The Assessment of the Energy Potential of Biomass of Animal and Plant Origin in the Context of Local Development: The Case of Turkey*

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Abstract: *This study was carried out because of the importance of energy of biomass, which is one of the renewable energy sources, for such country as Turkey having a production potential of biomass energy raw materials. Biomass energy has become a subject emphasized in Turkey as well as in the world after the 2000s and investigated in economic, environmental and social dimensions. With this study assessing the effects brought about by biomass production and consumption in the context of local development, Turkey's theoretical potential of plant origin was found as 5.527 TOE and its economic potential was found as 4.421 TOE, and the biomass energy achieved the energy value of 949.308 TOE that can be produced economically based on animal sources. At the same time, Turkey is a country that has not completed its development. In the case of the production of this amount of biomass energy that has been calculated potentially, its contributions to the local development and its positive and negative sides have been examined. Some of these are the series of contributions such as rural employment, an increase in the income level, technological development, reduction of migration and healthy living conditions. The effect of biomass energy production on food supply, the fact that biomass sources are inputs for some sectors such as construction sector, and the less energy content in comparison with fossil fuels can be considered as negative effects on local development. In this study, the economic potential for biomass energy production in Turkey, which is not sufficiently studied in the literature, was calculated, and the potential of biomass of plant and animal origin for Turkey was calculated for the first time. The effects of this potential on Turkey's development were examined.*

Keywords: *Biomass of Plant Origin, Biomas of Animal Origin, Local Development, Turkey*

1. Introduction

Renewable energy and biomass energy, a type of renewable energy, are one of the issues that have been overemphasized since the 1990s. The fact that the countries of the world turned to renewable energy sources from fossil fuels and diversified their energy sources, the increasing importance of renewable energies in the energy security context, the lack of stability in energy prices, the fact that the countries adopted growth strategies based on local dynamics, the source of which they had in their lands, reducing transportation costs, alternatives to generate electricity were among the factors that brought this issue to the agenda of the world and made the scientists conduct studies on the issue (IEA, 2015). Biomass energy that is one of the renewable energy sources is an important energy source particularly for developing countries, and the production and use of it are increasing every day.

As a county that has biomass energy sources and production potential, Turkey is a country that can use biomass energy potential for growth and development objectives. Turkey is a country dependent on energy. On one hand, industrialization and urbanization continuously increased energy needs; on the other hand, available energy resources became unable to respond to this need because of the price volatility and the fact that they are stock assets. Moreover, the reasons such as the facts that commonly used fossil fuels lead to environmental disasters, that they are not distributed equally geographically and cause foreign trade deficits led the countries to turn to renewable energy sources. Because of the reasons that the countries having fossil fuel energy

started to consider their energy assets as a strategic element during and after 1973 energy crisis, biomass energy sources came into question because of their characteristics that they continue their presence within a continuous loop and do not cause environmental pollution, and contribute to the development of countries using their own resources. Ecological economists argued that depleted fossil energy sources could limit the countries' growth and development momentum after the 1980s. This situation can be overcome by renewable energy sources such as biomass energy source that is inexhaustible until the existence of a new energy technology, and the growth and development's sustainability depends on this (Bayramoglu, 2014).

Biomass energy is a type of renewable energy that is obtained from biomass such as agricultural, animal, forestry, municipal and industrial waste by chemical and biological methods (Yapraklı & Bayramoglu, 2014, pp. 319-336). Biomass energy can be obtained anywhere and anytime if the necessary investments and production infrastructure are made. From this perspective, it will make a major contribution to national and local economic development of the countries, including Turkey, which are poor in fossil fuels and have to allocate huge resources for energy. These effects can be evaluated under three main headings: economic, environmental and socio-demographic. All countries of the world need energy sources such as biomass energy that is environmentally friendly and the source of which is in their own land in order to reduce income differences between regions. It can be said that the countries and regions having these types of energy develop faster than the others.

2. The Relationship Between Biomass Energy and Local Economic Development

The effects of biomass energy on local economic development can be evaluated under three main headings: economic, environmental and socio-demographic (Duygu & Cısdık, 2008). Among these, economic effects drew attention particularly in the period after 1973 energy crisis. These effects can be mentioned as the instability of the energy markets, the effects caused by the inefficient use of energy, energy saving, the contribution of the production and use of renewable energy to technology and employment. Besides, the contributions that renewable energies would make to particularly local economy are ensuring energy diversity, that the countries increase their domestic production based on their own resources, reducing the dependence on foreign energy and import supply, energy production according to local conditions and appropriate policy strategies to geopolitical factors.

In addition to those mentioned above; another benefit is the diversification of energy for the continuity of production. This can only be achieved by introducing local elements. Increasing the use of biomass energy in local economic activities and developing technology in this field will reduce dependence on foreign sources of energy, contribute to stability of energy prices that are volatile, and can help to achieve the economic growth with low costs by reducing costs in energy sector and enabling the development of new job opportunities (Arenas and Real, 2008, p.1). On the other hand, countries can not benefit enough from biomass sources existing on their own lands. The reasons are inadequate regulations related to this subject, lack of sufficient incentive mechanism, incoordination in the sector and lack of planning (Aktakas, 2006). Additionally, if the capital and qualified staff problems of the energy sector are solved, it can contribute to the elimination of regional income disparities with revenue growth, employment opportunities, and new job areas.

Again, the economic impacts in the local economic development process based on biomass energy cover issues of economic prosperity such as poverty reduction, employment growth, income growth, access to social services, gender equality, population growth, agricultural production growth, climate change. Therefore, the production and consumption of biomass energy will make a positive contribution to the added value at the regional level and support the acceleration of local development.

Biomass energy supply and demand also have socio-demographic effects. One of the ways to reduce the migration from rural areas to cities in large numbers in developing countries is to improve the standards of living in rural areas. To achieve this, the rural population should be given the opportunity to benefit from fair and equal economic opportunities. Maintaining the charm of life in rural areas is only possible with proper living conditions. The factors such as education, health, infrastructure, employment, life expectancy at birth, the working age population are changing rapidly. That the problems in rural areas were continuously deepening led to increased interest in these regions. Among the reasons for this situation, in addition to economic factors, the increasing difference between living standards in urban and rural areas can be mentioned. One of the means of productivity growth, employment growth, reducing the migration and improving living standards is to increase the production and consumption opportunities based on clean energy sources. To activate the local potential

and continue the economic development based on local or regional advantages are possible with the development of biomass energy production and consumption technologies (Başar, 2016; http://www.enerji.gov.tr., 2016).

To increase the living standards in rural areas can be possible by activating biomass production and consumption mechanisms. By using biomass energy, it can be possible to provide lighting, give communication and heating-cooling services, maintain uninterrupted education, health and communication services. It can also enable girls in rural areas to spend the time that they used to spend to collect firing material in educational and social activities, convince the education and health personnel and other public officials in staying in rural areas, reduce migration from rural areas to cities, reduce the deaths and diseases resulting from the use of traditional biomass resources (http://www.fao.org/docrep/t1804e/t1804e04.htm, 2016).

As for the environmental effects of biomass use; among the reasons for environmental disasters, besides the brutal and excessive use of natural resources, the damage of the use of fossil fuels to the environment can also be mentioned. The relationship between energy, environment, and development dates back to 1973 energy crisis. A large part of the environmental problem is caused by the use of fossil energy. Today, economic development and local economic growth, in particular, are measured according to the importance that the countries give to the environment. The most basic element of increasing the standards of living is to have clean air, clean water, and clean soil and continue to use them without contamination. Biomass energy has the potential to fulfill important functions both in the world and local economies. Thanks to biomass energy that is a clean energy the gases harmful to the environment will be reduced (Bayramoğlu, 2014). When the positive and negative environmental effects of the use of biomass energy are considered together; that it reduces the greenhouse gas emission when used as a substitute for fossil fuels, contributing to biodiversity, increasing the carbon content in the soil and preventing erosion can be mentioned as examples of positive effects. Although a few, some negative effects can be mentioned as well. These are the increase in greenhouse gas emissions due to the energy agriculture, loss of biodiversity, change in the land use manner, the increase in water use and the environmental damages of the use of agricultural pesticides (Bhattacharya, et al, 2005, pp.153–166)

3. Literature Research on Turkey's Biomass Potential

Very few studies were conducted in Turkey on energy potential based on biomass potential. These studies generally began in the 2000s. The first of these studies was carried out by Kaygusuz (2001). The researcher did his study on all biomass sources based on 1998 data and reached the conclusion that the biomass source was the second source after hydro-electric. It was found out that up to 10% of Turkey's energy needs could be obtained from biomass resources, and this was, based on animal and vegetal sources, equal to 16,920 Ktoe (Kaygusuz, 2001, pp.775-799). Additionally, Demirtaş (2002) carried out a research on Turkey's energy production potential based on biomass sources and made predictions for 5 year-periods for the period 2000-2025. As a result of the study based only on agricultural waste, he found 6963 Ktoe, 6760 Ktoe, 6446 Ktoe, 6029 Ktoe, 5681 Ktoe and 5393 Ktoe biomass energy potential for the years 2000, 2005, 2010, 2015, 2020, 2025 respectively. With this research, it was concluded that Turkey had a large energy potential (Demirbaş, 2002, pp. 921-929). Kaygusuz and Türker (2002) determined 40-53 million tons of dry waste for all biomass energy potential based on 1998 data and estimated that 470 PJ -620 PJ BE could be obtained from 27-36 million tons of this waste. At the end of the research, it was concluded that it was necessary to develop energy policies appropriate to the economic structure, public support was needed, and it would make a significant contribution to health, building, and particularly education fields (Kaygusuz & Türker, pp. 2002, 383-401).

Sürmen (2003), starting from the point that biomass energy was important for the Turkish economy, reached the conclusion that the share of domestic sources within the total energy consumption of Turkey was 37% and 52% of this amount was based on biomass. He concluded that the amount of selected agricultural waste of Turkey was 39,35 million tons, and the energy value was 187,4 million kWh(Sürmen, 2003, pp. 83-92). Demirtaş (2004) concluded that, for the year 2001, based on the agricultural and animal waste, the national energy production of Turkey, bioenergy potential of which was 2,2 -3,9 billion m^3, would be 79,399 Ktoe in 2020, 95,946 Ktoe in 2025, and benefiting from this potential could make contribution to economic growth (Demirbaş, 2004, pp. 361-366). In the study based on animal and agricultural biomass sources, Acaroğlu and Aydoğan (2012) estimated that the share of biomass energy, which was 7,9 Mtoe, within renewable energy sources was large, and the total calory values of biomass energy that can be obtained from animal and vegetal sources were $60{,}552\times10^3$ GJ and 227,983,298 GJ respectively (Acaroğlu & Aydoğan, 2012, pp.. 69-76). Additionally, Yapraklı and Bayramoğlu (2013), in their study on TRA1 and TRA2 regions

of Turkey, taking into consideration the vegetal and animal biomass sources, found out that the dry theoretical and economic biomass energy potential in TRA1 region was 6,015 and 4,809 TOE respectively; and the dry theoretical and economic biomass energy potential in TRA2 region was 5,088 and 4,070 TOE respectively. The theoretical and economic animal biomass energy potential in TRA1 region was found as 790 and 593 respectively, and the theoretical and economic biomass energy potential in TRA2 region was found as 1,215 and 866 TOE respectively (Yapraklı & Bayramoğlu, 2013).

Apart from these studies, Balat (2005), Öztürk and Başçetinçelik (2006), Koçer, Öner and Sugözü (2007), Demirbaş (2008), Umutlu (2012), Kaygusuz and Keleş (2008), Demircan (2006), Esengün, Gündüz and Erdal (2007), Gokcol et al., (2009), Kızılaslan (2009), Demirbaş (2006), Özgür (2008), Gezer, Acaroğlu and Hacıseferoğulları (2003), Bilgen et al., (2015), Özcan, Öztürk and Oğuz (2015) concluded that Turkey had a big potential based on biomass sources and with the production it would make great contribution to many fields such as economic growth, employment, building, education, all obstacles to the production of biomass energy must be eliminated and public supports must be applied both in legal aspects and financially.

4. Data Sources and Method

For this study, animal and vegetal production values for whole Turkey were obtained from Turkish Statistical Institute (TSI), which is the national statistical agency of Turkey. This source was deemed adequate, for the data obtained from the study on animal and vegetal production of Turkey in 2014 were reliable, and other international databases reached this data through TSI. The information obtained from this study, which was conducted because of the importance of the difference between development levels of rural and urban regions, took into consideration the studies of the researchers such as Öztürk and Başçetinçelik (2006), Kurt and Koçer (2010), Voivontas et al. (2001) and Milhau and Fallot (2013). Here, the energy amount that can be generated based on animal and vegetal biomass sources of whole Turkey was calculated separately as theoretical and economic (Koçer, Öner & Sugözü, 2006; Kurt & Koçer, 2010, pp. 240-247; Voivontas, et al., 2001, pp.101-112) Based on these studies, vegetal waste amounts were calculated by multiplying the separated share product with 0.15 for agricultural use and with 0.8 for agricultural and non-agricultural use. Approximately one-third of wet vegetal waste is equal to dry waste amount. The calorific value of a ton of dry vegetal waste is 4050 (kcal)/kg as average. According to the unit conversion system, the calorific value of 1 kcal/kg of vegetal waste is equal to $1{,}10^{-7}$ TOE biomass energy value. The animal waste amount was taken as 3,6 tons/year for bovine animal, 0.7 tons/year for small cattle and 0.022 tons/year for poultry. Dry waste/animal manure was calculated as tons taking into account these amounts per animal, and the useful quantity of this amount was reached. It was found out that 200 m^3 biogas (65% methane and 35% CO2) can be obtained from one ton of animal waste. According to unit conversion system, the average calorific value of 1 m^3 biogas is 5200 kcal/m^3 and is equal to approximately 0,00052 TOE biomass energy value (Bayramoğlu, 2014).

Amount Of Animal And Vegetal Waste Of Turkey

Table 1 created by utilizing TSI database for 2015 gives the total value of some selected products.

Table 1.

Turkey's Total Vegetal Production / Waste Quantities (2015 / ton)

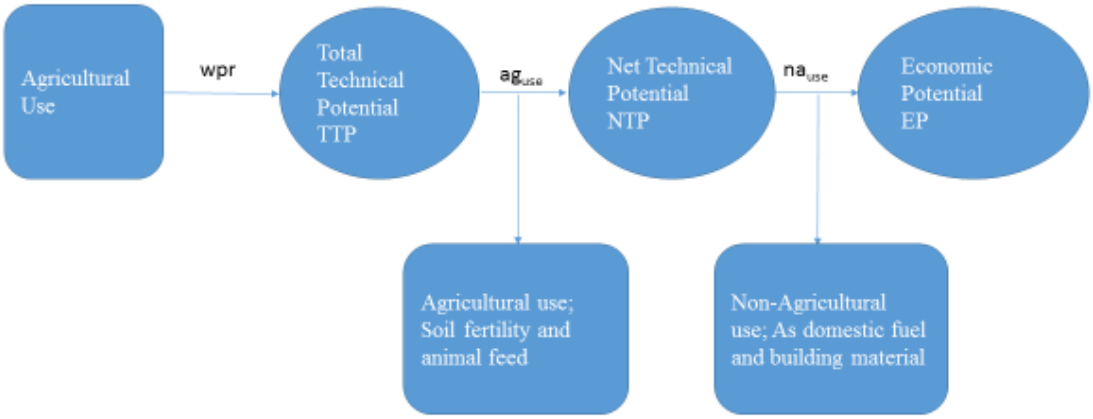
Cereals	Sugar beet, corn, and seeds	Forage crops	Vegetable	Fruits
32,714,157	98,257	40,246,496	28,579,781	18,363,563
Straw/Meadow	Agricultural products for textiles	Energy Plants	Potato/Root crops	
40,316,496	3,196,001	1,869,014	5,211,650	
Total	170,595,415			

Source: Calculated by the Author utilizing Turkish Statistical Institute database.

Table 1 created by utilizing TSI database for 2015 gives the total value of some selected products.

As it is seen in the table, according to the official data, the amount of wet vegetal waste is 170.595.415 tons in Turkey. Ornamental plants are not included in this amount, for they are evaluated as units.

Turkey's theoretical and economic potential of biomass energy can be calculated on the basis of the data in Tables 1 and 4. The theoretical biomass energy potential is the amount of all animal and vegetal waste produced. The economic biomass energy potential is the remaining amount that can be used for energy after deducting the amount of use for several purposes such as agricultural and food purposes. Some studies in the literature were benefited from when calculating the amount of theoretical and economic energy.



- Fig.1. Three definitions of crop residue potentials with different recoverability ratios
- Source: Antonio Milhau and Abigail Fallot
- Assessing the Potentials of Agricultural Residues for Energy: What the CDM Experience of India Tells us About Their Availability,
- *Energy Policy, Article in Press*, Available at: 2015

Using the findings of the said studies, vegetal waste amounts are calculated according to the product types using 1.1 notations.

$$TTP = \sum (\text{Amount of Product} \times wpr) \quad 1.1$$

Here, TTP shows the annual amount of products produced while wpr symbolizes the waste product rate. Wpr is found as 1.6 taking the average of waste amounts of 22 different products, for waste amounts of agricultural product are different. TTP is calculated by the multiplying amount of product with waste product rate.

1.2 notation is used to reach theoretical product amount

$$NTP = TTP \times ag_{use} \quad 1.2$$

Here, NTP shows net theoretical potential and ag_{use} shows the remaining amount after agricultural use. Agricultural use means the use for soil fertility and animal feed.

1.3 notation is used for economic potential

$$EP = NTP \times na_{use} \quad 1.3$$

Here, EP shows economic potential, and to reach this, theoretical potential should be multiplied with na_{use} for non-agricultural use. Non-agricultural use means the use of the waste as domestic fuel and building material [35]

For agricultural products, ag_{use} ratio is 0.15 in average, and na_{use} ratio for non-agricultural use is 0.80 in average. One-third of wet vegetal waste is equal to dry vegetal waste, and average calorific value of one ton of dry vegetal waste is 4050 (kcal)/kg. According to the calculation using unit conversion system 1 kcal/kg calorific value of vegetal waste is equal to $1{,}10^{-7}$ tons of petroleum (http://www.birimcevir.com, 2016).

In Table 3 that is created based on the data in Table 2, total theoretical potential of Turkey was calculated by multiplying annual amount of product with average waste amounts, then net theoretical potential was calculated by deducting agricultural use of vegetal products, and finally economic potential was calculated by deducting non-agricultural use of vegetal waste from net potential.

Table 2. The Amount of Theoretical and Economic Waste with Plant Origin for Turkey (TOE)

Turkey	Annual Product Amount	Waste Product Ratio (wpr)	Total Theoretical Potential (TTP)	Net Theoretical Potential Ratio	Net Theoretical Potential Amount (NTP)	Economic Potential Ratio	Economic Potential Amount (EP)
Wet	170,595,415	1.6	272,952,664	0.15	40,942,899	0.80	32,754,319
Dry	56,865,138	1.6	90,984,221	0.15	13,647,633	0.80	10,918,106

Net Theoretical Potential for Dry Vegetal Waste		Economic Potential for Dry Vegetal Waste	
Calorific value (kcal/kg) (10^3)	Biomass Energy Value (TOE)	Calorific Value (kcal/kg) (10^3)	Biomass Energy Value (TOE)
55,272,913	5,527	44,218,329	4,421

Conversion was made using http://www.birimcevir.com/enerji-ve-is-birimleri/enerji-ve-is-birimleri.aspx

According to Table 2, there are minimum net theoretical biomass energy potential of 5.527 TOE and economic biomass energy potential of 4.421 TOE, which can be obtained from vegetal waste of whole Turkey. Economic potential shows the amount of energy that can be generated using all vegetal waste of Turkey.

Table 3. Distribution of Turkey's Total Number of Animals by Type and Amount of Waste 2015 (Head)

Turkey	Number	Annual Waste Amount (Tons)	Total Waste Amount (Tons)
Bovine animal	14,244,673	3.6	51,280,822
Small cattle	41,462,349	0.7	29,023,644
Poultry	298,029,734	0.022	6,556,654
Equidae	343,397	0.022	7,554
Pork	2,655	3.6	9,558
Camel	1,442	3.6	5,191
Total	354,084,250	-	86,883,423

Source: Calculated by the author using Turkish Statistical Institute data.

Conversion was made using http://www.birimcevir.com/enerji-ve-is-birimleri/enerji-ve-is-birimleri.aspx

As it can be seen from the data in Table 3, Turkey's total livestock assets for 2015 are 354 084 250 head. Total animal waste is 86.883.423 tons/year based on the average waste amount. Turkey's bovine animal asset increased at the rate of 66,6%, and small cattle asset increased at the rate of 75.4% in 2015 compared to 2002. It means that the opportunity to obtain biomass energy increased as a result of the increase in the total livestock. The amount of waste that can be used economically was calculated as 65% for bovine animals, 13% for small cattle and 99% for the poultry. Additionally, energy values that can be obtained from one ton of waste are found as 33 m^3 (65% methane, 34% CO_2) for bovine animals, 58 m^3 for small cattle and 78 m^3 for poultry. According to the unit conversion system, the average calorific value of 1 m^3 biogas is 5200 kcal/m^3 and equal to approximately 0,00052 TOE biomass energy.

Table 4. Turkey's Total Animal Biogas Amount by Type (m^3- TOE, 2015)

Turkey	Waste Amount (Ton)	Economic Waste Amount Ratio (%)	Economic Waste Amount	Energy Value (m^3)	Biogas Amount (m^3) (10^3)	Calorific Value 5200 kcal/m^3 (10^9)	TOE Value of Biogas
Bovine Animals	51,303,125	65	33,347,031	33	1,100,452	5,722	572,235
Small Cattle	29,023,644	13	3,773,073	58	218,838	1,137	113,795
Poultry	6,556,654	99	6,491,087	78	506,304	2,632	263,278
Total	949,308						
Reference: Calculated by the author using Turkish Statistical Institute data. * Includes equidae, pork, and camel							

Referring to the values calculated in Table 4, it can bee seen that Turkey has a biogas production capacity of 949.308 TOE. This value corresponds to significant potential for an energy-dependent country.
When both animal-origin and vegetal-origin biomass energy potentials are evaluated, it can be seen that the biomass energy with vegetal origin that can be used economically is 4.421 TOE and the animal waste amount that can be used economically is 949.308 TOE.

5. The Contribution That Biomass Energy Will Make To The Local Development

Biomass energy was started to be discussed worldwide along with other renewable energy sources after 1973 energy crisis. Volatility in energy production based on fossil fuels and environmental pollution caused by them and the adoption of sustainable development on the same dates increased the interest in biomass energy that is one of the renewable energy types. Economically, as a phenomenon attracting attention due to its supply and demand characteristics, biomass energy is one of the actors creating energy markets. Because it is a domestic resource for energy production, it is seen by developing countries including Turkey as a mean to reduce the difference between rural and urban regions, reduce the energy deficit, minimize the dependence on foreign resources.

The contributions that the production and consumption of biomass energy will make to local development can be listed as follows (Schmidhuber, 2006, p.8); BAKA, 2012, p.8; IEA, 2011, p.18; Anonim, 2011, p.6);

That the biomass energy is obtained from domestic resources is important for energy security,

The establishment of biomass energy production facilities will contribute to the increase of the revenue of the region where they will be established,

In terms of employment problems, the establishment of plants based on biomass energy will contribute to the reduction of unemployment,

Because these regions have migration problems, the development of plants based on biomass energy and the infrastructure will help to reduce the migration,

Thanks to the production and consumption of biomass energy, the environmental problems caused by animal and vegetal waste and the diseases arising from this waste can be eliminated.

The protection of rural areas, the environmental sensitivity of which is low and that are less polluted compared to the urban regions, can be possible through the use of biomass energy.

Prevention of greenhouse gases caused by the use of fossil fuels can only be possible through the use of renewable energy,

The solution of important worldwide issues such as climate change is possible through the use of renewable energies like biomass,

Healthy life, leaving future generations a healthy environment, reducing health spending also depends on the use of biomass energy,

The use of air, soil and water and the increase of their quality depend on biodiversity.

In addition to the topics mentioned above, the contribution of biomass energy supply and demand can be listed as; contribution to the development of new technologies, creating local solutions to employment, helping to increase the level of education, reducing poverty particularly locally by increasing incomes.

There are also some negative impacts of the production and consumption of biomass energy. These are listed below (Christy, 2008. p. 17)

The production of biomass energy is a sector that can not be developed quickly due to high first production costs,

It has a lower energy content than fossil fuels,

Raw materials needed to produce biomass energy are materials that are also needed by other sectors for the purposes such as fertility of soil, feeding and building material, and paper.

The priority given to agriculture for energy can reduce the cultivation of products required for food, and this can increase the food prices,

Transportation and storage of biomass resources are high-cost businesses.

When all these positive and negative effects are considered together, it can be said that the positive contribution of biomass energy to the local development is higher, and its production can make a great contribution to the development of the country if the appropriate political measures are taken.

6. Conclusion and Evaluation

Biomass energy is an issue that came to the agenda of the world and at the same time of Turkey particularly after 1973 energy crisis, and studies were made on it. It is certain that the production and use of biomass energy that is one of renewable energy types will make a great contribution to the development process and the solution of development problems of the developing countries like Turkey. In this regard, in this study, the contribution of the production of energy based on biomass sources to the development and, in particular, local development has been investigated. After the year 2000, studies have been carried out on this subject in Turkey. However, these studies only explained the theoretical potential and were not interested in how much biomass energy could be produced economically. In this study, by benefiting from the previous studies, the energy production potentials of Turkey have been calculated separately as theoretical and economic based on animal and vegetal sources. This study is expected to be exemplary in this respect for the studies to be carried out in the future.

Turkey is a country that is greatly suited for biomass energy production based on vegetal sources for its climate zone and the land of 770.760 km², and it is also suited for biomass energy production with its livestock asses of 354.084.250. According to the calculations made, biomass energy value with vegetal origin is theoretically 5.527 TOE and biomass energy amount that can be produced economically is 4.421 TOE. Biomass energy production potential with animal origin is 949.308 TOE economically. These values are important amounts for Turkey, an energy-dependent country. On the other hand, the contribution of biomass energy production to the rural development is rather high. These are energy security, rural employment, the increase in the income level, reducing the migration, reducing the environmental pollution, reducing the dependence on fossil fuels and inhibition of the release of greenhouse gases, increasing the conditions of healthy life, creating leisure time for the people living in rural areas, increasing biodiversity. However, it is possible to say that the production of biomass energy also has some disadvantages. They are as follows: raw materials of biomass energy are also an economic input for some other sectors, they have lower energy content than fossil fuels, and the development of energy agriculture may lead to reduced supply of food products. Considering the presence of the potential, it can be said that the positive effects are much more than the negative effects of the production of biomass energy. Considering the contribution to the development of the countries, it must be put more emphasis on economically and must be supported by public policies.

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