

# Turkey's Energy Sector and Some Remedies against Environmental Pollution

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**Abstract**—In Turkey, particularly after the 1950's, increases in the levels of industrialization, urbanization and a rapidly increasing population led to increases in the nation's consumption of energy. These energy increases could not be met solely from domestic resources. Consequently importing petroleum and petroleum based energy products was the cheapest means by which energy requirements could be immediately satisfied. However as a result of the 1973 oil crisis, limiting consumption and increasing the use of domestic energy sources was necessary.

The natural result of this policy was the building of more hydro-electric energy generation plants and new coal fuelled power plants using domestic low qualified lignite resources. Using locally mined lignite was increasingly being used for domestic heating. However, the heavy dependence upon low quality lignite for power generation and widespread domestic heating has caused environmental problems. Limiting industrial waste, using resources efficiently and increasing diversity of resources with non-biomass sources will contribute to a cleaner healthier environment. It is necessary to take measures which will save energy and also increase the productivity of energy producing plants.

There is a potential for energy saving in both energy production and consumption as both are adversely affected by a system of inefficient energy transfer.

*Keywords*-Environmental pollution, energy sector, energy production

## I. ENERGY AND ENVIRONMENT

All living creatures from the simple cell amoebae to human beings need an externally supplied source of energy to live, grow and produce. Plants take sun-light as their main source of energy. Animals convert the chemicals in the food they eat into the energy they require to sustain their lives [5]. Solar energy may be thought of as an infinite resource and food production as a renewable resource. The environment and its ecology would be enhanced, if all the energy resources used by man were renewable and did not affect the planet's ecological balance.

## II. THE ENERGY SECTOR AND NATIONAL POLICY IN TURKEY

As Turkish economy experienced high levels of growth in the 1990s, the country's boom in industrial production resulted

in higher levels of pollution and greater risks to the environment. With domestic energy consumption on the rise, Turkey has been forced to import more oil and gas [8]. Economic growth and energy consumption have gone hand-in-hand, and the effect has been increasing air pollution. Although low compared to advanced European economies, Turkey's per capita carbon emissions are increasing [7]. Turkey's population is expected to grow to 83.4 million in 2022. Turkey's growing energy demand is projected to result in 8.50 quads (214.1 Mtoe) in 2020. As this increase is realized, Turkey's total CO<sub>2</sub> emission is expected to rise to 818.2 Mt CO<sub>2</sub>[2].

As fossil fuel energy becomes scarcer, Turkey will face energy shortages, increasing energy prices, and insecure energy within the next decades. In addition, Turkey's dependence on fossil fuel consumption will contribute to domestic environmental pollution and global warming. Because of these reasons, the development and use of renewable energy resources and technologies are becoming more vital for sustainable economic development [4].

In Turkey the control of the energy sector is designed so that it should provide affordable and secure supplies of energy to industrial, manufacturing and related sectors, in order that through efficient industrial output, Turkey may join the ranks of the developed nations. However, Turkey is still a developing nation. Developed nation status is possible, if research is made into the efficient use of energy resources. Where technology is lacking it must be developed and implemented as part of an energy policy [18].

Environmental Law and Ministry of Environment was created in 1991. Turkey is building an extensive network of hydro-electric energy sources in the Eastern and South Eastern Anatolia, and cleaner-burning natural gas is moving to replace coal in power generation.

The Ministry of Energy and Natural Resources is the main body for the formation and implementation of energy policy in general and renewable energy in particular. In a good faith measure to help gain entry into the EU, Turkey ratified the Kyoto Protocol aimed at reducing global greenhouse gas (GHG) emissions in 2004 [7]. The Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electric Energy was accepted at May, 2005. The objectives of the law are increasing the use of renewable energy to generate electric energy, diversifying energy resources, reducing

greenhouse gas emissions, assessing waste products and protecting the environment.

Current Turkish Energy policy aims to provide an economic and secure supply of energy to allow a growth of the economy in order to develop and support social development programs without jeopardizing the environment. The Ministry of Energy and Natural Resources assesses the country's energy requirements and decides on the best strategy for short and medium term energy policies, according to the principles already stated. State, private sector and foreign investors must increase their investments in the energy sector to allow domestic energy sources to be developed efficiently, rapidly and profitably [22]. A developed energy sector means an increase in productivity, protection against current loss in energy transfer, using sewage energy and decreasing consumption without affecting social welfare. Energy saving has a very important role in meeting energy needs of country [21].

Turkey's energy policy is depends on the following items:

- Using public, private, and foreign capital,
- Accelerating privatization in the energy sector,
- Taking into consideration supply costs of energy imports,
- Using indigenous resources as much as possible,
- Diversifying energy supplies and ensuring energy security of supply,
- Adding new and renewable sources (geothermal heat, solar, wind, etc.) as soon as possible to the energy supply system,
- Ensuring sufficient, reliable and economic energy supplies on time,
- Implementing measures for energy efficiency,
- Planning energy research and development activities to meet requirements,
- Minimizing losses in energy production, transmission, distribution and consumption,
- Protecting the environment and public health in the production of energy.

As basic strategy, improvement of domestic production by increasing efficiency of plants by rehabilitation, diversification of energy sources to secure fuel supply, accelerating the existing construction programs, initiation of new investments are taken into considerations to achieve these energy policies. As Government's financial resources are not enough to achieve these objectives, acceleration of private investments is very urgent [6].

### III. THE ENERGY SECTOR AND ENVIRONMENTAL POLLUTION

In the production of energy from source fuels (fossil or nuclear fuels), from its beginning to consumption there is a

resultant environmental pollution. The effective control of CO<sub>2</sub> emissions are on the Turkish environmental agenda [22]. Reducing energy problems means using limited resources profitably, optimization of energy production and consuming energy in the most efficient way [17].

One of the most important inputs related to the economic production of goods and services, is energy. Presently, Turkey cannot decrease its energy consumption, or choose some irrational alternatives. Due to the present levels of pollution, it is very difficult, if not impossible for Turkey to maintain a high level of industrial development [11]. Accordingly, regulations must be produced which relate to the control of energy saving, altering source energy fuels, making better fuels available to consumers, using renewable energy resources and the reduction of pollutant emission limits.

Decreasing waste production to the lowest level is as important as using resources profitably. In Turkey energy consumption is increasing two or three times more rapidly than rate of increase in population. Due to the current structure energy production and supply, there are increases in environmental problems. These environmental problems are threatening human health. Moreover loss of production and changes in the ecological balance produce short and long term negative effects.

Energy saving goes a long way to meet the energy needs of industry and individual households. It is the best and the cheapest way of preventing environmental pollution. Continually increasing environmental pollution is a world-wide problem [21].

The energy sector; production, consumption and transformation of energy, has an important effect on the increasing levels of air pollution, greenhouse gas which is released into the atmosphere. Energy production must be cheap, safe, ecological, renewable, logical and economical. The society must be conscious of these factors. Draft projects must be developed for encouraging energy saving [20].

### IV. POTENTIAL RENEWABLE ENERGY SOURCES

Turkey has a rich variety and potential of renewable energy resources. Turkey is the seventh richest country in the world in geothermal potential for its direct use and for electricity generation [3]. Turkey is ranked as fifth biggest geothermal energy user for heating and hot spring purposes after China, Japan, USA and Island [13]. In addition, the solar energy is abundant due to its geographical position. Turkey is also has a high amount of hydro-energy potential [12]. In addition to hydro-electric power, Turkey is encouraging the construction of wind power plants with a goal of deriving 2% of its electricity from wind power [8]. Wind energy potential in Turkey is estimated as 160 TWh [12]. Although Turkey has great renewable energy potential its share in the total energy production is decreased in 2007. In 2007, these sources had share of 4.5 % of total energy demand. The production of the energy by renewable energy sources remains fairly constant during 2000-2007 periods [2].

The renewable energy sources confirm that these sources have the potential to provide Turkey's future energy supply

and consumption. To develop this potential, Turkey would have to commit to the development and implementation of renewable energy technologies and energy conservation. The implementation of renewable energy technologies would reduce the current national and global environmental problems as well as national energy insecurity associated with the production and use of fossil resources.

On the other hand, the role of the government in formulating and implementing favorable policies for renewable energy development is vital. But the private sector, which has the capacity to mobilize funds, needs to be involved in renewable energy development [10]. While renewable energy sources have made great inroads in Turkey's energy supply mix, there is a need for more research and development on renewable energies to increase their efficient utilization [8].

## V. SOME NECESSARY REMEDIAL MEASURES

Turkey has been providing innovative, renewable and clean energy solutions to the energy sector since 2008 [9]. But, it is necessary to prepare projects and plans for the industrial manufacturing sector which encourages the use of energy efficient technology, which consumes the minimum energy for each unit of production instead of increasing energy consumption for each person to achieve the same output [16]. In Turkey, energy production is affecting environment negatively. In general, there aren't any coherent environmental policies in the energy sector, and environmental projects are not regulated to minimize the effect of pollution.

In the energy sector, there are technologies which are preventing some types of environmental pollution. But, Turkey is using low quality lignite to producing electricity. This causes environmental pollution and the technology used to decrease this pollution is too expensive to import in order to solve the problem.

An effective environmental policy in Turkey must take into account the following principles to solve environmental problems:

- There must be a long term energy policy. Turkey has to review her energy and environmental policy in the light of current and improved international agreements and to prepare a dynamic and applicable master plan to reduce environmental disadvantages to the lowest levels in the production and consumption of energy resources. This would ensure maintaining the optimal use of energy resources.
- An economical evaluation must be made for the phases of production, transformation, consumption and recycling of energy, taking into account environmental factors including the effect of climatic changes on energy production.
- Energy needs can be met from domestic resources. Energy production systems which have the least adverse effect on the environment have to be developed and installed. In order to achieve this end, current power stations and some stations to be built later, have to use a suitable technology which can

efficiently convert existing energy resources into a pollution free energy.

- Turkey has important new and renewable potential energy sources, whose use will not detrimentally affect the environment. Using these resources must be the target. Research and Development programs for Cleaner energy production have to be prepared and supported [15]. New and renewable potential energy resources should be found and their share in current energy production should be increased [19]. Alternative energy resources, especially the consumption of renewable energy resources should be increased. Also more national focus on promoting renewable energies based on non-biomass is necessary.
- As a clean energy resource, the production and use of natural gas should be encouraged at the expense of traditional fossil fuel sources.
- The efficient distribution of energy supplies has improved and maintained.
- Turkish power system should be fully synchronous with its neighbors [1] for saving energy because of time differences.
- Legal regulations relating to energy have to be improved. The regulations for environmental protection, and energy production and consumption should be evaluated together.
- Saving energy has positive and direct effects on environmental pollution. For this reason, public awareness programs for the efficient use, consumption and saving of energy has to be developed [15]. All parts of society must have the responsibility of optimal use of energy and energy saving [19]. Each individual has to decrease the amount of energy he or she consumes. Similarly the energy consumption in houses, the business sector, industry and transportation has to be decreased [16].
- Areas where pollution occurs have to be mapped; water, air, land. Particular attention must be paid to these areas of the country [15].

## VI. CONCLUSION

Some developed countries have managed to control and decrease the environmental pollution derived from the production of energy. They have the technical capability and can afford to apply it to energy production. However, these activities increase the cost of energy. The increased cost of energy is applicable to new investments necessary for energy saving, renewal of energy distribution, new transfer lines, cleaning of fuels, upgrading technology. New emission taxes and other financial instruments may be to be used to meet these costs. In the short-term prices may increase, but in the middle to long term, the efficiency of the energy supply will probably show a decrease or stabilization in the cost of energy.

Turkey has to take steps to provide livable environment for her current population and for future generations. Turkey has to

decrease the effects of her environmental pollution and integrate with world environmental policies no matter what it costs [14].

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