This Project is co-funded by
the European Union and the Republic of Turkey

TECHNICAL ASSISTANCE FOR PROMOTING DECENT FUTURE OF WORK APPROACH WITH A FOCUS ON GENDER EQUALITY

(EuropeAid/140341/IH/SER/TR)

TURKEY

QUANTITATIVE DESK RESEARCH REPORT
ENERGY SECTOR

HRD OS HUMAN RESOURCES DEVELOPMENT OPERATING STRUCTURE

WEglobal

REPUBLIC OF TURKEY
MINISTRY OF FAMILY, LABOUR AND SOCIAL SERVICES

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
BASEAK	Balcıoğlu Selçuk Ardıyok Keki
BTC	Baku-Tbilisi-Ceyhan Crude Oil Pipeline
BTE	Baku-Tbilisi-Erzurum Natural Gas Pipeline
EIA	Environmental Impact Assessment
FIT	Feed-in tariff
FTE	Full-Time Equivalent
GJ	Giga Joules
GWEC	Global Wind Energy Council
GWNET	Global Women's Network for the Energy Transition
ICT	Information and Communications Technology
IRENA	Institute of Renewable Energy Agency
ITG	Turkey-Greece Interconnector
MCDM	Multi Criteria Decision Making
MWh	megawatt-hour
OECD	Organisation of Economic Cooperation and Development
PV	(solar) photovoltaic
RES	Renewable Energy Systems
SCP	South Caucasus Pipeline
SGC	Southern Gas Corridor
STEM	STEM
TANAP	Trans-Anatolian Natural Gas Pipeline
TAP	Trans-Adriatic-Pipeline
TÜİK	Turkish Statistical Institute (TURKSTAT)
TVET	Technical Vocational Education and Training
TWh	TeraWatt Hour(s)
YEKA	Turkish acronym for Renewable Energy designated areas

1. EXECUTIVE SUMMARY

Turkey has the highest rate of growing energy demand among OECD countries over the last 15 years. Located near around seventy percent of the world's proven oil and gas reserves, Turkey is one the biggest natural gas and electricity markets in its region. The country produces its own lignite (brown coal) but imports three-quarters of its energy, including half the coal and almost all the oil and gas it requires. Turkey's electricity is generated mainly from coal, gas, and hydro, with a small but growing amount from wind, solar and geothermal.

The country meets a quarter of its energy demand from national resources. In 2019, the country was almost 40% fossil fuel energy dependent on Russia; it imports 99% of its natural gas and 93% of the petroleum it uses. In the 2010s, fossil fuel imports were probably the largest structural vulnerability of the country's economy: they cost $41 billion in 2019 representing about a fifth of Turkey's total import bill.

For the Plan of development, the main objective is to ensure uninterrupted, high-quality, sustainable, reliable, and affordable energy supply. Given the importance of this sector for Turkey, we have incorporated an economic analysis of each of the sub-sectors.

There are needs of employment particularly in two areas: nuclear and renewables energies (Globally, the renewable energy sector employed 11.5 million people, directly and indirectly, in 2019). Available evidence suggests that renewable energy employs more people than do fossil fuels. An input output analysis (Garrett-Peltier, 2017) performed to evaluate public and private energy investment found that, on average, spending USD 1 million on renewables creates 7.49 FTE jobs, almost triple the 2.65 FTE jobs in fossil fuels. **Most of these jobs are still held by men**. The share of women in the renewable energy workforce is about 32%, compared to 22% in the energy sector overall (IRENA, 2019).

Building the skills based necessary to support the ongoing global energy transition from fossil fuels to renewables requires more vocational training, stronger curricula, more teacher training and expanded use of information and communications technology for remote learning. One of the subjects discussed globally are the possibility that **renewable energy can be better integrated into national curricula**, and other possibility is the **technology-enhanced learning** Innovations in the use of ICT can play an important role in the delivery of education and training related to renewable energy. For this, **Public-private partnerships** are needed (Engaging the private sector is crucial for meeting sectoral labour requirements, promoting national skill standards, providing on-the-job training, and improving the quality of training overall)

Educating girls and women must be a priority. In the renewable energy sector, women's participation in science, technology, engineering, and mathematics (STEM) jobs is far lower than in administrative jobs (28% versus 45%) (IRENA, 2019). The difference is more pronounced in the wind energy sector, where women account for only 14% of the STEM total, compared to 45% in administrative jobs (IRENA, 2020). Strategies to increase the representation of women in the renewable energy sector often focus on workplace accommodations, mentorship, and professional development. Jobs in renewable energy are important beyond the energy sector: incomes spent on food or consumer goods and services stimulate many different industries in local, national, and global economies.

2. INTRODUCTION

Turkey has the highest rate of growing energy demand among OECD countries over the last 15 years. Located near around seventy percent of the world's proven oil and gas reserves, Turkey is one the biggest natural gas and electricity markets in its region.[1] Consumption of **energy in Turkey** is around the world average of about seventy gigajoules (GJ) per person per year.

Turkey produces its own lignite (brown coal) but imports three-quarters of its energy, including half the coal and almost all the oil and gas it requires. Turkey's energy policy prioritises reducing imports, but the OECD[2] has criticised the lack of carbon pricing, subsidising fossil fuels and not taking more advantage of the country's abundant wind and sunshine. Road transport in the country consumes the most oil products. The country's electricity is generated mainly from coal, gas, and hydro, with a small but growing amount from wind, solar and geothermal.

Turkey meets a quarter of its energy demand from national resources. In 2019, the country was almost 40% fossil fuel energy dependent on Russia; it imports 99% of its natural gas and 93% of the petroleum it uses. In the 2010s, fossil fuel imports were probably the largest structural vulnerability of the country's economy: they cost $41 billion in 2019 representing about a fifth of Turkey's total import bill.[3]

In 2017, renewables generated a tenth of Turkey's electricity, which reduced gas import costs. However, being mainly hydroelectricity, the amount that can be produced, and this percentage, is vulnerable to drought.

The main elements of the energy strategy can be summarized as follows:

- Considering increasing energy demand and import dependency, prioritization among energy supply security related activities,
- Within the context of sustainable development, giving due consideration to environmental concerns all along the energy chain,
- Increasing efficiency and productivity, establishing transparent and competitive market conditions through reform and liberalization,
- Expanding research and development activities on energy technologies.

In this scope, the following goals are aimed:

- Route and source diversification of oil and natural gas imports,
- Increasing the ratio of indigenous and renewable energy sources in our energy mix,
- Increasing energy efficiency,
- Adding nuclear to their energy mix. Turkey aims to add nuclear power into its energy mix to decrease negative environmental effects of energy production, to meet its energy demand increase as well as to reduce its energy import dependency. To this end, construction of two nuclear power plants (NPPs) in Akkuyu and Sinop are on the agenda.[4]

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[1] The data is from Presidency of Turkey. Ministry of Energy and Natural Resources, available at:

http://www.enerji.gov.tr/en-US/Mainpage - Info Bank

http://www.enerji.gov.tr/en-US/Pages/Electricity

http://www.enerji.gov.tr/en-US/Pages/Petrol

http://www.enerji.gov.tr/en-US/Pages/Natural-Gas

http://www.enerji.gov.tr/en-US/Pages/Coal

[2] OECD (February 2019). OECD Environmental Performance Reviews: Turkey 2019 (Report). OECD Environmental Performance Reviews. OECD Publishing.

[3] https://www.climate-transparency.org/media/turkey-country-profile-2020

[4] http://www.enerji.gov.tr/en-US/Pages/Nuclear

Turkey gives an important place to Renewable Energy and became a founding member of International Renewable Energy Agency (IRENA) on 26 January 2009.[5] According to an article published by BCCT Member **Balcıoğlu Selçuk Ardıyok Keki (BASEAK)** the most significant regulatory developments in Turkey's renewable energy sector in 2020 are as the launching of tenders for mini solar YEKAs (the Turkish acronym for renewable energy designated areas) expected to take place within 2020. The Ministry of Energy and Natural Resources announced that 74 tenders are to be held for solar projects, each with installed capacity of 10-20 MW. The projects will be spread across 36 provinces and have an aggregate installed capacity of 1 GW.

For other part, the pandemic has coincided with a time of intense construction activity in respect of existing renewable projects. The project-owners were under significant time pressure since the construction needed to be completed before the end of 2020 for such projects to benefit from the FIT mechanism. Also, in March 2020, the Electricity Generation License Regulation was amended to regulate hybrid and multisource power plants. Prior to the amendments, the lack of regulation had been a restrictive factor in respect of these projects. The regulations on RES support scheme and local content incentive have also been amended to include hybrid and multi-source renewable power plants.

And finally, the "Green Tariff" has become available from August 2020. Consumers who wish to procure electricity exclusively from renewable resources may opt for the application of "Green Tariff" and purchase electricity at the prices specified in such Tariff. (In July 2020, the Electricity Market Balancing and Settlement Regulation was amended to enable the settlement calculations of such consumers to be carried out separately.)[6]

With this aim, Turkey has undertaken and carried out several important natural gas and oil pipeline projects in the region. In this scope, South Caucasus Pipeline (SCP), Baku-Tbilisi-Erzurum Natural Gas Pipeline (BTE), Turkey-Greece Interconnector (ITG) and the Trans-Anatolian Natural Gas Pipeline (TANAP) projects have already been realized. These projects can be considered within the Southern Gas Corridor (SGC) concept. SGC will enhance source and route diversification of natural gas imports. The Trans-Adriatic-Pipeline (TAP) project, another SGC project, has not been realized yet.

Inauguration of TANAP was held in Eskişehir on 12 June 2018 and gas flow to Turkey commenced as of 30 June 2018. As of 1 July 2019, TANAP was completed ahead of schedule with the aim of transporting natural gas produced in Shah Deniz 2 Gas Field in Azerbaijan along with other areas in the south of the Caspian Sea to Turkey and then to the rest of Europe.

Turk Stream Natural Gas Pipeline is another project which enhances natural gas supply security of Turkey. Composed of two lines with the capacity of 15,75 bcm each and with a length of 930 km, the project establishes a new interconnection between Turkey and the Russian Federation under the Black Sea and thus allowing a direct natural gas supply to Turkey. The first line of the project aims to supply natural gas to Turkey and the second line to European countries. The TurkStream project replaced the Russian gas supplied from the western (Trans Balkan) pipeline.

On Oil and Natural Gas Pipeline Projects, we can mention:

A. Crude Oil Pipelines[7]

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[5] http://www.enerji.gov.tr/en-US/Pages/Hydraulics

http://www.enerji.gov.tr/en-US/Pages/Wind

http://www.enerji.gov.tr/en-US/Pages/Solar

http://www.enerji.gov.tr/en-US/Pages/Geothermal

http://www.enerji.gov.tr/en-US/Pages/Bio-Fuels

[6] https://www.bcct.org.tr/news/the-turkish-renewable-energy-sector-significant-regulatory-developments-in-2020/70620

[7] https://enerji.gov.tr/en-US/Pages/Oil-Pipelines

- Kirkuk-Yumurtalık Crude Oil Pipeline (Iraq-Turkey Crude Oil Pipeline)
- Baku-Tbilisi-Ceyhan Crude Oil Pipeline (BTC)

B. Natural Gas Pipelines[8]

- Baku-Tbilisi-Erzurum Natural Gas Pipeline (BTE)
- Turkey-Greece Interconnector (ITG)
- Blue Stream Natural Gas Pipeline
- Iran – Turkey Natural Gas Pipeline
- Trans-Anatolian Natural Gas Pipeline Project (TANAP)
- TurkStream Natural Gas Pipeline

The Plan of development:

The main objective is to ensure uninterrupted, high-quality, sustainable, reliable, and affordable energy supply. The Policies and Measures to achieve this goal are:

- A competitive investment environment will be developed to meet the growing demand for energy while observing the viability of an energy market that is financially strong, stable, transparent, and predictable and that protects consumers and takes sustainability into consideration.
- Rehabilitation of the publicly operated power plants will be completed
- Nuclear Power Plants (NPPs) will be included in the electricity generation portfolio, efforts will be continued to increase the share of nuclear energy in electricity generation and institutional capacity will be strengthened.
- The use of domestic lignite reserves in the production of electrical energy in accordance with environmental standards will be increased.
- Natural gas supply security will be strengthened and access to natural gas will be increased.

3. ECONOMIC DATA

a. Electricity

The annual gross electricity consumption in Turkey in 2018 has risen by 2.5% to 304.2 TWh. Electricity generation increased by 2.5% to 304.8 TWh. Electricity consumption is expected to increase by 4.3% annually, reaching 375.8 TWh in 2023 in the base scenario. The annual gross electricity consumption in Turkey in 2018 has risen by 2.5% to 304.2 TWh. Electricity generation increased by 2.5% to 304.8 TWh.

Electricity consumption is expected to increase by 4.3% annually, reaching 375.8 TWh in 2023 in the base scenario.

As the end of the 2018, 37.2% of our electricity generation was obtained from coal, 30.3% from natural gas, 19.7% from hydropower, 6.5% from wind, 2.6% from solar energy, 2.4% from geothermal and 1.3% from other sources.

By the end of 2018, the installed capacity of our country has reached 88,551 MW. The distribution of our installed power by resources is as follows: 31.9% hydraulic, 29.5% natural gas, 22.2% coal, 7.9% wind, 1.4% geothermal, 5.7% solar and 1.4% other sources.

Additionally, as the end of the 2018, number of electricity energy generation plants in Turkey was 7,423 (including unlicenced plants). As of the end of August 2019, the installed capacity of our country has reached 90,403 MW.

b. Crude Oil

[8] https://enerji.gov.tr/en-US/Pages/Natural-Gas-Pipelines-and-Projects

To have a brief history of the last 20 years of Oil Exploration in Turkey, we consult the General Directorate of Petroleum Affairs:

2001: Natural Gas Market Law No. 4646 was prepared for liberation and alignment with EU Directive. Market operations concerning natural gas were separated from oil operations in accordance with the Law passed on 2nd May 2001 and taken outside the scope of Petroleum Law; Statutory Decree No. 397 regulating natural gas import and distribution was abolished. Natural gas market was taken in the scope of roles and power of the Energy Market Regulatory Authority (EMRA) established in accordance with the Electricity Market Law No. 4628 and the title of the institution was changed into EMRA.

2003: The provision of the Petroleum Law was amended with the Law on Working Permits of the Foreigners approved on 27th February 2003 No. 4817 and the opportunity to employ foreign administrative and professional staff and expert staff was provided to the oil right owners via the permission by the Ministry of Labour and Social Security upon the opinions of EMRA and the Ministry of Interior Affairs were taken.

Operations which require license for execution such as oil transmission, refinery and storage at large amounts were taken outside the scope of Petroleum Market Law which was enforced on 20th December 2003 No. 5015. Free use of distribution, shipment and relevant operations were taken in the scope of a legal regulation for the first time.

2007: New Turkish Petroleum Law No. 5574 was approved by the General Assembly of the Turkish Grand National Assembly (TGNA) on 17th January 2007 whose drafting was completed in Industry, Trade, Energy, Natural Resources, Information and Technology Commissions of the TGNA. The Law, whose four provisions, one being interim, was sent by the 10th President A. Necdet Sezer to the TGNA was re-accepted after excluding one provision in the Commission and sent to the General Assembly. Law has been in the agenda of the TGNA since February 2007.

2013: The new Turkish Petroleum Law No. 6491, which has been in operation since 2007, was put into effect on 30.05.2013 by publication in the official gazette. In the context of the new law, the exploration and operation license periods have been extended, the "State Right" has been removed from the search license areas and the possibility of expropriation has been created. Moreover, it has been decided to leave the "guarantee" issue to the minister's discretion in the case of oil discovery or non-traditional methods.

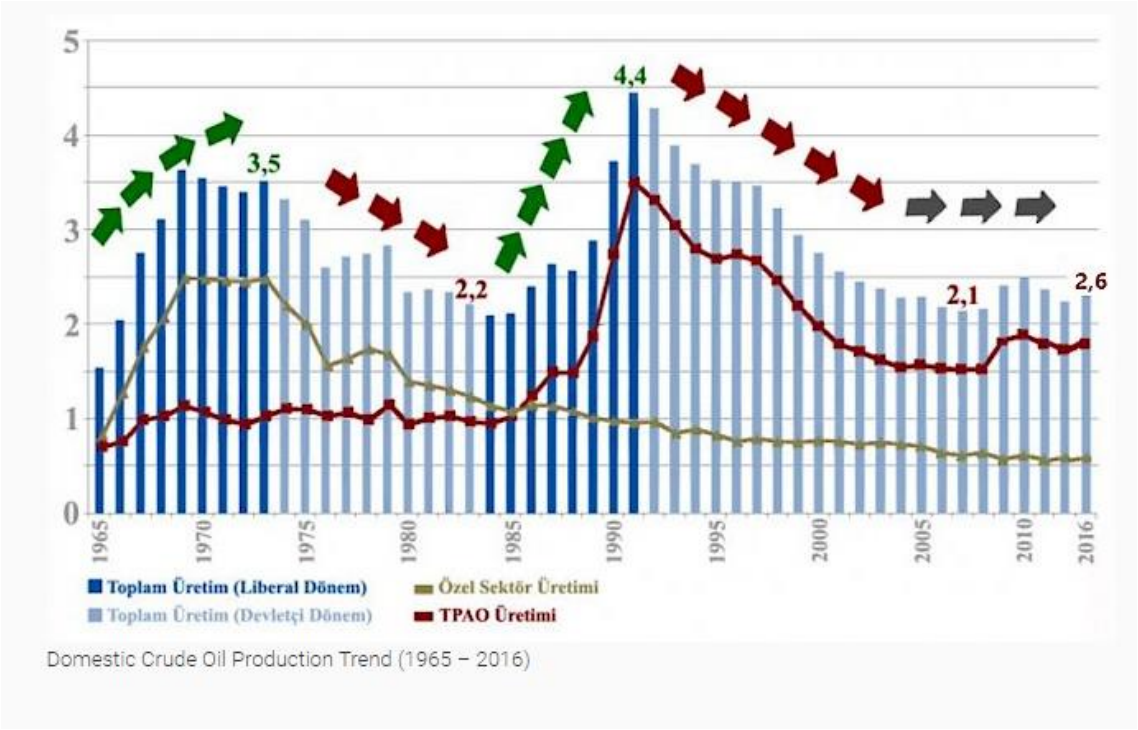
The main Statistics of Oil Production in Turkey are:

Oil Production (2019)	**2,9 million tons**
Daily Average Production (2018)	**54.386 barrel/day**
Rate of Production Meeting Consumption (2018)	**%8**
Total Producible Reserve	**209,6 million tons**
Cumulative Production (1954 – 2018)	**158,6 million tons**
Remaining Producible Reserve (2018)	**51,0 million tons**

Source: https://www.petform.org.tr/

The Domestic crude oil production Trend can be visualised in the next figure:

Figure 1. Domestic Crude Oil Production 1965 - 2016

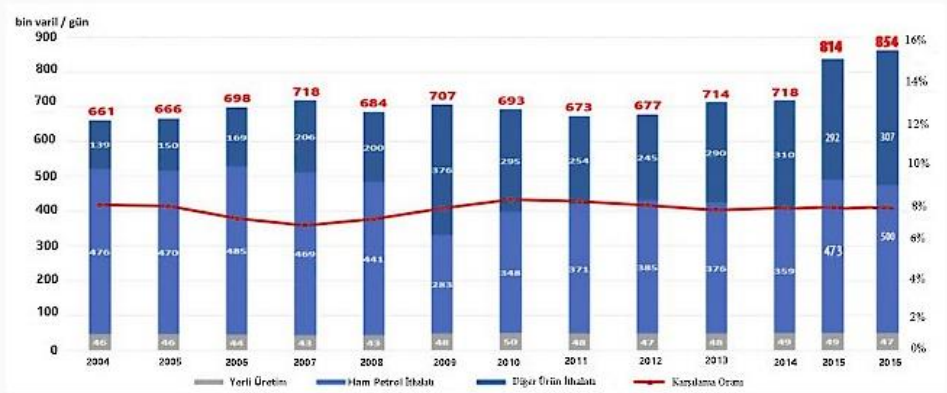


Domestic Crude Oil Production Trend (1965 – 2016)

Source: https://www.petform.org.tr/

If we compare this with the increment of consumption, we can understand the decisions on import and to increment the production of renewable energy.

Figure 2. Production consumption Rate (2004 – 2016)



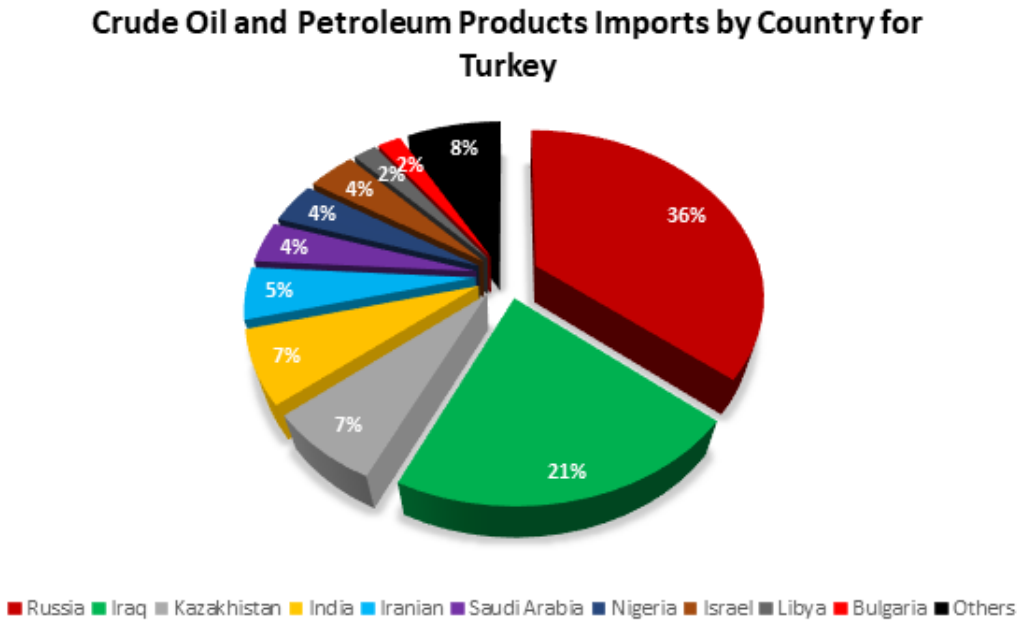
Production Consumption Rate (2004 - 2016)

Source: https://www.petform.org.tr/

According to diverse sources in 2018 there are 41 (19 foreign + 22 native) Investor Companies and 265 license owners. On Exploration - Production Sector of Contribution to the Turkish Economy (2001 - 2018), there is 9,5 milyar USD on investment, the Domestic Production Market Value was 8,3 billion TL and there are 10.000 people employed.

Turkey imports crude oil and petroleum products to these countries:

Figure 3:



Source: Ministry of Energy and Natural Resources

c. Natural Gas

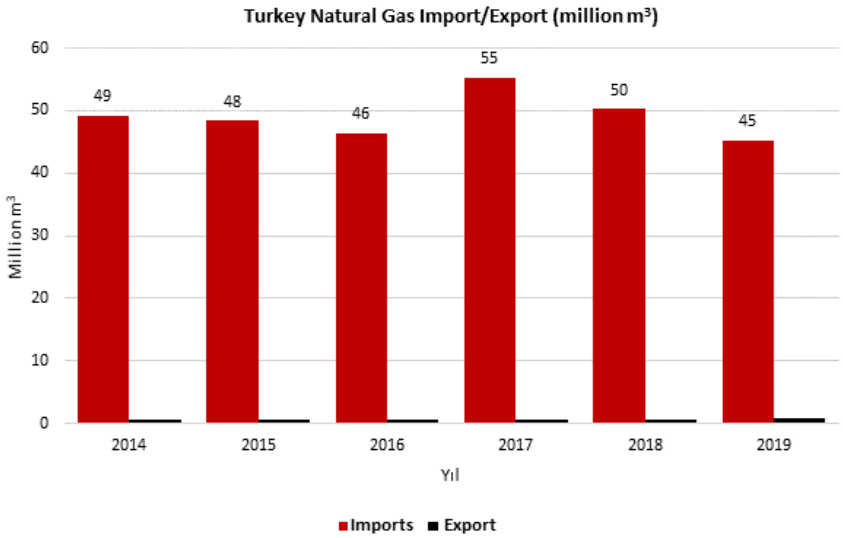
Natural gas, which is flammable, lighter than air, colourless and odourless, consists of light molecular hydrocarbons such as ethane (C2H6) and propane (C3H8) as well as methane (CH4), which constitutes its greatest density. In addition to light hydrocarbons, it also contains small amounts of heavy hydrocarbons, carbon dioxide, nitrogen, helium, and hydrogen sulphide. Natural gas can be found alone underground or can also be found with oil. Natural gas is used extensively in electricity production, in residences, industry and service sector.

In the world, Russia, Iran, Qatar, Turkmenistan, and the USA have rich natural gas reserves. Russia, Iran, Qatar, China, and Canada followed the USA with the highest production in 2019. As of the end of 2019, the world natural gas reserve was realized as 198.8 trillion m3 and 4 trillion m3 of natural gas was produced from these reserves in the same year.

Turkey consumed about 45.3 billion m3 in 2019, a total of 483 million m3 of natural gas and production. The remaining producible reserve is approximately 3.36 billion m3. With the new fields discovered because of the drilling performed for natural gas in our country in 2018 and 2019, natural gas production has increased in the last two years, and production has increased by 20% in 2018 and 11% in 2019 compared to previous years.

In 2019, approximately 45.21 billion m3 of natural gas was imported. LNG imports accounted for 28% of the total natural gas imports in 2019. In the same year, only 762 million m3 natural gas was exported to Greece.

Figure 4: Turkey Natural gas Import/Export (million m3

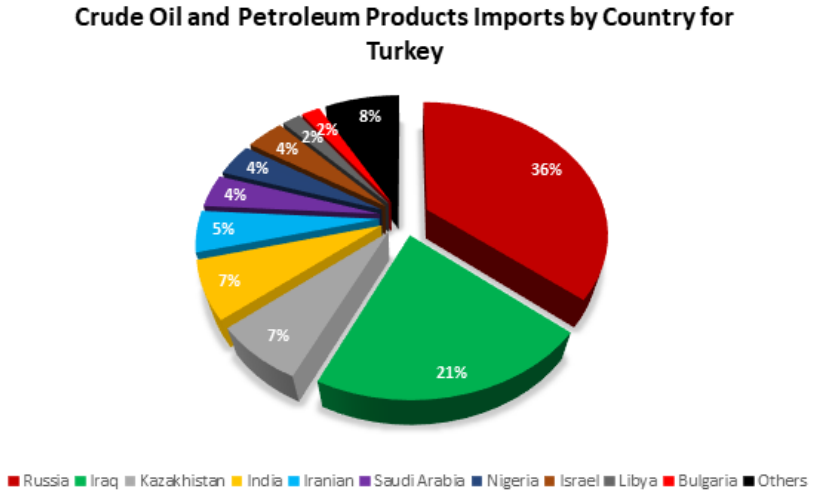


The natural gas market in the world acts in parallel with the oil market. Natural gas prices were also quite low in 2020, when oil prices saw their lowest levels.

Within the scope of the activities to meet the increasing need for oil and natural gas from domestic resources as much as possible, the studies carried out in our country's poorly sought-after basins and especially in the marine areas in the Black Sea and the Mediterranean have accelerated. In recent years, hydrocarbon exploration has gained momentum with seismic data collection and drilling activities in our seas, as developments in marine drilling technology have revealed exploration and production opportunities in areas with high water depths (1.000-2.500 m). In this context, 2 seismic exploration and 3 drilling vessels were provided through both purchasing and domestic manufacturing.

To ensure the diversity of resources in the field of natural gas supply security of our country and to become a natural gas trade centre in the medium and long term, our works continue in line with national energy policies.

Figure 5: Crude Oil and Petroleum Products Imports by Country for Turkey



d. Hydraulics[9]

Among the various sources of energy, hydroelectricity power plants are preferred due to being environmentally friendly and carrying low potential risk. Hydroelectricity plants are non-dependent domestic resources working in harmony with the environment, being clean, renewable, and free of fuel expenses, having long lifespan and exceptionally low operating cost.

The theoretical hydroelectricity potential of Turkey is 1% of theoretical potential of the world, while its economic potential is 16% of the economic potential of Europe. In 2018, electrical energy generated by hydroelectricity plants was 59.9 billion kWh. By the end of August 2019, electrical energy generated by hydroelectricity plants has reached 68.4 billion kWh.

By the end of the 2018, 653 operational hydroelectricity power plants having a total of 28,291 MW have 31.9% share in Turkey's total installed capacity. By the end of August 2019, hydroelectricity installed capacity has reached 28,437 MW.

e. Wind

Wind comes about from the varied temperatures created by solar radiation on the surface of the earth. These different temperatures cause humidity and pressure levels to vary as well, and the difference in the pressure levels causes the air to move. Approximately 2% of the solar energy which reaches the earth is converted into wind energy.

The characteristic of the wind differs (in respect of time and region), based on local geographic differences and the non-homogenous temperatures of the surface of the earth. Wind is stated as two separate parameters – speed and direction. Wind turbines[10] are the principal structural elements of wind energy plants and are machines which convert the kinetic energy of the moving air, first to mechanic energy, and then to electricity energy.

It has been accepted that wind plants with a capacity of 5 MW can be established in Turkey at heights of 50 meters above ground level, and in areas with a wind speed exceeding 7.5 m/s. In the light of this acceptance, a Potential Wind Energy Map (PWEM) has been prepared, where the source wind details obtained using a mid-scale weather forecast model and micro-scale wind flow model are given. The wind energy potential of Turkey has been estimated as 48,000 MW. The total area which is equivalent to this potential is just 1.30% of the total surface area of Turkey.

f. Solar

Solar energy is a renewable energy source which has features such as not to pollute the environment and create harmful waste as well as ease of installation and use. Solar energy uses include direct or indirect electricity generation, hot water generation, space heating and cooling, process heat for industrial enterprises and greenhouse heating. An exceedingly small amount from solar energy it is produced in

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[9] **Hydropower** or **waterpower** is power derived from the energy of falling or fast-running water, which may be harnessed for useful purposes. Since ancient times, hydropower from many kinds of watermills has been used number of times as a renewable energy source for irrigation and the operation of different mechanical devices. In the late 19th century, hydropower became a source for generating electricity and it start talking about hydroelectricity.

Since the early 20th century, the term has been used almost exclusively in conjunction with the modern development of hydroelectric power. International institutions such as the World Bank view hydropower as a means for economic development without adding substantial amounts of carbon to the atmosphere, but dams can have significant negative social and environmental impacts. It starts using the word Hydraulics. It is a technology and applied science using engineering, chemistry, and other sciences involving the mechanical properties and use of liquids. In its fluid power applications, **hydraulics** is used for the generation, control, and transmission of power using pressurized liquids.

[10] Wind turbines are only able to start generating electricity energy at a specific wind speed. A wind turbine will generate energy in between the cut-in and cut-out speeds. The cut-in speeds of modern wind turbines are between 2-4 m/s, their nominal speeds are between 10-15 m/s, and their cut-out speeds are between 25-35 m/s. Each wind turbine reaches the maximum power value which can be obtained from the system at a specific wind speed. This maximum power is known as nominal power and the wind speed at this level is known as the nominal speed. Wind turbines automatically stop after a certain wind speed has been exceeded, to ensure that the system is not damaged. This maximum speed is known as the system cut-out speed.

Turkey, but it is utilized in the production of hot water. Studies on the utilization of solar energy gained momentum especially after the 1970s, solar energy systems showed a technological progress and a decrease in cost and established itself as an environmentally clean energy source.

Turkey has high solar energy potential due to its geographical location**.** The energy potential that can be produced from the sun is approximately 380 billion kWh. Turkey's gross solar energy technical potential 87.5 Million Tons of Oil Equivalent (TOE) is the size. 26.5 of this value is suitable for thermal use and 8.75 is suitable for generating electricity.

According to the Solar Energy Potential Map (SEM) of Turkey prepared by Ministry of Energy and Natural Resources,

1. Average annual sunshine duration = 2766.5 hours / year
2. Average daily total sunshine time = 7.58 hours / day
3. Average annual radiation intensity = 1527.1 kwh / m2-year
4. Average daily radiation intensity = 4.18 kwh / m2-day

The number of days that the sun can be used at efficient rates is as high as 110 days a year. During the 10 months of the year, it can be technically and economically exploited at 63% of the country's surface area and 17% throughout the year. Solar energy potential of Turkey and sunshine duration values by months is given in **Table 2.**

Table No 2: Turkey's Monthly Average Solar Potential

Months	**Monthly Total Sun ENERGY**		**SUNSHINE TIME**
	(kcal/cm^2-month)	(kWh/m^2-month)	(hours/months)
JANUARY	4.45	51.75	103.0
FEBRUARY	5.44	63.27	115.0
MARCH	8.31	96.65	165.0
APRİL	10.51	122.23	197.0
MAY	13.23	153.86	273.0
JUNE	14.51	168.75	325.0
JULY	15.08	175.38	365.0
AGUST	13.62	158.40	343.0
SEPTEMBER	10.60	123.28	280.0
OCTOBER	7.73	89.90	214.0
NOVEMBER	5.23	60.82	157.0
DECEMBER	4.03	46.87	103.0
TOPLAM	112.74	1311	2640
AVERAGE	308.0 cal/cm^2-daily	3.6 kWh/m^2-daily	7.2 hours /daily

Source: ministry of Energy and Natural Resources

Distribution of annual solar energy potential of our country by geographical regions is shown in **Table 3.**

Table No. 3: Turkey's Total Annual Potential of Solar Energy Distribution by Region

Regions	Total Energy ($kWh/m^2/year$)	Sunshine Time (hours / year)
Southeastern Anatolia	1460	2993
Mediterranean	1390	2956
Eastern Anatolia	1365	2664
Central Anatolia	1314	2628
Aegean	1304	2738
Marmara	1168	2409
Black Sea	1120	1971

Turkey's region with the greatest potential to benefit from solar energy is the South-eastern Anatolia Region. This place has a strong and cold climate and receives the most radiation in winter. Altitude is high. The air condenses in the form of water vapor, rain and snow, and the atmosphere is clearer and radiation shielding is minimal. The Mediterranean Region is our second largest region. The region receiving the least radiation is the Central and Eastern Black Sea Region. This region has both a high latitude and a humid climate. Excess water vapor in the atmosphere causes the radiation to be shielded. [11]

g. Geotermal

Geothermal energy is the heat energy transported to the surface by hot water, steam and gases which are above the regional atmospheric average temperature and may contain more dissolved minerals, various salts, and gases than the ground and surface waters around it.[12] In Turkey, approximately 61,000 residences are currently heated by geothermal fluids. A total of 665 MW_t is utilized for space heating of residential, public, and private property, and 565,000 m^2 of greenhouses. The proven geothermal heat capacity, according to data from existing geothermal wells and natural discharges, is 3132 MWt. [13]

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[11] Nowadays, two different technologies used quite different forms and areas for production electrical energy from solar energy. Though solar energy technologies vary in terms of method, material, and technological level, they can be divided in two major groups:

Photovoltaic Technology: Semi-conducting materials, which are also known as photovoltaic solar energy systems, convert the sunlight directly into electricity.

Photo-emissive Solar Technologies and Concentrated Solar Power (CSP): In this system heat is obtained from solar energy and can be used either directly or in the generation of electricity.

[12] **Utilization areas of geothermal energy.**

For electricity generation, after the separation of steam and water in fluid separators produced from wells drilled in geothermal fields, electricity is generated by turbine and generator. As heat, geothermal resources at low temperature are evaluated to meet greenhouse, organic agriculture, crop drying and regional heat needs. At spas, minerals into low temperature geothermal waters are used useful for human health.

[13] **Geothermal energy in Turkey: the sustainable future, available at:** https://www.sciencedirect.com/science/article/abs/pii/S1364032104000176

Turkey is Europe's 1st country in terms of installed capacity and in point of its geothermal potential is the world's 4th country. Top five countries in this area are the USA, Indonesia, Philippines, Turkey, and New Zealand

Turkey is located on an active tectonic zone as geological and geographical location and for this reason our country is rich in terms of geothermal energy resources. Turkey have approximately 1.000 geothermal springs that located all over the country that have various of temperatures.

The geothermal capacity of our country is extremely high. 78% of these geothermal fields are situated in Western Anatolia, 9% in Central Anatolia, 7% in the Marmara Region, 5% in Eastern Anatolia and 1% in the other regions. 90% of our geothermal resources are low and medium enthalpy geothermal areas which are suitable for direct applications (heating, thermal tourism, industrial usage, etc.), while 10% are suitable for indirect applications (generation of electricity). First geothermal electricity generation held in 1975 was initiated by Kızıldere power plant with 0.5 MWe power.

To develop existing resources and to search for new resources/fields, drillings reached from 2.000 meters to 28.000 meters. Since 2005, with the support of the Ministry of Energy and Natural Resources, the development of existing geothermal resources initiated and began to search for new potential areas. In 2008, in conjunction with the Geothermal Resources and Natural Mineralized Waters Law, private sector began to introduce development and investment of geothermal projects also. In conjunction with this development, the country's total geothermal heat capacity (visible amount of heat) reached to 35.500 MWt.

h. Biomass

Biomass can be defined as the total mass of living organisms that belong to a society consists of species or consist of several species. Biomass is also defined as an organic carbon.

The main biomass resources include:

1. **Herbal Biomass Resources**[14]
2. **Forest and Forestry Product Biomass Resources** [15]
3. **Animal Biomass Resources**[16]
4. **Organic wastes, biomass resources obtained from urban and industrial wastes**[17]

It is estimated that the biomass potential in Turkey is about 8,6 million tonnes of equivalent petrol (MTEP), and biogas quantities that can be produced from biomass is 1,5-2 MTEP.

i. Nuclear

Nuclear energy is an energy which occurs by splitting (fission) big atoms (Uranium, plutonium) or by merging (fusion) small atoms (like hydrogen). The spread of nuclear power plants began with the oil crisis of the early 1970s. Countries that do not have oil and other hydrocarbon resources have inclined to nuclear power plants to reduce their dependence on these resources and ensure security of energy supply. Nuclear power plants continue to be established all over the world, despite a slowdown due to

[14] Oil-bearing crops (canola, sunflower, soybean, etc.); Sugar and starch crops (potatoes, wheat, corn, sugar beets, etc.); Staple crops (flax, kenaf, hemp, sorghum, miscanthus, etc.); Protein crops (peas, beans, etc.); Herbal and agricultural residues (branches, stalk, straw, root, bark, etc.)

[15] Wood and forestry waste (energy forest, energy crops, various trees)

[16] Cattle, horses, sheep, chickens waste, slaughterhouse waste and animal wastes that arise during the processing of products

[17] Sewage sludge, paper industry and food industry wastes, industrial and domestic wastewater, municipal waste, and large industrial facilities waste

accidents Three Mile Island (TMI) in the US in 1979 and Chernobyl incident in Soviet Russia on 1986 (today in the Ukrainian borders).

The concept of safety culture came to fore in the light of the lessons learned from these accidents. There have been both administrative and technical improvements to establish and operate safer nuclear power plants all over the world. On the one hand, the establishment and operation of nuclear inspecting institutions began to be monitored and controlled; On the other hand, new techniques, technology, standardization, and quality systems have been developed to produce safer equipment and systems.

Nowadays, nuclear power plants have become an electricity source preferred by countries due to their unique characteristics. The need for a reliable, affordable, sustainable, and accessible energy source with increased environmental awareness places more emphasis on nuclear power plants than other alternatives.[18][19]

The half-century goal of Turkey to establish a nuclear power plant has begun to actualize with the signing of the Intergovernmental Agreement on Cooperation on the Establishment and Operation of a Nuclear Power Plant on Akkuyu Site between Government of Turkish Republic and the Russian Federation on 12 May 2010. Within the scope of mentioned agreement process, the Project Company was established on 13 December 2010 in Ankara with the name of Akkuyu Nükleer A.Ş. In the meantime, positive decision on Environmental Impact Assessment (EIA) report (December 2014) was obtained from Ministry of Environment and Urban Planning and 36 months electricity production license was obtained from Energy Market Regulatory Authority. The Site Parameters Report prepared by Akkuyu Nükleer A.Ş. was submitted to TEAK, which is approved. Following the approval of this report, the construction license application which is a prerequisite for the construction of Akkuyu Nuclear Power Plant is submitted to TAEK. The ultimate objective is to get the first unit of Akkuyu Nuclear Power Plant to commissioned by 2023.

On May 3, 2013, an intergovernmental agreement on nuclear power plant construction and cooperation for the Sinop Nuclear Power Plant which is the second nuclear power plant project of our country was signed with Japan.

To meet the rapidly increasing demand for electric power and to reduce the risks arising from import dependency, it is planned to commission 2 nuclear power plants by 2023 and start the construction of the 3rd power plant.

Nuclear power plants should be not regarded only as electricity generation facilities. The nuclear power plant project, which consists of approximately 550 thousand components and equipment, will provide

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[18] Nuclear power plants produce continuously electricity generation without being affected by climate conditions. Capacity factor of any nuclear power plant is about %90; Nuclear power plants do not release greenhouse gases during operation. For this reason, they are an important alternative to prevent global warming; The cost of fuel in electricity unit cost pricing is exceptionally low compared to other sources. Therefore, the possible fluctuations in fuel prices can not affect the electricity production costs; Uranium, which is nuclear fuel raw material, has spread to different geographies in the world; The installation area of nuclear power plants is exceedingly small compared to all other power plants. For this reason, agriculture, inhabiting, and natural life are affected slightly.

[19] Nuclear plants established today considering the experiences, good practices and developing technology that have been experienced for about 70 years are referred to as 3rd (+) Generation. Cooling for 72 hours without external human intervention, airplane crash protection, passive safety systems, digital control rooms, compact equipment and system designs and other vital advancements made it possible for nuclear power plants to have a safer design.

By August 2019, 450 nuclear reactors have been operating in 31 countries and 52 nuclear reactors are being built in 19 countries. These reactors account for 10% of the world's electricity supply. On a country-by-country basis, By nuclear energy; France supplies about 72%, Ukraine 53%, Sweden 40%, Belgium 39%, European Union 28%, South Korea 24%, and USA 19% of their electricity demand.

There are 9 nuclear reactors that are being built in China, 7 in India and 6 in Russia. In addition, there are 2 nuclear reactors which are being built in the United States, 4 in the United Arab Emirates, 4 in South Korea, 1 in France and 1 in Turkey.

added value to our country's industry together with the dynamism and employment opportunities it provides to other sectors

j. Renewable Energy

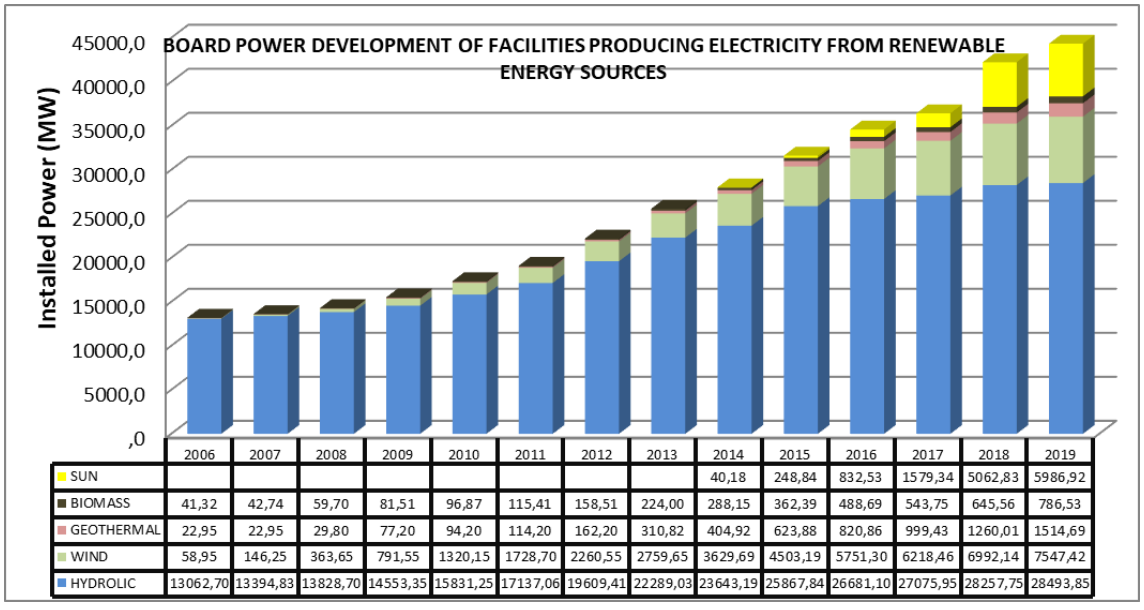
This paragraph has a big importance because Turkey is evaluating the development of renewable energy through the follow up of the works carried out with the European Union, and the collaboration with international organizations that Turkey are a member of (IEA, IRENA, KEI, G20, D-8, etc.)

Turkey has also created bases for energy statistics, evaluation, and policy/strategy determination studies; has determined Renewable Energy Resource Areas (YEKA), to declare the determined areas YEKA by conducting the necessary technical and administrative infrastructure studies and has organized YEKA Rights of Use Competitions within the framework of the Regulation on Renewable Energy Resource Areas.

The Development Plan includes a special section to these energies, intending to work on determining, and making maximum use of renewable energy sources potentials, and to make technical evaluations of the applications for unlicensed production and unlicensed production applications made to EMRA based on solar and wind energy, and to formulate opinions for the changes in the scope of the associate/license.

The next figure shows the development of facilities producing electricity from renewable energy sources:

Fig. No. 6. Board Development of facilities producing electricity from renewable energy sources:



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SUN									40,18	248,84	832,53	1579,34	5062,83	5986,92
BIOMASS	41,32	42,74	59,70	81,51	96,87	115,41	158,51	224,00	288,15	362,39	488,69	543,75	645,56	786,53
GEOTHERMAL	22,95	22,95	29,80	77,20	94,20	114,20	162,20	310,82	404,92	623,88	820,86	999,43	1260,01	1514,69
WIND	58,95	146,25	363,65	791,55	1320,15	1728,70	2260,55	2759,65	3629,69	4503,19	5751,30	6218,46	6992,14	7547,42
HYDROLIC	13062,70	13394,83	13828,70	14553,35	15831,25	17137,06	19609,41	22289,03	23643,19	25867,84	26681,10	27075,95	28257,75	28493,85

Wind and solar energy are the most important. [20] In the Turkey Development Plan, Electricity generation from renewable energy sources is specially considered (it "will be increased and necessary planning and

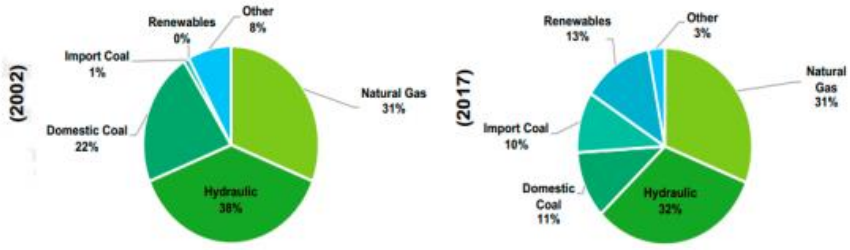
[20] Although solar energy technologies started in an experimental and narrow scope at the beginning, today it has become a new commercial sector, especially in terms of residential technologies. Especially being a clean energy source and working at almost zero cost after installation increases the importance of solar energy. Solar energy is used today as an alternative solution in developed countries to alleviate the environmental problems caused by fossil fuels. It is not possible to provide the energy requirement needed for industry, residences, or individual uses, directly from the sun as in plants. For this reason, solar energy can be used in various ways. Many technologies have been developed to take advantage of the sun's rays. Although solar energy technologies vary widely in terms of method, material, and technological level, some of them use solar energy directly as light or heat energy, while other technologies are used to obtain electricity from solar energy. Areas of use of solar energy include direct or indirect electricity generation, obtaining hot water, space heating and cooling, process heat energy for industrial organizations and greenhouse heating.

investments will be realized in order to ensure the safe integration of renewable energy generation to the grid"). Energy storage systems, including pumped storage HEPP, will be installed to eliminate the constraints of increasing renewable energy on the grid. Buildings that are more efficient and produce their own energy will be expanded. Energy efficiency in existing buildings will be promoted through support systems.

The Plan also mentioned the need to establish a National Green Building Certificate System

This also represents opportunities of inversion for Turkey. Therefore, the government aims to increase the ratio of renewable energy resources (RES) in total installed capacity to 30 percent by 2023. By this date, total energy investments are expected to be approximately $110 billion. At this stage, site selection and deciding appropriate RES are the most important feasibility parameters for investment. In this study, "Site Selection in Turkey" issue for RES (solar, wind, hydroelectric, geothermal, biomass) is evaluated by the ELECTRE which is one of the Multi Criteria Decision Making (MCDM) methods. The study emphasizes the importance of energy generation from renewable and sustainable sources and is concerned with improving the position of the country. The Turkish government offers many purchasing guarantees and high incentives, especially in the renewable energy sector. As a result of the analysis, the most suitable energy sources are presented according to the geography and energy potential of the regions. The study aims to inform energy firms, and everyone related with RES about Turkey's RES opportunities. [21]

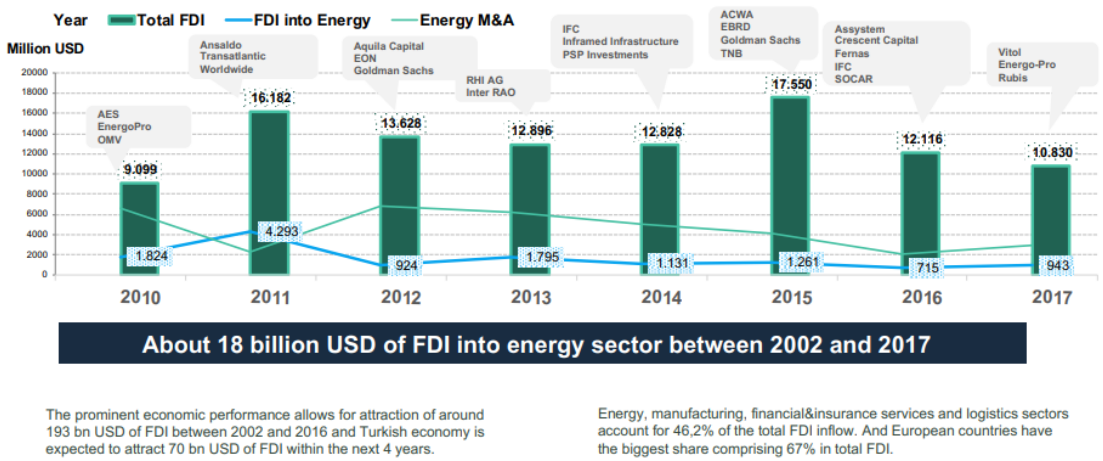
Figure No. 7. Comparison of installed capacity shares (%) in 2002 and 2017



The need for energy in Turkey until 2023 is expected to increase between 4–6 percent annually, so Turkey aims to increase the capacity of RES energy to 30 percent by 2023. The estimated energy investment will be approximately 110 billion dollars up to 2023. Therefore, Turkey is a significant market for companies and investors operating in the energy sector.

Figure No. 8. Investments in Turkey in energy in the last years

[21] Republic of Turkey, Ministry of Investment

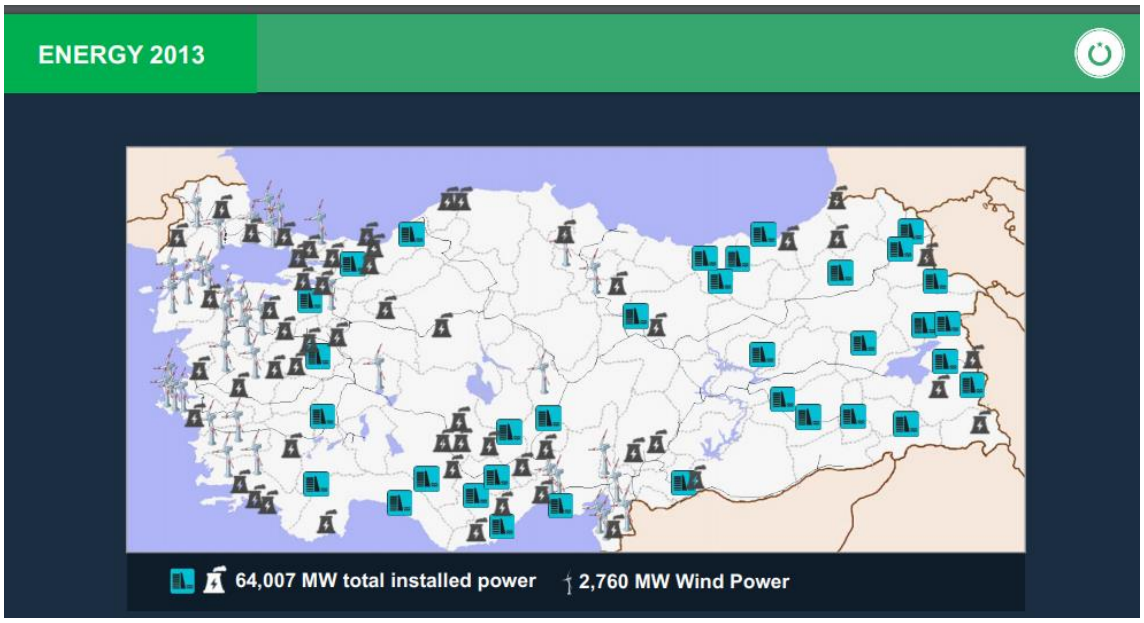


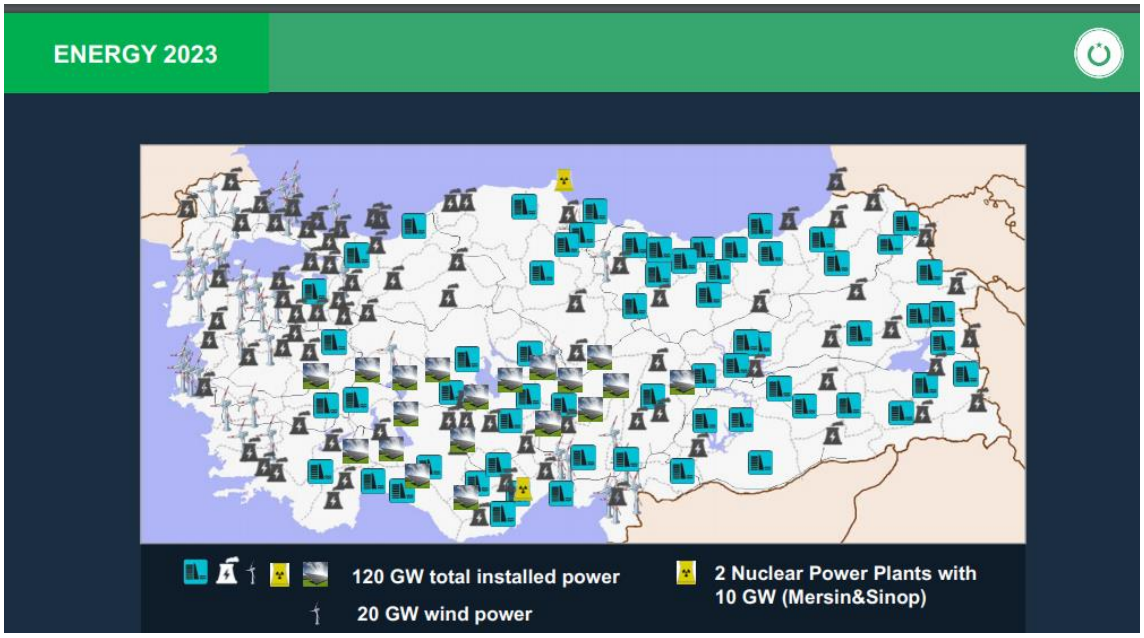
Source: Republic of Turkey, Ministry of Investment

The next figures show a comparison between the total installed power in 2013 and 2023.

Figure No. 9. Turkey Energy total installed power in 2013 and 2023

This project is co-funded by
the European Union and the Republic of Turkey





4.EMPLOYMENT:

According to Turkish Statistical Institute (TURKSTAT) – TÜİK (Table on Distribution of paid employees by sector), the sector D. Electricity and others has 114.929 employees, with an annual change of 1.7%.

Table No. 4. Distribution of paid employees by sector

Distribution of paid employees by sector, January 2021

Sector	Number of Paid Employee		Annual difference	Annual change%
	January 2021	January 2020		
B-N - Industry, construction, trade and services	**12 589 820**	**11 969 591**	**620 229**	**5.2**
B-E - Industry	**4 482 267**	**4 134 857**	**347 410**	**8.4**
B - Mining and quarrying	126 224	118 989	7 235	6.1
C - Manufacturing	4 178 170	3 841 481	336 689	8.8
D - Electricity, gas, steam and air conditioning supply	114 929	113 039	1 890	1.7
E - Water supply; sewerage, waste menagement and remediation activities	62 944	61 348	1 596	2.6
F - Construction	**1 318 984**	**1 079 830**	**239 154**	**22.1**
G-N - Trade and services	**6 788 569**	**6 754 904**	**33 665**	**0.5**
G - Trade	2 860 383	2 741 097	119 286	4.4
H - Transportation and storage	927 405	950 775	-23 370	-2.5
I - Accommodation and food service activities	781 236	940 467	-159 231	-16.9
J - Information and communication	230 958	211 934	19 024	9.0
K - Financial and insurance activities	203 060	204 588	-1 528	-0.7
L - Real estate activities	89 040	80 811	8 229	10.2
M - Professional, scientific and technical activities	559 998	521 995	38 003	7.3
N - Administrative and support service	1 136 489	1 103 237	33 252	3.0

Source: TUIK

Even when it is no possible to find much information on employment sub sectors in this area, we can particularly mention the needs of employment in two areas: nuclear and renewables energies. Related to nuclear energy, the Ministry of Energy and Natural resources consider for instance to meet the need for an engineer to work in Akkuyu, 88 of the 245 students who were sent to receive education in Russia graduated in the previous days and they have started to work within Akkuyu Nuclear Power Plant Project. Turkish students will be employed in different fields from engineering to managerial level in the Akkuyu Nuclear Power Plant Project.

Globally, the renewable energy sector employed 11.5 million people, directly and indirectly, in 2019. Renewable energy employment has continued to grow worldwide since 2012, when the International Renewable Energy Agency (IRENA) began to assess it on an annual basis. The solar photovoltaic (PV), bioenergy, hydropower and wind power industries have been the biggest employers. The bulk of global jobs relate to modern energy use, but the 2019 estimate includes jobs tied to the use of decentralised solar PV to expand energy access in parts of Sub-Saharan Africa and in South Asia. The figure 8 shows the evolution of IRENA's renewable energy employment estimates since 2012. **Most of these jobs are still held by men**. The share of women in the renewable energy workforce is about 32%, compared to 22% in the energy sector overall (IRENA, 2019).

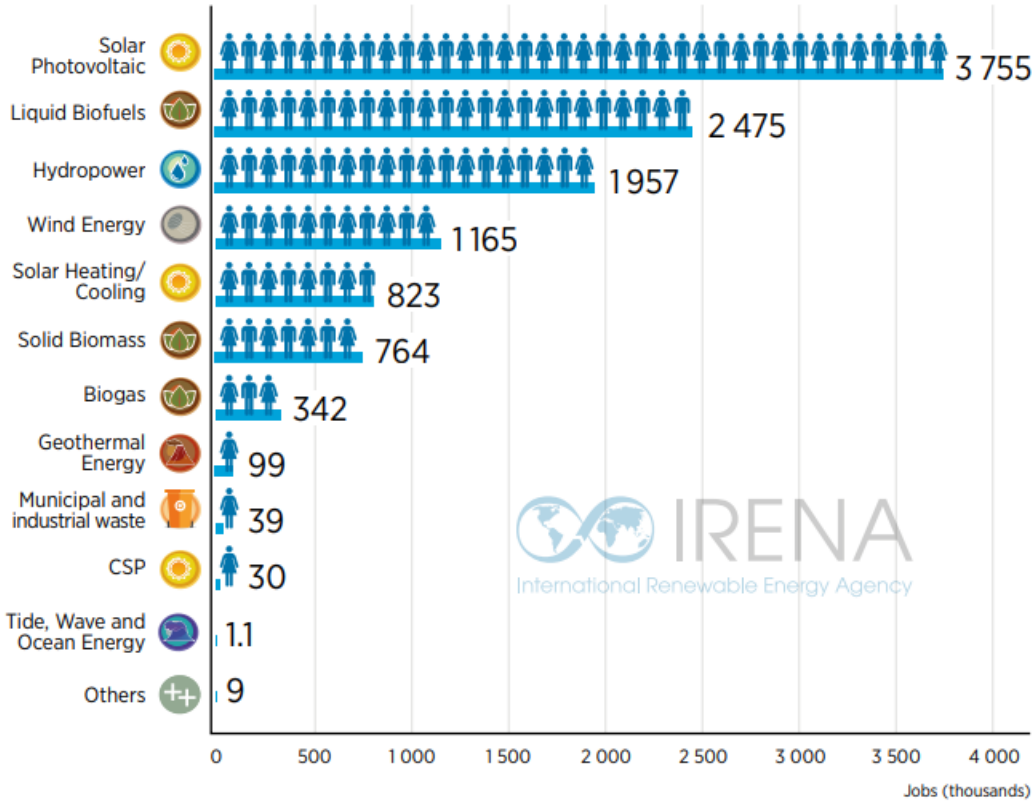
Although precise estimates remain scarce, off-grid decentralised renewables are creating a growing number of jobs, while also propelling employment in productive uses ranging from agro-processing and health care to communications and commerce in local communities. The solar PV industry retains the top spot, with 33% of the total renewable energy workforce. In 2019, 91% of global PV employment was concentrated in the ten countries that lead in worldwide deployment and in the production of equipment. Driven by output growth of 2% for ethanol and 13% for biodiesel, biofuels jobs worldwide expanded to 2.5 million.

Employment in wind power supports 1.2 million jobs, **21% of which are held by women**. Onshore projects continue to predominate, but the number of countries with offshore farms now stands at 18, up from 10 a decade ago. Supply chains are expanding.

Hydropower has the largest installed capacity of all renewables, but its growth is slowing. The sector employs close to 2 million people directly, many in operations and maintenance.

The next figure shows an estimate for employment in solar PV, liquid biofuels, wind, solar heating and cooling, and hydropower. Less information is available for other technologies such as biogas, geothermal energy, and ground-based heat pumps, concentrated solar power (CSP), waste-to-energy and ocean or wave energy. These other technologies also employ fewer people

Figure No. 10 Renewable energy employment by technology



Note: Others include jobs not broken down by individual renewable energy technologies.
Source: IRENA jobs database.

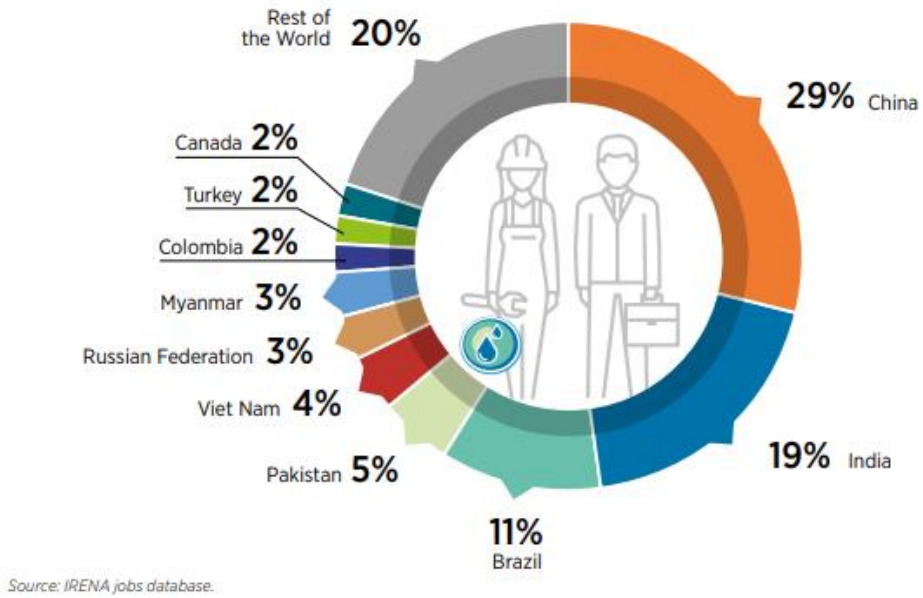
Source: IRENA

An important consideration on gender diversity in the Renewal Energies is that based on a survey of over 1 000 individuals and organisations, *IRENA's Wind Energy: A Gender Perspective* (IRENA, 2020, carried out in collaboration with the Global Wind Energy Council (GWEC) and the Global Women's Network for the Energy Transition (GWNET)) shows that the wind energy sector is male dominated, with women representing just 21% of the workforce (substantially lower than the 32% share of women in the renewable industry globally [IRENA, 2019]). While respondents perceived that women possess the required skills and knowledge, they highlighted perceptions of gender roles and culture social norms as major barriers to gender equality in the sector. The under-representation of women in the science, technology, engineering, and mathematics workforce (at just a 14% share) means that the wind industry is failing to tap a rich pool of talent that could add valuable perspectives and open new pathways for innovation. To address the persistent gender imbalance, the wind sector needs to diminish ingrained stereotypes, facilitate inclusion and more diverse perspectives, and replicate best practices. Some initiatives already recognise women as agents of change.

Other important consideration we want to add is about Hydropower. Given its deployment over many decades, hydropower is still the largest source of renewable electricity in the world, accounting for 44.6% of the total installed renewable energy capacity in 2019. China, Brazil, the United States and Canada were the top countries that year. However, global net additions of capacity in 2019 were the lowest in the last 17 years and 43% below the value in 2018 (IRENA, 2020a).

IRENA estimates jobs in the hydropower sector based on an employment-factor approach, which allows the revision of previous estimates and an examination of direct jobs in the main segments of the value chain: manufacturing, construction and installation, and operations and maintenance (O&M). The results reveal that approximately 1.93 million people worldwide worked in the sector in 2019.

Figure 11: Hydropower employment by country, 2019



Renewables energies represents great opportunities to Turkey for employment and to give an important opportunity for women in non traditional/stereotyped activites. For this possibility, the inclusion of more women in management teams is needed. Increasing the number and visibility of women leaders in executive positions as well as positively affecting women's employment, it will change the perception that the energy sector is a male-dominated world, and thus women are often exposed to glass It will help them “break the ceiling”.

Creating more flexible working conditions and comfortable working spaces it always helps. In addition to the perception that men are dominant in the energy sector, the perception that there is no work / private life balance should also be broken.

Other possibility is to attract women workers early to the energy sector. Young talents in the energy sector but especially for young women due to their potential to create a new perspective

5. EDUCATION RELATED TO EMPLOYMENT IN THE SECTOR

Building the skills base necessary to support the ongoing global energy transition from fossil fuels to renewables requires more vocational training, stronger curricula, more teacher training and expanded use of information and communications technology for remote learning.

One of the subjects discussed globally are the possibility that **renewable energy can be better integrated into national curricula** – not only in science and technology but also in social studies – for students in primary, secondary, and tertiary education and at technical and vocational institutions. Industry leaders can play a major role in imparting that knowledge – and thus in educating the workforce of the future. The chronic shortage of skilled workers in expanding access to modern forms of energy could constitute a major barrier to the deployment of renewables. Installations undertaken by unskilled workers can result in performance issues and a negative perception of renewable technologies. Training initiatives are critical to forestall such outcomes and instead translate potential benefits into reality.

Other possibility is the **technology-enhanced learning** Innovations in the use of ICT can play an important role in the delivery of education and training related to renewable energy. Models and simulations can be used to build learners' technical skills, and flexible delivery of online content can improve access for learners. Learning-management systems can be applied to deliver personalised learning content that considers the different starting points of learners. ICT can also be used to increase collaboration between industry and technical and vocational education and training (TVET) institutions, thus allowing experts to contribute to the curriculum as well as deliver instruction digitally. [22]

Public-private partnerships Engaging the private sector is crucial for meeting sectoral labour requirements, promoting national skill standards, providing on-the-job training, and improving the quality of training overall. Public-private partnerships can play an especially important role in TVET. The private sector can contribute to skill delivery in several ways, including course delivery, work-based learning and apprenticeships, and transfers of knowledge and equipment. The private sector is playing an increasingly significant role in the financing of TVET programmes. Dunbar (2013) discusses the need to move away from the traditional fragmented model of training markets, which are financed primarily through fees, toward a more integrated market that incorporates a range of funding mechanisms, including payroll-based training levies, tax incentives, scholarships and donations, vouchers, and student loans.

Educating girls and women in the renewable energy sector, women's participation in science, technology, engineering, and mathematics (STEM) jobs is far lower than in administrative jobs (28% versus 45%) (IRENA, 2019). The difference is more pronounced in the wind energy sector, where women account for only 14% of the STEM total, compared to 45% in administrative jobs (IRENA, 2020). Strategies to increase the representation of women in the renewable energy sector often focus on workplace accommodations, mentorship, and professional development. These approaches reach only the small number of women who have already made a conscious career path decision. Influencing the choices girls make earlier in life, when aspirations and affinities are still being discovered, can help increase the number of women in the renewable energy sector specifically, as well as in STEM fields more broadly. Early career choices are often shaped by gendered cultural norms and perceptions.

6. ANALYSIS OF THE MARKET

Even when many of our conclusions are included in the point 4. Employment and 5. Education for employment with a real gender perspective, we would like to add that:

- In our societies, a job is how most working people secure an income for themselves and their families. Beyond ensuring an adequate number of jobs, labour representation is often essential to ensuring good jobs that will provide an adequate wage or salary in a safe and productive workplace.
- Jobs build experience, hone skills and can provide a path to self-fulfilment by way of a worker's pride in performing a task well or in helping a community or country accomplish an important objective, such as creating a clean energy system.

[22] Technology-based learning, however, can result in greater inequality in areas where low-income communities lack access to the requisite equipment and infrastructure.

- Jobs in renewable energy are important beyond the energy sector: incomes spent on food or consumer goods and services stimulate many different industries in local, national, and global economies.
- Available evidence suggests that renewable energy employs more people than do fossil fuels. An input output analysis (Garrett-Peltier, 2017) performed to evaluate public and private energy investment found that, on average, spending USD 1 million on renewables creates 7.49 FTE jobs, almost triple the 2.65 FTE jobs in fossil fuels.
- Learning curves, economies of scale and new technologies such as drones and artificial intelligence will shape the labour intensity of renewables in years to come. The dynamics will probably differ somewhat in the agricultural supply chains for bioenergy, where informal employment is often the norm in developing countries

7. ENERGY SECTOR FACTSHEET

	QUANTITATIVE AND QUALITATIVE DATA
BASELINE	• **Electricity:** Electricity consumption is expected to increase by 4.3% annually, reaching 375.8 TWh in 2023 in the base scenario. As the end of the 2018, 37.2% of Turkey electricity generation was obtained from coal, 30.3% from natural gas, 19.7% from hydropower, 6.5% from wind, 2.6% from solar energy, 2.4% from geothermal and 1.3% from other sources. • **Crude Oil:** There are 41 (19 foreign + 22 native) Investor Companies and 265 license owners. On Exploration - Production Sector of Contribution to the Turkish Economy (2001 - 2018), there is 9,5 millard USD on investment, the Domestic Production Market Value was 8,3 billion TL and there are 10.000 people employed. • **Natural Gas:** Turkey consumed about 45.3 billion m3 in 2019, a total of 483 million m3 of natural gas and production, most of them imported. • **Hydroelectricity:** The hydroelectricity potential of Turkey is 1% of theoretical potential of the world, while its economic potential is 16% of the economic potential of Europe. By the end of the 2018, 653 operational hydroelectricity power plants having a total of 28,291 MW have 31.9% share in Turkey's total installed capacity. • **Wind:** Wind plants with a capacity of 5 MW can be established in Turkey at heights of 50 meters above ground level, and in areas with a wind speed exceeding 7.5 m/s. • **Solar:** Turkey has high solar energy potential due to its geographical location. The energy potential that can be produced from the sun is approximately 380 billion kWh. • **Nuclear:** Nuclear power plants should be not regarded only as electricity generation facilities. The nuclear power plant project, which consists of approximately 550 thousand components and equipment, will provide added value to Turkey´s industry together with the dynamism and employment opportunities it provides to other sectors. • **Renewable Energy:** Turkey has also created bases for energy statistics, evaluation, and policy/strategy determination studies; has determined Renewable Energy Resource Areas (YEKA), to declare the determined areas YEKA by conducting the necessary technical and administrative infrastructure studies and has organized YEKA Rights of Use Competitions within the framework of the Regulation on Renewable Energy Resource Areas. • The Development Plan includes a special section to these energies, intending to work on determining, and making maximum use of renewable energy sources potentials, and to make technical evaluations of the applications for unlicensed production and unlicensed production applications made to EMRA based on solar and wind energy, and to formulate opinions for the changes in the scope of the associate/license. • According to Turkish Statistical Institute (TURKSTAT) – TÜİK the sector D. Electricity and others has 114.929 employees, with an annual change of 1.7%. • There are employment needs in two areas: nuclear and renewables energies (Globally, the renewable energy sector employed 11.5 million people, directly and indirectly, in 2019). • Employment in wind power for example, supports 1.2 million jobs, 21% of which are held by women. An important consideration on gender diversity in the

	Renewal Energies shows that the wind energy sector is male dominated, with women representing just 21% of the workforce. • Renewable energies represent great opportunities to Turkey for employment and to give an important opportunity for women in nontraditional/stereotyped activities. For this possibility, the inclusion of more women in management teams is needed. • Other possibility is to attract women workers early to the energy sector. Young talents in the energy sector but especially for young women due to their potential to create a new perspective.
POTENTIAL	• Turkey has the highest rate of growing energy demand among OECD countries over the last 15 years. Located near around seventy percent of the world's proven oil and gas reserves, Turkey is one the biggest natural gas and electricity markets in its region. • Turkey produces its own lignite (brown coal) but imports three-quarters of its energy, including half the coal and almost all the oil and gas it requires. • Turkey gives an important place to Renewable Energy and became a founding member of International Renewable Energy Agency (IRENA) on 26 January 2009. • The "Green Tariff" has become available from August 2020. Consumers who wish to procure electricity exclusively from renewable resources may opt for the application of "Green Tariff" and purchase electricity at the prices specified in such Tariff. • Turkey has undertaken and carried out several important natural gas and oil pipeline projects in the region. In this scope, South Caucasus Pipeline (SCP), Baku-Tbilisi-Erzurum Natural Gas Pipeline (BTE), Turkey-Greece Interconnector (ITG) and the Trans-Anatolian Natural Gas Pipeline (TANAP) projects have already been realized. These projects can be considered within the Southern Gas Corridor (SGC) concept. • For the Plan of Development, the main objective is to ensure uninterrupted, high-quality, sustainable, reliable, and affordable energy supply.
SKILLS	• Building the skills base necessary to support the ongoing global energy transition from fossil fuels to renewables requires more vocational training, stronger curricula, more teacher training and expanded use of information and communications technology for remote learning. • One of the subjects discussed globally are the possibility that renewable energy can be better integrated into national curricula – not only in science and technology but also in social studies – for students in primary, secondary, and tertiary education and at technical and vocational institutions. • Industry leaders can play a major role in imparting that knowledge – and thus in educating the workforce of the future. • Other possibility is the technology-enhanced learning Innovations in the use of ICT can play an important role in the delivery of education and training related to renewable energy. • Public-private partnerships for meeting sectoral labour requirements, promoting national skill standards, providing on-the-job training, and improving the quality of training overall. • Educating girls and women in the renewable energy sector, women's participation in science, technology, engineering, and mathematics (STEM) jobs is far lower than in administrative jobs.
AREAS FOR POSSIBLE POLICY INTERVENTION	• Jobs in renewable energy are important beyond the energy sector: incomes spent on food or consumer goods and services stimulate many different industries in local, national, and global economies.

	• Available evidence suggests that renewable energy employs more people than do fossil fuels. And it represents a real opportunity for women. A specific policy of care must be needed.

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This project is co-funded by
the European Union and the Republic of Turkey

This publication was prepared with the financial support of the European Union. The content is totally under the responsibility of the consortium lead by WEglobal Consultancy Inc. and does not necessarily reflect the opinions of the European Union.