

WHY TURKEY SHOULD AIM FOR 100% RENEWABLE ENERGY?

Turkey should change its energy policy to simply optimize energy consumption by supporting energy efficiency, give up on supporting environmentally hazardous energy generation such as nuclear, coal, or shale gas, and aim for 100 percent renewable energy. This will help relieve the economy by reducing energy importation, protect the environment by reducing carbon emissions, and provide energy independence which is a national security matter. Turkey can set a great example in the global energy industry, leading the way for many countries to transit to carbon-free economies.

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Turkey's energy demand is increasing consistently. The country's energy policy focuses on increasing the supply of energy to fuel its economic growth. As a result of this energy supply policy, import of oil and gas has increased, negatively affecting the current account deficit, and more power plants have been built. To mitigate the risks of energy dependence and the negative consequences of energy importation, the current policy is to support nuclear, coal (lignite), and shale gas opportunities in the country. However, this comes with a serious environmental cost. This article aims to explain why Turkey should take an alternative path and head straight to 100 percent renewable energy.

Increase in Energy Demand

According to the General Population and Housing Census results published by the Turkish Statistical Institute, Turkish population has grown from 16,158,018 in 1935 to 35,605,176 in 1970 and reached 67,803,927 in 2000.¹ The Turkish Statistical Institute's Address-Based Population Registration System (ADNKS) reveals that Turkey's population reached 75,627,384 in 2012. It will be no surprise to see Turkey become the most populated country in Europe in the next decade. This trend is arguably also fuelled by the pronatalist policies and advocacy by the Turkish Prime Minister for Turkish women to have at least three children each. An increasing population means that there will be an increase in demand for basic needs such as food, water, housing, and energy.

According to the World Bank, Turkey's energy consumption per capita was 1,054 kWh in 2000. After 10 years, this figure had risen to 2,408 kWh per capita.² The population growth leads to an increase in energy consumption and thus in energy demand. This upward trajectory is likely to continue for future generations in Turkey. According to the International Energy Agency (IEA), energy usage in Turkey is expected to double over the next decade, while growing electricity demand is expected to increase at an even faster pace.³

Each summer for the past few years, Turkey breaks new daily energy consumption records. Daily consumption reached 772 million kWh on 29 August 2013.⁴ The authorities of the Ministry of Energy and Natural Resources have indicated a

1 See: Turkish Statistical Institute (TÜİK) website, www.turkstat.gov.tr

2 "Electric Power Consumption (kWh per capita)," *The World Bank*, <http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC>

3 "Turkey: Overview," *U.S. Energy Information Administration (EIA)*, <http://www.eia.gov/countries/cab.cfm?fips=TU>

4 "Elektrikte Tüketim Rekoru," [Consumption Record in Electricity], *Hürriyet*, 1 September 2013, <http://www.hurriyet.com.tr/ekonomi/24627614.asp>

set of drivers increase the energy consumption in summer: agricultural irrigation in the east and the southeast of the country, the industrial production and the frequent use of air-conditioning due to the hot climate.

When energy demand constantly increases in an energy dependent country like Turkey, energy consumers pay more for electricity, oil, and gas every year. Currency devaluation is also a major contributor to the increase of energy prices, which has resulted in high inflation and has led Turkish consumers to pay even more.

“Germany currently has an installed capacity of more than 35 GW of solar power, even though its solar irradiation on average is considerably lower than Turkey’s least sunny Black Sea region.”

Economic Consequences of Energy Imports

The current account balance measures how much a country saves compared to other countries. When government, people, and companies together produce more than they spend on consumption and capital investment, the result is a positive current account balance. If national expenditure exceeds domestic production, this inevitably results in an account deficit that has to be financed.

For the full year of 2012, Turkey’s current account deficit narrowed sharply to 48.9 billion dollars (six percent of GDP) from 77.2 billion dollars in 2011 (10 percent of GDP). To import energy, Turkey paid 54.1 billion dollars in 2011, which was 70 percent of the current account deficit and paid 60.1 billion dollars in 2012, which means Turkey could have incurred a surplus if the country did not import energy.⁵ In the first five months of this year, the current account deficit has reached 31.92 billion dollars, a more than 22 percent increase compared to the previous year.

Surplus countries overcome financial crisis in the best shape and still have the best outlook for their economies and currencies. Turkey is clearly a deficit country. Considering that the global economy is expected to face serious challenges in the short to medium-term, it is realistic to say that the Turkish economy is quite vulnerable, partly due to energy importation.

⁵ “Turkey in Statistics 2012,” *Turkish Statistical Institute (TÜİK)*, www.tuik.gov.tr/IcerikGetir.do?istab_id=5

Energy Independence as a Matter of National Security

Turkey imports natural gas from Russia, Iran, Azerbaijan, Turkmenistan, Nigeria, and Algeria and imports oil from Russia, Azerbaijan, Iran, Saudi Arabia, Iraq, Kazakhstan, and Syria. In other words, Turkey depends on these countries to supply its energy needs and this dependence will continue if there is no concrete change in Turkey's energy policy.

“Turkey should begin prioritizing renewable energy, as it possesses a substantial potential in solar, wind, hydro, geothermal, and bio-combustible energy resources.”

The gas disputes between Russia and Ukraine were not in distant past. They grew beyond simple business disputes and turned into transnational political issues, plunging Europe into an energy crisis. During harsh winters, Europe is threatened with energy supply shortages, since some countries of the continent heavily depend on natural gas imports from Russian suppliers, which are transported through Ukraine. Turkey could find itself in a similar situation – a result of energy dependence which is a national security matter.

This risk is compounded by the reality that many countries that export fossil fuels to Turkey are also politically unstable.

According to Mr. Taner Yıldız, Turkey's Minister of Energy and Natural Resources, the risks of energy dependence and the negative consequences of energy importation can be eliminated by focusing on the country's domestic energy resources, while clearly supporting nuclear, coal (lignite), and shale gas opportunities in the country. However, this comes with a serious environmental cost.

The Environmental Effects of Supporting Nuclear, Coal, and Shale Gas Options

Nuclear

In an interview on 24 May 2013, Taner Yıldız told *Hürriyet Daily News*: “Our plan is to operate our third plant, and to build the majority of this plant –whether 60 or 80 percent of it I don't know yet– depending on the performance of our first two nuclear plants.”⁶

6 “Turkey Plans to Operate 3rd Nuclear Power Plant,” *Hürriyet Daily News*, 28 May 2013, <http://www.hurriyetdailynews.com/turkey-plans-to-operate-3rd-nuclear-power-plant.aspx?pageID=238&nid=47726>

Turkey recently concluded two major nuclear plant tenders with a Russian and Japanese-French consortium, with a plan to reduce its natural gas imports over the next decade as these plants become operational. According to Yıldız, the government has already started making plans for the third nuclear plant, as the growing domestic energy needs are unlikely to be met by the first two.

“Turkey has a huge agricultural and dairy industry that could support sustainable biodiesel and bio-ethanol production.”

He went on to explain: “We will not rush to decide on the third plant, but we have already prepared our negotiation dossier. We could swiftly conclude the procedures, but our Prime Minister gave us another target,” he said, adding that this target was to build the third plant mostly using the country’s own national sources.⁷

There are many risks involved in operating nuclear power plants such as nuclear waste, waste heat, and most importantly nuclear accidents. Turkish citizens, especially those from the Black Sea region still clearly remember the catastrophic Chernobyl nuclear accident that occurred on 26 April 1986. Long-term health effects such as cancers and deformities are still being seen in the region. After the nuclear accident in Japan’s Fukushima Daiichi Nuclear Power Plant, a visionary country like Germany declared to phase-out of nuclear energy no matter what. For instance, Germany’s main electric grid operators announced last year that the country needs 3,800 kilometers of new power lines by 2022 in order to prepare for the planned phase-out. Amid criticism that her energy revolution has stalled, the German Chancellor Angela Merkel has called for a faster grid expansion that will cost about 20 billion euros over the next 10 years.

As Germany prepares for its phase-out of nuclear energy, the percentage of solar, wind, hydro, and biomass energy in the country is expected to increase by 35 percent by 2020. Germany currently has an installed capacity of more than 35 GW of solar power, even though its solar irradiation on average is considerably lower than Turkey’s least sunny Black Sea region.

Coal

Taner Yıldız issued a written statement in June 2013, declaring that the exploration by the Mineral Research and Exploration (MTA) in the Dinar district of Afyon,

⁷ *Hürriyet Daily News* (28 May 2013).

which had been continuing for five years, has now been completed and that they had discovered lignite reserves in the area totaling around 950 million tons.

“We aim to build a thermal power plant, worth 5 billion dollars, that will have 3,500 MW of power. It means employment for 6,000 or 7,000 in the plant’s construction and the mining field,” he said.⁸

Yıldız emphasized that Turkey’s goal was to generate one-third of its electricity *via* coal by 2023. “We aim to raise the local coal-fired power plant’s capacity to 30,000 MW in the next 10 years,” he announced, adding that these plants would be built using resources from the Turkish Coal Enterprises’ (TKİ) coal mining fields in Afşin-Elbistan, Karapınar-Konya, Dinar-Afyon, and Alpu-Eskişehir.

Yıldız also mentioned that a coal field in the Karlıova district of Bitlis had been transferred to the private sector with the condition that a coal power plant be constructed. “The private sector will build a thermal power plant that will have 240 MW of power and which will be worth 700 million dollars.”⁹

According to Greenpeace, coal-fired power plants are the biggest source of man made CO₂ emissions. This makes coal energy the single greatest threat facing our climate. Unfortunately, governments across the world, including the Turkish government, are allowing industry to invest hundreds of billions of dollars into building hundreds of new coal-fired power stations worldwide in the coming years. If they are built, CO₂ emissions from coal are expected to rise by 60 percent by 2030. This will undermine any international agreements to tackle climate change.

In addition, politicians and bureaucrats always link the investment in power generation with the employment that it would generate. They always highlight coal being the cheapest energy resource, but they never comment on health costs for people and families that are affected by the mining accidents and the CO₂ emissions that are created by coal-fired plants. In reality, there is no such thing as “clean coal” and the cost of human life is beyond any measure.

Shale Gas

It is suggested that there is a huge potential of shale gas reserves in Turkey, specifically in the Central Anatolian cities of Ankara, Konya, and Nevşehir; although it

8 “New \$5 Billion Thermal Power Plant on the Way in Turkey,” *Hürriyet Daily News*, 11 June 2013, <http://www.hurriyetdailynews.com/Default.aspx?pageID=238&nid=48580>

9 *Hürriyet Daily News* (11 June 2013).

is not feasible to give accurate figures about the reserves before the completion of exploration activities. On 18 June 2013 during the share and operations transfer ceremony of the 600 MW Seyitömer thermal power plant, Taner Yıldız stated that: “We have already undertaken a series of shale gas exploration activities around Turkey, for example we have been drilling below 3,000 meters with Shell in the eastern city of Diyarbakır, and planning such activities in the Thrace Basin.” The Shell and Turkish Petroleum Corporation (TPAO) began exploring for shale gas in the eastern province of Diyarbakır’s Sarıbuğday-1 natural gas field in September 2012.¹⁰

The Southeast Anatolia Basin in southern Turkey and the Thrace Basin in western Turkey have active shale oil and gas exploration underway by TPAO together with several international companies, according to the latest report by the U.S.-based Energy Information Agency (EIA), as reported by *Hürriyet Daily News*.¹¹

On 24 April 2012, a coalition of environmental and health NGOs including Food & Water Europe, Friends of the Earth Europe, Greenpeace, and Health and Environment Alliance made a position statement on shale gas, shale oil, coal bed methane, and fracking, informing the public about their concerns in the following areas:

Climate-Related Energy: Development of shale gas will be at the expense of cheaper and safer policies that could have saved energy, speed up the transition to renewable energy, and reduced greenhouse gas emissions.

Water Pollution: Fracking involves pumping vast amounts of freshwater into underground, much of which becomes irretrievable and/or contaminated.

Air Pollution and Soil Pollution: Fracking disrupts the landscape and impacts rural and conservation areas. Furthermore, there are noise, seismic activity, cumulative and combined health and environmental impacts on communities and workers in the unconventional gas industry.

These concerns clearly indicate that nuclear, coal, and shale gas are not what Turkey should concentrate on when the country sets out to reap the benefits of its domestic energy resources. Turkey should begin prioritizing renewable energy, as it possesses a substantial potential in solar, wind, hydro, geothermal, and bio-combustible energy resources.

10 “Turkey Looks to Realize its Huge Shale Gas Potential,” *Hürriyet Daily News*, 19 June 2013, <http://www.hurriyetdailynews.com/turkey-looks-to-realize-its-huge-shale-gas-potential-.aspx?pageID=238&nid=49033>

11 *Hürriyet Daily News* (19 June 2013).

Renewable Energy in Turkey

The Ministry of Energy and Natural Resources has a Directorate for Renewable Energy and has been working on supporting mechanisms for quite some time now. The Ministry enacted its first specific Renewable Energy Law in May 2005, namely the Law on Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy. An amendment was made to the law in December 2010 to set up standards –such as tariffs– in the renewable energy industry.

The law guarantees to purchase licensed/non-licensed electricity from renewable energy producers as seen in the following table per kWh:

Schedule I (Provision of the law dated 29 December 2010 and numbered 6094)	
Type of Production Facility Based on Renewable Energy Resources	Prices Applicable (U.S. Dollar cent/kWh)
a. Hydroelectric production facility	7,3
b. Wind power-based production facility	7,3
c. Geothermal power-based production facility	10,5
d. Biomass-based production facility (including landfill gas)	13,3
e. Solar power-based production facility	13,3

The Energy Market Regulatory Authority (EMRA) in Turkey published new regulations and legislations related to renewable energy production in 2012. EMRA has started to collect license applications for the first 600 MW solar power plant in Turkey in June 2013. All the files are now being studied by EMRA officers and the license holder will be announced soon. Furthermore, the limit for unlicensed electricity production increased from 500 kW to 1 MW within the year. Publishing regulations on the unlicensed projects by the Turkish Electricity Distribution Company (TEDAŞ) and EMRA officers will kick start the distributed generation industry.

Solar

We can clearly state that good intentions to support the renewable energy industry in Turkey are not sufficient. Especially, when Turkey's vast renewable energy potential is considered. For example, Germany already has a solar power installed capacity of more than 35,000 MW. Turkey has a capacity of less than 15 MW and the solar irradiation in Turkey is much higher than Germany.

“Due to the improved technologies and constant increase of fossil fuel prices, the renewable energy industry does not depend on subsidies anymore.”

According to the Energy Ministry, Turkey's annual average total sunshine duration is calculated at 2,640 hours (daily total is 7.2 hours), and average total radiation pressure at 1,311 kWh/m²-year (daily total is 3.6 kWh/m²). Thus, solar energy potential is calculated at 380 billion kWh/year.

Photovoltaic (PV)¹² and Concentrating Solar Power (CSP)¹³ should be vastly utilized in Turkey. Turkey is known to have the second best solar irradiation in Europe after Spain in terms of both Direct Normal Irradiance (DNI) and Global Horizontal Irradiance (GHI).

Wind

With Turkey's Wind Energy Potential Atlas (REPA), which was established in 2007, it is calculated that our country has a minimum wind energy potential of 5,000 MW in regions with annual wind speed of 8.5 m/s and higher and 48,000 MW with wind speed higher than 7.0 m/s.

Geothermal

According to the Ministry of Energy, Turkey –as located on the Alpine-Himalayan belt– holds a substantially high geothermal potential of 31,500 MW. Areas with potential are concentrated in western Anatolia (77.9 percent). To date, 13 percent of this potential (4,000 MW) has been made available by the Ministry General Directorate.

¹² Photovoltaics (PV) is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. Global Horizontal Irradiance (GHI) is relevant for PV.

¹³ Concentrated solar power (also called concentrating solar power, concentrated solar thermal, and CSP) systems use mirrors or lenses to concentrate a large area of sunlight, or solar thermal energy, onto a small area. Electrical power is produced when the concentrated light is converted to heat or steam, which drives a heat engine (usually a steam turbine). Direct Normal Irradiance (DNI) is relevant for CSP.

Biofuel

Biofuel is defined as all kinds of fuels, at least 80 percent of whose content (in volume) is obtained from living organisms that were harvested within the last 10 years.¹⁴ It is used in the form of biodiesel, bio-ethanol, biogas, and biomass.

In Turkey, biodiesel is a fuel that can be used wherever diesel is used with the exception of very cold regions. While biodiesel can replace diesel fuel in the transportation sector, it can also be used in housing and manufacturing sector instead of fuel oil.

Bio-ethanol is an alternative fuel whose raw material is obtained through fermentation of sugar, starch or cellulose containing agricultural products like sugar beet, corn, wheat, and other woody plants, and is used by blending certain ratios with benzene. In Brazil for instance, ethanol is very commonly used.

Turkey has a huge agricultural and dairy industry that could support sustainable biodiesel and bio-ethanol production.

Biogas is mainly methane and carbon dioxide gas which is a product of biological decomposition (of animal wastes, vegetable wastes, urban and industrial wastes) under anaerobic conditions (i.e. anaerobic fermentation). Biogas technology allows us to produce energy from organic waste and can also be used as fertilizer to increase quality and yields for agriculture and dairy production.

The amount of biogas that can be produced in Turkey, considering its animal waste potential, is reported as 1.5 to 2 million tons equivalent of petroleum (MTEP).

Our biomass sources include agriculture, forests, animals, organic urban waste, etc. Our waste potential is around 8.6 MTEP. Biofuels have the potential to replace fossil fuels in Turkey.

Hydro

According to the Energy Ministry sources, Turkey's technically feasible hydroelectric potential is 140 GWh/year. This is probably the only "controversial" renewable energy type, since there are downsides to building hydroelectric plants, i.e. damaging the environment and water resources. Planning and implementation of

¹⁴ Definition used by the Turkish Ministry of Energy.

hydroelectric power plants should be done in an efficient and environmentally friendly manner.

Additionally, there are other alternatives for renewable energy resources in Turkey, such as wave and hydrogen. We should also emphasize the fact that there has been huge technological progress for all renewable energy types over the past couple of decades. Due to the improved technologies and constant increase of fossil fuel prices, the renewable energy industry does not depend on subsidies anymore.

“Reliance on imported fossil fuels such as coal, oil, and natural gas exposes Turkey to vulnerabilities such as energy dependence, environmental degradation, and a high current account deficit.”

Finally, both the Turkish government and the private sector need to emphasize the importance of energy efficiency. There is a common phrase in the industry: the cheapest energy source is the energy saved, but the cheapest price is not always the best in terms of efficiency and the environment. Although some steps have been taken to improve this and change the mindset, a much more coherent and strategically planned sustainable policy is needed which becomes progressively more compelling.

Conclusion

As energy demand is expected to grow further, reliance on imported fossil fuels such as coal, oil, and natural gas exposes Turkey to vulnerabilities such as energy dependence, environmental degradation, and a high current account deficit.

As declared by Greenpeace in 2010, the planet is on the brink of uncontrollable climate change.¹⁵ If annual average temperatures rise by more than two degrees Celsius, the entire world will face more natural disasters, hotter and longer droughts, waning of agricultural areas, and massive loss of species. Since climate change is caused by burning fossil fuels, we urgently need an energy revolution that could change the world’s energy composition. To avoid dangerous climate change, global emissions must peak in 2015 and start declining thereafter, reaching as close to zero as possible by mid-century.

¹⁵ “Energy [R]evolution 2010: A Sustainable World Energy Outlook,” *Greenpeace International* (7 June 2010), <http://www.greenpeace.org/international/en/publications/reports/Energy-Revolution-A-Sustainable-World-Energy-Outlook/>

Fighting climate change is paramount: as such, it is essential that sustainable power generation becomes virtually carbon-free as soon as possible. Renewable energy is the only solution in this regard.

Fossil fuels should be utilized as raw materials. For instance, oil should be used for petrochemicals and natural gas should be utilized to manufacture fertilizers. These materials should always be recycled.

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In a sun-rich country like Turkey, whether *via* centralized systems such as solar power plants or *via* decentralized systems for houses, hotels, shopping malls, hospitals, factories etc., solar energy can meet most of the energy demand. The country’s other renewable energy resources, i.e. the wind, geothermal, biofuels, hydro, wave, hydrogen, also have huge potential. Contrary to the arguments claiming that renewable energy cannot provide baseload power; one can rely 100 percent on renewable energy sources to generate power 24

hours a day by simply installing storage technologies such as heat storage or power storage systems, or by utilizing geothermal systems and biofuels to back up your solar or wind systems. Furthermore, biofuels have the potential to replace fossil fuels in Turkey, as they can be grown by humans *en masse*.

Turkey should change its energy policy to simply optimize energy consumption by supporting energy efficiency, give up on supporting environmentally hazardous energy generation such as nuclear, coal, or shale gas and aim for 100 percent renewable energy. This will help relieve the economy by reducing energy importation, protect the environment by reducing carbon emission, and provide energy independence which is a national security matter. This will also put Turkey at the leading edge of the curve in the global energy industry, where even developed countries will have to follow Turkey once it proves that 100 percent renewable energy is not just a dream, but a reality. The time has come for the inevitable transition to renewable energy and carbon-free economies.



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