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Biyokütle Enerji Kullanımı Açısından İran ve Türkiye'nin Karşılaştırılması

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ÖZ:

Biyokütle enerjisinin sürdürülebilirlik, yerel kaynaklardan elde edilebilirlik ve çevre üzerinde olumsuz bir etkisi olmaması gibi avantajları vardır. Biyokütle enerjisi, çevre dostu sürdürülebilir enerji üretimi ve gelişimini hedefleyen ülkeler için de önemli bir hedeftir. İran ve Türkiye, bölgenin sosyal, ekonomik ve siyasi ilişkilerinde tarihi bir geçmişe sahiptir. Her iki ülkenin de kalkınma çabaları olsa da en önemli konu enerji arzı ve güvenliği olarak öne çıkıyor. Bu doğrultuda çalışmanın amacı, her iki ülkenin yenilenemeyen enerji kaynakları dışındaki biyokütle enerjisi kullanımlarını karşılaştırmak ve bu konudaki çaba ve potansiyelleri ortaya koymaktır. Sonuçta yenilebilir enerji her iki ülke için de önemli bir yerli kaynak olarak ortaya çıkmıştır. Aşılması gereken sorun olarak da teknoloji geliştirilmesidir

ANAHTAR KELİMELER: Yenilenebilir enerji, bioenerji, biomas, Türkiye, İran, kalkınma.

ABSTRACT:

Biomass energy has some advantages such as sustainability, availability from local resources and no adverse effects on the environment. Biomass energy is also an important goal for countries aiming for environmentally friendly sustainable energy production and development. Iran and Turkey are two neighboring countries in the region and they have social, economic and political relations presently as happened in the past. Although both countries have development efforts, the most important issue stands out as energy supply and security. In this respect, the aim of the

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study is to compare the biomass energy use of both countries other than non-renewable energy sources and to reveal the efforts and potentials in this regard. As a result, renewable energy has emerged as an important domestic resource for both countries. The problem to be overcome is the development of technology.

KEYWORDS: Renewable energy, bioenergy, biomass, Turkey, Iran, development.

"Comparison of Iran and Turkey in Terms of Biomass Energy Use"

1. INTRODUCTION

The use of woody biomass remaining from forestry activities as an energy source has gained importance in recent years due to the compelling effect of international decisions taken to prevent climate change and the increase in fuel prices (Bougnom et al, 2012; Brack, 2007). Because of the development of human societies and industries in developing countries, the global demand for renewable energy supply is growing rapidly. Major energy demand is still met by fossil fuels such as oil, coal, and natural gas, and the excessive consumption of fossil fuels over the past century made many problems all over the world such as greatly increased the level of polluting gases including greenhouse gases such as carbon dioxide, methane, nitrous oxide, and Chlorofluorocarbons in the Earth's atmosphere (Figure 1).

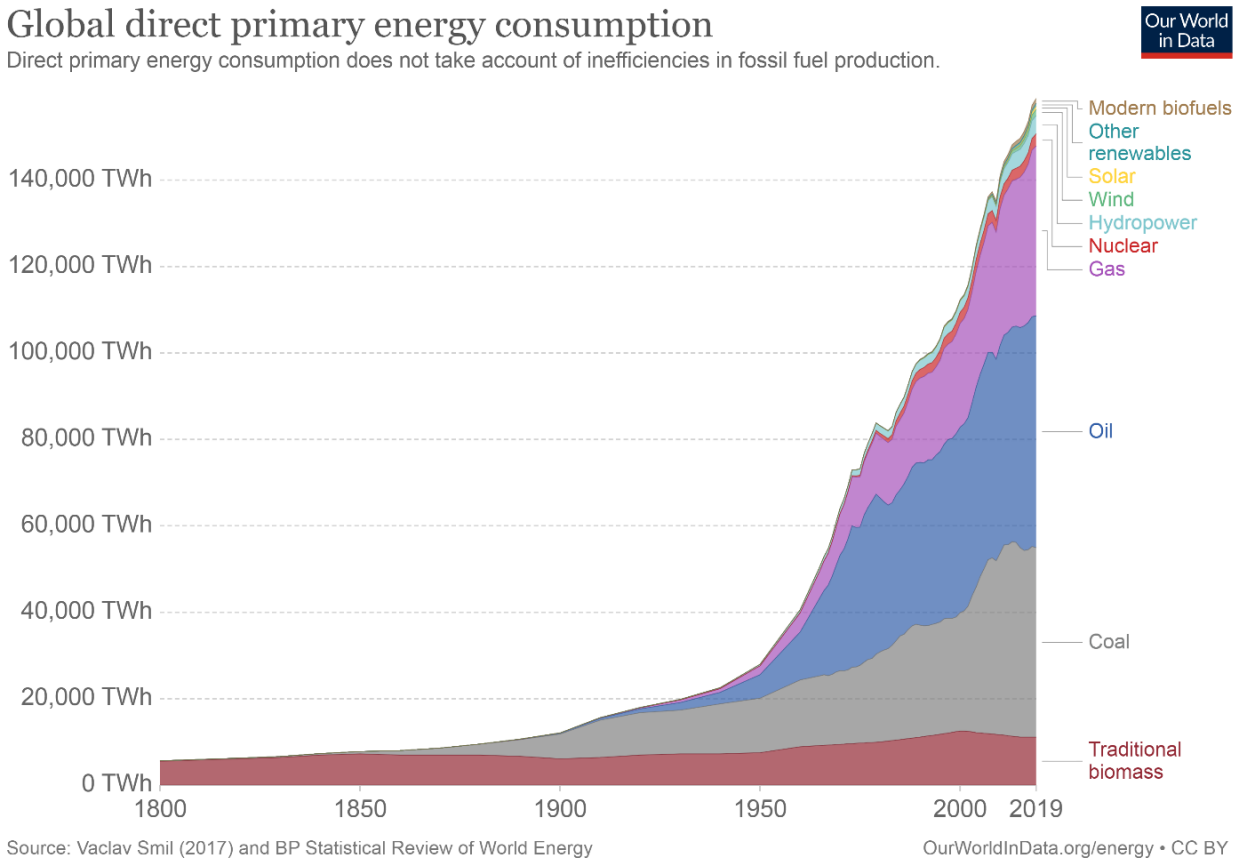

Figure 1. Primary energy consumption in the world

As seen in the energy consumption graph created by Smil (2017) and British Petroleum Statistics in Figure 1, the use of coal and oil increase dramatically. These gases can trap heat in the atmosphere and cause many problems such as acid rains, global warming and changes in the ecosystem (Kargari and Rezaeinia, 2020). These factors, along with minimizing global energy supply, oil market instability and financial crises, have led to the search for alternative fuels. Concerns about climate change and the security of energy supply have largely led to the production of

renewable energy from biomass, and today many countries around the world are seeking to increase the production of renewable energy from natural resources (URL-1; Ballesteros et al, 2006). According to the British Petroleum statistical data, the consumption of primary energy in Iran is 4.16% and 2.11% of the world and Asia in 2019, respectively (URL-2).

2. COMPARISON OF ENERGY CONSUMPTION BETWEEN TURKEY AND IRAN

As shown in Figure 2a and Figure 2b energy consumption in Iran is higher than in Turkey. Energy consumption in Iran is almost 68% higher than the average energy consumption in the world, which will lead to harmful consequences in the terms of environment, public health, and economy (Sarraf et al., 2005; Balances, 2001). Natural gas and oil are The main sources of energy and both sources are used for industrial or house applications in Iran. It's the same situation although the amounts differ from each other also applies to Turkey.

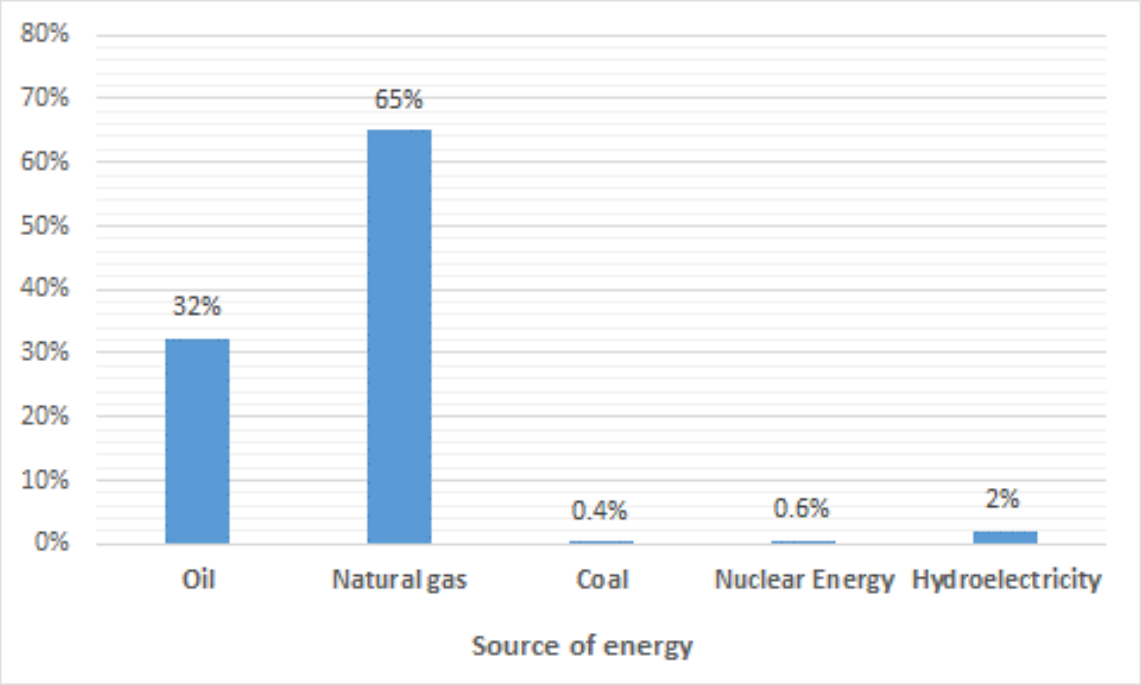

Figure 2a. Energy consumption of Iran in 2019

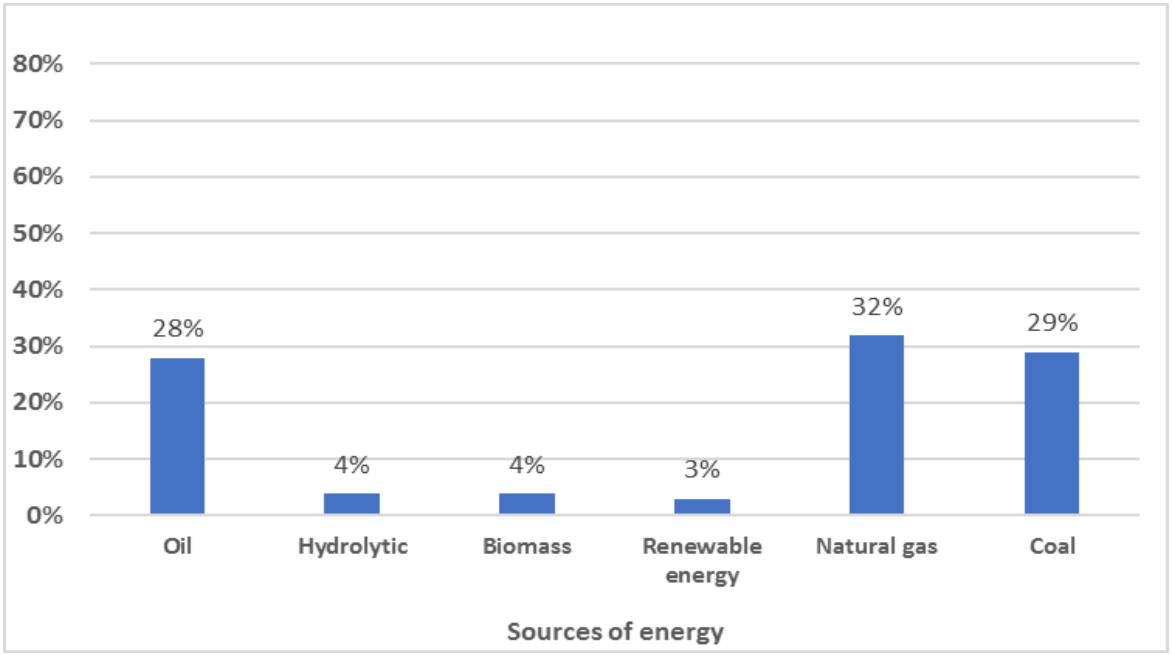

Figure 2b. Energy consumption of Turkey in 2019

The orientation towards renewable energy is of great importance for both countries. Turkey's energy resources are more limited compared to Iran. While Iran is a natural gas producer, Turkey is a consumer. However, this situation does not prevent countries from investing in renewable energy resources. The population of both countries over 80 million clearly shows the need for development and energy. In addition to the high population, the population growth rate is one of the most important indicators showing that the energy need will be higher in the future.

2.1.The Place of Renewable Energy in Energy Consumption

Renewable energy refers to the types of energy that are produced from natural resources and this type of energy could be re-created or renewed by nature in a short period of time. Solar energy, wind power, hydropower or waterpower, geothermal energy, tidal energy, biomass energy, wave power and fuel cell are some types of renewable energy.

Nowadays, due to a high rate of biomass resources in Iran (around 25 million tons) and Turkey (around 17 million tons), many technologies have been developed or have being developed for various sources and their applications both in Iran and Turkey (Nabavi et al, 2020; İlleez, 2020). Biomass is the mass of living organisms which include plants, animals, and microorganisms, or biochemically, cellulose, lignin, sugars, fats, and proteins. Biomass consists of both upper and underground tissues of plants, for instance, leaves, branches, as well as tree roots. Moreover, the unit of biomass is often reported as mass per unit area and usually as dry weight (Searchinger et al, 2008). Biomass is one of the major sources of renewable energy sources, which includes biodegradable components of agricultural and wood wastes, animal and plant wastes, and related industries, as well as biodegradable industrial and urban wastes. According to the scientific definition of biomass, biomass refers to fuels that are made from the mass of phytoplankton and the mass of zooplankton.

Moreover, using the projected potentials of renewable energy will not only help to energy extraction but it has some advantages in reducing pollution and environmental issues by waste management. According to the statistical review of world energy, the rate of renewable energy production in Iran increased compared to 2018 that the growth rate per annum in 2019 was 12.5% (URL-2, 2020). According to figure 3, urban wastes and agricultural wastes are the main sources of biomass in Iran (Ahmadi et al, 2020). Turkey General Directorate Energy Affairs of institutions attached to the Ministry of Energy and Natural Resources (MoENR) by biomass energy potential in Turkey's 2019 results are shown in Figure 3 too.

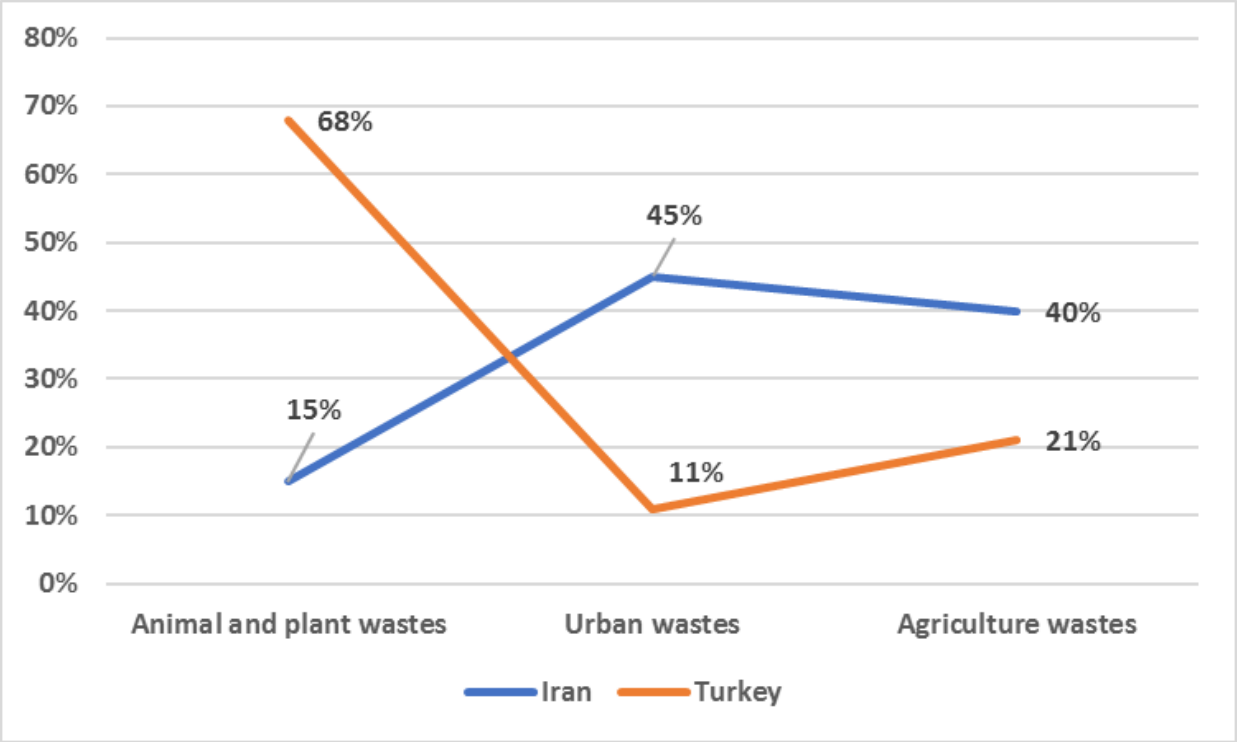

Figure 3- Biomass resources in Iran and Turkey

Due to the high forests, pastures, and agricultural lands in Iran and Turkey, agricultural and forest wastes are mentioned as one of the main sources of biomass energy production that this source is classified as below Figure 4 (URL-1).

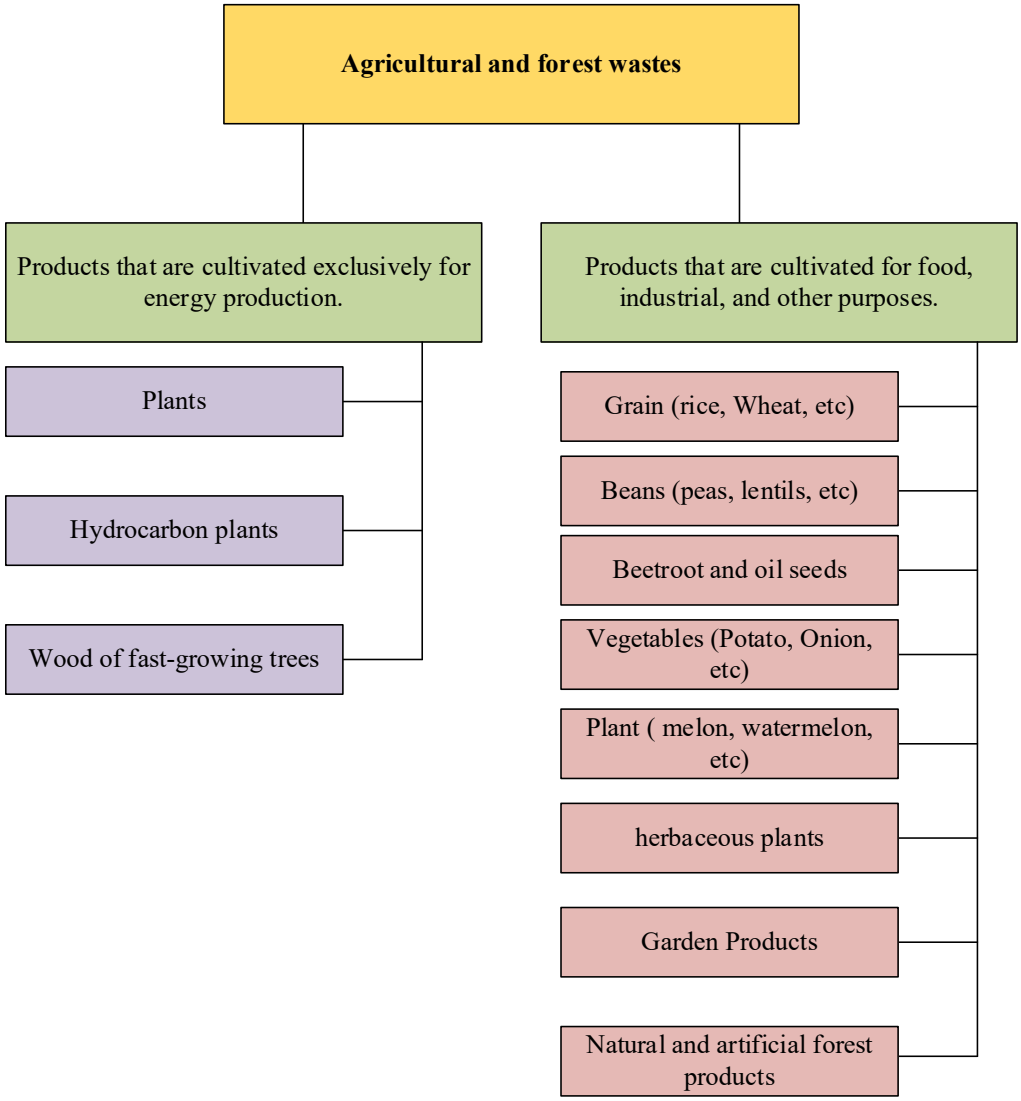

Figure 4- Types of agricultural waste

In this study, we collect some data about the production of renewable energy from biomass and introduce some factors for this process. Our main aim in this project is to delineate some significant information and compare them between Iran and Turkey.

2.2. Bioenergy Applications with a Global Approach

Bioenergy is a biological substance derived from plants and lignocellulosic materials. Biomass as a renewable energy source can be used directly through combustion (Heat generation) or indirectly after converting into various forms of biofuels. Different biomass technologies are at different stages of development from laboratory development scale to fully commercialize. The use of biomass energy is currently classified into three conventional methods (URL-1).

1. Combustion (incinerators, wood burners, carbonization charring)
2. Thermochemical (plasma, gasification, pyrolysis)
3. Biochemical (landfill, anaerobic digestion, biofuel production)

Biofuels has fewer disadvantages compared to fossil fuels, especially about environmental issues. There are two types of biofuels that consist of liquid and gas. One of the most common uses of biomass is energy generation in the

form of biofuels that the production and consumption of biofuels are shown in Figure 5. Biomass can generate electricity or heat, unlike fossil fuels, biomass resources are replaced easily and quickly. Also, by producing fuel from these sources, less carbon dioxide enters the atmosphere. Biomass is converted into energy and other products in a variety of ways; Methods of energy conversion include direct combustion, gasification, and a combined cycle power plant.

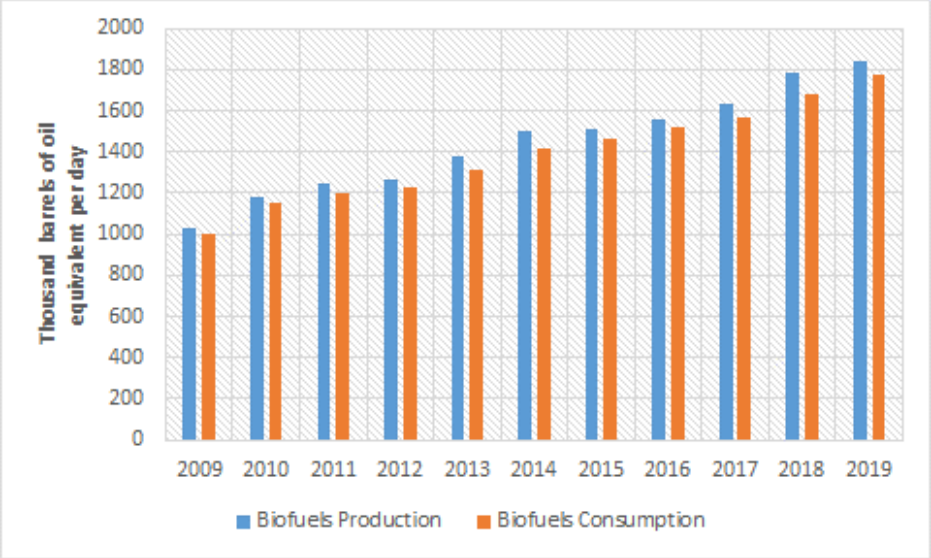

Figure 5-Biofuels Production and Consumption in the World

In general, biofuels are used for transportation, and annual plants such as canola, sugarcane, and cereals are the main biomass resources to produce bioenergy while electricity and heat energy are produced from woody and herbaceous plants such as switch grass, giant straw, willow, poplar (Zegada-Lizarazu and Monti, 2011). Advanced methods can convert biomass directly into oil, diesel, and jet fuel. Generally, generation electricity and biofuels are the main outcomes from the process on the biomass. According to the following Figure 6, the production of biofuels from wood resources has the highest value in the world.

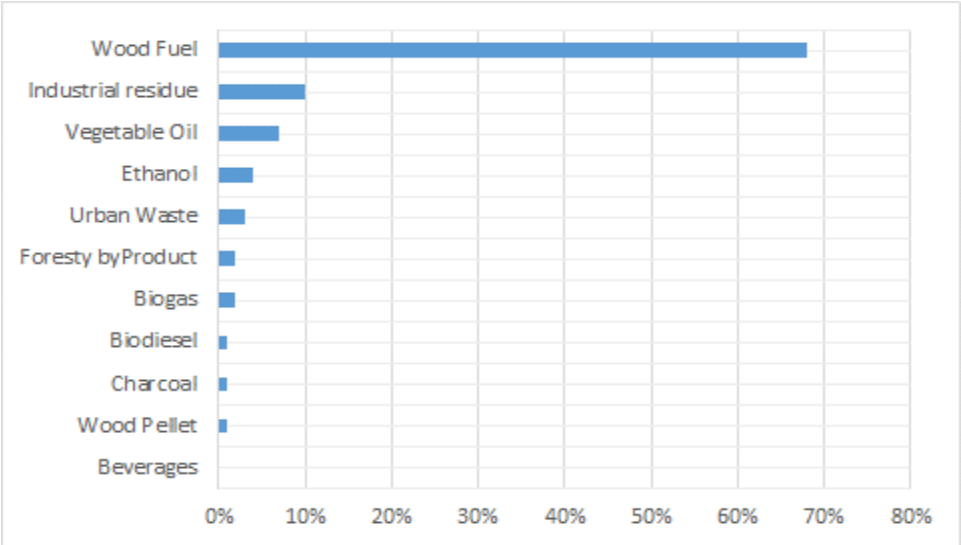

Figure 6- Global biomass distribution in the world (Searcy et al, 2007; IEA, 2018)

The following figure indicates that the cost of the generation of 1 MWh electricity by various types of energies. According to Figure 7, solar energy has the highest cost for production.

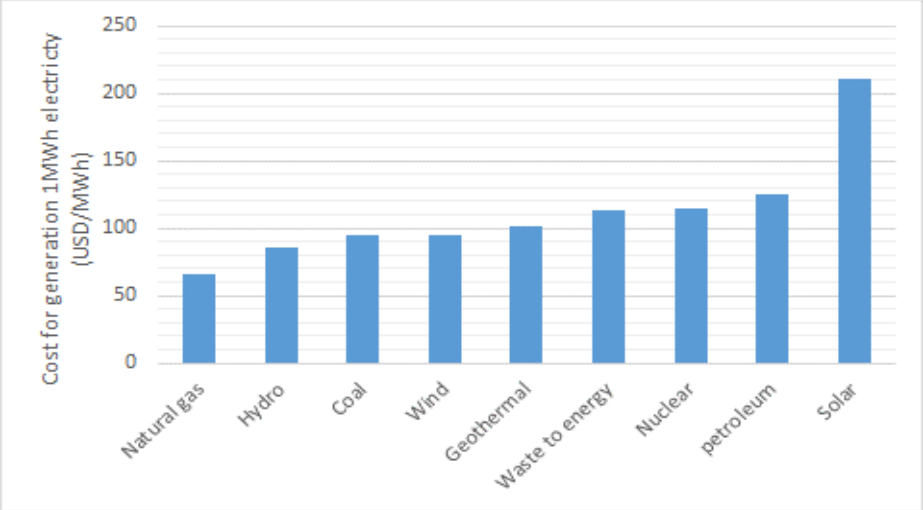

Figure 7- Cost for production energy in the world (Searcy et al, 2007)

On the other hand, in the evaluation made by IRENA (2020) in terms of renewable energy sources, it is seen that especially renewable energy generation prices are decreasing every year (Figure 8). The increase in the production of nuclear energy can be interpreted as an indication that environmental concerns come to the fore, especially despite the production cost in terms of solar energy. On the other hand, the same graph shows that investments in solar energy have increased and diversified, and the costs have decreased further.

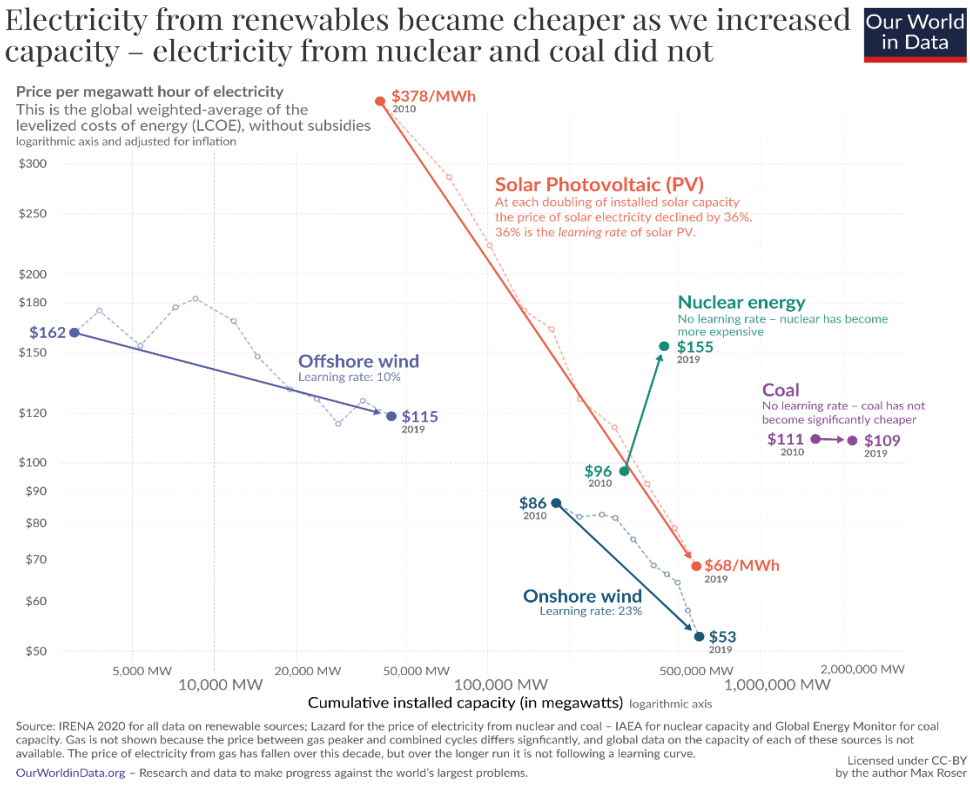

Figure 8- Cost for production energy in the world (IRENA, 2020)

3. BIOMASS RESOURCES IN IRAN

Nowadays, many different agricultural crops have been analyzed or suggested for energy production that these agricultural crops consist of woody plants, annual and perennial herbaceous plants, sugar and starchy plants, and oilseeds. Among the plants that are used for biomass energy production, some are common in the biorefinery process such as corn, cotton, poplar, sorghum, sugarcane, bamboo, eucalyptus, oil palm, etc. and according to Figure 9, distribution of renewable power plant in Iran can be shown that it can be seen the high concentration of biomass power plant in the center of Iran.

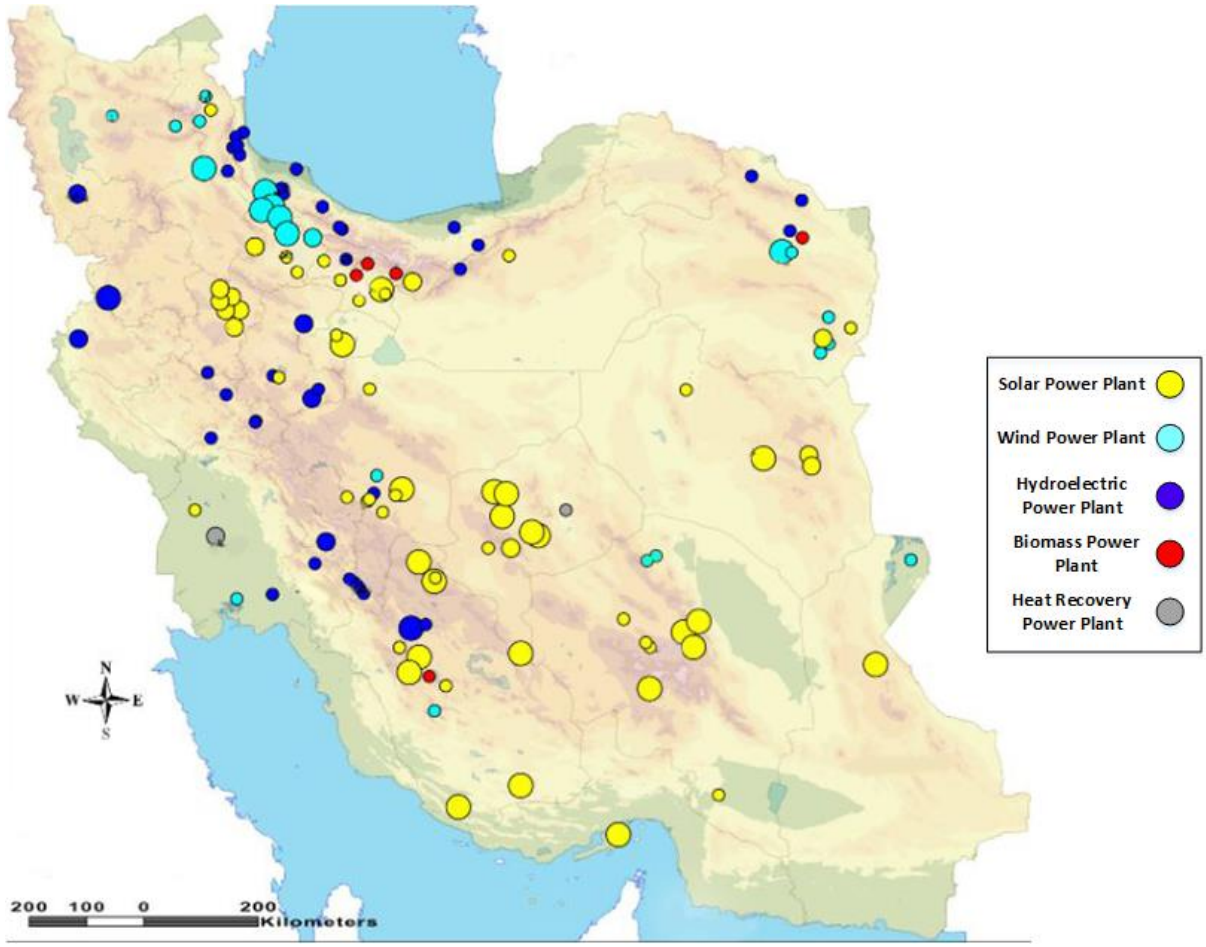

Figure 9-Distribution of Renewable energy in Iran (URL-1).

3.1.Agriculture and Wood Wastes

Agricultural product wastes include straw and other plant wastes that cannot be marketed. In Iran, more than 200 million tons of agricultural waste is produced annually. This amount of waste will meet 10 to 15 percent of the country's energy needs. Wood fuel is a term that refers to a variety of fuels from forest waste that can be used as raw material for producing energy in power plants. Iran's forests can produce a significant amount of biomass annually and significant energy can be extracted if biofuel power plants are constructed and developed (URL-1).

In addition, due to the vast arable lands and lands under the cultivation of agricultural products in different parts of Iran, they are the main source of biomass. As seen in Figure 10, the density of biomass resources in the northern and western parts of Iran is higher than in other places.

Figure 10-Distribution of agricultural biomass resources in Iran (URL-1)

Wood or wood fuels is a term, including types of fuels from the waste of forest resources, waste from wood and paper industries, and processing facilities adjacent to forest areas that this type of fuel can be used as a material primarily in power plants to supply energy to the same or other industries. As shown in Figure 11, wood fuel production in Iran has decreased from 2010 to 2019.

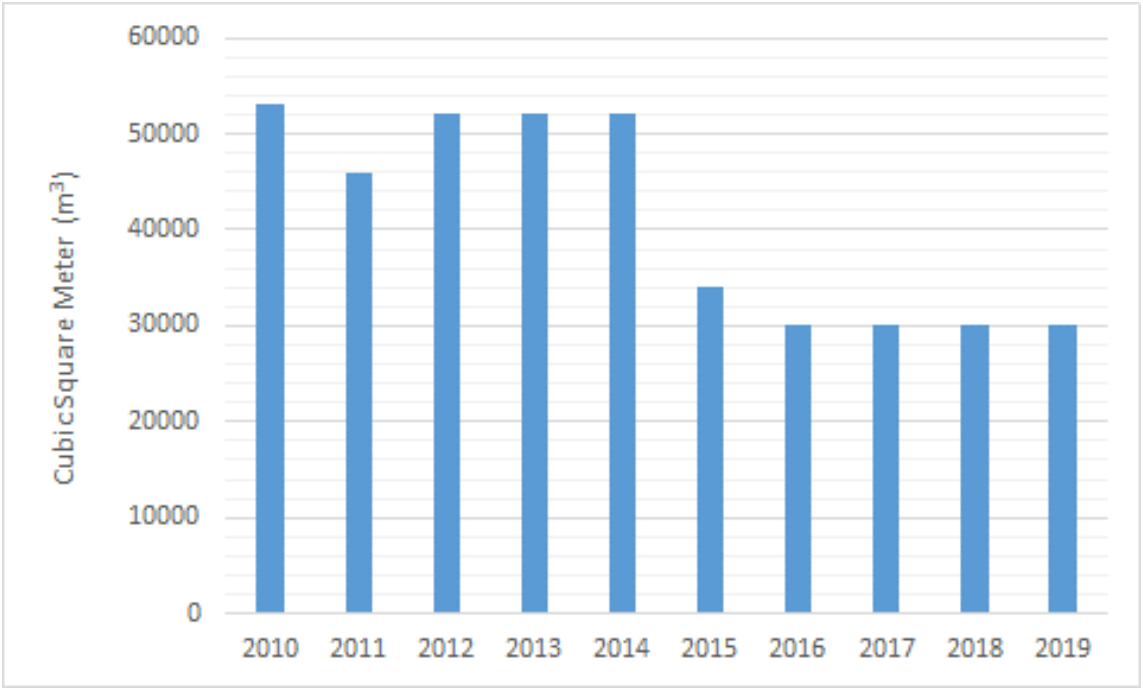

Figure 11- Fuel wood production in Iran (FAO, 2020)

According to the high density of the forest region in northern Iran, there is the main source of forest biomass in that region as seen in Figure 12. The potential of biomass in this region is approximately between 6500 to 7200 tones but other places in the west and northwest of Iran have a smaller amount compared to the north region.

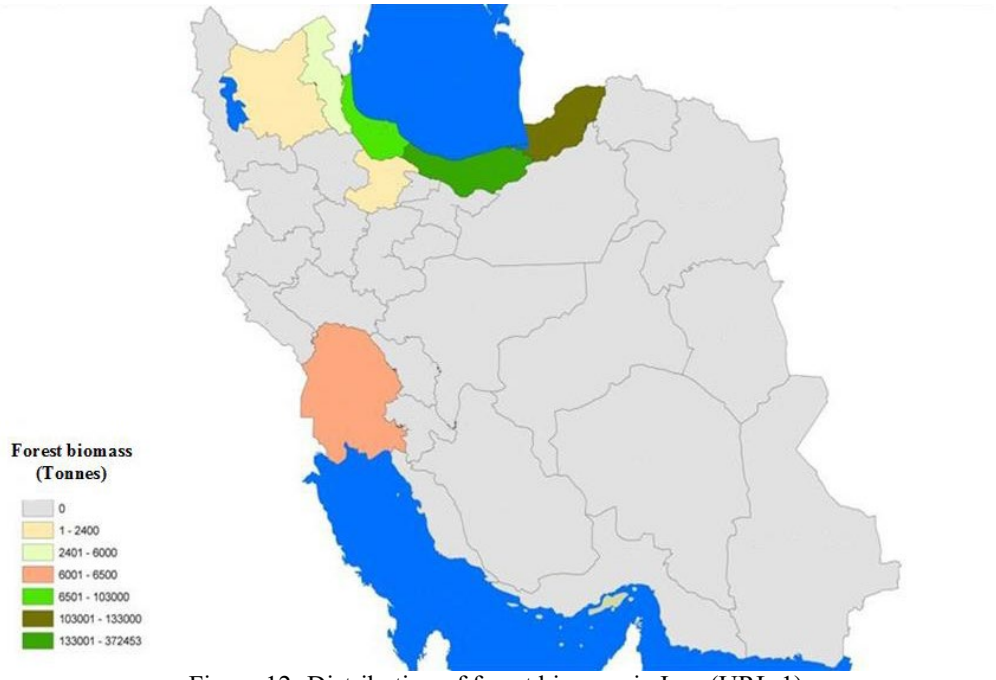

Figure 12- Distribution of forest biomass in Iran (URL-1)

3.2. The Place of Biomass in Electrical Energy

Biomass power plants can provide part of the energy required by the country and they can be effective in resolving the huge environmental crisis caused by household waste and various organic pollutants, both solid and liquid, and they have significant economic effects on the country. One of the serious problems in the research and development of biomass power plants in Iran is accessibility to energy resources. While bioenergy has many advantages for environmental issues as well as employment in this industry. According to Figure 13, natural gas and oil are the main energy in Iran (URL-1).

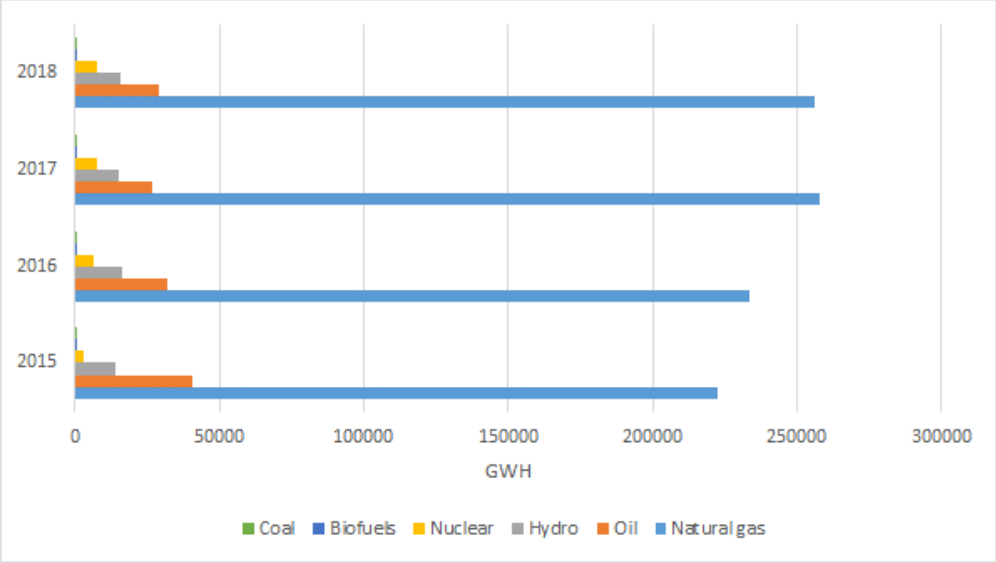

Figure 13-Energy production by sources in Iran (IEA, 2018)

4. BIOMASS RESOURCES IN TURKEY

In terms of biomass material production, Turkey is a country with suitable features such as land availability, water resources, and climatic conditions. Every year, 5.4 million tons of oil equivalent of the energy potential of agricultural residues can be achieved in Turkey (Karayılmazlar et al, 2011). In addition, there is a potential corresponding to 5.9 million tons of wood, forest and industrial waste and 1.5 million tons of oil equivalent as animal waste (Yıldırım and Ünsal, 2012). The share of organic waste in Turkey is 65% of the overall total waste. Therefore, Turkey is said to have a very large capacity for organic waste (Yıldırım and Candan, 2013). However, it is seen that most of these wastes are dumped into the environment in an uncontrolled manner and left to rot (Şenol, 2017). This means appears as environmental pollution. Therefore, the evaluation of these wastes is important in terms of both environmental pollution and energy need.

The amounts of energy generated from renewable energy sources in Turkey by MoENR (Republic of Turkey Ministry of Energy and Natural Resources) are shown in Figure 14. The number of renewable energy power plants are composed of 269 solar, 112 wind, 412 hydrological, 21 geothermal, and 59 biomass-based. In Turkey, 32 percent hydroelectric power, 10.2 percent wind power, 7.5 percent solar power, 1.7 percent geothermal and 1.8 percent biomass power plants constituted the installed power of Turkey.

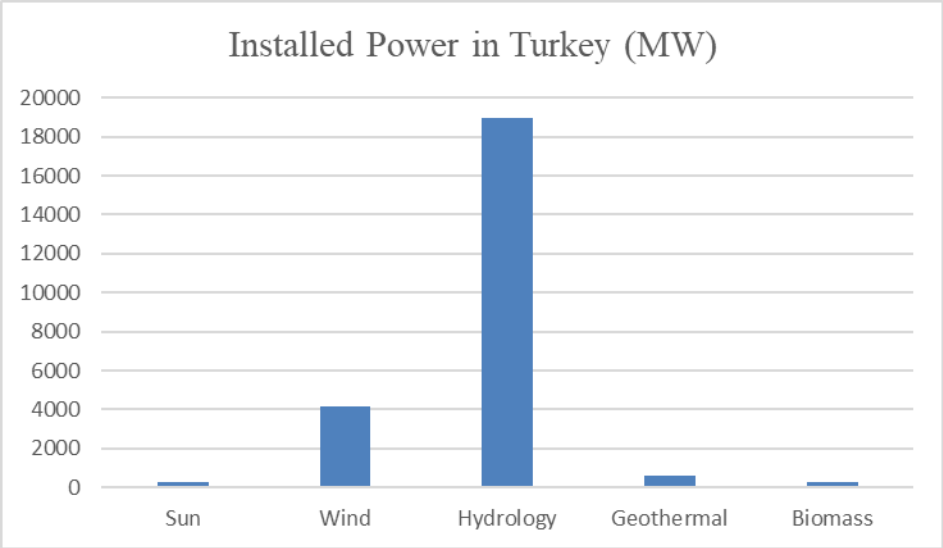

Figure 14-Energy production by renewable sources in Turkey (MoENR, 2020)

It is seen that the weight of Turkey's investments in terms of renewable energy sources is of hydrological origin. In this sense, it can be said that Turkey needs a policy change in terms of energy investments.

4.1.Agriculture and Wood Wastes

Turkey in the geographical area concerned with land use is the compatible relationship between the terrain and climate. Thus, forestry in Turkey's humid regions, the livestock and crop production in each region can be made in high mountainous and arid regions. This feature is in different ecological regions in Turkey, it gives the possibility to produce agricultural products specific to the region. Turkey owned agricultural receive important as it is located in the world. In agriculture, soil fertility, good workability and climatic conditions are as important as the width of the area (Gökbulak et al, 2018). Therefore, Turkey's land is among the important agricultural areas in the world.

According to the statistics published by the Ministry of Agriculture and Forestry (MoAF), approximately 61 million tons of agricultural waste is produced annually in Turkey (MoAF, 2020). Besides a large amount of agricultural waste production capacity in Turkey, it is quite high. According to an annual average of Turkey is given in Figure 15 in the amount of agricultural waste.

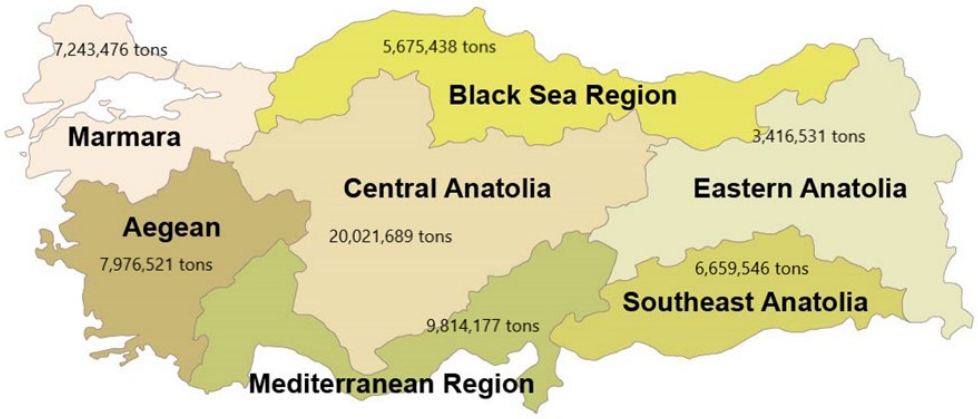

Figure 15- Distribution of agricultural biomass resources in Turkey (MoAF, 2020)

4.2.The Place of Biomass in Electrical Energy

If we look at in terms of Turkey's electricity production sources; Natural gas comes first (43.8%). Then, respectively, hydraulic (24.8%), lignite (12.6%), imported coal (12.2%), wind (3.1%), liquid fuel (1.6%), hard coal (0%), 7), geothermal (0.5%), asphalted (0.3%) and other sources (0.4%). As seen in meeting the electrical energy need, petroleum-based resources stand out (MoENR, 2012). In addition, natural gas, which is the most important source of supply, is imported from other countries increasing foreign dependency on energy.

When the biomass resources available in the forests in Turkey; the areas where frequent maintenance is carried out, the areas where stand maintenance is carried out, the cover cleaning areas, the maintenance and cleaning cuts made within the scope of YARDOP, all kinds of shells and cones, in the marquis areas in the Mediterranean-Aegean-Marmara Regions; Rhododendron etc. in the Black Sea Region. It can be met from the cuts to be made within the 5-year plan in the areas (Saraçoğlu, 2010; EHAE, 2018). Energy production potential from Turkey is a country with high wood to be seen. Therefore, the use of this potential, Turkey is an important advantage in the recovery of the dependent on external energy sources (Yıldırım, 2015).

The fuelwood production in Turkey was around 6.1 million steres, wood wastes that were not used for the product were 3.5 million steres and brushwood was 0.4 million steres, equaling to 10 million steres in total (GDF, 2011; GDF 2020). The distribution of wood/forests that can be utilized as biomass belonging to Regional Forest Directorates (wastes in the forest and brushwood) are shown in Figure 16.

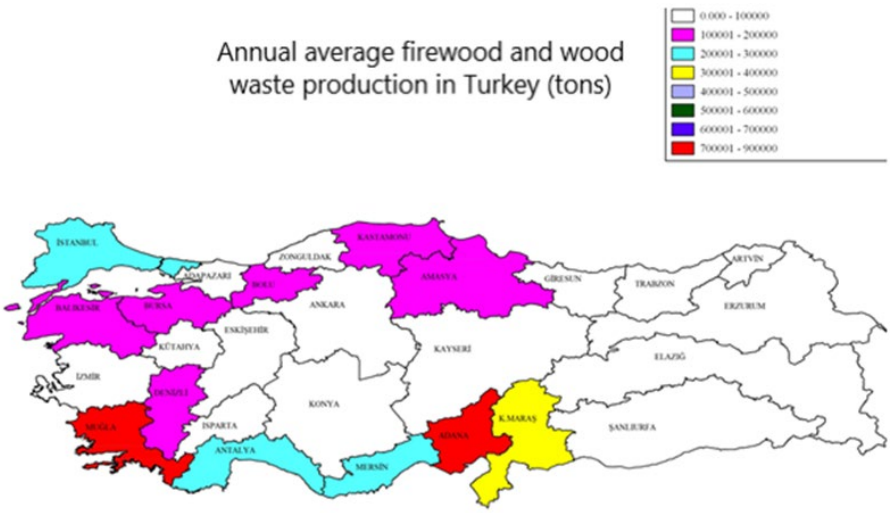

Figure 16- Distribution of forest biomass in Turkey

5. RESULT AND DISCUSSION

Fossil fuels production is the most common type of energy in the Middle East due to its low cost, but environmental pollution and economic issues are the main problems for using this type of energy. As a result, recently the use of renewable energy attracted some developing countries.

There are some barriers for the development of renewable energies in Iran and Turkey such as lack of financial source and maintenance but governments and investors all over the world will try to substitute these types of energy with fossil fuels and use them as green energy.

This type of energy is a suitable alternative to fossil fuels. The generation of heat and electricity from biomass can be useful for our country in order to reduce in consumption of these energy.

Considering commercial electricity generation, it is seen that forest biomass capacity is insufficient for large capacity thermal and other power plants. In this respect, energy production from forest biomass should not be considered in large capacities, but should be considered as a support fuel that reinforces biomass fuel. In addition, smaller-scale investments should be paved and their use should be widespread, especially in rural areas for our country.

The development of renewable energy is the largest share of pollution reduction in Iran and Turkey and according to studies of the United Nations Framework Convention (UNFCCC) in Iran, for production of every 100 MW of wind or solar power plants, it can prevent consumption of 90 million liters of diesel and 250,000 cubic meters of water and production of 250,000 tons of carbon dioxide. Renewable energy development policies should seek to achieve goals such as moving towards sustainable development of energy production systems, achieving a level of sustainable development of production and energy market, raising public awareness and social acceptance of renewable energy use, increasing technology performance, and promotion of competitiveness in terms of price. Geographical location and climatic conditions in Iran and Turkey have led to the production of various forms of renewable energy. According to studies, biomass energies are the suitable alternative fuels that can provide energy equal to 70 billion tons of crude oil which is 10% of them is suitable for world supply.

As a result, renewable energy, providing part of the country's energy needs and fuels for substitution with fossil fuels for environmental development. Currently in Iran, about 875 MW of renewable energy is generating electricity, which has been able to directly and indirectly create about 45,000 jobs opportunities.

In the quarter of 2019, Turkey managed to increase its installed capacity of electricity by 445 MW and 100% of which is provided by renewable energy and domestic energy sources. Turkey is gradually increasing its capacity to generate electricity through non-imported energy sources in order to maximize the use of domestic and renewable resources to improve its economic performance. In this period, hydropower resources are 5.22 percent (100 MW), wind energy with 70 MW, solar energy with 30 MW, and other renewable energies including geothermal, biomass, and waste with 20 MW are in the next categories.

In conclusion, it can be said that Turkey and Iran need to increase the use of renewable energy. The important issues here are population structure, urbanization and investments in industrialization. On the other hand, the renewable energy potential of both countries emerges as an important advantage in terms of energy diversity.

Compliance with the Ethical Standard

Conflict of Interest: The authors declares that there is no conflict of interest.

Ethics Committee Permission: Ethics Committee approval is not required.

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REFERENCES

Ahmadi, A., Esmaeilion, F., Esmaeilion, A., Ehyaei, M.A., 2020. Benefits and limitations of waste-to-energy conversion in Iran. Renewable Energy Research and Application, 2020. 1(1): 27-45.

Balances, E., 2011. Power and Energy Planning Department. Ministry of Energy of IR IRAN.

Ballesteros I., Negro M.J., Oliva J.M., Cabañas A., Manzanares P., Ballesteros M., 2006. Ethanol Production From Steam-Explosion Pretreated Wheat Straw. In: mcmillan J.D., Adney W.S., Mielenz J.R., Klasson K.T. (eds) Twenty-Seventh Symposium on Biotechnology for Fuels and Chemicals. ABAB Symposium. Humana Press. Https://doi.org/10.1007/978-1-59745-268-7_ (Ref. Date: 11.08.2020).

Bougnom, B.P. ;Niederkofler, C. ;Knapp, B. A. ;Stimpfl, E. ;Insam, H., 2012. Residues from renewable energy production: their value for fertilizing pastures. Biomass and Bioenergy, 39: 290-295.

Brack, D., 2007. The impacts of the demand for woody biomass for power and heat on climate and forests. Chatham House, p. 4-10.

EHAE (Enerji Hukuku Araştırma Enstitüsü), 2018. Çalıştay Raporu: 2020 sonrası YEK kanunu ve YEKDEM nasıl olmalı. https://www.enerjihukuku.org.tr/storage/2018/01/2020-sonras%C4%B1-yek-kanunu-ve-yekdem-nas%C4%B1l-olmal%C4%B1-%C3%A7al%C4%B1%C5%9Ftay-raporu-1.pdf (Ref date: 08.06.2020)

FAO, 2020. Food and Agriculture Organization Forestry Production and Trade. Http://www.fao.org/faostat/en/#data/FO (Ref. Date: 08.06.2020).

GDF, 2011. Türkiye ormancılık istatistikleri 2011. https://web.ogm.gov.tr/ekutuphane/Istatistikler/Ormanc%C4%B1l%C4%B1k%20%C4%B0statistikleri/Ormanc%C4%B1l%C4%B1k%20%C4%B0statistikleri%202011.pdf (Ref Date: 08.06.2020).

GDF, 2020. Türkiye ormancılık istatistikleri 2020. https://web.ogm.gov.tr/ekutuphane/Sayfalar/Istatistikler.aspx?RootFolder=%2Fekutuphane%2FIstatistikler%2FOrmanc%C4%B1l%C4%B1k%20%C4%B0statistikleri&FolderCTID=0x012000301D182F8CB9FC49963274E712A2DC00&View={4B3B693B-B532-4C7F-A2D0-732F715C89CC} (Ref Date: 08.06.2020).

Gökbulak, F., Uygur Erdoğan, B., Yıldırım, H.T., Özçelik, M.S. 2018. Causes of land degradation and rehabilitation efforts of rangelands in Turkey. Forestist 68(2): 106-113.

IEA, 2018. International Recommendations for Energy Stattistics (IRES). Https://unstats.un.org/unsd/energystats/methodology/documents/IRES-web.pdf (Ref. Tarihi: 08.06.2020)

İLLEEZ, B., 2020. Türkiye'nın Enerji Görünümü: Türkiye'de Biyokütle Enerjisi. Https://www.mmo.org.tr/sites/default/files/TEG-2020-13_%20Biyok%C3%bctle%20Enerjisi%20_B%C3%bclent%20%C4%b0lleez.pdf (Ref. Date: 08.06.2020).

Karayılmazlar, S., Saraçoğlu, N., Çabuk, Y., Kurt, R., 2011. Biyokütlenin Türkiye'de Enerji Üretiminde Değerlendirilmesi. Bartın Orman Fakültesi Dergisi, 13(19): 63-75.

Kargari, A. And Rezaeinia, S., 2020. State-of-the-art modification of polymeric membranes by PEO and PEG for carbon dioxide separation: A review of the current status and future perspectives. Journal of Industrial and Engineering Chemistry, 84: 1-22.

MoAF, 2020. Agricultre production and wastes in Turkey. https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim (Ref. Date: 08.06.2020).

MoENR, 2020. Turkey energy sources and production. https://enerji.gov.tr/activity-detail?id=14 (Ref. Date: 08.06.2020)

Nabavi, V., et al., Feasibility study on the production and consumption of wood pellets in Iran to meet return-on-investment and greenhouse gas emissions targets. Renewable Energy, 2020. 151: p. 1-20.

Saracoğlu, N., 2010. The biomas potential of Turkey for energy production: part I. Energy Sources Part B: Economics Planning and Policy, 5(3): 272-278.

Sarraf, M., Jagannathan, V., Andersen, I., Saba., J.P., Poortman, C.J., 2005. Islamic Republic of Iran: Cost assessment of environmental degradation. World Bank, Policy Note, Report number: 32043, Volume: 1 Washington, DC.

Searchinger, T., Heimlich, R., Houghton, R.A., Dong, F., Ekobeid, A., Fabiosa, J., Tokgoz, S., Hayes, D., Yu, TH., 2008. Use of US croplands for biofuels increases greenhouse gases through emissions from land-use change. Science. 319(5867): 1238-1240.

Searcy, E., Flynn, P., Ghafoori, E., Kumar, A., 2007. The relative cost of biomass energy transport. Applied Biochemistry and Biotechnology, 137(1-12): 639-652.

Şenol, M., 2017. Energy Yeild Optimization of a Large-Scale pV Oower Plant Self-Consumption Mehanism. Doctor of Philosophy in Electrical and Electronics Engineering. Eastern Mediterranean University February 2017 Gazimağusa, North Cyprus.

URL-1, 2020. Renewable Energy and Energy Efficiency Organization of Iran. 2020. Http://www.satba.gov.ir/en/iranresourceassesment-Iran-resource-Assesment (Ref Date: 11.08.2020)

URL-2, 2020. Statistical Review of World Energy. Https://www.eqmagpro.com/wp-content/uploads/2020/06/bp-stats-review-2020-all-data-1_compressed.pdf (Ref. Date: 11.08.2020)

Yıldırım HT, Ünsal.Ö., 2012. Wood Used in Energy for Renewable Energy Sources and Future Scenarios. Turkey, in Energy Congress and Exhibition. Ankara.

Yıldırım, HT, and Candan, Z., 2013. Renewable bio-energy from wooden biomass in Turkey. Pro Ligno, 9(4): 82-88

Yıldırım, HT, 2015. Biomass resources and its potential use as energy sources in Turkey. Pro Ligno, 11(4): 680-685

Zegada-Lizarazu, W. And Monti, A., 2011. Energy crops in rotation. A review. Biomass and bioenergy, 35(1): 12-25.