ANNUAL REPORT 2016-17

World Institute of Sustainable Energy

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ABOUT WISE

The World Institute of Sustainable Energy (WISE) is a not-for-profit organization established in 2004, based in Pune, India. WISE is committed to the cause of promoting sustainable energy and sustainable development through the advancement of low-carbon, renewable, and energy efficient pathways that pave the way to achieving the sustainable goals of energy security, livelihood security, and climate security.

Since its inception, WISE has pioneered many important initiatives. These include:

- Developing state-level action plans/roadmaps for climate mitigation through accelerated deployment of clean energy technologies and energy efficiency measures.
- Developing a renewable energy pathway for achieving the target of 15% renewable energy by 2020, as specified by the National Action Plan on Climate Change (the Government of India officially accepted WISE's findings for inclusion in the five-year plan targets).
- Developing state-level vision documents and renewable energy action plans for the transition to a low-carbon and energy efficient economy.
- Facilitating India's transition towards low carbon development by supporting implementation of national policies and programs through the development of offshore wind power (for the first time ever) in India, in collaboration with the EU (as part of a global consortium).
- Developing state-level policies and capacity building for renewable development agencies.
- Research in critical areas like transition to a sustainable energy system by 2050, wind power and solar energy, power sector reforms, etc.
- Piloting a model Renewable Energy law for India.

Our Work with International Governments has led to:

- strengthening cooperation with and building capacities of member countries.
- developing implementation mechanisms for accelerating RE development and fostering sustainable development in India.

Our work with the Central and State Governments of India has led to:

- development of roadmaps and regulatory frameworks for advancing RE development in the country.
- facilitating renewable energy in twelve states, including Maharashtra, Rajasthan and Gujarat (west); Kerala, Karnataka, Tamil Nadu and the UT of Puducherry (south); Bihar and Uttar Pradesh (north); Chhattisgarh (central); West Bengal and Odisha (east).

Our work with the RE Industry/Associations has resulted in:

- introducing appropriate financing mechanisms and boost indigenous manufacturing within the sector.
- enhancing human resources/skills development to build competencies, strengthen the sustainable energy sector, and ensure the smooth transition to a low-carbon economy.

Reflections

There are moments in the history of an institution when you feel that the raison d'etre of its establishment and existence has been more than vindicated. For us in WISE, 2016-17 has been such a year, when few major policy initiatives were taken by the government for accelerating development of renewables in the country. The Government of India announced a policy for repowering of old wind power projects, for which WISE has in the past supported MNRE to develop the basic data and framework. The announcement of the draft wind –solar hybrid policy has been another landmark; we have been propagating this idea for a long time. Other major initiatives were inclusion of RE in the GST framework, the migration from feed-in-tariff to competitive bidding etc.

A major highlight of WISE's work during the year was our selection for the development of power procurement and power distribution business models for the first greenfield smart city being developed in Gujarat, which is part of the Delhi-Mumbai corridor project. This was an extension of our regulatory work. Another major new initiative, was the beginning of work on the comprehensive portal for renewables in India – 'all about renewables'. This unique initiative is supported by the Shakti Sustainable Energy Foundation. The U.S. National Academy of Sciences chose WISE to prepare a comprehensive O&M Manual for solar projects, as part of the USAID supported PEER programme.

As would be seen from the variety of projects we undertook during the year, our contributions to low-carbon development has been significant. While the country is making major strides in capacity addition of RE, we would also hope that the country builds up a strong manufacturing base, with a vertically integrated supply chain for solar power in India. This will greatly contribute to the 'Make in India' initiative.

Since the 2015 Paris Agreement, India is a major player in the global climate mitigation efforts. Being part of the solution will also reap domestic benefits or co-benefits. Along with accelerating RE development, we should also comprehensively address other critical issues in the journey towards sustainable development. Because renewables is just one part of sustainability.

G M Pillai

Founder Director General

Power Policy and Regulation

Facilitating development of renewable energy-based decentralized generation (mini-grids) in the state of Odisha was one of the key activities undertaken by WISE this year.

Development of Mini-Grid Renewable Energy Regulations for Odisha

Majority of the people living in remote, rural areas in India still do not having access to electricity which is vital for a better quality of life. To address this critical issue, WISE with support from the Shakti Sustainable Energy Foundation, took up the important task of facilitating development of renewable energy-based decentralized distributed generation and supply (mini-grids) in the state of Odisha.

The major outcomes of the assignment were:

- Formulation of mini-grid renewable energy generation and supply regulations.
- Enhance the capacity of the state to advocate, promote and deploy RE-based, mini-grid projects on a large scale.
- Enhance energy access and socio-economic development of the underserved/un-electrified rural areas in the state.

WISE worked closely with officials of the Odisha Electricity Regulatory Commission and based on their inputs and those received from the Odisha Renewable Energy Development Agency (OREDA), and the extensive background research by WISE, an initial approach paper was prepared. The paper detailed the different options available for establishing a mini-grid regulatory framework in Odisha.

The final approach paper and a comparative paper on Regulations framed by other ERCs were submitted to OERC in January 2017. Subsequently, a presentation was made before OERC highlighting the options available before the Commission for various issues related to mini-grid regulations. The work is currently ongoing.

Development of Power Distribution Business Models and Power Procurement for New-age, Smart City

A new-age, smart city is being developed along the dedicated freight corridor planned between Delhi and Mumbai. The Smart City's transmission and distribution system will use state-of-the-art technologies, including smart grids that would help provide high quality and reliable power, matching or exceeding the benchmarks of developed cities the world over. The project management consultant for the city engaged WISE to evolve power sourcing and distribution business models and support them on various technical tasks/matters. After analyzing the power requirement for different consumer classes of the city, WISE evolved various business models for power distribution, as well as options available for power procurement. These were presented and discussed in a workshop and stakeholder's comments were invited. The project is currently ongoing.

Determining Tariffs for the Gujarat Electricity Regulatory Commission

WISE was appointed by the Gujarat Electricity Regulatory Commission (GERC) for preparation of a discussion paper and associated work for determining the tariff for four RE technologies – wind, biomass and bagasse based co-generation, small hydro, and MSW-to-energy. The scope of work under each technology included:

A. Preparation of a discussion paper considering factors affecting the tariff for RE power projects which *inter-alia* include (i) capital cost, (ii) life, (iii) plant load factor (PLF), (iv) O&M charges, (v) fuel cost related parameters, if applicable, and (vi) financial parameters like depreciation, interest on loan and interest on working capital, loan repayment period, etc.
B. Attend public hearings, if any, arranged by the Commission, analyse the suggestions/objections made by the stakeholders (before and after the public hearing) and incorporating the same in subsequent documentation.
C. Analysis and submission of final orders to GERC, incorporating the comments on discussion paper.

WISE prepared each discussion paper after duly analysing the relevant policies and regulations applicable in the state as well as data associated with each RE technology. Along with the tariff, other commercial issues related to open access transactions were also included. The discussion papers were then presented to GERC for their comments. Further, WISE also attended the public hearings held at GERC and the final orders were prepared after incorporating the comments / suggestions received. Except biomass, the final orders for the other RE technologies were issued during the year under review.

Consumer Counsel for the Odisha Electricity Regulatory Commission

WISE is Consumer Counsel for Odisha Electricity Regulatory Commission since 2011 and assisted the Commission in systematic analysis of the annual revenue requirement (ARR) and tariff petitions submitted by the power utilities of the state for 2017-18. The scope of work included preparing a summary of and analysis of the tariff petitions filed by the utilities (from the consumer's perspective) and ARR, and presenting these during public hearings at OERC. The power utilities who submitted the petitions were generating and transmission companies, bulk suppliers, load despatch centre and distribution companies.

The summaries and detailed analyses by WISE were finally incorporated in the respective tariff orders issued by OERC.

Tariff Fixation for a Waste-To-Energy Project in Kolhapur

The Kolhapur Green Energy Pvt. Ltd. (KGEPL) engaged WISE in determining the tariff for a 1.8 MW municipal solid waste (MSW)-to-power project in Kolhapur. WISE prepared the tariff fixation petition, presented the case before the Maharashtra Electricity

Regulatory Commission (MERC), and attended the technical validation sessions and public hearings, defended the arguments and queries, and took in-principle approval from the Maharashtra Energy Development Agency for setting up the project. Following WISE's efforts, the final tariff order was passed by MERC in October 2016

Providing Regulatory Assistance to the Mula Pravara Rural Electric Cooperative Society

The 'Mula Pravara Rural Electric Cooperative Society (MPECS)', has license to supply electricity in 183 villages covering 1880 sq.km. area in Shrirampur and Rahuri talukas (completely) and Newasa, Rahata and Sangamner talukas (partially) in Ahmednagar district of Maharashtra. WISE supported MPECS to re-examine the rationale and decisions of MERC that resulted in termination of its license. WISE further started preparation of a comprehensive report on Bulk and Retail Supply Tariff (as approved by MERC) during the license period up to 2011. The scope of work included:

- Study the decision of the Government of Maharashtra to apply a viable bulk supply tariff to the distribution licensee and the effect of its implementation.
- Study the tariff orders of MERC in fixing a fully allocated cost-based bulk supply tariff, right from 2000-01, and analyse the revenue realization as per the equivalent retail tariff fixed for MSEDCL from time to time during the license period.
- Provide an opinion on the methodology followed by MERC while fixing the bulk supply tariff and pass on distribution losses and various operating costs of MSEDCL.
- Study the tariff philosophy adopted by other state electricity regulatory commissions in similar case.

The project is currently ongoing.

Analysis of the MERC (Draft) RE Tariff Order for SHP

The Maharashtra Electricity Regulatory Commission as per the MERC (Terms and Conditions for Determination of Renewable Energy Tariff) Regulations, 2015, had notified the draft tariff order in the matter of determination of generic tariff for renewable energy technologies for 2017-18. WISE analysed the draft tariff order published by MERC for SHP projects. The normative parameters proposed by the Commission for tariff determination, especially the capital cost, interest rate and O&M expenses were analysed.

Based on the above, WISE presented the range of capital costs applicable for SHP projects. Similarly, analysis on O&M expenses for 2017-18 was also presented.

RENEWABLE ENERGY

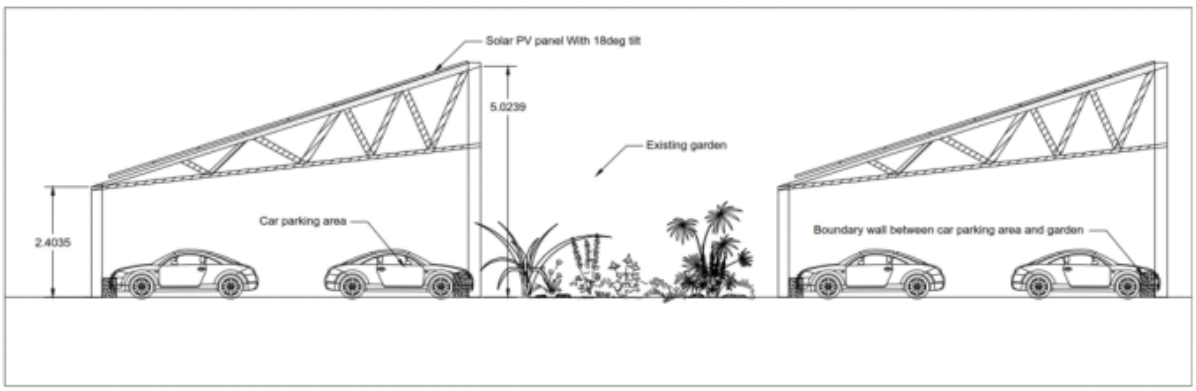
RE TECHNOLOGIES

SOLAR POWER

Feasibility Studies for Installation of Solar Power Plants for the Kochi Metro Rail and other Companies across India

Kochi Metro Rail Limited

WISE assisted the Kochi Metro Rail Limited (KMRL) in conducting a feasibility analysis for installing 2.4 MW ground-mounted solar power plants at their yard in the rural area of *Muttom* in *Idduki* district. Site visits, contour map preparation, and soil tests were carried out and detailed design of the power plants was undertaken in due consultation with KMRL. Technical analysis was carried out which included overview of the state policy and regulatory framework, overview of solar power generation technologies and their performance, solar radiation assessment including irradiance values such as Global Horizontal Irradiance (GHI) and diffuse radiation by using best-in-class METEONORM software and sources, project capacity evaluation, estimation of expected generation, preparation of electrical SLD, plant layout, power evacuation methods, feasibility of agro-farming under solar PV plant and PV panel recycling methods. Final report was submitted within 90 days of project commencement.



Proposed car port model designed by WISE for BP Oman, BINA, MP

NMDC complex in Chhattisgarh where rooftop solar plants were installed under WISE's guidance and technical supervision.

Bharat Oman Refineries Limited

Bharat Oman Refineries Limited, assigned WISE with the task of conducting a feasibility study for installation of 250 kW solar PV power plant atop their car parking shed in Bina, Madhya Pradesh. The site visit involved a weather parameter study, solar radiation assessment including irradiance values such as Global Horizontal Irradiance (GHI) and diffuse radiation by using best-in-class METEONORM software and sources, project capacity evaluation, estimation of expected generation, preparation of electrical SLD, plant layout and power evacuation methods, besides overview of the state policy and regulatory framework. Different options for a car port structure were provided by WISE along with the financial analysis comprising BOM, tentative cost, and rate of return calculation. WISE successfully completed and submitted the feasibility report.

KVN Innovations and Project Pvt Ltd

KVN Innovations and Project Pvt Ltd, Telangana, sought WISE's support for conducting feasibility studies (technical and financial) on concentrated solar thermal (CST) systems with compact linear fresnel reflector (CLFR) technology, which included a) trackers, b) structures and reflector assemblies, c) receiver tubes, and d) thermal energy storage systems. For techno-feasibility study, WISE considered analysis of two technologies other than CLFR. The project involved developing a solar PV feasibility report as well. Both the feasibility reports (thermal and PV) were submitted within a span of two months of the project start date.

Installation of Rooftop Solar at NMDC's Units in Three States

The National Minerals Development Corporation (NMDC) Limited approached WISE for supporting them in installing rooftop solar projects at their production units located in Chhattisgarh, Telangana, and Karnataka. For installation of rooftop solar plants, site visits to all the three states were carried out effectively and data related to weather parameters, rooftop geography, shadow effect, electrical load, electricity consumption patterns and requirement of each NMDC complex administration, etc., was duly collected and analysed.

Project reports for each NMDC production unit was prepared separately. Since each production unit has a number of rooftops and they are not physically connected, each rooftop was considered as a separate entity for the purpose of carrying out the feasibility analysis. These included, simulation of power plant using PVsyst, shadow analysis, electrical SLD, structural drawings, plant layouts, etc. Common financial models for each production unit were prepared accordingly. Post WISE's intervention, NMDC went on to install the rooftop plants.

The WISE and CRISIL team at Maher, Pune. Also seen (center) is Sister Lucy Kurien, Founder of Maher.

WISE also completed the feasibility study for a 10 MW ground-mounted project for NMDC at their sponge Iron Unit in Paloncha, Telangana, which involved the study of climatic and geographic parameters, plant layouts, space utilization factor, power evacuation methods, etc. Financial feasibility study was also conducted for different energy evacuation models based on suggestions provided. The final report along with the techno-economic document was submitted within a month of the project period.

Installation of Solar PV Security Lighting System for *Maher* (Women and Child Welfare Centre) in Maharashtra

CRISIL Ltd. sought WISE's support to install a solar PV security lighting system for *Maher*, a Women and Child Welfare Centre located in Shirur in Pune, Maharashtra. The project was conducted under the CSR activity of CRISIL Foundation—the public charitable trust of CRISIL Ltd. *Maher* (meaning "my mother's home" in Marathi) is an interfaith and caste-free Indian, non-governmental organization that provides shelter and support to destitute women and children. After considering the requirements of the welfare centre, CRISIL, under WISE's technical guidance, installed 13 solar street lighting systems for the women's hostel and main building campus. As part of this project, WISE conducted two training programmes in August and September 2016 for CRISIL employees. The training programmes involved the basics of renewable energy technologies and introduction to solar PV installations.

Installation of solar PV lighting system at Maher Pune, carried out under technical supervision and support from WISE.

MES College of Engineering, Pune.

Master RE Plan for Green Campus at MES College of Engineering, Pune

The MES College of Engineering, Pune, approached WISE to conduct basic energy audit and explore possibilities of implementing renewable energy options such as wind energy, solar powered street lights, solar pumps, charging stations, biogas plants, etc., and propose suitable measures for energy conservation and energy efficiency. The project entailed multiple site visits and detailed design of the power plant, which was carried out in due consultation with the college. Technical analysis involved solar radiation assessment including irradiance values such as Global Horizontal Irradiance (GHI) and diffuse radiation by using best-in-class METEONORM software and sources, project capacity evaluation, estimation of expected generation, preparation of electrical SLD, plant layout, power evacuation methods, along with overview of the state policy and regulatory framework. Technical designs with respect to all the proposed RE technologies were duly discussed and final report was submitted.

WISE-USAID Project on Comprehensive Performance Evaluation and O&M for Solar in India

With the Government of India setting the target of achieving 100 GW solar power by 2022, all the concerned stakeholders in India are channelizing their efforts towards meeting this goal. But in order to ensure optimum generation of the solar projects during their lifetime, it is critical that effective performance evaluation, along with appropriate operation and maintenance of the projects is carried out effectively, which would result in optimum electricity generation and aid in meeting India's emissions reduction targets.

But as per WISE's research, there is a huge knowledge gap present in conducting O&M of solar plants in India. To fill this huge void, the United States Agency for International Development (USAID) supported WISE to execute a two-year project titled 'Developing Performance Evaluation and O&M Strategy for the Indian Solar Sector', under its 'Partnerships for Enhanced Engagement in Research (PEER), Cycle 5' programme.

The project involved site visits to different solar power plants all over India, solar PV component-wise study, research on O&M best practices, and development of simple performance evaluation and O&M methods.

As the part of this project, WISE organised a one-day seminar on Performance Evaluation and O&M of Solar Power Plants in India in January, 2017 in Pune. Details of the seminar are provided on Page No.13.

WIND POWER

Facilitating Offshore Wind in India (FOWIND)

The 'Facilitating Offshore Wind in India (FOWIND)' project funded by the European Union's Indo-European Cooperation on Renewable Energy is a five-year project which commenced in 2013-14. WISE is one of the key consortium partners for the project and is responsible for executing the project activities in the state of Gujarat. In the year under review, WISE conducted a grid study in Gujarat for developing a 500 MW offshore wind project in the Gulf of Kutch. WISE worked with GETCO for assessment of the load flow study which was a part of FOWIND's grid study report. During the last two years, FOWIND (WISE) has been responsible for disseminating its research and analysis findings on offshore wind to state utilities, energy planners and other relevant stakeholders in the country.

As part of the project, WISE along with the lead partner, the Global Wind Energy Council (GWEC) and DNV GL organised a one-day engineers training workshop on offshore wind project development in August 2016 in Bangalore (details are provided on Page No.14).

Apart from FOWIND, WISE executed an assignment for Sitac Management and Development Pvt. Ltd, New Delhi, to assess policy and regulatory provisions for wind projects in Maharashtra, Madhya Pradesh, Karnataka, and Tamil Nadu.

RE INFORMATION MANAGEMENT

Comprehensive Periodic Tracking and Dissemination of RE Developments in India

India has declared its intention to gradually and voluntarily transition to a low carbon economy. Three main pathways have been indicated, i) capacity addition of 175 GW RE by 2022; ii) 40% of all electricity generation capacity in India by 2030 to be from non-fossil-fuel based energy sources; and iii) 33% to 35% reduction of emissions intensity (above 2005 levels) by 2030.

While stakeholders are making steady progress in the development of renewables, the lack of a suitable tracking mechanism for monitoring the various developments taking place in the RE sector and their timely dissemination is hindering their ability to make informed decisions and develop suitable solutions. Considering the large federal structure, size and complexity of the country, it would be a timely task if developments related to renewables on

multifarious fronts are independently tracked/ monitored and the data made available to the public, stakeholders and government entities on a periodic basis through print and electronic communication. While there have been previous attempts to create some web portals/ publications, they were either not regularly updated or did not have in-depth coverage and analysis of all the major developments in the RE sector.

The WISE-SHAKTI-IREF Portal

In keeping with the above objective, WISE, in association with the Indian Renewable Energy Federation (IREF), and with support from Shakti Sustainable Energy Foundation, decided to come together and create a renewable energy portal (specifically renewable electricity) that would track developments happening in the renewable energy space on a regular basis and build an altogether new approach to information and knowledge dissemination, providing the latest, up-to-date, validated information on renewable energy (specifically renewable electricity) using state-of-the-art, user-friendly interface. Specifically, the portal would include sector-holistic information, ranging from cross-linkages with the power sector, manufacturing details, capacity addition information, new technologies, to latest news updates and analysis of policy and regulatory orders, all under one and the same roof. The conceptualization, design and development of the RE portal were key activities in the current year. In addition to the portal, WISE also started work on bringing out a status report on renewable energy, that aimed to assimilate data from the portal and present an annual review of India's renewable sector, besides providing some analysis of key issues.

OUTREACH AND TRAINING

S.K Singh, Director General, NISE, seen addressing the participants at the WISE-USAID Seminar on Solar O&M. Seated on the dais are senior officials from WISE, NCPRE IIT-B, and NREL.

WISE-USAID SEMINAR ON PERFORMANCE EVALUATION AND O&M FOR SOLAR PV IN INDIA

The United States Agency for International Development (USAID) supported WISE to execute a two-year project titled 'Developing Performance Evaluation and O&M Strategy for the Indian Solar Sector'. As the part of this project, WISE organised a one-day seminar to kick-start the project in January, 2017 in Pune. The event brought together some 80 delegates from the Indian solar sector and key officials from autonomous government agencies and research institutes like the National Institute of Solar Energy (NISE) and the National Centre for Photovoltaic Research and Education (NCPRE, IIT Bombay), who provided their critical views on the subject, and on expanding capacity to address current and future developmental challenges, placing national strategies in a global context and positioning institutions for high performance of solar plants. Besides imparting information and knowledge, the conference provided a valuable networking opportunity and set the stage for further cooperation among government and research institutions for O&M of solar plants in India. Mr. S K Singh, Director General, National Institute of Solar Energy (NISE), New Delhi, inaugurated the seminar. Other dignitaries present at the inaugural session were senior officials from WISE, NCPRE-IIT B, and the National Renewable Energy Laboratory (NREL), US.

Seen: WISE officials, Dibin Chandran, Principal Invigilator (extreme L) of the project and Surendra Pimparkhedkhar, Sr. Fellow, P&R (extreme R) who were speakers at a session in the Solar O&M seminar (with S.K Singh, DG, NISE).

Anand Wagh, Sr. Associate Fellow, WISE, and Project Coordinator, FOWIND, welcoming the participants at the Engineers Training Workshop on Offshore Wind in Bangalore.

FOWIND ENGINEERS TRAINING WORKSHOP

WISE along with its lead partner, the Global Wind Energy Council (GWEC) and DNV GL organised a one-day engineers training workshop on offshore wind in August 2016 at the Trade Centre, Bangalore. The objective of the programme was to raise awareness about the engineering, grid management and planning aspects of offshore wind power development. FOWIND has been working closely with the Gujarat Electricity Transmission Company (GETCO) and the Tamil Nadu Electricity Generation and Distribution Company (TANGEDCO) to map the pathway for integrating variable generation from large-scale offshore wind in India. The training programme was well received by all the participants.

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