



Specialized Institutions

8.1 The Ministry has set up three technical specialized institutions viz., Solar Energy Centre (SEC), Centre for Wind Energy Technology (CWET) and Sardar Swaran Singh National Institute of Renewable Energy (SSS-NIRE). SEC and C-WET have been functioning and SSS-NIRE is expected to become functional shortly. Indian Renewable Energy Development Agency Ltd. (IREDA), a 100% government owned company, is registered as a non-banking financial company with the Reserve Bank of India functioning under the administrative control of this Ministry.

SOLAR ENERGY CENTRE

8.2 Solar Energy Centre (SEC), a research and technology evaluation facility of the Ministry, works on science and engineering aspects of solar energy technologies. With its head quarters in the Ministry in Delhi, the R&D campus of the Centre is located at the border of Delhi and Haryana on a land allocated by the Government of Haryana. The activities undertaken during the year in SEC are as follows:

Solar Resource Assessment

8.3 Reliable solar radiation data is a prerequisite for proper design of solar energy systems including solar power plants in different sites of the country. A revised solar radiation handbook entitled 'Solar Radiant Energy Over India' was brought out in the recent past through a joint effort by SEC and IMD (India Meteorological Department). Through another collaborative project between SEC and NREL (National Renewable Energy Laboratory) solar radiation maps covering the entire country at 10 km x10 km spatial resolution have been constructed through assessment techniques based on satellite imagery. The maps contain monthly and annual Direct Normal Irradiance (DNI) and Global Horizontal Irradiance (GHI) data developed from hourly satellite data spanning between January 2002 and December 2008. The maps have been posted in the Ministry's website in October 2010. As a part of SEC-NREL collaboration, a workshop is jointly being organized in February 2011 on the Solar Advisor Model (SAM) developed by NREL and Sandia National Laboratory (SNL) for researchers, designers of solar power systems and solar project developers for possible performance predictions of various solar power projects based on technology, weather data, financial and incentives assumptions. The radiation research group in SEC continued to collect solar radiation and other related data in the campus and worked on a variety of models for analysis and deduction of information.

Solar Thermal Activities

8.4 Stirling power systems: Three Units of Solar Thermal Stirling Engine of 3 kW capacity each have been installed and commissioned in the campus under a collaborative project of SEC and ONGC Research Centre. The engines have been synchronized with the campus PV grid and the electricity produced during the sunshine hours is being utilized in the Technical Block of SEC campus. The objective of the project is to carryout long term performance evaluation under Indian conditions.

8.5 Megawatt-scale solar thermal power testing, simulation and research facility:

IIT Bombay in collaboration with SEC has been assigned the task of establishing a 1 MWe Grid Interactive Solar Thermal Power Plant and the National Test Facility that will enable testing of components and systems of Solar Thermal Power Generation at SEC campus. A consortium consisting of few industries namely, Tata Consulting Engineers, Tata Power, Larsen & Toubro, Clique Developments, KEI Solatherm, KG Design Services are in partnership in this project. So far, five Project Operation Committee (POC) meetings were organized to review the implementation status of the project by IIT Bombay. The last POC meeting was held in



International Training Programme 2010 at Solar Energy Centre

the month of December, 2010 to discuss the integration, operation and control policy of all the equipment to be supplied by various vendors for the successful implementation of the plant. Also, the time schedules for supply of these equipments by each individual vendor have been discussed and fixed, in order to complete the project on time. Procurement of all the major equipments – solar fields, heat exchangers, turbine, condenser, generators, etc. has been completed. Detailing of the plant from mechanical, process & piping, electrical & control and civil engineering aspects are in the final stage. A Workshop on the Testing and Simulation Facility to get the feedback from potential users was also conducted in 2010 by IIT Bombay, Mumbai, with an aim to make simulator development and testing facility more realistic and useful to the potential users. Site preparation work for setting up of solar concentrator collectors has been completed and handed over to the two vendors who will be setting up solar concentrator collectors based on different technologies. Foundations for fixing solar concentrating collectors, other equipments including power block are in progress. Work on laying of internal roads for transportation of materials has also been initiated. SEC has initiated the steps for setting up of a dedicated 11 KV HT cable (AB type) line to its campus to evacuate the power from the proposed plant.

8.6 Concentrated solar thermal (CST) parabolic dish technology for steam generation- an R&D-cum-demonstration project: M/s Megawatt Solutions Pvt. Ltd.,

Chennai has been awarded implementation of above project with 50% Ministry's support at SEC campus. The broad objective of the above project is to perform research, design and development on parabolic solar dish concentrator technology for steam generation application, creating a test bed for technology refinement and development activity, and developing best practices for technology development, component manufacturing, system integration, installation, operations and monitoring. Foundation and fabrication of parabolic reflector structure, thermal receiver and support structure for parabolic collector of one dish has been completed at site. Foundation for setting up of the remaining three dishes has also been completed. Installation of the sub-components i.e. expansion tank to account for expansion of oil upon heating and nitrogen blanketing system on the top to prevent oxidation of the oil is under progress.

8.7 Development of a modular central receiver concentrated solar power (CSP) plant for decentralized power generation- an R&D-cum-demonstration project:

The above project has been sanctioned to M/s SunBorne Energy Technologies Pvt. Ltd., Gurgaon to implement at SEC campus with Ministry's support during the third quarter of the current financial year with the aim of setting up a 1 MWth CSP Central Tower Pilot Facility in partnership with SEC. The main objective of this project is (i) development of optimized design of the heliostat field, volumetric air receiver and thermal storage, the three major components of a Concentrated Solar Power (CSP) Central Receiver plant and (ii) Development of



Solar Air Conditioning Laboratory at Solar Energy Centre

local sources for all the key components of the plant with a focus on lowering costs, which will make the technology competitive with other forms of energy. Preliminary project activities such as clearing and preparation of site for setting up of the project is under progress.

8.8 Solar thermal air conditioning systems: SEC initiated a project on development of high efficiency solar thermal air conditioning systems in collaboration with M/s Thermax

Ltd., Pune to implement at its campus with 50% financial support from the Ministry. The objectives are development of cost effective high efficiency cooling engine with COP of 1.7, indigenous components for vapor absorption machine, and medium temperature solar concentrating collectors with improved efficiency including integration of the components to achieve consistent performance of the system. The cooling capacity of the above system is 100 kW (30 tonnes). The development work is in progress. Also the foundation work for setting up of the solar concentrating collectors in the campus has been initiated. In the interactive research project taken up in collaboration with CMERI, Durgapur on development of a solar adsorption based space cooling system for parametric study and techno-economic assessment, a finite differential model for temperature distribution across the silica gel bed has been developed, the system design has been completed and necessary components have either been fabricated or procured. The design for the cold storage based on solar-biomass hybrid system (a project in partnership with TERI, Thermax and CSIRO) has been finalized and the site for its installation has been identified in the campus of SEC.

8.9 Solar thermal test and evaluation facility (STTEF): Testing of domestic (thermosyphon) Flat Plate Collector (FPC) and Evacuated Tube Collector (ETC) based Solar Water Heating Systems (SWHS) was continued during the current Financial Year 2011-12 as per Bureau of Indian Standard (BIS) and the test procedure laid down by the Ministry. 11 samples of ETC based SWHS, 3 samples of FPC and 1 Box Type Solar Cooker were received for testing till 31.12.2010. Test Reports of 7 ETC based SWHS systems and 1 Box Type Solar Cooker have been issued on the basis of Thermal Performance Evaluation carried out under outdoor conditions.

8.10 Comparative performance study of domestic solar water heating systems: A Comparative Performance Study on the Flat Plate Collectors (FPC) and Evacuated Tube Collectors (ETC) based Solar Water Heating Systems (SWHS) on the basis of different climatic conditions in India at three different locations i.e. Pune, Hamirpur and Gurgaon has been initiated under UNDP/GEF-Global Solar Water Heater Project. The objective of the study is to carryout thermal performance test on FPC & ETC based domestic SWHS as per the test procedure laid down by the Ministry. Solar Water Heating Systems have been supplied by International Copper Promotion Council (India) and radiation and weather data measuring control equipments have been supplied by UNDP. Installation and commissioning of SWHS and other equipments has been completed and Thermal performance tests are under progress.



Solar PV Test Bed at Solar Energy Centre

Solar Photovoltaic Activities

Photovoltaic Test facility

8.11 The indoor photovoltaic test facility (PVTF) at SEC is involved in testing and evaluation of solar cells, photovoltaic (PV) modules, balance of systems and complete PV systems.

8.12 Solar Cell Laboratory: A state-of-the-art class 'A' Solar cell tester and Spectral Response (SR) system has been installed and commissioned in the Solar Cell Laboratory. A similar system has also been commissioned in Indian Association of Cultivation of Science (IACS), Kolkata under the SEC-IACS-CEL interactive project for development of reference solar cells and PV modules. The Cell tester and SR system can test different technology solar cells of size up to 30cm x 30cm. So far 15 cells have been tested by using this system.

8.13 PV Module Testing Laboratory: The Module Testing Laboratory of the PVTF is currently equipped to conduct the full range of qualification testing (except the hail impact test) of crystalline silicon PV modules of size upto 120cm x 100 cm. The International quality system conforming to IEC 17025 has been evolved in the laboratory. During the year, the Laboratory has got NABL accreditation for conducting the testing of PV modules as per IEC 61215 and BIS standards. The light soaking test station for measurement of stabilized STC (standard test condition) performance of thin film PV modules is likely to be commissioned by the end of the financial year 2010-11, enabling the laboratory to perform qualification testing for thin film PV modules as per IEC 61646. During the year, a total of 129 PV modules of crystalline and thin film technology were tested for their performance. Qualification testing as per IEC 61215 has also been completed for crystalline modules from two manufacturers. The PV module testing laboratory is also equipped to conduct performance testing of large size PV modules upto 200 cm x 200 cm. In order to conduct qualification testing on such large size modules, the procurement formalities for walk-in

environmental chambers have been finalized during the year.

8.14 Systems Research and Evaluation Laboratory: Performance evaluation of 37 solar lanterns, 26 home lighting systems, 38 street lighting systems and 11 luminaries and charge controllers based on light emitting diode (LED) as well as compact fluorescent lamp (CFL) has so far been undertaken in the Systems Testing Laboratory of PVTF. These lighting systems were evaluated as per MNRE and user specifications. About 40% of the above stated lighting systems submitted by the manufacturers were tested for developmental purpose with a view to develop efficient and cost competitive products as per the user defined specifications.

8.15 PV Outdoor Test Facility: Collection and analysis of data, and monitoring of performance of PV modules set up in the outdoor test facility continued during the year. The modules of different technologies: crystalline silicon, amorphous silicon, HIT cell modules, cadmium telluride/cadmium sulphide, copper indium diselenide and concentrator PV modules. Analysis of performance of a megawatt scale solar PV power plant set up in Asansol (West Bengal) has also been undertaken. The performance of photovoltaic modules of different technologies in the outdoor test bed after prolonged exposure to the harsh outdoor conditions of the campus (composite zone) provide valuable inputs regarding their applicability for actual use for electricity generation. The experience gained

from these experiments has been widely shared (without identifying the actual producers of the modules) with technical fraternity, manufacturers, developers and policy makers through research papers in international journals, international and national conferences, and consultations. The results have evoked considerable interest amongst technology developers of the country and elsewhere for further developmental work regarding durability and reliability of PV modules to be deployed under actual field conditions of various climatic zones.

8.16 Regional Test Centres for Solar Photovoltaics: SEC coordinates the activities related to regional test centres for solar photovoltaics. Test centres have been supported at Electronic Test and Development Centre (ETDC) Bangalore, Central Power Research Institute (CPRI) Bengaluru, Electronics Regional Test Laboratory (ERTL) Kolkata. During the year, action has been initiated to upgrade ETDC Bengaluru and ERTL Kolkata by providing state-of-the-art equipment for testing and performance evaluation. A number of consultative meetings have taken place to firm up the specifications and test protocols. Procurement of equipments has been entrusted to CDAC (Centre for Development of Advanced Computing), an institute of Ministry of Information technology who will be advised by a group of scientists from the test laboratories.

8.17 Interactive research projects: Work on development of secondary solar cells and modules taken up for making indigenous reference standards available to the manufacturers and users continued in CEL, IACS and SEC related to fabrication of appropriate cells and modules, calibration facilities and protocols. Under the SEC-IIT Bombay project on development of high efficiency HIT solar cells, the parameters for deposition rates and control over thickness of the doped and intrinsic i-layer have been optimized. The doped and intrinsic layers have also been characterized. A consortium project on 'Stability and performance of Photovoltaic (Stapp)' between India-UK group of organizations has recently been undertaken. The other Indian institutes participating in the project are IIT Bombay, IIT Kanpur and IIT Kharagpur. From UK side the participating

institutes are Loughborough University (LU), Imperial College of London (ICL), Strthclyde University (SU) and Northumbria Photovoltaic Application Centre (NAPC).

Battery Research and Evaluation Facility

8.18 Solar Energy Centre is implementing a research project in collaboration with Central Electrochemical Research Institute, Karaikudi, Tamilnadu (CECRI) for design and development of batteries for solar photovoltaic applications. The project aims to undertake failure analysis of the used batteries in the existing solar photovoltaic applications, design and development of suitable lead acid batteries and test protocols for batteries for SPV applications, and exploring battery chemistry other than lead acid for such applications. The study of existing circuit designs for charge controllers and optimizing their performance has also been undertaken. Under the project PWM type of charge controllers were evaluated with commercially available series types of charge controllers. These charge controllers are now being field evaluated in 20 hybrid lead acid batteries developed under this project at CECRI. Similar experiment is being done at SEC by using 20 hybrid lead acid batteries in LED street lighting systems. Draft Standards for lead acid batteries for solar photovoltaic application were also developed under the project. These standards were widely circulated to all the battery manufacturers and SPV system integrators and were also discussed in a one –day dissemination workshop jointly organized by SEC-CECRI at Chennai on 1st October 2010. These standards have been forwarded to Bureau of Indian Standards (BIS) for acceptance by them. Routine testing of batteries as part of SPV systems continued during the year and about 150 batteries were tested for their capacity and charge efficiency by December 2010.

Visitors' Programme

8.19 As one of the accredited institutes under Indian Technical and Economic Cooperation

(ITEC) Programme of Ministry of External Affairs (MEA), Solar Energy Centre organized a International Training Programme on Solar Energy Technology and Applications from 18th October 2010-5th November 2010. The programme was attended by 29 participants from 21 countries from Asia, Europe, Africa and Latin America and Caribbean countries. This programme generated much interest among the countries about Indian Renewable Energy Programme and developing bilateral cooperation activities between India and these countries. SEC continued to host visits of researchers, students, officials and other dignitaries from the country and abroad to its research facility to provide an exposure and disseminate technological developments. Scientists from laboratories in USA, UK, Japan and Germany visited SEC research facility to develop interactive programmes. The visitors during the year amongst others include deputy prime minister of Mauritius and director general of UNIDO. So far during the year, 12 under graduate and post graduate students have participated in the research programmes of SEC to undertake their project work. A consultancy project for development of solar power packs for ATMs' of State Bank of India (SBI) has been completed and report sent to State Bank Academy, Gurgaon. SEC scientists continued to provide information and technical assistance to manufacturers, developers and technology providers on their mission to promote solar energy technologies. For disseminating the outcome of research and updated information, during the year scientists of the Centre published research articles in journals and books, presented papers in conferences, delivered lectures as guest faculty, chaired technical meetings, participated in scientific deliberations, and served in the editorial boards of national and international

research journals.

Centre of Excellence

8.20 It has been decided to upgrade Solar Energy Centre as a centre of excellence under the Jawaharlal Nehru National Solar Mission (JNNSM). Consultation process for the same has already been initiated. The activities of the Centre have also been geared up. SEC's developmental work on off-grid solar energy systems, knowledge gained from its PV outdoor test bed, solar radiation handbook and maps of the country, the SAM workshop, its work on solar power generation and technology evaluation have provided valuable inputs for formulation and implementation of the JNNSM. As elaborated above, a number of technology development projects have been initiated in SEC in partnership with research organizations and industry. Work related to hydrogen and fuel cell has also been initiated. A number of actions have been taken to upgrade the infrastructure including strengthening technical manpower. An MoU has been concluded between SEC and NBCC (National Buildings Construction Corporation) for design and construction of an administrative building, a 30 room guest house and a cafeteria in the campus of SEC. The buildings are being designed on the basis of energy efficient building design principles with incorporation of renewable energy and would be GRIHA rated.

CENTRE FOR WIND ENERGY TECHNOLOGY

8.21 Centre for Wind Energy Technology (C-WET), Chennai is a knowledge-based institution, established to cater for a healthy, orderly and quality conscious technology development in wind energy in the country. C-WET is envisioned to serve as a technical focal point of excellence to foster the development of wind energy in the country. It is an autonomous institution under the Ministry of New and Renewable Energy.

Organization

8.22 C-WET, Chennai comprises of five units, functionally organized as Research and Development, Wind Resource Assessment, Wind Turbine Testing, Standards and Certification and Information, Training & Commercial Services. C-WET has its test beds and experimental wind farm at Wind Turbine Research Station (WTRS), Kayathar, Tuticorin District of Tamil Nadu.

8.23 Each unit has a charter that fulfills overall objectives set for C-WET. The functioning of



2 MW R&D Wind Turbine at Kayathar, Tamil Nadu

each unit is so organized that while keeping the independence at the operational level intact, supplement and complement each other's activities to give holistic solutions to stakeholders.

Research and Development (R&D) Unit

8.24 The Unit carries out in-house R&D and coordinates research and development programs through effective networking with academic institutions, industry, experts and consultants working in a wide spectrum of disciplines for the benefit of wind energy sector. The brief of the work executed during the year are detailed as under:

Performance Quantification Study on two 20 Years design life exhausted 200kW Wind Turbine Gear Boxes before & after a Nano-coating on their Gear Meshing Surface

8.25 The Unit has initiated an in-house research project on "Performance Quantification study on two nos. 20 years design life exhausted 200 kW wind turbine gearboxes before and after a nano-coating on their gear meshing surface". The project will involve comparison of vibration, temperature and sound before and after the application of nano-

coating concentrate to the gearbox oil.

R&D Experimental 2MW Wind Turbine dedication to the country at WTRS facility, Kayathar

8.26 The 2MW Experimental/Research Wind Turbine at CWET's Kayathar WTRS facility has been successfully commissioned and has been dedicated to the country by the Hon'ble Minister for New and Renewable Energy Sources, Dr.Farooq Abdullah. A slew of R&D activities have been planned on the Wind Turbine as a first measure work on the establishment of a Health/Condition Monitoring system. This exercise would help the industry to move away from a diagnostic approach of maintaining Wind Turbines to a Prognosis method of Turbine maintenance. MoUs have been signed with Park College of Engineering and PSG college of Technology, Coimbatore for R&D / Academic co-operation.

Implementation of Certificate / Post Graduate Diploma Courses in Wind Energy at PSG College of Technology, Coimbatore.

8.27 Based on the inputs received from the Industry and various wind sector stakeholders that a severe shortage of manpower exists in the wind Sector, CWET has encouraged academic institutional partnership to tide over the bottleneck. In the process, the proposal submitted by PSG College of Technology, Coimbatore for conducting five certificate/ post Diploma Graduate courses has been approved by the Research & Development Council and a Memorandum of Understanding was signed between CWET & PSG College of Technology on 19th November 2010. The courses are due to be started in January 2011 at Coimbatore. CWET was instrumental in preparation of the syllabus for the said courses and will also provide necessary support in Training of Trainers.

Study on power quality issues in grid connected wind farms and identification of remedial measures

8.28 A project aiming to recommend appropriate integration of the new wind generation system foreseen for the Indian wind power based on measurements at site and simulation studies has commenced. Data collection is in progress at 110 kV Sultanpet and Gudimangalam substations. Reactive power consumption, voltage and current imbalance, voltage sag and swell, frequency deviation and harmonics have been recorded.

Power Evacuation Studies for Grid Integrated Wind Energy Conversion System

8.29 The project, proposed by Anna University, Chennai, aims at optimization of wind turbine operation by ensuring evacuation of the available wind power into the grid. As a part of this project, it is proposed to identify the locations where wind penetration into the grid is a problem and enhance the power evacuation with a TCSC (Thyristor Controller Series Capacitor) controller and VSC (Voltage Source Converter) based HVDC (High Voltage Direct Current Transmission) link.

8.30 Data collection for Tirunelveli network has been completed. Modelling of wind generators for power flow studies is in progress.

Technology demonstration project on grid connected wind solar hybrid system

8.31 The unit proposes to install 45 kW hybrid system consisting of grid connected miniature small wind farm and solar photovoltaic plant to serve as a demonstration project to meet the load demand partially and to undertake research relevant activities. With the advent of smart grid concepts the days are not far when net metering and distributed generation would become a reality in the Indian grid. C-WET, being a model institution, the deployment of the grid connected system will help in studying important aspects related to grid behavior and understanding the peculiarities of such systems and the concept of net metering for formulation of a policy.

Empanelment of Small Wind Turbines

8.32 The Unit is in the process of empanelling small wind turbines with MNRE based on a review of documents submitted by manufacturers. As a step towards this, a Committee has been constituted with the approval of Secretary, MNRE, to review the status of various manufacturers of small wind energy systems and their recommendation for empanelment as MNRE approved manufacturers. The Committee will finalize the list of manufacturers / models of SWES to be empanelled as per the conditions stipulated in the Modified Scheme for the programme on "Small Wind Energy and Hybrid Systems" during 2010-11 and 2011-12. Three lists have been released in this year with name of manufacturers who qualified for empanelment and their specific small wind turbine models. As on date, four models from two manufacturers have been listed in the empanelled category and seven models from five manufacturers have been listed under the provisional empanelled category.

8.33 Small Wind Turbines from different manufacturers have been installed at WTRS for Testing. The unit is presently in the process of type testing four small wind turbines of 1.4kW, 3.2kW, 3.5kW and 5kW rating at its Wind Turbine Research Station, Kayathar as per the requirements of IEC-61400-2. The measurements would be continued to the next windy season 2010 to meet the requirements of International Standards. Further, four more SWT models are expected to be installed at WTRS for testing before the start of the next windy season.

Wind Resource Assessment (Wra) Unit

120 m Anemometry at four locations

8.34 The MNRE has sanctioned a project to establish four 120 m tall masts at some of the prominent wind farm locations in the country. These stations will also serve as permanent reference stations to study inter-annual variation of wind. Three stations have been established in previous years and the fourth station has been installed during the current financial year. The stations are at Jagmin, (Satara district, Maharashtra), Lamba, (Jamnagar district), Akal (Jaisalmer District, Rajasthan) and Jogimatti (Chitradurga district, Karnataka. Wind measurements are

being carried out at 5 levels (10, 30, 60, 90 and 120m). Apart from this, temperature, pressure and solar radiation data will be collected from these stations. The data from these stations will serve as valuable research material for wind energy and related applications.

Wind monitoring stations under private sector

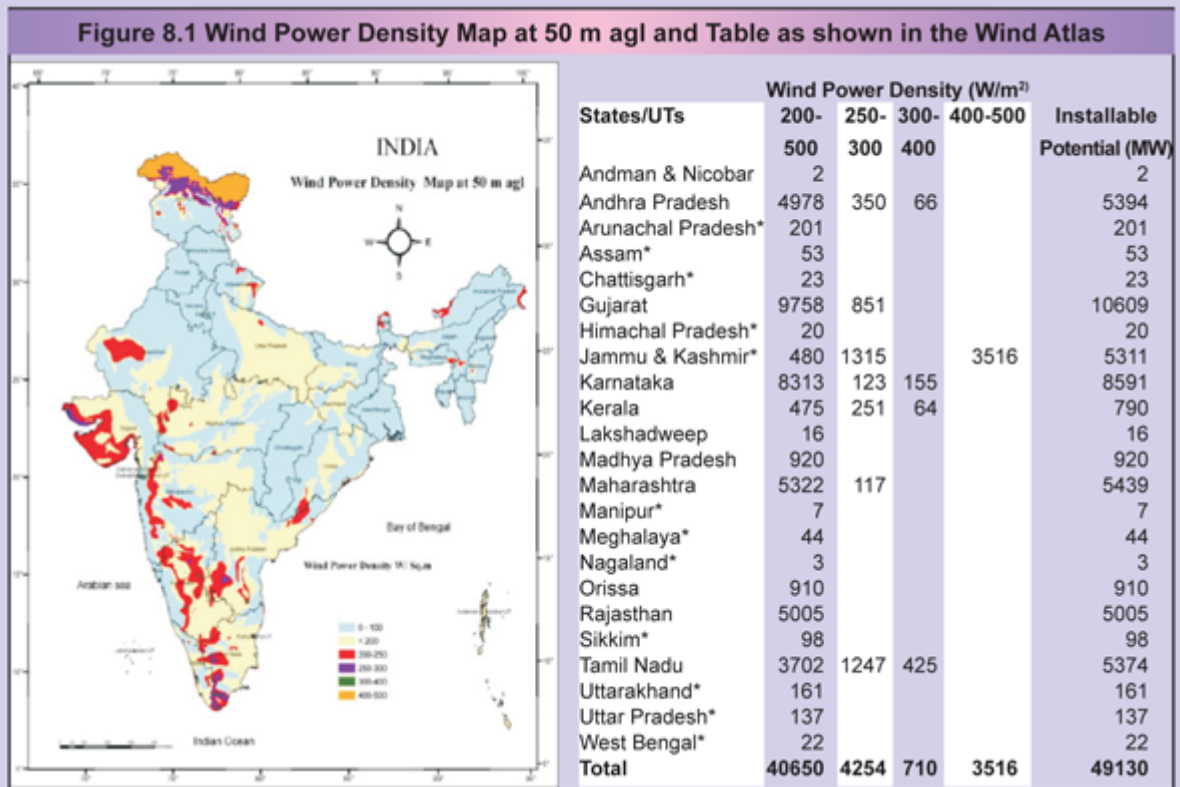
8.35 MNRE has issued guidelines for wind measurement by private sector during June

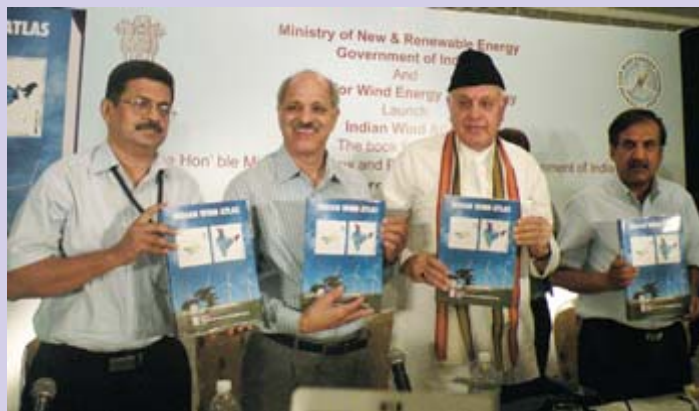
2008. As per the new guideline private developers, who are willing to collect wind data at specific locations, should inform the details of the site to C-WET, Chennai through the concerned State Nodal Agency. Such information will be registered by C-WET on a nominal payment of Rs.5000/- per site. During this period 210 sites have been registered from Andhra Pradesh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Tamilnadu.

8.36 Apart from the registration of new sites C-WET regularly carries out verification of procedure of wind monitoring stations established by the private entrepreneur. 144 numbers of such exercises have been carried out during the year.

Indian Wind Atlas

8.37 To establish the meteorological basis for estimating the wind climate and wind energy resources of any particular site in India, the Indian Wind Atlas has been prepared. The main objective of the Wind Atlas is to provide suitable wind power data for evaluating the potential site for large electricity-producing wind turbine installations. The Atlas has been prepared with involvement of RISO National Laboratory for Sustainable Energy, Denmark. The information in the Atlas is valuable to wind energy developers and potential wind energy users because it allows them to choose a general area of estimated high wind resource for more detailed examination. It gives an updated overview of the wind climatological situations of India, based on reliable measured wind data and using contemporary numerical





Dr. Farooq Abdulah, Hon'ble Minister for New and Renewable Energy releasing Indian Wind Atlas at Chennai

mesoscale models. Extensive use of micro and meso scale models like Wind Atlas Analysis and Application Programme (WASP) and Karlsruhe Atmospheric Meso Scale Model (KAMM) used for the preparation of the wind atlas. The wind power density map of India is as shown in **Figure 8.1** The new estimate of installable potential in the country is given in the table. The Wind Atlas was prepared during the month of February 2010 and was released the book for public by Dr. Farooq Abdullah, Hon'ble Minister of New and Renewable Energy on 29 April 2010.

WRA in uncovered / new areas

8.38 72 wind-monitoring stations are under operations as on 31.12.2010. 16 new wind monitoring stations have been commissioned in various States under Ministry's Wind resource Assessment Programme during this period.

Offshore Wind Resource Assessment at Dhanuskodi, Rameshwaram, Ramanathapuram District

8.39 MNRE sanctioned a project titled as "Offshore wind resource assessment at Dhanuskodi, Rameshwaram, Ramanathapuram District". The project has two parts, namely, Wind measurements at Dhanushkodi with 100 m anemometry and SAR (Synthetic Aperture Radar) Data collection and analysis for offshore assessment between Kanyakumari and Rameswaram. An agreement has been executed between C-WET & Riso, DTU on 19th August 2010 for collecting and analysis of offshore SAR data between Rameshwaram and Kanyakumari. C-WET Scientists attended SAR workshop at RISO, Denmark during 25-29 October 2010.

Development of Wind Forecasting Model With Special Reference to Complex Terrain

8.40 A project titled "Development of Wind forecasting model with Special Reference to Complex Terrain" was sanctioned by the Ministry to C-WET. C-WET approached M/s RISO-DTU, Denmark and they agreed to carry out the project. An agreement has been executed in June 2010 between C-WET and M/s RISO DTU, to execute the project within 18 months. "PREDICTOR" model has been identified and the same is being used for forecasting at 50.4

MW wind farm at Khandke Hills, Ahmednagar in Maharashtra. A workshop to execute the project was conducted by M/ s RISO DTU at C-WET during 5-9 October 2010.

Consultancy projects

8.41 WRA unit carried out more than 45 project in various areas like micro-siting & technical due diligence, installation of wind monitoring stations, power performance guarantee test etc., during the year. It also includes preparation of detailed project report for the establishment of 3 x 250 kW wind farm at Kavaratti, Lakshadweep Islands.

Wind Turbine Testing (WTT) Unit

Wind Turbine Test Station (WTTS)

8.42 C-WET's Wind Turbine Test Station (WTTS) near Kayathar in Tamil Nadu was established with the technical assistance of Riso National

Laboratory, Denmark under Danish International Development Agency (DANIDA) grant and with partial financial assistance and guidance of Ministry of New and Renewable Energy (MNRE). During the year C-WET has signed agreements for type testing of three wind turbine models.

Achievements

8.43 The recertification audit as per the requirements of ISO 9001:2008 was conducted by DNV at WTTS, Kayathar test site during June, 2010. The unit was recommended for re-certification valid upto August 2013. NABL Recertification / Re-assessment Audit as per the requirements of ISO/IEC 17025-2005 was completed successfully during August 2010 at WTTS, Kayathar valid upto October, 2012.

Standards and Certification (S&C) Unit

8.44 The unit has completed a certification project on "Inclusion of 65m hub height tubular tower in the Provisional Type Certificate of Pawan Shakthi – 600 kW wind turbine model". Provisional Type certification of one wind turbine model is under progress. In addition, renewal of Provisional Type Certificate of three wind turbine models has been completed.

8.45 The formulation of Indian Standards on wind turbines is under progress, in close co-ordination with Bureau of Indian Standards (BIS).

8.46 The "Revised List of Models and Manufacturers (RLMM) of wind turbines – Main List" and "Addendum - I" & "Addendum – II" to the "Main List" have been issued, as finalized by the committee appointed by MNRE.

8.47 Preliminary activities for development of web portal for issuing RLMM Application Form online with the support of a software consultant have been carried out.

8.48 Unit Chief, S&C and S&C Scientist along with R&D Scientist participated in the training course on "NREL codes for design aspects of wind turbines" from 1-15 October

2010 conducted by National Renewable Energy Laboratory, USA to initiate one of the main activities identified under the MOU signed between NREL and C-WET.

Information, Training And Commercial Services (Itcs) Unit

Global Wind Day 2010 Celebration

8.49 The ITCS unit celebrated Global Wind Day on June 15, 2010 with events among school children and other stake holders. Wind energy inter school quiz competition, demonstration of renewable energy facilities available at C-WET to school children and teachers, and special lectures by experts marked this year's Global Wind Day.

8.50 The quiz competition was organized with an idea to create awareness among school children and to identify the basic knowledge of students on wind energy. 130 schools in and around Chennai were invited to participate in the Wind Energy Quiz event in which 14 schools registered to participate in the events. 36 students and 15 teachers from the schools participated in the Quiz competition.

Ninth National Training course

8.51 ITCS unit organized the 9th National Training course on "WIND ENERGY TECHNOLOGY" during 21-23 July 2010 to address all aspects of Wind Power starting from Wind Resource Assessment to personnel in project implementation and operations & maintenance in a focused manner. The course was attended by 91 participants from academic institutes, industry, state nodal agencies, developers and consultants from various parts of the country.

Special Training course

8.52 The ITCS unit organized a special training course on "**Wind Turbine Technology And Applications**", during 27 December 2010 to 6 January 2011. The course was attended by 31 participants from Kargil Renewable Energy Development Agency (KREDA), Ladakh Renewable Energy Development Agency (LREDA) and Ministry of New and Renewable Energy.

8.53 During the course period, participants visited Wind Turbine Research Station (WTRS), wind farms, Wind Turbine manufacturing unit and solar PV plant.

Sixth International Training course

8.54 ITCS unit organized the Sixth International Training course on "**Wind Turbine Technology and Applications**" during 18 October - 3 November 2010 to address all aspects of Wind Power starting from wind resource assessment to project implementation and operations & maintenance in a focused manner. The course was attended by 24 participants from academic institutes, industry, developers and engineers from 17 countries.

C-WET Website

8.55 ITCS unit had successfully installed a new server to foster state-of-art research environment inside C-WET and the same has been used to host C-WET website. The C-WET official website can be accessed @ <http://cwet.res.in> and also www.cwet.tn.nic.in. The unit is also managing and maintaining the e-mail, internet, intranet, e-security and computers inside the campus.

Publications

8.56 "PAVAN" a wind energy newsletter carrying information on C-WET's quarterly activities, technical articles on wind energy and events was published quarterly by ITCS unit. During this period, the 25th, 26th & 27th issues of PAVAN were issued. ITCS unit also publishes course material book during training courses, which is a ready reference study material for the participants to revise their studies. ITCS unit published the course material book during ninth national training, sixth international training and special training for officials from KREDA, LREDA and Ministry of New and Renewable Energy.

Participation in Exhibitions

8.57 ITCS unit had set up stall in the following exhibitions and various C-WET services and activities were disseminated to the stakeholders.

- Global Energy 2010, 2-5 December 2010 at Palace Grounds, Bangalore.
- 98th Indian Science Congress: Pride of India Expo during 3-7 January 2011 at SRM University, Chennai.
- International Renewable Energy Expo and Conference - 2011 "VaVoVa - 2011" during 14-16 January 2011 organized by Tamil Nadu Energy Development Agency at Chennai Trade Centre.
- "Science Festival" at Science City, Chennai, organized by Ministry of Higher Education, Tamil Nadu during 29 January - 2 February 2011.

C-WET – IWTMA Event

8.58 Indian Wind Turbine Manufacturers Association (IWTMA) and C-WET jointly organized a one day workshop on WindSim software for Wind Resource Assessment on 23 August 2010. Professionals from wind industry, C-WET scientists & engineers attended the programme.

Academic Visits to C-WET facilities

8.59 Regular visits are organized to motivate students towards research on wind energy, achieving indigenization and to create awareness about the activities and services of C-WET. About 400 students from various Indian colleges and institutes visited C-WET to understand the *facilities*.

SARDAR SWARAN SINGH NATIONAL INSTITUTE OF RENEWABLE ENERGY (SSS-NIRE)

8.60 The Ministry is establishing an autonomous institution named as 'Sardar Swaran Singh National Institute of Renewable Energy (SSS-NIRE)' at Wadala Kalan, Distt.

Kapurthala, Punjab. The objective of the Institute is to conduct research, development and demonstration activities in the area of bio-energy, bio-fuels, synthetic fuels in their all forms for stationary and transport applications.

8.61 Approval for revalidation and continuation of 10 sanctioned posts of SSS-NIRE from Dept. of Expenditure, Ministry of Finance has been obtained. Eight officers/ officials have already joined the Institute during the last year. The process of recruitment for the remaining two posts have been completed and offers of appointments issued.

8.62 The work of construction of buildings and other infrastructure development of the Institute campus has been entrusted to Central Public Works Department (CPWD) on "Deposit Work" basis. The CPWD has been given the task of completing the construction works by June, 2011.

8.63 The R&D activities in the Institute have been initiated including action for furnishing of R&D-I Block towards building up a *state- of-the-art* laboratory. The furnishing of Administrative Block has also been taken up.

8.64 In order to produce feed material for carrying out experiments on various Bio-energy R&D and technology demonstration projects, a land area of about 3 hectare of the Institute has been planted with eight species of *Jatropha curcas* and growth characteristics of the same are being monitored.

INDIAN RENEWABLE ENERGY DEVELOPMENT AGENCY LTD

8.65 The Indian Renewable Energy Development Agency Ltd. (IREDA) was established in 1987 as an independent specialised Public Sector Undertaking under the Ministry of New and Renewable Energy (MNRE) with the objective of operating a revolving fund for promoting and developing new and renewable sources of energy (NRSE). It has since completed twenty three years of its existence and has played a key role in the development of renewable energy in India.



Building of SSS-NIRE

Lending Operations

8.66 During the current financial year up to December 2010, IREDA has sanctioned loans to the tune of ₹2346.31 crore and disbursed ₹455.02 crore against the annual targets of ₹1900.00 crore and ₹900.00 crore respectively. The loans were sanctioned for the establishment of about 2425 MW of installed capacity of power generation. The cumulative sanctions and disbursements as on 31st December 2010 were of the order of ₹14525.80 crore and ₹7099.10 crore respectively. The sector-wise break-up of sanctions and disbursements is given in **Table 8.1**.

Sector	Cumulative Loan Sanction	Cumulative Disbursement
Wind Power	6210.02	3156.56
Hydro Power	3796.66	1469.72
Cogeneration & Biomass Power	2848.03	1667.88
Waste to Energy	66.81	49.95
Energy Efficiency & Conservation	642.41	199.97
Solar Thermal	205.03	157.50
Solar Photovoltaic	619.31	321.57
Biomass Briquetting	19.47	9.99
Biomass Gasification	12.43	5.12
Biomethanation from Industrial Effluents	72.47	57.60
Miscellaneous	33.16	3.24
Total	14525.80	7099.10

Policy Initiative

8.67 In line with the MNRE scheme IREDA has formulated refinance scheme for promotion of solar off-grid (photovoltaic and thermal) and decentralized applications

MoU with MNRE

8.68 Based on the Audited figures, the performance of IREDA in achieving the targets set for the year 2009-10 in its Memorandum of Understanding (MoU) entered into with the

Ministry is rated as "Excellent" as per our working, but the rating from DPE is awaited. IREDA has also signed an MoU with the MNRE for the year 2010-11 which first time stipulates targets under Corporate Social Responsibility (CSR) and Sustainable Development.

Resource Mobilisation

8.69 The Government of India contributed equity of ₹50.00 crore during April-December 2010 raising paid-up capital of IREDA to ₹589.60 crore as on 31st December 2010 against the authorized share capital of ₹1000.00 crore. It has raised resources to the tune of ₹400.00 crore through issue of Long Term Taxable Bonds. KfW released ₹96.92 crore under the 2nd line of credit and ₹47.06 crore under the 3rd line of credit. Nordic Investment Bank also released ₹113.45 crore. Further IREDA has signed loan agreement with AFD (French Development Agency) for availing line of credit of Euro 70 million and negotiated with Japan International Cooperation Agency (JICA) for JPY 30 billion. KfW has also committed a fourth line of credit for Euro 200 million.



Biomass Power Project funded by IREDA

Dissemination of Information

8.70 IREDA continued to create awareness of its financing policies towards promotion of renewable energy technologies/energy efficiency and conservation (EEC) and also their potential benefits. Print and electronic media were used for sustained publicity. IREDA News which is quarterly house publication for dissemination of information on developments taking place in renewable energy sector was put on website.

Computerisation

8.71 During the current financial year up to December 2010, IREDA has taken a number of steps for office automation with a view to improving efficiency of the organisation. HR activities such as medical card, dispatch, visitors, leave application, festival advance, outdoor duty slip have been computerised. All the desktop computers have been upgraded with higher capacity of RAM to improve performance.

Promotional Efforts

8.72 IREDA continued to sponsor / co-sponsor various types of programmes to promote Renewable Energy Technologies. It has supported total ten Seminars/ Workshops/ Business Meets during April –December 2010.

Women Development

8.73 IREDA pays special attention for development of women entrepreneurs. Toward this, special concessions in its lending terms and conditions are given to women entrepreneurs.

Planning

8.74 IREDA has prepared its Plan for the year 2011-12 which envisages loan sanction of ₹2500.00 crore and loan disbursement of ₹1160.00 crore.



Small Hydro Power Project funded by IREDA



Shri Debashish Majumdar, CMD, IREDA presenting the dividend cheque to Dr. Farooq Abdullah, Hon'ble Minister for New and Renewable Energy at New Delhi

Human Resource Development

8.75 In order to equip its employees with new skill sets and knowledge IREDA invested 483 man-days in technical and non-technical training of the employees during April-December 2010. All the employees were provided laptop computers to improve IT knowledge and to enhance performance.

8.76 The morale of the employees continued to remain high during the year, facilitating smooth working of the Company and contributing to the achievement of its goals/ targets. All efforts to achieve employee satisfaction were made through various measures like job

rotation, promotions, welfare measures and introduction of new schemes etc.

Corporate Social Responsibility

8.77 IREDA is committed to shoulder social responsibility. During current financial year, IREDA initiated tree plantation drive under CSR and upto December 2010, tree plantation was done in five IREDA funded projects.