

ANNUAL REPORT 2021-22



NATIONAL INSTITUTE OF SOLAR ENERGY

(An Autonomous Institute of Ministry of New and Renewable Energy, Government of India)

NATIONAL INSTITUTE OF SOLAR ENERGY

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18.	Dr. Jai Prakash, Director (Technical), National Institute of Solar Energy (NISE)	Member Secretary

Special Invitee:

Representative nominated by Secretary, Department of Science & Technology (DST), New Delhi

EXECUTIVE COMMITTEE

1.	Director General, National Institute of Solar Energy (NISE)	Chairman
2.	Deputy Director General-I, National Institute of Solar Energy (NISE)	Member
3.	Deputy Director General-II, National Institute of Solar Energy (NISE)	Member
4.	Director (Technical), National Institute of Solar Energy (NISE)	Member
5.	Deputy Director (Admin)/Administrative Officer, National Institute of Solar Energy (NISE)	Member Convener

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Gurugram-Faridabad Road, Gwal Pahari
Gurugram - 122003 (Haryana)

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OVERVIEW

National Institute of Solar Energy (NISE) plays a crucial role in supporting and implementing Ministry of New and Renewable Energy (MNRE) initiatives in the field of solar energy. The activities in NISE are mainly related to research and development, testing and standardisation, capacity building, managing special projects, etc., in pursuit of the National Solar Mission (NSM) objectives. During the FY 2021-22, NISE is involved in various activities in line with the institute's mandate by utilising its resources and infrastructure. The details of the activities performed during the year are represented in this annual report. Chapter 1 introduces the institute, its vision, its thrust area, and objectives. The detailed activities of various technical divisions pertaining to research, development, and demonstration in solar photovoltaic cells, solar photovoltaic systems, solar thermal and green hydrogen are given in Chapter 2. Chapter 3 represents the testing and standardisation activities of the various laboratories at NISE, such as the Solar Cell Testing Lab, Solar PV Module Testing Lab, Solar Inverter Testing Lab, Battery Testing Lab, Solar Water Pump Testing Lab, Solar Light /LED Testing Lab, Solar Thermal Systems Testing Lab and Calibration Lab. NISE's capacity-building mandate and details of various skill development programs are provided in Chapter 4. The outreach activities, including technical consultancy services, customer service cell (CSC) and approved list for models and manufacturers (ALMM), are presented in Chapter 5. Chapter 6 presents the general activities and facilities, including administrative activities of NISE. The publications and patents are given in Chapter 7.

Finally, the audited financial accounts have been presented in Chapter 8.

Key Highlights

- (i) Filed two (2) patents and published 13 research papers in international journals and conferences, three (3) book chapters and three (3) technical reports.
- (ii) Two new equipment's Electrochemical Capacitance Voltage (ECV) Profiler and Field Emission Scanning Electron Microscopy (FESEM) with an EDS facility, were procured and commissioned in the solar cell characterisation lab.
- (iii) The controlled wafer of PERC solar cell was optimised and tested with an efficiency of 21.72%.
- (iv) Initiated the procurement of the equipment and recruitment of manpower for a secondary reference solar cell (156 mm x 156 mm) project funded by the Department of Science and Technology
- (v) Comparative study was performed on bifacial and mono-facial PV modules for albedo effect in an east-west orientation. The bifacial modules were installed in two configurations, latitude tilt and vertical tilt, whereas mono facial at latitude tilt.
- (vi) A joint report was prepared in collaboration with the industry on ways to increase the daily water output of a solar

- water pumping system using bifacial PV modules.
- (vii) Solar Driven Light Electric Vehicle (sLEV) was tested at NISE integrated with a PV module over the roof of the vehicle. It had been analysed that the total energy demanded by the sLEV for the full day running as per the defined running pattern is 1.27 kWh, out of which 1.03 kWh is being provided by the PV module installed on the roof, the rest of the energy (0.24 kWh) was drawn from the battery.
- (viii) A novel low-cost portable mini-greenhouse - based solar dryer was tested at Union Territory of Ladakh for drying apricots.
- (ix) Efforts have been made to estimate the wind loads on the concentrator and study its effect on the optimisation of the support structure of the parabolic trough solar collector (PTSC). The analysis was performed on the large aperture diameter (9 m) for various wind speeds, directions, and concentrator orientations.
- (x) The charging performance of the radially cascaded phase change materials (PCMs) for medium-temperature applications was analysed using organic phase change materials. The study's main objective is to optimise the dimension of thermal energy storage for the cooking application.
- (xi) NISE procured an additional 10 Nm³/hr alkaline electrolyser to enhance hydrogen production at the facility.
- (xii) Three methodologies/protocols were developed at NISE (i) Development of testing methodology for evaluating the performance of automated cleaning system used in SPV power plants, (ii) Development of testing protocols for solar cold storage and (iii) Development of testing protocols for SPV water pumping system as per MNRE guidelines.
- (xiii) A total of 13 short-term training programs were conducted at NISE through an online platform (Webex). Out of which 12 are national programs, and one (1) is the e-ITEC program for international participants. The national programs were attended by 425 participants, whereas e-ITEC program was attended by 36 participants from 18 developing countries.
- (xiv) A total of 3987 participants were trained through the Suryamitra skill development program and 841 through Varunmitra Skill Development Program till March 2022.
- (xv) NISE laboratories successfully tested 107 samples through the customer service cell.
- (xvi) NISE has carried out various consultancy projects involving vetting technical documents, performance assessment of Solar Power plants and the inspection of solar PV manufacturing facilities.
- (xvii) Till date NISE had conducted 46 ALMM inspections of manufacturing plants with a cumulative capacity of 11,497 MW/year.

Governing Council

The affairs of NISE are managed by a Governing Council (GC) headed by Secretary MNRE. The GC of NISE has members from industry, research institutions, Government departments, and experts from the field of solar energy. In FY 2021-22, one GC meeting was held on 3rd December 2021 (12th GC meeting).

Executive Committee

The Executive Committee (EC) of NISE takes decisions related to technical, administration, policy, finance & accounts-related matters and improves the overall functioning of NISE. EC has five members: Director General, NISE (Chairman), Deputy Director General-I, Deputy Director General-II, Director as members and Deputy

Director (Admin)/Administrative Officer as Member Convener. A total of six (06) EC meetings were held dated 28th June 2021, 12th August 2021, 16th August 2021, 16th September 2021, 11th February 2022 and 23rd March 2022.

Finance Committee

The Finance Committee (FC) of NISE approves the annual accounts of NISE before submission to the GC and Annual General Meeting (AGM). The FC have three members: Financial Advisor, MNRE as Chairman, Joint Secretary (Solar), MNRE and DG (NISE). The two meetings of the FC of NISE were held on 15th November 2021 (10th FC meeting) and on 25th March 2022 (11th FC meeting). The Finance Committee has approved the Audited Accounts, and Audited Reports for FY 2020-21 in the meeting held on 15th November 2021.

INTRODUCTION

The National Institute of Solar Energy (NISE) is an autonomous institute under the Ministry of New and Renewable Energy (MNRE), Government of India, mandated for research and development, solar component testing and certification, capacity building, and development of solar products and applications. NISE is situated at Gwal Pahari on the Gurugram-Faridabad road in Haryana. The institute is approximately 22 km away from the Indira Gandhi International Airport and 30 km from the New Delhi railway station. It has a 200-acre lush green campus registered as a society under the Haryana Registration and Regulation of Societies Act 2012 (Registration No. is HR-018-2013-01092).

The technical support of NISE complements the requirements of MNRE to become a self-reliable renewal power-producing nation and accept the series of challenges that intervened amidst the implementation of the National Solar Mission (NSM). NISE has been established in the solar energy sector through continuous efforts by developing newer technologies and standards and catering to the changing needs in the industry. Further more, NISE envisions accelerating the proliferation of the renewable energy sector by intently working together with the Government of India.

1.1 Vision of NISE

To establish itself as one of the world's premier referral leading institute in the field of Solar Energy through Resource Assessment; Research & Development; Design, Development, and

Demonstration of solar energy technologies for various applications; Testing, Certification, and Standardisation; Monitoring and Evaluation; Economics and Policy Planning; Human Resource Development and active collaborations with prominent National & International organisations.

1.2 Objectives

The main objectives of the NISE are as follows:

- (i) To function as the National Research Organization for undertaking and/or sponsoring Research and Development Projects on various aspects of solar energy technologies
- (ii) To act as an Apex Organization for Testing, Certification, development of specifications, and standards
- (iii) To create skilled manpower and offer consultancy services on Solar energy technologies.

1.3 Quality Policy of NISE

NISE is committed to providing performance evaluation and testing services for Solar Cells, PV Modules, Solar Water Pumping System, Inverters, Charge Controllers, Batteries, Advanced Lighting System and calibrating Solar cells, PV Modules, Pyrheliometer, and Pyranometer. The test facilities established at NISE meet the requirements to conduct the tests as per the National / International Standards.



Figure 1.1: Aditya Bhawan building of NISE



Figure 1.2: Surya Bhawan Building of NISE

This is being achieved by using the best engineering practices, continuous upgradation of the infrastructure, and updating of the state-of-the-art test facilities, test methods, test personnel and continual improvement in the effectiveness of the Quality Management System as per International Standard ISO 17025:2017.

1.4 Organisation Structure of NISE

The rules of affairs at NISE are managed by a Governing Council chaired by Secretary, MNRE, and an Executive Committee chaired by Director General, NISE. An organisational chart of the structure and management of NISE is shown in Figure 1.3.

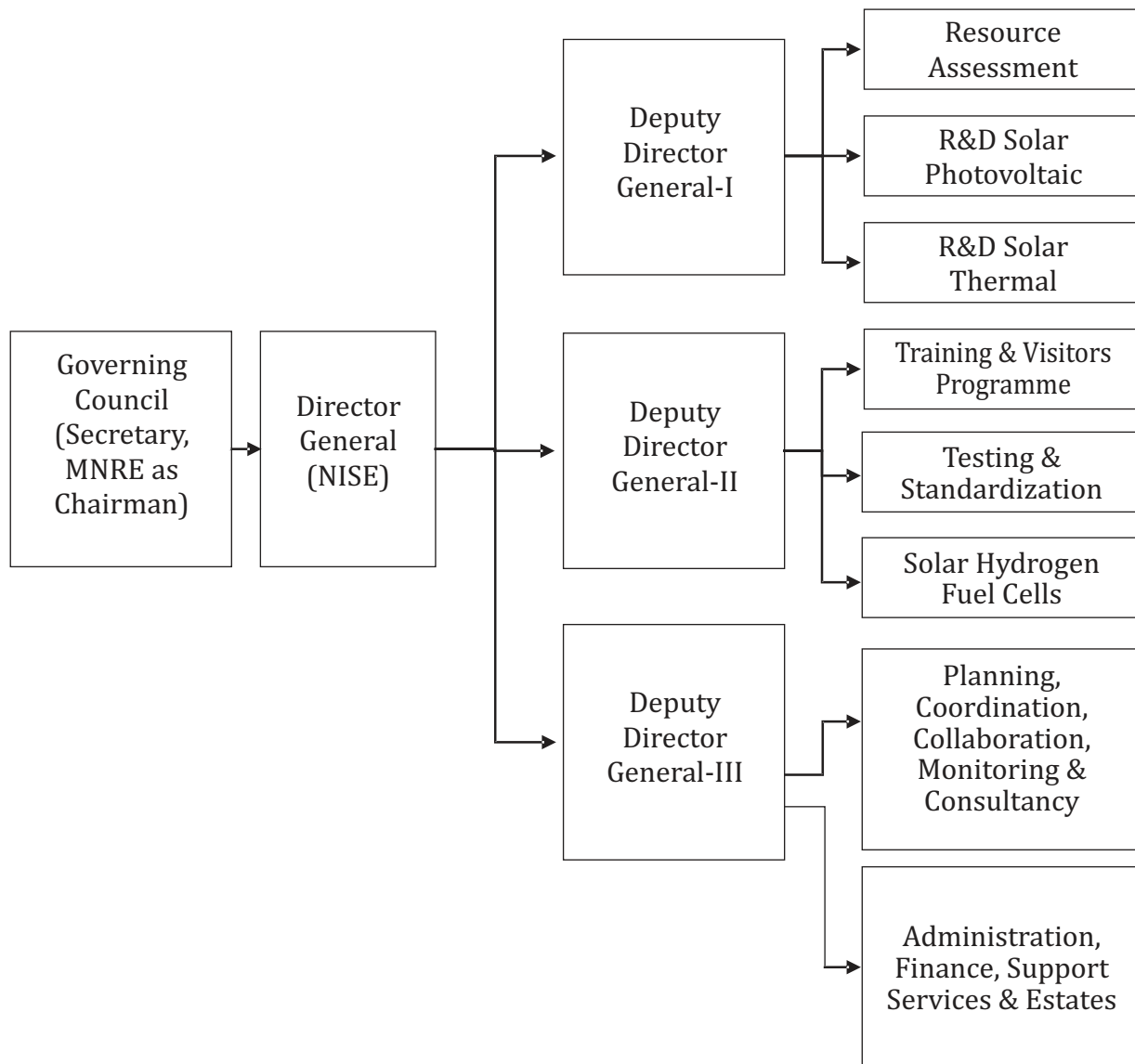


Figure 1.3: Organization Structure of NISE

The Governing Council comprises 18 members from industry, premier institutions, MNRE, NISE and experts from reputed organisations. The council is chaired by the Secretary of MNRE (ex-officio President, NISE). The Executive Committee has five members headed by the DG, NISE, to manage the day-to-day affairs of NISE and to take decisions on matters under the power delegated to it. During the period of the report, six Executive Committee meetings were held under the chairmanship of DG, NISE. The Finance Committee of NISE has three members comprising of Financial Advisor (MNRE) as Chairman and Joint Secretary (Solar), MNRE and DG (NISE). The Deputy Director Generals are supported by Directors, Administrative officer, Deputy Directors, Assistant Directors, and Executive Assistants for various technical and administrative activities.

1.5 Thrust Areas

The basic function of NISE is to serve as a technical focal point in solar energy-related areas. NISE is committed to performing at its best in all spheres relating to solar energy and continually provides assistance and guidance with a high quality standard in its work. NISE recognises the development process and continuously relates to significant and notable changes in the solar industry. NISE has the following thrust areas for its contribution and knowledge exploration in this area.

- (i) To work increasingly in frontline areas that transcend discipline. The following thrust areas form part of this effort:
 - Research and Development in Solar Photovoltaic and Solar thermal systems

- Solar Resources Assessment
- Testing of Solar Systems and devices (both large and small).
- Standards and Certification
- Database Management and Information dissemination
- Capacity Building, training, teaching and visitors programme
- Collaborations, Monitoring and Consultancy Services
- Development of Solar Energy Products & Hybrid System
- Consultancy Services, Monitoring, and Collaborations (National and International)
- Innovations, solar product development & commercialisation
- Solar Hydrogen and Fuel Cells

- (ii) To have a perception and value system appropriate to the pursuit of high engineering science to meet the critically evaluated need of the industry.
- (iii) To maintain and foster interactive linkages with leading technological Institutions and Institutes of research in India and abroad.
- (iv) Interface between Government, Industry, Academia and Individuals.

1.6 Major Activities

The main functions of the institute include:

- (i) Assisting the Ministry in implementing the NSM objectives through appropriate mechanisms, evolving Science &

Technology (S&T) programmes and projects, managing special projects, overseeing and coordinating with all relevant stakeholder agencies in the pursuit of the above objectives.

- (ii) The institute is responsible for providing thrust to R&D in solar energy and related technologies under the Mission. It would facilitate work related to demonstration and technology validation projects. The institute will also consider the sector-specific R&D needs to commercialise solar applications. These target sectors could be buildings, rural areas, and industries for lighting and any other applications. The objective of solar application and R&D efforts should also target the replacement of kerosene and diesel used by the sectors stated above.
- (iii) The institute is responsible for R&D, resource assessment, training, testing / standardisation work assigned to the institute by the Ministry from time to time. It will maintain a data bank for use by industry and other institutions.
- (iv) The institute also undertakes R&D projects on different aspects of solar energy technologies, hybrid systems and storage techniques/systems.
- (v) The internal administrative functions, international cooperation projects on research, training, and testing, technology validation are also undertaken by the institute.
- (vi) The institute also works as the Secretariat for the work of the R&D Advisory Council.

The Solar Research Advisory Council facilitates the development of a technology roadmap and provides inputs on all matters related to R&D and capacity building to the Mission Steering Group. The institute also works closely with the Solar Corporation of India, set up by the Ministry for the implementation of the Mission.

- (vii) The institution, under the guidance of the Ministry and the Mission Steering Group, is responsible for Coordination with the (i) other Centres of Excellence identified under the Mission, (ii) R&D projects funded in the field of solar energy in the country, (iii) other S&T Ministries / Organisations in the country.
- (viii) The institute strives to bridge the gap between existing R&D institutions and industry and get the industry on board through partnership programmes and projects.
- (ix) The institute collaborates with international S&T organisations for R&D and capacity-building activities in the areas of solar energy assigned to the institute by the Ministry from time to time.
- (x) The institute keeps track of the latest global developments based on technology forecasting and fore sighting relating to solar energy and related technologies, including storage techniques, and provides inputs to the Ministry and the Mission Steering Group for the accelerated development of indigenous solar energy technologies and industry in the country.

- (xi) The institute also provides technical support to other R&D and testing organisations, as considered necessary.
- (xii) The institute assists the Ministry in the preparation of a technology roadmap and the related S&T policies for effective implementation of the S&T component of the Mission.
- (xiii) The institute also coordinates the work of technical monitoring of projects covered under the S&T roadmap for the Mission and undertakes technical studies and evaluations.
- (xiv) The institute is eligible to receive research grants from MNRE, and other Ministries / organisations, including international funding to carry out various assigned tasks and R&D activities.
- (xv) The institute also supports capacity building and supports students, teachers, and research personnel to work for higher degrees, including Ph.D. The institute would develop suitable linkage with various academic and research organisations for this purpose.
- (xvi) Any other tasks assigned by the Government from time to time.

RESEARCH DEVELOPMENT AND DEMONSTRATION

2

NISE carry out research activities in various solar energy technologies such as Solar photovoltaic cell, Solar photovoltaic module, solar thermal, green hydrogen and allied applications. The details of various research activities performed during the year are provided in this chapter.

2.1 Solar Photovoltaic Cell

The Solar PV R&D division of NISE is focused on developing new solar cell architectures using different materials (Silicon, Perovskite, etc.) and having different morphologies (nanowire, micro-wire, homogeneously distributed micro pyramids, inverted micro pyramids, etc.). The details of the ongoing projects are as follows:

2.1.1 Development of high efficiency (21%/19%) PERC type of c-Si/mc-Si solar cells

The project is funded by MNRE and is taken up in collaboration with Bharat Heavy Electricals Limited Amorphous Silicon Solar Cell Plant (BHEL ASSCP), Gurugram. The project's main objective is to develop Passivated Emitter and Rear Contact (PERC) type solar cells with benchmark efficiencies in the country. PERC cells consist of an extra dielectric passivation layer to the rear side of the solar cell to minimise photo-generated charge carrier recombination at the rear side by passivating dangling bond-related defects. This enables manufacturers to achieve higher efficiencies than with standard solar cells reaching their physical limits.



Figure 2.1: ISO Class 8 clean room for housing test & characterisation equipment

The project activities are divided among BHEL ASSCP & NISE, wherein the cell processing part is under the former and NISE undertakes the testing & characterisation of the materials and devices. Under the project, NISE has also contributed capital funds to establish an ISO Class 8 clean room for an advanced PV characterisation laboratory. The 140 m² laboratory houses all the testing and characterisation equipment for the project under a single roof. The photograph of the facility is shown in Figure 2.1.

NISE has already set up the following testing & characterisation equipment proposed under the project:

- (i) Spectral Response Measurement System (QE-SRMS)
- (ii) Spectroscopic Ellipsometer
- (iii) Optical Microscope
- (iv) Semi-Automatic Four Probe Resistivity Meter
- (v) Surface Profilometer

During FY 2021-22, NISE procured and commissioned two new equipment to the lab:

- (i) Electrochemical Capacitance Voltage (ECV) Profiler

- (ii) Field Emission Scanning Electron Microscopy (FESEM) with an EDS facility

The facility was used to test the cell samples fabricated by BHEL ASSCP for optimising process parameters and making benchmark-efficient solar cells. During the year, optimisation trials for diffusion, laser contact opening and rear & front dielectric layer depositions using Plasma-enhanced chemical vapour deposition (PECVD) are optimised.

- (a) **Optimisation of texturing process through morphological characterisation**

Texturing of the front surface of the Silicon wafer reduced the reflection of solar light from the front surface, which increases the electron-hole pair production. This texturing is usually done by KOH solution. In this process, micro pyramids are formed on the surface, as shown in Figure 2.2. These micro pyramids' height, base width, and density must be controlled to optimise the reflection loss. In this regard, the FESEM is an inevitable tool to see the front surface in a microscopic view and determine the shape and size of the pyramids, thereby optimising the surface texturing process.

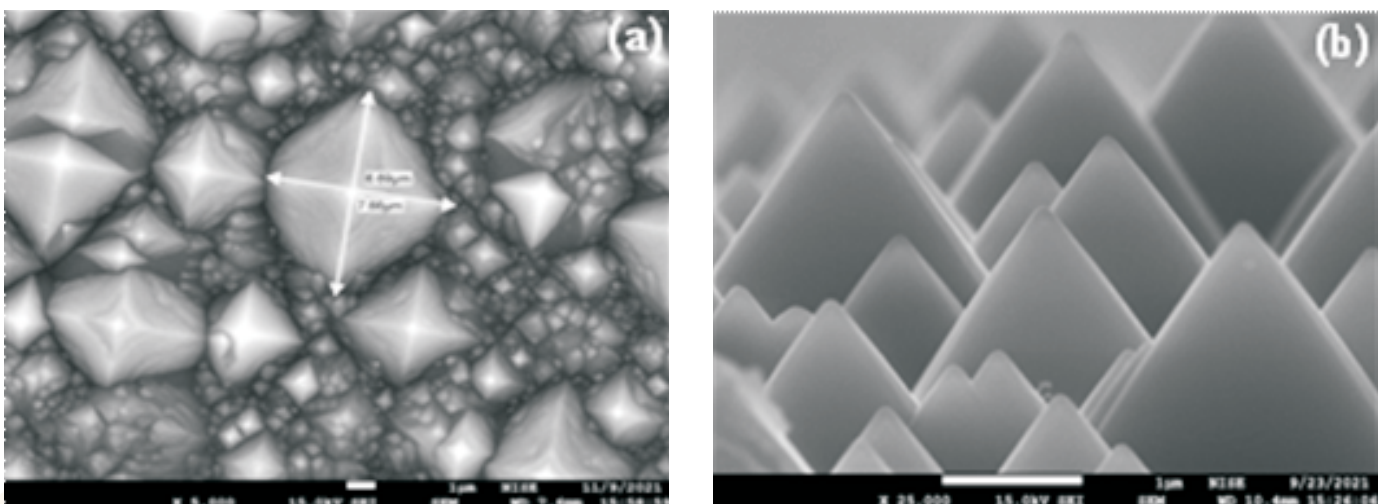


Figure 2.2: FESEM images of the micro pyramids (a) top view and (b) side view

(b) Optimisation of laser grooving for rear contact formation

Laser grooving is the process of making rear-side holes or slits through the passivation layer. In this process using laser, grooves are formed on the rear side of the p-n junction through the passivation

layer so that metal paste can come in contact with silicon. In the below FESEM image (Figure 2.3 (a)), the grooved shows that Al pastes not entered inside the groove (this type of contact increases series resistance). In Figure 2.3 (b), Al paste entered the groove that makes ohmic contact with the Si surface.

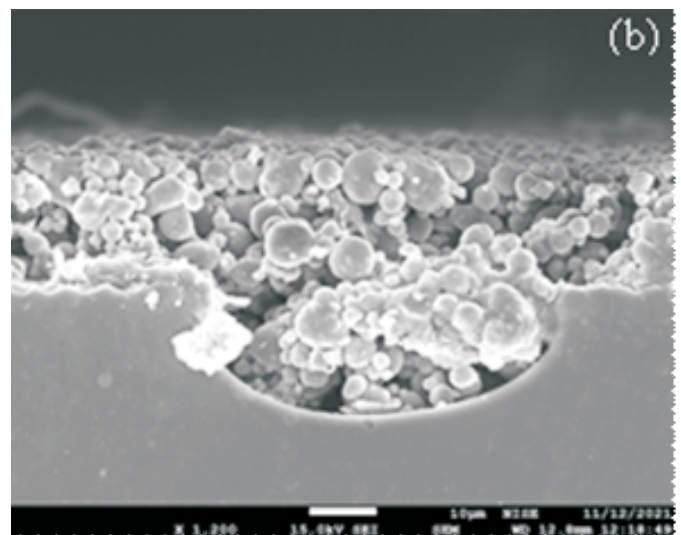
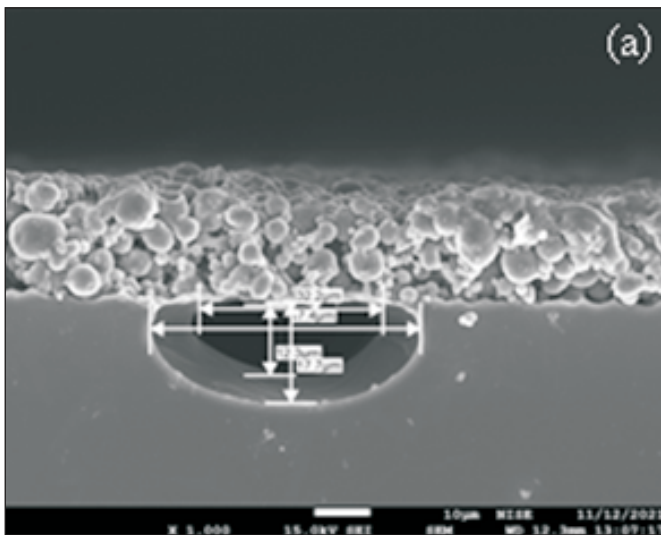


Figure 2.3: FESEM images of the Al paste on the grooved surface (a) Al paste not entered inside the groove and (b) Al paste in the groove.

(c) Optimisation of PECVD deposited antireflection coating and passivation layer thickness and optical properties by Spectroscopic Ellipsometry

Efforts were made to study the effect of SiN_x on Si, Al₂O₃ on Si, SiN_x/Al₂O₃ on Si and SiO₂ on Si. These SiN_x and Al₂O₃ layers were deposited using a plasma-enhanced chemical vapour deposition (PECVD) system. Ellipsometry was used to measure the optical properties and thickness of the single layer or stacking on Si. Later, the thickness and optical properties were tuned by varying PECVD parameter

(d) Fabrication of PERC Solar Cell

PERC solar cell was fabricated based on the optimisation, and the same was tested at the NISE. The results of the Solar cell on controlled wafers with a minority carrier lifetime of 94 μs have shown efficiency around 21.723 (V_{oc} = 0.67 V, I_{sc} = 10.11 A, FF = 0.789)

2.1.2 Design, development, and qualification of large area (156 mm x 156 mm) secondary reference solar cells

NISE is working on a DST-funded project for developing a large area (156 mm x 156 mm) secondary reference solar to replace a

conventional small area (20 mm x 20 mm) secondary reference solar cell. This will reduce the influence of measurements in the inhomogeneity of solar simulators and thereby increase the accuracy of the output. During the year, procurement of equipment and recruitment of manpower was initiated.

2.2 Solar Photovoltaic Systems

The Solar PV systems R&D division of NISE focuses on projects for performance analysis and enhancement in PV system technologies, integrated applications of PV & balance of systems. The details of the ongoing projects are as follows:

2.2.1 Performance analysis of bifacial and mono-facial PV module

In this study, the performance analysis of the mono facial (10 kWp) module at a latitude tilt, bifacial module at latitude (5 kWp) and bifacial at

a vertical tilt (5 kWp) was performed on the PV power plant installed at NISE as shown in Figure 2.4. The performance analysis of the vertical installation of the bifacial module was done for east-west facing orientation only. It had been observed that the performance of the bifacial PV module at the latitude tilt is higher, followed by the mono-facial module at the latitude tilt and the bifacial module at the vertical tilt. The results of the experimental study were further verified from the simulated studies. The performance ratio estimation of the bifacial module was not well defined as the power rating of the module should also include the power-driven by the rear side. A detailed study is required to attain a proper definition of PR in terms of input irradiance and rating of the bifacial PV module. The performance of the bifacial module depends on tilt, latitude of the site, albedo, and ground clearance height. Initially, the analysis was performed for the albedo effect only; however effect of other parameters is under investigation.





Figure 2.4: Photograph of the Solar PV power plant (a) Mono facial at latitude tilt (10 kWp), (b) Bifacial at latitude tilt (5 kWp) and (c) Bifacial at vertical tilt (5 kWp).

2.2.2 Accelerated stress testing of potential induced degradation susceptibility of PV modules under different climatic conditions

Potential Induced Degradation (PID) is one of the severe failure modes observed in the field with high system voltage, high humidity, and high operating temperature. The PV module needs to

be tested for PID susceptibility as per site conditions before installation in the field. This study analysed the effect of temperature, humidity, and voltage on leakage current and PID for multi-crystalline silicon and HIT module technologies. The effect of PID stress on PV modules in terms of electrical degradation and visual defects was also analysed. Some of the results of the study are presented in Figure 2.5.

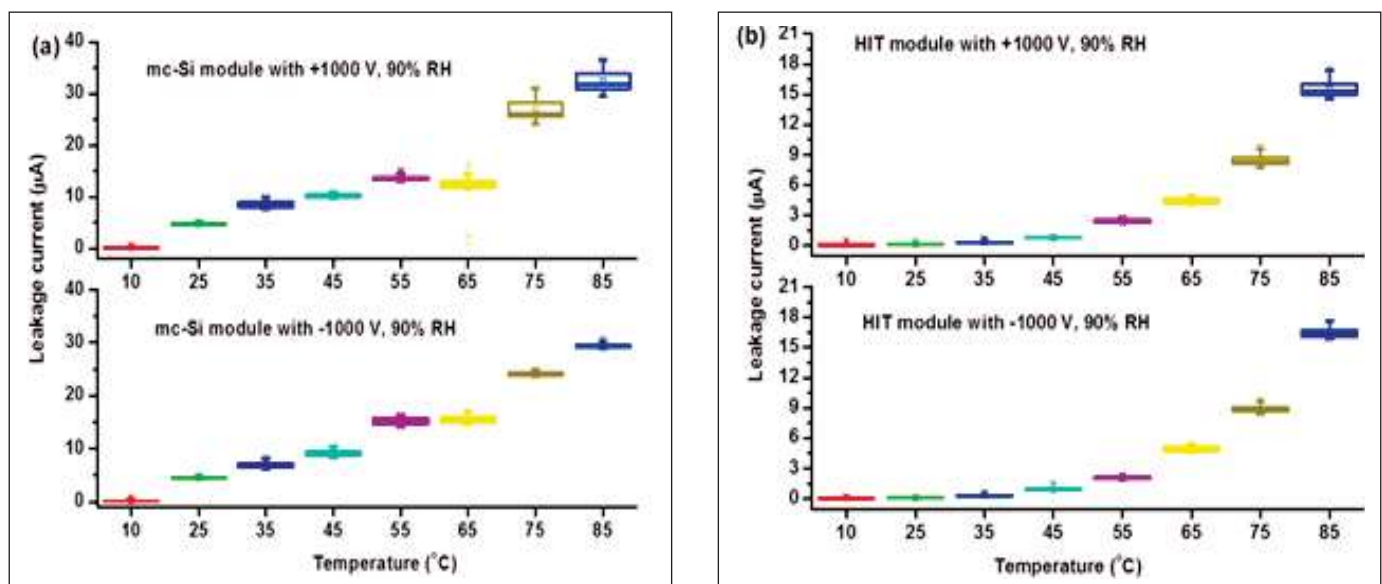


Figure 2.5: Leakage current distribution of (a) mc-Si and (b) HIT modules at a fixed applied voltage of 1000 V and 90% RH for different temperatures.

For the studied multi-crystalline module, the deviation of degradation between one cycle and three cycles of PID stress for the I_{sc} , V_{oc} , and P_{max} was 98%, 18% and 87% respectively. In this study the design of accelerated stress testing of the PID of the PV module for different climatic zones of India had also been undertaken. The stress testing condition was designed at harsh conditions of temperature and humidity for representative sites of climatic zones. It was found that the required testing time for PV modules in the case of hot & humid climatic zone is more compared to other climatic zones.

2.2.3 Performance enhancement by novel hybrid PV array without and with bypass diode under partial shaded conditions

Partial shading can significantly hamper the output performance of field-installed PV arrays. In this study, a procedure was analysed to mitigate the adverse impact of partial shading on PV arrays by opting for a PV configuration which is least susceptible to partial shading losses. For this purpose, a new configuration of PV array, a

hybrid of Total Cross Tied and Series (TCT-S), was designed and studied. TCT-S array has a series configuration at the module level and a cross-tied configuration at the cell level. Experimental investigations in actual field conditions were conducted on the novel hybrid array with and without bypass diodes under unshaded and partially shaded conditions. The results were compared with the conventional pure series configuration of the PV array. Twelve distinct partial shading conditions, ranging from a single shaded cell in the entire array to partially shading all the modules within the array, was considered for this analysis. The output power, power loss, utilisation factor and power enhancement of the proposed configuration were investigated with and without bypass diode under the considered partial shading scenarios. The maximum enhancement achieved by the proposed novel configuration of the PV array, compared to the conventional array, was 55.4% and 62.8% without and with bypass diodes, respectively. Moreover, it was also observed that in the absence of a bypass diode, while the conventional array output power is dragged down to zero with only one cell failure, the proposed TCT-S array can still generate approximately 90% power.

2.2.4 Design and Development of High-Efficiency Solar Water Pump Project

The project is funded by MNRE with the main objective to increase the Overall Wire to Water Efficiency of the Solar Water Pumping Systems (SWPS) up-to 45%, creation of state-of-the-art testing facility (50 hp) and preparation of best practices guidelines, document & standardisation

procedure for each component of the SWPS. A joint report was prepared in collaboration with the industry on ways to increase the daily water output of a solar water pumping system using bifacial PV modules. Under this project, the NISE team also visited villages in Haryana to conduct a site survey and discussions with farmers about their welfare and experiences after adopting solar water pumping systems for irrigation.

2.2.5 Solar PV rickshaw with extended range (in km) and reduced battery capacity

An attempt had been made to integrate solar photovoltaic (SPV) modules with the EV. Solar radiation is intermittent, so to meet the power demand of the EV battery storage system was used to provide constant power. SPV module was integrated with the EV to charge the battery and drive the EV according to the availability of irradiance. SPV module had been integrated over the roof of the electric vehicle and therefore named as Solar Driven Light Electric Vehicle (sLEV). The sLEV was integrated with a 300 Wp PV module, a 650 W BLDC motor and a 32 Ah lead-acid battery bank operating at 24 V. Finally, it had been concluded that the total energy demanded by the sLEV for the full day running as per the defined running pattern is 1.27 kWh out of which 1.03 kWh is being provided by the PV module installed on the roof, rest of the energy (0.24 kWh) was drawn from the battery. As a result, the range in km up to which the vehicle can run was increased, and the battery requirement became limited. The result of power production and energy consumption is shown in Figure 2.6 and 2.7, respectively.

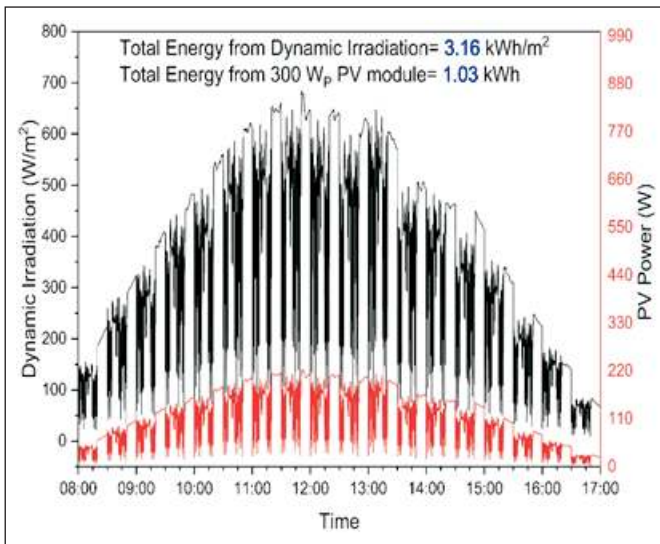


Figure 2.6: Dynamic radiation and power produced by the PV of the sLEV.

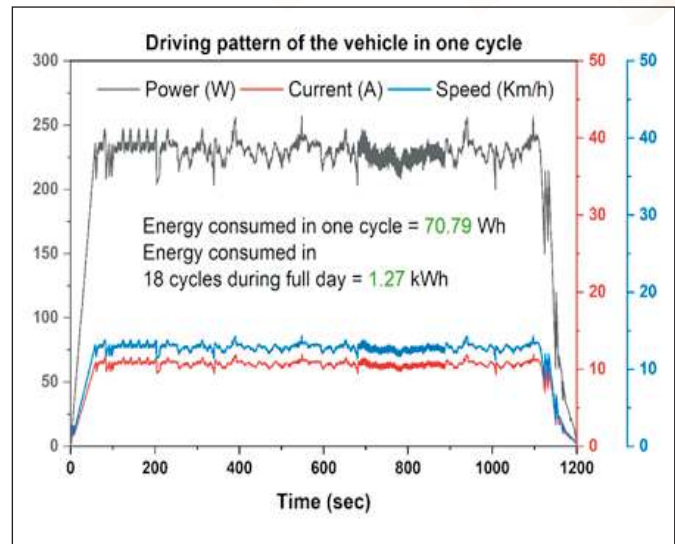


Figure 2.7: Energy consumption of sLEV driving pattern in one cycle

2.3 Solar Thermal

The Solar Thermal division of NISE is actively involved in projects that lead to the deployment and commercialisation of various solar thermal technologies for the industrial thermal process applications such as heating, cooling, drying etc. The details of the ongoing projects are as follows:

2.3.1 Demonstration of Solar Powered Heat Pump with Thermal Energy Storage Backup for Space Heating and Cooling at NISE, Gurugram

NISE has taken up a demonstration project to showcase the potential of a solar-powered heat pump for customised heating/ cooling solutions, with thermal energy storage for use during non-

sunshine hours. NISE worked towards system designing, installation, commissioning, data collection and analysis of the system. The schematic and photographic presentation of the system is shown in Figure 2.8 and Figure 2.9. A 3 TR heat pump unit was installed to provide space heating/ cooling for a conference room and an occupant room, totalling 150 m³ in the Aditya Bhawan building of NISE. The system is powered by a 10 kWp solar PV connected to a 5 hp solar variable frequency drive (VFD). A 10,000 L storage tank was also part of the system, which provides 350 MJ of storage capacity as hot/cold water. Three 2TR water cooler indoor units were installed, two in the conference room and one in the occupant room, to study the system's performance.

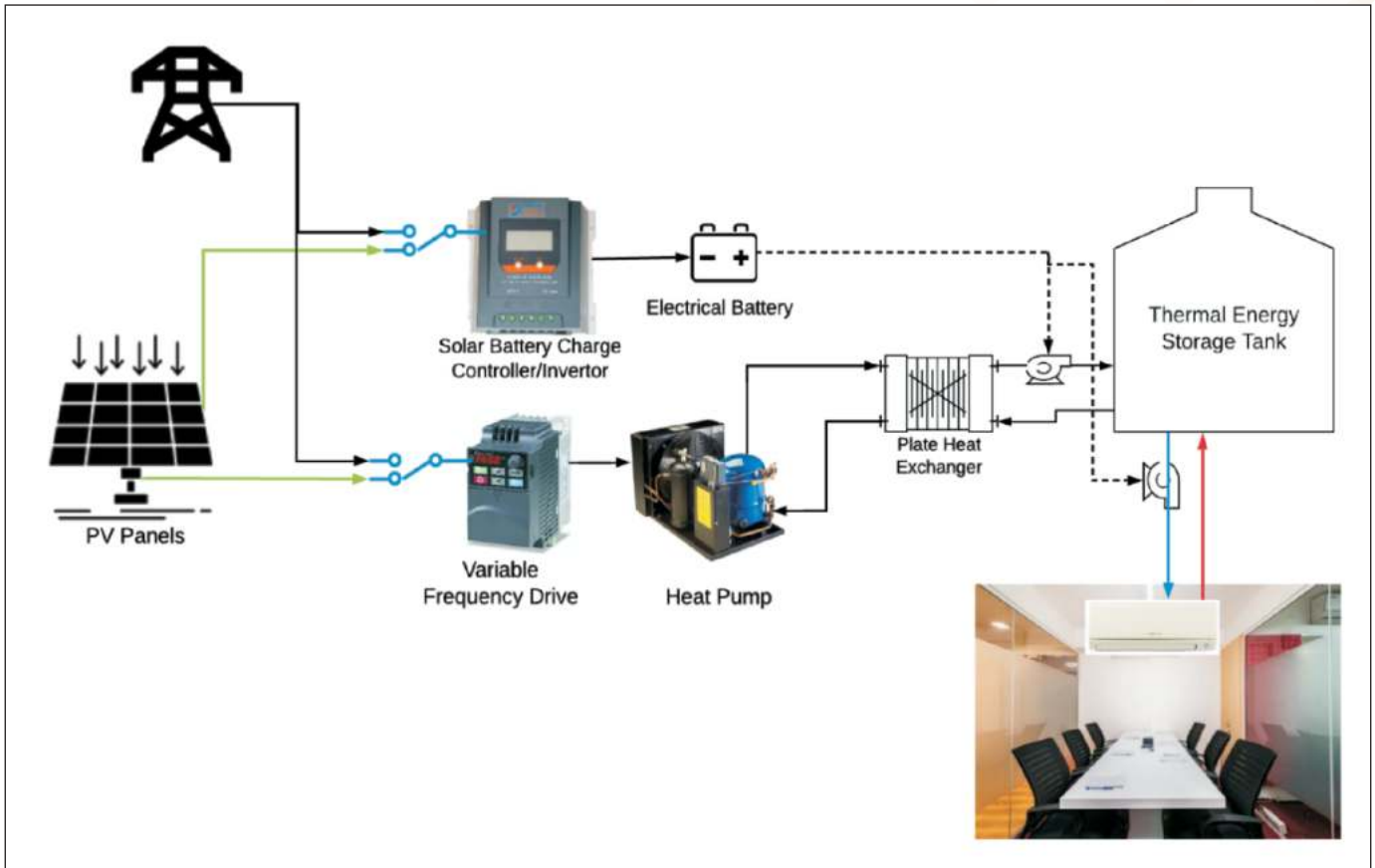


Figure 2.8: Schematic of Solar Powered Heat Pump with Thermal Energy Storage



Figure 2.9: Photograph of (a) heat pump outdoor unit with thermal storage tank and (b) indoor unit of heat pump

2.3.2 Design, development, and field testing of Mini-Greenhouse based Solar Dryer

NISE designed and developed a low-cost portable mini-greenhouse-based solar dryer. The product was field tested in the Union Territory of Ladakh for drying apricots during August 2021, as shown

in Figure 2.10. The tested unit had a capacity of approximately 200 kg per batch. The unit provided a faster drying solution to the apricot farmers of Ladakh with increased output. The unit is cheaper, portable, and convenient to use, and final dried apricot was with improved quality, hygiene and without any discolouration.



Figure 2.10: Mini-Greenhouse based Solar Dryer (a) Field testing in Ladakh, (b) Placing of apricots on mesh tray, (c) Fresh apricots fed inside the dryer, (d) Apricots during the drying process

2.3.3 Investigation on Wind-Structure Interaction of Large Aperture Parabolic Trough Solar Collector

The solar fields are located in open terrain and are highly susceptible to a strong wind gusts. To ensure the reliable operation of the collector in the field, solar collectors were designed for the range of the nominal wind speed. However, highly fluctuating wind load in practice still causes operational issues, affecting the solar collector's optical performance and lifespan. The solar field constitutes the maximum cost share in the parabolic trough solar collector (PTSC) based power plants. The reflector and support structure contributes to the significant cost of the solar field to ensure reliable operation under wind gusts. Keeping this in view, an attempt had been made to estimate the wind loads on the concentrator and study its effect on the optimisation of the support structure of PTSC. The present study includes the determination of the force (lateral and vertical), pitching moment, and pressure distribution on the concentrator. The structure of the PTSC was subjected to wind and gravity loads in different orientations throughout its operation. The main subcomponents of the collector are the mirrors and the cantilever arms to support the mirrors to maintain the parabolic profile. This analysis attempted to estimate the deformation of the large aperture diameter (9 m) for various wind speeds, directions, and concentrator orientations.

2.3.4 Numerical Investigation on Thermal Energy Storage (TES) System for Medium Temperature Applications

There are several types of TES systems available,

but in terms of simplicity, usage cost, and technical feasibility, latent heat thermal energy storage (LHTES) systems have the highest adaptability among all TES. A major area of concern in the LHTS system is the non-uniform heat transfer rate (HTR) between heat transfer fluid (HTF) and PCM during the charging or discharging cycle. It is mainly due to the loss in energy content of HTF. It results in lower storage efficiency and non-uniform melting and solidification. This problem may be addressed by using multiple PCMs having different thermophysical properties. It helps in increasing the exergy performance of a given storage system. In this regard, an attempt was made to study the charging performance of the radially cascaded PCMs for medium-temperature applications using medium-range organic phase change materials. The effect of inlet HTF temperature on the performance of the TES system has been carried out with a constant mass flow inlet condition. The study's objective was to optimise the dimension of the TES and its performance for the solar cooking application.

2.4 Green Hydrogen

NISE has a dedicated Hydrogen Energy and Fuel Cell Division to carry out R&D in Hydrogen generation, dispensing and Fuel Cells. NISE campus has a solar PV-based green Hydrogen generation cum storage and dispensing facility that was set up under MNRE funded project. The facility comprises an alkaline electrolyser of 5 Nm³/hr hydrogen production capacity, a two-stage reciprocating compressor to raise the pressure of hydrogen up to 450 bar, a high-pressure hydrogen storage tank of about 60 kg capacity and an H35 hydrogen dispenser which

can dispense hydrogen at 350 bar to the vehicles @1 kg/min. This facility is powered by a 120 kWp SPV system installed on the roof of one of the buildings of NISE. This is India's first solar-based green hydrogen-generating facility.

MNRE further supported the facility with the following objectives:

- (i) Operation and maintenance of the existing hydrogen production cum dispensing station
- (ii) Augmenting its hydrogen production capacity by installing another electrolyser (10 Nm³/hr)
- (iii) Completion of field trials and demonstration of hydrogen-fuelled vehicles at NISE

During the year, augmentation of hydrogen production capacity was undertaken by procuring

an additional 10 Nm³/hr alkaline electrolyser, as shown in Figure 2.11. NISE's total hydrogen production capacity would be 15 Nm³/hr (about 1.35 kg/hr) when both electrolysers become operational. The new electrolyser delivered at the NISE hydrogen facility and is being commissioned to be integrated with the existing facility.



Figure 2.11: Installation of new electrolyser at NISE hydrogen generation facility

TESTING AND STANDARDISATION

3.1 Testing laboratory

NISE has dedicated facilities to support testing activities in solar photovoltaic cells, PV modules, inverters, batteries, solar pumps, solar PV lighting, and solar thermal systems. NISE also supports customised development testing as per the customer's requirements.

3.1.1 Advanced Solar Cell Characterisation Facility

The lab uses instruments for measuring textured and thin film solar cell optical constants. The facility has equipment for Automatic single and multi-point mapping of sheet resistance and resistivity of silicon wafers and solar cells, measuring film thickness, roughness and 2-dimensional stress, surface texture, laser ablation and LBSF microstructure analysis of front side metallisation. The facility is also capable of measuring the optical, morphological, and electrical properties of silicon wafers and solar cells. The laboratory has the capability of doing testing as per the following standards:

- (i) IEC 60904-1:2020 Photovoltaic devices - Part 1: Measurement of photovoltaic current-voltage characteristics
- (ii) IEC 60904-7: 2019 Photovoltaic devices - Part 7: Computation of the spectral mismatch correction for measurements of photovoltaic devices
- (iii) IEC 60904-8: 2014 Photovoltaic devices - Part 8: Measurement of spectral

responsivity of a photovoltaic (PV) device

3.1.2 Solar Photovoltaic Testing Facility (PVTf) Laboratory

NISE has a NABL-accredited laboratory (TC-5697) for PV module testing as per ISO/IEC 17025: 2017 for qualification testing and customised testing. This facility is also recognised as a Type 2 category facility by the Bureau of Indian Standards (BIS) for PV Module testing. The lab also supports various R&D activities related to the performance and reliability of the PV modules of different technologies. The laboratory has the capability of doing testing of PV modules as per the standards mentioned in Table 3.1. A photograph of the testing is shown in Figure 3.1 and Figure 3.2. During the year, 58 samples were tested using the PVTf facility.

Furthermore, the following R&D-based testing's can also be facilitated by the lab:

- (i) Photovoltaic (PV) module performance testing and energy rating - Part 2, 3 & 4: power rating, Spectral responsivity, incidence angle and module operating temperature measurements, Energy rating of PV modules, Standard reference climatic profiles
- (ii) Light-induced degradation testing (LID) and Light and elevated temperature-induced degradation (LeTID) testing of PV modules as per standard and customer requirements.

- (iii) The lab also performs climate-specific model-based accelerated testing of PV modules to ensure the reliable operation of the module under harsh outdoor climatic conditions.
- (iv) The lab also offers testing and standardisation of cleaning devices for PV modules as per specifically designed testing procedures. Also, model-based testing of cleaning devices can be performed to check the performance and reliability of the PV modules after operating numerous cleaning cycles by the system.
- (v) To improve the bankability of customer's innovative products as per the customised testing procedure, NISE helps them to develop the product with the expertise of the NISE core technical team.
- (vi) Testing and standardising PV modules for long-term performance and reliability analysis by continuous monitoring are also offered. Damage and fault analysis of the PV module is also a part of the testing.

Table 3.1: Testing standards followed by PVTF laboratory

Standard No.	Details
IEC 61215-1-1: 2016/IS 14286-1-1: 2019	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules
IEC 61215-1-2: 2016/IS 14286-1-2: 2019	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-2: Special requirements for testing of thin-film Cadmium Telluride (CdTe) based photovoltaic (PV) modules
IEC 61215-1-3: 2016/IS 14286-1-3: 2019	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-3: Special requirements for testing of thin-film amorphous silicon based photovoltaic (PV) modules
IEC 61215-1-4: 2016/IS 14286-1-4: 2019	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-4: Special requirements for testing of thin-film Cu(In,Ga)(S,Se) ₂ based photovoltaic (PV) modules
IEC 61215-1-1- 2021 (DML testing facility is under procurement)	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules
IS/IEC 61701: 2011/IEC 61701:2020	Salt mist corrosion testing of photovoltaic (PV) modules
IEC 61853-1	Photovoltaic (PV) module performance testing and energy rating - Part 1: Irradiance and temperature performance measurements.
IEC TS 62804-1:2015	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon

IEC TS 60904-1-2:2019

Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices



Figure 3.1: A photograph of Solar Photovoltaic Testing Facility (PVTF)

In the FY 2021-22, the laboratory upgraded its facilities by adding the following equipment and system,

- | | |
|--|---|
| <ul style="list-style-type: none"> (i) Dark IV Testing of PV modules. | <ul style="list-style-type: none"> (ii) Accessibility tester (iii) Cord anchorage torsional tester (iv) Ignitibility test set up (v) Impulse voltage tester |
|--|---|





Figure 3.2: A photograph of cord anchorage torsional tester

3.1.3 Advance SPV system and lighting laboratory

The Solar Photovoltaic (SPV) Lighting laboratory is involved in the performance testing and reliability of off-grid PV systems against the latest standards and specifications adopted by BIS/MNRE. The products include all types of lighting in solar photovoltaics, e.g., Solar lantern, Solar study lamps, Solar home lighting, Solar street lighting, etc. The lab is well equipped with modern testing equipment like an Integrating Sphere Photometer for Total Luminous Flux measurement, Digital Programmable AC/DC power supplies, and other Digital Auxiliary equipment for conformity/ type testing of a wide

range of products. In this FY 2021-22, 18 tests were performed in this facility. A photograph of the testing is shown in Figure 3.3 and Figure 3.4. The laboratory is proficient in testing below standards:

- (i) IES LM-79-08/IS 16106: 2012 (Method of Electrical and Photometric Measurements of Solid-State Lighting products)
- (ii) Testing of solar lighting systems as per MNRE specifications
- (iii) User specification-based testing
- (iv) Performance analysis of Solar based Light Electric vehicles (sLEV)



Figure 3.3: A photograph of luminaire testing facility with integrated sphere



Figure 3.4: Testing of sLEV at the advance SPV system and lighting laboratory

3.1.4 Power Electronics Laboratory

The Power Electronics Laboratory of NISE is a NABL-accredited laboratory (TC-5697) as per ISO/IEC 17025: 2017 and is well equipped to test all types of power conditioning units (PCUs), including hybrid, standalone and grid-tied inverters and pump controllers up to 100 kVA. A photograph of the testing is shown in Figure 3.5. The BIS also recognises the facility for IS 16169: test procedure of islanding prevention measures for utility-interconnected photovoltaic inverters.

The lab under takes the following tests as per IEC/IS standards:

- (i) IEC 61683:1999 - Photovoltaic systems - Power conditioners - Procedure for measuring efficiency
- (ii) IS 16169/ IEC 62116:2008 Test procedure of islanding prevention measures for

utility - interconnected photovoltaic inverters

- (iii) CEI IEC 61727:2004 Photovoltaic (PV) systems - Characteristics of the utility interface
- (iv) IS16797:2019/ IEC 62509:2010 Battery charge controllers for photovoltaic systems - Performance and functioning of the charge controller
- (v) EN50530:2010 Overall efficiency of grid-connected photovoltaic inverters
- (vi) IEC 60068-2 -1: 2007 Environmental test A: Cold
- (vii) IEC 60068-2 -2: 2007 Environmental test B: Dry heat
- (viii) IEC 60068-2 -14:2009 Environmental test N: Dry heat change of temperature
- (ix) IEC 60068-2 -14:2005 Environmental test Db: Damp heat cycle



Figure 3.5: Power Electronics Laboratory Setup

3.1.5 Battery Test & Characterisation Laboratory

The battery test and characterisation laboratory at NISE are (NABL) involved in testing the performance, reliability and life cycle of major secondary battery storage technologies, including Lead-acid, Nickel-Cadmium and Lithium-Ion Batteries. The laboratory is equipped with the latest technologies like deep cycle battery testers, a programmable power supply, advanced hardware and software, a data logger, and a temperature-controlled water bath. A photograph of the testing is shown in Figure 3.6. The laboratory is recognised by BIS for IS 16270: 2014- secondary cells and batteries for solar photovoltaic application general - requirements and methods of test services.

The laboratory is equipped for testing as per below IEC/IS standards:

- (i) IS 16270:2014: Secondary cells and batteries for solar PV application- general requirements and methods of test
- (ii) IS 1651:1991: Stationary cells and batteries, lead acid type (with plante positive plates)
- (iii) IS 13369:1992: Stationary lead acid batteries (with Tubular positive plates) in Monobloc Containers
- (iv) IS 15549:2005: Stationary Valve Regulated Lead Acid Batteries- Specification
- (v) IEC 61427: Secondary cells and batteries for PV energy systems- General requirements and methods of test
- (vi) IS 16047 (Part 3): 2018: Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes-Secondary Lithium Cells and Batteries for Portable Applications Part 3 Prismatic and Cylindrical Lithium Secondary Cells, and Batteries Made From Them (First Revision)



Figure 3.6: Battery Test Laboratory Setup

To facilitate R&D in the upcoming major secondary battery technologies such as Li-ion, IS standard 16046: Part 2: 2018: Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes -Safety Requirements for Portable Sealed Secondary Cells and Batteries made from Them for Use in Portable Applications Part 2 Lithium Systems (Second Revision), is being incorporated under the laboratory.

3.1.6 Solar Photovoltaic Pump Test Facility

Solar Water Pump (SWP) Laboratory at NISE is a well-equipped, fully-automated, state-of-the-art

testing facility in India, conducting performance testing of PV-based water pumps in strict conformation with MNRE guidelines. Previously, the laboratory was equipped to test solar water pumps with capacities ranging from 0.5 hp to 10 hp. To cater for the futuristic demands for high-powered solar water pumps in India, the test facility had been upgraded for testing up to 50 hp solar water pumps, a photograph of the inaugural ceremony is shown in Figure 3.8. The facility is proficient in testing against national and international standards.



Figure 3.7: Inaugural ceremony of the 50 hp solar water pump test facility at NISE on 12th August 2021

It is equipped with the latest test equipment, including solar array simulators, automatic data loggers, power analysers, power meters, flow meters, pressure transmitters, automatic gate valves, various sophisticated sensors and

dedicated software. The facility is used for testing all major pump technologies such as submersible, surface, AC and DC systems as per national and international standards. The laboratory has also tested pumps under innovative Distributed

Renewable Energy (DRE) solutions for rural livelihood applications. The solar water pump division also facilitates undertaking R&D activities in solar water pumping systems. The laboratory is also involved in creating awareness of the PM-KUSUM scheme.

The following list of standards was adopted in the testing of solar PV water pumps:

- (i) MNRE, Guidelines on the testing procedure for solar photovoltaic water pumping systems. Annexures- I, II and III of circular no. F. No. 41/3/2018-SPV division dated 17.7.2019
- (ii) IEC 62253
- (iii) MNRE specification for Solar PV water pumping systems for micro pumping application (2016-2017)
- (iv) MNRE specifications no. 32/645/2017-SPV of KUSUM Programme specifications and testing procedure for solar water pumping systems
- (v) MNRE test methods for SPV water pumping systems (2014-15); (2015-16) & (2017-18)
- (vi) BIS test methods for IS 17429:2020
- (vii) BIS test methods for IS 17018: Part 1 2018 [RD: IS 9283:2018, IS 3043:1987, and IS 9079:2018].

3.1.7 Solar Radiation Resource Assessment (SRRA)

As a part of the Solar Radiation Resource Assessment initiative of MNRE, one Advanced

Monitoring Station (AMS) and one Solar Radiation Resource Assessment (SRRA) station was established at the NISE campus, as shown in Figure 3.8. The SRRA stations are used to generate high-quality (1 minute) solar radiation data of various parameters such as Global Horizontal Irradiance (GHI), Diffuse Horizontal Irradiance (DHI), Direct Normal Irradiance (DNI), Spectral DNI, Ground Reflected radiation and Infrared radiation. As a part of the BSRN network, the SRRA station of NISE is listed as Station No. 56, with site specification as plain terrain, and medium black soil. The baseline Surface Radiation Network (BSRN) is the Global Network of solar radiation measurement stations from various countries monitored by the World Meteorological Organisation (WMO). The Solar Radiation Calibration Laboratory (SRCL) at NISE has been operational since 2016 to calibrate solar radiation measuring sensors from the National solar radiation network of MNRE (SRRA). The laboratory was established following the WMO guidelines, where calibration was performed as per the International Standards Organisation (ISO). It has highly precise reference standard sensors such as the Primary Standard Sensor/Absolute Cavity Radiometer (Highest Solar Radiation Standard) and a number of secondary Standard Reference Sensors for achieving radiometric calibration traceable to the World Radiometric Reference (WRR) scale with high accuracy and precision.

In addition, the facility also caters for the calibration needs of other Government/private organisations in the country. Calibration status of SRRA stations - Solar Radiation Calibration

Laboratory calibrated 10 radiometric sensors during this year.

3.2 Standardisation

NISE has been working with various organisations such as BIS, MNRE and industry partners to develop testing methodology / protocols for various solar technologies. During the year, the following methodology / protocols were developed by NISE:

- (i) Development of testing methodology for evaluating the performance of automated cleaning system used in SPV power plants
- (ii) Development of testing protocols for solar cold storage
- (iii) Development of testing protocols for SPV water pumping system as per MNRE guidelines



Figure 3.8: Solar Radiation Resource Assessment (SRRA) station facility at NISE.

SKILL DEVELOPMENT & CAPACITY BUILDING

4

The National Institute of Solar Energy extends capacity-building opportunities for skilling up young minds through national and international training programmes. The organisation empowers aspirants by conducting skill development programmes, training, short-term courses, client specific courses related to solar energy technologies. The proposed mandate enables it to meet the challenges, maintain quality and upgrade itself in this competitive environment. NISE organised various technical training programs for both national and international participants. International training programs were also organised for active growing solar environment and sustainability.

In FY 2021-22, newly developed training courses were conducted for the enhancement of knowledge sharing in an online mode through the

Webex platform. A total of 13 programmes, including national (12) and international (1 ITEC) level training programs, were conducted during the year, wherein 461 participants were trained in various domains of solar energy.

4.1 National Training Program

During the year, NISE has conducted 12 training programs for aspirants from government departments, schools, colleges, armed forces, nodal agencies, and public sector undertaking companies through training courses devised explicitly according to the need of the participants. The training was imparted by the scientific officials of NISE as well as domain experts from academia and industry. The details of the training program are given in Table 4.1.

Table 4.1: Skill development programs (national) conducted at NISE during FY 2021-22

Training/ Program	Number of Programs	Duration	Number of Participants
Start-up in Solar Energy Technologies	3	28 th -30 th July 2021 15 th -17 th Dec. 2021 16 th -18 th Feb. 2022	142
Design of Solar PV Systems	2	25 th -27 th Aug. 2021 29 th Nov. to 1 st Dec. 2020	62
Solar Thermal Technologies Performances Evaluation and Their Applications	1	23 rd -24 th Sept. 2021	7
Virtual Training Global trends and policy frameworks in RE	1	27 th -29 th Sept. 2021	30

Sri Vishwakarma Skill University, Lab Experiment & Training	1	13 th -15 th Dec. 2021	25
Skill development programme on Hydrogen Energy: Production, Storage and Utilisation	1	15 th Dec. 2021	33
Explore the Potential of Blockchain Technology in Energy Sector, 15th-17th December 2021	1	15 th - 17 th Dec. 2021	11
Training for ONGC officials	1	17 th Jan. 2022	15
Webinar on Hydrogen Energy: Overview and Production Processes on 16th February,2022 (10:30 am – 1:30 pm)	1	16 th Feb. 2022	100
TOTAL	12		425

4.2 International Training Program

NISE organises three weeks solar training program under the Indian Technical and Economic Co-operation (ITEC) sponsored by the Ministry of External Affairs, Govt. of India. The program also provided a platform for mutual knowledge sharing in the field of Solar energy.

During the year, one e-ITEC program was conducted through an online platform (Webex) from 22nd November 2021 to 26th November 2021, attended by 36 participants from 18 developing countries. The details of the country-wise participation of the delegates in the e-ITEC Training program is given in Table 4.2.

Table 4.2: Country-wise list of participants in the e-ITEC training program

Sr. No.	Country Name	Trained Participants
1	Azerbaijan	4
2	Bangladesh	1
3	Benin	1
4	Bhutan	2
5	Ecuador	2
6	Egypt	2
7	Ethiopia	1
8	Guinea	1
9	Kingdom of Eswatini (Formerly Swaziland)	2
10	Maldives	1

11	Mauritius	2
12	Myanmar	2
13	Sri Lanka	6
14	Sudan	1
15	Tanzania	1
16	Thailand	2
17	Trinidad & Tobago	4
18	Zambia	1
	Grand Total	36

4.3 Suryamitra Skill Development Programme

Suryamitra Skill Development Programme was designed to develop a skilled and employable workforce for catering for the needs of Solar PV-related industries and project developers. The participants were trained to perform jobs related to the installation, commissioning, and operation & maintenance of a Solar PV system. MNRE sanctioned a target of 4500 Suryamitras in December 2020 for FY 2020-21 after the COVID restrictions were relaxed for the physical training.

NISE allocated 175 batches to various training centres (TC) at the end of Feb 2021 through an Expression of Interest (EOI). Post allocation, considering the time required for the mobilisation of the participants and the outbreak of the COVID-19 pandemic during April- May 2021, the target of 4500 Suryamitra was further extended to FY 2021-22. A total of 3987 Suryamitra were trained till March 2022. The state-wise details of participants trained under the programme is shown in Table 4.3, and a glimpse of the programme is shown in Figure 4.1.







(d)

Figure 4.1: Glimpse of the Suryamitra training programme conducted at various training centres in India

Table 4.3: State-wise number of participants trained under the Suryamitra Skill Development Programme

Sr. No.	State	Total Suryamitra Trained 2020-21 as on 31 st March 2022
1	Andhra Pradesh	219
2	Arunachal Pradesh	0
3	Assam	90
4	Bihar	179
5	Chandigarh	0
6	Chhattisgarh	174
7	Delhi	30
8	Goa	30
9	Gujarat	261
10	Haryana	86
11	Himachal Pradesh	30
12	Jammu & Kashmir	88
13	Jharkhand	60
14	Karnataka	79
15	Kerala	60
16	Ladakh UT	30
17	Lakshadweep	0
18	Madhya Pradesh	505
19	Maharashtra	176
20	Meghalaya	30
21	Manipur	0
22	Nagaland	0
23	Orissa	180
24	Puducherry	0
25	Punjab	27
26	Rajasthan	351
27	Tamil Nadu	199
28	Telangana	316
29	Tripura	0
30	Uttar Pradesh	548
31	Uttarakhand	89
32	West Bengal	150
	Total:	3987

¹ Trained numbers are based on the certificates uploaded by training partners at NISE Suryamitra Skill Development Portal.

4.4 Varunmitra Skill Development Program

NISE, under the sponsorship of MNRE, started a solar water pumping program named as Varunmitra Skill Development Program. This course provides hands-on practice for Solar PV Water Pumping Systems. The program's main objective is to impart knowledge of site feasibility, water table, efficiency and different types of heads, and solar water pumping

components such as controllers, batteries, motors, pump-motor sets, sensors, and actuators. This course follows the SGJ/Q0112 (SGJ/N0134) Qualification Pack of SCGJ. The program was sanctioned in FY 2020-21; however, due to the pandemic outbreak, few batches concluded in FY 2021-22. Under this program, a total of 841 participants were trained in FY 2020-21 and FY 2021-22, as shown in Table 4.4, and a glimpse of the program is shown in Figure 4.2.

Table 4.4: State-wise number of participants trained under the Varunmitra program

S. No	State	No. of Participants
1	Andhra Pradesh	30
2	Assam	30
3	Bihar	30
4	Chhattisgarh	21
5	Gujarat	60
6	Haryana	60
7	Himachal Pradesh	30
8	Jharkhand	59
9	Karnataka	57

10	Madhya Pradesh	52
11	Maharashtra	60
12	Orissa	28
13	Puducherry	30
14	Punjab	30
15	Rajasthan	60
16	Tamil Nadu	60
17	Telangana	30
18	Uttar Pradesh	60
19	West Bengal	54
Grand Total		841



(a)



Figure 4.2: Glimpse of Varunmitra training programme conducted at various training centres in India

OUTREACH ACTIVITIES

5.1 Technical Consultancy Services

NISE offers various consultancy services pertaining to all domains of solar energy technologies, such as Solar photovoltaic, Solar thermal, green hydrogen, and balance of systems. The division provides specialised technical services to stakeholders, i.e., facility owners, investors, financial institutions, armed forces, banks, etc., for various aspects of solar project implementation and performance mapping. The details of the services are as follows:

- (i) Field-level testing of solar components and systems
- (ii) Inspection and assessment of Solar Power plant /system/ manufacturing facility
- (iii) Technical document vetting, such as tender documents, detailed project reports, solar power plant design etc.
- (iv) Due diligence and troubleshooting of Solar power plant
- (v) Pre-feasibility studies of solar-related projects
- (vi) Preparation of detailed project report (DPR)
- (vii) Establishment of solar-based technical facilities/labs



Figure 5.1: On-site performance mapping of floating SPV (WBPDCL, West Bengal)

NISE started on-site testing of large-scale Solar Photovoltaic Projects for the quality and performance of Solar Plants. A photograph from field testing of a floating Solar PV plant is shown in Figure 5.1. The technical expert's team advises clients on various technical parameters observed during on-site testing/inspection to enable the clients to take the appropriate measures to improve the plant's performance.

During the year 2021-22, NISE has carried out various consultancy projects involving vetting technical documents, performance assessment of Solar Power plants and the inspection of solar PV manufacturing facilities. NISE also signed MoU with Solar Energy Corporation of India for offering technical services in quality checks and inspection of the upcoming Solar PV manufacturing facilities. NISE is also working with UNICEF for the "Sustainable Innovations for Clean Energy in Immunization and Primary Health Care in India" project. In this project, UNICEF and NISE aim to jointly advocate for strengthening the reach and quality of immunisation and primary healthcare services by providing regular and high-quality solar energy at primary healthcare facilities across the country.

5.2 Customer Service Cell

The customer Service Cell (CSC) is centrally responsible for the management of testing, calibration, and consultancy services at the National Institute of Solar Energy. CSC enables its customers to avail of testing services from the online portal available at the NISE website. This testing portal allows easy access to the selection of testing services, payment, and release of

reports. NISE offers a comprehensive range of testing services (IEC, BIS, MNRE specifications etc.) that facilitate testing as per National /International standards for various solar energy products and their components. NISE offers world-class testing and calibration services through its various labs, i.e., Solar Cell Testing Lab, ii) Solar PV Module Testing Lab; iii) Solar Inverter Testing Lab; iv) Battery Testing Lab; v) Solar Water Pump Testing Lab; vi) Solar Light /LED Testing Lab; vii) Solar Thermal Systems Testing Lab, viii) Calibration Lab. CSC is a gateway to testing, calibration, and consultancy services through all the above-listed labs. CSC caters to all possible needs of the customer from the application stage to test progress and report handling. CSC has also proactively taken various quality interventions in its operations and improved the services of various labs. During the year, 107 samples were successfully tested in various labs at NISE.

5.3 Approved List for Models and Manufacturers (ALMM)

To ensure reliability of Solar PV manufacturers and to, protect the consumer interests and ensure better energy security of the country, the Ministry of New & Renewable Energy (MNRE), on 2nd January 2019, has issued "Approved Models and Manufacturers of Solar Photovoltaic Modules (Requirements for Compulsory Registration) Order, 2019". The order provides for the enlistment of eligible models and manufacturers of solar PV cells and modules complying with the BIS Standards and publishes the same in a list called the "Approved List of Models and Manufacturers" (ALMM). Only the models and manufacturers included in this list will be eligible

for use in Government/ Government assisted Projects/ Projects under Government Schemes & Program, installed in the country, including Projects set-up for the sale of electricity to the Government.

NISE had been designated as an implementation support agency for processing applications and

carrying out inspections, verifications, and quality checks on behalf of MNRE. Till date, NISE conducted 46 ALMM inspections of manufacturing plants with a cumulative capacity of 11,497 MW/year. Detail analysis of these manufacturing companies based on Capacity, Efficiency, and Technology is as under:

Table 5.1: Capacity-wise distribution of ALMM inspected companies

Capacity (MW)	Annual production capacity Inspected (MW/Year)	No. of companies
<100	847	18
100 - 500	5678	23
>500	4972	5
Total	11497	46

GENERAL FACILITIES & ACTIVITIES

NISE has state-of-art facilities for training, lecture rooms, a library, sports, an IT cell etc. NISE encourages its staff to take an active part in various activities. The events, i.e., celebrations of functions, debates, lectures, etc., are organised with full enthusiasm.

6.1 Library

The library uses e-Granthalaya software for the

circulation of books. On 12th August, 2021 NISE Library was renamed Dr. Maheshwar Dayal library by Dr. A. K Tripathi DG NISE, shown in Figure 6.1. Facilities and services of the library are availed by staff, visitors and trainees at NISE, a photograph of the library is shown in Figure 6.2.



Figure. 6.1: NISE Library was renamed Dr Maheshwar Dayal Library by DG NISE



Figure. 6.2: NISE Library was renamed Dr Maheshwar Dayal Library by DG NISE

The NISE Library possesses a vibrant collection of 8320 consisting of books, journals and other reading material. Besides books and journals, the library also has an extensive National and International Standards collection.

6.2 Sports Facilities

The sports facility developed at NISE ensures the quality and opportunity for its employees to participate in sports and physical activities. A well-trained coach within the institute imparted access to the gym, yoga, and indoor activities. As sports is an integral part of discipline and stress management, quality programme schedules, diet and yoga sessions are organised for the staff and trainees at NISE. However, the facility was not operational due to the pandemic outbreak and as per guidelines.

6.3 Information Technology (IT) Cell

NISE has a robust IT division to look after the e-office, website management, portals (testing services, Suryamitra skill development programme, Varunmitra skill development programme and recruitment portal etc.), CCTV

surveillance, software and hardware support for research and day-to-day activities, data repository, GeM procurement, online Tender wizard etc. IT division also maintains an inventory repository for proper asset maintenance and management.

6.4 Independence Day Celebration

Independence Day is one of the national festivals of India, which was celebrated on 15th August, 2021 with great zeal and respect through out the country. Like every year, Independence Day was celebrated with great enthusiasm in NISE. Photograph from Independence Day celebrations organised at NISE is shown in Figure 6.3.

6.5 Republic Day Celebration

Like every year, Republic Day (Figure 6.4) was celebrated with great enthusiasm in NISE on 26th January, 2022. The flag was hoisted in the courtyard of Aditya Bhawan of the institute by Shri Gangesh Upadhyay, DG NISE. A small parade was also organised by the security personnel of the institute on this occasion.



Figure 6.3: Independence Day celebrations



Figure 6.4: Republic Day celebration

6.6 Women's Day Celebration

Like every year, Women's Day was celebrated with great enthusiasm in NISE on 8th March 2022.

On this day, all women in the institute participated in a painting and quiz competition. Glimpse of the celebration is shown in Figure 6.5 and Figure 6.6.



Figure 6.5: Women Day Celebration at NISE



Figure 6.6: Prize Distribution ceremony of Women Staff at NISE

6.7 Vigilance Awareness Week

The Central Vigilance Commission observes Vigilance Awareness Week every year. This observance of Vigilance Awareness week was conducted during the birthday of Honourable Sardar Vallabhbhai Patel. This year it was observed from 26th October to 1st November 2021. NISE followed this endeavour actively. All the

institute's officers and employees pledged to continue striving towards a corruption-free nation by taking the "Satyanista Pledge". During this period, an essay competition and slogan writing competition were organised in NISE. NISE distributed prizes to the winning participants in the competition. A glimpse of the celebration is shown in Figure 6.7 and Figure 6.8.



Figure 6.7: Address by NISE officer during Vigilance awareness week at NISE

6.8 Committee for Prevention of Sexual Harassment of Women at Workplace

Following Government instructions, a complaints committee for women for redressal of complaints concerning sexual harassment in the workplace had been constituted at NISE. No complaints were received during the year 2021-22.

6.9 Promotion of Official Language

An official language section was established at the institute to implement the official language policy of the Government of India. Its functions are (i) Implementation of the Official Language Policy of the Govt. of India, (ii) Translation of work to the Hindi language, and (iii) Publications in Hindi.



Figure 6.8: Essay competition organised during Vigilance awareness week at NISE

During the year, concerted efforts were made to ensure proper compliance with the provisions of the Official Language Act - 1963 and Rules were framed thereunder. For the promotion of the official language policy and to create a more conducive environment for the officials to do more work in Hindi, various programmes / schemes were undertaken, which included,

- (i) To make the institute's revamped website bilingual
- (ii) All documents coming under section 3(3) of the OL Act 1963, e.g. Press Release, Tender Notices, Rules, General Orders, Notification and other Documents to be laid in the parliament were prepared bilingually

- (iii) Letters received in Hindi were invariably replied to in Hindi, and Rule (5) of the Official Language Rules 1976 was fully complied
- (iv) A display board has been installed at the entrance of the Surya Bhawan in the institute and a new Hindi word is demonstrated daily at the Reception
- (v) Standard forms were prepared in Hindi and uploaded on the website of NISE for the convenience of officers/staff
- (vi) The Annual Report 2020-21 of the institute was printed in both Hindi and English languages
- (vii) All navigation boards, general boards,

nameplates and rubber stamps etc., in the institute are bilingual

Quarterly meetings of the Official Language Implementation Committee were held to review the progress made in implementing the Official Language policy. The divisions were advised to achieve the targets specified by the Department of Official Language, Ministry of Home Affairs (MHA), Govt. Of India. During the year, various measures were taken as per Section 3 (3) of the Official Languages Act, 1963, to effectively implement the Official Language Policy in the institute. Special emphasis was laid on increasing

originating correspondence in Hindi. 'Hindi Pakhwada' was organised from 1st September 2021 to 14th September 2021 (Figure 6.9 and Figure 6.10) to create awareness and to increase the use of Hindi in official work. Various competitions like Hindi essay writing, poetry, and dictation were organised among the officers and employees of the institute. In these competitions, the officers and staff of the institute enthusiastically participated. Based on their performances, mementoes, certificates and cash prizes were awarded to the participants by the NISE officers.



Figure 6.9: Closing Ceremony of Hindi Pakhwada



Figure 6.10: Prize Distribution ceremony of Hindi Pakhwada at NISE

6.10 Right to Information Act

Institute is implementing the Right to Information (RTI) Act, 2005, as per the guidelines issued by the 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 institute's website, www.nise.res.in.

The institute has designated CPIOs and appellate authorities to respond to the RTI applications and the first Appeals following subjects assigned to them. A list of CPIOs and first Appellate authorities is given in Table 6.1. Respective CPIOs and First Appellate Authorities replied to RTI applications/Appels within the stipulated timelines to the extent possible.

Table 6.1: Name and Designation of the CPIOs and Appellate Authorities in NISE under Right to Information Act, 2005

S. No.	Subject	CPIO	Appellate Authority
1	All matters concerning Research and Development, Technology and Laboratory and Technology	Dr. Jai Prakash Director (Tech.)	Dr. Chandan Banerjee Deputy Director General
2	All matters concerning Finance	Shri Ankeshwar Mishra Deputy Director (Admin)	
3	All Administrative Matters (Except Financial Matters)	Ms. Aakanksha Sharma Administrative Officer	
4	Public Grievance Officer	Shri Ankeshwar Mishra	

The progress report in terms of RTI application/First Appeals received, disposed-off, and pendency during the year (from 01.04.2021 to 31.03.2022) is given in Table 6.2.

Table 6.2: Status of RTI Application received during 2021-22

Item	Received	Replied	Pending as on 31.03.2022
RTI Applications*	(57)	(47)	10
First Appeals*	(01)	(01)	(NIL)

* As per the Quarterly report submitted on RTI Portal.

6.11 Administration & Staff

The Government of India has sanctioned 41 regular posts, including Director General. The institute has framed recruitment rules for 41

sanctioned regular scientific, technical and administrative posts. The GC approved the rules in its 3rd meeting on 6th April 2015. The status of filling up the posts is given in Table 6.3.

Table 6.3: Recruitment status at NISE

S. No.	Name of the post	PB+GP	No. of Post			Status
			Tech.	Admin	Total	
1.	Director General	PB-4+10000	1	0	1	• 1 Vacant*. *Additional Charge of Director General-NISE was given to Shri Gangesh Upadhyay, Scientist-G, MNRE
2.	Deputy Director General	PB-4+8900	3	0	3	• Post filled: 1 (UR) • Posts advertised: 2 (UR)
3.	Director	PB-3+7600	2	1	3	• Post filled: 1 Technical (UR), 1 Admin (UR) • Posts advertised: 1 Technical (UR)
4.	Deputy Director	PB-3+6600	6	2	8	• Post filled: 5 Technical (UR), 1 Admin (UR) • Posts advertised: 1 Technical (OBC), 1 Admin (UR)
5.	Administrative Officer	PB-3+6600	0	1	1	• Post filled: 01 (UR)
6.	Assistant Director	PB-3+5400	7	2	9	• Post filled: 07 Technical (4-UR, 1-OBC, 1-PwD, 1-SC), 2 Admin (UR)
7.	Office Secretary	PB-2+5400	0	1	1	• Post under process for Re-designation
8.	Office Secretary -I	PB-2+4800	0	3	3	• Posts advertised: 1 (UR/PwD) • Post under process for Re-designation: 2 (UR)
9.	Executive Officer	PB-2+4800	4	0	4	• Posts advertised: 4 (3-UR, 1-OBC)
10.	Executive Assistant-I	PB-2+4600	8	0	8	• Post filled: 6 (3-UR, 2-OBC, 1-SC) • Posts advertised: 2 (UR)
	Total		31	10	41	01 post of DG-NISE Advertised by MNRE. 25 Posts filled. 12 Posts Advertised. 03 Posts are under process for Redesignation of Posts.

UR-Unreserved, SC-Schedule Caste, OBC-Other Backward caste, PwD-Person with Disability.

PATENTS AND PUBLICATIONS

During the FY 2021-22, various divisions of NISE filed two (2) patents and published ten (10) research papers in international journals of repute, three (3) research papers in international conferences, three (3) book chapters and three (3) technical reports. The details are as follows:

7.1 Patents

- (i) New way of designing top and bottom hot plates of a Laminator for Solar double glass by making a special die (Indian patent Application No. 202141030005)
- (ii) New way to improve the wire to water efficiency of Submersible Solar Bore Pump (Indian Patent Application No: 202141030006)

7.2 Journal Publications

- (i) Malan, A., & Kumar, K. R. (2022). Performance Benchmarking of Large Aperture Parabolic Trough Solar Collector for Various Optical Errors and Geometrical Concentration Ratio. *Energy Technology*, 10(2), 2100533.
- (ii) Parmar, R., Banerjee, C., & Tripathi, A. K. (2021). Performance Analysis of Cost Effective Portable Solar Photovoltaic Water Pumping System. *Current Photovoltaic Research*, 9(2), 51-58.

- (iii) Nouni, M. R., Jha, P., Sarkhel, R., Banerjee, C., Tripathi, A. K., & Manna, J. (2021). Alternative fuels for decarbonisation of road transport sector in India: Options, present status, opportunities, and challenges. *Fuel*, 305, 121583.
- (iv) Singh, A., Shaha, S. S., Sekhar, Y. R., Saboor, S., Nikhil, P. G., & Ghosh, A. (2021). Design and analysis of a solar-powered electric vehicle charging station for Indian cities. *World Electric Vehicle Journal*, 12(3), 132.
- (v) Jayasree, Y., Kumar, Y. K., Babu, G. S., & Bhaskar, P. U. (2021). Growth of Cu₂ZnSnS₄ thin films by hybrid chemical approach. *Physica B: Condensed Matter*, 618, 413199.
- (vi) Manna, J., Jha, P., Sarkhel, R., Banerjee, C., Tripathi, A. K., & Nouni, M. R. (2021). Opportunities for green hydrogen production in petroleum refining and ammonia synthesis industries in India. *international journal of hydrogen energy*, 46(77), 38212-38231.
- (vii) Agrawal, N., Bora, B., Rai, S., Kapoor, A., & Gupta, M. (2021). Performance enhancement by novel hybrid PV array without and with bypass diode under partial shaded conditions: An experimental study. *International Journal of Renewable*

Energy Research (IJRER), 11(4), 1880-1891.

- (viii) Mudike, R., Barbate, I., Tripathi, A. K., Nikhil, P. G., & Banerjee, C. (2021). Calibration of solar radiometers with traceability to the world radiometric reference using an absolute cavity radiometer. *Measurement*, 179, 109475.
- (ix) Clement, C. E., Singh, J. P., Khoo, Y. S., Halm, A., Tune, D., & Birgersson, E. (2022). Design of shading-and hotspot-resistant shingled modules. *Progress in Photovoltaics: Research and Applications*, 30(5), 464-480.
- (x) Clement, C. E., Singh, J. P., Birgersson, E., Wang, Y., & Khoo, Y. S. (2021). Illumination dependence of reverse leakage current in silicon solar cells. *IEEE Journal of Photovoltaics*, 11(5), 1285-1290.

7.3 Conference Publications

- (i) Singh, A., P G, N., & Singh, J. P. (2021). Techno-commercial Analysis of a Solar Powered Electric Vehicle Charging Station for Chennai, India, 2021 Fourth International Conference on Electrical, Computer and Communication Technologies (ICECCT), 2021, 1-5.
- (ii) Pali, B., Dhar, A., P G, N., & Singh, J. P. (2022). Effect of dynamic irradiance on the performance of the solar driven light electric vehicle (sLEV): experimental

investigation, 5th international conference on emerging trends in Mechanical and industrial engineering, The North Cape University, Gurgaon.

- (iii) Tiwari, G., Malan, A., & Ghakkar, N. (2022). Numerical investigation on charging of thermal energy storage for medium temperature applications. 5th international conference on emerging trends in Mechanical and industrial engineering, The North Cape University, Gurgaon.

7.4 Book Chapter

- (i) Nikhil, P. G., and Sivaramakrishnan, G. (2021). *Electro-Chemical Battery Energy Storage Systems - A Comprehensive Overview*, Scrivener Publishing, Wiley.
- (ii) A Book chapter on "Machine Learning for Renewable Energy Applications" by River Publisher (Dec 2021)
- (iii) Rai, S., Bora, B., Banerjee, C., Tripathi, A.K. (2021). *Off-Grid Solar Lighting Testing and Reliability* (Book name: *Fundamentals and Innovations in Solar Energy: Energy Systems in Electrical Engineering*), Springer, Singapore.

7.5 Technical Reports

- (i) A technical report on performance analysis of bifacial and mono facial PV module installed at NISE

- (ii) A report on experimental investigation on the performance of the solar-driven light electric vehicle (sLEV) in terms of extended range and reduced battery capacity
- (iii) A report on hydrogen production and demand in India

FINANCE AND ACCOUNTS

NISE has both an Internal Finance Division (IFD) and a Finance & Accounts Division (F&A) which look after the concurrence and preparation of accounts, respectively. IFD scrutinises and concurs with all financial proposals for payments, whereas the F&A division deals with budget preparation, maintenance of accounts and audit functions. NISE is registered with Income Tax as well as GST and complies with all the statutory provisions of both the Act. The statutory auditor of NISE is appointed out of the panel of Chartered Accountants provided by CAG. The annual

accounts are approved by the Finance Committee (FC) before submission of the same to the Governing Council (GC) and Annual General Meeting (AGM). The annual accounts of the NISE for the FY 2021-22, duly audited by the statutory auditor, presented herewith after duly approved by the finance committee in its 10th meeting held on 15th November 2021 and duly adopted by the Governing Council of NISE, in its 12th meeting and 5th Annual General Meeting held on 3rd December 2020.



INDEPENDENT AUDITOR'S REPORT

To the Members of NATIONAL INSTITUTE OF SOLAR ENERGY

Report on the Financial Statements

We have audited the financial statements of **NATIONAL INSTITUTE OF SOLAR ENERGY** ("The Institute"), which comprise the balance sheet as at 31st March 2022, and the statement of Income & Expenditure for the year ended and a summary of significant policies and other explanatory information.

Responsibility of Management for the Financial Statements

1. The Management is responsible for the preparation of these financial statements that give a true and fair view of the financial position and financial performance of the Institute in accordance with the accounting principles generally accepted in India. This responsibility also includes maintenance of adequate accounting records in accordance with the provisions of the Act for safeguarding of the assets of the Institute and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance of adequate internal financial controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the financial statement that give a true and fair view and are free from material misstatement, whether due to fraud or error.

Auditor's Responsibilities for the Audit of the Financial Statements

1. Our responsibilities is to express an opinion to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.



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2. As part of an audit in accordance with Standards on Auditing, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:
 - Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
 - Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
 - Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
3. Materiality is the magnitude of misstatement in the financial statements that, individually or in aggregate, makes it probable that the economic decision of a reasonably knowledgeable user of the financial statements may be influenced. We consider quantitative materiality and qualitative factors in (i) planning the scope of our audit works and in evaluating the results of our works; and (ii) to evaluate the effects of any identified misstatements in the financial statements.

Report on Other Legal and Regulatory Requirements

1. The internal control system of the Institute needs to be strengthened. During the course of our audit, some statutory, administrative and financial lapses were found, which are given in the **Annexure A** attached in summarized form. The details of such observation were provided to the management separately which they have noted for the future compliance and kept on record along their comments.
2. We report that:
 - (a) We have sought and obtained all the information and explanation which to the best of our knowledge and belief were necessary for the purpose of audit;
 - (b) In our opinion, proper books of account as required by law have been kept by the Institute so far as it appears from our examination of those books.
 - (c) The Balance Sheet and the Statement of Income & Expenditure dealt with by this Report are in agreement with the books of accounts.
 - (d) In our opinion, the aforesaid balance sheet & Income & Expenditure dealt with by this report complies with the Accounting Standards issued by the Institute of Chartered Accountants of India.



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Opinion

In our opinion and to the best of information and according to the explanation given to us, the aforesaid financial statements, **read together with the annexure attached**, give the information required by the Act in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India.

- a) In the case of the Balance Sheet, of the state of affairs of the Institute as at March 31, 2022;
- b) In the case of the Statement of Income & expenditure, of the **excess of income over expenditure** for the year ended on that date;

For M/S Rohit KC Jain & Co,
Chartered Accountants
(FRN: 020422N)


(Ritesh Wahi)
Partner
M. No. 597197
UDIN: 22517197AWFEBO6715

Place: New Delhi
Dated: 28.09.2022

Annexure - A

Annexure to the Independent Audit Report on the Financial Statement of National Institute of Solar Energy for the F.Y 21-22 as Referred in the said Report.

1. It has been observed that NISE has given advances at the end of the year for capital expenditure to CPWD, payment and adjustment for the FY 2021-22 as following:-

ADVANCE GIVEN		ADJUSTMENT RECEIVED	
DATE	AMOUNT	DATE	AMOUNT
As on 01.04.2021	2,51,99,958.00	30 Mar 2022	10,23,278.00
28 Mar 2022	93,89,100.00		
30 Mar 2022	31,10,220.00		
30 Mar 2022	32,11,119.00		
30 Mar 2022	32,52,411.00		
TOTAL	4,41,62,808.00	TOTAL	10,23,278.00

2. Interest earned on Fixed Deposits and Sweeps accounts in respect of Core Grant and Project Grant is payable to concerned ministry and/or Project Department. It has been observed that the earned interest is not paying on year-to-year basis. It is suggested to management that earned interest payable to ministry or department may be refund in the next FY year.
3. It has been observed that Income-Tax Refund for the AY 2015-16 and 2016-17 of Rs. 16,12,615 and Rs. 21,66,219 respectively is pending for receiving. NISE is bearing interest loss on the amount. The amount is in the nature of revenue, it is suggested that NISE may consult to their consultants for recovery of the same.
4. It has been observed that an amount of Rs. 26655548/- has been received by NISE in account of construction of World Museum. Since a long time has elapsed and same amount received is standing as on the date.
5. Following advances given in previous years and Utilization Certificate of the same was not submitted to NISE:-

NAME	DATE OF ADVANCE GIVEN	AMOUNT OUTSTANDING
Chief Executive Odisha Renewable Energy OREDA	01 May 2018	4,17,600
Govt. Polytechnic College Kerala	13 Oct 2015	6,29,160
Rajasthan Renewable Energy Corporation	10 Feb 2017	6,42,000



6. It has been noticed that an amount of Rs. 2,07,31,550 in respect of C-DAC is receivable outstanding from more than 3 years (listed below). The Case has been filed against the said vendor and the same is being pending before the court.

Party Name	2019-20	2020-21	2021-22
C-DAC	2,07,31,550/-	2,07,31,550/-	2,07,31,550/-

7. Grant not Received: -

We have observed that following amount is outstanding receivable from the MNRE and UC has been submitted for the same:-

Name of Ministry	2021-22
MNRE	60,17,606/-

As per management remarks for the FY 2020-21, it has been stated that the balance amount would be adjusted during the year 2021-22. But the balance amount still exists at the end of the year.

8. It has been observed that an amount of Rs. 17,01,786 is outstanding for payment. It is suggested that the EMD amount may be refunded to persons pertains with the completed work.
9. It has been observed that the TDS demand amounting Rs. 378950/- for past years is pending for payment on TRACES Portal of NISE.
10. It has been observed that some of parties are deducting TDS but not credited in 26AS of NISE. Some of them are listed below:-

NAME	TDS AMOUNT
Waaree Energies Ltd.	619620.00
Sri Savitri Solar P. Ltd.	103900.00
Innolia Energy P. Ltd.	2730.00
Bureau of Indian Standards	3640.00
Green Brilliance Renewable Energy	38250.00
Ganit Star Engineering	1185.00
ATC Energies System P. Ltd.	3180.00
UK Solar	910.00
Pearl Enterprises	3640.00
Gautam Solar P. Ltd.	2020.00
GEIE Solar	3640.00
Kosol Energie Pvt Ltd	100000.00
Novus Green Energy System Ltd	228750.00
TOTAL	1111465.00

It is suggested that the management have to follow up on the recoverable amount.



11. It has been noticed that there are non-generation of self-invoices preparation on payment paid through RCM Under GST. It has been suggested that Account division should prepare self-invoice where GST under RCM to be paid. Further, its being Observed that no GST is reversed with respect to the Common Input credit availed by the Management.
12. It has been noticed that some of amounts listed below under ALMM has been received and held with NISE from past 2 years. It is suggested that the amount may be adjust through providing services and generation of invoices to clients.

NAME	DATE	AMOUNT RECEIVED
Risen Energy	Aug 2020	7,05,39,210
Canadian Solar Industries	Sep 2020	1,77,00,000

13. Advance of Rs. 30,41,15,878/- is appearing under ALMM Scheme for which no revenue has been recognized during the year.
14. It's also being Observed during the Physical verification, Solar Plant installed at the Premises stands ideal, Management should take necessary steps to make it operational and generate revenue from the same.



NATIONAL INSTITUTE OF SOLAR ENERGY (An Autonomous Institute of Ministry of New & Renewable Energy, Govt. of India) Gurgaon-Faridabad Road, Gwalpahari, Gurgaon, Haryana-122003 BALANCE SHEET AS AT 31ST MARCH 2022			
CORPUS/CAPITAL FUND AND LIABILITIES	SCHEDULE	AS AT MARCH 31, 2022	AS AT MARCH 31, 2021
		TOTAL	TOTAL
Corpus/Capital Fund			
Gross Corpus/ Capital Fund	1	1,497,917,509	1,318,001,817
Less : Accumulated Depreciation		433,275,837	337,260,763
Net Corpus/ Capital Fund		1,064,641,672	980,741,054
Current Liabilities & Provisions	2	499,254,774	703,293,011
Total		1,563,896,446	1,684,034,066
ASSETS	SCHEDULE	AS AT MARCH 31, 2022	AS AT MARCH 31, 2021
		TOTAL	TOTAL
Fixed Assets			
Gross Block	3	1,137,005,620	1,014,915,552
Less : Accumulated Depreciation		433,275,837	337,260,761
Net Block		703,729,783	677,654,791
Current Assets, Loans & Advances	4	860,166,663	1,006,379,274
Total		1,563,896,446	1,684,034,066
SIGNIFICANT ACCOUNTING POLICIES AND NOTES TO ACCOUNTS	11		

As per our Audit Report of even date
For M/s Rohit KC Jain & Co., Chartered Accountants
(FRN-020422N)


(Ritesh Wahal)
(Partner)
M. No.517197

Place: Gurugram
Dated: 28/09/2022



For NATIONAL INSTITUTE OF SOLAR ENERGY


(Anil Kumar Yadav)
Director (Admin)


(Chandan Banerjee)
Dy. Director General


(Lalit Bohra)
Director General - IC

NATIONAL INSTITUTE OF SOLAR ENERGY (An Autonomous Institute of Ministry of New & Renewable Energy, Govt. of India) Gurgaon-Faridabad Road, Gwalpahari, Gurgaon, Haryana-122003			
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED ON 31ST MARCH 2022			
PARTICULARS	Schedule	Amount in ₹	
		2021-22 TOTAL	2020-21 TOTAL
INCOME			
Receipts from Testing & Operations	5	93,365,785	116,700,699
Grants/Subsidies utilised for Revenue Expenditure	6	423,475,798	818,886,544
Interest Earned	7	8,164,445	7,595,793
Other Income		3,241,553	7,872,035
Interest Earned on Grant Account		11,137,932	53,793,016
Depreciation (As per Contra)	3	96,015,076	86,917,578
Provision Written back (F. Y. 2020-21)		8,946,513	7,306,384
Total (A)		644,347,102	1,099,072,049
EXPENDITURE			
Establishment Expenses	8	43,229,877	43,228,674
Other Administrative Expenses	9	67,269,183	68,938,466
Operational Expenses	10	343,219,140	733,813,036
Interest Payable on Grant Account		11,268,319	53,793,016
Depreciation (As per Contra)	3	96,015,076	86,917,578
Total (B)		561,001,594	986,690,770
Net Surplus/(Deficit) for the year		83,345,507	112,381,278
Provision for Taxation		-	8,256,606
Balance being Surplus/(Deficit) for the year transferred to General Reserve (A-B)		83,345,507	104,124,673
SIGNIFICANT ACCOUNTING POLICIES AND NOTES TO ACCOUNTS	11		

As per our Audit Report of even date
For M/s Rohit KC Jain & Co. Chartered Accountants
(FRN-020422N)


(Ritesh Wahal)
(Partner)
M. No.517197

Place: Gurugram

Dated: 28/09/2022



For NATIONAL INSTITUTE OF SOLAR ENERGY


(Anil Kumar Yadav)
Director (Admin)


(Chandan Jaisrijee)
Dy. Director General


(Lalit Bohra)
Director General - IC

NATIONAL INSTITUTE OF SOLAR ENERGY

(An Autonomous Institute of Ministry of New & Renewable Energy, Govt. of India)
Gurgoan-Faridabad Road, Gwalpahari, Gurgoan, Haryana-122003

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2022			
	AS AT MARCH 31, 2022	AS AT MARCH 31, 2021	Amount in ₹
SCHEDULE 1- CORPUS/ CAPITAL FUND	Total	Total	Total
General Reserve			
Balance as at the beginning of the year	222,963,742	118,839,070	
Add : Transfer of income tax Reserve	3,222,730	-	
Add : Excess of income over expenditure during the year	83,345,507	309,531,979	222,963,742
Corpus Fund			
Balance of Grant Received from Govt. Non-Refundable			
Opening Balance(Refer Grant Sheet)	10,000,000	10,000,000	
Add: Amount received during the Year	-	-	
Closing Balance	10,000,000		10,000,000
Capital Reserve			
Grants adjusted against purchase of assets			
Opening Balance	610,738,050	505,415,071	
Add : Addition during the period	118,055,653	105,322,979	
Closing Balance	728,793,703		610,738,050
Capital Reserve for Building			
Grant utilised for advances given during the year			
Opening Balance	81,334,025	113,627,729	
Less : Net Adjusted during the Year	24,708,198	32,293,705	
Closing Balance	56,625,827		81,334,024
Total	1,497,917,509	1,318,001,817	








SCHEDULE 2- CURRENT LIABILITIES AND PROVISIONS	AS AT MARCH 31, 2022		AS AT MARCH 31, 2021	
		Total		Total
Current Liabilities				
Sundry Creditors				
- For goods and services				
-For 1 Year	11,042		38,926	
-For More than 1 Year	335,284	346,326	420,633	459,559
- Creditors For Capital Goods				
-For 1 Year	13,152,873		22,128,924	
-For More than 1 Year	961,162	14,114,035	6,572,930	28,701,854
- Creditors For Suryamitra Training Participants- For more than 1 Year				
-For More than 1 Year	249,938	249,938	3,694,194	3,694,194
Deposits				
- Earnest Money Deposit	1,712,786		1,975,700	
- Security Deposits	456,747		331,415	
- Deposit (Others)	131,064		1,306,577	
- Deposit (SERB)	1,035,000		-	
- Deposit (Unicef)	4,947,398		-	
- Advance Received from Customers- ALMM	304,115,878		205,452,547	
- Advance Received from Customers	5,177,315	317,576,188	7,778,026	216,844,264
Statutory Liabilities				
- TDS Payable under Income Tax	6,993,932		9,663,973	
- GST Payable (Incl TDS under GST)	2,406,729	9,400,661	412,869	10,076,842
Other Current Liabilities				
- Salary & Remuneration Payable (Incl. National Pension Fund)	25,935		225,462	
- Interest refundable to Ministry	25,326,810		65,024,016	
- Advances received against training (ISA)	9,175,300		24,950,745	
- Other misc. liabilities	77,936	34,605,981	1,133,453	91,333,676
Balance of Grants Payable to Government of India	119,303,822	119,303,822	339,002,179	339,002,179
Provisions				
Provision for Expenses	3,657,824		1,701,106	
Provision for Income Tax	-	3,657,824	11,479,336	13,180,442
Total		499,254,774		703,293,011

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NATIONAL INSTITUTE OF SOLAR ENERGY

(An Autonomous Institute of Ministry of New & Renewable Energy, Govt of India)
Gurgaon-Faridabad Road, Gwalpahari, Gurgaon, Haryana-122003

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH 2022														
SCHEDULE 3- FIXED ASSETS & DEPRECIATION														
PARTICULARS	Rate	GROSS BLOCK						DEPRECIATION					NET BLOCK	
		As at 01.04.2021	Addition before 30.09.2021	Addition After 01.10.2021	Sales/ Adjustment during the year	As at 31.03.2022	As at 01.04.2021	Current Depreciation on K+C	Current Depreciated on on D	Total Current Year Depreciation 31.03.2022	Total Depreciation (G+H)	WDV as on 31.03.2022 (F-I)	WDV as on 31.03.2021	
A	B	C	D	E	F	G	H	I	J	K				
Building-NISE	10.00%	597,793,647	26,100,000	471,731	-	624,365,378	201,200,155	42,269,349	23,587	42,292,936	243,493,091	380,872,287	396,593,492	
Desktop Computers	40.00%	7,642,672	5,756,700	1,180,000	-	14,579,372	5,312,756	3,234,646	236,000	3,470,646	8,783,402	5,795,970	2,329,916	
Printers and other IT Peripherals	15.00%	35,219,548	240,130	2,569,840	-	38,029,518	12,207,064	3,487,892	192,738	3,680,630	15,887,694	22,141,824	23,012,484	
Air Conditioner	15.00%	2,494,992	-	-	-	2,494,992	1,264,993	184,500	-	184,500	1,449,493	1,045,499	1,229,999	
Misc. Assets Guest House/ Office	15.00%	22,490,187	-	224,902	-	22,715,089	11,740,562	1,612,444	16,868	1,629,311	13,369,873	9,345,216	10,749,625	
Scientific & Laboratory Equipments	15.00%	235,793,605	6,174,065	65,167,905	-	307,135,575	77,311,401	24,698,440	4,887,593	29,586,033	106,897,434	200,238,141	158,482,204	
Vehicles	15.00%	590,361	-	325,000	-	915,361	384,406	30,893	24,375	55,268	439,674	475,687	205,955	
Furniture & Fixtures	10.00%	14,783,142	61,655	660,033	-	15,504,830	2,182,829	1,266,197	33,002	1,299,198	3,482,027	12,022,803	12,600,313	
Laptops	40.00%	803,541	-	1,840,000	16,587	2,626,954	725,018	31,409	368,000	399,409	1,124,427	1,502,527	78,523	
Other Assets (Training)	15.00%	7,928,390	-	673,800	-	8,602,190	4,259,141	550,387	50,635	600,922	4,860,063	3,742,127	3,669,249	
Softwares	40.00%	6,450,486	-	248,696	-	6,699,182	4,269,326	872,464	49,739	922,203	5,191,529	1,507,653	2,181,160	
500 KW Power Plant	15.00%	69,761,662	-	-	-	69,761,662	14,911,555	8,227,516	-	8,227,516	23,139,071	46,622,591	54,850,107	
Transformer	15.00%	1,629,733	-	-	-	1,629,733	348,355	192,207	-	192,207	540,562	1,089,171	1,281,378	
Assets under Solar Tower	15.00%	9,621,150	10,295,565	-	-	19,916,715	721,586	2,879,269	-	2,879,269	3,600,855	16,315,860	8,899,564	
Books/Standards and Periodicals	40.00%	1,682,036	109,410	7,223	-	1,798,669	377,262	565,674	1,445	567,118	944,380	854,289	1,304,774	
RO System	10.00%	230,400	-	-	-	230,400	44,352	27,907	-	27,907	72,259	158,141	186,048	
Total		1,014,915,552	48,737,525	73,369,130	16,587	1,137,005,620	337,260,761	90,131,195	5,883,881	96,015,076	433,275,837	703,729,783	677,654,791	



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SCHEDULE 4- CURRENT ASSETS, LOANS & ADVANCES	AS AT MARCH 31, 2022		AS AT MARCH 31, 2021	
		Total		Total
Current Assets				
Balance with Bank :				
-Saving & Current Accounts	14,560,427		26,867,399	
-Auto Sweep Account	148,029,057		405,713,718	
-Nostrro Account	55,532	162,645,016	-	432,581,116
Fixed Deposit:				
Fixed Deposits -Core & Project Grant)	69,664,371		67,806,582	
Fixed Deposits - Project Grant	-		28,486,458	
Fixed Deposits - Revenue	83,241,340		25,500,000	
Fixed Deposits - ALMM	333,000,000		258,000,000	
Fixed Deposit- Corpus Fund	88,574,514	574,480,225	27,511,153	407,304,193
Sundry Debtors:				
Sundry Debtors				
-For 1 Year	73,586		27,036,841	
-For More than 1 Year	6,670,439	6,744,025	8,534,503	35,571,344
Debtors Under ALMM (For 1 Year)	243,530	243,530	-	-
Loan & Advances & other assets				
Advances and other amounts recoverable in cash or in kind or for value to be received				
- Advances for capital assets				
-For 1 Year	19,354,290		26,030,491	
-For More than 1 Year	45,127,183	64,481,473	51,276,272	77,306,763
- Advances for training programs				
-For 1 Year	2,593,754		8,487,841	
-For More than 1 Year	5,514,587	8,108,341	8,529,452	17,017,293
- Advance to Vendors	860,637		2,324,280	
- Balances with Staff (Incl. Imprest. Accounts)	183,079	1,043,716	149,497	2,473,777
Deposits				
- Security Deposits	310,965		278,485	
- GST (Input Credit and GST Paid on Advance)	20,337,932		12,483,066	
- TDS Recoverable	17,992,605		17,584,402	
- Advance Tax/Income Tax Refundable (F.Y. 2014-15 & 2015-16)	3,778,834	42,420,336	3,778,834	34,124,787
Total		860,166,663		1,006,379,274



SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT AS AT 31ST MARCH 2022	2021-22		2020-21		Amount in ₹
		Total	Total	Total	
SCHEDULE 5- RECEIPTS FROM TESTING AND OPERATIONS					
Receipts from Testing					
- Testing of Solar Components	3,779,234		3,779,234	6,454,410	6,454,410
Receipts under ALMM					
- Application Fees	46,572,175				
- Inspection Fees	23,000,000		69,572,175	65,927,875	65,927,875
Other Operational Receipts					
- Receipts from Trainings and Seminars- For Domestic Participants	1,122,474			2,320,660	
-for International Participants	420,000			5,950,800	
- Administrative Charges	11,088,655			30,981,954	
- Consultancy Charges	7,383,247		20,014,376	5,065,000	44,318,414
Total			93,365,785		116,700,699



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SCHEDULE 6- GRANTS/SUBSIDIES & Subsidies Received)	2021-22		2020-21	
		Total		Total
Grants Received during the year-NISE(Core Grants)	136,641,000		130,000,000	
Less : Grant Refunded	-	136,641,000	3,000,000	127,000,000
Grants Received during the Year-NISE(Project Grants)	162,621,437		218,221,429	
Less : Grant Refunded	632,104		76,608,267	
Grant Unutilised brought forward from Previous Year-NISE	339,002,179	500,991,512	964,184,330	1,105,797,492
Grant Adjusted towards Revenue Expenditure :				
Current Year Expenditure-NISE	453,718,200		845,980,176	
Less : Expenses adjusted towards current year Revenue-NISE	26,584,507		25,392,526	
Less: Provision made against Revenue Expenditure	3,657,894		1,701,106	
Less: Expenses Adjusted against Previous Advances-NISE	15,454,410	423,475,798	21,610,705	818,886,544
		408,021,388		797,275,839
Less : Grants utilised for purchase of Fixed Assets-NISE	84,956,832		59,787,139	
Less : Grants utilised for Advances against Capital Expenses	18,962,850		14,700,000	
Less : Grants utilised for Advances against projects	6,322,720		11,428,936	
Less: Grant Utilised for Advance against General Exp.-NISE	64,900	110,307,302	10,603,400	96,519,475
Grants Payable to Government of India		119,303,822		339,002,179



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SCHEDULE 7- OTHER INCOME	2021-22		2020-21	
	Credited in Revenue	Total	Credited in Revenue	Total
Bank Interest				
- Interest earned on Savings account-NISE	364,424		1,347,102	
- Interest earned on Auto Sweep account	2,267,038		2,024,860	
- Interest earned on F.D	2,308,370		1,959,944	
- Interest earned on Corpus Fund	2,181,540		1,372,931	
Sub Total of Bank Interest	7,121,372		6,704,837	
Interest on Income Tax Refund	1,043,073	8,164,445	890,956	7,595,793
Miscellaneous Income				
- Guest House Charges	366,900		492,000	
- Other Income	2,874,653	3,241,553	1,039,337	1,531,337
Provision Written Back	8,946,513	8,946,513	-	-
Others (Solar Dryer Project)				
Supply of Solar Dryer Cum Space Heating System	-		74,350,998	
Add: Inventory of Solar Dryer System	-		-	
Less: Inventory of Solar Dryer System	-		6,783,030	
Less: Purchases of Solar Dryer Cum Space Heating System	-		61,227,270	6,340,698
Total		20,352,511		15,467,828



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NATIONAL INSTITUTE OF SOLAR ENERGY

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SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT AS AT 31ST MARCH 2022										Amount in ₹	
SCHEDULE 8- ESTABLISHMENT EXPENSES	2021-22					2020-21					
	Adjusted with grant	Adjusted against Advances	Provision for Expenses	Charged to Revenue	Total	Adjusted with Grant	Provision for Expenses	Charged to Revenue	Total		
Consultancy Charges	2,201,317	-	-	6,440,986	8,642,303	1,520,000	224,840	10,386,106	12,130,946		
Remuneration	34,490,707	-	-	96,867	34,587,574	30,935,728	-	162,000	31,097,728		
Total	36,692,024	-	-	6,537,853	43,229,877	32,455,728	224,840	10,548,106	43,228,674		



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SCHEDULE 9- OTHER ADMINISTRATIVE EXPENSES	2021-22					2020-21				
	Adjusted with grant	Adjusted against Advances	Provision for Expenses	Charged to Revenue	Total	Adjusted with Grant	Adjusted against Advance	Provision for Expenses	Charged to Revenue	Total
Electricity / Fuel Expenses	4,376,148	-	520,070	-	4,896,218	5,702,858	-	520,070	-	6,222,928
Outsourcing Services	21,764,205	-	1,790,184	3,662,449	27,216,838	18,768,765	-	627,490	4,394,900	23,791,155
Security Services	11,109,686	-	889,812	-	11,999,498	9,329,555	-	-	2,422,057	11,751,612
Training Expense (Reversal)	-	-	-	2,160,022	2,160,022	-	-	-	88,938	88,938
Miscellaneous Exp.	-	-	-	204,295	204,295	451,170	-	-	77,817	528,987
Office Expenses	1,453,502	25,000	-	511,486	1,989,988	375,590	-	4,012	520,238	899,840
Refreshment/Hospitality/Meetings	246,147	-	-	87,532	333,679	112,445	-	-	-	112,445
Legal & Professional Charges	1,030,343	-	-	-	1,030,343	1,040,732	-	218,271	113,745	1,372,748
Bank Charges	16,736	-	-	55,271	72,007	-	-	-	296,317	296,317
Gateway charges	-	-	-	84,176	84,176	-	-	-	129,915	129,915
Horticulture Expenses	623,618	-	370,865	-	994,483	-	-	-	778,530	778,530
Advertisement Expenses	-	-	-	-	-	-	-	-	-	-
Advertisement Expenses	-	131,285	-	-	131,285	-	1,254,047	-	-	1,254,047
Guest House Expenses	-	-	-	27,515	27,515	-	-	-	79,080	79,080
IT Expenses (Facilitation Charges)	167,189	-	-	-	167,189	473,372	2,468,915	-	-	2,942,287
Software Expenses	-	-	-	-	-	5,779,961	-	-	-	5,779,961
Seminars/Conferences/Training Programmes	221,240	-	-	569,374	790,614	13,200	-	-	1,172,187	1,185,387
Medical Reimbursement	-	-	-	227,663	227,663	-	-	-	-	-
Lab Expenses	1,488,232	-	-	-	1,488,232	-	-	-	-	-
Solar Dryer Expenses	-	-	-	877,753	877,753	-	-	-	-	-
Consumables/ Laboratory/Workshop Exp.	-	-	-	600,177	600,177	266,378	-	-	1,057,757	1,324,135
Electrical Consumables	1,009,478	-	-	-	1,009,478	127,934	-	-	-	127,934
Library Books, Periodicals and News paper	157,250	-	-	-	157,250	13,617	-	-	-	13,617
Postage, courier, Printing and Stationery	580,516	-	-	168,624	749,140	1,479,911	-	-	11,108	1,491,019
Interest & Penalty	6,457	-	-	140,162	146,619	7,351	-	-	53,163	60,514
Repairs & Maintenance Expenses (Building, Machinery & Computers)	2,914,824	1,046,278	-	-	3,963,102	686,115	-	49,549	382,161	1,117,825
Telephone & Lease line Expenses	1,119,853	-	24,791	1,175,105	2,319,749	3,638,491	-	28,590	1,442,779	5,109,860
Vehicle Running & Maintenance	251,591	-	-	-	251,591	75,094	-	-	-	75,094
Hiring of Vehicles Expenses	873,666	-	62,172	62,172	998,010	1,050,730	-	-	20,105	1,070,835
Tour / Travel & Transport	245,023	-	-	998,939	1,243,962	52,366	-	28,284	432,007	512,657
Tour / Travel & Transport-ALMM	-	-	-	1,138,306	1,138,306	-	-	-	742,069	742,069
Foreign Currency Fluctuations Expenses	-	-	-	-	-	78,731	-	-	-	78,731
Total	49,655,704	1,204,563	3,657,894	12,751,021	67,269,183	49,524,366	3,722,962	1,476,266	14,214,872	68,938,466

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SCHEDULE 10- OPERATIONAL EXPENSES	2021-22					2020-21				
	Adjusted with grant	Adjusted against Advances	Provision for Expenses	Charged to Revenue	Total	Adjusted with Grant	Adjusted against Advance	Provision for Expenses	Charged to Revenue	Total
Released to State Nodal Agencies for Skill Development	299,228,362	13,058,247	-	-	312,286,609	690,628,181	9,293,334	-	-	699,921,515
ITEC/SCAAP/TCS Columbo Training Programme (P11-TP MEA- ITEC)	-	-	-	72,937	72,937	1,934,944	-	-	-	1,934,944
Hydrogen Project Exp. (P02- Hydrogen)	2,642,735	-	-	42,797	2,685,532	8,091,747	-	-	-	8,091,747
Solar Powered Clean Drinking Project (P03-SDWP)	-	-	-	-	-	39,249	-	-	-	39,249
BHEL R&D Project (P01- PERC)	1,996,654	-	-	6,330,000	8,326,654	3,686,304	-	-	-	3,686,304
Solar Radiation Calibration Lab (SRCL) (P05-SRRA)	689222	-	-	-	689,222	2,352,584	-	-	-	2,352,584
Department of Science and Technology Project (P06- WPDST)	3028768	1,191,600	-	-	4,220,368	3,908,065	8,592,337	-	-	12,500,402
Department of Science and Technology Project (P06- WPDST-2)	811235	-	-	-	811,235	500,000	-	-	-	500,000
Solar Water Pumping System Project (P07-SWP)	3577176	-	-	-	3,577,176	4,150,596	-	-	-	4,150,596
Roof Top Grid Engineer Skill Development Project (P09 TP ROOFTOP)	-	-	-	-	-	-	2,072	-	-	2,072
GIZ Project Expenses	-	-	-	802,425	802,425	-	-	-	629,548	629,548
Varunmitra Skill Development Programme (P10-TP VARUNMITRA)	9,699,508	-	-	47,474	9,746,982	4,075	-	-	-	4,075
Total	321,673,660	14,249,847	-	7,295,633	343,219,140	715,295,745	17,887,743	-	629,548	733,813,036



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NATIONAL INSTITUTE OF SOLAR ENERGY

(An Autonomous Institute of Ministry of New & Renewable Energy, Govt. of India)
Gurgaon-Faridabad Road, Gwalpahari, Gurgaon, Haryana-122003

STATEMENT OF GRANTS FOR THE FINANCIAL YEAR 2021-22

PARTICULARS	Opening Balance 01.04.2021	Refund/Transfer during the year 2021-22		Receipt/Transfer during the year 2021-22		Utilization against advances 21-22	Utilization against Fixed Assets 21-22	Utilization against Revenue Expenses 21-22	Utilization against Admin Charges 21-22	Total Utilization 21-22	Closing Balance 21-22
		Refund to Ministry	Transfer	Received in Bank	Received Through Transfer						
National Institute of Solar Energy											
Grant for Creation of Capital Assets	1,739,956	-	-	50,212,000	-	18,962,850	32,519,098	-	-	51,481,948	470,008
Grant in aid- General	53,579	-	-	51,946,000	-	64,900	-	51,857,021	-	51,921,921	77,658
Grant in aid- Salaries	17,229	-	-	34,483,000	-	-	-	34,490,707	-	34,490,707	9,522
Grant for BHEL R&D Projects (P01- PERC)	25,469,902	-	-	1,800,000	6,330,000	-	30,125,030	1,996,654	-	32,121,684	1,478,218
Grant for Project Hydrogen (P02- Hydrogen)	67,955,082	-	-	-	-	391,440	11,118,600	2,642,735	-	14,152,775	53,802,307
Grant- Skill Development Programme	186,849,559	-	-	136,566,699	1,317,036	5,931,280	-	290,328,220	8,900,142	305,159,642	19,573,652
Grant for SERIUS (Indo US Project)	39,666	-	-	-	-	-	-	-	-	-	39,666
Grant- World Renewal Energy Museum	26,655,548	-	-	-	-	-	-	-	-	-	26,655,548
Grant- Solar Powered clean drinking water project (P05-SDWP)	-357,050	-	-	-	-	-	-	689,222	-	689,222	16,519
Grant - Solar Radiation Sensor Project (P05- SRRA)	-545,830	-	-	1,251,571	-	-	-	689,222	-	689,222	16,519
Grant - Varunmitra Skill Development Programme (P10- TP Varunmitra-2)	5,981,004	-	-	3,860,250	-	-	-	9,533,464	166,044	9,699,508	141,746
Grant - Solar Pumping Project (P07- SWPUMP)	8,451,862	-	-	11,495,681	-	-	11,194,104	3,277,176	300,000	14,771,280	5,176,463
Grant - Department of Science & Technology (P06- WPDST)	3,660,872	632,104	-	-	-	-	-	3,028,768	-	3,028,768	-
Grant - Department of Science & Technology (P06- WPDST-2)	13,030,800	-	-	-	-	-	-	311,235	500,000	811,235	12,219,565
Total Grant (Balance of Grant payable to Govt. of India)	339,002,179	632,104	-	291,615,401	7,647,036	25,350,470	84,956,832	398,155,202	9,866,186	518,328,690	119,303,822
Contributions for Corpus Fund											
NISE											
Contribution by IREDA	10,000,000	-	-	-	-	-	-	-	-	-	10,000,000
Total Grant Received from Govt. Non-Refundable	10,000,000	-	-	-	-	-	-	-	-	-	10,000,000



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SCHEDULE 11

SIGNIFICANT ACCOUNTING POLICIES AND NOTES TO ACCOUNTS FORMING INTEGRAL PART OF THE FINANCIAL STATEMENTS FOR THE F.Y 2021-2022.

A. SIGNIFICANT ACCOUNTING POLICIES

1. Accounting Convention

The financial statements are prepared on the basis of historical cost convention, unless otherwise stated and on the basis of accrual method of accounting.

2. Grant in Aid

- a) The Institute is getting budgetary support from Ministry of new & Renewable Energy, Government of India. These grants are recurring in nature and are termed as Core Grants. Besides the recurring grants, one-time grants are also received to take up specific projects or activities. Such grants have been classified as Project Grants. The unutilized grants at the end of year have been shown in the financial statements as Grant Payable to Government of India. Grants which are non-refundable are shown as corpus fund under General Reserve.
- b) The Institute has adopted the policy to set off allocable revenue expenses with the internally generated resources i.e. testing, training and Consultancy income in accordance with Rule 229 (iv) of GFR, 2017. The surplus from the same is being shown under the head General Reserve. However, expenses incurred against specific projects and activities have been set off against the grants received for that purpose.

3. Fixed Assets and Depreciation

- a) Fixed assets are stated at cost less accumulated depreciation.
- b) Depreciation has been provided on the basis of rates as prescribed under Income Tax Act 1961.
- c) The fixed assets are funded by the Grants in Aid (Capital) and hence, the charge of over the same is being recognised as a contra item in Income & Expenditure Account.

4. Employee Remuneration & Benefits

All Retirement and other Terminal Benefits such as Gratuity, Leave Encashment and Bonus etc. are not accounted on year-to-year basis and the same are recognized in the year of occurrence of event.

5. Revenue Recognition

Revenue is recognized on accrual basis.



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B. Notes to Accounts

1. NISE has created the Corpus Fund as per the guidelines approved by MNRE vide letter No. 354/12/2017 – NSM dated 24.06.2019 during the year. The balance of Corpus Fund as on 31.03. 2022 is Rs. 885.74/- lakhs (Previous year Rs. 275.11/-).
2. The guidelines for enlistment under “Approved Models and Manufactures of Solar Photo voltaic Modules (Requirements for Compulsory Registration) Order, 2019” issued by MNRE, NISE has been designated as Implementation Support Agency. The inspection/application fee under the said scheme is considered as revenue of the Institute.
3. The accumulated depreciation amounting to Rs. 433,275,837 (current year Rs. 96,015,076) has been charged to the Income & Expenditure account. Since the Institute is fully aided by the grant from Government of India, the same has been charged to the Grant in Aid (Capital) and is recognised in the Income & Expenditure account as a contra item.
4. The amount of interest earned on grants and payable to MNRE is Rs. 1,11,37,932 /- (previous year Rs. 53,793,016/-) and has been shown as contra item in Income and Expenditure account.
5. The Institute has taken over the facilities consisting of 200 acres of land, administrative block, 3 Nos. technical block from erstwhile solar Energy centre (MNRE), the ownership of which is under process of transfer.
6. Addition made during the F.Y. 2021-22 in Capital Reserve (Purchase of Assets) amounting to Rs. 11,80,55,653/- (Previous Year Rs. 10,53,22,979/-).
7. The Income Tax Assessment for AY 2020-21 is under process.
8. The institute was maintaining its income and expenditure on cash basis except statutory liabilities and Capitalized Assets. In view of the transition from cash to accrual system, the provision for expenses during the year has been made for an amount of Rs. 36,57,824/- (Previous year Rs 17,01,384/-).
9. An amount of Rs. 89,46,513/- out of the provision made in previous year, has been written back during the year, as the same has been paid through the grant account.
10. The balances of sundry creditors and debtors are subject to confirmation.
11. Previous year figures have been regrouped and rearranged to make them comparable with those of current year.

For M/s Rohit KC Jain & Co.
Chartered Accountants
FRN 020422N

CA. Ritesh Wadhwa
Partner
M. No.: 517197
UDIN:
Place: New Delhi
Date: 28/09/2022



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राष्ट्रीय सौर ऊर्जा संस्थान

(नवीन एवं नवीकरणीय ऊर्जा मंत्रालय, भारत सरकार के अधीन एक स्वायत्त संस्थान)

National Institute of Solar Energy

(An Autonomous Institute of Ministry of New and Renewable Energy, Govt. of India)

गुरुग्राम - फरीदाबाद मार्ग, ग्वालपहाड़ी, गुरुग्राम - 122 003, हरियाणा, भारत
Gurugram - Faridabad Road, Gwal Pahari, Gurugram -122 003, Haryana, India

To,

Dated: 27.09.2022

M/s Rohit KC Jain & Co.
Chartered Accountants
New Delhi.

Subject:- Management Reply on observation found during the Audit for the FY 2021-22.

Sir,

In reference of observations mentioned in Annexure-1 of the Audit-report for the FY 2021-22, we are submitting the point wise reply: -

1. The different works assigned to CPWD on the pattern of deposit work and under process. The advance will be settled after receiving of final UC of work completed. Thereafter, the work will be capitalized.
2. The Interest earned during the FY 2020-21 has been refunded to concerned Ministry and department in the FY 2021-22 except of the Grant received under Hydrogen Project, which has been refunded in the month of April 2022 along with audited UC. The Interest earned during the FY 2021-22 will be refunded in the current FY.
3. The TDS refunds for the AY 2015-16 and 2016-17 were held by the Income tax department. The NISE filed an appeal before the appellate authority. The proceeding of appellate authority was completed in the month of Jan 2022. The NISE has already initiated the process of getting refund from the income tax department for the AY 2015-16 and 2016-17.
4. The Governing council was appraised about the status for creation of world museum of Renewable Energy at NISE in its 6th meeting held on 10th May, 2018. The GC decided to defer the proposal.
5. The 50% fund was released as an advance to conduct the skill development program to the abovementioned training partner. The point wise reply is as follows:
 - i. The Training Partner has submitted the UC/SOE directly to NISE but at the time program was conducted through SNA i.e., OREDA and the same UC and SOE has not been endorsed by the OREDA. The NISE has communicated the issue multiple times to Training partner and SNA respectively to resolve the matter so that the advance given may be settled.

दूरभाष / Tel. No. : 0124-285 3060

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- ii. The NISE has received the copy of UC/SOE from the Govt. Polytechnic College Kerala in current financial year and to be settled accordingly.
- iii. The NISE has sent multiple reminders to Rajasthan Renewable Energy Corporation, but no response has been received from their side, The Institute will initiate the legal proceeding for the recovery.
6. The matter is still under discussion with MNRE and NISE has provided list of advocates for arbitration to MNRE for further course of action.
7. The break up and replies of above amount is as follows:

Sr.no.	Amount	Remarks
1.	Rs. 8,55,150/-	The amount spent for the inhouse skill development program (Suryamitra) conducted in F.Y. 2017-18 and the program division of NISE is reconciling their record for the settlement.
2.	Rs. 37,41,534/-	The amount spent for North East training program and the UC of the same has been submitted to the MNRE for final settlement but the NISE has not received the balance amount till date.
3.	Rs. 14,20,922/-	The amount spent for ITEC/IAFS international training program funded by MEA and the program division of NISE is reconciling their record with MEA for the settlement.
Total	Rs. 60,17,606/-	

8. The Maximum amount of EMD relates to the training partner associated with the Skill development program (Suryamitra). The Program division usually initiate the process for refund of EMD amount after completion of the training program.
9. The matter has been taken up and out of which demand for the FY 2021-22 has been settled on the portal and balance outstanding demand will be settled during the current FY.
10. Out of Rs. 11,11,465/- amounting to Rs. 6,19,620/- of M/s Waaree Energies Ltd has been credited in the 26AS of NISE and for the balance amount NISE has intimated the concerned parties either for refund of the above amount or deposit to the income tax authority.
11. The suggestion has been noted for implementation from the current year.



12. The above-mentioned advance pertains to the parties located in the foreign country; their inspection could not be initiated due to covid restriction on travelling abroad.
13. The Advance of Rs. 30,41,15,878/- includes the advance of Rs. 26,71,42,263/- from the parties located in foreign country, the inspection of their facility could not be initiated due to covid restriction on travelling, Hence the revenue received has not been recognized.
Rest of the balance Rs. 1,89,36,750/- has been recognized as revenue in the current financial year till August 2022.
14. The matter is already placed before PAC (Public Accounts Committee) of Parliament for consideration and further direction to NISE.

Kindly consider our representation.

Thanking You,



Yours Faithfully,

(Anil Kumar Yadav)
Director (Admin)







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NATIONAL INSTITUTE OF SOLAR ENERGY

(An Autonomous Institute of Ministry of New and Renewable Energy, Government of India)

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