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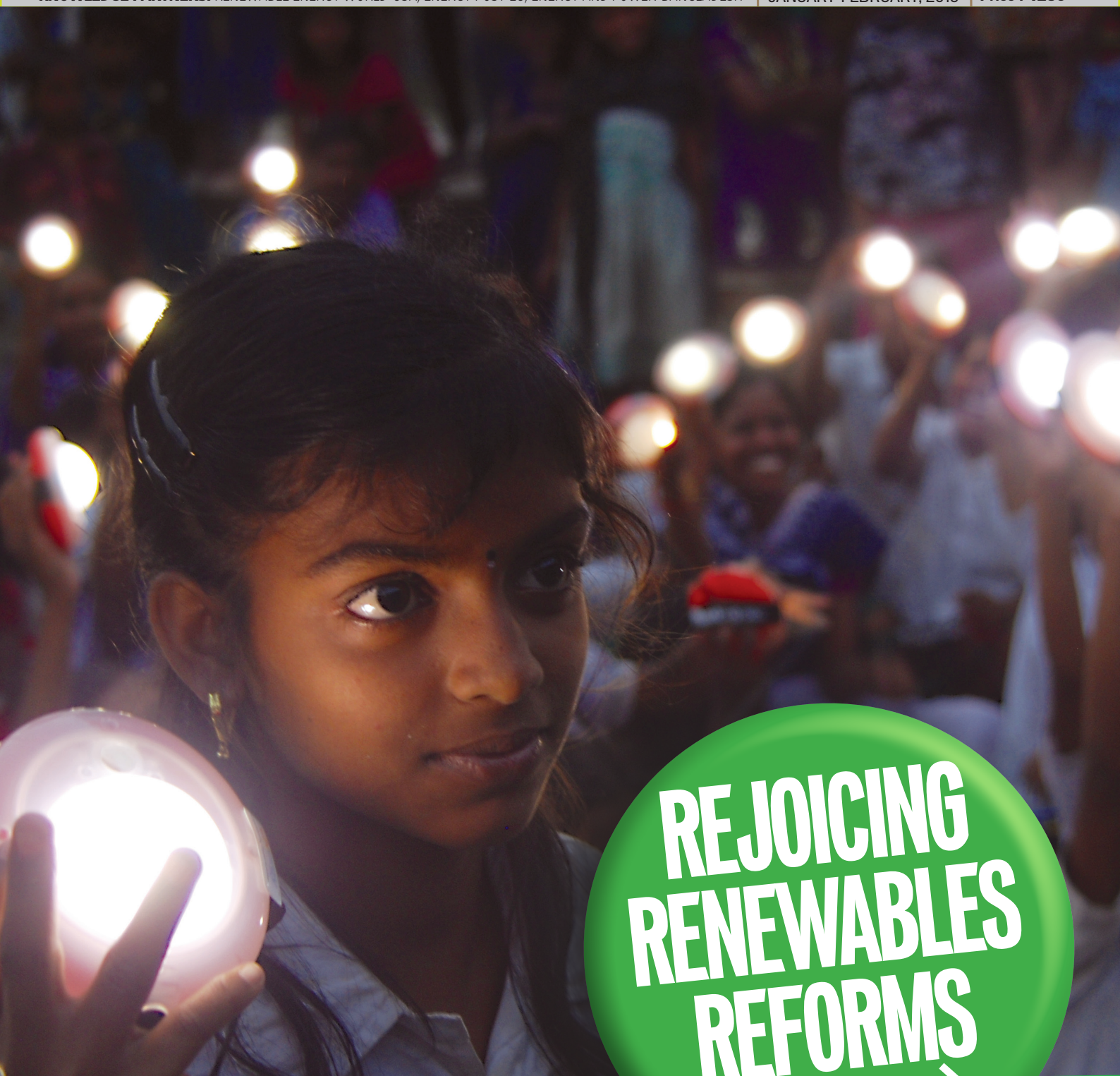
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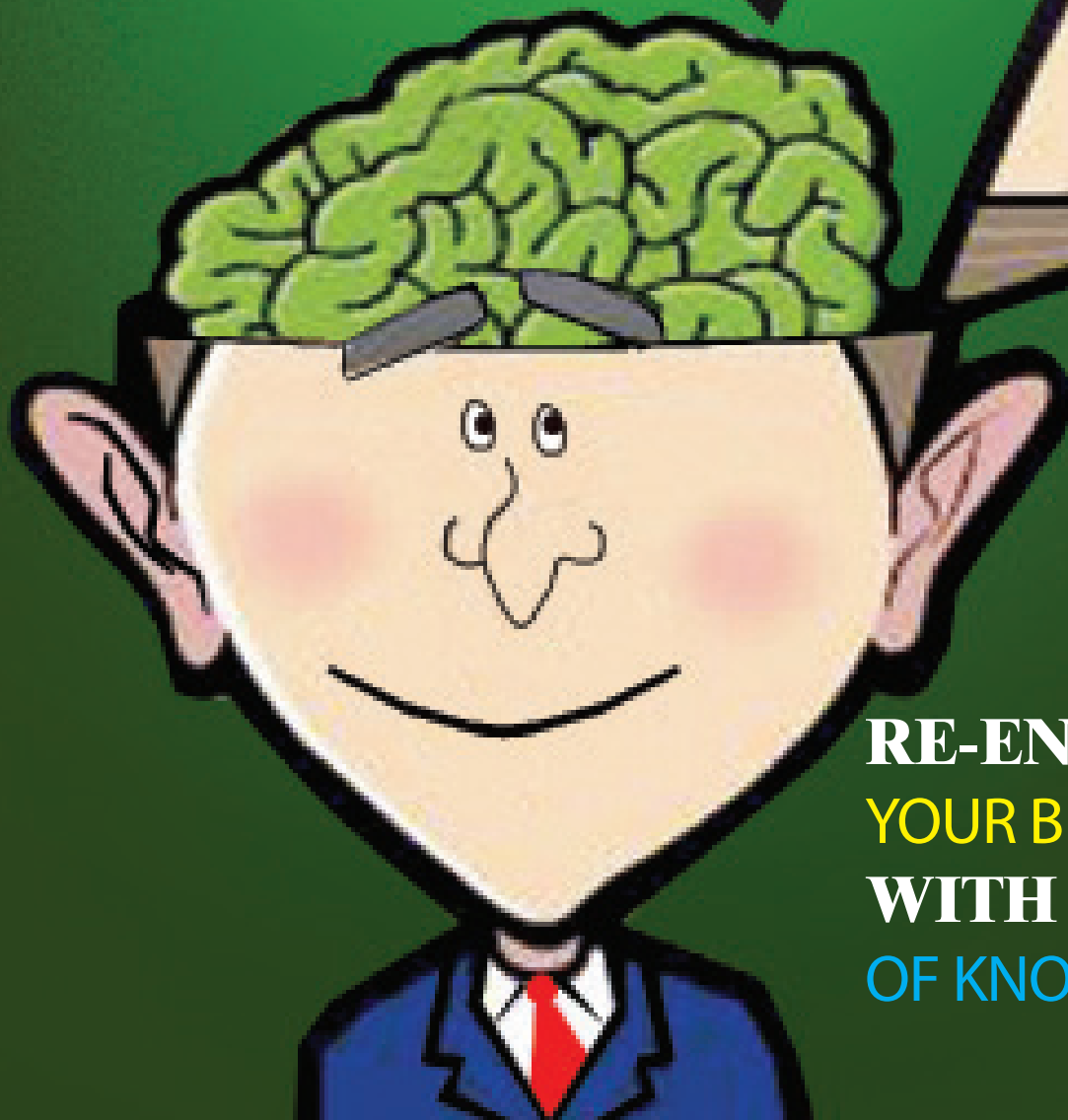
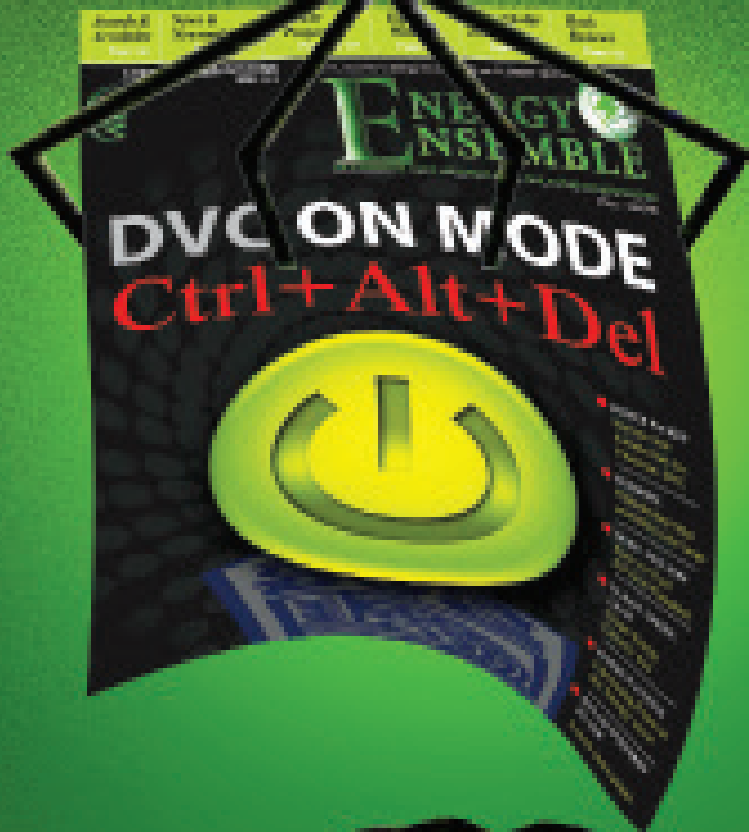
REJOICING RENEWABLES REFORMS



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India’s Coal Mining Sector Now Open For Business

At a time when the debate is raging on the wisdom of not privatizing the large PSU banks fully, the Narendra Modi government has taken the bold initiative of opening up coal mining to the private sector. **Pg 7-8**



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ONGC’s Acquisition of HPCL to be Credit Neutral

20 Cleantech Startups Making It Happen

Dassault Systèmes unveils ‘Electro Mobility Accelerator’ in India

Goldstone Infratech completes 1-lakh km on its 100% electric buses on Indian roads

Sealdah goes for solar makeover

Tata Power Club Enerji organizes awareness initiatives

Ultimate Sun Systems commissions solar plant at MM Medical College & Hospital Solan

‘One-fourth of Bengal’s total power to come from renewables’

West Bengal chief minister Mamata Banerjee may have shown red-card to Russia’s Rosatom on the nuclear power project in Haripur, but Mamata Magic seems to be working wonders in other clean energy spheres. With moves afoot to boost renewable energy’s contribution to one-fourth of West Bengal’s power portfolio, State Power Minister **Sobhandeb Chattopadhyay** in his first-ever comprehensive interview to **Sanchari Ganguli** of **Energy Ensemble** talks about the big-bang initiatives being undertaken to realize the mission. Affable and humble, Chattopadhyay decodes

Bengal power scenario and shares the blue-print of his government’s alternative energy aspirations to benefit the masses. After receiving global accolades for the ‘Kanyashree’ scheme, the West Bengal government has now embarked on yet another ambitious project to light up the lives of millions of rural residents with ‘Aloshree’.

Q: Although West Bengal is now in a position export power to other states after meeting its internal demand fully, it is perceived that there is an urgent requirement for more power to accelerate the economic and industrial growth of the state. What is your view on that and what actions are you taking to increase power supply for a possible demand growth in power?

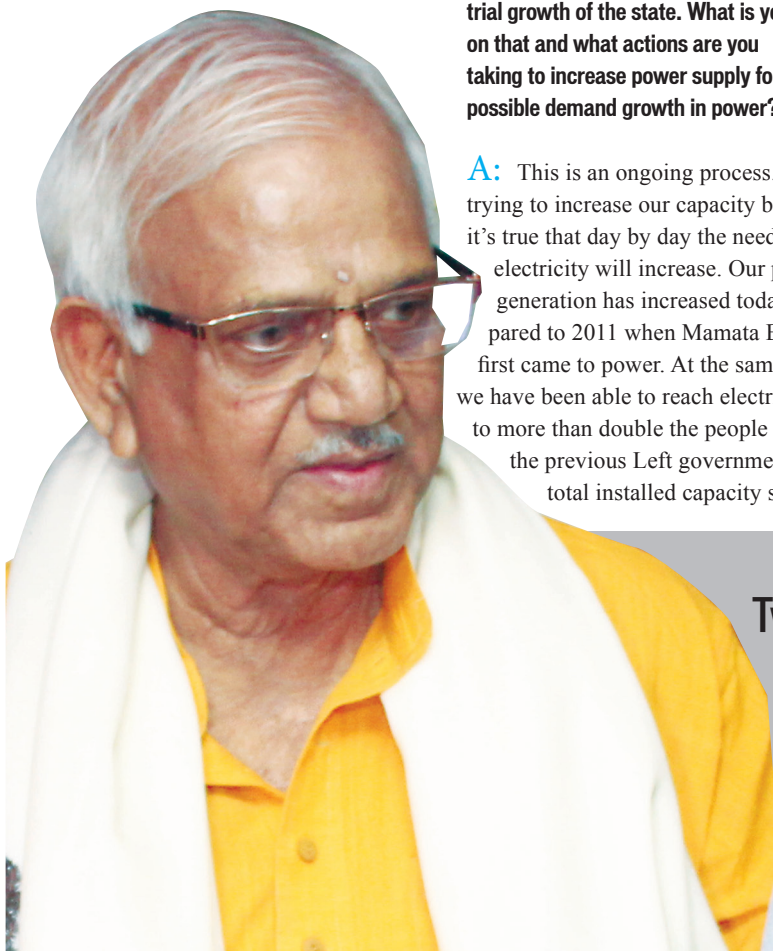
A: This is an ongoing process. We are trying to increase our capacity because it’s true that day by day the need of electricity will increase. Our power generation has increased today compared to 2011 when Mamata Banerjee first came to power. At the same time, we have been able to reach electricity to more than double the people than the previous Left government. Our total installed capacity stands at

9680.5 MW. The electricity we get from PDCL is 4865 MW. Among others, DPL (Durgapur Projects Limited) generates 660 MW. This is our overall capacity, but the actual figure varies from day to day depending on other factors. Grid-connected solar power reached 34.70 MW. Besides there are entities with whom we have power purchase agreement and we buy electricity from them. These entities are CESC 1725 MW, Tata Power 120 MW and IPCL 12 MW, and from central public sector entities we get another 1200 MW. Our peak power demand is not more the 6000 MW. So, there is actually no electricity deficit in Bengal. We sell 250 MW electricity to Bangladesh. We have 1000 MW more from Purulia pump-storage project; we have already started work on that project. At Sagardighi, we have started work for more than 660 MW thermal power stations. These are the recent projects in our hand. There are ten more solar plants and two floating solar plants which are coming up and these will increase our overall capacity to take Bengal forward.

Q: Are you drawing up a long term plan for generation of power and execution of power projects? Can you throw some light on these initiatives?

Two new programmes have been initiated by Chief Minister Mamata Banerjee in form of ‘Sobar Ghore Alo’ (Light At Every Home) and ‘Aloshree’.

SOBHANDEB CHATTOPADHYAY





A: Two new programmes have been initiated by Chief Minister Mamata Banerjee in form of ‘Sobar Ghore Alo’ (Light At Every Home) and ‘Aloshree’. The mission of ‘Aloshree’ is to provide 1,000 solar power plants (10-20kw plant size) per year in government schools and colleges. Already, we are in the process of providing these solar plants to schools and colleges.

That apart, many industries use their own power to produce electricity and this system is called captive power generation. Captive power plants are spread throughout the length and breadth of West Bengal. You can see them in jute mills, Patton Industries etc. This is an ongoing process for industry.

Q: What are your plans about improving and strengthening power transmission and distribution (T&D) for the state?

A: In 2011, our consumer count stood at almost 86 lakh. In just five and half years (2017), we have reached double the number at 1.78 crore consumers. There are some river banks where distributing electricity is an expensive proposition. It is a very difficult task to put poles on the riverbanks of Padma and Ganges rivers. There are 82 such places where we have envisioned giving solar power, thereby catering to the electricity needs of the masses. This will ensure that there will be production of electricity and people of those places can use power. Power generation can be done through the solar storage battery system, if needed. Subsequently, it can be used at night for different purposes.

Our growth has been really good in the field of T&D. We have seen 114% increase in the field of domestic consumers, and 76.91% in commercial consumers. Some say that we are not doing anything on the commercial front. They complain that the state is not increasing electricity capacity. All this is absolutely baseless and incorrect. We have seen 27.22% increase in industrial consumers. Increase of 99.3% has been witnessed in agricultural consumers.

As a whole, our growth is very

satisfactory. Now we are trying to reduce the voltage fluctuation problem in the state. The reason for voltage dropping is that our pace of substation installations has not been able to keep up with the rapid power supply expansion done by us. Electricity can be supplied to a place in a matter of few months while creating a substation will take at least two years. So, now we have decided that we will create another 215 substations. That is our target. Many of them are in different stages of implementation.

The supposed slow industrial growth in the state is not an outlier. If you survey the national and global scenario, industrial growth has moderated or stagnated across geographies. So, in fact industry is not growing enough and that is the problem everywhere. Our data shows that industrial consumers increased by 27.22% in West Bengal, which is a good achievement in the backdrop of anemic global growth trends. As soon as the Bhangar substation project is completed, we will be able to give high voltage power supply to vast areas of South 24 Parganas, meeting a key demand of those people.

Q: There were plans of setting up a nuclear power plant at Haripur (East Midnapore) in West Bengal. This was supposed to happen in a joint venture with Russia. The project has not taken off. Is the state government keen on pursuing nuclear power as a source of clean energy?

A: Chief Minister Mamata Banerjee will not allow nuclear power plant in our state. This is because the nuclear waste that will be generated is expected to cause health and environmental hazards. So, we will not do it. However, we are keen on green energy. When we came to power in 2011, there was just 2 MW of solar capacity. The tidal wind energy project on Sagar Island had to be abandoned. But we have focussed our energies on environment-friendly alternative energy sources, including biomass, and this has enabled us to grow fast in this space.

Q: Normally, we need particular wind-

speed, and frequency to generate wind energy. Most of the studies so far have showed that there are only 5-6 pockets in India that can be harnessed to produce wind energy. Unfortunately, West Bengal is not one of them. How is the Mamata Banerjee government planning to leverage the wind energy sector?

A: Yes, you are right. Here in our state, wind power is not conducive for generating electricity.

This is because we do not have steady wind. Uninterrupted wind force is required to keep the wind mill rotating, and this is what generates electricity. In Frazerganj (Sagar Island), there were four wind power plants. However, lack of steady wind flow made two plants inoperable. We are trying to get the two plants back in operation.

EE: Is there any incentive or incentive scheme being proposed for investing in the state’s power projects, particularly in the renewable energy sector? In this context, how much thrust you are laying on renewable energy?

A: We have a lot of plans on how to efficiently harness renewable energy sources. Our endeavour is to have one-fourth (25%) of the total power generation from renewable energy sources. According to the Central government, this share should be increased even more to one-half (50%). We are at the moment trying to generate one-fourth of total power from alternatives. Good that you have raised this question.

The whole world is moving towards clear alternative sources of energy and West Bengal is on the right track.

Q: What is the investment scenario in state power projects?

A: We are optimistic. Going by the response received at the Bengal Global Business Summit, we are extremely bullish about fresh capital inflows into the state’s power sector. Already, a few projects from the private sector are successfully running in our state.

Details of Power Scenario in West Bengal

TRANSMISSION IN WEST BENGAL: WBSETCL

Total No. of EHV Sub-Station	117
Total Installed MVA Capacity	26451
Total EHV Lines	12723 CKM
Total amount of energy handled per year (in MU)	43344.451

DISTRIBUTION IN WEST BENGAL

Entity	Licensed Area (Sq. Km)	No. of Consumers	Distribution loss (%)
WBSEDCL	88060	163.641 lakhs	27.74
DPL	125	0.577lakhs	5.19
CESC	567	30.368 lakhs	12.14
IPCL	618	1484 only	2.29

POWER UTILITIES IN THE STATE OF WEST BENGAL

Under State Public Sector

Name of Utility	Installed Capacity (in mw)	Command Area /Remarks
WBSEDCL	1075.95	Entire State excepting command areas under other utilities i.e. DPL,CESC Ltd, IPCL and DVC
WBPDCCL	4365	No command area of its own. WBSEDCL distributes entire power generation by WBPDCCL
Durgapur Projects Ltd.	660	Supplies power to part of Durgapur. Surplus power is fed to WBSEDCL grid.
WBREDA	-	No command area of its own. WBREDA helps the state Government, Panchayets, Municipal Bodies and NGOs on all matters relating to promotion of alternative sources of energy.
(WBGEDCL)	2	No command area of its own. WBGEDCL sells this power Solar grid connected to IPCL.
Total (STATE PUBLIC SECTOR)	6102.95	

National Hydroelectric Power Corporation Ltd. (NHPC) (Govt. of India Undertaking)

	292.00
(in West Bengal)	
Allocation for West Bengal TLDP – III & IV	292
Rangeet (From Sikkim)	17
Teesta (From Sikkim)	122

NVNL through Jawharlal Nehru National Solar Mission:

Allocation for West Bengal	50
TLDP- III (132 MW) + TLDP- IV(160 MW)	
(Solar Power Allocated from Rajasthan)	

Outside Hydel Power (Allocated for West Bengal)

Baghlier (From Kashmir)	100
Chukha (From Bhutan)	86
Kurichhu (From Bhutan)	30
TALA (From Bhutan)	390
Mython Power Ltd. (From Jharkhand)	280.5

DVC Allocation for West Bengal

Thermal :	4750.00	Hydel :	63.20
Total :	4813.20	(in West Bengal)	

Damodar Valley Corp. is jointly owned by the Govt. of India, Govt. of West Bengal and Govt. of Jharkhand. DVC is a multi-purpose river valley project set up under Act No. XIV of 1948 for unified development of the Damodar Valley area. DVC supplies power at 33 KV in the districts of Bankura, Bardhaman, Howrah, Hooghly and Purulia in WB. Caters to the core sector consumers like Railways, Collieries, Steel, Other Industries and WBSEDCL and CESC Ltd. at 132 KV and 33 KV. Connected load is 210.8 MVA in WB.

National Thermal Power Corporation (NTPC) (Govt. of India Undertaking) 2100.00 (in West Bengal)

Allocation for WB 786 (including thermal part of Bundled Power)

WBSEDCL has the following share from Central Power Station of Eastern Region including NTPC.

NTPC at Farakka I & II – 503.3 MW , III – 161.0 MW, Talcher – 100.2MW, Kahelgaon I&II – 21.5 MW

Power Allocated for West Bengal

TOTAL (CENTRAL PUBLIC SECTOR in WB)	7205.20
Thermal Power Under Private Sector	1725.00

State Private Sector

India Power Corporation Ltd.(IPCL)	12.00
State Private Sector	
APNRL (Adhunik power natural resource ltd.) at Jharkhand	100
Power Allocated for West Bengal (Private Sector in Jharkhand)	
TOTAL (PRIVATE SECTOR in West Bengal)	1737.00
TOTAL (INSTALLED CAPACITY IN WB)	15045.15

CPSU Power & Outside Power Allocated 2303.5

Eastern Regional Power Committee (ERPC) Under Central Electricity Authority (CEA). The Chairmen of Power Utilities of the five States of the Eastern Region are the members. One of the members is selected as the Chairman of the ERPC. An officer of CEA is the member-Secretary of ERPC. The main function of the ERPC is to ensure grid discipline. Eastern Regional Load Despatch Centre (ERLDC) Functioning under the control of POSOCO (a subsidiary of Power Grid Corporation of India Ltd.). It's main function is to control load despatch on real time basis.

(ALL FIGURES AS ON 31.3.2016) SOURCE - [HTTP://WBPOWER.GOV.IN/ORGANIZATION-UTILITIES/](http://wbpower.gov.in/organization-utilities/)



India's Coal Mining Sector Now Open For Business

By Kumar Shankar Roy

At a time when the debate is raging on the wisdom of not privatizing the large PSU banks fully, the Narendra Modi government has taken the bold initiative of opening up coal mining to the private sector. For long, Coal India and its regional subsidiaries, had a virtual monopoly over coal mining in India. To boost the supply of coal, the government has cleared new auction guidelines which will permit private players to participate without any pricing or end-use restrictions. Coal is critical to the Indian economy because nearly 75% of the power generated in India is thermal power, which is heavily reliant on coal supply.

The Press Information Bureau tweeted a note stating, "The opening up of commercial coal mining for private sector is the most ambitious coal sector reform since the nationalisation of this sector in 1973."

Vanita Bhargava, Partner, Khaitan & Co LLP says this is a welcome move for the industry which will now ease the availability of coal and stabilise the coal prices. "The methodology will help in maximizing the value and potential of coal. The opening of auction for private companies will provide a level playing field to the private players, will reduce ambiguity and bring about transparency in the process," Bhargava noted.

Under the new guidelines, Indian and international companies will be allowed to participate in coal auctions with the condition that they will infuse top-of-the-line technology into coal mining. Global mining giants like BHP, Rio Tinto, Anglo American and Glencore have been long expressing interest in prospecting coal in India.

Currently, only aluminium and power producers are allowed to bid for captive mines in India. But, under the new guidelines there are virtually no



restrictions and could be the first step towards the full privatization of mining sector in India. According to industry estimates, coal blocks will be commercially viable to private players only if they are offered in minimum blocks of 40-50 million tonnes. The revenue from these coal auctions will go the respective states and that should result in good buy-in from the states too" Kameswara Rao, partner and leader - energy, utilities and mining, PwC is of the view that power generators can source commercial coal to improve margins and availability. Further, as merchant power prices fall, power utilities and manufacturing industry too benefits from lower energy costs.

New owners of distressed assets will no longer worry about uncertain fuel supplies and can contract with commercial coal suppliers to revive their projects. "On a broader note, we will see industry consolidation, and rise of large vertically-integrated energy companies with interests in coal mining, power generation, transmission and distribution to retail supply," Rao remarked.

The volume growth and cost reduction from commercial coal development will keep import prices in check. How-

ever, the government must auction larger blocks in sufficient numbers in order to attract new investment in high-capacity fleet and competition.

The non-regulated sectors, such as cement and steel, have a greater dependence and ability to pay, and could dominate initial auctions. The downside is that the captive power producers who are relatively less efficient than mainstream power generators could be the first to benefit from the policy, especially in states where cross-subsidies in retail tariffs are high. As per Coal Consumers' Association of India, the government's move will likely result in coal production increase in the coming years transforming to a competitive market scenario. "The key features of this step are government has allowed 100% FDI in commercial mining and Export of coal as well," it said. The group said the success of commercial mining would largely depend regulations and norms pertaining to auction of mines, size of the mines to be offered, reserve price for auction of mines, whether the mine is commercially viable, sustainability would be a guiding factor to create interest amongst domestic and international mining giants etc



Power one of the most critical components of infrastructure: IBEF

Power is one of the most critical components of infrastructure crucial for the economic growth and welfare of nations.

The existence and development of adequate infrastructure is essential for sustained growth of the Indian economy.

India's power sector is one of the most diversified in the world. Sources of power generation range from conventional sources such as coal, lignite, natural gas, oil, hydro and nuclear power to viable non-conventional sources such as wind, solar, and agricultural and domestic waste. Electricity demand in the country has increased rapidly and is expected to rise further in the years to come. In order to meet the increasing demand for electricity in the country,

massive addition to the installed generating capacity is required.

India ranks third among 40 countries in EY's Renewable Energy Country Attractiveness Index, on back of strong focus by the government on promoting renewable energy and implementation of projects in a time bound manner.

India has moved up 73 spots to rank 26th in the World Bank's list of electricity accessibility in 2017, according to Mr Piyush Goyal, Minister of State (Independent Charge) for Power, Coal, Renewable Energy and Mines, Government of India.

In September 2017, the Government of India launched the Saubhagya scheme to provide electricity connections to over 40 million families in rural and urban

areas by December 2018 at a cost of US\$ 2.5 billion.

Market Size

Indian power sector is undergoing a significant change that has redefined the industry outlook. Sustained economic growth continues to drive electricity demand in India. The Government of India's focus on attaining 'Power for all' has accelerated capacity addition in the country. At the same time, the competitive intensity is increasing at both the market and supply sides (fuel, logistics, finances, and manpower).

Total installed capacity of power stations in India stood at 330,860.58 Megawatt (MW) as on December, 2017.

The Ministry of Power has set a



target of 1,229.4 billion units (BU) of electricity to be generated in the financial year 2017-18, which is 50 BU's higher than the target for 2016-17. The annual growth rate in renewable energy generation has been estimated to be 27 per cent and 18 per cent for conventional energy.

The Indian solar industry has installed a total of 2,247 megawatts (MW) in the third quarter of 2017, from 1,947 MW in the second quarter of 2017. The cumulative installed capacity reached 7,149 MW in the first nine months of 2017, covering more than one-third of total new power capacity addition in 2017.

Two under-construction hydro projects of NHPC in Himachal Pradesh and Jammu & Kashmir (J&K), expected to be commissioned in 2018, will produce 4,458.69 million units of additional power, according to the Ministry of Power, Government of India.

The total estimated potential of tidal energy in India is about 8,000 megawatt (MW), of which 7,000 MW is in the Gulf of Kambhat, 1,200 MW is in the Gulf of Kutch and 100 MW in the Gangetic Delta.

The number of small hydro power projects set up in India stood at 1,085 with total installed capacity of 4,399.355 megawatt (MW) as of November 30, 2017.

Investment Scenario

Around 293 global and domestic companies have committed to generate 266 GW of solar, wind, mini-hydel and biomass-based power in India over the next 5–10 years. The initiative would entail an investment of about US\$ 310–350 billion.

Between April 2000 and September 2017, the industry attracted US\$ 12.3 billion in Foreign Direct Investment (FDI), accounting for 3.44 per cent of total FDI inflows in India.

Some major investments and developments in the Indian power sector are as follows:

Energy Efficiency Services Ltd (EESL) has raised US\$ 454 million from Global Environment Facility (GEF)

for its energy-efficiency projects in an attempt to boost India's move towards becoming a low carbon economy.

IL&FS Financial Services Ltd has partnered with Jammu and Kashmir (J&K) Bank Ltd to finance nine hydropower projects in J&K with a total capacity of 2,000 MW, which require financing of around Rs 20,000 crore (US\$ 3.12 billion).

Sterlite Power has won one of the largest 1,800 km power transmission project worth US\$ 800 million in Brazil, the company's third project in Brazil and the largest ever project won by an Indian company in Latin America.

With the aim of giving a boost to renewable energy, the State Bank of India (SBI) and the World Bank have decided to sanction credit worth Rs 2,317 crore (US\$ 356.82 million) to seven corporates towards solar rooftop projects to generate a total of 575 megawatt (MW) of solar energy.

India added 467 MW of grid interactive wind power capacity between January–November 2017, while wind power projects with cumulative capacity of 9,500 MW are expected to be bid out by March 2018, according to Mr R K Singh, Minister of State (Independent Charge) for Power and New & Renewable Energy, Government of India.

A total of 26.3 million households which are below poverty line (BPL) have been electrified under the Rural Electrification component of Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY), according to the Ministry of Power, Government of India.

Government Initiatives

The Government of India has identified power sector as a key sector of focus so as to promote sustained industrial growth. Some initiatives by the Government of India to boost the Indian power sector:

“Saubhagya Yojana” programme was launched by Mr Raghubar Das, Chief Minister, Jharkhand to provide electricity to all 29,376 villages.

The companies within the solar power industry in India, specifically

the ones involved in the operation and maintenance (O&M) of solar power plants have welcomed the Government of India's move to introduce regulations for operating drones by February 2017.

Over 280 million LED bulbs were distributed to consumers in India by Energy Efficiency Services Limited (EESL) under Unnati Jyoti by Affordable LEDs for All (UJALA) as on December 19, 2017 and 524.3 million LED bulbs were sold by private players till October 2017.

In order to lower India's crude oil imports, the Government of India is going to promote coal gasification to convert high ash coal into methanol that can be used as cooking gas and transportation fuels[^], according to Mr V K Saraswat, Member of NITI Aayog.

Initiatives taken by the Energy Efficiency Services (EESL) have resulted in energy savings of 37 billion kWh and reduction in greenhouse gas (GHG) emissions by 30 million tonnes.

The Union and state governments have agreed to implement the Direct Benefit Transfer (DBT) scheme in the electricity sector for better targeting of subsidies, according to Mr Raj Kumar Singh, Minister of State for Power (Independent Charge).

All the states and union territories of India are on board to fulfil the Government of India's vision of ensuring 24x7 affordable and quality power for all by March 2019, stated Mr Raj Kumar Singh, Union Minister of State (IC) for Power and New & Renewable Energy, Government of India.

Uttar Pradesh Electricity Regulatory Commission, regulator of power sector in Uttar Pradesh, has approved several steps to strengthen the financial position of state utilities and increase opportunities for companies in the transmission and distribution (T&D) EPC business.

The Department of Economic Affairs, Government of India, signed a guarantee agreement for IBRD/CTF loan worth US\$ 98 million and grant agreement for US\$ 2 million with the World Bank for 'shared infrastructure for solar parks project'.



The Road Ahead

The Government of India has released its roadmap to achieve 175 GW capacity in renewable energy by 2022, which includes 100 GW of solar power and 60 GW of wind power. The Union Government of India is preparing a 'rent a roof' policy for supporting its target of generating 40 gigawatts (GW) of power through solar rooftop projects by 2022.

Coal-based power generation capacity in India, which currently stands at 192 GW is expected to reach 330-441 GW by 2040.

The 2026 forecast for India's non-hydro renewable energy capacity has been increased to 155 GW from 130 GW on the back of more than expected solar installation rates and successful wind energy auctions.

India could become the world's first country to use LEDs for all lighting

THE 2026 FORECAST FOR INDIA'S NON-HYDRO RENEWABLE ENERGY CAPACITY HAS BEEN INCREASED TO 155 GW FROM 130 GW ON THE BACK OF MORE THAN EXPECTED SOLAR INSTALLATION RATES AND SUCCESSFUL WIND ENERGY AUCTIONS.

needs by 2019, thereby saving Rs 40,000 crore (US\$ 6.23 billion) on an annual basis.

India's installed solar power capacity reached 14,771.69 as of September 2017.

The government's immediate goal is to generate two trillion units (kilowatt hours) of energy by 2019. This means doubling the current production capacity to provide 24x7 electricity for residential, industrial, commercial and agriculture use. A total of 16,064 villages out of 18,452 un-electrified villages in India

have been electrified up to December 2017 as part of the target to electrify all villages by May 1, 2018.

The Government of India is taking a number of steps and initiatives like 10-year tax exemption for solar energy projects, etc., in order to achieve India's ambitious renewable energy targets of adding 175 GW of renewable energy, including addition of 100 GW of solar power, by the year 2022.

The government has also sought to restart the stalled hydro power projects and increase the wind energy production target to 60 GW by 2022 from the current 20 GW.

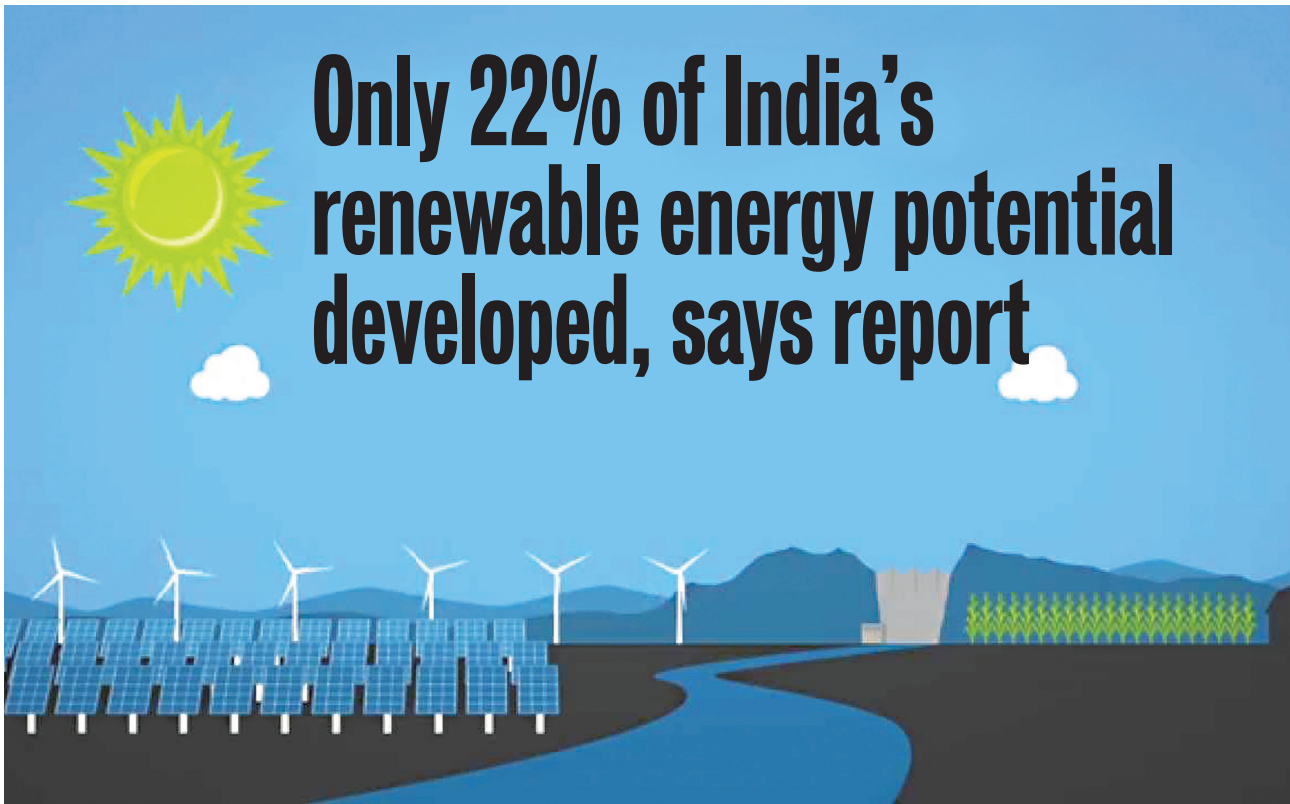
Exchange Rate Used: INR 1 = US\$ 0.015 as on January 04, 2018

References: Media Reports, Press Releases, Press Information Bureau (PIB)

Note: # - BMI Research, ## - according to Mr Gopal Singh, CMD, Coal India Limited, ^ - according to Mr V K Saraswat, Member of NITI Aayog.



E2 TOPIC



Only 22% of India's renewable energy potential developed, says report

INDIA IS COMMITMENT TO REDUCE CARBON EMISSIONS AND FUEL RELATED CONCERNS IN CONVENTIONAL SECTOR HAS INCREASED IN RECENT YEARS

Renewable energy is considered to be an important driver for low carbon growth and India's sustainable solution to issues related to electrification in remote locations. India has around 150 GW of known renewable energy potential. This potential is likely to be even greater than 150 GW, if all the sources including tidal, wave, geothermal with significant generation capacity will be mapped. Even with such a vast potential, only ~22% of renewable energy potential (i.e. 33 GW) is developed in the country.

The total installed capacity in India is around 256 GW (as on October 2014) primarily dominated by thermal sources of energy. Thermal energy (comprising

of oil, coal and natural gas) contributes around 69% of total installed capacity followed by hydro, renewables and nuclear energy. Renewable energy forms ~12.8% of total installed capacity. This also shows that we are progressively moving towards the National Action Plan for Climate Change (NAPCC) target of renewable energy (i.e. 15% by 2020).

India is commitment to reduce carbon emissions and fuel related concerns in conventional sector has increased in recent years; the Government has shifted focus towards development of renewable energy sources. This step will help India in achieving energy security, reducing adverse environmental impact, lowering carbon intensity and realizing its aspirations for leadership in high-technology industries by contributing to a more balanced regional and global development.

However, in order to achieve the NAPCC targets as specified above, India needs a substantial increase in renewable energy capacity in the next five years.

The targets specified in the 12th plan

period aim at faster, sustainable and more inclusive growth as is also evident from ambitious targets indicated in working group report of Ministry of New and Renewable Energy (MNRE).

Even with potential for providing predictable and sustainable electricity generation with relatively lower visual impact; ocean power / geothermal constitutes a meager percentage of the 30 GW in the 12th plan renewable energy targets for grid-connected renewable capacity addition. It has been learnt that marine power has traditionally suffered from relatively high cost and limited availability of sites with sufficient potential, thus constricting its total availability. However, following recent technological developments and improvements, both in design & turbine technology; it is expected that it will result in lowering of levelised costs for harnessing marine energy to competitive levels.

CRISIL Risk & Infrastructure Solutions

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Under the NBMMP, about 49.6 lakh Household Size Biogas Plants have been installed

The Ministry of New and Renewable Energy (MNRE) has been implementing programmes such as National Biogas and Manure Management Programme (NB-MMP), Biogas Power (Off-grid) Generation Programme (BPGP), and Waste to Energy Programme for setting up of Biogas Plants based on cattle dung and other mixed bio-degradable wastes to meet cooking, heating, lighting & small power and thermal energy

needs of the people of remote and rural areas of the country.

Minister of State (IC) for Power and New & Renewable Energy, Shri Raj Kumar in a written reply to a question on status of Biogas Programme in the country, in Lok Sabha has informed that under the NBMMP, about 49.6 lakh household size biogas plants have been installed since the inception of the biogas programme in the

The State-wise details of biogas plants installed since inception till up to 2016-17 are given below:

State/ Union Territories	Cumulative achievements up to 2016-17
Andhra Pradesh	549235
Arunachal Pradesh	3555
Assam	130375
Bihar	129844
Chhattisgarh	54825
Goa	4230
Gujarat	433317
Haryana	62085
Himachal Pradesh	47650
Jammu & Kashmir	3163
Jharkhand	7579
Karnataka	491764
Kerala	149568
Madhya Pradesh	365689
Maharashtra	899472
Manipur	2128
Meghalaya	10196
Mizoram	5412
Nagaland	7953
Odisha	270880
Punjab	177445
Rajasthan	71231
Sikkim	9044
Tamil Nadu	222870
Telangana	22591
Tripura	3620
Uttar Pradesh	440713
Uttarakhand	21558
West Bengal	366974
A&N Islands	137
Chandigarh	97
Dadra & Nagar Haveli	169
Delhi/ New Delhi	681
Puducherry	578
TOTAL	49,66,628

Chart 1

Particulars of Central Financial Assistance (CFA) & States / Regions and Categories

Family Type Biogas Plants under NBMMP

(1 to 6 cubic metre capacity per day)

	1 Cubic Metre (in Rs. Per plant)	2- 6 Cubic Metre (in Rs. Per plant)
NER States, Sikkim (except plain areas of Assam) and including SC and ST Categories of NE Region States.	15,000	17,000
Plain areas of Assam	10,000	11,000
Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Nilgiri of TamilNadu, Sadar Kurseong & Kalimpong Sub-Divisions of Darjeeling, Sunderbans(W.B.) and Andaman & Nicobar Islands.	7,000	11,000
Scheduled castes / Scheduled Tribes of other than NE Region States including Sikkim & for other Hilly States/ regions as given in Sl. No.3 above.	7,000	11,000
All Others	5,500	9,000
Additional CFA for toilet linked Biogas Plants.		1,200



country. Under the Head 'Biogas Programme' a provision of Rs.134 Crores was made in the budget estimate (BE) for the year 2017-18.

Under the National Biogas and Manure Management Programme (NBMMP), family type biogas plants are set up for individual households to provide biogas as clean fuel for cooking to the people of rural and remote areas. The details of the subsidy/ Central Financial Assistance provided under the NBMMP (Chart 1).



E2 EVENT

Ireda and Rumsl Signs Agreement for Large-Scale Solar Parks in Madhya Pradesh



Indian Renewable Energy Development Agency Limited (IREDA) and Rewa Ultra Mega Solar Limited (RUMSL) have signed an agreement for financing the shared infrastructure of two large Solar Parks in Madhya Pradesh. Ministry of New & Renewable Energy

(MNRE), World Bank & IREDA have been able to work out a proposal to channelize US\$ 100 Million for creating common infrastructure for ultra-mega solar parks in India to achieve the 100 GW solar capacity addition target by 2022, set by the Prime Minister Shri

Narendra Modi.

Under the World Bank Line of Credit, IREDA has sanctioned its first loan of Rs. 210.62 Cr. to RUMSL to finance two such solar parks in the state of Madhya Pradesh.

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Research On Dry Bottom Ash Handling Technology For Coal-Fired Plant

The environment protection requirements are more and more urgent issue in Mongolia, India as well as other developing countries. In order to reduce the polluting problem from the coal fired plant, air cooling dry bottom ash handling technology, one of innovative way will be more adopted for coal fired industry. There is no any water using during the bottom ash handling. A series of operational and environmental problems will be eliminated by the air cooling dry bottom ash handling technology. The dry solution of bottom ash handling avoids the problems and costs associated with waste water in ash handling process, improves the working performance and efficiency of the boiler. It can realize “zero waste water discharging” from coal fired plant. Also it can reduce the operation and maintenance cost dramatically comparing with the wet bottom ash handling technology in coal fired plant.

In other developed countries, there are some companies done some research on this technology and made certain achievements. But there are still many problems such as ash chemical property research and analysis, study on the heat exchange between air and ash, big clinkers handling etc. and limit its application.

Through the research and study of this subject, we focused on grasping the ash chemical property, heat exchange characteristics of steel belt conveyor, to analyze inner flow field distribution in this system and the heat transfer coefficient suitable for engineering practice and to determine the relationship among bottom ash rate, belt velocity and ash thickness for finalizing layout design principle.

At last, we would like that all our research would make this technology more mature,

practical and environment friendly technology and serve for green and ecological development [1].

EXPERIMENTAL CONDITION

During the research of inner flow field distribution, the heat transfer coefficient

and heat exchange characteristics, we have carried out the experimental research with high load, medium load and low load condition in order to compare the cooling effect of ash, the change of temperature and quantity of cooling air under different load conditions. Our requirements are to maintain the stable of main parameters, system air volume, furnace negative pressure, oxygen. In order to ensure the reliability of the experimental results, the following measures will be followed:

1. DURING THE TEST, THE BOILER WILL BE FIRED WITH CONVENTIONAL COAL AND THE BOILER WITH THE RATED LOAD

2. TO CONFIRM THE NORMAL OPERATION OF MAIN AND AUXILIARY EQUIPMENT OF BOILER.

3. BEFORE THE TEST, THE OPERATOR SHOULD ADJUST THE OPERATION CONDITION AND TO ENSURE THE BOILER WILL IN THE NORMAL OPERATION CONDITION.

4. DURING THE TEST, THE REQUIREMENT FOR BOILER CONDITION:

- The boiler will in normal operation during the test.

- FD, ID, primary fans and pre-heater will in normal operation.

- The whole unit, all equipment and instrument will be in normal and intact condition.

5. THE TIGHTNESS INSPECTION OF THE WHOLE BOILER UNIT

- To eliminate the leakage of flue gas, air and coal powder system

- To eliminate the leakage of water, steam and fuel system

6. DURING THE PERIOD OF TEST, ANY INTERFERE WITH THE TEST SUCH AS DRAIN DISCHARGE, SOOT BLOWING

AND THE START UP AND SHUT DOWN ARE NOT ALLOWED

RESULTS AND DISCUSSION

THE EXISTING BOTTOM ASH HANDLING TECHNOLOGY

At present, there are two kinds of traditional bottom ash handling technology for coal fired plant. One is water impounded bottom ash hopper sluice system. Another is bottom ash submerged scraper chain conveyor. But the above two kinds of bottom ash handling technology have the following disadvantages

and problems:

- Bottom ash will be cooled by water. High water consumption (normally slurry pumps and circulation pumps with high installed power).

- High power consumption.

- With the possibility to cause the shutdown of boiler.

- All heat of bottom ash will be completely lost in water. Also the loss of unburned carbon (6-15%) in bottom ash will result in energy loss.

- Radiation heat loss in the area of boiler throat. Hot bottom ash drops into the water and the produced vapor will cause the corrosion of water tubes at the boiler throat area.

- Components corrosion, wearing and high operation and maintenance cost.

- Big potential dangerous to operator (due to vapor explosion during soot blowers working period)

- The ash pond will occupy much land space and result in underground water pollution and ash emission problem.

- Wet ash as waste and cause much environmental pollution.

Air cooling dry bottom ash handling technology is a unique technology for dry extraction, cooling and handling of bottom ash from coal fired boiler.

It is an innovative and novelty technology comparing with traditional wet bottom ash handling system. The bottom ash will be cooled by natural air, disposed and conveyed in dry way. The performance will be much improved than wet bottom ash handling system. The main component of air cooling dry bottom ash handling technology is a super-steel belt which will run underneath boiler. It consists of high temperature and wearing resistance mesh and partially overlapped conveying pans. The super-steel belt is designed to withstand the arduous operating conditions under the boiler throat, characterized by high temperature and shock impact by large ash clinkers falling from the boiler during soot-blowers working period. It will be enclosed inside sealed case of ash conveyor and can be expanded freely in any direction thanks to its special configuration. The force will be transmitted to steel mesh through the friction between the driving pulley and steel mesh, while a hydraulic or pneumatic take-up device at tail pulley providing a constant



tension. The steel belt is supported by the carrying idlers across the entire width in order to absorb and withstand the heavy ash lump impact. All bearings of the carrying and return idlers will be installed outside of conveyor case to prevent from the over-heat as well as to facilitate the maintenance works. There is no relative movement between belt carrying pans and bottom ash, so the wearing of steel belt can be negligible.

Air cooling dry bottom ash handling system will mainly consist of mechanical seal, bottom ash hopper, pre-crushing bottom doors, steel belt conveyor, crusher, downstream bottom ash conveying equipment, bottom ash silo and ash unloading accessories. Mechanical seal will provide the tight connection between boiler throat and bottom ash hopper and it can absorb the downward and lateral expansion of boiler. The bottom ash hopper will be designed and built in eccentric way respect to boiler centerline, which ensures that big ash clinkers do not fall directly from the furnace onto the steel belt, but have their first cushion on the sloped (refractory material lined) hopper wall.

Under the bottom ash hopper, there will be provided with pairs of pre-crushing bottom doors. With pre-crushing bottom doors, the bottom ash hopper can be closed completely. The bottom ash will be accumulated inside of ash hopper during the maintenance of downstream equipment. Moreover, the pre-crushing bottom doors will pre-crush the big ash clinkers into the size less than 300 mm on the impact bars which will improve the cooling effect of big ash lumps dramatically. Bottom ash (the temperature is around 900 °C) generated from furnace will drop on the super-steel belt and will be transported to crusher at very low speed (normally belt speed can be set from 0.4 to 4 meters per minutes). Small amount of controlled ambient air (normally not over than 1% of total boiler combustion air) will be sucked into conveyor thanks to the negative pressure in the furnace. While cooling the bottom ash and steel belt, the air itself gets heated before enters into the boiler (up to 350 °C in normal condition) and it can be as the combustion air also provides oxygen for hot bottom ash. A significant burn-out of unburned carbon in the bottom ash takes place on the super-steel belt and the



Equipment Corrosion of Traditional Wet Bottom Ash Handling System.

heat will be returned to furnace. In traditional wet bottom ash handling system, all these heat was lost in the water. Test and much experience have verified that the heated cooling air will not affect the combustion of boiler and not influence the NO_x formation. Contrarily the considerable heat recovery will help to increase boiler efficiency.

During heat exchange between the cooling air and hot bottom ash, the cooling air will be heated up to 300-400 °C and the hot bottom ash will be cooled down below than 150°C. At lower layer of bottom ash conveyor, a cleaning chain will be installed to avoid the accumulation of fine ash on the bottom floor of conveyor. The cleaning chain consists of two lateral chains connected by scraper flights that sweep the accumulated dust over the conveyor floor to the conveyor head section, where it is discharged into the crusher.

LAYOUT DESIGN PRINCIPLE

In order to analyze air dynamic field of dry bottom ash handling system, we establish numerical model based on Fluent platform and to carry out numerical simulation on air flow character, to analyze inner flow field distribution and to find out the heat transfer coefficient suitable for engineering practice, and determine the relationship among bottom ash rate, belt velocity and ash thickness for finalizing layout design. Through the establishment of steel belt conveyor numerical model, to obtain flow field-distribution inside conveyor and provides reference for layout design.

Based on the above study and analysis as well as bottom ash rate, available space at site, the position of bottom ash silo, the purpose of bottom ash comprehensive utilization etc., the whole layout of air cooling dry bottom ash handling system can be very flexible and user friendly design.



TECHNICAL ADVANTAGES AND ECONOMIC FEATURES

TECHNICAL ADVANTAGES ANALYSIS

No water required, no waste water discharge: There is no water used during the bottom ash cooling and conveying processes; the seal between bottom ash hopper and boiler throat is a mechanical seal (not a water seal), and thus will save the water resource dramatically and realized “zero-emission” of the bottom ash system.

And eliminated all water related problems (waste water production, fresh water consumption, equipment corrosion, risk of ice formation, hot water splashing ect.)

Increase Boiler Efficiency: The existing heat in the bottom ash, and the heat generated by the burn-out of the unburned carbon as well as most of radiation heat at the boiler throat has been returned to the furnace, which has reduced the losses due to incomplete combustion and physical heat loss thus increasing boiler efficiency

Energy Saving and Decreasing: Compare with traditional wet bottom ash handling technology, it can decrease 30-70% power consumption

Increase Ash Utilization Value: Bottom ash is handled in a dry way and there is much better opportunity for sales and increases its comprehensive utilization

Lower Wearing and Higher

Reliability: Design velocity of belt will be 0.4-4m/min and expected working life for steel belt will be more than 10 years

System Simpler and Facilitate for Maintenance: All bearing blocks of carrying and return idlers will be installed outside of conveyor case and that will facilitate for replacement and maintenance works.

ECONOMIC FEATURES

The cooling and conveying of bottom ash will be without water, the cost of water use is zero.

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Vehicles in India need better fuel combustion efficiency even if they are BSIII engines'

WITH over 27 years experience in business, UK's Tim Patterson leads Fuel Economy Solution Limited, a global consultancy providing scalable solutions in fuel economy and CO₂/NO_x reduction in road transport, rail, marine and power generation sectors. He was the key speaker at Energy Ensemble's seminar titled "Fuel Economy-The Road Ahead" at Press Club Kolkata on 26th February 2018. In a tête-à-tête with Ritwik Mukherjee, Patterson shares the cutting-edge perspectives on fuel economy and talks about Green Economy Solution (GES Consultancy), a new arm to help provide advice, green economy educational workshops for key decision makers who want to stay up to date with the latest issues that may influence their decisions on investment in equipment, services from suppliers.



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When you are talking about a solution, you are obviously talking about a solution to a problem. So, how grave is the problem related to fuel economy globally and in India?

Yes, we are talking about a solution to a problem but it also is ambiguous on purpose as a pun on our liquid combustion catalyst, USI-1000, which we provide typically in a solution form. The problems relating to fuel economy globally currently are significant. The developing emissions control markets of the UN's defined South-south led by major countries such as India are all on different points along the green economy and fuel standards transformation curve. These problems are not just for the environment but economically for the private sector to maintain commerciality amongst such change and increase in costs associated with upgraded fuels and equipment needed to run efficiently on those newer, lower sulphur fuels.

Sulphur acts as a form of lubricant so when you change to a low sulphur fuel, the existing high sulphur designed engines in that market struggle to combust the fuel completely and perform in an optimally mechanical way. There

is less lubricity for the moving parts resulting in more engine wear and tear, injector problems and sometimes valve seat recession. This in turn decreases fuel efficiency and increases greenhouse gas emissions and maintenance costs.

With regards to India, the progression from BS III to BSIV is admirable but the whole country needs to move to BSIV and all vehicles need to achieve better fuel combustion efficiency even if they are BSIII engines, to make a major difference on pollution in the major cities.

Without some combustion catalyst aftermarket treatment or retrofit technology such vehicles will struggle to run, which in the industry could be very damaging to the economy in the road transport and agricultural sector.

What does your company do to address and solve this problem?

Our company can supply to the Indian market an aftermarket liquid combustion catalyst which can not only help in internal combustion engine efficiency improvements but is particularly helpful in managing and reducing the impact of using different fuel and engine standards. This is always a problem when an engine is running on a fuel it was not designed for.

Until all of the vehicles within the Indian market are renewed to BSIV standard after 2020, there will always be combustion efficiency issues with the older engines. The opportunities for combustion efficiency improvements in older engines running on lower sulphur fuel than it is designed for can reach in excess of 10%.

In BSIV equipment running on BSIV fuel we would expect between 8.5 and 10% efficiency improvements. All these savings would be accompanied



by reductions across all greenhouse gases, with up to 75% reduction in black smoke.

We are aware that there may be Indian or European OEMs out there who are re-selling their unsold or ex-lease BSIII vehicles stock into other less developed emissions controlled markets e.g. Africa. However, as they may be discovering by now since that cut off in April 2017, the difference in the (predominantly) BSI/II fuel available in many of those markets, and the lower sulphur BSIII engines for resale may well create challenges for main dealers running OEM R&M programmes. The damage to engines and costs to repair will be greater than usual and profits can suffer as a result.

The same problem could recur when India switches to BSVI engines using ULSD in 2020 when at some point new BSIV engines will become banned for use and they will in turn be re-sold into other higher sulphur markets. The problems described above get worse when a 50ppm sulphur BSIV engine is running on 500ppm BSII fuel. Fuel Economy Solution remain available to work with Indian OEMs overseas product management to investigate whether our technology can be provided for their main dealers and customers as an engine treatment during servicing and ongoing treatment for general fuel use by customers at the pump or by automatic dosing at an appropriate ratio that may help to manage the impurities (and their impacts) better i.e. in a way that is less damaging to the engine.

Have you done anything in India before? Are you in talks with any Indian organisation- private sector or government to bring in your solution to India?

As a company, we haven't traded in India before but my first experience of this country was in 2015 when I was invited to make a keynote address by Dr Bhatia, the Founder, entitled "Green Energy CSR in a Volatile World" at the World CSR

Congress in Mumbai.

Similarly, on 18th February this year, (World CSR Day), after being requested to deliver a keynote address in Mumbai entitled "Combustion Efficiency is KEY to the Green Economy Transformation of India 2.0", I was incredibly honoured to be asked by Dr Bhatia to present the Global CSR Awards with him. At the end of the awards ceremony, I found it extremely humbling that such a great man should choose to present me with a Kashmiri Jamawar Shawl. In my humble opinion, Dr Bhatia is one of the greatest leaders of our time. He is an inspirational figure changing the life of millions of people all over the world by encouraging better ethics and standards of behaviour in businesses, charities, NGOs and members of the international public alike.

In October 2017, I met the CEO of an Indian Industrial Zones developer at a UK India export workshop in Manchester, United Kingdom. He agreed to help my company get started in India.

His consultants, (Honeycomb Global), started working with us to find Indian partners. Initially, we were looking for a partner to help us with our core business, product testing in the commercial road transport sector and to handle product supply to those customers. On 21st February 2018, as part of a UK Northern Powerhouse trade delegation at a reception held in Bangalore by the UK Deputy High Commissioner Dominic McAllister, I signed an MoU with director of Yattya Technologies, Maulik Doshi.

Yattya Technologies are an incredible company with a software platform that not only enables GPS tracking of the vehicle, but they provide an available driver and available client brokerage service to the road transport sector. Their software platform enables compliance, business insurance and better fuel and driver expenses cash flow management.

Fuel Economy Solution is very humbled to be working with such an innovative technology partner as Yattya, who can by using GPS not only accurately track vehicle movements and clearly demonstrate the fuel efficiency changes that may occur after testing a combustion improver such as that provided by Fuel Economy Solution, but the software platform offers so much more value to customers. Value is critical to green economy transformation and our partnership with Yattya will deliver significant value to the existing Indian road transport sector.

Two weeks ago, Fuel Economy was honoured to receive from Dr Anil Garg, President of the World Petro-Coal Congress, an invitation to make a keynote speech at this year's event held in Delhi 15-17th February. It was such a complete surprise (but an incredible honour) for Fuel Economy Solution to be invited by Dr Garg to become a distinguished Member of the International Council Meeting of Petro-Gas-Coal held on Thursday 15th February 2018 at 1900hrs at the Park Hotel, Delhi. The overall impression I gained from the Congress was that the work of the Energy and Environment Foundation is a challenging but rewarding one. On one hand they want to enable transformation to the cleaner technologies we know we must eventually adopt completely, but on the other hand the Foundation have the extremely difficult task of stewardship in the meantime, to ensure the cleanest and most efficient development in the fossil fuel sector to enable societies to get to where they need to be without losing base load electricity supply.

How do we replace 90% of cement, 70% of steel and 50% of aluminium that comes from coal? A materials revolution is required to accompany a safe phase-out of all hydrocarbon use and in the meantime, we need to focus on combustion efficiency to enable the necessary green economy transformation while significantly reducing greenhouse gas emissions.

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Solar Energy - Micro and Macro Environment Perspectives



Kunal Bhattacharya

Vice President

Suncraft Energy Private Limited

The sun is the ultimate cradle of energy for our planet and it is ironic that our limited fossil fuel resources are in reality storehouses of solar energy. The sun is an eternal source of alternative and renewable energy, abundantly available, not focused only in small geographical pockets, and the cleanest source of energy for our planet.

But for the general population, choice of energy technology is dictated by economics, and not by the environment.

It is fortunate for the planet, then, that solar technology is economically viable today, as there is a general consensus that solar power will be heavily called upon as fossil fuels are depleted. Setting up a 1 kWp rooftop solar plant is equivalent to planting two trees. Harnessing the sun's energy directly rather than by burning fossil fuels holds great promise for the world's energy needs.

The economic attraction of solar power lies in its simple technology. Anyone can produce solar energy, so it has the potential to become a commodity product. Unlike hydropower plants or wind farms that need turbines to operate, solar energy generation doesn't rely on machines but on the inherent photovoltaic material property of solar cells.

A PV array only requires an inverter to convert DC power to a constant current, to run our modern AC-powered appliances. These arrays are modular, and can be scaled for mini-grids of a few Megawatts to solar parks generating hundreds of Megawatts of power. Scalability

draws competition and consumers benefit from cheap costs of energy.

Power generated from solar energy is currently available through two economic models. In the Capex model, the consumer bears the capital expense of installing the solar plant. The initial cost is usually recouped in around six years. In the Opex model, the consumer doesn't bear any capital expense. The energy provider bears the cost of installation and a power purchase agreement is signed with the consumer for as long as 25 years.

India's promise as a market for solar is obvious. More than 200 million people are still not connected to the grid. To remedy this, the Government of India (GOI) is pushing aggressively for cheap locally available power that will also support its target to cut carbon emission footprint by 30 to 35 percent by 2030.

In the Paris Agreement of 2016, the government pledged a national commitment to increase electric power generation from clean, non-conventional sources of energy. The ambitious national target of 1,00,000 MWp for solar power generation has a deadline of 2022, including a target of 40 GWp from rooftop solar alone.

By March 2017, solar plants with a cumulative capacity of 12,000 MWp were installed across the country. Experts expect solar capacity to double this year. In the next five years, there will be a potential market of 60 to 80 billion USD.

BY MARCH 2017, SOLAR PLANTS WITH A CUMULATIVE CAPACITY OF 12,000 MWP WERE INSTALLED ACROSS THE COUNTRY. EXPERTS EXPECT SOLAR CAPACITY TO DOUBLE THIS YEAR.

Irrespective of whether or not the 100 GWp target is achievable at the current pace, businesses that want a piece of this increasingly competitive market have access to encouraging incentives and tax benefits.

The 2003 Electricity Act grants license-free generation and distribution capability to industry players in rural areas. The provision for Accelerated Depreciation can help ease tax burden on solar plants by as much as 40 percent.

Few countries boast a ministry for new and renewable energy (MNRE), which has spearheaded programs like the Surya Mitra Skill Development Program to train the workforce needed for maintaining and repairing solar plants.

The process of setting up a 1 MWp solar plant in a two month period requires forty men on average. The employment potential of the industry is significant and this makes solar power a hot commodity in the national interest.

The GOI's initiatives to forge channel partnerships is also encouraging for the market. It has recognized players in states across the country, who are carefully vetted for compliance with IEC/IS standards and other qualifications, to be channel partners.

Despite the bright prospects, there are some caveats for businesses in the industry. While solar cells glittering in the sun is the quintessential picture of green energy, they are non-biodegradable. The process of manufacturing polysilicon, the solar cell material, from quartz, produces some hazardous byproducts.

Additionally, significant part of the energy required for manufacturing solar cells comes from conventional energy.

Power from coal, oil and nuclear energy may arguably be more expensive



today than solar, both economically and environmentally. But research is ongoing for better processes and materials in solar power generation.

New innovations like thin-film solar cell tech aim to make solar cells more energy-efficient and cost-effective in the present market, and the future is likely to bring more innovations in the form of new materials to replace silicon wafers, or process innovations to reduce eWaste. Since the solar industry is commoditized, businesses must not fail to factor in the inevitable disruption that these innovations will bring in the near future.

Competition in the solar energy industry rests on the weight of currently available technology. Entrepreneurs must therefore use a Blue Ocean strategy to make an entrance into the industry in the future.

Ireda and Rumsl Signs Agreement for Large-Scale Solar Parks in MP

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The agreement was signed by Shri S K Bhargava, Director (Finance), IREDA and Shri Avaneesh Shukla, Executive Engineer, RUMSL in the presence of Shri Upendra Tripathy, Interim Director General, International Solar Alliance (ISA). The broad terms and condition of the agreement include fixed interest rate of 8.5% p.a. for entire loan tenure, moratorium from principal repayments upto 5 years and loan repayment period of upto 20 years.

Speaking on the occasion, Shri K S Popli, CMD, IREDA appreciated the initiative of MNRE, support of The World Bank and more specifically of DEA to reduce the Sovereign Guarantee fee to 0.5%.

He further stated that this support from DEA will enable to expedite development of such proposals in other states also.

Shri Upendra Tripathy, Interim Director General, ISA mentioned that India being in leading position in solar technologies, there is

immediate attention for the development of 121 projects of solar technologies in 121 ISA member countries by April 21, 2018. He congratulated IREDA and RUMSL for achieving the feat in short time frame and also for the innovative Payment Security Mechanism which will ensure timely payment to the developer.

Shri Manu Srivastava, Principal Secretary and Managing Director, RUMSL mentioned that RUMSL, at present, is implementing two solar parks i.e. Rewa with capacity of 750 MW and Mandsaur with 250 MW capacity in the state of Madhya Pradesh.

With the solar park model, Payment Security Mechanism and the Line of Credit from The World Bank, the tariff for Rewa project is discovered as low as Rs.3.30 on levelized basis. Out of the total power proposed to be generated at Rewa solar park, 24% has been agreed to be purchased by Delhi Metro Rail Corporation and balance 76% by Madhya Pradesh Power Management Company Ltd (MPPMCL).

Power and Energy sector gets booster dose from Budget



By Kumar Shankar Roy

The 2018 Budget proposals have the potential to transform India's power and energy landscape. The thrust towards ensuring electricity access (24x7) to all rural households under "Saubhagya & DUGJY" schemes, mechanism to buy surplus solar energy from solar pumps by distribution utilities, reduction in tax rates for entities with Rs 250 crore turnover and access to bond market for meeting 25% of debt needs by large corporates augurs well for small, mid and

large firms in the power and energy industry. The combined effect of all measures will be positive and would go a long way in securing energy freedom for India.

Let us have a look at key proposals that concern the Power and Energy sector.

■ Allocation of ₹ 3800 crores and ₹4900 crores for Deendayal Upadhyaya Gram Jyoti Yojna (DUGJY) and Integrated Power Development Scheme (IPDS) respectively

■ Allocation of ₹16000 crores (of which ₹ 2750 crores allocated in FY 2019) under "Saubhagya" Scheme to enable last mile connectivity for rural households





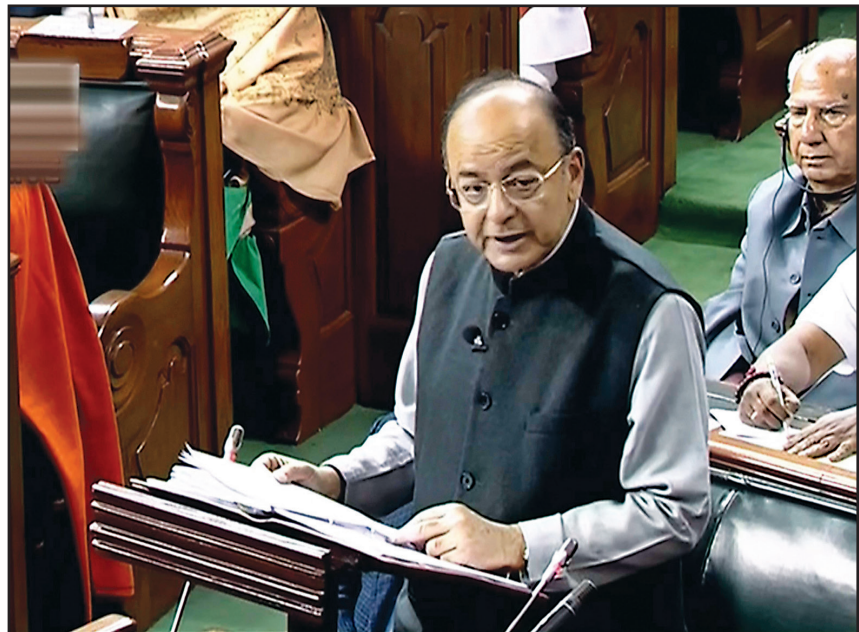
- Mechanism proposed to buy surplus solar energy from solar pumps by the discoms at reasonable price
- Increased capex by Railways particularly for electrification & augmentation of line network
- Allocation of ₹ 4200 crores for capacity addition in wind power, solar power and green energy corridor
- Measures proposed to facilitate the access to bond market for meeting the 25% of debt needs by large corporates, including those rated in “A” category.
- Lastly, reduction in corporate tax rate to 25% for entities with turnover of upto ₹ 250 crores.

Energy experts are bullish about the sector’s prospects post-budget. Sabyasachi Majumdar , Sr. VP, Group Head- Corporate Ratings , ICRA Ltd, says the allocations to DUGJY and IPDS is likely to provide a boost in energy demand to some extent, apart from improving the quality of life for rural households.

Furthermore, the Narendra Modi government has taken up a huge task of providing universal access of energy to the poorest of poor. Saubhagya target of 4 crore electricity connections and 8 crore gas LPG connection under Ujjwala are going to transform the socio-economic landscape of India, said Debasish Mishra, head of Energy and Resources at Deloitte Touche Tohmatsu India LLP.

The mechanism proposed to buy surplus solar energy from solar pumps by the distribution utilities as well as push for deployment of solar energy under smart city programme deserve special mention. These would facilitate solar capacity addition, given the improved tariff competitiveness of solar energy, point out Majumdar. However, the uncertainty over imposition of duties (import duty / safeguard duty / anti-dumping duty) including timelines & quantum thereof continues for the solar energy sector.

The measures proposed to facilitate the access to bond market for meeting 25% of debt needs by large corporate will allow the entities in power & renewables to diversify the funding sources at cost competitive rate, given



The long term focus on renewable energy sector will help in the Government’s RE target of 175 GW by 2022 which includes 100 GW of solar and 60 GW of wind. The roll out of second phase of solar power generation of another 20,000 MW will strengthen India’s position in the global solar industry.

SUBHASH SETHI,
CHAIRMAN, SPML INFRA LIMITED

the highly capital intensive nature of sector & large funding requirements. The reduction in tax rate to 25% for entities with turnover of Rs. 250 crores is a positive for renewable IPPs, given that a majority of them have capacities of less than 200 MW and thus revenues within the prescribed limit. Subhash Sethi, Chairman, SPML Infra Limited believes the target to achieve 100% rural electrification with an increase of 35% in budget allocation depicts government’s progressive thinking in meeting 100% electrification by 2018.

“The long term focus on renewable energy sector will help in the Government’s RE target of 175 GW by 2022 which includes 100 GW of solar and

60 GW of wind. The roll out of second phase of solar power generation of another 20,000 MW will strengthen India’s position in the global solar industry,” noted Sethi.

Meanwhile, India Ratings and Research (Ind-Ra) has maintained a stable outlook on the solar sector and revised the outlook on the wind sector to stable from negative for FY19. The agency anticipates favourable environment for wind and solar energy sectors as bids are being driven by central government agencies and power purchase agreements (PPAs) are becoming favourable to developers in terms of addressing grid curtailment and termination issues. Development of guarantee funds by states/bidders, incentives to local solar panels manufacturers and exploring of wind-solar hybrid projects and offshore wind projects indicate a sustaining growth momentum in renewable power.

Few hurdles such as uncertainties in solar panel costs, unpredictable behaviour of distribution companies (discoms) and operational troubles from wind turbine manufacturers need to be addressed by renewable developers. Ind-Ra believes avoidance of downtime of solar and wind plants are critical in ensuring the predicted internal rate of returns.



ONGC'S ACQUISITION OF HPCL TO BE CREDIT NEUTRAL

Oil and Natural Gas Corporation Ltd's (ONGC) acquisition of Hindustan Petroleum Corporation Limited (HPCL; 'IND AAA'/Stable) by FYE18 would be credit neutral for the ratings of HPCL, believes India Ratings and Research (Ind-Ra). ONGC, which is 68.94%-held by the government of India (GoI), will acquire the GoI's 51.11% stake in HPCL for INR369.2 billion. Thus, the GoI will indirectly own 35.23% in HPCL. Despite the change in ownership, HPCL will continue to operate as a separate entity with a strong brand. Its strategic importance to the GoI is likely to remain intact, given the company's role as the GoI's extended arm for fuel policy implementation.

Meanwhile, the acquisition of HPCL is likely to result in additional borrowings for ONGC.

In Ind-Ra's opinion, ONGC is likely to fund the acquisition by end-January 2018 and could use one or more of the three sources for funding: fresh debt, cash and cash equivalents, and monetisation of its stake in entities such as GAIL (India) Limited ('IND AAA'/Stable), Indian Oil Corporation Limited ('IND AAA'/Stable) and Petronet LNG Ltd ('IND AAA'/Stable/'IND A1+'). The combined value of its stake in the three entities is about INR344 billion. Ind-Ra expects ONGC's consolidated net leverage to remain comfortable at 1.3x-1.5x on a pro forma basis in FY19 (FY17: 0.8x), depending on the funding mix.

Benefits to HPCL

Ind-Ra believes HPCL could receive the following benefits from the transaction.

1. The acquisition may possibly result in some synergies in terms of low crude procurement cost for both HPCL and Mangalore Refinery and Petrochemicals Limited (MRPL; 71.63%-owned by ONGC and 16.96%-owned by HPCL). HPCL, along with HPCL-Mittal Energy Limited ('IND AA'/Positive) and MRPL, represented 15.3% of India's total crude import volume of 249 million metric tons (MMT).
2. HPCL may be able to capitalise on ONGC's petrochemical expertise while expanding its footprint in the segment.
3. The acquisition may result in the merger of MRPL with HPCL.

This would be beneficial as it would allow the combined entity to leverage its purchasing power. Moreover, the combined entity would be the third-largest refiner in India, with a refining capacity of 43.1MTPA, after Indian Oil Corporation (80.8MTPA) and Reliance Industries Ltd. ('IND AAA'/Stable; 60MTPA).

In case ONGC eventually looks to integrate MRPL (which has market cap of about INR229 billion) with HPCL and HPCL has to buy out ONGC's stake in a cash transaction valued at INR164 billion, HPCL may have to resort to additional borrowings. The reason behind additional borrowings is that HPCL is likely to register negative free cash flows over FY18-FY21 owing to its large impending capex (about INR421 billion) and limited cash and cash equivalents (FYE17: INR52.3 billion). Moreover,

HPCL may consider a combination of share swap and cash payout, where ONGC would get additional stake in HPCL against its shareholding in MRPL. In the event of MRPL merging with HPCL, Ind-Ra expects HPCL's net leverage to remain below 3.0x over FY18-FY20.

Moreover, Ind-Ra does not expect the acquisition to alter budgetary and upstream support to HPCL for its gross under-recoveries on both kerosene and LPG. The share of oil marketing companies in under-recoveries has been zero since FY16 on account of fuel reforms undertaken by the GoI in the past. The lower fuel subsidy bill was also a result of a decline in international crude price.

The agency notes that given the sharp increase in international crude price, oil marketing companies may be required to bear a part of the under-recoveries as the government, in the past, capped the subsidy burden it was willing to share per kilogram and per litre on LPG and kerosene, respectively. Any under-recovery over and above the level up to which the GoI can bear is to be borne by upstream and oil marketing companies. Although there is no mathematical basis for deciding the share of the subsidy to be borne by upstream or oil marketing companies, upstream companies have historically shared the bulk of the remaining subsidy burden post the government share.

Benefits to ONGC

The acquisition of HPCL is likely to increase ONGC's market share by 18.5% in the domestic space for downstream petroleum products. The consolidation of HPCL could aid in reducing the volatility in ONGC's cash flows to a certain extent, as a decline in the upstream margins of ONGC could be offset by an increase in refining margins of HPCL in the event of weakening crude prices and vice versa. Moreover, the acquisition helps in creating a large oil and gas company with a scale comparable to those of global giants.

Overall, Ind-Ra believes the acquisition is a win-win for both ONGC and HPCL.



20 CLEANTECH STARTUPS MAKING IT HAPPEN

If one dreams about owning a Tesla, there is a list of 20 startups that will inspire you more. Each of these cleantech companies is connected to building a clean energy future. The companies are either doing work through innovation for electric vehicles (EVs), EV charging, transportation, solar power, energy storage, or energy management.

If you look at Tesla's products, it's not just about watching their latest model. Tesla now rolls up EVs, battery storage, and solar all under the same roof, with a common purpose that in essence unifies its mission.

With Tesla, Musk has shown that it is easy to build a new model for energy companies. This is where a meeting point for people has emerged. Utility-scale power generation and control technologies with more localized distributed generation for consumers and businesses can do wonders.

Here are 20 companies making that clean energy future happen.

1. **Future Mobility Corporation (FMC)**
Santa Clara • 501-1000 Employees
Building full electric cars from the ground up.
2. **Proterra**
Zero-emission vehicles that enable bus fleet operators to reduce operating costs and deliver clean, quiet transportation to the community.
3. **Sighten**

- San Francisco • 11-50 Employees
The New Energy Operating System
4. **Advanced Microgrid Solutions**
San Francisco • 11-50 Employees
They are building a more efficient, more resilient, electric grid.
5. **OhmConnect**
San Francisco • 11-50 Employees
Replacing power plants with software
6. **Carbon Lighthouse**
San Francisco & New York City • 51-200 Employees
Actively managed energy service
7. **eMotorWerks**
San Carlos • 11-50 Employees
Innovative time-shifting algorithms to reduce costs, prevent grid congestion, and make EVs cleaner.
8. **Voltus**
San Francisco
Less energy, more cash.
9. **kWh Analytics**
San Francisco • 11-50 Employees
Solar Risk Management
10. **FreeWire Technologies**
San Leandro • 11-50 Employees
Energy solutions and industrial IoT for the built environment.
11. **EVmatch**
Santa Barbara • 1-10 Employees
Airbnb for electric vehicle charging
12. **Particle**
San Francisco • 11-50 Employees
The full-stack Internet of Things platform. Connect your devices to the web.
13. **Wunder**
Boulder & San Francisco • 11-50 Employees
Building the renewable utility of the future
14. **Autogrid Systems**
Redwood City
Enabling a Smarter Energy Internet
15. **Genability**
San Francisco • 11-50 Employees
Energy Savings Platform for Solar, Storage, EV, IoT, Utilities
16. **Elemental Excelerator**
Honolulu • 11-50 Employees
They fund \$1M to companies in energy, water, agriculture, resilience, and transportation
17. **Oakland** • 1-10 Employees

A Place Where Intelligent Energy Entrepreneurs Succeed

18. **Aclima**
San Francisco • 11-50 Employees
Aclima designs and deploys sensor networks that advance environmental awareness.
19. **Swiftly**
San Francisco • 1-10 Employees • Seed
Changing transportation, mobility, and cities through better data
20. **Everergi**
Sydney • 1-10 Employees
They are creating the future electricity platform for electric vehicle drivers

DASSAULT SYSTÈMES UNVEILS 'ELECTRO MOBILITY ACCELERATOR' IN INDIA

Dassault Systèmes (Euronext Paris: #13065, DSY.PA), announced the availability of 'Electro Mobility Accelerator' in India at the Auto Expo 2018. The solutions aims to provide industry-proven capabilities to develop new Electric Vehicle ideas, virtually simulate & validate performance, and ensure flexible, lean manufacturing, all on one secure, powerful platform.

As India is moving towards sustainable mobility, Dassault Systèmes 'Electro Mobility Accelerator' provides an all-in-one collaborative cloud and on premise environments. It helps in creating and delivering lightweight, compact and high-performance battery solutions, powertrains,



charging technology and software with an aim to integrate electric drive into all transportation and mobility sectors. Electro Mobility Accelerator aids in tracking ideas from initial concept to customer delivery, with integrated governance to improve productivity, and reduce development costs.

“The automotive landscape in India is evolving at a rapid pace. Our customers in India from large OEMs to component suppliers and start-ups have been scouting for solutions that enable quicker design, simulation, collaboration, improving productivity and designing electric vehicles and components for the future. Therefore, we are extremely excited to announce the availability of ‘Electro Mobility Accelerator’ to the automotive industry in India at the Auto Expo 2018. Globally, the solution is used in companies such as Rimac Automobili and Tesla who have already taken a step ahead towards the electric and autonomous vehicles journey.” said Xavier Silhouette, vice-president - Sales, Transportation & Mobility Industry, Dassault Systèmes.

Shree Harsha, Business Consulting Director, Transportation & Mobility, Dassault Systèmes India said, “The Government’s ambition for electric vehicles presents the automotive industry in India a huge opportunity to innovate. However, the success of electric vehicles in India depends on efficient and affordable batteries. Poor standards on batteries and range create anxiety for customers along with availability of charging infrastructure are huge constraints for this shift towards Electric Vehicles.”

“With ‘Electro Mobility Accelerator’ we can perform modelling and simulation to optimize materials, which are key to final battery performance along with calculation of electrical performance and thermal behavior. Also, the optimization of cell and pack geometry can be attempted to improve the overall performance including aging studies. System level simulation can be performed to analyze the energy consumption along with battery integration in the vehicle context for all environment and usages.”

Key Capabilities & Benefits of Electro Mobility Accelerator

- Provides an all-in-one collaborative cloud (or on premises) environment to imagine, create, design, simulate and deliver new

mobility concepts and services

- Track ideas from initial concept to customer delivery, with integrated governance to improve productivity, and reduce development costs
- Imagine more new innovative vehicle concepts, and validate feasibility faster
- Deliver robust innovation with proven end-to-end engineering & manufacturing solutions to shorten time-to-market.

GOLDSTONE INFRATECH COMPLETES 1-LAKH KM ON ITS 100% ELECTRIC BUSES ON INDIAN ROADS



Goldstone Infratech Limited (GIL), manufacturing 100 per cent electric buses and listed on Indian stock exchanges, today announced the completion of 1,00,000 km run on its fully Electric Buses in India.

The Company has completed 50,000 kms of commercial run on Indian roads - in Mumbai and Himachal - and additional 50,000 kms under trial run in various cities including Bengaluru, Hyderabad, Goa, Rajkot, Chandigarh and Delhi.

With this announcement, GIL becomes the first Company to have achieved this milestone - of crossing 1,00,000 km run for Electric buses –in the country.

As per estimates, every 10,000 km run of electric vehicles reduces 10.2 tonne of tail-pipe carbon (CO2) emission in the environment, in addition to substantial saving of Rs 19 per km (on net basis) in fuel

“We are delighted to complete this milestone and would like to thank the State

Governments in adopting this clean new energy, 100% electric buses in their fleet. We see a lot of excitement among state governments to embrace electrical buses for public transportation and are confident of crossing the next 1,00,000-km milestone within the first few months of 2018”, said Mr. N K Rawal, MD, GIL.

GIL is the first Company to have bagged orders of 31 buses and successfully delivered 100 per cent Electric buses to two state transport units (STUs) – Himachal Roadways and Transport Corporation (HRTC) and to BrihanMumbai Electricity Supply and Transport Undertaking (BEST)

The Company has successfully completed over 22,000 km commercial run in the Himachal sector- including the Manali-Rohtangpass route at an altitude of 13000 ft which is the steepest gradient for any electrical bus to operate in the World – and 28,000 km run on busy local routes in Mumbai. “GIL’s fully Electric buses are successfully plying commercially on the Himachal Roadway’s route of Manali-Rohtangpass and on busy local routes by BEST. Company has also completed trials of its electrical buses in various states including Delhi, Bengaluru, Hyderabad, Rajkot and Chandigarh and we are keen to serve in the fleets of State Transport Units and participate in the Smart Cities program announced by the government”, said Mr. Rawal.

The Company has two range of buses –eBuzz K7 (9 mtr) and eBuzz K9 (12 mtr) – and is adding a range of other buses in its portfolio basis customer requirements. All GIL buses are manufactured in India in technical collaboration with BYD of China. BYD is the World’s largest electrical vehicle manufacturer and has a large range of Electrical buses, cars and trucks that are successfully operating in many countries across the globe.

GIL buses are 100% electrical, zero emission, capable of seating 31 passengers in eBuzzK7 and 39 passengers in eBuzzK9 and covers up to 250 km @70 kmph on a single complete charge that takes about 4 hours.

GIL is the first Company to receive Automotive Research Association of India (ARAI) certification for its Electric Buses in the country.



SEALDAH GOES FOR SOLAR MAKEOVER

Sealdah Railway Station, one of the busiest railway terminals in the country started in 1869 under Eastern Railway, will soon be solar lit. Eastern Railways has come up with a unique solar project with the twin objectives of promoting the causes of clean energy and bringing down cost through energy efficiency.

The ambitious solar project at Sealdah in the heart of Kolkata will be implemented through RESCO (renewable energy services company) business model. Eastern Railways has teamed up with Erectcraft Energy, a new company floated by Suncraft Energy Private Limited, promoted by a group of IIT Kharagpur alumni to get this project executed in Public Private Partnership model. Interestingly, in this case, Erectcraft Energy, the private partner will invest in the solar project, while railways will pay a pre-fixed rate for per unit of electricity consumed for the next 25 years through a power purchase agreement. The project will go on stream by the end of the current fiscal itself, top railways officials said.

The 500 Kwp solar power plant will be installed at ten different rooftop locations with grid connection.

“The entire system will integrate a self cleaning mechanism so that the yield is more. Our system will also ensure that

solar energy is an acceptable complementary product with the grid power. The utility level solar energy project has already achieved the grid parity and in roof top solar energy also, railways will purchase the power at a much lesser price than the grid power,” said Kiron Bhat, an alumnus of IITKgp of 1977 batch.

“This is a huge opportunity for the company to scale up. The 500 kWp solar energy project will be able to generate nearly 7 lakh units annually, saving close to Rs 15 lakh for the railways. This solar energy will be a sensible addition to railways’ sources of electricity as it would help the railways reduce its carbon footprint as well,” said Kunal Bhat-tacharya, former CEO & director, Webel Venture Capital and also another alumnus of IITKgp and is now part of the Suncraft Energy management team.

Significantly, with as much as Rs 2,045 crore, (which is 54 per cent of the total allocation of Rs 3,762 crore for grid-interactive renewable energy schemes and projects) having been allocated for the solar sector in the Union Budget 2018-19, solar clearly appears to be the flavor of the season. The budget documents said that the funds are meant for development of solar PV projects on canal bank, canal tops, greening of islands, development of solar parks and ultra mega solar power projects, defense solar and rooftop solar schemes.

TATA POWER CLUB ENERJI ORGANIZES AWARENESS INITIATIVES

Tata Power, India’s largest integrated power company, through Club Enerji, has been successfully working with students from various schools across the nation to build awareness about the critical issue of energy and natural resources. In a decade, the company’s Club Enerji movement has grown from a pilot project to a national movement to save energy and preserve our environment. Tata Power Club Enerji has achieved a significant milestone as the program entered its 10th year.

Last year, Club Enerji has saved energy which is about 3.5 MU as compared to 3 MU previous years. The programme has so far formed 237188 Energy Champions, 290829 Energy Ambassadors and built 1526 self-sustaining Mini Energy Clubs. The initiatives under the programme include awareness rallies, skits, online modules, visit to Mahseer hatchery, TEDx speak, tree plantation drives, Annual teachers and principal meet, National Quiz contest etc. Among the most impactful initiatives has been , its energy conservation/ afforestation/ resource conservation rallies & Skits across cities like Mumbai, Delhi ,Pune, Bengaluru, Kolkata, Ahmedabad , Annual National Quiz Competition Club Enerji carnival and Hatchery visits in Lonavala to increase awareness of mahseer conservation .

The Club Enerji programme has reached out to over 500 schools in India and has sensitised over 15 million citizens, who in turn have helped save more than 21 MUs of electricity till date. The club also has around 1500 self-sustaining mini-clubs.

Commenting on the achievement, Mr Anil Sardana, CEO & MD, Tata Power said, “It gives me immense pride that Tata Power Club Enerji has set a benchmark in creating massive awareness on energy conservation. We have successfully achieved to make it a people’s movement than an initiative by Tata Power. Every year, the programme strives to engage with more schools and its students that will help us shape the minds of our younger generations to be sustainable individuals. It is important for everyone to understand the importance of energy conservation, and we are glad that



Club Enerji students are the key drivers of our cause. I take this opportunity to thank the students and management of the schools for making this initiative a grand success.”

In recognition of impact the programme has had on the society, Club Enerji has won several awards like ABCI Awards 2017 for the Club Enerji Disaster Management module, and Asia Pacific Enterprise Leadership Awards (APELA), Singapore to name a few. The commendable work being undertaken by the club was also showcased at a prestigious, global platform at TEDx IIM Ahmedabad event.

Tata Power started its school outreach programme, “Tata Power Energy Club” in 2007. In 2009, Club Enerji took its next big leap, with the programme turning into a national movement, covering more than 500 schools across Mumbai, Delhi, Pune, Ahmedabad, Bengaluru, Kolkata, Belgaum, Jamshedpur and Lonavla and further attained a new milestone of achieving over one million citizens sensitisation and more than one million units energy savings. School children, from Class III to Class IX, are taught the importance of conserving energy through innovative modules which include audiovisuals and power point presentations. Children are imparted energy saving and resource conservation tips during these sessions, usage of which have shown dramatic savings. Club Enerji reached out to more than 15.81 million, collectively saved 21 million units of electricity and is present in 11 cities across 500 schools in India.

Tata Power is India’s largest integrated power company with a growing international presence. The Company together with its

subsidiaries and jointly controlled entities has an installed gross generation capacity of 10649 MW and a presence in all the segments of the power sector viz. Fuel Security and Logistics, Generation (thermal, hydro, solar and wind), Transmission, Distribution and Trading. It has successful public-private partnerships in Generation, Transmission and Distribution in India namely “Tata Power Delhi Distribution Limited” with Delhi Vidyut Board for distribution in North Delhi, ‘Powerlinks Transmission Ltd.’ with Power Grid Corporation of India Ltd. for evacuation of Power from Tala hydro plant in Bhutan to Delhi and ‘Maitihon Power Ltd.’ with Damodar Valley Corporation for a 1050 MW Mega Power Project at Jharkhand. Tata Power is serving more than 2.6 million distribution consumers in India and has developed the country’s first 4000 MW Ultra Mega Power Project at Mundra (Gujarat) based on super-critical technology. It is also one of the largest renewable energy players in India with a clean energy portfolio of 3310 MW. Its international presence includes strategic investments in Indonesia through a 30% stake in the leading coal company PT Kaltim Prima Coal (KPC), 26% stake in mines at PT Baramulti Suksessarana Tbk (“BSSR”); in Singapore through Trust Energy Resources to securitize coal supply and the shipping of coal for its thermal power generation operations; in South Africa through a joint venture called ‘Cennergi’ to develop projects in sub-Sahara Africa; in Zambia through 50:50 joint venture with ZESCO for 120 MW Hydro which has become operational in 2016; in Georgia through AGL which is a joint venture with Clean Energy, Norway & IFC

for development of 187 MW hydro project and in Bhutan through a hydro project in partnership with The Royal Government of Bhutan. With its track record of technology leadership, project execution excellence, world class safety processes, customer care and driving green initiatives, Tata Power is poised for a multi-fold growth and committed to ‘lighting up lives’ for generations to come”.

ULTIMATE SUN SYSTEMS COMMISSIONS SOLAR PLANT AT MM MEDICAL COLLEGE & HOSPITAL, SOLAN

Underlining its commitment to drive the adoption of renewable energy systems and increase production capacity, Ultimate Sun Systems, an MNRE Channel Partner company and a pioneer in the field of renewable energy solutions, has installed and commissioned a 300 kW grid-tied rooftop Solar PV system at the MM Medical College & Hospital in Solan, Himachal Pradesh. The installation is expected to generate 369,000 kWh of electricity every year and significantly bring down the institute’s carbon footprint.

The 1,131 solar panels and 7 inverters installed by Ultimate Sun Systems at the hospital will lead to a reduction in carbon emissions by around 7,565 tons and unlock significant savings on electricity bills. The estimated cost of the project is INR 1.44 crore, of which INR 1.068 crore has been sanctioned as a subsidy from Himachal Pradesh Govt. Energy Development Agency. The project was completed in just 20 days, showing great efficiency in installation and showcasing Ultimate Sun System’s remarkable engineering skill. This is the company’s first project in Himachal Pradesh, where through HIMURJA, educational institutions can avail a subsidy of up to 70% of the project cost for solar installations.

Speaking on the achievement, Mr. B.S. Yadav, Managing Director, Ultimate Sun Systems, said, “It is indeed heartening that a major hospital such as MM Medical College is cutting down its dependence on conventional resources by opting for renewable energy. The rooftop solar PV plant



installed at the hospital will be equivalent of planting more than 12,000 teak trees and will significantly reduce carbon emissions in the atmosphere. We appreciate the management's effort to have a solar power generation unit and use the roof space to the fullest extent to produce energy in an efficient manner."

Spokesperson Dr. Tarsem Garg, Chairman, MMU, commented, "As a hospital, we constantly require large amounts of electricity to power medical equipment all over the campus. Most of this energy requirement was previously met through diesel generators. Switching to clean solar power will not only be cost-effective but will also help us make a positive contribution towards saving the environment. We are thankful for the complete end-to-end solutions offered by Ultimate Sun Systems, which have allowed us to make use of its eco-friendly technology and reduce our carbon footprint."

Recently, Ultimate Sun Systems had installed and commissioned a 500kW expansion to the existing 3mW rooftop solar plant at the Maharishi Markandeshwar Engineering College in Mullana, Ambala. The company, with its technical prowess and project expertise, aims to establish a strong foothold across India by 2020. One of India's fastest growing companies in the clean power domain, Ultimate Sun Systems plans to further expand to other Asian and African markets by offering environment-friendly, energy-efficient, and cost-effective solutions that provide a quick return on investment.

Ultimate Sun Systems is an 'MNRE Channel Partner' company & pioneer in the field of renewable energy solutions that are environmentally friendly, energy efficient



& cost effective. It offers various turnkey services like site & project feasibility, financial analysis, liaisoning with the banks for project funding, design, engineering, procurement, and construction & commissioning of solar PV systems. The company works on both CAPEX and OPEX models.

Founded in 2013, Ultimate Sun Systems aims to be identified as one of the leading companies in India across distributed power generation, catering to the growing power needs of rural and remote areas across the country. It is headquartered in Gurgaon, Haryana, and has offices & after-sales service network in Ambala (Haryana), Derabassi (Punjab), Aligarh (UP), Narnaul (Haryana), Bangalore (Karnataka), Coimbatore (Tamil Nadu), and Mumbai (Maharashtra)

Maharishi Markandeshwar University (MMU) is a leading NAAC 'A' rated University in North India and has become a symbol of quality education in technical, medical and other professional streams. Since its inception, the University is committed to excel in research, innovation and skill development. MMU offers a plethora of courses through its various teaching institutions spreading over three different Campuses at Mullana, Sadopur and Solan.

HEL HIGHLIGHTS ITS REHAB VILLAGE

The 600 MW Haldia Energy power plant, which will step into its fourth year of completion on February 21, has recently achieved a number of performance records, including winning the coveted "ICC Environment Excellence Award". The HEL pavilion at the Haldia Trade Fair has drawn a large number of eager visitors. At the Exhibition site, Mr. Rabi Chowdhury, Managing Director of Haldia Energy Limited, announced that the HEL administrative building at Haldia has just won the Green Building IGBC Platinum Rating from the Indian Green Building Council.

An interesting machine, developed specially by IIT Kharagpur for the HEL rehabilitation village, is intended to help incumbents earn economic self-sufficiency. The first muri-making machine, which can produce 35 kgs of muri in an hour, has



proved highly useful and profitable. The second muri machine from IIT Kharagpur is being installed at the HEL rehab village.

Another interesting exhibit at the HEL pavilion is pictures of the Group's major residential housing project at Haldia now nearing completion. Quest Properties, a RP-Sanjiv Goenka Group Company, which owns and operates the signature shopping mall Quest at Kolkata, has embarked upon this major residential project in Haldia. According to Mr. Dilip Sen, Managing Director of the project, "More than 200,000 sqft high-rise residential construction has been taken up within Haldia Municipal area. Quest Residency, Haldia will comprise four high-rise towers – 3 nos ground+12 floors and 1 no ground+11 floors. This modern building with 65% open area, will be a Haldia landmark. Construction is in full swing -- two towers comprising 156 flats will be handed over by the middle of this year. Snapshots of Quest Residency, Haldia, including an artist's impression of the project, are on display at the Haldia Fair pavilion. Commenting on Haldia Energy's involvement in rehab, an HEL spokesman said that an ideal village has been carefully set up to settle 300 families. In this model village, every household has hygienic sanitation arrangement. Each home is also provided with drinking water and electricity. Aimed at financial self-sufficiency, several earning opportunities have been opened up, eg. muri making, spice grinding and kitchen gardening. A number of women in the village have been specially trained to set up tailoring units to offer to discerning customers shirts, skirts, blouse, barmuda etc. Two other profitable units for the villagers are fishery and goatery.

Continued from pg 17

The senior members of the Petro-Coal-Gas industry, including ex-government ministers and technology heads that I met at the Congress were extremely open-minded to change, very encouraging of new ideas and extremely focused on the need for development of skills through better student engagement to inspire the next generation of petrochemical engineers to take the energy sector forward. Thanks to introductions from senior members of this community, Fuel Economy Solution hope to meet with several heads of R&D at government organizations in order to assess, analyse and (hopefully) validate our combustion technology for use across India.

Have you studied the Indian road transport sector to assess how beneficial your solution would be for the Indian market?

With 93% of all vehicles used on the road in India being two-wheelers (78%) and passenger cars (15%), it is clear that only helping the 3% of vehicles used (trucks) in commercial road transport does not solve the smog problem. However, we would expect to improve the economic transformation of the industry by improving fuel efficiency in these vehicles involved in distribution throughout the country.

The fuel used in the majority of vehicles privately run is to treat at the pump. This requires additional blending at the refinery to be included at point of sale. We remain willing and able to work with IOCL and other refiners to demonstrate how we can help in this respect. We see statutory dosing of fuel at the refinery with technologies such as our combustion improver on a very lost cost scale removes the fragmented go to market outcomes of product sold for retail profit in small containers at the pumps.

The small packages necessary to supply combustion improvers at the pump B2C would need fluorination and be HDPE and just create



an unsustainable packaging waste problem which defeats the object of going greener. The latency for lung cancers to develop over 40 years may not be a typical priority for governments in business for 5 years at a time. However up to 75% reduction in black smoke through improved fuel and combustion efficiency on all domestic vehicles fuelling at the pump would very quickly start to reflect in the lung health of the nation, especially those in urban areas. Health care costs would reduce, more than covering the costs of the tiny outlay of the catalyst added at the refinery and administered by the state on a massive scale. Workforce productivity would rise, employee sickness and absenteeism would reduce. I see this automatic dosing at fuel sold at the pump as a health preventative. Some may see it as naive. I'd like to think optimistic for human health.

Our solution would be extremely beneficial for the Indian market, both commercial and domestic. Commercial sector marketing is a known quantity to us so we can proceed in a standard manner to demonstrate the benefits to the private sector through our delivery partner, Yattya Technologies. With regards the 2 wheelers and passenger cars, this could be resolved by refinery dosing and delivered at the pump as standard so we remain available and willing with our information for key R&D centres of excellence at highly respected organizations such as

the PCRA, IOCL, and IEL.

Which are the areas where your technology can be implemented?

The key sectors where our technology can be effectively used today are commercial/domestic road transport, construction, and mining equipment.

However, in terms of rail transport, despite very few gas oil/diesel fuel efficiency models being developed globally, (due to the rapid adoption of electrification for passenger travel), even in Europe 30% of the trains are operated using gas oil/diesel, mainly by the freight network. Some freight operators in Europe using popular models such as the 66 loco have disabled notch 8, such is the expense caused by the fuel inefficiency in its use. To support green economy transformation industry must remain commercial and profitable.

Whether the Indian Railways becomes 100% electrified and how long that will actually take depends upon the difficulty of the terrain, the low use routes (which will provide little or no ROI on the investment), the length of route track kilometres that cannot accommodate co-routes for passenger and freight trains (where double stacked wagons won't fit the electric catenary systems).

I met Railway Minister Piyush Goyal at the World PetroCoal Congress in Delhi last week and offered to provide our expertise in treating the rail diesel supplied by RIL/Essar to improve emissions and reduce fuel usage. With 17,165 crore invested over the last 4 years to electrify 16,815 additional RTKs, our modelling forecasts show that a fuel efficiency saving of approximately 10% for the (currently 55% of energy mix) diesel used between now and planned 100% electrification in 2021 would create an offset saving of c.4,000 crore against the full 22,400 RTKs needed to complete installation at a cost of just under 23,000 crore.



We welcome working with Minister Goyal's team if required, or his contracted fuel suppliers, to create a value-add model in minimizing the environmental impact of running diesel DMUs and locos for the immediate future prior to full electrification. Any portside equipment using an internal combustion engine, such as diesel or diesel/electric hybrid rubber tyre gantry cranes, shuttle carriers and straddle carriers, can benefit from our combustion technology today. However, due to the marine IMO 0.5% global sulphur cap (from 3.5%) coming into force 1st January 2020, application of fuel treatments in the open water and inland waterway shipping sector itself now have a new place to start. High sulphur ship engines designed to run on 35,000 ppm sulphur heavy fuel oil will be inefficient running the new statutory 5,000 ppm sulphur fuel. The lack of sulphur impacts lubricity, increases wear and tear as well as operational

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TIM PATTERSON

costs. Emissions compliance will be a challenge with older vessels which may need retrofitting with scrubbers. LNG is in too high a demand to be a major solution across the sector today. Later this year, Fuel Economy Solution intends to carry out testing in Europe witnessed by Bureau Veritas (or a similar independent organization) and then bring the proven and documented benefits back to be made available for the Indian maritime industry, the PCRA and the Ministry

of Shipping and Ports.

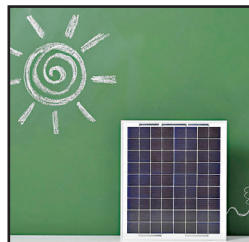
Cleaner coal combustion could well be achieved applying our catalyst in Indian CFPPs and we are looking for a plant owner to work with us on a research project. The cost of installing a new Indian power station base of IGCC technology may be prohibitive despite clear benefits on combustion efficiency improvements. It is particularly difficult for investors, who see a diminishing market with possible pre-ROI forced closures.

Development of coal gasification from existing coal stock is not straightforward or cheap but would be very welcome and much cleaner. If Fuel Economy Solution can work to identify a cleaner coal combustion solution for the most common (pulverised) CFPPs by end of 2019, then it may help the energy transition and buy some valuable time for the sector in the transformation to other sources when they are able to reliably deliver the required base load.

VIVAAN SOLAR LAUNCHES MY VIVAAN APP IS A GREEN GIFT TO DIGITAL INDIA

Known for its honest commitment to bring innovative solutions in India's solar sector, Vivaan Solar continued its mission and this time introduced a unique mobile app. 'My Vivaan App' is one-of-its-kind of an attempt to make solar power consumers more delighted and empowered. My Vivaan App can accurately monitor various aspects of solar power plants and deliver the reports and analytics to end users in an easily understandable form. The USP of this app is that users can monitor multiple projects in one application along with easily assessing O&M reports that contain Billing History, Energy Consumption Details, and Maintenance Report.

The app, which is widely available on the web, Android and IOS platforms can prove to be extensively beneficial when it comes to setting up photovoltaic solar panels. Vivaan App is designed for both the registered and the non-registered users as well. Users can track all our Solar Plant's Location and can also find distance & path from his/her current



location to the selected Solar Plant. On the successful launch of My Vivaan App, Mr. Amit Bansal, Director Finance,

Vivaan Solar said, "My Vivaan App is our initiative to promote green energy in India. The app empowers the consumers for the optimum utilisation of solar energy and keeps them updated about their daily consumption, maintenance status, billing details and generate a service request."

Download links:

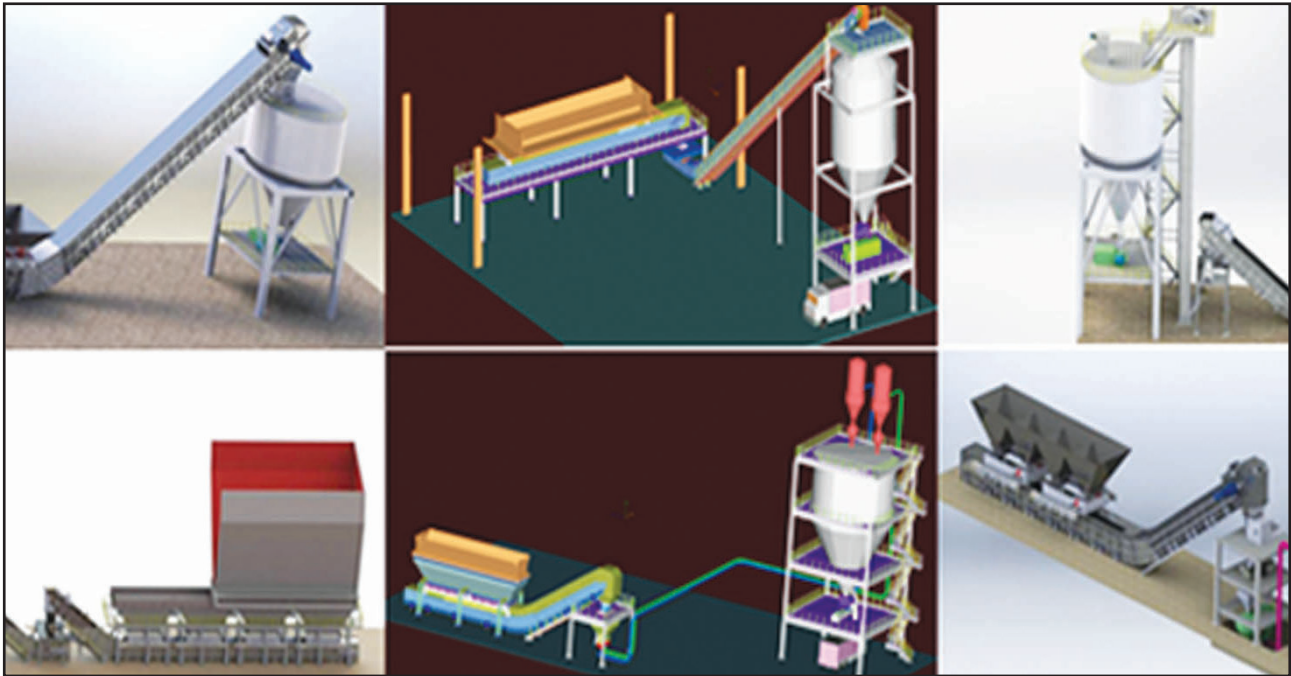
Google play: [My Vivaan – Android Apps on Google Play](#)

iTunes: [My Vivaan on the App Store](#)

etc.

Vivaan Solar is a solar PV installation and development company for both solar parks

and rooftop solar. Incepted in the year Aug 2012, the company started with meager 3 MW of solar park. To build a solar plant, the company does research for procuring Tier 1 components, incorporate best methods, and optimise to maximise project value. They do the installation and is currently focusing more on Rooftop Solar – industrial, commercial and residential too. In the solar park, the company holds 60 MW of solar park in MP, 5 MW in Punjab and 8 MW in Uttarakhand and moving for 20 MW in Karnataka. They have offices in Gwalior, Haridwar, and Bangalore. Its solar parks are in Ujjain, Uttarakhand, Punjab, and Karnataka. They have a rooftop presence in UP, Gwalior, Uttarakhand, Delhi & NCR as well. The company recently commissioned 5-megawatt peak (MWp) of the solar plants at four major and the busiest railway stations namely Hazrat Nizamuddin, Anand Vihar, Old Delhi and New Delhi stations which was launched by Piyush Goyal, Minister of Railways and Coal, GoI.



Typical Layout of Air Cooling Dry Bottom Ash Handling System.

Continued from pg15

More than 10-years' service life of the super-steel-belt, reducing the cost dramatically for operation, maintenance and overhaul works.

The existing heat in the bottom ash, the heat generated by the burn-out of the unburned carbon as well as most of radiation heat at the boiler throat (totally around 80% of heat) will be returned to the furnace, increased boiler efficiency and reduce coal consumption.

There is lower power consumption compared with the traditional wet ash handling system, 30-70% energy saving and reduce operation cost.

Flexible and user friendly design of the system, be more adaptable to the layout of whole plant and reduce investment cost.

Increase the value for comprehensive utilization of bottom ash, reduce environmental pollution.

Reasonable cost, comprehensive investment equivalent to that of a tradi-

tional wet bottom ash handling system.

Social Benefits from Dry Bottom Ash Handling Technology

To adopt dry bottom ash handling technology, no need to build ash pond and save the valuable land resource and meanwhile solve the dust emission problem of ash pond.

To improve bottom ash comprehensive utilization and save land resource and reduce the underground water pollution, the impact on geology composition and geography.

Dry bottom ash can be grinded and to replace raw material of cement and reduce CO2 emission.

Conclusions

In short, based on boiler operation feature, fuel characteristics, bottom ash property etc, there is a significant meaning to design dry bottom ash handling technology.

This technology is more simpler, advanced and can be deigned with different arrangement layout and could meet the auxiliary equipment requirement of

safety, high efficiency, reliability and dependability etc. It has the technical advantage and economic features of obvious water saving, energy saving, environment friendly, higher ash comprehensive utilization value and correspond to global policy "Energy Saving and Reduce Emission".

It will be popular technology for bottom ash handling both in new and existing coal fired plant.

Acknowledgement

For my research on dry bottom ash handling technology, I would like to thank all my teachers (Tungalagtamir B, Byambagar B, Munkhbaatar P) who have rich experience on the research of coal ash property and utilization. I am benefit from their noble morality, rigorous scholarship and aggressive spirit.

During the study period, teachers guidance not only make me to the higher academic level, also to open us my vision in the field of ash research. During drafting of this paper, it contains much countless painstaking efforts for literature search, field research, paper modification.

Only 22% of India's renewable energy potential developed, says report

Continued from pg 11

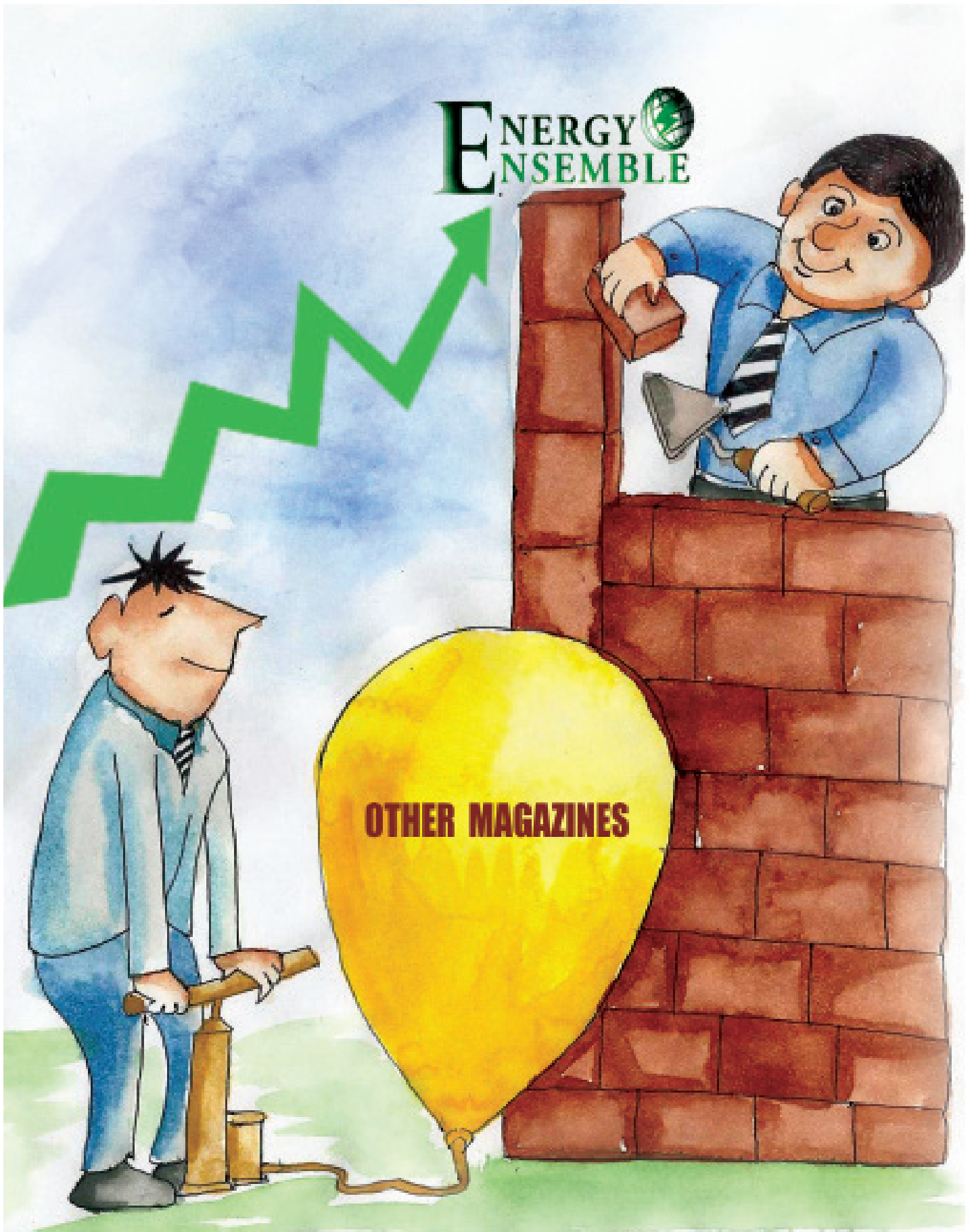
CRISIL Risk & Infrastructure Solutions Limited in association with Indian Institute of Technology, Madras hereafter referred to as ("CRIS-IITM") has been commissioned by Agence Francaise Developpement (AFD) and Indian

Renewable Energy Development Agency Limited (IREDA) to carry out a project titled "Study/ Survey & Preparation of Road Map on Tidal Energy Projects in India". This project is being conducted as part of Memorandum of Understand-

ing (MoU) between IREDA and MNRE, Government of India.

The project involves carrying out a study on tidal & wave energy in India and survey on the potential & proposition of a roadmap.

ENERGY ENSEMBLE



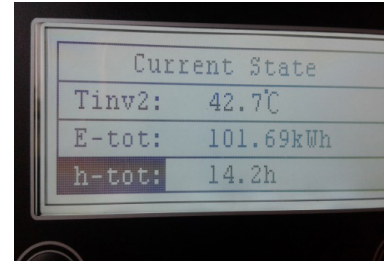
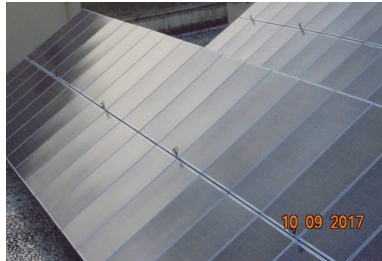
With best wishes from



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We render consultancy, implement solar power projects, manufacture and supply solar inverters, provide support in financing solar energy projects

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