

A REVIEW ABOUT PROGRAMS OF BIOMASS ENERGY IN IRAN

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ABSTRACT: Biomass energy is the only resource of renewable energy that produces energy in the form of electricity, heat, cold and car fuel and in the forms of solid, liquid and gas. Furthermore biomass materials can be used as petrochemical food. As what was said in this paper a review about programs of biomass energy in Iran (as under developing country) in this paper will be considered.

KEYWORDS: Renewable Energy, Biomass Energy, Iran.

INTRODUCTION

Biomass energy is the only resource of renewable energy that produces energy in the form of electricity, heat, cold and car fuel and in the forms of solid, liquid and gas. Further more biomass materials can be used as petrochemical food. Today useful and applicable resources of biomass aren't only limited to wood and dry leaf of the trees and it includes a wide range of materials such as liquid and solid rubbish of the cities and industrial rubbish and so on ([Charter, 1997](#)). Solid biomass includes non-fossil organic materials with biological origin that may be used as fuel for producing heat or electricity and it includes: wood, charcoal, wood wastes and other solid rubbish(s). We can say that it includes plant productions that have been cultivated with the aim of providing energy (such as spruce fir tree, willow tree and so on), materials produced in industrial processes (specially wood and paper industry) or materials produced by agriculture and forestry directly such as (charcoal, wood chip, the crust of the tree, saw dust, chips produced from wood grindstone and so on). So it includes rubbishes such as bamboo and straw, cover of rice pollard, crusts of oily seeds, straw, rubbish of ripe chipped and so on. Using biomass energy traditionally means burning wood and rubbish of animals, causes woods to be destroyed and destructs environment. But by combining chemical and

biological methods, it would be possible to change sugar, cellulose and other materials of agricultural products to liquid fuel. In recent years, using biomass as an energy resource, not only from the point of environmental situations but also because of social and economical reasons and because of easy availability has become attractive. Table (1) depicts area of woods and pastures of the country on the basis of their accumulation in 2010. In this year from 101.8 million hector of mentioned earths, 83.3% has been allocated to pastures, 14.1% forests area been allocated to other applications. Surveys show that 55.2% of total of these areas has been allocated to low accumulated pastures (WWW.SUNA.ir).

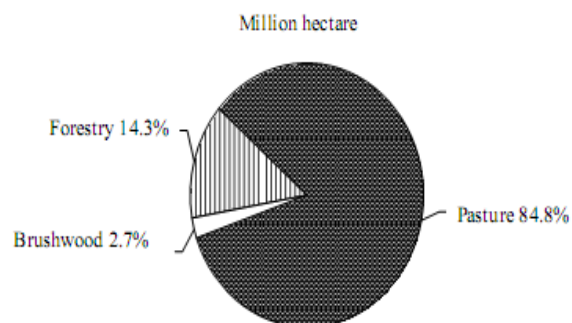


Figure 1: area of forestry, pasture and other application of lands in 2010.

Table 1: area of woods and pastures on the basis of the amount of accumulation in 2010

Kind of areas of natural Resources of the country	Area out of north	Area of north	total	percent
Woods: thick ⁽¹⁾	755784.0	1024506.2	178029.2	1.7
Semi-thick ⁽¹⁾	2807360.2	660951.9	3468312.1	3.4
Low ⁽¹⁾	7843948.2	256893.6	8100841.8	8.0
Mandayi	25760.2	0	25760.2	0.03
Hand-planted	918894.5	24963.8	943858.4	0.9
?	2541559.7	123493.2	2665052.9	2.6
Total	12351747.1	1967315.6	14319062.7	14.1
Pasture: thick ⁽²⁾	6343419.2	837830.8	7181250.0	7.1
Semi-thick ⁽²⁾	20680512.2	738639.0	21419151.2	21.0

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Low-thicks ⁽²⁾	56098537.6	116052.2	56214589.7	55.2
Total	83122469.0	1692522.0	84814991.0	83.3
Total	98015775.8	3783330.7	101799106.5	100.0

(1) Covering accumulation in thick forests is over 50% 45% in semi-thick forests is 25 to 50% and in low-thick forests is 5 to 25%.

(2) covering accumulation in accumulated pastures is over 50%, in semi-thick pastures is 25 to 50%, and in low-thick ones is 5 to 25%. Although renewable natural resources of country are in the form of until body, but from the point of exploiting and management system in the country, there separated and different sections will be evaluated. These three sections are: Pastures, desert and forest.

1.1. Pastures

Pastures is a kind of earth with the cover of natural self-growing that its cover plant consists of multi year grassy plants bush plants, small trees and rarely scattered trees and in graze season it is used for feeding animals and also it has different and numerous function

such as: protecting water and soil, setting the circle of water in the nature, environmental values, producing products such as drag and industrial plants and in case of preparing conditions, it is one of the resources of providing food for domestic and wild animals. With respect to diversity of weather in the country and kind of the plant covering pastures from the point of being ready to be used for grazing animals and the time of exploiting are divided in to three groups: country pastures (suitable for spring and summer), pastures suitable for fall and winter and semi-season pastures (Reid, 2001).

Al though most of the pastures of the country don't have considerable quality, but they are valuable changing pasture and forestry lands to agricultural and nonagricultural lands, being too many domestic animals in the pastures over their capacity, destroying bushes, cutting trees for burning and getting fire the pastures, are from the main reasons of destroying pastures and developing non-quality ones. In 2010, the area of pastures of the country have been estimated about 84.8 million hectare, that 66.3% are low-accumulated pastures, 25.3% are semi-

accumulated ones and only 8.5% of the pastures are accumulated ones from geographical point of view, only, only 2% of pastures of the country are in the northern part and the remaining part, it means, 98% are in the area of pastures deserts and forests of the country is reviewed every some years, by the organization of pastures and forests. On the basis of the last surveys, about 51.5% of the pastures of the country are long to six provinces such as: Sis tan-Baluchistan, Fars, Khorasan Razavi, Yazd, Isfahan, and southern Khorasan.

Table (2) depicts dispersion of the pastures of the country, the amount of animals living in each area and the amount of provender that is collectable in the country in 2010, the weight of dry provender that are collectable in the pastures of the country in the surveying year are 10.7 million tons and regulating collectable provender with respect to fluctuation of raining is 9.1 million tons.

Provinces such as Fars, Khorasan (Razavi, northern and western) and western Azerbaijan with 1432, 856 and 610 thousand tons have the most amount of animals living this is in the case that the most amount of animals living in pastures be long to provinces such as: Kohkiloye-Boyerahmad, Kermanshah and Eastern Azerbaijan orderly 1.42, 0.85 and 0.62 tons in hectare.

Table 2: area and distribution of the pastures of the country in 2010, for each province separately

East Azerbaijan	2473441	0.62	704	598
West Azerbaijan	2472508	0.57	718	610
Ardebil	903896	0.45	280	465
Isfahan	6328655	0.17	547	465
Alborz	438169	*	*	*
Elam	1112357	0.35	213	181
Boshehr	1262995	0.13	104	88
Tehran	848298	0.19	88	75
Charmahal-bakhtyari	908152	0.17	91	78
Khorasan Razavi	6558356			
Northern Khorasan	1555206	0.16 ⁽¹⁾	1005 ⁽¹⁾	854 ⁽¹⁾
Southern Khorasan	6288092			
Khuzestan	2477691	0.14	262	223
Zanjan	1137060	0.30	162	138
Semnan	3731083	0.21	574	488
Sis tan-Baluchistan	10648499	0.11	621	527
Fars	7319987	0.40	1684	1432
Qazvin	853485	0.34	160	136
Qom	723019	0.11	46	39
Kurdistan	1294397	0.51	496	422
Kerman	6267925	0.11	470	399
Kerman (Jiroft-Kahnoj)	1918375	*	*	*

Kermanshah	1188438	0.85	311	264
Kohkiloye-Boyerahmad	478812	1.42	515	438
Golestan	862825	0.26	176	149
Gilan	244986	0.44	104	88
Lorestan	883505	0.46	289	246
Mazandaran (Sari)	387559	0.58	262	223
Mazandaran (noshahr)	197152	0.48	71	60
Markazi	1772951	0.27	266	226
Hormozgan	4093342	0.12	226	192
Hamadan	665767	0.17	114	97
Yazd	6518007	0.07	141	120
Total	84814991	10.14	10700	9095

(1) It is the total of provinces: Khorasan Razavi, Southern & Northern Khorasan

* The amount aren't available

1.2. Desert

Desert is one of the main ecosystems of land the consists of bushy lands that many kinds of plants are scattered there and they have been isolated by soil and sand many deserts are located be side mountains-in fact, desert is a kind of expanded land that because of low raining during the year, has low covering of plants. Deserts have surrounded cities of the country such as Tehran, Isfahan, Shiraz, Mashhad, and Ahvaz, as a whole deserts of Iran are divided in to two following groups: coastal deserts, that in the form of a tube have expanded from west to east, from Gowatr harbor in the east to Khuzestan in the south of Iran, and to Persian gulf and Oman sea. The most important characteristic of these deserts is high moisture especially in warm season.

Internal deserts: these deserts are located in the center east and west part of the country and have a wide area, and they are divided in to two groups: warm and semi warm (WWW.SUNA.ir). In Iran with respect to regional conditions and so humanistic factors that cause deserts development such as growth of population, grazing continually, using water from underground sources excessively, pollution of underground water through industrial, citizen and agricultural waste water, changing efficiency of lands, unsuitable management of the pastures and unessential management of agricultural lands, phenomenon of developing deserts has increased seriously. With respect to the importance of the problem, the organization of forest and pastures of the country conducts a plan for fixing running sand and destroying deserts or in other words preventing from developing deserts.

1.3. Forest

It is a kind of land that is mainly covered with tree small tree and other plants, provided that its area isn't less than 0.5 hectare and its cover tree isn't naturally less than 50% forest, according to the kind of arising and specifications of its structure is divided in to three groups: virgin forest, natural forest, and artificial or hand-made forest.

Producing oxygen, attracting dust and particles, carbonic gas and other chemical gases existing in the air and preventing from influencing of noise are from benefits of forests areas. Cutting the trees unsuitably and destroying forests in a wide area, changing the efficiency of forest lands, in creasing developmental projects, developing and villages, in creasing different kinds of pollutants and decreasing raining after drought of recent years, are from the main reasons that now have faced forests with a great risk ([Reid, 2001](#)).

Management of forests consists of: forming forests through planting the trees and keeping them, keeping and protecting existing forests, reforming or them, or re-establishing destroyed forests, exploiting the trees correctly, protecting from the animals of forests, and forests economy. The forests of Iran from geographical point of view are divided in to two groups: north forests and forests out of north. The area of the forests of the country at the end of 2010 has been 16984.1 thousands hectare that 47.7% of them has been low and 10.5% of it has been plenty from the point of accumulation. From the point of area of the forests provinces such as Fars, southern Khorasan, Lorestan and Sis tan-Baluchistan have grades between 1 to four. 25.3% of thick forests are in Mazandaran province, 20% of low-thick forests are in Fars province and 36.8% of hand-made forests are in Isfahan province, 78% of mandayi forests are in Hormozgan province and 31.9% of small forests are in Sis tan-Baluchistan province.

Table 3: distribution of the forests of the country in 2010 for each province separately

Name of the Province	Thick forest	Semi-thick forest	Low-thick forest	hand-made forest	Mandayi forest
East Azerbaijan	69.0	30.3	44.1	-	-
West Azerbaijan	17.7	21.0	62.3	-	-
Ardebil	3.2	2.2	45.8	0.5	-

Isfahan	-	0.4	64.4	347.0	-
Alborz	-	-	2.3	0.1	-
Elam	2.6	211.1	416.8	4.0	-
Boshehr	-	-	190.5	13.1	0.7
Tehran	-	-	14.7	9.2	-
Charmahal-bakhtyari	12.6	105.2	217.8	0.1	-
Khorasan Razavi	3.8	29.2	465.4	169.0	-
Northern Khorasan	19.2	116.6	285.2	3.7	-
Southern Khorasan	-	3.0	588.1	120.9	-
Khuzestan	293.3	299.4	294.8	50.7	-
Zanjan	0.03	3.3	57.7	-	-
Semnan	64.0	64.0	168.6	43.5	-
Sistan-Baluchistan	-	21.7	338.9	5.1	0.5
Fars	59.7	540.7	1617.2	1.4	-
Qazvin	2.4	15.1	8.8	6.0	-
Qom	-	-	-	4.1	-
Kurdistan	85.7	188.9	95.6	2.1	-
Kerman	0.1	19.0	383.2	28.7	-
Kerman (Jiroft-Kahnoj)	4.0	27.3	129.6	-	-
Kermanshah	11.5	209.6	307.1	0.2	-
Kohgiluyeh-Boyer-Ahmad	63.9	251.1	478.8	1.9	-
Golestan	163.1	147.4	93.9	10.8	-
Gilan	308.8	161.1	65.9	9.8	-
Lorestan	42.9	608.2	575.3	-	-
Mazandaran (Sari)	451.3	215.0	26.2	0.8	-
Mazandaran (Noshahr)	101.3	137.5	70.8	3.6	-
Markazi	-	-	-	1.5	-
Hormozgan	-	28.9	964.3	40.3	20.1
Hamadan	0.1	-	-	1.3	-
Yazd	-	11.0	26.4	69.7	-
Total	1780.3	3468.3	8100.8	943.9	25.8

1.4. Producing Forests Crops

Three provinces of Gilan, Mazandaran and Golestan are allowed to produce forest crops, that the amount of production of these provinces in 2010 has been about 783.8 thousands of cube meters, that in comparison with the year before, it has decreased about 8.40% in the surveying year from the total of allowed production of forests crops of the country, orderly has belonged to Mazandaran, Gilan and Golestan with 63.6%, 23.5% and 12.9%.

From the total of production of forest crops in this year, about 248.9 thousands of cube meters has allocated to firewood, 3.3 thousands of cube meters to other productions. In other words, the portion of firewood, charcoal and other wood, producing from the total is orderly 31.8%, 4% and 67.8%. In 2010, the most and the least

change in producing forest crops in comparison with the year, before has allocated to the decrease of firewood in Golestan (29.6%), and decrease of charcoal in Gilan (37.9%) and Mazandaran 18.7%. From the reasons of decreasing production in 2010 we can point to wide fire accidents in the provinces such as Golestan, Mazandaran and Gilan in the second half of 2010, that caused to destroy many of these lands factors such as drought, warm winds, lightning and even not being the culture of tourism and tourism exploiting of the forests haven't been the only reasons of these fire accidents and factors such as occupation of lands and changing their efficiency in the border of forests have been effective in this process.

Table 4: producing forest crops of the country during 2004-2010

Year\province	firewood	charcoal	other productions	Total
2004	299213	17154	570007	886374
2005	307547	11112	561637	880296
2006	294943	5568	543965	844476
2007	309579	4884	612599	927062
2008				
Gilan	33676	4584	132442	170702
Mazandaran	185592	600	445959	632151
Golestan	91288	-	43589	134877
Total	310556	5184	621990	937730
2009				
Gilan	38342	4380	139625	182347
Mazandaran	142382	738	386810	529930
Golestan	97615	-	46111	143726
Total	278339	5118	572546	856003
2010				
Gilan	35257	2718	145898	183873
Mazandaran	144940	600	353095	498635
Golestan	68717	-	32592	101309

 Total 248914 3318 531585 783817

Considerations: the total of productions is without calculation of 5% falling.

1.5. Not Allowed Taking of Charcoal

Forests are the main resources for producing wood and cellulosic crops. So, in addition to environmental aspect from economical and social point of view they are very important. About destroying forests and natural lands, many factors have helped each other land have changed the problem to a crisis. Cases such as: too much depending of families and animal keepers to the forest, un-allowed use of firewood for cooking and heating purposes, cutting valuable trees, changing forest to fruit gardens

and changing efficiency of forest lands have rule in this regard.

The effect of different activities of local societies and the cover of grass in different parts of the country and powerful potential of rebuilding the sites are different.

Table (5) depicts the amount of un-allowed firewood taking during 2004-2010 that has been discovered and confined by the police, of course for each province separately. In 2010, 49.5% of un-allowed taking of firewood has been related to these three provinces: Charmahal-Bakhtiari, Lorestan and Mazandaran.

Table 5: the amount of un-allowed taking of charcoal during 2004-2010

Province/year	2004	2005	2006	2007	2008	2009	2010
East Azerbaijan	2020	1293	6614	1794	4374		250
West Azerbaijan	-	-	-	-	-	-	-
Ardebil	12730	4390	6682	95	21938		8110
Isfahan	-	-	700	1200	2944		3035
Elam	5890	-	1500	-	3885		2110
Boshehr	969	2766	1681	877	1353		6870
Tehran	-	-	-	-	-	-	-
Charmahal-bakhtyari	27577	18831	24455	45401	29845		18399
Khorasan	-	-	2000	2000	-		3330 ⁽¹⁾
Khuzestan	9942	4118	4530	-	-		16
Zanjan	-	-	-	-	-	-	-
Semnan	1642	-	-	5802	-		-
Sis tan-Baluchistan	-	1380	-	1700	-		232
Fars	130	-	14447	20404	21005		2840
Qazvin	-	-	-	-	-	-	-
Qom	-	-	-	-	-	-	-
Kurdistan	840	536	300	-	1870		900
Kerman	4330	2123	122	150	-		-
Kerman (Jiroft)	-	-	-	-	12900		-
Kermanshah	6987	4655	4964	3965	11580		1429
Kohgiloye-Boyerahmad	5201	4044	-	-	10186		5377
Golestan	1505	840	3	-	5490		240
Gilan	5100	3224	-	-	7780		10019
Lorestan	8242	14977	20130	46294	40281		15996
Mazandaran (Sari)	4140	3033	9005	5560	10430		11715
Mazandaran (noshahr)	-	60	200	607	-		-
Markazi	-	-	-	-	-		-
Hormozgan	-	-	-	1156	-		1250
Hamadan	-	-	-	-	-		-
Yazd	-	-	-	-	-		1000
Total	97245	66270	97333	137005	185861	157221.5	93118.2

The amount of discovered charcoal is related to Khorasan Razavi

1.6. Using Solid Biomass

This energy is one of the best and most useful kinds of energies that has been paid attention from many years ago. The resources of biomass energies can be the form of energy holders such liquid and gas fuels or after changing (for example to energy) they can provide the need of different sections, that this subjects is the preference of biomass to other kinds of renewable energies (Charter, 1997).

The extent of the users of biomass is very vast, for example it starts from small families' especially in rural areas and restaurants and

continues to small, medium and large industrial and commercial units.

Biomass is mainly used in developing countries and it has an important role in economical conditions of rural and tribal families. Since the beginning of 1991 and by paying attention to excessive use of wood, bush and other materials in the country, studies of replacing fuel in Iran has begun and every year some part of the design has been studied and at present it is continuing. Some of the action and results of performing this design during 1995-2009 are as the following:

- surveying and studying 110 million hectares of the areas of natural lands of Iran

- buying and distributing 48.9 thousands of instruments that use gas and oil
- buying 48 tankers for transporting fuel
- constructing 211 branches for setting oil, constructing and installing 526 tank pore restoring oil and 61 place for selling liquid gas in the form of cylinders
- constructing and running 390 units of bakery and changing 8 bathes from firewood fuel to fossil fuel
- running 1105 agency for distributing liquid gas
- paying money for 258.6 thousands of liquid gas
- distributing 25.4 liters of fossil fuel a many villagers, tribes and habitants of forests
- installing 3 sunny water heater in Kurdistan province some of the action and results of the design in 2010 are:
- buying and distributing 7117 instruments that use oil and gas for cooking bread, food and heating
- Distributing 1661.6 thousands liters of fossil fuel
- Installing and running 8 branches for selling oil in the country (5 branches in Charmahal-Bakhtiari and 3 branches in Kermanshah)

- Building and installing 14 tankers for restoring oil and running 20 bakeries for cooking bread (the most units of bakeries has belonged to Khorasan Razavi)
- Installing and running 115 sites for distributing liquid gas (the most number of these sites are in Lorestan and Fars provinces with 42 and 36 representation of distributing liquid gas)
- Paying money for liquid gas from 91 thousands of capsules to 7.5 thousands of capsules in 2010.

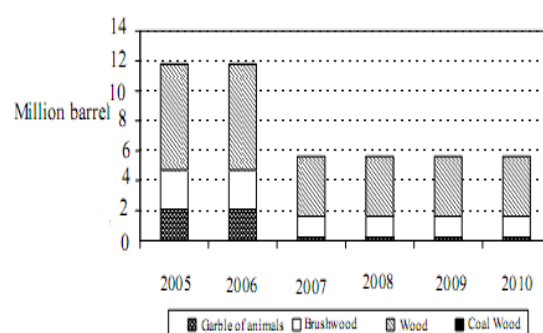


Figure 2: using different kinds of biomass in the country during 2005-2010

Table 6: Estimating the use of charcoal, bush and rubbish of animals in home section for each province⁽¹⁾ separately in 2010

Province	firewood	charcoal	bush	coal wood
East Azerbaijan	413637	250	182699	1835
West Azerbaijan	293079	-	86806	1278
Ardebil	13620	8110	37519	1978
Isfahan	70169	3035	13342.2	4363
Elam	64384	2110	128	8968
Boshehr	12350	6870	-	2024
Tehran	-	-	-	-
Charmahal-Bakhtyari	652756	18399	3413	281473
Khorasan	1593101	3330	154685	275223
Khuzestan	44390	16.2	14561	6252
Zanjan	77285	-	86239	103626
Semnan	23520	-	1109.43	10289
Sis tan-Baluchistan	441279	232	1426	9465
Fars	212955	2840	52228	36058
Qazvin	13298	-	25364.2	851
Qom	-	-	-	-
Kurdistan	745602	900	197	-
Kerman	1682151	-	-	165377
Kermanshah	84533	1429	23432.4	53.0
Kohgiluyeh-Boyerahmad	1118739	5377	-	-
Golestan	436138	240	375	27109
Gilan	12991	916019	-	-
Lorestan	887443	15996	3267	9357
Mazandaran (Sari&Noshahr)	184185	211715	770	-
Markazi	-	-	-	-
Hormozgan	63323	1250	-	1017
Hamedan	-	-	-	-
Yazd	26891	1000	-	1631
Total of use before conducting the design of replacing fuel	9167819	1199118	884579.2	948227
Estimating the use after conducting the design of replacing fuel by related organs	5000000	1199118	86360	500000

(1) Statistics have got from the studies of fuel design in 34 provinces that has begun since 1994 of course at present the stage of revising in some provinces is containing and the level of study is increasing on the basis of experts point of view the amount of use in 2010 in comparison with 2009 hasn't had any change.

In addition to the above cases in the field of using solid and liquid rubbishes of the cities and

biodiesel there are also projects that at present they are being conducted.

Table 7: Specifications of the projects of liquid and solid rubbishes of the cities and biogas project of power ministry.

Name of project	Kind of technology	The place of the project	Beginning year	Exploiting year	Percent of progress to the end of 2010	Capacity of project	Useful age
Measuring potential of 5 biomass resource in the country	measuring potential	whole country	1998	2000	100	-	-
Measuring the possibility of erecting biomass power station in 2 sites of the country	measuring potential	Fars, Shiraz	2004	2005	100	1060 ⁽¹⁾	13
-	-dafngah	Khorasan, Mashhad	2003	2005	100	650 ⁽²⁾	13
Erecting biomass power station in Shiraz	dafngah	Fars	2009	2009	100	1200	-
Erecting biomass power station in Mashhad	dafngah	Khorasan	2009	2009	100	660	-
Studying for erecting biomass power station	Measuring potential	whole country	2006	2011 ⁽³⁾	75 ⁽⁴⁾	10000	>20
Measuring potential of the biomass resources	measuring potential	whole country	2005	2011	46 ⁽⁴⁾	-	-
Measuring possibility of biogas production in Saveh	study	central	2007	2011	88	600	-
Erecting a pilot for producing biodiesel	studying the design and construction	central	2009	2010	100	70 ⁽⁵⁾	10

(1) On the basis of measured potentials, erectable capacity in the site of interring solid rubbishes of Shiraz is 1060 Kilo watt but by paying attention to the specifications and site of interring them in the past years, now the capacity of exploiting in the place of interring is 450 Kilo watt.

(2) The real amount of producing electrical energy from solid rubbishes in Mashhad on the basis of erected equipments is about 456 Kilo watt hour per mount, that of course in the case of mounting new equipments, the production will increase much more than this.

(3) Because of shortage of money in the fourth program and changing services, the time of this project has increased.

(4) Because of changing the timing program, the percent of progress in regard to the previous year has been corrected.

(5) Liter fuel in an hour

Table 8: Producing electricity from biogas power stations of the country

Site	whole of nominal capacity (Kilo watt)	whole of practical capacity (Kilo watt)	producing electricity in the form of navije (Giga watt/hour)	internal consumption
2009: Biogas power station of Shiraz ⁽¹⁾	1200	1065	0.348	91
Biogas power station of Mashhad ⁽²⁾	660	600	1.459	404
Total	1860	1665	1.807	495
2010: Biogas power station of Shiraz	1200	1065	2.178	*
Biogas power station of Mashhad	660	600	3.789	*
Total	1860	1665	5.967	*

(1,2) Please refer to the footnote of Table (7).

* The amounts aren't available.

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