

Biomass Fuel Supply Study in the State of Rajasthan

The information on biomass resource study for Rajasthan is taken from the report “Biomass Fuel Supply Study” of Rajasthan Renewable Energy Corporation Limited (RRECL) prepared by Dalkia Energy Services Limited (DESL). The study estimated the district wise surplus of biomass for energy production on a long term sustainable availability basis in Rajasthan. The objective of the study was to assess the amount of the biomass resource produced, consumed, and available in surplus in the state of Rajasthan.

Methodology for the study

The biomass resource information, data was collated through extensive primary and secondary research as well as meetings with government officials, agricultural department, forest department, farmers, traders, biomass power producers, brick kilns & other industries were done. The data used in the study was gathered from following sources:

- The agricultural data on area, production and yield for the period from FY 2005-06 to FY 2008-09 was taken from the official website of Directorate of Agriculture, Government of Rajasthan (www.rajasthankrishi.gov.in).
- The data on area under wasteland for the categories such as degraded forest Land, Government barren/saline/waste land and Panchayat waste land/ barren land/ saline land suitable for development of, Prosopis juliflora/ other energy plantation was collected from Department of Land Resources, Ministry of Rural Development, Government of India.
- The data of operational brick kilns was gathered from Mining department.
- The various industries in the districts were visited to collect the information for the biomass being used by the industry for power and steam generation.
- Data from traders were collected on trading of biomass in the area.

Further, the data on surplus biomass availability was collected and cross checked from following sources:

- Government official, food grain dealers, biomass dealers farmers and others
- Accounting the biomass left in the field for a specific time period
- Actual measurement of the quantum of biomass utilized for thatching, fodder, fuel and manure on a sample basis and extrapolating the same.

District wise agricultural residue production

Based on the average crop production data and crop residue ratio, district wise agricultural residue was calculated as provided in the following Table.

District wise average agricultural residue production (MT) in Rajasthan

District	Agro-residue production (MT)
Ajmer	573,002
Alwar	2,779,051
Banswara	667,256
Baran	1,358,801
Barmer	576,793
Bharatpur	1,847,912

Bhilwara	1,059,945
Bikaner	1,191,696
Bundi	1,178,519
Chittorgarh	1,800,653
Churu	940,681
Dausa	1,104,580
Dholpur	753,147
Dungarpur	232,977
Ganganagar	3,008,269
Hanumangarh	3,045,597
Jaipur	1,578,853
Jaisalmer	276,425
Jalore	1,075,775
Jhalawar	1,079,676
Jhunjhunu	1,313,474
Jodhpur	1,195,261
Karauli	1,045,207
Kota	1,163,207
Nagaur	2,057,014
Pali	664,907
Partapgarh	778,389
Rajsamand	332,612
Sawai Madhopur	907,276
Sikar	1,509,763
Sirohi	360,942
Tonk	969,826
Udaipur	756,542

The major findings of the study were

- Hanumangarh, Ganganagar, Alwar, Nagaur and Bharatpur are the top five districts for agricultural residue generation.
- Dungarpur, Jaisalmer, Rajsamand and Sirohi have biomass generation less than 5,00,000 MT. Dungarpur has the lowest production because of low crop productivity. Only about 32% of the total geographical area is under agriculture and average annual rainfall in in district was about 272 mm. This has resulted in poor yield of agricultural crops..
- Other districts have biomass generation in the range of 5,00,000 MT to 15,00,000 MT.

District wise potential biomass generation from Prosopis juliflora

As per the Rajasthan biomass policy 2010, the biomass power plant developers shall identify suitable land for development of Prosopis juliflora within reserved area of power plant registered with RREC after approval of the project. The categories of land that can be used for plantation are:

1. Degraded forest land which suitable for the development of Prosopis-Juliflora/ other energy plantation.
2. Government wasteland/ barren land/saline land

3. Panchayat wasteland/ barren land/ saline land.
4. Private Khatidari land, which is barren and unutilized. The state is having large area of private Khatidari land, which is alkaline, saline in nature and can be developed with energy plantation.

In order to calculate the energy plantation on the above specified categories of land, the average yield considered for Prosopis juliflora after 3 years of crop planation is 2950 MT/sq.km. The energy potential on degraded forest area, barren land, and saline affected land was considered and total biomass production from energy plantation of Prosopis Juliflora was calculated as 52261079 metric tonnes. The results are provided in the Table.

Total energy plantation on wasteland categories of Rajasthan state

Name of the district	Total land available for Plantation (sq. km)	Average Juliflora Yield (MT/sq. km)	Potential biomass production (MT)
Ajmer	734.82	2950.0	2167719
Alwar	1624.55	2950.0	4792423
Banswara	767.48	2950.0	2264066
Baran	1528.14	2950.0	4508013
Barmer	682.59	2950.0	2013641
Bharatpur	221.19	2950.0	652511
Bhilwara	582.29	2950.0	1717756
Bikaner	74.54	2950.0	219893
Bundi	1045.38	2950.0	3083871
Chittaurgarh	638.28	2950.0	1882926
Churu	55.36	2950.0	163312
Dausa	10.97	2950.0	32362
Dhaulpur	118.56	2950.0	349752
Dungarpur	199.81	2950.0	589440
Hanumangarh	37.71	2950.0	111245
Jaipur	940.02	2950.0	2773059
Jaisalmer	1324.79	2950.0	3908131
Jalore	622.20	2950.0	1835490
Jhalawar	1059.85	2950.0	3126558
Jhunjhunu	385.12	2950.0	1136104
Jodhpur	269.80	2950.0	795910
Karauli	680.67	2950.0	2007977
Kota	355.01	2950.0	1047280
Nagaur	435.63	2950.0	1285109
Pali	872.19	2950.0	2572961
Rajsamand	41.53	2950.0	122514
Sawai Madhopur	970.62	2950.0	2863329
Sikar	22.14	2950.0	65313
Sirohi	651.98	2950.0	1923341
Sriganganagar	0.00	2950.0	0
Tonk	506.86	2950.0	1495237

Udaipur	255.54	2950.0	753843
Total	17715.62		52261079

The findings of the study were:

- Alwar, Baran, Jaisalmer, Jhalawar, Bundi are the top 5 districts for availability of wasteland under the categories degraded forest land, Govt./Panchayat/Private –waste, barren and saline land, which is suitable for plantation of the species *Prosopis juliflora*.
- Sriganganagar, Sikar, Rajsamand, Hanumangarh, Dausa, Churu, Bikaner, Bharatpur, Jodhpur and Dungarpur are having plantation potential of less than 1000000 MT as these districts have less area under the specified wasteland categories.

District wise biomass consumption in Rajasthan

The biomass is consumed in Rajasthan by farmers and villagers and by local industries such as brick kilns, briquetting units, solvent plant, existing biomass power plants, etc. The district wise biomass consumption information as obtained from the field site is provided.

District wise biomass consumption in Rajasthan

S. No.	Name of the district	Biomass consumption (MT)
1.	Kota	1122512
2.	Alwar	2050393
3.	Jaipur	1472340
4.	Baran	790549
5.	Barmer	388032
6.	Bharatpur	1128797
7.	Bhilwara	968060
8.	Bikaner	885011
9.	Churu	661927
10.	Jhunjhunu	995027
11.	Bundi	824821
12.	Chittaurgarh	1472510
13.	Dausa	807821
14.	Dholpur	479325
15.	Dungarpur	225356
16.	Ganganagar	1828880
17.	Hanumangarh	1725436
18.	Jaisalmer	150003
19.	Jalore	757783
20.	Jhalawar	840975
21.	Jodhpur	723965
22.	Karauli	651745
23.	Ajmer	421247
24.	Banswara	607804
25.	Nagaur	1394194

26.	Pali	414343
27.	Rajsamand	247968
28.	Sawai Madhopur	478943
29.	Sikar	1201978
30.	Sirohi	420202
31.	Tonk	629658
32.	Udaipur	565585
33.	Partapgarh	681942

The findings of the study were:

- Alwar, Ganganagar, Hanumangarh, Chittaurgarh, Nagaur and Jaipur are the top 6 districts for consuming biomass. The districts have large number of brick kilns, briquetting units, power plants that consume large amount of biomass.
- Jaisalmer, Dungarpur, Rajsamand, Barmer, Pali, Sirohi, Ajmer, Sawai Madhopur and Dholpur have biomass consumption less than 400000 MT.
- The biomass consumption in rest of the districts is in the range of 400000 MT – 1500000 MT.
- Mustard crop has two residues- husk and stalk. While mustard husk is the commercially traded biomass in the state of Rajasthan, there is no commercial utilization of mustard stalk in industries and biomass based power plants. Around 50% of stalk is used as domestic fuel by the farmers and villagers and rest is left in field or burnt in the fields. The districts such as Kota, Sirohi, Jaipur, etc. are importing husk from other districts and not consuming surplus mustard stalk available in the district. Power plants need to develop appropriate fuel logistics to procure surplus mustard stalk from the fields.

District wise biomass surplus available

The district wise surplus biomass available for the conversion into energy is provided in the Table.

District wise surplus biomass available based on field survey in Rajasthan

S. No.	Name of the district	Average Biomass Generation (MT)	Biomass Consumption (MT)	Surplus Biomass (MT)
1.	Kota	1163207	1122512	40695
2.	Alwar	2779051	2050393	728657
3.	Jaipur	1578853	1472340	106512
4.	Baran	1358801	790549	568252
5.	Barmer	576793	388032	188760
6.	Bharatpur	1847912	1128797	719114
7.	Bhilwara	1059945	968060	91886
8.	Bikaner	1191696	885011	306685
9.	Churu	940681	661927	278754
10.	Jhunjhunu	1313474	995027	318447
11.	Bundi	1178519	824821	353698
12.	Chittaurgarh	1800653	1472510	328143
13.	Dausa	1104580	807821	296759
14.	Dholpur	753147	479325	273822

15.	Dungarpur	232977	225356	7621
16.	Ganganagar	3008269	1828880	1179389
17.	Hanumangarh	3045597	1725436	1320161
18.	Jaisalmer	276425	150003	126422
19.	Jalore	1075775	757783	317992
20.	Jhalawar	1079676	840975	238702
21.	Jodhpur	1195261	723965	471296
22.	Karauli	1045207	651745	393462
23.	Ajmer	573002	421247	151755
24.	Banswara	667256	607804	59453
25.	Nagaur	2057014	1394194	662819
26.	Pali	664907	414343	250564
27.	Rajsamand	332612	247968	84644
28.	Sawai Madhopur	907276	478943	428333
29.	Sikar	1509763	1201978	307785
30.	Sirohi	360942	420202	-59260
31.	Tonk	969826	629658	340168
32.	Udaipur	756542	565585	190957
33.	Partapgarh	778389	681942	96447

The findings of the study were:

- It can be noted from above table that net surplus biomass in Sirohi district is coming negative. The reason for the same is import of biomass from other districts in order to meet the fuel requirements of brick kilns. Also a 20.0 MW biomass power plant Sambhav Energy Ltd., is operating in the neighbouring district.
- Hanumangarh, Ganganagar, Alwar, Bharatpur, and Nagaur are the top 5 districts for the availability of surplus biomass for power generation. This is on account of high biomass generation in these districts despite the fact that district have high biomass consumption also.
- Sirohi, Dungarpur, Kota, Banswara, Rajsamand, Bhilwara and Pratapgarh have low surplus biomass as the biomass production in the districts are low and thus donot contribute large amount of biomass residue for power production.