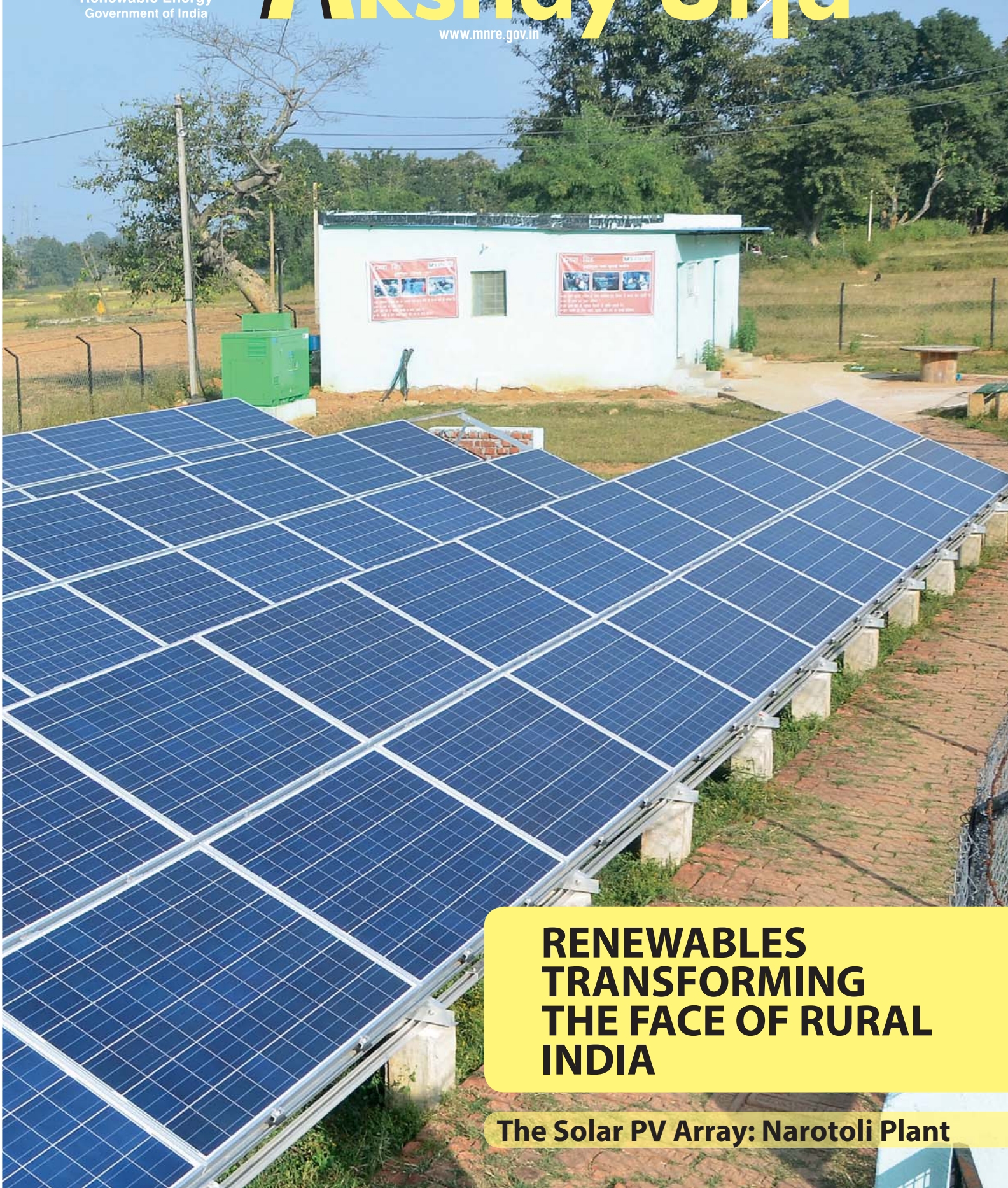




Ministry of New and
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Government of India

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CREDA has installed solar power plants in 900 health centres in Chhattisgarh and is also maintaining it since the last ten years. This article highlights the work done by CREDA through which health services have been transformed by solar electrification in Chhattisgarh.



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An MNRE-supported mini-grid of 22.5 kWp was installed by Minda at Narotoli village in Jharkhand in July 2016. The national grid reached Narotoli in early 2018. Both grids continue to co-exist supporting each other and the biggest beneficiaries are the people of Narotoli.



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DURGA Energy has evolved from the Dungarpur initiative, under the SoULS initiative, a flagship programme of IIT-Bombay. **Professor Chetan S Solanki** highlights this initiative of empowering women through promotion of quality off-grid solar solutions.



I liked reading the cover story on spectacular journey of four years of MNRE published in the June 2018 issue of *Akshay Urja*. It was also nice to read news that MNRE has set up the biggest solar power plant in Uttar Pradesh. India has set up an ambitious target of setting up of 1 lakh MW solar power plants in the country by 2022. The Minister also said that in view of the progress made so far, India will meet the target ahead of the schedule. The Power Minister said that solar energy is important for India's energy security and the Government is working in a fast track mode in this direction.

Anirudh Yadav

Lucknow, Uttar Pradesh

The RE feature article on renewables published in the June 2018 issue is a very interesting article indeed. The author is right when he says that "with great strides being made in both technology and the human role in environmental degradation, I hope I will not remain alone in my desire to put into practice methods to meet our needs in the modern world without smoking out our planet." The RE Success Story article on successful use of renewable energy and other energy-efficient equipment is also a very informative article published in this issue.

Nidhi Kapoor

Mumbai, Maharashtra

I am a regular reader of *Akshay Urja* magazine since the last 5-6 years. I was very happy to read in the magazine that key clean energy technologies have been growing faster than many experts predicted. Solar and wind power have already touched cost competitiveness. Innovations are shepherding the renewable revolution. A team of MIT researchers has demonstrated that theoretically predicted ceiling for

converting sunlight into electricity of about 32 per cent, called the Shockley-Queisser Limit, can be far exceeded. All across, renewables are witnessing disruptive innovations.

Rajesh Bose

Kolkata, West Bengal

In the feature article on solar PV cooking published in the April 2018 issue of the magazine the author says that solar thermal has primarily been explored for cooking and hence solar cooking has become synonymous with solar thermal cooking. Solar PV technology has always been considered expensive and unviable. The author brings out how and why solar PV technology route for cooking can begin now and overtake the solar thermal route for cooking. He also says that solar PV cooking solutions can fulfill all domestic cooking needs and can be customized as per the user's choice and needs. Usage of induction cookstoves with PV modules and batteries can provide the required power to cook all types of Indian cuisines, matching the performance of LPG-based cooking. With further expected reduction in the cost of battery and PV module and increase in efficiency of cooking, the author rightly believes that it can become one of the preferred cooking solutions.

Mohd. Zahid

Jaipur, Rajasthan

I am a science student in Osmania University in Hyderabad. All the articles and updates published in the June 2018 issue of the magazine are quite informative and interesting for students like us who are interested to know about development of renewable energy in the country.

Sriniwas Rao

Hyderabad, Telangana

I liked reading the article on 'maximizing solar power generation' making use of existing roofs published in the previous issue of the magazine. The author of this article has rightly described the use of various types of rooftops for solar power generation which is very useful in my profession. I am very glad to know that the MNRE has been facilitating different initiatives for harnessing renewable energy in lighting cooking and motive power in rural areas as well as in urban industrial and commercial application. To maximize the use of solar power; the Ministry is making all efforts in rural and urban areas to create awareness of the benefits of solar power. The other informative articles on Govt. of India's Saubhagya scheme; Building Green from Principles to practice; AND Solar paints are good.

Thanks to MNRE and TERI team for publishing such wonderful and useful articles in your magazine.

Er. Anant B Tamhane

Consulting Engineer, Renewable Energy
Nagpur, Maharashtra



Dear Reader, Thank you very much for your suggestions and encouragement. The editorial team of *Akshay Urja* will make every effort to make this magazine highly informative and useful to all our readers. We welcome your suggestions and valuable comments to make further improvements in the content and presentation.

Editor, Akshay Urja



आनन्द कुमार
ANAND KUMAR



सचिव
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SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF NEW AND RENEWABLE ENERGY

Message

India is progressing well on its path of installing 40 per cent of renewable power generation capacity by 2030 as per its commitment (Intended Nationally Determined Contributions or INDCs) as part of the Paris Climate Agreement. Our installed capacity has reached 71.5 GW by July 31, 2018. Additionally, we have installed off-grid systems of total cumulative capacity of more than 1 GW.

The Ministry of New and Renewable Energy is organizing the First Assembly of International Solar Alliance (ISA); 2nd IORA Renewable Energy Ministerial Meet and 2nd Global Renewable Energy Investment Meeting and Expo, (RE-INVEST 2018) from 2nd to 5th October 2018 in New Delhi.

All these three events will be inaugurated in a common function by the Hon'ble Prime Minister of India Shri Narendra Modi, in august presence of Mr António Guterres, Secretary General, United Nations at 6:30 pm on 2nd October 2018 in Vigyan Bhavan, New Delhi. The Business and Technical Sessions of ISA Assembly, IORA Meet and RE-INVEST 2018 Expo will be held in India Expo Mart, Greater Noida, UP.

The 2nd RE-INVEST aims at accelerating the worldwide effort to scale up renewable energy and connect the global investment community with Indian energy stakeholders. 2nd RE-INVEST will include a 3-day Conference on renewables, cleantech and future energy choices, and an exhibition of renewables-related manufacturers, developers, investors and innovators.

Akshay Urja Newsletter is serving well as a platform for informing about Government of India's policies, plans and programmes in renewables. Our efforts are towards making it more informative with an ever widening reach. I am sure the present issue will be successful in providing you a panoramic view of the use of renewables at the grassroots level which are transforming the face of rural India.

With best wishes


(Anand Kumar)



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Joint Secretary

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नवीन और नवीकरणीय ऊर्जा मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF NEW AND RENEWABLE ENERGY

From the Editor's Desk

Dear readers,

In his message to this issue Secretary, MNRE, has observed that India is progressing exceptionally well on its path of achieving 40 per cent renewable power generation capacity by 2030. We have not only reached an installed capacity of 71.5 GW by July 31, 2018, but have also installed off-grid systems of total cumulative capacity of more than 1 GW.

The government is aiming to increase share of clean energy through massive thrust in renewables. Core drivers for development and deployment of new and renewable energy in India have been energy security, electricity shortages, energy access, and climate change. In this regard, the present issue focusses on the usefulness of renewable energy at the grassroots level in rural India. While Professor Chetan S Solanki highlights an initiative of empowering women through promotion of quality off-grid solar solutions, another article sheds light on MNRE-supported Mlinda mini-grid at Narotoli village in Jharkhand that provides 24x7, three-phase electricity and facilitates economic development in the village. This co-existing of the national grid with a mini-grid with MNRE support and facilitating pro-actively the GDP growth and farmer incomes is possibly one of the solutions to 100 per cent access to energy in rural India.

We have also highlighted the work done by the Chhattisgarh State Renewable Energy Development Agency (CREDA) in this issue. Significantly, CREDA has won the International Ashden Award 2018 under Sustainable Energy and Health category. The article highlights the work done by CREDA through which health services have been transformed by solar electrification in Chhattisgarh. This issue also talks about the TERI-JEEViKA programme that has created market for clean energy access at the bottom of the pyramid and has lighted up 50,000 households through self-help groups in Bihar.

There are other related case studies and success stories in this issue which I hope the readers will find interesting and useful. We look forward to your comments and feedback about the present issue.

With best regards

(Gopal Krishan Gupta)

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RENEWABLE ENERGY NEWS

CABINET APPROVES CONTINUATION OF OFF-GRID AND DECENTRALIZED SOLAR PV APPLICATIONS PROGRAMME: PHASE III

The Cabinet Committee on Economic Affairs, chaired by the Prime Minister Shri Narendra Modi, has given its approval for the implementation of Phase-III of the off-grid and decentralized Solar PV (photovoltaic) Application Programme to achieve additional 118 MWp off-grid solar PV capacity by 2020. Phase-III of Off-grid and Decentralized Solar PV Application Programme covers the following components:

- **Solar streetlights:** 300,000 numbers of solar streetlights will be installed throughout the country with special emphasis on areas where there is no facility for streetlighting systems through grid power, North-eastern States, and Left-Wing Extremism (LWE)-affected districts.
- **Stand-alone solar power plants:** Solar power plants of individual size up to 25 kWp will be promoted in areas where grid power has not reached or is not reliable. This component is mainly aimed at providing electricity

to schools, hostels, panchayats, police stations, and other public service institutions. The aggregated capacity of solar power plants would be 100 MWp.

- **Solar study lamps:** 2,500,000 numbers of solar study lamps will be provided in North-eastern States and LWE-affected districts.

For solar streetlights and solar power plants, financial support up to 30% of the benchmark cost of the system will be provided except for the North-eastern states, hill states, and island UTs where up to 90% of the benchmark cost will be provided. For solar study lamps, only 15% of the lamp cost is to be borne by beneficiary student and balance will be provided as financial support as such systems will be provided to school-going children in backward and remote areas. The total project cost of the three components included under the Phase-III is 1,895 crore of which 637 crore will be provided as central financial assistance.

The off-grid solar systems will also open better livelihood opportunities for beneficiaries in rural and remote areas, thereby increasing self-employment in such areas. It is estimated that, besides increasing self-employment, the implementation of Phase-III is likely to generate employment opportunity equivalent to 8.67 lakh man-days for skilled and unskilled workers.

Off-grid and Decentralized Solar PV Applications Programme has high impact in the rural and remote areas of the country where grid power has either not reached or is not reliable. During the Phase-III, the programme is likely to benefit 40 lakh rural households. In addition, the off-grid solar power plants proposed in the programme to provide electricity to schools, hostels, panchayats, police stations, and other public service institutions will help communities at large and also help in increasing participation of women in education, social, and livelihood activities. ■

Source: pib.nic.in

Delhi CM Inaugurates Rooftop Solar Power Plants in Dwarka

With an aim to promote the usage of solar energy, the Chief Minister of Delhi, Shri Arvind Kejriwal, inaugurated solar power plants at Dwarka's residential societies on August 4, 2018. The total capacity of the plants is 416.5 kW. The societies included are Ispat CGHS, Saksham Apartments, Supriya Apartments, Balaji Apartments, and Navrattan Apartments.

According to the officials, the plants would generate more than 4.8 lakh units of power each year, and, cumulatively, 1.2 crore units of power over the life of the plant (25 years). This clean solar energy would replace over 1 crore kg (or 10,000 tonnes) of carbon dioxide emissions, said an official. The price of the power would be ₹4.6 per unit and would further reduce by ₹2 as the installations would be eligible for an incentive of ₹2 per unit from the



Government of Delhi. So, the actual price per unit would be ₹2.6. This is the first time solar plants are being set up on such a grand scale. Customers would save ₹2.5 per unit of power generated, resulting in lifetime savings of over ₹3 crore to the societies.

The plants are one of the largest under the BSES Rajdhani Power Ltd. (BRPL) 'Solar City Initiative —Solarise Dwarka' initiative launched on January 7, 2018. The Solarise Dwarka initiative is

being implemented by the BRPL in collaboration with TERI and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ India) under its Indo-German Solar Partnership project. ■

Source: <http://www.dnaindia.com/>



GOVERNMENT TO BID OUT 25 GW SOLAR CAPACITIES IN LADAKH

The government will come out with a single bid for setting up 25 GW of solar capacity in Ladakh, Power and New and Renewable Energy Minister Shri R K Singh has said, and asserted that renewable energy is a must for sustainable development. He also said that India will achieve the target of having 175 GW of renewable energy before 2022.

“I am going to come out with the huge bid in Ladakh which is highest solar potential area. I have got a survey done,” he said. “We have potential of 35 GW in Ladakh. So we will come out with single bid of 25 GW with storage and deliverable at Una,” Shri Singh said at CII’s Government and Business Partnership Conclave in New Delhi.

He further said that the government will come out with renewable bids with



storage component. “We have come out with 10 GW solar bid with manufacturing component. We will come out with more such bids to make sure that manufacturing comes to India.” About 16 GW of renewables are at various stages of development and about 28 GW has been bid out. “It comes to 116 GW. We will achieve our target of having 175

GW before 2022. Renewable energy is the future. It is our responsibility to the planet.” Shri Singh also said that the government will bring tariff policy under which unscheduled load shedding will be penalized. ⚡

Source: energy.economictimes.indiatimes.com

INDIA TO COMFORTABLY ACHIEVE 100 GW SOLAR ENERGY TARGET BY 2022

India is all set to comfortably achieve 100 GW of solar energy capacity by 2022 and has already installed solar capacity of 23.12 GW till July 2018. The data regarding generation of power from various renewable energy projects is consolidated by the Central Electricity Authority (CEA).

“The Ministry of New and Renewable Energy (MNRE) has planned a detailed trajectory so as to meet the target of 100 GW by 2022. A capacity of 23.12 GW was already installed up to July 2018. Projects of around 10 GW are under implementation and tenders for additional 24.4 GW have been issued,” Power and New and Renewable Energy Minister Shri R K Singh said in a written reply to the Rajya Sabha. “The country is on track to comfortably achieve the target of 100 GW of solar capacity by 2022,” he added.



The minister said solar power projects require around 4 to 5 acres of land per MW and the MNRE monitors the development of upcoming and commissioned renewable energy projects with implementing agencies, such as the Solar Energy Corporation of India (SECI),

the National Thermal Power Corporation (NTPC), state nodal agencies, and state governments/UT administrations through regular meetings, video conferences, and on-site visits. ⚡

Source: economictimes.indiatimes.com

KARNATAKA PIPS TN TO BECOME TOP STATE IN RENEWABLE ENERGY

With 27% of its power generation coming from renewable energy, Karnataka has emerged the leading State for renewable energy in India this year, piping Tamil Nadu. According to a new report by the Institute for Energy Economics and Financial Analysis (IEEFA), the State reached 12.3 GW of the total installed capacity as of March 2018, having added 5 GW in 2017/18 alone.


“Karnataka had been building its wind energy capacity steadily over 10 years, but it moved ahead of Tamil Nadu due to a rapid scaling up of solar capacity in 2017/18, when it installed more than 4 GW of new photovoltaic generation. Currently, it has 5 GW of solar capacity and 4.7 GW of wind capacity. The remainder of its renewable portfolio (2.6 GW) includes small hydro, biomass, plus heat and power cogeneration,” the report said.

The Pavagada industrial solar park—said to be the second-largest



solar development currently under construction in the world—has been credited with reversing the State’s fortunes in renewable energy, along with “positive renewable energy policies” such as open access, the introduction of a hybrid wind-solar development policy and “significant steps to reverse

Karnataka’s historic reliance on energy imports.”

However, the report mentions certain ‘threats’ to solar energy in the State, including a lack of transmission network infrastructure and policies such as repealing the zero wheeling charge order. 

Source: www.thehindu.com


NIWE INSTALLS A LIDAR FOR ASSESSMENT OF OFFSHORE WIND RESOURCE AT THE GULF OF KHAMBAT



The National Institute of Wind Energy (NIWE), an autonomous institution under the Ministry of New and Renewable Energy, Government of India, has installed a remote sensing instrument—LiDAR for assessment of offshore wind resource at the Gulf of

Khambhat, off the Gujarat Coast. The Indian Renewable Energy Development Agency (IREDA), a non-banking financial institution under the MNRE has conducted the following studies with foreign assistance during the last three years and the current year:

- Study/Survey and Preparation of the Roadmap on Tidal Energy Projects in India.
- Study on the business models for decentralized systems, such as solar PV/hybrid mini-grids, PV irrigation pumps and household lighting systems under access to Clean Energy Programme.
- Study for analysis of battery and solar PV modules recycling processes in India along with development of market outreach strategy for rooftop solar PV.
- Study on the Investment Potential of Biofuels in India.

A total of 31.67 GW of renewable energy capacity has been installed through the implementation of various renewable energy programmes/schemes during the last three years and the current year (up to June 2018) in the country, including the state of Uttarakhand. 

Source: pib.nic.in



OVER 43 PER CENT OF ELECTRICITY NEEDS MET THROUGH RENEWABLE ENERGY: INFOSYS


India's second-largest software services firm, Infosys, saw over 43% of its electricity requirements being met through renewable energy sources during 2017/18, a report today said. As per Infosys' 11th *Annual Sustainability Report*, 43.7% of the company's electricity requirements—equating to more than 100 million units—is sourced from renewable sources.

The Bengaluru-based company has an installed capacity of 46.1 MW of solar energy across the country, it added. "During fiscal 2018, 109.7 million units of our overall energy requirement came from green power. Out of this, 22.8 million units of electricity was produced from solar photovoltaic (PV) in our campuses," the report said.

The company said that it is in the process of adding another 12 MW off-site solar power plant in Karnataka and around 7 MW of on-site solar plants



in Hyderabad, Bengaluru, Mangaluru, Mysuru, Thiruvananthapuram, and Chandigarh campuses. "In 2017/18, we have installed 1 MW capacity of rooftop solar in Pune, Chennai, and Hyderabad, and a 30-MW solar farm in Sira in Karnataka," the report noted. "We are committed to a strategy to use renewable

energy on our campuses. We are also a signatory to the global RE100 initiative. Our efforts included aggressive targets to reduce consumption and switch to renewable energy resources for our business operations," the report said. 

Source: economictimes.indiatimes.com

REC COMMITS USD 1 MN TO INTERNATIONAL SOLAR ALLIANCE

State-run power sector financier Rural Electrification Corporation (REC) has announced its commitment of USD 1 million to International Solar Alliance (ISA). "In view of the World Environment Day 2018, REC contributed USD 1 million to the ISA becoming a corpus contributor," an REC statement said. REC Chairman and Managing Director Mr P V Ramesh handed over the cheque to Interim Director General of ISA Shri Upendra Tripathy in the presence of Shri R K Singh, Union Minister (IC) for Power and New & Renewable Energy. REC's Director (Technical) Mr S K Gupta and other senior officials from the two organizations were also present at the event. The pact was inked on June 4, 2018, at the World Environment Day exhibition at Vigyan Bhawan in New Delhi. Mr Ramesh said, "The REC is extremely proud to partner with ISA and promote sustainability through global collaboration, especially with India



» The Minister of State (I/C) for Power and New and Renewable Energy, Shri Raj Kumar Singh handing over the USD1 million cheque from REC to the Interim DG of International Solar Alliance, Shri Upendra Tripathy, on the occasion of the World Environment Day 2018, in New Delhi on June 04, 2018. The Secretary, MNRE, Shri Anand Kumar and CMD, REC, Dr P V Ramesh are also seen.

hosting the World Environment Day this year." The REC finances projects throughout the power sector value chain and has been focussing on increasing

its renewable energy portfolio as well as venturing into the e-vehicle and storage infrastructure. 

Source: www.businesstoday.in

GUJARAT LAUNCHES SKY SCHEME FOR FARMERS TO GENERATE SOLAR POWER

The Gujarat government has launched a solar power scheme for farmers—Suryashakti Kisan Yojana (SKY) enabling them to generate electricity for their captive consumption as well as sell the surplus power to the grid and earn an extra buck.

Announcing the pilot project of the scheme in Gandhinagar, Chief Minister of Gujarat, Shri Vijay Rupani, termed it a revolutionary step towards empowering farmers to generate their own electricity using solar energy and help doubling their income.

As per the scheme, farmers with an existing electricity connection will be given solar panels as per their load requirements. The State and Central governments will give 60% subsidy on the cost of project. The farmer is required to take 5% cost, while 35% will be provided to him as an affordable loan with interest rates of 4.5%–6%.



The scheme duration is 25 years, which is split between a 7-year period and an 18-year period. “This is a first such scheme in the country, where farmer would produce his power and sell the surplus to the State

power utility,” said the Chief Minister, adding that the work on the scheme will begin soon. The scheme envisages setting up of separate feeders for agricultural solar energy consumption. ❌

Source: www.thehindubusinessline.com

SOLAR WATER PUMPS CAN HELP INDIA SURPASS 100 GW TARGET

India can surpass the target of attaining 100 GW solar energy by 2022, provided it replaces all traditional water pumps by solar water pumps, said a study. According to the report, these grid-connected, net-metred solar pumps will also play an important role in providing secondary income to farmers, while giving them access to quality power for irrigation.

The analysis was released at a conference hosted by Greenpeace India, GERMI, and IWMI-Tata Program to discuss the necessary steps for successful implementation of KUSUM—a government scheme promoting solar irrigation pumps. At present, while the 60-GW target for large scale solar is on track, the 40 GW target for rooftop solar is still to gather momentum, with only 2.4 GW of the total rooftop capacity installed as of March 2018, it said. A preliminary assessment shows that replacing 100% of all agricultural consumption in the next five years would require a total solar PV installed capacity of close to 150 GW. This is far more than India’s solar target of 100



GW by 2022. Even achieving a modest 10% of this potential in the next five years would translate to a very significant commissioned capacity of almost 15 GW, it added. Farmtops can revolutionize the way solar energy is deployed in the country. Issues that go with large solar parks such as land acquisition, setting up expensive transmission infrastructure, transmission losses, and a host of other hassles can be avoided.

“The KUSUM scheme is timely and the Centre must work with all states

to come out with a standard operating procedure (SOP) to facilitate smooth implementation,” said GERMI’s Akhilesh Magal.

The analysis also found that Maharashtra has the highest farmtop solar potential with 21.1 GW, followed by Karnataka (18 GW), Rajasthan (17.5 GW), Madhya Pradesh (14.9 GW), Gujarat (12.5GW), Uttar Pradesh (10.8 GW), and Telangana (10.4 GW). ❌

Source: energy.economictimes.indiatimes.com



BACTERIA-POWERED SOLAR CELL FOR OVERCAST CONDITIONS

University of British Columbia researchers have found a cheap, sustainable way to build a solar cell using bacteria that converts light to energy. Their cell generated a current stronger than any previously recorded from such a device, and worked as efficiently in dim light as in bright light.

This innovation could be a step towards a wider adoption of solar power in places, such as British Columbia and parts of northern Europe where overcast skies are common. With further development, these solar cells—called ‘biogenic’ because they are made of living organisms—could become as efficient as the synthetic cells used in conventional solar panels.

Solar cells are the building blocks of solar panels. They do the work of converting light into electrical current. Previous efforts to build biogenic solar cells have focussed on extracting the natural dye that bacteria use for photosynthesis. It is a costly and complex



process that involves toxic solvents and can cause the dye to degrade. The UBC researchers’ solution was to leave the dye in the bacteria. They genetically engineered *E. coli* to produce large amounts of lycopene—a dye that gives tomatoes their red-orange colour and is particularly effective at harvesting light for conversion to energy. The researchers coated the bacteria with a mineral that could act as a semiconductor, and applied the mixture to a glass surface.

With the coated glass acting as an

anode at one end of their cell, they generated a current density of 0.686 milliamps per square centimetre—an improvement on the 0.362 achieved by others in the field.

“We recorded the highest current density for a biogenic solar cell,” said Yadav. “These hybrid materials that we are developing can be manufactured economically and sustainably, and, with sufficient optimization, could perform at comparable efficiencies as conventional solar cells.”

Source: www.sciencedaily.com

EUROPE CAN THRIVE ON RENEWABLE ENERGY DESPITE UNPREDICTABLE WEATHER

Researchers in Ireland, Switzerland, and the United Kingdom have shown how long-term weather patterns affect wind and solar renewable energy technologies across Europe. Using 30 years of meteorological data, the scientists have examined and further modelled the impact of renewable energy on the electricity sector out to the year 2030. The work suggests that despite the unpredictable nature of wind and solar energy, the European power system can comfortably generate at least 35% of its electricity using these renewables alone without major impacts on prices or system stability. The paper appeared on July 26, 2018, in the journal *JOULE*.

Wind and solar energy have exploded in popularity across Europe in the last decade as green alternatives to traditional carbon-based energy, quadrupling in use between 2007 and 2016. However, these technologies are not without their drawbacks—both are susceptible to fluctuating weather patterns, raising concerns about Europe’s ability to endure long spells with low winds or overcast skies. Researchers have used decades



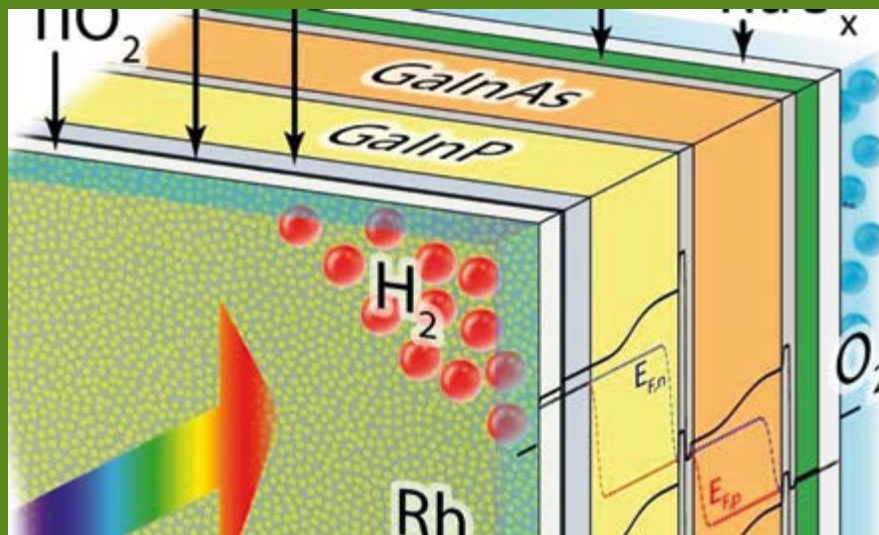
of historic weather data to model this variability in wind and solar energy and its effect on markets, but many studies only analyse data from one given year or focus solely on one country or a small region. The researchers challenge both the temporal and spatial limitations of previous studies by analysing electricity system operation across Europe—including power transmission between countries and technical operational constraints—using wind and solar data spanning the 30-year period from 1985 to 2014. By uncovering trends from this

longstanding data trove across a vast, interconnected region, the team was able to model how Europe would fare under five different renewable energy scenarios with varying sustainability ambitions 12 years into the future. It turns out that the breadth and depth of their data pool made all the difference when it came to understanding trends in CO₂ emissions, system costs, and system operation—all of which are essential to the effective development of energy policy.

Source: www.sciencedaily.com

NEW WORLD RECORD FOR DIRECT SOLAR WATER-SPLITTING EFFICIENCY

An international team of researchers has now succeeded in raising the efficiency of producing hydrogen from direct solar water-splitting to a record 19%. They did so by combining a tandem solar cell of III-V semiconductors with a catalyst of rhodium nanoparticles and a crystalline titanium dioxide coating. For the monolithic photocathode investigated here, the research teams combined additional functional layers with a highly efficient tandem cell made of III-V semiconductors developed at Fraunhofer ISE. This enabled them to reduce the surface reflectivity of the cell, thereby avoiding considerable losses caused by parasitic light absorption and reflection. "This is also where the innovation lies," explains Prof. Hans-Joachim Lewerenz, Caltech, USA: "Because we had already achieved an efficiency of over 14% for an earlier cell in 2015, which was a world record at the time. Here we have replaced the anti-corrosion top layer with a crystalline titanium dioxide layer that not only has excellent anti-reflection properties, but to which the catalyst particles also adhere."



Under simulated solar radiation, the scientists achieved an efficiency of 19.3% in dilute aqueous perchloric acid, while still reaching 18.5% in an electrolyte with neutral pH. These figures approach the 23% theoretical maximum efficiency that can be achieved with the inherent electronic properties for this combination of layers. "The crystalline titanium-dioxide layer not only protects the actual solar cell from corrosion, but also

improves charge transport thanks to its advantageous electronic properties," says Dr Matthias May, who carried out part of the efficiency determination experiments at the HZB Institute for Solar Fuels in the forerunner laboratory to the Solar-Fuel Testing Facility of the Helmholtz Energy Materials Foundry (HEMF).

Source: www.sciencedaily.com

WORLD SAW LARGEST RISE IN RENEWABLE ENERGY CAPACITY IN 2017

According to the REN21's *Renewables 2018 Global Status Report*, renewable power accounted for 70% of net additions to global power-generating capacity in 2017, the largest such increase in modern history.

But the heating, cooling, and transport sectors, which together account for about four-fifths of the global final energy demand, continue to lag far behind the power sector. Solar photovoltaic (PV) capacity reached record levels.

Solar PV additions were up 29% relative to 2016, to 98 GW. More solar PV generating capacity was added to the electricity system than the net capacity additions of coal, natural gas, and nuclear power combined, said the report. Wind power also drove the uptake of renewables with 52 GW added globally.



Investment in new renewable power capacity was more than twice that of the net, new fossil fuel and nuclear power capacity combined, despite large, ongoing subsidies for fossil fuel generation. More than two-thirds of investments in power generation were in renewables in 2017

owing to increasing cost-competitiveness and the share of renewables in the power sector is expected to only continue to rise. China, Europe and the US accounted for nearly 75% of the global investment in renewables in 2017. However, when measured per unit of gross domestic product (GDP), the Marshall Islands, Rwanda, the Solomon Islands, Guinea-Bissau, and many other developing countries are investing as much as or more in renewables than developed and emerging economies. Both energy demand and energy-related carbon dioxide emissions rose substantially for the first time in four years. In the power sector, the transition to renewables is underway but is progressing more slowly than is possible or desirable.

Source: economictimes.indiatimes.com



GLOBAL RE-INVEST 2018

A Curtain Raiser on the Biennial
RE Investors' Meet & Expo



India is placed strategically on the global clean energy map, with rising demand and supply, an exponentially expanding and informed market, and a proactive policy support, including 100% foreign investment in renewable energy development. With this view, The RE-Invest series of Investors' Meet & Expo hosted by the Ministry of New and Renewable Energy (MNRE), Government of India, showcases India's renewable energy potential and the Government's efforts to scale up capacity to meet the national energy requirement in a socially, economically, and ecologically sustainable manner. The 2nd Global RE-Invest India-ISA Partnership Renewable Energy Investors Meet & Expo is set to be held from October 3–5, 2018, at the India Expo Mart, Greater Noida, Delhi-NCR.

The Ministry of New and Renewable Energy (MNRE), Government of India, is organizing the 2nd Global RE-Invest INDIA-ISA Partnership Renewable Energy Investors Meet & Expo from October 3–5, 2018, at the India Expo Mart, Greater Noida, National Capital Region of Delhi, India. The 2nd Global RE-INVEST will host the First Assembly of International Solar Alliance (ISA) and the Meeting of the Energy Ministers of Indian Ocean Rim Association (IORA) countries. Today, India is the world's largest clean

energy market, with exponentially increasing demand and supply and proactive policy support, including 100% foreign investment in renewable energy development. RE-INVEST is a global platform to explore strategies for development and deployment of renewables. It showcases India's clean energy market and the Government's efforts to scale up capacity to meet the national energy demand in socially, economically, and ecologically sustainable ways.

The RE-Invest series has been envisioned as a global event to deliberate

upon strategies for the development and deployment of renewables. India is placed strategically on the global clean energy map, with rising demand and supply, an exponentially expanding and informed market, and a proactive policy support, including 100% foreign investment in renewable energy development. The 2nd Global RE-Invest will provide a vibrant platform for the international energy industry, investors and financiers, project developers, manufacturers, multilateral agencies, R&D institutions, think tanks, civil society, and academicians to engage, ideate, and innovate for a



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PROSPECTS OF THE GLOBAL RE-INVEST 2018

The 2nd Global RE-Invest will build upon the success of RE-INVEST 2015 and explore the advances made on the ground to achieve India's target of 175 GW renewable energy capacity by 2022. It will provide an international forum to established players as well as new segments of investors and entrepreneurs to engage, ideate, and innovate. The event is expected to be attended by over 5,000 domestic and international delegates and delegations from 100+ countries. The 2nd Global RE-Invest will feature 150 speakers in over 50 conference sessions, and special events such as an exclusive CEOs Conclave. The exhibition will feature manufacturers, project developers, investors and energy stakeholders showcasing their capabilities, technologies and investment opportunities alongside G2G (Government-to-Government), G2E (Government-to-Employee), G2B (Government-to-Business), B2G (Business-to-Government) interactions. Speakers, exhibitors, and participants at the 3-day Conference-Expo will include global investors, leading renewable energy project developers, manufacturers, financiers, advisors,

multilateral agencies, R&D institutions, think tanks, civil society organizations, and members of academia.

ORGANIZERS OF THE EVENT

RE-Invest 2018 is being organized by MNRE in partnership with the Indian Renewable Energy Development Agency (IREDA) and the Confederation of Indian Industry (CII).

PARTICIPANT PROFILE

- Government officials and policymakers
- Investors and financiers
- Project developers
- Manufacturers
- EPC, OEM, and ancillaries
- E-mobility and storage companies
- Start-ups and innovators
- Multilateral agencies
- R&D institutions
- Academia and think tanks
- Civil society
- International media

THE CONFERENCE

The 2nd Global RE-INVEST will feature over 50 sessions, including:

- Inaugural Ceremony
- First Assembly of the ISA
- Meeting of the IORA Energy Ministers
- Chief Ministerial Plenary
- Country and State Sessions
- Policy and Financing Plenaries
- Technical and Breakout Sessions
- Ministerial Valedictory
- CEO Conclave

THE EXHIBITION

The 2nd Global RE-INVEST Exhibition will be a major platform to:

- Showcase capabilities, technologies, and investment opportunities
- Benchmark products and services against the best-in-class



- Network and explore buyer-seller matches
- Participate in G2B and B2B interactions

WHY EXHIBIT AT RE-INVEST?

The 2nd Global RE-INVEST Exhibition will be a major platform to:

- Position your company as a key player in the renewables market
- Reach out to thousands of international decision-making investors
- Showcase capabilities, technologies, and investment opportunities
- Benchmark products and services against the best-in-class
- Network and explore buyer-seller matches in new markets
- Participate in G2B and B2B interactions

INTERNATIONAL SOLAR ALLIANCE

The International Solar Alliance is a treaty-based international intergovernmental organization of 121 solar resource-rich countries. The ISA was launched by Shri Narendra Modi, Hon'ble Prime Minister of India, and H E François Hollande, former President of France, at the UNFCCC COP21 at Paris on November 30, 2015. The ISA's major objectives include deployment of 1,000 GW of solar capacity and mobilization of US\$ 1,000 billion investment into the sector by 2030. The ISA Framework Agreement came into force on December 6, 2017. As of July 20, 2018, the Agreement has been signed by 65 Member Countries, Countries, and ratified by 33 Members. **AU**

Source: <https://re-invest.in>



HEALTH SERVICES TRANSFORMED BY SOLAR ELECTRIFICATION

CREDA Receives Ashden Award 2018

The Chhattisgarh State Renewable Energy Development Agency (CREDA) has won the International Ashden Award 2018 under Sustainable Energy and Health category. CREDA has installed solar power plants in 900 health centres in Chhattisgarh to ensure reliable power on a 24X7 basis and is also maintaining it since the last ten years. This article highlights the work done by CREDA through which health services have been transformed by solar electrification in Chhattisgarh.

The Chhattisgarh State Renewable Energy Development Agency (CREDA) and the State Health Department have collaborated to install, operate, and maintain solar PV systems in 900 health centres across the state, improving health outcomes. The programme is seen as an exemplar of best practices and of interdepartmental collaboration. This is part of a much larger solar PV electrification programme across the state.

⚡ CREDA RECEIVES 'ASHDEN INTERNATIONAL AWARD 2018

CREDA received the 'Ashden International Award 2018' for Sustainable Energy and Health Innovation at a ceremony at the Royal Geographical Society in London on June 14, 2018. On behalf of CREDA, Mr Sanjeev Jain, Chief Engineer CREDA participated in the International Conference and received the

"My target was to deliver 20 babies a month but now that we're able to offer a 24/7 service, as we can rely on the lights at night, we're delivering up to 80 babies per month."

Prathibha Vajre, supervising manager at the woman's health centre



award in London. The Ashden Awards are given to sustainable energy pioneers and are a globally recognized measure of excellence. Former UN Climate Chief and key architect of the Paris Climate Agreement, Christiana Figueres, was the keynote speaker at the Award Ceremony. Ten awards were presented at the ceremony to organizations working on the frontline of energy innovation, sustainable buildings, energy market disruption, and clean air in towns and cities, both in the UK and globally. As a part of its activity, CREDA and the State Health Department have collaborated to install, operate, and maintain solar PV systems in 900 health centres across the State. There were 221 entries received for the 2018 Ashden Award. A rigorous assessment including field visit and two judging meetings by the Ashden team shortlisted 19 brilliant energy solutions and 10 wonderful winners. CREDA was one of them.

On assessment of CREDA's work, The Ashden Judges said, "This is a model of

public health and energy agencies coming together to achieve significant impact at a scale that is highly successful and deserves to be replicated elsewhere". All winners received a prize of up to £20,000 along with tailored support to help scale up their work.

🔥 THE CONTEXT

Primary Health Centres (PHCs) are the foundation of rural healthcare in India. Although the quality of healthcare improves with access to electricity, one in two health centres in India is either un-electrified or suffers from irregular power supply (CEEW and Oxfam, 2017). Before CREDA decided to tackle this, the situation in Chhattisgarh state was no different. Most PHCs had no reliable source of power, partly because the state is heavily forested, thus making grid extension difficult. Health centres were finding it hard to provide care at night; women were giving birth in the dark and staff carried candles with them in case of power cuts. The Chhattisgarh State Health

Department collaborated with CREDA on a programme to provide solar power at all Primary Health Centres.

🔥 IMPROVING HEALTHCARE SERVICES IN CHHATTISGARH

CREDA is managing the entire process, including the system design and stakeholder engagement, the tendering process for equipment and installation and the training, operation, and maintenance services. The first installations took place in 2011. Initially, CREDA selected off-grid health centres but now the systems are being installed in grid-connected locations to provide security of supply during frequent power outages.

The demand for a new PV system comes from the Health Ministry. CREDA takes a consultative approach to understand the Health Centre's current and future electricity needs. Effective operation and maintenance is taken very seriously. Staff is trained to optimize system use and



» In health centres with access to solar PV, vaccines last longer as reliable electricity keeps the freezer temperature more stable

CREDA contracts installation companies to carry out maintenance for five years. After that, the systems installed in government-owned health centres are maintained by CREDA, who monitors the monthly performance of all systems.

⚡ TECHNOLOGY AND FINANCING

A PV system was designed and installed at each health centre following an energy audit and the installation of energy-efficient appliances. Energy-efficient equipment includes LED lighting, freezers, vaccine refrigerators, computers, centrifuges (for blood analysis), baby warmers, fans, and microscopes. Systems are sized between 2 and 10 KWp depending on the size of the health centre. The operation of the system is simple; the solar system is connected to the load with a changeover system, so load can be shifted to the grid (where and when available), ensuring 100% energy security.

CREDA is a non-profit implementation agency, which delivers large renewable energy roll-out programmes for State Ministries working in areas, such as health, education, and rural development. The Health Ministry at the central and state level supports for the Health Centre solar electrification programme. The operation and maintenance is supported from the State budget. The health centres

themselves do not need to contribute to the installation of the PV systems nor pay for electricity generated on site. CREDA has installed a further 6.7 MW of solar generation in a wide variety of settings, including schools, government buildings and households as well as solar PV for agriculture, drinking water, and cold storage.

⚡ IMPACT ON HEALTHCARE

The solar electrification of 900 health centres and district hospitals has benefitted about 80,000 patients per day. The centres can now provide 24-hour healthcare, so they can treat many more patients. Access to regular electricity has enabled reliable water supply, safe refrigeration for vaccines, and powered theatre equipment, fans, and baby heaters. Health centre staff has reported up to a fourfold increase in the number of babies delivered at their health centres now that women can give birth safely at night. Dr Archana Panday at a PHC serving up to 34,000 people, said the greatest advantage is “the service they were able to offer to women in labour, by providing fans and having light to see by”.

Another benefit of reliable power is the ability to digitize patient services and dramatically improve operational efficiency. New smart-card services

allow patients to register for free medical treatment and a reliable Internet connectivity means medicines can be ordered online. Apart from benefitting the patients, the solar systems have resulted in 80% reduction in the energy costs as compared to grid or back-up diesel.

The programme is seen as an exemplar of interdepartmental collaboration and CREDA is already sharing its lessons with other states in India. CREDA has been proactive in creating demand for renewables by demonstrating the social and economic benefits, driving increasingly ambitious programme targets with the Ministries.

⚡ THE FUTURE

CREDA has significant roll-out plans that prioritize local public health centres, followed by village electrification where grid access is not an option for geographical or political reasons. CREDA will be working to help achieve India's clean energy 2022 and 2030 targets, moving on to solar in urban areas, and looking at how to integrate electric vehicles and the associated infrastructure required to support them. **AU**

Article Courtesy: Shri Sanjeev Jain, Chief Engineer, Chhattisgarh Renewable Energy Development Agency (CREDA), Raipur, Chhattisgarh, India.



with **US**

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SOLAR-POWERED DRIP IRRIGATION

Transforming Agriculture in a Remote Village of the Sundarbans

The Gosaba Island situated in the Sunderbans region of West Bengal in India is surrounded by tidal rivers connected with

the Bay of Bengal, bringing water of high salinity (more than 30 dS/m), which is not suitable for irrigation in agriculture. Good-quality groundwater is also unavailable for

irrigation due to various technical reasons. Due to these difficulties, farmers in this village are unable to grow Rabi crops. Farm ponds, which harvest the rainwater during monsoon, are the only source of water for irrigation in the post-monsoon period.



⚡ SUCCESS OF SOLAR-POWERED DRIP IRRIGATION TECHNOLOGY

To increase the cropped area, solar-powered drip irrigation technology has been introduced in the island under the CSI4CZ project. Analysis of monthly weather data available at Canning Town shows that the average bright sunshine hours (BSH) during the Rabi season



is 7–9 hours a day, which is sufficient to harness the solar energy for use in agriculture. Under this technology, solar panels were installed near the pond and a nano pump (0.1 hp) was used for lifting water from the farm pond to a tank (1,000 litre capacity) placed at 2.5 m height on a platform. During day time, water is lifted to the tank and the stored water is applied to high-value vegetable crops through drip irrigation system by gravity method. The drip discharge rate was 2.4 litres per hour. The field was divided into different plots, each plot was controlled by a valve, which facilitated crop diversification.

⚡ EFFECTIVENESS AT GROUND ZERO

The solar drip system was installed in the farm of Mr Nitai Hari Mandal in 2017. He cultivated crops, such as cucumber, bitter gourd, and okra during the Kharif season by providing supplemental irrigation during deficit rainfall period. The system effectiveness was enhanced through different mulching materials, such as paddy straw, black plastic, and white plastic, for controlling the weeds (Table 1) and conserving the soil moisture. The yield of vegetables was very promising under black plastic mulching and the crop was free from weed infestation. Since October 2017, he has grown chilli, knol-khol, and okra. Knol-khol and okra were harvested in January 2018. Chilli crop continued up to May 2018 which provided regular income to Mr Nitai Hari Mandal as he sold green as well as dry chillies. After the harvest of knol-khol and okra he started growing bitter gourd. Thus, he is able to grow vegetables round the year by this technology. There was 20%–30% more yield; savings of 40%–60% irrigation water; 40% saving of labour, and an increase in the cropping intensity by up to 300% as compared to traditional practices.

The economics of the cultivation under solar drip system (Table 2) for an area of 725 m² indicated that the system is quite profitable in terms of gross return (₹2,5679), net return (₹13,876) and output-input ratio (2.2). The profitability of the system can be further increased



Table 1: Effect of mulching with drip irrigation on weed biomass in vegetables*

| Treatment | Weed Biomass (kg plot ⁻¹) |
|-------------------------------|---------------------------------------|
| Crop | |
| Okra | 11.17 |
| Cucumber | 10.25 |
| Bitter gourd | 11.78 |
| LSD (P=0.05) | 0.46 |
| Mulching with drip irrigation | |
| Control | 26.78 |
| Black plastic | 2.14 |
| White plastic | 2.75 |
| Paddy straw | 12.39 |
| LSD (P=0.05) | 0.77 |

* Sample plot size was 153 m² under each crop

Table 2: Costs and return of crops grown under solar drip system


| Particulars | Crops* | | | | |
|------------------------------|--------|-----------|-------|--------------|----------|
| | Chilli | Knol-khol | Okra | Bitter gourd | Cucumber |
| Total production (kg) | 325 | 40 | 312 | 250 | 340 |
| Average selling price (₹/kg) | 35 | 24 | 12 | 18 | 15 |
| Gross return (₹) | 11,375 | 960 | 3,744 | 4,500 | 5,100 |
| Total cost (₹) | 2,438 | 636 | 2,675 | 3,610 | 2,444 |
| Net return (₹) | 8,937 | 324 | 1,069 | 890 | 2,656 |
| Output-input ratio | 4.67 | 1.51 | 1.40 | 1.25 | 2.09 |

*Area under the system is 725 m²

Source: ICAR-Central Soil Salinity Research Institute, Regional Research Station, Canning Town, West Bengal 743 329)



by increasing the area under operation as well as availing the subsidy from the government schemes.

This initiative was supported by the Australian Centre for International Agricultural Research (ACIAR) and has funded a project, 'Cropping System Intensification in the Salt-affected Coastal Zones of Bangladesh and West Bengal, India (CSI4CZ)'. 

Article Courtesy: <https://icar.org.in>



DISTRIBUTED RENEWABLE ENERGY

Transforming Women's Lives in Rural Bihar



This article talks about the TERI–JEEViKA programme that has created a market for clean energy access at the bottom of the pyramid and has lighted up 50,000 households through self-help groups in Bihar.

India has evolved from being a power-deficit country to having sufficient power. Further, the Central government's Saubhagya Scheme is working towards ensuring complete village electrification by 2019. Public-private partnerships (PPP) can help realize that vision by plugging the gaps in the power-supply chain and providing clean, reliable, and affordable energy through distributed renewable energy (DRE). In line with this, and under its Lighting a Billion Lives (LaBL) campaign, The Energy and Resources Institute (TERI) has built a

partnership with Bihar Rural Livelihoods Promotion Society's (BRLPS) JEEViKA programme through an innovative institutional model to make clean energy products affordable to local women-based self-help groups (SHGs). Till date, the programme has benefitted over 50,000 households across Bihar by providing access to solar home lighting systems (SHLS) and clean cookstoves.

The programme aims to complement the government's vision of enriching rural livelihoods by providing reliable electricity to every household. Under

this Public-Private-People Partnership (PPP) model, 60% of the funds are tapped from the savings of the SHGs of the JEEViKA programme, and the remaining 40% mobilized by TERI through grants and CSR funds. The programme beneficiaries—located across Gaya, Khagariya, Madhubani, Purnia, and West Champaran districts—suffer from erratic grid power supply. In Purnia alone, 28,261 households benefitted from the programme. TERI's efforts not only helped upgrade the cooking and lighting systems of the communities, they also enhanced



education and good health. Additionally, the programme also helped improve the livelihood opportunities through small enterprises, such as weaving, sewing, vending, etc., made possible due to the additional hours of lighting in the evening brought about by solar products.

Lacchmi Devi, a member of a SHG in rural Bihar, came all the way to Patna to tell her story. Under TERI's LaBL campaign, SHG members like her bought solar home lighting and cooking systems from their weekly savings to complement the erratic electricity supply in their village. The increased hours of lighting in the evening brought about by the system meant her children could study better and for longer hours. "When they secured first division in their exams, other women (who were reluctant earlier) also got interested in the system," she said.

Lacchmi Devi's household is one of the over 50,000 in Bihar that has been provided clean cooking and lighting through an Integrated Domestic Energy System (IDES), a solar-powered solution designed by TERI that comprises a solar panel for charging battery to run two LED lights, a mobile charging point, and a forced-draft improved biomass cookstove that is more efficient as it consumes less fuelwood and emits less smoke. The IDES are made available to women SHG members through a

unique financial model. Of the total cost, 60% is paid by the women in monthly installments and 40% is contributed by CSR funds and grants from bilateral/multilateral donors.

TERI utilized the network of SHGs formed under JEEViKA to create livelihood opportunities across the supply chain of clean energy products. It trained and mentored around 20 local energy entrepreneurs (EEs) who procure IDES from accredited manufacturers, install them in households, and ensure maintenance with the support of a network of around 300 solar technicians also trained under the programme. While the average annual income of solar technicians ranges from ₹36,000–₹50,000, EEs are able to earn ₹5–₹10 lakh a year.

At a regional conference organized by TERI in Patna to share experiences on 'Accelerating Rural Development through Enhancing Energy Access' on July 17, 2018, where Lacchmi Devi came to share her story, the thrust was on moving forward and exploring new opportunities that can be tapped through decentralized renewable energy. The conference highlighted how 'Public-Private-People Partnership (PPP)' can be effectively used to provide universal energy access.

Archana Tiwari, State Project Manager, Social Development, JEEViKA, stressed on the need for the women to have a vision for livelihood enhancement

through access to power for longer hours of the day. She suggested options such as opening online ticket booking offices or buying refrigerators for small shops to store products for a longer time. She also motivated cluster-level federations (CLFs) to create at least 500 entrepreneurs. With each CLF having around 2,500 to 3,000 households under it, she said that they have the biggest role to play in any progress. She also encouraged TERI to do a vision exercise with the women.

Speaking at the conference, The Energy Minister of Bihar, Shri Bijendra Prasad Yadav said, "Surveys show Bihar has high potential for non-conventional energy. We need new thinking and new approaches for this. There should be a survey on how we can generate solar power even in flood-prone areas of Bihar, and find out future possibilities that are realistic, keeping geographical considerations in mind."

BRLPS CEO Balamurugan D talked about how the programme has led to skill development amongst women too. In collaboration with IIT-Bombay and the Ministry of New and Renewable Energy (MNRE), Government of India, over six lakh solar lamps have been assembled by JEEViKA's women, he highlighted. TERI also announced the establishment of the six-week TERI-ENVIS Centre Green Skill Development Training Programme, to be held in Purnia, Bihar. Supported by the MNRE, the programme will train 10+2 passouts and college dropouts as technicians to support solar industry implementation.

In conversations in the development sector, terms like 'market creation' and 'livelihood enhancement' may sometimes mask the endearing nature of seeing change in people's lives right before one's eyes. As M K Poddar, General Manager, Agriculture Insurance Company of India Limited—one of the CSR funders of the project said, "To see improvement of lives at the grassroots level with our contribution... it is a source of great joy." **AU**

Article Courtesy: Ms Aastha Manocha, <http://www.teriin.org>



HYBRID SOLAR SYSTEM for Power Loom

The Story of Sultan Ansari

For Varanasi weavers, the adoption of solar energy is increasingly raising their competitiveness in the marketplace and boosting their income. Homes of so many weavers today have a story to tell, of how a reliable solar supply system was now alleviating their years of struggle with the patchy grid and diesel generator supply that hurt product quality and earnings. In this article, **Kishor Kumar Choudhary** and **Mohd Asim Mirza** highlight the case of Sultan Ansari from Varanasi who has installed a hybrid solar system at home to deal with the grid supply disruption and problems of diesel generators.



The home of Sultan Ansari in village Tadiya (Muslimpura, Kotwa) on the outskirts of Varanasi is buzzing with a wonderful renewable energy story. Amidst the continuous chattering and screeching of six looms and colourful wisps of discarded silk thread rolling like tumbleweed on the floor in his red-brick home, sits one fresh story of respite and hope.

The knowledge that a disruption in grid power supply will not stop work or degrade the quality of saree he and other weavers at home are busy making, is a big assurance and relief. Weavers know fluctuating supply can break threads, resulting in a cloth that loses price in customer's eye. That is why they despise erratic supply and is now eager to adopt a hybrid solar system (solar energy + grid) that helps solve much of their energy problem.

Sultan and all seven members of his family are engaged in weaving and depend entirely on this for a living. Sultan is 26 years old, skilled, and ambitious. "I started working with my mother and sisters who help my father in putting the bobbins together," says Sultan whose family has been in the craft for at least five generations. Sultan, too, has spent a decade in the craft to know of its opportunities and the challenges, and truly understands the equity Banarasi saree enjoys globally. "Banarasi sarees are different because of the hard work and dedication that goes into weaving them. It's the finish as well as the finesse of the product... those are the two main things that make them stand out."

Varanasi, a city of many millennia and many meanings, has done a great job of preserving the craft of weaving silk sarees and other clothes that have amazed the world for centuries. Generations have engaged in it, helping advance and embellish the craft, and ensuring it remains a top draw in the marketplace. They have faced waves of challenges from a changing global economy to altering consumer tastes, preferences, rising wages, expensive raw

materials, and stiff competition from cheaper clothes produced at modern assembly lines. Weavers have been further challenged by their limitation of not able to market the product in an economy where rising inflation forced many of them to go elsewhere to earn a living.

One major shift came when most weavers shifted from handloom to power loom during the last two decades. Power loom drastically dropped the effort and the time consumed in producing a saree, raising the volume of work each weaver produced in a month and the wages he earned.

But the quantum of investments power loom required, not every traditional weaver was capable of mobilizing. The shift to power loom also brought another challenge, of inadequate and unreliable grid supply. To compensate for this, they had to have an expensive power backup from diesel generators.

Weavers know fluctuating supplies can wreck the business. "During the electricity fluctuation, the passing shuttles, filled with bobbins of fine silk thread, back-and-forth across their looms get stopped and when electricity resumes the bobbin thread gets broken. That broken thread becomes visible in the silk cloth and attracts lower cost," says Sultan, who has now moved on to installing hybrid solar system at home to deal with the grid supply disruption and problems of diesel generators.

✚ INSTALLING HYBRID SOLAR SYSTEM AT HOME

"The solar system gives me a 'power of freedom'. Now, I can control 4 looms at a time," he says, adding that uninterrupted power provides fine quality and craftsmanship. On an average, it takes about 6–7 days for Sultan to weave one Banarasi silk sari. But he also weaves other types of sarees and dress materials which take just 1–2 days. The installation of the hybrid solar system has made his operation more efficient and effective.

Like Sultan, many others in his community are now shifting to a hybrid solar system backed by cleaner, smaller,

and more powerful lithium batteries. This has been a momentous shift as it attacks the central weakness of inadequate and unreliable supply of grid power that has held back the community from prospering as it induced uncertainty in their business and imposed many unproductive hours every day.

Sultan intended to run his power looms for an average of 16–18 hours a day along with his co-workers, and was looking for an effective and economic power back-up. In this process, through a local energy enterprise, he got in touch with The Energy and Resources Institute (TERI), a not-for-profit research organization, involved in inter-disciplinary activities for conducting scientific research and development in the fields of energy, environment, and sustainable development. TERI identified the problem and set out to solve the problem by figuring out a solution that would work for weavers.

With the financial assistance received from Indus Towers Limited, under their Corporate Social Responsibility (CSR) support, a hybrid solar system was installed at Sultan's premises by TERI. Now, Sultan gets an uninterrupted supply of power. Aiming for optimal utilization and lower cost of the system, a 2-kWp capacity of solar panel was planned, and a hybrid system designed with solar, grid and lithium battery being the order of power source priority. Since the load factor of the power loom varies within a broad range (150 W–700W, for a very short duration), due to different design patterns of clothes, a relatively higher capacity (5 kVA) PCU was considered. The changeover time from the selection of one power source to another was kept in microseconds so that the design of cloth is not affected at all. Through this TERI-Indus Tower intervention, the profitability of loom weaving has increased, which is further trickling down in the wages of skilled artisans. **AU**

Mr Kishor Kumar Choudhary is the Principal Investigator of the project and Mohd Asim Mirza is the team member of the project at TERI, New Delhi.



LIGHTING HOMES AND POWERING PRODUCTIVE LOADS

Development in Narotoli Village with Mini-grids

An MNRE-supported mini-grid of 22.5 kWp was installed by Mlinda at Narotoli village in Jharkhand in July 2016. The national grid reached Narotoli in early 2018. Both grids continue to co-exist supporting each other and the biggest beneficiaries are the people of Narotoli. The national grid supplies single phase power for 6–8 hours daily. The MNRE-supported Mlinda mini-grid provides 24x7, three phase electricity with less than 6 hours downtime per year and facilitating economic development in the village. This co-existing of the national grid with a mini-grid with MNRE support and facilitating pro-actively the GDP growth and farmer incomes is possibly one of the solutions to 100% access to energy in rural India.



» Women entrepreneurs at Narotoli



Situated in the southern part of Chhota Nagpur Plateau in the Gumla district of Jharkhand is Narotoli, a beautiful, but remote tribal village. The tribal community in this village is amongst the most disadvantaged in India with majority of the population falling in the lowest wealth quintile based on the National Family Health Survey (NFHS) framework. The annual household income of Narotoli is less than ₹50,000. Subsistence farming mainly forms the mainstay of the economy: all the farmers practice Kharif cultivation with only 23% diversifying into a second cropping season.

The national grid had not reached the village till April 2018. People used to depend and spend significant resources on kerosene for lighting and expensive charging services for devices such as mobile phones. Such fuels were not only polluting but the light emitted was of poor quality and affected study time of children as well as the time spent by women on economic activities. Farm machinery was run on diesel which is expensive, polluting, and inefficient. Machines such as rice hullers lay sparingly used despite having potential of increasing incomes for farmers through value addition to the agricultural produce. Narotoli is blessed with water sources in the form of a pond, a stream, and a check-dam. The state government has

Mlinda is a Paris-based environmental organization working towards sustainable consumption and production. In India, Mlinda is headquartered in Kolkata and one of the flagship projects is rural electrification through solar-based mini-grids.

installed two 10-HP diesel lift pumps with a system of underground pipelines for shared irrigation. However, the rising cost of diesel combined with difficulties of maintenance rendered the pumps unusable. Approximately, 62 households in Narotoli also maintained poultry coops as a source of additional income. However, the absence of electricity proved it difficult to run them in a more viable manner. Lack of reliable and good quality energy had made other agri value-addition businesses, such as *atta chakkis*, pulverizers in the village, inconceivable.

With an aim to reduce these emissions by tackling major sources of emissions, and at the same time to solve the problem of poor energy access to rural communities, Mlinda installs solar mini-grids and sells the energy for domestic and productive uses in rural areas. Mlinda supports the communities to build financially and environmentally

sustainable businesses from the energy produced. The goal set by Mlinda is to achieve positive social, economic, and environmental gains for the rural communities. Mlinda aims to make the rural electrification project sustainable, scalable, and replicable and provide affordable, reliable, and clean energy to rural communities. Between 2013 and 2015, with the support of MNRE, Mlinda installed 310 pico-grid systems. Each system ranged from 220 Wp and 8 kW peak. 90 kWp was installed in 1,900 homes, three market areas, 90 shops and 1 school hotel. Between 2016 and 2017, with support from the MNRE, Mlinda installed and operated eight mini-grids in two phases, covering five villages in phase I in 2016 and four villages in phase II in 2017. Each system was between 20–30 kWp with a total installed capacity of 210 kWp. Mlinda connected a total 948 homes; 134 irrigation pumps; 14 rice hullers; 3 oil expellers; 2 cold storages; 58 poultry coops, and 5 wheat milling machines.

In keeping with government's objective of bringing development to the most backward villages in India by employing renewable energy as a trigger for inclusive economic growth, the MNRE, Government of India, supported Mlinda in selecting Narotoli in its Phase 1 of the Rural Electrification Project in 2016. Other village selection criteria included the potential demand for energy for productive loads, irrigable land area, type of land, water sources, villager's ability and their willingness to pay. A solar-powered mini-grid of 22.5 kWp capacity was installed by Mlinda in Narotoli in June 2016. In total, 8 grids were commissioned during the same period with support from the MNRE. All the 78 households in the village have taken connection to the mini grid. Mlinda's focus was to develop productive and commercial loads which would lead to economic gains for the community. With the assistance of product financing from Mlinda, a group of 40 farmers of Narotoli have bought two electric lift pumps of 7.5 and 5 HP. They have formed rental groups for utilizing the pumps. This has



» Micro enterprise based on oil expelling produces pure and natural mustard oil



enabled them to practice dry season (Rabi) cropping for subsistence as well as commercial needs.

The 62 poultry coop owners also switched from kerosene lights to LED bulbs and infrared heating for new-born chicks, as this has proved safer and a more commercially viable option for them as compared to kerosene and coal.

The mini-grid in Narotoli powers three-phase productive loads, such as oil expeller machine, big irrigation pumps, rice hullers, as well as wheat mills. The micro-enterprise based on oil expelling and wheat mill has been incubated with the main aim of improving local incomes by encouraging farmers to bring more land under cultivation and, consequently, enhance the commercial viability of the grids by ramping up utilization of the energy produced (Table 1).

Table 1: Narotoli Productive Load Profile—powered by the MNRE- supported mini-grid

| | |
|--|----|
| Small irrigation pumps (≤ 2 HP) | 21 |
| Big irrigation pumps (5/7.5 HP) | 2 |
| Rice hullers (7.5 HP) | 2 |
| Oil expeller (10 HP) | 1 |
| Grinder for grain, millets, and spices (2 HP/3 HP) | 2 |
| Poultry units | 62 |

In a period of two years, substantial change is visible in Narotoli. As the community is getting used to reliable and good quality electricity from the grids, their aspirations are also growing. Along with basic lightning and mobile charging needs, they are now using fans, televisions, air coolers, and refrigerators. Utilization of electricity from the mini-grid has

gone up to 42% of the energy generated in the two years of operation.

A resident of Narotoli, Sayana Kullu, feels that the lighting bulb has enabled her to work for a longer duration in the field.

A resident of Narotoli, Sayana Kullu, says, “The lighting bulb has enabled me to work for a longer duration in the field. I no longer need to rush back from the fields in the early afternoon to prepare dinner. I can now prepare freshly cooked meal even after dark. I don’t have to push my children to study before dark, they can do it later as well. It is such a relief!”



» AJB under inspection by Mlinda Engineers

She now does not need to rush back from the fields in the early afternoon to prepare dinner. She can now prepare freshly cooked meal even after dark. She does not have to push her children to study before dark.

An impact assessment study conducted by Sambodhi, a Delhi-based MLE entity, for the 8 MNRE-supported mini-grids has reported the following changes:

- Increase in the per capita gross domestic product (GDP) in the



» 0.75 HP pump for irrigation

project villages of 10.6% against the 4.6% GDP growth in comparison villages

- Reduction in CO₂ equivalent of emissions per capita of 13% against 1.5% in comparison areas
- Increase in energy efficiency of GDP by 115% as against the 15% increase in comparison areas.

⚡ THE WAY FORWARD

Till date, 16 more villages such as Narotoli in the Gumla district have been commissioned with mini-grids. Mlinda plans to cover 50 villages by 2020 under the Rural Electrification Project with MNRE support. However, there are some challenges that are being addressed, such as:

- Ramping up utilization of energy from the mini-grids to reach over 90% utilization in a short time frame.
- To build adequate throughput of raw materials through the village-level micro businesses so as to motivate farmers to bring more land under cultivation to cater to the demand of local micro businesses.
- To build capacities of the local entrepreneurs/farmer producer groups to run the micro businesses.

On completion of the Rural Electrification Project in 50 villages, Mlinda aims to:

- Double farmer incomes in five years
- Create 165 new jobs in the target villages
- Arrest distress migration to cities by providing opportunities in the villages
- Increase village GDP by 100% by 2024
- Reduce 30 tonnes of CO₂ emissions annually per village
- Improve energy efficiency of GDP by 200%. **AU**

Article courtesy: Mr Vijay Bhaskar, Country Director, Mlinda. Contact: vbhaskar@mlinda.org; Website: <http://www.mlinda.org>

Note: The Economist (July 14, 2018) had also published a story on mini-grids and development in Narotoli village based on the work done by Mlinda.



SHAKTI SURABHI

BIOMETHANATION PLANT

A Cheaper Way to Cleaner Cooking and Greener Garden



The Natural Resources Development Project, popularly known as VK-NARDEP, is an integral part of Vivekananda Kendra and has been working in the field of sustainable development for more than 25 years. Its work in renewable energy has won the organization, the prestigious international Ashden Award. Now, VK-NARDEP has come out with Shakthi Surabhi—a biomethanation plant.

The Pradhan Mantri Ujjwala Yojana is bringing good transformation in the rural areas. However, there is a need for cleaner and cheaper method of cooking gas that does not depend on fossil fuels. With depleting fossil fuels, the cost of LPG cylinders is rising steeply and the subsidies are slowly giving way to unsubsidized prices. Therefore, the rural population will have a limited reach towards LPG cylinders. This will have adverse effects not only for the rural households but also for the environment. The rural women will be forced to rely back on primary fuels such as fuelwood—which involves a time-consuming forage into the adjacent forest areas. Such an increased pressure on fuelwood will lead to deforestation and also a conflict of interest between basic livelihood needs of the population and conservation of natural resources. There is also another



problem. The burning of the fuelwood and the direct burning of dried cattle dung are both inefficient means of fuel-usage. They also create air pollution and add to global warming. Indoor or household air pollution is another critical problem.

With increasing droughts and fluctuating monsoons, the farmers who form the bulk of rural community are also finding it hard to maintain the livestock population. In such a situation, the cattle dung-based biogas plants are more a liability than a useful addition in the agro-ecosystem. Therefore, for the marginal farmers and the rural population of India what is needed is a technology that can provide them with cooking gas—an efficient fuel—that will help them improve the domestic fuel efficiency while naturally integrating the technology to the environment—both economically and ecologically.



WORKING OF A BIOMETHANATION PLANT

In the cattle dung, different type of microbes are present. They are invisible to our eyes. Of these, the important microbes are methane-producing bacteria called methanogens. Methanogens work in anaerobic conditions. The process is basically fermentation. Initially, the digester is fed with cow dung mixed with water or slurry and the gas holder is closed in order to create anaerobic conditions inside the digester. Fresh and wet cattle dung can only produce these methanogenic bacteria. Thus, the anaerobic bacteria develop inside the digester. Digested slurry from another biomethanation plant can be used for developing microbial colony in a faster way. If the bacterial colonies develop fast inside the plant, then the plant can be fed with kitchen waste immediately.



Thus, digested slurry works as an inoculum or starter. Methane-producing anaerobic bacteria start developing in a few days. In an ideal condition, the process is completed within 3–4 weeks. Once methane bacteria have developed completely, further cow dung is not required. Now the kitchen waste can be fed into the plant. The well-established microbial family of methanogenic bacteria reacts with the kitchen waste and produces biogas. This biogas has more amount of methane and lesser amount of carbon dioxide and traces of other gases. The gas gets collected in the gas holder while the digested slurry comes out through outlet pipe. This slurry will have no odour; will not attract flies or mosquitoes; and this can be used as a liquid manure.

FIXED MODEL BIOMETHANATION PLANT

Vivekanand Kendra-NARDEP (VK-NARDEP) has come out with an innovative, low-volume fixed model Shakthi-Surabhi plant that is aimed at solving the energy problems of the rural community and, particularly the marginal farmers without livestock or with reduced number of cattle.

The fixed model Shakthi-Surabhi plant provides the threefold advantage of nutrient slurry for gardening and agriculture, disposal of waste for hygienic livelihood, and primary energy for cooking. This fixed plant model is in principle similar to the portable model. However, it is economically more viable than the portable model. The digester in this plant can be constructed using bricks and ferro-cement rings material instead of fibre. A mason experienced in biogas plant construction or even a semi-skilled mason can build this plant in two days. However, unlike the usual biogas plant, this will be constructed above the ground. Usually for a fixed-model Gobar plant, (small size) skilled masons are required, which becomes a limiting factor for the plant construction in rural areas. However, in the case of low-volume fixed plant Shakthi-Surabhi model, semi-skilled masons can easily

construct the plant in a very short duration of time.

APPLICATION—CASE STUDIES

Wherever constructed, the plant has contributed to energy savings and financial savings for the households. The experience of a rural housewife (Mrs Annakili from Sivasubramaniapuram) taken during the regular user feedback survey by VK-NARDEP is typical of hundreds of housewives who use the plant. A 1 cu m. Shakthi-Surabhi biogas plant gives biogas for about 1.5 hours every day. Earlier, she needed an LPG cylinder once in two months. But, now she needs it only once in six months. Now she has a homestead garden where the diluted slurry has brought out a better yield and a greener home garden from where she gets 'organic' vegetables.

Rural-employed women also find uses of Shakthi-Surabhi biogas plant helping them in ways more than one according to the survey. Being a weaver, a respondent prepares lot of starch for the cloth she weaves. She uses the leftover of her trade as input for the plant and found that the plant gave enough gas to run a stove twice both in the morning and evening for 75 minutes. However, it does not stop with individual households. The larger capacity plants have been built which have helped communities to deal with the pollution problem through organic wastes differently. It is not only individual households but also larger institutions with hostels and community kitchen halls that find the technology very useful. The biomethanation plant has been installed in institutions also. One such is at the visitor centre's cafeteria at Auroville. VK-NARDEP also conducts regular awareness camps regarding the technology for the lay public, specialized groups, rural women, women SHGs, Panchayat presidents, etc. It also conducts regular user-experience sharing camps with other users and technicians of the technology for continuous inputs and improvements.^{AU}

Contributed by Shri V Ramakrishnan, Director, Vivekananda Kendra—NARDEP, Kanyakumari, Tamil Nadu, India. Email: vknardep@gmail.com, Website: www.vknardep.org

BRAHMA KUMARIS

**A Role Model for Community-Scale Solar System
Developments and Usage**





Prajapita Brahma Kumaris Iswhariya Vishwavidyalaya (Bk) which has more than 8,000 meditation centres in India and more than 500 abroad is actively involved in the research and demonstration of alternative renewable energy concepts for more than 20 years now. Here, **Shri B K Yogendra** provides a chronological overview of the various initiatives and activities of Brahma Kumaris in the field of renewable energy and highlights that in order to give a strong impulse towards the development of clean technologies and a sustainable society, the Brahma Kumaris World Spiritual University along with its sister organization World Renewal Spiritual Trust, is actively involved since 20 years in the research and demonstration of alternative renewable energy concepts.

The Brahma Kumaris is mainly administered by women and teaches spiritual and ethical values in India as well as in more than 100 countries of the world. The institution is a non-governmental organization (NGO) of the United Nations, affiliated to the Department of Public Information (DPI). It has general consultative status on the roster of the UN Economic and Social Council/UNICEF. The institution has participated in several UN peace projects. The Brahma Kumaris has received six UN Peace Messenger Awards.

THE BRAHMA KUMARIS DEPARTMENT OF RENEWABLE ENERGY

Established in 1992, the Brahma Kumaris Department of Renewable Energy works in tandem with the World Renewal Spiritual Trust (WRST), an affiliate of the Institution. After focussing almost exclusively on education in values and spirituality since its foundation in 1937, the University expanded its purview to include the field of renewable energy. This decision was taken in the context of worldwide environmental degeneration and the pressing need to meet the requirements for electricity and other power sources for its many residents and visitors. It is the aim of Brahma Kumaris to highlight the relation between our awareness and the technology we choose. The organization believes that this holistic approach based on respect, cooperation, and love is the key to a sustainable future. Brahma Kumaris inspires people to make

use of renewable energy technologies by organizing training workshops, conferences, and publishing research papers and articles. The research projects of Brahma Kumaris and the WRST aim to build up the capacity and expertise of individuals, groups, and organizations so that the design/layout of the different solar systems can be replicated.

THE CHRONOLOGY

In 1996, a 10-kW hybrid system (wind/solar), sponsored by the Australian Government was successfully installed. Also, a solar steam cooking system for 1,000 people was successfully installed in the same year which was sponsored by GTZ and designed by Wolfgang Scheffler/Brahma Kumaris/Eco Centre, Valsad, and HTT, one of the leading German companies in heat transfer technology. The parabolic concentrators of the cooking system are made in India and have a total surface area of 190 sq. m. With an output of 650 kg steam per day, the cooker is a fine example of the

successful use of solar-thermal energy on a large scale.

During 1997/98, the Brahma Kumaris installed 100 solar pumping systems at Mt. Abu and Abu Road under the IREDA Scheme.

In January 1998, a solar steam cooking system for a maximum of 35,000 meals per day was designated and constructed in Shantivan Complex, Abu Road. This system consists of 84 concentrators of 10 sq. m each and generates the steam directly in the receivers. The system produces around 3,500 kg steam per day. The plant was successfully commissioned and tested and has been running excellently for the past many years. Since then, solar steam cooking systems developed by the Brahma Kumaris have been recognized by the Ministry of New and Renewable Energy (MNRE) and are eligible for ~ 50% grant of the total costs from the Government of India.

In 1999, the nearby village of Salgaon (Mt. Abu) was equipped with solar street light systems/solar lanterns and solar





cooking boxes with the assistance of Brahma Kumaris and funds under the rural demonstration scheme. In 1999, 60 branches of the Brahma Kumaris/WRST throughout India were equipped with a 5-kW solar PV system (World Bank funded).

In the year 2000, 3 x 50 kW solar photovoltaic power plants with Sun power inverters were installed at the Brahma Kumaris headquarters. In 2002, a second steam cooking system for 600 people was set up in Yelapur (Hubli), and an additional system for 2,000 people was constructed at Om Shanti Retreat Centre near Delhi.

In 2003, one more solar steam cooking system with financial assistance of the MNRE with an increased dish size of 12.6 sq. m (10 in number) and new improved layout to provide steam for the canteen, sterilizers, and laundry that can provide 900 kg of steam per day was completed at the Global Hospital and Research Centre in Mt. Abu. In the same year, The Brahma Kumaris Peace Park in Mt. Abu received a grant to set up a solar demonstration area with hot water systems/solar home light system and cooking box for greater public awareness.

In 2005, a smaller solar steam cooking system with 7 dishes and state-of-the-art receiver/tracking/steam tank design was completed at the Headquarters of Brahma Kumaris in Mt. Abu.

In 2006, a 200-kW SPV stand-alone solar power plant was installed at the Om Shanti Complex of Brahma Kumaris near Delhi. This plant was partly funded by the MNRE and caters to most of the load of the complex. In 2007, a new 16 sq. m prototype dish was successfully designed and tested as an R&D with the MNRE.

Apart from these projects, the organization has also distributed 20,000 solar lanterns, 500 home lighting systems, and 400 solar cooking boxes and operated a solar Aditya shop with the help of the MNRE to market further solar lantern, solar cooking box, and solar home light system.

In 2011, the Brahma Kumaris and WRST initiated the design, development, and installation of 'India One', a 1-MW

solar thermal power plant in Abu Road, Rajasthan. This research project uses the newly in-house developed 60 m² parabolic dish and features an innovative thermal storage for continuous operation. 'India One' will generate heat and power for a campus of 25,000 people and will be a milestone for decentralized clean power generation with storage in India.

🔥 KEY FEATURES OF 'INDIA ONE', A 1-MW SOLAR THERMAL POWER PLANT

- No less than 770 of 60 m² parabolic reflectors with the static focus spread across 35 acres of land
- Fully automatic network-enabled dual axis tracking for each reflector
- No less than 770 of static cast iron cavity shape receivers interconnected with piping network
- For the first time, decentralized thermal storage for continuous 24-hour operation
- Direct generation of super-heated steam up to 410 °C on demand
- Two-stage twin turbine and generator from Siemens.

In 2014, the WRST was awarded with an assignment for Development of Awareness Cum Training Centre on Concentrating Solar Thermal (CST) Technologies under UNDP-GEF Concentrated Solar Heat Project, MNRE, Government of India. The CST Center is located at 'India One' Solar Thermal Power Plant in Abu Road, Rajasthan. One of the main objectives of the assignment is to create awareness amongst various groups of stakeholders from industries, institutions, and commercial establishments with the aim to generate proposals for installations of CST-based systems at their establishments.

Brahma Kumaris and WRST are currently conducting research and training in the following technologies:

- Solar steam cooking systems
- Solar-thermal power generation and thermal storage

- Photovoltaic stand-alone systems as well as grid-connected systems

- Solar hot water plants

There is an urgent need for a new paradigm that integrates clean technologies into our day-to-day life. At present, the world energy supply highly depends on conventional energy sources, such as gas, oil, and coal. Global warming, environmental degradation, and increased fuel prices threaten the future of humanity. The current crisis is a clear call to transform our awareness and lifestyle. In order to give a strong impulse towards the development of clean technologies and a sustainable society the Brahma Kumaris World Spiritual University along with its sister organization WRST is actively involved since 20 years in the research and demonstration of alternative renewable energy concepts. This not only helps bring awareness amongst those interested but also motivates them to use the applications that are sourced from renewable energy.

The Brahma Kumaris headquarters comprises three large complexes at Mt. Abu and Abu Road— Pandav Bhawan, the International Headquarters; the Academy for a Better World (Gyan Sarovar), near Mt. Abu; and Shantivan Campus at Abu Road. The institution can accommodate up to 25,000 people at a time. All these three campuses host various spiritual programmes, seminars, and workshops throughout the year and millions of people from all over the world and from all walks of life come to attend these sessions. All these campuses proudly exhibit the solar applications-based projects that are running successfully since more than 15 years. The practical demonstration of these running projects gives exposure, learning, confidence and hope for a better and clean future. Through all these years, the institute has become a role model and a guide not just for a spiritual life but also motivates people to adopt solar-based applications for family, community, society and a better world. **AU**

Shri B K Yogendra, Project Coordinator, India One Solar Plant, Brahma Kumaris, Mt. Abu, Rajasthan, India.



YES BANK LAUNCHES YES SCALE

Cleantech to Scale up Startups in Energy Efficiency, Waste Management, and Water Management

On July 9, 2018, YES BANK launched YES SCALE: Cleantech Accelerator, as part of its multi-sector start-up accelerator YES SCALE (Smart City, Clean Tech, Agritech, Lifesciences Tech, Edu Tech). YES SCALE: Cleantech Accelerator will focus on scaling up startups working on energy efficiency, waste management, and water management—paving the way for a cleaner future.

YES SCALE platform will provide affiliated startups with access to technology, mentorship, funding, and commercialization. Affiliated startups will have access to funding of USD 1 mn through various investment partners and will be one of the few global programs to provide zero-equity grant of up to ₹20 lakh for pilot or proof of concept.

The Accelerator was launched at the YES BANK Annual Cleantech Conference 2018 by Shri Praveen Kumar, Additional Secretary, Ministry of New and Renewable Energy, Government of India. The event also witnessed Demo Presentations by finalists of Renewable Energy Startup Awards—institutionalized by the MNRE and supported by YES BANK & IIMA-CIIE. Final winners will be felicitated at MNRE event, later this year. The start-up

itches included innovative solutions on smart design, smart analytics and network intelligence capabilities, IoT and blockchain-based solutions, water management and operational intelligence for wind turbines and solar plants.

On the occasion, YES BANK, together with YES Global Institute unveiled two knowledge publications, titled 'Electric Vehicles: The Colour is Green' and 'Renewable Energy: India's Energy Game Changer'. The former highlights a roadmap for the successful transition to electric vehicles by establishing electric mobility infrastructure, fiscal incentives, robust market linkages, and a strong regulatory framework. The renewable energy report underscores the potential, current trends and roadmap to drive the next wave of growth in the sector.

Speaking on the occasion, Rana Kapoor, MD & CEO, YES BANK and Chairman, YES Global Institute said, "With YES SCALE, we will replicate this model across YES BANK's focus sectors, such as Smart Cities, Agriculture, Clean Energy, Education and Healthcare, to build deep interventions jointly with our corporate clients. This is fully in line with the Bank's vision since inception—which was to cater to the 'sunrise sectors of



India's economy' using knowledge banking to deliver impactful ecosystem solutions."

Shri Praveen Kumar, Additional Secretary, MNRE, said, "Renewable Energy has been recognized as the most important weapon for clean environment. While setting the target to generate 175 GW by 2022, government took a leap of faith which has been responsible for the tremendous growth in the sector. India looks well on course towards achieving the target. If industry and academia come together, solar tariffs could come down even further." The event witnessed participation from Mr Manoj Kohli, Executive Chairman, SB energy; Prof. V. Ramgopal Rao, Director, IIT-Delhi; Mr Rakesh Kumar, Programme Director & Sr Consultant, International Solar Alliance; and Mr Aipt Sharma, Principal, Global Environment Fund. **AU**

Source: www.yesbank.in



THE STORY OF DURGA

Empowering Women through a Sustainable Solar Ecosystem

DURGA Energy has evolved from the Dungarpur initiative, under the Solar Urja through Localization for Sustainability (SoULS) initiative, a flagship programme of IIT-Bombay envisaging to create a thriving and sustainable solar ecosystem to provide clean, reliable, affordable, and complete energy access in the rural areas of India. **Professor Chetan S Solanki** highlights this initiative of empowering women through promotion of quality off-grid solar solutions.



Dungarpur is one of the backward districts of Rajasthan, located in the southern part of the state, chiefly dependent on the seasonal agriculture, animal husbandry, and forest produce as the three sources of subsistence. Characterized by frequent droughts and dry climatic conditions, the hilly terrains and undulating nature of the land supports low crop produce. With marginal agricultural activities and non-existent industrial undertakings, people of Dungarpur have to migrate in search of livelihoods. The population of the district is primarily tribal, therefore, literacy rate of the district is very low. Further aggravating the difficulties of the residing population in the district is the significant number of households that lack clean and reliable energy access with 61% of households dependent on kerosene for lighting and around 94% of households relying on firewood for cooking purposes. Energy insecurity for these tribal communities has significant environmental, economic, social, and health consequences. Moreover, household air pollution (HAP), from burning kerosene and wood, harms women and children's health. Social norms make women and girls responsible for securing the needed fuel, increasing the burden on them and making them more prone to the health hazards of HAP.

This significant percentage of households relying on inefficient fuels for electricity and cooking purposes demands access to energy that would be reliable, clean, and affordable given the limited paying capacity of the households. However, conventional methods of provisioning energy access may not work in the district due to the requirements of natural resources and huge investment, geographically isolated and scattered nature of households and settlements, and vast environmental costs imposed due to the setting up of heavy power plants. In addition to the above, the low paying capacity of households due to lack of decent livelihood opportunities adds to the unviability of the conventional methods. More importantly, the time



» DURGA installing 24x7 solar home lighting

lag between the access to electricity and the operability of the power plant will result in the missed opportunities in terms of gender, education, health, quality of life, poverty, and economic development for the current as well as future generations. Provision of sustainable, reliable, affordable, and complete energy access to the marginalized communities in Dungarpur is, therefore, imperative.

In regions such as Dungarpur, stand-alone solar photovoltaic (PV) technology works well since it receives solar insolation of 5–7 kWh/m² and is endowed with 325 sunny days in a year. Further, the remoteness of the region makes solar PV technology a viable option to provide energy access to the last mile households, unlike the conventional methods. The diffusion of the technology should involve local communities to undertake the ownership, responsibility, and mobilization of the technology, the absence of which has led to the failure of the other solar interventions causing low penetration of technology even in the areas where it is best suited. Since women and girl children in a household are most vulnerable to the hazards of the inefficient fuels, their involvement can be of paramount importance to facilitate the transition to clean and reliable energy access. Under this purview, IIT Bombay initiated a solar intervention to involve women of Dungarpur in forming and operating one-of-its-kind module manufacturing plants

to expedite complete energy access to the households that still have negligible or unreliable electricity. This manufacturing plant was named as the Dungarpur Renewable Energy Technologies Pvt. Ltd. or DURGA Energy.

🔌 DURGA ENERGY

DURGA Energy has evolved from the Dungarpur initiative, under the Solar Urja through Localization for Sustainability (SoULS) initiative, a flagship programme of IIT-Bombay envisaging to create a thriving and sustainable solar ecosystem to provide clean, reliable, affordable, and complete energy access in the rural areas of India. Under the Dungarpur Initiative, the self-help group (SHG) of women formed under the Rajasthan State Rural Livelihood Mission (Rajeevika) were trained to assemble, distribute, and repair and maintain the solar study lamps. Under the initiative, 136 women were trained in assembling the solar study lamps, benefitting 40,000 students and further resulting in five women opening their own solar shops in the region. The initiative also won the Prime Minister's award for excellence in the innovation category on April 21, 2017. After the successful implementation of the initiative by the women, the decision to establish DURGA energy was taken.

Initially, there were concerns regarding whether women will be able to take up this uphill task of implementing the solar project and whether their family



members will be supportive of their unconventional decision to be the solar providers. However, the enthusiasm, eagerness, and excitement that was shown by the women addressed all these apprehensions. Women were confident that they will receive a good response from the communities as the area is energy-deprived and their families will appreciate their contribution to the household income. The confidence shown by the women and recognizing the potential, IIT-Bombay along Rajeevika decided to establish DURGA Energy.

DURGA Energy is a private limited for-profit company completely owned and operated by the tribal women SHGs formed under the four cluster level federations (CLFs) of Antri, Biladi, Jhontri, and Punali of the Rajeevika. The company was established through investments and grants from Rajasthan Tribal Development Fund, Rajeevika, Nagar Parishad, and Corporate Social Responsibility (CSR) Idea Cellular with IIT-Bombay as the knowledge and technology partner. The foundation stone of the company was laid on a day of immense national significance (January 26, 2017), while the company has been fully operational from October 2017. Rajeevika has provided around 8% of the funds required for setting up DURGA Energy. The district administration of Dungarpur also provided 37% of the total funds required for setting up



» DURGA women installing solar panels

the manufacturing unit. Besides this, they have also given the necessary administrative support in acquiring the land, obtaining necessary government permissions, and getting clearance on water, electricity, and labour laws. The CSR division of Idea cellular is one of the funding partners and they have provided approximately 30% of the total funds required for setting up DURGA. While some contribution for setting up the plant was given by the CLFs themselves, Nagar Parishad, Dungarpur, played a pivotal role in setting up DURGA through developing 27,000 sq. ft. of land by doing all the necessary civil work.

❏ PROMOTION OF QUALITY OFF-GRID SOLAR SOLUTIONS

After setting up the plant, through the tribal area development fund (TADF), tribal area development department has provided 37% of the total funds required for running the company. The vision of the company is to promote quality off-grid solar solutions in a sustainable manner, for both the company and the community. The motivation behind setting up the DURGA Energy is to achieve the following objectives:

- Empowering women through skill transfer of solar technology and create livelihood through it
- Providing appropriate energy access (via off-grid solar systems) to the community

- Creating a local solar ecosystem to ensure sustainability.

The company has an installed capacity of 2 MWp, with state-of-the-art equipment and machines, including solar cell cutter and tester, tabbing and stringing stations, framing machines, laminator, module simulator, and electro-luminance tester, amongst others. The company is engaged in manufacturing and selling solar modules, providing a range of solar solutions, including installation and service, (e.g., solar home-powering system, solar pump, solar streetlights, etc.), supporting local rural solar retailer/entrepreneurs and providing livelihood opportunities for the local community. The company provides employment to 200 local people at Dungarpur, with 50–75 locals provided with direct employment, and about 125 locals supported indirectly. The first project of DURGA Energy was the installation of grid-connected solar PV systems at two locations in Dungarpur town and the client was Nagar Parishad, Dungarpur. The first system with the capacity of 7 kWp was installed at Shahid Smarak Park, while the other system with the capacity of 3 kWp was installed at Rain Basera. **AU**

Dr Chetan S Solanki, Professor, Department of Energy Science and Engineering, IIT Bombay. PI, Solar Urja through Localization for Sustainability (SoULS) and National Center for Photovoltaic Research and Education (NCPRE).





MICRO-CREDIT FINANCING

A Vehicle for Clean Energy in Rural India

In this article, **P B Singh** explains how TERI's partnership with a local micro-finance institution helps take clean cooking and lighting technology into poor homes in a village in Bihar.

Consumer finance is very important for business operations in order to drive the demand for products and create a sustainable market. However, it is not restricted to high-end products in urban markets and is also required for the bottom-of-the-pyramid (BoP) market (the poorest and largest set of consumers) for the penetration of clean energy and clean cooking products. Most high-performing clean energy products may cost more than the monthly income of a typical rural BoP household.

Considering this, a project by The Energy and Resources Institute (TERI) and the Department for International

Development (DFID), Government of UK, meant to provide access to clean energy has been placing equal importance on providing finance to the rural poor. The programme has executed partnerships with micro-finance institutions (MFIs) and self-help group (SHG) federations to provide consumer finance for clean energy products. The norms and regulations for lending are more relaxed in the case of MFIs.

The DFID-TERI Clean Energy partnership aimed to foster underserved communities' access to clean energy and healthier living conditions by facilitating the adoption of improved biomass cookstoves (ICS). As part

of the partnership, TERI undertook targeted initiatives for awareness generation, technology development, commercialization, and market value chain creation. For last-mile delivery, TERI partnered with local non-governmental organizations (NGOs), local entrepreneurs, and MFIs who could provide easy consumer finance to those willing to purchase ICS through local retailers, called energy enterprises (EEs). Additionally, the partnership emerged as an early advocate of Integrated Domestic Energy Systems (IDES), a solar energy-based technology product, which addressed the dual challenges of basic lighting and clean cooking.



In October 2013, TERI offered the Prayas Saakh Avam Bachat Swaylambi Sahkari Samiti, an MFI in Kanti Block of Bihar's Muzaffarpur district, the opportunity to get involved. Prayas Samiti was an MFI in the banking sector. Its members could open an account in their banks and raise loans to run their small-scale businesses effectively. Under the TERI-DFID programme's implementation project, the families residing in villages near Narsanda Chowk, where the Samiti was located, were to be approached and encouraged to adopt clean cooking and lighting technology.

Under the project, TERI provided the IDES, which consists of two luminaries, a mobile charging point, a forced draft cookstove (Unnat Chulha), and a solar panel for charging. An agreement was signed between TERI and Prayas Samiti and follow-up meetings held with the Samiti staff members to discuss ways to spread awareness about the programme.



The Prayas Samiti Energy Enterprise was formed under the project. It was entrusted with the responsibility of installation and maintenance of IDES whose solar-charged luminaries provided 4–5 hours of lighting in the evening. The system's Unnat Chulha used less fuel (firewood), produced less smoke, and considerably reduced cooking time.

As part of the partnership, Prayas provisioned easy access to consumer finance to its beneficiaries interested in buying IDES on a reduced rate. The interest rate was 1.5 per cent per month, on a reducing rate basis. TERI also rolled out an arrangement whereby the buyers were to only pay the principal amount and the interest was paid to Prayas from the DFID-TERI Clean Energy partnership project fund.

The IDES was demonstrated in various villages of Kanti Block, but the residents still had doubts about its durability and maintenance and hence were hesitant to buy it. It was then that Sheela Devi, who had been associated with Prayas for five years, stepped forward.

Sheela Devi lived in a joint family of 14 members in which most men worked as daily wage labourers to make ends meet. She wanted to establish her own business, but was short on financial resources. Prayas Samiti helped her secure a loan to open a small grocery shop. After a while, she applied for another loan of ₹2 lakh to open a domestic flour mill that required a diesel engine to run the motor. However, due to insufficient electricity supply in the evening hours, the mill could not be kept open till late evening, cutting down income opportunities. Further, lack of electricity at night forced her to use a



kerosene lamp, which also slowed down the progress of her business.

It was in this situation that Sheela Devi stepped forward to accept the IDES. The system was installed in her house with one bulb in her kitchen and another to light up the room where she used to operate the flour mill. This also helped her run her grocery shop till late in the evening, resulting in increasing her earnings. Her children could also study comfortably at night under the light of the LED bulb. The cookstove provided as a part of the IDES also helped her save fuelwood, which was otherwise difficult to arrange. Most importantly, the cookstove's advanced combustion technology reduced the amount of smoke that traditional cookstoves emitted.

After her experience, many families in the village also decided to install the IDES at their houses and got themselves registered with Prayas Samiti. Of the total 60 IDES beneficiaries, 35 availed a loan from the Samiti to install the system. Soon, Sheela Devi herself got a second loan for a second IDES in her home. Post-installation, TERI continued monitoring to ensure the proper upkeep of the IDES and providing user training to beneficiaries. According to Sheela Devi, the presence of Prayas Enterprise just 2–3 km from her village and their prompt response to phone calls was also of great help in the maintenance of the system. She happily says, "My family is no longer dependent on grid electricity to run our shop and neither is there any danger of electric shocks or exposure to smoke. AU

Article Courtesy: Mr P B Singh; <http://www.teriin.org/>



SOLAR IRRIGATION IN RURAL INDIA

The Success Story of Samastipur, Bihar

This article highlights how solar irrigation in Bihar has helped farmers double the yield. It is a wonderful example of how renewable energy is transforming rural India.

At a time when farmers across the country are in distress, solar power-irrigated agricultural fields at Chakhaji village in Pusa block, Samastipur, Bihar, are lush green. Standing resplendently are bumper crops of peas, tomatoes, a variety of vegetables, and tobacco.

Since the solar power irrigation project was launched towards the end of 2016, dividends have been good. There is no more dependency on the polluting diesel pump sets or the vagaries of state electricity to pump water into the fields. Solar panels herald improved irrigation, carbon-free air, and increased earnings for farmers.

SUCCESSFUL MODEL

Two experienced organizations in the developmental sector, the Aga Khan Rural Support Programme (AKRSP), and the International Water Management Institute/Tata Power, joined hands and worked out a successful business model over five years, since 2011. Now, five entrepreneurs are providing water for irrigating 180 acres of land at a charge. The Aga Khan Foundation (AKF) and its sister agency, the AKRSP, India, focus on supporting marginalized communities' economic development and environmental protection through community-based approaches to natural resource management (NRM) and





livelihood enhancement at the village level. Particular focus is also put on facilitating wider learning and outreach at state and national levels. The programme currently works in over 2,800 villages, directly benefitting almost 1.6 million people, in the states of Bihar, Gujarat, Madhya Pradesh, and Uttar Pradesh.

“Earlier, though groundwater was available at a depth of 25–35 ft, taking it to fields was a problem,” says Ajit Chaudhary of AKRSP. “Electricity was available only for 4–5 hours in a day.” Diesel pumpsets for irrigation were expensive, emitted carbon dioxide, and had to be replaced periodically. Initially, a system was worked out where farmers would pay ₹120 for an hour of water supply to an irrigation development committee representing two groups of 90 farmers. The water was drawn through a shallow borewell using diesel pumps. Though farmers were able to get an extra crop in the zaid season, which falls between Rabi and Kharif, the managers of the committee were not getting the viable returns.

The business model was reworked with the community and solar-powered irrigation using 5 HP pumps was introduced through farmer entrepreneurs who could make the initial investment of ₹50,000. AKRSP and IWMI/Tata Power made an investment of ₹8 lakh–₹3.5 lakh for the solar panels, advanced as loan and the rest as subsidy.

A solar-powered 5-HP submersible pump provides approximately one lakh litres of water per day on a sunny day, enough to irrigate 20–25 acres of land. Similarly, a 5,000 litre tank can be filled in 22 minutes for drinking purposes. Since the water comes from a greater depth, it is also contamination-free.

Yatin, an entrepreneur at Chakhaji village, has 20 solar panels and irrigates 30 acres for 110 farmers at ₹90 for an hour’s supply. He also irrigates his one acre of farmland and is in tune with the farming problems of the region. With 5-HP pumps and bigger pipes, the volume of water released is more and the pumping time is less. Since the introduction of the solar-powered irrigation scheme in 2016, Yatin’s earnings have trebled to ₹120,000 annually. He has paid off the ₹35,000 loan for the solar panels and by 2020 hopes to become the sole owner of the solar-irrigated system.

Every three months, entrepreneurs are trained on maintaining the system and cleaning the panels.

🔥 INCREASE IN INCOME

Farmers’ incomes have increased too. Arun Kumar Singh, who has an acre of land, says as against ₹6,000 paid for water in a season earlier, he now pays ₹2,000 and because of the increased flow, yields have doubled. He is able to get two, sometimes three, crops in a season.

Ram Dulhari, a widow, has two acres

of land but cultivates just half-an-acre. The rest is leased out at ₹3,300 per acre and she uses the income to educate her children. With solar-powered irrigation, the value of the leased land has increased. Market savvy, she grows peas because it entails less labour and good returns. Notably, ten farmers at Chakhaji are women.

Cementing the community is the Kisan Vikas Samiti, which provides streetlights, and the Adarsh Kisan Club that helps finance loans and also looks at social issues. In 2011, computer classes were started for girls in the village and 16 girls, who completed the course, are employed.

In the adjoining village of the traditional Kushwaha farming community, entrepreneur Neel Kamal supplies water to 50 acres for 100 farmers, 10 of them single women. In addition to the seasonal vegetables, farmers cultivate tobacco and fruits. Since the soil here is sandy, Kamal says more water is required. Fifty per cent of the farmers settle their water fees promptly, the rest when they sell their crop.

Solar-powered water is available for eight hours a day, but most farmers make do with just 2–4 hours. It is only in winter and under foggy conditions that the sun’s rays may not be adequate. They can then turn to diesel to meet their requirements. **AU**

Article Courtesy: <https://www.thehindubusinessline.com>; Picture Courtesy: <http://www.akdn.org/>



» The Minister of State (I/C) for Power and New and Renewable Energy, Shri Raj Kumar Singh releasing the booklet “State Distribution Utilities - Sixth Annual Integrated Rating”, at the Conference of Power and New & Renewable Energy Ministers of States & UTs, in Shimla, Himachal Pradesh on July 03, 2018. The Chief Minister of Himachal Pradesh, Shri Jai Ram Thakur, the Secretary, Ministry of Power, Shri Ajay Kumar Bhalla, the Secretary, MNRE, Shri Anand Kumar and other dignitaries are also seen.

Conference of Power and New & Renewable Energy Ministers of States and UTs

“We are one team and should work together to provide electricity connection to every poor household in India. Access to energy is a prerequisite for a poverty free India. Energy is the engine of growth and no country can ever develop with millions of its citizen living without electricity” said Shri R K Singh, Union Minister (IC) for Power and New & Renewable Energy. The Minister was addressing the Conference of Power and New & Renewable Energy Ministers of States & UTs held at Shimla on July 3, 2018.

The conference which saw participation of Power Ministers and Secretaries from the States/UTs and senior officials from power and renewable energy (RE) sectors deliberated upon various issues pertaining to the power and RE sectors in India. Various Government programmes were taken up for discussion, such as Power for All, Saubhagya, IPDS, UDAY and RE sector during the one-day conference.

Calling the DISCOMs as the axis of power sector, the Minister called upon the

states to plug DISCOMs losses. He said that subsidies in power sector should be routed through Direct Benefit Transfer (DBT). Talking of infrastructure creation in States, the Minister highlighted slow utilization of the funds approved by the centre. He also said that Centre is ready to provide more funds if needed for infrastructure creation and the States meeting their targets speedily will be incentivized. Calling the prepaid meters a pro-poor step, Shri Singh said that today a poor person may find it difficult to pay one month's electricity bill at one go. Smart prepaid meters will enable him to pay in small installments as per his convenience without the fear of his connection being cut. It will also eliminate the problem of wrong bills being raised. Talking of reforms in power sector, the Power Minister said that affordability is the key and a mechanism needs to be put in place so that power from most efficient plants is utilized first. This would bring down electricity prices.

On the issue of coal shortage, Shri

Singh said that supply of coal has increased but the coal problem is persisting because our demand is increasing which is a good sign for the development of our country. Listing various steps taken to address coal shortage, he said that states have been given freedom to import coal if they needed so. At the same time efforts are being made to start new mines and increase transportation capacity.

On the renewable energy front, the Minister said that it has tremendous potential but balancing need to be done by power generated from hydro and gas. He also cautioned that hydro and gas should serve as peaking load not based load. He also mentioned that the Government was bringing hydropower policy to address various issues facing hydro power sector. The Minister said that he would make every effort and work in collaboration with States to ensure that every citizen of India has round-the-clock power supply. pib.nic.in

Source: pib.nic.in



Shri R K Singh Inaugurates Solar Plant at Gurdwara Rakab Ganj Sahib, New Delhi

The Minister Calls for a Clean Environment for Our Future Generations



“India is making rapid strides in the field of renewable energy and we will overshoot the target of 175 GW renewable energy by 2022,” said Shri R K Singh, Minister of State(IC) for Power and New & Renewable Energy, Government of India. He was speaking as the Chief Guest at the inauguration of 1,500-kWp capacity solar plant developed by the Delhi Sikh Gurdwara Management Committee (DSGMC) at the Gurdwara Rakab Ganj Sahib. The event took place on June 20, 2018.

This plant is expected to generate 2 million units of energy annually, resulting in annual savings of ₹1 crore. The Rakab Ganj Sahib project is expected to reduce carbon footprint of around 1,800 tonnes every year. Over the life cycle of the plant, 45,000 tonnes of carbon emission would be reduced. The DSGMC has been working for solarizing rooftops of the Gurdwaras and educational institutions associated with it.

Lauding this noble initiative by the DSGMC, Shri Singh said that this would



inspire other institutions to go green and become environment conscious. He said that 20 cities in India are ranked amongst the most polluted in the world and there is an urgent need to reduce fossil fuel use so that we leave a better world for our children. The Minister reiterated the Government's commitment to bring electricity to every household by December 31, 2018.

The solar plant was inaugurated by Sant Balbir Singh Ji Seechewal and Baba Sewa Singh Ji. Shri Hardeep Puri, Minister of State (I/C) for Housing & Urban Affairs and Dr Harsh Vardhan, Minister of Environment, Forest and Climate Change were amongst the dignitaries present at the occasion. **AU**

Source: pib.nic.in

NITI AAYOG AND CII LAUNCH PARTNERSHIP ON SDGs



Union Minister Shri Raj Kumar Singh, Minister of State (IC), Power and New & Renewable Energy, Government of India, mentioned that business and government must partner for sustainable development of India. He was speaking at the launch of NITI Aayog and CII Partnership on SDGs, at the Government and Business Partnership Conclave in New Delhi on August 8, 2018, organized by NITI Aayog, Confederation of Indian Industry (CII), and UN.

The Minister said that in sustainable development three things matter the most: energy, water, and circular economy/green industry. To action his 2022 agenda, he expressed confidence that India will achieve its clean energy goals even earlier than 2022 and urged everyone to be conscious and responsible towards the environment.

Shri Amitabh Kant, CEO, NITI Aayog, in his address highlighted the high pace of India's urbanization at a time when the countries such as the USA are almost through with this process. Given our population, Shri Kant emphasized, "the

only way to grow and develop sustainably is to use technology to leapfrog; use new and renewable energy and push for R&D and innovation to generate demand for electric vehicles, hydrogen cars, etc., and to find local solutions for 7 million strong population around the world."

Speaking at the occasion, Mr Yuri Afanasiev, UN Resident Coordinator, said that "conditions in India are favourable due to its nature, history, and demography, to come up with solutions towards a sustainable and circular economy for the world to emulate."

Shri Rakesh Bharti Mittal, President CII, and Vice Chairman, Bharti Enterprises Ltd stressed that the current theme of CII 2018/19 'India RISE: Responsible. Inclusive. Sustainable.' is aligned with the sustainability agenda. Shri Chandrajit Banerjee, Director General, CII, mentioned that CII's nine Centres of Excellence are well-aligned to the SDGs.

CII-NITI Aayog have entered into a three-year partnership and an MoU was signed. This partnership focusses on specific activities that seek to develop: 1.

Vision and Action Agenda for businesses and industries to contribute to SDGs; 2. Annual Status Reports; 3. Sector-specific Best Practise Documents. On this occasion Dr Ashok Kumar Jain, Adviser, NITI Aayog, spoke about the partnership and welcomed CII for innovative initiatives going forward.

CII launched the report—*Indian Solutions for the World to Achieve SDGs*. The report deep-dives into each of the SDGs, targets, and business implications thereof. The report cites examples that illustrate how companies have incorporated the SDGs framework into their business strategy and have gone about achieving them. Distinguished Participants in the Conclave included senior officials from Ministry of Housing and Urban Affairs, Ministry of Power, Ministry of New and Renewable Energy, and Ministry of Drinking Water and Sanitation and representatives of several State governments, such as Telangana, Andhra Pradesh, and Gujarat. www.cii.org.in

Source: pib.nic.in



SOLAR PANEL COOKER

A New Design

A solar cooker is a device which uses the energy of direct sunlight to heat, cook or pasteurise food materials. Because they use no fuel and there is no cost involved in operating them, many non-profit organizations are promoting their use worldwide in order to help reduce fuel costs and air pollution, and to slow down the deforestation and desertification

caused by gathering firewood for cooking. Solar cookers are also sometimes used for cooking outside, especially when using fire is risky or there is no fuel. The solar cooker is very useful. It uses a renewable source of energy. Panel solar cookers are inexpensive solar cookers that use reflective panels to direct sunlight to a cooking pot that is enclosed in a clear plastic bag. Here, the author presents a

new design of solar panel cooker which has a simple design, is light weight, and has a sophisticated appearance.

⚡ DIMENSIONS OF THE NEWLY DESIGNED COOKER

- Base- length x width- 1.5 ft x 1 ft
- South-facing back wall- length x width- 1.5 ft x 0.5 ft
- South-facing mirror reflector - length x width- 1.5 ft x 1 ft
- North-facing mirror reflector - length x width- 1.5 ft x 6 inch
- Maximum aperture area (during test at 12 hrs) – 1.5 ft 5.25 inch x 1.5 ft
- Glass bowl- diameter- 8.5 inch, Height- 4.5 inch
- Cooking pot- diameter- 6 inch, Height- 3 inch

⚡ MATERIALS USED

- G I sheet
- G I strips
- Stainless steel “L” channel
- Mirror reflector
- Aluminium reflector
- Borosilicate glass bowl
- Aluminium cooking pot painted with dull black paint except the bottom end (spray painted by automobile muffler paint)

⚡ TOTAL COST OF PROTOTYPE FABRICATION

Approximately ₹3,000 including borosilicate glass bowls and cooking pots.



» Solar cooker with mirror reflector and polished aluminium reflector at base and back wall



» Cooker in folded condition



» Glass bowl on pot stand and cooking pot in glass bowl placed on another pot stand



» Solar cooker and cooking pots inside glass bowl



Main cost: two borosilicate glass bowls.
Price of each bowl is ₹790.

⚡ TEST REPORT

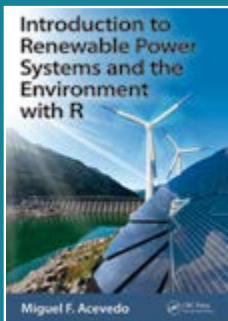
Test timing: 10–40 hours to 13–40 hours

- Cooker is reoriented after every 20 minutes interval during test
- Reflectors are adjusted after every 40 minutes interval during test
- Average solar irradiance during test: 0.6 kW per sq. m
- One pot is filled with rice and the other pot is filled with water
- Ambient temperature: 32 °C
- Initial water temperature: 28 °C
- Weight of each cooking pot with lid: 0.3 kg
- Weight of rice after cooking: 0.5 kg
- Weight of water filled in another pot: 1 kg (volume of pot: 1.3 L)
- Time taken for cooking of well boiled soft rice: 2 hours (at 12–40 hrs)
- Water temperature in the other pot after 3 hours (at 13–40 hrs): 85 °C

⚡ MERITS OF THE NEW COOKER

The cooker design is simple, light weight, and has a good appearance. Additional benefit of this cooker is that, glass bowls of this cooker can be used for microwave cooking. Also, these bowls can be used as fruit or salad bowl. Given this, the cooker's high cost is justified due to the expensive borosilicate glass bowls that are available in the market.^[10]

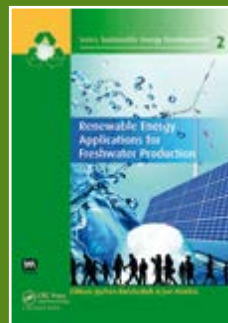
Design and prototype by Mr Sankha Subhra Datta, Jalpaiguri, West Bengal, India. Retired Senior Section Engineer (Mechanical). N F Railway, E-mail: subhradatta611@gmail.com



INTRODUCTION TO RENEWABLE POWER SYSTEMS AND THE ENVIRONMENT WITH R

Miguel F Acevedo; CRC Press, 439 pages

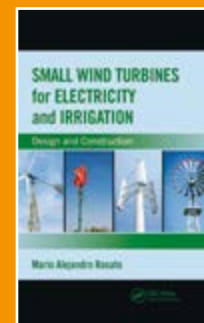
This textbook introduces the fundamentals of renewable electrical power systems examining their direct relationships with the environment. It covers conventional power systems and opportunities for increased efficiencies and friendlier environmental interactions. While presenting state-of-the-art technology, the author uses a practical interdisciplinary approach explaining electrical, thermodynamics, and environmental topics within every chapter. This approach allows students to feel comfortable moving across these disciplines. The added value are the examples of software programs using open-source systems which serve as learning tools for the concepts and techniques described in the book.



RENEWABLE ENERGY APPLICATIONS FOR FRESHWATER PRODUCTION

Jochen Bundschuh, Jan Hoinkis; CRC Press, 286 pages

This book provides an overview on possible cost-efficient techniques and application opportunities for different scales and shows why the implementation of these technologies faces numerous technological, economic, and policy barriers and provides suggestions how they can be overcome. It serves as a synoptic compendium of the fundamentals of freshwater production using renewable energies, applicable to all types of water, ranging from brackish to marine water and also including industrial and communal residual water. The book is aimed at professionals, academics and decision makers worldwide, working in the areas of water resources, water supply, land planning, energy planning, greenhouse gases emission mitigation and rural development. The book is possibly the first to address the topic of using renewable energy for decentralized clean water production. It has been written by internationally renowned authors with first-hand experience working on the production of freshwater using renewable energy sources



SMALL WIND TURBINES FOR ELECTRICITY AND IRRIGATION: DESIGN AND CONSTRUCTION

Mario Alejandro Rosato; CRC Press, 327 pages

This practical book deals with the technology of small-power wind turbines as opposed to widely diffused industrial wind turbines and wind farms. It covers the most common wind turbine technologies in the small power segment: horizontal axis both for electrical generation and water pumping, vertical axis of the Darrieus type, and vertical axis of the Savonius type. With each chapter following the same didactic scheme—a theoretical explanation and practical examples showing calculation procedures—it allows anybody with basic technical knowledge to design and build a small wind turbine for any site. A set of simple spreadsheets is available for download, each providing further examples of how to solve specific design problems and allowing the reader to play with changing parameters and see what-if. This simple trial-and-error learning process allows beginners to develop the feeling of the orders of magnitude involved in the design of a small wind power system, its potential advantages on other alternative solutions, and its limitations under some special circumstances.



NATIONAL

October 3-5, 2018 | Greater Noida, India

2nd Global RE-INVEST 2018

Website: <https://re-invest.in/>

October 12, 2018 | Bengaluru, India

Solar Roofs Karnataka 2018

Website: <http://solarquarter.com/solarroofs/index.php/past-edition/conference/solarroofs-karnataka-2018>

October 25-26, 2018 | New Delhi, India

EV India Charging Conclave 2018

Website: <https://www.evindiacharging.com/1>

November 2, 2018 | Mumbai, India

REIFF - Renewable Energy Investment & Finance Forum 2018

Website: <https://www.tradeindia.com/TradeShows/72312/REIFF-Renewable-Energy-Investment-Finance-Forum.html>

December 4-5, 2018 Chennai, India

Green Power 2018

Website: <http://www.greenpower-cii.com/>

INTERNATIONAL

October 8-10, 2018 | Maryland, USA

Maryland Clean Energy Summi

Website: <https://mcecs Summit.org/>

October 16-17, 2018 | North Carolina, USA

BioCycle Conference On Renewable Energy From Organics Recycling (BioCycle Refor)s

Website: <http://biocyclerefor.com/>

October 22, 2018 | London, UK

4th International Conference on Renewable, Conventional Power and Green Technology 2018

Website: <https://www.eventbrite.co.uk>

November 7-8, 2018 | London, UK

Future of Biogas Europe

Website: <https://www.eco-business.com/events/future-of-biogas-europe/>

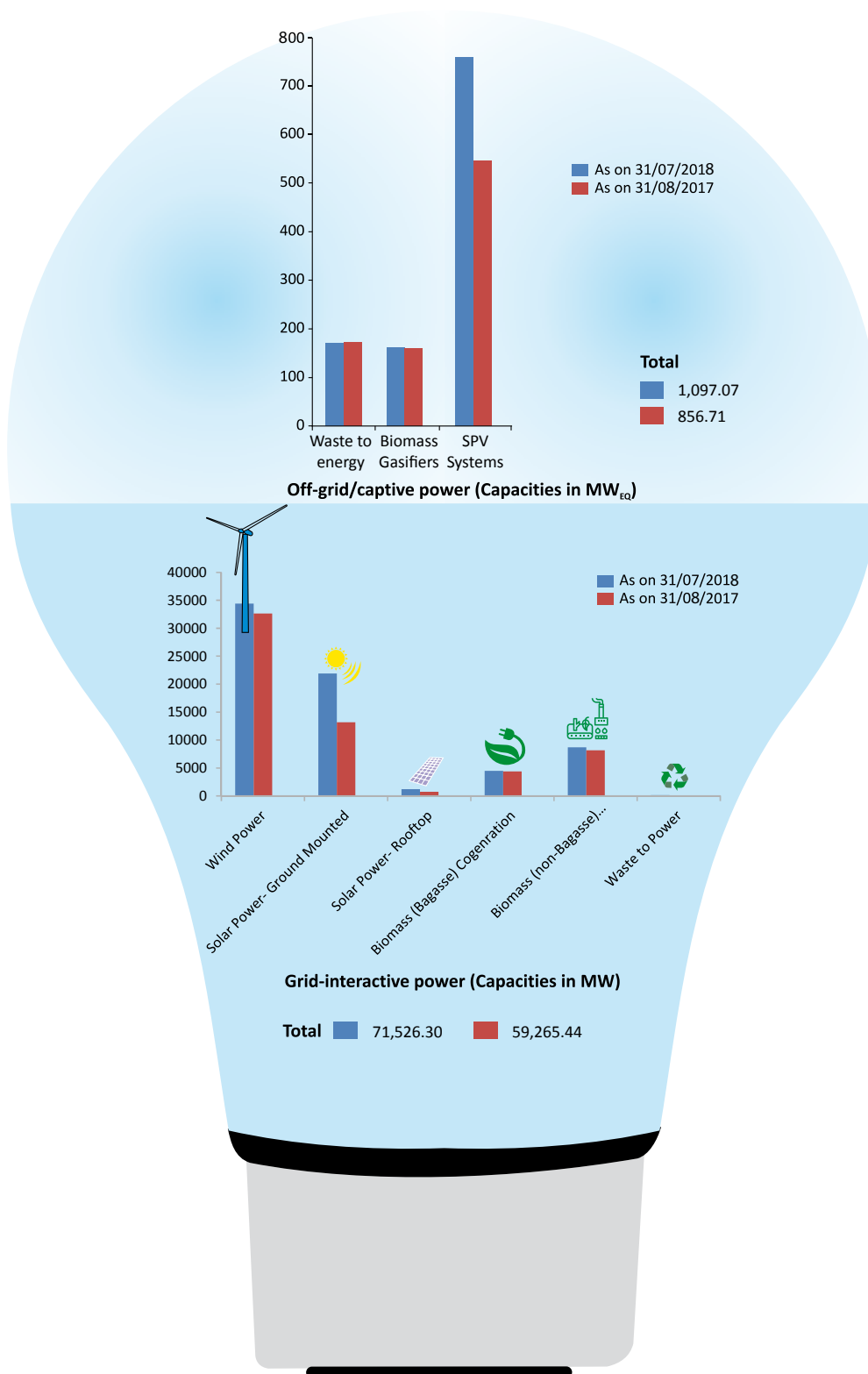
November 26-27, 2018 | Nonthaburi, Thailand

Solar & Off-Grid Renewables Southeast Asia

Website: <https://seasia.solarenergyevents.com/>



RENEWABLE ENERGY AT A GLANCE: INDIA



Source: <https://mnre.gov.in/physicaprogreachievements>

Govt. of India
Ministry of New and Renewable Energy
"PRAKRITIK URJA PURASKAR YOJNA"

Ministry of New and Renewable Energy, Government of India is operating 'Prakritik Urja Puraskar Yojna' to encourage original book-writing in Hindi/translation of books in Hindi in the field of New and Renewable Sources of Energy.

Under the scheme, there is a provision to award a first prize of Rs. 1,00,000/- (Rs. One Lakh), second prize of Rs. 60,000/- (Rs. Sixty Thousand) and a third prize of Rs. 40,000/- (Rs. Forty Thousand) for the books originally written in Hindi.

Preference will be given to the books originally written in Hindi. If any translated book is selected for award in that case prize money will be half of the amount given to original books.

All authors, whether Government employees or Non-Governmental persons, can participate in the scheme. Entries are invited for the award for the calendar year 2017. Under the Scheme, books originally written in Hindi or translated into Hindi should be published from the year 2013 to 2017.

The last date of receipt of entries is October. 31st, 2018. Entries will be accepted in prescribed proforma only. For prescribed proforma and further details, please visit this Ministry's website www.mnre.gov.in

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- Upto 30% Central Financial Assistance (CFA) for residential, institutional, and social sector buildings which is upto 70% in North-Eastern States, Sikkim, Himachal Pradesh, J&K, Uttarakhand, and Islands
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CONTACT

- Solar Energy Corporation of India (website www.seci.gov.in, Phone Number: 011-71989200, Email: corporate@seci.gov.in)
- Empaneled Channel Partners/New Entrepreneurs (list available at MNRE website www.mnre.gov.in)
- State Nodal Agencies for respective States (<http://www.mnre.gov.in/related-links/>)
- Indian Renewable Energy Development Agency (www.ireda.gov.in, Phone Number: 011-26717428, Email: abhilakh@ireda.gov.in)



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