

## National energy strategies of Germany and Turkey

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### Suggested Citation:

Berkin, A. (2017). National energy strategies of Germany and Turkey. *World Journal of Environmental Research*. 7(1), 40-51.

Received from 20 October 2016; revised from 14 December 2016; accepted from 2 February 2017.

Selection and peer review under responsibility of Prof. Dr. Haluk Soran, Near East University, Cyprus.

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### Abstract

Since the last decade, the energy policies of some countries have changed. The investments in renewable energy sources have significantly increased in developed and developing countries, as the cost of the renewable plants are decreasing, during the same time. Germany, one of the most important country of Europe in terms of energy, has fastened its green energy policy, while Turkey, one of the most important developing countries in terms of energy demand, has showed a huge growth with the help of the agreements and new energy policy according to the European Union acquis. Germany and Turkey has always been in contact with each other because of their background. In this paper, their energy policies, future plans, energy production and consumption will be analysed and compared.

Keywords: Germany, Turkey, energy policies, energy strategies.

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## 1. Introduction and Background

It is a fact that energy consumption shows the disparities between the richest and poorest countries in today's world. (Tester et al., 2012) So, it can be said that there is a positive relationship between economy and energy consumption. When the energy consumption and nominal GDP's of the top countries are analysed, it becomes more obvious. In that sense, there are several countries taking attention because of their high level of energy consumption, GDP and population. European Union (EU27), China and United States of America are at the top of those three lists.

To more focus on the European Union, the graphs and studies show that Germany is leading the economy of European Union with the help of its location and population -81 million- which is the most populated country in the European Union. Germany is also the leader of energy consumption in the European Union with 286 million tonnes of oil equivalent (Mtoe).

Interestingly, Turkey plays an important role for the German economy. One of the main reasons of that are 2.5 million Turkish people living in Germany, which strengthened the business relations between the two countries. Another reason is that almost 350.000 people are employed by German companies which belong to 70.000 Turkish businessmen whereas 4000 huge German companies are active in Turkish market (Wilson, 2010). So, Germany has become the number one partner of Turkey in terms of foreign trade.

During the Luxemburg Summit in 1999, under the presidency of Schroder, Germany was the number one supporter of Turkey for the European Union and it is claimed that religion and culture differences are not an obstacle to be a member of the European Union (Aghayev, 2014) Now, Turkey is still considered as a candidate for the European Union, and trying to accomplish Copenhagen Criteria. Regarding that, Turkey is reforming its legal framework in line with *acquis communautaire*. (Sirin, 2012) According to European Commission, there are 33 chapters to be completed for the full-membership, one of them is about energy.

Energy policy of the European Union summarizes its energy policy under a term called "Energy Union". Energy Union summarizes its five main goals as:

- Supply Security: Diversifying Europe's sources energy and making more efficient.
- A fully-Integrated Internal Energy Market: Only without any technical or regulatory barriers, there can be freely competitive energy prices.
- Energy Efficiency: Consuming less energy to reduce pollution
- Emission Reduction: Encouraging private investment in new infrastructure and technologies to reduce GHG emission.
- Research and Innovation: Supporting breakthroughs in low-carbon technologies.

Using these five main points, the progress report for the European Union membership of Turkey has been prepared. According to the Chapter 15: Energy in the Progress Report of Turkey, Turkey is considered as moderately prepared country in the field of energy. One of the main points regarding energy in the progress report are the fact that Turkey has been diversified its supply sources and promoted energy efficiency and renewable energy. Also, new pipeline projects, such as Trans-Anatolian natural gas pipeline project is introduced in the report. Liberalization and privatization electricity and gas market is categorized as "important progress". Moreover, a good progress is reported in terms of renewable energy. The ministry of Energy and Natural Resources of Turkey started a new energy plan which will increase the renewable energy generation capacity to 61 GW by 2023. Hence Turkey is going to have two nuclear power plants in the near future, *Acquis want Turkey* to adopt or create nuclear safety and radiation protection guidelines.

Now, Turkey is having the fastest medium to long term growth in energy demand among other International Energy Agency (IEA) countries according to "Energy Policies of Countries – Turkey".

Turkey stands at the 6<sup>th</sup> place in energy consumption in Europe with 108 Mtoe, after Germany, France, United Kingdom, Italy and Spain, respectively.

Since the start of the EU candidateship, it can be said that the EU played a really important role on the renewable energy policy of Turkey. As the most important leader of European Union, Germany and its energy policy will be compared to Turkey, in terms of their energy diversification, electricity production and energy policies.

## **2. System Descriptions**

To analyse and compare those two countries, Germany and Turkey, in terms of their energy policy, some main topics are selected. Firstly, general energy policies of both countries will be evaluated. The governmental goals regarding energy management, and energy supply will be mentioned. To have a reliable study, “total primary energy supply” of both countries will be mentioned in the first part, and energy production and consumption of both countries will be shown with the sources of energy. Since both countries use different sources, from fossil fuels to renewables, they will be evaluated under fossil fuels, renewables and nuclear energy topics.

## **3. Critical Analysis of Literature**

### *3.1. General Energy Policy*

#### *3.1.1. Germany*

Although the dependence on oil has been decreasing year by year, the most significant source of energy is oil for Germany. As a governmental goal, Germany is trying to decrease the usage of oil, like other fossil fuels. However, it is predicted that oil will remain as the most significant in 2030 with 28.2% of total primary energy supply (TPES) (IEA, 2013).

Since 15 years, the share of coal and natural gas has remained stable, 24.8% and 22.3% TPES respectively. By 2030, German government will try to increase the share of natural gas to 25% of TPES. The government goal is to decrease energy from coal to 12% till 2030 (IEA, 2013).

Although there is a huge investment in renewable sources in Germany, especially since 15 years, the most of the energy from renewable sources is coming from biofuels and waste. In the next 15 years, Germany’s goal is to increase the energy from renewable sources to 33% of the TPES by 2030 (IEA, 2013).

Nuclear energy is an important source for energy for Germany, with 9% of TPES in 2011. The German government has decreased it from 13.1% since 2000. By 2022, nuclear energy will be phased out, as the governmental goal, so Germany will shut down all of the nuclear power plants one by one (IEA, 2013).

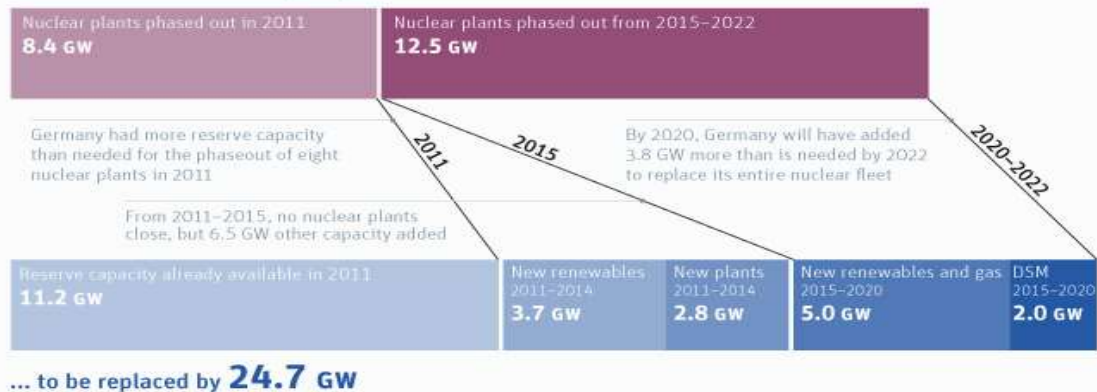
Germany’s energy transformation policy –investing more in renewable sources and replace fossil with renewables, shutting down the nuclear power plants, is called as “Energiewende”. According to Energiewende, Germany should be able to develop cost-effective market-based approaches. It is a complicated long-term process, according to the German government. The key issue is to lower the energy consumption in the country. It is also mentioned that photovoltaics has been an expensive technology, but it is becoming cheaper, especially with the help of German companies. Nuclear phase-out schedule is shown with the graph below:

## Germany can easily replace its nuclear capacity on the phaseout schedule

Replacing nuclear plants with reserves, new renewables, gas, and demand-side management (DSM)

Source: Institute of Applied Ecology, own calculations

### 20.9 GW of nuclear capacity



German Energy Transition energytransition.de

Figure 1. Source: energytransition.de

With the Energiewende program, Germany built up the world's leading green technology sector, and reduced its dependency on fossil fuels, which is imported. So, on one hand it reduced the imports of the fossil fuels for the economy, on the other hand Energiewende has created more than 370,000 new jobs for people (IEA, 2013).

Energiewende is criticized a lot because of its cost and its reliability. It is mentioned that there will always be a back-up power. Germany, like many countries, have reserve capacity in the need of emergent situations. For Germany, mainly oil-fired power plants are the reserve capacity, so it is planned to continue during the Energiewende process. In order to reach this goal, Germany is currently investing more than €1.5 billion per year for energy research (Schiermeier, 2013).

Baseload is also mentioned in the Energiewende, which is the one of the most criticized policy of Energiewende. Baseload power consumption would be considered roughly 40 gigawatts. Medium load would be considered between 40-60 gigawatts and the peak load can be considered between 60-80 gigawatts. Yet, it seems like it is not possible to produce energy from renewables to supply baseload. However, Paul Hockenos, Al Jazeera, explains how Germany will overcome this baseload problem. He claims that it is not possible to provide baseload energy with renewables, but a system with renewables could change the old "baseload" model with the decentralized smart grid model, which would distribute electricity where it is needed. For instance, when the sun is shining in Bavaria, but no wind on the North Sea, Bavaria could supply energy to the North Sea coast, and vice versa. While some of the people say it is a possible way, as now France is also following the German Energiewende policy, some say it is impossible and not a reliable way. Boisvert claims that Energiewende is supporting fossil-fuel and coal-burner power plants as well (Boisvert, 2013).

Still, wind power is showing a terrible performance because of its capacity factor (17%) so, the German government has targeted 10 GW of offshore wind by 2020, which are twice more expensive as onshore turbines (Boisvert, 2013).

Below, we can see two graphs: The first one is obtained by Energy Balances of OECD Countries, which shows the TPES of Germany between 1973 and 2011.

The pie chart indicates the primary energy consumption of Germany in 2014, in terms of Mtoe and percentages.

**Total primary energy supply, 1973-2011**

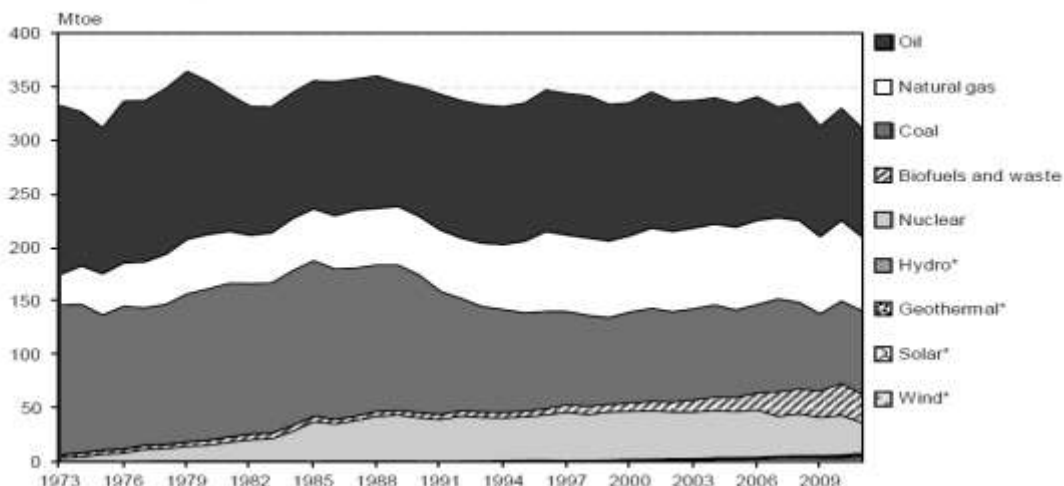


Figure 2. Source: International Energy Agency

### 3.1.2. Turkey

According to IEA records, Turkey is considered as the fastest medium-to long-term growth in energy demand among the IEA member countries, with the help of its young growing population. Although Turkey had a great and positive process in all areas of energy policy, energy security attracted more action and focus than market reform and environmental protection, unlike Germany. Following the European Union acquis, Turkey experienced a good progress regarding liberalisation of energy, which causes Turkey to rely on the private sector as the source of energy investments. This also helped to differentiate energy distribution into different business activities like transmission, generation, distribution, wholesale trading and retail supply, which caused to create a competitive energy sector (IEA, 2012).

With the growing population and growing economy, Turkish government would use more of its large coal reserves over the next decade. There will be more investments for hydro, wind and PV solar power plants in the future. Two nuclear power plants are going to be built in Turkey. Construction of Turkey's first nuclear power plant has already started. Recent Energy Minister Taner Yildiz mentioned that nuclear power plants would help Turkey to diversify the energy resources and decrease the dependence on imports of foreign sources. (Anadolu Ajansi, 2014) The problem regarding the nuclear power plants, according to the European Commission's Turkey report, is the fact that the framework law on nuclear energy and radiation regarding fuel management and radioactive waste management has not been adopted yet. Since 1990, energy-related carbon dioxide emissions have doubled. Although Turkey is a member of the United Nations Framework Convention on Climate Change (UNFCCC) and became a party to the Kyoto Protocol in 2009, Turkish government did not set any regulations to decrease the emission amount. This was an exemption of UNFCCC, which gives a special status to Turkey that Turkey does not have to have a quantitative emissions reduction target. Turkey is also the only OECD country that does not have any goals regarding decreasing the emission amount till 2020. For example, following the European Union acquis, Turkey is planning to utilize its coal mines,

restructuring the coal mining sector and privatising some of the mines. So, till 2023 coal mines are going to be used (IEA, 2012).

However, investments in renewable energy is increasing. The Ministry of Energy and Natural Resources started a new national renewable energy action plan in February 2015, according to European Commission’s Turkey Report. This plan aims to increase the energy generation from renewables to 61 GW by 2023, 20 GW from it would be of wind power (IEA, 2012).

Turkey’s TPES was 99 Mtoe in 2008, and 72% of its TPES is imported, mostly all of its oil and natural gas. 90% of TPES in 2008 was from fossil fuels, whereas the percentage of renewables for TPES was the remaining 10% (IEA, 2012).

Below, we can see the TPES of Turkey between the years 1973 to 2008 and primary energy consumption by sources in 2014 for Turkey:

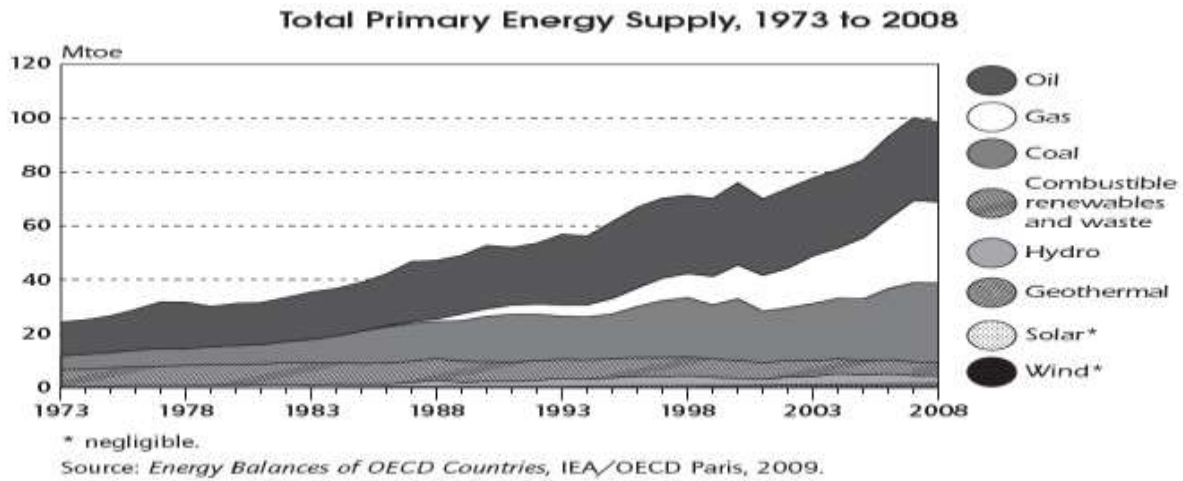


Figure.3 Total Primary Energy Supply, 1973 to 2008

### 3.2. Energy Production and Consumption

#### 3.2.1. Germany

The pie-charts below indicates the energy production and consumption by sources in Germany in year 2014:

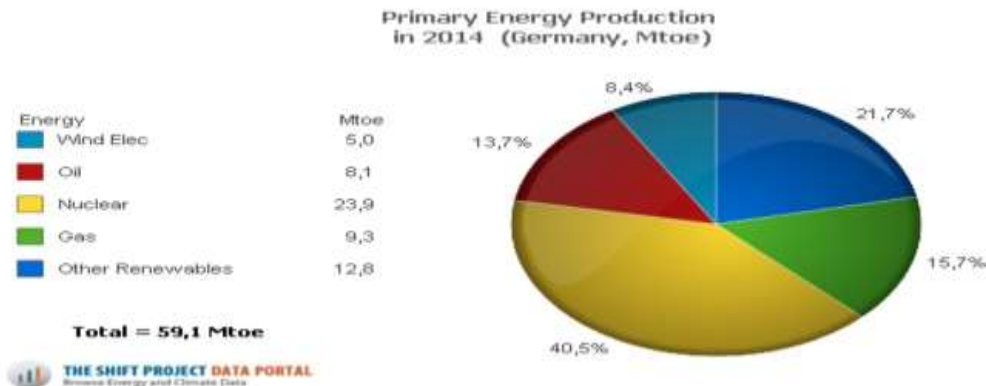


Figure 4. Source: The Shift Project Data Portal

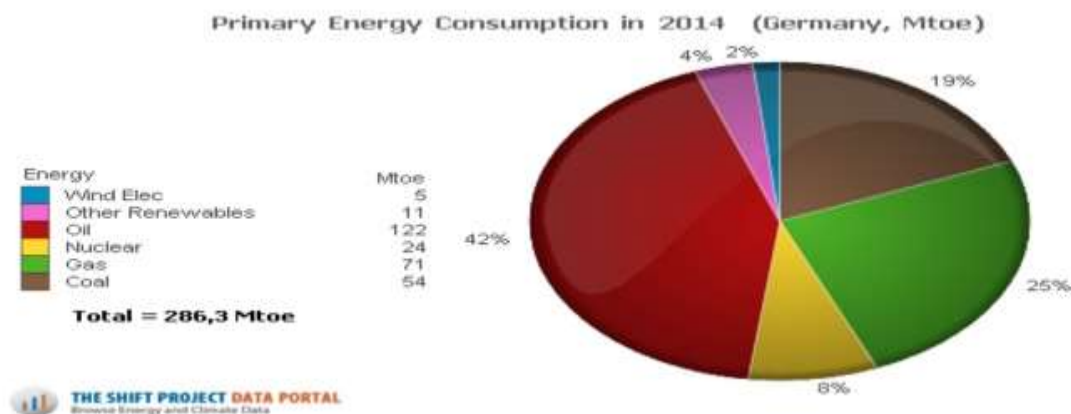


Figure 5. Source: The Shift Project Data Portal

For 2014, it is clear that Germany produces its energy using nuclear power plants, which reaches to 40.5% of its energy production (23.9 Mtoe) After Fukushima disaster in Japan in March 2011, German government accelerated its Energiewende policy and eight of 17 nuclear reactors had been shut down in Germany (Feldhoff, 2014). The dramatic decrease of nuclear sources in energy production can be clearly seen to compare 2010 data with 2014 data. The energy production using nuclear power was more than 50% in Germany in 2010. As mentioned in the “general policy” section of this paper, Germany is planning to phase out nuclear energy by 2022. This energy transition led Germany to increase energy production using renewable sources. To compare production and consumption, although Germany produces a huge amount of energy using nuclear sources, in the consumption side, nuclear energy consumption stays only at 8% in Germany.

As it is seen on the pie-chart, wind power forms 8.4% of total energy production in Germany with 5 Mtoe. Especially in the northern regions of Germany, huge wind turbines can be seen along the motorways (Schiermeier, 2013). The main problem regarding wind and solar power plants is about their capacity factors. In 2011, wind power produced 46TWh with 17% capacity factor. On the other hand solar electricity production in 2011 was 28 TWh with the capacity factor of 11%, which is very low compared to fossil-fuel plants in terms of the capacity factor (Boisvert, 2013). Energy consumption from wind power plants is still low in Germany. It can only supply 2% of total German energy consumption.

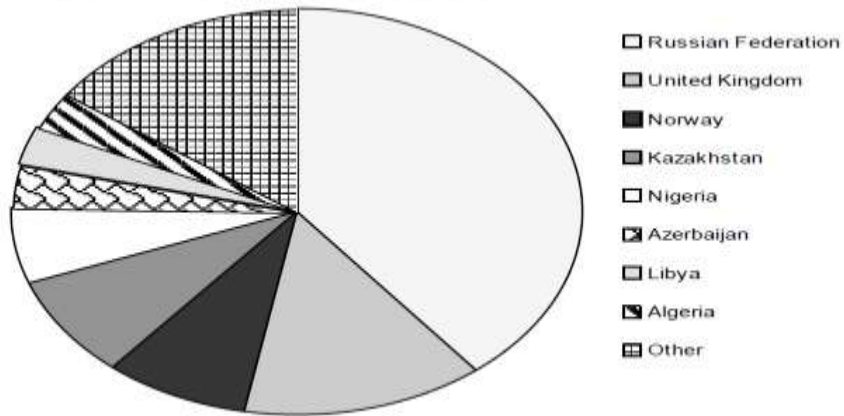
Biofuel and waste are the main source of renewable energy for production. Germany produces huge amount of biofuel and waste for energy production, yet all renewables, including solar, is only enough for 2% of Germany’s energy consumption.

When the fossil fuel based sources for production are analysed, it can be seen that natural gas forms the 15.7% of the total production. The production was 14.8 bcm in 2011 and it is mentioned the natural gas production has been declining since the beginning of the century. 25% of total energy consumption is using natural gas, with 71 Mtoe, which makes Germany to be the second largest natural gas market in IEA Europe. Because of this huge gap, Germany imports most of its natural gas, which was 89.6 bcm in 2011, sourced mostly from Russia (37%), Norway (31%) and the Netherlands (25%) (IEA, 2014).

Although oil is one of the most significant energy source in Germany, in terms of supply, the domestic oil production only consists of 13.7% of the total energy production. The production of oil is mainly in the north regions of Germany, Schleswig-Holstein and Lower Saxony. To compare production and consumption, on the pie charts, Germany can only produce 8.1 Mtoe of oil, while the consumption is 122 Mtoe. This huge gap is closed with imports. Total imports of oil in 2011 were 2515

thousand barrels per day. Below, we can see the crude oil imports by country of origin in 2011 with a pie chart:

Figure 18. Crude oil imports by country of origin, 2011



Source: *Oil, Gas, Coal and Electricity Quarterly Statistics, Second Quarter 2012, IEA/OECD 2012.*

Figure 6. Crude oil imports by country of origin, 2011

Energy production using coal, 94% lignite, is only 3.1% in Germany, although Germany is the largest producer of lignite in the world. Some of the mines are planned to be closed till 2018. 54 Mtoe of coal was consumed in Germany in 2014. Germany mostly imports coal from the United States, Colombia and Russia (IEA, 2014).

In total, to compare both production and consumption, it can be clearly said that German energy is depending on imports as production was 59.1 Mtoe in total and consumption was 286.3 Mtoe in 2014. This gap is mostly because of oil and natural gas, 193 Mtoe in total (IEA, 2014).

### 3.2.2. Turkey

The pie-charts below indicates the energy production and consumption by sources in Turkey in year 2014:

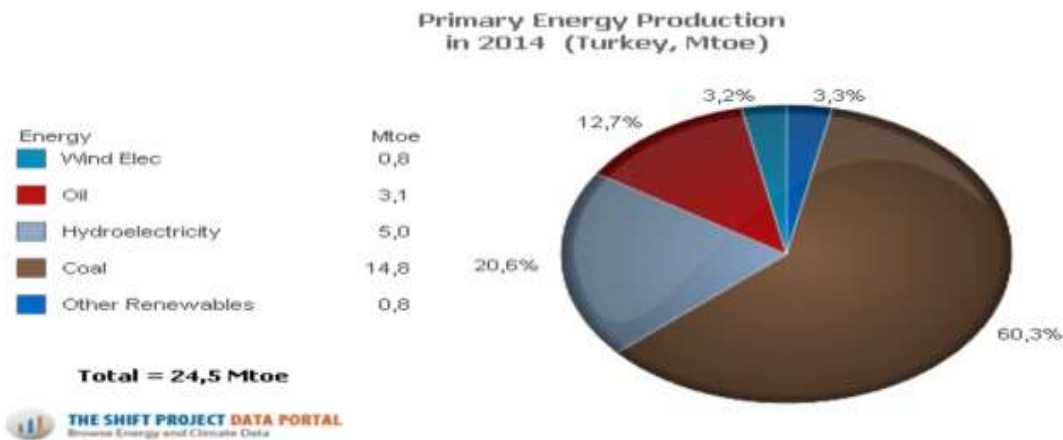


Figure 7. Source: *The Shift Project Data Portal*



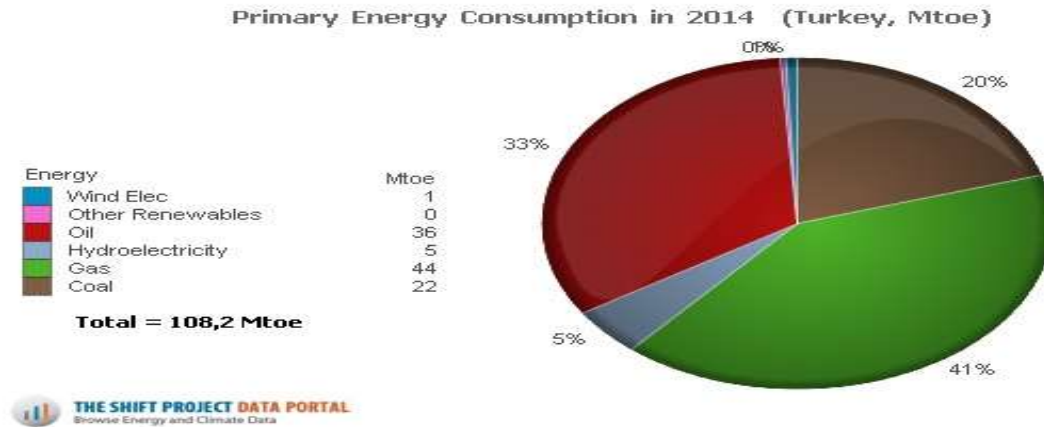


Figure 8. Source: *The Shift Project Data Portal*

In the pie chart, as it can be seen, Turkey produces its energy mostly (60.3%) using coal, about 14.8 Mtoe. Coal also includes lignite on the chart. 87% of domestic lignite is used for electricity generating. For power generation in 2008, 45.1 TWh out of 57.47 TWh of coal-fired power generation was by using domestic coal. There was 9800 MW of installed lignite and coal-fired capacity in Turkey in 2008. In terms of Mtoe, Turkey produces almost 15 Mtoe of coal, whereas consumes 22 Mtoe of coal. Russia and the United States are the partner countries for the import of coal (TSP, 2015).

Turkey produces 20.6% of its energy by using Hydropower plants, which is accounted for 5 Mtoe. According to EMRA, hydropower plants forms 14000 MW of hydropower capacity in Turkey, and the new hydropower plants are being constructed. The energy produced and consumed in Turkey are equal, 5 Mtoe (TSP, 2015).

Both production and consumption of energy by renewable sources are very low in Turkey yet.

Oil production of Turkey forms almost 13% of total energy production in Turkey, with 3.1 Mtoe. The production comes mostly from the south-east of Turkey. Almost the all production is made by Turkish Petroleum Corporation. Oil forms the second most important energy source in terms of consumption in Turkey, with 33% and 36 Mtoe. So, this gap is closed by mainly Iran (35%), Russia (32%), Saudi Arabia (16%) and Iraq (9%). Turkey imports oil also for exporting. (IEA, 2009) The graph of U.S. Energy Information Administration below helps better to understand the gap between production and consumption of oil in Turkey:

**Figure 2. Turkey petroleum and other liquids consumption and production**

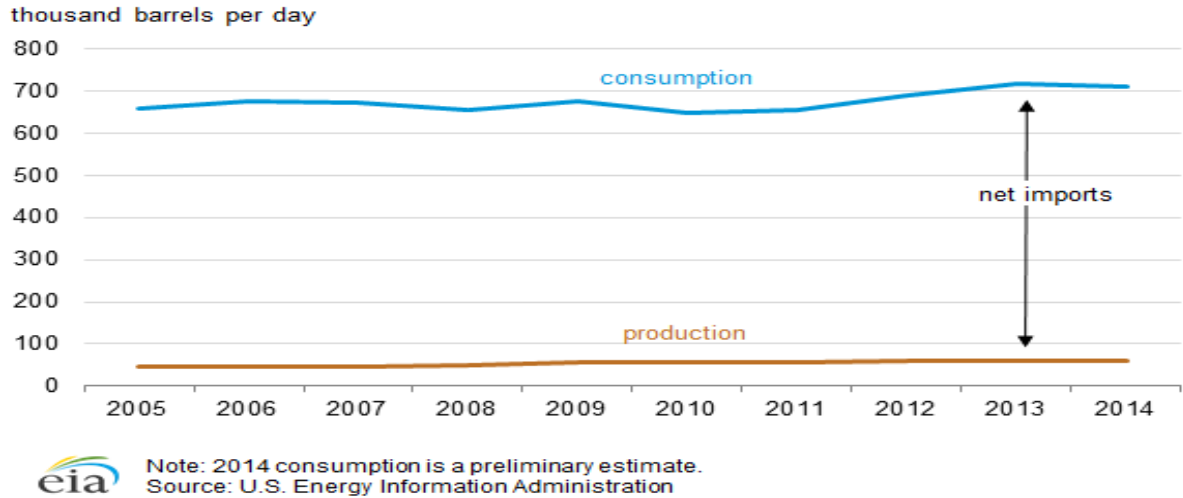


Figure 9. Turkey petroleum and other liquids consumption and production

When the consumption graph is analysed, natural gas takes attention with 44% of the pie chart. Natural gas consumption increased suddenly after 1990's in Turkey, and now it is the main source of energy. Natural gas is mostly used for power generation but also used by household consumption very often. The production of natural gas is almost zero in Turkey, which makes Turkey to import natural gas, from Russia (52%), Azerbaijan (15%), Algeria (14%) and Iran (16%) (IEA, 2009). The imports are secured with long-term gas supply contracts, as can be seen on the graph below:

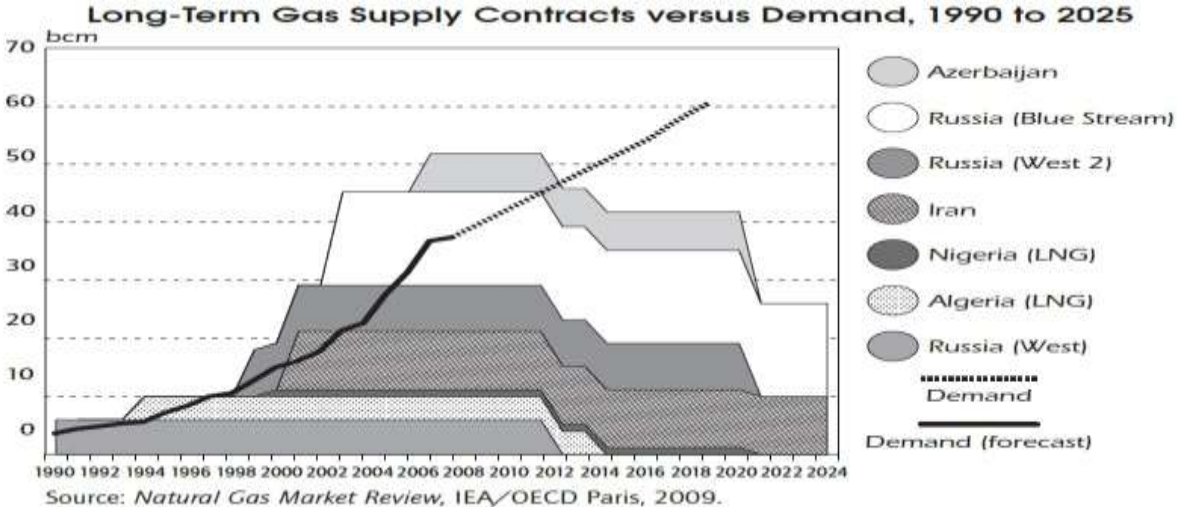


Figure 10. Long-Term Gas Supply Contracts versus Demand

In general, Turkey produces 24.2 Mtoe of energy sources, whereas consumes 108.2 Mtoe of energy sources, which makes Turkey a country depending on imports, in terms of energy sources, like Germany. (IEA, 2009)

#### **4. Conclusion**

To sum up, Germany and Turkey have different energy strategies. After the Fukushima disaster, Germany started to shut down its nuclear power plants, which plays one of the most important role for the new energy strategy of Germany, which also affects the other countries, especially the European Union countries, in terms of their own energy strategies. However, for Germany, it is still a controversial issue, whether Energiewende would be successful or not, as renewables would not sustain the baseload, 40 GW, as it can be seen on the graphs in critical analysis of literature part. On the other hand, some argue that it would work with different grid technologies. If Germany can complete its energy transition with Energiewende, and can sustain the baseload with renewables, it would lightened the future with renewable energy source and could change the view of energy policies of all developed countries.

Whereas, Turkey is having two nuclear plants, although the investment in renewables continues, especially for the wind power plants. Turkey is trying to decrease its dependence to imports by using these nuclear power plants. When the exports of the two countries are analysed, it can be seen that oil is one of the most important source for both countries. Turkey is continuing the use of their hydropower plants with huge projects, like the South Eastern Anatolia Project (GAP). With the nuclear power plants, hydropower plants and agreements regarding natural gas imports, Turkey's dependence on imports would decrease in the future. Turkey is also trying to complete the goals of the European Union acquis as a member of the European Union country. With the exemption rule of decreasing the emission amount of UNFCC, Turkey could lessen the imports and could boost its economy in a positive way.

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