

CHAPTER 4

POWER FROM OTHER RENEWABLES

4.1 WIND ENERGY

4.1.1 Introduction

India's wind energy sector is led by indigenous wind power industry and has shown consistent progress. The expansion of the wind industry has resulted in a strong ecosystem, project operation capabilities and manufacturing base of more than 15,000 MW per annum. The country currently has the fourth highest wind installed capacity in the world with total installed capacity of 45.88 GW (as on 31st March, 2024) of which 3.25 GW was added during FY 2023-24. The number of units generated from wind power projects during FY 2023-24 was 83.38 billion units.

4.1.2 Potential of Wind Energy in India

Wind is an intermittent and site-specific source of energy and therefore, an extensive Wind Resource Assessment is essential for the selection of potential sites. Over a period of time, the Ministry, through National Institute of Wind Energy (NIWE), has installed 913 wind-monitoring stations all over the country as on 31.03.2024 and issued wind potential maps at 50 m, 80 m, 100 m, 120 m and 150 m above ground level. The latest assessment indicates gross wind power potential of 695.50 GW and 1163.85 GW in the country at 120 meter and 150 meter respectively, above ground level. Most of this potential exists in eight windy States as given in Table 4.1 below

Table 4.1 Wind Power Potential in India at 120 meter and 150 meter, above

S.No.	State	Wind Power Potential at 120 mtr agl (GW)	Wind Power Potential at 150 mtr agl (GW)
1	Andhra Pradesh	74.90	123.33
2	Gujarat	142.56	180.79
3	Karnataka	124.15	169.25
4	Madhya Pradesh	15.40	55.42
5	Maharashtra	98.21	173.86
6	Rajasthan	127.75	284.25
7	Tamil Nadu	68.75	95.10
8	Telangana	24.83	54.71
	Total (8 windy States)	676.55	1136.71
	Other States	18.95	27.14
	All India Total	695.50	1163.85

The wind atlas is available on the NIWE's website <http://www.niwe.res.in> and wind potential map at 120 m and 150 m above ground level is given below in Fig. 4.1 and Fig. 4.2.

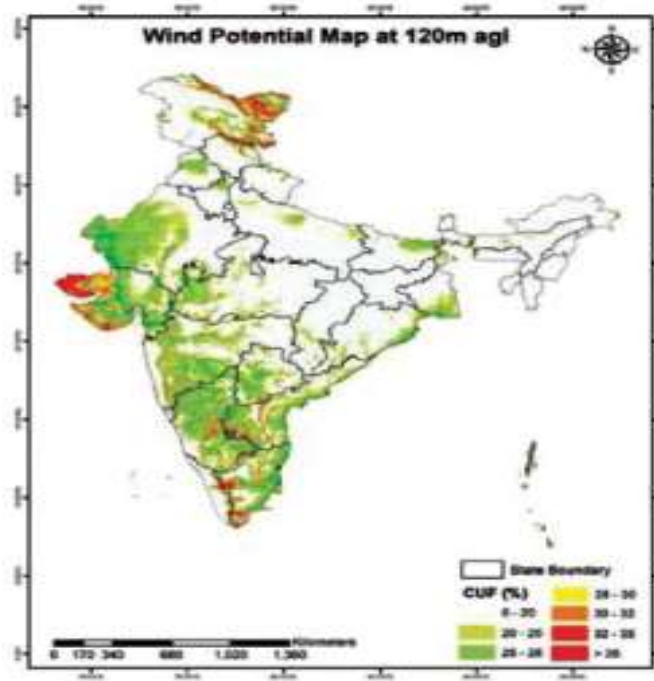


Fig. 4.1: Wind Potential Map at 120 Meters above ground level

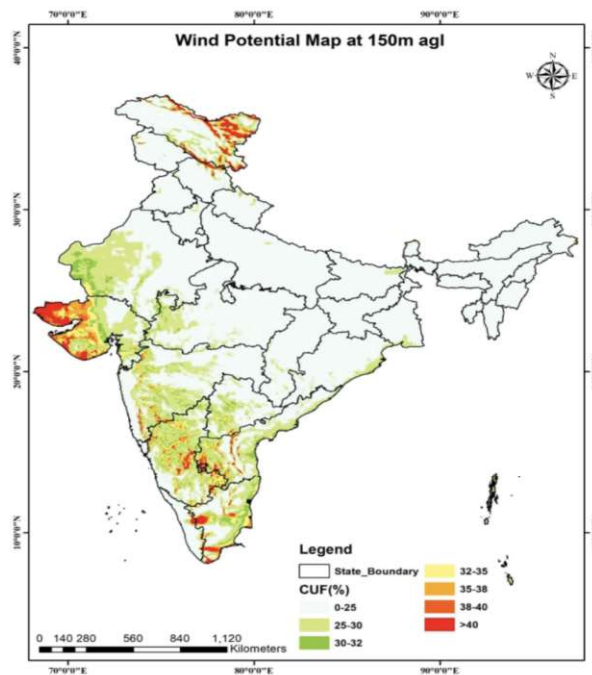


Fig. 4.2: Wind Potential Map at 150 Meters above ground level

4.1.3 Installed capacity of Wind Power in the country

The installed capacity of grid-interactive wind power in the country as on 31.03.2024 is 45.88 GW and state wise installed capacity (in MW) is shown in Table 4.2.

Table 4.2: State wise Wind Power installed as on 31.03.2024

S.No.	State	Installed Capacity
1	Andhra Pradesh	4096.65
2	Gujarat	11722.72
3	Karnataka	6019.61
4	Kerala	63.5
5	Madhya Pradesh	2844.29
6	Maharashtra	5207.98
7	Rajasthan	5195.82
8	Tamil Nadu	10603.54
9	Telangana	128.1
10	Others	4.3
	Total (MW)	45886.51

The year-wise electricity generation from wind energy source is shown in Table 4.3.

Table 4.3: Year wise Electricity Generation from Wind Energy Sources

S.No.	Year	Generation (MU)
1	2014-15	33768
2	2015-16	33029
3	2016-17	46004
4	2017-18	52666
5	2018-19	62036
6	2019-20	64639
7	2020-21	60149
8	2021-22	68640
9	2022-23	71814
10	2023- 24	83385

4.1.4 Technology development and manufacturing base for Wind Power

The Wind Turbine Generator technology has evolved and state-of-the-art technologies are available in the country for the manufacture of wind turbines. Around 75% localization has been achieved with strong domestic manufacturing capacity for wind energy turbines and its components in the country.

As per the guidelines for Development of Onshore Wind Power Projects, the Revised List of Models and Manufacturers of wind turbines (RLMM) enlisted turbines are eligible for installation in the country. RLMM enlistment is done based on the recommendation of RLMM committee chaired by JS(Wind) which evaluates Type Certificate, ISO Certificate, Hub, and Nacelle manufacturing/assembly facility in India. The committee meetings held on a monthly basis. During the period between 1st April 2023 and 31st March 2024, the committee has recommended six numbers of new wind turbine models for enlistment in RLMM.

All the major global players in this field have their presence in the country and 27 different models of wind turbines are being manufactured by 12 different companies, through (i) joint ventures under licensed production (ii) subsidiaries of foreign companies, and (iii) Indian companies with their own technology. The unit size of the largest machine has gone up to 5.2 MW.

Wind turbines and components manufactured in India are also being exported to various countries. The current annual production capacity of wind turbines in the country is more than 15,000 MW.

4.1.5 Tender/bidding in Wind Energy sector

Government issued Guidelines for Tariff Based Competitive Bidding Process for Procurement of Power from Grid Connected Wind Power Projects vide resolution notified on 8th December, 2017. The Government revised its Guidelines for Tariff Based Competitive Bidding Process for Procurement of Power from Grid Connected Wind Power Projects vide resolution notified on 26th July, 2023.

The objectives of the guidelines were to facilitate renewable capacity addition and fulfilment of RPO requirements of distribution licensees; to provide transparent and standardized procurement framework based on competitive bidding with appropriate risk sharing between stakeholders to enable power procurement at competitive prices; improve bankability while ensuring reasonable return to investors; provide a framework for inter-state/ intra-state, long-term, sale-purchase of power as a further measure to de-risk the sector.

The guidelines are applicable to wind power projects of minimum 10 MW capacity for intra-state projects and minimum 50 MW for inter-state projects. The salient features include capacity allocation through bucket filling method; consideration of already built-up untied capacity for participation in bid; PPAs for 20 years with provisions extension up to 25 years and generation compensation in case of grid unavailability or reduced offtake.

4.1.6 Status of tenders for Wind Power Projects

To enable DISCOMs of the non-windy States to fulfill their Wind Renewable Purchase Obligation (RPO), through purchase of wind power at a tariff determined by transparent bidding process, MNRE through SECI has auctioned wind power capacity in twelve tranches. Further, NTPC and the states of Gujarat, Maharashtra and Tamil Nadu have also auctioned wind power capacities

- 1) Cumulative commissioned capacity till 31/03/24: 45.88 GW
 - 2) Capacity under implementation: 21.246 GW
 - 3) Total ongoing bids: 1.2 GW
- Total (1+2+3): 68.33 GW**

The details of tenders auctioned for Wind Power are shown in Table 4.4.

Table 4.4: Details of Tenders Auctioned for Wind Power

S. No.	Bidding Agency	Capacity awarded (MW) (A)	Capacity Cancelled (MW) (B)	Net Capacity MW C=(A-B)	Capacity Commissioned (MW)	Bidding Agency Type	Min. Tariff (Rs./kwh)
1	SECI-I	1049.9	50	999.9	999.9	Central	3.46
2	SECI-II	1000	239.9	760.1	760.1	Central	2.64
3	SECI-III	2000	849.8	950.2	1150.2	Central	2.44
4	SECI-IV	2000	1016.1	721.9	983.9	Central	2.51
5	Tamil Nadu (TANGEDCO)	450	0	49.5	450	State	3.42
6	Gujarat (GUVNL)	500	30	470	470	State	2.43
7	Maharashtra (MSEDCL)	500	0	350	500	State	2.85
8	SECI-V	1190	300	534.3	890	Central	2.76
9	NTPC	1150	1150	0	0	Central	2.77
10	SECI - VI	1200	227	973	973	Central	2.82
11	SECI - VII	480	300	180	180	Central	2.79
12	GUVNL Ph.-II	202.6	0	162.6	202.6	State	2.80
13	SECI - VIII	440	0	138.6	440	Central	2.83
14	SECI IX	970	0	51.30	970	Central	2.99
15	SECI X	1200	0	282.60	1200	Central	2.77
16	SECI XI	1200	0	0	1200	Central	2.69
17	SECI XII	1100	0	0	1100	Central	2.89
18	GUVNL Ph.-III	1000	0	0	1000	State	2.84
19	SECI XIII	600	0	0	600	Central	2.9
20	SECI XIV	690	0	0	690	Central	3.18
	Total	18922.5	4162.8	6624	14759.7		

4.1.7. Incentives available for Wind sector

The Government has taken several steps to promote renewable energy, including wind energy, in the country. These, inter alia, include;

- Permitting Foreign Direct Investment (FDI) up to 100 percent under the automatic route,
- Waiver of Inter State Transmission System (ISTS) charges on transmission of electricity generated from solar and wind sources for projects to be commissioned up to 30th June 2025,
- Exemption from payment of ISTS charges for a period of 25 years, starting from the date of commissioning of the project for offshore wind power projects commissioned on or before 31st December 2032 and established via PPAs or under merchant basis,
- Declaration of trajectory for Renewable Purchase Obligation (RPO) up to the year 2030.
- Setting up of Ultra Mega Renewable Energy Parks to provide land and transmission to RE developers on a plug and play basis,
- Laying of new transmission lines and creating new sub-station capacity for evacuation of renewable power,

- Setting up of Project Development Cell for attracting and facilitating investments,
- Standard Bidding Guidelines for tariff based competitive bidding process for procurement of Power from Grid Connected Solar PV and Wind Projects, RTC and hybrid projects,
- Government has issued orders that power shall be dispatched against Letter of Credit (LC) or advance payment to ensure timely payment by distribution licensees to RE generators,
- Notification of Promoting Renewable Energy through Green Energy Open Access Rules 2022.
- Notification of Late Payment Surcharge and related matters Rules 2022,
- Notification of Electricity Amendment Rules 2022 with provision of Uniform Renewable energy Tariff for Central Pool.

In addition to the above, the following steps have been taken specifically for promoting wind energy:

- Declaration of trajectory for Wind Renewable Purchase Obligation (Wind RPO) up to the year 2030.
- Concessional custom duty exemption on certain components required for manufacturing of wind electric generators, During the period 1st April 2023 to 31st March 2024, about 1142 Nos of CCDC certificates issued
- Generation Based Incentive (GBI) is being provided to the wind projects commissioned on or before 31 March 2017,
- Technical support including wind resource assessment and identification of potential sites through the National Institute of Wind Energy, Chennai, a
- Issuance of 'Elevation Certificate' by NIWE for obtaining NOC from Ministry of Defense.

Ministry also facilitates issuance of No Objection Certificate from Ministry of Defence. In the period between 1st April 2023 and 31st March 2024, applications for about 1788 Nos of turbines have been sent to MoD.

4.1.8 Offshore Wind development in India

India's mainland is blessed with a coastline of about 7600 kms surrounded by seawater on three sides and has tremendous power generation potential from offshore wind energy. Considering this, the Government had notified the National Offshore Wind Energy Policy as per the Gazette Notification dated 6th October 2015. As per the policy, Ministry of New and Renewable Energy will act as the nodal ministry for development of Offshore Wind Energy in India and work in close coordination with other government entities for Development and Use of Maritime Space within the Exclusive Economic Zone (EEZ) of the country in an effective manner for production of enormous quantity grid quality electrical power for national consumption.

National Institute of Wind Energy (NIWE), Chennai has been designated as the nodal agency to execute various pre-feasibility activities relating to resource assessment, surveys and studies within EEZ (Exclusive Economic Zone), demarcation of offshore potential blocks and facilitating offshore wind energy project developers for setting up offshore wind energy farms.

Based on the preliminary assessment from satellite data and data available from other sources, potential zones off the coast of Gujarat and Tamil Nadu have been identified (Fig. 4.3 and Fig. 4.4).

Data collection (wind, geophysical, geotechnical, oceanographic) for 1.0 GW project capacity equivalent area off Gujarat coast has been completed and the rapid environmental impact assessment studies are also completed.

In order to attract the large investment needed/required for development of the sector in India, Government of India has already announced its intention of conducting 37 GW of offshore wind energy auctions by 2030.

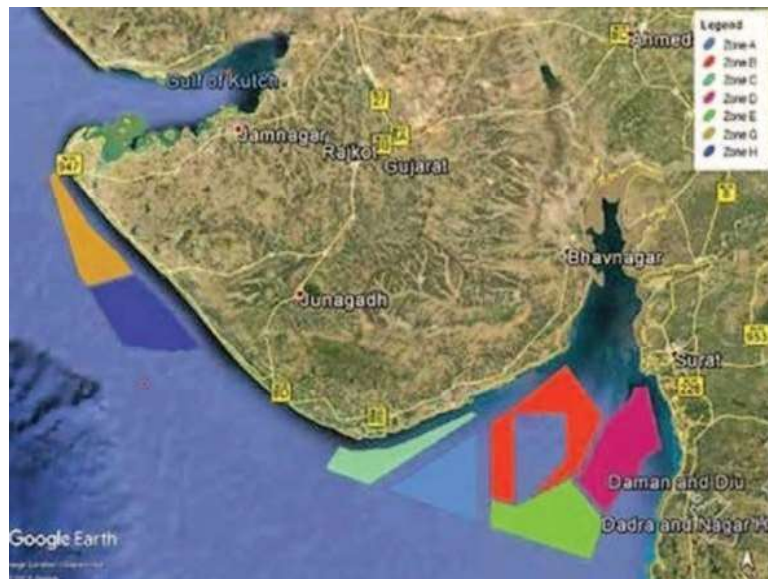


Fig. 4.3 Gujarat Offshore Wind Potential Zone



Fig. 4.4 Tamil Nadu Offshore Wind Potential Zone

4.1.9 Studies to Assess the Offshore Wind Potential

1. Offshore measurements off Gujarat and Tamil Nadu coast:

LiDAR based offshore wind potential measurements for 2 years have been completed at Gulf of Khambhat off Gujarat coast. The offshore LiDAR wind data measurement report for the first and second years have been published for benefit of stakeholder. Four more LiDARs have been procured by NIWE for carrying out offshore wind resource assessment off Gujarat and Tamil Nadu coast. The LiDARs have already been validated in the WTRS test station, Kayathar. NIWE is in the process of carrying out the offshore wind measurement along with other oceanographic measurements off the coast of Tamil Nadu.

2. Geophysical investigation at Gulf of Khambhat off Gujarat coast:

In order to ascertain the nature of sub sea surface and soil profile available at recommended depths for the design of foundation for offshore structures, a detailed geophysical survey is required to be carried out. Onsite Geo-physical investigation (single beam bathymetry survey, side scan sonar, sub- bottom profiling, and magnetometer survey and sediment samples) covering an area of 365 sq. km for 1GW offshore project in Gulf of Khambhat off Gujarat Coast has been completed.

3. Geotechnical Investigation at Gulf of Khambhat and Gulf of Mannar off Tamilnadu Coast:

In order to understand the subsoil profile and load bearing capacity of the seabed geotechnical studies were carried out at five locations off the coast of Gujarat. The geotechnical investigations at three locations off the coast of Tamil Nadu have been completed.

4. Marine Spatial Planning for offshore wind farms in Tamil Nadu

Marine Spatial Planning (MSP) for offshore wind projects off the coast of Gujarat and Tamil Nadu were carried out as joint initiatives between India and Denmark to acknowledge the marine traffic movements in the identified offshore zones. Under MSP, the screening of offshore zones was carried out considering various key factors such as wind speed, water depth, marine traffic, oil blocks, Environmentally sensitive zones, etc. with an objective to prepare Levelized Cost of Energy (LCOE) Heat maps. The aim was to arrive at the best possible use of the offshore zones for offshore wind farm development in an efficient, safe and sustainable way. Based on the MSP report, the best suitable offshore sites for initial offshore wind projects have been demarcated (Fig 4.5).

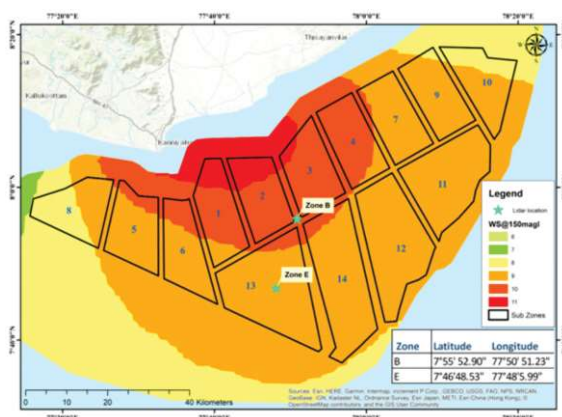


Fig 4.5: Proposed Sites for Offshore Wind Projects off the coast off Tamil Nadu

5. Port Infrastructure Study

A study with collaboration of Denmark Energy Agency (DEA) was carried out to investigate existing port and terminal infrastructure, around the identified offshore wind sites in the coastal regions of Tamil Nadu and Gujarat with respect to the specific needs of offshore wind. Four ports in Gujarat and five ports along the Tamil Nadu coast were screened for suitability for offshore wind farm. Based on the report, Pipavav and Hazira Port for Gujarat offshore wind zones and Tuticorin and Vizhinjam for Tamil Nadu offshore zones are identified for upgrading to cater to the requirements of offshore wind development (Fig 4.6 and Fig 4.7).

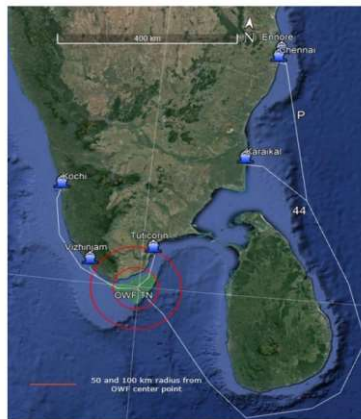


Fig 4.6: Ports screened for offshore wind farm of farm TN Cost



Fig 4.7: Ports screened for offshore wind farm of Gujrat Cost

4.1.10 Offshore Wind Turbine Research and Test Centre at Dhanushkodi, Tamil Nadu:

In order to strengthen the domestic capacity for design and development of new offshore wind energy turbines, a testing cum research facility was necessary and NIWE has already identified the suitable site at Dhanushkodi, Tamil Nadu for establishment of the testing cum research centre. The required land for the purpose has been allotted by Govt. of Tamil Nadu. The preliminary Detailed Project Report (DPR) Preparation for the test centre is under preparation by NIWE.

4.1.11 Strategy for Offshore Wind Energy Development in India:

Ministry issued the revised "Strategy for Establishment of Offshore Wind Energy Projects" dated 26th September 2023, after consultation with various stakeholders. It also includes three revised business models for development of offshore wind projects in Economic Exclusive Zone (EEZ) of the country.

Model-A: This approach will be followed for demarcated offshore wind zones for which MNRE/NIWE has carried out or proposed to carry out detailed studies/surveys. Presently, part of identified Zone B3 (365 Sq.km) equivalent to 0.5 GW off the coast of Gujarat and 0.5 GW equivalent site off TN coast will be considered in phase-1 of this model. MNRE through its implementing agencies will come up with bid for procurement of offshore wind power capacity under this model. Necessary central financial assistance in the form of Viability Gap Funding (VGF) would be available to achieve a predetermined power tariff.

Model-B: This approach will be followed for sites identified by NIWE. Proposed offshore wind sites demarcated within identified zones would be allocated for a fixed period on a lease basis through single-stage two envelope bidding. Project development shall be carried out by the prospective developer in these sites without any Central Financial Assistance (CFA). The power generated from such projects shall be either used for captive consumption under open access mechanism or sold to any entity through a bilateral power purchase agreement or sold through Power Exchanges.

Model-C: In this model, Developer may identify any offshore wind site within the EEZ excluding the sites considered under Model-A & Model-B and carry out studies and surveys. The Government will come up with bid for project development/allocation of the seabed. The bidding process may be through bidding on lease/allocation fee or revenue sharing in case of projects for captive consumption/third party sale/sale through exchange under open access mechanism; tariff based competitive bidding in case of power procurement by DISCOMs/Central Govt./State Govts.; any other transparent bidding mechanism.

The strategy paper also indicates offshore wind auction trajectory of 37 GW by 2030, as given in Table 4.5 below:

Table 4.5: Offshore Wind Auction Trajectory

Year	Total Auction Trajectory (in GW)	Auction Capacity under Model-A (in GW)	Auction Capacity under Model-B (in GW)	Auction Capacity under Model-C (in GW)
2023-24	4.5	0.5	4	-
2024-25	3.5	0.5	3	-
2025-26	7	-	3	4
2026-27	7	-	3	4
2027-28	5	-	1	4
2028-29	5	-	-	5
2029-30	5	-	-	5
Total	37	1	14	22

The Ministry has also invited call for proposal for carrying out Studies/Surveys in identified offshore sites proposed to be leased out for offshore wind project development under Model-B and within Exclusive Economic Zone (EEZ) of the country (Model-C) via public notice dated 17th August 2023. The notice invites proposals from interested developers to carry out study/surveys in order to have preparedness for participating in the bids.

Central Transmission Utility has carried out transmission planning for 10 GW offshore wind capacity (05 GW each off the coast of Gujarat and Tamil Nadu) and the same has been issued vide report titled "Transmission System for Integration of over 500 GW RE Capacity by 2030" published by Central Electricity Authority (CEA).

Various reports have also been published in collaboration with multilateral agencies under inter-country partnerships focusing on multiple aspects of the offshore wind energy sector. Reports on "Capability Assessment of India's Offshore Wind Supply Chain" by NIWE, mec+, Catapult Offshore Renewable Energy and 'Support to pre-feasibility assessment for the Test Research Centre for Offshore Wind Turbines at Dhanuskodi' by Danish Energy Agency were published in last one year.

4.1.12 Global Wind Day Celebration – 2023

The Ministry of New and Renewable Energy (MNRE) celebrated “Global Wind Day” on 15th June 2023 with the central theme of ‘Pawan-Urja: Powering the Future of India’. The day-long celebration witnessed discussions on multiple topics pertaining to wind energy in India such as offshore wind, progress and development of wind energy in India, wind energy manufacturing and green finance. The event has participation from central and state government officials; wind turbine manufacturers, developers, and associations; financial institutions; central public sector enterprises; academia; think-tanks and other associated stakeholders.

The event also witnessed the launch of the 150m above ground level Wind Atlas by NIWE. Further the States of Rajasthan, Gujarat and Tamil Nadu were felicitated for achieving the highest wind capacity addition, achieving the highest wind capacity addition through open access and initiating efforts for repowering, respectively.



Fig 4.8: Global Wind Day Celebrations 2023

4.2 ENERGY FROM WIND-SOLAR HYBRID

4.2.1 National Wind-Solar Hybrid Policy

The Ministry issued National Wind-Solar Hybrid Policy on 14th May, 2018 and amended on 13th August, 2018. The main objective of the policy is to provide a framework for promotion of large- scale grid connected wind-solar PV hybrid systems for optimal and efficient utilization of wind and solar resources, transmission infrastructure and land. The wind-solar PV hybrid systems will help in reducing the variability in renewable power generation and achieving better grid stability. The policy also aims to encourage new technologies, methods and way-outs involving combined operation of wind and solar PV plants.

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4.2.2 The Major Highlights of the Policy are as under:

- i. A wind-solar plant will be recognized as hybrid plant if the rated power capacity of one resource is at least 25% of the rated power capacity of other resource.
- ii. Both AC and DC integration of wind-solar hybrid project are allowed.
- iii. The power procured from the hybrid project may be used for fulfilment of solar RPO and non-solar RPO in the proportion of rated capacity of solar and wind power in the hybrid plant respectively.
- iv. Existing wind or solar power projects, willing to install solar PV plant or Wind Turbine Generators (WTGs) respectively, to avail benefit of hybrid project, may be allowed.
- v. All fiscal and financial incentives available to wind and solar power projects will also be made available to hybrid projects.
- vi. The Central Electricity Authority (CEA) and Central Electricity Regulatory Commission (CERC) shall formulate necessary standards and regulations including metering methodology and standards, forecasting and scheduling regulations, REC mechanism, grant of connectivity and sharing of transmission lines, etc., for wind-solar hybrid systems.
- vii. Storage may be added to the hybrid project to ensure availability of firm power for a particular period.

4.2.3 Wind-Solar Hybrid Projects

The following are the Projects under the Wind-Solar Hybrid Programme

- i. In order to implement the National Wind-Solar Hybrid Policy, a scheme for setting up of 2500 MW Inter State Transmission System (ISTS) connected wind-solar hybrid projects was sanctioned on 25.05.2018. The Solar Energy Corporation of India (SECI) was the nodal agency for implementation of the scheme through tariff based transparent competitive bidding process
- ii. Guidelines for Tariff Based Competitive Bidding Process for procurement of power from Grid Connected Wind Solar Hybrid Projects were issued on 14.10.2020 and further revised on 21.08.2023. The objective is to promote renewable capacity additions and RPO fulfilment; facilitate a transparent and fair procurement of electricity through competitive means; provide for a standardised framework for an Intermediary Procurer as an Aggregator/Trader; and provide a risk-sharing framework between various stakeholders. Procurement shall be from hybrid power projects with minimum bid capacity of 10 MW and 50 MW for projects connected to the intra-state transmission system and inter-state transmission system, respectively. The rated power capacity of one resource (wind or solar) shall be at least 33% of the total contracted capacity, and solar and wind components of the hybrid project can be located at the same or different locations. It has provisions for payment security mechanism, generator compensation for off-take constraints, adding storage to the hybrid power project, etc.
- iii. Wind-solar hybrid projects of 11260 MW capacity have been awarded through e- reverse auction (as shown in Table 4.6) of which 1440 MW have been commissioned till March, 2024.

Table 4.6: Details of tenders auctioned for Wind-Solar Hybrid Power Projects

S.No.	Bid	Capacity awarded (MW)	Capacity Commissioned (MW)	Min. Tariff (Rs./kwh)
1	SECI Hybrid - I	840	840	2.67
2	SECI Hybrid -II	600	600	2.69
3	SECI Hybrid -III	1110	0	2.41
4	SECI Hybrid -IV	1200	0	2.34
5	MSEDCL Maharashtra	500	0	2.62
6	SECI Hybrid -V	1170	0	2.53
7	SECI Hybrid -VI	1200	0	4.64
8	NTPC Hybrid -I	1080	0	3.35
9	SECI Hybrid -VII	900	0	3.15
10	NHPC Hybrid -I	960	0	3.48
11	SJVN Hybrid -I	1500	0	3.43
12	GUVNL Gujarat Hybrid -I	200	0	2.99
	Total	11260	1440	

4.2.4 Concessional Custom Duty Exemption Certificates for manufacturing of Wind Turbines

Ministry is issuing concessional custom duty exemption certificates (CCDCs) to the manufacturers of wind operated electricity generators as per Ministry of Finance tariff notification no. 50/2017-customs dated 30.06.2017 as amended from time to time. To avail concessional custom duty benefits for essential imports of major components/sub-components/ part/sub-parts of all such components/sub-components for such manufacturing in India, the eligible turbine and component manufacturers listed in RLMM (Registered list of Models & Manufacturers) are required to get the bill of material for turbine models approved and then apply in prescribed application formats to this Ministry for issue of CCDC (Concessional Custom Duty Certificates) for their import consignments. In order to make the entire process fast and transparent, an online portal was developed and is active since Oct, 2019. A total 898 nos. of CCDC have been issued during 01.01.2023 to 31.12.2023.

4.3 BIOMASS POWER

4.3.1 Ministry has been promoting Biomass Power with an aim to recover energy from biomass such as surplus agricultural residues, wood produced from energy plantation, wood waste from industrial operations, agro based industrial residue, forest residue, weeds, palm leaves, coconut shells and husk etc.

4.3.2 Biomass Potential available in the country

The potential for power generation from about 228 MMT surplus agricultural residue is estimated at about 28446 MW. With progressive higher steam temperature and pressure and efficient project configuration in new sugar mills and modernization of existing ones, the potential of surplus power generation through bagasse cogeneration in sugar mills is estimated at around 13866 MW. Thus, the total estimated potential for biomass power is about 42312 MW.

4.3.3 Programme for promoting installation of Biomass based projects

The Ministry has notified Biomass Programme on 2nd November, 2022 with a budget outlay of Rs.158 crores under the umbrella of National Bioenergy Programme (Phase-I) for duration of FY 2021-22 to FY 2025-26 with an objective to harness the available biomass potential in the country. This programme has a provision of Central Financial Assistance (CFA) for setting up of Biomass Briquette/Pellet manufacturing plants and Biomass (non-bagasse) based cogeneration projects in the country. The details of CFA under this programme are as follows:

- a. Briquette/Pellet manufacturing plants: Rs.9.00 lakhs/ TPH (Maximum CFA- Rs.45.00 Lakh per project).
- b. Non-Bagasse Cogeneration Projects: Rs.40 Lakhs/ MW (Maximum CFA- Rs. 5.00 crore per project).

4.3.4 Achievements

More than 800 Nos. of Biomass IPP and Bagasse/non bagasse cogeneration-based power plants with aggregate capacity of 10,355 MW have been installed in the country mainly in the states of Maharashtra, Uttar Pradesh, Karnataka, Tamil Nadu, Andhra Pradesh, Chhattisgarh, West Bengal and Punjab up to March 2024. This includes 7562 MW from Bagasse Cogeneration Sector, 1871 MW from Biomass IPP Sector and 921 MW from biomass (non-bagasse) cogeneration sector.

4.4 SMALL HYDRO POWER

4.4.1 The Ministry of New and Renewable Energy (MNRE) is vested with the responsibility of developing hydro power projects of capacity up to 25 MW, categorized as Small Hydro Power (SHP) Projects. These projects have the potential to meet power requirements of remote and isolated areas in a decentralized manner besides providing employment opportunity to local people. Small Hydro Power projects are further categorized into small, mini and micro hydel projects based on their capacity as follows:

Micro Hydel ≤ 0.1 MW

Mini Hydel > 0.10 MW to ≤ 2.00 MW Small Hydel > 2.00 MW to ≤ 25.00 MW

4.4.2 The estimated potential of small/mini/micro Hydel projects in the country is 21133.61 MW from 7133 sites located in different States of India. The SHP projects in the country are being set-up both in public and private sectors. Setting up of SHP projects normally require about 3-4 years depending upon its size and location. An aggregate capacity of 5003.25 MW been achieved as on 31st March, 2024 through 1180 Small Hydro Power projects. In addition, 100 projects of 514.10 MW are at various stages of implementation. Table 4.7 provides state-wise details of identified potential, projects completed and those under execution.

Table 4.7: State wise list of potential sites, installed projects and on-going projects in SHP sector (as on 31.03.2024)

S.No.	State	Total Potential		Project Installed						Project under implementation	
				upto 2022-23		upto 2023-24		Total			
		No.	Total Capacity MW	Nos.	Capacity MW	Nos.	Capacity MW	Nos.	Capacity MW	Nos.	Capacity MW
1	Andhra Pradesh	359	409.32	45	163.31	0	0	45	163.31	1	1.20
2	Arunachal Pradesh	800	2064.92	157	133.11	0	0	157	133.11	5	6.05
3	Assam	106	201.99	6	34.11	0	0	6	34.11	0	0
4	Bihar	139	526.98	29	70.7	0	0	29	70.7	0	0
5	Chhattisgarh	199	1098.2	10	76	0	0	10	76	0	0
6	Goa	7	4.7	1	0.05	0	0	1	0.05	0	0
7	Gujarat	292	201.97	22	91.64	0	0	22	91.64	2	21.66
8	Haryana	33	107.4	9	73.5	0	0	9	73.5	0	0
9	Himachal Pradesh	1049	3460.34	202	969.71	0	0	202	969.71	45	251.84
10	UT of Jammu & Kashmir	103	1311.79	20	146.68	4	23.25	24	169.93	5	29.65
11	UT of Ladakh	199	395.65	30	40.99	1	2.00	31	42.99	5	5.6
12	Jharkhand	121	227.96	6	4.05	0	0	6	4.05	0	0
13	Karnataka	618	3726.49	170	1280.73	0	0	170	1280.73	6	16.45
14	Kerala	238	647.15	39	266.52	2	10	41	276.52	4	32.85
15	Madhya Pradesh	299	820.44	14	123.71	0	0	14	123.71	3	7.7
16	Maharashtra	270	786.46	72	381.08	1	1.20	73	382.28	7	8.10
17	Manipur	110	99.95	8	5.45	0	0	8	5.45	0	0
18	Meghalaya	97	230.05	5	32.53	1	22.50	6	55.03	1	3.0
19	Mizoram	72	168.9	20	45.47	0	0	20	45.47	0	0
20	Nagaland	98	182.18	14	32.67	0	0	14	32.67	1	2.4
21	Odisha	220	286.22	13	115.63	0	0	13	115.63	3	56.5
22	Punjab	375	578.28	59	176.1	0	0	59	176.1	5	4.05
23	Rajasthan	64	51.67	10	23.85	0	0	10	23.85	0	0
24	Sikkim	88	266.64	18	55.11	0	0	18	55.11	0	0
25	Tamil Nadu	191	604.46	21	123.05	0	0	21	123.05	0	0
26	Telangana	94	102.25	30	90.87	0	0	30	90.87	0	0
27	Tripura	13	46.86	3	16.01	0	0	3	16.01	0	0
28	A&N Islands	7	7.27	1	5.25	0	0	1	5.25	0	0
29	Uttar Pradesh	251	460.75	10	49.1	0	0	10	49.1	1	1.5
30	Uttarakhand	442	1664.31	103	218.82	0	0	103	218.82	6	65.55
31	West Bengal	179	392.06	24	98.5	0	0	24	98.5	0	0
Total		7133	21133.61	1171	4944.30	9	58.95	1180	5003.25	100	514.10

4.4.3 In 2023-24, 9 projects of aggregate capacity of 58.95 MW have been synchronized to the grid by 31st March, 2024 (Table 4.8).

4.4.4 Under the 'Ladakh Renewable Energy Initiative (LREI)', Kargil Renewable Energy Development Agency (KREDA) and Ladakh Renewable Energy Development Agency (LREDA) are implementing Small/ Mini hydro projects in their respective regions. A total of 7 Hydro projects with aggregate capacity of 10.55 MW are being implemented by KREDA, out of which 5 projects with aggregate capacity of 6.55 MW has been commissioned by KREDA till date.

LREDA is implementing 06 nos. of projects with aggregate capacity of 3.65 MW, out of which 3 projects with aggregate capacity of 1.55 MW has been commissioned by LREDA till date.

Table - 4.8 List of SHP projects commissioned during 2023-24 (till 31.03.2024)

S.No.	Name of Project	Capacity	Agency/ State	Date of Commissioning
1	Baltikulan	5.00	M/s Mass N-ErgyPvt. Ltd., UT of J&K	Jun-23
2	Khari	3.75	M/s Khari Hydro Power Project Pvt. Ltd., UT of J&K	Jun-23
3	Butakulan	6.00	M/s S.A. Power Utilities (UT of Jammu & Kashmir)	Jun-23
4	Khadakwasla	1.20	M/s Sneus Hydrel Pvt. Ltd., Maharashtra	Jul-23
5	Ganol	22.50	Meghalaya Power Generation Corporation Pvt. Ltd.	Jul-23
6	Mukkudam	4.00	M/s Mukkudam Electro Energy Pvt. Ltd., Kerala	Oct-23
7	Raru	2.00	Kargil Renewable Energy Development Agency	Jan-24
8	Peruvannamuzhy	6.00	Kerala State Electricity Board	Jan-24
9	Lashpathri-I	8.50	M/s Mass N-ErgyPvt. Ltd., UT of J&K	Mar-24
Total		58.95		

4.5 WASTE TO ENERGY

4.5.1 Programme on Energy from Urban, Industrial, Agricultural Wastes and Residues

The Ministry has been implementing the scheme "Programme on Energy from Urban, Industrial and Agricultural Waste/Residues" (Waste to Energy Programme) aimed at generation of biogas, BioCNG and Power from different wastes, such as vegetable and other market wastes, slaughterhouse waste, agricultural residues and industrial wastes & effluents. In addition to Bio-CNG/Biogas, biogas plants generate organic fertilizer as a by-product which is valuable for agricultural fields.

Such projects are being set up in a number of industry sectors namely distillery, paper and pulp solvent extraction, dairy, starch industries, sugar mills, pharmaceutical industries etc. and sewage treatment plants

For the continuation of the above scheme for the period FY 2021-22 upto FY 2025-26, the Ministry has issued guidelines under the Phase-I of the umbrella of National Bioenergy Energy Programme on 02.11.2022 with an allotment of Rs 600 crores. The Waste to Energy Programme provides Central Financial Assistance (CFA) for setting up of Waste to Energy projects for generation of Biogas/ BioCNG/ Power.

4.5.2 Objectives of the Scheme

- To promote setting up of projects for recovery of energy in the form of Biogas/ Bio-CNG/Power from Urban, Industrial and Agricultural Waste and Captive Power and Thermal use through Gasification in Industries.
- To promote Biomass Gasifier for feeding power into the grid or meeting captive power and thermal needs of rice mills/other industries and villages.

- To create conducive conditions and environment, with fiscal and financial regime, to develop, demonstrate and disseminate utilization of wastes and residues for recovery of energy.

4.5.3 Subsidy/Grant/Incentive provided under the Scheme

The CFA pattern for Waste to Energy projects are as follows:

- Biogas generation: Rs 0.25 crore per 12000 cum/day (Maximum CFA- Rs.5.00 crore/project)
- BioCNG/Enriched Biogas/Compressed Biogas generation: (Maximum CFA- Rs.10 crore/project)
 - Bio CNG generation from new Biogas plant- Rs 4.0 Crore per 4800 Kg/day;
 - BioCNG generation from existing Biogas plant- Rs 3.0 Crore per 4800 Kg/day;
- Power generation based on Biogas: (Maximum CFA- Rs. 5.00 crore/project)
 - Power generation from new biogas plant: Rs 0.75 Crore per MW
 - Power generation from existing biogas plant: Rs 0.5 crore / MW
- Power generation based on bio & agro-industrial waste (other than MSW through incineration process): Rs. 0.40 crore/MW (Maximum CFA- Rs.5.00 Crore/Project)
- Biomass Gasifier for electricity/ thermal applications:
 - Rs. 2,500 per kWe with dual fuel engines for electrical application
 - Rs. 15,000 per kWe with 100% gas engines for electrical application
 - Rs. 2 lakh per 300 kWth for thermal applications.

4.5.4 This programme also supports other Government of India initiatives such as Gobaradhan of Department of Drinking Water and Sanitation, and the Sustainable Alternative Towards Affordable Transportation (SATAT) of Ministry of Petroleum and Natural Gas (MoPNG). Enhancing production and availability of Compressed Bio-gas (CBG) as an alternative and affordable clean fuel for cooking and transportation sector is envisaged under these initiatives.

4.5.5 Progress during the Financial year 2023-24

- Physical Achievement:** As on 31.03.2024, during the FY 2023-24, the capacities added in respect of various output products are given as under:

S.No.	Output Product	No. of Plants	Capacity Addition in FY 2023-24 (MWeq)	States
1	Bio CNG / CBG	21	24.78	Madhya Pradesh, Tamil Nadu, Punjab, Karnataka, Uttarakhand, Uttar Pradesh, Andhra Pradesh, Maharashtra, Gujarat, Haryana, Rajasthan
2	Biogas	1	0.51	Haryana
3	Power	5	6.46	Goa, Karnataka, Gujarat, West Bengal
	Total	27	31.76	

ii. Biourja Application Portal: The Ministry of New and Renewable Energy has revamped the Biourja Application Portal (www.biourja.mnre.gov.in) to facilitate submission and processing of applications for grant of CFA for Bioenergy projects. All communication with developers in respect of their applications is envisaged through this portal.

4.5.6 Cumulative Physical Achievement :

As on 31.03.2024, the total installed capacity is 585.80 MWeq, including 249.74 MW capacity of Grid-interactive Waste to Power projects, and 336.06 MWeq capacity Off-grid Waste-to-Energy projects. The generation details as well as the output till 31.03.2024 is given as under:

The Product Output and Cumulative Capacity of Waste-to-Energy Projects

S.No.	Output Product	Cumilative Installed Capacity
1	Biogas	8,24,647 m3 per day
2	Bio-CNG/CBG	4,24,335 kg per day
3	Power (Grid & Offgrid)	428.67 MW

4.5.7 Photographs:



Fig 4.9: (a) BioCNG plant set up by M/s Patiala RNG Pvt Ltd at Patran, District Patiala Punjab

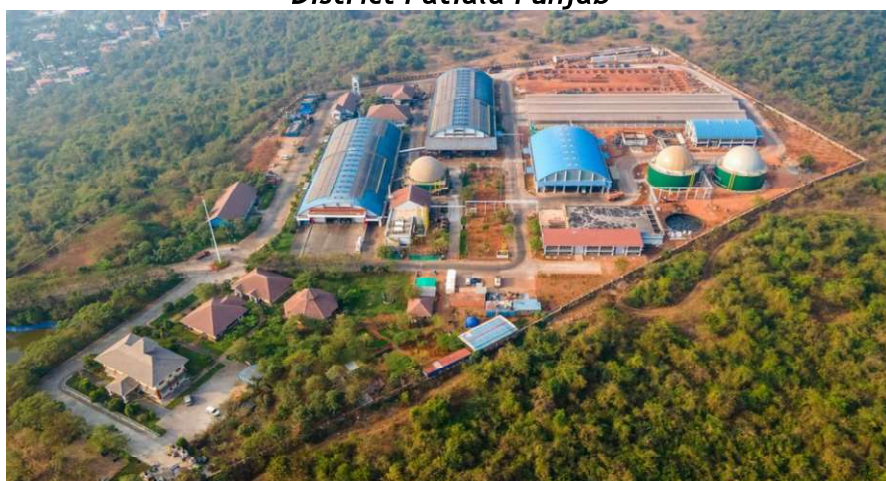
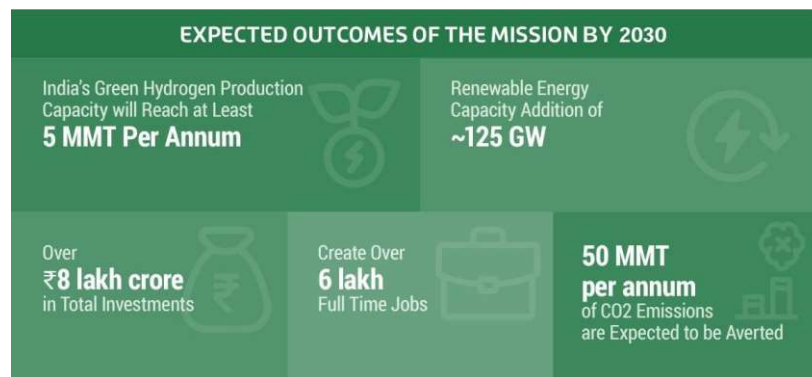


Fig 4.10: (b) Biogas to power project set up by M/s. Goa Waste Management Corporation in Saligaon, Goa

CHAPTER 5

NATIONAL GREEN HYDROGEN MISSION (NGHM)

5.1 In his Independence Day address on 15th August 2021, the Hon'ble Prime Minister announced the National Green Hydrogen Mission (NGHM) with the goal of making India the global hub for Green Hydrogen production and export. With abundant renewable energy potential and land resources, India has the capability to produce low-cost Green Hydrogen on a large scale. In line with the Hon'ble Prime Minister's vision, the National Green Hydrogen Mission (NGHM) was launched on 4th January 2023.



5.1.1 The outlay for the NGHM is Rs. 19,744 crores, including an outlay of Rs. 17,490 crores for the Strategic Interventions for Green Hydrogen Transition (SIGHT) Programme; Rs. 1,466 crores for pilot projects; Rs. 400 crores for the R&D Programme; and Rs. 388 crores towards Outreach, Skilling and other components of the NGHM.

5.2 For effective implementation under the Mission, a flexible and result-oriented governance structure has been created in the form of an Empowered Group (EG) and an Advisory Group (AG).

5.2.2 The Empowered Group (EG) is responsible for the overall implementation of Mission objectives, addition, or deletion of any activities/projects, recommending fiscal, monetary or regulatory interventions to appropriate authorities, removal of difficulties in interpretation or giving effect to any provision of this Mission document. The EG ensures complementarity of the Mission with other Government of India programmes and activities related to Hydrogen and facilitates cohesive action among the various Ministries/ Departments participating in the Mission.

5.2.3 The Advisory Group (AG) is chaired by the Principal Scientific Advisor to the Government of India and comprises of experts from academic and research institutions, industry, and civil society. AG advises the EG on all science and technology related matters pertaining to the Mission. The AG has recommended the R&D roadmap based on industry requirements, impact potential of various pathways, alignment with core competencies of institutions, and current state of maturity of technology and research.

5.3 Through the Mission, the Ministry will facilitate demand creation, production, utilization, and export of Green Hydrogen. Under the Strategic Interventions for Green Hydrogen Transition (SIGHT) Programme of NGHM, two distinct financial incentive mechanisms, targeting domestic manufacturing of electrolyzers and production of Green Hydrogen, will be provided. Also, to support the deployment of green hydrogen and its derivatives, Rs. 1466 crores has been allocated for the pilot projects in hard-to-abate sectors like Steel, Shipping & Transportation. Along with these initiatives, Rs. 200 crores has been allocated for the development of large-scale hydrogen hubs.

- 5.3.1** Under SIGHT Programme Component-I: Incentive Scheme for Electrolyzer Manufacturing, an outlay of Rs. 4,440 Crore has been allocated to provide support for indigenous manufacturing of electrolyzers, to lower the levelized cost of Hydrogen production. Under Tranche-1 of the Component-I, bids have been issued for 1.5 GW electrolyser capacity and this has been awarded to 8 companies. Another bid of 1.5 GW electrolyser capacity (Tranche II) has also been issued by SECI.
- 5.3.2** Under the SIGHT Programme Component II: Incentive Scheme for Green Hydrogen Production, Rs. 13,050 crores has been allocated to provide support for domestic production of Green Hydrogen and its derivatives to enhance its cost-competitiveness with fossil fuel based alternatives. Under Tranche-1 of Mode-1 (bidding on least incentive demanded over the three-year period) of the Component-II, 4,12,000 Metric Tonne per annum capacity has been awarded to 10 companies. Another bid of 450,000 MT capacity (Tranche II) has also been issued by SECI. Scheme guidelines for the incentive scheme under Mode 2A (Green Ammonia for Fertilizers) and Mode 2B (Green Hydrogen for Refineries) by demand aggregation model have also been notified on 16th January 2024.
- 5.3.3** Under the NGHM, it is proposed to implement pilot projects for replacing fossil fuels and fossil fuel-based feedstocks with Green Hydrogen and its derivatives. In line with these objectives, scheme guidelines have been issued for pilot projects in the Shipping sector and Transportation sector on 1st February 2024. Scheme guidelines for the use of Green Hydrogen in the steel sector have been notified on 2nd February 2024.
- 5.3.4** Given the technical and logistic challenges inherent in transporting hydrogen over long distances, a cluster based production and utilization model would enhance the viability of green hydrogen and its derivatives in the initial years. For the development of the hydrogen ecosystem, scheme guidelines for setting up Hydrogen Hubs (which will act as the backbone of the decarbonization efforts in the country) in India have been notified on 15th March 2024.
- 5.4** A robust framework of Regulations, Codes, and Standards (RCS) is an essential prerequisite for establishing the Green Hydrogen ecosystem. To initiate work in this direction, the Ministry has constituted a Working Group (WG) comprising relevant Ministries, Government agencies, standardization bodies, regulators, and industry stakeholders. This WG outlines critical challenges and desired actions regarding standards and regulations to enable the scaling up of the Green Hydrogen ecosystem in India safely and reliably. Considering the substantial volume and scope of activities, thematic sub-groups have been constituted to work on RCS related to different aspects of the Green Hydrogen value chain.
- 5.5** The Ministry notified the Green Hydrogen Standard On 18th August 2023. As per the standard, "Green Hydrogen" shall mean Hydrogen produced from renewable energy, including, but not limited to, production through electrolysis and conversion of biomass. Emissions from Green Hydrogen produced through electrolysis would include non-biogenic greenhouse gas emissions arising from water treatment, electrolysis, gas purification, drying and compression, and shall not be greater than 2 kg CO₂ eq/ kg Hydrogen, averaged over a period of 12 months. Emissions from Green Hydrogen produced through conversion of biomass would include the non-biogenic greenhouse gas emissions arising from biomass processing, heat/steam generation, conversion of biomass to Hydrogen, gas purification and drying and compression and shall not be greater than 2 kg CO₂ eq/ kg Hydrogen, averaged over a period of 12-months.

5.6 The Ministry organized the first International Conference on Green Hydrogen (ICGH) from 5th - 7th July, 2023 in partnership with the Ministry of Petroleum and Natural Gas (MoPNG), Council for Scientific and industrial Research (CSIR) and Office of the Principal Scientific Adviser to the Government of India. The primary objective of the conference was to explore the establishment of a Green Hydrogen ecosystem and promote a comprehensive approach to achieve global decarbonization goals using Green Hydrogen. In addition to focused discussions on Hydrogen production, storage, distribution, and its applications, the conference also addressed topics such as Green Financing, Workforce Upskilling, and promotion of startup initiatives. During the conference, the Principal Scientific Adviser launched an Inter-ministerial draft R&D Roadmap for the Green Hydrogen Ecosystem. This roadmap provides an overview of R&D in all aspects of the hydrogen value chain, including production, storage, transportation, and applications.

5.6.1 On the eve of World Hydrogen and Fuel Cell Day (celebrated annually on 8th October) the Ministryorganised an event to explore and leverage the boundless possibilities of Hydrogen as a source of green and sustainable energy. The event was organized in association with Solar Energy Corporation of India Limited and brought together Hydrogen experts from the industry, academia and government. On this occasion, Bureau of Energy Efficiency (BEE), Ministry of Power, released the details of the Draft Accreditation Procedure and Eligibility for Accredited Carbon Verification Agencies to strengthen the domestic carbon market. BEE underlined the necessary framework and the roles of diverse stakeholders for the development and functioning of the Indian carbon market. Furthermore, to throw more light into the world of Hydrogen, a podcast and video on Hydrogen was also released during the event.The final R&D roadmap was also launched on 7th October 2023 at the World Hydrogen Day Event. It is expected that this roadmap would serve as a guide for development of a vibrant research and development ecosystem required to commercialize Green Hydrogen and contribute to India’s ambitious climate and energy goals.



5.7 Scheme guidelines for the implementation of the R&D scheme have been notified on 15th March 2024 to facilitate the scaling up and commercialization of technological advancements by providing requisite policy and regulatory support. Under this R&D scheme, the call for proposals has also been issued on 16th March 2024 inviting R&D proposals from eligible entities.

5.8 India, during its G20 presidency with the theme 'One Earth, One Family, One Future,' aimed to foster the sharing, collaboration, and cultivation of a sense of responsibility among G20 member nations. The goal was to accelerate the Energy Transition and enable sustainable growth. The G20 summit offered an opportunity to advance the global stance on Green Hydrogen through the G20 Energy Transition Working Group (ETWG) to expedite the development of a global hydrogen economy.

5.8.1 Recognizing the nascency in technology development across the Green Hydrogen ecosystem, India's presidency also established, within the G20 framework, a Green Hydrogen Innovation Centre anchored by the International Solar Alliance (ISA). The Centre would serve as a hub to accelerate research, innovation, technology development, policy and standardization and drive collaborative partnerships, capacitybuilding, global awareness, and advocacy for advancing Green Hydrogen adoption.

5.9 MNRE in collaboration with the International Solar Alliance (ISA) hosted an event on 'Solar Energy for Universal Energy Access' on the sidelines of the 4th Energy Transition Working Group (ETWG) meeting on 19th July 2023 in Goa. In this event, MNRE released two reports on Advancing Collaboration for Green Hydrogen Production and Advancing Technologies to bridge the gap in Electrolyzer Technology.

5.10 One of the major outcomes of the G20 summit leadership was the ratification of five High-Level Voluntary Principles on Hydrogen for achieving global net zero GHG emissions/ carbon neutrality goals by accelerating measures towards the production, utilization, and trade of Hydrogen and its derivatives (such as Ammonia) produced from zero and low emission technologies. These include the following:

- a) Encourage collaboration on the development of national standards and work towards a globally harmonized approach on certification for Hydrogen and its derivatives (such as Ammonia) produced from zero and low emission technologies.
- b) Promote free and fair trade of Hydrogen and its derivatives such as Ammonia produced from zero and low emission technologies in line with WTO rules, supported by resilient and diversified supply chains.
- c) Accelerate technological innovation, business models, and R&D collaboration to enhance international cooperation.
- d) Promote investments, mobilize finance, and develop infrastructure for enhancing the production, utilization, and global trade of Hydrogen and its derivatives (such as Ammonia) produced from zero and low emission technologies.
- e) Support and enable voluntary information sharing, cooperation, dialogue, knowledge exchange, and capacity building on Hydrogen and its derivatives (such as Ammonia) produced from zero and low emission technologies, with an aim to contribute to net zero GHG emissions/ carbon neutral pathways, including through the development of regional and international initiatives and institutions.

CHAPTER 6

RENEWABLE ENERGY FOR RURAL APPLICATIONS

6.1 The Ministry of New & Renewable Energy (MNRE) has been implementing Biogas Schemes for the dissemination and deployment of biogas plants in remote, rural and semi-urban areas of the country since November 2022. These erstwhile biogas schemes i.e. New National Biogas and Organic Manure Programme (NNBOMP), Biogas Power Generation (Off-grid) and Thermal energy application Programme (BPGTP), have been amalgamated into the Biogas Programme and were approved for continuation under the umbrella National Bio-energy Programme (NBP) on 02.11.2022 for the period from 01.04.2021 to 31.03.2026.

The objectives of the Biogas Programme are to support setting up of biogas plants for clean cooking fuel, lighting, meeting thermal and decentralized power generation needs of users, which ultimately results in Green House Gas (GHG) emission reduction, improved sanitation, facilitating management and utilization of biogas plant produced slurry as an organically enriched Solid Biogas Fertilizer, Women Empowerment, and creation of Rural Employment etc.

6.2 ACHIEVEMENTS UNDER THE BIOGAS PROGRAMME

The State/UT-wise installed small biogas plants, are given in Table 6.1.

Table 6.1: The State/UT-wise achievements for family type/small biogas plants, under the Biogas Programme.

State UT	Cumulative Number of small bio gas plants installed (as on 31.03.2024)
Andhra Pradesh	2,68,628
Arunachal Pradesh	3,686
Assam	1,39,435
Bihar	1,30,091
Chhattisgarh	60,717
Goa	4,245
Gujarat	4,38,320
Haryana	64,092
Himachal Pradesh	47,718
Jammu & Kashmir	3,201
Jharkhand	7,890
Karnataka	5,16,091
Kerala	1,54,879
Madhya Pradesh	3,83,347
Maharashtra	9,39,275
Manipur	2,128
Meghalaya	11,156
Mizoram	5,857
Nagaland	7,954
Odisha	2,71,932
Punjab	1,89,148
Rajasthan	73,145
Sikkim	9,044

State UT	Cumulative Number of small bio gas plants installed (as on 31.03.2024)
Tamil Nadu	2,24,148
Telangana	3,16,870
Tripura	4,132
Uttar Pradesh	4,41,447
Uttarakhand	3,66,083
West Bengal	1,216
Andaman & Nicobar	97
Chandigarh	169
Dadar & Nagar Haveli	681
Daman & Diu	0
Delhi	587
Lakshadweep	0
Puducherry	17,541
Total	51,04,950

6.3 STATUS OF IMPLEMENTATION OF THE BIOGAS PROGRAMME

With the announcement of the biogas programme on 2nd November, 2022, total 24,000 number small biogas plants have been installed upto 31.03.2024. For the current financial year 2024-25, the State-wise physical targets of 25,000 number of small biogas plant installation has been allocated by MNRE to the 46,000 number of designated Biogas Programme Implementing Agencies of the State and Union Territories. So far under Biogas Programme, about 51.04 Lakh of small biogas plants (1-25 cubic meter/day capacity) and 349 number of medium sized biogas plants (above 25-2500 cubic meter/day capacity) have been supported by MNRE with a total capacity of about 10.6 MW in the country.

During the month of October, 2023, a national review meeting under the Chairmanship of Secretary, MNRE was organized to highlight the salient features and implementation mechanism of Biogas programme. For ease of application, centralized management of biogas beneficiaries' requests, monitoring of installation, and maintenance on installed biogas plants etc. The Ministry has updated the national biogas web-portal (www.biogas.mnre.gov.in). The Biogas Programme is being implemented through the Agriculture Farmers Welfare and Rural Development Departments of the States, Dairy Co-operatives, State Nodal Agencies (SNAs), Biogas Development and Training Centers (BDTCs), Khadi and Village Industries Commission (KVIC), National Dairy Development Board (NDDB), Amul Dairy etc. For the inclusion of simple, cost effective and portable pre-fabricated designs of small biogas plants under the Biogas Programme of MNRE, the Ministry has approved two more flexi domestic biogas plant developers/ vendors namely (a) M/s Oxy Plasticare Pvt Ltd. (b) M/s Baramati Ecosystem Pvt Ltd., and one dry fermentation technology-based biogas plant design i.e. for BDTC, Punjab Agriculture University, Ludhiana, making a total of 6 new designs of biogas plant under the MNRE Biogas Programme. MNRE has also approved the biogas slurry filtration unit for digested biogas slurry. With use of this slurry filter, the solid and liquid component of the freshly digested slurry gets separated, and the same can be used directly or as value-added product as an organic manure.

6.4 SUBSIDY AND OTHER CENTRAL FINANCIAL ASSISTANCE UNDER BIOGAS PROGRAMME

6.4.1 The details of Central Financial Assistance (CFA) for different components under this programme are as follows:

- a) For small biogas plants (1-25 cubic meter/day plant capacity): Rs. 9800/- to Rs.70,400/- per plant based on size of the plant in cubic meter; and
- b) For Power generation and thermal application (capacity ranging from above 25 to 2500 cubic meter biogas generation per day), (3 to 250 kWe Power Generation capacity per day): Rs. 35,000/- to Rs. 45,000/- per kilowatt for power generation and Rs. 17,500 /- to Rs. 22,500/- per kilowatt equivalent for thermal applications (25 - 2500 cubic meter/day plant capacity). The eligible CFA would be 20% higher than Standard CFA for Islands, NE States, SC/ST beneficiaries, and for biogas plant installed in Registered Gaushalas, Govt registered Gothans.

6.4.2 In May 2023, the Ministry has also amended the guidelines for the 40% advance release of CFA against the annual allocated targets for small biogas plants to the designated state's PIA. Similarly, the provision has been introduced for the release of 50% of the annual approved budget outlay as an advance for BDTCs activities under the Biogas Programme.