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Estimation of Biomass Potential in Pirgulu Innate Zone

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Abstract Biomass potential is one of the very interesting energy sources in the nature. In the paper the estimation of biomass potential from the cattle husbandry was given. While calculating the resource all populations amount within the families living in the region were taken into account. Also the difference between the biomass quantity from cow and buffalo has been appreciated. At the same time the total biogas reserve obtained from the biomass collected in the personal husbandries was defined. Finally the ecological and economical aspects of biogas has been validated.

Keywords Biomass Potential, Biogas Reserve, Cattle Husbandry, Personal Farms

1. Introduction

Multiple works are being carried out in alternative energy field over all the world at present. Thus in several world countries, solar, wind, thermal water, hydroenergy, biomass, wave and other renewable energy potentials have been calculated[3,14,16] and these energy resources are being widely used now. For both energy supply and ecological problems solution renewable enrgy sources application is profitable from ecological facet per each country.Particularly in the countries or zones where cattle-breeding sector has developed perfectly biomass potential is able to be utilized in order to generate bigass energy[5,10,12]. The biogas can be used in any field of the life and also in different buildings to provide heating need. Biogasapplication practise exists and proved itself in the international level. Biogas energy plants as other reneable energy equipments are to be exploitated individually and in centralized form. Combined application of biogas lets good condition generation to utilize the current resources effectively in preventing environment from being polluted and reducing amount of the ecological questions formation[6,8]. At the same time forets safety and decreasing forest wood hewing biogas is one of the most beneficial cleen energy sources. Forests protection and reforestation are very actual matters now. It should be taken into considration that the initial reason of forest cutting comes from the heat demand of the population. Finally in order to delay fuelwood hewing[7,2,4] beside solar and wind energy potentials biomass potential is worthy source to generate biogas[15]. In the contact with woodlands for the purpose of supplying settlements with bogas energy the total amount of biomass reserve (wet brick) ought to be determined and calculated.

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During organizing biogas generation population amount in the region, heat energy necessity and collected biomass reserve should be taken into account beforehand. Therefore around the investigation area, in thesettlements and villages surrounding Pirgulu region total amount of the polulation was determined statistically. Because while calculating biomass from the cattle-breeding husbandries this factor is important, at least. Potential determination is too necessary in order to validate biomass application.

In formating the energy sector initially energy stocks and reserves are to be calculated[9,16]. Whilst utilizing the energy stocks economical and ecological aspects have to be appreciated for vindicating the energy potential

exploitation in the life and different fields of industry sectors. Really almost in the former SSR period cattle -breeding husbandry was developed and extended in the country. But the waste of this industry field are partly used in cultivation of soils by fertilizing. The rest wates haven't used anyway. Historically cattle-breeding wastes were utilized by the population as the energy source in dry brick [1,16] form especially there where finding energy sources was impossible in mountainous and foothil regions. But biogas generation didn't come to their mind. Lately biogas usage leads to biomass utilization from cattle-breeding farms. Practically in German[3], Turkey[8] and other countries biogass generation is realized and they supply the local population with biogas source[11]. One of the companies who is busy with biogas energy plants purchase is russian one by name "Kiska". This company proposed his energy plants to be instolate in some mountainous village on the mountainous zone. In this zone energy transportation and pipline building are difficult because of the natural condition andrelief state[5,13]. Some of the houses agreed to use these plants with working biomass resource. Effective result was obtained. So this proves that application and exploitation of the existing bimass potential in the regions of the country is possible and profitable. That's the time to carry out this work

in the connecting zones with the forests where hugely forest fuelwood is used for providing energy need. So the biomass potential has to be calculated and determined for validating the potential usage in advance.

2. Object and Methods of the Study

While selecting investigation zone the renewable energy potential reserve and location of the villages surrounding woodlands have been taken into consideration. One of such innate zone is Pirgulu region which is rich with wealthy flora, fauna on the Great Caucasus mountain in Shamakhi region. Pirgulu innate zone has a lot of renewable energy resources. Due to the objective of the investigation amount of families, populations in the settlements in the region have been determined and tabled below. Here not only the villages surrounding Pirgulu, also other villages in the region which carry the fuelwood from Pirgulu woodland were considered in calculations.

Also for the purpose of biogas generation and heat energy supply average amount of cattle (cow and buffalo) in the personal husbandry of one settlement on the total quantity has been determined. In the investigation zone in villages amount of biomass obtained from the personal cattle -breeding farms was revealed beforehand. Also the daily biomass (wet brick) weight from the cattle was defined and used in the calculation. During studying it was validated that amount of cattle-breeding in surrounding zone of Pirgulu consists of 1338,25 buffalos, 2676,5 cows, total index is 4014,75. Averagely weight of biomass obtained from coq is 8-12 kg (sometimes 10 kg), weight of biomass obtained from buffalo is 15-20 kg (sometimes 17,5 kg). Due to the indicates above at table 2, average daily amount of biomass from cattle-breeding (cow and buffalo) has been determined and given at the table.

On indexes obtained after calculations realized in villages surrounding Pirgulu biogas amount generated from biomass collected in the personal cattle-breeding for each settlement has been calculated, then defined. Averagely 1m^3 biogas is generated from 10 kg biomass, by this way in Avakhil village biomass obtained from cow in cattle-breeding farm per a person has been calculated. The result was 44 kg. but the daily biomass reserve averagely for Avakhil 44×490=21 560 kg cow biomass. So, during a day from this cow biomass averagely 21560÷10=2156 m^3 biogas is generated.

In the very village biomass amount collected from buffalo per a person averagely is 47,3 kg. While taking into account all the population 47,3×490=23177 kg, so biogas generated from buffalo biomass will be 23177÷10=2317,7 m^3.

Generally biogas quantity generated from cow and buffalo cattle-breeding biomass 2156+23177=25333 m^3. by this way according to the population amount for other villagesaverage daily biomass quantity and biogas capacity generated from this biomass were determined. The results of thecalculation have been given at the following table correspondingly.

Table 1. Amount of the population living in villages surrounding Pirgulu State Nature Preserve

№	Villages	Family amount	Population amount	Average family member	Buffalo amount per a person	Cow amount per a person
1	Avakhil	99	490	4,9	2,7	4,4
2	Chabani	76	387	6	3,4	4,9
3	Chukhuryurd	794	1048	1,32	1,3	2,5
4	Dedegunesh	52	198	3,8	4,7	4,5
5	Demirchi	102	582	5,7	2,3	4,5
6	Ahmadli	123	502	5	2,7	3,3
7	Angakharan	196	856	4,4	1,6	3,2
8	Archiman	139	856	4,4	1,6	3,2
9	Hajili	73	365	5	1	4,6
10	I Chagan	44	365	5	3,6	3,3
11	II Chagan	36	149	4,2	4,3	4,7
12	Kechmeddin	51	211	4,1	2,9	5,8
13	Galaderesi	36	143	4	2,9	6,1
14	Galeybugurd	192	801	4,2	2,6	5,2
15	Gizmeydan	258	1114	4,3	4,4	3,8
16	Gonagkend	166	829	5	3,4	4,9
17	Gurdtepe	139	804	6	1,7	3,5
18	Meysari	162	690	4,2	1,2	2,4
19	Malham	414	1392	3,4	1,6	3,4
20	Nagarakhana	212	864	4	1,7	3,3
21	Pirbayli	38	184	5	1,9	3,9
22	Pirgulu settlement	6	41	6,8	×	×
23	Safali	31	134	4,3	1	1,9
24	Sis	79	348	4,4	1,9	3,9
25	Talishnuru	77	317	4,1	1	1,9
26	Yeni Gizmeydan	23	95	4,1	1,5	3
27	Zarat Kheyberi	40	233	5,8	3,3	6
sum:	27 villages (one settlement)	3658	13546	*Average* 4,5	3	4,2

Table 2. Biomass amount in personal cattle farms in villages surrounding Pirgulu State Nature Preserve

№	Villages	Average daily buffalo biomass amount, kg	Average daily cow biomass amount, kg	Average daily biomass amount from cattle, kg
1	Avakhil	47,3	44	45,7
2	Chabani	59,5	49	54,25
3	Chukhuryurd	22,8	25	23,9
4	Dedegunesh	82,3	45	63,65
5	Demirchi	40,3	45	42,65
6	Ahmadli	47,3	33	40,15
7	Angakharan	28	32	30
8	Archiman	28	32	30
9	Hajili	17,5	46	31,75
10	I Chagan	63	33	48
11	II Chagan	75,3	47	61,15
12	Kechmeddin	50,8	58	54,4
13	Galaderesi	50,8	61	55,9
14	Galeybugurd	45,5	52	97,5
15	Gizmeydan	77	38	57,5
16	Gonagkend	29,8	49	78,8
17	Gurdtepe	12,8	35	23,9
18	Meysari	21	24	22,5
19	Malham	28	34	31
20	Nagarakhana	29,8	33	62,8
21	Pirbayli	33,3	39	36,15
22	Pirgulu settlement	×	×	×
23	Safali	17,5	19	18,25
24	Sis	26,3	30	28,15
25	Talishnuru	57,8	60	58,9
26	Yeni Gizmeydan	38,5	42	40,25
27	Zarat Kheyberi	85,8	54	69,9
sum:	27 villages (one settlement)	43	40,7	46,5

Table 3. Average index of biomass and biogas potential obtained in the settlements on populations' amount

№	Villages	Buffalo biomass due to population amount *(kg)*	Cow biomass due to population amount *(kg)*	Biogas from buffalo *($м^3$)*	Biogas from cow *($м^3$)*
1	Avakhil	23177	21560	2318	2156
2	Chabani	23026,5	18963	2303	1897
3	Chukhuryurd	23894,4	26200	2390	2620
4	Dedegunesh	16295,4	8910	1630	891
5	Demirchi	23454,6	26190	2346	2619
6	Ahmadli	23744,6	16566	2375	1657
7	Angakharan	23968	27392	2397	2740
8	Archiman	10237,5	26910	1024	2691
9	Hajili	22995	12045	2300	1205
10	I Chagan	13855,2	8648	1386	865
11	II Chagan	7569,2	9089	757	909
12	Kechmeddin	16247	8018	1625	802
13	Galaderesi	4261,4	7007	427	701
14	Galeybugurd	10252,8	28035	1026	2804
15	Gizmeydan	23394	26736	2340	2674
16	Gonagkend	23212	28186	2322	2819
17	Gurdtepe	23959,2	26532	2396	2654
18	Meysari	22977	26910	2298	2691
19	Malham	24360	26448	2436	2645
20	Nagarakhana	22723,2	25920	2273	2592
21	Pirbayli	10635,2	11040	10636	1104
22	Pirgulu settlement	×	×	×	×
23	Safali	11497,2	7236	1150	724
24	Sis	23142	24360	2313	2436
25	Talishnuru	9985,5	19971	9986	1998
26	Yeni Gizmeydan	5652,5	4085	5653	409
27	Zarat Kheyberi	23253,4	23300	23254	2330
sum:	27 villages (one settlement)	467769,8	496257	91361	49633

Table 4. Biomass and biogas generation from cow farms in villages surrounding Pirgulu State Nature Preserve

№	Villages	Cow amount per a person (head)	Average daily Biomass kg	average annual biomass kg	Average annual biogas generation m^3	Average monthly biogas generation m^3	Demand provision reserve %
1	Avakhil	4,4	88	31680	3168	264	58
2	Chabani	4,9	98	35280	3528	294	65
3	Chukhuryurd	2,5	50	18000	1800	150	33
4	Dedegunesh	4,5	90	32400	3240	270	60
5	Demirchi	4,5	90	32400	3240	270	60
6	Ahmadli	3,3	66	23760	2376	198	44
7	Angakharan	3,2	64	23040	2304	192	42
8	Archiman	3,2	64	23040	2304	192	42
9	Hajili	4,6	92	33120	3312	276	61
10	I Chagan	3,3	66	23760	2376	198	44
11	II Chagan	4,7	94	33840	3384	282	62
12	Kechmeddin	5,8	116	41760	4176	348	77
13	Galaderesi	6,1	122	43920	4392	366	81
14	Galeybugurd	5,2	104	37440	3744	312	69
15	Gizmeydan	3,8	76	27360	2736	228	50
16	Gonagkend	4,9	98	35280	3528	294	65
17	Gurdtepe	3,5	70	25200	2520	210	46
18	Meysari	2,4	48	17280	1728	144	32
19	Malham	3,4	68	24480	2448	204	45
20	Nagarakhana	3,3	66	23760	2376	198	44
21	Pirbayli	3,9	78	28080	2808	234	52
22	Pirgulu settlement	×	×	×	×	×	×
23	Safali	1,9	38	13680	1368	114	25
24	Sis	3,9	78	28080	2808	234	52
25	Talishnuru	1,9	38	13680	1368	114	25
26	Yeni Gizmeydan	3	60	21600	2160	180	40
27	Zarat Kheyberi	6	120	43200	4320	360	80
sum:	27 villages (one settlement)	average	4,2	78,5	28273,8	2827,4	235,6	52

Table 5. Biomass and biogas reserves from buffalo farms in villages surrounding Pirgulu State Nature Preserve

№	Villages	Buffalo amount per a person	Average daily biomass, kg	Annual biomass index kg	Annual biogas generation m^3	Average monthly biogas generation m^3	Demand provision reserve %
1	Avakhil	2,7	67,5	24300	2430	202,5	45
2	Chabani	3,4	85	30600	3060	255	56
3	Chukhuryurd	1,3	32,5	11700	1170	97,5	21
4	Dedegunesh	4,7	117,5	42300	4230	352,5	78
5	Demirchi	2,3	57,5	20700	2070	172,5	38
6	Ahmadli	2,7	67,5	24300	2430	202,5	45
7	Angakharan	1,6	40	14400	1440	120	26
8	Archiman	1,6	40	14400	1440	120	26
9	Hajili	1	25	9000	900	75	16
10	I Chagan	3,6	90	32400	3240	270	60
11	II Chagan	4,3	107,5	38700	3870	322,5	71
12	Kechmeddin	2,9	72,5	26100	2610	217,5	48
13	Galaderesi	2,9	72,5	26100	2610	217,5	48
14	Galeybugurd	2,6	65	23400	2340	195	43
15	Gizmeydan	4,4	110	39600	3960	330	73
16	Gonagkend	3,4	85	30600	3060	255	56
17	Gurdtepe	1,7	42,5	15300	1530	127,5	28
18	Meysari	1,2	30	10800	1080	90	20
19	Malham	1,6	40	14400	1440	120	26
20	Nagarakhana	1,7	42,5	15300	1530	127,5	28
21	Pirbayli	1,9	47,5	17100	1710	142,5	31
22	Pirgulu settlement	×	×	×	×	×	×
23	Safali	1	25	9000	900	75	16
24	Sis	1,9	47,5	17100	1710	142,5	31
25	Talishnuru	1	25	9000	900	75	16
26	Yeni Gizmeydan	1,5	37,5	13500	1350	112,5	25
27	Zarat Kheyberi	3,3	82,5	29700	2970	247,5	55
sum:	27 villages (one settlement)	average 3	60	21530,8	2154	179,5	39,5

Table 6. Total biogas reserv from both husbandry in the surrounding villages

№	Biomass potential in the villages	Biogas from cow husbandry %	Biogas from buffalo husbandry %	Total average biogas %
1	Avakhil village with 490 peoples, 2,7 buffalos, 4,4 cows per a person, average total biomass is 22368,5 kg on cattle-breeding	58	45	52
2	Chabani village with 387 peoples, 3,4 buffalos, 4,9 cows per a person, average total biomass is 20994,8 kg on cattle-breeding	65	56	61
3	Chukhuryurd village with 1048 peoples, 1,3 buffalos, 2,5 cows per a person, average total biomass is 25047,2 kg on cattle farm	33	21	27
4	Dedegunesh village with 198 peoples, 4,7 buffalos, 4,7 cows per a person, average total biomass is 25047,2 kg on cattle-breeding	60	78	69
5	Demirchi village with 582 peoples, 2,3 buffalos, 4,5 cows per a person, average total biomass is 24822,3 kg on cattle-breeding	60	38	49
6	Ahmedli village with 502 peoples, 2,7 buffalos, 3,3 cows per a person, average total biomass is 32566,45 kg on cattle-breeding	44	45	45
7	Angekharan village with 856 peoples, 1,6 buffalos, 3,2 cows per a person, average total biomass is 25680 kg on cattle-breeding	42	26	34
8	Archiman village with 856 peoples, 1,6 buffalos, 3,2 cows per a person, average total biomass is 18573,75 kg on cattle-breeding	42	26	34
9	Hajili village with 365 peoples, 1 buffalo, 2,4 cows per a person, average total biomass is 17520 kg on cattle-breeding	61	16	39
10	I Chagan village with 365 peoples, 3,6 buffalos, 3,3 cows per a person, average total biomass is 11251,6 kg on cattle-breeding	44	60	52
11	II Chagan village with 149 peoples, 4,3 buffalos, 4,7 cows per a person, average total biomass is 8329,1 kg on cattle-breeding	62	71	67
12	Kechmeddin village with 211 peoples, 2,9 buffalos, 5,8 cows per a person, average total biomass is 12132,5 kg on cattle-breeding	77	48	63
13	Galaderesi village with 143 peoples, 2,9 buffalos, 6,1 cows per a person, average total biomass is 5634,2 kg on cattle-breeding	81	48	65
14	Galeybugurd village with 801 peoples, 2,6 buffalos, 5,2 cows per a person, average total biomass is 19143,9 kg on cattle-breeding	69	43	56
15	Pirbeyli village with 1114 peoples, 4,4 buffalos, 3,8 cows per a person, average total biomass is 25065 kg on cattle-breeding	50	73	61,5
16	Gonagkend village with 829 peoples, 3,4 buffalos, 4,9 cows per a person, average total biomass is 25699 kg on cattle-breeding	65	56	60,5
17	Gurdtepe village with 804 peoples, 3,4 buffalos, 4,9 cows per a person, average total biomass is 25245,6 kg on cattle-breeding	46	28	37
18	Pirbeyli village with 690 peoples, 1,2 buffalos, 2,4 cows per a person, average total biomass is 24943,5 kg on cattle-breeding	32	20	26
19	Malham village with 192 peoples, 1,6 buffalos, 3,4 cows per a person, average total biomass is 25404 kg on cattle-breeding	45	26	36
20	Nagarakhana village with 864 peoples, 1,7 buffalos, 3,3 cows per a person, average total biomass is 48643,2 kg on cattle-breeding	44	28	36
21	Pirbeyli village with 184 peoples, 1,9 buffalos, 3,9 cows per a person, average total biomass is 10837,6 kg on cattle-breeding	52	31	42
22	Pirgulu settlemnet	×	×	×
23	Safali village with 134 peoples, 1 buffalo, 1,9 cows per a person, average total biomass is 9366,6 kg on cattle-breeding	25	16	21
24	Sis village with 134 peoples, 1,9 buffalos, 3,9 cows per a person, average total biomass is 23751 kg on cattle-breeding	52	31	42
25	Talishnuru village with 137 peoples, 1 buffalo, 1,9 cows per a person, average total biomass is 14978,25 kg on cattle-breeding	25	16	21
26	II Gizmeydan village with 95 peoples, 1,5 buffalos, 3 cows per a person, average total biomass is 4868,75 kg on cattle-breeding	40	25	33
27	Pirbeyli village with 233 peoples, 3,3 buffalos, 6 cows per a person, average total biomass is 1217,19 kg on cattle-breeding	80	55	68
Sum:	27 villages (included one settlement)	average 52	39,5	46

From the table it is cleared that in 31 villages including one settlement around Pirgulu region averagely total biomass amount obtained from cow and buffalo husbandries will be 562713,9+605307=1168021 kg. Total capacity of biogas generated from the very biomass is 102278+60540=162818 m^3. in Pirgulu zone of Shamakhi region in 27 settlements in the personal cattle-breeding farms average daily biomass amount (by 20 kg biomass weight) from cow farm was calculated and determined. At the result (1 m^3 biogas from 10 kg biomass) average annual and average monthly biogas generation, at the same time percentage index of total average monthly biogas potential in supplying gas demand was calculated.

Also by the new method average daily, annual biomass potential from buffalo farms (average weight is 25 kg) and on this basis average annual and monthly biogas generation, then percentage index of biogas in total average monthly gas demand provision was calculated and defined.

Finally after having clarified biomass potential obtained from both cattle-breeding farms, it was revealed that biogas generation can provide the total gas demand averagely (52+39,5)÷2=46%.

Also on the base of results the biomass potential possibilities have been determined for biogas generation. This gives opportunity to the investors to put capital for this energy field.

3. Results and Discussions

In the direction of renewable energy potential assessment and appreciation of Pirgulu region research was firstly realized. According to the monitoring, investigations and calculations carried out in 2004-2010 years in the region, beside solar and wind energy potentials of the zone biomass resource has been calculated. Total amount is enough for biogas generation in the villages surrounding Pirgulu region. All biomass has been obtained from cattle-breeding farms. Due to the reference analysis it is clear that none of the region of Azerbaijan including Pirgulu biomass potential for generating biogas hasn't implemented before. In settlements of investigation area several renewable energy potentials are to be utilized together in settlements located around woodla nds for supplying heat energy potential provision. In spite of solar and wind energy reserves biomass potential can be used in biogas generation. Personal cattle-breeding husbandries crate the suitable condition for collecting biomass reserves. This energy potential holds economical and ecological advantages for the population and the government. Because the biomass obtained from cattle farms is collected periodically and biogas generated from this biomass is able to supply the holder of that husbandry with gas for heating his house and farm. This is the irreplaceable energy source instead of fuelwood cut from the forests.

4. Conclusions

Calculations and observations have been realized in 31 settlements around the investigation area. Finally the the conclusions have been come into:

- Personal cattle-breeding consists of 4014,75 including 1338,25 buffalos and 2676,5 cows;
- In 31 settlments there are averagely 3,6 buffalos, 4,6 cows per a person, total amount is 3,9 from both;
- Average biomass amount due to the population biomass amount was determined 562713,9 kg from buffalo and 605307 kg from cow, total biomass from cattle-breeding farms is 1168020,9 kg;
- Biogas generation consists averagly of 102278 m^3 from buffalo biomass and 60540 m^3 from cow biomass collected inthe personal husbandries, the total amount is 162818 m^3.

It has been revealed on the reports realized in Pirgulu region since 2004 year, biomass energy potential holds great importance for protecting fuelwood from forests and supplyi ng energy need in the villages. There is enough biomass potential in the personal cattle-breeding husbandries.

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