

CHAPTER 1

Reserves and potential for generation

Reserves and Potential

Energy reserves are part of the energy resources that, based on technical, economic and other relevant (e.g., environmental) considerations, can be recovered and for which extraction is justified. The exact definition of reserves depends on the kind of resources in focus.

Globally, the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC 2009) provides a scheme for classifying and evaluating these resources according to three dimensions, namely, their economic and social viability, the field project status and feasibility, and the geological knowledge about these resources. System of Environmental Economic Accounting (SEEA)-Energy groups the detailed categories of UNFC into three aggregated classes characterizing the commercial recoverability of the resources as follows:

Categorization of mineral and energy resources relevant for energy

Class A: Commercially recoverable resources

Class B: Potentially commercially recoverable resources

Class C: Non - commercial and other known deposits

Thus, primary energy production relies on the capture or extraction of fuels or energy from natural energy flows, the biosphere and natural reserves of fossil fuels within the national territory in a form suitable for use mostly when extraction and sale have been confirmed to be economically viable.

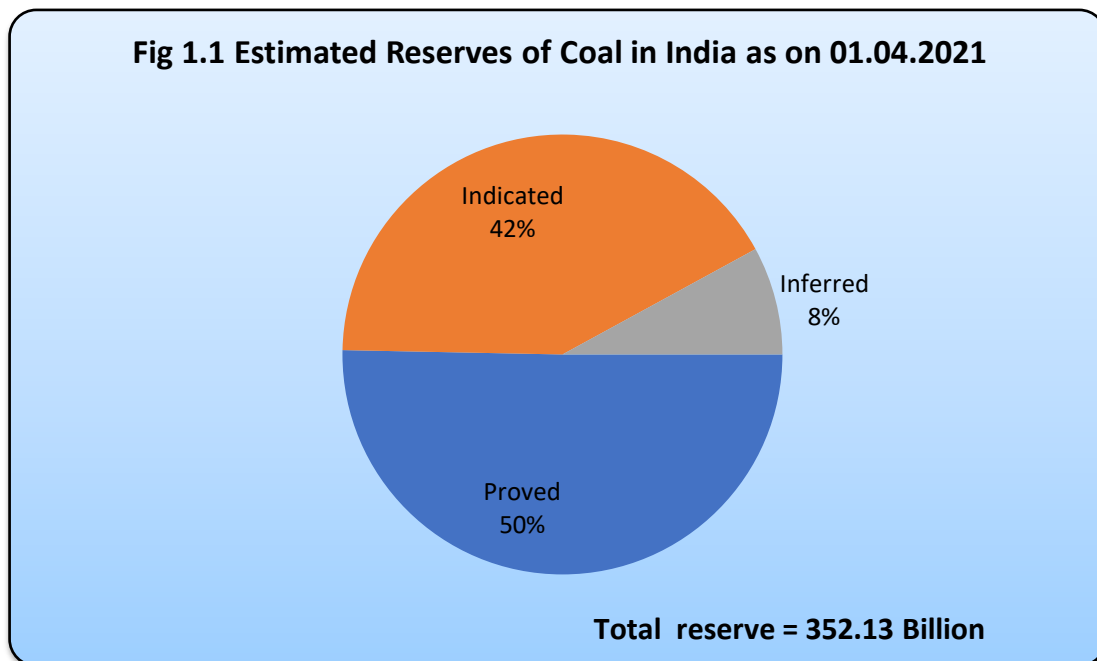
A good measure of the overall resource and the geographical and technical potential of what can be produced is also often represented by the potential in case of renewable power.

India has one of the largest proven coal reserves in the world. However, one of the objectives of India's energy mix has been to promote the production of energy through the use of renewable energy sources in accordance with climate, environment and macroeconomic considerations in order to reduce dependence on fossil fuels, ensure security of supply and reduce emissions of CO₂ and other greenhouse gases.

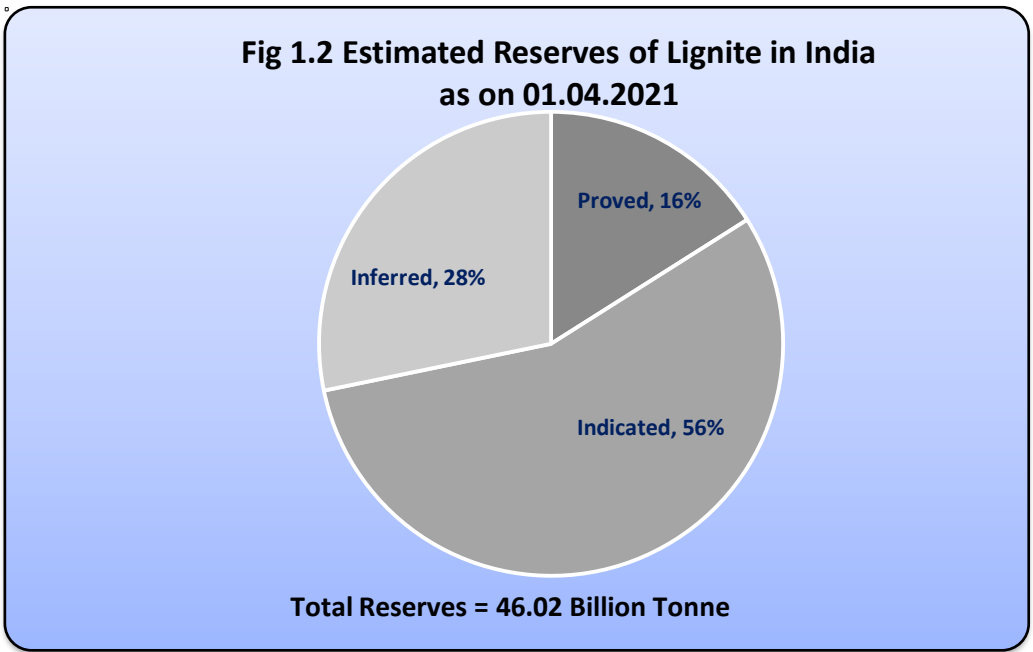
This chapter presents data on these reserves and potential in a concise form.

Highlights

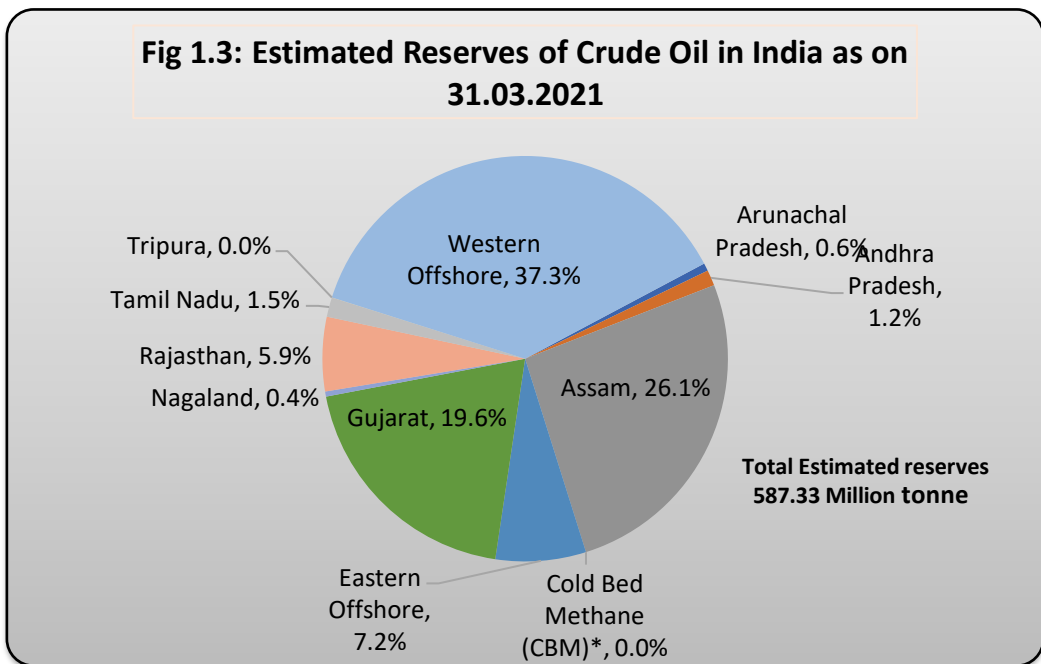
- India has rich deposits of coal in the world. Total estimated reserves of coal as on 01-04-2021 were 352.13 billion tonnes, an addition of 8.11 billion tonnes over the corresponding period of previous year. In terms of percentage, there has been a growth of 2.36% in the total estimated coal reserves during the year 2020-21 over 2019-20 (Table 1.1.).
- The top three states with highest coal reserves in India are Jharkhand, Odisha, Chhattisgarh, which account for approximately 70% of the total coal reserves in the country.
- Out of the total reserves in the country, proven reserves i.e., those available for extraction in terms of i.e., economic viability, feasibility study and geological exploration level, account for almost 50% of the total as depicted below in Fig 1.1.



- The estimated total reserves of lignite as on 01-04-2021 has remained unchanged over previous financial year and stood at 46.02 billion tonnes (Table 1.1(A)). Though there are some changes against 'Proved' and 'Indicated' segment, as 587 million tonnes of Lignite has been shifted under 'Proved' category from 'Indicated' category during FY: 2020-21. The highest reserves of lignite are found in the state of Tamil Nadu. Out of the total Lignite reserves in the country, proven reserves account for almost only 16% of the total as depicted below in Fig 1.2.

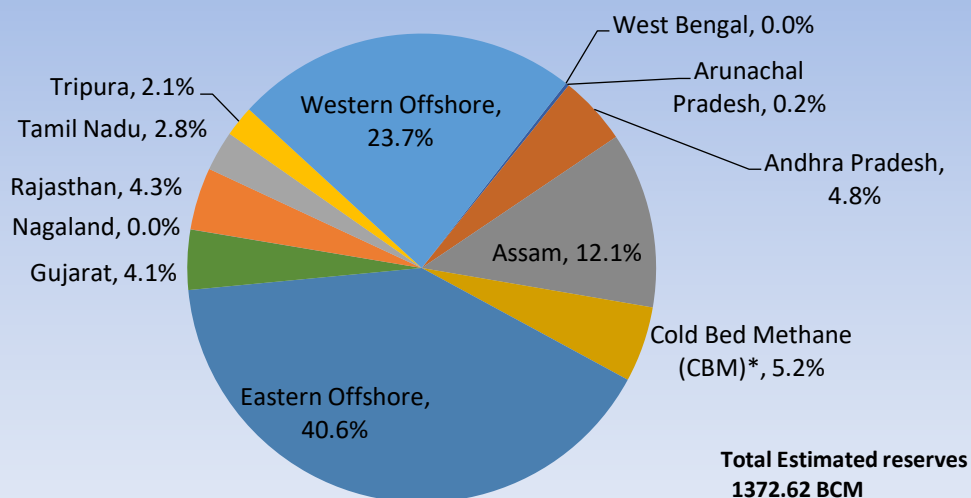


- The estimated reserves of crude oil in India as on 01-04-2021 stood at 587.33 million tonnes against 603.36 million tonnes in the previous year. Geographical distribution of Crude Oil indicates that the maximum reserves are in the Western Offshore (37%) followed by Assam (26%) (Table 1.2).



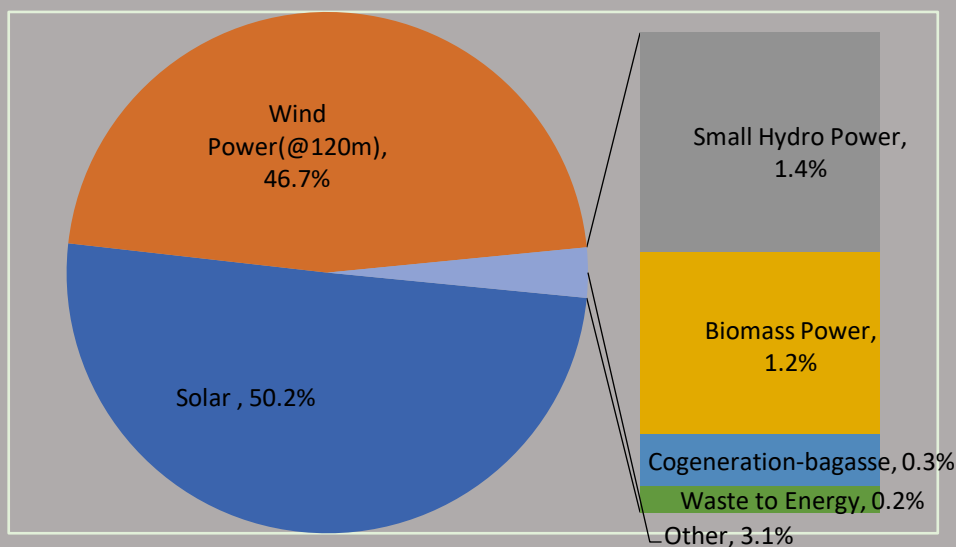
- The estimated reserves of Natural Gas as on 01-04-2021 was at 1372.62 Billion Cubic Meters. The maximum reserves of Natural Gas are in the Eastern Offshore (40.6%) followed by Western offshore (23.7%).

Fig 1.4 :Estimated Reserves of Natural Gas in India as on 31.03.2021



- There is a high potential for generation of renewable energy from various sources like wind, solar, biomass, small hydro and cogeneration bagasse in India. The total potential for renewable power generation in the country as on 31.03.2021 is estimated at 14,90,727 MW This includes solar power potential of 7,48,990 MW (50.24%), wind power potential of 6,95,509MW (46.66%) at 120m hub height, SHP (small-hydro power) potential of 21,134 MW (1.42%), Biomass power of 17,538 MW (1.18%), 5,000 MW (0.34%) from bagasse-based cogeneration in sugar mills and 2,556 MW (0.17%) from waste to energy (Table 1.3).

Fig 1.5: Source wise Estimated Potential of Renewable Power in India as on 31.03.2021



- The geographic distribution of the estimated potential of renewable power as on 31.03.2021 shows that Rajasthan has the highest share of about 18.2% (271219 MW). This is followed by Gujarat with 12.1% (share 180215 MW). Maharashtra and Karnataka come next with a 11.2% and 10.3% share (166743MW and 154162 MW respectively). These four (4) states are having more than 50% of the total potential of Renewable Power in India.

Fig 1.6: Statewise Estimated Potential of Renewable Power in India as on 31.03.2021

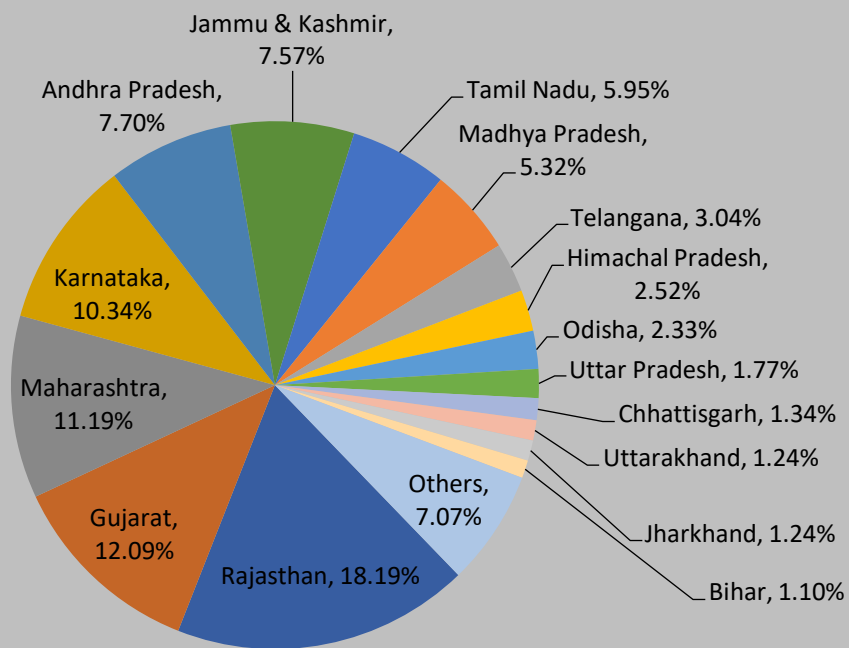


Table 1.1: Statewise Estimated Reserves of Coal

(in Million Tonnes)

States/ UTs	Proved		Indicated		Inferred		Total		Distribution (%)	
	01.04.2020	01.04.2021	01.04.2020	01.04.2021	01.04.2020	01.04.2021	01.04.2020	01.04.2021	01.04.2020	01.04.2021
Andhra Pradesh	97	921	1,078	901	432	425	1,607	2,247	0.47	0.64
Arunachal Pradesh	31	31	40	40	19	19	90	90	0.03	0.03
Assam	465	465	57	57	3	3	525	525	0.15	0.15
Bihar	310	310	2,431	3,143	11	11	2,751	3,464	0.80	0.98
Chhattisgarh	24,985	31,562	42,368	40,425	2,079	1,437	69,432	73,424	20.18	20.85
Jharkhand	49,469	52,046	30,284	28,882	5,850	5,288	85,602	86,217	24.88	24.48
Madhya Pradesh	12,597	13,479	12,888	13,060	3,799	3,678	29,285	30,217	8.51	8.58
Maharashtra	7,624	7,770	3,257	3,320	1,847	1,847	12,728	12,936	3.70	3.67
Meghalaya	89	89	17	17	471	471	576	576	0.17	0.16
Nagaland	9	9	22	22	415	416	446	446	0.13	0.13
Odisha	40,872	43,326	36,067	35,222	7,713	6,330	84,652	84,878	24.61	24.10
Sikkim	0	0	58	58	43	43	101	101	0.03	0.03
Uttar Pradesh	884	884	178	178	0	0	1,062	1,062	0.31	0.30
West Bengal	15,189	15,199	13,125	13,296	4,623	4,597	32,937	33,092	9.57	9.40
Telangana	10,841	11,089	8,521	8,328	2,863	3,433	22,225	22,851	6.46	6.49
All India Total	1,63,462	1,77,179	1,50,391	1,46,949	30,168	27,998	3,44,019	3,52,126	100.00	100.00
Distribution (%)	47.52	50.32	43.72	41.73	8.77	7.95	100.00	100.00		

Total may not tally due to rounding off

NOTE: Figure as on 01.04.2021 has been revised.

Source: Office of Coal Controller, Ministry of Coal

Table 1.1(A): Statewise Estimated Reserves of Lignite

(in Million Tonnes)

States/ UTs	Proved		Indicated		Inferred		Total		Distribution (%)	
	01.04.2020	01.04.2021	01.04.2020	01.04.2021	01.04.2020	01.04.2021	01.04.2020	01.04.2021	01.04.2020	01.04.2021
Gujarat	1279	1279	284	284	1160	1160	2722	2722	5.94	5.92
Jammu & Kashmir	0	0	20	20	7	7	28	28	0.07	0.06
Kerala	0	0	0	0	10	10	10	10	0.02	0.02
Puducherry	0	0	406	406	11	11	417	417	0.92	0.91
Rajasthan	1169	1169	3030	3030	2151	2151	6349	6349	13.88	13.80
Tamil Nadu	4340	4927	22497	21910	9653	9653	36490	36490	79.17	79.29
West Bengal	0	0	1	1	3	3	4	4	0.00	0.01
All India	6788	7374	26237	25651	12994	12994	46018	46018	100	100
Distribution (%)	15	16	57	56	28	28	100	100		

Total may not tally due to rounding off

NOTE: Figure as on 01.04.2021 has been revised.

Source: Office of Coal Controller, Ministry of Coal

Table 1.2: Statewise Estimated Reserves of Crude Oil and Natural Gas

States/ UTs/ Region	Crude Oil (Million Tonnes)				Natural Gas (billion cubic metres)			
	01.04.2020		01.04.2021		01.04.2020		01.04.2021	
	Estimated Reserves	Distribution (%)	Estimated Reserves	Distribution (%)	Estimated Reserves	Distribution (%)	Estimated Reserves	Distribution (%)
Arunachal Pradesh	3.12	0.5%	3.64	0.6%	2.72	0.2%	3.14	0.2%
Andhra Pradesh	7.85	1.3%	7.33	1.2%	63.85	4.7%	65.50	4.8%
Assam	155.45	25.8%	153.05	26.1%	166.60	12.1%	166.63	12.1%
Cold Bed Methane (CBM)*	-	-	-	-	72.23	5.3%	71.61	5.2%
Eastern Offshore	42.05	7.0%	42.34	7.2%	556.33	40.6%	557.07	40.6%
Gujarat	118.60	19.7%	115.41	19.6%	57.13	4.2%	56.79	4.1%
Nagaland	2.38	0.4%	2.38	0.4%	0.09	0.0%	0.09	0.0%
Rajasthan	34.78	5.8%	34.77	5.9%	61.80	4.5%	59.06	4.3%
Tamil Nadu	9.03	1.5%	9.08	1.5%	37.09	2.7%	37.89	2.8%
Tripura	0.07	0.0%	0.07	0.0%	29.45	2.1%	29.18	2.1%
Western Offshore	230.04	38.1%	219.27	37.3%	324.60	23.7%	325.65	23.7%
West Bengal	-	-	-	-	-	-	0.02	0.0%
Total	603.36	100%	587.33	100%	1371.90	100%	1372.62	100%

* CBM : Cold Bed Methane (Jharkhand, West Bengal and M.P.)

Notes:

1. Proved and indicated Balance Recoverable Reserves as on 1st April.
2. Western offshore includes Gujarat offshore
3. Total may not tally due to rounding off

Source: M/o Petroleum & Natural Gas

Table 1.3: Sourcewise and Statewise Estimated Potential of Renewable Power in India

(in MW)									
Sl. No.	States/ UTs	Wind Power	Small Hydro	Biomass Power	Cogeneration-bagasse	Waste to Energy*	Solar Energy	Total	Distribution (%)
1	Andhra Pradesh	74906	409	578	300	123	38440	114756	7.7%
2	Arunachal Pradesh	274	2065	8	-	-	8650	10997	0.7%
3	Assam	246	202	212	-	8	13760	14428	1.0%
4	Bihar	3650	527	619	300	73	11200	16369	1.1%
5	Chhattisgarh	348	1098	236	-	24	18270	19976	1.3%
6	Goa	8	5	26	-	-	880	919	0.1%
7	Gujarat	1,42,560	202	1221	350	112	35770	180215	12.1%
8	Haryana	419	107	1333	350	24	4560	6793	0.5%
9	Himachal Pradesh	151	3460	142	-	2	33840	37595	2.5%
10	Jammu & Kashmir	3	1707	43	-	-	111050	112803	7.6%
11	Jharkhand	-	228	90	-	10	18180	18508	1.2%
12	Karnataka	1,24,155	3726	1131	450	-	24700	154162	10.3%
13	Kerala	2311	647	1044	-	36	6110	10148	0.7%
14	Madhya Pradesh	15404	820	1364	-	78	61660	79326	5.3%
15	Maharashtra	98213	786	1887	1250	287	64320	166743	11.2%
16	Manipur	-	100	13	-	2	10630	10745	0.7%
17	Meghalaya	1	230	11	-	2	5860	6104	0.4%
18	Mizoram	-	169	1	-	2	9090	9262	0.6%
19	Nagaland	-	182	10	-	-	7290	7482	0.5%
20	Odisha	8346	286	246	-	22	25780	34680	2.3%
21	Punjab	278	578	3172	300	45	2810	7183	0.5%
22	Rajasthan	127756	52	1039	-	62	142310	271219	18.2%
23	Sikkim	-	267	2	-	-	4940	5209	0.3%
24	Tamil Nadu	68750	604	1070	450	151	17670	88695	5.9%
25	Telangana	24835	102	-	-	-	20410	45347	3.0%
26	Tripura	-	47	3	-	2	2080	2132	0.1%
27	Uttar Pradesh	101	461	1617	1250	176	22830	26435	1.8%
28	Uttarakhand	54	1664	24	-	5	16800	18547	1.2%
29	West Bengal	1050	392	396	-	148	6260	8246	0.6%
30	Andaman & Nicobar	1277	7	-	-	-	-	1284	0.1%
31	Chandigarh	-	-	-	-	6	-	6	0.0%
32	Dadar & Nagar Haveli	-	-	-	-	-	-	-	-
33	Daman & Diu	-	-	-	-	-	-	-	-
34	Delhi	-	-	-	-	131	2050	2181	0.1%
35	Lakshadweep	31	-	-	-	-	-	31	0.0%
36	Puducherry	382	-	-	-	3	-	385	0.0%
37	Others\$	-	-	-	-	1022	790	1812	0.1%
All India Total		6,95,509	21,134	17,538	5,000	2,556	7,48,990	14,90,727	100%
Distribution (%)		46.66	1.42	1.18	0.34	0.17	50.24	100.00	

\$ Others includes installations through NGOs/IREDA in different states

* Industrial waste

Source: Ministry of New and Renewable Energy