measures can remove some of the barriers to energy efficiency improvements, but the cost-effectiveness of these measures should be evaluated.

One specific hurdle for fully exploiting Turkey's energy saving potential is the energy prices, which have not been based on cost for all consumer groups. Setting energy prices at levels below costs (including externalities) encourages the inefficient use of energy and makes energy efficiency investments less

profitable. Every effort should be made to eliminate the cross-subsidies as quickly as possible. It is encouraging that it has been announced that the process will begin in the electricity sector in 2005. Another positive development is that the free delivery of electricity to some consumer groups has been stopped. However, cross-subsidies still remain in the gas sector.

Noting that energy consumption in the industrial sector is expected to grow rapidly, stronger policies beyond those contained in the Energy Efficiency Law appear necessary. Introducing specific fiscal and financial incentives, as proposed by the new law, can help but attention should be paid to their cost-effectiveness and care needs to be taken to avoid supporting such investments in the industrial sector, which would be implemented without any incentives. Third-party financing, including ESCOs, can help but a prerequisite for the effectiveness of this measure will be cost-reflective energy prices. There appears to be scope for a greater use of auditing in the industrial sector.

Voluntary agreements with the industry sector have worked successfully in some IEA member countries. Key elements of a successful voluntary agreement include adequately ambitious, specific and measurable targets, careful monitoring and incentives to enter the agreement to gain large coverage. Typically, entering the agreement is voluntary but once the industrial facility enters, it becomes binding. Different countries have introduced different incentives to encourage the industry to enter the agreements. Such incentives have included reimbursement of certain energy and environmental taxes, promises not to increase energy taxes for industries that enter the agreements and meet their targets, subsidised energy audits and, recently, the provision of more emission credits in the EU emissions trading scheme for industries that have taken early measurable action.

Surveys show that there is also ample potential for energy efficiency improvements in the public sector, particularly public buildings. It appears that the good auditing initiative has not been followed by concrete implementation measures to exploit this potential.

Good initiatives have been taken to develop stronger building codes, which have also been made mandatory. If implemented conscientiously, the new stricter codes can bring about a significant improvement in energy efficiency in new residential and commercial buildings. However, it appears that, despite considerable efforts, enforcement of the codes has not been entirely successful given that, for example, only 70% of new buildings have double glazing. The energy efficiency review team of the Energy Charter Protocol (September 2002) identified three obstacles which have contributed to the problem. First, consumers have other priorities than insulation owing to their low income levels. In addition, not all buildings in big cities are licensed and registered. Finally, there is often no individual metering of heating energy in

apartment buildings with central heating. With all due regard to these obstacles, the codes should still be enforced up to the utmost practicable extent.

Most of the heating energy is consumed in existing buildings because the building stock is renewed slowly. Therefore, the introduction of mechanisms to improve energy efficiency in existing buildings is essential to speed up energy efficiency improvement in buildings. The extension of the new mandatory building codes to refurbished buildings makes a contribution. However, there may be a need to develop incentives to undertake refurbishment.

Turkey has adopted the EU standards for major appliances and boilers and implemented labelling of white goods in line with respective EU directives. However, the EU directives have not been updated for a considerable time and no longer represent world best practices. Furthermore, there have been no studies and there are no specific policies and measures in place for space cooling. Given the relatively warm climate in many parts of Turkey, the use of air-conditioning is likely to increase rapidly together with increasing living standards. To minimise the growth of electricity demand for air-conditioning and other electrical appliances, all equipment in the market should be as efficient as possible. In this respect, world best standards should be applied.

There seems to be no comprehensive and co-ordinated energy efficiency policy for the transport sector. Better statistics would help in developing appropriate policies and measures, and in monitoring their effectiveness. It also appears that there is considerable room for improvement in interdepartmental co-ordination among the different ministries responsible for transport, private cars, taxation and energy policy.

Energy demand in the transport sector has been increasing more slowly than the economy and car ownership is still relatively low compared to other IEA member countries. However, experience in other countries has shown that together with increasing income levels, car fleet can start to grow very rapidly. Therefore, it is important that efforts are made to decouple demand growth from economic growth, which is one of the key measures used in transport policy to curb demand. The various possibilities to do this should be fully explored. The options include: slowing down passenger and freight transport activity growth; a modal shift towards more energy-efficient modes, such as rail transport or public road transport; promoting public transport by providing funding to cities; promoting non-motorised transport modes together with pedestrian areas and strict parking rules; and enforcing and improving the fuel efficiency of the car fleet. Transport policy should contribute to energy and environmental policy objectives through, for example, better traffic management and decreasing empty trips by trucks while improving transport services through reduction of congestion.

The Turkish transport system relies heavily on road transport while the share of rail transport is very small. The planned infrastructure investments can help

to encourage rail and public transport. However, it is not yet clear that these measures will suffice to substantially increase the use of rail transport and reduce the risk of rapid growth in the use of private cars.

It is important that new cars are as efficient as possible; this will be particularly noteworthy if car ownership starts to grow significantly in the coming years. The European agreement with the car industry to bring on the market more fuel-efficient cars could be adopted also by Turkey and valorised in such a way that the car fleet will increasingly consist of such fuel-efficient cars. The scrapping premiums already introduced in Turkey work to this effect and should continue. Further measures, such as car labelling, purchase tax (based on vehicle fuel economy or CO_2 emissions) and circulation tax incentives should be considered. Once a fuel economy labelling and rating system would be in place, the purchase taxes could be tied, at least to some extent to the ratings.

RECOMMENDATIONS

The Government of Turkey should:

- *Promptly enact the Energy Efficiency Law, implement the measures in the Energy Efficiency Strategy and carefully monitor and evaluate their impacts, including the cost-effectiveness.*
- *Strengthen energy efficiency measures in the industrial sector by:*
  - *Introducing specific fiscal and financial incentives and third-party financing.*
  - *Expanding energy audit and energy manager obligations beyond large enterprises.*
  - *Exploring the possibility of voluntary agreements with industries with quantitative targets.*
- *Encourage energy efficiency in buildings by:*
  - *Demonstrating leadership by improving energy efficiency in public buildings.*
  - *Strongly enforcing the building standards for new buildings.*
  - *Introducing mechanisms to improve energy efficiency in existing buildings.*
  - *Setting high efficiency standards for air-conditioning equipment and other appliances.*
- *Integrate energy efficiency objectives in developing transport policy by, for example, promoting public transport, fostering inter-modal changes away from road transport and improving the energy efficiency of the vehicle fleet through economic and regulatory incentives. Improve transport statistics.*

INDUSTRY STRUCTURE

The largest enterprises in the Turkish oil sector are listed in Figure 11. The Turkish Petroleum Corporation (TPAO), the Turkish Petroleum Refinery Corporation (TÜPRAŞ) and Petrol Ofisi (POAŞ) do not have any statutory monopoly but have large market shares in their own fields.

- TPAO, a fully state-owned enterprise, is responsible for the exploration and production (E&P) of oil and gas sources both inside and outside the country.
- TÜPRAŞ, owned 65.8% by the State and 34.2% by the private sector[10], is dealing with the petroleum refining activities. DITAŞ is TÜPRAŞ's subsidiary which transports crude oil to its refineries.
- The Petroleum Pipeline Company (BOTAŞ), a fully state-owned enterprise, is responsible for the oil and natural gas transportation as well as gas importation.
- POAŞ, which has been fully privatised, is the largest distributor and marketer of petroleum products.

Full privatisation of TÜPRAŞ was initiated in June 2003 but has not yet been finalised because of appeals made to a court and it is now pending a decision from the Council of State. The government will keep a golden share, which will give it a power of veto in a limited number of areas, such as supply services to the military.

OIL PRODUCTION AND EXPLORATION

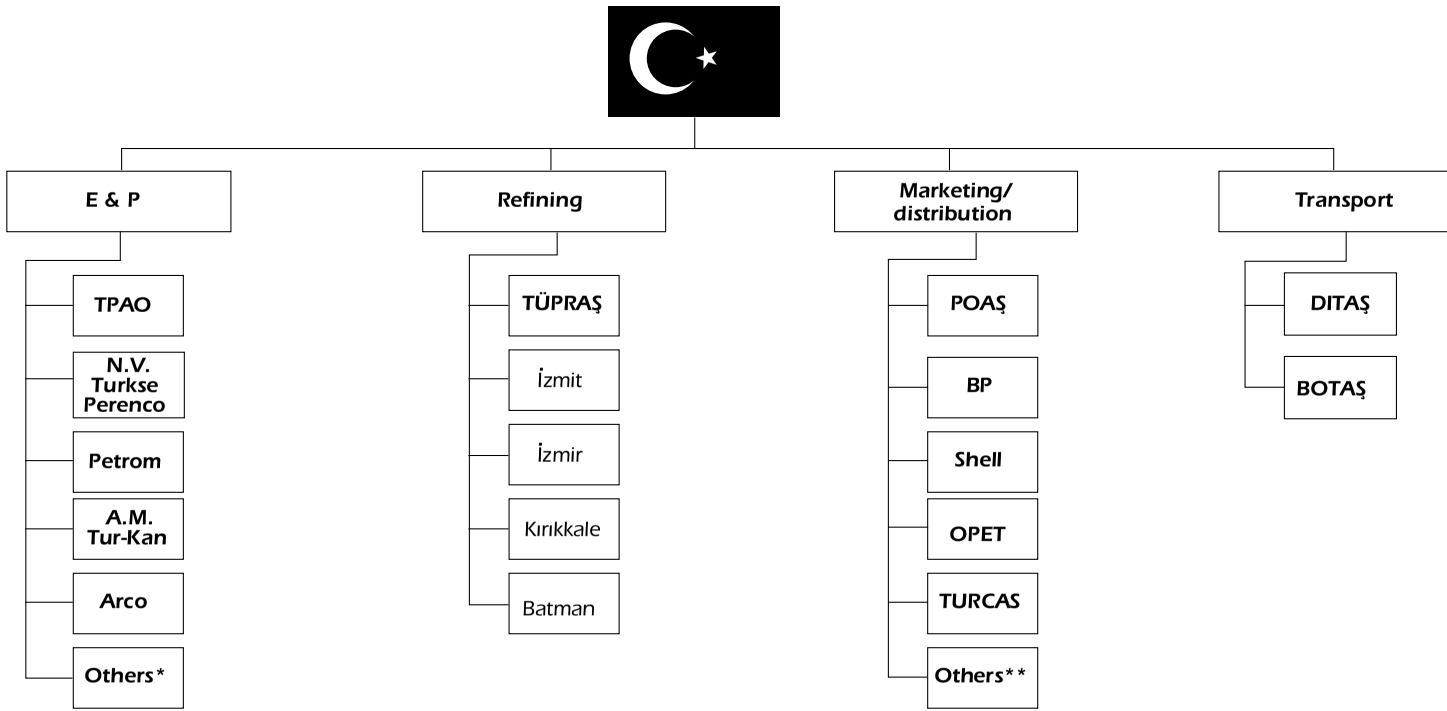
PRODUCTION

Turkey's oil reserves are relatively small. Oil is produced mainly in the south-east, with a small amount coming from the north-west of the country (see Figure 12). Since its peak in 1991, domestic oil production has been declining owing to the depletion of resources. While Turkey produced 3.7 Mt of oil in 1999, production was 2.5 Mt in 2003 and is expected to be decline by almost half by 2010.

10. Stocks have been floated in the İstanbul Stock Exchange.

Figure 11

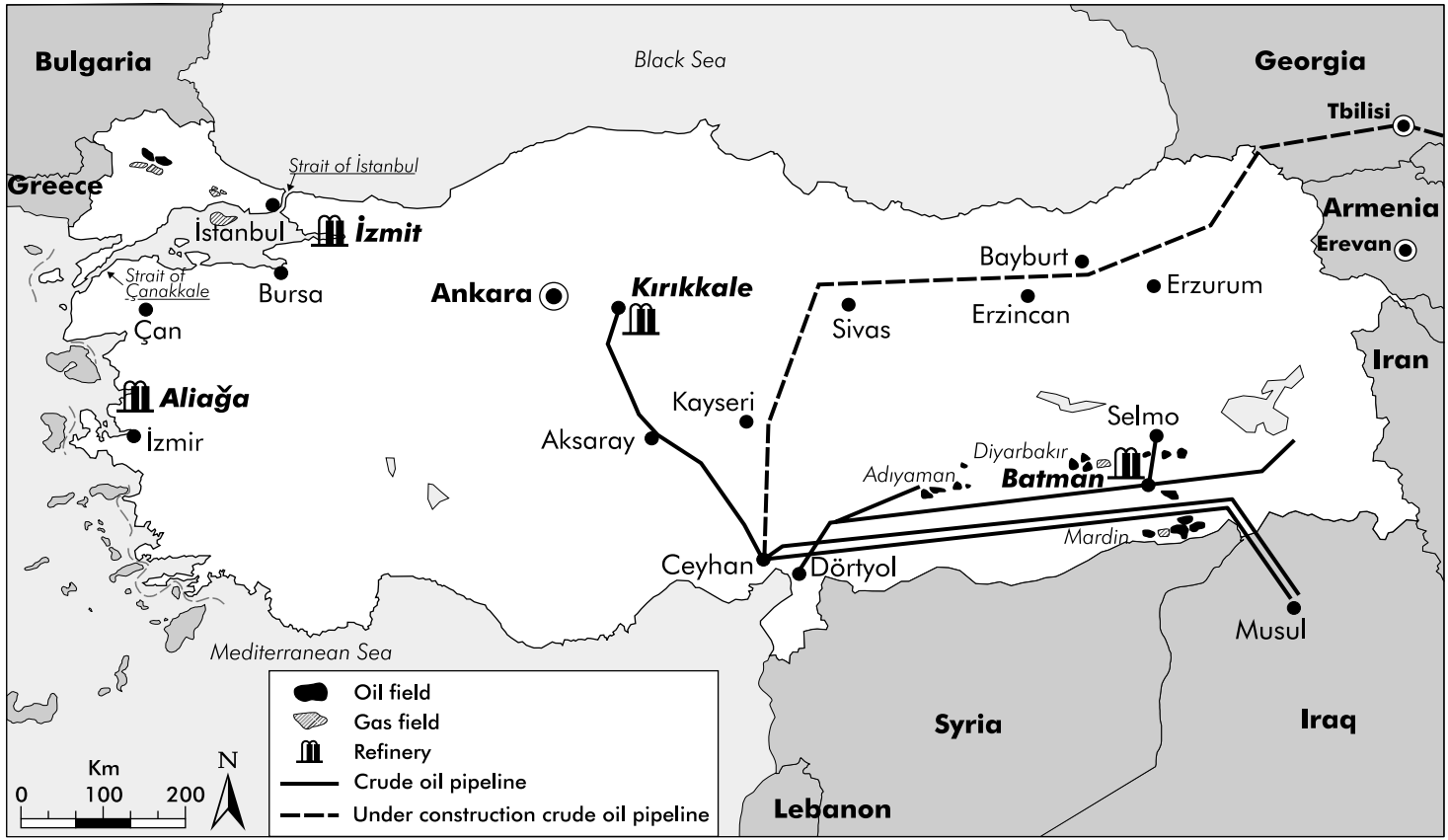
Petroleum Industry Structure



* "Others" include Eresan Aladdin Trans Medical, Aladdin MOL Magyar, TGT HUFFCO (Pinnacle Turkey Inc.), Amity Oil.
** "Others" include Total, Bölünmez, Turkuaz, Petline, Aytemiz, Tuta, Delta, Karpet, Siyam, GS, Itinbaş and 56 LPG distributors.
Source: MENR.

Figure 12

Petroleum Reserves and Infrastructure in Turkey, 2003



Sources: BOTAŞ and MENR.

It has been estimated that Turkey's remaining proven recoverable oil reserves are about 295 million barrels (see Table 5). At current production rates, these reserves will last approximately another 18 years.

Table 5

Oil Reserves in Turkey, 1 January 2004

	Reserves	*Recoverable reserves*	*Cumulative production*	*Remaining reserves*
Million barrels	6 419	1 140	845	295
Million tonnes	940.3	162.4	119.6	42.8

Source: PIGM.

TPAO is the largest oil producer and accounts for 68.4% of the total oil production, followed by 25% for Turkse Perenco N.V. (see Table 6). In 2003, 29 companies (19 foreign and ten domestic) carried out exploration activities in Turkey. Twelve companies (two domestic and ten foreign) produced oil, either individually or as a part of joint ventures.

Table 6

Crude Oil Production in Turkey, 2003

Company	*Production (thousand tonnes)*
TPAO	1 624
Perenco N.V.	594
Madison Oil Turkey Inc.	13
Petrom (Dorchester)	118
Others	26
Total	**2 375**

Sources: PIGM.

EXPLORATION

In 2003, TPAO held 158 oil concessions, 110 for exploration and 48 for production, covering altogether over 18 million hectares. Five of the production concessions were international joint ventures with Perenco and Madison Oil Turkey. TPAO carries out onshore exploration in various areas, especially in the south-eastern part of the country. Offshore exploration focuses on the Black Sea.

Up to now, 8 500 km^2 2-D and 1 200 km^2 3-D seismic activities were carried out by the joint ventures of TPAO and BP in the Eastern Black Sea. Moreover, an offshore drilling operation is planned for 2005.

The main policies for encouraging exploration and production are:

- To explore hydrocarbons in non-explored regions.
- To re-explore hydrocarbons in explored regions.
- To increase the value of the exploration drilling.
- To make new joint ventures with domestic and foreign companies in onshore and offshore explorations.

THE DRAFT PETROLEUM LAW

The Petroleum Law, which will cover "petroleum activities", namely exploration and production of oil and natural gas, is in an advanced stage of drafting. The objective of the law is to enable the expedient, continued and effective exploration, development and appraisal of the petroleum resources of Turkey in accordance with national interests. All the (non-market) petroleum activities in Turkey will be regulated by the Petroleum Law.

The draft law confirms that the Turkish petroleum resources are under the rule of the State. It also separates Turkey into two petroleum regions, namely onshore and offshore. Other provisions of the law include:

- The right to acquire permits, licences and leases for petroleum activities is held by TPAO on behalf of the State.
- To encourage exploration, royalties (now a flat rate of 12.5%) will be made progressive so that the production volume and other characteristics of the production will be taken into account; smaller production volumes will be subject to lower royalty rates.
- Limitations on the number of licences have been abolished and the licence procedures have been aligned with EU rules. Monetary sanctions are applied to licensees that have not conformed to their investment programmes (work and investment schedule). Production licensees/lessees will pay rent for each licence/lease area while rental taken from exploration licensees is abolished.
- In addition to exploration, oil production is encouraged by removing customs and import taxes on production equipment.
- Access is opened to studies, which were previously secret, in order to activate the use of available information.

OIL REFINING

Total crude oil processing capacity in Turkey is 27.6 Mt per year. It was 32 Mt per year until September 2004 but reduced when one private refinery closed down. In 2003, 26.5 Mt of crude oil was processed and 26.7 Mt of oil products were produced in refineries. Oil product imports were 8.1 Mt and exports 3.8 Mt in 2003.

At present, there are four refineries in Turkey, namely İzmit (11.5 Mt per year), İzmir (10 Mt), Kırıkkale (5 Mt) and Batman (1.1 Mt), all owned by TÜPRAŞ. The only private refinery, that of ATAŞ in Mersin (4.4 Mt per year), was closed because it was not economically feasible to make the investments needed to meet the new fuel standards.

The domestic refinery capacity has been sufficient to meet petroleum products demand but the forecast consumption of 39.8 Mt by 2010 and 58.9 Mt by 2020 exceeds the current refinery capacity. The need for new capacity will be most acute in the Marmara (7 to 10 Mt per year) and Mediterranean (5 Mt per year) regions. Any new refineries will be constructed by the private sector.

Capacity utilisation rates of the Turkish refineries have been relatively low in recent years compared with those of West-European refineries owing to the effects of the August 1999 earthquake and the period of economic instability in 1999 to 2001.

TÜPRAŞ has started to make investments in order to compete with the European refineries by increasing productivity and profitability and by improving product quality to prevent pollution. Its aim is to produce more white products, which have a higher value in the market. Furthermore, investments are being made to produce unleaded gasoline and low-sulphur diesel and fuel oil. TÜPRAŞ oil products are planned to conform to all EU fuel standards by the end of 2006 although there is a transition period until 2009. At present the products conform to pre-2000 EU standards.

TÜPRAŞ has elaborated an Investment Master Plan consisting of a total of US$ 2.0 billion of investments, of which 80% have been completed. As a result of the investments, its production capacity of unleaded gasoline increased from 3.1 Mt to 4.7 Mt in 2002 and is expected to reach 5.8 Mt by 2006. Its production of normal leaded gasoline stopped in August 2002 and lead content of super leaded gasoline was reduced from 0.4 g per litre to 0.1 g per litre. The İzmir refinery desulphurisation project will be completed in 2005, while those in the other three refineries will be completed in 2006.

TÜPRAŞ plans to expand its İzmit refinery; it has suitable land next to the refinery. It has also launched feasibility studies on a new oil refinery to be built on land belonging to the Körfez Petrochemical and Refinery Complex.

DISTRIBUTION

There are 21 distribution companies in Turkey. The number of distributing companies increased after the market liberalisation started in 1989. The number of dealers has been increasing recently, from 9 150 in 1999 to 11 375 in 2003. As shown in Table 7, POAŞ has the biggest market share. Adoption of the Petroleum Market Law in 2003 will enable refineries to enter the distribution sector after the beginning of 2005.

Table 7

Oil Retailers[1] and their Shares in the Turkish Market, 2003

Company	*Sales (Mt)*	*Market share (%)*	*Number of dealers*
Petrol Ofisi (POAŞ)	5.8	35.1	4 483
Turcas	1.1	6.67	663
Shell	2.4	14.5	589
BPAO	2.7	16.4	639
Total	1.0	6.06	687
Opet	1.5	9.09	1 864
Tu-Ta	0.009	0.055	104
Petline	0.2	1.21	257
Turkuaz	0.2	1.21	337
Bölünmez	0.3	1.82	193
Aytemiz	0.7	4.24	495
Delta	0.05	0.3	240
Erk Petroleum	0.001	0.006	22
Altınbas	0.3	1.82	249
Enerji Petroleum	0.2	1.21	235
Full Gs Petroleum	0.02	0.12	71
Türkoil	0.005	0.030	49
Siyam Petroleum	0.02	0.12	53
Others[2]			145
Total	**16.51**	**100**	**11 375**

[1] Excluding LPG.
[2] "Others" refers to the recently established Gurpet, Birleşik Petrol and Sunpet.

Source: MENR.

DEMAND, SUPPLY AND TRADE

DEMAND

Total oil demand increased from 23.6 Mtoe in 1990 to 31.7 Mtoe in 2003 but there was a temporary decline in demand for oil products in 1999 and 2001, resulting from the 1999 earthquake and 2001 economic crisis. The share of

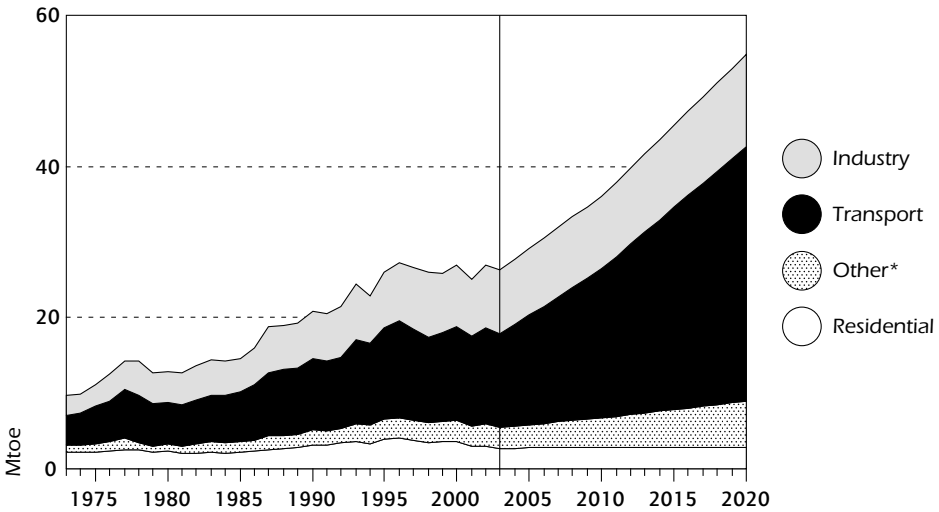
oil in TPES declined from 44.5% in 1990 to 37.9% in 2003, which is slightly lower than the IEA average. The government's forecast shows an increase of 30% in total oil demand between 2003 and 2010 and 28% between 2010 and 2020.

In 2003, 14% of total oil supplies were used in the energy sector where oil accounted for 6.5% of total electricity generation. TFC of oil was 26.4 Mtoe of which 12.3 Mt was used in the transport sector, 8.5 Mt in the industry sector, 2.7 Mt in the residential sector and 2.8 Mt in the remaining sectors (see Figure 13). Overall, TFC of oil increased by 27% from 1990 to 2003, but declined between 2002 and 2003 owing to the increased use of natural gas.

The breakdown of oil product consumption has changed. Diesel consumption grew by 28% between 1990 and 2003 while gasoline consumption dropped by 14%. This reflects both an increase in the number of diesel-driven vehicles and a rapid increase in diesel use in the agricultural sector. LPG demand in transport use increased between 1998 and 2000 owing to a government subsidy and a zero-taxation policy; it replaced primarily gasoline. The trend was reversed in 2001 with an increase in taxation and removal of the subsidy. Nevertheless, LPG remains an important transport fuel as its share was 8.9% of the total oil product demand in the sector in 2002.

Figure 13

Final Consumption of Oil by Sector, 1973 to 2020



* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; and country submission.

Demand for most products is expected to continue to rise as the economy grows. Government projections put the TFC of oil at 36.1 Mtoe in 2010 and 54.8 Mtoe in 2020. It expects a sharp increase in demand for middle distillates, mainly diesel and jet fuel. Demand for gasoline is expected to increase – as LPG use in transport has been declining since 2000 – but not as fast as middle distillates. Increased use of natural gas could slightly reduce the use of fuel oil.

SUPPLY

Crude oil imports play an important role given Turkey's small crude oil production – 2.5 Mtoe supplying 7.9% of total oil demand in 2003. Import dependence will increase because of the natural depletion of the fields. Owing to its heavy import dependence, Turkey has made efforts to diversify supplies to reduce supply risks, including diversifying import sources and developing oil projects abroad (see section on International Petroleum Production Projects).

In 2003, crude oil came mainly from the Middle East and Africa; the largest sources were Iran (29%), Libya (19%) and Saudi Arabia (16%). TÜPRAŞ has recently re-signed an import contract with Iraq; it imported about 600 000 barrels from Iraq in September and October 2004. In 2003, Turkey imported 8.3 Mt of refined products. Forty per cent came from the former Soviet Union, 26% from various OECD countries, 17% from Africa (mainly Algeria) and 17% from other sources. Product imports consisted primarily of LPG, diesel and fuel oil. Imports are necessary because refineries can yield only 3% to 4% of LPG from their total production despite higher demand. In addition, heating oil demand is highly seasonal, further complicating refined product production.

Fuel smuggling is a major problem in Turkey. The petroleum distributors' organisation Petder estimates that as much as one-fifth of the motor fuels consumed in 2003 were smuggled products costing the State approximately US$ 2 billion in lost taxes. The problems will be addressed by the introduction of a chemical marker in oil products, as stipulated by the Petroleum Market Law of 2003. The law authorises EMRA, the regulatory authority, to establish the marker system, carry out monitoring and apply sanctions.

INTERNATIONAL PETROLEUM PRODUCTION PROJECTS

TPAO is very active in developing petroleum (oil and gas) projects abroad (see the box). Its long-term strategy is to increase its production substantially, from about 49 000 barrels per day (bpd) in 2004 to 150 000 bpd in 2010. The biggest share will come from international oil projects. TPAO's investments have grown from US$ 103 million (US$ 48 million in Turkey) in 2001 to US$ 684 million (US$ 165 million in Turkey) in 2004. In 2005, investments are estimated to triple as compared to 2004 driven largely by investments in the Black Sea. Although TPAO participates as part of a joint-venture in international oil projects, it can decide where oil corresponding to its share of production is sold.

Turkish Oil and Gas Projects Abroad

- TPAO is participating in three different offshore exploration and production joint ventures in the Azeri part of the Caspian Sea: the Azeri-Chirag Guneshli, Shah Deniz and Alov projects.
- TPAO holds a 6.75% share in the Azerbaijan International Operating Company (AIOC). AIOC develops the Azeri and Chirag fields and the deepwater part of the Guneshli field in the Azerbaijan sector of the Caspian Sea. The project is now in its early phase and production from 15 wells totalled 0.13 million bpd in 2003; TPAO's production share was 4.1 million barrels in 2003. Production is expected to reach its maximum level of 1.1 million bpd in 2009. The recoverable reserves of oil are estimated at 5.4 billion barrels and gas at 180 bcm (billion cubic metres).
- TPAO has a 9% share in the Shah Deniz project. The "notice of discovery and its commerciality for natural gas and condensate" was declared in March 2001. The first pre-drilling well has been completed and the drilling of a second well started in 2003. The estimated reserves are about 625 bcm of natural gas and 750 million barrels of condensate reserves. The maximum annual natural gas production capacity is 15 bcm and for condensates 13 million barrels. Deliveries of 6.6 bcm of natural gas shall be made to Turkey for 15 years, the first delivery being planned for October 2006.
- TPAO's share in the Alov exploration project is 10%. Exploration will be carried out in 2006-2008.
- In addition to the projects in Azerbaijan, TPAO is active in Kazakhstan and Libya and it is in close contact with Turkmenistan, Iraq and Syria to initiate oil and natural gas exploration and production. The project in Kazakhstan is the most advanced. TPAO holds 49% of the joint venture Kazakturkmunay (KTM) with the Kazakh Ministry of Geology and Energy. KTM produces oil in Western Kazakhstan; production in the Aktau Region was 3 800 bpd and in the Aktubinsk Region 5 300 bpd in 2003.

Source: TPAO.

TRADE

Turkey exports certain oil products such as gasoline, fuel oil and diesel/gas oil. Exports totalled 3.6 Mt in 2003 of which about one-third was sold to the OECD markets and one-third to the Middle East. There are various reasons for exporting oil products:

- The seasonality of heating oil demand creates an opportunity to export outside the heating season.

- The contraction of domestic demand for some products, such as gasoline and to some extent LPG.
- Refineries seek more foreign currency in order to hedge their dollar-based payments and high export premiums. This means that prices of exported products are close to domestic market prices.
- The refineries export some seed stocks that cannot be sold in the domestic market owing to the tightening environmental regulations.

TÜPRAŞ was the main exporter in 2003. Its export revenues from refined and petrochemical products were US$ 855 million, with a similar outlook for 2004.

Net oil imports have increased with an annual average growth rate of 2.5% since 1990, reaching 29.3 Mtoe in 2003. Table 8 shows the balance of imports and exports of oil products in 2003.

Table 8

Oil Product Import/Export Balance, 2003

Product	*Imports (1 000 tonnes)*	*Exports (1 000 tonnes)*	*Net imports (1 000 tonnes)*
LPG	3 081	308	2 774
Solvent	302	0	302
Naphtha	709	429	280
Premium gasoline	72	38	34
Unleaded gasoline	373	1 372	–999
Jet fuel	11	8	2
Kerosene	0	15	–15
Diesel/gas oil	2 737	895	1 842
Process oil	0	0	0
Heating oil	228	0	228
Fuel oil 6	558	506	52
Clarified oil	0	0	0
Lube oil	246	0	246
Asphalt	0	1	–1
Sulphur	0	0	0
Extract	0	0	0
Wax	0	0	0
Heavy vacuum gas oil	0	211	–211
Total	**8 318**	**3 783**	**4 534**

Source: TÜPRAŞ.

Given that Turkey signed the Customs Union Agreements with the EU in 1996, imports of oil products from EU member countries are not subject to the "Common External Tariff Rates" applied to imports from other countries.

PIPELINE INFRASTRUCTURES

Turkey has three major domestic crude oil pipelines (see Figure 12), all operated by BOTAŞ. One transports crude oil produced in petroleum districts near Batman to the port terminal at Dörtyol. Another transports crude oil produced in the Selmo oil field to Batman. The third pipeline links Yumurtalik and the Kırıkkale refinery.

The Turkey-Iraq crude oil pipeline consists of two parallel pipes and runs to Ceyhan. Turkey's main oil terminal with marine access to international markets is situated in Ceyhan.

Turkey has far-reaching projects to bring new oil supplies to Western markets from the Caspian region, especially Azerbaijan and Kazakhstan. The Baku-Tbilisi-Ceyhan (BTC) crude oil pipeline will transport Azeri crude oil via Georgia to Ceyhan. Its rated capacity will be one million bpd (50 Mt per year). The BTC consortium[11] led by BP invested US$ 1 billion in equity in the project and in February 2004 obtained US$ 2.6 billion loans from various international financing institutions, mainly International Finance Corporation and the European Bank for Reconstruction and Development. The BTC pipeline is planned to be operational in early 2005 and it is expected to transport 0.1 million bpd in 2006.

In March 2001, the Caspian Pipeline Consortium (CPC) commissioned a new pipeline from Baku to the Russian port of Novorossiysk wherefrom oil is transported by tankers through the Black Sea and the Turkish Straits to the international markets. The capacity of the CPC pipeline is 0.56 million bpd with plans to extend to 1.34 million bpd, which would cause additional strain to the narrow, twisting and congested Turkish Straits. Caspian oil also transits through Georgia, using the Baku-Supsa pipeline and rail until the port of Batumi. In August 2004, Ukraine authorised Russian oil companies to use the stalled Odessa-Brody pipeline in the reverse direction. This should increase seaborne Russian oil exports up to 180-245 thousand bpd (9 to 12 Mt per year).

11. BP (UK) – 30.1%, operator; State Oil Company of Azerbaijan (SOCAR) – 25%; Unocal (US) – 8.9%; Statoil (Norway) – 8.71%; Turkish Petroleum (TPAO) – 6.53%; ENI (Italy) – 5%; Total (France) – 5%; Itochu (Japan) – 3.4%; ConocoPhillips (US) – 2.5%; Inpex (Japan) – 2.5%; Delta Hess (joint venture of Delta Oil (Saudi Arabia) with Amerada Hess (US) – 2.36%.

To help to resolve congestion[12] and safety problems in the Turkish Straits, a number of bypass options are under consideration. One proposal is a pipeline from the Black Sea coast north of İstanbul (Kıyıköy) to the Aegean Sea near the Greek border (İbrikbaba). There are environmental considerations making the development of this option difficult. Another proposal is a 660-km long pipeline from the Black Sea port of Samsun in north-eastern Turkey to Ceyhan on the southern coast. The third option, promoted by Bulgaria, Greece and Russia, is to build a pipeline linking the Bulgarian Black Sea port of Burgas with Alexandropoulos on the Mediterranean coast of Greece. However, the project has been stalled for several years by a wide range of technical and economic issues. In addition to considering bypass options, Turkey has worked to enhance safety, increase capacity and improve traffic flow in the Turkish Straits during the day time by putting a US$ 45 million radar-controlled vessel traffic and management system into operation at the end of 2003.

PRICES

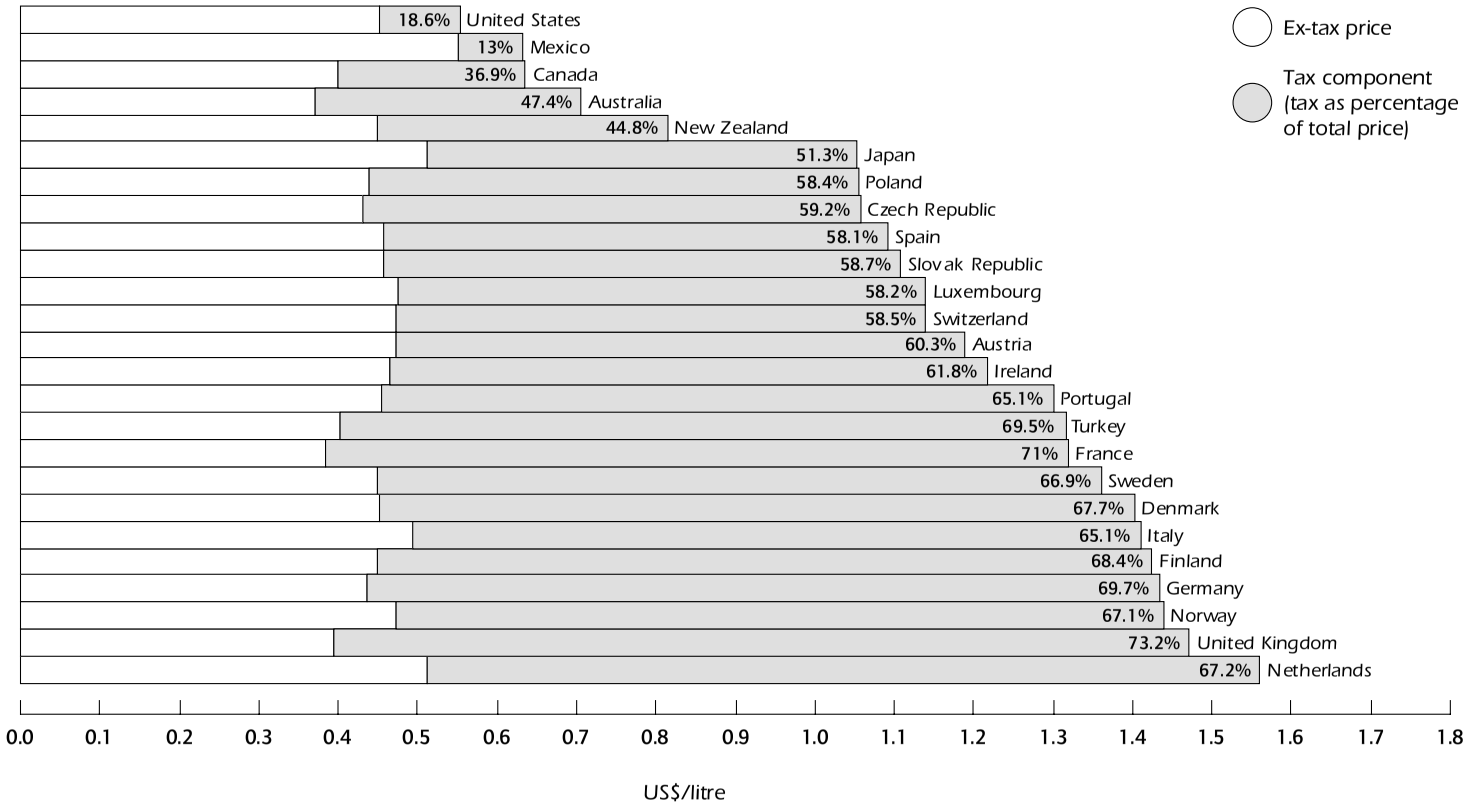
The Automatic Pricing Mechanism (APM) was operational from July 1998 until the end of 2004 to establish ceiling prices for gasoline, diesel, kerosene, heavy fuel oil, heating oil and LPG. The APM linked ex-refinery prices to CIF Mediterranean product prices. Prices were observed for seven days. If the revolving seven-day average of import price increased or fell by more than 3%, the ceiling price was changed. The prices were set by taking into consideration the five-day average of the week. If the ceiling caused losses to the refiners and retailers, they were reimbursed from a specific fund financed through an associated tax. The APM was introduced to enhance price stability and predictability, and to eliminate the economic disadvantage of the inland refineries caused by transportation. Since the abolition of the APM in the beginning of 2005, prices can be set freely. A distribution and transportation margin, a fuel consumption tax (see Chapter 3) and VAT are added to the free price.

Turkish gasoline and diesel prices are within the third-highest among OECD member countries owing to the relatively high taxes (see Figures 14 and 15). In the household sector, electricity and light fuel oil have approximately the same price given the high taxes on light fuel oil (see Figure 16). Taxes on natural gas and coal are much lower than taxes on light fuel oil or electricity, making them, particularly coal, most economical for heating purposes in households.

12. The export volumes of crude oil transiting the Black Sea from the Caspian Sea and Russia were 1.6 million bpd (81 Mt per year) in 2001 – or 3.5 % of world exports – and 2 million bpd (100 Mt) in 2002 to 2003. The volume is expected to grow gradually reaching 2.6 million bpd (130 Mt) in 2005 and 3.8 million bpd (190 Mt) by 2010.

Figure 14

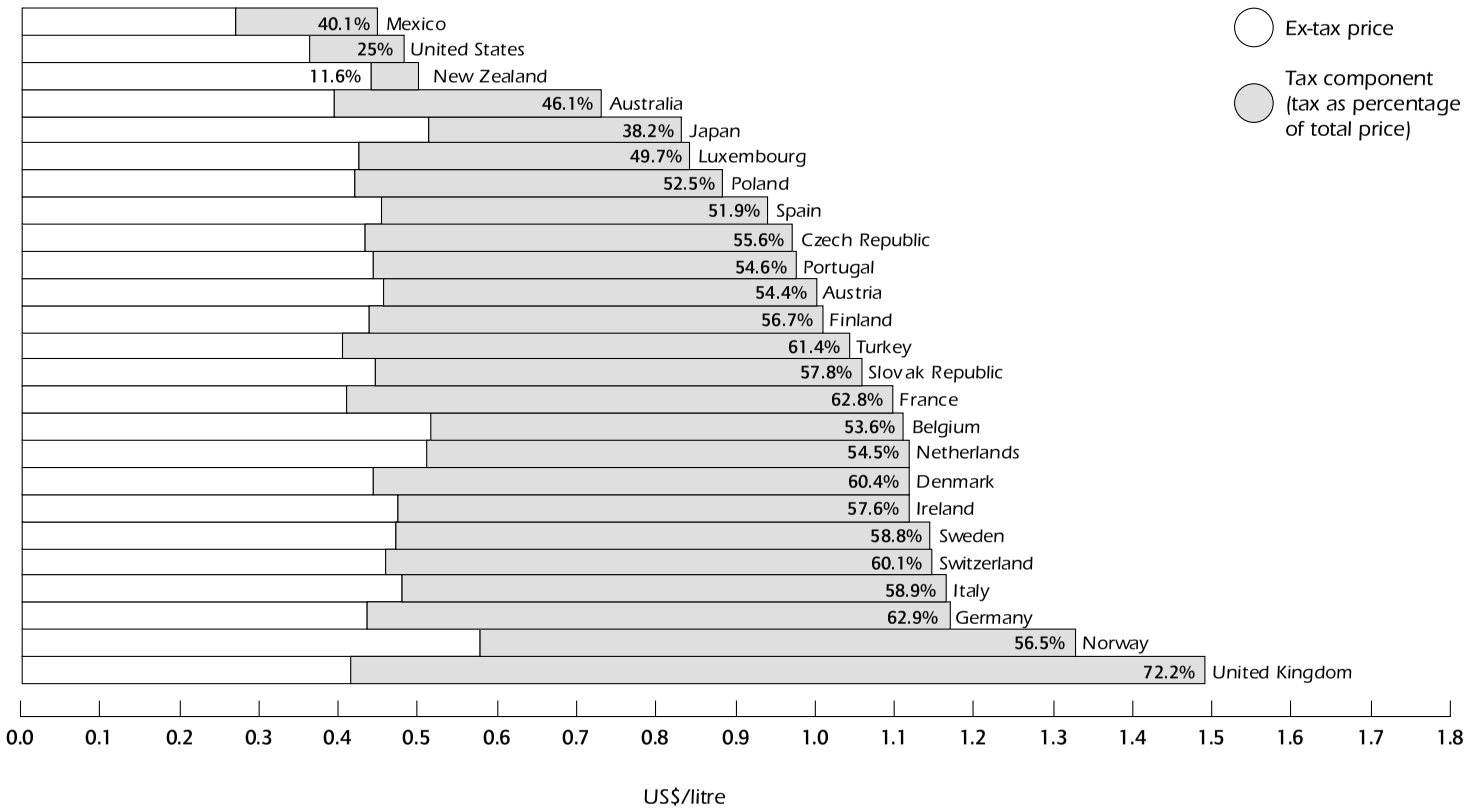
OECD Unleaded Gasoline Prices and Taxes, Third Quarter 2004



Note: data not available for Belgium, Greece, Hungary and Korea.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2004.

Figure 15

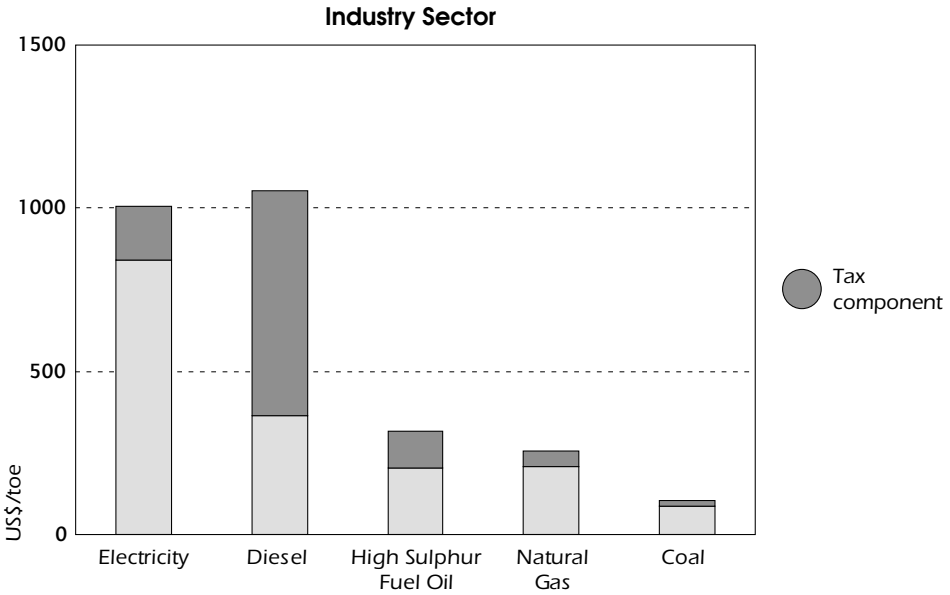
OECD Automotive Diesel Prices and Taxes, Third Quarter 2004

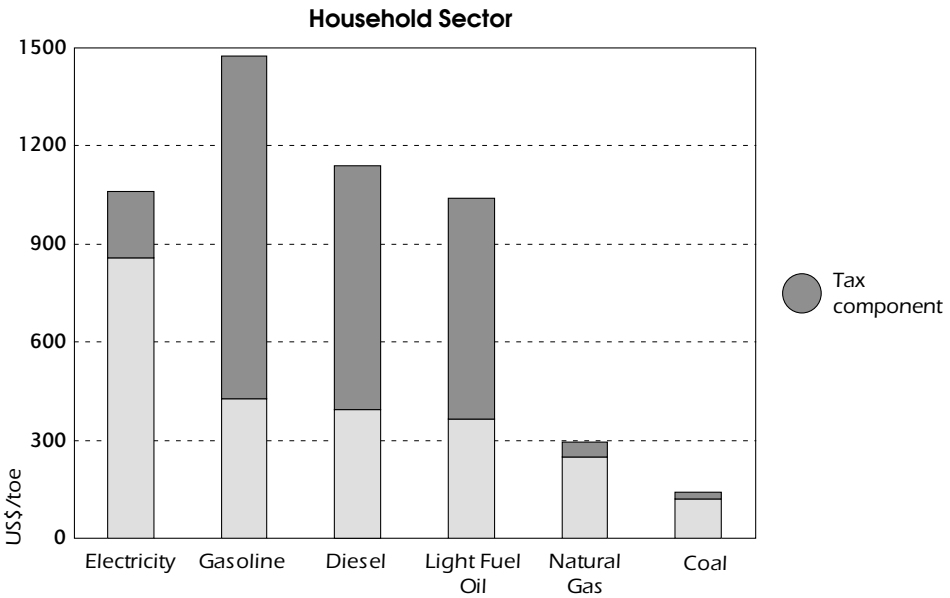


Note: data not available for Canada, Greece, Hungary and Korea.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2004.

Figure 16

Fuel Prices, 2003





Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2004.

MARKET REFORM

The liberalisation of oil product imports and exports started in 1989 when all refineries and retailers with adequate storage capacities were granted import licences and were allowed to set prices freely. However, the government continued to prescribe annual oil import programmes, oil producers were allowed to sell only 35% of their production to companies other than TÜPRAŞ, and TÜPRAŞ's ex-refinery prices for oil products were subject to government approval. Furthermore, a 1996 decree required oil and gas distribution companies to acquire at least 60% of their supplies from Turkish refineries.

The government has decided to reform the oil sector aiming at far-reaching liberalisation based on a clearer legislative framework. This is implemented through the Petroleum Market Law (No. 5015) which was passed on 4 December 2003 and entered into force on 20 December 2004. The law governs "petroleum marketing activities", namely imports, refining, stocks and distribution/retailing of oil with all oil sector operations separated from each other. The petroleum industry was extensively consulted during the preparation of the law.

EMRA is the independent regulator responsible for electricity, natural gas and petroleum markets (see Chapter 3 for general details). EMRA's mission in the oil market is to implement regulatory measures to ensure the establishment of a liberal, reliable and competitive petroleum market. Its specific duties include the following:

- Issuing the secondary legislation.
- Issuing licences.
- Preparing regulating procedures and principles regarding the applications, evaluation and granting of licences and their duration, modification, fees, termination and extension.
- Approval of certain tariffs (see hereunder).
- Carrying out preliminary investigations and inquiries concerning market activities.
- Enforcement of penalties or sanctions.
- Settling disputes related to purchase of domestic crude oil.
- Implementing a national chemical marker system in relevant oil products.
- Monitoring and supervising market activities.

EMRA has issued most of the regulations stipulated by the law. The regulations issued cover licensing, tariffs, technical requirements and the introduction of a national chemical marker to tackle fuel smuggling.

All oil market activities will be liberalised but under relevant licences issued by EMRA. Refining, processing, lube oil production, storage, transmission, bunkering activities, fuel distribution, transportation, vendor (retailing) activities and eligible consumption will all require licences. Separate licences are required for each activity and, in cases where an activity is conducted in more than one facility, for each facility. The procedures for licence applications and fees have been announced and first applications were filed in July 2004.

The APM ceased on 1 January 2005. The pricing for the purchase and sales of products shall now be constituted according to the nearest accessible free market conditions. For domestic crude oil, "market price" formed in the nearest delivery port or refinery shall be accepted as the price. EMRA is authorised to evaluate and solve problems that may arise from the calculation of the "market prices" and disputes on prices shall be settled by the arbitration of EMRA. Third-party access tariffs for storage facilities, which are coupled with transmission licences and for transmission networks are prepared by the licensees and approved by EMRA.

If a market failure risk emerges, EMRA is authorised to determine base or ceiling prices and take necessary measures regionally or nationally, but not for more than two months at a time. The law does not define the criteria for such market failures.

The law has several specific provisions aiming at increased competition in the oil product market:

- Distribution companies can supply a maximum 15% of their total supplies to retail outlets that they own.
- No distribution company may have more than a 45% share of the market.
- Distribution companies may not subsidise vendors they own or treat them differently from other vendor stations.
- Vendors will enter exclusive purchase contracts with one distribution licensee only.
- Only refinery, distribution and bunker delivery licensees are allowed to import crude oil and oil products.
- EMRA will prepare regulation for the import and export of non-liquid petroleum products.

The law also revises the oil stockholding regime (see section on Emergency Response Measures for more details).

EMERGENCY RESPONSE MEASURES

Turkish legislation gives the government substantial authority for oil crisis management, including the power to enforce the increase of domestic production by oil-producing companies and to relax oil product specifications, which would allow greater refinery throughput. The Turkish authorities also have wide-ranging powers to implement demand restraint measures.

The major implication of the 2003 Petroleum Market Law in terms of emergency response was the establishment of the National Petroleum Stock System. This brought domestic stockholding obligations in line with EU requirements without being completely compatible with IEA requirements, which are based on historical net import levels. The law obliges the following stakeholders to hold stocks: refineries, fuel and LNG distribution licensees and eligible consumers (consumption >20 000 tonnes of each fuel per year in a single facility). The Commission (National Petroleum Stocks) was given direct responsibility for the implementation of measures necessary to bring this into operation.

The Turkish National Emergency Sharing Organisation (NESO) consists of senior officials from oil companies and administrations and would be chaired by the Undersecretary of MENR. The NESO can also be extended to include EMRA and different ministries, including the Ministry of Transport which controls the transportation of crude oil and oil products, the Ministry of Foreign Affairs which would co-ordinate with the IEA, and other ministries deemed relevant to the situation by the General Secretariat of National Security Committee, which would act on behalf of the Prime Minister.

The dominance of TÜPRAŞ within the oil sector is expected to facilitate not only the logistics of national allocation but also communication and quick implementation of emergency measures.

With respect to IEA obligations on the holding of emergency oil reserves, Turkish compliance has improved steadily over the last ten years. Though seasonality and the cycle of data collection mean that stock levels do still sometimes fall below the 90-day obligation, Turkey has either been compliant or only marginally non-compliant since 1 January 2002. The most recent emergency reserve calculation of 1 July 2004 shows Turkey to be compliant at 91 days.

CRITIQUE

Turkey is one of the fastest growing petroleum markets among the European OECD countries. Given its successful diversification policy, Turkey has not become overly dependent on oil. However, its import dependence is growing because domestic production is declining as resources are depleted. Turkey's

active and successful policy to develop international oil projects effectively contributes to the reduction of security of supply risks caused by increased import dependence. Furthermore, the forthcoming Petroleum Market Law provides incentives for increased domestic exploration and production activities and creates a sound regulatory framework.

Large-scale fuel smuggling in Turkey is a problem that degenerates the operating conditions for the legitimate market operators and reduces state revenues. The issue must be solved in a quick, efficient and durable manner. It is positive that the new Petroleum Market Law addresses the issue by introducing a national chemical marker system in relevant oil products. This will be implemented by EMRA. The marker system should be implemented without delay and be supported by adequately high penalties. Furthermore, it will be important that EMRA is supported by the relevant government authorities.

The BTC pipeline project is progressing and allows import of the oil produced by TPAO in Azerbaijan. However, the commercial viability of the project is burdened by the fact that initially only 10% of the capacity of the pipeline will be in use owing to the production capacities of the Azeri projects. On the other hand, the planned connection line to some Kazakh production is under consideration and could increase its viability. The route, which will finish at Ceyhan, avoids the Turkish Straits, where growing traffic is causing increased congestion and safety risks despite the improved traffic control system. Some bypass options have been considered but have not been developed owing to various technical, economical and environmental considerations. Nevertheless, the government should actively encourage the industry to look for and develop alternatives. All the relevant parties should fully recognise the risks involved with the existing situation.

Since the closure of the ATAŞ refinery, TÜPRAŞ is the only refinery company in Turkey. TÜPRAŞ has a comprehensive investment programme to modernise its refineries and produce oil products in conformity with EU standards in 2007. For environmental reasons, it would be preferable that the investments be implemented in the planned schedule even though there is a transition period until 2009 and the ownership of the company will change in the forthcoming full privatisation.

The oil sector is going through significant changes even though it has been operating in a relatively liberalised manner for quite some time in comparison with the electricity and gas sectors. The reorganisation of the oil sector is implemented principally by the Petroleum Market Law of 2003. With the adoption of the law, oil market activities will be fully liberalised and quotas on import of petroleum products will be removed once the law enters into force.

EMRA has recently been assigned responsibility to issue secondary regulation and licences, approve TPA tariffs and carry out investigations concerning

market activities. While examples of extending the regulators' role also to the oil sector can be found in other countries, it is important that the special characteristics of the oil sector are given due attention. The stringent and itemised regulation needed in the network-based sectors cannot be used as a model for the oil market activities. In this respect, EMRA should aim at issuing simple and efficient regulations taking into account the opinions and suggestions of stakeholders, in particular market operators.

With the removal of the price ceiling mechanism (APM) at the beginning of 2005, the oil sector has been fully liberalised. This is a welcome development. Prices should be carefully monitored to see if price increases or decreases reflect the developments in the oil world markets, indicating that the domestic market functions well. There are many operators in the distribution market but they are generally small while POAŞ holds a 35% market share. It should be monitored that no single company will get a dominant position in the market.

The remaining public shares in TÜPRAŞ (65.8%) have been transferred to the Privatisation Administration. The tendering process has been delayed owing to complaints to the court and now awaits a decision of the Council of State. If privatisation proceeds, the authorities should ensure that the criteria used for judging the bids take into account the opening of the market to a multiplicity of actors, besides the sole objective of maximising the sale price.

TPAO has very ambitious plans for growth and so far has been able to largely finance its growth from internal resources. Despite its relative operational independence compared to most other state-owned energy enterprises, it does not enjoy full independence in respect to operation and investments. To facilitate fast growth, additional international financing may be necessary. Corporatisation, or possibly privatisation, could increase TPAO's ability to raise money on the international market and its ability to enter partnerships with international companies with technical expertise.

In the oil sector, unlike in the gas or electricity sector where transport networks are crucial, vertical integration does not compromise competition if there are enough players as shown by international experience. Instead, the key factor is having enough players. Allowing TPAO to enter the downstream market, particularly refining, could bring multiple benefits. First, it would increase security of supply as it would have direct access to oil production. Second, TPAO is a profit-making company that could find the finance to invest in new refining capacity, which could be more difficult for TÜPRAŞ given that it is heavily involved in upgrading existing refineries. By investing in refining, possibly with international partners, TPAO could bring immediate competition into the downstream market.

There have been fluctuations in the emergency stock levels, with levels falling under 90 days. However, the stocks have always climbed back to at least 90 days. Although some of the problems were caused by one-off exceptional

situations such as the 1999 earthquake, it will be important to keep the development of new stock capacities in phase with the forecast rapid increase in oil demand.

The legal basis for national stockholding has been established under the Petroleum Market Law. While the Petroleum Market Law already defines the obligations for certain market players, the secondary regulation should define precisely the obligation of each market player. The financing of the eventual state stockholding obligation needs to be defined in a clear and transparent way as obligated by the Petroleum Market Law. The Commission (National Petroleum Stocks) should consult with private stakeholders, in particular refineries (yet to be privatised) and the operators of storage facilities.

RECOMMENDATIONS

The Government of Turkey should:

- *Solve the problem of fuel smuggling.*
- *Encourage the industry to develop a Turkish Straits bypass, which is commercially feasible and is located far enough from the environmentally sensitive zones of the Black Sea, the Strait of İstanbul and the Marmara Sea.*
- *Ensure that the regulator focuses on the monitoring of competition in the downstream oil market and takes a light-handed regulatory approach.*
- *Complete the privatisation of TÜPRAŞ in a way that reduces its dominant role in the refining market.*
- *Corporatise TPAO and consider its privatisation. Give TPAO the possibility to integrate vertically in the downstream oil market.*
- *Establish clear and precise oil stockholding arrangements to define the obligation for each type of oil market operator.*

INDUSTRY STRUCTURE

Coal[13], particularly lignite, is Turkey's most important domestic energy source. The country produces hard coal and lignite. The government is launching a programme to study the country's coal potential in addition to the current process reserves.

Three main companies operating in the coal sector are the state-owned companies Turkish Hard Coal Enterprise (TTK), Turkish Coal Enterprises (TKİ) and the Electricity Generation Company (EÜAŞ). TTK has a *de facto* monopoly in hard coal production, processing and distribution. TKİ produces more than half of all lignite (55% in 2003), private companies produce around 10% and the rest is produced by EÜAŞ for its power plants.

There are no legal restrictions on operations by the private sector but the operating conditions have been unattractive for private capital. The situation has changed, however, owing to recent changes in the mining law enabling leasing to the private sector. This is expected to increase private-sector participation. Four lignite deposits have already been leased to the private sector and some hard coal sites were to be tendered by the end of 2004.

COAL PRODUCTION

HARD COAL

Hard coal is found and mined in only one location, the Zonguldak coal basin on the north-west Black Sea coast. The geological reserves of the basin, calculated down to 1 200 metres, are about 1 344 Mt of which 40% (550 Mt) are proven reserves. The Zonguldak coal basin has a very complex geological structure, which makes mechanised coal production impossible requiring labour-intensive conventional production methods. The calorific value of the coal varies between 6 200 and 7 250 kcal/kg.

TTK's production declined in the early 2000s and production in 2004, about 1.9 Mt, will be slightly lower than in 2003 (see Table 9). TTK aims to reach a production level of 4 Mt per year in the mid-term by finalising the ongoing works on level galleries and new service shafts and increase its production to 5.5 Mt by 2010. The hoisting and washing capacities of TTK already facilitate the production of 3 Mt of saleable coal per year.

13. In this report "coal" refers to different types of coal. When specific coal types, hard coal or lignite, are discussed it is always specified.

Table 9

Production and Productivity in Hard Coal Mining

Year	Production (sales; Mt)		Realisation	Productivity (kg/man-shift)	
	Projected	Actual	%	Underground	Total
2000	2.75	2.26	82	650	470
2001	2.75	2.36	86	679	501
2002	2.50	2.24	90	742	548
2003	2.43	2.01	83	774	563
2004	1.72	1.57[1]	92	834	602
2005[2]	2.17			911	661

[1] Actual as of August. 2004 production is expected to total about 1.9 Mt.
[2] Projected.

Source: TTK.

TTK's efforts to improve its productivity began in 1993 and are continuing. Productivity in TTK increased from 113 tonnes per person-year in 1993 to 165 tonnes in 2002. Nevertheless, this is much behind the productivity of many other hard coal producers, such as Australia (12 900 tonnes per person-year), the United States (12 800 tonnes per person-year), South Africa (4 740 tonnes per person-year), the United Kingdom (2 825 tonnes per person-year), Poland (729 tonnes per person-year) and Germany (536 tonnes per person-year).

Although part of the productivity increases come from improved production methods and technological improvements, productivity has been improved mainly by reducing TTK's workforce (see Table 10), to a large extent by retirement programmes. In 2003, the workforce was reduced by 1 709 bringing the total number down to 14 083. In 2004, about 1 500 workers retired. TTK has recognised the need to improve productivity by improving the ratio of underground workers versus surface workers. It aims to reduce the share of surface workers from the current one-third to one-fourth or one-fifth by continuing the retirement programmes for surface workers and by outsourcing operations such as social affairs, workshops, transport, coal preparation and harbour.

Table 10

The Workforce in Hard Coal Mining

Year	Surface	Underground	Ratio	Total
1990	13 325	21 024	1 : 1.58	34 349
1993	11 837	16 592	1 : 1.40	28 429
1997	6 397	12 277	1 : 1.92	18 674
2001	4 446	12 972	1 : 2.92	17 418
2002	4 027	11 765	1 : 2.92	15 792
2003	3 740	10 343	1 : 2.77	14 083
2004	3 575	8 977	1 : 2.51	12 552

Source: MENR.

Investments planned for 2004 totalled TL 14.5 trillion (in old liras). This was a typical level for planned investments over the past few years but actual investments usually somewhat fall behind the target. Investments are made to improve productivity by, for example, widening the high-pressure air breaking system and concentrating production areas. TTK's investment proposals are discussed with MENR and the DPT, which takes final decisions. YTL 26 million (in 2005 new liras; 26 trillion in old liras) have been allocated to facilitate the production plans for the coming years.

In 1996, TTK opened a tender for coal bed methane exploration in the coal basin. The basin was divided into three areas and contracts were signed with two foreign companies. The first research and production shaft was drilled to 1 583 metres in the Karadon district in 2000. Although good findings were anticipated on the basis of feasibility studies, the drilling results were not positive. TTK believes that the reason was inadequate techniques and will launch a new tender in January 2005.

LIGNITE

Lignite is found in almost all regions of the country (see Figure 17). The most important reserves are in the Afşin-Elbistan, Muğla, Soma, Tunçbilek, Seyitömer, Beypazarı and Sivas regions. About 90% of the lignite is produced through opencast mining and 10% by underground mining. At the end of 2003, proven lignite reserves totalled about 8.4 billion tonnes; 68% of Turkish reserves have low calorific value. The largest deposits, around 3.4 billion tonnes, are in the Afşin-Elbistan region and have an average calorific value of 1 100 kcal/kg; 23.5% of all reserves have a calorific value of 2 000-3 000 kcal/kg, 5.1% of 3 000-4 000 kcal/kg and the remaining 3.4% has 4 000 kcal/kg and over.

As shown in Table 11, the overall productivity in TKİ, which is the largest lignite company, has decreased from 2 018 tonnes per person-year in 1999 to 1 978 in 2003. Over the past few years both lignite production and the number of workers have declined.

Table 11

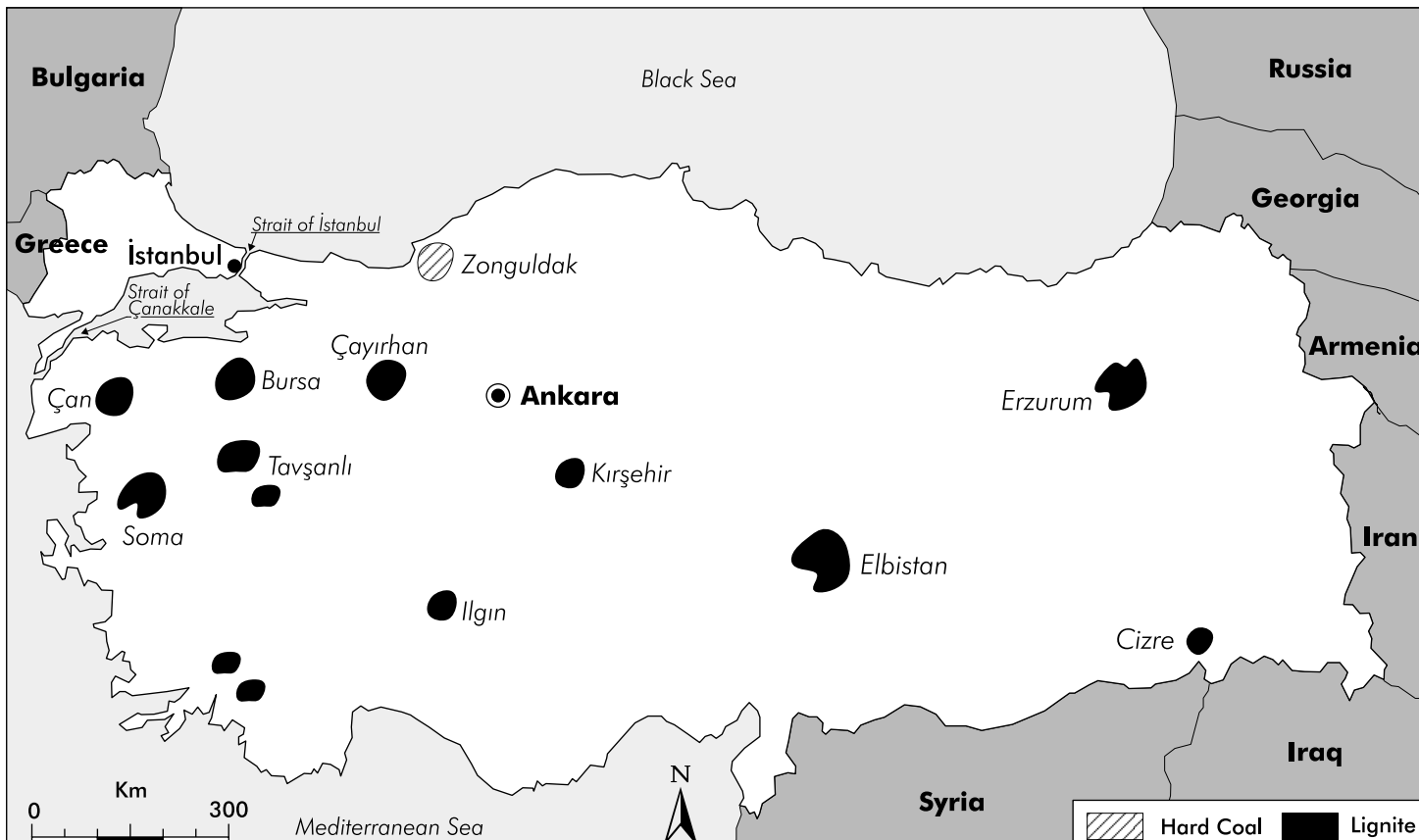
Lignite Production and the Workforce of TKİ

	Production (sales; Mt)	*Workforce*
1990	36.86	32 286
1999	38.64	19 150
2000	39.20	17 408
2001	33.61	16 362
2002	30.66	14 645
2003	25.69	12 986

Source: TKİ.

Figure 17

Coal Deposits in Turkey, 2004



Source: TKİ and General Directorate of Mineral Research and Exploration of Turkey.

TTK sets the price of hard coal. The selling price to iron and steel producers is US$ 100 per tonne and for power generation US$ 39 to 40 per tonne. In comparison, production cost of hard coal was US$ 187 per tonne in 2004 (US$ 141 per tonne in 2002). Prices are renegotiated every year with the users. The prices do not allow TTK to recover its costs and it receives the balance as a government subsidy, mainly for covering the labour cost. The government considers that continued subsidies are necessary to promote domestic hard coal production for the diversification of the portfolio or energy sources, such as security of supply reasons, as well as for social considerations in the mining regions.

According to the Producer Subsidy Equivalent (PSE) method, total subsidies paid by the Turkish Treasury to TTK amounted to US$ 266.3 million in 2003. This represents a rapid increase from the 1999 value of US$ 223.9 million. Table 12 details the PSE aid paid over the last 11 years. While hard coal production volume in Turkey is not big, aid per tonne of coal equivalent (tce) has been relatively high compared to the other IEA member countries which subsidise coal production[14].

Table 12

State Assistance to TTK

	1993	*1995*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004P*
Production (1 000 tonnes)	2 789	2 248	1 989	2 256	2 357	2 244	2 011	2 070
Total aid (billion TL)	4 330	12 228	94 045	229 482	240 420	389 734	409 550	436 000
Total aid (million US$)	386.1	262.6	223.9	367.2	180.0	253.5	266.3	271.8
Aid per tonne (1 000 TL)	1 553	5 440	47 283	101 721	102 003	173 678	203 655	210 628
Aid per tonne (US$)	138.4	116.8	112.6	162.8	76.4	113	132.4	131.3
Exchange rate (US$/1 000 TL)	11.22	46.56	420.00	625.00	1 335.64	1 537.44	1 538.00	1 604.00

P = provisional.

Source: Country submission.

14. There are no comprehensive data available after 2000. In 1999-2000, Turkish hard coal subsidies per tonne were by far the highest among the six IEA member countries which subsidised hard coal production. Thereafter, Japan has abolished coal subsidies and other countries have continued their restructuring programmes.

The subsidies for hard coal are not declining together with declining production and there are large annual variations. Production decreases when coal extraction workers retire. However, operation costs are not declining in parallel, leading to higher subsidies per tonne and high total subsidies.

Lignite prices are set by TKİ but its investment programmes are discussed with MENR and approved by the State Planning Organisation. At present, the production cost of lignite is about US$ 20 per tonne. The average selling price is about US$ 28; the price of lignite sold for power generation is lower, US$ 23 per tonne[15]. TKİ has not received any direct subsidies since 1994 and it has been able to cover its costs and make a profit. However, lignite power plants have a guaranteed market as long as the Turkish Electricity Wholesale and Trading Company (TETAŞ), a state-owned company, is buying all electricity from EÜAŞ's lignite-fired power plants; this guaranteed market will disappear once EÜAŞ is privatised and in any case within a maximum of five years as defined in the Electricity Market Law (provisional article number 6).

DEMAND AND SUPPLY

Total coal demand increased by 33% between 1990 and 2003 to 22.5 Mtoe. Its share of the TPES was 27%. Final consumption of coal grew by 77% over the period, reaching 13.4 Mtoe (see Figure 18). The government expects coal demand to grow by 56% by 2010 and two- to threefold between 2010 and 2020 driven by an increasing use of lignite in power generation.

Great variations can be seen in the demand for different types of coal. Steam coal demand has tripled since 1990 mainly driven by increased use in industry. The demand for coking coal is at the 1990 level. Lignite use increased by almost 35% from the 1990 level by 2000-2001 but declined sharply in 2002 because of a reduction in its use for power generation that year. Most lignite is sold to the lignite-fired power plants, the remainder is equally divided between the industry sector and heating in the residential and services sectors. Because of the new marketing strategy of TKİ, its sales to the residential and services sectors are slightly increasing and it is expected that this will continue in the future.

Table 13 shows that 60 to 65% of the indigenous hard coal went to electricity production, in practice to the Çatalağzı Power Plant operated by ÇATES. TTK is the only supplier of this plant. All TTK's coking coal is sold to Ereğli Iron and Steel Company and Karabük Iron and Steel Company, which are the biggest steel producers in Turkey and are located close to the coal basin.

15. Prices depend on the calorific value and selling volumes.

Table 13

TTK's Hard Coal Sales

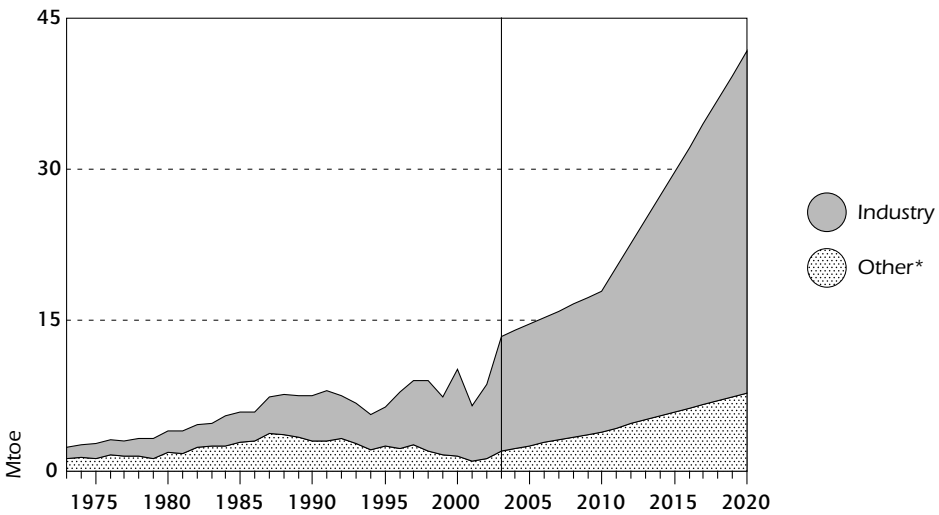
Sector	2001		2002		2003		2004	
	Mt	%	Mt	%	Mt	%	Mt	%
Steel industry	0.41	17.9	0.22	10.6	0.39	19.2	0.40	19.2
Power generation	1.48	64.5	1.39	66.2	1.27	62.4	1.27	62.4
Heating and other	0.40	17.6	0.49	23.2	0.38	18.4	0.35	18.4
Total	**2.29**	**100**	**2.10**	**100**	**2.04**	**100**	**2.02**	**100**

Source: MENR.

In 2003, total coal supply was 23 Mtoe, with domestic production accounting for about half of this (11 Mtoe). While domestic production is slightly less than in 1990, imports – all hard coal – have increased from 4 Mtoe in 1990 to 12 Mtoe in 2003. There are no quantitative restrictions or duties for coal imports. Low-sulphur hard coal is imported especially for residential use as well as for the iron and steel industry, which consumes about 25% of total hard coal imports. Hard coal imports for heating purposes have decreased because of the increasing use of natural gas.

Figure 18

Final Consumption of Coal by Sector, 1973 to 2020



* includes commercial, residential, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; and country submission.

In 2003, the main import source for coking coal was the United States (30%) followed by Australia (28%) and Canada (20%). Most of the steam coal imports came from Russia (55%), South Africa (19%), Colombia (15%) and China (9%).

CRITIQUE

Turkey has significant lignite reserves, which along with water for hydropower, are an important domestic energy source for the country. Domestic hard coal makes an additional but much smaller contribution. Hard coal imports have increased and this is likely to continue. Production levels of lignite, and to some extent hard coal, have declined in recent years.

Government projections for the growth in coal demand are aggressive driven mainly by the policy choice of rapidly increasing the use of lignite demand for power generation; therefore, the projections for coal should be interpreted as a "policy scenario", not "business-as-usual". However, given experience in other countries, it is not clear if this growth will be realised in a liberalised electricity market with private investment, especially with tightening environmental regulations. Any heavy-handed intervention by dictating that new generation investment must use domestic coal resources, or subsidising coal production to the degree it became the fuel of choice for investors, would distort the market and undermine the overall liberalisation process. Any exemptions from existing or future environmental regulations would, in turn, undermine environmental protection.

State-owned enterprises dominate mining operations. Despite recent efforts to improve productivity and significant reductions in the size of the overall workforce, productivity remains far short of world best practice. Operations appear to mirror the situation of subsidised production elsewhere in the world, which is being phased out. Production costs must be forced down. Lignite prices appear to be cost-reflective, but high compared with lignite production elsewhere. Sales depend on having a captive market because the plants close to lignite mines can neither use imported brown coal nor lignite mined in other parts of Turkey owing to the different parameters of the boilers. While lignite operations are not supported by direct subsidy, this fuel cost must be reflected in higher electricity charges. This would not be viable in an open market system where gas generating capacity could prove a more economically competitive option.

The only viable option is the far more vigorous pursuit of productivity so that coal can compete as a fuel on equal grounds, even in the face of costs associated with tightening environmental requirements. Private-sector practices must continue to be implemented as a matter of priority. The release of some production licences to the private sector, outsourcing of some

operational activities to private operators, and increasing the use of contract mining operations are useful steps. However, more radical action is required. Consideration should be given to the privatisation of further operations. Alternatively, moves to a greater proportion of lease and contract operations could be accelerated. Regardless of the approach, the government will need to step in with a significant one-off injection to cover redundancy costs, in particular to remove the significant and unproductive administrative overheads, as well as shouldering legacy costs associated with social dislocation. Otherwise new private investment in the mining sector will be hampered while it has to compete with state-subsidised or non cost-reflective operations.

Total hard coal subsidies have not been declining despite TTK's restructuring programme and the reduction in production. Furthermore, subsidies per tonne produced increased in the early 2000s. The arguments by the Turkish government for the continued subsidies to hard steam coal production are security of supply, resource diversification and social considerations. However, Turkey has large lignite resources, which make a much larger contribution to security of supply than its hard coal resources ever could. Furthermore, the international market in hard steam coal is well established and offers secure and reliable sources, at prices both now and in the future that Turkish national production is unlikely to be able to match even at considerably higher prices than at present. Therefore, an indefinite subsidy to national hard steam coal production is unnecessary in terms of energy policy and, albeit to a limited degree, distorts the international market.

The outlook for coking coal is more complex because the range of suppliers is more limited. Most imports of high-quality coking coal to Turkey come from Australia and Canada. In Australia, BHP Billiton has announced huge increases in production capacity, so physical supply of coking coal is unlikely to be a problem, and the Turkish steel industry could be confident that the international market for coking coal will remain very competitive compared with the Turkish domestic coking coal industry. As the competitiveness of coking coal compared to international prices is much better than that of steam coal, it seems sensible that TTK is concentrating more on supplying coking coal.

RECOMMENDATIONS

The Government of Turkey should:

- *Promote the advantages of domestic coal reserves as a fuel and continue reforms of the coal industry to ensure it can compete on equal and competitive terms in an open electricity market, but refrain from intervention*

(such as providing subsidies for coal or allowing exemption from environmental regulations), which would distort the market.

- *Rapidly step up efforts to increase productivity in coal mining, including through possible privatisation of state-owned operations, or accelerating current moves to lease and contract mining operations.*
- *Reduce coal subsidies with the aim of eliminating them, and set a clear deadline for this abolition. Replace the subsidies by restructuring programmes to address social impacts.*

POLICY OBJECTIVES IN THE GAS SECTOR

The objectives of the Turkish government in the natural gas sector are as follows:

- Increasing the use of natural gas.
- Expanding gas transmission networks.
- Building gas distribution networks in the cities.
- Establishing a liberal and competitive natural gas market.
- Diversifying the import sources for the security of supply.
- Developing transit infrastructures between the Caspian Sea and the Middle East and Europe.

INDUSTRY STRUCTURE

The state-owned company BOTAŞ is the only gas transmission company in Turkey. Its monopoly in natural gas imports, exports and wholesale trading was demolished with the enactment of the 2001 Natural Gas Market Law (Law no: 4646) and its current *de facto* dominating position in the import activities is subject to change in the course of the forthcoming gas market reform (see section on Market Reform).

Distribution is carried out by local distribution companies. For the time being, the major distribution companies are EGO in Ankara, İGDAŞ in İstanbul, İZGAZ in İzmit, AGDAŞ in Adapazarı, BURSAGAZ in Bursa and ESGAZ in Eskişehir. BURSAGAZ, ESGAZ and AGDAŞ have been privatised to the Çalık Group, the Kolin Construction Company and Erdem Holding, respectively. EGO, İGDAŞ and İZGAZ are owned by municipalities but will also be privatised. In 2003, the six distribution companies purchased a total of 4.6 bcm (equivalent to 21.5% of the total Turkish market) from BOTAŞ.

GAS EXPLORATION AND PRODUCTION

Turkey has small proven gas reserves. At the end of 2003, the remaining recoverable reserves were 8 bcm. In 2003, Turkey's gas production totalled 0.6 bcm. TPAO owns 16 of the 22 fields currently in operation. Most of them are onshore. The Kuzey Marmara field in the Marmara Sea was Turkey's first offshore field and the production began in 1997.

TPAO and local and foreign private companies conduct gas exploration and production in Turkey. Recent joint drilling by a TPAO-Madison Oil joint venture in Akçakoca in the western Black Sea resulted in gas discovery. TPAO is about to start a joint drilling programme with BP in Hopa/Artvin in the eastern Black Sea.

TPAO is also active in developing large-scale gas projects abroad (see Chapter 6 for more details).

Turkey is preparing a new Petroleum Law which will cover both oil and gas production and exploration (see Chapter 6 for more details).

SUPPLY SOURCES AND INFRASTRUCTURE

SUPPLY

Turkey's indigenous gas production corresponds to 3% of the total gas demand making the country almost fully dependent on gas imports. BOTAŞ is the sole natural gas importer. It has eight long-term sales and purchase contracts with six different supply sources as shown in Table 14. However, the gas trade has not started with Turkmenistan and Azerbaijan yet. In 2003, the shares of these sources were the Russian Federation 59.8%, Algeria 18.2%, Iran 16.6% and Nigeria 5.3%.

Since the last review, Iran has become a new supply source and a new route for Russian gas supplies has been commissioned. In 2001, a 10-bcm gas pipeline between Tabriz in Iran and Erzurum in Eastern Turkey was commissioned with a possibility to increase imports. Imports started in 2002, were 3.4 bcm in 2003 and should reach a plateau of 10 bcm by 2007.

The approximately 400-km offshore section of the Blue Stream pipeline – between Dzubga (Russia) and the Durusu terminal near the port of Samsun – has a capacity of 16 bcm and was undertaken by a joint venture between Gazprom and Italian ENI for the cost of US$ 2.3 billion. After a few months of operation, the deliveries to Turkey were suspended at the requirement of BOTAŞ in conformity with the contractual conditions. After price renegotiations, deliveries started reaching 1.3 bcm in 2003. A plateau of 16 bcm is expected to be reached in 2010.

Because of the 2001 economic crisis and overly optimistic expectations of economic development, natural gas demand has developed slower than anticipated. This has led to an oversupply risk because BOTAŞ has rapidly signed many long-term take-or-pay gas supply contracts in response to the former higher demand estimates. Merrill Lynch estimated that the existing contracts outstrip demand over the next two to three years by 9 to 13%, reaching 20% later in the decade. In contrast, BOTAŞ and the government do not consider oversupply as an imminent threat given that gas use is increasing

in the industrial and residential sectors throughout the country and because of the flexibility included in BOTAŞ's contracts (gas contracts typically include 10% flexibility from take-or-pay).

BOTAŞ has been operating an LNG terminal in Marmara Ereğlisi since 1994. The terminal is used to store LNG imported from Algeria and Nigeria and to re-gasify and inject into the main transmission line. Its total send-out capacity is 685 000 m^3 per hour and the annual operation capacity is 5.2 bcm of natural gas. Turkey has begun to top up its long-term LNG contracts with spot deliveries.

Out of the total natural gas imports of 21.2 bcm in 2003, about 16 bcm were imported via pipelines and about 5 bcm via the LNG terminal.

Table 14

Natural Gas Import Contracts

Existing agreements	*Volume (bcm/year)*	*Signature date*	*Length (years)*	*Operation date*	*Volumes delivered in 2003 (bcm)*
Russia (West)	6	February 1986	25	June 1987	11.4 (total Western pipeline)
Algeria (LNG)	4	April 1988	20	August 1994	3.8
Nigeria (LNG)	1.2	November 1995	22	November 1999	1.1
Iran	10	August 1996	25	December 2001	3.5
Russia (Black Sea)	16	December 1997	23	February 2003	1.2
Russia (West)	8	February 1998	23	March 1998	See above
Turkmenistan[1]	16	May 1999	30		0
Azerbaijan	6.6	March 2001	15	2006	0

[1] Contract suspended, among other things, for pending issue regarding the legal status of the Caspian Sea.

Source: MENR.

STORAGE

Underground natural gas storage facilities are planned to regulate fluctuations in consumption and to help in the case of gas supply deficits. However, owing to the oversupply risk arising from the take-or-pay supply contracts, gas storage is also needed to avoid penalties. Storage capacities will also be important for the development of transit capacities.

Three underground storage (UGS) projects are under development, namely the Northern Marmara-Değirmenköy project, Tuz Gölü (Salt Lake) and Tarsus (see Figure 19). The Northern Marmara-Değirmenköy UGS project uses the depleted natural gas fields in these two locations for storage. Its working gas

capacity will be 1.6 bcm per year and withdrawal capacity during high season will be 14 million cubic metres (mcm) per day. Construction has started and TPAO, who is the developer of the project, expects the facility to be operational in 2005. In the Tuz Gölü UGS project, natural gas will be injected into large caverns that will be produced by leaching of salt domes 700 m below ground surface. The engineering and consultancy studies for the project are under way and the environmental impact assessment has been completed. The third project is the Tarsus UGS, which would use sodium carbonate beds as UGS facilities.

TRANSMISSION

The gas transmission network is composed of 6 000 km of high-pressure transmission lines. Table 15 and Figure 19 show the existing pipelines as well as those under construction or planned. The total length of the transmission network will reach about 10 000 km, which includes the completion of lines under construction and planned.

Table 15

Natural Gas Pipelines in Turkey

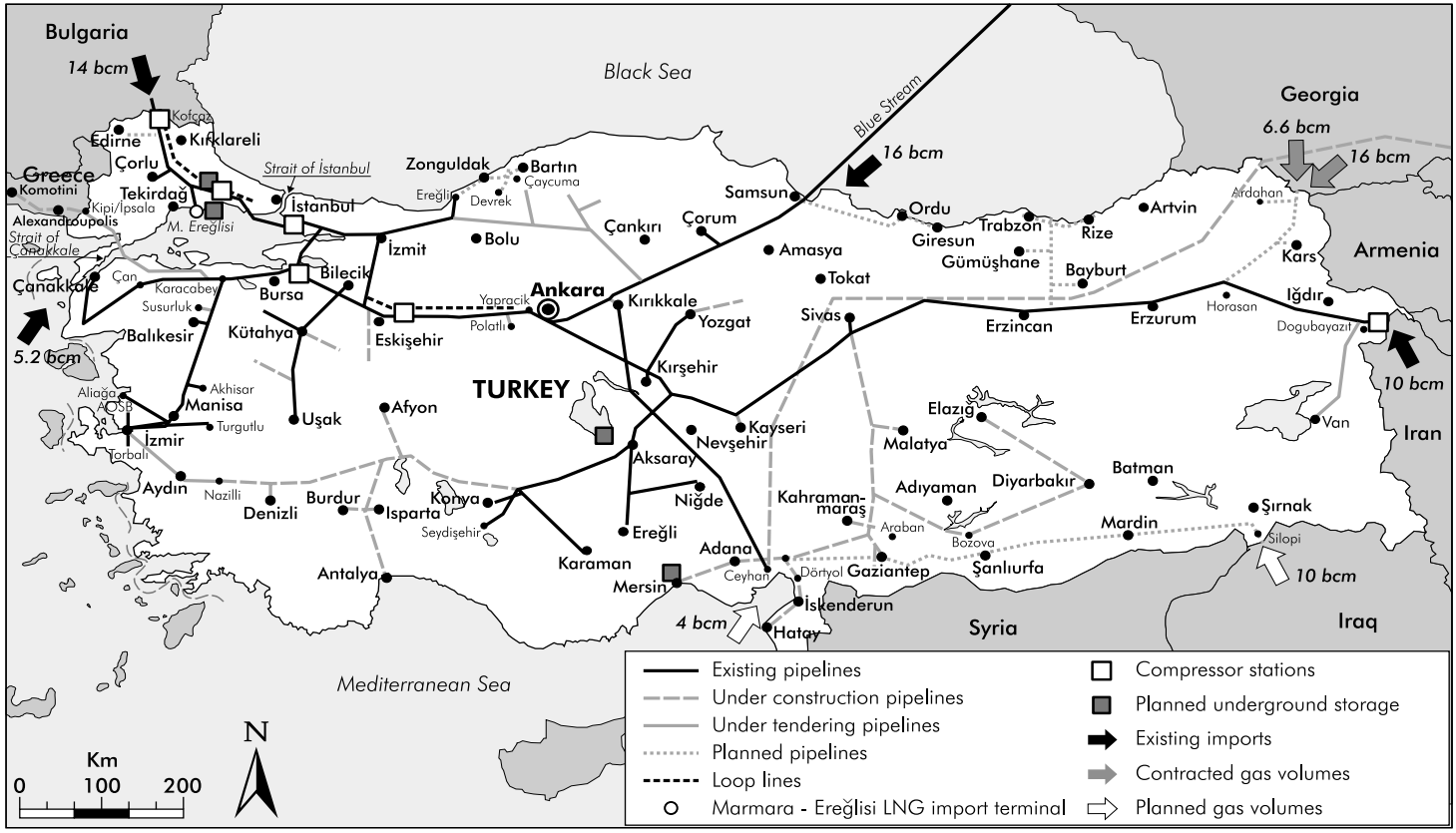
Pipelines	*Length*	*Diameter*	*Date of operation*
Existing national pipelines			
Main line Malkoçlar-Ankara	842 km	36 inches-24 inches (")	June 1987-August 1988
Pazarcık-Kdz. Ereğli	209 km	24"-16"	January 1996
Bursa-Çan	208 km	24"-8"	July 1996
Çan-Çanakkale	107 km	12"	July 2000
Eastern Anatolia main line	1 491 km	48"-40"-16"	December 2001
Karacabey-İzmir	241 km	36"	April 2002
Samsun-Ankara[1]	501 km	48"	January 2002
National pipelines under construction			
Southern (Sivas-Mersin)	565 km	40"	
Sivas-Malatya	168 km	40"	
Malatya-Gaziantep	182 km	40"	
Gaziantep-Mersin	215 km	40"	
Konya-İzmir	618 km	40"	
Konya-Isparta	217 km	40"	
Isparta-Nazilli	203 km	40"	
Nazilli-İzmir	198 km	40"	
Planned pipelines			
Eastern Black Sea region	308 km	24"-12"	
Kdz. Ereğli-Bartın	141 km	16"-12"	
Georgia border-Erzurum	225 km	48"	
Interconnector Turkey-Greece	200 km	36"	

[1] The domestic part of the Blue Stream pipeline.

Source: MENR.

Figure 19

Natural Gas Infrastructure



Source: *Natural Gas Information 2004*, IEA/OECD Paris, 2004.

TRANSIT

At present, there is no gas transit through Turkey but because of its advantageous geographical location, Turkey is determined to play an active role in bridging the European gas markets to Asia – especially transporting Caspian and Middle East gas to Europe. European gas demand is expected to increase considerably in this and the next decade. Therefore, Turkey is keen to develop new gas supply routes, to increase co-operation among the neighbouring countries and to stimulate the integration of the Turkish and European natural gas markets. It aims at implementing projects in line with the EU gas source diversification strategy and liberalised gas markets in Europe.

The three main cross-border gas pipeline projects are the Turkey-Greece Natural Gas Pipeline Project, the Turkey-Bulgaria-Romania-Hungary-Austria Natural Gas Pipeline (Nabucco) Project and the South Caucasus Pipeline (SCP) project.

Turkey has been implementing the "South European Gas Ring Project" in co-operation with Greece upon the invitation of the EC. The first phase of the project is interconnecting the natural gas grids of Turkey and Greece. The objective is to transport natural gas produced in the Caspian basin, Middle East, South Mediterranean countries and other international sources to the European markets. Intergovernmental Agreement of the Project was signed by respective ministers of both countries on 23 February 2003 and a natural gas sales and purchase contract was signed on 23 December 2003 by BOTAŞ and its Greek counterpart, the Public Gas Corporation (DEPA). According to the contract, BOTAŞ will sell 250 mcm of natural gas in the first year of the operation of the new pipeline, 500 mcm in the second year and 750 mcm thereafter to DEPA. The first delivery is expected to take place in 2006.

The total length of the Turkey-Greece interconnection, which is scheduled to be completed in 2006, will be 300 km of which 200 km will pass through Turkish territories and about 17 km will cross the Marmara Sea. An interconnection to link with Italy is also being considered and a feasibility study by DEPA and Edison Gas of the Greece-Italy Interconnection Project is approaching completion. It is envisaged that the transportation volume will reach 11 bcm of which 3 bcm will be consumed in Greece while the remainder will be transmitted to Italy.

The Nabucco Gas Pipeline project will connect Turkey with Austria via Bulgaria, Romania and Hungary. The Co-operation Agreement was signed among the associated companies of the respective countries on 11 October 2002. Nabucco Pipeline Study Company was established on 24 June 2004 to conduct studies on the business development issues regarding the

project; the commissioning of the pipeline is expected by the end of 2009. The total budget for the project is €4.6 billion. The total length of the pipeline is estimated at 2 845 km (1 283 km for the section Bulgaria-Baumgarten, Austria), with net capacity at 25.5 to 31 bcm per year. It will start at the Georgian/Turkish and Iranian/Turkish borders leading to Baumgarten and further, and will exit in Austria where it connects to other European markets.

The SCP project involves the construction of a 670 km pipeline capable of importing 8.1 bcm of gas from the Shah Deniz field in Azerbaijan to Turkey via Tbilisi. The capacity can be expanded to 22 bcm per year by adding new compression stations. The pipeline is planned to pass through the same corridor with the BTC oil pipeline. The SCP is expected to be commissioned by late 2006. The project cost is estimated at US$ 1 billion.

In the medium- to long-term future, Iraq and Egypt may also supply gas to the Turkish transit system for exports to Europe.

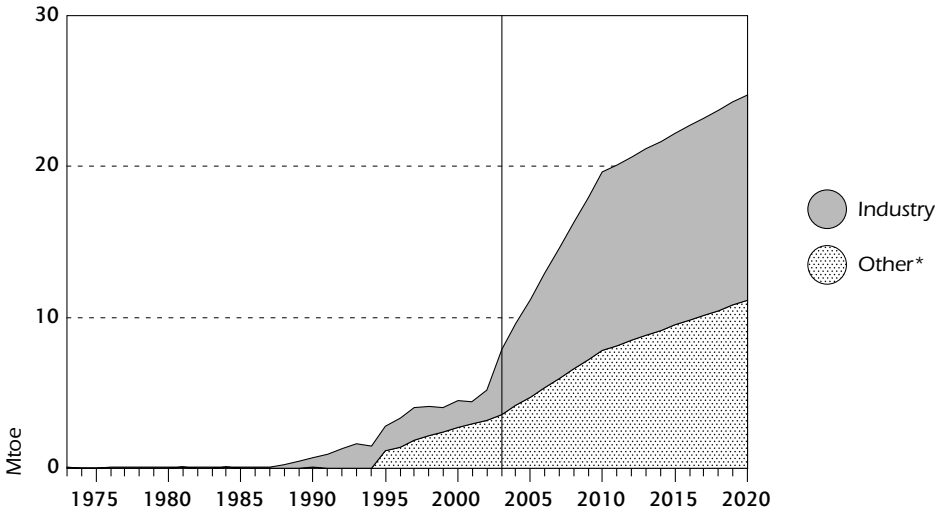
DEMAND

Natural gas consumption in Turkey began in 1987 and has increased rapidly, particularly since the mid-1990s. In 2003, gas supply totalled 19.5 Mtoe (21.2 bcm), accounting for 23% of the TPES. More than half of the gas was used for electricity generation and the share of gas in electricity generation was 45% in 2003. Total final consumption of natural gas was 7.9 Mtoe of which 55% was consumed by industry and 45% by the other sectors altogether (see Figure 20). According to the latest government forecasts, gas demand will increase by about 90% between 2003 and 2010 and almost triple between 2003 and 2020. The average annual growth rate would be 10.5% until 2010 and 3.2% thereafter. Given the overcapacities in power generation, new demand is expected to come almost exclusively from the industrial and residential sectors at least until 2010.

As the gas infrastructure is being expanded, new consumers are joining the networks. The construction of natural gas pipelines to the south-west of the country will be finished by the end of 2004. In addition, tender procedures for distribution and customer connection lines in 27 new regions have been initiated. At present six major cities are supplied with natural gas, namely Ankara, İstanbul, Bursa, Eskişehir, İzmit and Adapazarı. Sixty cities will have access to gas after the completion of the south pipeline stretching from Konya to İzmir and the north-east pipeline stretching from Gümüşhane to Trabzon and from Bayburt to Rize. BOTAŞ estimates that by the end of 2006, 80% of the population will have access to gas.

Figure 20

Final Consumption of Natural Gas by Sector, 1973 to 2020



* includes commercial, residential, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; and country submission.

SECURITY OF GAS SUPPLY

The government policy is to diversify gas import sources and, consequently, BOTAŞ has signed sales and purchase contracts with seven different suppliers in six countries and TPAO is developing international gas projects.

LNG imports and storage facilities are also given high importance in order to enhance the security of supply. Under the 2001 Natural Gas Market Law market players are required to prove to the regulator that their services are economic and safe. In addition, the law obliges gas importers and wholesalers to provide storage for 10% of their imported gas. The companies have been given five years to comply.

The seasonality of demand is relatively high, especially in the residential sector which is an important gas consumer. Over 70% of the annual gas consumption in this sector is consumed between December and March. To date, the seasonality of demand has been met uniquely by import flexibility and supply interruptions to interruptible consumers, but the new storage facilities will contribute in the future. BOTAŞ estimates that the gap between peak supply and peak demand is currently 10-15 mcm per day.

Only a small part of generating capacity is multi-fired, with plants running on natural gas playing a major role. Increases in gas consumption in cities during

winter have led to interruptions of gas supply to interruptible customers for peak-shaving purposes. Interruptions in gas supply take effect with an eight-hour prior notice but the notice period can be shorter in special circumstances. The interruptions are usually made between December and March and can last from several days to weeks. The price for interruptible customers is on average 3% less than the price for non-interruptible customers.

PRICES AND TARIFFS

It is the task of EMRA to determine the principles and procedures for setting the regulated prices and tariffs. At present, EMRA applies the price ceiling to storage, wholesale and transmission tariffs. As for distribution in existing distribution zones, EMRA determines unit service and depreciation charges for the supply of natural gas. For distribution zones tendered by EMRA, the unit service and depreciation charge is determined as a result of the tender.

In a rough comparison with other IEA member countries (see Figure 22), Turkish gas prices for industrial consumers appear to be in the mid-range, whereas those for household consumers are in the lower range. This is the outcome of the uniform ceiling price when cross-subsidies exist from industrial consumers to households. Figure 21 shows that prices for industrial consumers have increased since the late 1990s but not for household consumers. This implies that the cross-subsidies have been rapidly increasing.

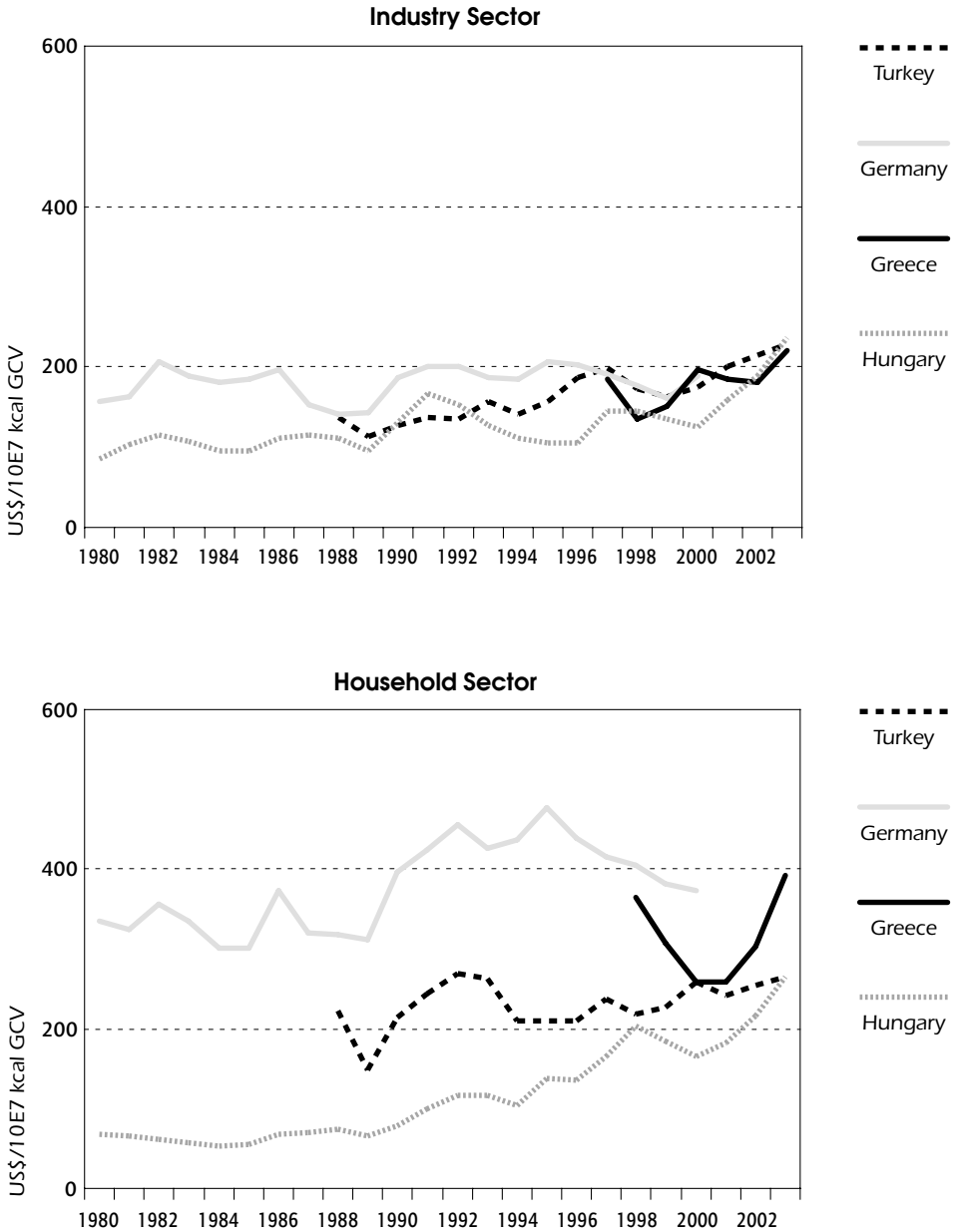
MARKET REFORM

The gas market operations are regulated by the Natural Gas Market Law (Law no 4646) of 2 May 2001. The law entered into force after an 18-month transition period on 2 November 2002. The objective of the law is to establish a competitive gas market, reduce state role in the sector and to harmonise the Turkish legislation with EU law. The law meets with the requirements of the 2003 EU Gas Directive.

EMRA is the independent regulator responsible for electricity, natural gas and petroleum markets (see Chapter 3 for general details). The main responsibility of EMRA in the gas sector is to set up and implement regulatory measures to ensure the establishment of a liberal and competitive natural gas market where all market segments will be open to new entrants. It also regulates and approves transmission, storage and wholesale tariffs, and until competition is achieved, all retail tariffs. The secondary legislation has been issued including regulation for licences, tariffs, internal installations, market certificates, transmission network operation, distribution and consumer services and facilities (infrastructures and equipment).

Figure 21

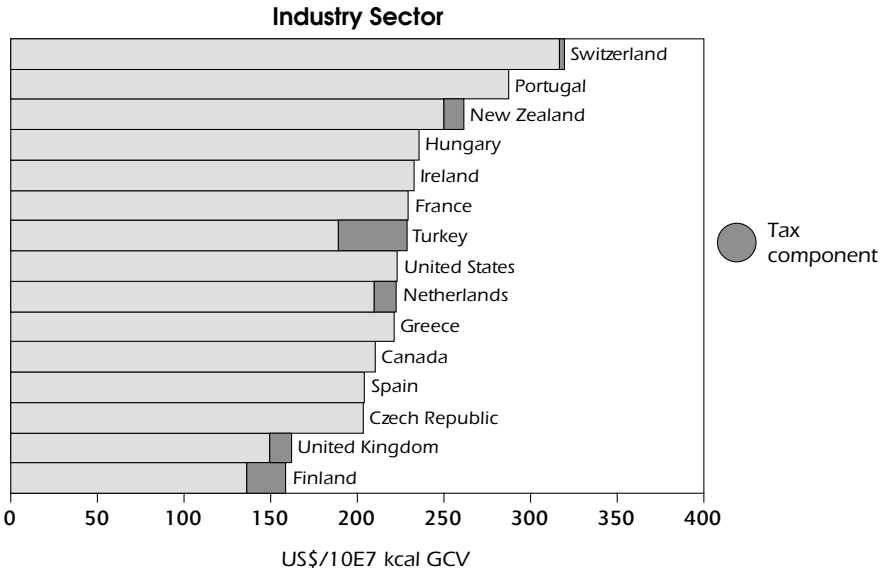
Gas Prices in Turkey and in Other Selected IEA Countries, 1980 to 2003



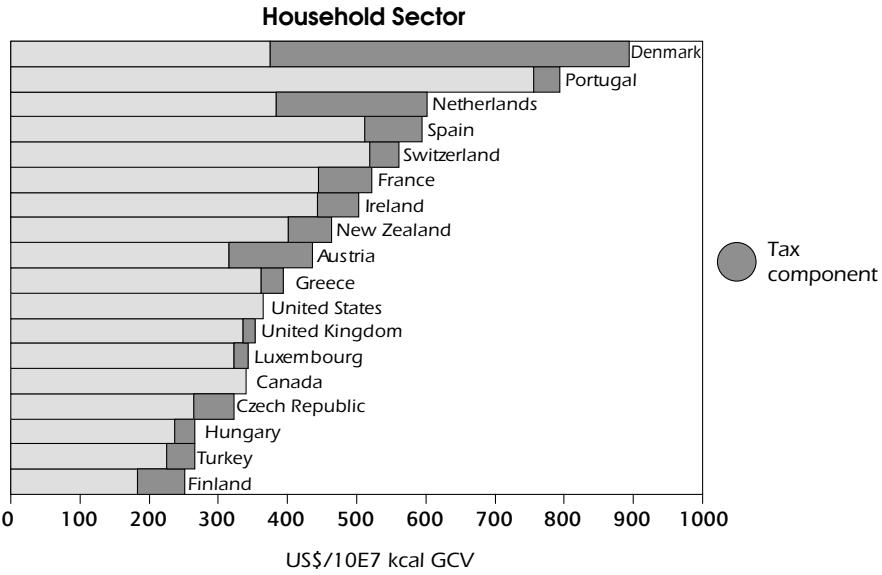
Note: GCV = gross calorific value.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2004.

Figure 22

Gas Prices in IEA Countries, 2003



Tax information not available for Canada and the United States. Data not available for Australia, Austria, Belgium, Denmark, Germany, Italy, Japan, Korea, Luxembourg, Norway and Sweden.



Note: Tax information not available for Canada and the United States. Data not available for Australia, Belgium, Germany, Italy, Japan, Korea, Norway and Sweden.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2004.

BOTAŞ is Turkey's sole natural gas importer and has a *de facto* monopoly of all gas supply in the country. As per the Gas Market Law, the monopoly rights of BOTAŞ on importation, distribution, storage and the sale of natural gas have been abolished. However, one importation restriction remains under the law, namely that other companies can only import gas from countries that BOTAŞ does not import from. All other operations except transmission will be possible for legal entities subject to relevant licences. Transmission activities will remain with BOTAŞ.

Consumers whose annual consumption is above the threshold set by EMRA have the right to choose their own gas suppliers. At present, the gas market opening rate is 80%. Although eligible consumers have the right to choose their suppliers, this right cannot currently be exercised because of the *de facto* monopolistic position of BOTAŞ in import and trade.

The Natural Gas Market Law limits the market share of any importer or wholesaler to 20% of the domestic market. This applies also to BOTAŞ who cannot enter new purchase contracts until its share of imports falls to the required level. To reach this, a contract transfer programme has been launched by BOTAŞ in accordance with the law, which requires BOTAŞ to transfer at least 10% of its minimum total purchase quantity within the take-or-pay contracts every year to reach the 20% market share by 2009. The law prioritises contract transfer. However, if a contract cannot be agreed upon between the new importer and the supplier, then the transfer can be realised through volume transfer provided that the importer agrees to undertake all cross-border liabilities of BOTAŞ and that the natural gas price is not lower than in the existing contracts. The implementation of the contract transfer programme has been delayed by about a year but the first tender has been launched in November 2004 corresponding to 16 bcm of gas. The transfer is expected to take effect in 2005.

The law stipulates BOTAŞ to be legally unbundled after 2009 to form separate companies for transmission, storage, importation and trade. Account unbundling was initially scheduled for November 2003. However, owing to delays it is re-scheduled to take place at the beginning of 2005 subject to the Parliament accepting an amendment to the Natural Gas Market Law. Another amendment, which would have significantly reduced the scope of the gas-release programme was proposed earlier in 2004 but was withdrawn because of heavy opposition from EMRA and other parties.

Rules for third-party access (TPA) to the transmission network and principles and procedures pertaining to TPA tariffs are set in the Network Code, which was finalised by EMRA in August 2004. The Network Code entered into force on 1 September 2004. The TPA tariff will be based on an entry-exit system and will be subject to EMRA's approval. Transmission capacity will not be offered to third parties until the code enters into force. The transmission and

distribution companies are obliged to demonstrate to EMRA that their operations are cost-efficient, effective and reliable. They also have an obligation to connect all users to the networks. In the case of rejection of TPA, the rejected party can complain to EMRA whose decision is final and binding.

Legal entities must obtain licences in order to engage in any market activity. Separate licences are required for each market activity and, in cases where an activity is conducted in more than one facility, for each facility. A licensing process in the natural gas market started in November 2002 and as of February 2005, EMRA had granted 65 licences for different natural gas market activities, namely storage, importation (all for BOTAŞ), wholesale, distribution, transmission (only for BOTAŞ) and CNG operations.

EMRA is responsible for organising tenders for natural gas distribution licences in the cities. Prequalification for tendering is based on the financial strength and experience of the potential licensees. Evaluation of the tenders is based on the unit service and depreciation charge for supplying one kWh of natural gas to consumers. Licences are granted for a minimum of 10 and a maximum of 30 years. The tender process was carried out in 17 cities in 2003 and in almost 20 cities in 2004.

CRITIQUE

SUPPLY AND DEMAND

While the gas market has not reached full maturity in some segments, natural gas now accounts for 23% of the TPES in Turkey. Gas already contributes significantly to supply diversity and reduces the adverse environmental impacts, including GHG emissions and traditional pollutants, caused by some more traditional energy carriers in Turkey. Further benefits can be gained when access to gas is extended to more industrial and residential consumers. Little growth is expected in the short- to mid-term future in power generation owing to current generating overcapacity.

Domestic gas production is currently very small and Turkey imports most of the gas it needs. Although some new discoveries have recently been made, the share of imported gas will continue to grow. From a security of supply perspective, it is commendable that Turkey has been continuously diversifying its gas supply sources since its introduction of gas in 1987 by contracts with multiple sources and by developing gas projects abroad through TPAO.

While long-term take-or-pay gas import contracts have been contributing to security of supply, they reduce the feasibility and possibilities to seek cheaper gas sources, such as purchases from spot markets. The rigidity of take-or-pay

contracts, together with overestimated gas demand, has also created a situation of oversupply risk. For example, deliveries through the Blue Stream pipeline were temporarily suspended in 2003 and some other import contracts have not been activated. While the contracts are insufficient to cover the winter supply peak, there could be up to 20% of oversupply on an annual basis later this decade. The government expects new industrial and residential gas consumers to help to mitigate the oversupply risk. However, it is not clear if this will be sufficient especially as residential consumers, in particular, use gas mainly in the winter peak. As future gas demand is uncertain, Turkey should make efforts to develop a portfolio approach and sign more flexible contracts, including spot, medium- and long-term contracts.

Some 60% of natural gas consumed in Turkey in 2003 was imported from Russia. The dependence on Russian gas has been reinforced by commissioning of the 16 bcm Blue Stream pipeline (the new direct Russia-Turkey line) and the associated supply contract. The level of demand as well as the diversity, volumes and price of contracted supplies and the available capacity of the existing Trans-Balkan pipeline (the old import pipeline from Russia through Bulgaria) have raised the question of the effective use of the Blue Stream pipeline, which required major investment. Although the rapid growth of transmission capacity and projects appears to be a strength, there are also risks of misallocation of investment if gas demand does not grow as expected.

Gazprom has acquired a 40% stake in the distribution company Bosphorus Gas and appears to plan to be active in the Turkish gas market. If the market power of any external suppliers in the downstream gas market becomes excessive, it could have a negative implication on the achievement of a diversification policy, effective domestic competition and the development of transit lines. On the other hand, it could perhaps reduce prices by taking advantage of the power of an upstream company if acting on a competitive basis. The situation warrants active monitoring of the market.

STORAGE

The new gas storage facilities can clearly help to meet peak demand. As the estimated gap between peak demand and peak supply capacity is now 10 to 15 mcm per day and the maximum daily emission capacity of the first underground storage facility will be 11 mcm, it will make a significant contribution. On the other hand, the mandatory gas storage adds an extra cost, which could act as one more entry barrier and therefore reduce competition. Therefore, decisions to build storage facilities to cover peak supply caused by seasonality should be made on the basis of economic criteria taking into account the alternative approaches, namely more flexible supply contracts, interruptible consumers and multi-firing in power plants.

GAS NETWORKS AND TRANSIT

The domestic gas network is rapidly being extended. There are many important transmission pipeline projects under construction or planned and the distribution networks are being extended rapidly. It should be ensured that end-use tariffs, which are still subject to regulation owing to a lack of competition, enable the necessary investments while allowing consumers to enjoy competitively-priced services.

Turkey's determination to play an active role in bridging the Asian and the European gas markets is facilitated by its geographic location close to many important gas-producing countries. Large transit pipeline construction projects have already begun and others are being promoted by Turkey and various interested parties. The government should be highly commended for its determination and successful long-term view in these large-scale projects, which enhance supply diversity, security of supply and competition not only in Turkey but also in Europe. However, there are some preconditions for the success of the projects. One of the preconditions being the regulatory systems – including pricing – for gas transit, which needs to be discussed and approved by EMRA in line with the Energy Charter Treaty because this will be crucial for the viability of the planned transit routes. Another is the need to implement and even accelerate the reform of the domestic gas market given that a large share of the gas imported through the pipelines will be consumed in Turkey. Yet another issue to be considered is congestion, which could develop in the interconnections and networks owing to transit and possible increased domestic competition in the future (see section on Market Reform).

PRICING AND TARIFFS

The flat price cap means that there are cross-subsidies between different consumer groups, notably from industrial consumers to residential consumers, and between different geographical areas. Distorted prices can undermine efficient and timely private investment and lead to inefficient use of energy. Therefore, it is positive that the government considers the uniform price caps as a temporary measure. However, the criteria for abolishing caps should be made clearer as it has currently only stated that the price caps will be removed "when competition develops". It should also be noted that even in monopolistic markets prices should be based on cost.

MARKET LIBERALISATION

It is commendable that the government has recognised the potential benefits of competitive markets and has initiated reform. With the Natural Gas Market Law (NGML) of 2001, the structure of the market will be substantially

modified with an intention to transform the monopolistic market structure into a competitive one by encouraging new market entry and investments. Many of the key provisions of the law have been implemented, such as establishing the regulatory responsibilities in the sector with an independent regulator (EMRA) and allowing, in principle, a large part of the market to choose suppliers. However, a significant amount of work still lies ahead because no competition has developed. The main concerns, as discussed in more detail hereunder, are BOTAŞ's *de facto* monopoly in imports, the lack of an independent transmission system operator and the lack of incentives for eligible consumers to change suppliers caused by the TPA tariff structures in the distribution networks. Yet another concern is that gas market reform is behind that in the electricity market given the increasing convergence of these two markets.

By law, the monopoly rights of BOTAŞ in imports, and consequently in practice the wholesale pricing of natural gas, are to be reduced gradually. Because BOTAŞ has a dominating position in the gas market and there are few possibilities for new entrants to import gas owing to current supply overcapacity, the NGML requires BOTAŞ to transfer part of its import contracts every year through a tendering process (the gas contract transfer programme). Reducing BOTAŞ's share in imports will be absolutely necessary for the market liberalisation to be successful and competition to develop. However, the process has been delayed by the complexity of releasing these contracts. It is positive that the first attempt to transfer 10% of BOTAŞ's contracts was recently launched but it is not clear if contract transfer will be successful because the suppliers may not accept the new contracting parties. The roles of BOTAŞ and of the government in implementation of gas release programme are not fully clear. While some of the import contracts are executed within the framework of intergovernmental agreements, it is BOTAŞ which will have to implement the contract transfer programme. The government should define its role to facilitate successful negotiation of contract transfer. If contract transfer does not proceed as expected, the government should be ready to rapidly implement volume transfer.

Past delays in contract transfer have demonstrated that the initial schedule for the contract transfer programme has not been realistic. They have also demonstrated the complexity of this transfer mechanism. A new schedule needs to be worked out. It should also be evaluated what is the desired level of the maximum market share of any one company, including BOTAŞ, of the gas imports to allow for adequate contestability. Examples of market share caps can be found in other IEA member countries but the levels are not as low as 20%; for example, ENI has a 60% market share cap in Italy. However, care should be taken that the new schedule and cap would not eternalise the dominant position of BOTAŞ. On the other hand, BOTAŞ also needs to find its new role in the liberalised markets and it should eventually be allowed to enter new importation contracts. A clear strategy with practical milestones

and time schedule for the implementation of the reform in the gas sector, comparable to that published in March 2003 in the electricity sector, appears necessary. Therefore, it is positive that the government has launched the development of such a schedule.

At present, import sources by other parties are limited to countries that BOTAŞ does not import from. This provision can hamper new entry once gas demand increases and there will be room in the market for new gas supply contracts. The government should refrain from setting market rules which prohibit the market players from looking for the cheapest sources of supply and favour one company.

In the future, when imports from parties other than BOTAŞ expand and when total import volumes increase, congestion may develop in the infrastructures as seen in many other IEA member countries. Therefore, market-based mechanisms, such as auctioning, should be developed for the fair allocation of the interconnection capacity.

BOTAŞ has been nominated as the national transmission system operator (TSO), but it is not a so-called "independent TSO", which is a prerequisite for the effective functioning of liberalised gas markets. It will be mandated to implement account unbundling from the beginning of 2005. This will increase transparency in setting TPA tariffs for the transmission networks. However, this is insufficient to create a level playing field in the market. With vertical separation there is no longer an economic benefit for the owner of a grid monopoly to favour its supply activity. Legal unbundling of the supply/wholesale function from the operation of the transmission networks will be necessary to create a truly independent TSO and to comply with the 2003 EU Gas Directive. Legal unbundling helps to avoid situations where a vertically integrated transport company might discriminate in favour of its own gas supply business. The same rules should also apply for future gas storage capacities.

Further transparency and thus a more level playing field can be gained by making the legally unbundled supply/wholesale company a corporate company that, despite possibly staying under government ownership, would be allowed the flexibility to operate like a private enterprise. The government should not interfere with its day-to-day operation and management.

Turkey will implement regulated TPA, in line with the 2003 EU Gas Directive. Regulated TPA tariffs can enhance transparency and fair treatment if combined with the establishment of an independent TSO. It should be ensured that the rules for the calculation of TPA tariffs are fully transparent. In the longer term, exemptions to TPA, in accordance with Article 22 of the EU Gas Directive, can be used to stimulate investment in new facilities, particularly by new entrants.

The regulation for the downstream gas market needs to be reviewed. At present, the key criterion in tendering the gas distribution areas is the TPA tariff, which is the same for all consumers and is measured in cubic metres.

Since the rate is flat, distribution companies have become concessionaries in their distribution areas because consumers do not have any incentive to change suppliers. It would be advisable to consider other options, such as making the TPA tariffs at least partly based on volumes. Special consideration would also be needed for TPA tariffs for consumers who build their own pipelines.

Serving consumers, particularly small ones, requires access to flexibility services which can be purchased from storage owners. This should be a commercial service, which any competent market entity should be able to undertake. At present, it has been forbidden for BOTAŞ. While mandatory TPA can facilitate access to storage facilities, to encourage investment, new facilities built by new entrants could be exempted from the TPA obligation for a given time.

RECOMMENDATIONS

The Government of Turkey should:

- *Encourage the expansion of the gas distribution networks to new cities for the environmental benefits and to enable imports by new entrants from any supplier, thereby reducing BOTAŞ's market power.*
- *Continue to promote gas transit routes and establish the necessary regulatory framework.*
- *Make natural gas prices cost-reflective for all consumer groups. Eliminate cross-subsidies between different customers.*
- *Develop and support mechanisms to divest existing imports, in accordance with a defined schedule, to provide a fair chance for new entrants. Clarify the role of the government and BOTAŞ in this process.*
- *Lift the restrictions on sources of natural gas imports by other parties from countries where BOTAŞ is importing, while paying due attention to diversification of supply sources.*
- *Monitor the market power of external gas suppliers.*
- *Define the exact steps to be taken to establish a fair and transparent open market as envisaged in the Gas Market Law. Closely monitor the progress.*
- *Establish an independent gas transmission system and storage operator by effective unbundling of BOTAŞ. Corporatise BOTAŞ.*
- *Review TPA tariffs to the distribution networks and storage to enhance the possibilities of eligible consumers to switch suppliers.*

SUPPLY

Turkey has substantial renewable energy resources. Renewables make the second-largest contribution to domestic energy production after coal. In 2003, energy from renewable sources amounted to 10 Mtoe (12% of TPES). This shows very little increase from 1990 when 9.7 Mtoe renewables were used (18% of the TPES). More than half of renewables used in Turkey are composed of combustible renewables and waste, the rest being mainly hydro and geothermal (see Table 16). Combustible renewables and waste used in Turkey are almost exclusively non-commercial fuels, typically wood and animal products, used in the residential sector for heating. The use of biomass for residential heating, however, has declined owing to replacement of non-commercial fuels by commercial fuels. The contribution of wind and solar is still small but is expected to increase.

Table 16

Renewable Energy Supply in Turkey, 1990 to 2003

	1990	*1995*	*2000*	*2001*	*2002*	*2003*
Primary energy supply						
Hydro (ktoe)	1 991	3 057	2 656	2 065	2 897	3 038
Geothermal, solar and wind (ktoe)	461	654	978	1 056	1 142	1 215
Biomass and waste (ktoe)	7 208	7 068	6 457	6 211	5 974	5 748
Renewable energy production (ktoe)	**9 660**	**10 779**	**10 091**	**9 332**	**10 013**	**10 001**
Share of total domestic production (%)	38	40	38	37	40	42
Share of TPES (%)	18	17	12	12	13	12
Generation						
Hydro (GWh)	23 148	35 541	30 879	24 010	33 684	35 330
Geothermal, solar and wind (GWh)	80	86	109	152	153	150
Renewable energy generation (GWh)	**23 228**	**35 627**	**30 988**	**24 162**	**33 837**	**35 480**
Share of total generation (%)	40	41	25	20	26	25
Total final consumption						
Geothermal, solar and wind (ktoe)	392	580	910	974	1 048	1 134
Biomass and waste (ktoe)	7 208	7 068	6 457	6 211	5 974	5 748
Renewable energy TFC (ktoe)	**7 600**	**7 648**	**7 367**	**7 185**	**7 022**	**6 882**
Share of TFC (%)	18	15	12	13	12	11

Source: MENR.

Electricity generation from renewables totalled 35.5 TWh and contributed 25% to total generation in 2003. In 1990, generation from renewables was 23.2 TWh and their share in power generation was higher, representing 40%. Hydro is the dominant source of renewable electricity, with only 0.15 TWh derived from other sources. Hydro production fluctuates annually depending on the weather.

HYDROPOWER

Hydropower generation climbed from 2 Mtoe (23.1 TWh) in 1990 to 3.0 Mtoe (35.3 TWh) in 2003, growing on average by 3.8% per year. Figure 23 shows the development of hydropower and Table 17 indicates the 2004 status of hydropower projects in Turkey.

Table 17

Hydropower in Turkey, 2004

Status	*Installed capacity (MW)*	*Average annual generation (TWh)*	*Number of projects*
In operation	12 618	45.2[1]	135
Under construction	3 219	10.7	41
Final design completed	3 585	10.9	15
Feasibility study completed	6 918	25.1	143
Master plan completed	5 161	17.9	89
Reconnaissance completed	4 759	17.5	255
Total	**36 260**	**127.4**	**678**

[1] Annual generation has increased significantly from 2003 because of the commissioning of the large Birecik Power Plant.

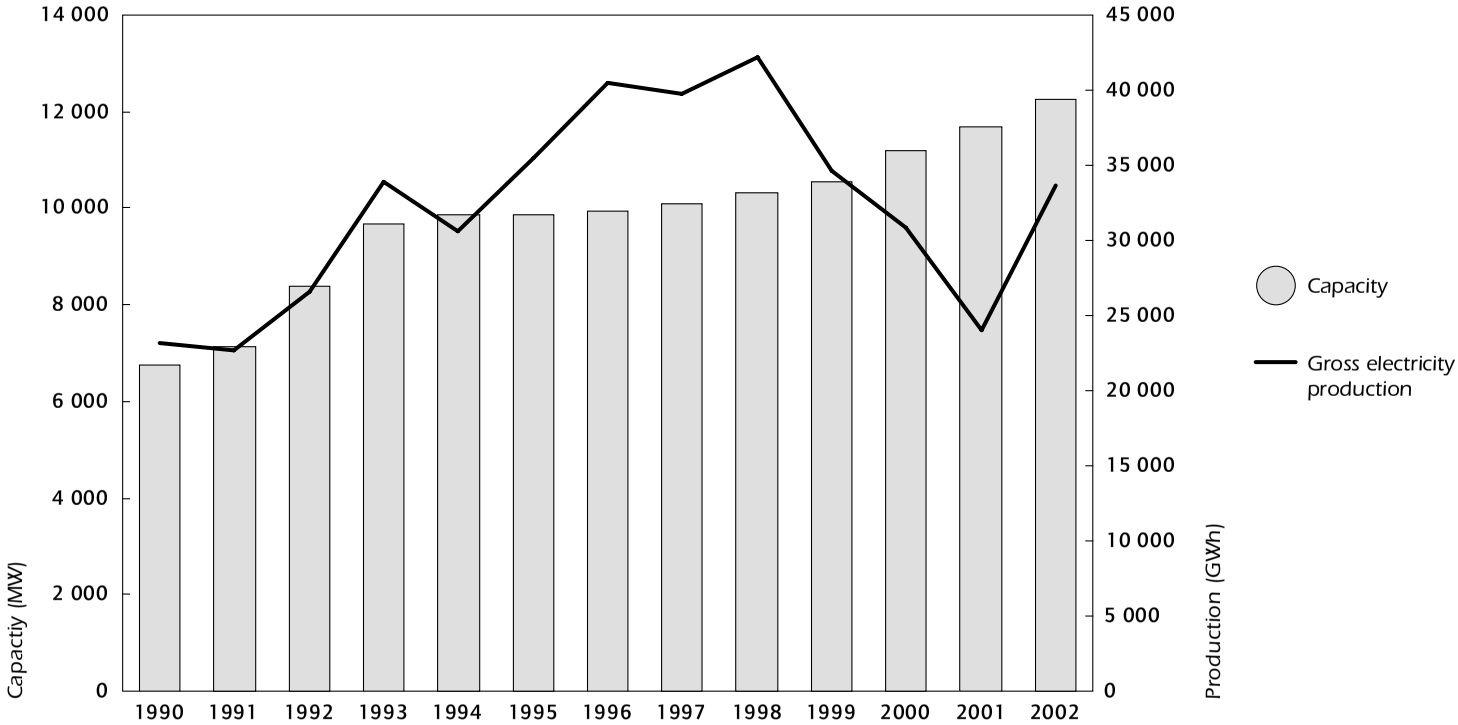
Source: MENR.

The economic hydropower potential has been estimated at 128 TWh per year, of which 35% has been exploited. The government has a strategy for developing the hydropower potential and expects a few hundred plants to be constructed over the long term adding more than 19 GW of capacity. Construction costs would be approximately US$ 30 billion. The government expects hydropower capacity to reach about 31 000 MW in 2020. Some 500 projects (with a total installed capacity over 20 400 MW), which are in different phases of the project cycle, are awaiting realisation.

Turkey's hydro generating capacity includes the huge South-East Anatolia Project (GAP) which is one of the most ambitious water development projects ever undertaken. GAP is an integrated hydroelectric and irrigation project and its objectives are the reduction of Turkey's regional disparity in economic

Figure 23

Hydropower Capacity and Electricity Production, 1990 to 2002



Source: *Renewable Energy, Market & Policy Trends in IEA Countries*, IEA/OECD Paris, 2004.

prosperity, employment and infrastructure. The GAP project is situated in the lower reaches of the Euphrates and Tigris rivers and in the plains between them. The project covers an area of almost 74 000 km^2, equalling one-tenth of Turkey's total land surface. Upon completion, GAP will include 21 dams, 19 hydropower plants and a network of tunnels and irrigation canals. The hydropower plants will have an installed capacity of 7.5 GW producing 27 TWh of hydroelectricity annually. Major hydro dams of the GAP include: Atatürk (2 400 MW of capacity), Karakaya (1 800 MW), Ilısu (1 200 MW – highly controversial owing to environmental concerns), Cizre and Silvan/Kayseri (240 MW each), Batman (198 MW), and Konaktepe and Karkamış (180 MW each); 12% of the irrigation projects and 72% of the hydropower projects have been completed, including the Karakaya, Atatürk, Birecik, Karkamış, Dicle, Kralkızı and Batman power plant projects. The completion of the whole project is expected in 2014. The total cost of the project has been estimated at US$ 32 billion of which investments of US$ 16 billion have already been made.

Turkey and its downstream neighbours Syria and Iraq are located in one of the driest regions of the world. Their combined water needs exceed the capacity of the Euphrates and Tigris rivers. Turkey maintains that the dam system will stabilise water supplies as it will help regulate the highly erratic water flow in the Tigris.

Table 18

The GAP Project, 2004

Name of dam or power plant	*Status*	*Capacity (MW)*
Karakaya		1 800
Atatürk		2 400
Kralkızı		94
Dicle	In operation	110
Batman		198
Karkamış		189
Birecik		672
Total in operation		**5 463**
Kayacık		–
Şanlıurfa	under construction	50
Total under construction		**50**
Erkenek		7
Garzan	preliminary research	90
Silvan		240
Adıyaman	master plan	195
Ilısu		1 200
Cizre	planned with credit	240
Total planned		**1 972**

Source: MENR.

Turkey has a lot of potential for small hydropower (< 10 MW), particularly in the eastern part of the country. At present the total installed capacity of small hydropower is 176 MW in 70 locations, with annual generation of 260 GWh. Ten units are under construction with a total installed capacity of 53 MW and estimated annual production of 133 GWh. Furthermore, 210 projects are under planning with a total capacity of 844 MW and annual production of about 3.6 TWh.

GEOTHERMAL ENERGY

The contribution of geothermal to TPES was 0.86 Mtoe in 2003, including 89 GWh of electricity generation. Turkey has significant potential for geothermal energy production, enjoying one-eighth of the world's total geothermal potential. This potential has been estimated at 4.5 GW of electric capacity (GW_e) and 31.1 GW of thermal capacity (GW_{th}); most of this is of relatively low enthalpy making it unsuitable for electricity generation but can still be used for direct heating applications. By the end of 2003, Turkey's total direct geothermal heating capacity was 1 077 MW_{th}, of which 619 MW_{th} provided heat for 71 000 residences, 131 MW_{th} for 63.5 hectares of greenhouses and 327 MW_{th} was used to provide hot water to about 200 spas. The government estimates that 500 000 residences could be heated by geothermal power by 2010, representing heat use of 2 190 MW_{th}.

Despite having already announced the first geothermal energy programme in 1972, Turkey still has only one operating geothermal power plant, a 17.5 MW_e facility in the Denizli-Kızıldere field. The facility includes nine production wells and has an integrated liquefied CO_2 and dry ice production factory. Another geothermal power station (49 MW_e) and five heat plants (73 MWt_h) will be added. Two geothermal electricity generation projects with a capacity of 13.45 MW and a slightly smaller one have been licensed. The cost of electricity from geothermal resources is between €0.03 and €0.10 per kWh; the bottom end of this range is competitive with conventional systems.

There are 11 other geothermal fields, all in far south-west Turkey, which may be suitable for geothermal power production. The Germencik-Aydın field in the Aydın Province is the most promising one. Power generation potential in this field has been estimated to exceed 100 MW_e.

SOLAR ENERGY

According to a solar estimate made in 1983, there are on average 2 640 sunshine hours per year in Turkey and the average solar intensity is 3.6 kWh per square metre per day (see Table 19 for regional data). However, because these historical estimates are not sufficiently accurate for electricity generation

projects, new solar potential measurement projects are under way and data will be collected in selected sites in different parts of the country over a five-year period. At the moment, measures are being conducted in the cities of Ankara, Adana, Isparta, Kayseri and Balıkesir. The measurements in the cities of Antalya, İzmir and Aydın cities have been completed.

Table 19

Regional Solar Energy Potential of Turkey

Region	*Total solar energy (kWh/m² per year)*	*Sunshine duration (hours per year)*
South-eastern Anatolia	1 460	2 993
Mediterranean	1 390	2 956
Eastern Anatolia	1 365	2 664
Central Anatolia	1 314	2 628
Aegean Region	1 304	2 738
Marmara Region	1 168	2 409
Black Sea	1 120	1 971

Source: MENR.

Flat-plate solar collectors used for domestic water heating are widely used and commercially available in Turkey. In 2003, the collector surface area installed in Turkey was 10 million m^2, including both household systems and large-scale use in hotels, industrial activities, etc. Using these collectors for heating contributed 0.35 Mtoe to energy production. Annual collector manufacturing capacity is 1 million m^2. The EİE installed a computer-aided test stand in order to enable the manufacturers to improve the quality and efficiency of the collectors. It used the test stand to help the Turkish Standard Institute to develop new standards for collectors.

The EİE has also developed a parabolic solar cooker and has studied the possibility to use vacuum tube solar collectors in heating and cooling.

In the area of photovoltaics (PV), the EİE has implemented some small-scale stand-alone systems but also one grid-connected project. Examples of the stand-alone PV systems are a few lighting units, traffic warning systems used during road maintenance works, irrigation and pumping systems. In order to investigate the operational properties of PV systems, one stand-alone 1.6 kW peak (kWp) PV system for power generation was installed already in 1985. A 4.8 kWp grid-connected PV system is installed in Didim Training and Research Centre to gain experience about the operating problems of grid-connected systems. Another 1.2 kWp grid-connected PV system was installed in Ankara in 2002.

WIND ENERGY

According to Turkey Wind Atlas, Turkey's technical wind energy technical potential is 88 000 MW and its economic potential is 10 000 MW. The Aegean coast, Marmara and the East Mediterranean regions are very favourable locations for wind power generation. In recent years, interest in wind energy has greatly increased in Turkey with many studies on the resources and private sector investing in wind power plants.

In Turkey, wind energy use has been focusing on grid-connected systems. At present, total installed wind power capacity is 20.1 MW in two power plants in Izmir, one in Çanakkale and one in İstanbul. Furthermore, licence applications for a total capacity of 4 800 MW (November 2004) have been submitted to EMRA by private developers after the beginning of the electricity market reform.

Wind measuring stations have been installed in many parts of the country to enable the evaluation of the wind potential. This has not been done solely by the public sector as wind measurements have been carried out at nearly 500 different sites by private enterprises as part of feasibility studies for wind power plants.

Wind measurement data from the past ten years (1989-1998) were processed in 2002 into a Wind Atlas, which gives a general idea about Turkey's wind potential. This study was carried out by the EİE and the State Meteorological Organisation. In the study, data for 45 selected meteorological stations were processed. Long-term planning studies project that wind energy capacity could reach 1 769 MW by 2010 and 3 019 MW by 2020.

Wind Atlas will be further converted into a Wind Energy Potential Atlas by considering the current wind data, land structure and grid connection. The objective is to define areas where wind energy can be used and to provide necessary information to planners and investors.

BIOGAS

Biogas production potential has been estimated at 1.5 to 2 Mtoe but only two small units (in total 5 MW) are in operation and one new facility (1 MW) has been licensed. There are, however, R&D activities in the area.

COMMERCIAL BIOMASS AND WASTE

At the end of 2003, the total installed capacity of waste-fired power plants was 27.6 MW, all of which was in the industrial sector. One waste-fired power plant with 11.5 MW of installed capacity was commissioned in 2004. There are no power plants in operation using biomass.

Biofuels are discussed in Chapter 4 together with other alternative transport fuels.

INSTITUTIONS

The EİE, the state economic enterprise affiliated with the MENR, undertakes reconnaissance and feasibility studies to develop renewable resources for electricity generation and accordingly conducts engineering studies towards their realisation. In the past, it also developed new hydropower projects under the Build-Operate-Transfer (BOT) model[16]. The EİE has prepared the draft Renewable Energy Law together with the MENR (see section on Policy).

EMRA is responsible for taking measures, implementing incentive schemes and ensuring co-ordination with the related institutions to promote the use of renewable energy resources. It issued the Electricity Market Licensing Regulation covering also the licensing of renewable electricity generation facilities and could be the authority to issue green electricity certificates in the future.

POLICY

OBJECTIVES

As summarised in Table 20, the government estimates renewable energy supply to increase from 10 Mtoe in 2003 to 12 Mtoe by 2010 and 20 Mtoe by 2020. While the absolute volume of renewable energy use grows, its share of the TPES declines outstripped by rapid growth of fossil energy use. Electricity generation from renewables is expected to increase from 35.5 TWh in 2003 to 62 TWh by 2010 and 118 TWh by 2020. Use of renewables for heat production is estimated to drop from 6.9 Mtoe in 2003 to 6.6 Mtoe by 2010 but to grow to 9.3 Mtoe by 2020.

EXISTING LICENSING ARRANGEMENTS

EMRA has issued the Electricity Market Licensing Regulation for the liberalised electricity markets. The regulation defines the following as renewable energy resources: installations using wind, solar, geothermal, wave, tide, biomass, biogas, hydrogen and canal- and river-type hydropower as well as hydropower generating facilities with an installed capacity of 50 MW or below and a reservoir area smaller than 15 km^2 or a reservoir volume smaller than 100 million m^3. The regulation provides several incentives for these generation facilities:

- Exemption from annual licence fees for the first eight years of operation.
- The transmission company TEİAŞ and the distribution licensees are obliged to provide a network connection to renewable electricity generation facilities.

16. The BOT and BOO schemes were put in place in the 1980s with the objective of attracting private investors. The 2001 Electricity Market Law abolished the model in favour of new projects.

Table 20

Renewable Energy Projections in Turkey

	2003	*2005*	*2010*	*2015*	*2020*
Primary energy supply					
Hydro (ktoe)	3 038	4 067	4 903	7 060	9 419
Geothermal, solar and wind (ktoe)	1 215	1 683	2 896	4 242	6 397
Biomass and waste (ktoe)	5 748	5 325	4 416	4 001	3 925
Renewable energy production (ktoe)	**10 002**	**11 074**	**12 215**	**15 303**	**19 741**
Share of total domestic production (%)	42	48	33	29	30
Share of TPES (%)	12	12	10	9	9
Generation					
Hydro (GWh)	35 330	47 287	57 009	82 095	109 524
Geothermal, solar and wind (GWh)	150	490	5 274	7 020	8 766
Renewable energy generation (GWh)	**35 480**	**47 777**	**62 283**	**89 115**	**118 290**
Share of total generation (%)	25	29	26	25	25
Total final consumption					
Geothermal, solar and wind (ktoe)	1 134	1 385	2 145	3 341	5 346
Biomass and waste (ktoe)*	5 748	5 325	4 416	4 001	3 925
Renewable energy TFC (ktoe)	**6 882**	**6 710**	**6 561**	**7 342**	**9 271**
Share of TFC (%)	11	9	7	6	6

* Fuel consumption of autoproducers used to generate electricity on site.

Source: MENR.

Table 21 summarises the licences issued by EMRA for renewable energy generating facilities since the beginning of the electricity market reform in 2001. Licensed new generating capacity totalled 1 408 MW in July 2004. According to the Wind Energy Power Plants Investors Association, licence applications have been filed for a total of 4 000 to 5 000 MW wind capacity.

Table 21

Renewable Electricity Generation Licences, as of November 2004

Fuel	*Licences for new installations*		*Licences for existing installations*	
	Number	*Capacity (MW)*	*Number*	*Capacity (MW)*
Wind	37	1 408	1	1.5
Hydropower	12	172	27	906
Geothermal	4	46	-	-
Biogas	1	1	2	5
Landfill gas	2	16	1	4
Total	**56**	**1 643**	**31**	**916**

Source: MENR.

LEGISLATION

The present legislation has no purchase obligations for renewable electricity but the feed-in tariff is fixed by the regulation issued by EMRA at equal or less than the wholesale price that the state-owned wholesale company TETAŞ uses in its electricity sales to the Turkish Electricity Distribution Company (TEDAŞ), a state-owned company.

The government is drafting a Renewable Energy Law, which promotes the use of renewables in liberalised energy markets. The law introduces feed-in tariffs and a purchase obligation for the distribution companies from certified renewable energy producers. Under the new law each new project implemented before 2011 will benefit from seven years of feed-in tariffs. Under this law, hydro and geothermal power producers will receive a fixed feed-in tariff of 15% above TETAŞ's wholesale electricity price. Producers of all other renewables, except large hydro, will receive a tariff of 20% above the wholesale electricity price. However, a minimum price of 5 eurocents per kWh and a ceiling of 6 eurocents per kWh will be applied. The EİE expects the feed-in tariffs to encourage principally small hydropower, followed by wind[17] and geothermal energy.

Distribution companies will be obliged to purchase a certain minimum amount of power from eligible renewable energy sources, defined as a percentage of their sales. This share will be gradually increased to a minimum of 8% by 2011 when the feed-in tariff system will be fully replaced by this quota system. In effect, the feed-in tariff scheme will be a transitional scheme. The government has also expressed some interest in the introduction of certificate trading but the draft Renewable Energy Law does not include provisions for it.

POLICIES FOR HEAT PRODUCTION FROM RENEWABLES

There is no comprehensive policy to exploit the potential of renewables in heat production, co-generation and transportation. One provision in the forthcoming Renewable Energy Law about use of renewables for heat production will be tax incentives, which will be given to households installing solar collectors. It also requires that in the provinces and municipalities with sufficient geothermal resources, the primary sources of heating should be geothermal or solar thermal resources. The government is drafting the Geothermal Energy Law, which will address the use of this resource. The Ministry of Environment and Forestry has already provided loans to municipalities for the construction of geothermal district heating systems.

17. Typically, the cost of wind power today at the very best sites is 2.7 to 3.1 eurocents per kWh.

OTHER POLICIES AND MEASURES

A World Bank loan of US$ 202 million is ready to be used by the investors interested in renewable electricity generation. These loans are expected to finance 30 to 40% of the capital costs. It is expected that the loan, together with the new law, will particularly increase wind and small hydropower.

Renewables are one of the main R&D areas in Turkey (see Chapter 11).

CRITIQUE

Turkey's substantial renewable energy resources make a sizeable contribution to its energy mix. However, the contribution has grown very little and its share has declined rapidly since 1990 because, while the use of hydropower and to some extent geothermal and solar thermal energy has increased, the use of non-commercial biomass has declined. Commercial use of renewable energy in Turkey, excluding large-scale hydropower, has not developed in proportion to the large resource base and the trends seen in many other IEA member countries. The principal reason appears to have been that there were few promotional measures and large-scale power generation projects to meet the growing electricity demand that dominated the policy. The recently introduced licensing regulation and associate promotional provisions are positive developments. It is commendable that the government has decided to step up these activities and is drafting new Renewable Energy and Geothermal Energy Laws.

As for the use of commercial renewables, hydropower has the largest contribution followed by geothermal. Only about 35% of the potential hydro resources have been exploited and the government intends to utilise the remaining potential by 2020. Some of these projects are, however, challenging to implement because of various environmental, economic, social and international considerations. Another way to increase hydropower capacity could be the refurbishment of existing power plants. The economic lives of existing power plants are estimated to be 50 years. The actual potential for refurbishment is studied by EÜAŞ.

The government has proposed the Renewable Energy Law to exploit indigenous and environmentally sustainable energy resources, which are not, or are not fully, competitive. However, the introduction of the law has been delayed repeatedly after it was announced in July 2003 to be introduced in the first quarter of 2004. This is hampering investor confidence. To date, 1 366 MW of generation licences have been granted but implementation of the projects, some of them licensed more than a year ago, has not started as the investors are waiting for the introduction of the law. The law should be introduced as soon as possible because it can contribute to the development of power plants based on renewable energy sources, thus increasing the use

of domestic energy resources and bringing environmental advantages, which are positive externalities currently not captured by the market. It should be noted, however, that other policies, such as increased investments in energy efficiency, carry similar benefits and can have a lower cost than renewables; there appears to be abundant potential to improve energy efficiency in cost-effective ways in Turkey (see Chapter 5).

The new Renewable Energy Law will introduce a feed-in tariff scheme and a purchase obligation for renewables for a transition period up to 2011. Thereafter the feed-in tariffs for new projects will be abolished and renewables will be promoted solely by the purchase obligation and possibly a certificate trading mechanism. The tariffs can give incentives for potential investors, particularly for projects in good locations. The maximum level, 6 eurocents per kWh, is moderate as compared to the levels given, for example, to wind power in some other IEA member countries[18], meaning that the scheme may not become excessively expensive for consumers, which is a common risk in feed-in tariffs. Careful monitoring and adjustment of the cost of the scheme will, however, be necessary to assure maximum effectiveness.

The purchase obligation for the distribution companies is likely to be a strong incentive for the development of renewables, particularly once it reaches the level of 8%. However, available resources and the cost of developing them can vary substantially among the different distribution areas in the country. Therefore, it needs to be ensured that distribution companies can buy renewable electricity from certified producers located in other distribution regions to fulfil their obligation and at minimum cost. It will be very important to develop a sound certification and accreditation system possibly in the form of certificate trading. The certificate trading system is relatively new and its real effectiveness remains to be demonstrated. Several IEA member countries, including Australia, Austria, Japan, Italy, Sweden and the United Kingdom, as well as the Flemish region of Belgium, have already introduced portfolio standards (quota obligations) together with tradable green electricity certificates or a similar scheme, and Norway and Sweden are preparing a joint scheme. Turkey would benefit from studying and learning from those programmes and exchanging experiences with these countries.

The licence applications for wind power, for 4 000 to 5 000 MW, already reach the government's projections for 2020. It is not clear what the policy will be for licensing wind power given that the industry has rapidly filed applications, *i.e.* will all applications be approved without any cap? Licence fees are reduced or exempted for renewable energy projects in order to promote them. However, given the small licence fee, the impact is limited. Licensing procedures, which

18. For example, when first introduced in 2002, the feed-in tariffs for wind power in Germany were set at €0.091 per kWh for at least the first five years of operation after commissioning. Thereafter, depending on the quality of the site, the rate is reduced to €0.0619 per kWh. These rates have been subject to annual reductions of 1.5% for new installations.

have very often become a bottleneck in developing renewable energy projects in many IEA member countries, appear to work well in Turkey. There is also currently not much public opposition to wind power, which is a growing hurdle for wind power development in many other IEA member countries.

The introduction of intermittent renewable energy sources, principally large quantities of wind power, can affect optimal grid performance. Problems could occur either when wind capacities are providing too little or too much power. Technical solutions and business and regulatory practices are being developed in other countries to help the integration of large wind capacities, and could provide lessons for Turkey. The grid's continuous modernisation may reduce the investment required to accommodate added wind capacity. This would reduce the financial burden on wind power companies and, finally, on consumers. The EİE is conducting research on wind power's impact on the grid system reliability and possible combination of a wind and small hydro pumping system to minimise such an impact. Turkey has the advantage of having significant hydropower resources making this a seemingly sensible approach in Turkey.

Despite that about two-thirds of renewable energy is used in Turkey for heat, there are no specific targets and policies in place to promote heat production from renewables. While at present non-commercial biomass dominates the use of renewables for heat production, there is also a large potential for the use of geothermal and solar thermal applications in Turkey. Solar collectors are already a significant, completely market-driven business in the country. The government expects the use of geothermal and solar thermal energy to double between 2003 and 2010. The planned tax incentives for households for the installation of solar collectors can help and further growth could be sought by trying to find new applications, such as increasing the use of solar collectors in non-residential buildings. The Geothermal Energy Law is planned to have provisions which could provide a significant boost for the use of this resource for residential heating. The organic component of waste incineration should be considered as a renewable option in the future, but this should be done using the appropriate technology to ensure high health and environmental standards, in particular with respect to airborne emissions.

RECOMMENDATIONS

The Government of Turkey should:

- *Consider steps to accelerate economic hydropower projects, including refurbishment, consistent with the protection of the environment, to utilise the remaining hydropower potential.*
- *Enact the Renewable Energy Law as envisaged and monitor and evaluate its cost and effectiveness.*

- *Share information and experience with other countries introducing quota- and certificate-based promotional schemes for renewables.*
- *Assess the impact on the network reliability and stability resulting from increased penetration of intermittent wind power and explore ways to minimise such an impact. Consider a combination of wind power and pumped storage hydro for this purpose. Share information and experience with other countries on technical and regulatory approaches to intermittency.*
- *Investigate the extent to which policies and measures are needed to promote the use of renewables in heat production, co-generation and transport.*

ELECTRICITY, NUCLEAR POWER AND CO-GENERATION

POLICY OBJECTIVES IN THE ELECTRICITY SECTOR

The objectives of the Turkish government in the electricity sector are:

- Diversification of primary energy sources.
- Use of domestic energy resources, including increasing the share of renewable energy sources in electricity generation.
- Creating a liberal and competitive electricity market in line with the EU directives.
- Creating a good investment environment for new generating capacity as well as transmission and distribution networks.
- Unbundling and privatisation of the state-owned companies.
- Creating an environment-friendly power system, and in this context, investing in environmental retrofitting projects for the existing power plants.
- Developing regional interconnections and participating in regional markets.
- Increasing efficiency in electricity generation and consumption.
- Decreasing the cost and end-user prices of electricity.

INDUSTRY STRUCTURE

The Turkish electricity industry has been dominated by large, publicly owned and vertically integrated companies but the situation is changing. In the past, the major player was the Turkish Electricity Authority (TEK), which was established in 1970 and had a statutory monopoly until 1984. Starting in 1984, the private sector was able to participate in generation, transmission and distribution through three different modes, namely Build-Operate-Transfer (BOT), Build-Own-Operate (BOO) and Transfer of Operating Rights (TOOR)[19].

19. In the BOT schemes private investors build power plants and operate them for a given time. Transfer of the plants to government ownership occurs after the depreciation period, generally after 15 or 20 years of operation. In the BOO schemes electricity generated is sold to TETAŞ (former TEAŞ) under long-term power purchase agreements but the investors remain the owners of the power plants. TOOR is a model, which allows private-sector operation of energy infrastructures but not private ownership. In Turkey, one electricity distribution region and two power plants are operating under the TOOR.

Following recent market liberalisation, these modes were abolished but legal obligations arising from them had to be taken into account in market reform.

In 1993, TEK was split into two separate state-owned companies, namely Turkish Electricity Generation-Transmission Corporation (TEAŞ) and Turkish Electricity Distribution Company (TEDAŞ). With the Electricity Market Law issued in 2001, a profound structural reform was initiated in the electricity sector. TEAŞ was unbundled into three companies responsible for different sub-sectors, namely EÜAŞ (generation), TEİAŞ (transmission) and TETAŞ (wholesale). TEİAŞ is and will be the sole transmission and market operator; however; direct participation by the private sector is allowed in all other segments of the industry. None of the four companies have been corporatised and they are all subject to close government control of managements and budgets. However, EÜAŞ and TEDAŞ will soon be privatised (see section on Market Reform).

EÜAŞ owns 61% of the total installed capacity of 35.6 GW (2003). Power plants under BOT and BOO contracts account for 25% of the total installed capacity and 40% of generation. Therefore, the share of others, mostly co-generation plants, is 14% of total capacity.

TEDAŞ and its seven affiliated regional distribution companies dominate the distribution and retailing sector. Turkey's distribution network has been divided into 21 regions, one of which is currently operating under a TOOR contract. The government's objective is to privatise the remaining 20 distribution regions by the end of 2006.

TETAŞ has been established principally to take over the BOO, BOT and TOOR contracts in the context of market liberalisation (see section on Market Reform).

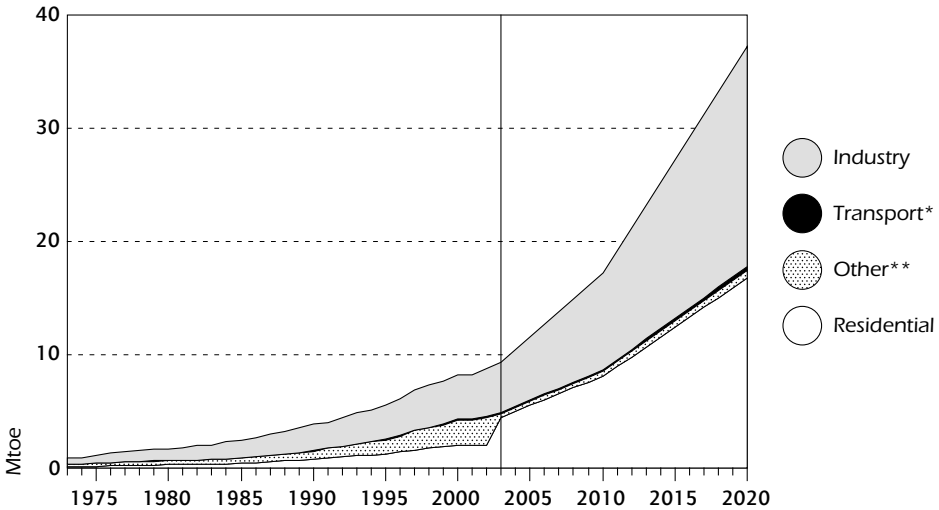
DEMAND

Electricity demand increased significantly during the past decades, stimulated by economic growth and rising living standards. In 2001, electricity supplies (before losses) declined by 1.1% as a consequence of the economic crisis but in 2002 again consumption increased by 4.5% and in 2003 by 6.3% in parallel to economic recovery.

Final consumption of electricity (net consumption) was 47 TWh in 1990 and reached 110 TWh in 2003. Final consumption is divided roughly evenly between the industrial and residential sectors (see Figure 24). Final consumption per capita increased from 786 kWh in 1990 to 1 554 kWh in 2003, whereas gross electricity consumption per capita increased from 958 kWh to 1 994 kWh. The sizeable difference between the net and gross figures is explained by non-technical distribution losses (theft), technical losses and own use by power plants.

Figure 24

Final Consumption of Electricity by Sector, 1973 to 2020



* negligible.
** includes commercial, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; and country submission.

Recently, MENR published new demand projections up to 2020 (see Table 22). The government expects electricity demand to increase from 141.2 TWh in 2003 to 242 TWh in 2010 and 500 TWh in 2020 with an average annual growth rate of 7.7%.

The government has recognised the significant saving possibilities through load management. Some time-of-use tariff schemes have been introduced for industrial consumers and the objective is to expand their use to a wider range of consumers.

Table 22

Long-term Sectoral Electricity Demand, TWh

	2003	*2005*	*2010*	*2020*
Industry	53.2	64.7	101.1	227.8
Residential and services	52.2	60.5	94.1	195.3
Agriculture	3.7	4.0	5.0	7.4
Transport	0.9	1.1	1.7	4.0
Net demand	**110.0**	**130.2**	**201.9**	**434.6**
Gross demand	**141.2**	**163.2**	**242.0**	**499.5**
Gross consumption per capita (kWh)	1 994	2 232	3 085	5 692

Sources: MENR.

In addition to the existing winter peak, it has been observed that a secondary demand peak is developing for the summer because of air-conditioning. The summer peak is expected to exceed the winter peak, with air-conditioning equipment becoming increasingly common.

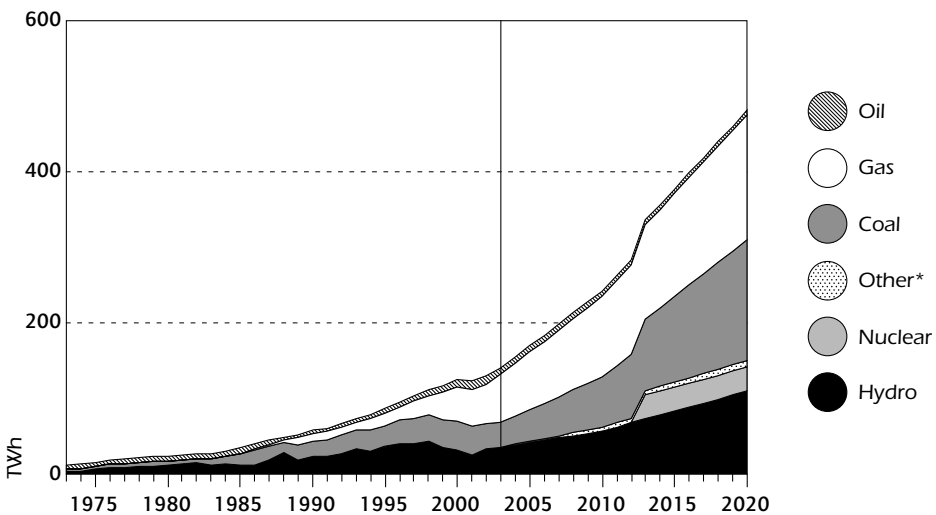
GENERATION

In recent years there have not been wide-scale blackouts because the reserve margin has become as high as 40% owing to overcapacities and because investments have been made to increase the reliability of the transmission network. Local power cuts still occur and most of the big offices, large shops and shopping centres have a backup generator and many citizens own household-sized generation units fuelled by diesel.

In 2003, the total installed capacity was 35 600 MW compared to the peak demand of 22 700 MW. Hydropower has the highest share (35%) followed by natural gas (33%), lignite (18%), hard coal (5%) and oil (9%). The share of non-hydro renewables is increasing but was still negligible at 34 MW in 2003. The contribution of different fuels to total generation (140.6 TWh in 2003) is slightly different, with natural gas having accounted for 45.2% of total generation, hydro 25.1%, lignite 16.8%, oil 6.5% and hard coal 6.1% (see Figure 25). The main reason for the high share of natural gas is the 2001 economic crisis which reduced gas demand in other sectors.

Figure 25

Electricity Generation by Source, 1973 to 2020



* includes geothermal, solar, wind, combustible renewables and waste.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2004; and country submission.

The government expects domestic generation to reach 242 TWh in 2010 and 481 TWh in 2020. The policy is to diversify fuel sources as well as their supply routes and origins. The government also aims to reduce import dependence and the share of natural gas in generation while increasing the share of renewables and domestic lignite. The quantitative objective is to keep the share of natural gas under 40%. In its most recent forecast, the government anticipates the share of gas to decline from 45.2% in 2003 to 34.3% in 2020 while the share of coal (principally lignite) would increase from 23% in 2003 to 33.3% in 2020 (see Annex A). Incentives will be provided to increase the use of other renewables (see Chapter 9) but the share of non-hydro renewables is expected to increase only to 1.8% in 2020 from the current 0.1%. Yet another long-term option is the use of nuclear power, which is expected to make a 6.6% contribution to generation in 2020. The share of oil will drop from 6.5% in 2003 to 1.3% in 2020.

While Turkey currently has surplus capacity, demand is growing quickly and the government and the State Planning Organisation expect it to exceed supply, potentially by 2009. Since 2001, publicly-owned generators have not been allowed to make investments in new power plants. Simultaneously, private projects have started, but there are some concerns that private investors find it difficult to compete with fully depreciated state-owned power plants. It is also difficult to compete because there is currently oversupply in the baseload segment of the market.

Some measures are taken to address the future supply gap. Many existing power plants require rehabilitation and replacement investments to increase thermal efficiency and to reduce emissions. The average efficiency of the lignite-fired power plants in Turkey is only 32% but that of the worst performer is only 20%. One of the reasons why the efficiency is so low is the failed privatisation attempts; rehabilitation investments of power plants have not been realised owing to privatisation expectations.

Rehabilitation has started with a budget of US$ 400 million over three years. Increased efficiency is expected to allow the rehabilitated power plants to increase their annual generation by 15 TWh. Reduction of transmission and distribution losses from the current levels of approximately 20% to 14% would result in an additional saving of 6 TWh. These two measures would postpone the gap by a couple of years to 2009-2010.

EMRA will periodically monitor and report to MENR the status of the investments made by generation licensees.

NUCLEAR POWER

Despite several attempts in the past to build nuclear power plants, there is no commercial nuclear power plant in operation or under construction in Turkey. A nuclear research reactor has been operating in İstanbul since 1962.

The Turkish Atomic Energy Authority (TAEK) is in charge of all regulatory activities in the nuclear field, including nuclear and radiation safety. It issues regulations and licences and conducts inspections. TAEK also conducts nuclear R&D (see Chapter 11). In mid-2005, TAEK will be split into two parts. One will be an independent nuclear regulator and the other will continue to conduct nuclear R&D.

TEK received a site licence in 1976 for the construction of a nuclear power plant at Akkuyu in southern Turkey. During the 1980s there were two unsuccessful attempts to construct the plant. Two other nuclear power plant projects at Sinop by the Black Sea and again at Akkuyu were abandoned in the 1980s. All failed owing to difficulties in reaching agreement with the bidders. In the mid-1990s there was one more attempt to build a nuclear power plant at Akkuyu with a start-up date in 2005/2006 but the project was abandoned in 2000. At the same time, the entire nuclear programme was postponed indefinitely until economic conditions improve.

Although after 2001 there was no nuclear power project, the nuclear option was considered within the future alternative energy sources to reduce security of supply risks caused by the dominance of imported fuels and to ensure diversity in power generation. In 2004, the nuclear programme was revived by the Minister of Energy and Natural Resources and studies were launched for a long-term and comprehensive nuclear power programme. They will cover all aspects including the legal and institutional frameworks, and financial and human resources. Informing the public on the issues concerning nuclear power plants is included in the programme and TAEK has established a department for providing information to the public. Nevertheless, although given some consideration, no immediate solutions are planned to be presented yet for spent fuel and waste management from the outset of the programme. The target year for the commissioning of the first unit is as early as 2012. In total, nuclear capacity is planned to reach about 5 000 MW by 2020.

TAEK is studying the suitability of several different locations as potential nuclear power plant sites. One of them is Akkuyu where additional geotechnical and environmental studies have begun.

Turkey is a party to the International Atomic Energy Agency (IAEA) Convention on Nuclear Safety but it has not signed or ratified the Joint Convention on the Safety of Spent Fuel Management or the Joint Convention of Radioactive Waste Management.

CO-GENERATION (CHP)

Industrial companies generating electricity for their own and their shareholders' use are called "autoproducers"[20] in Turkish legislation. Given

20. According to the Electricity Market Law, autoproducers selling up to 30% of their generation are subject to autoproduction licences and not to the electricity production licensing. The current sales levels stand at 25%.

that industries often need heat (steam) in addition to electricity, most of them use CHP technology. Therefore, and because of past favourable legislation and government support for the autoproducers, Turkey is using CHP relatively extensively. In 1992, the autoproducers' installed capacity was only 4 MW_e but it has increased to about 4 000 MW_e. In 2003, autoproduction facilities contributed 18.7% to total generation. Almost all the CHP plants are installed in the industrial sector with very few used for district heating.

Until July 2002, a favourable legal framework for autoproducers was in force. The state-owned power companies (principally TEAŞ and TEDAŞ) had to purchase excess electricity from autoproducers, including co-generators, with a price equal to 85% of TEDAŞ's sale price to industrial consumers. The 2001 Electricity Market Law allows generators to sell their generated electricity directly to the consumers at prices agreed bilaterally. The legal framework no longer requires purchases, which has led to decreased prices paid to autoproducers. At the same time, gas prices for the industry have increased. For these reasons, and owing to the current electricity generating overcapacity, autoproducers have found it difficult to sell their electricity.

The secondary legislation (the Balancing and Settlement Code) includes special provisions for CHP plants. CHP plants are exempted from submitting bids and offers to the Financial Settlement Centre and from the National Dispatch Centre's normal instructions for loading and de-loading, which give CHP producers more production flexibility. Furthermore, the code stipulates that uncontracted energy fed to the system will be remunerated at a system imbalance price, which is a spot price representing the actual price of energy in that period.

TRADE AND TRANSMISSION

TRADE

Cross-border electricity trading is allowed for licensed market participants, namely wholesale and retail licensees. Electricity can be exported to and imported from countries where the national electricity system is operated in a manner that is compatible with the provisions of the Turkish transmission and distribution network regulation. The only exemption of this provision is the existing electricity import contracts.

Electricity imports and exports are small. Turkey imports 300 GWh per year from Turkmenistan via Iran. These imports started in December 2003 and will continue until 2006. Turkey exports 350 to 400 GWh per year to Azerbaijan and 750 to 800 GWh per year to Iraq.

INTERCONNECTIONS

Turkey has interconnections with most of its neighbouring countries:

- Bulgaria: two 400 kV.
- Azerbaijan (Nahcievan): 154 kV.
- Iran: one 154 kV and one 400 kV.
- Georgia: 220 kV.
- Armenia: 220 kV (the line exists but the transformer station is dismantled).
- Syria: 400 kV.
- Iraq: 400 kV (operated at 154 kV).
- Greece: 400 kV (under construction).

Turkey's system is not synchronously connected with neighbouring systems. Therefore, power import and export contracts signed before the introduction of the Electricity Market Law are carried out via "island" operation: Turkey's importing regional areas are run synchronously with the network of the neighbouring country, but isolated from the remainder of the Turkish grid. After the law, the method has been unit allocation, *i.e.* ability to operate a generation facility or a unit of a generation facility in the electricity system of another country in parallel to the national electricity system.

Turkey has been actively pursuing synchronisation of its network with the European grid of the Union for the Co-ordination of Transmission of Electricity (UCTE). Turkey is keen on achieving integration with the EU internal electricity market and on promoting cross-border electricity trade. The technical studies[21] for the synchronisation with UCTE, first through existing interconnectors with Bulgaria and then through a planned interconnector with Greece, are under way and synchronisation is anticipated in 2006. The main challenges are improving frequency control and operation and maintenance performance. Given UCTE's technical requirements, Turkey does not see short-term possibilities to synchronise with its eastern and south-eastern neighbours.

Nevertheless, the synchronisation of Turkish and Syrian power systems is studied within the scope of the EU-financed Med-Ring study, which investigates the synchronisation of all Mediterranean power systems. If the outcome of this and other related studies is positive and the UCTE approves, synchronisation of the two countries could take place in the longer term.

21. "Complementary Technical Studies for the Synchronisation of the Turkish Power System with the UCTE Power System" and "Ensuring the Compliance of the Frequency Performance of the Turkish Power System with UCTE Criteria".

Furthermore, Turkey is actively taking part in the South-East Europe regional market initiative. The government expects these initiatives to increase cross-border electricity trading.

TRANSMISSION AND DISTRIBUTION NETWORKS

Even though the long distances between the main consuming areas and the main electricity generation increase the line losses in electricity transmission, transmission losses in Turkey are comparable to those in other IEA member countries. The transmission network is well developed and the Grid Code has been published. Transmission projects are implemented by TEİAŞ, which needs to submit its plans for the improvement of the networks to the MENR and the State Planning Organisation for approval. Some of the recent projects include the renewal of the national and regional dispatch centres, which began in 2000 and the installation of a Scada-EMS-control system, which was implemented in 2004.

Losses in the distribution networks, however, are four times as high as the average for other IEA member countries. They peaked in 2000 when they reached 21.5% but declined to 19.5% in 2003 and 18% in 2004. Roughly half of the losses are technical and half non-technical (theft). Rehabilitation of the existing distribution network and investment in network operation tools, measurement and tele-information systems are necessary to increase reliability, to reduce losses and to cope with the network expansion needs. TEDAŞ and its affiliates have made and continue to make investments in these areas, which reduce technical losses. Investments totalled US$ 320 million in 2003 and US$ 280 million in 2004. Non-technical losses are addressed by meter inspections. In 2003, 341 000 inspections were carried out and US$ 20 million of fines were imposed, of which US$ 5 million were collected.

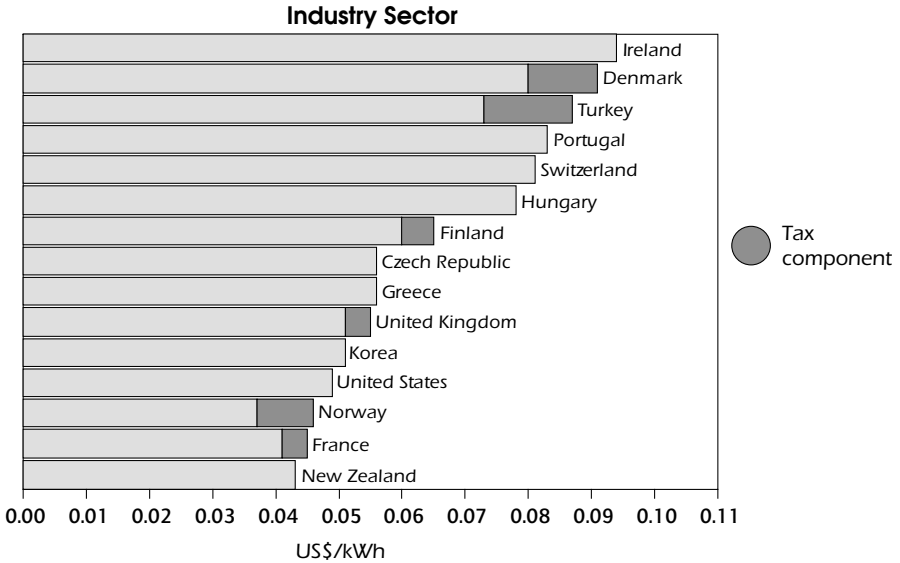
The government expects the policy to privatise distribution networks to facilitate further investment and efficiency improvements. The performance of distribution companies will be monitored by national and international benchmarking. Loss and leakage reduction targets and quality indices were to be established by the end of 2004. Also the distribution network code has been finalised.

PRICES AND TARIFFS

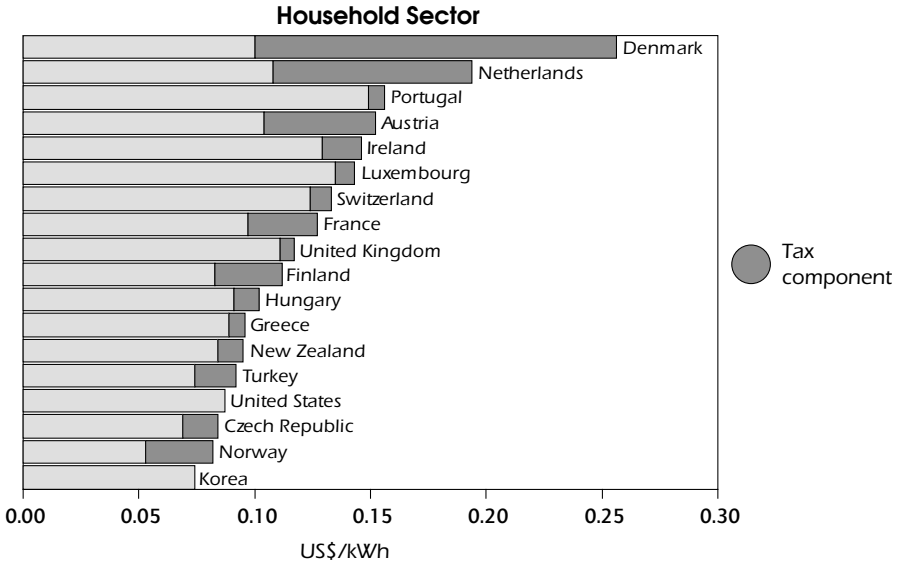
Electricity prices in Turkey have been relatively high for the industrial consumers compared to other IEA member countries, but for the residential consumers they have been in the mid or lower range (see Figure 26). In US dollar terms, electricity prices have been steady for both industrial and residential consumers since the mid-1990s (see Figure 27). Although prices for industrial consumers were reduced by 5% in 2003, industrial electricity prices remain very close to the prices paid by households indicating cross-subsidies in favour of residential consumers.

Figure 26

Electricity Prices in IEA Countries, 2003



Note: Price excluding tax for the United States. Tax information not available for Korea. Data not available for Australia, Austria, Belgium, Canada, Germany, Italy, Japan, Luxembourg, the Netherlands, Spain and Sweden.

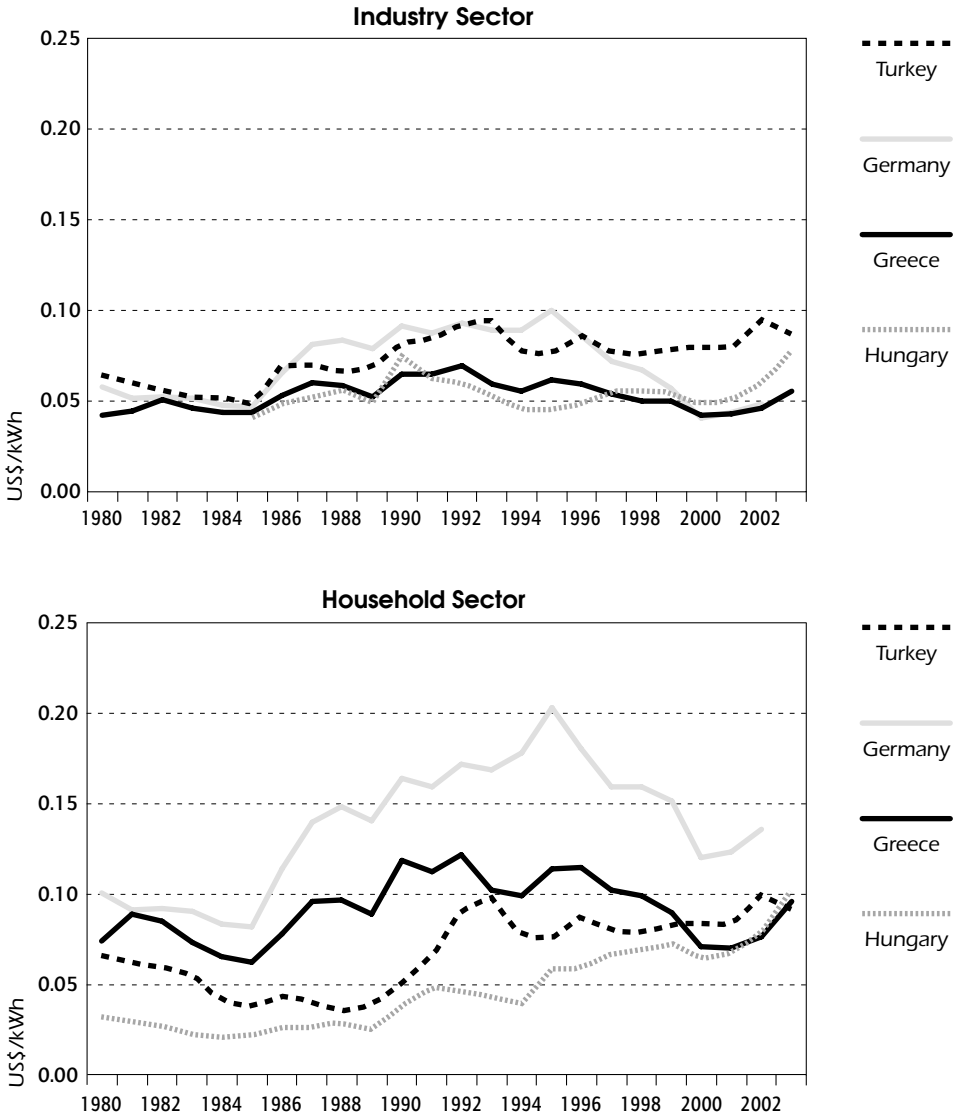


Note: Price excluding tax for the United States. Tax information not available for Korea. Data not available for Australia, Belgium, Canada, Germany, Italy, Japan, Spain and Sweden.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2004.

Figure 27

Electricity Prices in Turkey and in Other Selected IEA Countries, 1980 to 2003



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2004.

At present, the wholesale prices depend on the prices set in the previous power purchasing arrangements made with the BOO and BOT developers. In particular, BOT contract prices were set at a high level at the beginning of the contracts but by the time the investment was expected to be recovered, they

declined towards the average cost of generation in Turkey. Currently, the wholesale electricity price is around US$ 0.052 per kWh, and it is expected to decrease gradually as the share of the power purchasing agreements in total generation decreases. The BOO and BOT schemes cover as much as 25% of installed capacity in the market and 40% of generation. TETAŞ accounts for 85% of the wholesale market, and its wholesale tariffs, unlike those of the private companies, are regulated.

With the electricity market reform, the price structures in the electricity market will change fundamentally. The government expects prices to fall, as the market evolves through the development of competition. The new tariff structure principles, to be implemented from January 2005, are as follows:

- Costs not directly related to market operations must not be included.
- Cross-subsidies are not allowed. Instead, direct support will be given to the poor.
- Tariffs must be cost-reflective.
- Direct subsidies shall be given to the needy instead of subsidising the tariffs.

Eligible consumers, who are directly connected to the transmission grid and who have purchasing contracts with TETAŞ, are given the possibility to keep regulated tariffs. Alternatively, they can buy through bilateral contracts directly from private generators.

For social reasons, end-use prices for the captive consumers are uniform across the country although the cost of supply varies from region to region. High supply cost often coincides with regions of lowest income levels. Part of the market reform is revising the calculation method for the end-use price for captive consumers. The price for the captive consumers shall be kept uniform for a transitional period, which will last until regional cost differences mainly due to non-technical losses, will be minimised, *i.e.* five years. During this period, the price for captive consumers will be calculated by using a so-called "price equalisation mechanism" whereby all supply costs are taken into account, the price is calculated on the basis of these tariffs, and reimbursements are provided for the distribution companies with a supply cost exceeding the uniform price. Performance standards will be established for losses and efficiency and no operational costs and/or losses will be reimbursed above the predefined target value.

EMRA has established calculation methodologies for the transmission, distribution, wholesale and retail tariffs. The main principles are a revenue cap for the transmission tariff, a hybrid system (a combination of a price cap and a revenue cap for network use) for the distribution tariff, cost-based tariffs for TETAŞ's distribution tariff, and a price cap for the sale tariffs to non-eligible

consumers. The licensees calculate and submit their tariffs to EMRA for review and approval. Approved tariffs are published in the Official Gazette and on EMRA's website. An incentive-based tariff-setting mechanism has been envisaged for network operations.

MARKET REFORM

OBJECTIVES

The government has launched the market liberalisation and privatisation process in anticipation of the following benefits:

- Reducing costs by efficient operation of electricity generation and distribution systems.
- Increasing supply quality and reliability and ensuring security of supply.
- Reducing the technical and non-technical losses in the distribution sub-sector to the level in OECD member countries.
- Ensuring that rehabilitation and expansion investments are performed by the private sector without creating liabilities for the public institutions.
- Transferring to consumers the benefits obtained through increased competition, cost reductions and regulation of service quality.

LEGISLATION

The Electricity Market Law (Law 4628) of 20 February 2001 is the main law governing the electricity market. It made former laws on private investment in the electricity sector obsolete (Laws 3096, 3996 and 4283). The Electricity Market Law entered into force on 3 March 2001 but its implementation was subject to a two-year transitional period. It aims at creating a competitive, transparent and commercially viable electricity market that encourages private investment without government guarantees and provides sufficient, reliable and low-cost electricity to consumers. It is for the most part compatible with the EU Electricity Directive of 2003. One of the main differences is that state-owned generation companies can only sell to the wholesale company and not directly to the eligible consumers. The government intends to modify the Electricity Market Law to change this provision.

STRATEGY PAPER CONCERNING ELECTRICITY MARKET REFORM AND PRIVATISATION

Following the 2001 economic crisis, a new policy was introduced for economic reform. This includes the privatisation of power generation and distribution. Given that this could not be implemented, despite two attempts, owing to

legal reasons as well as economic and social considerations, the government issued the Strategy Paper Concerning Electricity Market Reform and Privatisation in March 2004. The strategy outlines the major steps to be taken during the period up to 2012 and addresses various issues, such as the privatisation of distribution assets and power plants, transitional contracts and security of supply.

According to the strategy and subsequent government discussions, privatisation of the sector will be implemented along the following lines:

- The privatisation activities will be performed by the Privatisation Administration.
- The privatisation process will not be solely aimed at the maximisation of the privatisation income.
- There will be utmost efforts to ensure that privatisation does not lead to permanent increases in electricity prices.
- The participation of financially strong companies able to achieve the objectives and principles of the programme will be encouraged.
- Some priority investments for the rehabilitation of power plants and upgrading of transmission facilities as well as operational and maintenance activities will be performed independently from the privatisation process.
- Legislation will be modified, if required by the Privatisation Administration, to accelerate and facilitate privatisation of generation and distribution.
- Privatisation will start in the distribution sector in 2005 and will be completed in 2006. The government's reason to start liberalisation in the distribution sector is that the distribution companies, holding retail licences and operating in a liberal market, have to build confidence with investors in generation activities.
- Generation privatisation will start in mid-2006, after the privatisation of distribution has been completed. Generation assets will be brought together into several groups composed of different types of assets for privatisation to enhance competition. Seventeen hydropower plants, which total 7 055 MW of capacity will remain in government ownership.
- The privatisation approach will take into account existing public liabilities and will not lead to additional state guarantees.
- The transmission system and market operator, TEİAŞ, will remain in state ownership.
- Only distribution companies are allowed to supply non-eligible consumers.

Transitional contracts will be signed between distribution companies and the generation groups/companies within EÜAŞ's portfolio, between distribution companies and TETAŞ and between EÜAŞ's hydro generation and TETAŞ:

- The first group of contracts will be put in place before the privatisation of the distribution companies to give the generation companies/groups a track record prior to their privatisation. These contracts will be in force also after privatisation to give predictable revenues for the early years.
- The second group allocates energy purchased by TETAŞ through existing contracts and from the generation groups/companies within EÜAŞ's portfolio to the distribution companies. If TETAŞ will be unable to recover adequate revenues to cover its liabilities arising from long-term power purchasing agreements, these excess liabilities will be recovered through a surcharge on the transmission TPA tariffs.
- The third group covers electricity generated by the hydropower plants, which will not be privatised. TETAŞ can buy electricity at a low price from these plants to compensate for the additional burden caused by electricity purchases at prices exceeding the market price from the BOO and BOT schemes. The transitional contracts in the first and second group will initially cover about 85% of total demand of non-eligible consumers in each distribution region.

The security of supply aspects included in the strategy are investments in rehabilitation of thermal power plants and the transmission system, including frequency control, pursuing UCTE synchronisation, preparation of tenders for ancillary service agreements by TEİAŞ and periodic reports from EMRA to MENR on the status of investments by the licensees. Furthermore, the strategy includes the following provision: "In order to ensure fuel and resource diversity and prior planning of supply resources, MENR and Undersecretariat of State Planning Organisation will carry out the new arrangements required for generation investments using domestic resources, including large-scale hydropower plants". The strategy does not specify what the "arrangements" would be and what would be the criteria for considering such "arrangements" necessary.

REGULATOR

EMRA is the independent regulator responsible for electricity, natural gas and petroleum markets (see Chapter 3 for general details). Its specific tasks in the electricity sector are as follows:

- Issuing licences for market activities.
- Regulation of the existing TOOR contracts.
- Preparing and enforcing regulations and performance standards.

- Preparing tariff calculation methodologies, including those for sales to non-eligible consumers.
- Enforcing and auditing the price modification formulas for inflation.
- Approving the regulated transmission tariffs and wholesale and end-use prices.
- Monitoring market performance, supervising the market participants and ensuring the conformity of the market behaviour within the provisions of the Electricity Market Law.

EMRA has already issued most of the secondary legislation.

UNBUNDLING AND NETWORK ACCESS

Legal unbundling has been implemented to some extent for electricity transmission by the creation of the transmission system and market operator, TEİAŞ. However, the State still has a strong role in all the state-owned companies. Ownership unbundling will follow when the government proceeds with its privatisation plan of the other state-owned electricity sector companies, except for TEİAŞ.

Separate accounts are required for all licensed activities and in different facilities/regions as well as for sales to eligible and captive consumers and for non-market activities. Consequently, account separation of network and retailing activities has been implemented in the distribution companies.

Turkey has introduced regulated TPA whereby access to the network is regulated by EMRA. EMRA's tariff regulation introduced zonal TPA tariffs where the country is divided into 22 regions. This type of TPA tariff is often referred to as "point tariff".

LICENSING

The regulator issued a licensing regulation in August 2002. All market operations are subject to acquiring a specific licence from the regulator. The prerequisites, which the applicant must fulfil for obtaining a licence, have been defined in the licensing regulation; there are no requirements regarding the use of specific fuels in order to obtain a licence. As of October 2004, 104 new licences amounting to 3.8 GW had been given by EMRA, of which 35 units (550 MW) have already started commercial operation. By September 2004, 14 wholesale licences had been given to private companies.

MARKET OPENING

The Electricity Market Law set the initial eligibility threshold for consumers to enter the market at 9 GWh per year. Eligible consumers began changing their

suppliers as of 3 March 2003. In January 2004, the eligibility limit was reduced to 7.8 GWh corresponding to a 29% market opening. As of October 2004, about 270 eligible consumers had signed a bilateral contract with a new supplier.

By law, the regulator has the right to lower the eligibility threshold every year until full market opening has been achieved. In contrast, the Strategy Paper Concerning Electricity Market Reform and Privatisation, issued by the government in March 2004, fixes the eligibility threshold at 7.8 GWh until the beginning of 2009 and envisages the implementation of full market opening by the beginning of 2011.

MARKET OPERATION

The Balancing and Settlement Code was issued by the regulator in November 2004 to regulate the settlement of imbalances of bilateral agreements occurring in the market. The Financial Settlement Centre, operated by the transmission company TEİAŞ, acts as a market operator and collects day-ahead bids and offers, including those for the spot market. All bilateral agreements have to be registered at the Centre. The Financial Settlement Centre compares the generated and consumed amount on a monthly basis for three different time zones within a day, and settles imbalances according to TEİAŞ's regulated bid and offer prices. 141 suppliers (supplying 1 404 consumers) have registered at the Settlement Centre.

The market will be based on a bilateral contracts market. Preparations have started for the spot market that is planned for 2005. Transitional balancing and settlement regulation was to be implemented on 1 January 2005 and the final balancing and settlement system shall be implemented in mid-2006 after completion of all measurement, tele-information and data process hardware and software.

One of the tasks of TEİAŞ is to protect system security. It is preparing tenders for leasing capacity for ancillary services and making preparations for Ancillary Services Agreements.

STRANDED COSTS

The state-owned wholesale and trading company TETAŞ took over all purchasing obligations arising from the contracts with generators operating under BOT, BOO and TOOR schemes, including long-term purchasing power agreements and Treasury guaranties. The power purchase obligations from these private generators constitute the stranded cost element in the new system. The stranded costs are being mitigated by offsetting them by "stranded benefits", *i.e.* selling electricity from EÜAŞ's low-cost hydro generation plants to TETAŞ for a five-year period.

CRITIQUE

SUPPLY SOURCES AND SECURITY OF SUPPLY

Electricity demand in Turkey has grown rapidly, with the exception of a couple of years that followed the 2001 economic crisis. Given the temporary drop in demand growth, Turkey has a high reserve margin which, together with investments in the transmission networks, has reduced the risk of larger black-outs. However, local power cuts still occur.

Power demand will continue to grow rapidly, which will necessitate more capacity in the mid-term. The recently launched rehabilitation programme for the thermal power plants to increase their efficiency is a prudent approach, provided that it is economically justified, because it postpones the need to invest in new capacity and could bring some environmental benefits. It can also make the thermal power plants more attractive to private investors in the context of the government's privatisation programme.

Nevertheless, new capacity will be needed in the next decade and it will be necessary to ensure a good investment climate to attract investors. Some key elements of a good investment climate are stability, predictability and transparency in policy-making, a good legislative and regulatory framework for an open and competitive market (including regulated TPA and effective unbundling), an independent regulator and transmission system operator, undistorted, cost-reflective energy prices and clear environmental requirements, which are equally enforced among all market players. Furthermore, it needs to be ensured that there will be an adequate number of players in the market with no one having excessive market power. At the time of the 2001 IEA Energy Policy Review of Turkey, none of these requirements was fulfilled but Turkey has made significant progress in most of the areas during the last four years, as discussed under the section "Market Liberalisation and Privatisation".

In the liberalised markets, market participants should be allowed to make the generation investment decisions without direct government involvement. In Turkey, the process is enabled by the licensing procedures whereby no specific requirements to use certain fuels are set for the licensees. At the same time, the government aims to significantly increase the use of domestic energy sources, notably lignite and renewables, and unspecified "new arrangements" have been mentioned in the Electricity Strategy. This could cause uncertainty in the investors about a possible future intervention by the government, and, consequently, discourage private investment. To maintain the confidence of the investors and to support efficient market outcomes, the government should refrain from interfering with the licensing requirements or setting specific generation mix requirements to the generation company destined for privatisation. All investment decisions, including those made by the state-

owned enterprises, should be based on economic criteria. If any, generation mix requirements should be set for all generation companies on a level playing field.

While in the liberalised markets governments continue to have a role in enhancing security of supply, it will no longer be possible to continue the former central planning role of the government, which would seriously undermine the confidence of private investors and is fundamentally incompatible with efficient market operation and responses. However, this does not imply an absence of government policy. Governments set the legislative and regulatory framework which should not be static but evolve as markets evolve. To continue the policy-setter role, governments should monitor market developments and be ready to respond to issues as they arise, for example the abuse of market power, regulatory balance, governance and incentive structures and features of market design. The government should also ensure that market participants have access to good quality and timely information to support efficient decision-making. Establishment of an efficient spot market as discussed in section "Market Liberalisation and Privatisation" is another priority.

The objective of government policy should be to create a competitive, unbundled and efficiently operating electricity market, consistent with the IEA *Shared Goals* rather than trying to continue the planning approach, which would intervene in efficient market outcomes. In this context, effective government policy requires governments to stand behind market reforms and to implement policies that reduce operational or policy uncertainty with a view to assisting efficient market operation and development. Only as a last resort and only where market failure has been proven, should governments intervene in the operation of competitive markets. Policies and measures for reducing GHG emissions or promoting renewables and CHP are examples of such government intervention to address market failures. Even in such cases, the intervention should be as market-based as possible. Furthermore, transparent criteria should be created to judge whether such an intervention is necessary for security of supply reasons.

Allowing markets to signal the need for new investment in generation means that prices will go high on occasion. The government needs to anticipate that such fluctuations will occur and ensure that consumers are aware of price risks and have options to mitigate these risks. However, establishing inappropriately low price caps should be avoided because they are an investment barrier endangering security of supply and can reduce energy efficiency as shown by international experience in, for instance, California and Ontario.

Peak capacity is becoming a more critical issue in many IEA member countries. The problem can be addressed in two ways. First, the government needs to ensure that the market is effectively competitive, *i.e.* that high prices during a

tight market are not the consequence of the abuse of market power. This requires low levels of concentration in generation markets and adequate market surveillance. Second, an attempt needs to be made to find mechanisms that will reduce the volatility of prices without disrupting the use of market signals to invest. Effective financial markets in electricity exchanges provide the mechanism for minimising price volatility for purchasers without masking efficient wholesale price formation signals. Hence, financial markets provide a means to allow efficient management and mitigation of price volatility without the need for discretionary administered price caps, which can increase regulatory risk and undermine efficient price-investment responses.

Several governments have recently reviewed and rejected capacity mechanisms because they expected them to increase the cost of electricity and questioned their effectiveness in stimulating efficient new investment. The principal difficulty is that the mechanism may give a further advantage to incumbents. There may also be incentives in the short term for gaming the rules, for instance by manipulating availability of plants to increase revenue. Another potential shortcoming is that they may discourage innovation and increase pollution by maintaining existing uneconomic power generating capacity. Nevertheless, for a transition period a well-designed temporary capacity mechanism could help to ensure adequate capacity at all times in the context of rapid demand and policy/regulatory uncertainty. But it is not easy to plan a successful mechanism and even at best it can only be a rather poor substitute for genuine price signals. Therefore, Turkey should also avoid introducing capacity mechanisms for ensuring security of supply.

TRANSMISSION

The important initiative to synchronise the Turkish power system with the European UCTE grid is progressing well and the government should continue to pursue this as a high priority project. One of the obstacles was removed by the recent resynchronisation of the South-East European grids with UCTE. Synchronisation will bring Turkey multiple benefits such as improved security of supply and enhanced competition by enabling imports. As some of the prerequisites for the synchronisation require further improvement of the networks and their management, one of the immediate benefits will be increased reliability in the domestic networks. Also the allocation of interconnection capacity, particularly in the links with Bulgaria and Greece, needs to be considered from the outset to enhance competition. Transparent market mechanisms based on economic criteria, namely willingness to pay, should be preferred; this can be implemented, for example, through auctioning mechanisms.

Increased interconnections, however, bring a new kind of challenge as shown by the 2003 blackouts in North America and Europe. Some of the lessons

learned include the importance for the system operators to monitor and assess a wide area and to evaluate actions. The system operators' capacity to manage increasingly complex network environments in real time must be improved. Better co-operation, co-ordination and communication can help to reduce the potential for cascading failures, particularly where regional markets span more than one system operator's area of responsibility. It will be very important for the Turkish TSO to develop a strong working relationship with the TSOs in the neighbouring areas, particularly South-East Europe. Furthermore, the events highlight that governments continue to play a role to ensure reliable electricity supply but this should occur in a manner that is compatible with the liberalised markets.

DISTRIBUTION

Despite some reductions in distribution losses during the last couple of years, both technical and non-technical losses are still a concern. It will be necessary to continue, and possibly accelerate, the efforts. The government expects the privatisation of the distribution companies to help to further reduce losses. However, efficiency improvements, such as reduction of losses, are not guaranteed from privatisation if further measures are not taken to encourage efficiency. In this respect, the plan to implement performance standards and benchmarking is helpful because it is combined with regulation, which provides economic incentives for efficiency. The legislation permits distribution companies to keep any savings from outperforming a benchmark for a defined period.

One of the former inefficiencies of the power market, namely free deliveries of electricity to certain consumer groups, has been removed. This is a positive development because free electricity deliveries compromise both energy efficiency and economic efficiency. However, a new problem of increased non-payment has arisen. This should be abated by inciting normal contract discipline; particularly after privatisation the distribution companies will certainly have no interest in endlessly supplying non-payers.

PRICING AND TARIFFS

To date, there have been cross-subsidies both between different consumer groups, notably from industrial consumers to residential consumers, and between different geographical areas. Distorted prices can undermine efficient and timely private investment and lead to inefficient use of energy and a reduced quality of supply in distribution areas where prices are not cost-reflective.

It is a positive development that the government has announced that energy prices for each consumer group will be based on cost and that transparent tariff calculation rules have been established by the regulator. The

possibilities for the regulator to ensure the effective implementation of the rules are enhanced by the establishment of the transmission system operator, TEİAŞ, and by the mandated account unbundling inside the distribution companies that is yet to be established. These measures offer the potential for removing cross-subsidies between the different consumer groups. However, regional cross-subsidies will remain at least for five tariff implementation periods, as defined in the strategy.

While all consumers have been equipped with metering, installation of more advanced meters would allow the development of more sophisticated tariff schemes and flexible demand response when the market becomes tight towards the next decade. Better demand response would help to address the sharpening summer peak demand and enhance energy efficiency. Furthermore, better metering, including remotely read interval meters, could be an economically feasible way to address the high non-technical losses.

MARKET LIBERALISATION AND PRIVATISATION

The government should be highly commended for the initiative to create competitive electricity markets. The actions implemented in this direction have created a window of opportunity to implement successful reform with clear and significant benefits and for Turkey to become a regional leader in the context of the development of the South-East European regional electricity market. Now, decisive action will need to be taken to see the process through to a successful conclusion.

A major step was taken when the Electricity Market Law (EML) was issued in 2001. One of its most important provisions was the establishment of an independent regulator, which has quickly and efficiently issued most of the necessary secondary legislation. The legislation has been supplemented by a strategy, which outlines the practical steps to be taken towards the implementation of the EML as well as the privatisation process. The government is considering the amendment of the EML allowing EÜAŞ to enter into direct contracts with consumers, which would be in line with the EU Electricity Directives. Care should be taken that this does not result in increased market power of the state-owned incumbent.

However, despite the good legislative and regulatory framework, little competition has developed. There are multiple reasons for this: there is a lack of consumer choice caused by the small number of market players; new entrants have difficulties to compete with the state-owned incumbent who owns competitive depreciated generation units, including hydropower; the current generating overcapacity and lack of cost-reflective prices have made new investment unattractive; the BOO and BOT schemes have a relatively high market share and a relatively small share of consumers are eligible to

choose suppliers. Furthermore, power producers have no real choice of gas supplier because reform of this sector is lagging behind the electricity sector reform.

The power purchasing agreements cover as much as 25%, or 9 000 MW, of the market as compared to the baseload requirement, which is currently about 12 000 MW. It is sometimes pointed out that this is blocking new entry because there is no room in the baseload markets. Although it seems that the baseload market is currently saturated, in competitive electricity markets, where inherent price and quantity volatility is revealed, profitable opportunities may exist for smaller, more flexible plant investments to enter the market. Such investments could operate in the shoulder/peak markets as well as baseload markets.

Although overcapacities create an entry barrier in the short term, there is also a positive side. They buy time for the necessary transition to a competitive market. The transition would be much more difficult in a situation of tight supply. Turkish consumers have also developed their own decentralised means of response to any irregularities in power supply, for example price peaks, which adds flexibility that may be invaluable in the transition.

The power market is gradually being opened. Since January 2004, 29% of the electricity market has been open to competition. Many other countries have taken a step-by-step approach but Turkey has not defined the exact steps towards further market opening at the outset of the process. The EML gives the regulator the power to reduce the eligibility limit annually until full market liberalisation has been achieved. However, in contrast with the EML, the government in its recent strategy set the limit at the current high level until 2009. This approach reflects the plan to privatise generation whereby the government wants to provide the investors a guaranteed market for the first years of operation. After 2009 full liberalisation will follow in three years but the exact steps have not been defined. Not defining the liberalisation schedule from the outset of market liberalisation can create regulatory uncertainty, which makes it difficult for the market players to adequately carry out long-term strategic planning and make investment decisions. Incentives to private investors could be enhanced through actual market opening and regulatory stability, rather than guaranteeing protected market positions. Furthermore, the new generation companies will eventually be exposed to full competition and some of them, those able to improve their efficiency faster than their competitors, may actually be keen to start competition. Finally, more rapid liberalisation would benefit the end-users because they would have more choice and, consequently, there would be a downward pressure on electricity prices. However, it should be noted that the main driver of an immediate price fall is likely to be substantial excess capacity but it will quickly evaporate owing to rapid demand growth, leaving the possibility of higher prices and a tighter supply-demand. Therefore, any delays in market liberalisation or transitional arrangements, which unduly distort the process, have the potential to remove the period of lower electricity prices.

A fully independent transmission system operator is one of the prerequisites for creating a level playing field for all market participants. An important step in this direction has been taken by the creation of the transmission system and market operator, TEİAŞ. However, TEİAŞ is still dependent on the government budget and the government is heavily involved in its operation. Therefore, it cannot be considered independent. The independence of TEİAŞ needs to be increased considerably if the government intends to attract private investors and to create a level playing field for them. TEİAŞ should collect all the financing it needs, including for the network investments, from the markets through the TPA tariffs, regulated by EMRA, and no contribution should come from the state budget. The government should not interfere with the day-to-day operation and management of TEİAŞ. Its role should be limited to reviewing TEİAŞ's transmission network development plans.

The principle of operational independence applies to all energy companies as long as they remain under government ownership, and also to the remaining state-owned hydropower generation. Although state-owned companies can be found in many IEA member countries with liberalised electricity markets, the main difference as compared to Turkey is that these companies are given the independence and flexibility to operate like private companies.

While privatisation *per se* is not a prerequisite for effective functioning of the markets, the Turkish decision to privatise generation and distribution in the near future is pragmatic and can bring multiple, almost immediate benefits. Privatisation income and avoided state investments in the power sector ease the burden on government budgets. It gives the companies the independence and flexibility they need to function more efficiently. Competition is facilitated in power generation when the number of players grows provided that there will be enough eligible consumers. Along with finance, the private sector can bring market-oriented skills, access to advanced technology and usually faster build-up of supply capacity (once needed) than would be the case under public-sector management.

There are some prerequisites for a successful privatisation process. International experience suggests that "best practise" sequencing to minimise regulatory risk and uncertainty would involve establishing the legal/regulatory framework, market rules, market institutions and structures and undertaking structural reform before undertaking divestment. This matters greatly in relation to maximising investor confidence, which will determine the success or otherwise of the divestment process and subsequently the effectiveness of market-based investment responses to meet rapidly growing demand. Many of these conditions are fulfilled, such as the establishment of the legal and major parts of the regulatory framework and an independent regulator, but some work remains to be done, particularly in creating a fully independent transmission system operator, a spot market and making the prices cost-reflective. International experience also shows that it is

very unusual to start the privatisation from distribution rather than generation. For the distribution investors, the risk of not having an efficient upstream wholesale market in place is usually considered larger than the risk for the generators arising from lack of downstream restructuring.

The high guaranteed buy-back price for the BOO and BOT schemes is the stranded cost element of the reform. The State Planning Organisation estimates the burden caused by the BOO and BOT schemes to fade by 2011 when the average price in the agreements will decline close to the market price. However, 2011 is a long time to accommodate such a substantial distortion to efficient price formation; it can possibly have a really detrimental impact on efficient investment and operation of the market.

Immediate buy-out of at least part of these agreements by the government would be a clear-cut solution that would be enabled by the privatisation profits. Instead, it has been decided that the state-owned wholesale company (TETAŞ) "inherits" the contracts while being compensated by cheap supplies from the state-owned hydropower plants. There is one major setback to this approach, namely the marginal price-setting function of the hydropower assets, which are the most flexible swing producer in the Turkish wholesale market, is lost for the duration of this transitional arrangement (five years). Therefore, it should be ensured that the state-owned company with the hydro assets will have strong incentives to run them efficiently under the competitive market conditions. It should also be evaluated whether it would be possible to use some of the privatisation profits to buy out part of these contracts sooner, at least the capital repayment component (representing the difference between long- and short-term marginal cost), which would release the hydropower assets to compete on the market.

New entry to a market characterised by overcapacity and limited possibilities for imports is difficult. One way to bring liquidity to the market, hence introducing more competition, is to establish an electricity exchange built on a spot market. It would also bring the necessary transparency to the market in terms of efficient pricing. Such an exchange should be operated by a neutral organisation with a clear mandate, and made secure from individual stakeholders' interests.

NUCLEAR POWER

Turkey aspires to build nuclear power in the future in order to respond to the growing electricity demand while avoiding increasing dependence on imported fuels. The risk of hightened dependence on imported fuels may not be very large since Turkey is importing natural gas from multiple countries and is developing large infrastructure projects, which will also enable increased gas supplies in the future. In addition, the generation mix is relatively diversified as compared to many other IEA member countries. Should Turkey

set generation mix requirements, they should be set for all generation companies on a level playing field to ensure that these requirements are met fairly and efficiently.

The competitiveness of nuclear power in a liberalised electricity market in Turkey needs to be clarified. This issue has not yet been addressed in the recent announcement of the reopening of the nuclear programme. In most other countries, combined-cycle gas turbines have proven to be the most attractive alternative given their low capital cost, high efficiency and short construction time. A special feature for Turkey is its seismic instability; although technologies for the abatement of these risks exist, they add to the cost of nuclear power. On the other hand, nuclear power does not bear any CO_2 cost. At present, there is only one international example, namely Finland, where nuclear power is being built in fully liberalised energy markets. The power generators in Turkey will not necessarily have a commercial incentive to develop nuclear power.

The tentative schedule for the commissioning of the first unit is as early as 2013. This is a highly ambitious schedule given the lead times needed for the construction of nuclear power plants. Many important prerequisites need to be fulfilled before actual construction can begin. For example, to establish the independent nuclear regulator as planned, provide licences, identify a suitable site, define the desired technologies and identify options for the back-end of the nuclear cycle and update nuclear legislation in these aspects.

Responsibilities for nuclear waste management and disposal, including funding, should be clearly defined in the legislation. Waste disposal options need to be defined from the outset of launching a nuclear power project. One of the reasons is that funds need to be collected from the outset for waste disposal and the eventual decommissioning of the power plants. Another reason is that waste management and disposal is a focus of public opinion. Although it will take some time before the technical side of the waste issue becomes acute, it will be much earlier from the viewpoint of public acceptance. Joining the relevant IAEA conventions will become necessary if Turkey is to proceed with its nuclear programme.

CO-GENERATION

Industrial co-generation contributes a relatively by large share to Turkish power generation. Combined heat and power (CHP) generation has developed rapidly owing to the past favourable legal framework and the existence of heat demand in the energy-intensive industries. Abolishing the favourable legal framework recently and increasing gas prices have caused financial difficulties for the CHP operators. The government is drafting new energy efficiency legislation part of which will be aligning the CHP policies to the recent EU CHP Directive. In any possible future policies and measures the government may consider for the promotion of CHP, cost-effectiveness should be a driving force. Inefficient CHP that does not bring real fuel savings and

emissions reductions as compared to state-of-the-art separate electricity generation and heat production should not be promoted. Given that the existence of sufficient heat loads should be the primary parameter for establishing CHP, a study on the potential of CHP could help to define efficient policies. Anecdotal evidence implies that there is still unexploited potential for CHP in Turkey.

RECOMMENDATIONS

The Government of Turkey should:

- *Encourage the rehabilitation of the thermal power plants to increase their efficiency where economically feasible.*
- *Allow the market participants to decide when and what kind of new power capacity will be built. Clarify the level of intervention which is considered necessary for security of supply and environmental reasons, and clearly specify the criteria under which such interventions should occur.*
- *Continue the efforts for synchronisation of the Turkish power system with the European grid of the Union for the Co-ordination of Transmission of Electricity (UCTE).*
- *Ensure that effective regulation creates incentives for distribution companies to continue decreasing technical and non-technical losses.*
- *Make sure that the transmission system and market operator (TEİAŞ) is independent from government control in its normal operation, including the development of the network.*
- *Encourage the establishment of an electricity exchange to facilitate trade and to introduce more competition.*
- *Carefully consider the sequence of market reform. In particular, ensure that the legal and regulatory framework, independent transmission system operator and spot market are fully implemented before proceeding with privatisation.*
- *Ensure that the privatisation programme can be efficiently implemented without delays.*
- *Create a sound legal framework for the use of nuclear power. Clarify the role of nuclear power in the future in terms of economic competitiveness. Define nuclear technology choices and waste disposal options before building nuclear power plants.*
- *Evaluate the potential for co-generation and pay due attention to the cost-effectiveness of future policies.*

ENERGY RESEARCH AND DEVELOPMENT

GENERAL ENERGY R&D POLICY

The Supreme Council for Science and Technology (SCST) periodically establishes R&D priorities. The Scientific and Technical Research Council of Turkey (TÜBİTAK), which is the main public R&D body, has an advisory role in setting these priorities. The State Planning Organisation (DPT), which reports directly to the Prime Minister, is responsible for overall co-ordination of national economic and social development programmes, allocation of funds to public investment projects and advising the government. It provides financing for research centres, universities and industrial organisations according to its needs and priorities.

While there has been no specific national R&D programme related to energy in Turkey, the main objective stated by the government for the national energy R&D activities has been to enhance security of supply. TÜBİTAK is now co-ordinating a specific national energy R&D programme between 2005 and 2010.

Recently, the SCST decided that new national science and technology policies should be formulated, and priority areas should be set in order to create an innovative economy and a creative society by 2023, the hundredth anniversary of the foundation of the Turkish Republic. Consequently, the elaboration of the National Research and Technology Foresight Programme (Vision 2023 Programme) started at the beginning of 2002 under the co-ordination of TÜBİTAK. Whereas until now most technology development has focused on short to medium-term applications, the Vision 2023 Programme covers the period 2003-2023. It has the following objectives:

- Building long-term science and technology objectives for Turkey.
- Determining strategic technologies and priority areas for R&D.
- Formulating science and technology policies for the next 20 years, while being supported by a whole spectrum of stakeholders and creating public awareness of the importance of science and technology for socioeconomic development.

Energy and natural resources is one of the areas included in the Vision 2023 Programme. The following priority topics for energy have been developed to address the energy policy goals:

- Clean coal technologies.
- Fuel cells for transport, stationary and portable applications.
- Wind energy technologies.

- Hydrogen combustion technologies.
- Electricity production from solar energy.
- Energy storage technologies.
- Hydropower plants (mini and micro).
- Nuclear energy.
- Control technologies for power systems.
- Energy conservation technologies in industry.
- Reduction of energy consumption and using renewable energies in buildings.

Turkey has recognised that it has a comparatively low advantage in science and technology compared to the EU member states. Therefore, the government has identified four priority areas of work to make advancements in areas of science and technology, namely an appropriate environment for the development of R&D, qualified human resources, information and communication infrastructure, and innovation systems. One of the responses to these challenges is the creation of the Researcher Information System (ARBIS) project. ARBIS aims to create an interactive and informative database for researchers, educators and academic personnel working for governmental, public or private bodies in Turkey.

ENERGY RESEARCH INSTITUTES AND ACTIVITIES BY THE INDUSTRY

Founded in 1963, TÜBİTAK is the principal organisation responsible for promoting, developing, organising and co-ordinating R&D in the fields of exact sciences in Turkey in line with the national targets of economic development and technical progress. It reports directly to the Prime Minister. TÜBİTAK's main tasks are the following:

- Determining Turkey's science and technology policies.
- Supporting, encouraging and co-ordinating scientific research.
- Establishing and operating special institutes to conduct R&D geared to the targets of the five-year economic development plans and the priorities set by TÜBİTAK's Science Board. TÜBİTAK is composed of 19 in-house research institutes.
- Providing scholarships and other support to researchers and organising contests to discover and train future scientists.
- Supporting R&D activities and innovations in industry, promoting university-industry collaboration and establishing techno-parks to facilitate their realisation.

- Implementing tasks undertaken through international scientific and technical co-operation agreements.
- Publishing scientific journals, as well as books and monthly popular science magazines that make science accessible to the public.
- Supporting scientists and researchers with awards and programmes that provide incentives for scientific publications.

Although much energy-related R&D is also conducted in the universities, comprehensive statistics do not exist. Some of the government's R&D budget is used by the EİE, which is itself part of the government and has activities in the areas of energy efficiency and renewables.

The Technology Development Foundation of Turkey (TTGV) was established in 1991 to raise industry's awareness of R&D and to support technology development projects of the Turkish industry through World Bank financing. TTGV is an independent non-profit organisation established jointly by the private and public sectors. It is a non-governmental organisation with a special status that has undertaken a national mission of fostering the continuous and effective technology development activities of industrial companies. TTGV participates in The Association for Technology Implementation in Europe (TAFTIE), which groups European organisations involved in similar activities.

Both TAEK (the Atomic Energy Authority) and the energy industry also conduct energy R&D. However, there are no comprehensive statistics available about industry-based energy R&D. TAEK's nuclear R&D budget is approximately US$ 50 million per year. In 2005, TAEK will be restructured by dividing it into two bodies, one which will continue nuclear energy R&D and another which will form an independent nuclear energy regulator.

Some industrial companies, such as the gas and oil production company TPAO, have substantial R&D activity. TPAO's R&D budget totalled US$ 6 million in 2004.

There are some incentives, including financial ones, to promote R&D in industry but most of these measures are only starting. The government has a R&D Assistance Programme for Industry under which TÜBİTAK and the Undersecretariat of Foreign Trade can provide grants for up to 50% of the project cost. TTGV provides low-interest loans.

In the past, there was not much co-operation between the different research organisations, industry and government-sponsored R&D programmes. However, over recent years there have been active attempts to increase co-operation and collaboration and, consequently, the situation has improved. For example, financing for TÜBİTAK's projects is coming increasingly from the industry, particularly for R&D on distributed generation.

R&D ACTIVITIES

Energy-related R&D activities have focused on advanced and new energy technologies since the 1990s. Non-nuclear energy R&D activities in Turkey can be divided into two groups according to their size. The first category covers a number of small-scale clean energy R&D projects and university projects on photovoltaics, solar heating and biogas. The second category covers medium- or large-size projects of an international nature. The research for these projects has mainly been focused on fuel cells, photovoltaics and biomass.

The non-nuclear energy R&D activities in Turkey can be divided into the four following categories according to their focus:

- Fuel technologies: solid fuels (lignite, coke, petrocoke) analysis; liquid fuels (gasoline, diesel, fuel oil) analysis; fuel additives.
- Advanced energy technologies: energy conversion systems such as fuel cell technologies (*e.g.* studies on using boron as a hydrogen-carrying material in fuel cells; studies on using Black Sea deposits of hydrogen sulphur for hydrogen production; proton exchange membrane fuel cells; molten carbonate fuel cells; reformers; system simulation, design and integration); energy conservation in industry and buildings; absorption cooling systems; solar heating; photovoltaics; combustion (*e.g.* clean use of fossil fuels) and biomass gasification and co-generation.
- Platform technologies: electric and hybrid vehicles; electrical energy storage systems (flywheel and battery); gas sensors and automatic control; hydrogen combustion; energy efficiency in vehicles; alternative motor fuels (ethanol, methanol, etc.).
- Power electronics: power electronics circuit design; programming, control and signal processing; power system simulation and analyses; solid state switches design and prototyping; and network analysis.

Nuclear R&D in Turkey comprises reactor technologies, fuel cycle technologies and technologies for agricultural, industrial and medical applications. The fuel pilot plant (CNAEM) facilitates R&D on the front-end of the nuclear fuel cycle, such as uranium purification and pellet production. Other activities include radioisotope production, neutron activation analysis (NAA), material testing, and training. Turkey has had a nuclear research reactor in operation in İstanbul since 1962.

THE R&D BUDGETS

The state energy R&D budget increased considerably in the mid-1990s, peaking at US$ 12 million in 1997 to decline again to US$ 3.3 million by 2002. In 2003, the estimated budget was US$ 5.5 million (see Table 23).

Table 23

Government's Energy R&D Budget, 2002-2003

million US$ (2003 prices and exchange rates)

Area	*2002*	*2003 estimate*
Energy conservation	0.36	0.29
Fossil fuels	0.37	0.89
Renewable energy	1.05	1.24
Nuclear[1]	0.03	0.09
Power and storage	1.08	1.28
Other	0.44	1.71
Total	**3.33**	**5.51**

[1] This does not include nuclear R&D done by TAEK. Its average annual budget is about US$ 50 million.

Sources: *OECD Economic Outlook No 74*, OECD Paris, 2004; and country submission.

23% of the state energy R&D budget was used for renewables (principally geothermal and solar), 23% for electricity transmission and distribution, 16% for fossil fuels (principally coal), 5% for energy conservation and 2% for nuclear; 31% of the state energy R&D budget was used for "other energy R&D", which comprises mainly hydrogen and fuel cell technologies. There is, however, a lot of uncertainty in the exact breakdown, as well as the total levels of the state energy R&D budget because of problems in the collection of the data.

As compared to GDP, the Turkish state energy R&D budget is one of the smallest (together with Portugal) among the IEA member countries (see Figure 28). In 2005 the government will allocate US$ 300 million to the Vision 2023 Programme with ambitious plans to increase the level to US$ 8.4 billion in 2010 (2% of the GDP), whereas the current public R&D budget totals US$ 1.6 billion. The Vision 2023 Programme expenditures on energy R&D are planned to multiply from current levels.

In Turkey, there are three financing sources for publicly funded academic R&D. About 40% of the public R&D funds are administered by the DPT, 40% by the Ministry of Finance and the remaining public funding for academic research comes from various ministries and state departments in the form of contract research.

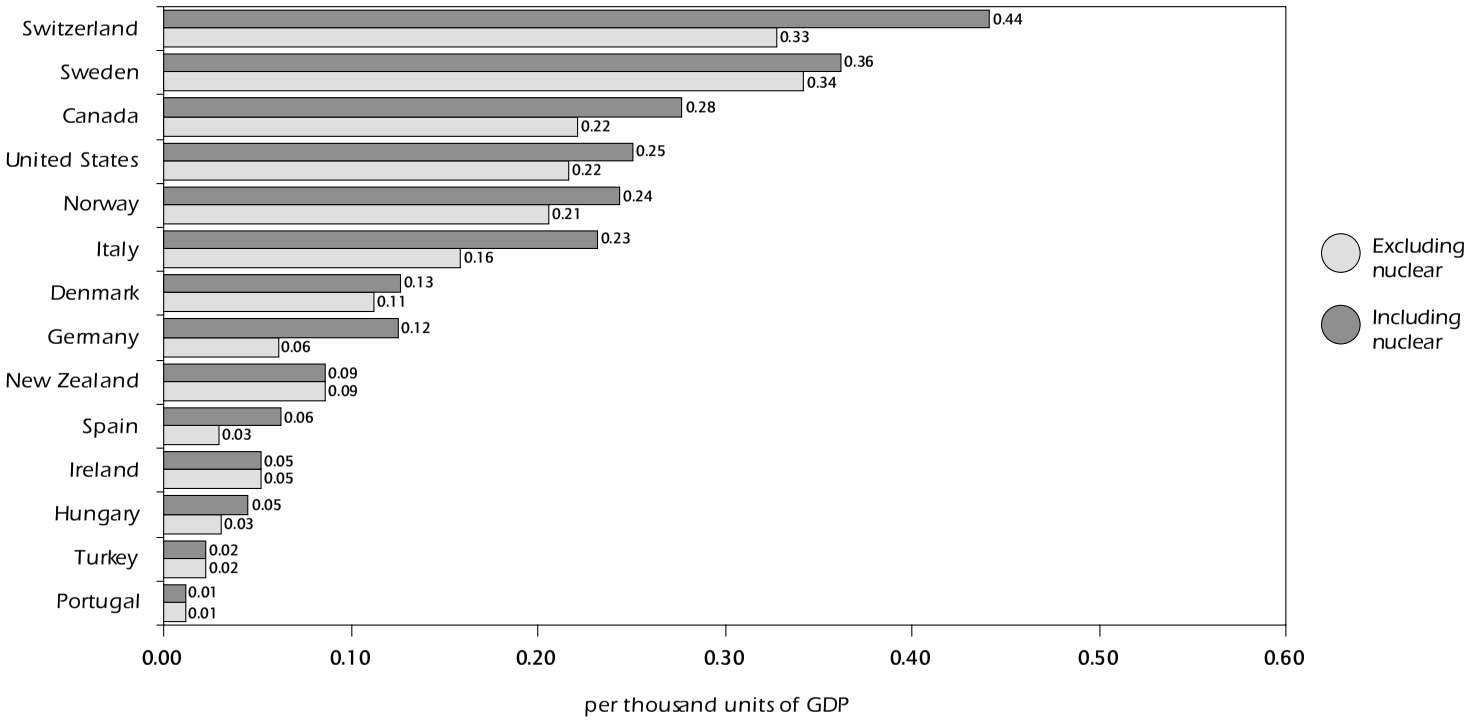
INTERNATIONAL ACTIVITIES

Turkey participates in the following seven Implementing Agreements (IEA Framework for International Technology Co-operation):

- Co-operative programme for assessing the impacts of high-temperature superconductivity on the electric power sector.

Figure 28

IEA Government Budgets on Energy R&D per GDP, 2003*



* estimates.

Note: Data not available for Australia, Austria, Belgium, the Czech Republic, Finland, France, Greece, Japan, Korea, the Netherlands and the United Kingdom. Luxembourg has no energy R&D programme.

Sources: *OECD Economic Outlook No.75*, OECD Paris, 2004; and country submissions.

- Energy conservation in buildings and community systems programme (ECBCS).
- Energy conservation through energy storage.
- Energy technology systems analysis programme (ETSAP).
- Hydrogen.
- Photovoltaic power systems.
- Plasma wall interaction in textor.

Turkey is considering extending its participation in the Implementing Agreements. It is considering joining, for example, the Implementing Agreements on the Co-operative programme on process integration technologies and the Programme of research, development and demonstration on advanced energy-related technologies for the pulp and paper industry.

Turkey was not a full partner of the EU fifth framework programme and, therefore, could not access its financing. However, it still participated in two projects, namely "Integrated research on materials, clean and efficient energy technologies and processes to enhance molten carbonate fuel cells in a sustainable development" (IRMATEC) and "Development and demonstration of a small-sized hybrid system with the combination of the molten carbonate fuel cell technology and a micro-turbine " (MOCAMI). It is a full partner of the EU sixth framework programme where it participates in the following three projects:

- Preparing for a hydrogen economy by using the existing natural gas system as a catalyst (NATURALHY).
- The birth of the European Distributed EnErgy Partnership that will help the large-scale implementation of distributed energy resources in Europe (EU DEEP).
- Application of nanotechnologies for separation and recovery of volatile organic compounds from waste air streams (ANVOC).

TÜBİTAK participates in two of the EU's Joint Research Centre (JRC) projects, namely "Cleaning of syngas from waste or biomass gasification/pyrolysis for storage or direct use for energy production" and "Novel flue gas cleaning systems for waste and biomass energy production plants".

In October 2003, an agreement was signed between UNIDO and the MENR on the establishment of the International Centre for Hydrogen Energy Technologies (ICHET) in İstanbul. The objective of ICHET is to further advance the applied R&D on hydrogen energy and to stimulate hydrogen energy technology application in industrial development globally, but in particular in

developing countries. The areas of work will include hydrogen energy policy, economics, production, storage and utilisation techniques.

MONITORING AND ASSESSMENT

There are no uniform methodologies used to monitor and assess the energy R&D carried out in the different R&D establishments. Each funding organisation has its own management committee as well as project monitoring committee consisting of both academia and professionals. Each project has its own success criteria ranging from pure research to product-based achievements. TÜBİTAK has an "evaluation and monitoring system" using experts both from industry and universities; its projects are monitored at six-month intervals.

CRITIQUE

Turkey faces significant energy and environment policy challenges. They include curbing the growth of GHG emissions under the trend of declining energy efficiency, continuing to use domestic low-quality lignite under tightening environmental regulation and competition and increasing rapidly the use of renewable energies and, particularly, the revived nuclear programme. The government needs to explore all possible means to respond to these challenges. The possibilities provided by effective energy R&D policy should be fully explored. Therefore, it is imperative that the ministry in charge of energy policy has a coherent energy R&D strategy or programme to help achieve its energy policy goals. In this context, Vision 2023 can help. To increase the cost-effectiveness of energy R&D and to make better use of the results, it is necessary to develop more co-ordinated monitoring and assessment mechanisms as well as to improve dissemination of the results.

TÜBİTAK is making a good effort to identify activities that support government energy policy. It is also positive that the government has recently launched its long-term R&D strategy, Vision 2023 Programme, which contains several energy R&D priorities and is supported by an increase in financing. Nevertheless, while national priority setting exercises have been undertaken, the findings of the 2001 *IEA Energy Policy Review of Turkey* demonstrate that the public research efforts are still broad, lack focus and are somewhat scattered. Given the limited public resources for energy R&D, it is essential to focus on areas where Turkey has a competitive advantage and where the best pay-off may be anticipated. Clearly, coal, hydro and other renewables should be priority considerations, where short- to medium-term outcomes should be achievable. Given development aspirations, Turkey will continue to be a "technology taker" for the foreseeable future. R&D efforts need to focus on the acquisition and adaptation of the best available technology to suit the particular Turkish circumstances. Early market deployment of such technologies should be a priority.

Until the Vision 2023 Programme, academia had not been directed by a special energy programme towards selected basic research areas. Hence, a tremendous amount of basic research results are scattered in context. Neither the universities nor the governmental research institutes and funding organisations have directed funds towards selected energy goals. The links between basic research and energy R&D should be strengthened. In this context it is positive that from now on common goals set by the Vision 2023 Programme will also shape the basic research areas.

Turkey's overall performance in terms of R&D expenditure as a percentage of GDP is well below OECD averages, which is not surprising given Turkey's stage of development. This is also reflected in energy-related R&D figures, where private investment in R&D is low. Data on energy-related R&D appear to be inconsistent and not particularly robust. Collecting accurate data on energy-related R&D is a prerequisite for effective co-ordination in pursuing energy R&D strategy.

Turkey is actively seeking possibilities to participate in international research programmes, such as EU programmes and IEA frameworks and a decision has been made to establish an international hydrogen research centre in Turkey. Such participation can have many attractions and benefits. For example, it helps to alleviate the impact of small public funding. However, care must be taken to ensure that Turkey can realise benefits commensurate with the investment.

Efforts must be made to improve the overall levels of private-sector energy R&D. Existing support for general R&D should be better promoted. It is positive that co-operation between TÜBİTAK and industry is becoming more intensive but still greater efforts should be made to encourage public-private partnerships involving industry, universities and public-sector research institutions.

Evidence from other countries clearly indicates a fall-off in R&D in the various components of the electricity and gas sectors following privatisation. In the rush to competitiveness and productivity improvements, R&D expenditures are often an early victim. The government will need to actively facilitate and encourage R&D investment by newly privatised and corporatised entities to overcome this short-sighted strategy. The major stand-alone operations like BOTAŞ, TPAO and TAEK have strong R&D programmes that need to be supported and maintained.

RECOMMENDATIONS

The Government of Turkey should:

- *Build on the work done within the Vision 2023 Programme to prepare a coherent energy R&D strategy. It should have adequate financing and efficient allocation in line with energy policy objectives to maximise energy R&D's contribution to the significant energy policy challenges in coming years.*

- *Concentrate on the adaptation of existing technologies and their early deployment, particularly in areas where there is a clear competitive advantage and need.*
- *Improve the collection of data on governmental R&D funding.*
- *Actively encourage the formation of private-public partnerships and, as appropriate, provide incentives for energy companies to increase R&D expenditures.*
- *Facilitate adequate R&D investment by the state-owned entities and ensure that incentives are provided post privatisation.*

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	2002	2003P	2010	2020	2030
TOTAL PRODUCTION		**15.52**	**25.86**	**24.43**	**23.81**	**36.69**	**65.65**	**..**
Coal[1]		5.21	12.41	11.64	10.81	22.67	36.76	..
Oil		3.59	3.61	2.39	2.49	1.57	0.69	..
Gas		–	0.18	0.31	0.51	0.24	0.23	..
Comb. Renewables & Wastes[2]		6.45	7.21	6.05	5.75	4.42	3.93	..
Nuclear		–	–	–	–	–	8.23	..
Hydro		0.22	1.99	2.90	3.04	4.90	9.42	..
Geothermal		0.05	0.43	0.82	0.86	1.98	4.81	..
Solar/Wind/Other		–	0.03	0.32	0.36	0.92	1.58	..
TOTAL NET IMPORTS[3]		**8.74**	**27.98**	**50.73**	**60.46**	**88.89**	**156.63**	**..**
Coal[1]	Exports	–	–	–	0.01	–	–	..
	Imports	0.01	4.21	8.27	12.14	12.33	43.54	..
	Net Imports	0.01	4.21	8.27	12.14	12.33	43.54	..
Oil	Exports	0.86	1.90	3.13	4.04	–	–	..
	Imports	9.68	23.18	31.52	34.00	39.61	60.22	..
	Bunkers	0.09	0.12	0.53	0.64	–	–	..
	Net Imports	8.73	21.16	27.86	29.32	39.61	60.22	..
Gas	Exports	–	–	–	–	0.67	0.67	..
	Imports	–	2.68	14.34	18.95	37.63	51.98	..
	Net Imports	–	2.68	14.34	18.95	36.96	51.31	..
Electricity	Exports	–	0.08	0.04	0.05	–	–	..
	Imports	–	0.02	0.31	0.10	–	1.56	..
	Net Imports	–	–0.06	0.27	0.05	–	1.56	..
TOTAL STOCK CHANGES		**0.11**	**–0.83**	**0.26**	**–0.55**	**–**	**–**	**..**
TOTAL SUPPLY (TPES)		**24.37**	**53.01**	**75.42**	**83.72**	**125.59**	**222.27**	**..**
Coal[1]		5.15	16.94	19.79	22.50	35.00	80.29	..
Oil		12.50	23.61	30.53	31.72	41.18	60.92	..
Gas		–	2.86	14.73	19.45	37.19	51.54	..
Comb. Renewables & Wastes[2]		6.45	7.21	6.05	5.75	4.42	3.93	..
Nuclear		–	–	–	–	–	8.23	..
Hydro		0.22	1.99	2.90	3.04	4.90	9.42	..
Geothermal		0.05	0.43	0.82	0.86	1.98	4.81	..
Solar/Wind/Other		–	0.03	0.32	0.36	0.92	1.58	..
Electricity Trade[4]		–	–0.06	0.27	0.05	–	1.56	..
Shares (%)								
Coal		*21.1*	*32.0*	*26.2*	*26.9*	*27.9*	*36.1*	..
Oil		*51.3*	*44.5*	*40.5*	*37.9*	*32.8*	*27.4*	..
Gas		–	*5.4*	*19.5*	*23.2*	*29.6*	*23.2*	..
Comb. Renewables & Wastes		*26.5*	*13.6*	*8.0*	*6.9*	*3.5*	*1.8*	..
Nuclear		–	–	–	–	–	*3.7*	..
Hydro		*0.9*	*3.8*	*3.8*	*3.6*	*3.9*	*4.2*	..
Geothermal		*0.2*	*0.8*	*1.1*	*1.0*	*1.6*	*2.2*	..
Solar/Wind/Other		–	*0.1*	*0.4*	*0.4*	*0.7*	*0.7*	..
Electricity Trade		–	*–0.1*	*0.4*	*0.1*	–	*0.7*	..

0 is negligible, – is nil, .. is not available.
P is provisional.

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2002	2003P	2010	2020	2030
TFC	**20.04**	**40.55**	**56.52**	**63.83**	**97.31**	**167.78**	**..**
Coal[1]	2.94	7.57	8.61	13.39	17.85	41.69	..
Oil	9.70	20.80	26.94	26.36	36.08	54.81	..
Gas	0.04	0.72	5.22	7.89	19.62	24.79	..
Comb. Renewables & Wastes[2]	6.45	7.21	5.97	5.75	4.42	3.93	..
Geothermal	0.05	0.36	0.73	0.78	1.65	4.48	..
Solar/Wind/Other	–	0.03	0.32	0.35	0.50	0.86	..
Electricity	0.85	3.87	8.73	9.32	17.20	37.22	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*14.7*	*18.7*	*15.2*	*21.0*	*18.3*	*24.8*	..
Oil	*48.4*	*51.3*	*47.7*	*41.3*	*37.1*	*32.7*	..
Gas	*0.2*	*1.8*	*9.2*	*12.4*	*20.2*	*14.8*	..
Comb. Renewables & Wastes	*32.2*	*17.8*	*10.6*	*9.0*	*4.5*	*2.3*	..
Geothermal	*0.2*	*0.9*	*1.3*	*1.2*	*1.7*	*2.7*	..
Solar/Wind/Other	–	*0.1*	*0.6*	*0.5*	*0.5*	*0.5*	..
Electricity	*4.3*	*9.5*	*15.5*	*14.6*	*17.7*	*22.2*	..
Heat	–	–	–	–	–	–	..
TOTAL INDUSTRY[5]	**4.30**	**13.71**	**21.88**	**28.83**	**44.01**	**79.44**	**..**
Coal[1]	1.14	4.52	7.31	11.38	13.94	33.88	..
Oil	2.60	6.16	8.25	8.55	9.59	12.21	..
Gas	0.00	0.67	2.01	4.36	11.79	13.65	..
Comb. Renewables & Wastes[2]	–	–	–	–	–	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	0.01	0.12	0.12	0.17	0.26	..
Electricity	0.55	2.35	4.20	4.43	8.53	19.44	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*26.5*	*33.0*	*33.4*	*39.5*	*31.7*	*42.7*	..
Oil	*60.5*	*44.9*	*37.7*	*29.6*	*21.8*	*15.4*	..
Gas	*0.1*	*4.9*	*9.2*	*15.1*	*26.8*	*17.2*	..
Comb. Renewables & Wastes	–	–	–	–	–	–	..
Geothermal	–	–	–	–	–	–	..
Solar/Wind/Other	–	*0.1*	*0.5*	*0.4*	*0.4*	*0.3*	..
Electricity	*12.9*	*17.2*	*19.2*	*15.4*	*19.4*	*24.5*	..
Heat	–	–	–	–	–	–	..
TRANSPORT[6]	**4.49**	**9.58**	**12.93**	**12.40**	**19.92**	**34.04**	**..**
TOTAL OTHER SECTORS[7]	**11.26**	**17.26**	**21.71**	**22.60**	**33.39**	**54.30**	**..**
Coal[1]	1.28	3.03	1.30	2.01	3.91	7.81	..
Oil	3.15	5.11	5.89	5.50	6.73	8.92	..
Gas	0.04	0.05	3.16	3.52	7.82	11.12	..
Comb. Renewables & Wastes[2]	6.45	7.21	5.97	5.75	4.42	3.93	..
Geothermal	0.05	0.36	0.73	0.78	1.65	4.48	..
Solar/Wind/Other	–	0.02	0.20	0.23	0.33	0.61	..
Electricity	0.29	1.49	4.46	4.81	8.52	17.44	..
Heat	–	–	–	–	–	–	..
Shares (%)							
Coal	*11.4*	*17.6*	*6.0*	*8.9*	*11.7*	*14.4*	..
Oil	*28.0*	*29.6*	*27.1*	*24.3*	*20.2*	*16.4*	..
Gas	*0.3*	*0.3*	*14.5*	*15.6*	*23.4*	*20.5*	..
Comb. Renewables & Wastes	*57.3*	*41.7*	*27.5*	*25.4*	*13.2*	*7.2*	..
Geothermal	*0.4*	*2.1*	*3.4*	*3.5*	*4.9*	*8.3*	..
Solar/Wind/Other	–	*0.1*	*0.9*	*1.0*	*1.0*	*1.1*	..
Electricity	*2.6*	*8.6*	*20.6*	*21.3*	*25.5*	*32.1*	..
Heat	–	–	–	–	–	–	..

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2002	2003P	2010	2020	2030
ELECTRICITY GENERATION[8]							
INPUT (Mtoe)	**2.77**	**11.08**	**24.09**	**24.75**	**41.21**	**84.49**	**..**
OUTPUT (Mtoe)	**1.07**	**4.95**	**11.13**	**12.09**	**20.81**	**41.40**	**..**
(TWh gross)	12.43	57.54	129.40	140.58	242.02	481.38	..
Output Shares (%)							
Coal	*26.1*	*35.1*	*24.8*	*23.0*	*27.3*	*33.3*	..
Oil	*51.4*	*6.9*	*8.3*	*6.5*	*2.9*	*1.3*	..
Gas	*–*	*17.7*	*40.6*	*45.2*	*44.1*	*34.3*	..
Comb. Renewables & Wastes	*1.6*	*–*	*0.1*	*–*	*–*	*–*	..
Nuclear	*–*	*–*	*–*	*–*	*–*	*6.6*	..
Hydro	*20.9*	*40.2*	*26.0*	*25.1*	*23.6*	*22.8*	..
Geothermal	*–*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	..
Solar/Wind/Other	*–*	*–*	*0.0*	*0.0*	*2.0*	*1.7*	..
TOTAL LOSSES	**4.03**	**11.58**	**18.74**	**19.97**	**28.28**	**54.49**	**..**
of which:							
Electricity and Heat Generation[9]	1.70	6.13	12.96	12.66	20.40	43.09	..
Other Transformation	1.32	2.89	1.00	2.69	2.25	2.83	..
Own Use and Losses[10]	1.00	2.56	4.78	4.62	5.63	8.58	..
Statistical Differences	**0.30**	**0.88**	**0.16**	**–0.09**	**–**	**–**	**–**

INDICATORS

	1973	1990	2002	2003P	2010	2020	2030
GDP (billion 1995 US$)	68.40	144.57	204.87	216.75	313.22	582.45	..
Population (millions)	38.45	56.20	69.67	70.78	78.46	87.76	..
TPES/GDP[11]	0.36	0.37	0.37	0.39	0.40	0.38	..
Energy Production/TPES	0.64	0.49	0.32	0.28	0.29	0.30	..
Per Capita TPES[12]	0.63	0.94	1.08	1.18	1.60	2.53	..
Oil Supply/GDP[11]	0.18	0.16	0.15	0.15	0.13	0.10	..
TFC/GDP[11]	0.29	0.28	0.28	0.29	0.31	0.29	..
Per Capita TFC[12]	0.52	0.72	0.81	0.90	1.24	1.91	..
Energy-related CO_2 Emissions (Mt CO_2)[13]	52.8	128.8	193.7	..	329.4	594.9	..
CO_2 Emissions from Bunkers (Mt CO_2)	0.4	0.9	4.3	..	2.7	2.7	..

GROWTH RATES (% per year)

	73–79	79–90	90–02	02–03	03–10	10–20	20–30
TPES	3.7	5.2	3.0	11.0	6.0	5.9	..
Coal	4.1	9.0	1.3	13.7	6.5	8.7	..
Oil	3.1	4.2	2.2	3.9	3.8	4.0	..
Gas	–	–	14.7	32.0	9.7	3.3	..
Comb. Renewables & Wastes	3.1	–0.7	–1.4	–5.0	–3.7	–1.2	..
Nuclear	–	–	–	–	–	–	..
Hydro	25.7	7.6	3.2	4.9	7.1	6.7	..
Geothermal	3.8	19.7	5.5	4.9	12.7	9.3	..
Solar/Wind/Other	–	–	22.6	10.2	14.5	5.6	..
TFC	4.1	4.3	2.8	12.9	6.2	5.6	..
Electricity Consumption	11.3	8.2	7.0	6.7	9.2	8.0	..
Energy Production	1.9	3.7	–0.5	–2.5	6.4	6.0	..
Net Oil Imports	5.1	5.5	2.3	5.3	4.4	4.3	..
GDP	4.5	4.5	2.9	5.8	5.4	6.4	..
Growth in the TPES/GDP Ratio	–0.8	0.7	0.0	4.9	0.5	–0.5	..
Growth in the TFC/GDP Ratio	–0.4	–0.2	–0.1	6.8	0.8	–0.8	..

Please note: Rounding may cause totals to differ from the sum of the elements.

FOOTNOTES TO ENERGY BALANCES AND KEY STATISTICAL DATA

1. Includes lignite.
2. Comprises solid biomass, biogas and industrial waste. Data are often based on partial surveys and may not be comparable between countries.
3. Total net imports include combustible renewables and waste.
4. Total supply of electricity represents net trade. A negative number indicates that exports are greater than imports.
5. Includes non-energy use.
6. Includes less than 1% non-oil fuels.
7. Includes residential, commercial, public service and agricultural sectors.
8. Inputs to electricity generation include inputs to electricity and CHP. Output refers only to electricity generation.
9. Losses arising in the production of electricity and heat at public utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of 10% for geothermal and 100% for hydro.
10. Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.
11. Toe per thousand US dollars at 1995 prices and exchange rates.
12. Toe per person.
13. "Energy-related CO_2 emissions" specifically means CO_2 from the combustion of the fossil fuel components of TPES (*i.e.* coal and coal products, peat, crude oil and derived products and natural gas), while CO_2 emissions from the remaining components of TPES (*i.e.* electricity from hydro, other renewables and nuclear) are zero. Emissions from the combustion of biomass-derived fuels are not included, in accordance with the Intergovernmental Panel on Climate Change (IPCC) greenhouse gas inventory methodology. Also in accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2002 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

Member countries* of the IEA seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives they therefore aim to create a policy framework consistent with the following goals:

1. **Diversity, efficiency and flexibility within the energy sector** are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2. Energy systems should have **the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3. **The environmentally sustainable provision and use of energy** is central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should where practicable have regard to the Polluter Pays Principle.

4. **More environmentally acceptable energy sources** need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA members wish to retain and improve the nuclear

* Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5. **Improved energy efficiency** can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6. Continued **research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-member countries, should be encouraged.

7. **Undistorted energy prices** enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8. **Free and open trade** and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9. **Co-operation among all energy market participants** helps to improve information and understanding, and encourage the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at their 4 June 1993 meeting in Paris.)

GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention and subsequently abbreviated, this glossary provides a quick and central reference for many of the abbreviations used.

AIOC	Azerbaijan International Operating Company.
APK	Research, Planning and Coordination Board (of MENR).
APM	Automatic Pricing Mechanism.
ARBIS	Researcher Information System project.
bcm	billion cubic metres.
BOO	build-own-operate.
BOT	build-operate-transfer.
BOTAŞ	Petroleum Pipeline Corporation.
bpd	barrels per day.
BTC	Baku-Tbilisi-Ceyhan crude oil pipeline.
CO	carbon monoxide.
CO_2	carbon dioxide.
CPC	Caspian Pipeline Consortium.
CHP	combined production of heat and power; sometimes when referring to industrial CHP, the term "co-generation" is used.
CNG	compressed natural gas.
DEPA	Public Gas Corporation (Greece).
DPT	State Planning Organisation.
DSI	State Hydraulic Works.
E&P	exploration and production.
EC	European Commission.

EECB Energy Efficiency Coordination Board.
EİE Electrical Power Resources Survey and Development Administration.
EİGM General Directorate of Energy Affairs.
EML Electricity Market Law.
EMRA Energy Market Regulatory Authority.
ESCO energy service company.
ESP electrostatic precipitator.
EU European Union.
EÜAŞ a state-owned electricity generation company.

FGD flue gas desulphurisation.
FPSF Fuel Stabilisation Fund.
FTC fuel consumption tax.

g gram.
GAP South-east Anatolia Project.
GCV gross calorific value.
GDP gross domestic product.
GHG greenhouse gases.
GTZ Deutsche Gesellschaft für Technische Zusammenarbeit.
GW gigawatt, or 1 watt $\times 10^9$.
GW_e gigawatt of electric capacity.
GW_{th} gigawatt of thermal capacity.
GWh gigawatt-hour = 1 gigawatt $\times$ 1 hour.

IAEA International Atomic Energy Agency.
ICHET International Centre for Hydrogen Energy Technologies.
IEA International Energy Agency.
IPCC Intergovernmental Panel on Climate Change.
İTÜ İstanbul Technical University.

JICA Japan International Cooperation Agency.

kcal	kilocalorie, or 1 calorie $\times 10^3$.
kg	kilogram, or 1 gram $\times 10^3$.
km	kilometre, or 1 metre $\times 10^3$.
km^2	square kilometre.
KTM	Kazakturkmunay venture.
ktoe	thousand tonnes of oil equivalent; see toe.
kWh	kilowatt-hour = 1 kilowatt $\times$ 1 hour = 1 watt $\times 10^3 \times$ 1 hour.
kWp	kilowatt (peak).
kV	kilovolt, or 1 volt $\times 10^3$.
LCP	large combustion plant.
LNG	liquefied natural gas.
LPG	liquefied petroleum gas.
m	metre.
m^2	square metre.
m^3	cubic metre.
mcm	million cubic metres.
MENR	Ministry of Energy and Natural Resources.
mg	milligram.
Mt	million tonnes.
Mtoe	million tonnes of oil equivalent; see toe.
MW	megawatt, or 1 watt $\times 10^6$.
MW_e	megawatt of electric capacity.
MW_{th}	megawatt of thermal capacity.
NECC	National Energy Conservation Centre.
NESO	National Emergency Sharing Organisation.
NGML	Natural Gas Market Law.
Nm^3	Normal cubic metre.
NO_x	oxides of nitrogen.
NO_2	nitrogen dioxide.

O_3	ozone.
OECD	Organisation for Economic Co-operation and Development.
PIGM	General Directorate of Petroleum Affairs.
PM	particulate matter.
PM_{10}	particulate matter (particles less than or equal to 10 micrometres in diameter).
POAŞ	Petrol Ofisi.
PSE	Producer Subsidy Equivalent.
PV	photovoltaics.
R&D	research and development, especially in energy technology; may include the demonstration and dissemination phases as well.
SCP	South Caucasus Pipeline project.
SCST	Supreme Council for Science and Technology.
SO_2	sulphur dioxide.
SO_x	sulphur oxides.
TAEK	Turkish Atomic Energy Authority.
tce	tonnes of coal equivalent.
TEAŞ	Turkish Electricity Generation-Transmission Corporation.
TEDAŞ	Turkish Electricity Distribution Company.
TEK	Turkish Electricity Authority.
TEİAŞ	Turkish Electricity Transmission Company.
TETAŞ	Turkish Electricity Wholesale and Trading Company (a state-owned electricity wholesale company).
TFC	total final consumption of energy.
TKİ	Turkish Coal Enterprises (a state-owned lignite producer company).
TL	Turkish lira (old, before 1 January 2005 revaluation).
toe	tonnes of oil equivalent, defined as 10^7 kcal.
TOOR	transfer of operating rights.
TPA	third-party access.

TPAO	Turkish Petroleum Corporation.
TPES	total primary energy supply.
TSO	transmission system operator.
TSP	total suspended particulates.
TTGV	Technology Development Foundation of Turkey.
TTK	Turkish Hard Coal Enterprise.
TÜBİTAK	The Scientific and Technical Research Council of Turkey.
TÜPRAŞ	Turkish Petroleum Refinery Corporation.
TWh	terawatt-hour = 1 terawatt $\times$ 1 hour = 1 watt $\times$ 10^{12} $\times$ 1 hour.
UCTE	Union for the Co-ordination of Transmission of Electricity.
UGS	underground storage.
UNDP	United Nations Development Programme.
UNFCCC	United Nations Framework Convention on Climate Change.
UNIDO	United Nations Industrial Development Organization.
US	United States.
VAT	value-added tax.
WHO	World Health Organization.
YTL	Yeni Turkish lira (new, after 1 January 2005 revaluation).
µg	microgram, or 1 gram $\times$ 10^{-6}.
µm	micrometre, or 1 metre $\times$ 10^{-6}.

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