

A wide-angle photograph of a landscape at sunrise or sunset. The sky is filled with warm, golden-yellow hues. In the center, a bright sun sits low on the horizon, casting long, dramatic rays of light across the scene. These rays pierce through a layer of low-hanging mist or fog that rests in the valleys between distant mountain ranges. In the foreground, a vibrant green field of tall grass or crops stretches across the bottom of the frame. A dense line of dark evergreen trees marks the edge of the field, silhouetted against the bright light. The overall atmosphere is serene and majestic, capturing the beauty of a natural sunrise.

1: OVERVIEW

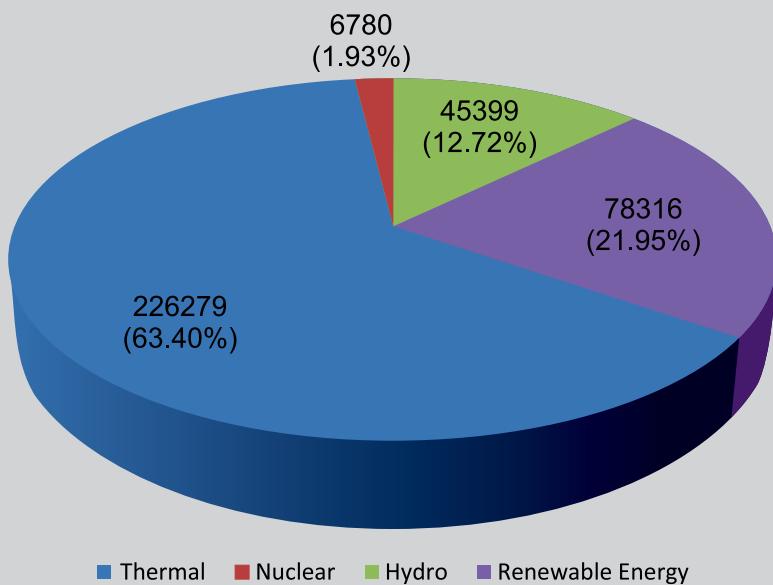


OVERVIEW

- 1.1 Renewable energy has started playing an increasingly important role for augmentation of grid power, providing energy access, reducing consumption of fossil fuels and helping India pursue its low carbon development path. Ahead of COP 21, India submitted its Intended Nationally Determined Contribution (INDC) to the UNFCCC, outlining the country's post-2020 climate actions. India's INDC builds on its goal of installing 175 gigawatts (GW) of renewable power capacity by 2022. India has set a target to increase the country's share of non-fossil-based installed electric capacity to 40 percent by 2030. The INDC also commits to reduce India's GHG emissions intensity per unit GDP by 33 to 35 percent below 2005 levels by 2030, and to create an additional carbon sink of 2.5 to 3 billion tonnes of carbon dioxide through additional tree cover.
- 1.2 At the national level, over the years, India has successfully created a positive outlook necessary to promote investment in, demand for and supply of renewable energy that includes Solar, Wind, Bio, Hydro and Waste to Energy. In addition to grid power, decentralized distributed renewable energy technologies provide viable options for meeting lighting, cooking and productive energy needs in rural areas.
- 1.3 Launched in January 2010, the National Solar Mission (NSM) was the first mission to be operationalized under the National Action Plan on Climate Change (NAPCC). Using a three-phase approach, the mission's objective is to establish India as a global leader in solar energy, by creating the policy conditions for solar technology diffusion across the country as quickly as possible. The initial target of the mission of installing 20 GW grid-connected solar power plants by the year 2022 was enhanced to 100 GW to be achieved by the same target year.
- 1.4 A range of policy instruments has been adopted to implement this mission. The revised tariff policy requires all States to reach 10.5 percent solar RPO by the year 2022. The first phase of the mission opted for a 'reverse bidding mechanism'; reverse bids (discounts) on benchmark tariffs set by the Central Electricity Regulatory Commission (CERC) were invited from prospective project developers. Solar water heaters and rooftop Solar systems have been promoted in Government, commercial and residential areas through regulatory intervention such as mandates under building by-laws and its incorporation in the National Building Code. Off-grid and rooftop solar applications have been promoted through provision of subsidies from the Central Government. Research and development is also being encouraged through approvals of R&D projects and the establishment of Centres of Excellence by the Ministry. These measures led to decline in purchase prices of solar power in India much more than expectations. Overall, NSM is proceeding well according to schedule. During the year, one of the major focus area of action was to address barriers confronting large-scale adoption of solar power, including available land, low-cost finance, domestic manufacturing capacity, and skilled manpower. Major areas of action remaining are strengthening of the planned infrastructure, protocols and power grid infrastructure for evacuation of Renewable Energy.
- 1.5 Various policy measures undertaken included guidelines for procurement of solar and wind power though tariff based competitive bidding process, standards for deployment of Solar Photovoltaic systems and devices, provision of roof top solar and Guidelines for development of smart cities, amendments in building bye-laws for mandatory provision of roof top solar for new construction or higher Floor Area Ratio; infrastructure status for solar projects, raising tax free solar bonds, providing long tenor loans, incorporating measures in Integrated Power Development Scheme (IPDS) for encouraging distribution companies and introducing net-metering.
- 1.6 In the year 2015, the Government of India announced a target for 175 GW cumulative renewable power installed capacity by the year 2022. A capacity of 78.31 GW has been set up by March 2019



Figure 1.1 : India-Source Wise Installed Power Generation Capacity (MW) as on 31.03.2019



constituting 21.95 percent of the total installed capacity (See figure 1.1). India achieved 4th global position in wind and renewable power and 5th global position in solar power deployment respectively. The renewable power deployment has more than doubled in last five years i.e. from April 2014 to March 2019. Annually more than 10 million man-days employment is being created in the sector. Solar power capacity has increased by more than 11 times in the last five years from 2.6 GW to 28.18 GW in March 2019. The target for 2022 is not just within reach but is set to be exceeded. During the year a record of 120 billion+ units of renewable electricity was generated.

- 1.7 The focus of promotion of renewable energy policies and initiatives taken in the last four years have led to large-scale penetration of and use of such technologies across the rural countryside. More than 36000 Suryamitras have been trained in the last five years to cater to the growing needs of the solar energy sector. Such initiatives have created employment opportunities at multiple levels. Apart from this, nearly 1450 Varunmitras and Rooftop Solar Grid Engineers were trained during 2018-19.
- 1.8 India has been playing a leadership role in encouraging for the establishment of a solar based economy across the globe. India, in partnership with France, promoted the establishment of International Solar Alliance (ISA) in 2015. In 2018, ISA has been transformed into a treaty based organisation headquartered in India.
- 1.9 Hon'ble Prime Minister while inaugurating the First Assembly of ISA on 2nd October 2018, equated solar energy to oil reserves and projected ISA to become 'OPEC of the future'. He also gave a clarion call for 'One World, One Sun, One Grid' for sharing solar energy across the borders.
- 1.10 The ISA Assembly also adopted India's resolution for amending the Framework Agreement of the ISA for opening up the ISA membership to all member countries of United Nations helping to put solar energy in the global agenda and ensuring access to sustainable and clean energy for all.
- 1.11 Several new policy initiatives have been taken up during the last four years including:-



- i. National Solar – Wind Hybrid policy notified; Wind-Solar hybrid projects of 840 MW have been auctioned through transparent competitive bidding by SECI, with discovered minimum tariff for hybrid project at Rs.2.67/unit;
- ii. Tender invited for setting up Solar PV manufacturing capacities linked with assured off-take of 3000 MW;
- iii. EoI invited for 150 MW floating Solar power plants;
- iv. The capacity of the Solar Park Scheme was enhanced from 20,000 MW to 40,000 MW;
- v. Two solar parks Kurnool (1000 MW) in Andhra Pradesh and Bhadla-II (680 MW) in Rajasthan are fully operational; Solar Power projects of aggregate capacity of 5,835 MW have been commissioned inside various Solar Parks;
- vi. Transparent bidding process – which has led to significant reduction in per unit cost of solar (Rs.6.17 in 2014 to Rs.2.44 in 2018) and wind power (Rs.4.20 in 2014 to Rs.2.43 in 2018);
- vii. The country currently has the fourth highest wind power installed capacity in the world with total installed capacity of 35.62 GW. The current annual manufacturing capacity of wind turbines in the country is about 10000 MW;
- viii. 1,115 small hydropower projects aggregating to over 4,593 MW have been set up in various parts of the country. In addition, 116 projects of about 650 MW are in various stages of implementation (as on 31.03.2019);
- ix. Over 500 biomass power and cogeneration projects with aggregate capacity of 9075.5 MW have been installed in the country up to March 2019. 138.30 MW capacity grid interactive projects and 111.43 MW capacity off-grid power projects using biomass waste, 78 biogas generation plants with 6,65,606 cubic meters per day generation capacity and 16 Bio-CNG generation plants with 59028 kgs per day generation capacity have been set up in the country so far;
- x. India's offshore wind potential has been recognised under the National Offshore Wind Policy under which NIWE has been authorised to allocate offshore wind blocks to developers on the basis of open international competitive bidding. First LiDAR installed and commissioned off Gujarat coast for gathering wind resource data. Five additional LiDARs (two for Gujarat and three for Tamil Nadu) are in the process of installation. Expression of Interest (EoI) for the India's first offshore wind project of 1.0 GW capacity off Gujarat coast was floated on 10.04.18;
- xi. Revised Tariff Policy mandating Renewable Purchase Obligation (RPO) and Renewable Generation Obligation (RGO);
- xii. Waiver of Inter-State Transmission charges for Solar and Wind Energy upto 2022;
- xiii. RPO trajectory for 2022 notified;
- xiv. Round the clock Renewable Power policy finalized;
- xv. 389 biogas based projects corresponding to a total power generation capacity of 8.951 MW with a cumulative total biogas generation of 87,990 m³ per day have been set up in the country up to 31.03.2019;
- xvi. Under Green Energy Corridor project, approx. Rs. 1,940 crore have been disbursed to the States from the Government of India share to cover projects awarded under it.



- xvii. On 22 May 2018, the Ministry constituted RPO Compliance Cell to coordinate with States, SERCs and CERC on matters relating to RPO Compliance. A centralized online platform has been developed to monitor RPO compliance status for all states, enabling States to feed information on RPO compliance in the portal by Obligated Entities in respective States and collation of data at the national level;
- xviii. About 2.4 lakh Solar PV water pumps have been sanctioned and over 2.37 lakh solar pumps have been installed;
- xix. 44.04 lakh Solar Urja Lamps distributed to students in the states of Assam, Bihar, Jharkhand, Odisha & Uttar Pradesh in villages which had more than 50% un-electrified households. Under this scheme 528 trainings conducted for local people and 7276 rural women have been trained to assemble solar lamps;
- xx. More than 6.59 lakh solar street lights including 304500 lakh street lights under Atal Jyoti Yojana have been installed across the country and 17.80 lakh solar home lights has been set up at homes and hamlets in villages;
- xxi. Financing scheme developed jointly with IREDA and MNRE, to provide financial support to Concentrated Solar Thermal (CST) projects by bundling the MNRE's subsidy and a soft loan from IREDA, thereby providing upfront access to 75% of CST project cost; and
- xxii. Under the Suryamitra program, total of 364 nos. of programs with 5700 Suryamitras have been organized in 2018-19 (till 31.03.2019);

1.12 NEW SCHEMES

The Cabinet accorded its approval for the following new schemes:-

- a) Scheme for setting up of 14 MW Solar PV Project with aggregate battery storage capacity of 42 MW (capacity of 7 MW solar projects with battery storage of 21 MWh each in Leh and Kargil at different locations under Prime Minister Development Package (PMDP) – 2015 for J&K.
- b) Central Public Sector Undertakings (CPSU) Scheme Phase II (Central Producer Scheme) for setting up 12,000 MW Grid Connected Solar Photovoltaic (PV) Power Projects by the Government Producers with VGF support for self-use or use by the Government/Government entities, either directly or through Distribution Companies.
- c) Grid Connected Rooftop Solar Programme Phase II with two Components; Component A for setting up of 4,000 MW of Grid Connected Rooftop Plants in residential sector with Central Financial Assistance; and Component B for Incentives to DISCOMS based on achievement for installing additional grid connected roof top capacity in all sectors over and above the base level, with the incentives being limited to the first additional 18,000 MW of rooftop capacity added in the country. Achievements above this level will not be eligible for any incentive.
- d) Scheme for farmers for installation of solar pumps and grid connected solar and other renewable power plants in the country aiming to add solar and other renewable capacity of 25,750 MW by 2022. The scheme has three components, namely, Component A: 10,000 MW Decentralized Ground Mounted Grid Connected Renewable Power Plants of individual plant size up to 2 MW; Component B: Installation of 17.50 lakh standalone Solar Powered Agriculture Pumps of individual pump capacity up to 7.5 HP; and Component C: Solarisation of 10 lakh Grid-connected Agriculture Pumps of individual pump capacity up to 7.5 HP



- 1.13 Research and Development continued to remain major focus area. Major programmes were supported in the area of solar photovoltaic, solar thermal, hydrogen, fuel cells and wind-solar hybrid systems. In solar, high efficiency crystalline silicon solar cells of 18% efficiency was achieved in lab scale under a project at IIT, Bombay. Support for developing solar cells using other materials, storage and power electronic system was provided to R&D/academic institutions. Support for developing solar thermal systems and components was provided for technology development and demonstration for utilizing solar energy for thermal and power generation applications. Research and Development supported in hydrogen and fuel cells focused on technology development and demonstration for hydrogen production and storage for stationary and transport applications. Research and Development efforts in renewable energy continued to make advances in making such technologies affordable and sturdy with assured quality. With this in mind, the government has notified the National Laboratory Policy on testing, standardization and certification as well as Quality Control Order titled ‘Solar Photovoltaics, Systems, Devices and Components Goods (Requirement for Compulsory Registration) Order 2017’ for Solar PV systems and components under the BIS Act. Quality Control Order.
- 1.14 During the period 01.01.2018 to 31.03.2019 a total of 15,445.31 MW capacity has been added as given in **Table 1.1.**

Table 1.1: Achievement in Grid Connected Renewable Power (in MW)		
Sector	Achievement (01.01.2018 - 31.03.2019)	Cumulative Achievements (on 31.03.2019)
Wind Power	2777.51	35625.97
Solar Power - Ground Mounted	10314.23	26384.30
Solar Power - Roof Top	814.06	1796.36
Small Hydro Power	175.00	4593.15
Bio Power (Biomass & Gasification and Bagasse Cogeneration)	1364.51	9778.31
Waste to Power	0.00	138.30
Total	15445.31	78316.39

2: INTRODUCTION



*Model representation of
'Atal Akshay Urja Bhavan' Ministry's upcoming building.*



INTRODUCTION

2.1 In 1982, a separate Department of Non-Conventional Energy Sources (DNES) was created in the Ministry of Energy to look after all the aspects relating to new and renewable energy. The Department was upgraded into a separate Ministry of Non-Conventional Energy Sources (MNES) in 1992 and was rechristened as Ministry of New and Renewable Energy (MNRE), in October 2006.

2.2 ALLOCATION OF BUSINESS RULES

2.2.1 Under the Allocation of Business Rules, the MNRE has been assigned the following specific items:

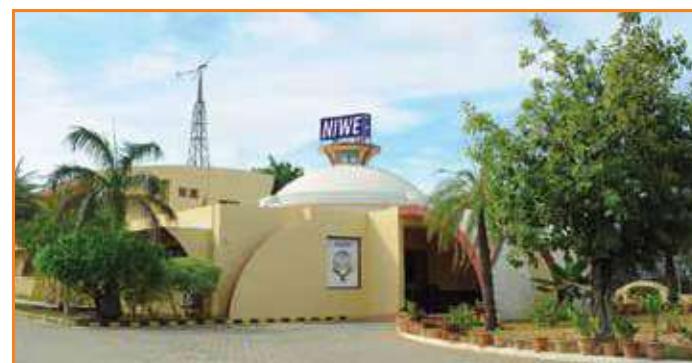
- Research and development of biogas and programmes relating to biogas units;
- Commission for Additional Sources of Energy (CASE);
- Solar energy including solar photovoltaic (SPV) devices and their development, production and applications;
- All matters relating to small/mini/micro hydel projects of, and below, 25 MW capacity;
- Programmes relating to improved chulhas and research and development thereof;
- Indian Renewable Energy Development Agency Limited;
- Research and development of other nonconventional/renewable sources of energy and programmes relating thereto;
- Tidal energy;
- Integrated Rural Energy Programme (IREP);
- Geothermal energy

2.3 STRUCTURE OF THE MINISTRY

2.3.1 Shri Anand Kumar is the Secretary in Ministry of New and Renewable Energy with effect from 23rd June, 2017. He is supported by Additional Security, Joint Secretaries and Advisors. Various programmes and activities are being implemented by the Ministry through Central Electricity Authority, State Nodal Agencies (SNAs), Academic Institutions, Research & Development Laboratories, Public Sector Undertakings and State and Central Government Departments.

2.4 INSTITUTIONS UNDER THE MINISTRY

2.4.1 To support the Ministry, there are five institutions consisting of three autonomous bodies i.e. National Institute of Solar Energy (**NISE**), National Institute of Wind Energy (**NIWE**) and National Institute of Bio Energy (**NIBE**) and two public sector undertakings i.e. Indian Renewable Energy Development Agency (**IREDA**) and Solar Energy Corporation of India (**SECI**). NISE is located at Gurugram, Haryana and serves as the technical focal point for research



National Institute of Wind Energy (NIWE), Chennai, Tamil Nadu



and development in solar energy sector. NIWE is located at Chennai, Tamil Nadu and serves as the technical focal point for research & development in wind energy sector. NIBE is located at Kapurthala, Punjab and is focusing on research & development in bio energy sector. IREDA, a Non-Banking Financial Institution under the administrative control of this Ministry, provides term-loans for renewable energy and energy efficiency projects. SECI functions as the implementing and executing arm of the Ministry for implementation of the National Solar Mission and Wind energy projects. In addition, the Department of Hydro and Renewable Energy (DHRE) formerly known as the Alternate Hydro Energy Centre (AHEC), Indian Institute of Technology, Roorkee provides technical support for small hydro power development. However, DHRE is not an institution under the control of the Ministry.



National Institute of Bio Energy (NIBE), Kapurthala, Punjab



National Institute of Solar Energy (NSIE), Gurugram, Haryana

2.5 PUBLIC GRIEVANCES REDRESSAL

2.5.1 Grievances are received in the Ministry through President's Secretariat, Prime Minister's Office, Department of Administrative Reforms and Public Grievances (DARPG), other Ministries/Departments and from the individuals concerned on MNRE's Window of CPGRAMS portal of DARPG. With a view to deliver expeditious redressal of grievances in a responsible and effective manner, the following measures have been put in place in the MNRE.

- i. Sh. B.L. Ram, Scientist 'G' was designated as Liaison Officer for implementation of scheme of reservation for persons of Schedule Caste (SC) and persons with disability. Sh. G.L. Meena, Scientist-'G' was designated as Liaison Officer for implementation of Scheme of reservation of persons of Scheduled Tribe (ST) category.
- ii. A committee has been constituted to enquire into the complaints of sexual harassment, if any for women working in this Ministry.
- iii. Grievances/petitions/complaints received are forwarded by Public Grievance Cell, MNRE to the Division Head concerned for redressal/taking necessary action and final disposal, with the request to send a final reply to the petitioner, as per time schedule provided. These petitions are monitored on regular basis to keep track of their disposal by reminders, etc. The position regarding final disposal of petitions is also intimated to the authority from which the grievance was received, by post or through CPGRAMS and the individuals concerned.



- iv. Time Frame for Redressal of the Grievance/petition:

Sl. No.	Subject	Time Frame
1.	Issue of acknowledgement to the petitioner	03 days
2.	Forwarding of the grievances/petition to the concerned authority	07 days
3.	Issue of interim reply to the petitioner or to send communication seeking additional information from petitioner.	15 days
4.	Final disposal of petition/grievance and time limit for informing the position of the outcome.	60 days

2.6 CITIZENS'/CLIENTS' CHARTER OF MNRE

- 2.6.1 In order to ensure timely delivery of services to its Clients/Citizens and redressal of their grievances in a time-bound manner the Ministry has brought out a Citizens'/Clients' Charter (CCC), incorporating its mission, main Services/Transactions and commitment to its clients and the people of India in general, and is available on MNRE's website. It aims at providing a mechanism for timely redressal of clients'/ citizens' grievances. It also aims at addressing problems of interface between the Ministry and its clients'/ citizens' and also continuously improving the quality of public services for the people at large to make them responsive to their needs and wishes.

3: NATIONAL SOLAR MISSION



3.1 INTRODUCTION

National Solar Mission (NSM), launched on 11th January, 2010, had set a target for development and deployment of 20 GW solar power by the year 2022. The Cabinet in its meeting held on 17/6/2015 had approved revision of target under NSM from 20 GW to 100 GW.

3.2 1000 MW CAPACITY GRID-CONNECTED SOLAR POWER PROJECTS IMPLEMENTED THROUGH NTPC VIDYUTVYAPAR NIGAM LIMITED (NVVN) UNDER NATIONAL SOLAR MISSION (NSM) PHASE-I

This scheme covered large solar power plants of total 1,000 MW capacity connected to grid at 33 kV and above - 500 MW capacity each based on Solar Thermal (ST) and Solar Photovoltaic (SPV) technologies. It included three stages: (i) Migration Scheme (ii) NSM Phase-I, Batch-I and (iii) NSM Phase-I, Batch-II.

3.3 MIGRATION SCHEME

In order to facilitate quick start-up to NSM and for speedier implementation of the then on-going projects under advanced stage of implementation in different States, this scheme was introduced in Feb 2010 to allow the migration of such projects to NSM. A total of 16 projects of 84 MW capacity (54 MW SPV and 30 MW ST) were approved under this scheme for long-term procurement of power by NVVN at Central Electricity Regulatory Commission (CERC) notified tariff for 2010-11 viz. Rs.17.91/unit for SPV and Rs.15.31/unit for ST. 11nos. SPV projects of 48 MW capacity have been commissioned under this scheme.

3.4 NSM PHASE-I, BATCH-I & BATCH-II

- (i) Under NSM Batch-I and Batch-II, solar power projects were allotted through a process of reverse bidding. Bids for same were invited in two batches: Batch-I of 150 MW SPV and 470 MW ST in Aug 2010 and Batch-II of 350 MW SPV in Aug 2011.
- (ii) In Batch-I the eligible project capacities were 5 MW for SPV and upto 100 MW for ST. 28 SPV Projects with an aggregate capacity of 140 MW and seven ST Projects with an aggregate capacity of 470 MW were allotted. The bid tariffs for SPV projects were in the range of Rs.10.95-12.76/unit, with average of Rs.12.12/unit, and for ST projects in the range of Rs.10.49-12.24/unit, with average of Rs.11.48/unit. 28 SPV projects of 140 MW aggregate capacity and three ST projects of 200 MW aggregate capacity have been commissioned under NSM Phase-I, Batch-I.
- (iii) In Batch-II for SPV, the project capacity fixed was 5-20 MW. 27 SPV projects with an aggregate capacity of 340 MW were allotted at tariff ranging between Rs.7.49-9.44/unit, with average of Rs.8.77/unit. 26 SPV projects of aggregate 330 MW capacity have been commissioned under NSM Phase-I, Batch-II.
- (iv) Two projects, a 5 MW SPV project by Delhi Mumbai Industrial Corridor Development Corporation Limited (DMICDC) and a 10 MW SPV project by Solar Energy Corporation of India (SECI), have also been set up under the MNRE bundling scheme of NSM Phase-I.
- (v) Thus, under NSM Phase-I, 533 MW solar PV projects and 200 MW solar thermal power projects have been commissioned under the bundling scheme.
- (vi) Power generated from the commissioned plants is being purchased by the NVVN and sold to State Utilities/ Discoms under a mechanism of bundling with power from unallocated quota of power from coal based stations of NTPC on equal capacity basis to effectively reduce the average per unit cost of bundled



solar power to the purchasing Utility. A Payment Security Mechanism involving a revolving fund of Rs.486 crore has been put in place to ensure timely payments to developers in the event of delays/ defaults in payments by the purchasing State Utilities to NVVN.

3.5 FOCUS AREA UNDER PHASE II OF NSM

A) Grid connected Projects

- (i) Unlike Phase-I, NSM Phase-II aims for achieving significantly higher scales of targets of 100 GW. Hence, Ministry has contemplated all possible options for implementation of the Mission. Selection of capacity for Phase-II, grid connected projects is being done via different schemes such as Bundling, Generation Based Incentive (GBI), Viability Gap Funding (VGF), transparent bidding and e-reverse auction, etc. The Government has finalized tendering trajectory in order to achieve the Mission target of 100 GW by 2022 with the details as given in **Table 3.1**.

Table 3.1: Year-wise targets under National Solar Mission	
Year	Tendering target (MW)
2017-18	20,000
2018-19	30,000
2019-20	30,000

- (ii) **Solar Energy Potential:** Based upon availability of land and solar radiation, the potential solar power in the country has been assessed to be around 750 GWp. State-wise details of estimated solar energy potential in the country is given in **Table 3.2**.
- (iii) **Achievements:** As on 31.03.2019, a total solar power capacity installed is 28,180.66 MW. In addition capacity of around 14,041 MW are under installation and for around 35,972 MW tenders were issued but LoI are yet to be issued. State wise details of cumulative installed capacity (as on 31.03.2019 is given in **Table 3.3**.

3.6 SCHEMES UNDER NATIONAL SOLAR MISSION

3.6.1 NTPC STATE SPECIFIC BUNDLING SCHEME

- (i) NTPC/NVVN has been identified by the Govt. of India as the nodal agency for purchase and sale of grid connected ‘Solar PV Power’ under the ‘State Specific Bundling Scheme’ as envisaged in National Solar Mission by Ministry of Power (MoP), Government of India (GoI). Accordingly, under NSM Phase-II, Batch-II, Tranche-I, NTPC has signed Power Purchase Agreements (PPAs) with Solar Power Developers and back-to-back Power Sale Agreements (PSAs) with Discoms for 3000 MW.
- (ii) Under the above scheme, solar power projects were planned to be developed in different states as under:
 - a. Andhra Pradesh – 1250 MW (1100 MW OPEN + 150 MW DCR)
 - b. Rajasthan – 650 MW (550 MW OPEN + 100 MW DCR)
 - c. Uttar Pradesh – 100 MW (OPEN)
 - d. Karnataka – 600 MW (500 MW OPEN + 100 MW DCR)
 - e. Telangana – 400 MW (350 MW OPEN + 50 MW DCR)
- (iii) Out of the sanctioned 3000 MW solar power projects under NSM Phase-II, Batch-II, Tranche-I, 47 projects with an aggregate capacity of 2750 MW was commissioned with NTPC allocating 1375 MW thermal capacity up to 31.03.2019. Remaining 250 MW will be commissioned in the next F.Y. 47 projects



Table – 3.2 State-wise estimated Solar Energy Potential in the Country

Sr. No.	State/UT	Solar Potential (GWp) #
1.	Andhra Pradesh	38.44
2.	Arunachal Pradesh	8.65
3.	Assam	13.76
4.	Bihar	11.20
5.	Chhattisgarh	18.27
6.	Delhi	2.05
7.	Goa	0.88
8.	Gujarat	35.77
9.	Haryana	4.56
10.	Himachal Pradesh	33.84
11.	Jammu & Kashmir	111.05
12.	Jharkhand	18.18
13.	Karnataka	24.70
14.	Kerala	6.11
15.	Madhya Pradesh	61.66
16.	Maharashtra	64.32
17.	Manipur	10.63
18.	Meghalaya	5.86
19.	Mizoram	9.09
20.	Nagaland	7.29
21.	Odisha	25.78
22.	Punjab	2.81
23.	Rajasthan	142.31
24.	Sikkim	4.94
25.	Tamil Nadu	17.67
26.	Telangana	20.41
27.	Tripura	2.08
28.	Uttar Pradesh	22.83
29.	Uttarakhand	16.80
30.	West Bengal	6.26
31.	UTs	0.79
TOTAL		748.98

Assessed by National Institute of Solar Energy



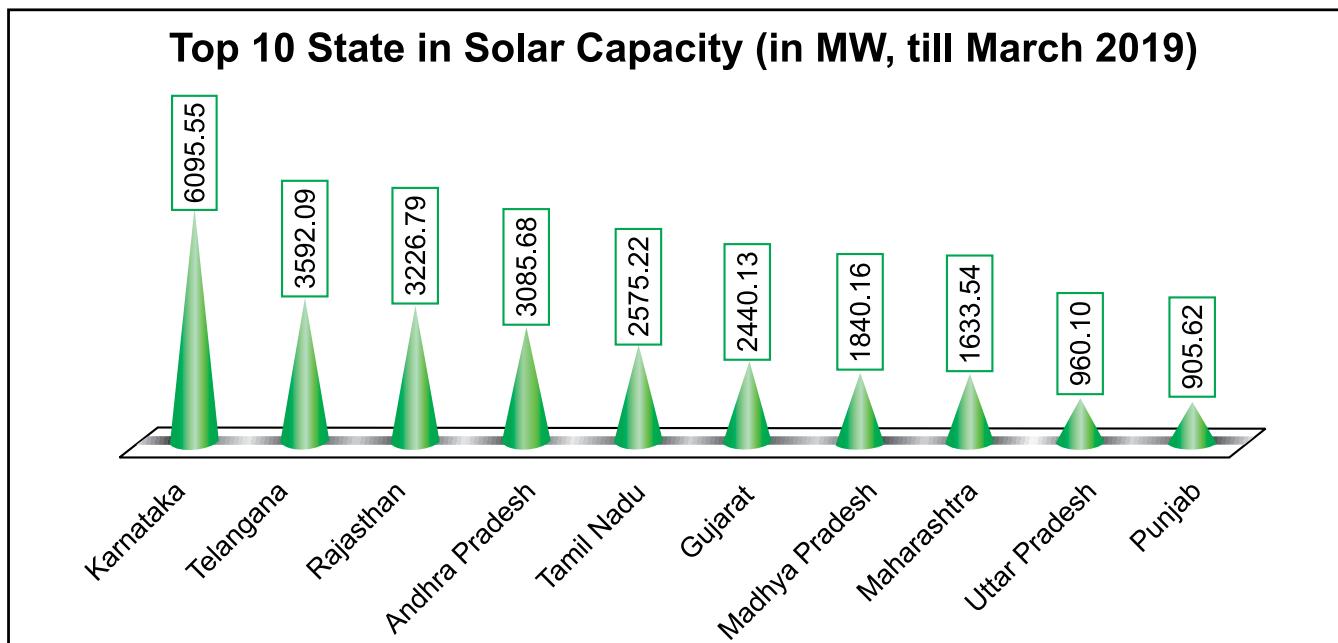
Table – 3.3 Commissioning Status of Grid Connected Solar Projects as on 31.03.2019

Sr. No.	State/UT	Cumulative capacity till 2017-18 (MW)	Capacity added in 2018-19 till 31-03-2019 (MW)	Cumulative Capacity till 31-03-2019 (MW)
1	Andaman & Nicobar	6.56	5.17	11.73
2	Andhra Pradesh	2195.46	890.22	3085.68
3	Arunachal Pradesh	5.39	0.00	5.39
4	Assam	12.45	9.95	22.40
5	Bihar	142.45	0.00	142.45
6	Chandigarh	25.20	9.51	34.71
7	Chhattisgarh	231.35	0.00	231.35
8	Dadra&Nagar Haveli	5.46	0.00	5.46
9	Daman & Diu	10.61	3.86	14.47
10	Delhi	69.57	57.32	126.89
11	Goa	0.91	2.98	3.89
12	Gujarat	1588.00	852.13	2440.13
13	Haryana	216.85	7.67	224.52
14	Himachal Pradesh	0.73	21.95	22.68
15	Jammu & Kashmir	1.36	13.47	14.83
16	Jharkhand	25.67	9.28	34.95
17	Karnataka	4944.12	1151.43	6095.55
18	Kerala	107.94	30.65	138.59
19	Lakshadweep	0.75	0.00	0.75
20	Madhya Pradesh	1305.35	534.81	1840.16
21	Maharashtra	1239.18	394.36	1633.54
22	Manipur	0.06	3.38	3.44
23	Meghalaya	0.02	0.10	0.12
24	Mizoram	0.20	0.30	0.50
25	Nagaland	1.00	0.00	1.00
26	Odisha	79.57	315.16	394.73
27	Pondicherry	0.16	2.98	3.14
28	Punjab	905.62	0.00	905.62
29	Rajasthan	2332.77	894.02	3226.79
30	Sikkim	0.00	0.01	0.01
31	Tamil Nadu	1908.57	666.65	2575.22
32	Telangana	3291.25	300.84	3592.09
33	Tripura	5.09	0.00	5.09
34	Uttar Pradesh	694.41	265.69	960.10
35	Uttarakhand	260.08	46.67	306.75
36	West Bengal	37.32	38.63	75.95
Total		21651.46	6529.20	28180.66



with an aggregate capacity of 2750 MW were commissioned with NTPC allocating 1375 MW thermal capacity up to 30/11/2018. Further allocation of 100 MW thermal capacity has been done with 200 MW of project in Kadapa Ultra Mega Solar Park in Andhra Pradesh on 01.06.2019. The remaining 50 MW capacity is likely to be commissioned by December 2019.

Figure 3.1: Top 10 States in Solar Installation (capacity in MW as on 31-03-2019)



3.6.2 SCHEME FOR DEVELOPMENT OF SOLAR PARKS AND ULTRA MEGA SOLAR POWER PROJECTS

- (i) The Scheme for ‘Development of Solar Parks and Ultra Mega Solar Power Projects’ was rolled out on 12-12-2014 with aggregate capacity 20,000 MW. Further, the capacity of the Solar Park Scheme was enhanced from 20,000 MW to 40,000 MW on 21-03-2017 to set up at least 50 solar parks by 2021-22.
- (ii) Solar Park is a large area of land developed with all necessary infrastructures and clearances for setting up of solar projects. The capacity of the solar parks is generally 500 MW and above. However, smaller parks (up to 20 MW) are also considered in States/UTs where there is shortage of non-agricultural land. Approximately 4 to 5 acres per MW of land is required for setting up of solar parks. The total Central Grants approved under the Scheme is Rs.8100.00 crore.
- (iii) Under the scheme, the Ministry provides Central Financial Assistance (CFA) of up to Rs.25 lakh per solar park for preparation of Detailed Project Report (DPR). Beside this, CFA of up to Rs.20.00 lakh per MW (Rs.12 Lakh/MW for development of internal infrastructure of solar park and Rs.8 Lakh/MW for development of external power evacuation infrastructure of solar park) or 30% of the project cost, including Grid-connectivity cost, whichever is lower, is also provided on achieving the milestones prescribed in the scheme. The approved grant is released by Solar Energy Corporation of India Ltd. (SECI) as per milestones.

3.6.3 PROGRESS OF SOLAR PARK SCHEME

The target of the Solar Park Scheme is to develop at least 50 solar parks with aggregate installed capacity of 40,000 MW of solar power by 2021-22.



50 MW Phelan Energy Pvt Ltd, Bhadla Ph-IV, Jodhpur

- **Capacity approved:** Based on the proposals received from the States, 42 solar parks of aggregate capacity 23,499 MW has been approved to 17 States up to March-2019.
- **Commissioned capacity inside solar parks:** Solar projects of aggregate capacity 5835MW have been commissioned inside various solar parks till March-2019
- **Solar parks fully operational:** The Kurnool solar park (1000 MW) in Andhra Pradesh and Bhadla-II solar park (680 MW) in Rajasthan are fully operational.
- **Solar parks partially developed:** Aggregate capacity of 3045 MW commissioned in nine solar parks namely Ananthapuramu solar park (650 MW out of 1500 MW) in Andhra Pradesh, Ananthapurumu-II solar park (400 MW out of 500 MW) in Andhra Pradesh, Kasargod solar park (50 MW out of 200 MW) in Kerala, Neemuch-Mandsaur solar park (250 MW out of 700 MW) & Rewa Solar Park (490 MW out of 750 MW) in Madhya Pradesh, Pavagada solar park (1400 MW out of 2000 MW) in Karnataka, Bhadla-III solar park (500 MW out of 1000 MW) in Rajasthan, Bhadla-IV solar park (250 MW out of 500 MW) in Rajasthan and UP solar park (165 MW out of 440 MW).



50 MW SB Energy Two Pvt Ltd, Bhadla Ph-IV Solar Park, Jodhpur



3.6.4 SCHEME FOR SETTING UP OVER 300 MW OF GRID-CONNECTED SOLAR PV POWER PROJECTS BY DEFENCE ESTABLISHMENTS UNDER MINISTRY OF DEFENCE AND PARA MILITARY FORCES WITH VIABILITY GAP FUNDING UNDER PHASE-II/III OF NSM.

- (i) The Cabinet has approved the Scheme in its meeting held on 10th December, 2014. The Ministry has issued Administrative Approval on 07th January, 2015.
- (ii) In-principle approval of 270 MW has been given to different Defence Organisations. Out of this, 75 MW has already been commissioned and balance capacities are under implementation stage.

3.6.5 PILOT-CUM-DEMONSTRATION PROJECT FOR DEVELOPMENT OF GRID CONNECTED SOLAR PV POWER PLANTS ON CANAL BANKS AND CANAL TOPS.

- (i) Government of India, under National Solar Mission (NSM), had approved the implementation of 'Pilot-cum-Demonstration Project for Development of Grid Connected Solar PV Power Plants on Canal Banks and Canal Tops'. Administrative Approval was issued on 5th December, 2014, with a target of 100 MW Grid Connected Solar PV Power Plants on canal-bank and canal tops (50 MW on canal tops and 50 MW on canal-bank).
- (ii) As on 31.03.2019, CFA of around Rs.161 crores (including SECI's charges) has already been released to SECI for onward disbursal to Project Implementing Agencies of the respective States.

3.6.6 CURRENT STATUS OF PROJECTS

The Scheme is closed for new sanctions. Under this Scheme, based on the allocation requests received from different States, MNRE has sanctioned full targeted capacity of 50 MW canal-bank and 50 MW canal-top solar PV power projects in the States of Andhra Pradesh, Gujarat, Karnataka, Kerala, Punjab, Uttarakhand, Uttar Pradesh and West Bengal. As on 31.03.2019, 50 MW canal-bank solar PV projects and 44 MW canal-top solar PV projects have been commissioned.

3.6.7 SCHEME FOR SETTING UP OF 1000 MW OF GRID CONNECTED SOLAR PV POWER PROJECTS BY CPSUS AND GOVT. ORGANIZATIONS UNDER VARIOUS CENTRAL/STATE SCHEMES/SELF USE/3RD PARTY SALE/MERCHANT SALE WITH VIABILITY GAP FUNDING (VGF) UNDER PHASE-II OF JNNSM.

- (i) The Ministry launched the above scheme in January 2015 to set up 1000 MW of Grid Connected Solar PV Power Project by CPSUs and Govt. Organizations with VGF.
- (ii) The Scheme is closed for new sanctions. Under this Scheme, MNRE has sanctioned around 882 MW grid-connected solar PV power plant capacity to 9 CPSUs/Govt. Organizations, out of which around 877 MW capacity solar PV projects have been commissioned as on 31.03.2019.
- (iii) As on 31.03.2019, VGF of around Rs.792 crore (including SECI's charges) has already been released to SECI for onward disbursal to CPSUs/Govt. Organizations who have set up solar PV power projects under the Scheme.

3.6.8 VIABILITY GAP FUNDING (VGF) SCHEME

Under VGF Schemes, 750 MW, 2000 MW and 5000 MW of Grid connected Solar Power Projects have been taken up. Solar Energy Corporation of India (SECI) has been designated as implementing agency for these schemes. Details of each of three scheme are given below:



3.6.9 750 MW VGF SCHEME UNDER NSM PHASE-II, BATCH-I

- (i) Solar Energy Corporation of India (SECI) is implementing the first VGF scheme of 750 MW, under NSM Phase-II, Batch-I for setting up large scale ground-mounted solar PV projects on pan-India basis. After a transparent selection and award process, project capacity of 680 MW was commissioned. These projects are under commercial operation.
- Rs. 500 crore for Payment Security Mechanism (PSM) to SECI for 750 MW, 2000 MW and 5000 MW VGF Scheme initially.
 - Total 680 MW capacity of SPV plants have been commissioned in 7 States (Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Karnataka, Tamil Nadu & Odisha).
 - Total VGF Disbursement by SECI to SPDs, for the period from 01.01.2018 to 31.03.2019 is Rs.184.801 crore.
 - No further capacity likely to be added under the scheme.

(ii) State-wise details of commissioned projects are given in **Table 3.4.**

Table 3.4: State-wise details of commissioned projects under 750 MW VGF Scheme under NSM Phase-II, Batch-I	
State	Capacity
Rajasthan	355 MW
Gujarat	40 MW
Maharashtra	25 MW
Madhya Pradesh	220 MW
Karnataka	10 MW
Tamil Nadu	10 MW
Odisha	20 MW
Total	680 MW

3.6.10 2000 MW VGF SCHEME OF NSM PHASE II, BATCH III

Scheme for Setting up of over 2000 MW Grid connected solar PV Projects with VGF under NSM Phase-II, Batch-III.

- Guidelines issued on dated 04th August 2015. Power purchased by SECI @ Rs.4.43/kWh (PPA) and sold to buying utilities @ Rs.4.50/kWh (PSA).
- Bidding has been carried out amounting to Rs.1515 crore out of the total approved scheme allocation of Rs.2100 crore.
- 2 categories: DCR (250 MW) & Open (1750 MW). Project Size is from 10 MW to 50 MW (in multiples of 10 MW).
- State-specific tenders based on the demand from State. Projects could be set up either in the Solar Parks and or outside the solar park.
- VGF up-to Rs.1.31 crore per MW (DCR) and Rs.1 crore per MW (Open) is being provided. Average bidder for VGF under the open category is Rs.63.27 lakh/MW and DCR category is Rs.1.11 crore/MW.



- RfS have been issued for 3015 MW capacity in 5 States/UTs (Andhra Pradesh, Chhattisgarh & Karnataka, Maharashtra and Uttar Pradesh,), LoI placed: 2295 MW, PPA signed: 2295 MW & PSA signed: 2195 MW. (As on 31.03.2019).
- Total 2155 MW Capacity reported as commissioned in the states of Andhra Pradesh, Chhattisgarh, Karnataka, Maharashtra, and Uttar Pradesh at both solar park and non-solar park locations.
- Total VGF Disbursement by SECI to SPDs, as on 31.03.2019 is Rs. 121.62 crore (Cumulative, as on 31.03.2019)

3.6.11 5000 MW VGF SCHEME BATCH IV PHASE II

- (i) Scheme for Setting up of over 5000 MW Grid Connected Solar PV Projects with VGF under NSM Phase-II, batch-IV
- The Scheme was launched in 2015-16, to be implemented in 4 years (at least 1250 MW in each year). Project Size is Minimum 10 MW up-to 50 MW (in multiples of 10 MW).
 - Initial provision was that power will be purchased by SECI @ Rs.4.43/kWh and sold @ Rs.4.50/kWh. Now onwards the bidding under the scheme will be carried out at discounted tariff below from bench mark tariff Rs.4.43/kWh with zero VGF option.
 - Project Size is Minimum 10 MW upto 50 MW (in multiples of 10 MW).
 - VGF support of Rs.1.25 crore per MW (DCR) & Rs.1.00 crore per MW (Open)
 - Projects could be set up either in the Solar Parks or out-side locations. The tenders will be state-specific based on the demand from particular state. Inter-state solar power transmission is permissible under the scheme.
 - For the period from 01.01.2018 to 31.03.2019,RfS has been issued for 1225 MW capacity in 3 States (Andhra Pradesh, Karnataka and Uttar Pradesh), LoI placed: 950 MW, PPA signed: 950 MW, PSA signed: 950 MW.
 - Tariff of Rs.2.70/kWh arrived in Solar discounted tariff bidding.
 - Total 1470 MW Capacity has been commissioned in the State of Maharashtra, Odisha and Rajasthan in solar park and non-solar park locations (from 01.01.2018 to 31.03.2019).
 - Total VGF Disbursement by SECI to SPDs, as on 31.03.2019 is Rs.191.63 crore. (Cumulative, as on 31.03.2019)
- (ii) State-wise tendering/projects status for projects up to 31.03.2019, is given in **Table 3.5.**

Table 3.5: State-wise status of tendering under 5000 MW VGF Scheme

S. No.	State	NIT issued	LoI issued	PPA signed	PSA signed
1	Andhra Pradesh	750 MW	750 MW	750 MW	750 MW
2	Karnataka	200 MW	200 MW	200 MW	200 MW
3	Uttar Pradesh	275 MW	-	-	-
		1225 MW	950 MW	950 MW	950 MW



3.6.12 STATUS UNDER STANDARD BIDDING GUIDELINES (SBG)

- a) The Bidding under SBG was launched on 3rd Aug, 2017 for further expediting the development of Solar PV power plants. Under this scheme projects of capacity 5 MW and above are considered.
- b) The Scheme has provision for intermediary procurer and end procurer of solar power. Also there is provision for procurement in terms of Power and Energy terms.
- c) Bids are invited with solar tariff as component which can be either fixed for 25 years or tariff with annual escalation fixed for the PPA period of 25 years. No VGF has been sought by the bidders.
- d) The requirement to show equity infusion for achievement of financial closure is done away with, in this scheme.
- e) Projects could be set up either in the Solar Parks or out-side locations. The tenders will be state-specific based on the demand from particular state. Inter-state solar power transmission is permissible under the scheme.
- ff) For the period from 01.01.2018 to 31.03.2019, RfS has been issued for 29720 MW; in states of Assam, Maharashtra, Rajasthan, ISTS connected projects, 10 GW ISTS Connected Cum Manufacturing and 7.5 GW in Leh & Kargil Dist., J&K.
- g) For the period from 01.01.2018 to 31.03.2019, LoAs have been issued for 4550 MW and PPAs have been signed for 2600 MW.
- h) The tenders under this scheme have also fetched lowest tariff of Rs.2.44/Unit, in solar PV tariff bidding process.
- i) State-wise status of tendering under SBG for projects up to 31.03.2019, is given in **Table 3.6.**

Table 3.6: State-wise status of tendering under Standard Bidding Guidelines Scheme

S. No.	State	NIT issued	LoA issued	PPA signed	PSA signed
1	Assam	70 MW	-	-	-
2	2000 MW ISTS-I	2000 MW	2000 MW	2000 MW	2000 MW
3	3000 MW ISTS-II	3000 MW	600 MW	600 MW	685 MW
4	10GW ISTS Connected Solar PV Projects linked with Manufacturing (Ph-I)	10000	-	-	-
5	750 MW (Rajasthan) Tranche-I	750 MW	750 MW	-	-
6	250 MW Dondaicha Solar Park (MH)	250 MW	-	-	-
7	7.5 GW J&K	7500 MW	-	-	-
8.	1200 MW ISTS-III	1200 MW	1200 MW	-	-
9.	3GW ISTS Connected Solar PV Projects linked with 1.5GW Manufacturing (Ph-II)	3000 MW	-	-	-
10.	1200 MW ISTS-IV	1200 MW	-	-	-
11.	750 MW (Rajasthan) Tranche-II	750 MW	-	-	-
Total		29720 MW	4550 MW	2600 MW	2685 MW



3.6.13 GENERATION BASED INCENTIVES PROGRAMME FOR SMALL SOLAR POWER GENERATION

Rooftop PV and Small Solar Power Generation Programme (RPSSGP)

- a) After successful demonstration of MW projects in Demo Scheme, Ministry launched a Generation Based Incentives (GBI) programme on 16th June 2010 to give a thrust to rooftop PV and other small solar power plants connected to grid under Phase I JNNSM. Implementing Agency is IREDA.
- b) 100 MW Solar capacity was allocated and 91.8 MW from 72 projects in 12 States were commissioned. GBI is applicable for 25 years from the commissioning date and payable to the distribution utility.
- c) Ministry provides fixed GBI from Rs.8.69 to 12.24 /Kwh to the State utilities at a rate equal to the difference of the CERC tariff for 2010-11 (Rs.17.91 per kWh) and a base rate of Rs.5.50 per kWh.
- d) Annual budget requirement by Ministry under RPSSGP scheme is approx. Rs.180.00 crore for 91.8 MW (inclusive of IREDA's Service Charges).
- e) IREDA has disbursed GBI of Rs. 238,40,08,910/- from 01.01.2018 to 31.03.2019 to SPDs, under the scheme based on the claims received from respective State utilities.

3.6.14 DEMO SOLAR GBI

MNRE had announced the Demonstration Programme on Grid Interactive Solar PV Power Generation (Demo Solar GBI) in the FY 2008-09 before the starting of JNNSM. Salient features are as under:

- a) Initially the scheme was formulated for 25 MW for Demonstration of MW capacity solar PV plants. Projects of capacity from 1 MW to 5 MW were commissioned.
- b) MNRE provides Generation Based Incentive (GBI) to these projects. The GBI is being released directly to the project developer through IREDA.
- c) Seven projects were commissioned from FY 2009-10 to 2011-12.
- d) Against the target capacity of 25 MW, a total of 19 MW from seven project developers could be commissioned by in 6 states (**Andhra Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, and West Bengal**) with a capacity ranging from 1 MW to 5 MW each.
- e) Ministry releases GBI to Developers through IREDA maximum upto Rs.12/kWh for maximum period of 10 years.
- f) IREDA has disbursed GBI of Rs. 10,96,12,837/- from 01.01.2018 to 31.03.2019 to SPDs, under the scheme

3.6.15 GRID-INTERACTIVE ROOFTOP AND SMALL POWER PLANTS PROGRAMME

- (i) The Ministry is implementing "Grid Connected Rooftop and Small Solar Power Plants Programme" which is providing subsidy upto 30% of benchmark cost for the general category states and upto 70 % of benchmark cost for special category states, i.e. North Eastern States including Sikkim, Uttarakhand, Himachal Pradesh, Jammu & Kashmir and Lakshadweep, Andaman & Nicobar Islands for installation of grid connected rooftop solar power plants in building of residential, institutional and social sector. For Government sector achievement linked incentives upto 25% of the benchmark cost in general category States/UTs and 60 % of the benchmark cost for special category States/UTs is being provided. About



4200 MW is being targeted under this scheme (2100 MW with subsidy and 2100 MW without subsidy) by year 2019-20.

- (ii) So far, about 2098 MW solar rooftop systems have been sanctioned/ approved under the scheme. Aggregate 1436.26 MW have been reported as installed in the country as shown in **Table 3.7**. Solar rooftop projects are being implemented by State Nodal Agencies (SNA), Solar Energy Corporation of India (SECI), Public Sector Undertakings (PSU) and other Multi Government Agencies (MGAs), Private Developers etc.
- (iii) Model Power Purchase Agreement (PPA), Memorandum of Understanding and Capex Agreement for government sector projects have been developed which were duly vetted by Department of Expenditure, Ministry of Finance and Department of Legal Affairs, Ministry of Law & Justice. In addition, the following reference documents have been developed:-
 - Compendium of policies and regulations of GOI, State/UTs
 - Best Practice Guide on Solar Rooftop
 - Working paper on international solar alliance: nurturing possibilities
- (iv) Commitment Certificate of about 3890 MWp has been received from different Ministries/Departments.
- (v) Solar Rooftop Calculator has also been developed for financial calculations of grid connected solar rooftop projects on PAN India basis. SPIN (Solar Photovoltaic Installations) is an e-governance initiative of the Ministry. It is an online system designed to monitor almost all activities involved in Solar Rooftop programme.
- (vi) Rs.1577.99 crore has been released as Central Financial Assistance to different implementing agencies for installation of grid connected rooftop projects of which Rs.446.77 crore has been released in FY 2018-19.
- (vii) Phase II of the Grid connected rooftop solar programme was approved for with a target for achieving cumulative capacity of 40,000 MW from Rooftop Solar (RTS) Projects by the year 2022. The programme will be implemented with total central financial support of Rs.11,814 crore. In the Phase-II Programme Central Financial Assistance (CFA) for the residential sector has been restructured with availability of 40% CFA for RTS systems up to 3 kW capacity and 20% for RTS system capacity beyond 3 kW and up to 10 kW. For Group Housing Societies/Residential Welfare Associations (GHS/RWA), CFA will be limited to 20% for RTS plants for supply of power to common facilities, however, the capacity eligible for CFA for GHS/RWA will be limited to 10 kW per house with maximum total capacity upto 500 kWp, inclusive of RTS put in individual houses in the GHS/RWA. Central financial support will not be available for other category i.e., institutional, educational, social, government, commercial, industrial, etc. Under Phase-II Programme, focus will be on increased involvement of DISCOMs. Performance based incentives will be provided to DISCOMs based on RTS capacity achieved in a financial year (i.e. 1st April to 31st March every year till the duration of the scheme) over and above the base capacity i.e. cumulative capacity achieved at the end of previous financial year.

3.6.16 INITIATIVES BY STATES/UTS

- (i) Electricity Regulatory Commissions of all States/UTs have notified net metering regulations /tariff orders.
- (ii) So far, 23 States namely Andhra Pradesh, Assam, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir ,Jharkhand, Karnataka, Kerala, Madhya Pradesh, Manipur, Odisha, Punjab, Puducherry, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand and West Bengal have come out with Solar Policy supporting grid connected rooftop systems.



Table 3.7: State-wise Solar Rooftop Systems Capacity Commissioned as on 31.03.2019

S.No.	State /UTs	Subsidized (MW)	Non Subsidized (MW)	Total (MW)
1	ANDAMAN and NICOBAR ISLANDS	1.00	0.00	1.00
2	ANDHRA PRADESH	41.56	16.98	58.53
3	ARUNACHAL PRADESH	0.00	4.12	4.12
4	ASSAM	10.05	1.68	11.73
5	BIHAR	1.67	1.36	3.02
6	CHANDIGARH	20.66	5.22	25.87
7	CHHATTISGARH	8.69	1.55	10.24
8	DADRA and NAGAR HAVELI	0.00	0.48	0.48
9	DAMAN and DIU	0.00	0.39	0.39
10	GOA	2.44	0.51	2.94
11	GUJARAT	130.73	71.74	202.47
12	HARYANA	37.52	56.19	93.72
13	HIMACHAL PRADESH	3.46	2.22	5.68
14	JAMMU and KASHMIR	5.75	0.59	6.34
15	JHARKHAND	8.98	1.62	10.60
16	KARNATAKA	12.78	107.97	120.75
17	KERALA	20.18	17.97	38.15
18	LAKSHADWEEP	0.00	0.00	0.00
19	MADHYA PRADESH	20.21	13.42	33.62
20	MAHARASHTRA	67.87	118.36	186.24
21	MANIPUR	2.11	1.33	3.44
22	MEGHALAYA	0.04	0.08	0.12
23	MIZORAM	0.30	0.10	0.40
24	NAGALAND	0.00	0.00	0.00
25	NCT OF DELHI	61.30	12.42	73.72
26	ORISSA	9.47	1.69	11.16
27	PUDUCHERRY	0.77	1.00	1.77
28	PUNJAB	22.88	38.72	61.60
29	RAJASTHAN	36.74	58.46	95.20
30	SIKKIM	0.00	0.01	0.01
31	TAMIL NADU	48.51	94.45	142.95
32	TELANGANA	30.31	23.52	53.83
33	TRIPURA	0.00	0.00	0.00
34	UTTAR PRADESH	40.81	42.43	83.23
35	UTTARAKHAND	21.78	45.19	66.96
36	WEST BENGAL	12.67	13.27	25.94
Total		681.22	755.04	1436.26



700 kWp Grid Connected Rooftop power plant project at Ahmedabad Airport, Gujarat

- (iii) Govt. of Haryana, Chhattisgarh, Uttar Pradesh and Chandigarh has issued mandatory notification for installation of solar rooftop plants for certain categories of buildings.
- (iv) Chief Electrical Inspector to Government (CEIG) inspection has been made optional by States of Andhra Pradesh, Tamil Nadu, Karnataka, Gujarat, Madhya Pradesh, Odisha, Haryana, Delhi, Maharashtra and Rajasthan for solar rooftop plants upto certain capacity.

3.6.17 INITIATIVES FOR LOANS AND INTERNATIONAL FUNDING

- (i) Reserve Bank of India has included renewable energy projects under priority sector lending for which bank loans up to a limit of Rs.15 crore to borrowers will be available for renewable energy projects including grid connected solar rooftop systems. For individual households, the loan limit is Rs.10 lakh per borrower.
- (ii) Department of Financial Services has advised all Public Sector Banks to provide loans for grid connected rooftop solar systems as home loan/ home improvement loan.
- (iii) Concessional loans of around 1125 million US dollars from World Bank (WB) and Asian Development Bank (ADB) have been made available to State Bank of India (SBI) and Punjab National Bank (PNB) respectively for solar rooftop projects.
- (iv) Multilateral grant of USD 5 million by ADB, USD 1.8 million from USAID and USD 28.8 million from World Bank has been approved for solar rooftop programme.
- (v) Indian Renewable Energy Development Agency has formulated a scheme of low cost financing with interest rate of 9.9% to 10.75 % per annum.
- (vi) The Central Electricity Authority (CEA) has also notified the ‘Installation and Operation of Meters’ guidelines vide its amendment regulation in 3rd December 2014.



3.6.18 NEW SCHEMES

The Cabinet accorded its approval for the following new schemes:-

- a) Scheme for setting up of 14 MW Solar PV Project with aggregate battery storage capacity of 42 MW (capacity of 7 MW solar projects with battery storage of 21 MWh each in Leh and Kargil at different locations under Prime Minister Development Package (PMDP) – 2015 for J&K.
- b) Central Public Sector Undertakings (CPSU) Scheme Phase II (Central Producer Scheme) for setting up 12,000 MW Grid Connected Solar Photovoltaic (PV) Power Projects by the Government Producers with VGF support for self-use or use by the Government/Government entities, either directly or through Distribution Companies.
- c) Grid Connected Rooftop Solar Programme Phase II with two Components; Component A for setting up of 4,000 MW of Grid Connected Rooftop Plants in residential sector with Central Financial Assistance; and Component B for Incentives to DISCOMS based on achievement for installing additional grid connected roof top capacity in all sectors over and above the base level, with the incentives being limited to the first additional 18,000 MW of rooftop capacity added in the country. Achievements above this level will not be eligible for any incentive.
- d) Scheme for farmers for installation of solar pumps and grid connected solar and other renewable power plants in the country aiming to add solar and other renewable capacity of 25,750 MW by 2022. The scheme has three components, namely, **Component A:** 10,000 MW Decentralized Ground Mounted Grid Connected Renewable Power Plants of individual plant size up to 2 MW; **Component B:** Installation of 17.50 lakh standalone Solar Powered Agriculture Pumps of individual pump capacity up to 7.5 HP; and **Component C:** Solarisation of 10 lakh Grid-connected Agriculture Pumps of individual pump capacity up to 7.5 HP

3.7 OFF GRID SOLAR PHOTOVOLTAICS

- 3.7.1 Under Phase-III of the Off-Grid and Decentralized Solar PV Programme for 2018-19, Ministry is providing Central Financial Assistance (CFA) to implementing agencies for deployment of Solar Street lights, Solar pumps, Solar Power Packs and other solar applications to meet out the electricity and lighting needs of the local communities/institutions/individuals in the rural areas. State Nodal Agencies (SNA) are the primary implementing agency through which CFA of 30% of benchmark cost or tender cost, whichever is lower, is being provided in General Category States and CFA of 90% of benchmark cost or tender cost, whichever is lower, in NER, Hill States and Island UTs.



5 HP Solar Pump installed in the State of Andhra Pradesh



3.7.2 More than 96,376 pumps were sanctioned during 2017-18. Overall, about 2.37 lakh solar pumps have been installed under the programme till 31.03.2019, out of which 65,892 nos. of solar pumps were installed during 2018-19. A total of 212 MW capacity solar PV off-grid power packs / power plants have been installed till 31.03.2019.

3.7.3 Some major Off Grid Solar PV projects under implementation during 2018-19 are as follows:

- 70,00,000 study lamps for school going children are being distributed, over a period of two years from Jan 2017 to March 2019, in the states of Assam, Bihar, Jharkhand, Odisha and Uttar Pradesh, where household electrification was less than 50%.
- Out of 96,376 pumps sanctioned during 2017-18, state-wise details of the pumps installed are shown in **Table 3.8**.

Table 3.8 State-Wise Details of Solar PV Pumps		
S.No.	State	Pumps Installed (Nos.)
1	Andhra Pradesh	15000
2	Bihar	225
3	Chhattisgarh	15000
4	Gujarat	3537
5	Jharkhand	392
6	Madhya Pradesh	14000
7	Maharashtra	1000
8	Orissa	530
9	Punjab	2000
10	Rajasthan	7134
11	Tamilnadu	525
12	Uttar Pradesh	9588
Total		68931

The above figures include the pumps installed during 2017-18 and 2018-19.

3.7.4 During the year, the solar systems having total capacity of 244.2 MW which includes solar study lamps, solar home lights, solar street lights, solar pumps, Mini/micro grids and power plants, were installed in various states. Some of the highlights of the completed projects during the current financial year are given below:

- 15000 nos. of solar pumps have been installed in the State of Chhattisgarh.
- 15000 nos. of solar pumps have been installed in the State of Andhra Pradesh.
- Project for installation of 15,000 nos. of solar street lights completed in the State of Himachal Pradesh.
- 15 Mini grids have been installed in various districts of Uttar Pradesh.
- Project for installation of 2657 nos. of SPV Power Plants of aggregate capacity of 5439 kW completed in the state of Kerala.
- Under Atal Jyoti Yojana, 38,608 nos. of Solar Street Lights have been installed during FY 2018-19 till 31.03.2019.
- Under 7 million solar study lamps scheme, over 33.34 lakh solar study lamps have been distributed during FY 2018-19 till 31.03.2019.



3.7.5 Cumulative numbers/capacity of the off-grid solar applications installed in various States as on 31.03.2019 is as given in **Table 3.9**.

Table 3.9: State-wise Cumulative Capacity installed under Off-grid SPV Programme

S.No.	Agencies	Solar Home Light (Nos)	Solar lamp (Nos)	Solar Street Light (Nos)	Solar Pump (Nos)	Solar Power Plant (kWp)
1	Andhra Pradesh	22972	77803	8992	34045	3815.595
2	Arunachal Pradesh	35065	18551	5008	22	963.2
3	Assam	46879	498271	9547	45	1605
4	Bihar	12303	1258294	29858	2107	6770
5	Chhattisgarh	42232	3311	2042	61970	31249.9
6	Delhi	0	4807	301	90	1269
7	Goa	393	1093	707	15	32.72
8	Gujarat	9253	31603	2004	11522	13576.6
9	Haryana	56727	93853	34625	1293	2321.25
10	Himachal Pradesh	22592	33909	78000	6	1905.5
11	Jammu & Kashmir	144316	51224	14156	39	8129.85
12	Jharkhand	9450	747295	10301	3857	3769.9
13	Karnataka	52638	7781	2694	6343	7754.01
14	Kerala	41912	54367	1735	818	15825.39
15	Madhya Pradesh	7920	529101	10833	17813	3654
16	Maharashtra	3497	239297	10420	4315	3857.7
17	Manipur	24583	9058	11205	40	1580.5
18	Meghalaya	14874	40750	5800	19	2004
19	Mizoram	12060	10512	5325	37	2955.6
20	Nagaland	1045	6766	6235	3	1506
21	Odisha	5274	99843	14567	9327	567.515
22	Punjab	8626	17495	42758	3857	2066
23	Rajasthan	187968	225851	6852	48175	30349
24	Sikkim	15059	23300	504	0	850
25	Tamil Nadu	290376	16818	39419	4984	12752.6
26	Telangana	0	0	1103	424	7450
27	Tripura	32723	64282	1199	151	867
28	Uttar Pradesh	235909	1336733	258863	20465	10638.31
29	Uttarakhand	91595	163386	22119	26	3145.03
30	West Bengal	145332	17662	8726	653	1730
31	Andaman & Nicobar	468	6296	390	5	167
32	Chandigarh	275	1675	898	12	730
33	Lakshadweep	600	5289	2465	0	2190
34	Puducherry	25	1637	417	21	121
35	Others	24047	125797	9150	609	23885
36	NABARD (2015 onwards)	116226	0	0	4012	0
Total		1715214	5823710	659218	237120	212054.17



3.7.6 Capacity installed in various States during 2018-19 (as on 31.03.2019) is as given in **Table 3.10**.

Table 3.10 Capacity installed under Off-grid SPV Programme during 2018-19

S.No.	Agencies	Solar Home Light (Nos)	Solar lamp (Nos)	Solar Street Light (Nos)	Solar Pump (Nos)	Solar Power Plant (kWp)
1	Andhra Pradesh	0	26443	0	9501	0
2	Arunachal Pradesh	16120	4118	3337	0	313.1
3	Assam	0	445994	1626	0	0
4	Bihar	0	759915	12603	225	2601.4
5	Chhattisgarh	34478	0	0	22095	1019
6	Haryana	0	0	12607	0	0
7	Jammu & Kashmir	0	0	0	0	410
8	Jharkhand	0	371975	2178	155	130
9	Karnataka	0	0	0	1507	0
10	Madhya Pradesh	3904	0	1455	12229	0
11	Maharashtra	0	0	0	1000	0
12	Meghalaya	7030	15875	900	0	919.5
13	Mizoram	0	923	269	0	717.6
14	Odisha	0	0	2083	530	0
15	Punjab	0	0	0	2000	0
16	Rajasthan	0	0	0	7134	19499
17	Tamil Nadu	5861	0	184	525	0
18	Telangana	0	0	98	0	335
19	Uttar Pradesh	0	1055096	16629	8382	0
20	Uttarakhand	0	69459	0	0	209.5
21	Others	0	0	0	609	0
Total		67393	2749798	53969	65892	26154.1

Figure 3.2 Solar street lights installed during last five years including FY2018-19

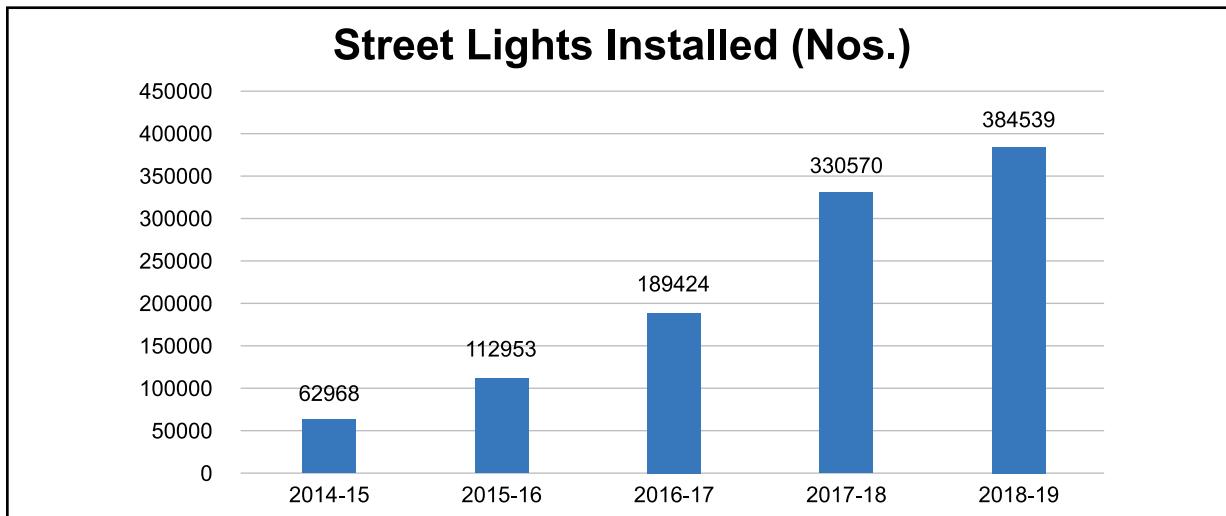


Figure 3.3 Solar pumps installed during last five years including FY 2018-19

Solar Pumps Installed (Nos.)

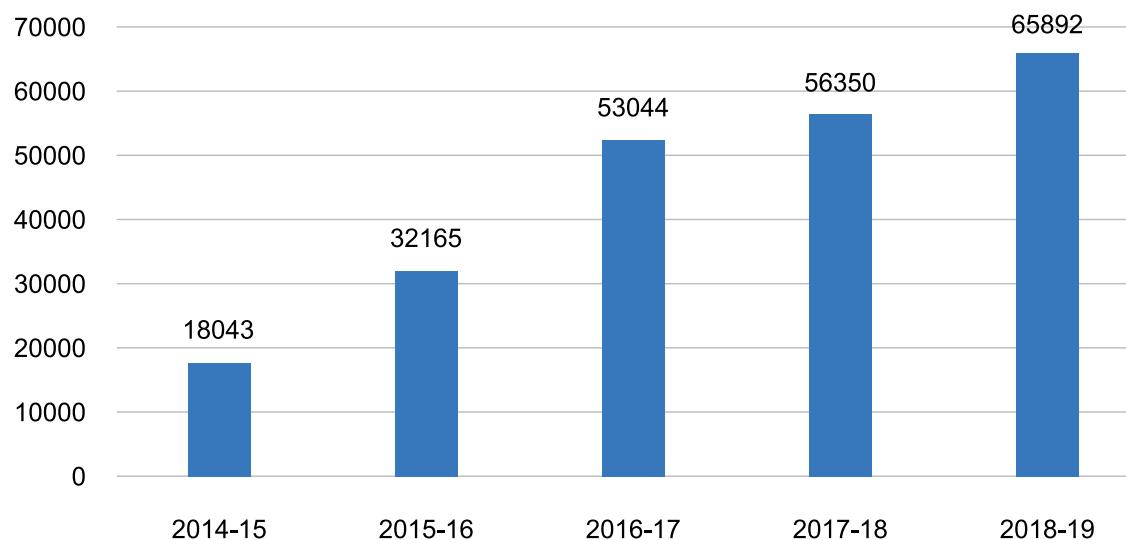
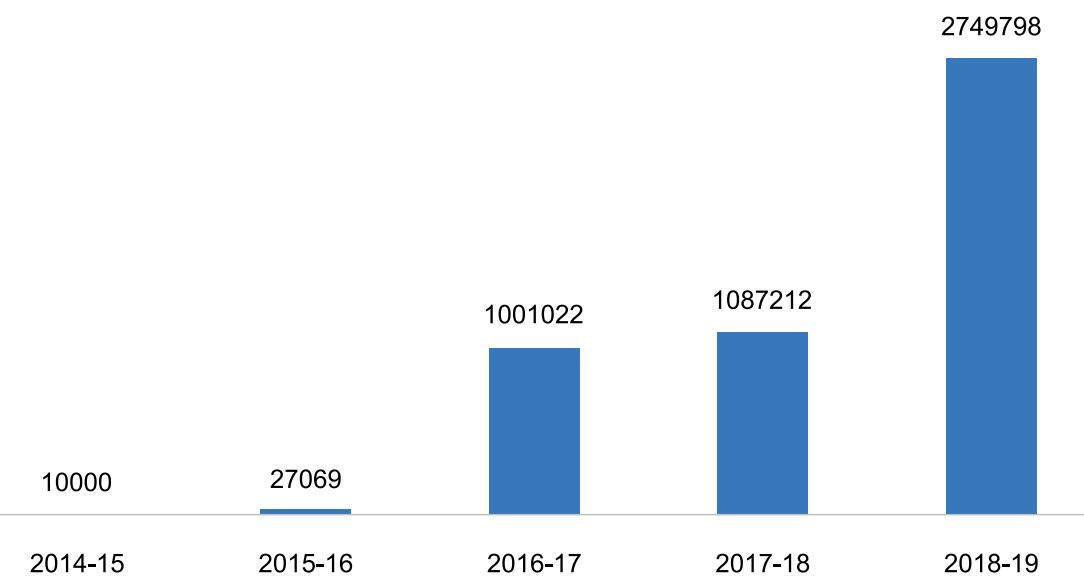


Figure 3.4 Solar lamps/lanterns distributed during last five years including FY 2018-19

Solar Lamps/Lanterns Distributed (Nos.)



**Table- 3.11 Cumulative systems installed up to 31.03.2019**

SPV Systems System	Cumulative up to 31.03.2019
Lanterns and Study lamps (No)	58,23,710
Home Lights(No)	17,15,214
Street Lights(No)	6,59,218
Solar Pumps(No)	2,37,120
SPV Plants(MWp)	212.05

3.8 MNRE'S SCHEME OF 70 LAKH SOLAR STUDY LAMPS

- 3.8.1 Ministry of New and Renewable Energy (MNRE), Government of India had sanctioned a scheme to provide 70 Lakh students in the states of Assam, Bihar, Jharkhand, Odisha & Uttar Pradesh which have more than 50% un-electrified households (Census 2011) with high quality, affordable clean light through solar study lamp.
- 3.8.2 Under the Scheme being implemented by IIT Bombay, rural women trained by IIT Bombay, assembled Solar Study Lamps at Assembly and Distribution Centres in identified Blocks and distributed them to students with the assistance of school administration at a cost of Rs. 100/- per lamp and balance cost of lamp through financial support from MNRE. IIT Bombay had also been entrusted to develop rural entrepreneur under the scheme. By 31.03.2019, about 44.04 lakh lamps have been distributed. Further, 528 trainings have been conducted for local people and 7276 have been trained under the programme.

*Assembly and distribution of solar study lamps under 70 lakh lamp scheme of MNRE*

3.9 NEW SCHEMES

A. Off-grid and Decentralised Solar PV Applications Scheme: Phase-III

3.9.1 The Off-grid and Decentralized Solar PV Applications Programme as part of the National Solar Mission is primarily focused on providing energy access solutions in the rural and remote areas. During Phase-I and Phase-II of the programme main thrust was given on important applications especially relevant to rural development such as solar lighting, solar water pumps for irrigation and drinking water facilities, solar study lamps for students and mini/micro-grids. Based on the experience gained during the Phase I and Phase II, the programme of Off-grid and Decentralised Solar PV Applications has been expanded in Phase III, with improved technology and cost reduction through innovative procurement mechanisms.

Under Phase-III of the Programme, it is targeted to create 118 MWp equivalent solar power capacity by 31.03.2020 through off grid solar PV applications. The Phase-III of the Programme, for which approval was issued on 7 August 2018 covers installation of (i) 3,00,000 solar street lights; (ii) off-grid solar power plants of individual size up to 25 kWp and total aggregated capacity of 100 MWp for providing electricity to schools, hostels, panchayats, police stations and other public service institutions; and (iii) distribution of 25,00,000 solar study lamps to school going children in North Eastern States and LWE affected districts.

3.9.2 Under Phase-III of the Programme, 30% CFA will be provided for installation of solar street lights and off-grid solar power plants in general and 90% CFA will be provided in North Eastern States including Sikkim, Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Lakshadweep and A&N Islands. For solar study lamps for school going children 85% subsidy will be provided..

B. Atal Jyoti Yojana (AJAY): Phase-II

3.9.3 Ministry in September 2016 launched ‘Atal Jyoti Yojana’ for installation of SSL Systems in the States with less than 50% households covered with Grid Power as per 2011 census these include Assam, Bihar, Jharkhand, Odisha and Uttar Pradesh. The scheme provided for installation of 2000 numbers of SSLs in each of the parliamentary constituency of these five States. By the scheme closing date i.e. 31.3.2018 sanction from MPLADS funds were received for 96 parliamentary constituencies for installation of 1.45 lakh solar street lights in these 96 constituencies. Till date, over 1.31 lakh street lights have been installed under the Scheme.

3.9.4 Considering the success of the AJAY scheme, coverage of the scheme in Phase-II has been expanded for implementation of the scheme in North Eastern States including Sikkim and hilly States of Jammu & Kashmir, Himachal Pradesh and Uttarakhand and islands of Andaman & Nicobar and also in the aspirational districts of other States. A total of 3,04,500 Solar Street Lights (SSLs) will be installed.

3.9.5 Under Phase-II of the Scheme, 2000 numbers of SSLs will be provided in each of the Parliamentary Constituencies of NE States, Hilly States and Islands as mentioned above. In the five States covered under earlier AJAY scheme (Phase-I), 1000 numbers of SSLs will be provided in each of the Parliamentary Constituencies, which will be irrespective of number of SSLs already installed in Phase-I of AJAY scheme. Further, out of total 115 aspirational districts, 67 districts are lying in the states mentioned above and hence will get automatically covered. Parliamentary constituencies lying in uncovered balance 48 aspirational districts, will also be provided with up to 2000 numbers of SSLs based on the extent the Parliamentary Constituency lies in the aspirational district.

3.9.6 Under Phase-II of AJAY Scheme, SSLs with improved LED capacity of 12 W will be provided as per MNRE specification and 75% of the cost of SSL System will be provided through MNRE budget and the remaining 25% to be provided from MPLADS fund.



C. Scheme for farmers for installation of solar pumps and grid connected solar power plants

- 3.9.7 Scheme for farmers for installation of solar pumps and grid connected solar power plants was launched by the Government on 08th March 2019. The scheme aims to add solar and other renewable capacity of 25,750 MW by 2022 with total central financial support of Rs. 34,422 Crore including service charges to the implementing agencies. The Scheme consists of three components:
- Component A: 10,000 MW of Decentralized Ground Mounted Grid Connected Renewable Power Plants of individual plant size up to 2 MW.
 - Component B: Installation of 17.50 lakh standalone Solar Powered Agriculture Pumps of individual pump capacity up to 7.5 HP.
 - Component C: Solarisation of 10 Lakh Grid-connected Agriculture Pumps of individual pump capacity up to 7.5 HP.
- 3.9.8 Components A and C of the Scheme will be implemented in Pilot mode till 31st December 2019. The Component B, which is an ongoing sub-programme, will be implemented in entirety without going through pilot mode. The capacities to be implemented under pilot mode for the Components A and C are as follows:
- Component A: Commissioning of 1000 MW capacity of ground/ stilt mounted solar or other renewable energy source based power projects
 - Component C: Solarization of 1,00,000 grid connected agriculture pumps
- On successful implementation of pilot run of Components A and C of the Scheme, these components would be scaled-up, after getting necessary approval.
- 3.9.9 Under the Component A of the Scheme, DISCOM would be eligible to get PBI @ Rs. 0.40 per unit purchased or Rs. 6.6 lakh per MW of capacity installed, whichever is less, for a period of five years from the COD. The renewable power generated will be purchased by DISCOMs from individual farmers/ group of farmers/ cooperatives/ panchayats/ Farmer Producer Organisations(FPO) at a feed-in-tariff (FiT) determined by respective State Electricity Regulatory Commission (SERC).
- 3.9.10 Under Component B and C, CFA of 30% of the benchmark cost or the tender cost, whichever is lower, of the stand-alone solar agriculture pump/ solarization cost will be provided. The State Government will give a subsidy of 30%; and the remaining 40% will be provided by the farmer. Bank finance may be made available for farmer's contribution, so that farmer has to initially pay only 10% of the cost and remaining up to 30% of the cost as loan. For North Eastern States, Hilly States and Island UTs, the Government of India subsidy is 50%.

3.10 SCALE-UP OF ACCESS TO CLEAN ENERGY SCHEME

- 3.10.1 The Ministry of New and Renewable Energy (MNRE) is implementing a two-year project titled "Scale Up of Access to Clean Energy (ACE) for Rural Productive Uses", an initiative to enhance the use of reliable and affordable renewable energy for rural productive uses and livelihoods in un-served and under-served areas, initially in 19 districts covering 1500 beneficiaries in the three states of Assam, Madhya Pradesh and Odisha for strengthening rural livelihoods, improving income generation and reduce use of fossil fuels. Subsequently, the scheme would be applicable to all districts of the 3 target states covering additional 28500 beneficiaries. The estimated total project cost of this scheme is about US\$ 23.04 Million (equivalent Rs.148 Cr.), with Rs.70 crore being the contribution of Government of India, Rs.31 crore contribution from GEF and UNDP and Rs.47 crore to be mobilized through sources such as State Govt. funds, CSR, beneficiary contribution, etc.



Solar Field in the Kalgidhar Trust

SUCCESS STORY 3.1

The Kalgidhar Trust, Barusahib, Sirmour, Himachal Pradesh has installed a Scheffler dish based solar cooking system for 5500 people. The solar fields have 28 dishes of 32 m² each with a cumulative reflector area of 896 m². Initially, they used LPG for cooking. The project was completed with a total expenditure of Rs. 2.33 crore and Ministry's support of Rs. 98,21,952/- . The CST based cooking system is operated for an average of 8 hrs per day delivering an average output 20.26 lakh Kcal/day. This results in an average saving of 218 kgs of fuel, benefitting a saving of about Rs. 1322.00 per day.



Cooking food in Solar Kitchen



SUCCESS STORY 3.2

Indian Ordnance Factories organization- a family of 41 ordnance Factories under the aegis of its corporate headquarters at Ordnance Factory Board, Kolkata- possesses the unique distinction of over 200 years' experience in Defence production and engaged in production, testing, logistics, research, development and marketing of a comprehensive product range in the area of land, sea and air systems. Indian Ordnance Factories, Nagpur, engaged in manufacturing of products for Defence and Security in which having Industrial Canteen for its employees catering to the need of 500 to 600 persons.

With an interest in to reduce the consumption of LPG for process heating in cooking as well to bring monetary savings they installed Parabolic Dish based Concentrated Solar Thermal Technology (CST) project in premises of Ordnance Factory, Ambazari, and Nagpur Maharashtra. Concentrated Solar thermal steam based cooking system of 180 m² in RESCO mode at their industrial canteen roof which helped them in reducing the consumption of LPG by 20 Kg per day. The total expenditure incurred was Rs.34,84,111/- and the Ministry's financial support of Rs.10,37,733/-.



Parabolic dish based CST system installed at Indian Ordnance Factory, Nagpur.



SUCCESS STORY 3.3

Raichur, Bellary & Koppal Districts Co-operative Milk Union Ltd. through National Dairy Development Board (NDDB) has implemented CPC based CST project for crate-washing and CIP sections, and to the pasteurization process. The project provides hot water at 95°C as boiler feed. The roof-mounted solar thermal solution was designed with high-efficiency Compound Parabolic Concentrators (CPC) with a collector area of 354 m². The project was completed with a total expenditure of Rs.39.92 lakh and Ministry's support of Rs.11,97,984/-.

The system comprises a primary circuit with the array of CPC modules, a secondary circuit with storage tanks to store the heat and a process integration circuit. The heat transfer liquid (water treated by reverse osmosis) circulating in the closed-loop primary circuit is heated in the CPC modules, and then exchanges its heat with softened water in the secondary circuit. This hot water in the secondary circuit is stored in stainless steel tanks. When the temperature of the water in the tanks exceeds a threshold value, process pumps transfer the hot water to the applications. The entire system is designed for reliable and automated operation including start-up and shut-down. In addition, a remote monitoring solution permits instantaneous, daily, and monthly performance to be viewed at a glance. On an average the systems delivers pressurized hot water at the rate of 9 lakh Kcal/day saving approximately 113 kg of Furnace Oil/day benefiting a savings of about Rs.3400/- per day.



Solar Field and storage tanks at M/s. Raichur, Bellary & Koppal Districts Co-operative Milk Union Ltd.

- 3.10.2 Scheme will be implemented through State Renewable Energy Development Agencies (SNAs) and State Rural Livelihood Missions (SRLMs) as the Implementing Agencies. Livelihood activities and requirement of RE applications for each state will be assessed and verified by the SRLMs.



3.11 “OFF-GRID AND DECENTRALIZED CONCENTRATED SOLAR THERMAL (CST) TECHNOLOGIES FOR COMMUNITY COOKING, PROCESS HEAT AND SPACE HEATING & COOLING APPLICATIONS IN INDUSTRIAL, INSTITUTIONAL AND COMMERCIAL ESTABLISHMENTS”

- 3.11.1 The scheme was announced for the promotion of solar energy usage in applications where thermal energy is required. Thermal energy requirement in industries for process heating are regularly met using fossil fuels, which has an adverse effect on the environment. Thermal energy is also required in places like hostels; canteens, etc. where community cooking is being done. It can also be used for space heating/cooling applications in domestic and commercial applications.
- 3.11.2 During the period from 01.01.2018 till 31.03.2019, 18 CST systems with 9996 m² collector/reflector area were installed and commissioned. 46 CST project of area aggregating to 14109.99 m² are under various stages of installation for process heating, space cooling, steam cooking and other industrial or and commercial applications.

3.12 MNRE–GEF–UNIDO PROJECT

- 3.12.1 Ministry of New and Renewable Energy (MNRE), in association with United Nations Industrial Development Organization (UNIDO) has been implementing the project ‘Promoting business models for increasing penetration and scaling up of solar energy’ to assist in the commercialization of concentrating solar technologies by innovations in the technical and financial support.
- 3.12.2 A financing scheme developed jointly with IREDA and MNRE, now provides financial support to CST projects by bundling the MNRE’s subsidy and a soft loan from IREDA, thereby providing upfront access to 75% of CST project cost. Through this modality the project aims to support the capex requirement of the CST manufacturers and suppliers during the design and installation phase of the project. The project also helps systems integrators for diversified application of CST technologies in industrial process heat in existing and unexplored industrial sectors
- 3.12.3 Four CST projects with a collector area of 1313 m² have received support under the project. In addition, a “200 MW CST Roadmap 2022” has been developed to serve as a guiding document for MNRE to take strategic actions in the coming years for large-scale deployment of CST technology in India during the next four years. It presents the actual market potential of CST technologies for process heat applications (heating and cooling), estimated as 13.45 GW (6.45 GW excluding low temperature applications), out of which 200 MW can be easily realized within the next 4 years.

3.13 GREEN ENERGY CORRIDOR

- 3.13.1 In order to facilitate integration of large scale renewable generation capacity addition, the Cabinet Committee of Economic Affairs (CCEA) in FY 2015-16, approved the creation of Intra-state Transmission System in the states of Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Tamil Nadu, rich in renewable resource potential and where large capacity renewable power projects are planned, at an estimated cost of Rs.10,141.68 crore with Government of India contribution from National Clean Energy Fund (NCEF) of Rs.4056.67 crore. The activities envisaged under the project includes establishment of Grid sub-stations of different voltage levels with aggregate transformation capacity of approx. 19000 MVA (Mega Volt Ampere) and installation of over 8500 circuit kilometres (ckt-kms) of transmission lines in these eight states. The creation of the Intra-State Transmission System will facilitate the evacuation of renewable power from generation stations to load centres.



- 3.13.2 The project is scheduled to be completed by Financial Year 2019-20 with funding mechanism consisting of 40% Central Grant, 40% KfW loan (Euro 500 million) and the remaining 20 percent as State contribution. As on 31.03.2019, a total of approx. Rs.1940 crore has been disbursed to the States from the Government of India contribution, and works related to installation of transmission towers and their stringing for an aggregate 3500 ckt-kms have been completed. The following works, mentioned in the States below, have been completed in 2018-19:
- a) **Gujarat:** (i) LILO of both circuits of 220 KV D/C Tebhda – Nyara line at Moti Gop substation (M/C line); (ii) 220 kV 320 MVA Bhachunda GIS substation (Dis. Kutch); (iii) LILO of one circuit of 220 kV D/C Akrimota – Nakhatrana line at Bhachunda; (iv) LILO of one circuit of 220 kV D/C Hadala - Sartanpar at 220 kV Wankaner; (v) LILO of one circuit of 220 KV D/C Gandhinagar TPS – Chhatral line at Vadavi (AL-59); (vi) 220 KV D/C Radhanpur – Sankhari line.
 - b) **Karnataka:** (i) 400/ 220 kV 1000 MVA Substation in Gadag (Doni); (ii) 220 kV DC LILO from 220 kV Gadag-Lingapur DC line to the 400/220 kV station at Gadag(Doni); (iii) 220 kV DC line for having LILO arrangement of 220 kV Narendra-Haveri first circuit to 220 kV Station Bidnal in Haveri and Dharwad districts.
 - c) **Madhya Pradesh:** (i) 220 kV Double Circuit Double Strung line from Julwaniya 400 kV S/s to Sendhwa 220 kV S/s; (ii) 220/132 kV S/s at Sendhwa; (iii) 132 kV Interconnector between Sendhwa 220 kV S/s and Sendhwa 132 kV S/s; (iv) 220 kV Double Circuit Double Strung line from Badnawar 400 kV S/s to Kanwan 220 kV S/s; (v) 220/132 kV S/s at Kanwan; (vi) 132 kV Inter connector between Kanwan220 kV S/s and Kanwan132 kV S/s; (vii) 132 kV Double Circuit Double Strung line from Kanwan 220 kV S/s to Teesgaon 132 kV S/s; (viii) Second circuit stringing of 132 kV Jhabua - Meghnagar 132 kV Double Circuit Single Strung line; (ix) 220/132 kV S/s at Gudgaon; (x) Second circuit stringing of Maihar - Amarpatan 132 kV Double Circuit Single Strung line; (xi) 220/132 kV S/s at Sailana 400 kV S/s; (xii) 220 kV Interconnector between Sailana 400 kV S/s and Ratlam Switching 220 kV S/s; (xiii) Second circuit stringing of Alot - Sitamau 132 kV Double Circuit Single Strung line.
 - d) **Rajasthan:** (i) 400 kV D/C Barmer - Bhinmal (PGCIL) line; (ii) 400 kV D/C Jaisalmer-2 - Barmer line.
 - e) **Andhra Pradesh:** (i) 400kV Quad Moose DC line from 400 kV Uravakonda Substation to 400 kV Hindupur Substation; (ii) Stringing of 2nd Ckt on 132 KV DC/SC Line from Badvel-Porumamilla Line

4: POWER FROM OTHER RENEWABLES



POWER FROM OTHER RENEWABLES

4.1 GRID INTERACTIVE AND OFF-GRID RENEWABLE POWER

- (i) India has renewable energy potential such as wind, solar, biomass, small hydro etc. As per estimates, India has a wind potential of more than 300 GW at a hub height of 100 metre, solar potential of ~750 GW assuming 3% wasteland is made available, small hydro potential of ~20 GW, and bio energy potential of 25 GW. Further, there exists significant potential from decentralized distributed applications for meeting hot water requirement for residential, commercial and industrial sector through solar energy and also meeting cooking energy needs in the rural areas through biogas. Renewable energy also has the potential to usher in universal energy access. In a decentralized or standalone way renewable energy is appropriate, scalable and a viable solution for providing power to un-electrified or power deficient villages and hamlets.
- (ii) In March 2019, the cumulative renewable power installed capacity was 78.31 GW. Capacity addition of 42.70 GW grid connected renewable power installed capacity has been achieved during the last five years in April 2014 to March 2019.

4.2 GRID INTERACTIVE RENEWABLE POWER

4.2.1 WIND ENERGY PROGRAMME

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 about 10,000 MW per annum. The country currently has the fourth highest wind installed capacity in the world with total installed capacity of 35.62 GW (as on 31st March 2019) and 62 Billion Units were generated from wind power during 2018-19.



Wind Turbine with Hybrid Lattice Tower installed in Kutch, Gujarat



100 MW wind farm in Jaisalmer, Rajasthan

4.2.2 POTENTIAL OF WIND ENERGY IN INDIA

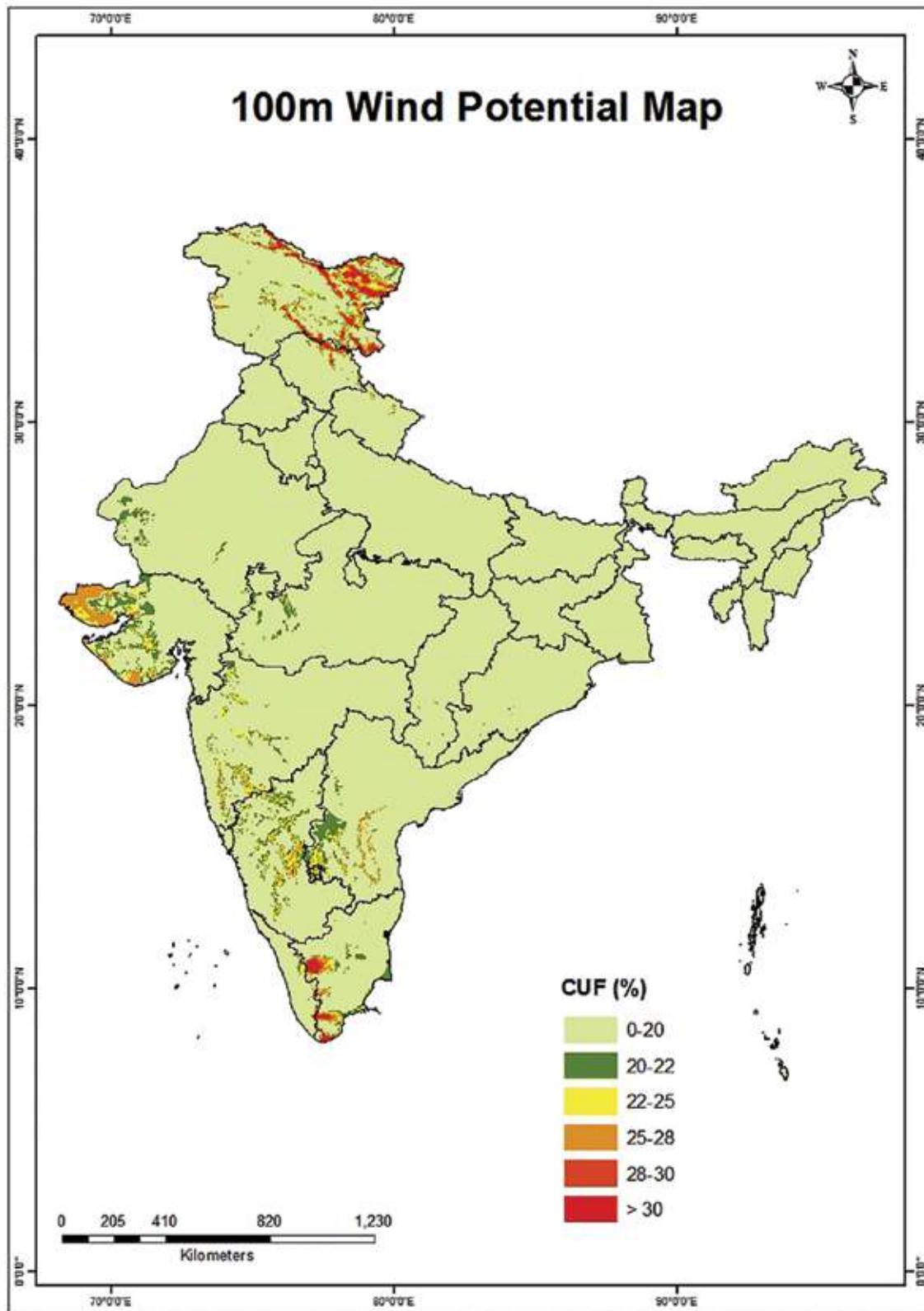
- (i) Wind is an intermittent and site-specific source of energy and therefore, an extensive Wind Resource Assessment is essential for the selection of potential sites. The Government, through National Institute of Wind Energy (NIWE), has installed over 900 wind-monitoring stations all over country and issued wind potential maps at 50 m, 80 m and 100 m and presently, in the process of assessing wind potential at 120 m above ground level. The latest assessment indicates gross wind power potential of 302 GW in the country at 100 meter above ground level. Most of this potential exists in seven windy States as in **Table 4.1:-**

Table 4.1: Wind Power Potential in India at 100 meter above ground level

S. No.	State	Wind Power Potential at 100 meter in GW
1	Andhra Pradesh	44.23
2	Gujarat	84.43
3	Karnataka	55.86
4	Madhya Pradesh	10.48
5	Maharashtra	45.39
6	Rajasthan	18.77
7	Tamil Nadu	33.80
Total (7 windy States)		292.97
Other States		9.28
All India Total		302.25



- (ii) The online wind atlas is available on the NIWE website <https://niwe.res.in/> and wind potential map at 100 m above ground level is given below:





4.2.3 INSTALLED CAPACITY OF WIND POWER IN THE COUNTRY

- (i) The Installed Capacity of Grid-interactive wind power in the country as on 31.03.2019 is 35.62 GW and state-wise installed capacity (in MW) is shown in **Table 4.2:**

Table 4.2: State wise Wind Power Installed as on 31.03.2019		
S. No.	STATE	Wind Power (MW)
1	Andhra Pradesh	4090.45
2	Gujarat	6073.07
3	Karnataka	4694.9
4	Madhya Pradesh	2519.89
5	Maharashtra	4794.13
6	Rajasthan	4299.72
7	Tamil Nadu	8968.905
8	Telangana	128.1
9	Kerala	52.50
10	Others	4.30
Total (MW)		35625.965

- (ii) 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		
Sr. No.	Year	Wind (MU)
1	2014-15	33768
2	2015-16	33029
3	2016-17	46004
4	2017-18	52666
5	2018-19	62036

4.2.4 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 70-80% indigenisation has been achieved with strong domestic manufacturing in the wind sector. All the major global players in this field have their presence in the country and over 43 different models of wind turbines are being manufactured by more than 15 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 machines has gone up to 3.00 MW. The current annual production capacity of wind turbines in the country is about 10000 MW.

4.2.5 TENDER/BIDDING IN WIND ENERGY SECTOR

- (i) The 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 objective is to provide a framework for procurement of wind power through a transparent process of bidding including standardization of the process and defining of roles and responsibilities of various stakeholders.



200 MW wind farm at Ananthapur, Andhra Pradesh

These guidelines aim to enable the Distribution Licensees to procure wind power at competitive rates in a cost effective manner.

(ii) To enable Discoms of the non-windy States to fulfil their non-solar Renewable Purchase Obligation (RPO), through purchase of utilise wind power at a tariff determined by transparent bidding process, MNRE through SECI auctioned 8.4 GW of wind power capacity in 5 tranches. NTPC auctioned another 1.2 GW. Further, the states utilities of Gujarat and Maharashtra have auctioned for procurement of 1.5 GW and 0.5 GW wind power respectively and state utility of Tamil Nadu auctioned 0.5 GW, making a total of 12.1 GW of auctions since first bid.

(iii) The status of tenders for Wind Power projects :-

(1) Cumulative commissioned capacity till 31/03/19:	35.62 GW
(2) LOI issued but not commissioned (under implementation):	8.98 GW
(3) Projects tendered but LOI to be issued:	5.7 GW
Total (1+2+3):	50.30 GW

Thus as against target of 60 GW by 2022, the Ministry had 50 GW of project either commissioned or in pipeline.

(iv) The Minimum Tariffs discovered from tenders auctioned for Wind Power are shown in **Table 4.4**.

4.2.6 INCENTIVES AVAILABLE FOR WIND SECTOR

(i) The Government is promoting wind power projects in entire country through private sector investment by providing various fiscal and financial incentives such as Accelerated Depreciation benefit; concessional custom duty exemption on certain components of wind electric generators. Besides, Generation Based Incentive (GBI) Scheme was available for the wind projects commissioned by 31 March 2017.

**Table 4.4: Minimum Tariffs discovered from tenders auctioned for Wind Power**

Sl. No.	Bid	Capacity (MW)	Type	Min. Tariff (Rs./kwh)
1.	SECI-I	1000	Central	3.46
2.	SECI-II	1000	Central	2.64
3.	SECI-III	2000	Central	2.44
4.	SECI-IV	2000	Central	2.51
5.	Tamil Nadu	500	State	3.42
6.	Gujarat (GUVNL)	500	State	2.43
7.	Maharashtra (MSEDCL)	500	State	2.85
8.	SECI-V	1200	Central	2.76
9.	NTPC	1200	Central	2.77
10.	SECI-VI	1200	Central	2.82
11.	GUVNL Ph.II	1000	State	2.80
Total		12100		

- (ii) In addition to fiscal and other incentives as stated above, following steps also have been taken to promote installation of wind capacity in the country:
- Technical support including wind resource assessment and identification of potential sites through the National Institute of Wind Energy, Chennai.
 - In order to facilitate inter-state sale of wind power, the inter-state transmission charges and losses have been waived off for wind and solar projects to be commissioned by March, 2022.

4.2.7 NATIONAL WIND-SOLAR HYBRID POLICY

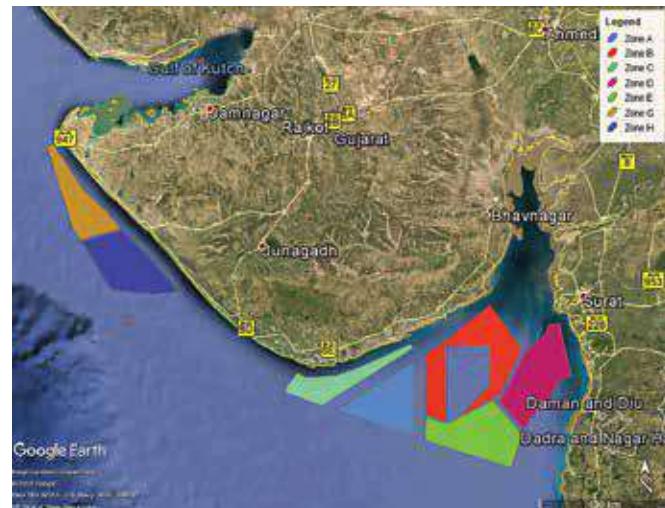
- (i) The Ministry issued National Wind-Solar Hybrid Policy on 14th May, 2018. The main objective of the policy is to provide a framework for promotion of large grid connected wind-solar PV hybrid system for optimal and efficient utilization of wind and solar resources, transmission infrastructure and 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.
- (ii) Wind solar hybrid projects of 840 MW capacity have been auctioned by SECI through transparent competitive bidding process. The discovered minimum tariff for hybrid project was Rs. 2.67/ unit.

4.2.8 INDIA'S OFFSHORE JOURNEY

- (i) India is blessed with a coastline of about 7600 km surrounded by water on three sides and has good prospects of harnessing 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 and shall be responsible for overall monitoring of offshore wind energy development in the country. National Institute of Wind Energy (NIWE), Chennai will be the nodal agency to carryout resource assessment, surveys and studies in EEZ, demarcate blocks and facilitate developers for setting up offshore wind energy farms.



Tamil Nadu Offshore Wind Potential Zone



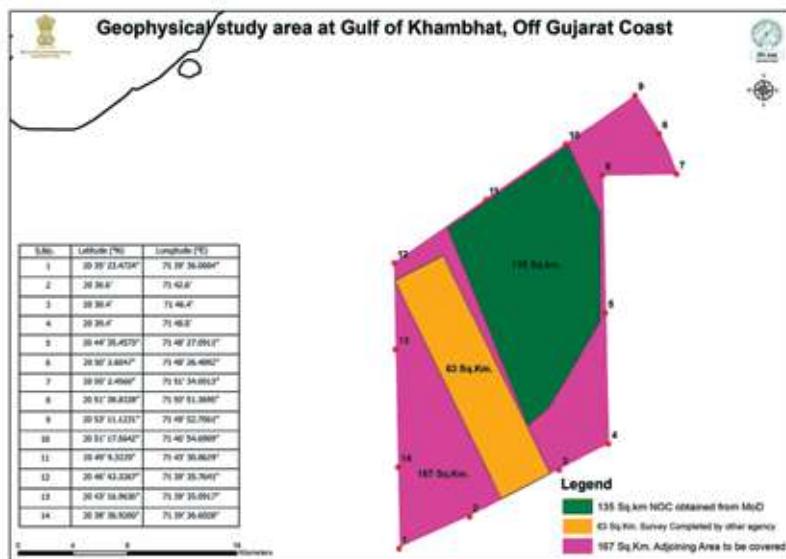
Gujarat Offshore Wind Potential Zone

4.2.9 PRESENT STATUS

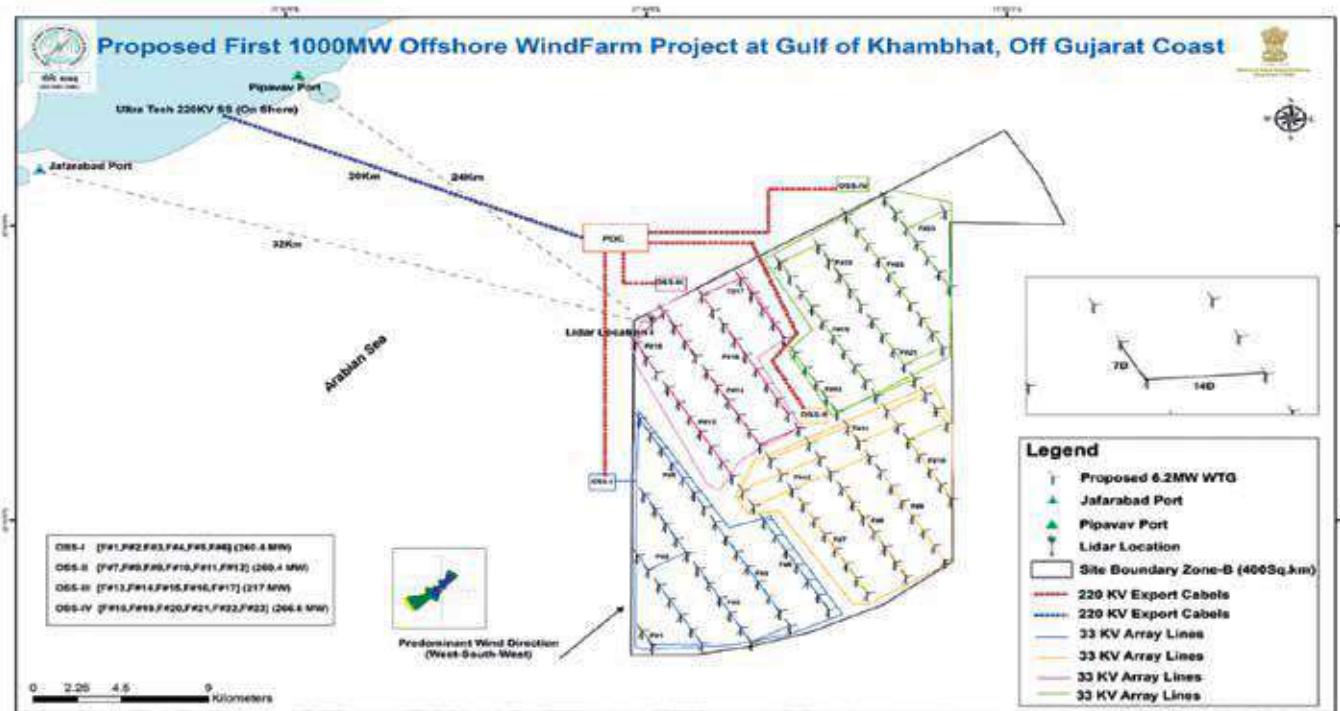
- (i) Based on the preliminary assessment from satellite data and data available from other sources eight zones each in Gujarat and Tamil Nadu have been identified as potential offshore zones for exploitation of offshore wind energy. Initial assessment by NIWE within the identified zones suggests 36 GW of offshore wind energy potential exists off the coast of Gujarat only.
- (ii) The first offshore wind energy project of 1.0 GW capacity is planned in the identified zone-B off the coast of Gujarat in order to bring the economy of scale and localization of necessary ecosystem for offshore wind energy sector.
- (iii) In principle (stage-I) clearance as per the national offshore wind energy policy from relevant Ministries/ Departments for a 1.0 GW offshore wind energy project in Zone –B off Gujarat coast has already been obtained. Further, stage-II clearances required for carrying out required studies/surveys for the selected areas have been obtained by NIWE and NIWE is in the process of collecting geophysical and geotechnical data.
- (iv) The ‘Guidelines for Offshore Wind Power Assessment Studies and Surveys’ was approved and issued by NIWE in September, 2018 to facilitate stakeholders who are interested for carrying out the study/survey activity for development of offshore wind energy project.
- (v) One LiDAR was commissioned in November 2017 for Offshore Wind Resource assessment off the coast of Gujarat and collection of data started since then. Funds for additional 5 LiDARs (Two for Gujarat and Three for Tamil Nadu) have been released to NIWE and NIWE is in the process of installing the same.
- (vi) Geo-physical Survey for 70 Sq. km (Gujarat) has been done through an EU funded project and additional area of 295 Sq. km aggregate for installation of a capacity of 1.0 GW off Gujarat coast has been done with the help of NIOT (National Institute of Ocean Technology, Chennai). NIWE is also carrying out the rapid Environmental Impact Assessment (EIA) studies for the proposed one GW offshore wind project off the coast of Gujarat. In addition, NIWE will carry out Geophysical and Geotechnical studies in a selected area off the coast of Tamil Nadu.
- (vii) Expression of Interest (EoI) for the first offshore wind project of 1.0 GW capacity off Gujarat coast was floated on 10.04.18 by NIWE. Thirty five International, OEMs, Multinational and Indian Developers participated in the EoI and subsequent consultation process, providing their inputs for bidding process.



LiDAR platform and graphical representation of LiDAR



Geophysical study area at Gulf of Khambat, off Gujarat Coast



Proposed First 1000 MW off shore wind farm project at Gulf of Khambat, off Gujarat Coast

4.2.10 BAGASSE CO-GENERATION IN SUGAR MILLS (UPTO MARCH 2020) GRID - CONNECTED

- 4.2.11 Ministry has been promoting ‘Biomass Power and Bagasse Co-generation Programme’ with the aim of recovering energy from biomass including bagasse, agricultural residues such as shells, husks, de-oiled cakes and wood from dedicated energy plantations for power generation. A new scheme (up to March 2020) to support biomass based cogeneration in sugar mills and other industries was notified on 11.05.2018. The potential for power generation from agricultural and agro-industrial residues is estimated at about 18,000 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 8,000 MW. Thus the total estimated potential for biomass power is about 26,000 MW.

4.2.12 Sugar industry has been traditionally practicing incidental cogeneration by using bagasse as a fuel for meeting the steam and power requirements of sugar processing and sugar mill complex. With the advancement in the boiler and turbine technologies for generation and utilization of steam at high temperature and pressure, sugar industry has been producing electricity and steam for their own requirements and selling surplus electricity to the grid by optimally utilising the bagasse. The sale of surplus power generated through optimum cogeneration is helping a sugar mill to improve its viability and profitability, apart from creating additional power generation capacity in the country.

4.2.13 The Programme has bagasse based cogeneration in sugar mills for export of surplus power to grid with the following objectives:

- i. To promote efficient and economic use of surplus biomass for power generation.
- ii. To maximize surplus power generation from sugar mills using improved technologies.
- iii. To promote technologies of co-generation for supplementing conventional power.

4.2.14 For the purpose of biomass based cogeneration programme the following terms are broadly adopted:-

(i) Biomass Resources

The programme will provide CFA for projects utilizing biomass like bagasse, agro-based industrial residue, crop residues, wood produced through energy plantations, weeds, wood waste produced in industrial operations, etc. Municipal Solid Waste (MSW) is not covered under the programme.

(ii) Financing Institutions

All registered financial institutions, development and investment corporations; all nationalized bank, private banks, central & state co-operative banks, state and public sector leasing, and financing corporations.

(iii) Promoters

Promoters include individual and independent registered companies; joint sector and public sector companies; state agencies and; private and public sector investors having technical and managerial capabilities for implementing Bagasse cogeneration projects.

(iv) Central Financial Assistance (CFA)

The new scheme to support biomass based cogeneration in sugar mills and other industries (up to March 2020) was notified on 11.05.2018. Under the scheme Central Financial Assistance (CFA) will be provided at the rate of Rs.25 Lakh per MW for bagasse cogeneration projects on surplus exportable capacity under the scheme. CFA will be calculated on surplus exportable power as mentioned in Power Purchase Agreement (PPA) or Appraisal Report. The CFA will be back-ended and will be released in one instalment after successful commissioning and commencement of commercial generation and performance testing of the plant. The CFA will be released to the term loan account to reduce the loan component of the promoter. No advance CFA will be released under the scheme. CFA will be provided only for projects which will be installing new boiler and turbines.

(v) Achievements

Over 500 biomass power and cogeneration projects with aggregate capacity of 9103.50 MW have been installed in the country up to March 2019. These projects have been commissioned mainly in the states



24 MW Bagasse Based Co-generation Power Plant, Kukkuwada, Tehsil & Dist. Davangere, Karnataka

of Tamil Nadu, Uttar Pradesh, Karnataka, Andhra Pradesh, Maharashtra, Chhattisgarh, West Bengal and Punjab. State wise details are given in **Table - 4.5.**

**Table 4.5: Installed Capacity of Grid Connected Biomass/
Bagasse Power Plants up to 31.03.2019**

State	Total Capacity (in MW)
Andhra Pradesh	378.20
Bihar	113.00
Chhattisgarh	228.00
Gujarat	65.30
Haryana	121.40
Karnataka	1783.60
Madhya Pradesh	93.00
Maharashtra	2499.70
Telangana	158.10
Punjab	194.00
Rajasthan	119.30
Tamil Nadu	969.00
Uttarakhand	73.00
Uttar Pradesh	1957.50
West Bengal	300.00
Odisha	50.40
Total	9103.50



4.2.14 SMALL HYDRO PROGRAMME

- 4.2.15 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. The SHP projects do not encounter the problems associated with large hydel projects of rehabilitation and resettlement and do not disturb the ecological balance of the areas. These projects have potential to meet power requirements of remote and isolated areas in a decentralized manner besides providing employment opportunity to local people.
- 4.2.16 The estimated potential of small / mini/ micro hydel projects in the country is 21133.65 MW from 7133 sites located in different States of India. In cumulative terms, 1115 small hydropower projects aggregating to 4593.155 MW have been set up in various parts of the country. In addition, 116 projects of about 650 MW are in various stages of implementation as on 31.03.2019. **Table-4.6** provides state-wise details of identified potential, projects completed and under execution.
- 4.2.17 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. The national target for SHP is to achieve a cumulative capacity of 5000 MW by 2022, under overall targets of achieving a cumulative grid connected Renewable Energy Power Projects of 175,000 MW.
- 4.2.18 As per the SHP Scheme (2014), the Ministry has been providing Central financial assistance / financial support in the form of grants / assistance / subsidy towards the following schemes / activities / sub-schemes.
- A) Resource assessment and support for identification of new sites; Scheme to support identification of new potential SHP sites, preparation of Plan and Detailed Project Report (DPR) including detailed survey & investigation (DSI) for SHP project sites to the Central / States Govt. dept. and agencies/ local bodies.
 - B) Scheme to support for setting up new SHP projects in the private/ co-operative/ joint sector, etc.
 - C) Scheme to support for setting up new SHP projects in the Government Sector.
 - D) Scheme to support for Renovation and Modernization of existing SHP projects in the government sector.
 - E) Scheme to support for development / Upgradation of Water Mills (mechanical/ electrical output) and setting up Micro Hydel Projects (up to 100kW capacity).
 - F) Research & Development and Human Resource Development: Support to R&D projects, strengthening of technical institutions, setting up turbine laboratory, business meets, training programmes/ courses, fellowships, etc., monitoring of SHP projects, consultancy and/ or any other activity felt necessary for the SHP development. The Financial assistance was considered for these activities on case to case basis.
- 4.2.19 At present there is no SHP Scheme in the Ministry of New and Renewable Energy.
- 4.2.20 The Ministry is also implementing a project titled ‘Ladakh Renewable Energy Initiative’ since June 1st, 2010 to minimize dependence on diesel / kerosene in the Ladakh region and meet the power requirement through renewable energy sources available locally. The approach is to meet power requirements through small / micro hydel and solar photovoltaic power projects /systems and use solar thermal systems for water heating, space heating and cooking requirements. The total cost of the project was Rs.473.00 crore.



Table-4.6: STATE WISE NUMBERS AND AGGREGATE CAPACITY OF SHP PROJECTS (UPTO 25 MW)

POTENTIAL, INSTALLED & UNDER IMPLEMENTATION (as on 31.03.2019)							
Sl. No.	State	Total Potential		Cumulative achievement till 31.03.2019		Projects under Implementation	
		Nos.	Total Capacity (MW)	Nos.	Total Capacity (MW)	Nos.	Capacity (MW)
1	Andhra Pradesh	359	409.32	44	162.11	0	0
2	Arunachal Pradesh	800	2064.92	156	131.105	10	7.05
3	Assam	106	201.99	6	34.11	1	2
4	Bihar	139	526.98	29	70.7	0	0
5	Chhattisgarh	199	1098.2	10	76	0	0
6	Goa	7	4.7	1	0.05	0	0
7	Gujarat	292	201.97	12	61.3	9	48.81
8	Haryana	33	107.4	9	73.5	0	0
9	Himachal Pradesh	1049	3460.34	189	860.61	26	285.5
10	Jammu & Kashmir	302	1707.45	44	179.03	22	51.3
11	Jharkhand	121	227.96	6	4.05	0	0
12	Karnataka	618	3726.49	168	1254.73	4	35
13	Kerala	238	647.15	34	222.02	8	73
14	Madhya Pradesh	299	820.44	12	95.91	0	0
15	Maharashtra	270	786.46	69	375.575	10	14.4
16	Manipur	110	99.95	8	5.45	0	0
17	Meghalaya	97	230.05	5	32.53	1	22.5
18	Mizoram	72	168.9	18	36.47	4	8.7
19	Nagaland	98	182.18	12	30.67	0	0
20	Odisha	220	286.22	10	64.625	5	60.5
21	Punjab	375	578.28	56	173.55	7	4.9
22	Rajasthan	64	51.67	10	23.85	0	0
23	Sikkim	88	266.64	17	52.11	0	0
24	Tamil Nadu	191	604.46	21	123.05	0	0
25	Telangana	94	102.25	30	90.87	0	0
26	Tripura	13	46.86	3	16.01	0	0
27	A&N Islands	7	7.27	1	5.25	0	0
28	Uttar Pradesh	251	460.75	9	25.1	2	25.5
29	Uttarakhand	442	1664.31	102	214.32	7	10.85
30	West Bengal	179	392.06	24	98.5	0	0
Total		7133	21133.62	1115	4593.155	116	650.01



1.5 MW Sangrah SHP in Kargil district of Jammu & Kashmir under 'Ladakh Renewable Energy Initiative'

The project envisaged setting up of small/minи hydel projects at a total cost of Rs.267.00 crore. Two Small Hydro Power Projects are currently under testing stage. Brief details of the projects are given below:-

- (i) **Sangrah SHP (1.5 MW):** Sangrah SHP is located at Sangrah, Sankoo which is 68 kms from Kargil. The project will electrify approximately 1100 households which include villages/hamlets of Thangboo, Purtikchay, Gyaling, Sangrah Thang, Karpokhar, Sankoo.
- (ii) **Chilong SHP (1.0 MW):** Chilong SHP is located at Chilong, Tai-suru, Kargil of J&K which is 68 kms away from Kargil.



1.0 MW Chilong SHP in Kargil district of Jammu & Kashmir under 'Ladakh Renewable Energy Initiative'



SUCCESS STORY 4.1

COMMISSIONING OF 1.00 MW ZHANGDONGRONG SMALL HYDRO POWER PLANT IN WEST KAMENG DISTRICT OF ARUNACHAL PRADESH.

Arunachal Pradesh, with an area of 83,743 sq.km. is the largest State in the North Eastern region and lies in the Himalayan region with a wide variety of altitudinal gradients and climatic conditions. In order to fulfil the long standing demand of the people living in the border areas of Arunachal Pradesh, Honourable Prime of India announced a package for illumination/electrification of villages located in Border Districts of Arunachal Pradesh lying along the international borders of China, Bhutan and Myanmar through a mix of grid-connected/decentralized small/mini/micro Hydel Projects and Solar Photovoltaic Systems.

Zhangdongrong SHP (1 MW) located in West Kameng district is one of the projects which was implemented under the Prime Minister's Package by the Department of Hydro Power Development (DHPD). The project was fully funded by Ministry of New & Renewable Energy. This project consists of two turbo impulse horizontal turbines of 500 kW installed capacity and both the units have been synchronized to make the whole system compatible for operation in isolated as well as grid mode. It will benefit 19 villages with nearly 4000 population. Availability of assured and continuous power supply will improve the living standards and will also arrest the migration of population from these remote villages.

The project was inaugurated by the Hon'ble Chief Minister of Arunachal Pradesh, Shri Prema Khandu on 5th of May, 2018



The 1 MW Zhangdongrong SHP in West Kameng District of Arunachal Pradesh under package for illumination/electrification of Villages located in Border Districts



- 4.2.21 The Hon'ble Prime Minister had announced a package of Rs.550.00 crore to electrify/ illuminate border villages of Arunachal Pradesh. Accordingly, a plan was made to electrify / illuminate 1053 un-electrified villages of all border districts of Arunachal Pradesh by installation of 5758 SPV Home Lighting Systems and 153 Micro Hydel/ Small Hydel Projects. The project has been completed, except for eight Small Hydro Power projects that remain to be commissioned by the Department of Hydro Power Development.

- 4.2.22 The Ministry has also been implementing Watermills (WM) and Micro Hydel Projects (MHP). It has potential to meet the power requirements of remote areas in a decentralized manner. A number of mini/micro hydro projects have been set up in remote and isolated areas, mainly in Himalayan and Western Ghat region. While these projects are developed by various state agencies responsible for renewable energy, the projects are normally maintained by entrepreneurs or by local community / Gram Panchayat / tea garden owners' participation. It has been estimated that there are more than 1.5 lakh potential water mill sites in the Himalayan regions of India. With the R&D efforts, new and improved designs of water mills have been developed for mechanical as well as electricity generation of 3-5 kW.



Watermill in Arunachal Pradesh

4.2.23 DEVELOPMENT OF HYDRO TURBINE R&D LABORATORY AT AHEC, IIT ROORKEE

- (i) With the support of the Ministry of New and Renewable Energy, a state-of-art Hydro Turbine R&D Laboratory was commissioned at Alternate Hydro Energy Centre (AHEC), Indian Institute of Technology, Roorkee (IITR). The laboratory is a design and validation facility and is equipped with State of the Art SCADA based Automatic Control System with electro-magnetic flowmeter, pressure transducers and sensors. This Hydraulic Turbine R&D Laboratory has been granted National Accreditation Board for Laboratories (NABL) accreditation. The operation of the laboratory is as per IEC-60193.
- (ii) The Laboratory was inaugurated by Hon'ble Union Minister of State for Power and NRE Shri R.K. Singh in the presence of Shri Anand Kumar, Secretary MNRE and Prof A.K. Chaturvedi, Director IITR on April 10, 2018.



Inauguration of Hydro Turbine R&D Laboratory at AHEC, IIT Roorkee



4.2.24 WASTE TO ENERGY

4.2.25 Programme on Energy from Urban, Industrial & Agricultural Wastes/ Residues

- (i) During the year 2018-19, the Ministry has continued the implementation of the ‘Programme on Energy from Urban, Industrial and Agricultural Waste/Residues’ aimed at generation of biogas, BioCNG and Power from different wastes, such as municipal solid wastes, vegetable and other market wastes, slaughterhouse waste, agricultural residues and industrial wastes & effluents. About 100 tons/day of municipal solid waste have capacity to generate 1MW of power and 100 tons/day of cow dung can generate about 1600 kgs of BioCNG per day. In addition to Bio-CNG/Biogas, biogas plants generate organic fertilizer as a by-product which is valuable for agricultural fields.
- (ii) The objectives of the scheme are as under:
- To promote setting up of projects for recovery of energy in the form of Biogas / BioCNG/Enriched Biogas/ Power from urban, industrial and agricultural wastes; and captive power and thermal use through gasification in industries.
 - To promote Biomass Gasifier based power plants for producing electricity to meet the unmet demand of captive power and thermal needs of rice mills and other industries and villages for lighting, water pumping and micro-enterprises.
 - To create conducive conditions and environment, with fiscal and financial regime, to develop, demonstrate and disseminate information on recovery of energy from waste and residues.

4.2.26 Subsidy/Grant/Incentive provided under the Scheme

- (i) Central Financial Assistance (CFA) for projects of different categories is given in the form of capital subsidy to the promoters and in the form of Grants-in-Aid for other activities, as given below:
- Biogas generation : Rs.1.0 crore per 12000 cum/day ;
 - Bio-CNG generation (including setting of Biogas plant) : Rs.4.0 crore per 4800 kg/day;
 - Power generation based on Biogas (including setting of Biogas plant): Rs.3.0 crore per MW.
 - For gasifier based project CFA varies from Rs.6.67 lakh per MW to Rs.1.5 crore per MW depending upon type and usage of gasifier.
- (ii) Other Incentives and Support Measures available to Waste to Energy the sector are –
- Concessional Customs Duty and GST at rate of 5% for initial setting up of grid connected projects for power generation or production of Bio-CNG from wastes;
 - Preferential Tariff announced by the CERC /SERC;
 - Energy Buyback, Wheeling & Banking;
 - Incentives to State Nodal Agencies - Service Charge @ 1% of the Subsidy restricted to Rs.5.00 lakh per project;
 - Financial Assistance for Promotional Activities - for Organizing Capacity Building Programmes, Awareness Creation, Business Meets, Seminars / Workshops, Publication of Newsletters, Resource Assessment, Technology Validation and Performance Monitoring and Evaluation subject to a maximum of Rs.3.00 lakh per activity.



- f. According to the amended Tariff Policy, Distribution Licensee(s) shall compulsorily procure 100% power produced from all the Waste-to-Energy plants in the State, in the ratio of their procurement of power from all sources including their own, at the tariff determined by the Appropriate Commission under Section 62 of the Act.

4.2.27 Progress during the year 2018-19

- 4.2.28 During the year 2018-19, three Biogas generation projects of installed capacity of 57,426 cubic meter per day in Madhya Pradesh and Maharashtra and two Bio-CNG generation projects of 8600 kgs./day capacity in Gujarat for thermal application from industrial effluents/urban waste were installed.
- 4.2.29 Details of the projects are given below:
- 19,926 m³/day Biogas Generation Plant from Maize Processing Effluent by M/s Tirupati Starch and Chemicals Ltd. at Dist. Dhar, Madhya Pradesh.
 - 13500 m³/day Biogas Generation Plant from Starch Processing Effluent by M/s Sanstar Ltd. at Dist. Dhule, Maharashtra.
 - 24000 m³/day Biogas generation plant from Starch and allied Manufacturing Unit by M/s Gujarat Ambuja Exports Ltd. at Jalgoan, Maharashtra
 - 6400 kgs/day Bio-CNG generation plant at 180 MLD Sewage Treatment Plant, AMC, Ahmedabad by M/s Rockstone Infrastructure Pvt. Ltd.
 - 2200 kgs/day Bio-CNG based on Vegetable Waste, Hotel waste & cow dung at Sardar Market, Dumbhal, Surat by M/s Agricultural Produce Market Committee (APMC), Surat.
 - 138.30 MW capacity Grid interactive projects, 111.43 MW capacity Off-grid power projects, 78 biogas generation plants with 6,65,606 cubic meters per day generation capacity and 16 Bio-CNG generation plants with 59028 kgs per day generation capacity have been set up in the country so far.



24000 m³/day Biogas generation plant from Starch and allied Manufacturing Unit of Ms Gujarat Ambuja Exports Ltd. at Jalgoan, Maharashtra.
Inset shows Digester Overview



4.3 OFF-GRID RENEWABLE POWER

4.3.1 SMALL WIND ENERGY AND HYBRID SYSTEMS

4.3.2 During the year 2018-19, 20 water pumping wind mills and 62.60 KW Aero-generator small wind and hybrid systems were installed. The state-wise installation of Water Pumping Mills and Aero-generation/Wind Solar Hybrid System is given in **Table 4.7**. The scheme expired on 31.03.2017 and no more projects are sanctioned under this scheme.

**Table 4.7 : Installation of Cumulative Water Pumping Mills and Aero-generators/
Wind-Solar Hybrid Systems**

S. No.	State/UT	Water Pumping Mills (Nos.)	Aero-generated & Hybrid Systems (kW)
1.	Andaman & Nicobar	2	0
2.	Andhra Pradesh	6	271.0
3.	Arunachal Pradesh	0	7.0
4.	Assam	3	6.0
5.	Bihar	46	0.0
6.	Goa	0	194.0
7.	Gujarat	1066	20.0
8.	Haryana	0	10.0
9.	Himachal Pradesh	0	4.0
10.	Jammu & Kashmir	0	96.0
11.	Karnataka	28	39.0
12.	Kerala	79	8.0
13.	Madhya Pradesh	0	24.0
14.	Maharashtra	26	1833.6
15.	Manipur	0	140.0
16.	Meghalaya	0	201.0
17.	Mizoram	0	21.0
18.	Nagaland	0	20.0
19.	Odisha	0	13.0
20.	Puducherry	0	5.0
21.	Punjab	0	50.0
22.	Rajasthan	222	14.0
23.	Sikkim	0	16.0
24.	Tamil Nadu	60	257.0
25.	Tripura	0	2.0
26.	Uttarakhand	0	24.0
27.	West Bengal	0	74.0
Total		1536	3349.6



Small Wind and Solar PV Hybrid System at Puga, Ladakh, J&K

4.3.3 BIOGAS POWER

4.3.4 Biogas Power (Off-grid) Generation and Thermal Application Programme (BPGTP)

The Ministry is implementing biogas based schemes/ Programme for promoting biogas generation for decentralized applications viz. decentralized power generation in the capacity range 3 kW to 250 kW and also for thermal energy applications having biogas generation capacity in the matching size range of 30 m³ to 2500 m³ per day. The organic bio-degradable wastes from various sources such as cattle dung/ animal wastes, food & kitchen waste, poultry dropping waste, agro-industry waste, etc. are the feed stock for Biogas plants.

4.3.5 Implementation of BPGTP

The Biogas based Power Generation and Thermal Application Programme (BPGTP) is implemented through the Agriculture and Rural Development Departments of the States, Dairy Co-operatives, State Nodal Agencies (SNAs), Biogas Development and Training Centres (BDTCs), Khadi and Village Industries Commission (KVIC) and National Dairy Development Board (NDDB) from the current year, 2018-19.



4.3.6 Central Financial Assistance (CFA) for BPGTP

The CFA under the programme being provided in the range of Rs.25,000/- per kW to Rs.40,000 per kW for power generation and Rs.12,500/- per kW to Rs.20,000/- per kWe for thermal applications respectively. The CFA rates vary depending upon the category of beneficiaries and location /region for the projects installed.

4.3.7 Achievements

During the period from 01.01.2018 to 31.03.2019, 15 projects have been commissioned with power generation capacity of 1086 kW and corresponding biogas generation capacity of 10,770 m³ per day. With this, a total no. of 389 biogas based projects corresponding to a total power generation capacity of 8.951 MW with a cumulative total biogas generation of 87,990 m³ per day have been set up in the country.

4.3.8 BIOMASS GASIFIER PROGRAMME (BMP)

- 4.3.9 The Ministry is promoting multifaceted biomass gasifier based power plants for producing electricity using locally available biomass resources such as small wood chips, rice husk, arhar stalks, cotton stalks and other agro-residues in rural areas. The focus of the biomass gasifier programme is to meet captive electrical and thermal needs of rice mills and other industries which in turn help in replacing / saving of conventional fuels such as coal, diesel, furnace oil, etc. In addition, it helps in meeting the unmet demand of electricity for village for lighting, water pumping and micro-enterprises.
- 4.3.10 Capacity of 3150 kW equivalents during 2018-19 has been installed in industries in Uttar Pradesh and Madhya Pradesh for meeting captive demand of electricity and for thermal application.



Biogas Power Project of 40 kW (350 m³) installed at VPO-Gehlewal, Samrala, Ludhiana, Punjab

4.3.11 RENEWABLE PURCHASE OBLIGATION (RPO)

- 4.3.12 Section 86 (1) (e) of Electricity Act 2003 mandates the State Electricity Regulatory Commissions (SERCs) to *“Promote Co-generation and generation from Renewable sources of energy by providing suitable measures for connectivity to Grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of total consumption of electricity in the area of distribution licensee.”* Renewable Purchase Obligation (RPO) originates from this articulation. Under the mandate, SERCs are responsible for notifying the State RPO targets and their compliance. On 22 July 2016, the Ministry of Power (MoP) had notified the uniform RPO trajectory for all States from the year 2016-17 to 2018-19. Further, on 14 June 2018, MoP notified the uniform RPO trajectory up to the year 2021-22 that seeks 21% RPO (*10.5% non-solar and 10.5% solar*) by 2021-22.
- 4.3.13 The RPO compliance monitoring is crucial to ensure that the RPO targets are met and regulatory action is initiated on non-compliance. The issue relating to RPO compliance remains part of the Agenda of the meetings with States, including the Power Minister’s Conferences. On 22 May 2018, the Ministry of New and Renewable Energy has constituted RPO Compliance Cell to coordinate with States, SERCs and CERC on matters relating to RPO Compliance. Further, a centralized online platform has been developed to monitor RPO compliance status for all the states. This will enable states to feed information on RPO compliance in the portal by Obligated Entities in respective States, and collation of data at the national level.
- 4.3.14 A National workshop of State Nodal Officers for RPO Compliance was held on 18 September 2018, wherein it was decided to conduct regional meetings in all four regions of the country for training and sensitization of Online RPO Compliance portal. The first regional workshop of Southern States and UTs on RPO compliance was held on 18 January 2019. The workshop provided hands-on training to the Obligated Entities for the RPO provisions, and reporting on the RPO portal on a regular basis.



5: INTERNATIONAL SOLAR ALLIANCE

- 5.1 Launched in November 2015 on the side-lines of COP 21, the International Solar Alliance (ISA) has now transformed into a treaty based international intergovernmental organisation headquartered in India. Out of 71 countries that have signed Framework Agreement of the ISA, 48 countries have deposited their instruments of ratification.
- 5.2 The Union Cabinet, in its meeting held on 11 April 2018, approved the proposal for entering into Headquarters (Host Country) Agreement between the Government of the Republic of India and the ISA. Under the Host Country Agreement, ISA Secretariat's judicial personality is recognized. Subsequently vide Gazette Notification dated 6 June 2018, the Ministry of External Affairs notified ISA under the United Nations Privileges & Immunities Act, 1947.

5.3 FIRST ASSEMBLY OF ISA

- (i) The First Assembly of the ISA was held on 3 October, 2018 in India Expo Mart, Greater Noida, Uttar Pradesh, India. 37 ISA member Countries, including India and France, attended the Assembly. In addition, 25 countries that have signed the Framework Agreement of ISA but yet to ratify; 13 Prospective Member countries that are yet to sign the Framework Agreement of the ISA; and 3 Partner countries that are beyond inter-tropical zone attended the Assembly as Observers. Shri R.K.Singh, Hon'ble Minister for New and Renewable Energy and Power, Government of India presided over the Assembly and Ms Brune Poirson, Hon'ble Minister of State for Ecological and Inclusive Transition, Government of France served as Co-President.
- (ii) Hon'ble Prime Minister, while inaugurating the First Assembly of ISA, RE-INVEST 2018 and IORA RE Minister's Meeting on 2nd October 2018, equated solar energy to oil reserves and envisioned ISA to become OPEC of the future. He also gave a clarion call for '*One World, One Sun, One Grid*' for sharing solar energy across the borders.
- (iii) The first Assembly of ISA was unique in many ways. India was appointed the President by acclamation. The Assembly adopted India's resolution for amending the Framework Agreement of the ISA for opening up the ISA membership to all countries that are members of United Nations. This will help in putting solar energy in the global agenda for ensuring access to sustainable and modern energy for all at affordable rates. Further, the Assembly adopted the Work-programme and Budget for the Calendar Year 2019; and launching of the ISA's Programme on Scaling Solar E-Mobility and Storage.
- (iv) India has offered to meet ISA Secretariat expenses for initial five years. The Government of India has allotted 5 acres of land to the ISA in National Institute of Solar Energy (NISE) Campus, Gurugram, and



First Assembly of ISA

released a sum of Rs.145 crore, i.e. US\$ 20 Million for creating a corpus fund, building infrastructure and meeting day to day recurring expenditure. The Public Sector Enterprises of Government of India have also contributed US\$ 11 million for augmenting ISA corpus fund. Besides, the Ministry of External Affairs, Government of India has set aside US\$ 2 Billion for solar projects in Africa out of Government of India's US\$10 Billion concessional Line of Credit (LOC) for Africa. The Exim Bank of India is implementing this line of credit in close coordination with ISA countries in Africa.



First Assembly of ISA- Member Country representatives



RENEWABLE ENERGY FOR RURAL APPLICATIONS

6.1 The Ministry has been supporting programmes for the deployment of renewable energy systems and devices such as biogas plants, photovoltaic systems, biomass gasifiers, solar cookers and solar thermal systems, etc. for rural and semi-rural applications.

6.2 NEW NATIONAL BIOGAS AND ORGANIC MANURE PROGRAMME (NNBOMP)

The New National Biogas and Organic Manure Programme (NNBOMP) is being implemented with the objective to provide clean cooking fuel and to meet lighting, thermal and small power needs of farmers/dairy farmers/users including individual households and to improve organic manure system based on bio-slurry from biogas plants in rural and semi-urban areas by setting up of biogas plants. The programme has multiple benefits. It is helpful in mitigating hardship of rural women. It saves time and energy of rural people, which can be used for other livelihood activities. It also reduces pressure on forests and improves sanitation in rural and semi-urban areas.

6.2.1 IMPLEMENTATION

- (i) The programme is being implemented through the State Rural Development Departments, Khadi and Village Industries Commission (KVIC) and National Dairy Development Board (NDDB). In some of the States erstwhile programme implementing Renewable Energy Development Agencies and State Nodal Departments are also implementing the programme.
- (ii) The scheme has been modified with the view to make it a life changer for rural households/farmers/dairy farmers by bridging the gap of plant sizes from family size 1-6 M³/day to 1 to 25 M³/day to cover the uncovered potential and generate extra income from the biogas plants produced slurry which is an excellent organic manure / fertilizer. Simultaneously, slurry from biogas systems can be utilized by the farmers for their own crops cultivation for saving input cost of chemical fertilizers and pesticides/insecticides. Besides the above, the biogas being clean cooking fuel like LPG/PNG reduces household expenditures on clean cooking energy by at least upto Rs.8000/- to 9000/- per household per year in terms of LPG cost saving (2 cubic meter biogas plant).

6.2.2 CENTRAL FINANCE ASSISTANCE FOR BIOGAS PLANTS UNDER NEW NATIONAL BIOGAS AND ORGANIC MANURE PROGRAMME (NNBOMP).

Under the programme the CFA is being provided for setting up of biogas plants of size from 1 m³ to 25 m³. The CFA being provided is in the range of Rs.7,500/- per plant of 1 m³ to Rs.35,000/- per plant of 20-25 m³ depending upon the size of plants, location States or regions, category, etc. Besides this, financial support is also provided for turnkey job fee for construction, supervision, etc. It also provides support for skill development programme for Biogas Mitras and to BDTCs for conducting training courses. The details of the CFA are given in **Table 6.1**.

6.2.3 BIOGAS DEVELOPMENT AND TRAINING CENTERS (BDTCS)

Eight Biogas Development and Training Centers (BDTCS) have been established with the objective to set up good quality biogas plants as per established technical criteria. Their main function is to extend technical support required to the beneficiaries including training and skill development in Biogas sector, dissemination of knowledge and publicity of biogas schemes in close co-ordination with the State Programme Implementing Agencies of NNBOMP.

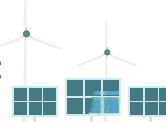


Table 6.1 Central Financial Assistance under the New National Biogas and Organic Manure Programme, (NNBOMP) w.e.f. 01.04.2018 for the Medium Term Plan of 14th Finance Commission up to March, 2020 for Biogas Plant size from 1 cu.m. to 25 cu.m. per day.

SN	Particulars of Central Financial Assistance (CFA) and States / UTs, Regions & Categories of beneficiaries	Biogas Plants under NNBOMP (size 1 to 25 cubic metre biogas per day) (In Rupees per plant)				
A	Central Subsidy Rates Applicable (In Rs. per plant)	1 Cubic Metre	2-6 Cubic Metre	8-10 Cubic Metre	15 Cubic Metre	20 - 25 Cubic Metre
1	NER States, including Sikkim and including SC and ST Categories of NER.	17,000	22,000	24,000	25,000	35,000
2	Special Category States (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, and Andaman & Nicobar Islands) and Scheduled Castes / Scheduled Tribes of all other States.	10,000	13,000	18,000	21,000	28,000
3	All other States (General Category)	7,500	12,000	16,000	20,000	25,000
B	Additional Subsidy for cattle dung based biogas plants if linked with sanitary toilets, only for individual households (Rs. Per Biogas Plant) fixed amount.	1,600	1,600	1,600	Nil	Nil
C	Turn-Key Job Fee for construction, supervision, commissioning, and free O&M warranty for five years trouble free operations of plant including quality control at all levels.	Rs.2500/- per biogas plant for fixed dome design construction based plants such as Deenbandhu and floating gasholder KVIC type brick masonry models from 1 to 10 M ³ and Rs. 4500/- per plant for 15 to 25 M ³ plant size. Turn Key Job Fee will also be provided for eligible biogas plants for pre-fabricated plants as per above mentioned models involving part construction work either for digester or dome. Turn Key Job Fee at the flat rate of Rs. 1000/- per plant will be also eligible for biogas plants of size ranging from 1 to 25 M ³ which are completely pre-fabricated / manufactured biogas plants and made up of standard quality material FRP / HDPE / PVC etc. as already approved or as and when approved by MNRE. However, no Turn Key Job Fee will be payable for bag type digesters made of rubberized nylon fabric (flexi model) plants as it does not involve higher construction techniques and any supervision of construction. The manufacturers and developers of such biogas plants for implementation under this scheme will have to provide a free warranty and guarantee of five years for all plants for post installation trouble free operations under the terms and conditions of Turn –Key Job Work Scheme applicable including for all those who are implementing the scheme on bidding basis.				
D.	Administrative Charges– for physical target achievement range of biogas plants (Amount in Rs.)					
1	100-3,000 nos. of Biogas Plants	1,00,000^				
2	3,001-7,000 nos. of Biogas plants	10,50,000^^				
3	Above 7,000 nos. of Biogas plants	24,50,000 *				
E	Support for Training courses including skill development Programme for Biogas Mitras					
1	Users Course	4,000				



2	Staff Course	10,000
3	Construction-cum Maintenance / Refresher Course	50,000
4	Turn-key Workers & Management Course/ Skill Development for TKWs / RETs / SHGs/ Officials of SND and KVIC	75,000
F	Biogas Development & Training Centres. Financial support for set functions and roles of BDTCs would be provided towards staff, conducting training courses, skill development courses, pilot plant demonstration, TA/ DA, consumables and contingencies as per allocated targets.	As per the pattern of CFA and staff strength / positions conveyed vide Ministry's sanction letter No. 19- 3/2011-BE (Pt.) dated 16th November, 2011, dated 2nd March, 2012 and continued vide sanction No 19-4/2017-BG/ R&D/Biogas dated 14th July, 2017. The annual outlay allocated year-wise shall be based on the yearly Plan of work & targets as approved activities by the MNRE.
G	Support for Communication & Publicity as per the physical achievement range of Biogas Plants (Amount in Rs.)	The financial support would be provided on lump - sum basis which is linked with the physical achievements as per the range/slab of biogas plants achievements. The publicity and information charges would be limited to the actual expenditure claimed and supported by copies of vouchers which would be subject to the maximum limits as given below.
1	Up to 1,000 plants	Rs. 2,00,000/-
2	1,001- 10,000 plants	Rs. 4,00,000/-
3	More than 10,000 plants	Rs. 6,00,000/-
H	Incentive for saving fossil fuels (diesel, petrol, kerosene, electricity etc.) to farmers by using biogas in 100% Biogas engines.	Incentive is eligible for purchase of 100% biogas engines and transportation of biogas from the site of the biogas plant to the site of biogas engine. The fixed CFA of Rs. 3000/- per 100% Biogas based Generator set / Biogas engine water Pumping System (BPS) for water pumping and meeting other small farm power needs from biogas, subject to a maximum of Rs. 4000/- per plant for plants of 15 to 25 Cubic Metre would be provided. The annual target for this will be approved by the Ministry based on the proposals received from the States and targets allocated by the MNRE.

Additional incentive to PIAs for implementation of NBOMP , biogas plants size 1 to 25 M³ (under the component 2.2 D above)

^ Extra Rs.400 per plant in excess of 100 biogas plants installed.

^^ Extra Rs.350 per plant in excess of 3000 biogas plants.

* Extra Rs.300 per plant in excess of 7,000 biogas plants subject to maximum of Rs.60.00 lakh (Rupees Sixty Lakhs only).

6.2.4 ACHIEVEMENTS UNDER THE NATIONAL BIOGAS PROGRAMME

Progress under the New National Biogas and Organic Manure Programme (NNBOMP); the State/UT-wise estimated potential and cumulative achievements of family type biogas plants under the NBMP till 31st March, 2018 (2017-18) and targets 2018-19 and achievements during the period from 01.01.2018 to 31.03.2019 under the New National Biogas and Organic Manure Programme (NNBOMP) are given in the Table 6.2.

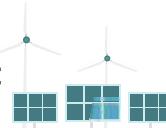


Table 6.2: State-wise estimated potential and State/ UT wise achievements for family / small biogas plants from 1981-82 to 2017-18 under the National Biogas and Manure Management Programme (NBMMMP) and targets 2018-19 and achievements under NNBOMP during the period from 01.01.2018 to 31.03.2019

State/ Union Territories	Estimated potential	Cumulative total achievement up to 31/03/2018 (2017-18)	Targets and achievements under national Biogas Programme (Nos. of Biogas Plants)	
			Target (2018-19)	Achievements from 01.01.2018 to 31.03.2019
1	2	3	4	5
Andhra Pradesh	1065000	553511	5000	3712
Arunachal Pradesh	7500	3552	400	39
Assam	307000	138423	7500	2165
Bihar	733000	129874	4500	0
Chhattisgarh	400000	56403	4000	3639
Goa	8000	4226	300	0
Gujarat	554000	434862	2600	865
Haryana	300000	62278	1700	272
Himachal Pradesh	125000	47645	900	12
Jammu & Kashmir	128000	3195	900	0
Jharkhand	100000	7796	2500	0
Karnataka	680000	497479	8900	9844
Kerala	150000	151397	3400	711
Madhya Pradesh	1491000	370957	7000	5117
Maharashtra	897000	909511	9500	13339
Manipur	38000	2128	400	0
Meghalaya	24000	10659	500	0
Mizoram	5000	5456	500	410
Nagaland	6700	7953	400	0
Odisha	605000	271605	4500	269
Punjab	411000	181993	5000	4058
Rajasthan	915000	71862	3700	394
Sikkim	7300	9044	300	0
Tamil Nadu	615000	223131	3100	65
Telangana	0	19644	2500	0
Tripura	28000	3643	500	20
Uttar Pradesh	1938000	440250	3550	237
Uttarakhand	83000	362915	2200	1357
West Bengal	695000	900	4000	0
A&N Islands	2200	97	0	0
Chandigarh	1400	169	200	0
Dadra & Nagar Haveli	2000	681	300	0
Daman and Diu			200	
Lakshadweep			300	
Delhi/ New Delhi	12900	578	600	0
Puducherry	4300	17541	150	0
KVIC	-		8000	3553
TOTAL :	12339300	5001358	100000	50078



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6.3 UNNAT CHULHA ABHIYAN PROGRAMME (UCAP)

- 6.3.1 The Ministry had been implementing a Programme named Unnat Chulha Abhiyan (UCA) to promote biomass Cookstoves. The UCA Programme was launched as central sector scheme in 2014 and continued during 12th plan period with the objective to provide a clean cooking energy solutions to household and community kitchen in rural areas where people are still dependent on solid biomass for meeting their cooking energy demand. Around 51641 Improved Biomass Cookstoves have been deployed under the UCA Programme, which includes 50,322 Family Type and 1319 Community Type.
- 6.3.2 To continue the programme/scheme further, the Ministry has commissioned a study to evaluate the previous scheme.

6.4 SOLAR COOKING

- 6.4.1 The Government has been conscious of the fact that the cooking in India is primarily through use of bio-mass or fossil fuel (through LPG). The burning of bio-mass for cooking purpose has health hazards for the user and has therefore been replaced with LPG cooking. Since LPG is imported to a large extent, a need has been felt to substitute bio-mass/LPG with clean energy for cooking. Solar energy is one such renewable source of energy that can ensure substitution of polluting biomass/imported LPG with cheaper and green source of energy. Accordingly, Ministry has taken an initiative to replace biomass/LPG with solar PV cooking system. So far following two pilot projects on solar PV cooking system have been completed:
- Providing solar cook stoves to 74 families of Bancha Village, Betul district of Madhya Pradesh.
 - Providing solar cook stoves to 99 families at Chouldari Tsunami shelters, South Andaman.
- Both these projects have provision of solar PV cooking system along with electric induction cook-stove and battery back-up for round the clock cooking facility to the household owner.
- 6.4.2 NISE, Gurugram is currently developing prototypes of two models of solar cookers with storage devices. The solar photovoltaic panel runs a DC heater and charge the thermal battery during day time. The thermal battery cum cook stove is placed inside the kitchen. The cook stove is covered with a lid when it is being charged and the lid can opened for doing cooking. Presently two such systems have been developed using different Phase Change Materials (PCM). The Solar chulha stores sun energy in heat form which provides cooking solution that works indoor, cooks all dishes for 24x365; provides convenience & conventional cooking experience.

6: RENEWABLE ENERGY FOR RURAL APPLICATIONS





7: RENEWABLE ENERGY FOR URBAN, INDUSTRIAL AND COMMERCIAL APPLICATIONS





RENEWABLE ENERGY FOR URBAN, INDUSTRIAL AND COMMERCIAL APPLICATIONS

7.1 The programmes being implemented during the year include: i) Energy Efficient Solar/Green Building Programme; ii) Waste to Energy and iii) Energy from Urban, Industrial and Agricultural Waste/Residues including Biomass Co-generation (non-bagasse) in Industry.

7.2 ENERGY EFFICIENT SOLAR/GREEN BUILDINGS PROGRAMME

7.2.1 Buildings are major consumers of energy in their construction, operation and maintenance. Globally, about 40% of energy consumption is estimated to be in building sector. At present, India is experiencing heavy construction activities in all spheres, thereby rapidly increasing the energy demand. This is also due to rapidly growing urbanization and the affordability of houses.

7.2.2 A green building minimizes the demand on fossil fuel based energy and maximizes the recycle, reuse, renewable energy and energy efficient devices & appliances. The need to reduce energy consumption and increase use of renewable energy in buildings has been an important objective of this Ministry. Consequently, energy conscious architecture has been promoted which includes the use of solar passive design concept, use of eco-friendly and less energy intensive building materials, integration of renewable energy and energy efficiency, water conservation, waste recycling, etc. This was the origin of the green building concept.

7.2.3 ACHIEVEMENTS AND PROGRESS

(i) The Ministry had been implementing a Scheme on ‘Energy Efficient Solar/Green Buildings’, since, February, 2009 which aims to promote the widespread construction of energy efficient solar/ green buildings in the country through a combination of financial and promotional incentives mainly for capacity building, awareness, seminar and workshops and other promotional activities, etc. Though, the scheme got over in March, 2017 with the end of 12th Plan period, the balance payments/settlements for already sanctioned projects have been taken up during the year.

(ii) Under the ‘Energy Efficient Solar/Green Buildings’ programme the following initiatives had been taken up to promote green building construction in the country.

- A GRIHA rating system has been developed by the Ministry in collaboration with The Energy and Resources Institute (TERI). An independent registered society ‘GRIHA Council’ is independently providing GRIHA Ratings.
- 97 building projects of Govt. with 3.05 million sq. m built-up area had been sanctioned for the exemption from the registration cum rating fees for acquiring GRIHA rating. So far, 11 buildings have been awarded GRIHA Ratings.
- Capacity building programmes including trainings, seminar, conferences, and workshops for Evaluators and Trainers on GRIHA Ratings and awareness programmes on Green Buildings, GRIHA Ratings and Green Architecture were organized across the country by various technical institutions.

7.2.4 DEVELOPMENT OF SOLAR CITIES PROGRAMME

(i) The ‘Development of Solar Cities’ programme aimed at minimum 10% reduction in projected demand of conventional energy at the end of five years, which can be achieved through a combination of



energy efficiency measures while enhancing supply from renewable energy sources. The Ministry assisted Municipal Corporations and Urban Local Bodies in preparation of a master plan for increasing energy efficiency and renewable energy supply in the city, setting-up institutional arrangements for the implementation of the Master Plan and awareness generation and capacity building activities.

- (ii) The Ministry had a target to support 60 cities/towns for Development as ‘Solar/ Green Cities’. Financial support of up to Rs.50 lakh for each city was to be provided for preparation of the Master Plan along with few DPR (up to Rs.10 lakh), oversight of its implementation (up to Rs.10 lakh), setting up and functioning of Solar City Cell in the city (up to Rs.10 lakh) and organizing promotional activities (up to Rs.20 lakh). So far, under the programme, ‘60’ cities have been approved/sanctioned, of which master plan of 50 cities have been prepared.
- (iii) As per programme, eight cities were being developed as ‘Model Solar Cities’ for which Bhubaneswar, Chandigarh, Gandhinagar, Mysore and Nagpur had been identified. The financial support upto Rs.9.50 crore was to be provided to each Model Solar City.
- (iv) Fifteen cities were being developed as ‘Pilot Solar Cities’ for which ‘13’ cities namely Agartala, Coimbatore, Rajkot, Shimla, Faridabad, Thane, Raipur, Shirdi, Leh, Aizawl, Puducherry, Vijayawada and Amritsar had been identified. The financial support upto Rs.2.50 crore was to be provided for each Pilot Solar City.
- (v) Though, the scheme got over in March, 2017 with the end of 12th Plan period, the balance payments/settlements for already sanctioned projects have been taken up during the year. So far, cumulative Rs.101.60 crore had been sanctioned and Rs.27.72 crore has been released under this programme.

7.2.5 GREEN CAMPUS

- (i) A Green Campus aims to reduce fossil fuel based consumption in next five years by 25% through renewable energy applications and energy efficiency measures. The financial support upto Rs.5.0 lakh was to be provided for developing a green campus in the educational Institutions, office complexes, residential and commercial complexes etc. Upto March, 2017, the Ministry had sanctioned financial assistance of Rs.2.60 crore @ Rs.5.00 lakh to 52 institutions (mainly technical/ educational institution) for preparation of Master Plan/ DPR for developing their campuses as green campus and an amount of Rs.1.30 crore is released to them till 31st March, 2019. So far, ‘25’ institutions have submitted Master Plans.

7.3 SCHEME TO SUPPORT BIOMASS BASED COGENERATION IN INDUSTRIES OTHER THAN SUGAR MILLS (UPTO MARCH 2020)

- 7.3.1 The industrial sector consumes approximately 35% of total electricity generated in the country. In the absence of quality and reliable power from the grid, the sector is increasing its own power generation capacity mainly through captive power plants based on fossil fuels such as coal, oil or natural gas. Several industries require electrical as well as thermal energy for their operations, which can either be met through different energy sources or through co-generation. The power and steam generated from such co-generation plants can be used for meeting the captive electrical requirements and the surplus power produced can be exported to the grid. Such projects are being set up in a number of industries like distilleries, paper and pulp, solvent extraction, rice mills, textiles, pharmaceuticals, etc.
- 7.3.2 A new scheme to support biomass based co-generation in industries other than sugar mills (effective up to March 2020) has been notified on 11.05.2018 for exploiting the vast potential of biomass power in the form of thermal energy and power for captive use in industry with the following major objectives:



- i. To promote setting up of projects for recovery of energy from urban, industrial and agricultural wastes/residues; and
- ii. To create conducive conditions and environment, with fiscal and financial regime, to develop, demonstrate and disseminate information on recovery of energy from wastes and residues.

7.3.3 Under the scheme a central financial assistance (CFA) @ Rs.25 lakh per MW on exportable power will be provided to bagasse based co-generation plants at sugar mills. Similarly for non-bagasse based co-generation plants at industries other than sugar mills CFA @ Rs.50 lakh per MW on installed capacity will be provided. CFA in both cases will be on reimbursement basis. Availing loan from any financial institution is mandatory for promoters to avail CFA.

7.3.4 Achievements

A cumulative capacity of 675 MW has been commissioned so far mainly in the states of Tamil Nadu, Uttar Pradesh, Haryana, Karnataka, Andhra Pradesh, Uttarakhand, Punjab and Rajasthan.

8: RESEARCH, DEVELOPMENT AND DEMONSTRATION (RD&D) IN NEW AND RENEWABLE ENERGY





RESEARCH, DEVELOPMENT AND DEMONSTRATION (RD&D) IN NEW AND RENEWABLE ENERGY

- 8.1 Research, design, development and technology demonstration for its validation are one of the core requirements for the growth of New & Renewable Energy. Ministry of New & Renewable Energy (MNRE) supports Research, Development and Demonstration (RD&D) to develop new and renewable energy technologies, processes, materials, components, sub-systems, products & services, standards and resource assessment so as to indigenously manufacture new and renewable energy systems and devices. The objective of the programme is to make the industry globally competitive and renewable energy generation and supply, self-sustainable/profitable and thereby contribute to increased share in total energy mix in the country.
- 8.2 RD&D Projects received from R&D institutions /universities, industries and NGOs, etc., in the field of solar, wind, solar-wind hybrid, storage, small hydro power, biogas, hydrogen and fuel cells, geothermal, etc., are considered by the Ministry for financial support.

8.3 POLICY AND GUIDELINES

- (i) A comprehensive policy framework on RD&D is in place to support RD&D in new and renewable energy sector, including associating and supporting RD&D earned out by industry for market development. Ministry provides up to 100% financial support to Government/non-profit research organizations/NGOs and up to 50% to industry.
- (ii) The policy framework provides guidelines for project identification, formulation, monitoring, its appraisal, approval and financial support. The RD&D projects received from R&D/academic institutions, industries, etc., are evaluated through subject experts. The qualifying projects are appraised by R&D Project Appraisal Committees. The projects recommended by the committees are sanctioned to prospective implementing agencies. The projects are monitored by Monitoring Committees. Projects on completion are reviewed in Project Appraisal Committee Meetings for their achievements.

8.4 RD&D FOCUS

The focus of Ministry's support to research efforts continued, with emphasis on cost reduction, reliability and efficiency improvement of renewable energy systems, components and BOS. Projects, in accordance with the R&D thrust areas of the ministry, in solar thermal, SPV, biogas, wind, wind-hybrid, storage, small hydro power, hydrogen and fuel cells, geothermal, etc., are supported for Research, Development & Demonstration. The projects in other areas not covered under the R&D thrust areas are also considered for financial support based on their applications and practical importance.

8.5 INSTITUTIONAL MECHANISM

The Ministry is supporting creation of enabling conditions for institutional mechanisms to enhance collaboration for faster development and demonstration of technology for commercialization. The Ministry has taken initiatives for strengthening its institutions, namely, National Institute of Solar Energy (NISE), Gurugram, National Institute of Bio-Energy (NIBE), Kapurthala and National Institute of Wind Energy (NIWE), Chennai with their functions for pursuing RD&D, testing, standardization and certification in solar, bioenergy and wind energy systems, respectively. In addition, the MNRE is also partnering with MHRD for implementation of research projects in NRE under IMPRINT and UAY initiatives. These initiatives envisage supporting projects in consortia including industry for technology development on cost sharing basis by partner ministries/departments/industries.



8.6 SOLAR R&D

The details of activities being carried under Solar R&D (SPV) are given below:-

8.6.1 Solar Photovoltaics

(i) The Ministry's flagship project in solar photovoltaics being implemented at IIT Bombay and christened National Centre for Photovoltaic Research and Education (NCPRE) Phase II, had several major areas. The progress made in each of these areas is briefly described below.

(a) **Education and Training:** A one day workshop on 'Power Electronics Challenges for Solar Industry in India' was organized on 6th July 2018 at IIT Bombay. The main objective of the workshop was to explore the main challenges faced by the Indian Solar industry, electronics Industry and brainstorm so as to decide on the path forward. Eminent speakers from both academia and industry gave lectures on a variety of topics related to application of power electronics in PV. **Fig. 1a** depicts a session in progress.

In addition, three familiarization workshops were held under a project called Photovoltaic Users Mentorship Programme in India (PUMP-In) that was proposed to MNRE earlier but was being implemented under NCPRE Phase II. The objective of the project was to extend the reach of Photovoltaic by training researchers from different institutions in India. A photograph of the participants in one such workshop has been presented in **Fig. 1b**.



Fig. 1a One day workshop on "Power Electronics Challenges for Solar Industry in India" organized by IIT Bombay



Fig. 1b Participants at a workshop under Photovoltaic Users Mentorship Programme in India (PUMP-In) organized at IIT Mumbai



- (b) **Crystalline Si Solar Cells:** Standard Al:BSF Solar cells with champion cell efficiency of 19.23 % were made on 6 in x 6 in, pseudo-square, mono Si wafers by carrying out all the processes at NCPRE but for the screen printing and contact firing steps which were done at Mundra Solar. Also, made over 18 % efficient, 6 in x 6 in mc-Si solar cells employing the texturisation process developed at NCPRE for diamond wire sawn (DWS) wafers and the rest of the processes at three different cell manufacturers. For PERC cell process, a spray technique was developed for the Al_2O_3 layer on the back side of solar cells. A 12.9 % efficient, 1 sq. cm, Carrier Selective Contact solar cell was developed employing a MoO_3 / n-Si(Fz) structure.
- (c) **Thin Film Materials and Devices:** Small area, single junction, perovskite solar cells having an efficiency of 7.6 % was fabricated with an aim to further improve and apply it on a Perovskite/Si tandem junction solar cell.
- (d) **Energy Storage:** The design of Li-ion pouch cell was modified in order to improve the stability and more than 100 such cells were made with a capacity of 0.5 Ah. Design optimization employing NMC-graphite chemistry further led to stable pouch cells with a capacity of 1.3-1.2 Ah (**Fig. 1c**).
- (e) **Power Electronics:** As an advancement on 300 VA inverter developed in NCPRE Phase 1 project, design parameters have been finalized, and five prototype inverters in each of 500 VA (stand-alone) and 1 kVA (grid connected) categories are being assembled for field testing (**Fig. 1d**). Also, the first prototype for 3HP BLDC motor with the surface pump assembly is manufactured (**Fig. 1e**). Sensor-less control algorithm for this motor is simulated in MATLAB and control PCB for the same is designed in DIPTRACE.

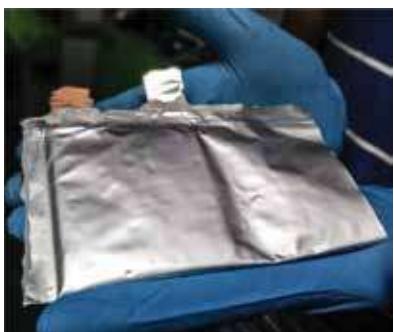


Fig. 1c Li-ion pouch cell developed by IIT Mumbai

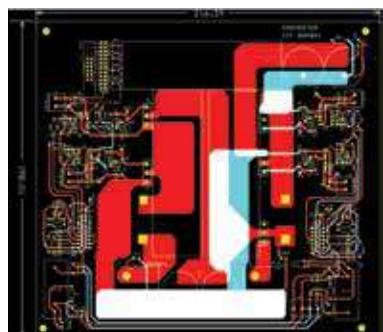


Fig. 1d 1 kVA (grid connected) photo type Inverter



Fig. 1e 3HP BLDC motor with the surface pump assembly

- (f) **Module Reliability:** All India Survey 2018 launched in March 2018 with many advanced features such as increased number of multi-megawatt sites, drone based survey in some of these, more effective, on-site EL imaging of modules, bringing back faulty modules back to IITB for root cause failure analysis etc. A dynamic load test facility (**Fig. 1g**) with in-situ EL imaging (**Fig. 1f**) has been developed to reduce incidences of cell cracking during transportation of modules. In addition, an LED based UV light chamber has been developed for subjecting module coupons to test and assess their quality.



Fig. 1f In-situ EL imaging

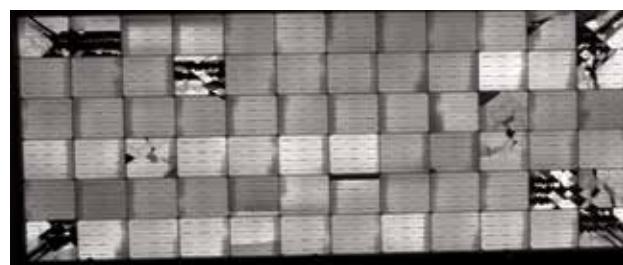


Fig. 1g Dynamic Load Test Facility



- (ii) The MNRE sponsored project on perovskite based thin film solar cells being implemented at IIT Bombay has focussed on low temperature process, stability issues, device fabrication on flexible substrates and larger devices. The perovskite cell on PET substrate showed 18 % efficiency and sustained 1000 bending cycles. The cell with encapsulation of Atomic layer deposited (ALD) Al_2O_3 showed stability over 4500 hours (**Fig. 2a**). Encapsulated cells showed good stability when tested in ambient conditions under continuous illumination with intermediate periods of recovery. Larger cells (1.2 sq. cm) have shown upto 11 % efficiency.

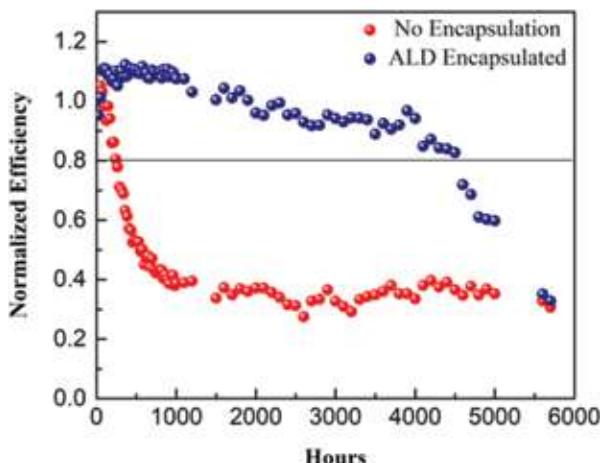


Fig. 2a

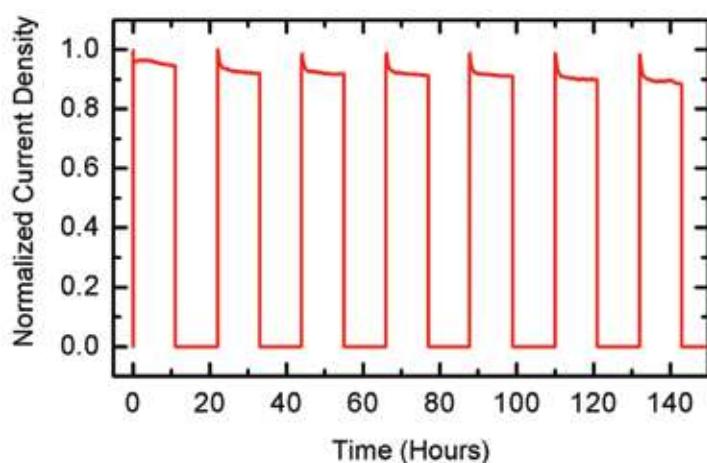


Fig. 2b

- (iii) MNRE has also sponsored research in the area of growth of silicon material (ingots and wafers) in a project under implementation at the SSN College of Engineering in Tamil Nadu. The directional solidification (DS) facility, created with indigenous efforts, has been successfully employed for growing multi-crystalline silicon ingots (**Fig. 3a**) which have been cut into bricks (**Fig. 3b**) and sawn into mc-Si wafers (**Fig. 3c**). These wafers have been characterized at the facilities in BHEL, Gurugram, mc-Si wafers NPL, Delhi, NCPRE, Mumbai and IEST, Shibpur in respect of the minority carrier life time (MLT). The data obtained from measurement at all the laboratories show MLT ranging from 6 to 21 microseconds depending upon the surface preparation that the wafers have been subjected to and indicate good quality of the Si material grown. Efforts are now underway to convert the wafers into mc-Si solar cells. A large number of journal and conference papers have also resulted out of the work carried out in the project.



Fig. 3a multi-crystalline silicon ingots

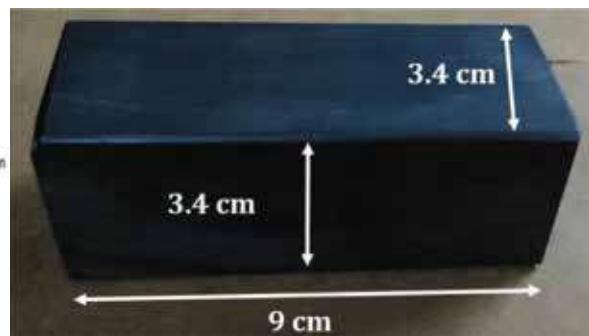


Fig. 3b multi-crystalline silicon bricks



Fig. 3c mc-Si wafers

- (iv) In the on-going project on development of high efficiency solar cells using n-type Si wafers at the Meghnad Saha Institute of Technology (MSIT), Kolkata, base line solar cells have been fabricated on small



(76 mm x 76 mm), n-type mono-Si wafers with champion efficiency of 16.8 %. The fabrication process entailed texturing of diamond-cut Si wafers (**Fig. 4a**), Boron diffusion, atomic layer deposition (ALD) of Al_2O_3 , silicon nitride anti-reflection coating (ARC), back passivation with hafnium oxide (HfO_2) and screen printed and fired Ag contacts. The I-V plot of the champion cell is shown in **Fig. 4b**. Further optimization of the process incorporating selective emitter and/or rear passivation is being attempted in conjunction with extensive simulation using SILVACO software programme.

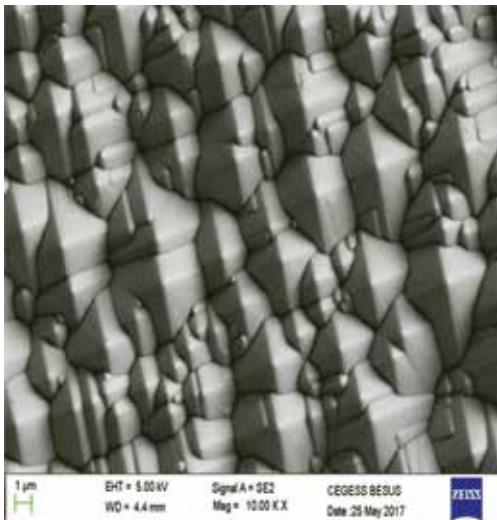


Fig. 4a

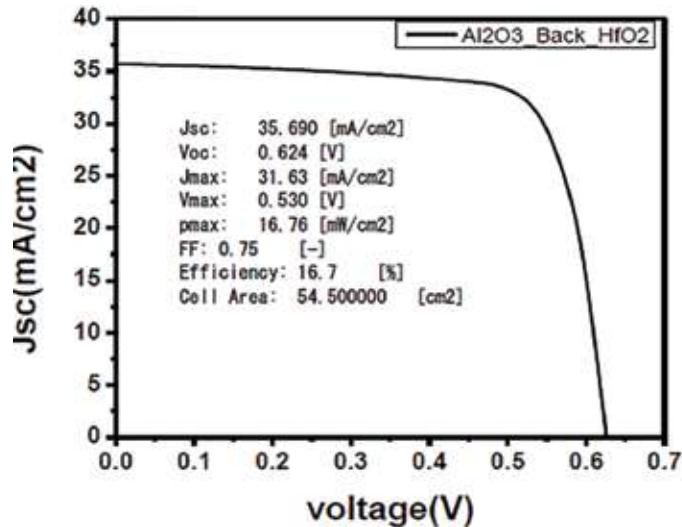


Fig. 4b

- (v) In a project aimed at providing drinking water to the masses, NISE has combined with Surya Eneretc, a Gurugram-based private company in developing Solar-powered Clean Drinking Water Systems suitable for various locations in the country. The first system (500 LPH, AC pump) installed at the NISE campus has been functioning satisfactorily for the past 18 months and has provided pure drinking water for the employees of NISE and ISA and resulted in a saving of Rs.7 lakh per year. The second prototype (fully DC, low power consumption, 100 LPH) has also been installed at Aditya Bhavan of NISE in June 2018 (**Fig. 5a**).

The prototype numbers 3 and 4 are ready for installation and sites have been identified for these machines. In-house controller and IoT system for these systems have also been designed, fabricated and installed in the prototype machines. Cloud based monitoring and control has been designed for these and is undergoing testing.

- (vi) MNRE has also sponsored two major projects on solar photovoltaics, the first one on development of high efficiency PERC solar cells and the second one on setting up a facility for primary standard for solar cells. Both are important from the point of view of achieving self-reliance in solar photovoltaics in the country. The PERC cell project is being implemented jointly by BHEL-ASSCP and NISE and the facility for primary reference is coming up at NPL, Delhi. In the PERC cell project, BHEL has the responsibility of cell processing while NISE has the responsibility of device simulation as well as complete characterization of solar cells. The process and the test equipment



Fig. 5a second prototype (fully DC, low power consumption, 100 LPH) at Aditya Bhavan, NISE



has been identified, the specification finalized and is under procurement. The primary reference facility is being built at PTB, Germany and when installed would provide a clear platform in the country for independent and accurate assessment of the performance of solar cells and modules.

(vii) Apart from this, MNRE sponsored R&D projects also include inverter and other BOS development projects at Vignan Institute of Technology and Science (VITS), Hyderabad, ERDA, Ahmedabad, and BITS, Pilani, etc.

8.6.2 Solar Thermal

8.6.2.1 The details of activities being carried under Solar Thermal (ST) are given below:-

(i) 1 MWe (3.5 MWth) solar thermal power plant with 16 hours thermal storage for continuous operation based on parabolic dish solar concentrators designed and fabricated indigenously, at an estimated solar to electricity efficiency of about 16-18 %. The configuration of the power plant will include 770 solar dishes having a provision of thermal storage and each having 60 m² area.

Estimated output of the power plant:

- i) 1 MW x 8 hours;
- ii) 0.8 MW x 16 hours;
- iii) cogeneration of 1 million litres of hot water per day;
- iv) 8 tonnes of steam for 24 hours a day.

The following milestones are achieved:

- Completed design, fabrication, painting, installation and commissioning of 770 nos. of 60 m² parabolic reflectors on concrete foundations with precise alignment as per the requirement.
- Completed design, development, detail engineering, Installation and commissioning of 770 nos. of static cavity Receivers for thermal storage on site.
- Completed Installation and commissioning of Turbine and Generator system inside Turbine Building.
- Completed Installation, execution and commissioning of Power evacuation system and power distribution system.
- Completed installation, commissioning of cooling tower with accessories.
- Completed installation and commissioning of Condenser system with successful running.
- Completed Installation and commissioning of 120 kVA Photovoltaic system with complete battery bank with full load capacity for parasitic load of the solar power plant.



1 MWe (3.5 MWth) solar thermal power plant with 16 hours thermal storage (770 solar dishes) at Mount Abu, Rajasthan



- (ii) The dessicant and ejector based cooling system using R-134a as refrigerant with solar thermal heat input, convectional condenser and evaporator works at pressure of 7-12 bar and 3-4 bar respectively for an environmental friendly air conditioning system has been developed at Maharashtra Institute of Technology, Pune as shown in fig. It is only required to design ejector and generator for higher pressure additionally. Experimental investigation of the system has been carried out to find out Coefficient of Performance, cooling load response to entrainment ratio, solar thermal source and sink temperature parameters.



Experimental set up of desiccant and ejector based environmental friendly Air conditioning system at Maharashtra Institute of Technology, Pune

- (iii) The Ministry has sanctioned a R&D Project entitled 'Development of a monitoring system for the energy reception elements in Solar Thermal Plants' to TERI New Delhi in collaboration with Spain. The project is to develop a reliable, low cost tool that gives a precise and direct evaluation of the optical efficiency of each solar collector element including identification of the cause of the error. The TERI has proposed to use LiDAR (Light Detection and Ranging) for measuring the misalignment of absorber tube of PTC. The use of this technique will be the first of its kind and entirely unique for measuring the geometric misalignments of PTC.

- (iv) Indian Institute of Science (IISc), Bangalore, has developed its first prototype of pressurized air solar receiver, as part of the project titled 'Development of High Efficiency Receiver for Supercritical CO₂ Integrated with Static Focus Parabolic Dish'. This hybrid volumetric and cavity type receiver design consists of open-end dome-end cylindrical cavity surrounded by concentric annular porous medium, as shown in the figure below. Receiver design provides flexibility for testing of different materials – steel mesh, ceramic honeycomb and foams. The receiver has been tested with a Scheffler dish concentrator having a fixed focus. The solar simulator facility under this project is being designed, built and characterized by IISc Bangalore in collaboration with 3EN CleanTech Pvt. Ltd., Dharwad, Karnataka.



Installation of cast Iron receiver with piping and Insulation

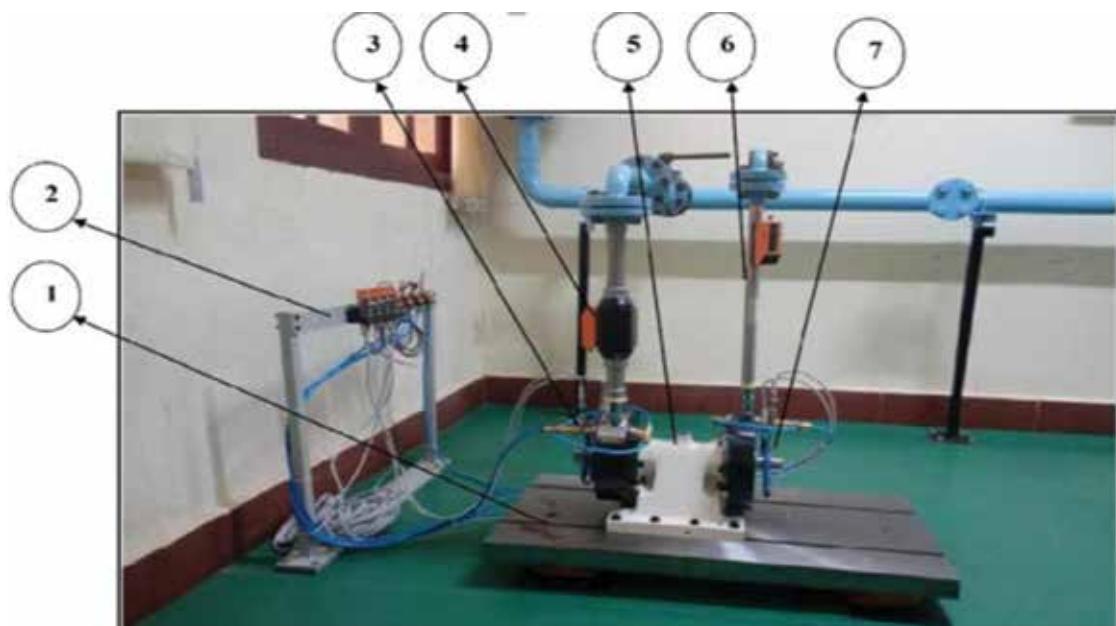
Casting of the Cast Iron conical cavity receivers (each receiver shall have thermal capacity of 130 kWh per day) is completed.



- (v) The MNRE has also sponsored a project 'Development of Supercritical CO₂ Turbomachinery for Solar Thermal Power Plants' to IISc Bangalore. The main objective of the project is (a) to conceive turbomachinery of different design configurations suitable for testing and analysis on the existing test loop at IISc. The first configuration would be a decoupled pump (turbine driven) and power generator involving design of two turbines and a pump, while the second configuration will be an integrated turbine, generator and pump (b) to select, size and develop mechanical system comprising of critical components like shaft seals and bearings of small sizes and for high speed operation. The seal in particular will have to deal with fluid pressures exceeding over 140 bar and temperatures above 500°C (c) to use the laboratory investigations and develop a completely new design of the turbomachinery power block for a scaled up capacity of 500 kW to 1 MW first to be retrofitted into existing CSP steam power plants having temperatures below 500°C and second to target higher turbine inlet temperatures of 700°C. An aeroloop control panel has been developed which controls the speed of the rotor and the highest of 70000 rpm was achieved. The close loop CO₂ cycle based plexy glass model has been developed.



Plexi-glass model for display



Aeroloop control panel assembly with instrumentation (1: baseplate, 2: instrument mounting, 3: turbine inlet temp/pressure, 4: turbine flow meter, 5: spindle housing, 6: Compressor flow meter, and 7: compressor inlet)



Fig. Aeroloop Control Panel

- (vi) A project entitled ‘Setting up facility for calibration of solar radiation measuring sensors and its analysis/modelling based on ground surface measurements.’ was sanctioned to NISE, Gurugram. Calibration Laboratory facility is completely functional and located at Surya Bhawan NISE. Since commissioning till March 2018, calibration of 23 SRRA stations equivalent to 69 solar radiometers has been achieved at laboratory facility. In continuation from April 2018 further calibration of sensors from 6 SRRA stations equivalent to 18 sensors has been completed. Analysis of calibration results undertaken for higher amount of ageing observed in sensors which causes degradation in quality of measured solar radiation data.

The commercial calibration mode program initiated in 2017 at NISE to extend the calibration services to any Organization /Institute in the country at applicable calibration charges. Total 21 Pyranometer were calibrated at facility under commercial program.



Calibration laboratory at NISE Surya Bhawan



Round robin testing of Primary Standard Reference sensor from Calibration laboratory at NISE, NIWE & IMD Pune March 2018.

- (vii) Central Tasar Research & Training Institute (C.T.R & T.I) Ranchi, Jharkhand has taken a lead in ‘Utilization of solar energy in Tasar post cocoon technology operations’. Solar energy can prove to be a cheap, localized source of energy for various stages of the Tasar silk industry, which has an agriculture base and is labour intensive in India. At C.T.R & T.I, Ranchi, a 10 kWp roof top hybrid solar power plant has been installed and a Hot air dryer for stifling & drying of Tasar cocoon is being operated by solar power. The testing was conducted for running of five reeling and spinning machines each with total capacity of 2 kW, as well as hot air dryer (for cocoon drying) with capacity of 3 kW for which no difficulties were observed. Thus total savings of 5 kW is possible by utilization of solar energy in existing post cocoon technology operation per day.

8.6.3 Solar Radiation Resource Assessment (SRRA) Stations

- (i) In order to strengthen the solar resource assessment and to meet the requirement of availability of Solar Radiation data, in Phase- I program, 51 SRRA stations and in Phase- II, 60 SRRA stations and 4 Advanced Measurement Stations were installed at selected locations spread all over the country. This exercise was coordinated by National Institute of Wind Energy (NIWE), Chennai an autonomous institution of the Ministry. A central server facility for data collection from all these stations has been set up at NIWE. The data so collected was used in developing a solar atlas for the country. NIWE has launched a Solar Atlas of India for firming of solar potential of the country. In addition, all the solar power projects selected under the Mission have also set up radiation monitoring equipment at their project sites.

8.7 SMALL HYDRO POWER

- 8.7.1 The Ministry has supported two R&D Projects which are ongoing in IIT Roorkee in the area of Hydro power. One of the R&D project is on ‘Development of laboratory for sediment monitoring and impact analysis studies in Hydro Power plant’ and the other project is on ‘Development of Efficient Cross Flow Turbine for Hilly Region’. Briefs of both the R&D projects are given below:



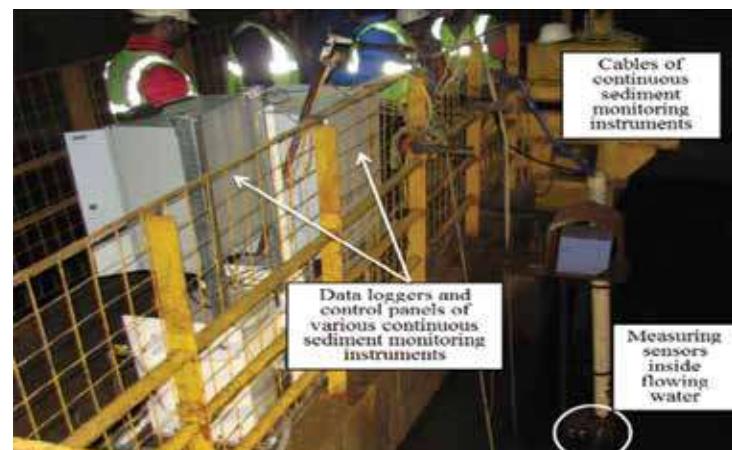
8.7.2 Sediment monitoring and Abrasion Testing Laboratory

(i) Hydro-abrasive erosion of hydro-turbine components through sediment-laden river water is one of the most challenging problems in the Himalayan region. To study and mitigate the hydro-abrasive issues in Himalayan region, a laboratory with state of the art instrumentation was established at AHEC, IIT Roorkee with support from the Ministry. The laboratory was inaugurated by Hon'ble Union Minister of State for Power and New and Renewable Energy, Mr. R.K. Singh, on April 10, 2018.



Inauguration of Sediment Monitoring and Abrasion Testing Laboratory – AHEC, IIT Roorkee by Hon'ble Union Minister of State for Power and New and Renewable Energy, Mr. R.K. Singh

(ii) The laboratory is equipped with facilities to study suspended sediment flow and its impact on hydropower components such as turbines, penstock, etc. The laboratory is being developed as a sediment depository for the Himalayan region and work as a knowledge centre to educate and train personnel to handle erosion issues effectively. The development of the laboratory has facilitated design and improvement of sediment settling basins, study of sediment flow dynamics, validation and development of hydro-abrasive erosion models as well as designing turbine blades and other components for less erosion.



Continuous sediment monitoring instruments installed at downstream side of desilting chamber of a hydropower plant

8.7.3 Development of Efficient Cross Flow Turbine for Hilly Region

(i) MNRE, has facilitated the development of micro hydro power plant up to 5.0 kW under water mill program, for electricity generation in remote locations. In order to tap these micro hydro power potential sites, conventional hydro turbines are not economical due to their high manufacturing and maintenance cost. Therefore, various locally fabricated turbines are preferred over conventional turbines. Among them, the cross-flow turbine has been considered techno-economically solution to harness the energy form such sites.

(ii) Cross flow turbine is very simple in design and suitable for low discharge, high head conditions. These conditions can easily be met in hilly regions. However, this turbine suffers the problem of poor efficiency. The runner of this turbine consists of two parallel discs connected with curved vanes or blades. As the water enters in runner having kinetic energy from a nozzle, it imparts 2/3rd part of its energy to the first stage of blades and passes through the open space between the two stages of blades or in the inner open cylindrical space. Water enters in the second stage of rotor blades and shares the remaining 1/3rd part of energy to the vanes or blades of turbine runner. It has been observed that the turbine experiences poor efficiency due to lack of guidance inside the open space of runner or when the water travels from first



stage to the second stage. Considering these aspects, MNRE has sponsored a research project to AHEC IIT Roorkee to carry out a study to improve the efficiency of cross-flow turbine by providing a guiding mechanism inside the turbine runner.

- (iii) Two different (symmetrical and un-symmetrical) types of airfoils (vanes) were employed inside the turbine runner as the guide mechanism for water. Numerical (CFD) simulations were carried out to compare the performance of cross-flow turbine without guide vane with the turbine having airfoils (symmetrical and un-symmetrical) as the guide vanes. The numerical results were validated with the experimentation performed in the Hydraulic Measurement Laboratory, Alternate Hydro Energy Centre (AHEC), IIT Roorkee.
- (iv) In order to deploy the modified cross-flow turbine, a potential site having a capacity of 5.0 kW, has been developed at Mandal village on Balkhila River in Chamoli district of Uttarakhand state. The modified turbine has been deployed and working satisfactorily under existing site conditions.



5.0 kW Modified Cross flow Turbine installed at Mandal village, Chamoli district, Uttarakhand

8.8 BIOGAS RESEARCH, DESIGN AND DEVELOPMENT

- 8.8.1 RD&D project on Biogas sector continued during the year. Work on the following projects was continued during the year:-
- (i) **'Development & Performance evaluation of a 3 KW biogas based power generation system utilizing Lignocellular Biomass'**, at IIT-Guwahati. Under this project, a 5 HP gasoline engine's operating parameters have been optimized for modifying the gasoline SI engine into 100% biogas fuelled SI engine. 16 m³ of biogas produced per day from lignocellulosic feed stock materials mainly cow dung, rice straw, duck weed and switch grass and a 3 kWe biogas power generation unit integrated with solar assistance backup system has been successfully installed and maintained by IIT Guwahati at Auaniati Satara, North Guwahati, Assam under this project. A center for demonstrating the potential of power generation by using raw biogas have been successfully established and this is becoming a training and knowledge center for local entrepreneurs and dairy farms to gather technical information for generating Off-grid power. All the objectives of the assigned project have been achieved. So far a total of Rs.22,29,000 /- out of total sanctioned amount of Rs.29,27,400 /- has been released for this project.



- (ii) **'Development of Hybrid-High rate bio-methanation reactor using locally available media for treating waste water and solid waste'** at Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) is going on and to be completed soon. Under this project, three lab scale hybrid reactors fabricated with acrylic sheet one of which served as control and the other two reactors with different packed media. The stability of the reactors attained with an effluent pH of 7 to 7.5 and the biogas production observed was 250-300 ml in each reactor. The performance evaluation of high rate reactor and hybrid high rate reactor with community wastewater was completed and Hydraulic Retention Time (HRT) was optimized. Total funds released so far: Rs.44,00,000/- out of total sanctioned amount of Rs.59,32,500/-.
- (iii) **Biogas upgradation:** The study was undertaken for upgrading the biogas produced from waste water of TNAU hostel premises. The maximum Methane content of 96.8% has been obtained in 2 metre scrubbing column with molecular sieve (100 %) material in the pressure of 7 bar. It has been concluded that molecular sieve is the best material for Biogas purification and height of the scrubbing column should not be less than 2 metre. The optimum pressure for getting maximum methane is 7 bar.
- (iv) In order to provide a sustainable solution for avoidance of in-field burning of paddy straw stubble in northern Indian states, a research project was awarded by MNRE entitled '**Development of suitable pre-treatment system for paddy straw disintegration for biogas generation leading towards commercialization of technology**' to the Indian Institute of Technology, Delhi. In the project a laboratory scale hydrothermal reactor was developed for pre-treatment of paddy straw at different temperatures and reactor loading rates. Further, a field scale hydrothermal reactor having 50 L capacity was fabricated for performing field scale experiment for performance evaluation of the model. Total funds released so far: Rs.25,00,000/- out of total sanctioned amount of Rs.49,77,440/-.



High rate reactors and Hybrid high rate reactors with steel GLS installed at TNAU ladies hostel



High rate reactors and Hybrid high rate reactors with masonry structure installed at TNAU boys hostel



Biogas production on hydrothermally pre-treated paddy straw in 300 L daily feed anaerobic digesters at IIT, Delhi



50 L capacity field scale hydrothermal reactor at IIT, Delhi



Commercial SI engine setup (Honda GX 200) –turned into biogas fueled SI engine at IIT Guwahati



Biogas generator and data monitoring system at IIT Guwahati

8.9 HYDROGEN ENERGY AND FUEL CELLS

- 8.9.1 The Ministry has been supporting a broad based Research, Development and Demonstration (RD&D) Programme on different aspects of hydrogen energy technologies that includes production of hydrogen, its storage and utilisation for stationary, motive and portable power generation applications using internal combustion engine and fuel cells and also for other applications. As on 31.3.2019, a total of 13 RD&D projects on different aspects of hydrogen energy and fuel cells are under implementation.
- 8.9.2 On-going projects include Hydrogen Production facilities through biomass gasification at IISc Bangalore. ‘Mission Mode Project on Hydrogen Storage materials (solid hydrides)’ by Banaras Hindu University; and ‘Development of hydrogen refuelling facility for demonstration of fuel cell vehicles’ by Indian Oil Corporation, Faridabad completed during this year. Three new projects were sanctioned during the year, these include ‘Studies on novel semiconductors towards increasing the efficiency of Photo-electrochemical (PEC) water splitting for hydrogen generation’ to Dayalbagh Educational Institute; ‘Design and development of 20kW Low Temperature Polymer Electrolyte Membrane (LT-PEM) fuel cell with high indigenous content’ to Centre for Fuel Cell Technology, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI-CFCT); and ‘Setting Up of a Centre of Excellence on Hydrogen Energy at National Institute of Solar Energy (NISE), Gwal Pahari, Haryana’ to NISE.
- 8.9.3 ARCI-CFCT, Chennai conducted a one-day workshop on ‘Empowering next generation power systems with hydrogen in India’ on the occasion of ‘National Hydrogen and Fuel Cell day’ October 8th, 2018. The workshop saw participation from industry, academia, research institutions and students working in Hydrogen and Fuel Cells, the discussions advanced ideas for pertinent areas of research, development and deployment in India.

8.10 WIND R & D

- 8.10.1 The following two R & D projects were sanctioned to National Institute of Wind Energy, Chennai during the FY 2018-19.



1. Integrated Wind and Solar Resource Assessment through Mapping and Measurements.
2. Met-Ocean measurements (Wave, tide, Current, water lever, etc) at Gulf of Khambhat and Gulf of Mannar for fostering the growth of offshore wind in the country.

8.11 Quality Control in Renewable Energy Sector

8.11.1 Policy for Testing, Standardization and Certification

As a follow up to the ‘National Policy for Testing, Standardization and Certification for Renewable Energy Sector’ for quality control of the renewable energy systems/components, that was notified by MNRE on 7th December 2017, the Ministry initiated interactions with experts from R&D institutions, test labs, industry for strengthening test labs for updating/developing standards and testing for quality control in renewable energy. Active interaction was made with Bureau of Indian Standards (BIS) through various committees for updating/developing standards matching Indian climatic conditions. A Standard, Testing and Quality Control Committee(STQCC) was constituted with Secretary, MNRE as the chairman to review and oversee the implementation of Quality Control in renewable energy in the country.

8.11.2 Quality Control of SPV Systems/Components

- (i) As follow up to the technical regulation for Quality Control of SPV Systems, Components and Devices (Requirement for Compulsory Registration under BIS Act) Order 2017 which was notified by MNRE vide Government of India Gazette Notification No. 2561 dated 5th September 2017, active interaction was made with BIS, industry and test labs for preparing for implementation of the said quality control order. The said order which includes SPV Modules, Inverters and battery storage was to come into force on expiry of one year from the date of its publication in the Official Gazette. However, the implementation was advanced to 16.04.2018 in order to ensure quality of the products in SPV power projects during the current year. All products listed in the order should conform to specified Indian Standards, and products qualifying the standards have to be registered with BIS by the respective manufacturers. It involves guidelines for series approval of samples for testing by test labs for granting registration as the products have different sizes, ratings, varieties, etc. Field surveillance of products will be done to ensure the quality of products in field as per performance certification done by test labs.
- (ii) In the case of SPV modules, considering that 3-4 months period required for completing performance testing and issuing the performance reports and the test labs were in the process of fulfilling BIS recognition, a provision for self-certification of quality of products as per specified standards by manufacturers was made. The implementation of the schedule for all the six products listed in the order was, in consultation with BIS and related stakeholders the extension was, revised time to time to avoid disruption in the supply chain, the final extension being till 31.03.2019. The domestic module manufacturers whose annual module production capacity is less than 50MW are exempted for BIS certification for two years till 4.09.2020 provided they have a valid IEC Certificate (either 2005 or 2016) for which IEC Certificate is valid, whichever is earlier, and that the IEC certificate has been obtained before 16.04.2018. The self-certification relaxation for SPV Modules was applicable up to 31st March 2019.
- (iii) The preparedness of test labs was reviewed periodically under the chairmanship of Secretary, MNRE for fulfilling the requirements of performance testing of identified products. As a result, three test labs for SPV Module Testing, two test labs for inverter testing and three test labs for storage battery testing got prepared for the purpose, who got recognized by BIS in 2018. Subsequently, guidelines for series approval of SPV Modules for testing in test labs were notified on 9th July 2018. The guidelines were monitored for improvement in implementation. Revised series guidelines for SPV Modules were developed in consultation with test labs, industry and BIS and the same notified on 16th April 2019 for implementation.



Active interaction was initiated with test labs and industry for developing series guidelines for battery storage and inverters. A ‘Brainstorming Consultations Meeting’ was held on 20th December 2018 in MNRE for discussion on inverter testing and for preparing series guidelines for inverters. Around 50 inverter industries and test labs participated in the meeting. After extensive consultations and discussion, the draft series guidelines for battery storage and SPV inverters are under finalization.

8.11.3 Test labs recognized by BIS for Quality Control

Sl. No.	Product	Indian Standard Number	Title of India Standard	Test Labs Recognized by BIS
1.	Crystalline Silicon Terrestrial Photovoltaic (PV) Modules (Si Wafer based)	IS-14286	Crystalline Silicon Terrestrial Photovoltaic (PV) Modules - Design Qualification and type Approval	1. Hi Physix Laboratory India Pvt. Ltd., Pune 2. UL India Pvt. Ltd., Bangalore 3. TUV Rheinland, Bangalore
2.	Thin-Film Terrestrial Photovoltaic (PV) Modules (a-Si, CIGs and CdTe)	IS-16077	Thin-Film Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval	1. Hi Physix Laboratory India Pvt. Ltd., Pune 2. UL India Pvt. Ltd., Bangalore
3.	PV Module (Si Wafer and Thin Film)	IS/IEC 61730 (Part-1) IS/IEC 61730 (Part-2)	Photovoltaic (PV) Module Safety Qualification Part-1 Requirements for Construction Photovoltaic (PV) Module Safety Qualification Part-2 Requirements for Testing	1. Hi Physix Laboratory India Pvt. Ltd., Pune 2. UL India Pvt. Ltd., Bangalore. 3. TUV Rheinland, Bangalore
4.	Power Inverters for use in Photovoltaic Power System	IS 16221 (Part-2)	Safety of Power Converters for use in Photovoltaic Power Systems Part-2 – Particular Requirements for Inverters	1. CPRI, Bangalore
5.	Utility – Interconnected Photovoltaic Inverters	IS-16169	Test Procedures of Islanding Prevention Measures for Utility-Interconnected Photovoltaic Inverters	1. CPRI, Bangalore 2. UL India Pvt. Ltd., Bangalore
6.	Storage Battery	IS-16270	Secondary Cells and Batteries for Solar Photovoltaic Application General - Requirements and Methods of Test	1. CPRI, Bangalore 2. CECRI, Karakudi, Tamil Nadu 3. Hi Physix Laboratory India Pvt. Ltd., Pune

8.11.4 BIS Registration

Bureau of Indian Standards (BIS) has accorded approval and registration for 62 manufacturers for their products based on performance testing reports issued by three test labs, which include 28 manufacturers from India and 34 from China and other countries.

9: RENEWABLE ENERGY IN NORTH EASTERN REGION





RENEWABLE ENERGY IN NORTH EASTERN REGION

9.1 Special attention is being given to the development of renewable energy in the entire North Eastern region through a separate budgetary allocation of 10% under various renewable energy programs for deployment of grid & off-grid solar energy systems, wind energy systems, small hydro projects, bio-gas plants, etc. in the region. During the year the budgetary support for renewable energy programs in the North Eastern region stood at Rs.504.53 crore. The state wise status of grid connected installed renewable energy capacity as on 31st March, 2019 in the region is shown in **Table 9.1**.

Table 9.1: State-wise installed capacity of Grid Interactive Renewable Power as on 31.03.2019						
S. No.	STATES / Uts	Small Hydro Power (MW)	Bio-Power (MW)	Solar Power (MW)	Total Capacity (MW)	Capacity Addition during 2018-19 (MW)
1	Arunachal Pradesh	131.105		5.39	112.49	2.495
2	Assam	34.11		16.68	50.79	4.230
3	Manipur	5.45		2.59	8.04	2.530
4	Meghalaya	32.53	13.80	0.08	44.91	0.060
5	Mizoram	36.47		0.20	36.67	0.000
6	Nagaland	30.67		1.00	31.67	0.000
7	Sikkim	52.11		0.01	52.12	0.010
8	Tripura	16.01		5.09	21.10	0.000
Total (MW)		338.455	13.80	31.04	357.79	9.325

9.2 SMALL HYDRO POWER PROGRAMME

(i) North Eastern States have a good potential to develop small hydro power projects. Among the NE States, Arunachal Pradesh has the highest potential followed by Sikkim, Meghalaya and Mizoram. MNRE has been giving special emphasis for the development of small hydro projects in the NE region. SHP projects can provide energy almost uninterrupted without any major maintenance or dependence on weather. The region, which is beleaguered by large energy deficits and poor quality of energy services, can benefit from greater decentralization and accountability associated with Small Hydro Power Projects. Small Hydro Power Projects can generate sufficient electricity to power domestic household, schools and clinics in rural areas and trigger entrepreneurship activities. The State-wise installed capacity vis-a-vis potential in North Eastern States & Sikkim is given in **Table 9.2**.

(ii) The major Small Hydro Power Projects currently under implementation are given in **Table 9.3**.

9.3 SOLAR PARKS

Ministry is implementing a Scheme for ‘Development of Solar Parks and Ultra Mega Solar Power Projects’. The main objective of Scheme is to scale up setting up of solar projects in a short span of time. Under the Scheme, it is proposed to set up at least 50 solar parks targeting setting up of 40,000 MW of solar power projects by 2021-22. All the States and Union Territories are eligible for getting benefit under the scheme. The capacity of the solar parks shall be 500 MW and above. However, smaller parks are also considered in States where there is shortage of non-agricultural land. The solar parks approved for States of NE region are given in **Table 9.4**.

**Table 9.2: State wise list of potential sites and installed projects SHP Projects in NER (as on 31.03.2019)**

Sl. No.	State	Total Potential		Total Installed	
		Nos.	Capacity (MW)	Nos.	Capacity (MW)
1	Arunachal Pradesh	800	2064.92	156	131.105
2	Assam	106	201.99	6	34.11
3	Manipur	110	99.95	8	5.45
4	Meghalaya	97	230.05	5	32.53
5	Mizoram	72	168.9	18	36.47
6	Nagaland	98	182.18	12	30.67
7	Tripura	88	266.64	17	52.11
8	Sikkim	13	46.86	3	16.01
Total		1384	3261.49	225	338.455

Table 9.3. Major SHP projects under implementation in North Eastern Region

Sr. No.	Name of the Project	Capacity (MW)	Implementing Agency
Arunachal Pradesh			
1	Namachik – I in Changlang District	0.5	Department of Hydro Power Development
2	Namachik – II in Changlang District	0.3	Department of Hydro Power Development
3	Pakhankha in Changlang District	0.5	Department of Hydro Power Development
4	Payu at Pinchi in KurungKumey District	0.5	Department of Hydro Power Development
5	NuranangPh-II in Tawang District	1	Department of Hydro Power Development
6	Khajalong in West Kameng District	2	Department of Hydro Power Development
7	Sumbachu SHP in Tawang District	3	Hydro Power Development Corporation of Arunachal Pradesh
8	Kush at SangramKurungKumey District	2	Department of Hydro Power Development
9	Taksang Chu SHP in Tawang District	3	Hydro Power Development Corporation of Arunachal Pradesh
10	KhinmeyGompa MHP in Tawang District	0.1	Department of Hydro Power Development
Meghalaya			
11	Ganol SHP West Garo Hills District	22.50	Meghalaya Power Generation Corporation Limited
Mizoram			
12	Kawlbem in Champhai District	3.50	Power & Electricity Deptt.,
13	Tlawva SHP in Champhai District	5.00	Power & Electricity Deptt.,
Nagaland			
14	Ponglefo SHP in Kiphire District	1.00	Department of Power,
Sikkim			
15	Chatten Stage-II in North Sikkim District	3 .00	Sikkim Power Development Corporation Limited



Table 9.4: Solar Parks Approved in the North Eastern Region States

Sl. No.	State	Capacity (MW)	Name of the Solar Power Parks Developer (SPPD)	Land identified at
1	Arunachal Pradesh	30	Arunachal Pradesh Energy Development Agency (APEDA)	Tezu township in Lohit district
2	Manipur	20	Manipur Tribal Development Corporation Ltd (MTDCL)	Bukpi village, Pherzawl District
3	Meghalaya	20	Meghalaya Power Generation Corporation Ltd (MePGCL)	Thamar, West Jaintia Hills & Suchen, East Jaintia Hills districts
4	Mizoram	20	Power & Electricity Department	Vankal, Mizoram
5	Nagaland	23	Directorate of New & Renewable Energy, Nagaland (DNRE)	Ganeshnagar (12 MW) of Dimapur and Jalukie (11 MW) of Paren districts

9.4 GRID CONNECTED ROOFTOP AND SMALL SOLAR POWER PLANTS PROGRAM IN NORTH EASTERN STATES

- (i) Government of India has setup an ambitious target of installing 100 GW of Solar Power by 2022 including rooftop solar (RTS) power plants. In order to achieve this task, MNRE is implementing Grid Connected rooftop and small solar power plants programme for installation of 4.2 GW of RTS power by 2019-20 with a financial outlay of Rs.5000 crore.
- (ii) The scheme provides central financial assistance to residential, institutional and social sectors to the tune of 70% of benchmark cost/project cost (whichever is lower) for special category States/UTs including North Eastern States as compared to 30% of benchmark cost/project cost for general category States/UTs. The benchmark cost of the system varies from Rs.53,000/- to Rs.60,000 per kWp. For government sector achievement linked incentives are being provided.
- (iii) As on 31.03.2019, Ministry has sanctioned/approved RTS projects of 55.05 MWp capacities to different North-Eastern States of which 32 MWp have been sanctioned in FY 2018-19 as shown in **Table 9.5**. So far, aggregate 19.83 MWp capacities have been reported as installed in these States. In addition, net-metering regulations have been notified by respective state regulatory commissions of these States. Rooftop solar policies have also been notified by Manipur and Assam State.

Table 9.5: Sanctioned Roof Top Solar projects in North Eastern Region

S. No.	State	Sanctioned Capacity (in MW)
1.	Assam	23.48
2.	Arunachal Pradesh	10.00
3.	Manipur	6.22
4.	Mizoram	6.85
5.	Tripura	0.50
6.	Meghalaya	8.00
	Total	55.05



200 kWp Rooftop Solar Plant installed in Down Town University, Guwahati, Assam

- (iv) Phase II of the Grid connected rooftop solar programme was approved for with a target for achieving cumulative capacity of 40,000 MW from Rooftop Solar (RTS) Projects by the year 2022. The programme will be implemented with total central financial support of Rs.11,814 crore. In the Phase-II Programme Central Financial Assistance (CFA) for the residential sector has been restructured with availability of 40% CFA for RTS systems up to 3 kW capacity and 20% for RTS system capacity beyond 3 kW and up to 10 kW. For Group Housing Societies/Residential Welfare Associations (GHS/RWA), CFA will be limited to 20% for RTS plants for supply of power to common facilities, however, the capacity eligible for CFA for GHS/RWA will be limited to 10 kW per house with maximum total capacity upto 500 kWp, inclusive of RTS put in individual houses in the GHS/RWA. Central financial support will not be available for other category i.e., institutional, educational, social, government, commercial, industrial, etc. Under Phase-II Programme, focus will be on increased involvement of DISCOMs. Performance based incentives will be provided to DISCOMs based on RTS capacity achieved in a financial year (i.e. 1st April to 31st March every year till the duration of the scheme) over and above the base capacity i.e. cumulative capacity achieved at the end of previous financial year.

9.5 OFF GRID SOLAR PV PROGRAMME

- (i) During 2017-18, the Ministry had sanctioned a ‘SOLAR STUDY LAMP SCHEME’ where 70 lakh solar study lamps are being distributed to school going children across the selected states including Assam. During 2018-19, a total of 4,45,994 nos. of solar study lamps were distributed in Assam.
- (ii) Under the Atal Jyoti Yojana (AJAY) Phase-II, Solar LED Street Lights in rural, semi-urban and urban areas are being installed in all States of North-east including Sikkim.



- (iii) Under Off-grid and Decentralised Solar PV Applications Programme, Solar Street Lights and Solar Study Lamps have been allocated in North-east. State-wise allocation is given in **Table 9.6**.
- (iv) Under Off-grid and Decentralised Solar PV Applications Programme, new projects for installation of off-grid solar power plants up to 25 kWp have been sanctioned in the States of Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura.
- (v) Under new scheme launched for farmers for installation of solar pumps, solarisation of existing agriculture pumps and installation of grid-connected renewable power projects, CFA up to 50% of the benchmark cost of tender cost, whichever is lower, is available to North-eastern States.

Table 9.6: State-wise allocation of Solar Street Lights and Solar Study Lamps in North Eastern Region

S. No.	State	No. of Solar Street Lights Allocated	No. of Solar Study Lamps Allocated
1	Arunachal Pradesh	20000	200000
2	Assam	20000	232342
3	Manipur	20000	75000
4	Meghalaya	20000	102000
5	Mizoram	20000	150000
6	Nagaland	9810	24000
7	Sikkim	16400	43034
8	Tripura	12000	300000

- (vi) Details of all SPV systems and standalone SPV power plants in the North Eastern region states as on 31.03.2019 is given in **Table 9.7**.

Table 9.7: State-wise allocation of SPV systems and standalone SPV power plants in North Eastern Region

S. No.	States	Solar Home Light (Nos)	Solar lamp (Nos)	Solar Street Light (Nos)	Solar Pump (Nos)	Solar Power Plant (kW)
1	Arunachal Pradesh	35065	18551	5008	22	963.2
2	Assam	46879	498271	9547	45	1605
3	Manipur	24583	9058	11205	40	1580.5
4	Meghalaya	14874	40750	5800	19	2004
5	Mizoram	12060	10512	5325	37	2955.6
6	Nagaland	1045	6766	6235	3	1506
7	Sikkim	15059	23300	504	0	850
8	Tripura	32723	64282	1199	151	867

9.6 BIOGAS PROGRAMME

- (i) The New National Biogas and Organic Manure Programme (NNBOMP) is being implemented for providing clean gaseous fuel mainly for cooking, lighting and organic manure to rural and semi-urban



households in the North Eastern Region States through State Government Nodal Departments/ State Nodal Agencies. MNRE has allocated targets to the State Rural Development Departments for implementing the NNBOMP in the States of Assam, Arunachal Pradesh, Manipur Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura during the year. A target of 10,500 number of biogas plants has been set in the North Eastern region for the year 2018-19.

- (ii) A Biogas Development and Training Centre for all the NER States for providing training and technical support under the NNBOMP has been continued and functional at Department of Mechanical Engineering, Indian Institute of Technology, Guwahati, Assam.
- (iii) Indian Institute of Technology, Guwahati (IITG) has successfully installed an integrated biogas digester system at Aaoni Aati Hatra (North Guwahati, District: Kamrup, State: Assam) which is producing 15 m³ of raw biogas per day. The power generated from the plant is being distributed to the houses of the Aaoni Aati Hatra, which is lighting their houses for 4-5 h/day during evening. IIT Guwahati successfully established a centre for demonstrating the potential of power generation by using raw biogas and this is becoming a training and knowledge centre for local entrepreneurs and dairy farms to gather technical information for generating off grid power.
- (iv) In Tripura, a village named Brajendranagar Bio-village under Pandabpur GP, Dukli RD Block, and West Tripura District has been adopted by The Directorate of Biotechnology, Government of Tripura to develop it as a Bio-Village by providing all types of bio-inputs for agriculture in the village. In this perspective, to make the objective more fruitful, TREDA formed initiative by covering 10 families of the village in first phase by installing family size biogas plants during this F.Y. 2018-19. This substituted the traditional cooking practice using firewood and the users are found very satisfied with these plants. In this way, the State Nodal Agency, TREDA targeted to develop the village as a model village in NNBOMP.

9.7 WIND ENERGY PROGRAMME

- (i) The Ministry has focused on wind resource measurement in NE states and as on 31.03.2019, a total 96 nos. of Wind Resource Assessment stations at 25 m & 50 m above ground level have been installed in NE regions and currently 44 nos. of Wind Resource Assessment stations are operational. The State-Wise break-up is given in **Table 9.8**.

Table 9.8: Wind Resource Assessment stations in North Eastern Region

State	No. of Stations installed & commissioned	Level of Wind Resource Assessment stations	No. of Stations in operation
Arunachal Pradesh	17	25 m & 50 m	8
Assam	18	25 m & 50 m	11
Tripura	10	25 m & 50 m	4
Manipur	14	25 m & 50 m	3
Mizoram	9	25 m & 50 m	4
Nagaland	6	25 m & 50 m	3
Meghalaya	18	25 m & 50 m	11
Sikkim	4	25 m	Nil
Total	96		44



- (ii) In addition, Wind Resource Assessment Studies are also carried out at NE region using the existing telecom towers and, as on 31.03.2019, a total 37 nos. of telecom towers are utilized for this purpose. The details is given in **Table 9.9**

Table 9.9: The details of telecom towers used in Wind Resource Assessment Studies North Eastern Region			
State	No. of Stations commissioned	Level of telecom tower stations	No. of Stations in operation
Meghalaya	15	50 m & 60 m	15
Mizoram	5	40 m & 60 m	5
Tripura	5	50 m & 60 m	5
Arunachal Pradesh	5	40 m & 50 m	5
Nagaland	7	50 m	7
Total	37		37

- (iii) During 2010, National Institute of Wind Energy (NIWE) in collaboration with RISO DTU, Denmark had prepared the Indian Wind Atlas for the country including NE Region. According to this Indian Wind Atlas, the wind potential of NE Region at 50 m level is estimated to be 406 MW. The State-wise break-up is given in **Table 9.10**

Table 9.10: Wind Potential of NE Region at 50 m level		
S.No	States	Estimated potential (MW) @ 50 m
1.	Arunachal Pradesh	201
2.	Assam	53
3.	Manipur	7
4.	Meghalaya	44
5.	Nagaland	3
6.	Sikkim	98
Total		406

10: GREENING OF ISLANDS OF ANDAMAN & NICOBAR AND LAKSHDWEEP





GREENING OF ISLANDS OF ANDAMAN & NICOBAR AND LAKSHDWEEP

10.1 Scheme for setting up of 52 MW Distributed Grid-connected Solar PV Power Projects in Andaman & Nicobar Islands and Lakshadweep Islands with Capital Subsidy from MNRE

10.1.1 MNRE on 05.04.2016, issued Administrative Approval for Implementation of a scheme for setting up distributed Grid-Connected Solar PV Power Projects of an aggregate capacity of 40 MW (now increased to 52 MW) in Andaman & Nicobar (A&N) and Lakshadweep Islands with Central Financial Assistance (CFA) of Rs.192.20 crore.

10.1.2 Objective

The objective of the scheme is to develop carbon free islands by phasing out use of diesel for generation of electricity and to contribute to the National Action Plan on Climate Change. The initiative will also help in reduction in cost of electricity generation.

10.1.3 Spatial Coverage

Distributed grid-connected solar PV power projects of an aggregate capacity of 52 MW would be established in different islands in Andaman & Nicobar Islands and Lakshadweep Islands.

10.1.4 Type of projects supported

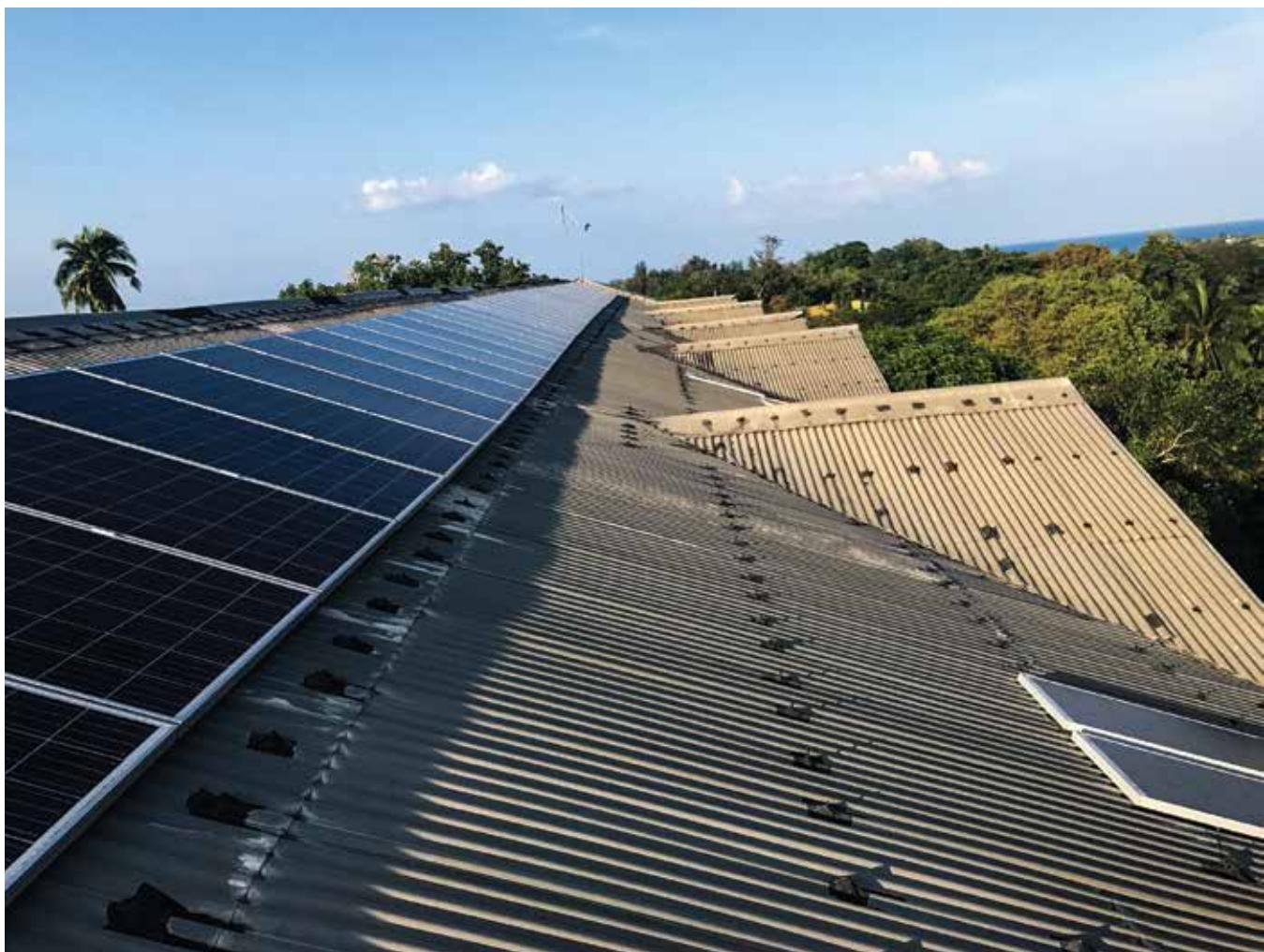
The Scheme supports setting up of standalone Solar PV Power Project, standalone Battery Energy Storage System (BESS), Solar PV plant with Battery Energy Storage System (BESS), Transmission System for Solar PV Power Plant and Floating Solar PV power plants (with or without Battery Energy Storage System) in Andaman & Nicobar Islands and Lakshadweep Islands.

10.1.5 Implementation Arrangement

- (i) The scheme will be implemented through Central Public Sector Undertakings (CPSUs) viz., NTPC Limited (NTPC), NLC India Limited (NLC), Rajasthan Electronic & Instruments Ltd. (REIL), Solar Energy Corporation of India Limited (SECI), etc., or by UT Administration on Build, Own and Operate (BOO) basis.
- (ii) Procurement of all Services and Hardware for setting up the power plants by Implementing Agencies (IA's) viz. NTPC, NLC, REIL, SECI, etc., or UTs



1 MW Solar PV Power Plant established at Port Blair, Andaman & Nicobar Islands



1 MW Solar PV Power Plant established at Port Blair, Andaman & Nicobar Islands

would be done through competitive bidding process.

- (iii) The total project cost will include cost of solar power plant, battery storage of upto 6 hrs and cost of infrastructure development such as land development, evacuation & transmission etc.
- (iv) A&N and Lakshadweep Administrations will buy the electricity from the Implementing Agencies at a tariff determined by JERC/CERC by taking into account the Central Financial Assistance (CFA).

10.1.6 Central Financial Assistance (CFA)

- (i) Total eligible Financial Assistance and its release pattern will be as under:
 - Ministry will provide 40% of the project cost discovered through competitive bidding process as grant;
 - No additional grant for the preparation of DPR, conducting field survey, fund handling / service charge will be provided
 - The Capital Subsidy will be released in three tranches as mentioned below:
 - a) 15% on completion of site development and civil works at site;



- b) 60% on successful commissioning of the plant and
- c) Balance 25% after one year of operation of the plant.

(ii) The release pattern mentioned above can be modified if felt necessary during implementation with the approval of the Competent Authority.

10.1.7 Status of Projects under Implementation

A total of around 42 MW solar PV power projects and 69 MW Battery Energy Storage System (BESS) have been tendered, out of which 20 MW SPV Plant with 8 MWh Battery Energy Storage System (BESS) at Attampahad & Dollygunj in UT of Andaman & Nicobar Islands is under advanced stage of implementation with 2.5 MW SPV capacity of this project commissioned as on 31.03.2019.

11: SPECIALIZED INSTITUTIONS





SPECIALIZED INSTITUTIONS

11.1 NATIONAL INSTITUTE OF SOLAR ENERGY

- 11.1.1 National Institute of Solar Energy (NISE), an autonomous institution of Ministry of New and Renewable (MNRE), is the National Research and Development (R&D) institution in the field of Solar Energy. NISE supports the Ministry of New and Renewable Energy (MNRE) in implementing the National Solar Mission (NSM), R&D activities in Solar Energy and various Skill Development Programmes.
- 11.1.2 NISE has established itself as a leading Institute in the field of Solar Energy through Resource Assessment, Research, Design, Development and Demonstration of Solar Energy Technologies for various applications such as Testing, Certification and Standardization, Monitoring and Evaluation, Economic and Policy Planning, Human Resource Development and Active collaborations with prominent National & International organisations, etc.
- 11.1.3 NISE is maintaining an NABL accredited Solar Photovoltaic module testing laboratory, lighting system test laboratory, battery testing facility and solar water pumping system test rig and outdoor test facilities. The Institute has fully developed testing facility for small and large size Solar Thermal Systems and Solar Resource Assessment.

11.1.4 SOLAR RADIATION RESOURCE ASSESSMENT (SRRA)

The Solar Radiation Calibration Laboratory (SRCL) at NISE has commenced calibration program of phase-II Solar Radiation Resource Assessment (SRRA) stations. During the year 2018-19, SRCL has calibrated a total of 36 sensors from 12 SRRA phase-II stations and 6 sensors from various private companies under commercial calibration mode.



Solar Radiation Calibration Facility at NISE



11.1.5 R&D ACTIVITIES

(i) PERC Project

NISE initiated the development of high efficiency Passivated Emitter Rear Cell (PERC) type Solar cells in a joint venture with BHEL-ASSCP, Gwal Pahari, Gurugram in 2018. This project involves the development of PERC type solar cells with bench mark efficiencies in the country. The major activity in the PERC project during the year 2018-19 was to determine the course of action for the procurement of special process and testing equipment. Process equipment such as Plasma Enhanced Chemical Vapour Deposition (PECVD) vacuum system, Laser scribe and Diffusion Furnace, etc., are under procurement, as are Spectroscopic Ellipsometer, ECV Profiler and four other testing equipment. NISE positions itself as provider for the Testing and Characterization of cells at various stages of process to identify the problem areas. Therefore, NISE initiated the design and fabrication of a 1500 sq. ft., Class 100,000 clean room for housing the test and characterization equipment. The establishment of this facility is in progress and is intended to be completed by July 2019.

(ii) Solar Product Development

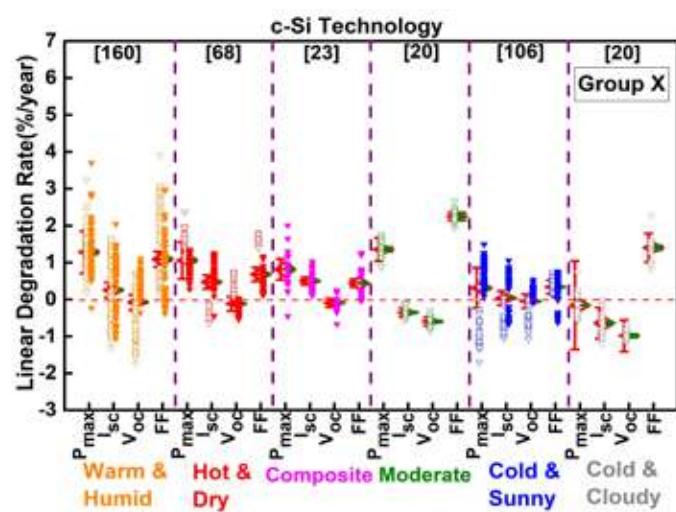
NISE has designed and developed an innovative solar drier cum space system (**SolDry**), Solar Powered cold storage unit, Solar powered bulk milk cooler with thermal storage system, Solar Cooking System, etc. During the year, NISE has successfully installed 10 units of SolDry (5 in Leh and 5 in Kargil) on trial basis for Department of Horticulture, Govt. of Jammu and Kashmir. These units were supplied for drying of Apricots, in addition to space heating to heat the room in winter. The systems were installed in July 2018 before the Apricot harvesting session. The system is being monitored and evaluated by NISE.



Installation of Solar Apricot Dryer cum Space Heating System at Minjee Village, Kargil District

(iii) All India Survey of Solar PV Module (2018-19) – Joint Project between NISE and NCPRE, IIT Bombay

This is a joint project between the Solar Photovoltaic division, NISE and NCPRE, IIT Bombay to study the field performance and reliability of SPV modules installed over period of time ranging from 20 years to recent installations in different climatic conditions of India. These data are needed to understand the reliability and process of degradation of PV modules under different Indian field conditions. Until now, three surveys have been conducted under this project. Although the modules qualify IEC 61215, 61646 and



I-V parameter degradation distributions with respect to six-zone classification system as seen in the All India Survey of Solar PV Module (2018-19)



61730 standards, due to the diversity of harsh climatic conditions existing in the country, the long term performance and annual degradation rates of these modules are different. The report of all these All India survey of PV module reliability is available on the website of NISE.

(iv) Development of Series Resistance Measurement Technique for C-Si Module

NISE has developed methodology for series resistance measurement of crystalline silicon module. Further, a case study has been undertaken for carrying out a comparative analysis of ten different methods of series resistance for three different technologies namely, hetero-junction intrinsic thin layer silicon, amorphous single junction silicon and multi-crystalline silicon.

(v) Methodology Development for Selecting Operating Head of Solar Photovoltaics Pumps with Optimum Efficiency

NISE after an in-depth investigation on the energy efficiency of Solar Photovoltaic Water Pumping (SPVWP) system based on solar radiation, temperature, and operational heads identified the shortcomings in the conventional design method based on Best Efficiency Point (BEP). It was found that BEP concept does not offer the best efficiency design. The study experimentally proved that the model based on weighted system efficiency and Solar Operational Duty Head (SODH) increased the performance of SPVWP system (9% gain) and consistently higher efficiencies in any season or under any climatic conditions.

(vi) Energy Rating Estimation of PV Module Technologies for Different Climatic Conditions

NISE has developed a methodology to derive data sets and energy rating of PV module for different climatic zones of India. In this study, energy ratings of three different technologies with the data sets based on the angle of incidence, spectrum, irradiance, wind and temperature using existing formulae have been analysed. The performance surfaces of PV technologies are designed based on the IEC 61853-1 & 2, and IEC 60891.

(vii) Co-ordination of National Research Activities in Solar Energy

NISE has been entrusted with the coordination work of National Research Activities in Solar Energy by MNRE, including the scrutinizing of R&D project proposals submitted to the Ministry at the initial stage, getting the expert comments, arranging RDPAC and RDSPAC meetings and recommending proposals to the MNRE for sanction. It has also been responsible for monitoring the on-going R&D projects through expert visits, organizing reviews, suggesting mid-course corrections and monitoring and verifying claims as an independent agency. During this period, 18 project proposals received were evaluated. The evaluations and recommendations are submitted to the MNRE for further processing.

11.1.6 TESTING AND PERFORMANCE EVALUATION

11.1.6.1 Solar Photovoltaic Testing Laboratory

The Photovoltaic module test lab is a NABL (National accreditation board for testing & calibration laboratories) accredited laboratory as per standard IS 17025:2005 for qualification testing of PV module. This lab got accreditation by BIS for PV module testing as Type 2 lab. During the year, the laboratory has capability of testing following IEC/IS standards (i) IEC 61215/ BIS 4186, (ii) IEC 61701, (iii) IEC 61730-1, 61730-2 (partial, accreditation process going on), (iv) IEC 61853/IS 16170 : Part 1 (accreditation process going on), (v) IEC TS 62804/MNRE specifications (accreditation process going on). The number of equipment have been added to the existing facility for upgradation of the lab. Further, the laboratory is adding the following test facility: (i) Full testing set up for IEC 61730-1, 2 (including fire test also), (ii) IEC 62759-1, (iii) IEC 62716, (iv) IEC 60068-2 (1, 2, 14, 27, 30 & 64), (v) IEC 61853-2. A total of 939 Modules of different technology were tested and certified in NISE.



11.1.6.2 Electroluminescence (EL) Test & Characterization Laboratory

Electroluminescence (EL) test and characterization facility for PV modules has been set up at NISE. Electroluminescence (EL) test is used to identify micro cracks and other invisible defects in solar cells and PV modules which are invisible to the human eyes. The greateyes LumiSolar Professional BL 16Mpx (Bottom Load) System is a high resolution Electroluminescence module inspection utility to in PV module. The Laboratory follows the standard DIN IEC 60904-Part 13 (Electroluminescence of photovoltaic IEC 82/1062/CD: 2016) for Electroluminescence study of PV module.

11.1.6.3 Mobile Test Set up

Mobile Solar testing facility developed at NISE comprises of testing equipment and set ups for conducting the PV power plant inspection, reliability testing of crystalline silicon as well as thin film PV modules & power plant as per International standards and user specifications. During the year, the following test facilities were added: (i) String and single module I-V testing facility, (ii) Equipment for characterizing the inverter, SPV pump and off grid solar applications like solar lighting system.

11.1.6.4 Solar Cell Characterization & Outdoor Module Testing Facility

Solar cell characterization group at NISE has added a new spectro-radiometer facility for testing spectral content of light for different wavelength. The lab is now capable of estimating mismatch current factor of solar cell with known spectral response data. The spectral response system installation in solar cell is under process. NISE is undertaking a process to incorporate new advanced testing facility for different solar cells.

11.1.6.5 Power Electronics Laboratory

NISE has established facilities for testing and evaluation of Solar Inverters/ power conditioning Units (PCU) of capacity ranging up to 50 KVA. All types of PCUs, hybrid, standalone, Grid-tied inverters (GI) and pump controllers can be tested. A total of 29 inverters were tested as per International standards and MNRE specifications.

11.1.6.6 Advanced SPV Systems and Lighting Laboratory

In the FY 2018-19, lighting system Laboratory has inducted a new Integrating Sphere with temperature controlled system, designed specifically to test photometric and colorimetric performance over a broad dynamic range of temperatures as per IES LM-82 and LM-79 recommended practices. Every year, revised technical specifications and design guidelines prepared by NISE, are issued by the MNRE, for supporting various government programmes. This lab has tested and certified 80 samples for various purpose such as Solar Street light, Charge controllers, solar power packs, etc.

11.1.6.7 Battery Test & Characterization

The Battery Test & Characterization laboratory is looking forward for the NABL accreditation for different tests under different standards. The battery test & characterization laboratory is engaged in different analysis, performance evaluation & research work as follows: (i) Development of Testing Profile/Test Methodologies for emerging battery technologies, (ii) Life Cycle Tests on different secondary battery, (iii) Exploring Battery health analysis technique, (iv) Degradation Analysis of secondary battery/Effect of different parameter on the degradation of battery. A total of 14 batteries were tested as per different National/International Standards.

11.1.6.8 Solar Water Pumping Test Facility

NISE has a fully Automated SPV Water pump system testing facility for 0.5HP to 10HP pump capacity for both submersible and surface pump. A total of 61 solar water pumps Submersible AC/DC and Surface



AC/DC pumps have been tested in the year 2018-19. An enhancement of testing capacity of Solar Water Pump from 100 meters head to 400 meters head was developed in this solar water pumping test facility at NISE.

11.1.7 SOLAR THERMAL TECHNOLOGIES, RESEARCH, TESTING & CERTIFICATION

NISE has undertaken various research projects on solar thermal energy for cooking, heating, cooling, power generation, process heat applications, desalination, thermal storage, bulk milk chilling system using thermal storage, cold storage facility with thermal storage and in-house research and development etc. In the area of Solar Thermal Power Generation Technologies, various RD&D Projects have been setup in the campus of NISE with financial assistance from the Ministry of New and Renewable Energy. During the FY 2018-19, a total of 4 solar thermal technologies were tested and certified at NISE.

11.1.8 SOLAR THERMAL RESEARCH AND DEVELOPMENT PROJECTS

An R&D Project was sanctioned by MNRE for completion of the pending works and achieving the objective of a project on ‘Central Receiver Facility’ during March, 2018. The project was earlier implemented by M/s Sunborne Energy Technologies Private Limited. The inventory of the project along with the stores of the project were finally handed over by the company to NISE in October, 2018. NISE has initiated dialogue with the IITs for possible technical cooperation for completion of the project.

11.1.9 HYDROGEN ENERGY CENTRE & FUEL CELL TESTING

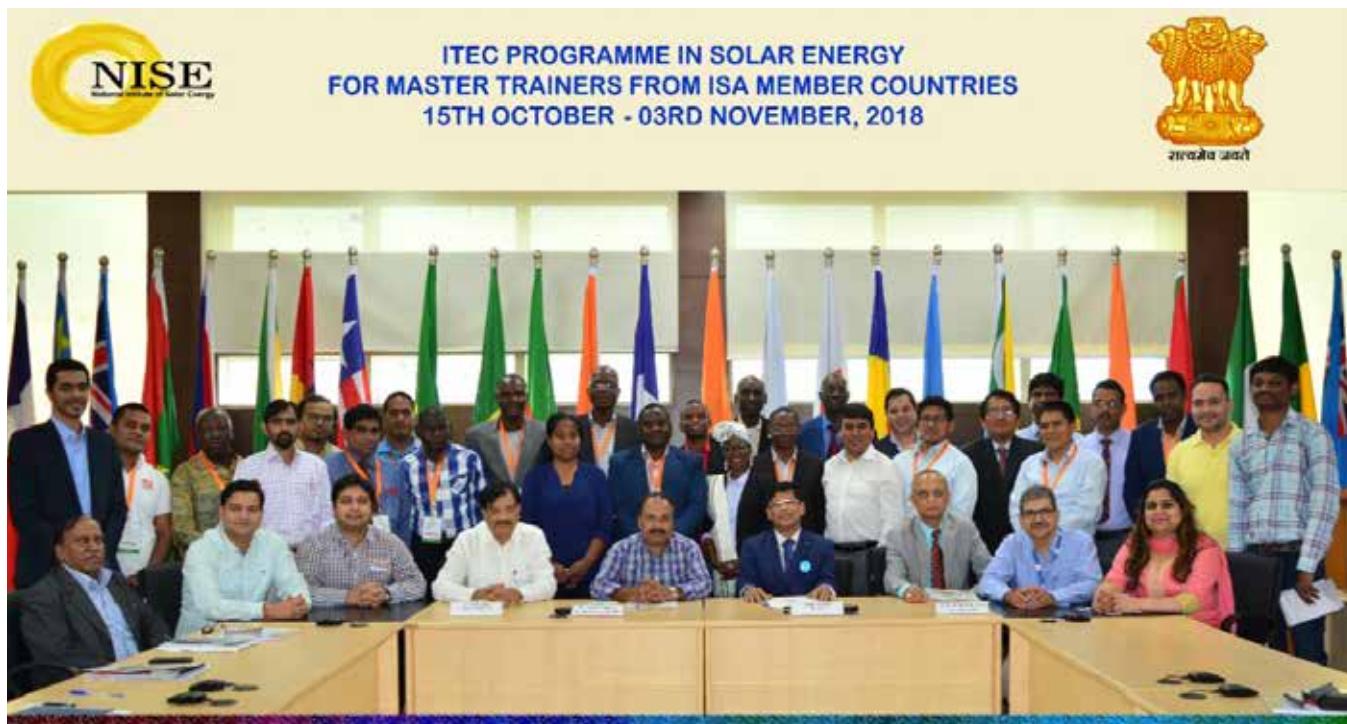
NISE assisted MNRE to organise meetings of Project Monitoring Committees in the areas of Fuel Cells and Hydrogen Storage during the year in its campus.

11.1.10 TRAINING AND SKILL DEVELOPMENT

NISE is organizing various skill development programmes throughout the country in the field of solar energy at NISE in association with partner institutes across India. The focus of these programmes is on technology development, system design, installation, commissioning, operation & maintenance and repair, etc. NISE is also organizing training programmes for start-ups, solar PV roof top projects, SPV



Renewable Energy Training Program for Armed Force Officials conducted at NISE



ITEC Programme in Solar Energy for Master Trainers from ISA Member Countries conducted at NISE

pumps, solar thermal technologies, hydrogen energy and fuel cells. A dedicated training programme on Renewable Energy Technologies for senior defence officers is conducted every year. NISE has also started a long term programme for solar professionals for six months duration from February 2018. A total of 10 training programs on various aspects of Solar Energy were conducted for imparting training to 695 participants at NISE.

11.1.11 INTERNATIONAL TRAINING PROGRAM

The Ministry of External Affairs, Govt. of India has identified NISE as a premier institute to conduct Indian Technical and Economic Cooperation (ITEC) Programme every year for international participants along with other international programmes like Indo African Forum Summit (IAFS). NISE has conducted ten International Programmes in FY 2018-19. These programmes are for a duration of three-weeks, focused on latest Solar and Renewable Energy Technologies. Apart from ITEC and IAFS programme, NISE has also conducted five programs for International Solar Alliance (ISA) member countries in the FY 2018-19. A total of 255 participants from 55 countries have participated in these International Training Programmes.

11.1.12 SURYAMITRA TRAINING & PLACEMENT

NISE is implementing ‘Suryamitra’ training program to train the ITI/diploma holders as a skilled workforce/ field technicians for installation, commissioning, operation and maintenance of solar technology to execute National Solar Mission (NSM) programme across the country. A network of institutions through Training Partners help conduct these training programmes. Since inception, cumulative 656 programmes have been conducted by NISE and other implementing agencies approved by it and a total of 19,180 Suryamitras have been imparted trainings under this programme up to 31.03.2018. During the FY 2018-19, 11,912 Suryamitras were imparted training.



11.1.13 VARUNMITRA TRAINING PROGRAMME

The MNRE sponsored three weeks ‘Varunmitra’ Training Programme with an objective to develop skilled workforce for solar water pumping system design, installation and commissioning has been designed by and implemented by NISE. The first of 20 programmes was started on 1st January 2019. NISE has allocated 14 institutions to implement this programme, which will follow SGJ/Q0112 (SGJ/N0134) Qualification Pack of SCGJ. A total of 427 participants were trained in the Varunmitra Training programme.

11.1.14 SOLAR ANALYTICS SKILL DEVELOPMENT PROGRAMME

The Solar Analytics programme aims at Developing Centre of Excellence (CoE) on analytics for organization as well as developing skills for managing the same. The program encompass the combination of solar domain with the technology like Internet of Things (IOT), Machine Learning, predictive modelling, forecasting, optimization which has to be understood by utility/solar plant engineers and decision makers to carve differentiator for their utility operations in resolving day to day problems. This first five days skill development programme was organized in Dec 2018 at NISE in which 11 participants actively participated.

11.1.15 ADVANCED PROFESSIONAL COURSE & ROOFTOP GRID PROGRAMME

- (i) A new six-month job oriented and technologically advanced training program, developed by NISE '*The Advanced Solar Professional Course*' was launched on 6th Feb 2018. This course aims for a trained manpower readily available to the Indian Solar Power sector in line with its present and future requirements. Certificates are awarded on successful completion of this course. The second batch with 32 participants was started on 8th October 2018 at NISE.
- (ii) During 2018-19, two ‘**Rooftop Solar Grid Engineer**’ training programmes were organised by NISE to improve knowledge and enhance skills of professionals and businessmen in the field of Solar Rooftop Grid-tied systems which is based on National Skill Development Corporation (NSDC) approved / certified Qualification Pack (QP) SGJ/0106. In the FY 2018-19, NISE has conducted 22 Rooftop Solar Grid Engineer Training Programme across the country. These training programmes were fully funded by MNRE. A total of 923 participants were trained & imparted knowledge for rooftop solar grid tied system.

11.1.16 COORDINATION ACTIVITIES

NISE has signed Memorandum of Understanding (MoU) with various organisations to operate a collaborative venture for development and dissemination of solar energy in the country and to ensure a clean energy environment. During 2018-19, NISE signed MoUs with Inficold India Pvt. Ltd., Jamia Millia Islamia (JMI) University, Aligarh Muslim University (AMU) and Central Electronics Limited (CEL).

11.1.17 CONSULTANCY SERVICES

NISE is extending various consultancy services such as site survey, preparation of Detailed Project Report, Solar System Design, vetting of tender documents and specifications, Project management & EPC advisory, Solar Feasibility Report on solar photovoltaic & solar thermal technologies, solar power plant performance, evaluation & monitoring in the field, and testing & performance of the solar systems with the help of Mobile Lab facilities etc.

11.2 NATIONAL INSTITUTE OF WIND ENERGY (NIWE)

- 11.2.1 The main activities of National Institute of Wind Energy (NIWE) include research and development; Wind and Solar Radiation Resource Assessment; preparation of Indian Standards for wind generation



technology; wind turbine testing and certification; information dissemination; human resource development; offer various consultancy services to customers; and to serve as a technical focal point for wind power development in India and support the growing wind power sector in the country.

11.2.2 WIND RESOURCE ASSESSMENT AND OFFSHORE

- (i) Wind Resource Assessment (WRA) programme data is being used widely to establish wind farms in the country. All the wind farms established in the country till now is based on the reference data collected under the WRA programme. As on date, 875 dedicated wind monitoring stations have been established with the help of State Nodal Agencies. In addition, the existing telecom towers in NE region are also utilized for carrying out wind resource assessment studies. During the year, 37 nos. of telecom towers in NE region are mounted with wind sensors and data collection from these towers are under progress. Of these, 108 Wind monitoring stations are under operation and 18nos. of new 50 m wind monitoring stations commissioned during the year. NIWE has also initiated the identification of telecom towers (150 nos.) in association with M/s. BSNL (for 83 locations) and M/s. Airtel (for 67 locations) for wind resource assessment in the North East. NIWE has undertaken the task of identifying the district wise indicative wind potential. Transmission Companies (STU & CTU) based on land grading (Rank I/II/III) would help State Nodal Agencies (SNAs) in identifying the technical potential of the States. During this period, many consultancy projects on Wind Resource Assessment have been completed and reports submitted during this period.
- (ii) In the current year, 61 sites have been registered for wind measurement by private sector from various states in India. The wind data from over 52 private Wind Monitoring stations have been analysed. Thirty-Five consultancy projects focused in various wind farm developmental needs were undertaken for a variety of clients from public/government/private sector during this period.

11.2.3 OFFSHORE ACTIVITIES

Offshore Wind Measurements at Gulf of Khamhat

The NIWE / FOWIND team has installed during the year a Remote Sensing instrument LiDAR for wind measurements at Gulf of Khamhat off Gujarat coast. The offshore structure and Remote sensing device LiDAR has been configured to measure the wind profile at 12 different heights suitable to the wind



Offshore Wind Measurements at Gulf of Khamhat



turbines available for offshore. NIWE has also initiated Tidal measurements at the LiDAR platform at Gulf of Khambat using the RADAR principle. NIWE is in the process of exploring the largest seabed areas off Gujarat and Tamil Nadu coasts to identify the potential subzones or blocks for promotion of offshore wind farm development in the country.

11.2.4 GEO-TAGGING (ON LINE REGISTRY) OF WIND TURBINES

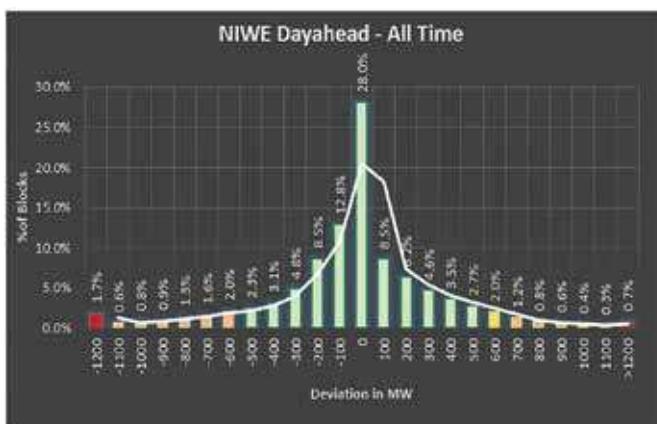
As on date, the wind turbine installed capacity in India stands at approx. 35000 MW with equivalent number of wind turbines. However, there is no centralized system for maintaining this vast database. In view of this, NIWE is in the process of developing a geo-tagged data base / online registry of wind turbines installed across the country with the support of central and state agencies. NIWE is currently working to devise the methodology for the static data collection and suitable procedure / guidelines for dynamic data collection.

11.2.5 STANDARDS AND CERTIFICATION

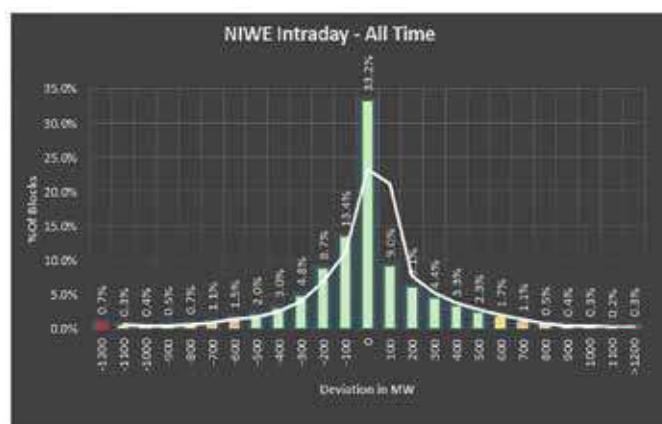
MNRE has approved NIWE as Type Certification Body in India for all the wind related issues. During 2017-18, based on the directives from MNRE, internationally accredited certification services were made available in India by NIWE through strategic tie-ups. NIWE is entrusted with the preparation of Indian Standards on wind turbines under the Committee, viz., Wind Turbines Sectional Committee (ETD 42) and NIWE provided technical support in preparation of Six Indian Standards on Wind Turbines and out of which one has been finalized. NIWE provides technical support to ETD division of BIS regularly on the works related to International Electro-technical Commission (IEC). Based on the efforts taken by NIWE and MNRE, Bureau of Indian Standards (BIS) has already obtained the membership for India in IECRE system.

11.2.6 TESTING AND FORECASTING

- (i) NIWE has been accredited under NABL for wind turbines tested according to International Standards. In this regard, an agreement was signed between NIWE and OEMs for Power Curve Measurements. NIWE is also testing small wind turbines at its Wind Turbine Research Station, Kayathar, Tamil Nadu.
- (ii) NIWE is providing wind power forecasting for the State of Tamilnadu since 2014. In addition, NIWE has signed MoUs with Gujarat, Rajasthan, Andhra Pradesh and Karnataka for providing pilot forecasting services to the respective States. The Centre for Excellence (CFE) in Variable Generation Forecasting (Wind & Solar Generation) has been established at NIWE.



Error Analysis day-ahead graph



Error Analysis Intraday graph



NIWE has developed In-house Data management system, Indigenous Wind and Solar Power Forecasting model, Monitoring System, Web portal, forecast simulation tools and security system. NIWE has created an operational forecast system with simulation tools, to predict the wind power up to 7 days ahead. In order to improve the forecasting model, NIWE has signed MoU with ISRO SAC for 'Development of Wind and Solar Power Forecasting using High Resolution Numerical Model'. Currently, NIWE is developing the indigenous Intra-day forecasting model and also carrying out various activities to improve/fine-tune the day ahead model from the inputs received during the delivery of pilot operational forecasts to RE SLDCs. NIWE has signed MoUs with Gujarat, Andhra Pradesh, Karnataka, Maharashtra & SRLDC for providing pilot forecasting services to respective states. The pilot forecasting services have already initiated for the entire state of Gujarat, Karnataka & specific Solar parks of SRLDC.

11.2.7 WIND TURBINE RESEARCH STATION (WTRS)

Wind Turbine Research Station is having cumulative installed capacity of 6400 kW wind turbine for conducting various R&D related activities in addition to Type Testing Facilities of Large WEG and Small Wind Turbine performance testing facilities at the Test Beds created with all infrastructure facilities at the Research Station. The performance of the hybrid system was monitored during the windy season 2017 by Solarisation of wind farm at WTRS, Kayathar by a hybrid study on grid integration. This model of Solarisation (wind – solar grid connected hybrid) of wind farm is first of its kind in India.

11.2.8 RESEARCH AND DEVELOPMENT AND ESTABLISHMENT OF PAN-INDIA RESEARCH NETWORK

NIWE established 'Pan-India Research Network' with an intention to create a hub of synergy for all wind related research in India for taking up industry identified issues by a consortia of Academia with support from MNRE through NIWE. The first Pan-India Research Network meeting was held at NIWE, Chennai during the 1st quarter of FY 2018-19. The Information Technology division is working to build its skills in the area of Data Analytics, Design Thinking, Machine Learning and Internet of Things (IoT), which are foreseen as critical areas of expertise that NIWE will need in this era of big data.

11.2.9 SOLAR RADIATION RESEARCH ASSESSMENT

It is a momentous occasion to state that four Solar Radiation Resource Assessment (SRRA) stations have been included in the Baseline Surface Radiation Network (BSRN) Global Network out of nine in Asia. The BSRN is the project under the umbrella of World Climate Research Program (WCRP) aimed at detecting important changes in the Earth's radiation field at the Earth's surface. Radiation measurements are indispensable for climate research as they provide the best check for the theory of radiative transfer in the Earth's atmosphere and can be used for the evaluation and improvement of models designed for weather and climate prediction. Furthermore, long-term measurements of surface radiation provide an opportunity for the detection of climate change. Quality Controlled data of 5 SRRA stations were provided to 3 stake holders under SDSAP policy.



International Conference on SWT organized by NIWE at Chennai

11.2.10 INFORMATION, TRAINING AND CUSTOMIZED SERVICES

- (i) NIWE successfully conducted the International Workshop on Small Wind Turbine (SWT) during 30th



November to 09th December 2018 sponsored by MNRE. 120 national and international participants from 36 countries attended the workshop, including the international trainers to share global small wind turbine knowledge. The hands on building sessions had acted as a catalyst to launch a strong national program to help start local entrepreneurial hubs to serve remote human habitats of India. The participants had experience of the installation, commissioning and operation & maintenance of the SWT.

- (ii) NIWE had successfully organized the three-day International conference on SWT from 10th to 12th December 2018 at Chennai, sponsored by MNRE. The main objective of the conference was to exchange the open source technical advances, to share experiences and discuss global best practices to enable the technology to expand rural wind electrification globally with particular emphasis on India. 250 national and international participants from 36 countries attended the conference. The conference brought together manufacturers, producers and experts from diverse energy sectors. The conference involved various discussions, sessions and poster presentations, which facilitated for the dissemination of best practices & experiences globally available in small wind turbine development.

11.3 SARDAR SWARAN SINGH NATIONAL INSTITUTE OF BIO-ENERGY

11.3.1 Sardar Swaran Singh National Institute of Bio-Energy (SSS-NIBE) earlier known as SSS-NIRE, Kapurthala (Punjab), an autonomous Institution of the Ministry of New and Renewable Energy, Govt. of India, is developing into a global centre of excellence in the field of bio energy. The objectives of the Institute is to carry out and facilitate research, design, development, testing, standardization & technology demonstration eventually leading to commercialization of RD&D output with a focus on bioenergy, biofuels & synthetic fuels in solid, liquid and gaseous forms for transportation, portable & stationary applications, development of hybrid/integrated energy systems, to undertake & facilitate human resource development and training in the area of bioenergy. The Institute has drafted a vision plan for next 10-years and submitted a comprehensive project proposal ‘Establishing pilot scale testing facility in the broad spectrum of bioenergy’ to emerge as Global Centre of Excellence in Bioenergy.

11.3.2 During FY 2018-19, the institute has completed the activation of e-office for its office work.



Working at biomass cookstove testing lab

11.3.3 Several projects on different R&D processes for biofuels and bioenergy are on-going under different divisions:

(i) **Thermochemical Conversion Division**

The basic testing facilities for biomass characterization, biomass gasification and cookstove testing, etc., have been created for thermochemical conversion of biomass including gasification, combustion, etc.,



and several important equipment like for biomass cookstove, pots of different sizes and dimensions, besides, few important instruments such as, CHNS analyzer, TG-DTA, etc., were procured and installed in the biomass characterization laboratory.

(ii) Biochemical Conversion Division

Biochemical Conversion Division has been established in R&D-II with the basic facilities of Analytical, Bioprocess, Microbiology and Molecular Biology Laboratories. Various research projects funded by the Department of Biotechnology, and Science and Engineering Research Board and in-house projects under SSS-NIRE Bioenergy Promotion Fellowship were completed or ongoing:

(iii) Development of NADP+dependent xylitol dehydrogenase in *Kluyveromyces marxianus*

The project entitled ‘Development of NADP+ dependent xylitol dehydrogenase in *Kluyveromyces marxianus*’ was funded by the Department of Biotechnology, Ministry of Science and Technology, Government of India for fulfilment of the objective of Bioenergy-Awards for Cutting Edge Research (B-ACER). The work was carried out at South Dakota School of Mines and Technology, Rapid City, SD, USA.



Ethanol production from ammonia pre-treated bagasse in SSF

(iv) Bio-refining of sugarcane bagasse for production of bioethanol and value-added products

A project entitled ‘Biorefining of sugarcane bagasse for production of bioethanol and value-added products’ under Indo-Brazil bilateral collaboration with IFSC/USP, Brazil and GNDU, Amritsar, funded by the Department of Biotechnology (DBT), Ministry of Science and Technology is going on since May 2016. The project cost from Indian side is INR 129.264 lakh.

(v) Biorefinery approach for generation of platform chemicals and bioethanol from indigenous lignocellulosic agrowaste bioresources

A project entitled ‘Biorefinery approach for generation of platform chemicals and bioethanol from indigenous lignocellulosic agrowaste bioresources’ has been sanctioned by DBT. The project cost is INR 69.60 lakh. The project was taken up with effect from Oct 26, 2017.

(vi) Process development for enhanced biobutanol production using butanol-tolerant isolate

A startup research grant project entitled ‘Process development for enhanced biobutanol production using butanol-tolerant isolate’ was sanctioned in Nov 2015 by Science and Engineering Research Board (SERB) to Dr. Shuvashish Behera, Young Scientist cum Principal Investigator to work at SSS-NIBE vide at a total cost of INR 32.30 lakh. The project has been completed in Nov 2018.

(vii) Training program on Bio-Energy

A three-day national training program on ‘Biogas Technology and its Implementation’ was organized at Sardar Swaran Singh National Institute of Bio-Energy, during Feb 27-Mar 1, 2019. The main objective of the national training program was to introduce the importance and various applications of bio-energy, characterization of biomass and assessment biomass gasification, waste utilization for biogas production, off-grid and grid power generation using biomass and biomass cookstoves. During the training program,



various renowned experts from academia and representatives from industry delivered their expert talks. The program was attended by representatives from SNA and Industry, entrepreneurs, academicians, research scholars and students from all over the country.

11.3.5 Testing and performance evaluation of biomass cookstove

Biomass cookstove testing centre is well equipped and has modern equipments for testing of different parameters of cookstove combustion such as CH₄, NO, SO₂, CO, CO₂, O₂, particulate matter, temperature, etc. The facility consists of high capacity cookstove hood, Multi component gas analyzer unit, Bomb calorimeter, SMS-4 particulate matter sampler, Microbalance, etc. The testing of Biomass Cookstove is being carried out as per BIS Standards. During FY 2018-19, three biomass cookstove were received from reputed developers for testing and performance evaluation, which were tested out as per BIS standard 2013.

11.4 SOLAR ENERGY CORPORATION OF INDIA LIMITED (SECI)

- 11.4.1 Solar Energy Corporation of India Ltd. (SECI) is a Section- 3 Company under the Companies Act, 2013, with 100 percent Government ownership, under the administrative control of the Ministry of New and Renewable Energy (MNRE).
- 11.4.2 The company was set up as an implementing and executing arm of the Jawaharlal Nehru National Solar Mission (JNNSM) for development, promotion and commercialization of solar energy technologies in the country. In 2015, the mandate of the company has been broadened to cover all segments of renewable energy, pursuant to the approval of the Government of India.
- 11.4.3 During F.Y. 2017-18 it registered a total revenue of Rs.1175.91 Cr. and net profit after tax (PAT) of Rs.64.72 Cr.



10 MW solar project in Rajasthan



10 MW solar project in Maharashtra

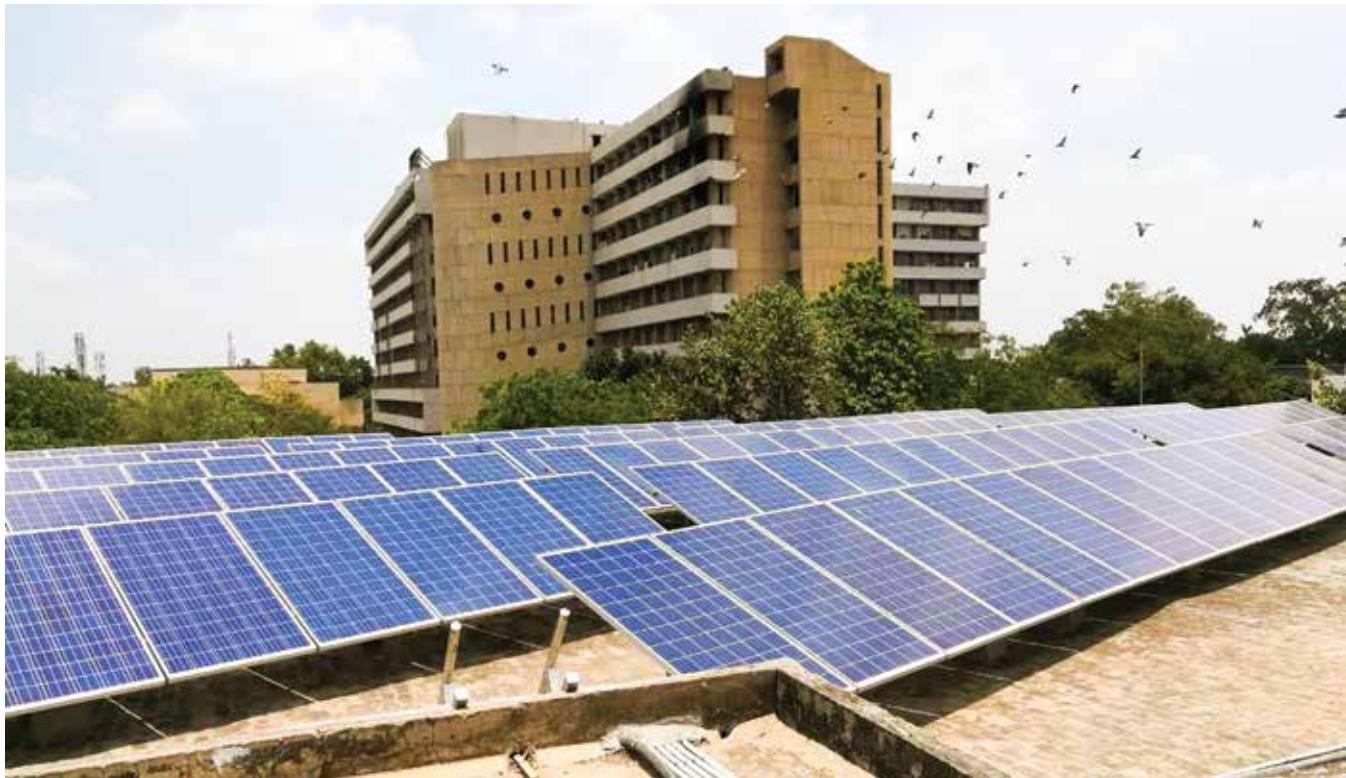
11.4.4 MAJOR BUSINESS ACTIVITIES

11.4.4.1 Implementation of Solar Tenders under National Solar Mission

- (i) SECI is the implementation agency for Batches-I, III and IV under Phase-II of the National Solar Mission (NSM). After introduction of Standard bidding guidelines by the Government, SECI undertakes tariff-based tendering for solar projects as well.
- (ii) Under these tenders, developers are paid a tariff pre-determined in the scheme, or as discovered in the bidding process, through a 25-year power purchase agreement (PPA) between SECI and the developer. Power from the projects is in turn sold by SECI to various DISCOMs/Bulk consumers through 25 year power sale agreements (PSA).
- (iii) Under these modes, SECI has awarded capacities of 11015 MW, out of which projects of 4555 MW capacity have been commissioned, cumulatively till 31.03.2019. In addition, tenders have been issued for 9700 MW capacity, for which bids are being called.



Wind Power project under SECI tender



Geological Survey of India, Lucknow

- (iv) The massive tendering and implementation mechanism established by SECI has led to global interest in India's solar energy programme and brought in huge investments in the sector, coupled with a steep decline in solar power tariffs – thereby providing economic benefits to DISCOMs.

11.4.4.2 Implementation of ISTS Connected Wind Power tenders

- (i) SECI is the implementing agency for large scale wind power projects on pan-India basis, towards fulfilment of National target. Till 31.03.2019, SECI has awarded capacities of 7240 MW, in five tranches, of which 729 MW is commissioned. Balance capacities are scheduled for commissioning in FY 2018-19 and FY 2019-20. Further, RfS for 2400 MW (Tranches-VI and VII) have been issued for inviting bids from developers (till 31.03.2019).
- (ii) SECI's initiatives in this sector have brought about rationalization of wind power tariffs through a system of competitive procurement process and has strengthened competition in the industry. These tenders have also made it possible for all states to avail the benefits of wind energy at economical tariffs by enabling large-scale inter-state transfer of wind power.

11.4.4.3 Grid-connected Rooftop Programme

- (i) SECI is one of the implementation agencies of the schemes for setting up of rooftop solar projects in India. SECI has implemented various tenders for rooftop solar involving both the CAPEX (investment by roof owner) and RESCO (PPA with roof owner) models.
- (ii) SECI had launched India's largest rooftop tender for social, residential, and institutional sectors in 2016-17 on pan-India basis, with provision of 30% subsidy for general category states and 70% for special category States. Under this tender, more than 2000 projects, totalling to 136 MW capacity have been successfully commissioned (till 31.03.2019).



- (iii) SECI had also launched a tender under the ‘Achievement Linked Incentive Scheme’ of MNRE for setting up rooftop solar projects on buildings in Central and State Government Ministries, Departments, etc., with provision of 25% incentive for general category States and 60% subsidy for special category States. Under this tender, about 900 projects, aggregating to 130 MW capacity have been successfully commissioned (till 31.03.2019).

11.4.4.4 Solar Parks

- (i) SECI has been designated as MNRE’s agency for handling the scheme for development of solar parks (40000 MW), for providing infrastructural support for setting up of solar projects, such as developed land and power evacuation facility, to project developers. Till 31.03.2019, 42 solar parks totalling 23499 MW capacity have been granted administrative approval by MNRE.
- (ii) Under this scheme, DPRs are submitted to MNRE for approval, once MNRE approves the solar park projects, subsidy is released based on achievement of milestones by MNRE through SECI.
- (iii) The solar parks in Andhra Pradesh, Karnataka, Madhya Pradesh, Kerala, Uttar Pradesh and Himachal Pradesh are being implemented through JVCs of SECI with the state designated agencies.



National Rice Research Institute, Cuttack

11.4.4.5 CPSU Scheme

SECI was designated as the Nodal Agency for implementing this scheme. Under the scheme, projects of 881.76 MW have been commissioned (till 31.03.2019).

11.4.4.6 Canal Top/ Canal Bank Scheme

SECI was designated as the Nodal Agency for implementation of the scheme and the role of the company



5 MW solar project at BDL, Ibrahimpatnam (under construction)

has been to oversee the implementation of projects in various states and provide CFA based on progress related milestones. Under the scheme, projects of total 94 MW capacity have been commissioned in 7 states viz. Andhra Pradesh, Gujarat, Kerala, Karnataka, Punjab, Uttarakhand, and West Bengal (till 31.03.2019).

11.4.4.7 Scheme for Defence Establishments

SECI was designated as the implementing agency for the scheme. Out of total capacity of 270 MW sanctioned by MNRE, 96 MW has been commissioned (till 31.03.2019).

11.4.4.8 Emerging Technology Areas

The following are the emerging technology areas that SECI is investing in

- Floating Solar-** Floating solar technology is an alternative for harnessing solar power in places with constraints on land availability/usage. Under this technology, solar PV panels are mounted on floating platforms on water bodies such as dam reservoirs, lakes, etc.

SECI is working for development of Floating Solar projects on a large scale in the country in many states. Joint working groups have been formed with NHPC/ NHDC and Tangedco, and visits for various reservoirs, such as Rihand, Hirakud, Omkareshwar and Indira Sagar Dam have been undertaken with initial estimated potential of 2500+ MW.

In 2018-19, RfS of 150 MW floating solar project at Rihand dam in Uttar Pradesh has been issued and techno-commercial evaluation has been completed (till 31.03.2019).



- b. **Solar wind hybrid-** Solar wind hybrid technology aims at optimization of land and common infrastructure, such as power evacuation, transmission network, etc., by combining wind and solar technologies. Based on the complementary nature of solar and wind resource availability, this technology gives better power output by partly cancelling the intermittency associated with the individual RE sources.

In 2018-19, SECI has issued RfS for development of solar-wind hybrid projects (tranche-I) under which letters of award (LoA) were issued for 840 MW capacity in January, 2019. RfS for tranche-II has been issued in March, 2019..

- c. **Manufacturing linked Solar-** With the objective to strengthen India's domestic manufacturing base in solar PV technology, in FY 2018-19, SECI has brought out tender for setting up of solar power projects alongwith solar manufacturing capacity.

- d. **Solar with Energy storage-** As the level of RE in India's electricity mix rises, there is a growing need to install energy storage technologies to meet the challenges of intermittency in RE generation.

SECI is working on several tenders with energy storage. As a demonstration case, SECI is planning to develop a 20 MWh battery storage system in its 160 MW solar-wind hybrid CAPEX project with World Bank funding.

- e. **Solarization of public transportation-** SECI is in discussion with Indian Railways for setting up of 10000 MW capacity of solar projects for captive use of railways. Feasibility assessment is in progress.

- f. **Round-the-clock RE-** SECI is working on developing solutions for providing 24x7 dispatchable RE power through a combination of multiple sources, combined with energy storage systems, to meet the local demand curve.



Rooftop solar project at BHU (under construction)



11.4.4.9 Project Development

Apart from creating large scale solar and wind capacities of BOO basis through tenders, SECI also engages in development of solar and wind capacities through its own investment and as a project management consultant (PMC). Some of the initiatives are listed below:

- A. Projects under PMC-** SECI is implementing about 500 MW of projects for various entities under PMC mode out of which about 100 MW has been commissioned. Some of the major projects under execution in FY 2018-19 are as follows:
 - **129 MW for SCCL-** SECI is undertaking development of 129 MW aggregate capacity of solar projects in different locations of Telangana, on behalf of SCCL. EPC contract has been awarded and the projects are under execution (till 31.03.2019).
 - **5 MW for BDL, Ibrahimpatnam -** SECI is developing a 5 MW solar project at BDL, Ibrahimpatnam. The project is under execution (till 31.03.2019).
 - **8 MW BHU-** SECI is developing 8 MW rooftop solar projects at BHU, Varanasi. Construction work is in progress.
- B. CAPEX Projects-** SECI has operational projects of 11 MW capacity under its ownership and the company is looking to expand its portfolio in renewable energy. Details of existing and ongoing projects are as follows:
 - **10 MW Badi Sid, Rajasthan-** The first solar PV project of 10 MW capacity of SECI was commissioned in Badi Sid, Jodhpur district of Rajasthan on 31.03.2016. The plant has generated about 18.5 MU in FY 2018-19 (till 31.03.2019).
 - **1 MW Andaman & Nicobar (A&N)-** SECI has installed 1 MW ‘first-of-its-kind’ rooftop solar power projects in Andaman & Nicobar Islands. The project was commissioned in June, 2017 and is under operation.
 - **160 MW solar-wind-BESS hybrid Project at Ramagiri, AP-** As an initiative for promoting innovation in RE, SECI is developing a 160 MW of solar-wind hybrid power plant with battery storage in Andhra Pradesh, with World Bank financing. The project site has been identified and the required land is under acquisition. Techno-commercial feasibility assessments of the project have been undertaken. Framework PPA has been signed between A.P. DISCOM and SECI. RfS for selection of EPC contractor has been issued in August, 2018 and bids are under evaluation.
 - **10 MW Solar PV Project at Karnataka (DRDO)-** A 10 MW project has been identified to set up at DRDO Kolar premises in Karnataka under an MoU signed with DRDO. RfS for selection of EPC contractor was issued in May, 2018 that has been awarded in Feb, 2019.
 - **Solarization project in Lakshadweep-** SECI Board of Directors has accorded in-principle approval for setting up of solar projects in Lakshadweep islands in a combination of 4 MW ground-mounted, 15 MW floating solar and 75 MWh battery storage, as an initiative towards diesel replacement in island regions.
 - **150 MW Floating solar project in Jharkhand-** SECI Board of Directors has accorded in-principle approval for setting up of a 150 MW floating solar project in Getalsud and Dhurwa reservoirs of Jharkhand.



11.4.4.10 Power Trading

SECI has a Category I Trading License from Central Electricity Regulatory Commission (CERC) to carry out power trading on pan-India basis. It is an active power trader, carrying out trading on both intra-state and inter-state levels. The company trades in renewable power generated from solar and wind power projects set up through tenders implemented by SECI. In FY 2018-19, over 6700 million units of electricity have been traded across 17 states and UTs (till 31.03.2019).

11.5 INDIAN RENEWABLE DEVELOPMENT AGENCY LIMITED

11.5.1 Indian Renewable Development Agency Limited (IREDA) is a Mini Ratna (Category-I) Government of India Enterprise under the administrative control of Ministry of New and Renewable Energy (MNRE). IREDA is a Public Limited Government Company established as a Non -Banking Financial Institution in 1987 engaged in promoting, developing and extending financial assistance for setting up projects relating to new and renewable sources of energy and energy efficiency / conservation with the motto: 'ENERGY FOR EVER'.

11.5.2 LENDING OPERATIONS

(i) During the Financial Year 2018-19, IREDA has sanctioned loans to the tune of Rs.11941.87 crore (corresponding previous year Rs.12130.01 crore) and disbursed Rs.9385.33 crore (corresponding previous year Rs. 8328.38 crore) against the annual target of Rs.15000 crore and Rs.9315 crore for sanction & disbursements respectively. The above said sanctioned loan (includes co-financed projects/takeover loans) would support capacity addition of 3266.37 MW. The sector wise breakup of sanctions and disbursements for the said period given below in **Table 11.1**.

**Table 11.1: IREDA – Sector-Wise Break-up of Sanctions and Disbursements
Up to 31.03.2019 (Unaudited)**

Sector	Loan Sanctions	(Rs. in crore) Disbursement
Wind Power	1524.94	1557.16
Hydro Power	134.37	352.65
Biomass and Cogeneration	24.87	21.83
Solar Energy	5748.62	3828.47
Bill Discounting	102.35	92.03
Energy Efficiency	0.00	2.47
Bridge Loan	4.78	4.79
Miscellaneous (STL+ Manufacturing +Waste to Energy+ NCEF+ Guarantee Scheme + Energy Access + Ethanol)	4401.94	3525.97
TOTAL	11941.87	9385.37

- (ii) The sector-wise break-up of cumulative sanctions and disbursements up to 31.03.2019 is given in the **Table 11.2.**

Table 11.2: IREDA – Sector-Wise Break-Up of cumulative Sanctions and Disbursements up to 31.03.2019 (Unaudited)		
Sector	Cumulative Loan Sanctions	Cumulative Disbursement
Wind Power	24526.67	16400.91
Hydro Power	8150.21	4665.94
Biomass and Cogeneration	5296.76	3359.96
Solar Energy	21451.51	11182.67
Bridge Loan	127.55	146.32
Bill Discounting	181.97	151.66
Energy Efficiency	1271.89	342.50
Miscellaneous (STL+ Manufacturing +Waste to Energy+ NCEF + Guarantee Scheme + Energy Access + Ethanol)	4401.94	9181.28
TOTAL	65408.50	45431.22

11.5.3 MOU WITH MNRE

Based on the unaudited accounts of financial year 2018-19, the Memorandum of Understanding (MoU) rating is ‘Very Good’. IREDA has also signed MoU with the MNRE for the year 2019-20.

11.5.4 RESOURCE MOBILIZATION

Paid up capital of IREDA is Rs .784.60 crore with a net worth of Rs. 2563.77 crore based on the financial results for the period ended March 31, 2019. During 2018- 19, IREDA has raised Rs. 2214.68 crore through international lines of credit.

11.5.5 DISSEMINATION OF INFORMATION

IREDA has continued to create awareness of Renewable Energy Technologies, Energy Efficiency & Conservation (EEC) and also its financial assistance schemes by hosting all its publications on its website. A monthly journal ‘Energy Next’ exclusively dedicated to Clean Energy is continued to support benefits through print media.

11.5.6 HUMAN RESOURCE DEVELOPMENT

- (i) ‘Human Resource’ is the most important assets of the organization. IREDA has achieved 256 training man days for this year which includes one week’s training program benefiting more than 15% employees and monthly lecture series for its employees by eminent personalities to harness their knowledge as well as to create awareness on concept for development succession planning, an effective process for recognizing, developing and retaining top leadership & talent, has been introduced. Subsequent to the celebration of International Yoga Day on 21st June, 2018. Yoga classes are being conducted by the Company for its employees.



- (ii) 17 Executive Trainees were selected through Campus recruitment during March, 2018 and total number of employees, as on 31st March, 2019, is 143 including 2 Board Level Executives and 1 CVO.

11.5.7 CORPORATE SOCIAL RESPONSIBILITY/SUSTAINABLE DEVELOPMENT/R&D ACTIVITIES

- (i) The Company spent Rs.12.56 crore during the FY 2018-19 on CSR activities for the project which were completed/ongoing during the year (including Rs.7.67 Crore paid for the projects which were sanctioned during the year 2018-19). Projects aggregating to Rs.15.60 Crore were sanctioned during the year and were in progress and few completed at the end of the year. The unspent amount on CSR initiative shall be spent upon the completion of the project. As a socially responsible corporate, IREDA is committed to increase its CSR impact and spend over the coming years, with its aim of playing a large role in India's sustainable development by embedding wider economic, social and environmental objectives.
- (ii) During the period April 2018 – March 2019, following activities/projects were undertaken by the Company under its CSR initiatives as shown in **Table 11.3**.

Table 11.3: CSR Initiatives undertaken by IREDA during 2018-19

Sr. No.	Description	Rs.
1	Promoting Education - Provision of Computer Lab related facilities to Girls Sr. Secondary Residential School and RPS Secondary School run by RBKS, Rajasthan at Jhadol Block, Udaipur District, Rajasthan.	1440000
2	Promoting Education - Financial support towards Remuneration of salary of Yoga Instructor for conducting Yoga Courses at Delhi Pharmaceutical Sciences and Research University (DPSRU).	360000
3	Promoting Education - Contribution to Barefoot College International for training of 60 'Solar Mamas' in Tilonia, Ajmer, Rajasthan.	6670000
4	Environmental Sustainability - Installation of 49 kWp Roof-Top Grid Connected Solar PV System at Samarthanam Trust for the Disabled in Bengaluru, Karnataka.	2695000
5	Promoting Education - Financial Support for running Skill Development Centre by providing Computer Lab related facilities & Sewing Machines to Srishti – Social & Educational Welfare society in Sangam Vihar, New Delhi	1236000
6	Health & Sanitation - Provision of medical equipment and furniture item at Integrated Muscular Dystrophy Rehabilitation Centre 'ManavMandir' at Solan, Himachal Pradesh.	3500174
7	Environmental Sustainability - 200 Solar PV Street Lighting Systems in Sidharthnagar Parliamentary Constituency, U.P.	4452000
8	Environmental Sustainability - 500 Solar PV Street Lighting Systems in Fatehpur Parliamentary Constituency, U.P.	11130000
9	Environmental Sustainability - 75 Solar PV Street Lighting Systems in College of Agriculture, Kaul, Kaithal, Haryana	1671100
10	Health & Sanitation: 50 Tricycles in Karakat, Bihar	1950000
11	Environmental Sustainability - 10 Solar Water Pumping Systems in Shahjahanpur, Uttar Pradesh	3575000
12	Aspirational District Development Program in Balrampur & Chandauli in Uttar Pradesh	66200000



13	Environmental Sustainability - 5000 Solar Lanterns and 50 Shelter Kits for Flood Affected People in Kerala	4000000
14	Environmental Sustainability - 8000 LPD Solar Water Heating System at Jawahar Navodaya Vidyalaya, Sindhudurg, Maharashtra	1700000
15	Environmental Sustainability - 30 Solar PV Street Lighting Systems in Khurrampur Village, Gurugram, Haryana	668430
16	Environmental Sustainability - 50 Solar PV High Mast Lighting Systems in Raibareli, Uttar Pradesh	4777500
17	Environmental Sustainability – Additional 50 Solar PV High Mast Lighting Systems in Raibareli, Uttar Pradesh	4777500
18	Environmental Sustainability - 100 Solar PV based Induction Cook Stoves in Andaman & Nicobar	7500000

12: SUPPORT PROGRAMMES





SUPPORT PROGRAMMES

12.1 INFORMATION AND PUBLIC AWARENESS PROGRAMME

- 12.1.1 India is a part of global renewable energy transition and stands among the top five countries in the world in terms of renewable energy capacity. The Ministry has worked systematically for putting in place facilitative policies and programmes for achieving the goal. Waiver of Inter-state transmission charges for sale of solar and wind power; Renewable Purchase Obligation trajectory, competitive bidding guidelines for procurement of solar and wind power; flexibility in generation and scheduling of thermal power stations; solar cookers programme; solar-wind hybrid policy; solar PV manufacturing linked with assured take-off; Atal Jyoti Yojana and standards for deployment of Solar PV systems are some of the major initiatives. In order to percolate all these initiatives, benefits and usage of renewable to the masses, information dissemination and publicity is essential. In this background, I&PA programmes for renewable energy are conceptualized and developed for implementation.
- 12.1.2 The Programme is implemented through use of existing Government channels viz. (i) Directorate of Advertising & Visual Publicity (DAVP); (ii) National Films Development Corporation (NFDC); (iii) Doordarshan; (iv) All India Radio (AIR); (v) Songs & Drama Division; (vi) State Nodal Department/ Agencies for renewable energy; and (vii) NGOs/Academic institution, etc., and participation in exhibitions of national importance by the Ministry and also through other relevant Institutions/Organization. It is also providing information and awareness through its three autonomous Institutions i.e. NISE, NIWE and SSS-NIBE and two PSUs i.e. IREDA and SECI extensively.
- 12.1.3 During the year, following I&PA activities were developed and implemented under the overall framework of the media strategy for renewable:-
- i. Press Conferences were organized for giving wide publicity on achievements in Renewable Energy Sector.
 - ii. Wide range publicity was given through Electronic, Print and Outdoor Media for the 2nd Global RE-Invest – 2018 held from 2-5 October 2018 at India Expo Mart, Greater Noida, UP.
 - iii. Publicity Campaign through Quarter page, half page and full page colour advertisements in different newspapers in Hindi, English and Regional languages including RE-Invest 2018.
 - iv. Four Radio spots on renewable energy were produced and broadcast on different Radio Stations through BOC; two video films were also produced.
 - v. Publishing of the Ministry's bi-monthly newsletter 'Akshay Urja' continued in English and Hindi.
 - vi. Logo Supports given to different organizations for different events/exhibitions on Renewable Energy.
 - vii. Ministry's Booklet namely 'We Care for the Planet' was prepared, and printed.
 - viii. Introduction on all RE activities is posted on Ministry's website with regular updates.
 - ix. Programmes, schemes, achievements are regularly posted on Social Media through Ministry's three Institutes and two PSUs.
 - x. Participation in exhibitions such as World Environment Day, Vibrant Gujarat, 15th Pravasi Bharat Diwas, etc., through the organisations under the Ministry.



12.2 PLANNING AND COORDINATION

- 12.2.1 The Planning and Coordination Division is responsible for overall planning and coordination for matters related to various schemes/programmes being implemented by the Ministry, various policy & fiscal reforms being undertaken, etc. Its work involves maintaining a close liaison with different Programme Divisions of the Ministry and with other concerned Ministries/Departments i.e. PMO/NITI Aayog/MEA/ Cabinet Secretariat, PIB, etc., and State Government Agencies i.e. State Nodal Agencies, etc., on a regular basis.
- 12.2.2 The activities handled by the division during the year 2018-19 majorly included compilation and regular updating of data base for achievements made in grid and off grid renewable power, preparation of reports for Standing Committee on Energy related to the Ministry's Demand for Grants and other specific subjects selected for examination, monthly reports of major achievements/ initiatives, action taken notes and monthly DO letter for PMO/Cabinet Secretariat/PIB, etc., multi-sectoral inputs/briefs for various meetings, inputs for speeches of Hon'ble President/Hon'ble Prime Minister/ Hon'ble Finance Minister/ Hon'ble Minister/ Secretary, replies to VIP, other references/ questionnaires/ Parliament Questions involving multiple schemes/ programmes, updating of various portals such as PMG, E-samiksha, Pragati, etc., time-bound compilation of comments on various draft Cabinet notes, EFC/SFC, etc., received from other ministries/departments, preparation of Output-Outcome framework for budget, etc.

12.3 HUMAN RESOURCES DEVELOPMENT

- 12.3.1 Human Resource Development (HRD) scheme of MNRE supports trainings for manpower at all levels including promoting higher studies/research courses in R&D/academic institutions in renewable energy by providing fellowships to students/scholars. Support is also provided to R&D/academic institutes for up-gradation of their libraries and labs for conducting higher degree courses such as M.Sc, M.Tech, and Ph.D in new and renewable energy. Under short term training programmes of HRD programme, a Skill Development Programme named *Suryamitra* was introduced in 2015 to train 50,000 skilled manpower to create trained workforce for installation, commissioning, operation and maintenance of solar projects.
- 12.3.2 The following are the various components of the HRD scheme:
- i) Support to educational and other organizations for conducting short-term trainings on various aspects of renewable energy with focus on skill development at all levels.
 - ii) Fellowships:
 - a. National Renewable Energy Fellowship (NREF) Scheme for pursuing M.Sc./M.Tech/ PhD/PDF degree courses.
 - b. National Renewable Energy Science Fellowship Scheme for eminent scientists working in research institutes with an innovative idea in solar energy.
 - iii) Support to higher educational institutions for laboratory and library upgradation.
 - iv) Suryamitra Skill Development Programme
 - v) Development of course/ study materials through experts/expert institutions

12.3.3 NATIONAL RENEWABLE ENERGY FELLOWSHIP SCHEME

- (i) Ministry continued its support to students/scholars for pursuing higher studies such as M.Sc, M.Tech,



Ph.D, PDF courses in renewable energy in 17 selected educational institutions by way of providing fellowships/stipend under NREF Scheme. In the beginning of 2018-19, 28 Ph.D, 43 M.Tech/M.E and 30 M.Sc fellowships were being provided under NREF programme out of which 16 fellows completed Ph.D, 14 students got M.Tech/M.E degree and 10 students got M.Sc (Renewable Energy) degree in 2018-19. During 2019-20, 30 M.Tech, 33 for JRF/SRF and 20 for M.Sc fellows are continuing under NREF programme. The NREF fellows/students have published 18 research papers in the national and international journals of repute, besides presenting 10 papers in seminars totalling to the scientific output of NREF fellows to 558 research papers and 166 papers in seminars and 3 filed patents. The list of supported institutes are given in **Table 12.1**.

Table 12.1: Institutions allotted Fellowships by MNRE under NREF scheme

S.No.	Institutions allotted Fellowships for M. Sc, M.Tech, JRF/ SRF (Ph.D)
1	Indian Institute of Technology, Delhi
2	Indian Institute of Technology, Roorkee
3	Indian Institute of Technology, Bombay
4	Indian Institute of Technology, Kharagpur
5	Malaviya National Institute of Technology, Jaipur
6.	Anna University, Tamilnadu
7.	Pune University, Pune, Maharashtra.
8.	Pondicherry University, Pondicherry.
9.	Tamilnadu Agricultural University, Tamilnadu
10.	Shri Mata Vaishno Devi University, Katra, J&K.
11.	Jadavpur University, Kolkata
12.	Cochin University of Science and Technology, Cochin
13.	Indian Institute of Engineering Science & Technology, Shibpur, West Bengal.
14.	Gandhigram Rural Institute (Deemed University), Tamilnadu
15.	University of Lucknow, Lucknow.
16.	National Physical Laboratory (NPL), CSIR, New Delhi
17.	Central University of Jharkhand , Ranchi

12.3.4 ENHANCEMENT OF LIBRARY AND LABORATORIES

- (i) Up-gradation activities of the laboratory and library facilities supported by the Ministry in the previous year in Pandit Deendayal Petroleum University, Gandhi Nagar and Tezpur University, Assam are undergoing. Gandhigram Rural Institute was supported for upgradation of laboratory facilities in the year 2019-20.

12.3.5 TRAININGS

- (i) The Ministry continued its support to institutes for conducting short term training programmes with varied levels and target groups in the various renewable energy areas. In the current year, Ministry supported five Institutes for conducting training programmes in the area of solar PV, Solar electrification, Solar Roof Top Grid Engineers Course, Solar water Pumping, Small hydro as shown in **Table 12.2**.

**Table 12.2: Institutes Supported by Ministry for conducting Training Programmes**

S. No.	Institutions allotted Short training programmes	Area	No. of training programmes	No. of participants trained
1	Indian Institute of Technology, Roorkee	Small Hydro	6	86
2	CSIR-National Physical Laboratory, New Delhi	Solar PV	2	55
3	Barefoot College (Social Work and Research Centre), Tilonia	Solar electrification (Solar Mamas)	2	40
4	National Institute of Solar Energy, Gurugram	Solar water Pumping (Varunmitra)	20	425
5	National Institute of Solar Energy, Gurugram	Solar Roof Top Grid Engineers Course	30	923

*Establishing solar panels for Rural Electronic Work shop Training of Rural Women at Barefoot college, Tilonia*



12.3.6 SURYAMITRA TRAINING

Ministry launched Suryamitra Skill Development Programme in the year 2015 to train 50,000 Suryamitras by the year 2020 and set a target to provide 19000 Suryamitras in the year 2019-20. Total 31,092 no. of Suryamitras have been trained up to 31st March, 2019. For the current year, Suryamitra Trainings are being organized through 190 training centres/organisations in different states across the country empanelled through Expression of Interest (EOI) floated by National Institute of Solar Energy in the month of March, 2018. During the current year 2019-20, 5700 no. Suryamitra training is allocated in 190 batches at 190 training centres throughout the country for 1st Quarter against the target of 19000 for the year 2019-20. The state wise progress of the Suryamitra programme is shown in **Table 12.3**. The state wise progress of Varunmitra and Solar Roof Top Grid engineers training is shown in **Table 12.4** and **Table 12.5**.

12.3.7 HRD PAVILION AT 2ND RE-INVEST 2018

An exclusive HRD pavilion was set up in Hall no.7, Stall no.8, India Expo Mart, Greater Noida, to showcase the HRD activities of the Renewable Energy Sector. Academic universities / institutes, research organisations, skill development agencies were invited to exhibit their academic and skill development courses & modules, innovations, etc., related to all areas of renewable energy sector. Seventeen institutes participated and exhibited their academic, research and skill development i.e 8 Universities, 2 IITs, 1 CSIR Laboratory, 3 institutes and 3 skill development institutes. About 120 suryamitras, students from different colleges, schools visited HRD Pavilion and Expo. The concept of HRD pavilion received overwhelming response. Ministry conducted quiz programme for students/Suryamitras and awarded prizes to the winners of the quiz competition.



Sh. Anand Kumar, Secretary, MNRE at HRD Pavilion during 2nd Re-Invest 2018, India Expo Mart, Greater Noida



Suryamitras at HRD Pavilion during 2nd Re-Invest 2018, India Expo Mart, Greater Noida

12.4 ADMINISTRATION – E GOVERNANCE, VIGILANCE, LIBRARY, RIGHT TO INFORMATION

12.4.1 E-GOVERNANCE

12.4.1.1 National Informatics Centre (NIC) is a premier S&T institute of the Government of India, working as an active catalyst and facilitator in ‘Informatics-led-development’ programme of the government for providing e-Government / e-Government Solutions adopting best practices, integrated services and Global solutions in Government sector.

12.4.1.2 Solar Photovoltaic Installation – Rooftop (SPIN)

- (i) Govt. of India has fixed a target of 40,000 MW by 2022 from solar rooftop area. It is one of the project monitored by the PMO. An online portal namely SPIN (<https://solarrooftop.gov.in>) is being maintained for



Table 12.3: Progress of Suryamitra Training in different States 2015-19 & 2019-20

S.No	State/UTs	Targets of Suryamitras to be trained by march 2020	No. of Suryamitras Trained in 2015-2019	No. of Suryamitras training allocated in 2019-2020	Total No. of Suryamitras
1	Andaman & Nicobar	100	0	0	0
2	Andhra pradesh	2000	1308	210	1518
3	Arunachal Pradesh	200	30	0	30
4	Assam	2500	833	150	983
5	Bihar	2500	1139	150	1289
6	Chandigarh	100	148	30	178
7	Chhattisgarh	2000	1227	210	1437
8	D. & N. Haveli	10	0	0	0
9	Daman & Diu	10	0	0	0
10	Delhi	500	432	120	552
11	Goa	400	174	30	204
12	Gujarat	2000	2136	270	2406
13	Haryana	1000	937	210	1147
14	Himachal Pradesh	500	324	60	384
15	Jammu & Kashmir	700	244	180	424
16	Jharkhand	2000	517	60	577
17	Karnataka	2500	1371	270	1641
18	Kerala	2000	495	60	555
19	Lakshadweep	100	30	0	30
20	Madhya Pradesh	4000	2522	660	3182
21	Maharashtra	4000	2933	360	3293
22	Manipur	500	150	30	180
23	Meghalaya	250	0	0	0
24	Mizoram	200	0	0	0
25	Nagaland	200	60	0	60
26	Orissa	2500	1766	360	2126
27	Puducherry	50	62	0	62
28	Punjab	2000	323	0	323
29	Rajasthan	2500	2006	360	2366
30	Sikkim	200	0	0	0
31	Tamil Nadu	2500	2142	450	2592
32	Telengana	2000	1914	360	2274
33	Tripura	250	148	30	178
34	Uttar Pradesh	5000	2608	450	3058
35	Uttrakhand	500	680	120	800
36	West Bengal	2500	2433	510	2943
	Total	50270	31092	5700	36792



Table 12.4: Progress of Varunmitra (Solar Water Pumping)Training in different States FY 2018-19

S. No	State	Targets of Varunmitras to be trained 2018- 19	No. of Varunmitras trained 2018- 19	Total 2018- 19
1	Andhra Pradesh	40	40	40
2	Assam	40	41	41
3	Gujarat	40	41	41
4	Haryana	20	27	27
5	Punjab	20	20	20
6	Maharashtra	40	40	40
7	Bihar	20	20	20
8	Jharkhand	20	20	20
9	Rajasthan	40	40	40
10	Tamil Nadu	40	56	56
11	Madhya Pradesh	20	20	20
12	Chhattisgarh	20	20	20
13	Uttar Pradesh	40	40	40
Total		400	425	425

Table 12.5: Progress of Roof Top Solar Grid Engineer Training in different States FY 2018-19

S. No	State	Targets of Roof Top Solar Grid Engineer to be trained 2018- 19	Roof Top Solar Grid Engineer trained 2018- 19	Total 2018-19
1	Rajasthan	80	94	94
2	Tamilnadu	80	87	87
3	Delhi	80	108	108
4	Gujarat	80	93	93
5	Karnatka	80	80	80
6	Maharashtra	80	80	80
7	Madhya Pradesh	80	80	80
8	Punjab	80	0	0
9	Chandigarh	80	0	0
10	Odisha	80	80	80
11	Haryana	80	61	61
12	Kerala	80	80	80
13	Telangana	80	0	0
14	Andhra Pradesh	80	0	0
15	Uttar Pradesh	80	80	80
Total		1200	923	923



monitoring the installation of Solar Rooftop all over the country. The application is being widely used by the general public for rooftop calculator and there by submitting the interest request to the portal. The State Nodal Agencies/ SECI and other implementing agencies are using the data for further installation. This year SPIN has been enriched with different modules such as feedback monitoring, integration of SPIN with DBT Bharat portal and DAR PAN Portal. The SPIN is also integrated with the State portals. Seven portals of States namely Assam, Chhattisgarh , Delhi, Goa, Gujarat, Odisha and UP were integrated by the end of March 2019. With these integration stake holders need to enter the data in their portal and the same will be reflected in SPIN portal.

(ii) Some of Highlights of SPIN

1. Solar Rooftop Calculator & Installation interest submission
2. Managing proposals, sanctions, targets of SNA, PSU's
3. Integration DAR PAN & DBT portal
4. Communication with stakeholders through NIC Email & SMS
5. Submission of feedback and its monitoring
6. Geo-Tagging of Rooftop Solar installations
7. Rooftop Solar awareness and policy updates
8. Integration with State portals of the Stake holders like SNA
9. Able to generate MIS reports quickly

12.4.1.3 Ministry Website (<http://mnre.gov.in>)

Ministry of New and Renewable Energy (MNRE) website was designed in-house using latest ICT tools. This year the website is hosted on the cloud platform from shared hosting. The site is being updated regularly in both English and Hindi.

12.4.1.4 e-Office

- (i) It is a web-based system implemented and maintained for effective online monitoring of movement of files and receipt in the ministry. The e-Office product aims to support governance by ushering in more effective and transparent inter and intra-government processes. The vision of e-Office is to achieve a simplified, responsive, effective and transparent working of all government offices. NIC's e-Office product is based on an Open Architecture Framework that contains the required flexibility for scaling and meeting the dynamic needs of the Government. The Ministry started using e-Office during June 2016, and till the end



Secretary Shri Anand Kumar and Joint Secretary Shri. Bhanu Pratap Yadav receiving the certificate from Dr. Jitendra Singh M/o State for PMO, Personnel, Public Grievance and Pensions.

of March 2019 around 13500 files and 75000 receipts have been generated. IREDA, a PSU of MNRE has also implemented e-office successfully.

- (ii) Based on the performance, Ministry has got the certificate of recognition of the commendable work from Dr. Jitendra Singh, Minister of State for Prime Ministers' Office, Personnel and Public Grievance and Pension. The certificate was received jointly by the Secretary MNRE, Shri. Anand Kumar and Joint Secretary Shri. Bhanu Pratap Yadav on 14/03/2018.

12.4.1.5 Customs Duty / Excise Duty Exemption for Solar Thermal and Photovoltaics

Ministry is issuing customs duty exemptions and excise duty exemptions for various developers based on various conditions. An online system namely CCMS has been designed, developed and implemented to assist the ministry to issue concessional custom duty and Excise duty certificate for Solar Thermal and Photovoltaic projects located throughout the country. The application is now hosted in cloud and as of now around 16000 certificates were approved since the inception in 2017.

12.4.1.6 Expenditure Management System

In order to monitor the progress of financial concurrence and expenditure by all the divisions of the Ministry, a web based application has been developed and implemented. The highlights of the applications are:

1. Division can view the concurrence of real-time basis
2. Substitute as central repository for expenditure register maintained by each individually
3. Provide online access to the concurrence / expenditure summary report
4. Pinpoints the Division / Schemes / Files where releases are not affected despite concurrence by IFD

12.4.1.7 Project Monitoring Through Video Conferencing Facility

Ministry's Video Conferencing facility is widely used for conducting meetings with different state agencies and foreign countries. PRAGATI (Pro-Active Governance and Timely Implementation) VC is being conducted every 4th Wednesday by the Hon'ble Prime Minister. It is being attended by Senior Officers of the Ministry.

12.4.2 VIGILANCE

- (i) The Vigilance Division of the Ministry of New and Renewable Energy (MNRE) is entrusted with taking anti-corruption measures in accordance with various rules, guidelines and instructions issued by the Government of India and the Central Vigilance Commission. The Vigilance wing of the Ministry looks after vigilance work within the Ministry and its three autonomous bodies, namely National Institute of Solar Energy (NISE), National Institute of Wind Energy (NIWE) and National Institute of Bio Energy (NIBE). The Division is entrusted with upkeep of Annual Performance Appraisal Reports (APARs) and Immovable Property returns (IPRs) of officials of the Ministry.
- (ii) The complaints received from various sources, viz CBI, CVC & others were dealt as per rules and Disciplinary proceedings were initiated where warranted.
- (iii) The Vigilance Awareness Week was observed in the Ministry from 29th October, 2018 to 3rd November, 2018. Following activities were undertaken as part of Vigilance Awareness Week:
- a. Administering the Integrity Pledge to all the staff and officers by the Secretary in MNRE of 29.10.2018 at 11AM.



- b. Expert lecture by Ex Faculty member of ISTM on Preventive Vigilance 'Eradicate Corruption-Build a New India' for the Ministry officials was conducted.
 - c. Essay competition for the officials of the Ministry was organized.
 - d. Slogans on curbing corruption and preventive vigilance with banners were placed in the premises of the Ministry.
 - e. An On-the-spot-Quiz was organized on Vigilance matters.
- (iv) As part of preventive vigilance, a list of sensitive and non-sensitive posts of the Ministry has been prepared and Administration Division of the Ministry has been sensitized to follow the rotation policy in postings. In addition, e-tendering and developing standards for procurements were also emphasized.
- (v) Probity related matters on e-portal was uploaded in respect of this Ministry and its Autonomous Organizations and vigilance related information in respect of Board Level Officers is being updated monthly on e-portal SOLVE. The Annual Performance Reports of all officers other than those of scientific cadre of the Ministry is being uploaded on SPARROW.

12.4.3 LIBRARY

- (i) The Library of the Ministry of New and Renewable acts as a reference centre and knowledge house in the field of renewable energy. At present about 15374 books (including gifted books) are available in the library covering very diverse areas including the subjects such as Renewable Energy, Climate Change, Natural Sciences, Sustainable Development, History, Sociology, Indian Literature, Computer Science, etc. A total number of 144 books have been added in the Library during the current year. The collection in the library also includes books of general interest like food, cooking, sculpture, painting, mountaineering, etc.
- (ii) The Library Committee constituted in the Ministry scrutinizes and recommends the books for procurement by the library.
- (iii) The library is currently subscribing to 41 periodicals in Hindi and English languages. Besides, as per requirement, a total number of 24 newspapers in Hindi and English languages are also being subscribed by the library. The library is providing awareness service through relevant newspapers clippings among its users. The library is also working on to provide better services to the users with the implementation of the library automation.

12.4.4 RIGHT TO INFORMATION ACT 2005

- (i) The Ministry is implementing the Right to Information (RTI) Act, 2005 as per the laid down guidelines of Department of Personnel and Training (DoPT), Central Information Commission and Ministry of Home Affairs. The Procedure / other details regarding seeking information under RTI Act 2005 are available at the MNRE website www.mnre.gov.in
- (ii) The Ministry has designated Central Public Information Officers (CPIO) and First Appellate Authorities (FAA) to respond the RTI applications and first Appeals in accordance with subjects assigned to them. A list of CPIOs and First Appellate Authorities is given in **Table 12.4**. The RTI Unit of this Ministry is headed by Ms. Alka Joshi, Dy. Secretary, who coordinates all the physical and online applications and persuades CPIOs and First Appellate Authorities to reply them within the stipulated time lines to the extent possible.
- (iii) The progress report in terms of RTI applications/First Appeals received, disposed-off as well as pendency during the period (01.01.2018 – 31.03.2019) is given in **Table 12.5**.



Table 12.4 : List of Designated Central Public Information Officers (CPIOs) and Appellate Authorities based on re-allocation of Work (As on 31/03/2019)

S. No	Subject	CPIO	Appellate Authority
1	Climate Change related initiatives including Clean Development Mechanism (CDM), Renewable Purchase Obligations (RPO) related issues, REC Policy, INSPA, NCEF, Hydrogen, Fuel Cell and IREP, Electrical Vehicle and National Board of Electric Mobility, New Technology, Specific references of Information & Public Awareness and Renewable Energy Policy and Regulations	Shri Dipesh Pherwani, Scientist 'B'	Dr. P.C. Maithani, Scientist 'G'
2	Planning and Coordination, IREDA	Shri Anubhav Uppal Scientist 'B'	Dr. Pankaj Saxena, Scientist 'F'
3	Innovative Financing for Renewable Energy Projects, Externally aided projects on Energy Access(partly funded UNDP/GEF, DFID, GIZ)	Shri Vijay Kumar Bharti, Scientist 'B'	Dr. G Prasad, Scientist 'F'
4	Solar Scheme for Farmers, Green Energy Corridor, Geothermal, Ocean / Tidal,	Shri Rohit Thakwani, Scientist 'B'	Shri Girish Kumar, Scientist 'E'
5	Solar Thermal Group-Solar Conc. and Solar Cookers, NTPC - Bundling Scheme NTPC - EPC Scheme	Shri Aravindh MA, Scientist 'B'	Shri H R Khan, Scientist 'G'
6	Biogas Power, National Biogas Programme, Biogas Training Centres and Biogas R&D	Shri S.R. Meena, Scientist 'C'	Shri G. L. Meena, Scientist 'G'
7	HRD & Training including ITEC Innovation Centre, Lab Policy, Standards and Quality Control.	Ms. Vasantha V. Thakur, Scientist 'D'	Dr. P.C Pant, Scientist 'F'
8	Off-Grid Solar, Agri Pump Scheme, Street Light , Home Light	Shri Shobhit Srivastava, Scientist 'C'	Shri Jeevan Kumar Jethani, Scientist 'E'
9	Small Hydro Projects (Private Sector) Watermills, Small Hydro Projects (Government Sector) of Uttarakhand, North] East Watermills, Mini -Micro Hydel	Shri S. K Shahi, Scientist 'C'	Dr. P. C. Pant, Scientist 'F'
10	VGF Scheme, GBI	Shri Neeraj Kumar, Scientist 'C'	Shri B.L Ram, Scientist "G"
11	Energy Storage, E-Mobility and International Solar Alliance and Specific references of Renewable Energy Policy and Regulations	Shri Tarun Singh Scientist 'C'	Dr. P.C. Maithani, Scientist "G"
12	Solar Rooftop Top, External aid under Rooftop Scheme, TA under RT Scheme	Shri Hiren Borah, Scientist 'C'	Shri Aujender Singh, DS
13	Small Wind Energy, Off – Shore wind, Manufacturing of Wind Turbine(CCDC) (Concessional Custom Duty Certificate,	Shri P.K Dash Scientist 'C'	Shri B.K Panda Scientist 'E'



14	Wind Energy, Wind RPO (Renewable Purchase Obligations), REC (Renewable Energy Certificate),	Shri Rahul Rawat, Scientist 'B'	Shri G Upadhyay Scientist 'F'
15	Solar (R&D), (ST&SPV), Solar Water Heater, Solar Thermal Group – Flat Plate/ Evacuated Tube Collector / Non concentrating Collector Systems – Air Heaters, driers, direct cooking system and All issues relating to Application relating to Regional Testing Centre,	Shri Anil Kumar, Scientist 'C'	Shri Rajesh Kumar, Scientist 'F'
16	Grid Connected PV&ST-I (HVVA related and all others), Greening of Islands	Shri Sanjay Karndhar, Scientist 'C'	Shri Ruchin Gupta, Director
17	CCDC Solar Power	Shri Arun Kumar, Scientist "C"	Shri Anand Nirvane, Scientist 'E'
18	Solar City Programme Green Building	Shri Arun Kumar, Scientist "C"	Shri H R Khan, Scientist 'G'
19	IT, Development of RE Portal	Sh. Sanjay Prakash, Scientist 'C'	Shri S.K Jagwani, Scientist 'F'
20	Organization of RE – Invest	Dr. P.C. Pant, Scientist 'F'	Shri Bhanu Pratap Yadav, JS
21	DBT Cell	Shri Sohail Akhtar, Scientist 'G'	Shri Bhanu Pratap Yadav, JS
22	R& D Coordination & Monitoring	Ms. Rohini Subramanyam	Dr. Rajesh Kumar, Scientist 'F'
23	GST related to Biogas	Shri S.R Meena, Scientist 'C'	Shri Ruchin Gupta Director
24	GST related to Wind CDC/EDE	Shri P.K Dash, Scientist 'C'	Shri Ruchin Gupta Director
25	GST related to Solar CDC/EDE	Shri Arun Kumar, Scientist 'C'	Shri Ruchin Gupta Director
26	GST related to Grid Solar	Shri Sanjay Karandhar, Scientist 'C'	Shri Ruchin Gupta Director
27	GST related to Off Grid Solar	Shri Shobhit Srivastava, Scientist 'C'	Shri Ruchin Gupta Director
28	GST related to Biomass	Ms. Priya, Scientist 'B'	Shri Ruchin Gupta Director
29	Biomass Power Schemes and Policies, Bio Energy Mission, Biomass Gassifier, Waste to Energy, Cookstove	Shri S. K Khurana, US	Sh. K. Salil Kumar, DS
30	I&PA and Seminar & Symposia, Conducting Studies based on statistical data available for RE	Raghunath, US	Sh. N. B Raju, Scientist 'E'
31	Vigilance	Ms. Sunita Dhewal, US	Shri Ruchin Gupta Director

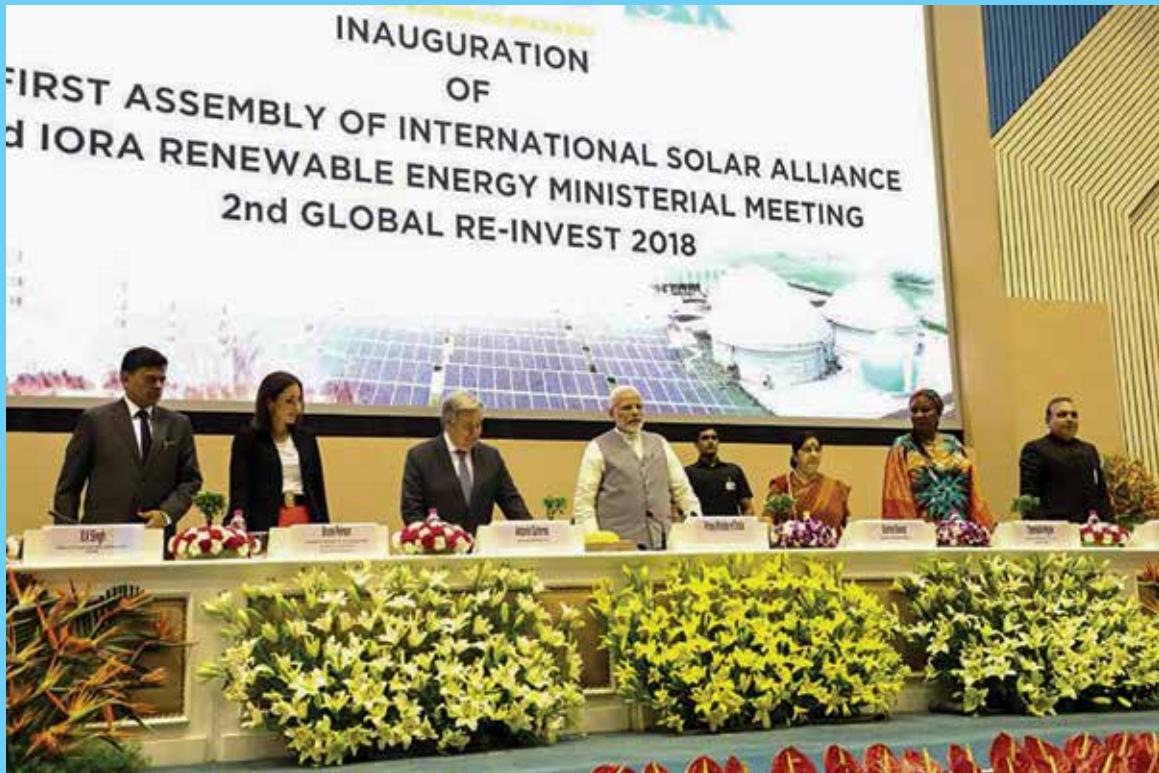


32	National Solar Mission, Solar Park, Defence Schemes,	Shri Devendra Singh, US	Shri Dilip Nigam, Scientist 'G'
33	SECI	Shri Devendra Singh US	Shri Ruchin Gupta Director
34	International Relations (IR)	Sh. Chalapathi Rao, Scientist 'C'	Ms. Veena Sinha, Director
35	O/o Minister of State (IC), NRE	Raghunath, US	Shri A.N Sharan, JS
36	Parliament Work,	Shri A.K. Singh, US	Dr. Pankaj Saxena, Scientist 'F'
37	Public Grievances	Shri A.K. Singh, US	Ms. Alka Joshi, DS
38	Administration	Shri Arvind Pokhriyal, US	Shri G Upadhyay, Scientist 'F'
39	SSS-NIBE	Shri Arvind Pokhriyal, US	Sh. K. Salil Kumar, DS
40	IFD	Shri K G Suresh Kumar, US	Shri Sandeep Mukherjee, DS
41	NISE	Shri Devendra Singh, US	Sh. K. Salil Kumar , DS
42	RTI Matters	Ms. Alka Joshi, DS	Ms. Sutapa Majumdar, EA
43	Hindi, Library	Ms. Alka Joshi, DS	Ms. Sutapa Majumdar, EA
44	SADP, Akshay Urja Shop,	Shri K.C Vasudevan, US	Shri J.K Jethani, Scientist 'E'
45	Budgeting, Expenditure monitoring, Audit & Statistical analysis	Shri K.C Vasudevan, US	Ms. Alka Joshi, DS
46	NIWE	Shri Rahul Rawat, Scientist 'B'	Shri K. Salil Kumar, DS
47	PAO, Budget	Shri Pratap Singh Sr. AO	Shri Sanjay Pandey, Controller of Accounts

Table 12.5: Details of RTI Applications Received, Disposed and Pending (Numbers) as on 31.03.2019

Item	Received	Disposed off	Pending
RTI Applications	1411	1355	56
First Appeals	83	82	01

13: International Cooperation on New & Renewable Energy





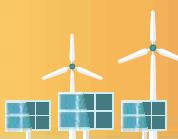
INTERNATIONAL COOPERATION ON NEW & RENEWABLE ENERGY

- 13.1 The International Relations (IR) Division of the Ministry has been continuously engaging with DEA, MEA, missions of various developed and developing countries, multilateral international organizations and missions of India abroad for cooperation in the field of New & Renewable Energy.
- 13.2 During the financial year 2018-19 also Ministry took several initiatives to promote New & Renewable Energy cooperation by signing Memoranda of Understanding (MoUs) / Implementation Agreements (IAs) / Supplementary Agreements (SAs) / Letter of Intent (LoI), etc. Ministry also convened Bilateral / Multilateral / Joint Working Group (JWG) Meetings through physical visits and Video Conference modes. The delegations were led at the level of Hon'ble Minister and senior officers of the Ministry for the purpose of these Bilateral / Multilateral / JWG meetings, signing of MoUs, etc.
- 13.3 MNRE has signed a total of 78 Memoranda of Understanding (MoUs) / Agreements / Letter of Intent (LoI) with around 45 countries in the field of New and Renewable Energy. Under these MoUs/Agreements, Joint Working Groups (JWGs) were set up to oversee identification, selection and formulation of joint activities for implementation. Interactions with countries were also undertaken through Joint Commissions / Joint Committees / Joint Working Groups setup by the other Ministries also, such as Ministry of External Affairs (MEA), Ministry of Environment, Forests and Climate Change (MoEFCC), Ministry of Commerce & Industry (MoCI), Ministry of Power (MoP) and NITI Aayog, etc. Mutually agreed projects and activities for cooperation are also established with many countries at bilateral level even though no specific MoU has been signed with them.
- 13.4 In addition, India has been collaborating under various multilateral / trilateral cooperation frameworks like South Asian Association for Regional Cooperation (SAARC), Association of South-East Asian Nations (ASEAN), Brazil-Russia-India-China-South Africa (BRICS), India-Brazil-South Africa (IBSA), etc.
- 13.5 The Ministry also engages with various international / multinational funding agencies, like World Bank, New Development Bank, KfW, African Development Bank (AfDB), United Nations Development Programme (UNDP), Asian Development Bank (ADB), United Nations Industrial Development Organization (UNIDO), GIZ and Global Environment Facility (GEF), who are providing project based financial assistance for renewable energy projects in India.
- 13.6 The Ministry also facilitates specialized training programmes in African and other developing countries in the fields of Solar Energy, Wind Energy, Small Hydro Power & Biomass at Indian through apex institutes, viz., National Institute of Solar Energy (NISE), Gurugram, National Institute of Wind Energy (NIWE), Chennai, Alternative Hydro Electric Centre (AHEC), IIT Roorkee and Indian Institute of Science (IISc), Bangalore under ITEC programme of Government of India.
- 13.7 During the year 2018-19, following Seven (7) Memoranda of Understandings (MoUs) were signed:
1. A Memorandum of Understanding was signed between Ministry of New and Renewable Energy (MNRE) of the Republic of India and the Ministry of Energy, Mines and Sustainable Development of the Kingdom of Morocco on 10th April, 2018 in New Delhi.
 2. A Memorandum of Understanding was signed between Ministry of New and Renewable Energy (MNRE) of the Republic of India and the Ministry of Energy and Mining of the Republic of Peru on 21st May, 2018 in Lima, Peru.
 3. A Memorandum of Understanding was signed between Ministry of New and Renewable Energy



(MNRE) of the Republic of India and Ministry of Electricity and Water Authority of the Government of the Kingdom of Bahrain on 15th July, 2018 in Manama, Bahrain.

4. A Memorandum of Understanding was signed between Solar Energy Corporation of India Limited (SECI), Government of India and Commissariat a l'Energie Atomique Et Aux Energies Alternatives (CEA) and Blue Storage, France on 03rd October, 2018 in New Delhi.
 5. A Memorandum of Understanding was signed between Solar Energy Corporation of India (SECI), Government of India and The Agence Francaise de Development (AFD), France on 8th October, 2018 in New Delhi.
 6. A Memorandum of Understanding was signed between Ministry of New and Renewable Energy (MNRE) of the Republic of India and Ministry of Energy and Water Resources, Republic of Tajikistan on 08th October, 2018 in Tajikistan.
 7. A Memorandum of Understanding was signed between the National Institute of Wind Energy (NIWE) under MNRE and the Technical University of Denmark (DTU Wind Energy), the Department of Wind Energy, Kingdom of Denmark on 17-12-2018 in New Delhi.
- 13.8 During the year 2018-19, various meetings were held as part of Bilateral / Multilateral cooperation, in the field of New and Renewable Energy with Hon'ble Minister, Secretary and senior officials of the Ministry.
- 13.9 During the year 2018-19, the following foreign visits have been undertaken by senior officials of the Ministry:-
- Shri. R. K. Singh, Hon'ble Minister of New and Renewable Energy and Sh. Manoj Kumar Singh, PS to Minister, MNRE visited Abu Dhabi, UAE from 16-18th January, 2018 to attend the World Future Energy Summit Conference and International Solar Alliance Forum.
 - Sh. G. Prasad, Scientist 'F', Ministry of New and Renewable Energy visited Ottawa, Canada from 29th January, 2018 to 1st February, 2018 to participate in the CIM-9/MI-3 Preparatory Meeting.
 - Sh. Gopal Krishna Gupta, Joint Secretary, Ministry of New and Renewable Energy visited Kyiv, Ukraine from 5-6th February, 2018 to participate in the 6th Meeting of the Joint Inter-Governmental Ukraine India Commission on Trade, Economics, Sustainable, Technical, Industrial and Culture Cooperation.
 - Sh. Anand Kumar, Secretary, Ministry of New and Renewable Energy, Sh. Bhanu Pratap Yadav, Joint Secretary, Ministry of New and Renewable Energy and Sh. K. Balaraman, DG, National Institute of Wind Energy visited Denmark from 26-28th February, 2018 to attend India-Denmark JWG meeting, MoU between NIWE and DTU and other events in Denmark.
 - Shri Gopal Krishan Gupta, Joint Secretary, Ministry of New and Renewable Energy visited Beijing, China during 13-15th April, 2018 to attend the 5th Strategic Economic Dialogue (SED) meeting.
 - Dr. Rajesh Kumar, Scientist 'F' Ministry of New and Renewable Energy and Dr. A. K. Tripathi, Director General, National Institute of Solar Energy (NISE) visited Tokyo, Japan during 23-27 April, 2018 in connection with establishment of 2 MW inverter test facility at NISE.
 - Dr. P.C. Maithani, Scientist, 'G' Ministry of new and Renewable Energy visited Bonn, Germany during 3-10th May, 2018 to attend the UNFCCC Bonn Climate Change Conference.
 - Shri A. N. Sharan, Joint Secretary, Ministry of New and Renewable Energy visited Abu Dhabi, UAE



during 07-09th May, 2018 to attend the 15th International Renewable Energy Agency (IRENA) Council meeting and other related events.

- Shri P.N.B.V. Chalapathi Rao, Scientist ‘C’ Ministry of New and Renewable Energy and Shri YBK Reddy, DGM Solar Energy Corporation of India (SECI) visited Sri Lanka during 9-10th May, 2018 to participate in SAARC knowledge Sharing Workshop on Modern Techniques including Renewable Energy Auction for economizing Renewable Energy Tariff.
- Shri Anand Kumar, Secretary, Ministry of New and Renewable Energy and Shri K. S. Popli, Chairman and MD, IREDA, visited Shanghai, China, during 28-30th May, 2018 to participate in the 3rd Annual Meeting of the Board of Governors of New Development Bank (NDB)
- Shri J. K. Jethani, Scientist, ‘E’ Ministry of New and Renewable Energy visited Manila, Philippines from 4-8th June, 2018 to attend the Asia Clean Energy Forum (ACEF) meeting.
- Shri A.N. Sharan, Joint Secretary, Ministry of New and Renewable Energy visited Bariloche, Argentina during 13-15th June, 2018 to attend the meeting of G-20 Energy Transitions Working Group.
- Shri Anand Kumar, Secretary, Shri Gopal Krishna Gupta, Joint Secretary, Ministry of New and Renewable Energy and Shri Jatindra Nath Swain, Managing Director, Solar Energy Corporation of India (SECI) visited Munich, Germany during 20-23rd June, 2018 to participate in the India-Germany Energy Forum and to visit a floating solar power plant and other innovative project sites and Intersolar Europe 2018.
- Shri Dilip Nigam, Scientist, ‘G’ Ministry of New and Renewable Energy visited Gauteng, South Africa, during 28-29th June, 2018 to attend the 3rd Meeting of the BRICS Energy Ministers as part of delegation led by Hon’ble Minister for Power and NRE.
- Shri Rohit Thakwani, Scientist, ‘B’ Ministry of New and Renewable Energy visited Bavaria, Germany, during 8-14th July, 2018 to attend One Week Technical Information Seminar/Training programme on ‘Consumption based power generation from Solar Energy for India.
- Shri J. K. Jethani, Scientist, ‘E’ Ministry of New and Renewable Energy, Shri J. N. Swain, Managing Director, Solar Energy Corporation of India, Shri A. K. Tripathi, Director General, National Institute of Solar Energy, Gurgaon and Shri P. K. Das, Assistant Director, National Institute of Wind Energy, visited Colorado, USA from 20-24th August, 2018 to attend the training programme on ‘Solar Resource Measurement and Modelling’.
- Dr. P. C. Maithani, Scientist, ‘G’ Ministry of New and Renewable Energy visited Bangkok, Thailand from 6-9th September, 2018 to participate in the United Nations Framework Convention on climate Change (UNFCCC) Meeting.
- Shri Anand Kumar, Secretary, Ministry of New and Renewable Energy visited London, UK during 10-13th September, 2018 to attend the UK’s International Zero Emission Vehicle (ZEV) Summit 2018, India –UK Energy for Growth Dialogue and India-UK Joint Working Group meeting.
- Ms Veena Sinha, Director, Ministry of New and Renewable Energy visited Changsha, China from 24-26th October, 2018 to participate in the 03rd Asia-Pacific Forum on Low Carbon Technology.
- Dr. B. S. Negi, Scientist ‘G’, Ministry of New and Renewable Energy visited Busan, South Korea from 23-24 October, 2018 to participate in the International Electro technical Commission (IEC) regulator forum 2018.



- Shri Anand Kumar, Secretary, Ministry of New and Renewable Energy and Shri A. N. Sharan, Joint Secretary, MNRE visited Abu Dhabi, UAE from 12-15th November, 2018 to participate in the 16th Meeting of the Council of International Renewable Energy Agency (IRENA) and related meetings.
- Dr. P.C. Maithani, Scientist, 'G' Ministry of New and Renewable Energy visited Katowice, Poland during 2-14th December, 2018 to participate in the 24th Session of the conference of the parties (CoP-24) under UNFCCC and 49th Session of the subsidiary body for Scientific and Technical Advice as part of delegation led by Hon'ble Minister of EF&CC
- Shri Dipesh Pherwani, Scientist, 'B' Ministry of New and Renewable Energy visited Pretoria, South Africa during 04-07th December, 2018 to participate in the 30th Steering Committee meeting of the International Partnership for Hydrogen and Fuel Cell in the Economy (IPHE)



2nd Indian Ocean Rim Association (IORA) Renewable Energy Ministerial Meeting



1st International Solar Alliance (ISA) General Assembly

- Shri Anand Kumar, Secretary and Shri G.K. Gupta, Joint Secretary, Ministry of New and Renewable Energy visited Katowice, Poland during 10-12th December, 2018 to participate in the 24th Session of the Conference of the Parties (CoP-24) under UNFCCC.
- Shri. R. K. Singh, Hon’ble Minister of New and Renewable Energy, Sh. Anand Kumar, Secretary, Ministry of New and Renewable Energy and Sh. Manoj Kumar, PS to Minister, MNRE visited Abu Dhabi, UAE from 13-14th January, 2019 to participate in the 9th Session of the IRENA Assembly Meeting and Abu Dhabi Sustainable Week.
- Sh. Anand Kumar, Secretary, Ministry of New and Renewable Energy and Sh. A. N. Sharan, Joint Secretary, Ministry of New and Renewable Energy visited Washington DC and San Francisco, USA from 25-28th February, 2019 to participate in the Meetings under India - US Strategic Energy Partnership.
- Sh. J. K. Jethani, Scientist ‘E’, Ministry of New and Renewable Energy visited Thimphu, Bhutan from 25-26th February, 2019 to participate in the Workshop on Sustainable Access to Clean Energy for Hindu Kush Himalaya organized by the ADB.
- Sh. Tarun Singh, Scientist ‘C’, Ministry of New and Renewable Energy visited Cape Town, South Africa from 25-26th February, 2019 to participate in the Conference on ‘Renewable Energy and Storage Systems’.
- Sh. P N B V Chalapathi Rao, Scientist ‘C’, Ministry of New and Renewable Energy and Sh. Manish Singh Bisht, Scientist ‘B’, Ministry of New and Renewable Energy visited Berlin, Germany from 25th February to 1st March, 2019 to participate in the Training on Grid Integration of Renewables at Renewable Academy (RENAC) organized by the GIZ.
- Sh. Tarun Singh, Scientist ‘C’, Ministry of New and Renewable Energy and Sh. Anubhav Uppal, Scientist ‘B’, Ministry of New and Renewable Energy visited Paris, France from 11-15th March, 2019 to participate in the 17th International Energy Agency (IEA) Energy Statistics Course.
- Sh. B. K. Panda, Scientist ‘E’, Ministry of New and Renewable Energy visited Denmark from 25-29th March, 2019 to participate in a study tour on Off-Shore Wind.



- 13.10 The 2nd IORA Renewable Energy Ministerial and Experts Meetings, 1st International Solar Alliance General Assembly and 2nd Global Renewable Energy Investment Meeting and Expo (REINVEST- 2018) were hosted by the Ministry of New and Renewable Energy, Government of India from 2 – 4 October 2018 in Delhi NCR, India. The three events were jointly inaugurated by the Hon’ble Prime Minister of India, Mr. Narendra Modi, in the presence of Mr Antonio Guterres, Secretary General of the United Nations on 2nd October 2018 in New Delhi.
- 13.11 Marking yet another milestone for 2018, IORA and ISA signed a Memorandum of Understanding on 3 October 2018. Recognising renewable energy as an efficient solution to address challenges of energy access, energy security and climate change, this MoU is aimed at enhancing sustainable development and deployment of solar energy within the region.
- 13.12 The Second IORA Renewable Energy Experts Meeting held on 3 October 2018 provided a platform for experts to discuss energy needs within the region, identifying challenges in cooperation and coordination among concerned agencies and potential avenues of collaboration. The Experts Meeting included sessions on energy needs for IORA, renewable energy vistas, challenges in renewable energy implementation (G2B) and possibilities and opportunities for international collaboration. Experts highlighted the need for capacity building and conceptualised the way forward for renewable energy in IORA through this document. The “Key Takeaways” were read out and adopted at the IORA Renewable Energy Ministerial held on 4 October 2018. 17 Member States represented by Energy Ministers and Senior Officials and Experts participated in the event and adopted the Delhi Declaration on Renewable Energy to move forward on the path of sustainable development.

11.13 ENGAGEMENT WITH INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA)

- 13.13.1 India is one of the Founder Members of the International Renewable Energy Agency (IRENA) which is an intergovernmental organization that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international cooperation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.
- 13.13.2 With a mandate from countries around the world, IRENA encourages governments to adopt enabling policies for renewable energy investments, provides practical tools and policy advice to accelerate renewable energy deployment, and facilitates knowledge sharing and technology transfer to provide clean, sustainable energy for the world’s growing population.
- 13.13.3 India served as a Member of the IRENA Council and also Chaired the IRENA Council Meetings in 2015 which is accountable to the Assembly and facilitates consultations and cooperation among Members and considers the draft work programme, draft budget and annual report.
- 13.13.4 India regularly participates in the meetings of Council and Annual General Assembly of IRENA and provides constructive suggestions.

13.14 INTERNATIONAL TRAINING PROGRAMMES

- 13.14.1 The Autonomous institutions of the Ministry, National Institute of Solar Energy (NISE) and National Institute of Wind Energy (NIWE) organize and conduct various International training programmes for delegates from different countries under Indian Technical and Economic Cooperation (ITEC).



- 13.14.2 The primary objective of these training programmes is to acquaint the participants with the latest developments in Solar and Wind Technologies, Policy Aspects, Quality Control and Utilization Aspects of Renewable Energy. These Training programmes would also help in encouraging the possibilities of bilateral and multilateral cooperation in the field of solar and wind energy projects. These programmes enhance the technical capabilities of the participants and impart knowledge of the Global trends on Solar and Wind Technologies. The knowledge acquired during the training can be utilized by the participants while deploying Renewable Energy Technologies in their respective countries.
- 13.14.3 NIWE organized the following International Training Courses / Workshops as shown in **Table 13.1**.

Table 13.1: International Training Courses and Workshops organized by NIWE

S. No.	Name of the programme / Course	Duration	No. of participants	No. of countries
1	22nd International Training Course on “Wind Turbine Technology and Applications” under ITEC	18.07.2018 To 17.08.2018	24	14 countries
2	Special International Training Course on “Wind Resource Assessment and Wind Farm Planning” under ITEC	19.09.2018 To 12.10.2018	17	11 Countries
3	Special International Training Course on “Design, Installation and Maintenance of Small Wind Turbine” under ITEC	14.11.2018 To 14.12.2018	31	14 Countries
4	Special international training course on “Design, Installation & Maintenance of Small Wind Turbine” for African Countries under AIFS-III.	15.11.2018 To 13.12.2018	21	10 Countries
5	International Workshop on Small Wind Turbine	30.11.2018 To 09.12.2018	120	36 Countries
6	International Conference on Small Wind Turbine	10.12.2018 To 12.12.2018	250	36 Countries

- 13.14.4 The Skill Development Division of NISE organized the following International Training programmes/ Workshops as shown in **Table 13.2**.

Table 13.2: International Training Courses and Workshops organized by NISE

S. No.	Name of the programme/ Course	Duration	No. of participants	No of countries
1	International Training Programme on Solar Energy Technologies and Applications under ITEC	27.08.2018 To 14.09.2018	30	16
2	International Training Programme on Solar Energy Technologies and Applications under ITEC	26.11.2018 To 14.12.2018	32	21
3	International Training Programme for master trainers from ISA member countries under ITEC	10.09.2018 To 29.09.2018	29	9
4	International Training Programme for master trainers from ISA member countries under ITEC	15.10.2018 To 03.11.2018	24	11
5	International Training Programme for master trainers from ISA member countries under ITEC	26.11.2018 To 15.12.2018	21	10
6	International Training Programme for Renewable Energy capacity building under IAES	24.09.2018 To 12.10.2018	16	08

14: PROMOTION OF OFFICIAL LANGUAGE HINDI





PROMOTION OF OFFICIAL LANGUAGE HINDI

- 14.1 With a view to implement the Official Language Policy of the Government of India, a Hindi Section has been set up in the Ministry. Its functions are as under:-
- (I) Translation work.
 - (II) Implementation of the Official Language Policy of the Govt. of India.
- 14.2 During the year 2018-19 concerted efforts were made to ensure proper compliance of the provisions of Official Language Act 1963 and Rules framed thereunder.
- 14.3 For promotion of Official Language Policy and to create more conducive environment for the officials to do more work in Hindi, various programs /schemes are being undertaken which include the following :
- (i) Website of the Ministry has been made bilingual and it is being updated from time to time.
 - (ii) A digital board has been installed at the entrance of the Ministry with new Hindi Word being displayed on daily basis. Inspirational quotes are also displayed.
 - (iii) Standard Drafts and Standard Forms have been prepared in Hindi and placed on the Website of the Ministry for convenience of officers/staff.
 - (iv) Hindi books are purchased in the Ministry and efforts are made to achieve the targets laid down by the Department of Official Language.
 - (v) Addresses of Nodal Agencies have been prepared in Hindi.
 - (vi) All documents coming under Section 3(3) of the O.L. Act 1963, eg. Press Release, Tender Notices, Rules, General Orders, Notifications, Cabinet Notes, Parliament Questions and other Documents to be laid in the Parliament are presented bilingually.
 - (vii) Letters received in Hindi are invariably replied in Hindi and Rule (5) of the Official Language Rules 1976 is fully complied with.
 - (viii) First working day of every month is celebrated as Hindi Divas in the Ministry. On this day the work is done mostly in Hindi.
- 14.4 During the year 2018-19, various measures were taken for effective implementation of Official Language Policy in the Ministry. As per the Quarterly Progress Report for the quarter ended on 31 March 2019, the percentage of Hindi correspondence with offices in Regions 'A' 'B' and 'C' was 78%, 67% and 64% respectively.
- 14.5 In order to review the progress made in the implementation of Official Language policy, quarterly meetings of Official Language Implementation Committee were held regularly. Discussions were held on quarterly progress reports received from various Sections/Divisions of the Ministry, IREDA, SECI, NIWE and NISE. The Sections/Divisions and other Organizations were advised to achieve the targets specified by the Department of Official Language.
- 14.6 In order to create awareness and to increase the use of Hindi in official work, 'Hindi Fortnight' was observed in the Ministry during 14th to 28th September, 2018. During the fortnight, a message from Hon'ble Minister (NRE) regarding progressive use of Hindi was read out. A number of competitions were held, with good participation by officers and staff of the Ministry. 39 officers and staff members belonging to Hindi and non-Hindi speaking categories were given cash awards and certificates based on their performances. Hindi Fortnight was also observed in various offices/undertakings of the Ministry.



14.7 Hindi Noting & Drafting Incentive Scheme of the Department of Official Language was continued during the year and ten officers/staff were awarded under this Scheme.

14.8 MEETING OF HINDI ADVISORY COMMITTEE

14.8.1 The Meeting of the Hindi Advisory Committee of the Ministry was held on 21st August, 2018 under the Chairmanship of Hon'ble Minister of State (I/C) for Power and New & Renewable Energy.

14.9 PRAKARTIK URJA PURASKAR YOJNA

14.9.1 To promote original book writing in Hindi or translated in Hindi related to the subjects of Non-Conventional Energy, Prakartik Urja Purskar Yojna is being implemented in the Ministry, since 1988. Under this scheme, there is a provision to award a first prize of Rs.100,000/-, second prize of Rs.60,000/- and third prize of Rs.40,000/- for the books written originally in Hindi. For the books translated into Hindi the amount of first, second and third prize is Rs.50,000/-, Rs.30,000/- and Rs.20,000/- respectively. An appreciation letter signed by the Secretary, MNRE is also given to the awardees. For the year 2016, following books have been selected for award:

- | | |
|--|-------------|
| i. Swaccha Urja Bhavisya Ki Shakti
(Shri Raj Bahadur Gupta) | - 1st Award |
| ii. Saur Urja Dwara Fasalon Se Aay Mein Vriddhi
(Dr. Rajeev Kumar Aggrawal) | - 2nd Award |
| iii. Swaccha Paryavaran Ke Liye Jaiv Urja
(Dr. Vineeta Singhal) | - 3rd Award |



Hindi Pakhwara - 2018 - Prize Distribution Ceremony.



Hon'ble Minister (NRE) presiding over the meeting of Hindi Sahakar Samiti held on 21st August, 2018 in New Delhi.

14.10 ORGANIZATION OF HINDI WORKSHOPS

- 14.10.1 With a view to encourage the officers/staff to do their official work in Hindi, Hindi workshop is organized in every quarter for the officers and staff of different categories. During the year, four Hindi workshops were organized. A number of officers/staff from the Ministry participated in these workshops.

14.11 INSPECTION OF SUBORDINATE OFFICES AND SECTIONS

- 14.11.1 With a view to assess the status regarding progressive use of Official Language, inspection of various offices and Autonomous Institutions/ PSU etc. are carried out from time to time by the officials of Hindi Section. Inspections of IREDA, SECI and NISE were carried out during the year under report.

15. ASSEMBLY OF IORA RENEWABLE ENERGY MINISTERIAL MEETING 2nd GLOBAL RE-INVEST 2018

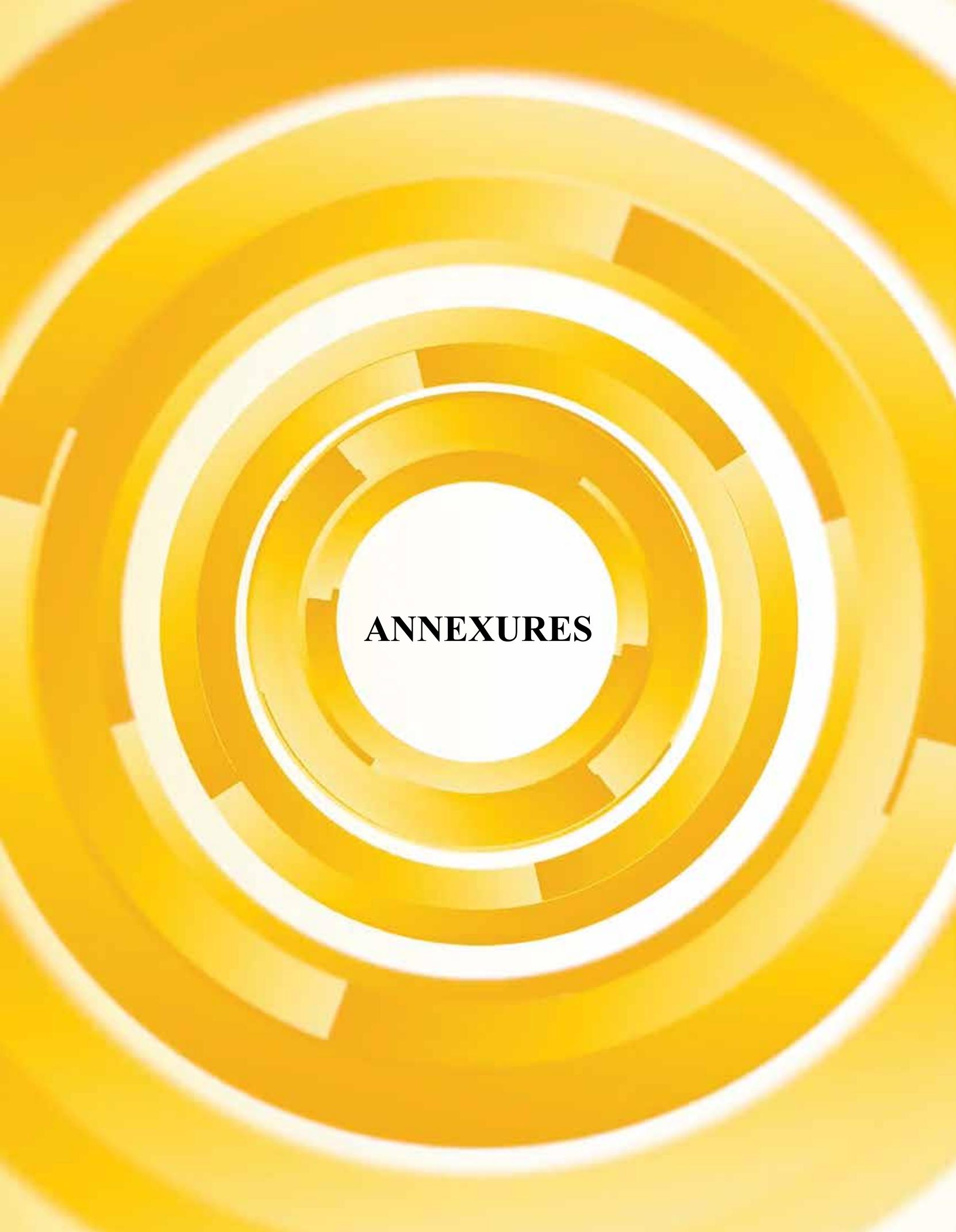


15: 2nd GLOBAL RE-INVEST

- 15.1 To consolidate these major gains across RE sectors and strategize upon the emergence of new utilisation avenues such as e-vehicles, the Ministry hosted the 2nd Global Renewable Energy Investors Meet and Expo (RE-INVEST) along with First Assembly of the International Solar Alliance (ISA), and the 2nd Energy Ministers meeting of the Indian Ocean Rim Association (IORA) countries from 3rd to 5th October 2018 in Delhi-NCR.
- 15.2 The Hon'ble Prime Minister Shri Narendra Modi inaugurated the events in a joint ceremony in the presence of H.E. Antonio Guterres, Secretary-General of the United Nations, on 2 October 2018 at Vigyan Bhavan, New Delhi. A highlight of the ceremony, which coincided with the 150th birth anniversary of Mahatma Gandhi, was the assembly and lighting of 100,000 solar lamps by students from 100 schools as part of IIT-Bombay's Solar Urja through Localisation for Sustainability (SoULS) programme.
- 15.3 The 2nd RE-INVEST aimed to accelerate the worldwide effort to scale up renewable energy and connect the global investment community with Indian energy stakeholders. The 45 in-depth sessions over 3 days of the conference saw animated exchanges on topics such as 'Bankers' Perspective on Renewables' and 'Making Renewables in India', which brainstormed on expanding India's RE market in the face of aggressive global competition. The closed-door RE-INVEST Corporate Conclave saw a thought-provoking discussion between global industry captains and India's renewable energy policymakers.
- 15.4 The 2nd Global RE-INVEST saw participation of over 20,000 delegates including representatives of over 77 countries out of which 40 were at ministerial level. Over 50 plenary and technical sessions were held at the event in which 150 speakers (including 55 international speakers) participated. There were nine country sessions (in partnership with Australia, EU, Finland, France, Germany, the UK and the USA), eight state sessions (Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Punjab and Uttar Pradesh) and over 500 business to business bilateral meetings.



- 15.5 Key achievements of the event include an MoU between the French Agency for Development and Solar Energy Corporation of India (SECI) on solar innovation; an MoU between the French Commission for Atomic and Alternative Energies (CEA), Blue Solutions and SECI on storage, grid management & e-mobility; and an India-US joint announcement on demand aggregation pilots.



ANNEXURES

ANNEXURE I

Present Sanctioned Strength and In Position Strength of MNRE as on 31.03.2019 is as follows:-

GROUP	A	B	C	TOTAL
SANCTIONED	141	86	87	314
IN POSITION	80	56	74	210
SC	10	12	24	46
ST	2	2	5	9
OBC	6	12	9	27
PH		2		2

IREDA

Employees Staff strength of IREDA as on 31.03.2019 are as under:-

Classification	Board Level	Group A	Group B	Group C	Group D	Total
Sanctioned	3	103	51	59	-	216
In-Position	3	126	15	22	-	166
SC	-	19	-	6	-	27
ST	-	7	2	1	-	10
OBC	-	22	2	3	-	27
Physically Handicapped	-	2	1	1	-	4

NIWE

Group-wise details of posts in National Institute of Wind Energy as on 31.03.2019 are as under:-

No. of Posts	Group			Total
	A	B	C	
Sanctioned	18	13	17	48
In Position	18	11	17	46
SC	3	2	5	10
ST	1	-	-	1
OBC	7	5	10	22
PH	-	-	-	-

NIBE

Information pertaining to the staff strength of Sardar Swaran Singh National Institute of Bio-Energy (SSS-NIBE), an autonomous institute functioning under the administrative control of Ministry of New and Renewable Energy as on 31.03.2019 are as under:-

Group	A	B	C	D	Total
Sanctioned	21	1	4	0	26
In Position	3	1	4	0	08
SC	0	0	0	0	0



ST	0	0	0	0	0
Physically Handicapped	0	0	0	0	0

NISE

Information pertaining to the staff of National Institute of Solar Energy (NISE), an autonomous institute functioning under the administrative control of Ministry of New and Renewable Energy as on 31.03.2019 are as under:-

Group	A	B	C	D	Total
Sanctioned	25	16	0	0	41
In Position	6	0	0	0	6
SC	0	0	0	0	0
ST	0	0	0	0	0
OBC	0	0	0	0	0
PH	0	0	0	0	0

Note: Recruitment is under process for the vacant posts and shall be completed by Sept. 2019.

PAY AND ACCOUNTS OFFICE, MINISTRY OF NEW AND RENEWABLE ENERGY

Sanctioned strength and in-position in respect of Pay & Accounts Office, Ministry of New & Renewable Energy as on 31.03.2019

GROUP	A	B	C	D	TOTAL
SANCTIONED	1	6	9	-	16
IN POSITION	1	4	8	-	13
SC	-	1	-	-	1
ST	-	-	1	-	1
OBC	-	-	2	-	2
PH	-	-	-	-	-

ANNEXURE II

CAG AUDIT PARA

Year	Report No.	Chapter	Para No.	Subject
2018	2 OF 2018	II	II	Review of Outcome Budget of Ministry of New and Renewable Energy
2018	2 OF 2018	IX	9.1	Non-utilisation of Solar Thermal Power Plants

ANNEXURE III

GRANTS IN AID TO STATES AND VOLUNTARY ORGANISATIONS

Fund released to implementing agencies (State Nodal Agency, PSU, Govt. Department, DISCOM etc.) under Grid Connected Rooftop Solar Programme in FY 2017-18				
Sr. No.	Sanction Number	Agency Name	Sanction Date	Amount (Rs.)
1.	318/6/2017-Grid Connected Rooftop	Agency for Non-conventional Energy & Rural Technology	24-07-2017	2,92,50,000.00
2.	03/16/2016-17/GCRT	National Institute of Solar Energy	29-03-2018	2,37,98,545.00
3.	318/15/2017-GCRT-(part 3)	NTPC Vidyut Vyapar Nigam Ltd.	28-03-2018	12,86,390.00
4.	318/36/2017-GCRT	Solar Energy Corporation of India Limited	12-03-2018	3,67,77,731.00
5.	318/30/2017-GCRT	Uttarakhand Renewable Energy Development Agency	08-03-2018	16,73,82,600.00
6.	318/271/2017-GCRT	Central Glass & Ceramic Research Institute	07-03-2018	10,23,750.00
7.	318/341/2017-GCRT	Zoram Energy Development Agency	29-12-2017	4,54,23,000.00
8.	5/25/2011-12/ST (Vol.-II)	Chandigarh Renewable Energy and Science & Tech. Promotion Society	29-12-2017	1,72,57,228.00
9.	318/290/2017-GCRT	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	21-12-2017	3,60,67,158.00
10.	318/291/2017-GCRT	Telangana New & Renewable Energy Development Corporation Limited	21-12-2017	2,72,22,855.00
11.	318/291/2017-GCRT	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	21-12-2017	1,21,24,233.00
12.	318/336/2017-GCRT	Arunachal Pradesh Energy Development Agency	21-12-2017	14,05,95,000.00
13.	318/338/2017-GCRT	Rajasthan Renewable Energy Corporation Ltd.	20-12-2017	11,68,02,000.00
14.	318/5/2017-GCRT	Agency for Non-conventional Energy & Rural Technology	19-12-2017	6,48,90,000.00
15.	318/15/2017-GCRT	Rajasthan Electronics & Instruments Limited	19-12-2017	93,72,285.00
16.	318/316/2017-GCRT	Delhi Metro Rail Corporation	18-12-2017	14,55,15,572.00



17.	318/206/2017-GCRT	Solar Energy Corporation of India Limited	18-12-2017	3,97,50,000.00
18.	318/151/2017-GCRT	Tripura Renewable Energy Development Agency (TREDA)	19-12-2017	70,00,000.00
19.	318/15/2017-GCRT	RITES Ltd.	30-11-2017	72,58,680.00
20.	318/288/2017-Grid Connected Rooftop	Orissa Renewable Energy Development Agency	30-09-2017	1,60,68,000.00
21.	318/285/2017-Grid Connected Rooftop	GNCTD Pay & Accounts Office No.X	29-09-2017	21,40,00,000.00
22.	318/4/2017-Grid Connected Rooftop	West Bengal Renewable Energy Development Agency	28-09-2017	6,30,00,000.00
23.	318/42/2017-Grid Connected	Madhya Kshetra Vidyut Vitaran Co. Pvt. Ltd.	28-09-2017	3,13,56,578.00
24.	318/286/2017-Grid Connected Rooftop	Chhattisgarh State Renewable Energy Development Agency	28-09-2017	1,36,50,000.00
25.	318/287/2017-Grid Connected Rooftop	Uttar Pradesh New and Renewable Energy Development Agency	28-09-2017	2,31,74,000.00
26.	318/21/2017-Grid Connected Rooftop	Andaman & Nicobar Administration (Electricity Department)	07-08-2017	3,02,82,000.00
27.	318/31/2017-Grid Connected Rooftop	Gujarat Energy Development Agency	27-09-2017	23,17,50,000.00
28.	318/30/2017-Grid Connected Rooftop	Uttarakhand Renewable Energy Development Agency	27-09-2017	10,35,00,000.00
29.	5/38/2013-14/RT	Chhattisgarh State Renewable Energy Development Agency	26-09-2017	1,93,34,324.00
30.	03/57/2015-16/GCRT	Rajasthan Electronics & Instruments Limited	12-09-2017	30,88,800.00
31.	03/16/2016-17/GCRT	National Institute of Solar Energy	14-08-2017	1,80,00,000.00

Fund released to NGO under Grid Connected Rooftop Solar Programme in FY 2017-18

Sr. No.	Sanction Number	Agency Name	Sanction Date	Amount (Rs.)
1.	318/39/2018-Grid Connected Rooftop	The Energy and Resources Institute-	29-03-2018	13,05,000.00

Fund released to implementing agencies (State Nodal Agency, PSU, Govt. Department, DISCOM etc.) under Grid Connected Rooftop Solar Programme in FY 2018-19				
Sr. No.	Sanction Number	Agency Name	Sanction Date	Amount (Rs.)
1.	318/33/2018-GCRT	Haryana Renewable Energy Development Agency	27-03-2019	94,01,587.00
2.	318/12/2019-GCRT	Rajasthan Electronics & Instruments Limited	27-02-2019	8,73,95,474.00
3.	318/287/2017-GCRT	Uttar Pradesh New and Renewable Energy Development Agency	25-02-2019	3,01,76,912.00
4.	318/89/2018-GCRT	Uttar Pradesh New and Renewable Energy Development Agency	31-12-2018	4,50,00,000.00
5.	318/77/2018-GCRT	Telangana New & Renewable Energy Development Corporation Limited	31-12-2018	1,27,39,267.00
6.	318/16/2018-GCRT	Renewable Energy Agency of Pondicherry	31-12-2018	10,40,823.00
7.	318/305/2017-GCRT	West Bengal Renewable Energy Development Agency	31-12-2018	2,61,27,948.00
8.	318/88/2018-GCRT	Rajasthan Electronics & Instruments Limited	31-12-2018	1,37,26,971.00
9.	318/35/2017-GCRT	Maharashtra Energy Development Agency	30-12-2018	40,36,36,657.00
10.	318/86/2018-GCRT	Himachal Pradesh Energy Development Agency	30-12-2018	8,92,92,000.00
11.	318/136/2017-GCRT	Gujarat Energy Development Agency	30-12-2018	9,20,47,185.00
12.	318/12/2018-GCRT	New And Renewable Energy Development Corporation Of Andhra Pradesh Limited	30-12-2018	24,02,48,139.00
13.	318/20/2018-GCRT	Gujarat Energy Development Agency	26-07-2018	18,90,00,000.00
14.	318/20/2018-GCRT	Maharashtra Energy Development Agency	26-07-2018	27,00,00,000.00
15.	318/20/2018-GCRT	New And Renewable Energy Development Corporation Of Andhra Pradesh Limited	26-07-2018	10,80,00,000.00
16.	318/20/2018-GCRT	Telangana New & Renewable Energy Development Corporation Limited	26-07-2018	15,30,00,000.00
17.	318/20/2018-GCRT	Chandigarh Renewable Energy and Science & Tech. Promotion Society	26-07-2018	2,70,00,000.00
18.	318/20/2018-GCRT	Punjab Energy Development Agency	26-07-2018	2,61,00,000.00



19.	318/20/2018-GCRT-PART (1)	Gujarat Energy Development Agency	26-07-2018	54,00,00,000.00
20.	318/20/2018-GCRT-PART (1)	West Bengal Renewable Energy Development Agency	26-07-2018	1,08,00,000.00
21.	318/20/2018-GCRT-PART (1)	Haryana Renewable Energy Development Agency	31-07-2018	10,80,00,000.00
22.	318/289/2017-GCRT-PART (2)	Mazagon Dock Limited	02-08-2018	25,20,000.00
23.	318/289/2017-GCRT	Garden Reach Shipbuilders & Engineers Limited	02-08-2018	8,40,000.00
24.	318/328/2017-GCRT	Lucknow Metro Rail Corporation Limited	06-08-2018	1,50,00,000.00
25.	318/35/2018-GCRT	Indian Oil Corporation Ltd.	13-08-2018	34,02,841.00
26.	318/9/2018-GCRT	Rajasthan Renewable Energy Corporation Ltd.	31-08-2018	14,91,85,199.00
27.	318/33/2017-GCRT	India SME Technology Services Limited	31-08-2018	88,81,818.00
28.	318/2/2018-GCRT	Kochi Metro Rail Limited	04-09-2018	1,58,47,200.00
29.	318/300/2017-GCRT	India SME Technology Services Limited	05-09-2018	1,87,06,860.00
30.	318/340/2017-GCRT	Telangana New & Renewable Energy Development Corporation Limited	07-09-2018	64,33,059.00
31.	318/335/2017-GCRT	Solar Energy Corporation of India Limited	13-09-2018	33,55,53,702.00
32.	318/31/2017-GCRT	Gujarat Energy Development Agency	21-09-2018	23,48,88,805.00
33.	318/136/2017-GCRT	Gujarat Energy Development Agency	27-09-2018	13,35,47,257.00
34.	318/82/2017-GCRT	PEC Limited	28-09-2018	82,48,200.00
35.	318/319/2017-GCRT	Himachal Pradesh Energy Development Agency	22-10-2018	83,22,835.00
36.	318/22/2018-GCRT	Punjab Energy Development Agency	19-11-2018	8,10,03,321.00
37.	318/67/2018-GCRT	West Bengal Green Energy Development Corporation Ltd.	26-11-2018	38,31,600.00
38.	318/26/2018-GCRT	SVPI Airport Ahmedabad	30-11-2018	84,01,558.00
39.	318/78/2018-GCRT	Telangana New & Renewable Energy Development Corporation Limited	24-12-2018	1,03,16,210.00
40.	318/136/2017-GCRT	Gujarat Energy Development Agency	19-04-2018	9,00,00,000.00

41.	318/31/2017-GCRT	Gujarat Energy Development Agency	19-04-2018	41,23,96,855.00
42.	318/289/2017-GCRT-PART (1)	Airport Authority Of India	08-05-2018	1,37,10,450.00
43.	318/62/2017-GCRT	Rajasthan Renewable Energy Corporation Ltd.	17-05-2018	1,26,95,554.00
44.	318/315/2017-GCRT	Chandigarh Renewable Energy and Science & Tech. Promotion Society	17-05-2018	16,05,55,698.00
45.	318/9/2018-GCRT	Rajasthan Renewable Energy Corporation Ltd.	17-05-2018	5,17,50,000.00
46.	318/12/2018/GCRT	New And Renewable Energy Development Corporation Of Andhra Pradesh Limited	24-05-2018	10,12,50,000.00
47.	318/35/2017-GCRT	Maharashtra Energy Development Agency	14-06-2018	9,77,00,000.00

Fund released to NGOs under Grid Connected Rooftop Solar Programme in FY 2018-19 - NIL

Fund released to implementing agencies under Solar Photovoltaic Division Programme in FY 2017-18					
S. No.	Sanction Number	Organisation Name	State	Fund released	
				Date	Amount (Rs. in lakh)
1	32/11/2018-SPV DIVISION	Administration of Union Territory of Lakshadweep	Lakshadweep	05-03-2018	396.53
2	42/01/2016-17/PVSE	Administrative Staff College of India	Hyderabad	20-12-2017	50.37
3	32/15/2012-13/PVSE (PART-II)	Agency for Non-conventional Energy & Rural Technology	Kerala	11-07-2017	3.87
4	32/15/2012-13/PVSE (PART-II)	Agency for Non-conventional Energy & Rural Technology	Kerala	30-06-2017	774.90
5	32/12/2018-SPV DIVISION	Arunachal Pradesh Energy Development Agency	Arunachal Pradesh	08-03-2018	153.60
6	32/16/2018-SPV Division	Arunachal Pradesh Energy Development Agency	Arunachal Pradesh	22-03-2018	81.16
7	32/17/2018-SPV Division	Arunachal Pradesh Energy Development Agency	Arunachal Pradesh	22-03-2018	324.17
8	32/18/2018-SPV Division	Arunachal Pradesh Energy Development Agency	Arunachal Pradesh	22-03-2018	51.20
9	32/3/2015-16/PVSE(Part-IV)	Arunachal Pradesh Energy Development Agency	Arunachal Pradesh	21-12-2017	155.40



10	32/3/2015-16/ PVSE(Part-IV)	Arunachal Pradesh Energy Development Agency	Arunachal Pradesh	21-12-2017	4.44
11	32/29/2015-16/PVSE (PART-2)	Aryavart Gramin Bank	Uttar Pradesh	21-06-2017	158.76
12	1/4/3/2011-12/RVE	Assam Energy Development Agency	Assam	25-09-2017	377.04
13	32/27/2017-SPV Division	Assam Energy Development Agency	Assam	28-03-2018	408.61
14	32/29/2018-SPV Division	Assam Energy Development Agency	Assam	29-03-2018	195.38
15	32/117/2017-SPV DIVISION	Central Electronics Ltd	Delhi	27-03-2018	202.20
16	32/48/2015-16/PVSE (PART-13)	Central Electronics Ltd	Delhi	25-08-2017	77.40
17	32/111/2017-SPV DIVISION	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	23-03-2018	213.37
18	32/6/2015-16/PVSE (PART-1)	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	25-09-2017	6.31
19	32/6/2015-16/PVSE (PART-1)	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	25-09-2017	57.53
20	32/6/2015-16/PVSE (PART-9)	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	18-08-2017	6.75
21	32/6/2015-16/PVSE (PART-9)	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	18-08-2017	157.50
22	32/6/2016-17/PVSE (PART-3)	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	27-06-2017	6075.00
23	32/6/2016-17/PVSE (PART-8)	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	27-09-2017	6.66
24	32/643/2017-SPV	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	28-12-2017	4860.25
25	32/664/2017-SPV Division	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	28-02-2018	4102.50
26	42/12/2016-17/PVSE	Energy Efficiency Services Limited	Delhi	29-09-2017	4000.00
27	42/12/2016-17/PVSE	Energy Efficiency Services Limited	Delhi	29-09-2017	1000.00
28	42/12/2016-17/PVSE	Energy Efficiency Services Limited	Delhi	29-09-2017	3800.00
29	42/12/2016-17/PVSE	Energy Efficiency Services Limited	Delhi	29-09-2017	1200.00
30	42/25/2016-17/PVSE	Energy Efficiency Services Limited	Delhi	29-09-2017	15872.00
31	32/9/2016-17/PVSE (PART-1)	Gujarat Energy Development Agency	Gujarat	28-09-2017	2621.87



32	32/656/2017-SPV DIVISION	Himachal Pradesh Energy Development Agency	Himachal Pradesh	08-03-2018	893.98
33	32/656/2017-SPV DIVISION	Himachal Pradesh Energy Development Agency	Himachal Pradesh	08-03-2018	39.92
34	32/658/2017-SPV DIVISION	Himachal Pradesh Energy Development Agency	Himachal Pradesh	30-01-2018	405.18
36	32/13/2014-15/PVSE (PART-1)	Jharkhand Renewable Energy Development Agency	Jharkhand	26-09-2017	360.00
37	32/13/2016-17/PVSE (PART-2)	Jharkhand Renewable Energy Development Agency	Jharkhand	24-08-2017	189.36
38	32/13/2016-17/PVSE (PART-2)	Jharkhand Renewable Energy Development Agency	Jharkhand	24-08-2017	5.68
39	1/15/1/2011-12/RVE	M.P. Urja Vikas Ltd	Madhya Pradesh	25-09-2017	1.65
40	1/15/14/2010-11/RVE	M.P. Urja Vikas Ltd	Madhya Pradesh	03-05-2017	8.30
41	1/15/15/2010-11/RVE	M.P. Urja Vikas Ltd	Madhya Pradesh	18-04-2017	33.44
42	1/15/16/2010-11/RVE	M.P. Urja Vikas Ltd	Madhya Pradesh	18-08-2017	0.82
43	1/15/17/2010-11/RVE	M.P. Urja Vikas Ltd	Madhya Pradesh	18-04-2017	35.99
44	1/15/18/2010-11/RVE	M.P. Urja Vikas Ltd	Madhya Pradesh	19-04-2017	30.55
45	1/15/2010-11/RVE	M.P. Urja Vikas Ltd	Madhya Pradesh	03-05-2017	7.06
46	1/15/4/2010-11/RVE	M.P. Urja Vikas Ltd	Madhya Pradesh	20-04-2017	0.21
47	1/15/8/2010-11/RVE	M.P. Urja Vikas Ltd	Madhya Pradesh	03-05-2017	2.03
48	1/15/9/2010-11/RVE	M.P. Urja Vikas Ltd	Madhya Pradesh	03-05-2017	2.20
49	32/16/2011-12/PVSE (PART-IV)	M.P. Urja Vikas Ltd	Madhya Pradesh	12-06-2017	48.64
50	32/16/2011-12/PVSE (PART-IV)	M.P. Urja Vikas Ltd	Madhya Pradesh	12-06-2017	3.33
51	32/16/2011-12/PVSE (PART-VII)	M.P. Urja Vikas Ltd	Madhya Pradesh	19-06-2017	207.31
52	32/16/2011-12/PVSE (PART-VII)	M.P. Urja Vikas Ltd	Madhya Pradesh	19-06-2017	9.15
53	32/16/2014-15/PVSE (PART-2)	M.P. Urja Vikas Ltd	Madhya Pradesh	30-06-2017	3.30
54	32/16/2014-15/ PVSE(Part-2)	M.P. Urja Vikas Ltd	Madhya Pradesh	30-06-2017	117.44
55	32/16/2017-18/PVSE (Part-1)	M.P. Urja Vikas Ltd	Madhya Pradesh	23-03-2018	4041.25
56	32/16/2017-18/PVSE (PART-1)	M.P. Urja Vikas Ltd	Madhya Pradesh	28-09-2017	2027.85
57	32/602/2017-SPV Division	M.P. Urja Vikas Ltd	Madhya Pradesh	27-03-2018	336.05
58	32/1/2018-SPV Division	Manipur Renewable Energy Development Agency	Manipur	26-03-2018	54.99



59	32/26/2018-SPV Division	Manipur Renewable Energy Development Agency	Manipur	22-03-2018	64.00
60	32/604/2017-SPV Division	Manipur Renewable Energy Development Agency	Manipur	22-12-2017	45.44
61	32/604/2017-SPV Division	Manipur Renewable Energy Development Agency	Manipur	22-12-2017	2.80
62	32/9/2018-SPV DIVISION	Manipur Renewable Energy Development Agency	Manipur	21-03-2018	391.03
63	32/91/2017-SPV Division	Manipur Renewable Energy Development Agency	Manipur	19-03-2018	93.44
64	32/14/2018-SPV Division	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	22-03-2018	64.64
65	32/19/2012-13/PVSE (PART-III)	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	28-09-2017	129.28
66	32/19/2014-15/PVSE (PART-1)	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	28-09-2017	2.32
67	32/19/2014-15/PVSE (PART-1)	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	28-09-2017	21.50
68	32/19/2014-15/PVSE (PART-2)	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	25-08-2017	16.55
69	32/19/2018-SPV DIVISION	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	20-03-2018	52.27
70	32/20/2018-SPV Division	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	22-03-2018	128.00
71	32/3/2018-SPV DIVISION	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	16-03-2018	98.96
72	32/3/2018-SPV DIVISION	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	16-03-2018	6.93
73	32/8/2018-SPV DIVISION	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	16-03-2018	143.52
74	32/8/2018-SPV DIVISION	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	21-03-2018	14.35



75	32/89/2017-SPV DIVISION	Meghalaya Non Conventional& Rural Energy Development Agency	Meghalaya	23-03-2018	137.76
76	32/21/2016-17/PVSE (PART-1)	Nagaland Renewable Energy Development Agency	Nagaland	28-09-2017	772.56
77	32/27/2018-SPV Division	Nagaland Renewable Energy Development Agency	Nagaland	23-03-2018	60.14
78	32/28/2018-SPV DIVISION	Nagaland Renewable Energy Development Agency	Nagaland	23-03-2018	51.20
79	32/2/2015-16/PVSE (PART-1)	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	Andhra Pradesh	30-06-2017	6480.00
80	32/2/2016-17/PVSE (PART-1)	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	Andhra Pradesh	01-08-2017	2.06
81	32/2/2016-17/PVSE (PART-1)	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	Andhra Pradesh	01-08-2017	48.20
82	32/6652017-SPV DIVISION	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	Andhra Pradesh	09-03-2018	1273.08
83	32/666/2017-SPV	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	Andhra Pradesh	28-02-2018	4593.43
84	32/48/2016-17/PVSE (PART-2)	New Mangalore Port Trust	Karnataka	21-06-2017	91.50
85	32/22/2016-17/PVSE (Part-5)	Orissa Renewable Energy Development Agency	Odisha	23-03-2018	257.40
86	32/38/2014-15/PVSE	Orissa Renewable Energy Development Agency	Odisha	17-08-2017	8.60
87	32/38/2014-15/PVSE	Orissa Renewable Energy Development Agency	Odisha	17-08-2017	600.70
88	32/24/2013-14/PVSE (Part-I)	Rajasthan Renewable Energy Corporation Ltd	Rajasthan	22-12-2017	72.69
89	32/24/2013-14/PVSE (Part-I)	Rajasthan Renewable Energy Corporation Ltd	Rajasthan	22-12-2017	0.70
90	32/24/2015-16/PVSE (PART-2)	Rajasthan Renewable Energy Corporation Ltd	Rajasthan	30-06-2017	3574.20
91	32/289/2017-SPV Division	Rajasthan Renewable Energy Corporation Ltd	Rajasthan	27-03-2018	737.64
92	32/289/2017-SPV Division	Rajasthan Renewable Energy Corporation Ltd	Rajasthan	27-03-2018	61.00
93	32/75/2017-SPV Division	Rajasthan Renewable Energy Corporation Ltd	Rajasthan	22-03-2018	4504.39



94	32/31/2015-16/PVSE (PART-1)	Telangana New & Renewable Energy Development Corporation Limited	Telangana	29-09-2017	1394.90
95	32/31/2015-16/PVSE (PART-2)	Telangana New & Renewable Energy Development Corporation Limited	Telangana	29-09-2017	270.00
96	32/31/2015-16/PVSE (PART-3)	Telangana New & Renewable Energy Development Corporation Limited	Telangana	29-09-2017	405.00
97	32/661/2017-SPV	Telangana New & Renewable Energy Development Corporation Limited	Telangana	28-02-2018	267.13
98	32/662/2017-SPV DIVISION	Tripura Renewable Energy Development Agency	Tripura	20-03-2018	72.50
99	32/69/2017-SPV DIVISION	Tripura Renewable Energy Development Agency	Tripura	19-03-2018	130.67
100	32/29/2015-16/PVSE (PART-3)	Uttar Pradesh New and Renewable Energy Development Agency	Uttar Pradesh	21-07-2017	2486.00
101	32/29/2015-16/PVSE (PART-8)	Uttar Pradesh New and Renewable Energy Development Agency	Uttar Pradesh	26-09-2017	3.60
102	32/29/2015-16/PVSE (PART-8)	Uttar Pradesh New and Renewable Energy Development Agency	Uttar Pradesh	26-09-2017	179.96
103	32/58/2017-SPV Division	Uttarakhand Renewable Energy Development Agency	Uttarakhand	08-03-2018	81.64
104	32/59/2017-SPV Division	Uttarakhand Renewable Energy Development Agency	Uttarakhand	29-12-2017	116.37
105	32/61/2017-SPV Division	Uttarakhand Renewable Energy Development Agency	Uttarakhand	14-03-2018	90.63
106	32/62/2017-SPV Division	Uttarakhand Renewable Energy Development Agency	Uttarakhand	14-03-2018	93.17
107	32/63/2017-SPV Division	Uttarakhand Renewable Energy Development Agency	Uttarakhand	30-01-2018	74.17
108	32/655/2017-SPV Division	Uttarakhand Renewable Energy Development Agency	Uttarakhand	08-03-2018	99.42
109	32/20/2014-15/PVSE (PART-1)	Zoram Energy Development Agency	Mizoram	25-08-2017	95.14
110	32/20/2014-15/PVSE (PART-1)	Zoram Energy Development Agency	Mizoram	29-08-2017	10.79
111	32/20/2014-15/PVSE (PART-2)	Zoram Energy Development Agency	Mizoram	28-09-2017	14.62



112	32/20/2014-15/PVSE (PART-2)	Zoram Energy Development Agency	Mizoram	28-09-2017	219.57
113	32/20/2015-16/PVSE (PART1)	Zoram Energy Development Agency	Mizoram	25-09-2017	1.25
114	32/20/2015-16/PVSE (PART-1)	Zoram Energy Development Agency	Mizoram	25-09-2017	28.92
115	32/20/2015-16/PVSE (PART-2)	Zoram Energy Development Agency	Mizoram	28-09-2017	176.64
116	32/20/2016-17/PVSE (PART-1)	Zoram Energy Development Agency	Mizoram	28-09-2017	47.50
117	32/20/2016-17/PVSE (PART-2)	Zoram Energy Development Agency	Mizoram	28-09-2017	180.31
118	32/20/2016-17/PVSE (PART-3)	Zoram Energy Development Agency	Mizoram	27-09-2017	110.00
119	32/20/2016-17/PVSE (PART-5)	Zoram Energy Development Agency	Mizoram	28-09-2017	409.93
120	32/20/2016-17-PVSE-PART-5	Zoram Energy Development Agency	Mizoram	28-03-2018	153.70
121	32/502/2017-SPV Division	Zoram Energy Development Agency	Mizoram	28-03-2018	39.19
122	32/88/2017-SPV Division	Zoram Energy Development Agency	Mizoram	28-03-2018	145.73

Fund released to implementing agencies under Solar Photovoltaic Division Programme in FY 2018-19					
S. No.	Sanction No.	Organization Name	State	Fund released	
				Date	Amount (Rs. in lakh)
1	32/21/2018-SPV Division	Agency for Non-conventional Energy & Rural Technology	Kerala	28-12-2018	849.57
2	32/5/2018-SPV Division	Bihar Renewable Energy Development Agency	Bihar	18-12-2018	525.94
3	32/664/2017-SPV Division	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	20-04-2018	4642.15
4	32/46/2018-SPV Division	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	04-12-2018	45.53
5	32/40/2018-SPV DIVISION	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	31-08-2018	3.36
6	32/40/2018-SPV DIVISION	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	31-08-2018	43.20
7	32/45/2018/ SPV DIVISION	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	31-08-2018	7.81



8	32/45/2018-SPV DIVISION	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	31-08-2018	178.76
9	32/48/2018-SPV DIVISION	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	31-08-2018	5.61
10	32/48/2018-SPV DIVISION	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	31-08-2018	119.16
11	32/664/2017-SPV Division	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	28-09-2018	175.00
12	32/664/2017-SPV Division	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	28-09-2018	204.63
13	32/664/2017-SPV Division	Chhattisgarh State Renewable Energy Development Agency	Chhattisgarh	28-09-2018	3909.56
14	32/30/2018-SPV Division	Energy Efficiency Services Limited	New Delhi	27-02-2019	7485.00
15	32/30/2018-SPV Division	Energy Efficiency Services Limited	New Delhi	27-02-2019	6924.00
16	32/30/2018-SPV Division	Energy Efficiency Services Limited	New Delhi	27-02-2019	6047.00
17	32/649/2017 SPV Division	Energy Efficiency Services Limited	New Delhi	28-12-2018	1894.84
18	32/34/2018-SPV DIVISION	Haryana Renewable Energy Development Agency	Haryana	31-08-2018	64.87
19	32/49/2018-SPV DIVISION	Himachal Pradesh Energy Development Agency	Himachal Pradesh	31-08-2018	6.48
20	32/49/2018-SPV Division	Himachal Pradesh Energy Development Agency	Himachal Pradesh	31-08-2018	151.07
21	32/658/2017-SPV Division	Himachal Pradesh Energy Development Agency	Himachal Pradesh	30-12-2018	980.43
22	32/57/2017-SPV Division	Himachal Pradesh Energy Development Agency	Himachal Pradesh	13-04-2018	34.28
23	32/51/2017-SPV Division	Himachal Pradesh Energy Development Agency	Himachal Pradesh	28-12-2018	663.37
24	32/6/2018-SPV Division	Indian Institute of Technology Bombay	Mumbai	20-04-2018	300.00
25	32/59/2018-SPV Division	Jammu & Kashmir Energy Development Agency	Jammu & Kashmir	18-10-2018	386.35
26	32/64/2018-SPV Division	Karnataka Renewable Energy Development Limited	Karnataka	30-12-2018	121.88
27	32/650/2017-SPV Division	Karnataka Renewable Energy Development Limited	Karnataka	28-03-2019	12.19
28	32/4/2019-SPV Division	Karnataka Renewable Energy Development Limited	Karnataka	31-03-2019	1350.00
29	32/16/2017-18/ PVSE(Part-I)	M.P. Urja Vikas Ltd., Bhopal	Madhya Pradesh	30-03-2019	982.43



30	32/16/2017-18/ PVSE(Part-I)	M.P. Urja Vikas Ltd., Bhopal	Madhya Pradesh	30-03-2019	1864.08
31	32/58/2018-SPV Division	Maharashtra Energy Development Agency	Maharashtra	13-11-2018	612.92
32	32/63/2018-SPV Division	Meghalaya Non Conventional & Rural Energy Development Agency	Meghalaya	28-12-2018	156.90
33	32/86/2017-SPV Division	Nagaland Renewable Energy Development Agency	Nagaland	28-12-2018	205.87
34	32/665/2017-SPV Division	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	Andhra Pradesh	30-12-2018	5713.29
35	32/665/2017-SPV Division	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	Andhra Pradesh	28-06-2018	575.40
36	32/665/2017-SPV Division	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	Andhra Pradesh	28-06-2018	1158.20
37	32/665/2017-SPV Division	New and Renewable Energy Development Corporation of Andhra Pradesh Limited	Andhra Pradesh	28-06-2018	4201.59
38	32/272/2017-SPV Division	Orissa Renewable Energy Development Agency	Odisha	13-12-2018	151.25
39	32/272/2017-SPV Division	Orissa Renewable Energy Development Agency	Odisha	13-12-2018	25.92
40	32/272/2017-SPV Division	Orissa Renewable Energy Development Agency	Odisha	13-12-2018	453.75
41	32/62/2018-SPV Division	Orissa Renewable Energy Development Agency	Odisha	18-12-2018	129.56
42	32/77/2017-SPV Division	Punjab Energy Development Agency	Punjab	13-09-2018	14.40
43	32/77/2017-SPV Division	Punjab Energy Development	Punjab	13-09-2018	336.00
44	32/652/2017-SPV Division	Punjab Energy Development	Punjab	28-12-2018	479.39
45	32/76/2017-SPV Division	Punjab Energy Development	Punjab	01-08-2018	109.34
46	32/51/2018/SPV- DIVISION	Punjab Energy Development Agency	Punjab	18-10-2018	383.64
47	32/659/2017-SPV Division	Rajasthan Renewable Energy Corporation Ltd.	Rajasthan	27-09-2018	396.10
48	32/659/2017-SPV Division	Rajasthan Renewable Energy Corporation Ltd.	Rajasthan	27-09-2018	263.33
49	32/659/2017-SPV Division	Rajasthan Renewable Energy Corporation Ltd.	Rajasthan	27-09-2018	1924.68



50	32/659/2017-SPV Division	Rajasthan Renewable Energy Corporation Ltd.	Rajasthan	29-03-2019	448.76
51	32/57/2018-SPV Division	Renewable Energy Development Agency Kargil	Jammu & Kashmir	20-11-2018	667.00
52	32/50/2018-SPV Division	Sikkim Renewable Energy Development Agency	Sikkim	15-03-2019	274.20
53	32/25/2018-SPV Division	Uttar Pradesh New and Renewable Energy Development Agency	Uttar Pradesh	30-11-2018	2196.75
54	32/2/2018-SPV Division	Uttar Pradesh New and Renewable Energy Development Agency	Uttar Pradesh	30-11-2018	357.07
55	32/642/2017-SPV Division	Vananchal Gramin Bank	Jharkhand	07-05-2018	99.18

Fund released to implementing agencies under Small Hydro Power Programme in FY 2017-18					
S. No.	Project/ Organisation	To whom reimbursed	State	Fund released (Rs. in Lakh)	Remarks
1	Sanction & release of 1st installment of subsidy to Manuni SHP (3.50 MW) by WinsomeTextile Industries Limited.	UCO Bank, Solan, H.P.	Himachal Pradesh	137.5000	
2	Release of 2nd and final installment of account for setting up of 3 MW Shimla SHP Project by M/s Sai Engineering	H.P. Cooperative Bank Ltd, Shimla	Himachal Pradesh	100.00000	
3	Sanction and release/reimbursement of final subsidy for setting up of Panwi (4 MW) SHP project in kinnaur, H.P installed by M/s Ascent Hydro Power Projects Limited Mumbai	SBI, Capital Market Branch, Mumbai	Maharashtra	203.00000	
4	Sanction & release/reimbursement of final eligible subsidy for setting up of Kadavi SHP (1.50 MW) project kolhapur district of Maharashtra by Shree Tatya Saheb Kore Warana Sahakari Navshakti Nirman Santhan Ltd, Warananager	SBI	Maharashtra	123.50000	
5	Sanction and release of 1st installment of eligible subsidy for setting up of Leond (2 MW) SHP project in Kangra District of H.P	PNB	Himachal Pradesh	150.00000	
6	Release of 2nd and final installment of subsidy for Baner Sangam SHP (5 MW) Project in Kangra District of H.P by M/s Yoindra Power Pvt Ltd, Kangra, H.P	SBI, Commercial Branch, Ludhiana	Himachal Pradesh	128.00000	
7	Release of 2nd and final installment of subsidy for Kurhed	UCO Bank	Himachal Pradesh	76.25000	



8	Release of 2nd installment of CFA for setting up of Ghaggar MHP (100 KW) to M/s Prem Sagar Hydro Power Consultants & Government Contractors, Chandigarh	HAREDA	Haryana	81.25000	
9	Release of 3rd installment of CFA for Evaluation of SHP programme to Deloitte	Deloitte Touche Tohmattu LLP, Gurgaon	Haryana	6.90000	
10	Release of final installment for evaluation of SHP scheme for M/s Deloittee, Gurgaon	Deloitte Touche Tohmattu LLP, Gurgaon	Haryana	11.90000	
Subtotal				1,018.30000	
11	Relaese of 2nd and final installment of subsidy to Yelekru Reservoir Stage - II (Gap - II) 1.5MW SHP installed by M/s Manihamta Power Projects Ltd.	IREDA	Delhi	45.50000	IREDA bond money
12	Release of bond money for disbursal of subsidy/central financial assistance (CFA) - Release of 1st installment of subsidy for setting up Serai - SHP (2MW) project in Kullu, district of Himachal Pradesh by M/s Pinnacle Hydro Energy Pvt. Ltd., Saket, Delhi	M/s Pinnacle Hydro Energy Pvt. Ltd.	Delhi	150.00000	IREDA bond money
13	sanction and release of full and final installment of subsidy for setting up of Thangarbalu SHP (27.75MW) in Raichur district of Karnataka by M/s Kare Power Resources Pvt. Ltd.	M/s Kare Power Resources Pvt. Ltd.	Bangalore	500.00000	IREDA bond money
14	sanction and release / reimbursement of full and final installment of eligible subsidy for setting up of vajra III (1.5MW) SHP project in Thane district of Maharastra by M/s Sahyadri Renewable Energy Pvt. Ltd., Bangalore	M/s Sahyadri Renewable Energy Pvt. Ltd.	Bangalore	45.50000	IREDA bond money
15	Release of 1st installment of subsidy for setting up Sarsuma SHP (9.75MW) project in Damoh district of Madhya Pradesh by M/s SAS Hydel projects Pvt. Ltd.	M/s SAS Hydel projects Pvt. Ltd.	Madhya Pradesh	250.00000	IREDA bond money
Total				2,009.30000	



Fund released to implementing agencies under Small Hydro Power Programme in FY 2018-19

S. No.	Project/ Organisation	To whom reimbursed	State	Fund released (Rs. in Lakh)
1	Setting up of SHP projects under LREI by Kargil Renewable Development Agency,Kargil - release of balance of sanctioned amount	KREDA	J & K	44.84000
2	R&M of WYC Canal Poewer House - C (16MW) by HPGCL, Haryana - Release of funds	HPGCL	Haryana	500.00000
3	LERI - Release of next Installment of fund / subsidy to KREDA for SHP Component.	KREDA	J&K	6,000.00000
4	Setting up of SHP projects by LREDA in Keh district of J & K under LERI project	LREDA	J&K	1,000.00000
5	Preparation of 10DPRs, Leh, J&K-approval of CFA and release of 1st instalment to LREDA	LREDA	J&K	30.00000
6	Release of 1st installment of subsidy for setting up of Peruvannamuzhy (6MW) SHP in Kerala by KSEB	KSEB	Kerala	500.00000
7	Release offinal installment ofCFA for Implementation of 67 MHP/SHP projects to APEDA	APEDA	Arunachal Pradesh	483.56451
8	Release of 2nd and final installment of MNRE CFA to APEDA for preparation of 02 DPR's in Arunachal Pradesh	APEDA	Arunachal Pradesh	10.00000
9	R&M of Tuipanglui (2x1500kW) SHP in Saiha Dist. Of Mizoram by Power & Electricity Department - Release of 1st Installment of CFA	Power & Electricity Deparment	Mizoram	38.22009
10	Setting up of Taksang Chu Nallah SHP (2x1.7MW) in Twang Dist. Of A.P. by Hydro Power Development Corporation of A.P. (HPDCAPL) - Release of part of 1st installment of subsidy.	HPDCAPL	Arunachal Pradesh	100.00000
11	Setting up of Kawlbem SHP (4MW) in Champai District of Mizoram by Power and Electricity Department, Government of Mizoram - Release of 3rd installment	Power and Electricity Department	Mizoram	700.00000
12	Detailed survey and investigation and Preparation of DPR for 07 Nos of new potential SHP sites by Dept. of Power (T&G) Kohima, Nagaland - Release of 2nd and final installment of CFA	NREDA	Nagaland	33.30000
13	Release of 2nd and final installment of CFA for organising 1 day regional workshop/seminar by HIMURJA	HIMURJA	Uttarakhand	0.90000
14	Evaluation study for validation of cost revision proposed by LREDA	AHEC, IIT Roorkee	Uttarakhand	7.55200
15	Evaluation study for validation of cost revision proposed by LREDA - release of final installment and settlement of account	AHEC, IIT Roorkee	Uttarakhand	11.32800



16	Setting up of pazahassi Sagar (7.5 MW) SHP at Pazahassi Irrigation Barrage of Irrigation Department in velappattanam river basin as Dam toe, run-of-the-river in Kannur district of kerala by KSEB ltd. - relaese of 1st installment of subsidy/fund reg.	KSEB	Kerala	500.00000
17	Setting up of 3 New SHP projects Saurashtra Branch Canal namely SHP 1 (3x5MW), SHP 2 (3x5 MW) and SHP 3 (3x5MW); Total 45MW, by SSNNL in gujarat - relaese of 3rd installment (part)	SSNNL	Gujarat	1,500.00000
18	Preparation of DPR for the ssichu MHP (100kW) project in Saichu village in Chamba district of Himachal Pradesh by HIMURJA Shimla - release of 2nd and final installment of CFA	HIMURJA	Himachal pradesh	2.78200
19	"Electrification/illumination of all villages along the State Border of Arunachal Pradesh "- 2nd and final release to AHEC IIT roorkee for examination of demands for gap funding of 11 Nos. of MHP/SHP projects implemented by DHPD, Arunachal Pradesh	AHEC, IIT Roorkee	Uttarakhand	7.59000
20	Renovation and Modernisation of Maicham Phase I (2x1000 kW) SHP Project in Serchhip District of Mizoram by Power & Electricity Department, Aizwal, Mizoram – Release of 1st installment of subsidy	Power & Electricity Department	Mizoram	50.00000
21	Development/upgardation of 21 nos. of watermills in Himachal Pradesh by HIMURJA, Shimla - Release of 2nd and final installment of CFA	HIMURJA	Himachal Pradesh	20.46629
22	Development/upgardation of 50 nos. of watermills in Kerala by Energy management Centre (EMC) - Release of 2nd and final installment of CFA	EMC	Kerala	41.25000
23	R & M of teirei SHP (3MW) in Mamit district of Mizoram by Power & Electricity Department, Government of Mizoram - Revision of CFA and release of 2nd installment of subsidy	Power & Electricity Department	Mizoram	38.84214
24	R & M of WYC Hydel Power House - c(2x8MW) in Bhudkalan, Dist Yamuna Nagar of Haryana being implemented by Haryana Power generation Corporation Lts. (HPGCL) - Release of next installment	HPGCL	Haryana	400.00000
Total				12,020.63



Fund released to implementing agencies under Biogas Programme in FY 2017-18 & 2018-19

S. No.	Project/ Organisation Name	State	Sanction No.	Fund released	
				Date	Amount (Rs. in lakh)
1.	NEDCAP	Andhra Pradesh	253/43/2018-BG 253/46/2017-BG 253/44/2018-BG 253/47/2018-BG	06.02.2019 28.12.2018 06.02.2018 06.02.2018	6000000 8012500 7200000 5212500
2.	CREDA	Chhattisgarh	253/40/2018-BG 253/41/2018-BG 253/157/2017-BG	28.12.2018 20.12.2018 29.03.2019	8700000 9000000 5467197
3.	RDPRD	Karnataka	253/22/2018-BG 253/141/2017-BG 253/23/2018-BG 253/53/2017-BG	30.08.2018 29.09.2018 30.08.2018 28.12.2018	42000000 33554800 9000000 7317900
4.	Kerala S/G	Kerala	253/21/2019-BG	25.03.2019	10800000
5.	MPSAIDC	Madhya Pradesh	253/48/2018-BG 253/143/2017-BG	31.12.2018 21.02.2019	28800000 14734029
6.	Maharashtra	Maharashtra	253/35/2018-BG	27.11.2018	42000000
7.	OREDA	Odisha	253/152/2017-BG	29.03.2019	6724000
8.	PEDA	Punjab	253/3/2019-BG 253/8/2017-BG	28.02.2019 26.02.2019	18000000 20159298
9.	RDPRD Rajasthan	Rajasthan	253/33/2018-BG	28.12.2018	7200000
10.	KVIC, Mumbai	KVIC, Mumbai	253/25/2018-BG 253/28/2018-BG(NEZ) 253/122/2017-BG(NEZ) 253/26/2018-BG 253/27/2018-BG	31.08.2018 31.08.2018 27.09.2018 31.08.2018 31.08.2018	21000000 5000000 6237500 15000000 9000000



Fund released to implementing agencies more than 50 lakhs in Green Energy Corridor FY 2017-18

S. No.	Sanction No.	Project/Organization Name	State	Fund released	
				Date	Amount (Rs. in lakh)
1	1/7/2015-EFM	Madhya pradesh Power Transmission Corporation Limited	Madhya Pradesh	22.06.2017	15446.70
2	1/7/2015-EFM	Gujarat Energy Transmission Corporation	Gujarat	22.06.2017	2018.10
3	1/7/2015-EFM	Madhya pradesh Power Transmission Corporation Limited	Madhya Pradesh	26.09.2017	20595.30
4	1/7/2015-EFM	Gujarat Energy Transmission Corporation	Gujarat	26.09.2017	2690.90
5	367-11/26/2017-GEC	Himachal Pradesh Power Transmission Corporation Limited	Himachal Pradesh	26.12.2017	473.00
6	1/7/2015-EFM	Tamil Nadu Transmission Corporation	Tamil Nadu	26.12.2017	1111.00
7	367-11/26/2017-GEC	Karnataka Power Transmission Corporation Limited	Karnataka	26.12.2017	2652.30
8	1/7/2015-EFM	Gujarat Energy Transmission Corporation	Gujarat	20.03.2018	3058.00
9	367-11/26/2017-GEC	Himachal Pradesh Power Transmission Corporation Limited	Himachal Pradesh	20.03.2018	840.70
10	367-11/26/2017-GEC	Himachal Pradesh State Electricity Board	Himachal Pradesh	20.03.2018	1111.00
Total					49997.00



Fund released to implementing agencies more than 50 lakhs in Green Energy Corridor FY 2018-19

S. No.	Sanction No.	Project/Organization Name	State	Fund released	
				Date	Amount (Rs. in lakh)
1	367-11/26/2017-GEC	Himachal Pradesh Power Transmission Corporation Limited	Himachal Pradesh	14.05.2018	2047.70
2	1/7/2015-EFM	Tamil Nadu Transmission Corporation Limited	Tamil Nadu	28.05.2018	5054.30
3	367-11/26/2017-GEC	Himachal Pradesh Power Transmission Corporation Limited	Himachal Pradesh	30.07.2018	3099.00
4	1/7/2015-EFM	Transmission Corporation of Andhra Pradesh Limited	Andhra Pradesh	06.08.2018	4708.43
5	1/7/2015-EFM	Gujarat Energy Transmission Corporation	Gujarat	31.08.2018	10746.00
6	1/7/2015-EFM	Madhya pradesh Power Transmission Corporation Limited	Madhya Pradesh	31.08.2018	4645.70
7	1/7/2015-EFM	Madhya pradesh Power Transmission Corporation Limited	Madhya Pradesh	07.09.2018	2517.48
8	367-11/26/2017-GEC	Karnataka Power Transmission Corporation Limited	Karnataka	27.12.2018	6785.80
9	1/7/2015-EFM	Gujarat Energy Transmission Corporation	Gujarat	27.02.2019	6839.00
10	367-11/1/2019-GEC	Maharashtra Electricity Transmission Corporation Limited	Maharashtra	28.02.2019	3556.59
Total					50000.00

