ANNUAL REPORT
2013-14

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NISE
National Institute of Solar Energy

NATIONAL INSTITUTE OF SOLAR ENERGY

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

Governing Council of National Institute of Solar Energy

1.	Dr. Satish B Agnihotri, Secretary, MNRE	President (ex-officio)
2.	Shri J.B. Mohapatra, JS&FA, MNRE	Member (ex-officio)
3.	Shri Tarun Kapoor, JS, MNRE	Member (ex-officio)
4.	Dr. Praveen Saxena, Scientist 'G', MNRE	Member (ex-officio)
5.	Shri Rajendra Nimje, MD, SECI	Member
6.	Dr. N. Murugesan, DG, CPRI	Member
7.	Principal Secretary (Energy), Govt. of Rajasthan	Member
8.	Shri Balour Singh, Director, PEDA	Member
9.	Shri H.R. Gupta, MD, Indosolar	Member
10.	Shri Vineet Mittal, MD, Welspun Energy Ltd.	Member
11.	Director General, National Institute of Solar Energy	Member
12.	Dr. O.S. Shastri, Scientist 'F', NISE	Member
13.	Dr. S.K. Singh, Scientist 'F', NISE	Member
14.	Dr. R.K. Malhotra, Director, R&D Centre, IOC, Faridabad	Member
15.	Prof. J. Vasi, Director (NCPV), IIT Bombay	Member
16.	Dr. Ashvini Kumar, Director (Solar), SECI	Member
17.	Prof. R.C. Budhani, Director, NPL	Member
18.	Shri S.S. Bedi, Scientist 'F', NISE	Member Secretary

Special Invitee

1.	Dr. S. Gomathinayagam, Executive Director, C-WET
2.	Prof.Yogender Kumar Yadav, Director, NIRE

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(An Autonomous Institute of Ministry of New and Renewable Energy Government of India)
Gurgaon-Faridabad Road, Gwalpahari,
Gurgaon – 122003 (Haryana)

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NATIONAL INSTITUTE OF SOLAR ENERGY (NISE)

INTRODUCTION

On 3rd September, 2013 the Govt. of India had given approval for setting up of an autonomous institution named "National Institute of Solar Energy" (NISE) under the Societies Registration Act to work as an apex National Centre in Solar Energy under the Ministry of New & Renewable Energy (MNRE), Govt. of India by converting the existing Solar Energy Centre (SEC) of the MNRE to coordinate research & technology and other related work under the Jawaharlal Nehru National Solar Mission (JNNSM). Setting up of an apex National Institute of Solar Energy is a part of the JNNSM.

Subsequently the Ministry of New and Renewable Energy converted the existing Solar Energy Centre at Gwalpahari Gurgaon (Haryana) in to an autonomous institution with the name "National Institute of Solar Energy" (NISE) to act as an apex National R&D Centre in Solar Energy and to coordinate research & development and other related work envisaged under JNNSM. The NISE has been registered as a Society on 28th October 2013 with Registration No. HR 018 2013 1092 under Haryana Registration and Regulation of Societies Act 2012.

Objective and the main functions of the National Institute of Solar Energy are as under:

1. The main functions of the autonomous institute would include assisting the MNRE in implementing the Mission objectives through appropriate mechanisms, evolving S&T programmes and projects, managing special projects, overseeing and coordinating with all relevant stakeholder agencies in the pursuit of the above objectives.
2. The institute would be 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 commercialize the 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 replacement of kerosene and diesel being used by the sectors stated above.
3. The institute would be responsible for R&D, resource, assessment, training, testing/standardization 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.
4. The institute would also undertake R&D projects on different aspects of solar energy technologies, hybrid systems and storage techniques/systems.
5. The internal administrative functions, international cooperation projects on research, training and testing, technology validation will also be undertaken by the institute.
6. The institute would also work as the Secretariat for the work of the R&D Advisory council. The Solar Research Advisory Council would facilitate the development of a technology roadmap and provide inputs on all matters related to R&D and capacity building to the Mission steering Group. The institute will also work closely with the Solar Energy Corporation of India setup by the Ministry for implementation of Mission.
7. The institution under the guidance of Ministry and the Mission Steering Group be responsible for Coordination with (i) other Centres of Excellence identified under the Mission, (ii) R&D projects funded in the field of solar energy in the country, and (iii) other S&T Ministries/Organizations in the country.
8. The institute would strive to bridge the gap between existing R&D institutions and Industry, and get the Industry on board, through partnership programmes and projects.
9. The institute would collaborate with the international S&T organizations to further R&D and related capacity building in the areas of solar energy and the related activities assigned to the institute by the Ministry from time to time.

10. The institute would keep track of latest global developments based on technology forecasting and fore sighting relating to solar energy and related technologies including storage techniques and provide inputs to the Ministry and the Mission Steering Group for the accelerated development of the indigenous solar energy technologies and industry in the country.
11. The institute would also provide technical support to other R&D and testing organizations, as considered necessary.
12. The institute would assist the Ministry in preparation of technology roadmap and the related S&T policies for effective implementation of the S&T component of the Mission.
13. The institute would also coordinate the work of technical monitoring of projects covered under the S&T roadmap for the Mission and also undertake technical studies and evaluation.
14. The institute will be eligible to receive research grants from MNRE, other Ministries/organizations including the international funding to carry out various assigned tasks and R&D activities.
15. The institute would also support capacity building and support students, teachers and research personnel to work for higher degrees including Ph. D. The institute would develop suitable linkages with various academic and research organizations for this purpose.
16. The proceedings to be accrued by the institute for activities related to testing training, technology transfer, consultancy, etc. would be kept by the institute for its further growth & development.

Facilities at NISE and major activities

NISE has started its operations after the first meeting of its Governing Council held on 15th January, 2014. The first meeting of the Finance & Accounts Committee was held on 31st January, 2014. It has assumed all technical activities of the erstwhile SEC and has also re-organized itself to undertake roles and responsibilities assigned to it by the Ministry.

Brief Report on 1st GC Meeting

The 1st meeting of the Governing Council of National Institute of Solar Energy (NISE) was held at 12:00 noon on 15th January, 2014 under the Chairmanship of

Dr. S.B. Agnihotri, Secretary, MNRE and President, NISE at the office of MNRE, New Delhi. Dr. P. Saxena, DG, NISE gave a brief background of creation of the institute and outlined the roles and responsibilities of NISE. The Chairman said the Ministry has conceived NISE with a vision to develop it as a world class institute, requiring it to acquire the envisaged stature with re-orientation of the management system, better infrastructure and highly skilled manpower.

The Chairman also mentioned that Public Private Partnership (PPP) with future investment coming from both Government and Private sector, would be important to expand the activities of NISE. Several members from the private sector and the Government bodies stressed on the need to focus on human resource development in RE, apart from research and development in the critical focal areas of solar thermal and photovoltaic, testing and certification and advanced materials.

The Governing Council approved, after deliberations, the broad structure of technical divisions and creating the three technical divisions in NISE to start its activities. The GC approved opening of the accounts of NISE in nationalized banks. The GC after discussions approved formation of the two Standing Committees, namely (i) Finance & Accounts Committee, and (ii) Research Advisory Committee. In addition, the GC approved formation of an Executive Committee consisting of five members headed by DG, NISE and delegated powers to it necessary for the day-to-day functioning of the Society.

The Governing Council decided that the delegation of powers of C-DAC may be studied and revised delegation of powers for NISE may put up to the President for approval. The GC authorised the President, NISE to approve the delegation of powers. Till such time the DG, NISE was given financial powers upto Rupees One Crore.

The matter of creation of Corpus Fund for NISE was taken up and discussed. It was felt that if NISE has to become a self-sustaining organization, it should build its corpus of funds for security of staff and long term sustainability of its operations. After some discussions, the Governing Council approved the proposal to create a corpus of about Rs.100 Crore for NISE over a period of next 10 years. The Chairman was of the opinion that surplus revenue generated by NISE at the end of the year should also be deposited in the corpus.

The GC after deliberations approved the proposal of DG, NISE for setting up of Administration and Finance Division of NISE and urged that this division should be as lean as possible and most of the work should be outsourced. It also suggested NISE should appoint internal auditors, statutory auditors and some consultants to deploy "Latest Accounting Methods". The Chairman said that there should be a concurrent audit in NISE.

DG, NISE presented the consolidated requirement of posts of various technical group, administrative and finance group and the office of the DG, NISE. After detail deliberations the GC approved the following:

i. The structure and creation of 133 posts. These posts to be filled in a phased manner as and when funds are made available. However, NISE would commence its activities with the existing posts of scientists and administrative staff existing in SEC.

ii. Rework on the posts required to be created equivalent to the existing posts in SEC and send proposal to the Ministry for creation of posts as approved by the cabinet.

iii. Request the Ministry to re-designated (as additional work) the existing scientific, administrative, technical and support staff as per structure of NISE to start the work of NISE, till regular posts are created and filled. They may continue to be MNRE employees and draw salary as being done now.

iv. Filling up of contractual posts mentioned above. The GC suggested that RSs may be given higher remuneration up to Rs.60,000/- per month depending upon their qualification and experience. The RS/SRS/JRS at present working in SEC will be given chance to continue in NISE.

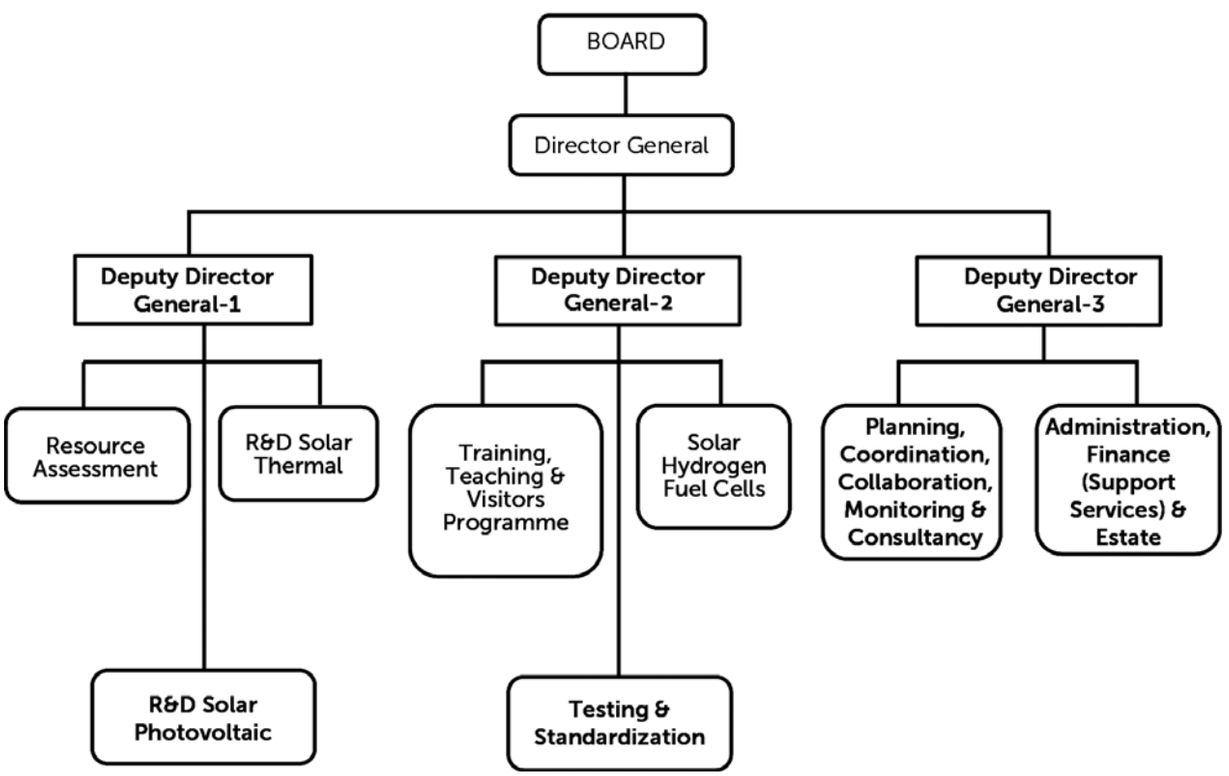
v. To appoint Internal Auditors, Statutory Auditors and some Consultants. The consultants may also be retired experienced Government servants.

The GC deliberated on the agenda item of broad principle of the Recruitment Rules, and was of the opinion that the NISE may have its own promotion policy which can be more attractive than Modified Flexible Complementing Scheme (MFCS) for scientific posts and Modified Assured Career Progression (MACP) for non-technical posts of the Government of India as modified from time to time. All posts would be governed by Government of India pay scale and associated benefits as decided by the Government of India from time to time.

The GC approved the age of superannuation for the Scientific officers and technical staff working in the Society as two years more than that in the Government, extendable to five years as applicable in academic institutions.

SEC (now NISE) was involved in demonstration, standardization, interactive research, training and testing solar technologies and systems. NISE has inherited basic infrastructure of SEC which includes with administrative block, three technical blocks and a small guesthouse. A New building and a 30 room international guest house are under construction, which is likely to be completed by June 2014. The NISE now operates from a 200 acre campus situated at Gwalpahari, Gurgaon on Gurgaon-Faridabad road. Availability of land is the strength of the institute which facilitate setting up of large size outdoor projects and scope of expansion in future.

Organizational Structure of the NISE



The Institute is serving as an effective interface between the Government and institutions, industry & user organizations for development, promotion and widespread utilization of solar energy in the country.

Proposed activities at NISE

In view of the scientific and technical responsibilities assigned to NISE and requirements of JNNSM, it is proposed to organize NISE in following Verticals:

- Solar Photovoltaic Division.
- Solar Thermal Division.
- Resource Assessment and Information Technology Division.
- Capacity Building & Training.
- Research, Design & Development.
- Solar Energy Storage.

CHAPTER-1

SOLAR PHOTOVOLTAIC DIVISION

The SPV division will have two groups (i) R&D group and (ii) Testing and Design (T&D) group. The R&D group would have core activity group working on Basic Research, Applied Research, Pre-commercial Research and the T&D group would have core activity group working on Design, Testing Certification and Design.

1.1 R&D Group:

Basic Research

"Basic Research" activity group is working on the development of materials, devices, designs and simulation of new concepts in the device design. The area would be:

- High efficiency Silicon solar cells using innovative concepts on lab scale.
- Development and up gradation of characterization facilities for wafers and cells.
- Development of reference devices and facilities for calibration of solar cells.
- Testing and evaluation of solar cells developed by other laboratories.
- Development of new materials, device structures and techniques.

Large area sun simulator quick sun 700A

Applied Research

"Applied Research" activity group is concentrating its efforts on developmental aspects of large area solar cells, techniques, development of PV modules and systems, performance and reliability aspects of PV modules and PV new modelling concepts, innovative system designs to reduce the stresses on the modules during long term field operation under different environments in collaboration with industry by way of developmental testing. This group would work with other testing laboratories to gather information and collaborative research. Following are the major areas of research for this group:

- Technology validation of new technologies.
- Establishment of long term outdoor test beds for performance studies on PV modules.
- Develop PV module performance maps of the country and offer these to the users.
- Creation of new facilities and laboratories for PV system and component testing.
- Working closely with QCI, NABL and BIS for modification and development of SPV standards.

1.2 Testing and Design Group

The Photovoltaic Division at NISE is maintaining a NABL accredited PV module testing laboratory, lighting system test laboratory, battery testing facility and a water pumping system test rig and outdoor test facilities. NISE is in process of establishing a comprehensive power electronics laboratory for inverter, charge controller and MPPT evaluation.

25 kWp crystalline silicon module test bed

SPV micro-morph test bed

The Photovoltaic Division (PVD) is participating in the joint research work with National Renewable Energy Laboratory (NREL), AIST, Loughborough University and PTB Germany. PVD is also working jointly with multinational PV module manufacturing industries by setting test beds for technology executed by INDO-UK and INDO-US joint consortiums in the area of Stability and Reliability of Photovoltaic modules. The indoor module testing facility of NISE can undertake technical and environmental tests on commercial large size modules.

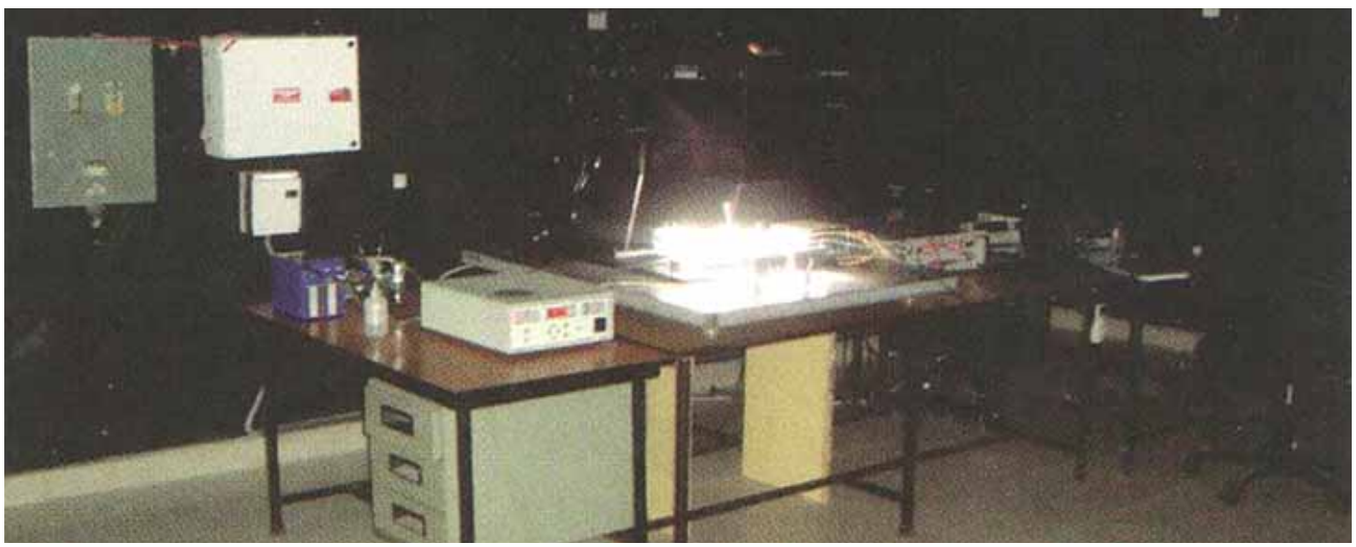
The existing power electronics laboratory, lighting system testing laboratory, and water pumping test facility will be upgraded to meet the testing requirements and corresponding PV standards. These facilities will be NABL accredited to establish suitability and acceptability of the test certificates. NISE will also setup new outdoor test beds for different module technologies at its campus as well as other suitable sites for the data collection, validation and mapping.

The NABL testing accredited qualification test laboratory for PV modules performance and qualification testing as per IEC 61215 and IEC 61646 will be further upgraded for testing as per other IEC standards 61730, 61701 and other relevant standards. The indoor qualification, environmental test facilities will be upgraded to conduct indoor research studies on controlled or simulated conditions also. Additional facilities will also be created for new tests as per revised and new standards. All these facilitates will be available to the industry, users and other organizations for certification and performance testing purpose at cost.

NISE will also setup a system design laboratory with the available design software for the verification and validation of the design developed by EPC contractors and developers for MW scale PV power plants.

Following are the major activities of the group:

- Up-gradation of the cell and module testing facilities.
- Development of module qualification and



Solar cell tester

PV lighting system testing and evaluation facility

25 kWp crystalline silicon module test bed

performance measurement facilities.

- Establish SPV system design laboratory for designing, validation of SPV systems/power plants.
- Offering the testing services to the industry, users and other organizations.
- Development of new systems designs, applications for rural and urban needs.
- Upgrade and establish PV system evaluation and certification facilities.
- Advisory and consultancy services to user organizations.

The Gross Annual Income in 2013-14 was approximately Rs. 47, 51,000/- (Forty Seven lakh fifty one thousand) by testing of Pumps, Inverters, modules, LEDs and Batteries in different testing Labs of NISE.

CHAPTER-2

SOLAR THERMAL DIVISION

2.1 R&D Group

Basic Research

The basic research activity group is focusing on development and optimization of components of various solar thermal technologies such as reflector, collector, receiver, heat carrier, selective coating, storage system and material. The activities of this group would also encompass development of new end use applications of solar thermal systems to enhance the capacity utilization (use of FPC based water heater for cooling during summer). This division would also engage in designing of solar hybrid systems for optimal utilization of solar energy and stabilization output. It will also be working on the development of new software applications for system designing and optimization.

To improve the competitiveness of solar thermal systems in comparison to conventional technologies, poly-generation employing an output management strategy will be researched. This strategy aims at overcoming the thermodynamic limitations in efficiency improvement by optimizing the system in such a way that waste products are converted into useful outputs.

- Component development & optimization.
- Development of new end – use applications.
- Design & optimization of solar hybrid systems with poly-generation.
- Development of software applications.

Applied Research

The applied research activity group is focusing on Evaluation of Technologies in field condition, develop end-use applications and related activities as follows:

- Technology evaluation and optimization.
- Performance evaluation, system optimization and development of control system for optimal performance.
- End use application based research, design and development.
- Characterization and preparation of state-of-art of different selective coating materials for different technologies / end-use applications.
- Development of protocol for online monitoring.

Performance mapping

Performance mapping of different solar thermal technologies and creation of Data Bank for various ranges of applications for different climatic conditions would be the activity of the

Testing of solar flat plate collector

Testing of concentrating solar cooker

group. The performance of solar thermal collectors depends heavily on a wide number of factors such as DNI, Ambient temperature, Wind velocity, Latitude and operational temperature. Therefore selection of appropriate and cost effective technology is critical. To facilitate this technology selection and minimizing the payback period, a data bank of different technologies for different operating conditions is being undertaken.

2.2 Testing and Design Group

Development and up gradation of test facility:

- Development of test protocol
  - » Thermal performance
  - » Optical performance
  - » Component testing
- Standardization of system
- Establishment of test standards

Testing and characterization of solar thermal technologies and their components & materials:

- Characterization and evaluation
  - » Solar thermal storage systems/materials (PCM, Sensible, Chemical)
  - » Selective coatings
  - » Thermic fluid

System Design Evaluation and optimization of systems and end use applications:

- » Design and optimization of Solar Thermal/Hybrid power plant.
- » System design for industrial process heat/cooling.
- » Thermal Energy audit.

The Institute has fully developed testing facility for small and large size solar thermal systems and Solar Resource Assessment. Among major projects / facilities include:

- National Solar Thermal Testing, Research and simulation facility.
- Concentrated Solar Thermal Energy Technology based on Parabolic Dish collectors.
- Solar Thermal Stirling Engine.
- Development of Modular Central Receiver Concentrated Solar Power Plant for Decentralized Power Generation.
- High Efficiency Solar Thermal Air-conditioning Systems - a collaborative project of Thermax Limited and NISE.
- Cold Storage with Solar –Biomass Hybrid System.

2.3 National solar thermal power testing, research and simulation facility:

A grid connected solar thermal power plant of 1 MW capacity is being setup at NISE. Partners of implementing consortium are: Indian Institute of Technology, Bombay (lead) Tata Power, Tata Consulting Engineers, Larsen & Toubro, Clique, KIE Solatherm and NISE (MNRE initiative under JNNSM).

The facility envisages a grid connected solar thermal power plant of 1 MW capacity. This will also include a test set up that enables companies and research institutions to test the performance of different solar concentrator options, coatings and materials, components and systems for a solar thermal power plant. In addition, the IIT Bombay led consortium is also developing a solar power plant simulator that simulates the performance of the actual solar thermal plant through component and system models based on appropriate mathematical equations. The details of the simulator are given below:

Solar dish stirling system

Solar Biomass System for electrification and cold storage

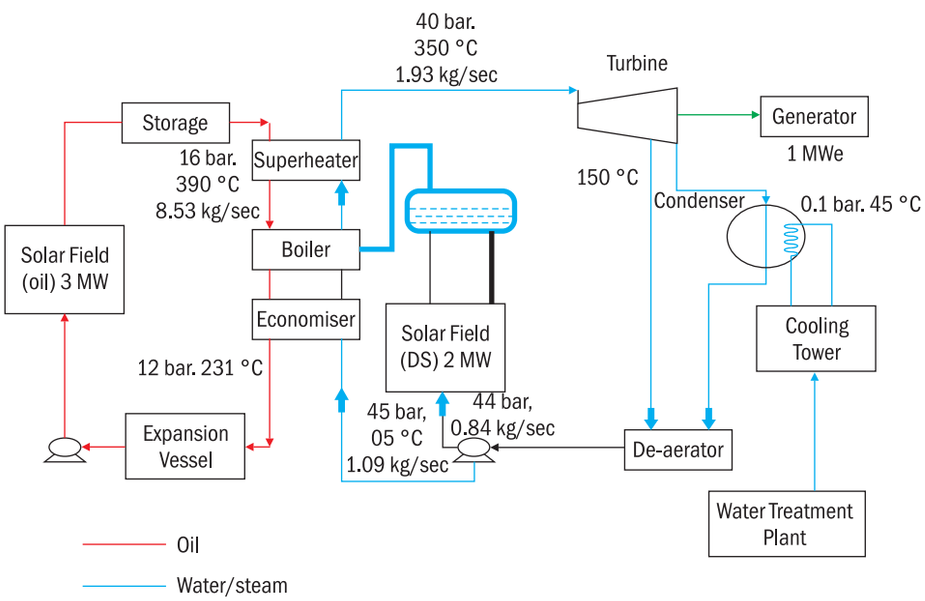
- Simulate performance for an entire solar thermal power plant.
- The development framework: Visual Studio 2008, Net 3.5, C#3.
- Model library for thermodynamic properties (using empirical equations) of working fluids and equipment.
- Model for data input and output.
- Instantaneous and Interval-based simulation.

2.4 Development of a Modular Central Receiver Concentrated Solar Power Plant for Decentralized Power Generation:

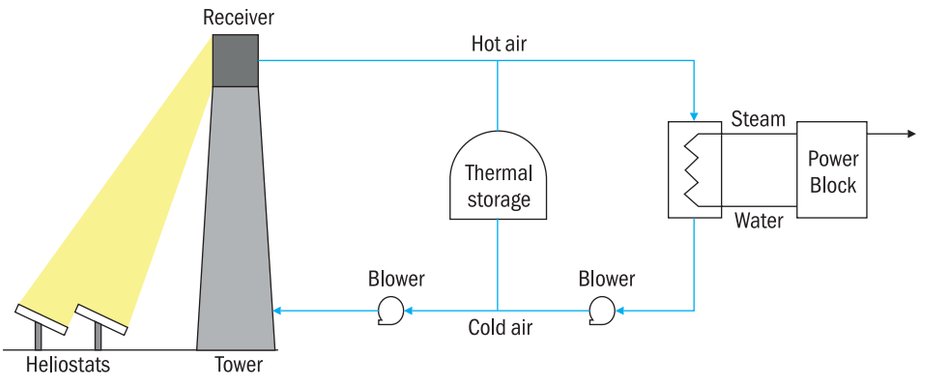
SunBorne Energy with support from MNRE is in the process of setting up a 1 MWTh CSP Central Tower pilot facility in partnership with NISE.

The objectives include:

- Development optimized designs of the heliostat field, volumetric air receiver and thermal storage, the three major components of a Concentrated Solar Power (CSP) Central Receiver plant.
- Development local sources for all the key components of the plant with a focus on lowering costs which will make the technology competitive with other forms of energy.



1 MW Power Plant Process Flow Diagram



Schematic of the proposed pilot power plant

Collaborative Institutions are :

Clean Energy Research Center, University of South Florida

IMDEA Energy, Universidad Rey Juan Carlos, Madrid, Spain,

Indian Institute of Technology, New Delhi,

Institute of Energy Technology, ETH Zurich,

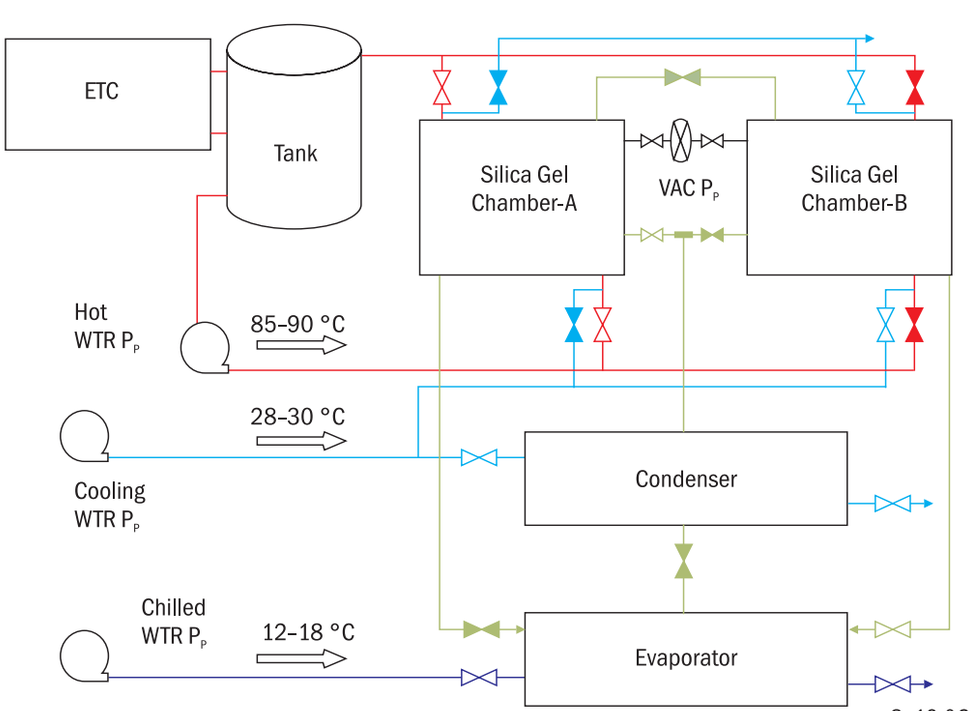
2.5 Solar adsorption air-conditioning

Objective of this project is development of a solar adsorption based space cooling system for parametric study and techno-economic assessment.

Micro-pored silica gel, which has larger adsorption capacity at low humidity, is suitable to be utilized in a closed cycle at sub atmospheric pressure refrigeration system. Water has large latent heat of vaporization and for air-conditioning applications, it is suitable because chilled water temperature required is in the range of 8 to 12°C.

Water, getting heated by solar radiation, desorbs the water vapour from one adsorber bed. The water vapour, thus released, gets cooled in the condenser, and then passed to the evaporator, wherein it again gets evaporated at low pressure, thereby providing cooling. At the same time, the second adsorber adsorbs water vapour from the evaporator.

Thus, the operation of the system follows a periodic succession of cycles. That is, at any time of operation, when one adsorber is in the desorption process (heating period), another adsorber will be in the adsorption process (cooling period). These periods are separated by isosteric heating and cooling of the adsorbers. In this way, a semi-continuous cooling effect may be obtained from the system.



Solar cooling system with adsorbent – adsorbate pair of silica gel and water

CHAPTER-3

RESOURCE ASSESSMENT DIVISION

Resource assessment is an important activity of NISE. 102 Automatic Solar Radiation Monitoring Stations have been installed and commissioned in 11 States under the Ministry's project on Solar Radiation Resource Assessment (SRRA) through Centre for Wind Energy Technology (C-WET) Chennai. Each Station houses various equipment/instruments to measure Direct Normal Irradiance (DNI), Global Horizontal Irradiance (GHI), Diffused Irradiance (DI) along with temperature, relative humidity (RH), wind direction and speed, pressure (weather meteorological data) in automatic mode and transferring the data through GPRS to a Central Receiver Station at C-WET, Chennai. There is a need to calibrate and maintain these equipment for authenticated data. Therefore, calibration and maintenance of equipment located in north India is being undertaken by NISE.

NISE would create a Solar Radiation Calibration Laboratory along with data analysis activities and mapping of solar resources in India. It would have following three activity groups:

- Data validation and Documentation
- Data analysis and modelling
- Mapping

Weather station at NISE

CHAPTER-4

INFORMATION TECHNOLOGY DIVISION

The primary objective of this group is to capitalize on the enormous power that IT and ITES has to offer by integrating all aspects of IT with the day to day functioning of the organization, making it more effective, economic and efficient. The group therefore is responsible for all IT related support, service and technological development required to support and strengthen the organization.

On a high level, the group is being logically divided into a software division, tools used across the organization besides suggesting improvisation on the software used, based on the latest advances in the domain across the world; a hardware division responsible for networking, infrastructure setup, IT assets management and maintenance etc.; a service division responsible for IT related developments including website creation and maintenance, database management, customized software/program development to implement the latest technical advancements as applicable to the organization etc.

CHAPTER-5

SUPPORT PROGRAMMES

5.1 Facilities for training & capacity building activities:

NISE has been carrying out training programmes on various aspects of solar energy and renewable energy including national level training programmes. NISE has also developed specialized training programmes for chartered engineers, professionals, and designers of solar power projects. It has also been carrying out international training programmes on solar photovoltaics and solar thermal activities. The solar PV and solar thermal technologies have been developed in the Institute which is used as a live demonstration for the trainees. It is now proposed to develop the training activity as one of the major and regular activity of NISE for which a schedule will be announced in advance. It is proposed that 12 training programmes would be organized during 2014-15 on various aspects of solar thermal and solar photovoltaic activities for which MNRE has provided funds. A national Solar Energy Training Network (SETNET) is proposed to be established by NISE in collaboration with USAID / India's partnership to Advance Clean Energy Development Technical Assistance Programme (PACE-D). In order to strengthen this activity and facilities, a budget of Rs. 50 lakhs is proposed.

5.2 Visitors' Programme and Human Resource Development:

The 'Visitors' Programme' of NISE aims to utilize the facility and expertise developed at the institute for undertaking scientific projects and interactive research, training and human resource development, dissemination of information and awareness creation. The Visitors' Programme' provides a platform to university and college teachers, students, and researchers from other organizations in the country to study various aspects of renewable energy including execution of short term projects. Under the programme, provisions have been made to award fellowships for researchers and students from all over the country. The programme also offers opportunity to young graduates and postgraduates to initiate a career in new energy technologies.

5.3 Making NISE campus as Smart Campus:

It is proposed that the NISE campus may be made as 'Smart Campus' by converting it into a 'Net zero electricity consuming centre' and use solar energy for in-building and for cooking. In this direction the new building of NISE is a solar passive building. It is proposed that the electrical load of the entire building would be met through in-house power generation from solar thermal power project, SPV power projects and a large part of cooking in the cafeteria would be done through solar steam cooking.

5.4 Setting up of 500 kW photovoltaic power plant for new building:

A detailed exercise has been carried out to assess available plane area and load of the building of NISE. The Details are as follows:

S. No	Building	Plane Area (Sq. metre)	Solar Area Panel (Sq. metre)
1.	Admin. Block	424.66	480.93
2.	Exhibition Block	88.38	100.09
3.	Central Courtyard	127.56	144.46
4.	Guest House	573.91	649.96
5.	Shaded Parking	1500.00	1698.75
Total		2720.00	3074.19

NISE falls under a "Composite" climatic zone of the six climatic zones of India. It is at Latitude 28° 25' N, Longitude 77° E. After a detailed analysis of the radiation pattern and weather parameters, it is observed that the optimum tilt angel will be 25° 42'. It has been found that the range of global radiation on the tilted surface vary from 50 to 950 W/ $m^2$and the maximum percentage of annual energy fall in the 600-900 W/m^2 irradiance range. The average range of ambient temperature at NISE varies from 25-35 °C, the range of humidity is from 25-40% and the wind speed is from 1 to 3 m/s.

Technology demonstration, validation and performance comparison of different solar technology is an important part of NISE activities. Being a newly established organization, and to showcase the strength of solar technologies, it is proposed that a 500 kW solar PV power project may be set up in the campus of NISE with different PV technologies. Accordingly six PV technologies are selected; the proposed capacities of PV arrays of each technology are given below:

Mono-crystalline	–	100kWp
Multi-Crystalline	–	100kWp
HIT-solar cells	–	50kWp
Sun power maxeon	–	50kWp
Thin films-CIGs	-	100kWp
Thin Films CdTe	-	100kWp

The arrays of the proposed technology PV modules will be installed on the roof of Admin block having an area of 500 m^2, exhibition block with an area 100 m^2, central court yard 150 m^2, shaded parking 170 m^2 and guest house approximately 500 m^2. Thus the total available area for PV array installation will be 3500 m^2. It will be possible to accommodate about 350 kWp PV array and balance of 150kWp PV array can be installed on some portion of ground.

It is also proposed that all three inverter configurations centralized, string and hybrid inverters are to be used to make it operational. In this way a customized PV technology based smart grid will be set up to handle all types of loads of Admin block, exhibition block, central court yard, guest house and shaded parking. This serves not only a technology demonstration but also provides highly stable and quality power supply at NISE. The above power plant of different PV technologies is expected to generate approximately 0.7 million units of electrical power annually which is more than the expected consumption of NISE. This amounts to a generation of 1400 units per kWp of installed PV array capacity.

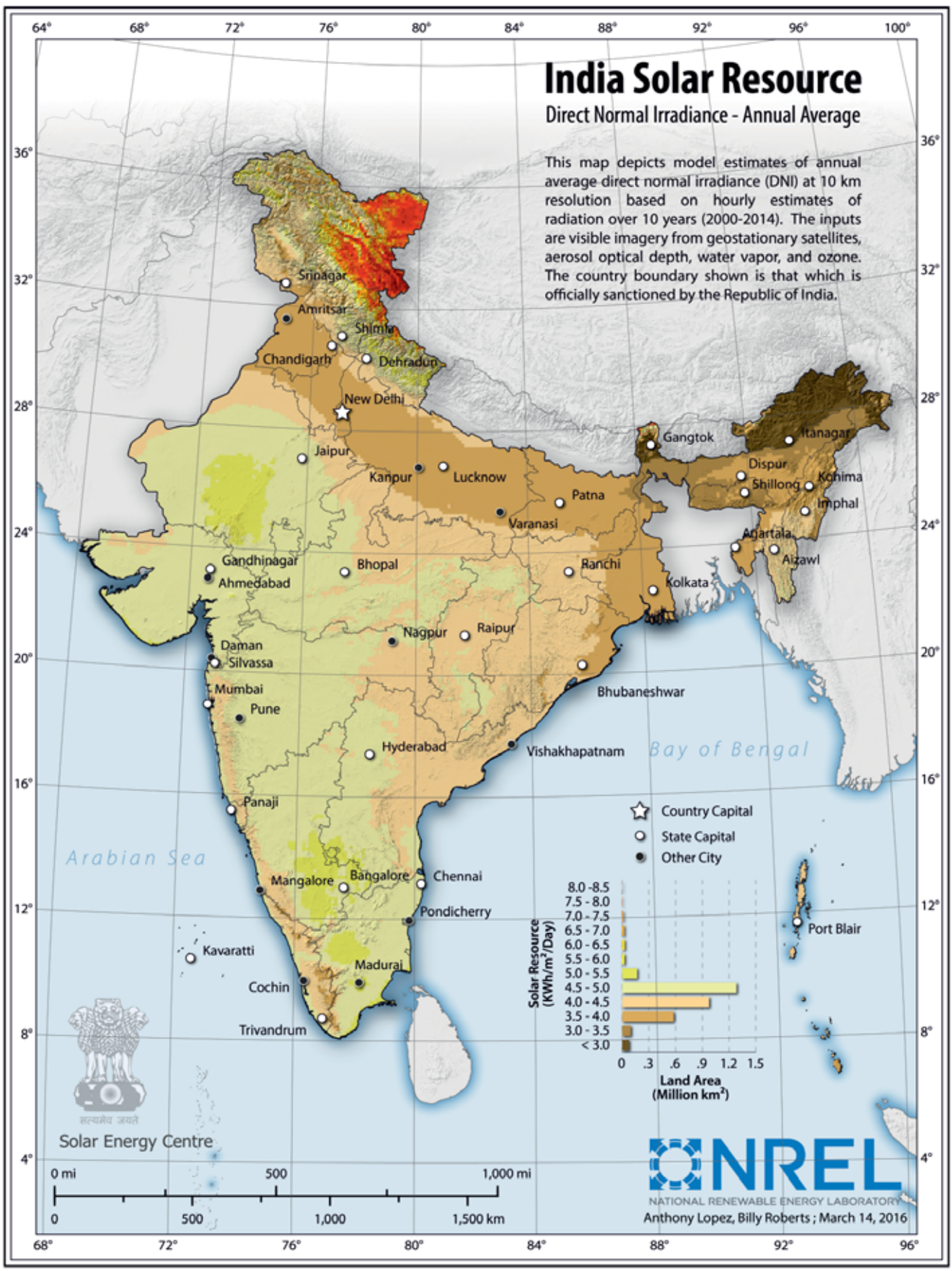
5.5 Solar steam cooking system for NISE

It is proposed to set up a Solar Cooking System at NISE. Steam and direct (roti or fry) both type of cooking are proposed here. It is proposed to go for a hybrid and fully automatic system for harnessing maximum solar energy. Fossil fuel (LPG) will accomplish only the deficit of solar output during the cloudy and non-sunny days. The system will consist LPG and Solar Hybrid boiler, thermic fluid, microprocessor-based tracking mechanism, parabolic collector, insulated oil storage container, steam cooking vessel and hot plate (for Roti).

Solar collector of 60 m^2 area is requisite to cook three meal/day for 200 people. 113 kg of steam @150°C is required for the same. The solar cooking system will reduce use of LPG and bring in savings for the institute. The table below details the upfront investment needed by the institute and the payback period. For better efficiency of system, a solar LPG hybrid system is being proposed.

Financial Requirement to make a Smart Campus

S.No	System	Total cost (Rs. in Crore)
1.	500 kW SPV power plant	Rs. 5.00 crore
2.	SPV inverters	Rs. 1.00 crore
3.	Integration with building	Rs. 0.20 crore
4.	Smart Grid facilities	Rs. 0.30 crore
5.	60 sq m Solar Thermal Dish	Rs. 0.25 crore
6.	Man power	Rs. 0.30 crore
7.	Contingency	Rs. 0.10 crore
Total		Rs. 7.15 crore


India Solar Resource
Direct Normal Irradiance - Annual Average
This map depicts model estimates of annual average direct normal irradiance (DNI) at 10 km resolution based on hourly estimates of radiation over 10 years (2000-2014). The inputs are visible imagery from geostationary satellites, aerosol optical depth, water vapor, and ozone. The country boundary shown is that which is officially sanctioned by the Republic of India.
Srinagar
Amritsar
Shimla
Chandigarh
Dehradun
New Delhi
Jaipur
Kanpur
Lucknow
Patna
Varanasi
Gangtok
Itanagar
Dispur
Shillong
Kohima
Imphal
Aizawl
Agartala
Kolkata
Ranchi
Gandhinagar
Ahmedabad
Bhopal
Nagpur
Raipur
Daman
Silvassa
Mumbai
Pune
Bhubaneshwar
Hyderabad
Vishakhapatnam
Bay of Bengal
Arabian Sea
Panaji
Mangalore
Bangalore
Chennai
Pondicherry
Kavaratti
Madurai
Cochin
Trivandrum
Port Blair
Country Capital
State Capital
Other City
Solar Resource (KWh/m²/Day)
8.0 -8.5
7.5 - 8.0
7.0 - 7.5
6.5 - 7.0
6.0 - 6.5
5.5 - 6.0
5.0 - 5.5
4.5 - 5.0
4.0 - 4.5
3.5 - 4.0
3.0 - 3.5
< 3.0
0 .3 .6 .9 1.2 1.5
Land Area (Million km²)
Solar Energy Centre
0 mi 500 1,000 mi
0 500 1,000 1,500 km
NREL
NATIONAL RENEWABLE ENERGY LABORATORY
Anthony Lopez, Billy Roberts ; March 14, 2016

CHAPTER-6

FINANCE & ACCOUNTS

V.D. TIWARI & CO.
Chartered Accountants

INDEPENDENT AUDITOR'S REPORT

To the Members of M/s National Institute of Solar Energy

Report on the Financial Statements

We have audited the accompanying financial statements of M/s National Institute of Solar Energy ("the Society"), registered and regulated by Haryana Registration & Regulation of Societies Act, 2012, which comprise the Balance Sheet as at March 31, 2014 and the Statement of Income & Expenditure for the year then ended, and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation of these financial statements that give a true and fair view of the financial position, financial performance of the Society in accordance with accounting principles generally accepted in India, including the Accounting Standards and pronouncements of the Institute of Chartered Accountants of India. This responsibility includes the design, implementation and maintenance of internal control relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the Society's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of the accounting estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Address: 201, Mahavir Bhawan, Najafgarh Road Commercial Complex, Opp. Milan Cinema, New Delhi- 110015
Phone No: 011-25920096, 45734000, 65164460

V.D. TIWARI & CO.
Chartered Accountants

Opinion

In our opinion and to the best of our information and according to the explanations given to us, the financial statements 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 Society as at March 31, 2014.

(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 V.D. Tiwari & Co.
Chartered Accountants
F.R.No: 002882N

Narender Kr. Tiwari
Partner
M.No: 506919

Place: New Delhi
Date : 13th January, 2015

Address: 201, Mahavir Bhawan, Najafgarh Road Commercial Complex, Opp. Milan Cinema, New Delhi- 110015
Phone No: 011-25920096, 45734000, 65164460

National Institute of Solar Energy
(An Autonomous Institute of Ministry of New and Renewable Energy, Government of India)
Gwal Pahari, Gurgaon - Faridabad Road, Gurgaon -122003
Tel. No. : 0124-2579207, 2579252 Fax : 0124-2579207
• Email : dgnise.mnre@gmail.com

Balance Sheet as at 31st March 2014

(Amount -in Rs.)

CORPUS / CAPITAL FUND AND LIABILITIES	Schedule	Current Year	Previous Year
CORPUS / CAPITAL FUND	1	-	-
RESERVES AND SURPLUS	2	3,88,60,000	-
EARMARKED / ENDOWMENT FUNDS	3	-	-
CURRENT LIABILITIES AND PROVISIONS	4	7,464	-
TOTAL		3,88,67,464	
ASSETS			
FIXED ASSETS	5	-	-
CURRENT ASSETS, LOANS, ADVANCES ETC.	6	3,88,60,910	-
MISCELLANEOUS EXPENDITURE (to the extent not written off or adjusted)		6,554	-
TOTAL		3,88,67,464	-

Significant accounting policies contingent liabilities and notes on accounts as per our separate report of even date attached.

For V.D. Tiwari & Co.
(FRN: 002882N)

TIWARI & CO. Chartered Accountants

CA Narender Kr. Tiwari
(Partner)
M.No: 506919
Place: New Delhi
Date : 13th January, 2015

For National Institute of Solar Energy
Director General

National Institute of Solar Energy NISE Ministry of New and Renewable Energy GURGAON

For National Institute of Solar Energy
Dy. Director General

National Institute of Solar Energy
(An Autonomous Institute of Ministry of New and Renewable Energy, Government of India)
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• Email : dgnise.mnre@gmail.com

Income and Expenditure Statement for the Year Ended 31st March, 2014

(Amount –in Rs.)

INCOME	Schedule	Current Year 2013-14	Previous Year
Income from Sales / Services	-	-	-
Grants / Subsidies	-	-	-
Fees / Subscriptions	-	-	-
Income from Invest.(Income on Invest. from earmarked/endow.Funds transferred to Funds.)	-	-	-
Income from Royalty, Publication etc.	-	-	-
Interest Earned	-	-	-
Other Income	-	-	-
TOTAL (A)		NIL	NIL
EXPENDITURE	-	-	-
Establishment Expenses	-	-	-
Other Administrative Expenses etc.	-	-	-
Expenditure on Grants, Subsidies etc.	7	-	-
Interest	-	-	-
Depreciation (Net Total at the year-end - corresponding to Schedule 8)	-	-	-
TOTAL (B)		NIL	NIL
Balance being excess of Expenditure over Income (B - A)		-	-
Less : Transfer to Earmarked/Endowment Funds - Schedule 3		-	-
Transfer to / from General Reserve		-	-
BALANCE BEING SURPLUS / (DEFICIT) CARRIED TO CORPUS/ CAPITAL FUND		NIL	NIL

Significant accounting policies contingent liabilities and notes on accounts as per our separate report of even date attached.

For V.D. Tiwari & Co.
(FRN: 002882N)

CA Narender Kr. Tiwari
(Partner)
M.No: 506919
Place: New Delhi
Date : 13th January, 2015

For National Institute of Solar Energy
Director General

For National Institute of Solar Energy
Dy. Director General

National Institute of Solar Energy
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SIGNIFICANT ACCOUNTING POLICIES & NOTES TO ACCOUNTS FOR THE PERIOD ENDING 31ST MARCH 2014

1. Registration

The Institute has been registered under Haryana Regn. & Regulation of Societies Act 2012 with No. HR01801092 dated 28TH October 2013.

2. Objective of the society

Undertaking and/or sponsoring Research & Development projects on various aspects of Solar Energy Technologies. Assisting Ministry of New & Renewable Energy ('MNRE') in implementing the National Solar mission objectives through appropriate mechanisms, evolving S&T programs and projects, facilitating work related to demonstration and technology validation of solar projects Imparting technical education related to Solar Energy to National as well as International bodies with collaboration of MNRE & Ministry of External Affairs or any other task assigned by the Government of India from time to time.

3. Basis of Accounting

The Institute is following double entry accounting based on mercantile system in accordance with the generally accepted accounting principles.

4. Grants from Parent Body, Ministry of New and Renewable Energy (GOI)

Government of India, Ministry of New & Renewable Energy has sanctioned the establishment National Institute of Solar Energy as an Autonomous Institute of Ministry under the Haryana Regn. & Regulation of Societies Act 2012.Grant is received from MNRE and accounted in books as and when received. They are to be utilized as per the norms notified by MNRE from time to time. Year Wise Details of Grant Released from MNRE to NISE till 31st March 2014 is as below:

Year Wise Details of Grant Released from MNRE (GOI) to NISE as on 31st March 2014

(Amount in Rs.)

Sr.No	Financial Year	Grant Received	Cumulative Grant
1	2013-2014	3,70,00,000	3,70,00,000
	Total		**3,70,00,000**

National Institute of Solar Energy Ministry of New and Renewable Energy GURGAON

V. D. TIWARI & CO. Chartered Accountants

5. **Project Funds from other sources**

Various funds been received from other consortiums for enhancement of Research and Development related to solar energy and ancillary fields. They are accounted in books as and when received and are utilized as per the norms notified by the consortiums. Year Wise Details of Grant Released from various Consortiums to NISE till 31st March, 2014 is as per the below table:

Year Wise Details of Grant Released from various Consortiums as on 31st March 2014

(Amount in Rs.)

Sr.No	Financial Year	Name of Consortium	Grant Received	Cumulative Grant
1	2013-2014	INDO-UK STAPP	18,60,000	18,60,000
			Total	**18,60,000**

For V.D. Tiwari & Co.
(FRN: 002882N)

CA Narender Kr. Tiwari
Partner
M.No:506919
Place: New Delhi
Date : 13th January, 2015

For National Institute of Solar Energy
Director General

For National Institute of Solar Energy
Dy. Director General

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March, 2014

(Amount - in Rs.)

		Current Year (F.Y 2013-14)	Previous Year
SCHEDULE 1 - CORPUS / CAPITAL FUND :			
Balance as at the beginning of the year		-	-
	Add: Grant Fund Carried Forward to Subsequent years Expenditure	-	-
	Add/ (Deduct) : Balance of net income/ (expenditure) transferred from the Income and Expenditure Account	-	-
	BALANCE AS AT THE YEAR - END	**NIL**	-
SCHEDULE 2 - RESERVES AND SURPLUS :			
1. Inaugural of New NISE Building			
	Opening Balance	30,00,000	-
	Add : Addition during the year	NIL	-
	Less: Deductions during the year	NIL	-
	Sub Total (1)	30,00,000	-
2. Indo UK STAAP Project-MNRE			
	Opening Balance	18,60,000	-
	Add : Addition during the year	NIL	-
	Less: Deductions during the year	NIL	-
	Sub Total (2)	18,60,000	-
3. R&D Cell Grant -MNRE			
	Opening Balance	1,00,00,000	-
	Add : Addition during the year	NIL	-
	Less: Deductions during the year	NIL	-
	Sub Total (3)	1,00,00,000	-
4. SPV Power Plant Grant -MNRE			
	Opening Balance	1,80,00,000	-
	Add : Addition during the year	NIL	-
	Less: Deductions during the year	NIL	-
	Sub Total (4)	1,80,00,000	-
4. Grant for 12 Training Programmes			
	Opening Balance	60,00,000	-
	Add : Addition during the year	NIL	-
	Less: Deductions during the year	NIL	-
	Sub Total (5)	60,00,000	-
	Total Grant in Aid from(1 to 5)	**3,88,60,000**	-

Significant accounting policies contingent liabilities and notes on accounts as per our separate report of even date attached.

For V.D. Tiwari & Co.
(FRN: 002882N)

CA Narender Kr. Tiwari
(Partner)
M.No: 506919
Place: New Delhi
Date : 13th January, 2015

For National Institute of Solar Energy
Director General

For National Institute of Solar Energy
Dy. Director General

Schedules Forming Part Of Balance Sheet As At 31st March, 2014

(Amount – in Rs.)

SCHEDULE 3 - EARMARKED / ENDOWMENT FUNDS	FUND - WISE BREAK UP			TOTALS		
	Fund WW	Fund XX	Fund YY	Fund ZZ	Current Year	Previous Year
a) Opening balance of the funds	-	-	-	-	-	-
b) Additions to the Funds :						
i. Donations / grants	-	-	-	-	-	-
ii. Income from Investments made on account of funds	-	-	-	-	-	-
iii. Other additions (Specify nature)	-	-	-	-	-	-
TOTAL (a + b)	-	-	-	-	-	-
c) Utilisation / Expenditure towards objectives of funds						
i. Capital Expenditure	-	-	-	-	-	-
- Fixed Assets	-	-	-	-	-	-
- Other	-	-	-	-	-	-
Total	-	-	-	-	-	-
ii. Revenue Expenditure						
- Transfer of Excess of Expenditure Over Income	-	-	-	-	-	-
Total	-	-	-	-	-	-
TOTAL (C)	-	-	-	-	-	-
NET BALANCE AS AT THE YEAR- END (a + b - c)	NIL	NIL	NIL	NIL	NIL	NIL

Significant accounting policies contingent liabilities and notes on accounts as per our separate report of even date attached.

Notes:

1) Disclosures shall be made under relevant heads based on conditions attaching to the grants
2) Plan Funds received from the Central / State Governments are to be shown as separate Funds and not to be mixed up with any other Funds

For V.D. Tiwari & Co.
(FRN: 002882N)

V.D. TIWARI & CO. Chartered Accountants

CA Narender Kr. Tiwari
(Partner)
M. No: 506919
Place: New Delhi
Date : 13th January, 2015

National Institute of Solar Energy NISE Ministry of New and Renewable Energy GURGAON

For National Institute of Solar Energy
Director General

For National Institute of Solar Energy
Dy. Director General

Schedules Forming Part Of Balance Sheet As At 31st March, 2014

	Current Year		Previous Year
SCHEDULE 4- CURRENT LIABILTIES AND PROVISIONS			
A. CURRENT LIABILITIES			
1. Acceptances	-		-
2. Sundry Creditors:	-		-
a) Solar Energy Centre		7,464.00	-
3. Advances Received	-		-
4. Interest accrued but not due on:	-		-
a) Secured Loans/borrowings	-		-
5. Statutory Liabilities:			
a) TDS Payable	-		-
b) CGEGIS Payable	-		-
c) CGHS Payable	-		-
d) GPF Payable	-		-
e) Contribution to other fund	-		-
f) GSLIC Payable	-		-
6. Other Current Liabilities			
a) Salary Payable	-		-
b) Accounting Charges Payable	-		-
TOTAL (A)		7,464.00	
B. PROVISIONS			
1. For Taxation	-		-
2. Gratuity	-		-
3. Superannuation/Pension	-		-
4. Accumulated Leave Encashment	-		-
5. Trade Warranties/Claims	-		-
6. Others (Specify)	-		-
TOTAL (B)	NIL		-
TOTAL (A+B)		**7464.00**	-

Significant accounting policies contingent liabilities and notes on accounts as per our separate report of even date attached.

For V.D. Tiwari & Co.
(FRN: 002882N)

V.D. TIWARI & CO. Chartered Accountants

CA Narender Kr. Tiwari
(Partner)
M.No: 506919
Place: New Delhi
Date : 13th January, 2015

For National Institute of Solar Energy
Director General

National Institute of Solar Energy NISE Ministry of New and Renewable Energy GURGAON

For National Institute of Solar Energy
Dy. Director General

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March, 2014

SCHEDULE 5 -FIXED ASSTES Description	Rate of Dep(%)	Gross Block				Depreciation				Net Block	
		Cost/valuation at the beginning of the year	Addition during the year	Deductions during the year	Cost/valuation at the year end	As at the beginning of the year	On Addition during the year	On Deductions during the year	Total up to the year end	As at the Current year end	As at the Previous year end
1 **FIXED ASSETS:** Land : a) Freehold b) Leasehold 2 Buildings : a) On Freehold Land b) On Leasehold Land c) Ownership Flats/Premises d) Superstructures on Land not belonging to the entity 3 Plant Machinery & Equipment : 4 Vehicles 5 Furniture & Fixtures 6 Office Equipments : 7 Computer /Laptop/ Peripherals/ : 8 Electric Installations 9 Library Books 10 Tubewells & Water Supply 11 Other Fixed Assets	NIL										
Total of Current Year											
Previous Year											
B. CAPITAL WORK IN PROGRESS											
TOTAL		NIL									

Significant accounting policies contingent liabilities and notes on accounts as per our separate report of even date attached

For V.D. Tiwari & Co.
(FRN: 002882N)

CA Narinder Tiwari
(Partner)
M.No: 503170
Place: New Delhi
Date : 13th January, 2015

For National Institute of Solar Energy
Director General

For National Institute of Solar Energy
Dy. Director General

Schedules Forming Part Of Balance Sheet As At 31st March, 2014

(Amount-in Rs)

Schedule 6 - Current Assets, Loans, Advances Etc.	Current Year	Previous Year
A. CURRENT ASSETS:		
1. Inventories:		
a) Stores and Spares	-	-
b) Loose Tools	-	-
c) Stock-in-trade		
Finished Goods	-	-
Work-in-progress	-	-
Raw Materials	-	-
2. Sundry Debtors		
a) Debts Outstanding for a period exceeding six months	-	-
b) Others	-	-
3. Cash balances in hand (including cheques/drafts and imprest)	-	-
4. Bank Balances		
a) With Scheduled Banks:		
-On Current Accounts	-	-
-On Deposit Accounts (includes margin money)	-	-
-On Savings Accounts	3,88,60,910	
b) With non- Scheduled Banks:		
-On Current Accounts	-	-
-On Deposit Accounts	-	-
-On Savings Accounts	-	-
5. Post Office-Savings Accounts	-	-
TOTAL (A)	3,88,60,910	-

For V.D. Tiwari & Co.
(FRN: 002882N)

CA Narinder Tiwari
(Partner)
M.No: 503170
Place: New Delhi
Date : 13th January, 2015

For National Institute of Solar Energy
Director General

For National Institute of Solar Energy
Dy. Director General

Schedules Forming Part Of Income & Expenditure For The Period/Year Ended 31st March, 2014

(Amount in Rs.)

		Current year	Previous year
SCHEDULE 7-EXPENDITURE ON GRANTS, SUBSIDIES ETC.			
a)	Grants given to Institution/Organisations	-	-
b)	Subsidies given to Institutions/Organisations	-	-
	TOTAL	-	-
	Note:- Name of the Entities, their Activities along with the amount of Grants/Subsidies are to be disclosed.		

Significant accounting policies contingent liabilities and notes on accounts as per our separate report of even date attached.

For V.D. Tiwari & Co.
(FRN: 002882N)

V.D. TIWARI & CO. Chartered Accountants

CA Narender Kr. Tiwari
(Partner)
M.No: 506919
Place: New Delhi
Date : 13th January, 2015

For National Institute of Solar Energy
Director General

National Institute of Solar Energy NISE Ministry of New and Renewable Energy GURGAON

For National Institute of Solar Energy
Dy. Director General

www.nise.res.in

NATIONAL INSTITUTE OF SOLAR ENERGY
(An Autonomous Institute of Ministry of New and Renewable Energy Government of India)
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