

Analysis of the Increasing Energy Demands' Effects on Alternative Energy Output in Turkey

Executive Summary:

As a country with a population in excess of seventy million, Turkey is a nation seeking to secure its own energy independence and thus so is becoming increasingly concerned about the issue of energy resource acquisition and development. Geographically speaking, Turkey lies to the east of Europe and to the west of Asia. While having neighbors in both Europe and the Middle East, it is commonly referred to as the bridge between east and west. Yet although Turkey has such close proximity to large oil producing nations such as Iran and Iraq, Turkey itself has very little in the way of oil resources.¹ As a result of this, Turkey has had to procure its own energy resources in a variety of different manners from importation to recently the development of alternative resources.

When we try to analysis the reasons for the major increase in the demand for oil, it can be attributed to three major causes: increased industrialization and urbanization, a rise in car ownership due to more blatant patterns of consumerism and finally the steady rise in the Turkish population. Without even looking at other research for analysis, just browsing the reasons purported by the OECD it is obvious why the demand for energy has been raised so significantly.² Each one of the three aforementioned factors would incur some form of unpredicted energy increase. In order to grow factories and city, developers as well as workers need access to earthmoving equipment which requires fuel. Just as well we can understand how a

¹ Kamil Kaygusuz. "Renewable energy potential and utilization in Turkey" Energy Conversion and Measurement. Volume 44, Issue 3, February 2003, Pages 459-478

² "Conclusion and Recommendations" The Environmental Performance Review: Turkey 2008. Organization for Economic Cooperation and Development pp. 1-10

rise in car ownership can also put a major strain on the acquisition of fuel resources due to the need to fuel these vehicles. Finally, as the entire earth's population is expanding so too is the Turkish population.

Due to the rapidly changing economic and commercial environment in Turkey, the rate of energy consumption is reaching unsustainable levels. Yet according to Dr. İbrahim Akkus and Dr. Önder Aydogu of the Geological Engineering Board, “unfortunately, even though Turkey owns various energy resources, fossil energy potentials do not meet the present energy consumption. 70% of energy requirements are being obtained from abroad.” Turkey is making itself dangerously dependent on other countries for its own consumption and energy demands. Yet the once the patterns of consumption and daily activity have been established, they become increasingly difficult to break.

Even more troubling than this figure is that, “almost 45 percent of the overall energy produced in Turkey uses natural gas purchased from Russia and Iran at a very high cost.”³ Not only is there the issue of the high economic cost there is also the political cost. As a country this is rich in traditional energy resources, such as coal and natural gas, Russia also is a country that at time can be considered politically unreliable. This can be supported by the row that developed between Russia and Ukraine this winter over political differences. While Turkey may seem like a good consumer of Russian products, presently this relationship could change based on political alliances. This end result would mean that Turkey would need to acquire its fuel sources from other regions and perhaps the price as well could be raised. Once

³ Trevor Seivert “Turkey - Cesme looks to wind energy for electricity” November 6, 2006. <http://www.windfair.net/press/3093.html> accessed March 15, 2009.

again this sets up a precarious situation for Turkey because it is almost totally dependent on other countries to provide it with fuel to grow its economy and industries.⁴

Yet even though it is oil deficient, Turkey has a variety of other natural resources that have allowed for the procurement of natural resources to produce energy to meet the population's needs. The three most common alternative energy sources in order of importance are: hydroelectric, wind, and geothermal power. This paper will explore each one of these topics and explain how each is helping to meet the challenges of energy demands and how this will affect the output as well as energy storage in Turkey.

⁴ Ibrahim Akkus and Onder Aydogdu. "Türkiye'nin Jeotermal Kaynaklarının Potansiyeli ve önemi" Ankara Beauru of Geological Enginnering. 2006.

Introduction:

As a country with very limited oil resources, Turkey has had to develop alternative methods of meeting its population's demands for fuel. While in years past this has included heavy reliance on importation of resources such as petroleum or oil, it has become clear to Turkey that it must develop its own infrastructure which will enable it to provide low cost energy to its citizens.

One of the major difficulties facing the nation with respect to depending on other nations for its energy resources is that Turkey is vulnerable to the unpredictable market changes. Recent incidents such as the Iraq war, unrest in Nigeria or unilateral OPEC price fixing has severely affected the Turkish economy. With the price of fuel ever rising, the domestic industries in Turkey as well as their bottom lines are affected. Changes in the price of oil means that all other sectors whether they be transportation, production or even agriculture are seeing a shrinking profit margin.

Unlike some countries, Turkey does not subsidize its oil imports and as a result passes on the full prices along with necessary taxes to the consumer as well as businesses. According to an OECD survey, Turkey has a tax rate on gasoline of 69.2%, which is the third highest among all OECD countries. It is after both Britain and Denmark. Perhaps this does not seem high but it should also be recognized that the Turkish lira does not also carry the same purchasing power as does the British Pound or the Danish Crone.⁵ Even more pressing an issue for Turkey is that according to the 2009 Turkey Oil and Gas Report, "Between 2007 and 2018, we are forecasting an

⁵ Turkey Consumes most Expensive Gas-Electricity, accessed March 15, 2009.
<http://www.turks.us/article.php?story=20060113114549613>, 2006

increase in Turkish oil consumption of 39.8%, with demand rising steadily from 666,000b/d to 905,000b/d by the end of the 10-year forecast period.”⁶ While this dangerously high increase being predicted, it is obvious that the energy demands in the country are rising and even more reason for Turkey to develop its natural resources in order to avoid overreliance on outside energy sources. By developing its own market, Turkey will be able to set its own prices for energy, meaning discounts for consumers as well as increase its particular standing in the market. Often oil resources have to be paid for in foreign currency and this once again would lead to a depreciation of the value of the Turkish lira.

Although still labeled a “developing” country, Turkey has begun to develop key industries that serve the population of Europe with agriculture as well as textiles. Yet higher fuel charges have begun to make these industries less profitable because of the high cost of transporting the goods to destinations such as Europe. Turkey has a real interest in developing its own internal alternative fuel industry in order to minimize its dependence on foreign fuel sources as well as to improve its internal sector’s profit margins.

As an aside to the economic motivations that Turkey has to develop its industry there are also political motives as well. As a country which has been vying for European Union membership for more than forty years, Turkey has a political interest in trying to develop its internal alternative fuels sector. The OECD suggests that “Turkey could do much more to take advantage of renewable energy sources. It also calls for stronger regulatory standards, in line with European Union legislation, and

⁶ “Executive Summary” The Turkey Oil and Gas Report. Business Monitor International. pp 10-35.

action to ensure that they are implemented effectively.”⁷ In an attempt to harmonize with the EU *acquis communautaire*, Turkey has slowly begun to support this industry. Another reason that is somewhat related to the idea of EU membership is the concept of environmental preservation and pollution. According to Dr. Kaygusuz, of Karadeniz Technical University “renewable energy resources appear to be one of the most efficient and effective solutions for sustainable energy development and environmental pollution prevention in Turkey.”⁸ Once again the EU is also exerting pressure on the country to bolster its commitments to certain international treaties such as the Kyoto Protocol and act responsibly with respect to energy production and pollution control.

It is clear that Turkey is faced with a real dilemma of great economic proportions. With its limited financial resources, the country must try and develop an alternative or renewable energy sector which will decrease its reliance on foreign energy sources. As the introduction and executive summary have adequately described are the reasons behind the pressing need for a mature and well established alternative fuel sector in Turkey. What this paper will analyze via academic articles, public policy as well as the latest research by both private as well as governmental agencies is the present system in an attempt to make predictions and recommendations for the future of the alternative fuel sector. In short, this study will analyze how increasing demand for alternative energy resources will affect energy output and facilities in Turkey.

⁷ OECD, page 3

⁸ Kamil Kaygusuz, “Renewable energy potential and utilization in Turkey.” *Energy Conversion and Measurement*. Volume 44, Issue 3, February 2003, pg 459- 478

Analysis of Hydroelectric Power

The concept of hydroelectric power is not new to Turkey. In fact for thousands of years, farmers have been damming the great Tigris and Euphrates Rivers in order to harvest the power of water. While in years past the main goal was for agricultural output such as processing corn or wheat, the government of Turkey has begun in the last twenty years to seriously invest in hydroelectric power. The first surveys into dam inquiries in Eastern Turkey were ordered by the creator of the Turkish Republic, Mustafa Kemal Ataturk in the 1930's. Prior to these efforts no official organization had aimed to develop the natural resources to meet the country's' growing energy demands.⁹

The largest and most well known hydroelectric facility in Turkey is known as the Southeastern Anatolian Project of GAP for short. This is quite an ambitious effort made by Turkey, it includes "Nine provinces in the Euphrates basin."¹⁰ As seen in Figure 1 below, the project encompasses a large section of Turkey's southeastern region. In addition to this, the use of the dam also has effects on other countries such as Syria and Iraq, which lie on the Turkish border. Figure 1 shows the specific details about the exact regions in Turkey that are included. This project is categorized as a Regional Development Project (RDP) and has the ultimate goal of realizing, 22 dams and 19 power plants.

⁹ "The Southeastern Anatolia Project (GAP)." The United States Foreign Agricultural Service. http://www.fas.usda.gov/remote/mideast_pecad/gap/introduction.htm

¹⁰ "The Southeastern Anatolian Project Action Plan 2008-2012" The Republic of Turkey, 2008 pp. 5

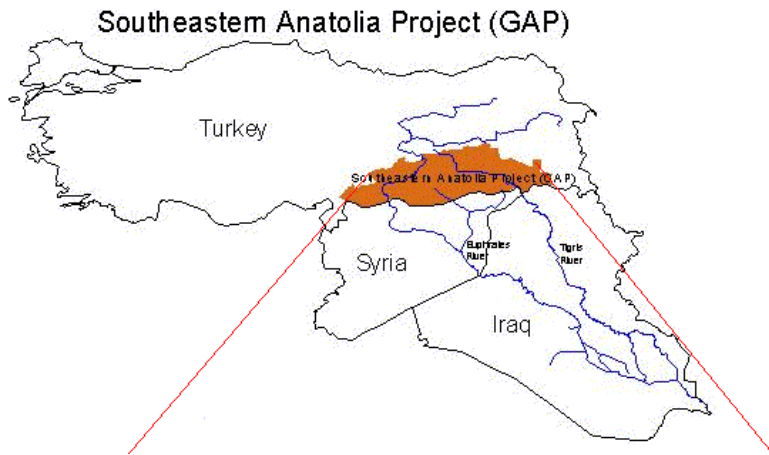


FIGURE 1: Location of the Southeast Anatolia Project (GAP)

Although many attempts were made to finalize the project, it was not until 1977 that the project received its official name and then due to delays it was the early 1980's when the Karakaya and Keban dams were actually realized and put into production.¹¹

Once again due to a series of delays, mostly financial, the project's master plan was finalized in 1989, meaning a full sixty years after the original surveys were done did the plan finally get put into action. According the most recently published GAP action plan, 2008-2012, approved by the republic's leader, Recep Tayyip Erdogan, a project of this size is unprecedented in Turkey. Although it has not yet been finalized, recent statistics claim that "when, completed, 28.5 percent of the total water potential of the country will be brought under control and GAP will irrigate nearly 1.7 million hectares of land, or 20 percent of Turkey's total irrigable land."¹² This is quite a significant figure seeing that Turkey is a very important player in the region when it comes to the exportation of agricultural goods. Even more noteworthy is that "Annual energy production from GAP will produce 22 percent of Turkey's total energy

¹¹ Ibid

¹² "The Southeastern Anatolian Project Action Plan 2008-2012" p 20

production with an installed energy capacity of 7476 MW.”¹³ Once again we can analysis this in terms of the total output for the country. By investing heavily and being able to create 22% of its own renewable energy it is clear that it will offer a low cost solution to the rising energy demands. Also being able to produces such a large amount of its own energy internally would make it once again less reliant on other countries for its fuel consumption needs should some type of political or economic issue develop.

When we look at the concept of hydroelectric power in general terms is seems like it is quite a positive addition to the Turkish alternative fuels section yet by examining it in terms of environmental effects there are many other factors to take into consideration. One of the major objections that individuals have to the establishment of a project such as this one, which is essentially a large dam, is the effect that it will have in the environment. By rerouting the flow of rivers it requires area up river to be flooded to make room for the water storage; because of this disruption, often times both animal and people need to be located, making individuals reluctant to support such a project if they are going to lose their home. Another unfortunately aspect of this process is that it can threaten the biodiversity in the area by completely wiping out certain species due to the need for space and the rerouting of the water flow.¹⁴

In addition to the other analysis that has been offered about hydroelectric power, one factor that the government continues to consider is the economic costs and benefits of hydroelectric power. By observing Figure 3 on the following page, it is clear that since the early 1970’s Turkey has been harvesting the power of

¹³ The United States Foreign Agricultural Service.

¹⁴ “The Southeastern Anatolian Project Action Plan 2008-2012”

hydroelectricity to support energy demands. In terms of economics, hydroelectricity is highly profitable after the initial investment. Yet the initial investment is quite large and the GAP projects financial cost has been estimated at 41 billion USD. ¹⁵Analyzing this investment in terms of the country, we can see it is a significant amount of money.

Yet although it has the potential to add great wealth and energy to the country, one aspect of that is particularly troubling about these figures is that the amount of hydroelectric power production essentially has not changed in the past thirty years. Although it has increased slightly, overall it has remained pretty stagnant since 1971. This has a great deal to do with the fact that the Master plan was not realized until 1989 and due to the lack of governmental funding the project has been unable to be fully realized. The hydroelectric power industry has made great progress but still has a long way to go in order to appropriately serve the citizen of Turkey.

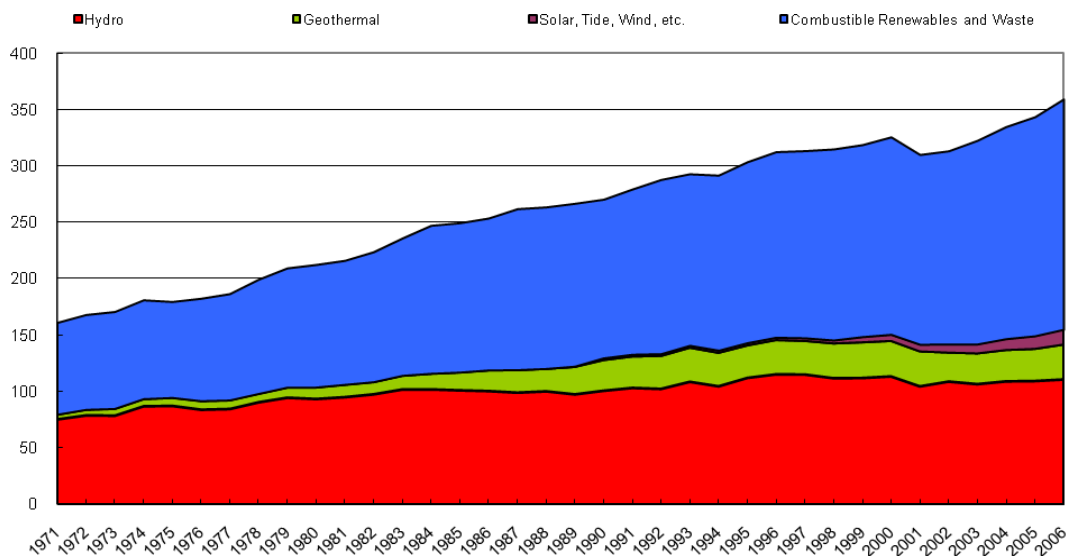


FIGURE 3: OECD Factbook 2008: Economic, Environmental and Social Statistics¹⁶

¹⁵ Ibid p. 32

¹⁶ OECD

Analysis of Geothermal Power

Geothermal power, like much of the power harvested from Mother Nature is primarily related to geological processes that occurred millions of years ago and scientists' ability to find and utilize these resources. According to the Earth Policy Institute (EPI) geothermal power, which is renewable energy, "originates from the earth's core and from the decay of naturally occurring isotopes such as those of uranium, thorium, and potassium."¹⁷ The process of using the earth's own heat to meet energy needs has occurred for thousands of years and allows "power to be generated by using underground pockets of high-temperature water or steam to drive a steam turbine."¹⁸ Yet what is most remarkable about this energy resources is that "the heat energy in the uppermost six miles of the planet's crust is vast and is 50,000 times greater than the energy content of all oil and natural gas resources."¹⁹ With this fact alone it is easy to see how a country such a Turkey, which is looking to secure its own energy autonomy, could benefit from geothermal energy. After the initial investment of infrastructure costs, the benefits would be essentially free energy; an idea that would be invaluable to a developing nation.

According once again to the EPI, Turkey ranks 16th in the world in the production of geothermal power. The 2007 production rate of 38 Megawatts of power or 243 million kilowatt hours was cited as a great improvement over the 1990 levels of

¹⁷ Jonathan G. Dorn "World Geothermal Power Generation Nearing Eruption" in the Earth Policy Institute. August 19, 2008.

¹⁸ Dorn Ibid

¹⁹ Dorn Ibid

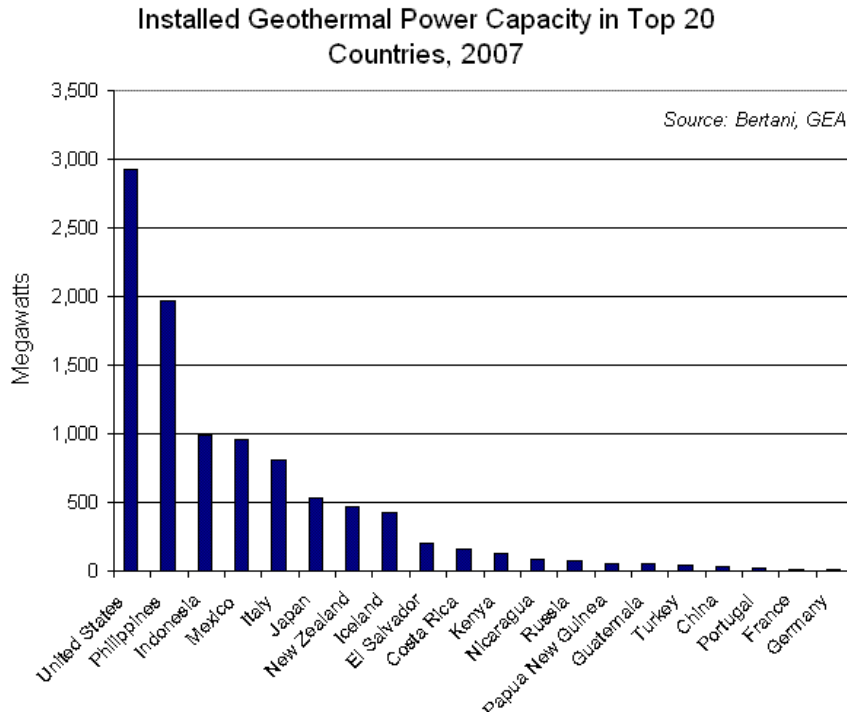


Figure 2: Geothermal Power Capacity

20.6 Million kilowatts.²⁰

In trying to understand why the country has been so successful at developing these resources we can see that “Turkey is located on the Alpine-Himalayan orogenic belt, which constitutes the major factor in having high geothermal potential.”²¹ The potential for Turkey to develop in this area is quite high seeing that at least 38% of the wells that are drill operate at a steady temperature of between 40-50 degrees; furthermore 32% more of the wells operate between 50-70 degrees.²² Presently, geothermal energy is used in a variety of ways in Turkey including: electricity generation, direct

²⁰ Dorn Ibid

²¹ “Geothermal Energy Utilization development in Turkey – Present Geothermal Situation and projections” Hasan Batik et al. Proceedings World Geothermal Congress 2000: Tohoku, Japan. May 28, 2000 page 85

²² Ibid pg. 85

use, space heating, heat pumps, and greenhouse heating.²³ This variety of uses shows the versatility of this alternative fuel. There are also a number of different types of structures powered by geothermal energy; some wells are used for electricity production but most are used for residential heating. Yet with all this potential, the total contribution of geothermal power to energy resources in Turkey is quite insignificant and is estimated at: 0.09%. Currently, geothermal is third among the alternative fuels production in Turkey after hydroelectric and wind power.²⁴ Yet the potential for this number to grow is quite limitless and Turkey has been labeled the 7th richest country in the world for geothermal power²⁵.

When we examine the environmental impact of this resource, most studies agree that by tapping into the Earth's own internal heating system, people have the opportunity to eliminate pollution that comes from the burning of fossil fuels. Yet there are also some drawbacks to supporting this type of alternative energy production. According to Dr. Kemal Akpınar, the major problem with the acquisition of this resource is the "The most of wells which are drilled by private sector are not drilled under control geological engineer and there is no any council to check appropriateness of these wells."²⁶ This lack of appropriate control over the construction and drilling of these wells has in the past lead to the "hot water polluting groundwater and surface water, dropping of temperature and pressure in some geothermal fields."²⁷ It is obvious that Turkey needs to establish an organization that will take

²³ Mustafa Balat, "Current Geothermal Energy Potential in Turkey and Use of Geothermal Energy. Energy Sources vol. 1 no: 1. pg. 57.

²⁴ Ibid pg. 57.

²⁵ Ibid pg. 57

²⁶ Kemal Akpınar. "The Matters Experienced On Subject of Geothermal Energy in Turkey And Importance of Geothermal Boreholes." İller Bankası Makina ve Sondaj Dairesi Başkanı Dışkapı, Ankara: 2006.

²⁷ Ibid pg. 2

charge of their potentially financial rewarding and valuable resource. Without adequate controls there is the potential for serious environmental polluting.

Economically speaking, there are both advantages and disadvantages of geothermal energy. When we consider the initial cost of the program it is considerable. The initial investment has been calculated at \$2,000 per standard dwelling (100 square meters).²⁸ While this may not seem like a large figure, it must be remembered that according to the OECD the average per capital income in 2006 was \$5400 USD.²⁹ Yet what needs to be remembered is that after this initial operating costs and the system is installed the maintenance is minimal and according to the Turkish Ministry of Environment “the payback period is six years”³⁰

Geothermal usages in Turkey even include a power plant that is solely powered from geothermal sources. The plant which is located in the city of Denizli in western Anatolia is appropriately named Denizli–Kızıldere. There are also six other fields that have been identified but none that produce as much as the Denizli plant. What is remarkable about the geothermal energy production in Turkey is that it has been estimated that this alternative energy is presently supplying nearly 90,000 tons of geothermal energy that were used in various heating usages such as over 50,000 households, tourist establishments, and greenhouses.³¹

²⁸ Balat pg. 64

²⁹ “Turkey Country Statistics.” UNICEF, http://www.unicef.org/infobycountry/Turkey_statistics.html

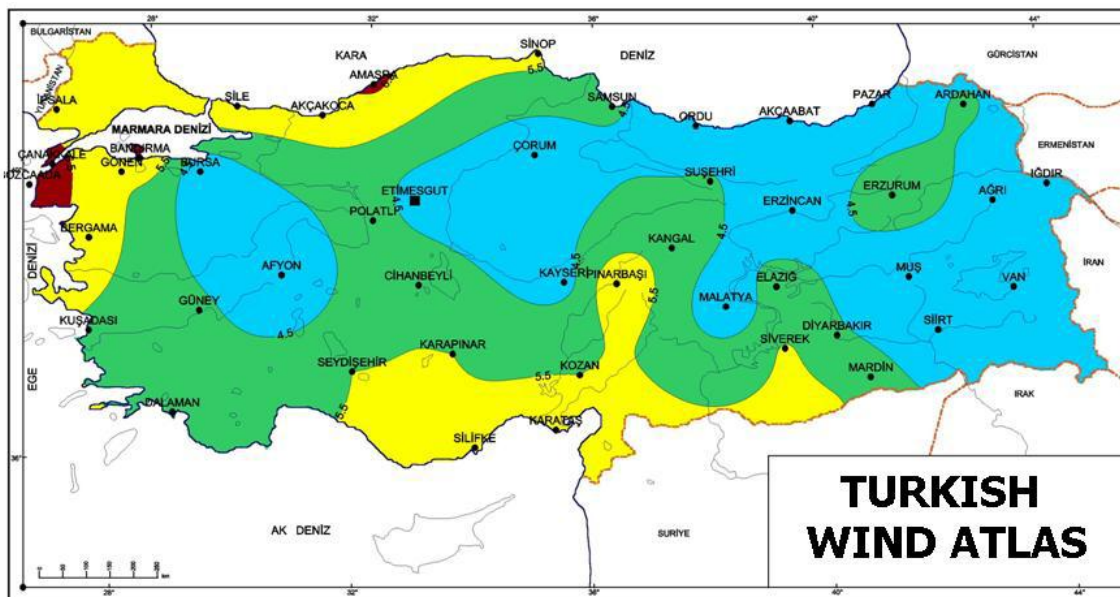
³⁰ Balat 64

³¹ Ibid pg 65

Analysis of Wind Power

One of the areas of renewable energy that is becoming increasingly important in Turkey is the concept of Wind Energy or in Turkish Ruzgar Enerjisi. With the installation of the first wind power plant in 1998, Turkey has steadily increased its potential to harvest wind energy with an increase 8% each year. Presently there are three major wind stations which produce and average of 250 kilowatts of energy.³²

Let us also examine the Wind Atlas, the gauge that is commonly used to determine the feasibility of developing a wind power program in a country.



Wind resources at 50 m above ground level for open plains (roughness class 1)

	> 7.5	6.5 – 7.5	5.5 – 6.5	4.5 – 5.5	< 4.5
v (m/s)	> 7.5	6.5 – 7.5	5.5 – 6.5	4.5 – 5.5	< 4.5
P (W/m²)	> 500	300 - 500	200 - 300	100 - 200	< 100

Figure 4: Turkish Wind Atlas³³

³² “Dr. Tanay Sidki Uyar . “Wind energy in Turkey.” DEWI Magazin Nr. 13, August 2008

³³ “Turkish Wind Atlas.” Turkish State meteorological Service. accessed March 15, 2009. <http://www.meteor.gov.tr/2006/arastirma/files/TurkishWindAtlas.pdf>

Looking at the figure above we recognize that certain areas of Turkey have great potential for the development of wind power plants. The north western region of the country is particularly subject to high winds, especially near the Dardanelles Strait. According to the classification done by European Wind Energy Association (EWEA) there are certain parameters that help us understand the figure. “fairly good (6.5 m/s) good (7.5 m/s), very good (8.5 m/s).³⁴ The key to a well operational plant once again would be to isolate a region that has these conditions.

Presently, there is a wind turbines establishment at a small island off the coast named Bozcaada which includes 18 turbines. This is a joint venture between the German company and the trust that is renting the land. Yet interestingly, the company sells the energy produced back to the Turkish government at a bulk rate. The Turkish government then distributes this energy to the consumers in Turkey. So essentially, a foreign company recognized the potential of wind power programs in Turkey and decided to develop this alternative resource. After an examination of this map it is clear that there is a great potential to develop this resources in other areas.

Yet another point that must be mentioned is that even though these certain suggested parameters have been established as guidelines for plant construction, there is also another wind power plant in Cesme, also in the west but to the south of the Dardanelles. According to the chart the location of the Cesme plant corresponds to the range of 5.5-6.5 which in EWEA standards is classified only as “fairly good” for wind power production. Yet in fact this is the location of the largest wind power plant in Turkey which contributes to the production of 140 million kilowatts per hour. This project is a partnership with the company German Enercon; once again there was a

³⁴ Ibid

quick recognition on the part of a foreign company that this region had the potential to make a great contribution to the wind power market.³⁵

The environmental impact of wind power is quite minimal. In fact with respect to pollution the only warning that can be given is with respect to the production of the materials used for the production of wind power materials. As mentioned in OECD Report, the wind power itself is pollution free. Yet the plastics or methods used to produce the metal and steel for the turbines do create industrial waste. In addition to this, the parts do wear out and so an appropriate center for the recycling of these used parts must be found. What is lacking in Turkey is a strong system to regulate this type of insurance that these materials will in fact not end up in a natural area. According to the Environmental law established in 1983 a Ministry of the Environment was create in 1991. When we consider the date of this Ministry we can see that it is 15-20 years after many other countries' ministries.³⁶The awareness of this issue is not paramount in Turkey and this is also one of the reasons that alternative fuels also have quite a low profile. There are other issues with respect to bird injuries but these are quite minimal.

Considering the economic impact of wind power we have a similar situation that occurs with the geothermal power. Currently, "the unit price of electricity trades between 0,5 and 2,5 cents when produced from either water or coal. Despite the expense of building wind energy plants, the unit price of electricity produced is around

³⁵ Trevor Seivert. "Turkey - Cesme looks to wind energy for electricity" November 6, 2006. <http://www.windfair.net/press/3093.html> accessed March 15, 2009.

³⁶ "The Southeastern Anatolian Project Action Plan 2008-2012"

six cents for the first five or six years.”³⁷ After this initial period the costs drops dramatically and then the energy that is supplied is essentially free for the companies making it profitable in either the 5th or 6th year. Thus once again Turkey has great potential but perhaps is lacking the physical plant resource necessary to harness these resources. Wind power in Turkey will also require a significant investment on the part of the government in order to be a worthwhile alternative energy resource.

Solar Power:

One short aside that I would like to make with respect to solar power is that there is no official solar power policy in Turkey. Although the country may have access to this renewable resource, there is no formalized solar power industry or organization that regulated or manufactures the power. Although there are some laws to may be enacted in the future presently there are no official policies on its production. Something that should also be mentioned is that in Turkey there are individual residences that use solar panels to generate energy on a large scale there is no major contribution to the overall energy output in the country.

³⁷ Ibid 1

Results and Conclusions:

One of the major conclusions that we can draw from this analysis is not just applicable to Turkey. Essentially that energy demand is growing at an unsustainable rate. With a rate in Turkey cited at 8% and world rate of 2%³⁸ _____, countries need to find way to support their energy habits. On a smaller level we can say that Turkey is a country which has made significant progress in the areas of alternative energy. Just as well the results of this study are unequivocally clear, that the demands on Turkey have forced the country to have to look to its own internal industries to meet the demands for its energy consumption. With an energy dependence rate of nearly 70%, Turkey has not been able to secure its energy dependence. This once again makes for a frightening reality for the future of Turkish industry. By having its prices dictated to it by another country, Turkey needs to recognize the consequences which may come with purchasing energy from certain countries. Yet more troubling than this idea that Turkey will forever be a consumer not a producer of energy. Not until the current energy crisis did this become a pressing issue for the country. Prior to that, Turkey was perfectly happy with the fossil fuels system. We can point to the fact that not until 1991 was there a Ministry of Environment established. While other countries have had these governmental agencies for many years, the idea of renewable energy as well as environmental protection is relatively new to Turkey. The deductions that we can make from this statement is that there are entire segments of the population that have little to no knowledge about how energy is produce or procured in Turkey. Without an

³⁸ "World Energy resource and consumption." Wikipedia, the Free Encyclopedia. 31 March 2009, 08:15 UTC. 31 March 2009
http://en.wikipedia.org/w/index.php?title=world_energy_and_consumption&olddid=281461936.

informed population, there is less likelihood that people will understand or support the methods needs to improve and develop renewable energies programs.

Another conclusion that we can draw is purely economic. As aforementioned the per capita income in Turkey is about \$5400 USD per year. Let us just compare the price of wind power at 6 cents as opposed to coal which is 2.5 cents. As a consumer in Turkey who is also looking out for personal interests, citizen would be more likely to understand how these energies affect their short-term economic goals as opposed to long term environmental goals. The long term goals need to be stressed to the consumer. This falls in the part of the government to education the population.

Furthermore we can draw some conclusions about the Turkish government and the importance that is being given to renewable energy resources, which is very little. For the past 20 years the GAP has been under construction, the first wind plants were produced in 1998 and geothermal energy is not readily available. By looking at these three major areas and what is being done or not done in Turkey we can see the small priority that is being given to environmental and renewable energy issues. Yet this lack of focus on this issue is quite ironic because if the Republics' government recognized how there program might be a way out of the economic difficulties, it would be better for them. By supporting renewable energies, the government needs to pay for the initial costs of the projects but then afterward can use the essentially free energy. Once again this lack of knowledgeable officials, political leaders as well as a citizenry means that these issues will continue to be low priority.

When we try to make predictions and generalizations about mankind we can see that Turkey as with many other countries has opened the door to renewable

energy. Although it may have started late, Turkey is making the attempt to fix its fossil fuel use patterns and create alternative resources that are renewable. One remarkable fact is that as a country in the developing world, Turkey is 16th in its production of geothermal energy, even above Germany. A statement like this means that the developing world especially countries such as China and India also need to be convinced that it is in their best interest to elect renewable energies in order to preserve resources but also to not contribute to the further pollution of the environment. Turkey's priorities, while not entirely focused on alternative energies are moving in the correct direction. If we can see a country with the limited economic and structural resources like Turkey practicing these renewable energy procurement methods we have some hope for the future of other countries.

Recommendations

Arguably, there are many ways in which Turkey can improve alternative energy. With the analysis that the paper has provided, it is clear to see that I have outlined the major types of alternative energies that Turkey has been investing in the last 30 years. Yet quite a few recommendations can be made in order to make sure that this sector continues to develop. First if we look at the hydroelectric power that is being produced in Turkey we can say it has an established program. Yet due to the delays and lack of financial investment from the government, the project is set to be finished in 2010. It must be remembered that the project was started in 1989. Nearly 20 years after its initiation, we will see the project completed. The Republic of Turkey should make its best efforts to stay committed to the program which will undeniably produce this clear

and renewable energy. Another aspect that is blocking the full development of this alternative energy source is being able to provide adequate energy deliver systems and options. Because of its ability to generate a great deal of power, the Turkish government needs to be able to provide these services and this energy at a low cost and be able to deliver it in a reliable manner.

Secondly, if we consider geothermal power, obviously some improvements can be made in this area as well. As aforementioned, it seems that Turkey has a great potential for geothermal production. Although not all of this energy can be utilized for the production of electricity what it can be used for is heating. By diverting this renewable energy into heating systems, the country with therefore be able to use the energy that is presently being spent by electrical grids to produce heat can be diverted into other section which require this energy. Furthermore, something that was recognized as well is that an independent organization or one perhaps supported by the government must be set up to regulate the building sites which wish to use geothermal power. This lack of regulation can result in abuse of the resources or perhaps poor construction which can cause other structural problems. Another recommendation that can be made would be to encourage the development of more wells and residences that are fueled by geothermal power. As the research has indicated Turkey is a country with the 7th largest potential for geothermal uses because of its geographic location. The government as well as private institutions need to recognize this and begin to take advantage of the resources that exists.

Furthermore another recommendation that can be made to improve the use and production of alternative fuels in Turkey would be the implementation of a solar

power program in Turkey. Presently there are no governmental agencies that have been established to regulate the use of this resource. When we consider Turkey's geographic location, we see that it is a Mediterranean country and located at the 39 degrees latitude, meaning for a significant period of the year, especially the summer months, Turkey has a great deal of sunshine. If this power could be harvested and utilized, this would provide the country with a limitless supply of energy.

Finally, when we look at the sector of wind power we can say that there are also other recommendations that can be made in order to improve services. One of the more obvious recommendations would obviously be to develop more wind power stations or at the present stations construct more wind turbines. Yet even more significant that this would be a governmental instituted program. Presently as aforementioned the existing wind power plants in Turkey are operated by private companies. The turbines in Bozcaada for example are nearly entirely owned by a German company. What the government should consider is program in which it participates in programs perhaps with investors that will allow for the development of domestically owned wind plants. At this rate, it would be able to offer the energy at a discounted rate to the citizens. By doing offering cheaper energy the government is helping to convince the public of the worthiness of the program and would more easily be able to garner the support of the public with respect to alternative fuels.

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