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Determination of Biogas Potential from Animal Waste in Kırşehir Province

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Abstract

In this study, it was aimed to determine the production potential of biogas producible from animal waste (bovine, ovine and poultry) in Kırşehir province and its districts and its equivalence to other types of fuels. When the animal existence is examined on the basis of districts of Kırşehir province, it is seen that there are 1347435 animals in total. While the poultry animals constitute 72.15% of the animal existence of the province, ovine animals constitute 16.28% of them and this is followed by bovine animals with 11.58%. Accordingly, the total amount of calculated annual manure for a total of 1347435 animals in the province is 736504.92 ton/year, while the amount of usable waste is 406168.26 ton/year and 81.09% of this amount is obtained from the waste of bovine animals, 11.12% of poultry and 7.79% of ovine animals. It is seen that 14855272.55 m^3 of biogas which can be obtained annually in the province in total is equivalent to approximately 69819781 kWh energy obtained from electricity or to the energy obtained from 51547795.74 kg wood or from 11141454.41 liters gasoline or from 9804479.88 liters diesel oil. Accordingly, the province-wide income that can be obtained from electricity is 8529120,97 $, 4393278,05 $ from wood, 17250263,22 $ from gasoline and 13091208,93 $ from diesel oil according to the data of the year 2017. The biogas energy potential from animal waste of Kırşehir province has the potential to create approximately 0.79% of the biogas potential of our country. As a result of the study, it has been suggested that biogas production has the potential not only to increase the living standards of the individuals who provide their livelihood on agriculture and animal husbandry in Kırşehir province, but also to create an important resource for the sustainable development of the region.

Keywords: Animal waste, manure, biogas, biogas potential

Kırşehir İlinin Hayvansal Atık Kaynaklı Biyogaz Potansiyelinin Belirlenmesi

Özet

Bu çalışmada, Kırşehir ili ve ilçelerinde hayvansal (büyükbaş, küçükbaş ve kanatlı) atıklardan elde edilebilecek gübre miktarlarından biyogaz potansiyelini ve diğer yakıt türlerine eşdeğerliğinin belirlenmesi amaçlanmıştır. Kırşehir ilinin ilçeler bazında hayvan varlığı incelendiğinde toplam 1347435 adet hayvan bulunduğu görülmektedir. İlin hayvan varlığının %72.15'lik bölümünü kanatlı hayvanlar oluştururken, % 16.28'lık kısmını küçükbaş, bunu da %11.58 ile büyükbaş takip etmektedir. Buna göre ilde toplam 1347435 adet hayvan sayısı için hesaplanan yıllık gübre miktarı toplamı 736504.9 ton/yıl iken kullanılabilir atık miktarı 406168.3 ton/yıl olup bu miktarın %81.09'unu büyükbaş, %11.12'ini kanatlı, %7.79'unu küçükbaş hayvanların atıklarından elde edilmektedir. İl genelinde yılda elde edilebilecek 14855273 m3 lük biyogaz miktarının yaklaşık 69819781 kwh elektrik enerjisine ya da 51547795.7 kg odundan ya da 11141454.4 litre benzine ya da 9804479.9 litre motorinden elde edilen enerjiye eşdeğer olduğu görülmektedir. Buna göre il genelinde 2017 yılı verilerine göre elektrikten elde edilebilecek gelir 8529120,97 $, odundan 4393278,05 $, benzinden 17250263,22 $ TL ve Motorinden 13091208,93 $ dır. Çalışma sonucunda Kırşehir ilinde geçimlerini tarım ve hayvancılıkla sağlayan bireyler için biyogaz üretimi bölgede yaşayanların refahını arttırırken aynı zamanda bölgenin sürdürülebilir kalkınmasında da önemli bir rol oynayabileceği belirlenmiştir.

Anahtar Kelimeler: Hayvansal atık, biyogaz, biyogaz potansiyeli

Introduction

When properly stored, the manure obtained from animal shelters enables producers to use the best food source for vegetative production. Yet, if the manure to be accumulated in a place is not well stored, the nutrient elements and microorganisms within it may cause surface and underground water pollution and this can create a risk of environmental pollution for human and animal health. Therefore, the wastes occurred in the shelters (solid and liquid manure) should be protected so as not to create environmental pollution until applied to the land (Harris et al., 2001). In the studies conducted in our country, however, it has been suggested by researchers that the manure, which is regarded as animal waste, has been left outdoors and stacked without proper storage and these wastes arising from animal husbandry enterprises may contaminate underground and surface water resources as a potential contaminant if necessary precautions are not taken (Atılgan et al., 2005; Erkan, 2005; Karaman, 2005; Boyacı et al., 2011). In fact, it has been suggested by researchers performing studies in our country that the animal wastes will contribute to the local and national economy by converting biomass energy into biogas energy without causing environmental pollution (Doğru, 2010; Altıkat and Çelik 2012; Yokuş and Onurbaş Avcıoğlu, 2012; Dursun et al., 2015; Gençoğlan et al., 2015; Ulusoy et al., 2015; Ilgar, 2016).

Given the fact that the environmental pollution has reached a level threatening human health today, it is of significance that the technology to be used not only provides inexpensive energy, but also does not cause environmental pollution. The production of biogas energy gains more importance day by day since it is cheaper than other energy sources besides being environmentally friendly (Karim et al., 2005). Turkey is an important agricultural country which has a high potential in terms of both animal and vegetative production. Despite the potential of organic waste for being able to put to good use, biogas, known as an energy production method, is not being benefited as it should be. Through further evaluation of the subject, an economical input in terms of energy can be provided, and, from the environmental point of view, ensuring a sustainable environment of high quality by reducing harmful waste and thus ensuring rural development can also be realized (Aybek et al., 2015).

The study was carried out to investigate the animal waste potential of Kırşehir province and to determine the contribution of the biogas potential determined by calculating the biogas potential that can be obtained from this potential to the national and local economy by comparing it with the equivalent quantities of other fuels.

Materials and Methods

The 2017 data of the Turkish Statistical Institute was used as material in the study (TUIK, 2017). The values of the wet manure quantities that can be produced on the basis of animal-weight and the amount of biogas producible from 1 ton of manure depending on the type of the animal (Koçen et al., 2006; Kılıç, 2011; Gençoğlan et al., 2015; ETKB, 2017) was calculated taking Table 1 into account.

Table 1. The wet manure quantities that can be produced on the basis of animal-weight and the amount of biogas producible from 1 ton of manure depending on the type of the animal

Type of the animal	Wet manure quantities that can be produced on animal-weight basis		The amount of biogas producible from 1 ton of manure (m^3 $year^{-1}$)
	Daily wet manure (kg day^{-1})	Annual (ton $year^{-1}$)	
Bovine	5-6%	3.6	33
Ovine	4-5%	0.7	58
Poultry	3-4%	0.022	78

Table 2. The equivalent of the effective heat of 1 m^3 biogas to different fuel types

Type of energy	Equivalent	Type of energy	Equivalent
Electricity	4.70 kWh	Butane	0.43 kg
Gas oil	0.62 L	Propane	0.25 m^3
Diesel oil	0.66 L	Charcoal	1.46 kg
Gasoline	0.75 L	Wood	3.47 kg

The thermal value of biogas stems from the flammable methane gas in its composition. Its thermal value varies between 4.700-5.700 kcal m^{-3} depending on the proportion of methane in its

composition. The equivalent of the effective heat of 1 m^3 of biogas to different fuel types is given in Table 2 (Alçiçek and Demirulus, 1994; Toruk and Eker, 2003; Ardıç and Taner, 2005; Yıldız et al., 2009; Kılıç, 2011; ETKB, 2017).

Result and Discussion

When the animal existence is examined on the basis of districts of Kırşehir province, it is seen that there are 1347435 animals in total. While the poultry animals constitute 72.15% of the animal existence of the province, ovine animals constitute 16.28% of them and this is followed by bovine animals with 11.58%. When the distribution of the animals in Kırşehir province based on districts is examined, the maximum animal existence is in Central district by %33.03, and this is followed by 28.45% in Mucur, by 19.92% in Boztepe, by 8.02% in Kaman, by 5.66% in Cicekdagi, by 2.96% in Akpinar and by 1.96% in Akcakent districts. The number of animals based on the province in total and districts is given in Table 3, the number of animals based on districts of Kırşehir province is given in Figure 1 and the distribution based on the types of animals in Kırşehir province is given in Figure 2.

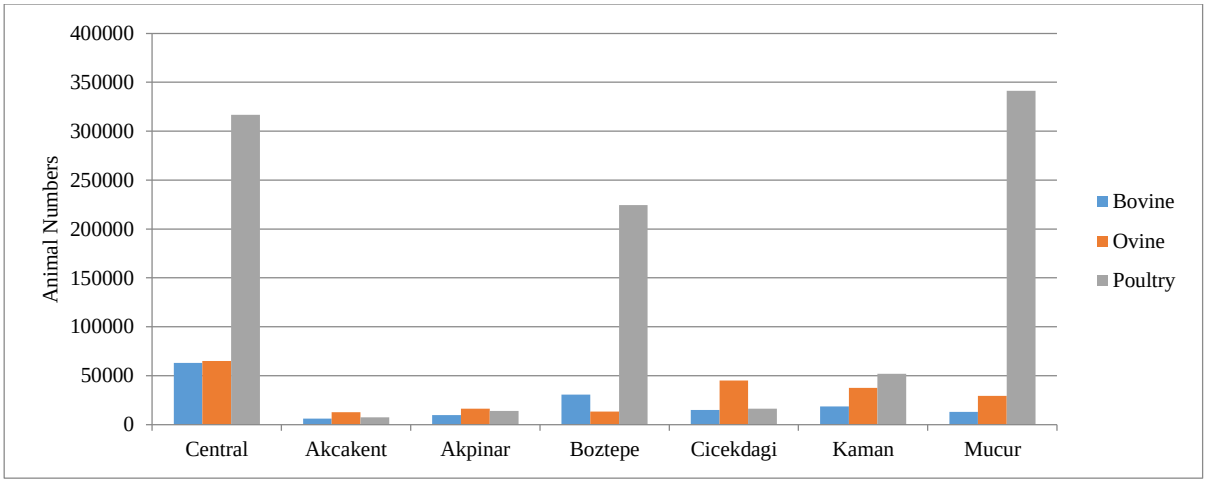

Figure 1. The number of animals based on districts of Kırşehir province

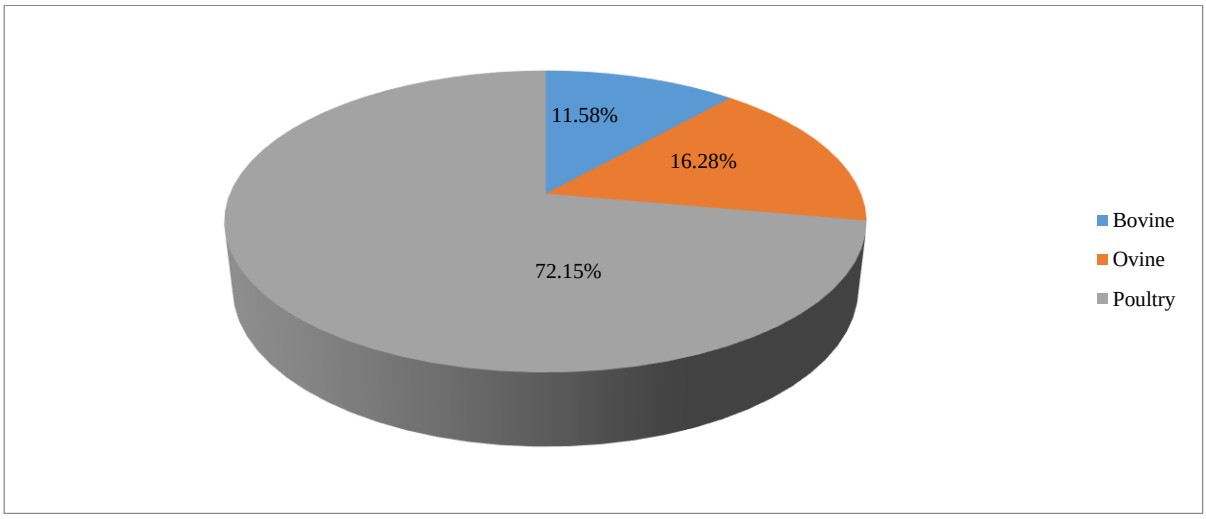

Figure 2. The distribution based on the types of animals in Kırşehir province

In the study, the annual amount of manure to be obtained from the total number of animals in the province and its districts based on the type of animal, the annual amount of usable manure to be obtained from manure per year and the amount of biogas that can be produced in the province and districts of Kırşehir calculated using the annual amount of usable waste are given in Table 4.

Accordingly, the total amount of calculated annual manure for a total of 1347435 animals in the province is 736504.92 ton $year^{-1}$, while the amount of available waste is 406168.26 ton $year^{-1}$ and 81.09% of which is obtained from the waste of bovine animals, 11.12% of poultry and 7.79% of ovine animals.

Table 3. The number of animals based on province in total and districts

District	Bovine	Ovine	Poultry	Total number of animals
Central	63153	65093	316840	445086
Mucur	12861	29235	341239	383335
Boztepe	30656	13370	224350	268376
Kaman	18379	37605	52050	108034
Cicekdagi	15037	44913	16300	76250
Akpinar	9655	16356	13880	39891
Akcakent	6258	12745	7460	26463
TOTAL	**155999**	**219317**	**972119**	**1347435**

Table 4. Producible biogas amounts in Kırşehir province and its districts

District	Type of animal	Number of animals	Annual amount of manure (ton year^{-1})	Annual amount of useable manure (ton year^{-1})	Biogas amount (m3 year^{-1})	Total biogas amount (m^3 year^{-1})
Central	Bovine	63153	227350.80	147778.00	4876674.66	5758495.98
	Ovine	65093	45565.10	5923.46	343560.85	
	Poultry	316840	6970.48	6900.78	538260.47	
Akcakent	Bovine	6258	22528.80	14643.72	483242.76	563184.22
	Ovine	12745	8921.50	1159.80	67268.11	
	Poultry	7460	164.12	162.48	12673.35	
Akpinar	Bovine	9655	34758.00	22592.7	745559.10	855465.97
	Ovine	16356	11449.20	1488.396	86326.97	
	Poultry	13880	305.36	302.31	23579.90	
Boztepe	Bovine	30656	110361.60	71735.04	2367256.30	2818957.93
	Ovine	13370	9359.00	1216.67	70566.86	
	Poultry	224350	4935.70	4886.34	381134.75	
Cicekdagi	Bovine	15037	54133.20	35186.58	1161157.10	1425899.05
	Ovine	44913	31439.10	4087.08	237050.81	
	Poultry	16300	358.60	355.01	27691.09	
Kaman	Bovine	18379	66164.40	43006.86	1419226.40	1706130.19
	Ovine	37605	26323.50	3422.06	198479.19	
	Poultry	52050	1145.10	1133.65	88424.62	
Mucur	Bovine	12861	46299.60	30094.74	993126.42	1727139.21
	Ovine	29235	20464.50	2660.39	154302.33	
	Poultry	341239	7507.26	7432.19	579710.46	
TOTAL		**1347435.00**	**736504.92**	**406168.26**	**14855272.55**	**14855272.55**

When Table 4 is examined, it is seen that Kırşehir province has an annual biogas production potential of 14855272.55 m^3.Taking the district-based total amount of biogas into consideration, the Central district is placed first with 5758495.98 m^3 annually, while it is followed by Boztepe with 2818957.93 m^3, by Mucur with 1727139.21 m^3, by Kaman with 1706130.19 m^3, by Cicekdagi with 1425899.05 m^3, by Akpinar with 855465.967 m^3 and by Akcakent with 563184.216 m^3.

The equivalent of annual biogas potential of Kırşehir province in total and its districts to today's energy sources is given in Table 5. When the table is examined, it is seen that 14855272.55 m^3 of biogas which can be obtained annually across the province is equivalent to approximately 69819780.90 kWh energy obtained from electricity or to the energy obtained from 51547795.74 kg wood or from 11141454.41 liters gasoline or from 9804479.88 liters diesel oil.

The values of the equivalent of annual biogas potential of Kırşehir province in total and its districts to today's energy sources in USD ($) is given in Table 6. When the table is examined, it is seen that the province-wide income that can be obtained from electricity is 8529120,97 $, 4393278,05 $ from wood, 17250263,22 $ from gasoline and 13091208,93 $ from diesel oil. The amount of income that can be obtained based on districts is given in Figure 3.

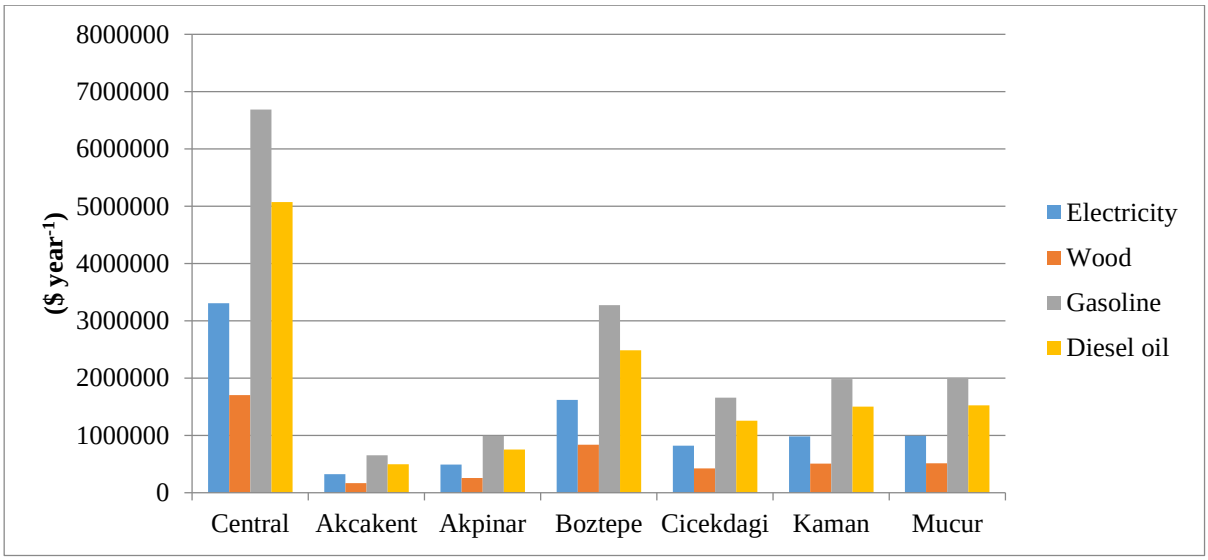

Figure 3. The amount of income that can be obtained based on districts

Table 5. The equivalent of annual biogas potential of Kırşehir province in total and its districts to today's energy sources

District	Type of animal	Biogas amount (m^3 $year^{-1}$)	Electricity (kWh $year^{-1}$)	Wood (kg $year^{-1}$)	Gasoline (liter $year^{-1}$)	Diesel oil (liter $year^{-1}$)
Central	Bovine	4876674.66	22920370.90	16922061.07	3657506.00	3218605.28
	Ovine	343560.85	1614736.01	1192156.16	257670.64	226750.16
	Poultry	538260.47	2529824.19	1867763.82	403695.35	355251.91
	Total	5758495.98	27064931.10	19981981.05	4318871.98	3800607.35
Akcakent	Bovine	483242.76	2271240.97	1676852.38	362432.07	318940.22
	Ovine	67268.11	316160.12	233420.34	50451.08	44396.95
	Poultry	12673.35	59564.73	43976.51	9505.01	8364.41
	Total	563184.22	2646965.82	1954249.23	422388.16	371701.58
Akpinar	Bovine	745559.10	3504127.77	2587090.08	559169.33	492069.01
	Ovine	86326.97	405736.75	299554.58	64745.23	56975.80
	Poultry	23579.90	110825.53	81822.25	17684.92	15562.73
	Total	855465.97	4020690.05	2968466.91	641599.48	564607.54
Boztepe	Bovine	2367256.32	11126104.70	8214379.43	1775442.24	1562389.17
	Ovine	70566.86	331664.24	244867.00	52925.15	46574.13
	Poultry	381134.75	1791333.34	1322537.60	285851.07	251548.94
	Total	2818957.93	13249102.29	9781784.03	2114218.45	1860512.24
Cicekdagi	Bovine	1161157.14	5457438.56	4029215.28	870867.86	766363.71
	Ovine	237050.81	1114138.83	822566.33	177788.11	156453.54
	Poultry	27691.09	130148.13	96088.09	20768.32	18276.12
	Total	1425899.05	6701725.52	4947869.69	1069424.28	941093.37
Kaman	Bovine	1419226.38	6670363.99	4924715.54	1064419.79	936689.41
	Ovine	198479.19	932852.19	688722.79	148859.39	130996.27
	Poultry	88424.62	415595.72	306833.44	66318.47	58360.25
	Total	1706130.19	8018811.90	5920271.77	1279597.64	1126045.93
Mucur	Bovine	993126.42	4667694.17	3446148.68	744844.82	655463.44
	Ovine	154302.33	725220.95	535429.09	115726.75	101839.54
	Poultry	579710.46	2724639.17	2011595.31	434782.85	382608.91
	Total	1727139.21	8117554.30	5993173.07	1295354.41	1139911.88
TOTAL		**14855272.55**	**69819780.90**	**51547795.74**	**11141454.41**	**9804479.88**

The biogas potential from animal wastes across Turkey has been determined as 1883009370 m^3/year as given in Table 7. When the table is examined, it is seen that the amount of biogas that can be obtained in the province annually is equivalent to approximately 8850144039.90 kWh

electricity or to the energy obtained from 6534042514.57 kg of wood or 1412257027.64 liter of gasoline or 1242786184.33 liter of diesel oil. The share of Kırşehir province in the potential has been calculated as 0.79%.

Table 6. The values of the equivalent of annual biogas potential of Kırşehir province in total and its districts to today's energy sources in USD dollars (1$=3.52 TL)

District	Type of animal	Electricity ($ year^{-1})	Wood ($ year^{-1})	Gasoline ($ year^{-1})	Diesel oil ($ year^{-1})
Central	Bovine	2799931,67	1442221,11	5662899,91	4297569,54
	Ovine	197254,68	101604,22	398950,28	302763,00
	Poultry	309041,02	159184,42	625039,67	474342,04
	Total	**3306227,38**	**1703009,75**	**6686889,86**	**5074674,58**
Akcakent	Bovine	277452,73	142913,55	561151,93	425857,68
	Ovine	38621,83	19893,78	78113,18	59280,02
	Poultry	7276,37	3748,00	14716,56	11168,39
	Total	**323350,94**	**166555,33**	**653981,67**	**496306,09**
Akpinar	Bovine	428061,06	220490,63	865759,32	657023,96
	Ovine	49564,43	25530,22	100244,74	76075,64
	Poultry	13538,35	6973,49	27381,49	20779,79
	Total	**491163,84**	**252994,34**	**993385,55**	**753879,38**
Boztepe	Bovine	1359154,84	700089,16	2748909,15	2086144,63
	Ovine	40515,80	20869,35	81943,76	62187,05
	Poultry	218827,65	112716,27	442581,91	335875,00
	Total	**1618498,29**	**833674,78**	**3273434,82**	**2484206,68**
Cicekdagi	Bovine	666675,73	343399,03	1348360,74	1023269,73
	Ovine	136102,19	70105,08	275268,52	208901,03
	Poultry	15898,78	8189,33	32155,49	24402,77
	Total	**818676,70**	**421693,44**	**1655784,76**	**1256573,53**
Kaman	Bovine	814845,60	419720,07	1648036,31	1250693,25
	Ovine	113956,38	58697,96	230478,32	174909,79
	Poultry	50768,80	26150,58	102680,58	77924,20
	Total	**979570,77**	**504568,62**	**1981195,22**	**1503527,23**
Mucur	Bovine	Büyükbaş	570201,28	293705,85	1153239,84
	Ovine	Küçükbaş	88592,33	45633,16	179179,20
	Poultry	Kanatlı	332839,44	171442,78	673172,31
	Total	**Toplam**	**991633,05**	**510781,80**	**2005591,34**
TOTAL		8529120,97	4393278,05	17250263,22	13091208,93

Table 7. Biogas and other energy equivalents of animal potential in Turkey

Type of animal	Number of animals	Biogas amount (m^3 $year^{-1}$)	Electricity (kWh $year^{-1}$)	Wood (kg $year^{-1}$)	Gasoline (liter $year^{-1}$)	Diesel oil (liter $year^{-1}$)
Bovine	14222228	1098240446.16	5161730096.95	3810894348.18	823680334.62	724838694.47
Ovine	41329232	218135686.50	1025237726.53	756930832.14	163601764.87	143969553.09
Poultry	333541262	566633237.54	2663176216.42	1966217334.25	424974928.15	373977936.77
Total	**389092722**	**1883009370,19**	**8850144039,90**	**6534042514,57**	**1412257027,64**	**1242786184,33**

In the studies conducted in our country, it has been suggested by researchers that animal wastes will contribute to the local and national economy. Accordingly, it has been reported by the researchers that an annual production of 2 million tons of manure from animal wastes took place in 2009 in Thrace Region (Tekirdag, Edirne, Kırklareli and Canakkale), the potential biogas production that can be achieved by the production of these manures was 77 million m^3 annually and the region has the potential to generate 362 million kWh of electricity from animal wastes and the electricity income that can be obtained from using livestock potential in biogas production is approximately 49715,9 $ per day (Doğru, 2010) , that an annual production of 2406665 tons of manure from animal wastes took place in 2013 in Thrace Region, the potential biogas production that can be achieved by the production of these manure was 95959785 million m^3 annually and the region has

the potential to generate 450 million kWh of electricity from animal wastes and the electricity income that can be obtained from using livestock potential in biogas production is approximately 70214,2 $ per day (Dursun et al., 2015), that an annual production of 1762051 tons of manure from animal wastes took place in 2016 in Canakkale, the potential biogas production that can be achieved by the production of these manures was 96934753 m^3 annually and the region has the potential to generate 456 million kWh of electricity from animal wastes (Ilgar, 2016).

Similarly, it has been reported by the researchers that an annual production of 1063905 tons of manure from animal wastes took place in 2015 in Bursa, the potential biogas production that can be achieved by the production of these manures was 49569899 m^3 annually and the region has the potential to generate 289 million kWh of electricity from animal wastes (Ulusoy et al., 2015), that an annual production of 2880000 tons of manure from animal wastes took place in 2012 in Sivas, the potential biogas production that can be achieved by the production of these manures was 41000000 m^3 annually and the region has the potential to generate 105 million kWh of electricity from animal wastes (Yokuş and Onurbaş Avcıoğlu, 2012), that an annual production of 1260000 tons of manure from animal wastes took place in 2012 in Igdir, the potential biogas production that can be achieved by the production of these manures was 21441000 m^3 annually and the thermal value of the amount of biogas that can be obtained annually in Igdir province in total is equivalent to the amount of heat to be obtained from approximately 13.5 million liters of gas oil, 74 thousand tons of wood, 17 million liters of gasoline and 100 million kWh of electricity (Altıkat and Çelik, 2012), that an annual production of 908075.74 tons of manure from animal wastes took place in 2013 in Kahramanmaras, the potential biogas production that can be achieved by the production of these manures was 14604867.70 m^3 annually and the thermal value of the amount of biogas that can be obtained annually in Kahramanmaras province in total is equivalent to the amount of heat to be obtained from approximately 68642878.10 kWh of electricity, 50678890.80 tons of wood and 10953650.80liters of gasoline (Gençoğlan et al., 2015), that an annual production of 1163677 tons of manure from animal wastes took place in 2015 in Yozgat, the potential biogas production that can be achieved by the production of these manures was 45070100 m^3 annually and the thermal value of the amount of biogas that can be obtained annually in Yozgat province in total is equivalent to the amount of heat to be obtained from approximately 211829472 kWh of electricity, 156393249 kg of wood, 19380143 kg of LPG and 36056080 liters of gasoline (Eryilmaz et al., 2015), that an annual production of 513335.48 tons of manure from animal wastes took place in 2017 in Adiyaman, the potential biogas production that can be achieved by the production of these manures was 15012856.70 m^3 annually and the thermal value of the amount of biogas that can be obtained annually in Adiyaman province in total is equivalent to the amount of heat to be obtained from approximately 70560426.49 kWh of electricity (Baran et al., 2017).

When examining the amount of biogas that can be obtained from animal waste-based fertilizer in Kırşehir province and its equivalents to other energy types, it is seen that the province showed similarities with the studies conducted in different parts of our country and it is obvious that it will contribute to the national and the local economy.

During biogas production, while the gases such as CH_4, CO_2, H_2S are released by fermentation of anaerobic bacteria, the microorganisms with disease agents in fertilizers dissappear at the same time. Moreover, it becomes very difficult for insects and fly larvae to live in the degassed fertilizer. Therefore, in biogas production, besides obtaining an energy source, it is also avoided fertilizer to pose a threat to the environment. An increase by 20% in the value of the fertilizer in terms of plant nutrition is provided subsequent to biogas production. It has been suggested by the studies that an increase by 16% in wheat yield, while an increase by 25% in beet yield occurred as a result of applying the same fertilizer to the soil after obtaining biogas (Alçiçek and Demirulus, 1994). It is seen that an increase by 28% in agricultural productivity was achieved as a result of using fermented fertilizer in agricultural areas after biogas is obtained from the fertilizer (Toruk and Eker, 2003). The animal and vegetable wastes in our country are mostly either burned directly for heating purposes or used as fertilizer in agricultural areas. Yet, the desired heat yield cannot be obtained when burned for heating purposes, it is also not possible to use waste as fertilizer after heat production. Thanks to the biogas technology, however, the fertilizer does not disappear from organic wastes, it becomes a much more valuable fertilizer (Doğru, 2010). The wastes used after biogas production do not pollute the environment, but instead they become a fertilizer which is much more valuable and necessary for organic farming. This transformation positively affects environmental health, especially in rural areas (Chang et al., 2015; Alayi et al., 2016).

As the researchers have pointed out, in additon to reducing environmental pollution after the production the manures used for biogas production are transformed into a much more valuable fertilizer and increase yields in agricultural areas and reduce the use of chemical fertilizers. Furthermore, besides the energy gain, if they obtained manure is sold, it is clear that the revenue to be obtained from the fertilizer sales will contribute to the local economy.

Conclusion

In meeting the increasing energy gap in the world and our country, the importance of alternative energy sources is increasing with each passing day. Besides being an alternative energy source, biogas which can be obtained from plant and animal wastes, has functions such as reducing the environmental damage of animal wastes and increasing usefulness to plants as an organic fertilizer. Therefore, it is considerably significant resource to be benefited from in terms of its possible contributions to the national economy.

Today, alternative energy sources, constituting a way to reduce external dependency in the energy sector in our country, have become highly important. As a result of the study carried out to determine the biogas potential of Kırşehir province on the basis of animal waste, it has been suggested that Kırşehir province, with the amount of biogas to be obtained from its animal existence, is one of our provinces that will contribute to reducing external dependence. As a consequence of its utilization by individuals living in rural areas in doings such as cooking, heating, consuming electricity at a lower cost, the biogas to be obtained from the animal wastes in the province will make great contributions to the national and local economy. For this contribution to be realized, the most important way to benefit from this source is to establish pilot biogas plants and disseminate them.

Even though when we say biogas the first thing that comes to mind is the energy use, the waste does not disappear after the biogas production; instead, it becomes a much more valuable organic fertilizer. Through this valuable fertilizer to be used in the enterprises engaged in vegetative production in Kırşehir province, while productivity in the agricultural areas of the province is increasing, general health and hygiene in the region will improve. At the same time, the damages of the content in fertilizer to underground and surface water resources will be prevented and greenhouse gas emissions from fossil fuels in the province will also be reduced. Consequently, it has been suggested by the study that biogas production, besides increasing the living standards of the individuals who provide their livelihood on agriculture and animal husbandry in Kırşehir province, has the potential to create an important resource for the sustainable development of the region.

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