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Turkey:
Energy Status and Expectations*

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Summary
Turkey has a growing economy demanding about 7% more energy each year. It's electric power generation capacity (approx. 41,000 MW) must be doubled in the next 10 years to meet the demand. Natural gas has a significant share in electricity production, which should be reduced. Domestic and renewable energies should be employed in meeting the demand. Turkey took major steps toward liberalization of its energy market. Private enterprises are expected to invest in the energy market in a timely manner. Turkey has an "energy corridor" position between the gas and oil producing countries and the importing countries. Turkey's efforts to actualize the use of renewable and domestic sources should be supported.

General Energy Consumption and Energy Sources

As the population and economy of a country grow, its energy demand also increases. The increase in the primary energy consumption of a developing country is higher than that of developed countries. This increase has been approximately 5.5% for Turkey during recent decades. While the primary energy consumption of the world for 2006 totaled about 10878 mtep (million tons petroleum equivalent), it was about 99.8 mtep for Turkey. Turkey had to import 73% of this energy from other countries. These numbers indicate that Turkey is an energy importing country.

By the year 2020, primary energy consumption in Turkey is expected to reach 222 mtep/year, and the preparations and energy policies suggest that 30% of this amount is to be met by domestic sources. This means that for the next 13 years, Turkey targets a 3% decrease in its dependence on foreign energy.

Turkey has very limited reserves of natural gas, oil, and coal. When the countries with oil and natural gas resources are listed, unfortunately Turkey will not even be among the top 50 countries. The situation is not much better when it comes to coal reserves. Turkey has only 0.46% of the world coal reserves. Solar energy and wind energy look promising; however, it will take years for solar-based electric power generation to compete with fossil-fuel-based electric power generation.

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Another potential of Turkey originates from its geographical position. It can be an "energy corridor" between the oil and natural gas producing countries and the countries that consume such commodities. This role has been integrated in the energy policy of the present government.

Status of Electric Power Generation

Equally important to the energy resources a country has are the primary sources it uses for the generation of electric power. Naturally, domestic sources should be preferred. The share of domestic and renewable sources in electric power generation should be kept high without disturbing system stability. If that is not possible, aiming to keep that share high should be the emphasis of the country's energy policy. In recent years, the Turkish government has maintained such a policy. Still, capital investments and planning in the energy field must have long term time scale. Changes in the approaches and solutions, however, may not be actualized over relatively short periods of time.

As a matter of fact, the establishment of natural-gas-fired electric power generation plants has been discouraged indirectly by the government through its encouragement of coal-fired thermal power plants, hydro-electric power plants, and other types of electric power plants energized with renewable sources such as wind and solar energy. This approach could be considered as part of the energy policy, yet its effects are not felt.

The electric energy consumption in Turkey increased from 128.3 billion kWh in 2000 to 189.4 billion kWh in 2007. The increase is about 47%, averaging nearly 7% per year (8.5% for 2007). When there is no crisis or a standstill in the economy, the increase in the demand for electric power is proportional to the growth rate of the economy, reaching numbers as high as 8%. This high rate is expected in developing economies whereas this rate tends to be much smaller for developed countries with small rates of population and economic growth.

The high rate of increase in Turkish electricity demand confirms this fact: investments in electric power generation must continue. Any neglect or delay will result in a deficit—the supply will not meet the demand. The purpose of the projections is to estimate possible bottlenecks and thus take precautions, as well as to make suggestions on how to allocate capital investment. 500 billion kWh electricity demand is expected in 2020 according to the high scenario, and 406 billion kWh according to the low one.

Considering the present electric power generation capacity of 40761 MW, to meet the demand in the year 2020, the high scenario requires approximately 96000 MW installed capacity while the low scenario requires 80000 MW capacity. This means that for the next 13 years, new additional power generation plants must be established for the capacity of 39.500 MW to 55.500 MW. This also means that Turkey needs huge new investments — totaling nearly 70 billion dollars—to be realized over the next 13 years.

A Promising Energy Policy?

An energy policy reveals a vision of the future that reconciles the facts of a country and its economic preferences and targets. In this context, the political stability of a country plays an important role in the proper formation of the energy sector and the maintenance of a proper energy policy, as energy investments are capital-intensive and long term.

With these considerations in mind, the fundamental tenets and goals of the energy policy in Turkey may be stated as follows:

- To provide energy economically, in timely manner, adequately, reliably, and in an environmentally friendly way to the largest possible extent;
- To meet the energy demand by means of indigenous energy resources; i.e., using natural gas for industrial purposes and for heating houses rather than in electrical production;
- To diversify energy services, particularly encouraging usage of renewable resources in electricity production, and for other purposes;
- To encourage increasing efficiency both in energy production and consumption;
- To liberalize the energy sector to increase productivity and efficiency, create a competitive energy market, and provide transparency;
- To take advantage of the geographical position of Turkey adopting "energy corridor" role in the context of "mutual independence";
- To give priority to the supply security in meeting the rapidly increasing energy demand;
- To encourage and intensify Research and Development in Energy Technologies such as hydrogen technologies;
- To take necessary steps in the direction of establishing nuclear power plants mainly as part of the endeavors to provide supply security and implement the diversification policy;
- To facilitate the development of clean energy technology solutions for all energy sources incorporating environmental concerns in all steps of the energy chain.

Within the frame of the energy policy outlined above, some fundamental steps have been taken. In 2001 the Electric Market Law and the Natural Gas Market Law were enacted. They were followed by the Petroleum Market Law in 2003, the Renewable Energy Law in 2005, the Energy Efficiency Law in 2007, and the Geothermal Resources Law in 2007. All of these laws have the potential to influence and change the energy sector in Turkey substantially.

The Past and Future of Energy in Turkey

Until the 1980s, electric power generation in Turkey was based on hydroelectric and coal-fired power plants. Except for the problems and the sluggishness in their establishment and

operation, they were the right choices. In fact, water and coal are the sources that Turkey can (and must) utilize with top priority.

Natural gas was primarily offered as a clean fuel for residential heating to combat the major air pollution problems in Istanbul and Ankara in 1987. In 1997, there were intense discussions on the energy shortage the country was expected to face in near future. This potential power shortage was emphasized, and a solution was offered: natural-gas-fired power plants. Based on the projections of very high demand and the suggested solution, the Blue Stream natural gas purchase contract was signed in December 1997 with Russia. The agreement was received with skepticism because the natural gas distribution network and substructure was quite inadequate to handle the large amount of gas that was agreed to be purchased. The gas through the Blue Stream pipeline will gradually increase to 16 billion cubic meters by the year 2010. In February 1998 another contract (Turusgaz) was signed for 6.6 billion cubic meters at the plateau level, again with Russia. The consumption of natural gas reached approximately 34.8 billion cubic meters in 2007.

Most of the natural-gas fired power plants in Turkey were built in the late 90s by private enterprises. The Treasury has guaranteed the purchase of the electricity produced by these enterprises. It is a well known fact that the use of natural gas for electric power generation is the most inappropriate of its potential uses. The use of natural gas for electric power generation translates it into the most expensive form of electricity production. The current government adopted a policy favoring the use of natural gas in residential and industrial heating rather than in the generation of electric power. The work to facilitate its residential use was intensified. After the Electric Market Law and Natural Gas Market Law were enacted, the construction of natural gas distribution networks for residential areas and the operation of these networks were tendered to private companies. By the end of 2007, the bidding process for the natural gas distribution network and its operation has been completed for many residential areas. Turkey is in a position to reconsider its natural gas imports. Diversifying forms of sources and source countries for import enhances supply security. We could conclude that Turkey should not refer to natural gas as a preferable source for electric power generation. Yet the delays/time scales in the establishments of the coal-fired thermal power plants and hydro electric power plants force decision makers to choose natural-gas fired power plants due to the relatively short time scales needed to build and operate them. Of course, in time natural gas imports from other countries such as Iraq and Egypt should be considered in addition to imports from countries in the Caspian region to reduce dependence on a few countries in the name of enhancing supply security.

Turkey's goal for hydroelectric power generation is significant, too. For the year 2006, the share of hydroelectric plants in the energy mix was 25.1%. By the year 2010, as the use of renewable sources continues to be encouraged, Turkey is expected to have an even larger share in the utilization of renewable sources. Furthermore, when the rehabilitation of the coal-fired power plants is completed, Turkey will be in a much better position in terms of CO_2 emissions.

The energy resources in Turkey are known. There are the potentials of wind and solar energies; there are also coal, water and geothermal resources. In addition, there is the geographical offering of "energy corridor" position. Despite all of these resources and opportunities, in the foreseeable future, Turkey does not appear to be able to change its "energy importer" status. Furthermore, even if all of the domestic resources are utilized (including the usable wind energy potential), Turkey will experience some difficulties in terms of energy security over the next ten years.

Renewable energy sources are gaining ground in Turkey. In recent years, the use of renewable energy sources in electric power generation has been encouraged, and regulations concerning renewable energy sources have been issued. In the last seven years, the wind power production capacity increased from zero to 176 MW. The number of applications to the Energy Market Regulatory Authority indicates that the installed capacity for wind power for the next ten years will be pronounced in thousands of megawatts. This is a milestone in the development of renewable energy use in Turkey. Solar energy has already been in use for heating purposes for many decades. As of the end of 2007, solar collectors with a total area of 10 million square meters were in use to produce hot water.

Turkey needs nuclear energy, too. Although some organizations oppose nuclear power, it should be considered as an alternative energy source to increase supply security and the multiplicity and diversity of energy sources. A nuclear power plant would not only produce electricity but also provide opportunities in other nuclear fields such as medicine and agriculture. It would not be wrong to consider nuclear energy as part of a comprehensive energy program.

The energy issue in Turkey is not an independent matter. It would be hard to imagine a Turkey having no energy bottleneck without solving the political and other economic problems. Energy investments are major investments, and they are for the long term. The biggest hurdle before such investments is political uncertainty and instability. Recently there has been a positive atmosphere in the economy and in politics, and this positive atmosphere also affects the energy sector. Radical steps are being taken to improve the future of the country in the energy field.

Turkey has been seeking to unearth its natural resources. During the last 5 years, the "search" budgets of the two major governmental institutions have been increased significantly. Investment budget of the General Directorate of Mineral Research and Exploration (MTA) increased from 19.25 million YTL in 2002 to 98.50 million YTL in 2008. The investment budget increased from 105 million YTL in 2002 to 575 million YTL in 2008 for the Turkish Petroleum Corporation (TPAO). These establishments regained their vigor in the last 4-5 years to resume their intended activities.

In addition to the unearthing of Turkey's domestic resources, interest in the renewable energy sources that are domestic by nature, and interest in renewable-related technologies must also be increased. This is a vital necessity to reduce Turkey's energy dependence on imported sources. Turkey can improve its energy policy to allow a widespread and

appropriate introduction of energy efficiency and renewable energy technologies. Only through such a policy Turkey can pave the way for a secure and sustainable energy future.

In Turkey's energy policy and its realization, environmental concerns are increasingly playing important roles. Such concerns may not be overlooked at the present time. In this context, in recent years there have been improvements in Turkey in parallel with its efforts to become a member of the European Union.

A New Horizon with the "Energy Corridor Concept"

When energy security is on the agenda, the diversity issue is an inevitable topic of discussion. Having a secure energy transportation route is an indispensable part of an energy security system. This creates an opportunity for the countries which occupy a convenient geographical position to provide a secure transportation route particularly for crude oil and natural gas by means of a pipeline system. Such countries found themselves in the position of having a chance to exploit this geographical asset. Within this context, Turkey has envisioned a special role for itself by virtue of its unique geographical position which is located between energy-resources rich countries generally in the East and energy-poor countries in the West, mainly West EU countries.

A long-term EU common energy policy is badly needed to enable the block to meet its future needs while satisfying its diversity requirements. The EU is a net importer of energy. Currently more than 40 percent of its existing natural gas consumption is met by import, and this rate is expected to rise from 40 to 67 percent by 2020, and to 81 percent by 2030. And, until now, Russia has been the main supplier for both the EU and Turkey.

European decision makers particularly consider source country diversity and route diversity possibilities. Natural gas has been the main topic of concern. For the European countries, Turkey seems to occupy an almost unique position for providing an alternative safe access corridor to new pipeline projects to transport natural gas from Azerbaijan, Iran, Iraq, Egypt, and Turkmenistan.

The existing Turkish administration has taken up this new "corridor" role much more eagerly than previous ones. In addition to its economic benefits, this role also gives impetus to the process of Turkey's accession to the EU. Turkey is in a position to play an important role in the EU's energy strategy.

Turkey and the Future of Energy

Petroleum appears destined to keep its throne in the kingdom of energy for the next quarter of the century. The experts in the field agree that there is instability in the oil market. They also agree that the era of the "cheap oil" is over. However, one could claim that the price of oil will go down if an alternative energy source or technology challenges the domination of oil by providing energy with a compatible or less expensive price tag. Unfortunately, such a

change appears to be impossible in the foreseeable future. Petroleum cannot be given up easily as an energy source, especially for transportation.

For electric power generation and residential heating, the importance of the renewable sources (hydro, solar, wind, geothermal, biomass, and others) is increasing. The importance of fossil fuels (coal, oil, and natural gas) is not expected to diminish over the next 20 to 30 years; however, it is certain that renewable energy sources will acquire significant shares of the primary energy consumption as well as in the field of electric power generation.

As a renewable source of energy, wind power promises to continue to gain popularity throughout the world. We are most likely to talk about wind energy as a solution (at least partly) to the energy problem more and more in the next decade. The present government made a significant contribution in the area by enacting the Renewable Energy Sources Law.

Another renewable energy source, geothermal energy, is familiar in Turkey. Most of the geothermal sources in Turkey are used for "hot springs" tourism and for heating purposes. There have been discussions on how these sources could be utilized more efficiently and properly. The initial work to pave the way for the production of electricity from such sources has already been done (by the end of 2007 existing installed capacity is 23 MW).

In the future of Turkish energy, solar power is likely to play a very important role. At present, solar energy use for heating purposes is widespread. The main goal is the electric power production from solar energy. There are some applications such as traffic lights and street illumination that currently utilize photovoltaic devices; however, they are quite rare.

Looking into the future of energy, one must not forget efficiency and energy saving strategies. As of today, Turkey can save enormously by using its existing energy efficiently. This savings can be accomplished by using proper insulation for buildings, selecting the proper form of energy, at the proper place and with the proper equipments and materials.

Expectations and Concerns

There have been some worries about the privatization of the natural gas sector in Turkey. Petroleum Pipeline Corporation (BOTAŞ) has been the only state-owned company that imported natural gas. The Natural Gas Market Law requires that BOTAŞ transfer all of the rights and responsibilities of natural gas purchase and sales contracts to private companies until its share in the import falls to 20% of the total annual consumption, which is the market limitation. Temporary Article 2 of the law requires this to be completed by the year 2009. (Progress to date has shown, however, that the transition needs a longer period than the law suggests). Public opinion questions the wisdom of this transfer, asking whether BOTAŞ should be scaled down to this level in the name of liberalizing the market.

We live in an era that views the downscaling of the government as desirable in many fields. The energy sector is no exception. This, however, should not mean that the role of the state as a player in the market should be reduced to nil. During such a role reduction, a liberal

and competitive market structure should be established. State-owned companies take part in accordance with the rules of the market. State-owned companies must obey the rules of the liberal and competitive market. Also, transparency should be established for all state-owned companies.

Turkey has taken the basic and important steps necessary to initiate a liberal and competitive energy market. However, more time is needed to establish a functioning competitive liberal market. Perseverance is also required in order to sustain the approaches that discourage violations of market rules. During an era in which the role of the state as an investor and operator in the energy market is gradually diminishing, one of the major responsibilities of the Ministry of Energy is to make investments attractive enough for the private sector. This step is a must in order to prevent an energy supply deficiency in the years to come.

Rumors about the investment intentions by the government in the energy field intimidate the private sector. Private enterprises interpret such rumors as signs of the government's tendency to return to old habits and worry that the market would be adversely affected by such activities. Such concerns hold private investors back from investing in the energy market. On the government side, despite its liberalization steps and attempts to downgrade its own role in the market, the hesitance on the part of private investors worries the administrators, who fear an energy supply deficit in the future. With this worry, the state intends to invest in the field before it is too late. The government administration has been in assuring conduct to encourage private investors. In return for the government's assurance, private investors should abandon their mistrust and launch their investments without further delay.

This observation should not be interpreted as an accusation that the private sector has made no investments at all. Indeed, throughout 2007, a number of major Turkish companies revealed their interest in the energy sector. Applications to Energy Market Regulatory Authority (EMRA) for license reflect this interest. There have been applications for all types of power plants. About 14.400 MW installed capacity has been licensed since 2002 until the end of 2007, and several thousand MW installed capacity is expected to receive licenses. However, the investors who have been licensed to build various thermal, hydro and wind power plants appear to be slow in starting the construction and placing orders for the required equipment. They appear less than eager to initiate their projects. The investors give the impression that they are expecting to be on a more secure ground.

As stated above, the laws (particularly the Electricity Market law and the Natural Gas Market Law) that were intended to liberalize the energy market in Turkey have been in effect since 2001. The secondary legislation has also been completed to a great extent. Some aspects of these laws that proved unrealistic within the real market conditions have been improved. In fact, more improvements are designated to take place within a year or so.

Conclusion

Turkey has taken major steps toward liberalization of its energy market. The success of the liberalization will depend on the participation of private investors, and strict observation of the market economy rules on the part of the government. Turkey has a growing economy which demands about 7% more energy each year. To meet this demand, major energy investments must be made in a timely manner. Natural gas has a significant share in electricity production, which should be reduced. Domestic energy supplies and renewable energies should be used to meet the energy demand. Clearly, utilizing domestic energy sources such as water, wind, and solar power would prove to be cheaper for a country in the long run. Domestic sources should also not be overlooked in terms of supply security. Turkey's efforts to actualize the use of renewable and domestic sources should be supported.