Ministry of New and Renewable Energy
Government of India

सत्यमेव जयते

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BIOPOWER INDIA

A QUARTERLY MAGAZINE ON BIOMASS ENERGY

SUCCESS STORY
Institutionalizing Fuel Linkage

LEAD ARTICLE
Performance of Cummins Producer Gas Engines

India Clean Cookstove Forum 2013

Study on Performance/Viability of Biomass-based Power Plants

CALL FOR ARTICLES

BioPower India invites articles from academicians, industry experts, investors, researchers, implementers, policy makers, and other stakeholders to share their experiences, expertise, and opinions in matters related to harnessing biomass energy and power in an efficient and cost-effective manner.

Submission Guidelines

- Articles for 'Lead Stories' should not exceed more than 2000 words, excluding author profile. The introduction and conclusion of the article should not exceed more than 250 words each.
- Other articles and case studies should not exceed more than 1000 words, excluding author profile. The introduction and conclusion of the article should not exceed more than 200 words each.
- 'Opinion pieces' should not exceed more than 500 words, excluding author profile.
- Title and abstract of the article should immediately precede the text. The abstract of the article should not exceed 150 words.
- A brief profile of the author (in 50–100 words) should be part of the end-text of the manuscript.
- A high resolution profile photograph, of at least 300 dpi, of the author should accompany the article.
- Images to accompany the text should be in high resolution, not less than 300 dpi and mailed as separate files.
- **Articles should be in English using MS Word, in the Arial font, size 12.**
- All text should be double-spaced, including references, endnotes, and footnotes, if any.

Kindly send in your articles to juanita.adcs@gmail.com or a.chilamburaj@undp.org

BioPower India will accept material submitted only in softcopy. Use "Submission" as the subject line of the email. The message should include (1) the author's name, (2) the title of the article, and (3) any relevant information about the author, including institutional affiliation, mailing and e-mail addresses.

डा. फारूक अब्दुल्ला
Dr. FAROOQ ABDULLAH

सत्यमेव जयते

मंत्री
नवीन और नवीकरणीय ऊर्जा
भारत सरकार
MINISTER
NEW AND RENEWABLE ENERGY
GOVERNMENT OF INDIA

February 20, 2014

MESSAGE

MESSAGE

I am happy to note that the Ministry of New & Renewable Energy is publishing the quarterly magazine – BioPower India.

The potential of biomass energy derived from sustainably harvested biomass resources is recognized globally. In the Indian context, the significance of biomass is immense with over three quarters of our rural households still dependent on biomass as their primary source of cooking energy. We estimate that nearly 18,000 MW of power can be generated from surplus biomass residues, and about 5000 MW additional power can be harnessed through bagasse-based cogeneration. Our Ministry has been implementing biomass power/cogeneration programme for over three decades now. Biomass power and cogeneration projects aggregating to nearly 4000 MW have been installed in the country for feeding power to the grid. In addition, the deployment of biomass and cogeneration-based decentralized distributed power for industrial and local use has also increased considerably in the past two decades.

Considering the huge potential for biomass-based power generation in our country, there is a need to enhance both the capacities and the confidence of our project promoters and developers. Besides, other stakeholders in the sector such as financial institutions, regulators, policy makers and state nodal agencies have to synergize their thoughts and actions through sharing and dissemination of information and experiences in this important sector.

BioPower India, being published under the MNRE and UNDP/GEF supported Biomass Power Project, is expected to address these issues and create a platform for increased awareness and knowledge about biomass at all levels.

I hope that BioPower India will provide a vibrant platform for these activities and act as a valuable knowledge repository.

I wish this endeavor all success.

(Farooq Abdullah)

सत्यमेव जयते
डा. सतीश बलराम अग्निहोत्री
Dr. Satish B. Agnihotri

सचिव
भारत सरकार
नवीन और नवीकरणीय ऊर्जा
SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF NEW AND RENEWABLE ENERGY

MESSAGE

MESSAGE

Biomass which is renewable in nature, carbon neutral and has the potential to provide large scale productive employment in rural areas is one of the promising renewable sources for generation of power/energy using commercially available thermal and biological conversion technologies. The Ministry of New and Renewable Energy has been implementing a wide range of programmes for generation of energy as well as grid interactive and off grid power for harnessing the estimated potential of 23,000 MW based on surplus biomass residues and bagasse cogeneration in sugar mills.

Today, biomass power has become an industry and our country has facilities for manufacturing of equipment, capacity to build, operation & maintenance of the power plants, absorption of new technologies/processes and resolving grid interfacing issues. The cumulative generation capacity of about 4000 MW through biomass power, including bagasse cogeneration, established so far in the country by the private sector promoters is a testimony to the effectiveness of the Ministry's efforts.

Besides direct and indirect employment generation in rural areas, the biomass power industry with current installed capacity of 1285 MW consumes about 14 million tonnes of biomass annually, thereby injecting about (Rs symbol) 3300 crore per annum into the rural economy.

The past two decades of implementing various schemes for the promotion of biomass power has also brought forward many challenges and barriers in its faster diffusion. I hope that BioPower India, published under the MNRE and UNDP–GEF-supported Biomass Power Project, will articulate and attempt to address these issues and create a platform for increased awareness and knowledge about biomass potential at all levels.

(Satish B. Agnihotri)

New Delhi
20th February, 2014

अक्षय ऊर्जा से देश विकास
गांव गांव बिजली, घर घर प्रकाश

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COVER IMAGE: 13 MW Biomass Power Plant, Shendra Green Energy Ltd, Aurangabad

FROM THE EDITOR

It gives me immense pleasure to bring forth to you the quarterly magazine *BioPower India*, published by the Ministry of New and Renewable Energy (MNRE) under the ongoing MNRE–UNDP/GEF Biomass Power Project.

The importance of biomass as a renewable source for generation of energy and power is well established. However, the challenge remains in making the sector viable and sustainable. I firmly believe that knowledge and experiences bridge the gap between current obstacles and future opportunities. *BioPower India* is an endeavour to provide a much-needed platform for voicing constructively critical perspective and creating a repository of knowledge.

The magazine has been designed to bring an all-rounded perspective and information on the biomass power sector. One of the important sections that the magazine will cover is updates on national/international policy and tariff guidelines and technological developments for the sector. In addition, *BioPower India* will feature quarterly updates on MNRE and states' initiatives in promoting biomass power; and feed-in-tariff for biomass power generation systems offered by the central and various state electricity regulatory commissions within the country. It will also bring to the readers a snapshot of national and international news and events.

In this issue, the lead articles brings you experiences from Thermax in the area of advanced biomass gasification technology for power generation and the performance of Cummins producer gas engines. The case study section captures the fuel supply institution established by IL&FS for its 13 MW biomass power plant in Aurangabad. This issue analyses the latest German biomass policy; and the path-breaking judgment by the Appellate Tribunal for Electricity that has allowed revision of biomass fuel prices by the Gujarat Electricity Regulatory Commission. The Events section reports on (a) the *India Clean Cookstove Forum 2013* held in New Delhi on 25–26 November 2013, (b) the meeting of the Sub-Group on Renewable Energies under the Indo–German Energy Forum held on 13 November 2013 and (c) the conference organized by the Independent Power Producers Association of India (IPPAI) on 24 October 2013 at Aizawl, Mizoram.

I would like to convey to my readers that the aim of this publication is not only to provide information and knowledge, but also to pro-actively engage with you. Towards that end, I earnestly invite comments and feedback from you.

May the year 2014 be a great start for all of us!

(V K Jain)

REMOVAL OF BARRIERS TO BIOMASS POWER GENERATION IN INDIA

The Ministry of New and Renewable Energy (MNRE), Government of India, in partnership with United Nations Development Programme/Global Environment Facility (UNDP/GEF) is implementing a project titled 'Removal of Barriers to Biomass Power Generation in India.' The objective of the project is to accelerate the adoption of environmentally sustainable biomass power technologies by removing the barriers identified, thereby laying the foundation for large-scale commercialization of biomass power through increased access to financing. The global development objective of the project is to improve electricity supply using renewable energy sources without increasing greenhouse gas (GHG) emissions.

The project seeks to promote combustion, gasification, and cogeneration technologies and focus on grid-connected biomass power projects for electricity generation using different types of captive and distributed biomass resources. Towards meeting this objective, the project will provide technical assistance to remove technical, regulatory, and institutional barriers to widespread use of biomass power. It also seeks to utilize investment risk mitigation support to promote repeated investments in biomass power generation projects.

One of the key barriers that the project aims to address is filling the existing gap in sharing of information and knowledge in the sector. The project has generated/disseminated knowledge products through various studies related to identification of barriers, resource assessment, evaluation of performance of the existing biomass power plants, and reviews of policy and regulatory framework. It has modified the procedure for empanelment of biomass gasifier manufacturers, and has developed benchmark norms for material specifications and performance standards for biomass gasifiers, amongst others.

As part of the ongoing initiatives, the project plans to develop an online repository of information and initiative on generating energy from biomass. An important step towards bridging the the knowledge gap is the publication of the quarterly magazine, BioPower India. Through this magazine, the project will disseminate information to promote the sector and share learning/inputs from field projects to support policy and regulatory decisions.

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Power generation from biomass

A potential of about 2,45,000 MW has been estimated from different renewable energy (RE) sources: over 1,00,000 MW each from wind and solar energy; 20,000 MW from small hydro power (SHP); and about 25,000 MW from different bioenergy sources.

The total installed capacity of power generation in the country is 2,30,600 MW, which includes 29,537 MW from RE sources and corresponds to 12.8% of the total power generation capacity. Most of the RE-based power projects are set up by the private sector. The government provides fiscal and financial incentives to set up such projects. A capacity addition of 11,262 MW, against a target of 10,522 MW, has been achieved from various RE sources during the past three years. During 2013/14, a capacity addition of 1468 MW has been achieved till 31 October 2013 against the target of 4325 MW. In a written reply in the Lok Sabha, the Minister for New and Renewable Energy (MNRE), Dr Farooq Abdullah, shared important information as the table below reveals. The table below gives physical and financial targets and achievements in the field of biomass power generation in the past three years.

Source: Contributed by MNRE, Govt. of India <http://pib.nic.in/newsite/pmreleases.aspx?mincode=28>

Targets and achievements of biomass power generation during the past three years and the current year (till 31 October 2013) (Targets and achievements in MW)

Programme / System	2010/11		2011/12		2012/13		2013/14	
	Target	Ach.	Target	Ach.	Target	Ach.	Target	Ach.
Biopower	472	473.50	475	487.90	475	472.00	425	78.00

Outlay and expenditure for power generation during the past three years and the current year (till 31 October 2013) (Rupees in crores)

Programme / System	2010/11		2011/12		2012/13		2013/14	
	Outlay	Expenditure	Outlay	Expenditure	Outlay	Expenditure	Outlay	Expenditure
Biopower	42	46.44	61	60.79	100	64.09	85	11.55

BioPower India welcomes the new Secretary, MNRE, and Patron of its Editorial Board

Dr Satish Balram Agnihotri took charge as the new Secretary of the Ministry of New and Renewable Energy (MNRE) on 27 November 2013, from the outgoing Secretary, Mr Ratan P Watal.

Dr Agnihotri is an IAS officer of Odisha cadre from the 1980 batch. He has done his Master's degree in Physics, followed by MTech in Environmental Sciences and Engineering from IIT Bombay. He later did an MA in Rural Development followed by a PhD thesis on 'Sex Ratio Patterns in Indian Population' from the School of Development Studies, University of East Anglia, Norwich, UK. He has also been an Adjunct Professor at the Centre for Technology Alternatives in Rural Areas, IIT Bombay.

Before joining MNRE, he was Director General (Defence Acquisition) in the Ministry of Defence. He has held key positions in the Government of India and the Government of Odisha. He has served the Odisha Renewable Energy Development Agency as its Chief Executive Officer. He was also with UNICEF Kolkata as Consultant on Child Nutrition and Health.

Dr Agnihotri steers the Ministry at a time marked by a slowdown in the expansion of biomass sector and challenges faced by it in the backdrop of an expanding renewable energy sector. He also chairs the Project Steering Committee, MNRE–UNDP/GEF project on 'Removal of Barriers to Biomass Power Generation in India'. The biomass industry looks forward to his able leadership and guidance.

Petroleum Ministry and MNRE sign MoU to set up SPVs

A Memorandum of Understanding (MoU) has been signed between the Ministry of New and Renewable Energy (MNRE) and the Ministry of Petroleum and Natural Gas (MoP&NG) with the aim to enhance energy security along with clean energy development through investments in solar, wind and other renewable energy (RE) projects. The MoU has been signed by the Secretaries in the two ministries, Dr Satish Agnihotri (MNRE) and Shri Vivek Rae (MoPNG), in the presence of Dr Veerappa Moily (Minister, MoPNG and MoEF) and Dr Farooq Abdullah (Minister, MNRE).

The MoU proposes to set up two special purpose vehicles (SPVs) for promoting the deployment of technologies to supplement conventional fossil-fuel-based power generation that will give boost to the development of large-scale grid-connected RE projects and implementing off-grid applications. The SPVs will be able to leverage the strength of oil and gas companies for promoting

RE projects. It is proposed that the SPVs would function independently like commercial organizations while utilizing various promotional schemes of MNRE and state governments for the purpose.

Source: Press Information Bureau, Government of India <http://pib.nic.in/newsite/pmreleases.aspx?mincode=28>

National Clean Energy Fund to subsidize capacity addition in NSM

The Government of India proposes to tap the National Clean Energy Fund (NCEF) proceeds to subsidise the capacity addition envisaged in the second phase of the National Solar Mission (NSM). The Government, on 3 October 2013, approved the implementation of a scheme for setting up grid-connected solar PV power projects of 750 MW aggregate capacity on Build-Own-Operate basis under Batch-1 of the second phase, NSM with Viability Gap Funding (VGF) support of about Rs1875 from NCEF.

The scheme envisages setting up of the projects on Build-Own-Operate basis, purchase of the generated power by Solar Energy Corporation of India (SECI) at a fixed levelized tariff of Rs 5.45 per kWh for 25 years and its onward sale to willing state distribution companies at a fixed tariff of Rs 5.50 per unit for 25 years. The projects will be selected on the basis of reverse bidding on VGF required by the developers. The detailed guidelines for implementation of the scheme were issued by the Ministry on 25 October 2013; and Request for Selection (RfS) document was issued by SECI on 28 October 2013.

Source: Contributed by MNRE, Govt. of India <http://pib.nic.in/newsite/pmreleases.aspx?mincode=28>

PwC to help DoT meet green target

The telecom industry is likely to urge PricewaterhouseCoopers's (PwC) Indian arm to suggest steps to help operators meet the Department of Telecommunications' (DOT) 'Go Green' targets set in January 2012. 'PwC India's Terms of Reference is likely to be broadened by seeking its suggestions on reducing carbon emissions,' said a senior executive representing Tower and Infrastructure Providers Association (Taipa), the industry body for telecom tower companies.

PwC India may also be asked to assess India's green telecom policy's alignment with global standards on containing carbon emissions as specified by Geneva-based International Telecom Union. As per India's 'Go-Green' laws, mobile phone companies need to migrate 50% of all cell towers in rural areas and 20% in urban areas to hybrid power by 2015. Hybrid power has been defined as a mix of grid supplies and renewable energy based on solar, wind, biomass or fuel cells.

Source: The Economic Times (http://economictimes.indiatimes.com/news/news-by-industry/telecom/telcos-may-seek-pwc-help-meet-dots-green-target/articleshow/25095107.cms)

Recycling agriculture waste in Punjab

Punjab Chief Minister Parkash Singh Badal has constituted a committee to study the feasibility of utilizing recycled agriculture waste as alternative fuel. The committee is headed by K S Pannu, Secretary, Department of Agriculture. The committee is expected to find ways to implement the project in the state in collaboration with a private firm. The Chief Minister has asked the Secretary to study all aspects of the project so that its implementation can benefit farmers. He said that Punjab has abundant quantity of biomass, which could be optimally used for captive power generation. This would greatly benefit the farmers of the state and also supplement their income considerably.

Representatives of 'Riela' company, led by Karl Heinz Knoop, gave a presentation regarding the project to the Chief Minister and apprised him about the technology through which agriculture waste would be utilized for producing fuel which would act as an alternative to coal.

The Chief Minister was told that the company would purchase agriculture waste like straw from farmers.

Source: Business Standard (http://www.business-standard.com/article/pti-stories/punjab-panel-to-look-into-plan-to-recycle-agriculture-waste-113101701028_1.html)

Bio-Energy Summit 2013: Biomass strong potential for rural economic growth

Alok Srivastava, Joint Secretary, Ministry of New and Renewable Energy (MNRE), Government of India, while addressing the inaugural session at the Bio-Energy Summit 2013, New Delhi, said that bio-energy, especially biomass, has a strong potential in rural areas and that growth in the sector will lead to economic growth in rural areas. The event was organized by the Confederation of Indian Industry (CII).

Srivastava said, 'It is also a key off-grid solution and solar and biomass hybrids can be deployed. There is a need for policy push for biomass as has been done for solar and wind and support mechanisms like incentives/subsidies/tax holidays need to be put in place. Companies need to be present across the feedstock value chain and mechanization in collection and storage is critical. To distribute improved cook stoves, MNRE is rolling out the National Biomass Cook Stoves Programme in the 12th Plan whereby 3.5 million cook stoves will be distributed.'

Dr S C Sharma, OSD (Petroleum), Planning Commission, said, 'The conversion of bioenergy to liquid and gaseous fuels has a strong potential to reduce the impact on the current account deficit and replacement of five percent of the liquid fuels by biofuels would result in savings of $5–6 billion annually.'

Pramod Chaudhari, Chairman, CII National Committee on Bio-Energy and Executive Chairman, Praj Industries Ltd, said, 'Bio-based economy will not only help in reducing dependency on the rising fuel imports but biomass-based power production also has the potential to provide distributed power at the rural level. However, bioenergy programmes have not been at par with traditional energy sources and there are challenges related to commercial sustainability, feedstock availability, availability of appropriate technologies, appropriate financing and market linkages.' He emphasized on the need for a strong policy push.

K Krishan, Co-Chairman, CII National Committee on Bio-Energy and Chairman, MPPL Renewable Energy Pvt. Ltd, said, 'Biofuels and biomethane can be used to mitigate petrol imports and the current

account deficit given that the country incurred an oil import bill of 15 billion dollars recently. Bioenergy can also address the issue of energy access and is a clean source of energy.'

Source: News Track India (http://www.newstrackindia.com/newsdetails/2013/09/11/267-Growth-in-bio-energy-sector-will-lead-to-economic-growth-in-rural-areas-Alok-Srivastava.html)

India prepares for waste-to-energy

The country is all set to convert its trash to energy as it gears up to strengthen its waste-to-energy sector and boost recycling and reuse. A host of European and American consultants have suggested economically viable and eco-friendly solutions in an attempt to aid India's transition into green technology.

Cappozzo Filippo, owner, EcoStar Recycling Technologies (Italian recycling solution provider), which is in use in seven Indian states, says that India is in an advantageous position in terms of procuring state-of-the-art environmental engineering technology.

In the case of municipal solid waste (MSW), Atul Narayan Vaidya, senior principal scientist with the solid and hazardous waste management unit of Nagpur's National Environmental Engineering Research Institute (NEERI), states that although indigenous technologies are there, most of them are of the old-school variety and cannot be applied to MSW, which is the primary waste in our country.

According to him, the foreign companies have been doing this for years and are superior. Going by a World Bank report, India generates 110,000 tonnes of MSW per day and the numbers are increasing. This means that MSW can be seen as a potent revenue source.

Cogen Systems, which represents the US-based Green Power Inc. (GPI) in India, has developed a technique for converting MSW into clean fossil-free fuel (a type of synthetic diesel) and operates not by selling technology but by building plants for investors or municipal waste processors.

The Indian government has recognized the waste-to-energy sector as a renewable technology and has allocated nearly Rs 200 crore ($44.5 million) to it. Though in the nascent stage, the sector is slowly picking up.

Source: Business Standard (http://www.business-standard.com/article/news-ians/india-gears-up-its-waste-to-energy-initiatives-113103000472_1.html)

Experts visit biomass-based plant site in Mizoram

A team of experts visited the proposed sites for construction of biomass-based power plants at Sihhmui and Lengte villages near Aizawl, Mizoram in October 2013. Harry Dhaul, Director General, Independent Power Producers Association of India (IPPAI) said that small biomass power plants using sawdust and forest residue was regarded as feasible in Mizoram, which has thick forest cover. Dhaul said that around three plants have been proposed with capacity of one megawatt each in a district.

The setting up of these biomass-based power plant sites in Mizoram would be a pioneering venture in the country.

Source: Business Standard (http://www.business-standard.com/article/pti-stories/expert-team-visits-construction-site-of-biomass-based-plant-113102500346_1.html)

INDIA TELECOM 2013: A platform for promoting new age technologies

India Telecom 2013, an international conference and exhibition, was organized jointly by the Department of Telecommunications (DoT), Government of India; the Federation of Indian Chambers of Commerce and Industry (FICCI); and all sector associations. Held during 5–7 December 2013 at Vigyan Bhavan, New Delhi, the event showcased the technologies and trends for the entire communications ecosystem.

The event was inaugurated by the Prime Minister of India, Dr Manmohan Singh. During his address, Dr Singh said, 'It is estimated that by 2020, India will be importing electronics products worth about 300 billion dollars, which will be more than the value of our imports of petroleum products. We need to act now to avoid a situation where we face difficulties in financing these huge imports. India should have manufacturing facilities which result in a balanced trade in electronics products and are a part of global supply chains.'

India Telecom 2013 focused on 'Internet of People to Internet of Things: The Future of Communication' as its agenda in an attempt to facilitate a close dialogue between the Government, industry and academia on how to achieve the full potential of 'Machine to Machine' (M2M) and new-age communication technologies in India.

The Telecom Equipment and Service Export Promotion Council (TEPC) organized the 5th Reverse Buyer Seller Meet (RBSM) on 6 December 2013 as a part of this event. Oriented towards increasing export of telecom equipment and services, the event saw over 40 buyers from 18 countries.

Source: Contributed by MNRE, Govt. of India <http://pib.nic.in/newsite/pmreleases.aspx?mincode=28>

India, Belgium agree to enhance cooperation in renewable energy

At a bilateral meeting between Dr Farooq Abdullah, Minister for New and Renewable Energy (MNRE), Government of India, and Her Royal Highness, Princess Astrid of Belgium on 27 November 2013, it was agreed that the two countries will work on a Memorandum of Understanding (MoU) for enhancing cooperation in renewable energy (RE). Princess Astrid, head of the Belgian Economic Mission to India, was accompanied by the Deputy Prime Minister and the Minister for Foreign Affairs, Foreign Trade and European Affairs, Didier Reynders, and Kris Peeters, President of the Region of Flanders and Flemish Minister for Economic, Foreign Policy. They were accompanied by a large business delegation.

Dr Abdullah briefed the visiting delegation on the energy situation in India and the rapid growth of the RE sector in India. He spoke of India's plans to add over 30 GW of RE to its energy mix in the next 5 years. He also highlighted India's conducive and investor-friendly policy framework for promoting RE. Dr Abdullah suggested that India and Belgium had great potential for enhancing cooperation in promoting

RE and offered to provide all possible assistance for the purpose.

The Belgian delegation recognized India's considerable achievements and strengths in RE and noted that India had made large strides in this field. The business delegation accompanying the official delegation also made brief presentations on their activities and reciprocated India's desire for enhanced energy cooperation between the two countries.

After detailed discussions, the two sides agreed to start work on an MoU between MNRE and the Government of Belgium in order to strengthen, promote, and develop RE cooperation between the two countries on the basis of equality and mutual benefit. Both countries also agreed to explore possibilities of coordination in RE through joint R&D programmes of mutual interest.

Source: Contributed by MNRE, Govt. of India <http://pib.nic.in/newsite/pmreleases.aspx?mincode=28>

India to help Cuba develop renewable energy resources

On 20 September 2013, while visiting Cuba along with a high-level delegation of experts, Dr Farooq Abdullah, Minister of New and Renewable Energy (MNRE), Government of India conveyed to the Vice President of the Republic of Cuba, Marino Murillo, that India will help Cuba develop its renewable energy (RE) resources. Dr Abdullah also held detailed discussions with the Cuban Minister of Energy and Mines, Alfredo Lopez Valdes.

Dr Abdullah briefed his counterpart on the energy situation in India and India's ambitious plans in RE. He informed Cuba that India currently has over 29 GW of grid-connected installed capacity using renewable sources of energy and that it has plans to add over 30 GW more capacity by 2017.

Both Mr Murillo and Mr Valdez sought India's support and expertise in helping Cuba achieve its objective of diversifying its energy mix by exploiting RE resources, especially in wind and bagasse-based cogeneration projects. Dr Abdullah offered India's support and expertise in setting up RE projects as well as in capacity building and project preparation. He also urged the Cuban side to take advantage of the Lines of Credit offered by India in setting up RE projects.

Source: Contributed by MNRE, Govt. of India <http://pib.nic.in/newsite/pmreleases.aspx?mincode=28>

India–Chile to enhance cooperation in renewable energy

At a meeting held on 13 September 2013 between the Chilean Energy Minister, Jorge Bunster, and Dr Farooq Abdullah, Minister for New and Renewable Energy (MNRE), Government of India, at Santiago, India and Chile agreed to enhance their cooperation in the field of renewable energy (RE).

The Chilean Energy Minister informed Dr Abdullah that Chile is almost entirely dependent on imports for its energy needs and is therefore keen to diversify its energy mix by introducing a large component of renewables. The country has considerable potential in wind, hydro, solar, and geothermal energy. He expressed his government's desire to set up a 50 MW solar thermal generating capacity in the north of the country.

Dr Abdullah offered India's support and expertise to Chile in setting up RE projects and also offered the services of Indian experts and institutions like Centre for Wind Energy, Solar Energy Centre, and Alternate Hydro Energy Centre for resource assessment of RE sources, training of personnel and also preparation of projects for exploiting these technologies in Chile. He also offered training slots in India to Chilean scientists, engineers, and technicians through the Indian Technical and Economic Cooperation Programme. The Indian Minister expressed his country's desire for a serious and meaningful cooperation with the entire Latin American region, especially Chile, in RE and offered all possible assistance.

Source: Contributed by MNRE, Govt. of India <http://pib.nic.in/newsite/pmreleases.aspx?mincode=28>

EIB and IREDA sign Euro 200 million agreement

Ms Magdalena Alvarez Arza, Vice President, European Investment Bank (EIB), and Mr Debashish Majumdar, CMD, Indian Renewable Energy Development Agency Ltd. (IREDA) signed a Finance Agreement in the presence of the Union Minister for New and Renewable Energy, Dr Farooq Abdullah in New Delhi on 21 February 2014. According to this Agreement, EIB has sanctioned a Line of Credit (LoC) of Euro 200 million to IREDA, to be utilized for financing Renewable Energy and Energy Efficiency projects in India. The total loan period considered in this Agreement spans across 20 years.

Source: Press Information Bureau, Government of India <http://pibmumbai.gov.in/scripts/detail.asp?releaseId=E2014PR602>

India and the Netherlands agree to enhance cooperation in renewable energy

Dr Farooq Abdullah, the Minister of New and Renewable Energy, presided over a ceremony on 11 February 2014 where the Dutch Ambassador Alphonsus Stoelinga and the Secretary of the Ministry of New and Renewable Energy, Dr Satish Balram Agnihotri signed a Memorandum of Understanding (MoU). Under this MoU, an Indo–Dutch Joint Working Group will be set up and the exchange of technical and institutional knowledge on clean energy will be facilitated.

Welcoming this decision, Dr Abdullah hoped that the signing of the MoU would be the beginning of a symbiotic and mutually beneficial wave of cooperation in the clean energy sector between India and the Netherlands.

Source: Press Information Bureau, Government of India <http://pib.nic.in/newsite/PrintRelease.aspx?relid=103419>

Sustainable low-carbon fuels from lignocellulosic biomass

Researchers at Finland's VTT Technical Research Centre have concluded that sustainable low-carbon fuels can be produced from lignocellulosic biomass. Such fuels can be produced at estimated gasoline-equivalent production cost of 0.5–0.7 €/litre (approx. 1.90–2.65 US$/gallon US), with first-law process efficiency in the range of 49.6%–66.7% depending on the end-product and process conditions.

Scientists Ilkka Hannula and Esa Kurkela evaluated 20 individual biomass-to-liquids (BTL) plant designs, based on their technical and economic performance. The research also reveals best efficiency and lowest production costs in the production of biomethanol. According to

contd. on page 13

Advanced Biomass Gasification for Power Generation

New indirect gasification technology for lower forms of biomass

Biomass to power, with a potential in excess of 23 GW per annum, will grow as new technologies enable the use of lower forms of biomass. While combustion-based Steam Rankine Cycle (SRC) is a well-established route for biomass to power, the gasification-based power generation (based on engine-driven power generation system) is the most attractive one. The advance biomass gasification proposed in this article is being demonstrated for the first time in the country. A 1-MW technology demonstration plant is coming up as a part of a joint development between Thermax Limited (TL) and Ruchi Soya Industries Limited (RSIL) at Washim, Maharashtra. When successfully commissioned, this will pave the way for a new technology for biomass gasification in India. This project is supported by the Ministry of New and Renewable Energy (MNRE) and the United Nations Development Programme–Global Environment Facility (UNDP/GEF) as Research and Development Demonstration Plant.

INTRODUCTION

Gasification-based power generation in the scales of 250 kW to 2 MW can deliver a plant efficiency at 27%–30%. This is at least 30% higher than the efficiency achieved through combustion-based power generation technology in this range. Gasification-based plants are less dependent on water and offer greater flexibility in their operation. Moreover, these power plants offer an option to generate Synthesis Natural Gas (SNG) and hydrogen which by themselves are fuels for applications in cooking and in the transport sector.

As India faces enormous challenges in the oil and gas sector, this technology provides an easy and elegant solution to generate gas from biomass. Additionally, gasification-based biomass-to-power plants through gas engines provide an opportunity for extraction of additional thermal energy from flue gas as well as from engine jacket cooling. This can be usefully converted into power or using an Organic Rankine Cycle (ORC) and/or into chilled water using vapour absorption cooling thereby further boosting the overall efficiency of conversion.

While there is every reason to shift the 'biomass to power' from the SRC route to the gasification route, the potential of biomass to gasification is not fully realized due to issues related to (a) efficiency at the gasification stage, (b) reliability at the engine stage, and (c) flexibility of biomass gasification plants in using a variety of biomass options.

A glance at some of the performance parameters of the existing plants indicates that there have been pressing issues in biomass to power using the gasification route. One is due to the lower 'Availability Factor' (AF) of biomass gasification plants (less than 60%) and another is the rigid 'Use Factor' (UF) of biomass in the gasification process (use of diverse biomass available as agricultural residue or forest residue in different landscapes of India needs to be pre-conditioned for making them compatible for use in gasification system). Some of the performance issues with the current generation technology are given in Table 1.

The advanced gasification-based power generation executed under MNRE–UNDP/GEF project obviates most of the performance-related issues. The basic design of the advance gasification system makes it possible to address the issues related to AF and UF and perhaps qualifies as path-breaking development in the field of biomass to power.

Uniqueness of advanced gasification technology

The advanced gasification technology for the 1 MW biomass-to-power plant is based on soya residue as the major feed. Table 2 gives the typical characteristics of the soya residue. Figure 1 shows the general flow diagram of the plant.

The heart of the technology is based on indirect gasification system. The process of indirect gasification segregates the process of combustion from pyrolysis, which is the main conversion step for biomass to gas. This is established by using a solid heat transfer medium, which acts as a barrier between these two zones. The heat transfer is carried

TABLE 1 BERI gasifier performance: actual v/s desired

Performance measure	Actual	Desired	Percentage of desired	Issues
Specific fuel consumption (kg/kWh)	2.0	1.3	154	Efficiency
Annual hours of grid-synchronized operation	780 (there are several reasons for this low value. Gasifier reliability is probably not involved here.)	7200	11	Reliability
Annual net generation (kWh)	1,56,000 (this is related to the comment above.	23,40,000	7	Availability
Net specific cost of manpower (Rs/kWh)	2.85	0.65	437	O&M
Net specific maintenance cost (Rs/kWh)	0.8	0.62	130	O&M

TABLE 2 Typical characteristics of soya residue

Test parameters	Results
Mineral water	2.57%
Carbon	43.17%
Hydrogen	5.76%
Nitrogen	0.81%
Sulphur	0.10%
Oxygen (Remainder)	47.59%
Sodium	1.99%
Potassium	19.86%
Chlorides	0.09%
Method of testing: As per ASTM D 3682, D 1102 & E 776 *Remarks:* Sample ashed at 550 °C	

out using solid circulation between the combustion zone and the pyrolysis zone. The design of the fluidized-bed system allows use of different forms of biomass. The two sections of gasification allow use of two types of biomass (tough biomass and easy-to-handle biomass) and provide basic flexibility.

The design depicts easy-to-handle biomass like wood chips and rice husk and also very difficult-to-handle biomass options such as straw and briquettes. This diversity is an important feature, which enables multiple fuels either blended or used as per the cyclical nature of the availability of biomass throughout the year and this is very critical for India.

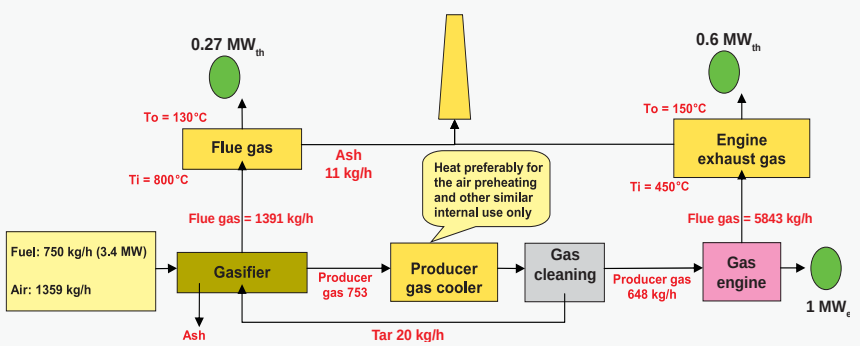
There are a number of other important features in this technology such as use of 'olivine sand as a bed material', which, while acting as the heat transport medium, helps in reducing heavy tars by cracking them catalytically. The design envisages recycling of the tars using an innovative 'water free' tar removal system and putting them back into the combustion zone of the reactor chamber. This results in high carbon conversion efficiency in excess of 98%.

The indirect nature of gasification has an important bearing on producing higher and consistent calorific value of the gas. The calorific value of the gas is in the range of 3200/kcal/Nm^3 and is almost three times that of conventional down-draft fixed bed gasifiers. Hence the gas essentially is 'synthesis gas ($CO+H_2$)' in nature and such high calorific value is an advantage in terms of handling smaller quantity of gas making the clean-up system compact and cost-effective.

Further, the high calorific value gas offers itself an enabling and smooth and stable engine operation. This is a big plus for this technology as the major reason for poor reliability of the gasification-based biomass-to-power plant is due to the inadequate clean-up system (Table 1). This inadequate clean-up system leads to poor performance of gas engines resulting in lower reliability. One more advantage of generating high calorific value synthesis gas from this indirect gasification is its ease of converting the synthesis gas into methane.

Compressed biogas opens up several other options of using this advanced gasification technology for applications in transport section. Box 1 gives some background developments, which have gone in advanced indirect gasification technology.

Figure 1: General schematic of the system



Description of the process

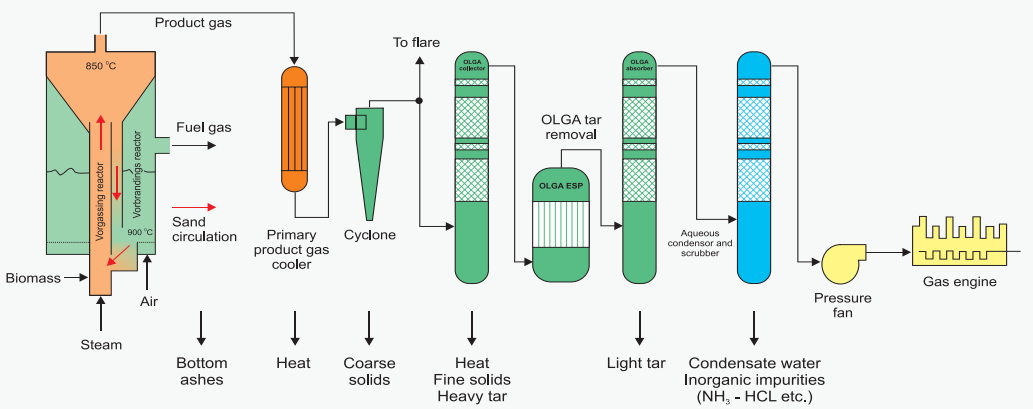
Figure 2 shows various elements of the advanced gasification and gas clean-up technology. The basic elements of the technology have the following multiple technology elements.

- Milena Gasifier developed by ECN – Holland, Primary Product Gas[1]
- Cooler designed and developed by Thermax[2]
- Coarse – Solid Removal System designed and developed by Thermax Enviro[3]
- Heavy Tar Removal System and Light Tar Removal System (together called as OLGA) developed by ECN – Holland, Final Gas Purification System for removal of ammonia[4]
- H_2S, HCL, etc. designed and developed by Thermax and rest of the power generation system integrated by TL and RSIL.[5]

The plant is designed to provide 95% conversion efficiency with fuel

consumption less than 1 kg/kWh at an availability factor of 85% with a calorific value of 3223 kcal/kg. The plant is also designed to extract additional thermal energy of 1 MW at high grade 150 °C and 0.6 MW at low grade 80 °C. The indirect gasification system provides energy extraction at a number of different locations such as flue gas, fuel gas, engine exhaust, and also jacket heat (Figure 1). The overall efficiency conversion is 74% (2.7 MW based on the input feed energy of 3.4 MW). When successfully commissioned, this plant may become the most efficient biomass to power in this range.

Figure 2: Technological elements of the gasification technology



Technological challenges

The basic know-how for the gasification and clean-up is obtained from ECN – Holland. The demonstration in India is being carried out by Thermax and RSIL under the R&D programme of MNRE–UNDP/GEF. The entire development of the technology, design and engineering is being carried out indigenously. The indirect gasification developed by ECN and scaled-up for the present purpose is a complex reactor vessel with several internal components designed to provide adequate separation between the combustion and the gasification zones.

There are several unique features in the design and engineering of the gasification reactor. Design and engineering of the system are being jointly developed by TL, ECN, and Dahlman (Royal Dahlman is a company which has licensed the technical know-how from ECN), which has led to an optimum design of the gasifier. Mechanical design to meet the aggressive process conditions of the gas system is entirely carried out by TL and posed its own challenges for taking care of stresses due to pressure and thermal in the overall design. The reactor vessel also uses high alloy steels (INCONEL) in some of its internal components to take care of temperature and creep.

BOX 1: Initial Developments on Indirect Gasification Technology

Vienna University of Technology, Austria, under the leadership of Prof. Hermann Hofbauer, took initiative in developing a high efficiency gasifier. The concept was based on a dual-bed or indirect gasification. In this concept, the gasification and combustion zones are separated out to generate the producer gas with high calorific value (up to 3500 kcal/Nm^3) and very low nitrogen content.

Many pilot-cum-demonstration plants were set up by the University, the first one was 100 kW_{th} input and was run between 1995 and 1999. The second one with improved design of the same capacity was started in 1999. Currently, there are two commercial-scale plants set up, namely CHP plant at Gussings of 8 MW_{th} and Oberwart plant of 8.6 MW_{th}.

Project details

A 1-MW Technology Demonstration Project is under execution at the RSIL site, Washim, in Maharashtra. The project is supported by MNRE–UNDP/GEF. Thermax is developing the technology and also carrying out the Engineering, Procurement, and Construction (EPC) of the project. The project is essentially collaborative in nature between TL and RSIL. The project execution is monitored by MNRE–UNDP/GEF under its Expert Committee. The project is likely to be commissioned between March and May 2014.

Future of biomass to power

India has a total potential of over 23 GW from biomass to power. And it is slated to grow forming a good percentage in the energy mix for the country. As a renewable energy resource, it can play a dominant role if right technology and manufacturing strategy are put in place. In India, where biomass as residue from agriculture, forestry, and energy plantations is available in diverse and dispersed form, setting up of biomass-to-power plants at 1–2 MW scale makes immense sense. These projects can be grid-connected or even off-grid type of projects. With the type of advanced gasification technology described in this article, when successfully commissioned, in next six months it can become a differentiator in the biomass-to-power technology. Table 3 proposes a few critical parameters of the MNRE–UNDP/GEF project.

To ensure that the country gets maximum benefit from the advanced gasification technologies, there are several parallel activities that need to be put in place. Development of gasification as described above is one such activity. However, the country needs simultaneous developments in

[1] The Energy Research Centre of The Netherlands (ECN) is the leading institute for energy research in The Netherlands.

[2] Thermax Ltd is a leading technology company with global footprints in energy and environment and is developing advance gasification technology in a collaborative manner. Its EPC wing is setting up the demonstration project.

[3] The Environmental Division of Thermax is building the coarse and wet electrostatic precipitation technology.

[4] The Research Technology and Innovation Center (RTIC) in Thermax is developing ammonia and H_2S removal system.

[5] Ruchi Soya is a leading agro-based industry in India.

TABLE 3 A few critical parameters of the MNRE–UNDP/GEF project

Criterion	Existing plants	Proposed plant
Conversion efficiency	80%–85%	>95%
Fuel consumption	1.3 kg/kWh	0.9 kg/kWh
Gas calorific value	1200 kcal/kg	3223 kcal/kg
Availability	Less than 60%	>85%
Bleed treatment	Difficult to treat	Simple and much cleaner
Overall plant size	Relatively bulky	Compact

feed processing and handling systems, gas clean-up systems, advanced engine developments, waste heat recovery to power or cooling technologies and system integration technologies. All these developments should be aimed to meet the efficiency, reliability, and cost criteria so that the power plants in sizes from a few kilowatts to a few megawatts can become economically viable options. Manufacturing facilities matching the needs of the technological elements described above will also need to be understood and action initiated. Initial stage of deployment will demand Viability Gap Funding (VGF) to be pumped into the technology and developmental needs to be taken up on a 'mission mode' to make the technology take firm root in Indian soil.

ECN's OLGA system for tar removal

Indirect gasification of biomass produces tars, which can range from 10–40 g/Nm^3. Such high molecular weight hydrocarbons create fouling in the downstream producer gas cooler, engine, etc. This also results in loss of energy, which could otherwise be used, if recovered. ECN Netherlands have done extensive research work on producer gas clean-up and finally developed OLGA technology wherein tars are recovered by scrubbing with oil and fed back to the gasifier. This improves the overall efficiency of the system by 5%–10%.

Another advantage of the technology is that it does not generate significant waste water and the same is easy to treat. ECN has developed a pilot-scale plant of 30 kW_{th} capacity, which is in operation since 2003. The unit was later scaled up to 800 kW_{th} (2008) and OLGA system was tested for the same. ■

BRIEF PROFILE Dr R R Sonde

Dr R R Sonde is the Executive Vice President (Innovation and Technology), Thermax Ltd, Pune. He has vast experience in the field of energy and environment, and has been working on the development of different technologies, including projects, based on renewable energy. Apart from the developments in newer clean coal technologies, heat pumping technologies, advance combustion systems, water and waste water technologies, his achievements in the field of renewable energy include development of hybridized solar thermal power plant, solar thermal air-conditioning systems, energy generation from municipal solid waste, Organic Rankine Cycle for low temperature heat recovery, harnessing geothermal energy in India, etc.

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estimates, the risks related to the commercialization of the synthesis technology are lower compared to other options.

However, these ground-breaking production plants would require significant public venture capital investment, for which initiatives are being planned at the Finnish and EU levels.

Source: Green Car Congress (http://www.greencarcongress.com/2013/07/vtt-20130704.html?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+greencarcongress%2FTrBK+%28Green+Car+Congress%29)

European Biomass Conference and Exhibition, June 2013

The European Biomass Conference and Exhibition (BC&E), for more than 30 years, has been combining a well-renowned international scientific conference with an industry exhibition. This event is held at different venues throughout Europe and ranks as one of the world's top leading events in the biomass sector. The event is supported by European and international organizations like the European Commission; United Nations Educational, Scientific and Cultural Organization (UNESCO); Natural Sciences Sector; the World Council for Renewable Energy (WCRE); the European Biomass Industry Association (EUBIA); the Sugarcane Industry Association, Brazil; Biomass Energy Committee (BEC), China; etc. The Technical Programme of the event is coordinated by the European Commission, Joint Research Centre.

The European BC&E 2013 was held at Copenhagen, Denmark, in June 2013. It was organized to review progress, to present and discuss the biomass industry, technology and science for the future. The online edition (http://www.etaflorence.it/proceedings) of the proceedings of this event contains a selection of over 360 papers from the Conference and over 470 other contributions.

These proceedings make an essential reading for all those in the biomass industry—policy makers, planners, researchers, etc.

Source: European biomass conference and exhibition (http://www.etaflorence.it/mailing/single_news/proceedings_2013/Proceedings_promotion.html)

Performance of Cummins Producer Gas Engines

Power generation from biomass is gaining support through Government-backed initiatives and user preference over conventional energy resources whose availability is constrained. Cummins, as a market leader, acknowledges this and has undertaken several R&D activities related to product development. Cummins producer gas engines are highly efficient and also cost-effective, and are backed by the highly dependable Cummins service and support teams. These engines, along with reliable gasifiers and sustainable supply chain, could be the answer to rural electrification in India and other developing countries.

INTRODUCTION

The renewable energy (RE) sector has been in the limelight due to rapid advancements in technology, market development, and the policy environment. The renewable policy initiatives were first introduced in 1982 to support R&D for RE and these initiatives have matured over time to support the transition of RE from being just another form of energy to it having a significant share in the energy future of the nation.

Power generation technologies can be based on several RE resources such as biomass, hydro, solar, and wind. Compared to other RE sources, biomass-related energy production is a technology, which can be made available 24x7 and across the world based on the availability of biomass. Conversion of biomass to power can be very efficient. It is an inclusive technology and helps in the development of rural economy reducing the need for fossil fuels. Moreover, sustainable biomass utilization does not add carbon dioxide to the atmosphere; hence it is environment-friendly. Also, the technology ensures voltage and frequency stability, which is a major concern in rural areas. Biomass-related technologies also have tri-generation capabilities for generation of power, heat, and refrigeration.

Biomass gasification

Biomass-based thermo-chemical technologies can be classified broadly into combustion and gasification and pyrolysis. Power generation in the megawatt range, such as bagasse cogeneration and biomass power, has traditionally been dependent on combustion in India. However, this technology is not suitable at the kilowatt level. Biomass gasification has shown good promise for small power applications.

The biomass gasification process involves ignition of fuel with limited amount of oxygen. Gasification releases all volatile matter present in the fuel into gaseous and liquid compounds, whilst non-volatile matter gets converted into a more stable form, known as char. The complex gas liberated has a composition shown below:

Carbon monoxide (CO)	- 18% (±2%)
Hydrogen (H_2)	- 18% (±2%)
Methane (CH_4)	- 2%
Carbon dioxide (CO_2)	- 10%
Nitrogen (N_2)	- Remaining

Considering CO and H_2 are fuel gases, the calorific value of the above mixture is generally found to be 1000–1200 kcal/m^3.

During this process, this gas also collects particulate matter, tar, and oil particles so generated. Popularly known as 'Producer gas' or 'Synthesized gas (Syn Gas)', it can be used as gaseous fuel for thermal applications (heat) as well as for generating electric power through gas-based internal combustion (IC) engines.

The biomass fuel that is used for generating producer gas can be dry wastes such as wood, agro-residues, coconut shells, loose biomass in briquette form, coffee and other plantation wastes. Conversion of these wastes to energy helps in achieving a nearly carbon-neutral technology.

Biomass gasifier engine sets are available in a wide range of capacities. Two types of engines are used. Diesel engines are modified and can be run on a mixture of diesel and producer gas. These are called dual-fuel engines. Typically 60%–85% diesel is replaced with producer gas. This way of generating power is comparatively more expensive mainly due to the diesel cost. The second type of engine used is 100% producer gas engine. As the name suggests, this engine can operate on 100% producer gas. As there is no dependency on diesel, this method of power generation can be inherently more competitive.

Applications of biomass gasification technology

Biomass gasifier-based electricity generation has typically been used for three types of applications.

1. Village electrification in an off-grid mode

In recent years, biomass gasifiers have been used for the electrification of remote villages. In India, several of the smaller size (10–100 kW_e) biomass gasifier systems have been established under two Government of India schemes called Remote Village Electrification (RVE) and Village Energy Security Programme (VESP). Apart from the government programmes, several non-governmental organizations (NGOs) and corporates have also established such systems.

2. Grid-connected biomass gasifier-based power plants

These are relatively larger sized power plants with typical 1–2 MW capacities with gasifiers equipped with internal combustion engines having capacities of a few hundred kilowatts. The generated output power is wheeled/fed into the State Electricity Board (SEB) grid through a power purchase agreement (PPA).

3. Biomass gasifier for captive power generation

With capacities ranging from 100 kW to 2 MW_e, biomass gasifier plants set up by organizations are used as captive power generation units and power consumption is mainly to cater to in-house requirements.

Work on producer gas engines at Cummins

To support global environment needs and rural development programmes using non-conventional energy resources, Cummins India Ltd has invested in R&D to design and manufacture gas-based generating systems, which operate on biomass-based producer gas to meet energy requirements on continuous duty and combined heat and power (CHP) applications. These gas generating systems have been designed to achieve the desired performance, reliability, and durability.

The existing product range of Cummins starts from 25 kW_e and extends up to 240 kW_e. The company's R&D team is working on extending its product range. The Cummins producer gas gensets have been installed in the power plants of various capacities ranging from 25 kW_e to 1.5 MW_e using single and multiple gensets operating in synchronization.

Cummins has successfully partnered over 35 installations with different capacities. Cummins helps customers by offering complete end-to-end solutions starting from a thorough study of the load and the application to engineering, supply of generator sets, and commissioning of the project. Cummins has a 24x7 service network spread across the country to help its customers with service and support.

Demanding that everything we do leads to a cleaner, healthier, and safer environment is a part of the Cummins Mission Statement and the company through its fuel-efficient producer gas engines has helped several customers to achieve substantial savings on fuel and operating costs while working towards a cleaner environment.

In exceptional cases where the customer requires further support, Cummins along with its service provider has done hand-holding for up to six months to acquaint the customer and its operational staff with the generator sets along with close monitoring of the performance of the complete power plant.

A prestigious customer of Cummins located in Hosur, near Bengaluru, India, has been running a 240 kW biomass gasifier-based power plant. The plant has clocked approximately 21,000 hours in operation in about four years and continues to do so. Based on the success of this pilot venture of the customer, it has set up a 1.5–2.0 MW biomass gasifier in Mundargi, Karnataka, India. Locally available biomass in the form of bamboo is used here. Cummins has been involved in both the installations.

India's first 1 MW 100% producer gas-based grid-connected power generation at Arashi Hi-Tech Bio-Power Pvt. Ltd: a case study

An independent power producer – Arashi Hi-Tech Bio-Power (P) Ltd, located in Sultanpet, a village in Tamil Nadu, India – had set up a power plant designed to house two 750 kg/h gasifiers, which supplied gas to engines/gensets operating on dual-fuel mode. In the first phase, one slow speed 750 kg/h gasifier, marine diesel engine operating on dual-fuel mode was commissioned. However, the operations on dual fuel were not optimized and were quite troublesome, resulting in frequent breakdowns and higher fuel consumption. To add to it, the increasing cost of diesel made the operation of this power plant an un-economical proposition.

Arashi Hi-Tech Bio-Power (P) Ltd was on the look-out for a dependable supplier with proven and reliable gas engine technology as they wanted to run gas gensets for longer hours within the maintenance intervals for generating low-cost economical power. Initially the plant was designed considering the ample availability of coconut shells as feed stock. However, during the course of time, it was realized that this feedstock might not be available on continuous basis and, therefore, the plant was modified to be able to use other readily available woody biomass such as *Prosopis juliflora*. In addition, five gas gensets powered by Cummins engine model GTA-1710-G operating with two 750 kg/h gasifiers allowed enough flexibility to the customer for continuous operations of the power plant as well as to enable him to plan maintenance activities without the slightest interruption to the entire system.

To meet the above-stated requirements, Cummins Power Generation proposed to supply 1 MW capacity power plant comprising gas gensets, paralleling switch gears, and a remote cooling system. The waste exhaust heat from one of the gas engines was used in the vapour absorption machine (VAM) for chilling the producer gas. Installation of this 1 MW power plant opened further opportunities for the customer prompting him to install the other 750 kg/h gasifier (total installed capacity of two 750 kg/h gasifiers) and commission the 1 MW power plant, thereby availing all fiscal and financial benefits offered by the Ministry of New and Renewable Energy (MNRE).

This biomass, after undergoing the required processes, produces approximately 1.5–2.0 tonnes of charcoal per day, which when sold in the market by the customer fetches attractive prices. As activated charcoal generated from coconut shells as fuel has special demand considering its applications, this benefit further offsets the operating costs for the customer.

Considering the eco-friendly technology for generating power from non-conventional RE sources, such power plants are also recognized as low pollutant plants and are, therefore, considered for 'carbon credit' benefits or Renewable Energy Certificates (REC) as per the case applicable.

The producer gas-based power generation initiative offers innumerable opportunities in terms of new sources of economical power for rural industries and distributed power generation opportunities for IPPs and rural electrification. ■

BRIEF PROFILE

Sunil Shahi

Working for Cummins India as Business Head & Sr GM – Power Solutions & Power Electronics since January 2011. In this role, he is responsible for sustainable growth and profitability of gas business and power electronics products in India. He has diverse work experience of over 17 years in the areas of national and international sales, engineering, strategy, project execution, and business diversification. In his last assignment, he played a key role in establishing 'Quippo Energy,' a gas-based rental CHPC solution provider, from scratch to a fleet size of 60 MW. He was also instrumental in diversifying Quippo into a turnkey EPC business with gas turbines and large gas engines. Sunil holds an Electrical Engineering Degree from NIT Hamirpur and Diploma in Management from IMT Ghaziabad.

BIOINDUSTRY RESHAPING AMERICAN ENERGY

The Bioenergy Technologies Office (BETO) and Advanced Biofuels USA co-hosted the Office's sixth annual conference 'Biomass 2013: How the Advanced Bioindustry is Reshaping American Energy', at Washington, DC on 31 July–1 August 2013. The conference highlighted the successes of the bioenergy industry over the past 20 years and provided a forum for exchange of ideas, to showcase new technologies, and discuss opportunities for the future. It was attended by both the Secretary of Energy and the Secretary of Agriculture, USA, and also received support from both sides of the Congressional aisle as Senator Chuck Grassley (R-IA) and Congressman John Garamendi (D-CA) addressed the conference.

The conference brought together stakeholders involved throughout the bioenergy supply chain to promote new partnerships, acknowledge recent progress and achievements, and explore new opportunities and challenges. It also focused on initiatives in sustainability, new trends in bioenergy, new directions for BETO, and possible future funding opportunities.

Source: Bioenergy Technologies Office (Department of Energy, US)
(http://www1.eere.energy.gov/bioenergy/biomass_2013.html)

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BioPower India is a quarterly magazine covering technological, operational, financial and regulatory aspects of various biomass conversion technologies such as combustion, cogeneration, gasification and biomethanation. Biomass specific project perspectives, technology innovations, industry/market outlook, financial schemes, policy features, best practices and successful case studies, etc. are also included in the publication.

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STUDY ON DEDICATED ENERGY PLANTATION ON WASTELANDS

Abellon Clean Energy Limited/MNRE – UNDP/GEF

Biomass is considered as one of the promising sources for generation of power/energy using commercially available thermal and biological conversion technologies. It is renewable in nature, carbon-neutral and has the potential to provide large production employment in rural areas. The Ministry of New and Renewable Energy (MNRE) has a range of programmes for harnessing grid-interactive and off-grid power from various renewable sources including biomass.

The biomass-based power plants set up so far in the country are mainly based on surplus agro and forest residues. Availability and collection of such biomass is found to be one of the major barriers in sustained operation of biomass power generation plants at a desired plant load factor (PLF). The felt-need, therefore, is to link such power plants with dedicated energy plantations to mitigate the risk associated with their sustainability.

India has about 467 lakh hectares of wasteland, both in forest and non-forest areas. High-yielding plantation in such wastelands offers a good option for secured supply of biomass to decentralized biomass-based power plants and other rural energy demands on sustainable basis. Such varieties could provide enough resources for sustaining a megawatt-sized plant from just about 130 acres of land.

Wasteland data of five states

State	Total geographic area (TGA) (km^2)	Total wasteland area (km^2)	Percentage of TGA
Mizoram	21,081	6021.14	28.56
Odisha	151,707	16,648.27	10.09
West Bengal	88,752	1,994.41	2.25
Madhya Pradesh	308,252	40,042.98	12.99
Rajasthan	342,239	93,689.47	27.38

Source: *Wastelands Atlas of India 2011*, Department of Land Resources, Ministry of Rural Development, Government of India

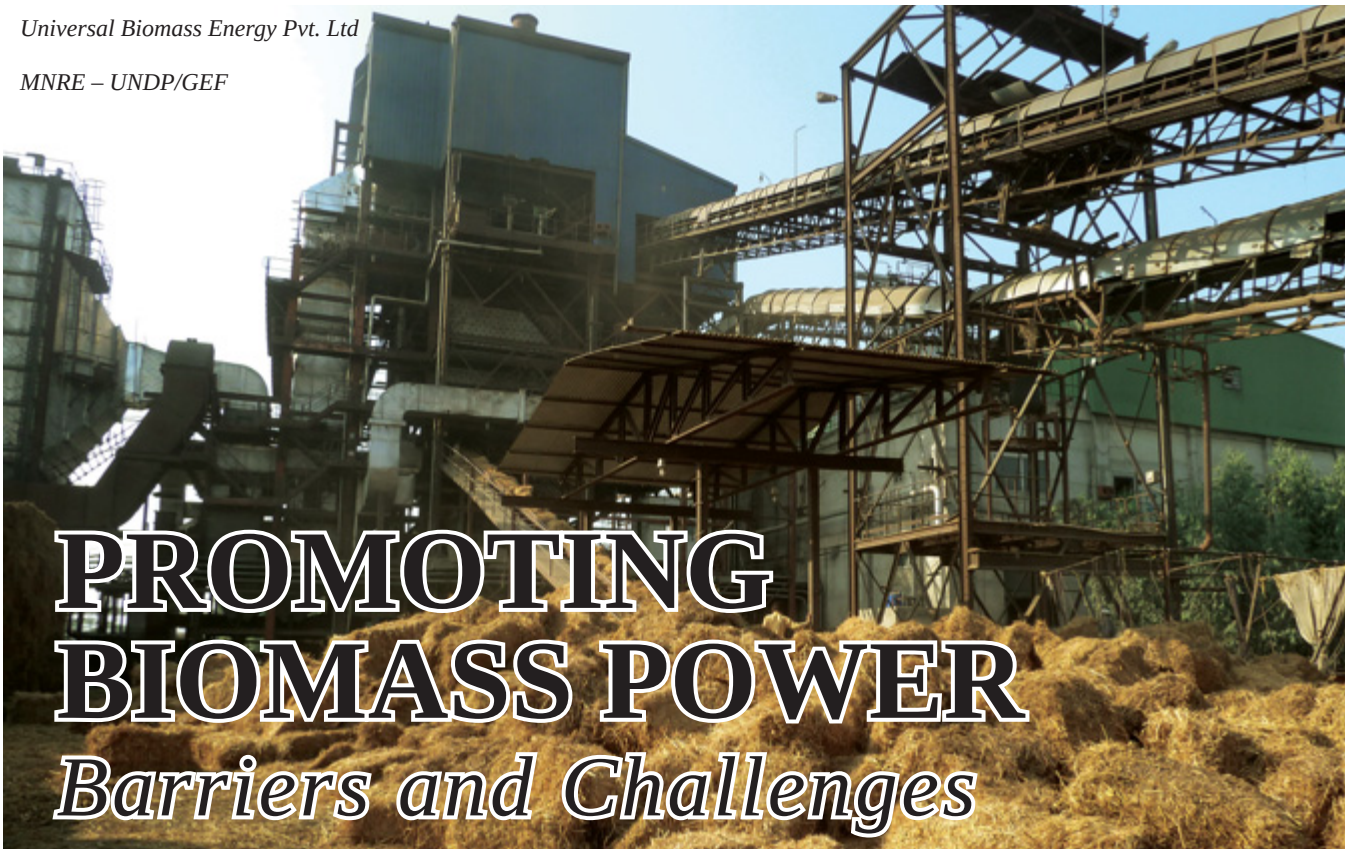
MNRE seeks to explore the feasibility of raising dedicated energy plantations in wastelands of fast growing, high-yielding plants/energy crops, under the MNRE-UNDP/GEF-assisted project 'Removal of Barriers to Biomass Power Generation in India.' The project is being implemented by MNRE and it aims to accelerate the adoption of environmentally sustainable biomass power technologies by removing the existing barriers in large-scale commercialization of biomass power. The study will focus on five states: Rajasthan, Madhya Pradesh, Odisha, West Bengal, and Mizoram.

The main objective of the study is to evaluate the availability and usage of degraded land/wasteland in the selected states for production of biomass feedstock for the biomass power generation projects. It will review the techno-commercial and social viability; and the existing policy and regulatory frameworks for energy plantation on wastelands in the states and at the central level. In addition, it is expected that the study would develop a perspective plan for at least two states from within the selected states for the accelerated utilization of wasteland for the production of biomass resources for power generation.

The study also envisages the formulation of minimum four collaborative project proposals in public–private partnership (PPP) mode, by considering the different agro-climatic conditions. This would include the selection of wasteland for dedicated energy plantation, selection of private project promoters, and formulating projects that provide a good business model for scaling-up of such initiatives. ■

Universal Biomass Energy Pvt. Ltd

MNRE – UNDP/GEF



PROMOTING BIOMASS POWER

Barriers and Challenges

The Ministry of New and Renewable Energy (MNRE) estimated the potential of biomass-based energy in the country about 15 years ago. Ever since, the Ministry has been promoting biomass-based power generation in the country through its biomass power/cogeneration programmes. During this period, biomass power projects aggregating to 3677 MW have been installed in the country for feeding power to the grid. However, the biomass power sector is currently facing certain challenges and barriers in large-scale deployment across the country. These barriers are related to delay in tariff revision by the state electricity regulatory commissions (SERCs) based on prevalent market prices of biomass, capex, etc., unavailability of biomass on a sustained basis due to competitive uses, and difficulty in obtaining soft finance for biomass power projects.

A Working Group has been constituted under the Chairmanship of Shri Alok Srivastava, Joint Secretary, MNRE to review such issues faced by biomass power plants and to suggest measures for accelerated development and deployment of biomass power in the country. The Working Group has met twice, on 21 June and 28 October 2013, to review the barriers that are being faced by the sector and identified the key issues that can be worked upon to resolve them. The Group will also suggest policy interventions to scale up the sector and revive existing biomass plants, while suggesting regular actions to re-validate the Biomass Atlas and initiating studies on fuel pricing.

The Indian Biomass Power Association (IBPA) in their representation to the Ministry highlighted the following:

i) Tariff remains the most critical issue for the biomass sector. The SERCs are reluctant to provide fuel adjustment for biomass power, for stated difficulties in establishing the biomass prices in the relevant period. As a result, many biomass power plants are suffering losses due to steep price rise of biomass during the past one year or so.

ii) Cash flow analysis presented by IBPA shows that biomass costs along with interest rate account for a high percentage of the total revenue generated by the plants (65%–85% for biomass and interest payment at 20%–40%) leaving near to nothing for other O&M costs, leave apart debt repayment.

iii) Banks and financial institutions charge a high interest rate on loans for capital equipment as well as working capital. In addition, because of the poor track record, bankers are extremely cautious about lending to this sector.

In the second meeting, the Working Group decided that a note on debt restructuring needs to be prepared jointly by MNRE and the IBPA, for submission to the Ministry of Finance, Government of India, for consideration. The note would also capture the need of interest subvention, including biomass power under Priority Sector Lending. As bankers would look forward to regulatory certainty while considering the restructuring, it would be important to take up the issues with SERCs of the major states.

In addition, MNRE may also approach the Central Electricity Regulatory Commission for finalizing the revised guidelines for biomass tariff. ■

CERC/SERC-determined tariff applicable for gasification and biogas-based

Rs/kWh

S No	State	Tariff order date	Year of commissioning	Biomass Power			Biomass cogen			Biomass gasification			Biomethanation power		
				Fixed cost	Variable cost	Net applicable tariff	Fixed cost	Variable cost	Net applicable tariff	Fixed cost	Variable cost	Net applicable tariff	Fixed cost	Variable cost	Net applicable tariff
STATE-WISE TARIFF DETERMINED BY CERC															
1	Andhra Pradesh	28-02-2013		2.21	3.34	5.55	2.95	2.45	5.40	2.46	3.45	5.91	3.30	3.62	6.92
2	Haryana			2.25	3.8	6.05	2.64	3.48	6.12	2.53	3.92	6.45			
3	Maharashtra			2.26	3.89	6.15	2.37	3.43	5.80	2.54	4.01	6.55			
4	Punjab			2.27	3.98	6.25	2.60	3.07	5.67	2.55	4.10	6.65			
5	Rajasthan			2.2	3.32	5.52				2.46	3.42	5.88			
6	Tamil Nadu			2.2	3.29	5.49	2.29	2.64	4.93	2.46	3.39	5.85			
7	Uttar Pradesh			2.21	3.4	5.61	2.98	2.73	5.71	2.47	3.50	5.97			
8	Others			2.23	3.57	5.80	2.59	2.97	5.56	2.49	3.68	6.17			
STATE-WISE TARIFF DETERMINED BY RESPECTIVE SERC															
1	Punjab	2013_06_25	2012-13	2.27	3.97	6.24	2.04	3.66	5.70	2.42	4.1	6.52	3.3	3.61	6.91
2	West Bengal	2013_03_22	Not applicable			5.41			3.34						6.24
3	Gujarat														
	Single tariff	Gasifier: 31-05-2010	1st 10 years			4.45			4.61			3.08			
		Biomass & Cogen: 31-05-2010	11th year onwards			4.8			4.96						
	Two part tariff	Biomass & Cogen: 31-05-2010	2012-13	1.59	2.41	4.00	1.66	2.43	4.09						
			2011-12	1.59	2.29	3.88	1.66	2.32	3.98						
			2010-11	1.59	2.18	3.77	1.66	2.1	3.76						
4	Andhra Pradesh	31-03-2009	2013-14	1.77	3.09	4.86	1.92	2.04	3.96						
			2012-13	1.77	2.94	4.71	1.92	1.94	3.86						
5	Bihar														
	Existing	30-11-2012	2011-12	1.87	2.42	4.29	2.29	2.32	4.61						
			2010-11	1.83	2.42	4.25	2.23	2.32	4.55						
			2009-10	Not applicable			2.02	2.32	4.34						
			2008-09				1.96	2.32	4.28						
			2007-08				1.9	2.32	4.22						
	New Plants	18-06-2013	2013-14	2.08	3.5	5.58	2.23	2.91	5.14						
6	Rajasthan	21-12-2012	Air cooled	2.47	3.05	5.52									
			Water cooled	2.23	2.85	5.08									
7	Haryana	03-09-2012	2012-13	Air cooled		5.88	Air cooled		3.83						
				Water cooled		5.59	Water cooled		3.83						
8	Madhya Pradesh														

biomass power plants (combustion, cogeneration, system) in various states of India

	Old Plants	"Biomass: 01-06-2012 Cogen: 03-09-2008	2012-13	1.91	2.45	4.36			2.8
			2011-12	1.87	2.45	4.32			2.82
			2010-11	1.83	2.45	4.28			2.83
			2009-10	1.79	2.45	4.24			2.86
			2008-09	1.75	2.45	4.20			2.88
			2007-08	1.72	2.45	4.17			
	New Plants	"Biomass: 2013_05_03 Cogen: 2013_03_31"	2013-14			5.64			
			2012-13			5.32			"6.28 (Pre-tax)"
9	Maharashtra (Both Existing and New Plants)	2013_03_22	2013-14	2.17	3.7	5.87	2.38	3.43	5.81
			Before 13-14	1.70	4.01	5.71	2.26	3.43	5.69
10	Odisha		Not applicable			4.09			4.4
11	Tamil Nadu								
	Existing plants	Biomass: 2009_04_27	2012-13	1.671	3.036	4.71	2.346	1.86	4.21
			2011-12	1.759	3.036	4.80	2.41	1.86	4.27
			2010-11	1.851	3.036	4.89	2.476	1.86	4.34
		Cogen: 2009_05_06	2009-10	1.833	3.036	4.87	2.543	1.86	4.40
			2008-09				2.52	1.86	4.38
	New Plants	Biomass: 2012_07_31	2012-13	1.658	3.036	4.69	2.11	1.86	3.97
		Cogen: 2011_11_21	2013-14	1.658	3.118	4.78			
12	Uttar Pradesh		Not Applicable						
13	Chhattisgarh	Fixed: 2011_12_28 Variable: 2013_07_02"	Not Applicable	1.78	3.57	5.35			
14	Jharkhand	2012_11_22	Not Applicable	Air cooled		5.531			
			Not Applicable	Water cooled		5.302			
15	Karnataka	2013_05_22	Not Applicable			5.3			
	1st Year	Co Gen: 2009_12_11	Old cogen projects						3.59
	2nd Year								3.63
	3rd Year								3.67
	4th Year								3.72
	5th Year								3.77
	6th Year								3.83
	7th Year								3.9
	8th Year								3.97
	9th Year								4.05
	10th Year								4.14

Study on Performance/ Viability of Biomass-based Power Plants

The Central Electricity Regulatory Commission (CERC) Regulations 2012, or the Renewable Energy (RE) Tariff Regulations 2012, provide for the terms and conditions and the procedures for determination of tariff for various RE technologies like biomass-based Rankine cycle power plants. In accordance with the Regulation 7 of the RE Tariff Regulations 2012, the Commission issued an Order that defines set norms for parameters like station heat rate (SHR), gross calorific value (GCV), auxiliary power consumption, O&M expenses, and capital cost, cost of biomass fuel, and plant load factor (PLF) and for determining generic levelized generation tariff of RE-based generation units.

Based on the recommendations of project developers, industry associations representing the biomass sector, and the Ministry of New and Renewable Energy (MNRE), Government of India, the CERC constituted a committee to visit existing plants and conduct a detailed study on the performance/viability of such plants operating in the country. This committee was constituted by the CERC vide OM dated 11 October 2012 and the facilities visited for the review include:

1. Biomass Power Plant at Rangpur, Kota District, Rajasthan, operated by Surya Chambal Power Ltd.
2. Biomass Power Plant at Bhaguara, Patiala District, Punjab, operated by Punjab Biomass Pvt. Ltd.
3. Biomass Power Plant at Pebair, Andhra Pradesh, operated by Surya Teja Power Project Ltd.
4. Biomass Power Plant at Ahmedabad, Gujarat, operated by Abellon Clean Energy Ltd.

The Committee has come up with a report based on its studies as well as on the information presented by Indian Biomass Association (IBPA) to the Committee. This report presents normative recommendations of the Committee.

Station heat rate (SHR)

In the RE Tariff Regulations 2012, the CERC specified SHR of 4000 kcal/kWh based on the Report of the Central Electricity Authority (CEA) Committee, field study by the National Productivity Council and reconditions by MNRE. SHR is an important factor for assessing the efficiency of a biomass-based power station; where efficiency is inversely proportional to SHR. If SHR reduces, efficiency increases along with fuel-saving.

Design SHR has also been evaluated by the IBPA based on design data of turbine heat rate and boiler efficiency submitted by suppliers and the average SHR has been derived at 4317 kcal/kWh.

On the basis of data supplied by IBPA, field visits, and discussions held during the visits, the Committee noted that the SHR of operating biomass plants needs to be enhanced. It recommended that SHR of 4100 kcal/kWh be considered for the determination of tariff.

Auxiliary power consumption

The RE Tariff Regulations 2012 specifies norms for auxiliary consumption for Rankine cycle-based plants with water-cooled condensers at 10% of gross generation of electricity.

The IBPA presented that currently most biomass power plants are being installed with air-cooled condensers, and certain other features to comply with the norms of Pollutions Control Board, which consumes more power. The IBPA also suggested that the auxiliary power consumption be considered at 12% for all biomass-based power plants with air-cooled condensers with additional equipment for processing fuel, etc.; for fuel preparation and feeding by way of running wood chippers and wood shredder, with unprocessed fuels.

After due analysis of the data collected during site visits, the Committee recommended that the auxiliary power consumption for air-cooled plants can be fixed at 12%.

Gross calorific value (GCV)

While specifying the GCV norm in the RE Tariff Regulations 2012, the CERC considered the GCV of biomass at 3250 kcal/kg; and after taking into account the use of 15% coal (average coal GCV at 3600 kcal/kg and 85% uses of biomass fuel of 3150 kcal/kg), the weighted average GCV was considered at 3300 kcal/kg.

Some stakeholders suggested that the studies that were referred to while specifying GCV did not take into account the

degradation of seasonal fuels in the non-season period and conditions during storage that leads to lower GCV.

Based on interactions and reference of records submitted by the biomass power plants, the Committee suggested that the normative GCV value for biomass plants for determination of generic tariff may be kept as 3100 kcal/kg for mustard husk, rice husk, and other kinds of biomass.

Operation and maintenance (O&M) expenses

The RE Tariff Regulations 2012 specifies O&M expenses of Rs 24 lakh/MW; in contrast, the data gathered from operational biomass power plants reveals that the O&M expenses are in the range of Rs 35 lakh/MW to Rs 72 lakh/MW. Considering the fact that biomass requires skilled manpower to operate and most plants have a locational disadvantage, higher salaries and wages for skilled and unskilled human resources need to be paid by the plant operator. In addition, fuel processing and feeding adds to the O&M expense. Hence the Committee suggested that there is a case for increasing the O&M to Rs 40 lakh/MW, with an annual escalation 5.72% per annum defined in the RE Tariff Regulations 2012 may be considered for tariff determination and the same could be extended prospectively to all the RE projects.

Capital cost

The RE Tariff Regulations 2012 specifies capital cost of Rs 455 lakh/MW, excluding evacuation and water-cooled condensers, for the FY 2012/13. The total capital cost includes the cost of biomass processing equipment, power plant and machinery required in the plant, and the cost of interest during construction.

Considering the data submitted by the IBPA and the interactions during the plant visits, the Committee recommended a capital cost of Rs 580 lakh/MW (excluding transmission infrastructure cost and including the cost of air-cooled condenser) and Rs 540 lakh/MW (excluding transmission infrastructure cost and including the cost of water-cooled condenser) for plant other than rice straw-based plant. Considering the additional investment in rice straw-based power plants on fuel procurement and collection equipment such as baler, cutters, tractors, and trolley, the Committee recommended a normative benchmark capital cost at Rs 630 lakh/MW.

Fuel pricing

The major problem faced by biomass developers is the fuel price fixing mechanism. According to IBPA, most biomass power plants spend 70%–90% of the revenue on fuel. The Committee is of the view that fuel pricing mechanism is a challenge and unless the fuel prices are fixed properly, the sector will keep facing stressful conditions.

Based on the submission of IBPA, the Committee recommended that the fuel prices should be fixed at the beginning of the year through an independent survey that can be carried out by the state nodal agencies. This would remove problems currently being faced by the biomass power sector.

Conclusion

The committee acknowledges and recognizes that the biomass power sector in the country is facing problems. It has minutely collected actual information and data from various stakeholders, and performed a rigourous analysis of technical, financial, and operational information. The Committee recommended the CERC the above-discussed revision to the norms of critical parameters set under RE Tariff Regulation 2012.

Note: The article is a summary of the report shared by the CERC with MNRE.

A 14.5 MW Biomass Power Plant in Punjab
Source: MNRE

JUDGMENT FOR FLEXIBLE BIOMASS FUEL COST AND TARIFF REGULATIONS

In a path-breaking judgment by the Appellate Tribunal for Electricity (Appellate Jurisdiction) in the matter of petition filed by Gujarat developers, it has been stated that biomass fuel cost and other parameters can be revised by the State Electricity Regulatory Commission in order to ensure viability of the projects and save plants from closure. The Gujarat Electricity Regulatory Commission had passed an order on 10 May 2012 rejecting the prayers of some appellants for re-determination of fuel cost in view of the steep price hike of biomass fuel with respect to their biomass-based generating plants. The Tribunal looked into the findings of the State Commission's order, inquired into the grievances put forward by the appellants and came up with this path-breaking judgment.

Background

On 17 May 2010, the State Commission passed an order determining tariff for procurement of power by distribution licensees from biomass-based generating plants with a fixed generic fuel cost at Rs 1600/MT with an escalation of 5% per annum. Accordingly, the State Commission also fixed the tariff for biomass projects for 20 years of operation. The Commission fixed levelized tariffs for the first 10 years and for the subsequent 10 years of operation.

On 15 July 2010, the Gujarat Biomass Energy Developers Association filed a Review Petition against the tariff order dated 17 May 2010 seeking revision in the biomass fuel cost. The State Commission, with reference to its order dated 16 November 2010, dismissed the petition holding that the same was not maintainable.

On 20 September 2010, Amreli Power Projects Ltd, one of the appellants, entered into a power purchase agreement (PPA) with Gujarat Urja Vikas Nigam Ltd (GUVNL) for sale of power from its Biomass Power Projects Ltd. On 26 November 2010, a similar PPA was executed by Junagadh Power Projects Pvt. Ltd, another appellant. Both the PPAs were entered in terms of the tariff determined by the State Commission in its order dated 17 May 2010, which was subsequently modified by the Commission with respect to biomass power projects with air-cooled condensers on 7 February 2011.

The biomass power plants of Amreli and Junagadh power projects started commercial operation on 1 March 2011 and 22 May 2011, respectively. Subsequently, they filed a petition before the State Commission requesting re-determination of biomass fuel price in view of the significant hike in the market price of biomass fuel and implementation of the order dated 7 February 2011 for increase in tariff for projects having air-cooled condensers.

The State Commission passed the common impugned order on 10 May 2012 rejecting the prayer of the appellants and yet, at the same time, allowed amendment in the PPA for increase in tariff on account of air-cooled condenser usage in the power plants of the appellants.

Submissions made by the appellants

- The appellants were not seeking a review of the order dated 17 May 2010 but were seeking re-determination of tariff due to uncontrollable factor. Also, the price of groundnut shell, cotton stalk, and juliflora have increased by 100%, 50%, and 65%, respectively over the price determined for 2010/11 in the tariff order dated 17 May 2010.
- The Gujarat Energy Development Agency stated as on 17 February 2012 that 'the cost of biomass works out to Rs 2360/MT.' This is against the price of Rs 1680/MT for the FY 2011/12 worked out with base price of Rs 1600/MT with 5% escalation as per the tariff order dated 17 May 2010.
- The State Commission had fixed the generic tariff for all biomass-based plants in the state of Gujarat by its order dated 17 May 2010 when no biomass plants were existing in the state.
- The State Commission, even after it has determined the tariff, has the power to re-determine the same as provided under Section 62(4) of the Electricity Act, 2003.
- In the 2012 Regulations of the Central Electricity Regulatory Commission, the price of biomass fuel has been increased to Rs 2476/MT for the FY 2012/13 with fuel cost escalation as per the specified formula, which has been ignored by the State Commission.

Observations by State Commission

The State Commission declined to re-determine the price of biomass fuel mainly due to the following reasons:

- It would result in review of the tariff order dated 17 May 2010, which is not permissible without deciding the maintainability of review of the order;
- Such review has been rejected by the order dated 16 November 2010 in a Review Petition filed by the Biomass Developers Association; and
- As biomass price is uncontrollable due to unorganized market, it was the duty of the project developers to ascertain the availability of fuel. Any uncertainty arising later on cannot be allowed to be passed on in the tariff, as it will affect the consumers' tariff.

Key observations and conclusions by the Tribunal

As per the generation data of biomass projects in Gujarat submitted by the appellants, the plant load factor (PLF) of biomass power plants has been going down every year since 2011/12 and the plants are operating at sub-optimal capacity.

Additionally, they have not been able to recover their fixed cost *vis-à-vis* the investment made in the generating station assets, which is recovered fully at 80% PLF.

Plant load factor (%)			
Name of the power station	2011/12	2012/13	2013/14
Amreli	31%	7%	3%
Bhavnagar	19%	15%	5%
Junagadh	35%	30%	21%

Source: Appellate Tribunal for Electricity (Appellate Jurisdiction), 2 December 2013

The Tribunal, thus, came to the conclusion that if the price of biomass fuel in the market has increased to the extent that it triggered partial closure of biomass plants and threatened total closure, the State Commission has powers to revise the biomass price and subsequently the tariff in a concluded PPA keeping in view the change in the circumstances of the case, which are uncontrollable. It also concluded that revision in tariff is required to meet the objective of the Electricity Act. The conclusions spell out that it is the duty of the State Commission to incentivize the generation of electricity from renewable sources of energy. In such an intervention, the Tribunal notes, the State Commission should balance the interest of the consumers as well as the generating company.

The Tribunal, while agreeing to the State Commission's provision that arranging supply of fuel is the responsibility of project developers, observed that the price of fuel is an uncontrollable factor, which will vary depending on the demand and supply situation in the market. Therefore, it concluded that adjustment in tariff on account of variation in fuel price is admissible under Section 62(4) of the Electricity Tariff.

The State Commission has been directed to pass the consequential order within four months from the date of communication of this judgment with no order on costs. ■

The article is a consolidated version and non-binding. Only the version available at http://aptel.gov.in/judgements/Appeal%20Nos.%20132%20&%20133%20of%202012_02.12.2013.pdf is binding.

UPCOMING EVENTS

International Biomass Conference and Expo 2014, Florida

The 7th annual *International Biomass Conference and Expo*, organized by BBI International and produced by Biomass Magazine, will take place on 24–26 March 2014 at Orlando, Florida. This event will bring together current and future producers of bioenergy and bio-based products, waste generators, energy crop growers, municipal leaders, utility executives, technology providers, equipment manufacturers, project developers, investors, and policy makers. It will unite industry professionals from all sectors of the world's interconnected biomass utilization industries—bio-based power, thermal energy, fuels, and chemicals.

This event is expected to draw nearly 1600 attendees as compared to the 1200 attendees it drew in 2013. It will include 30-plus panels and more than 100 speakers, including 90 technical presentations on topics varying from anaerobic digestion and gasification to pyrolysis and combined heat and power, all within the structured framework of five customized tracks: Pellets and Densified Biomass; Biomass Power and Thermal; Biogas and Landfill Gas; and Advanced Biofuels; and Bio-based Chemicals.

For more information, go to www.biomassconference.com.

Source: Biomass Conference and Expo

World Biomass Power Markets 2014, Amsterdam

The premier biomass power event, *World Biomass Power Markets*, will be held on 3–5 February 2014 at Amsterdam, Netherlands. The event, which is the industry forum for the biomass power, co-firing and solid waste-to-energy sectors, in 2013 drew a capacity crowd of nearly 400 biomass power professionals, featured a sold-out exhibition, three days of presentations and debates, and about millions of pounds of deals were worked out. The 2014 event is expected to be even bigger with over 500 key power industry professionals, 120 leading speakers, a 50-stand exhibition hall and over 30 hours of streamed content.

For more information on *World Biomass Power Markets 2014* and highlights of *World Biomass Power Markets 2013*, go to http://www.greenpowerconferences.com/EF/?sSubSystem=Prospectus&sEventCode=BP1401NL&sSessionID=7bdk9l13b49vboc7hd4sc2gjc6-690975.

Source: Green Power Conferences

European Biomass Conference and Exhibition, 2014

The *European Biomass Conference and Exhibition* (BC&E) is supported by European and international organizations like the European Commission; United Nations Educational, Scientific and Cultural Organization (UNESCO); Natural Sciences Sector; the World Council for Renewable Energy (WCRE); the European Biomass Industry Association (EUBIA); the Sugarcane Industry Association, Brazil; Biomass Energy Committee (BEC), China; etc. The Technical Programme of the event is coordinated by the European Commission, Joint Research Centre.

European BC&E provides a high-level scientific programme and parallel events that attract participants from wide-ranging backgrounds: researchers, engineers, technologists, standards organizations, financing institutions, and policy and decision makers. It is a global exchange platform of current knowledge and attracts industrial exhibitors, making the conference events a good ground for technology transfer and innovation.

European BC&E 2014 will be held in Hamburg, Germany. To learn more about it, go to http://www.eubce.com/Press-Release-16-October-2013.2108.0.html#.UpMQv9Jgc6.

Source: European Biomass Conference and Exhibition

GERMAN BIOMASS POLICY

On 30 June 2011, the German Bundestag adopted the 'Act on the amendment of the legal framework for the promotion of electricity generation from renewable energies', which completely revised the EEG (the Renewable Energy Sources Act or Erneuerbare-Energien-Gesetz). The revised version was promulgated in the Federal Law Gazette on 4 August 2011 and entered into force on 1 January 2012. ***Mr Simon Bergmann*** *of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety/BMU, brings to the fore the German Biomass Ordinance for electricity generation, which regulates the whole sector.*

Background

On the basis of the Draft of the Federal Government dated 6 June 2011 (Bundestag printed paper 17/6071) and the decision of the German Bundestag on 30 June 2011 (Bundestag printed paper 17/6363), the Biomass Ordinance – Biomass V has been drawn. It is the ordinance on the generation of electricity from biomass to regulate which substances can be classified as biomass, the substances for which an additional substance-based tariff may be claimed, the energy-related values to be used to calculate this tariff, how the substance-based tariff is to be calculated, etc.

The ordinance aims to chart out the scope of application of the Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz) as well as notes which technical procedures for electricity generation from biomass fall within the scope of application of the Act. It also refers to the environmental requirements to be met for generating electricity from biomass.

Substances classed as 'biomass'

As per the ordinance, 'biomass' shall mean energy sources from phytomass and zoomass; the secondary products and by-products resulting from phytomass and zoomass; as well as residues and waste whose energy content derives from phytomass and zoomass. This would include the following in particular:

- plants and parts of plants;
- energy sources derived from plants or parts of plants, whose entire components and intermediate products were generated from biomass as defined above;
- waste and by-products of plant or animal origin from the agricultural, forestry or fishing industry;
- biowaste within the meaning of section 2 no. 1 of the Ordinance on Biowastes (Bioabfallverordnung);
- gas produced from biomass as defined above through gasification or pyrolysis and secondary and by-products derived therefrom;
- alcohols produced from biomass (as defined above), whose components, intermediate, secondary and by-products were generated from biomass.

Apart from this, the ordinance observes that the following would also be classed as biomass:

- flotsam from water management or management of lake and river banks;
- biogas produced from anaerobic fermentation, provided no more than 10% by weight of sewage sludge is used for fermentation. However, the following substances should not be used:
  1. mixed municipal waste from private households and similar waste from other origins including biomass fractions derived from mixed municipal waste;
  2. harbour mud and other water body sludge and sediments;
  3. animal by-products within the meaning of Article 3 no. 1 of Regulation (EC) No. 1069/2009 of the European Parliament and of the Council of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No. 1774/2002 (OJ L 300 of 14 November 2009, page 1) amended by Directive 2010/63/EU (OJ L 276 of 20 October 2010, page 33).

The ordinance further notes that in cases where biomass substances used for electricity generation in existing installations fall within the meaning of section 2 (3) of the Renewable Energy Sources Act, 2000 (in the version applicable on 31 July 2004 and for which a tariff has already been paid prior to 1 April 2000), they shall continue to be classed as biomass in these installations.

Energy yields from recognized biomass

The ordinance categorically covers information on biomass substances not entitled to payment of a substance-based tariff and their energy yield, substances that fall under tariff class I and their energy yield, and substances that fall under tariff class II and their energy yield in three separate annexures. In conditions where liquid biomass is used for start-up, priming and supporting fuel, the ordinance mentions that the share of electricity generated from the necessary use of liquid biomass shall be allocated to the other substances used in accordance with their percentage share in the remaining electricity generation.

It is also pointed out that when proof of the energy yield of substances used for solid materials combustion or thermo-chemical gasification (calorific value Hi,N) is to be produced by the substance supplier, the certification of delivery must include the following information:

- the calorific value Hi,N of the substance used;
- the name of the testing laboratory that determined the calorific value Hi,N;
- the number of the test report;
- the sample number; and
- the date of the sampling.

Substances not recognized as biomass

The ordinance mentions what shall not qualify as 'biomass':

1. fossil fuels and secondary and by-products produced therefrom;
2. peat;
3. mixed municipal waste from private households and similar waste from other origins including biomass fractions derived from mixed municipal waste;
4. waste wood with the exception of industrial residual wood;
5. paper, cardboard;
6. sewage sludge within the meaning of the Sewage Sludge Ordinance (Klärschlammverordnung);
7. harbour mud and other water body sludge and sediments;
8. textiles;
9. animal by-products within the meaning of Article 3 no. 1 of Regulation (EC) No. 1069/2009 of the European Parliament and of the Council of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No. 1774/2002 (OJ L 300 of 14 November 2009, page 1) amended by Directive 2010/63/EU (OJ L 276 of 20 October 2010, page 33), where:
   a) category 1 material pursuant to Article 8 of Regulation (EC) No. 1069/2009 is involved;
   b) category 2 material pursuant to Article 9 of Regulation (EC) No. 1069/2009 is involved, with the exception of manure, digestive tract content separated from the digestive tract and colostrum within the meaning of the aforementioned regulation;
   c) category 3 material pursuant to Article 10 of Regulation (EC) No. 1069/2009 is involved, with the exception of hides, skins, hooves, feathers, wool, horns, hair and furs pursuant to Article 10 (b) (iii) to (v), (h) and (n), and such material is directly disposed of as waste by incineration; or
   d) category 3 material pursuant to Article 10 of Regulation (EC) No. 1069/2009 is involved, which is processed in processing establishments for category 1 or 2 material, and substances produced or otherwise created by being processed there;
10. landfill gas;
11. sewage treatment gas.

Technical processes

The ordinance notes single stage and multistage processes for electricity generation using the following types of installations as the deemed technical processes for generation of electricity from biomass:

1. combustion installations in combination with steam turbine, steam engine, Stirling engine and gas turbine processes, including Organic Rankine Cycle (ORC) processes;
2. combustion engine installations;
3. gas turbine installations;
4. fuel cell installations;
5. other installations that, as with the technical processes referred to in nos. 1 to 4, are operated with respect to the goal of climate and environmental protection.

It has also been observed that when electricity generation from biomass using a process mentioned above is only possible using priming and supporting fuel with substances other than biomass, then such substances may also be used. And in the case of combustion engine installations or combustion installations in combination with steam turbine, steam engine, Stirling engine and gas turbine processes (including Organic Rankine Cycle [ORC] processes), the ordinance has further directions. It says, 'up to 10 percent of the energy content in such cases may also involve the use of sewage treatment gas or gas produced through thermal processes with a lack of oxygen (syngas) if the gas (syngas) has been produced from sewage sludge within the meaning of the Sewage Sludge Ordinance.'

contd. on page 33

TABLE 1 Tariff structure for electricity from biomass (see page 33)

Tariff for	biogas (excl. biowaste fermentation and small manure installations) and solid fuel installations				biowaste fermentation installations [4] (Section 27a)	small manure installations (Section 27b)
rated average annual capacity	basic tariff	substance tariff class I [1]	substance tariff class II [2]	gas processing bonus (Section 27c(2))		
[kW_{el}]	[ct/kWh]					
≤ 75 [3]	14.3	6	8	≤ 700 standard cubic metre (scm)/h: 3 ≤ 1,000 scm/h: 2 ≤ 1,400 scm/h: 1	16	25 [5]
≤ 150						
≤ 500	12.3					
≤ 750	11	5	8 / 6 [3]		14	
≤ 5,000	11	4				
≤ 20,000	6	-				

[1] Over 500 kW and up to 5000 kW only 2.5 ct/kWh for electricity from bark or forest waste wood.
[2] Only for selected, ecologically desirable substances.
[3] Over 500 kW and up to 5000 kW only 6 ct/kWh for electricity from manure (only nos. 3, 9, 11 to 15 of Annex 3 of the Biomass Ordinance (BiomasseV)).
[4] Applies exclusively to biogas installations which ferment certain types of biowaste (pursuant to Section 27a (1)) and which are directly connected to a facility for post-rotting the solid fermentation residues. The post-rotted fermentation residues must be recycled. The tariff may only be combined with the gas processing bonus.
[5] Special category for biogas installations utilizing manure of up to 75 kW installed capacity at the site of the biogas generation plant; may not be combined (i.e. no additional basic tariff, substance tariff or gas processing bonus).

TABLE 2 Basic tariff for installations generating electricity from biomass (see page 33)

Degression rate[1]: 2.0%, duration of tariff payment 20 years. Excluding substance-based additional tariffs pursuant to substance tariff class I or II

year of commis-ioning	up to 150 kWel in ct/kWh	150–500 kWel in ct/kWh	500 kWel–5 MWel in ct/kWh	5 MWel–20 MWel
2012	14.30	12.30	11.00	6.00
2013	14.01	12.05	10.78	5.88
2014	13.73	11.81	10.56	5.76
2015	13.46	11.58	10.35	5.65
2016	13.19	11.35	10.15	5.53
2017	12.93	11.12	9.94	5.42
2018	12.67	10.90	9.74	5.32
2019	12.41	10.68	9.55	5.21
2020	12.17	10.46	9.36	5.10
2021	11.92	10.26	9.17	5.00

[1] The basic tariff (Section 27(1)), the tariff for biowaste fermentation installations (Section 27a), small manure installations (Section 27b) and the gas processing bonus (Section 27c (2)) are subject to the degression rate of 2.0% (Section 20(2) no. 5).

INSTITUTIONALIZING FUEL LINKAGE

The IL&FS experience

The Ministry of New and Renewable Energy (MNRE) assessed potential of about 23 GW for biomass-based power plants considering the agrarian economy of India and launched promotional policies for setting up of such plants during the 10th Five Year Plan. This is one of the least harnessed renewable energy (RE) sources in India today. Also, most of these installations are currently going through deep crisis with regard to their existence. Non-availability of sustainable fuel supply chain is one of the primary reasons for this. Biomass-based power plants can, however, play a prominent role in creating numerous livelihood opportunities in the rural economy amongst all the RE sources. Creating an institutional framework for establishing long-term biomass supply chains with the help of all stakeholders, led by the industry and supported with the government's policy framework through various ministries, will give the necessary impetus in reviving the biomass sector and exploiting its livelihood generation potential as a primary aspect.

INTRODUCTION

Growth in the agriculture economy is one of the most important driving factors for the growth of India especially in removing the disparity between urban and rural India. Biomass-based (agro waste) power projects could play a major role in the growth of rural economy. The Ministry of New and Renewable Energy (MNRE), realizing this fact and the potential of biomass power plants for its livelihood multiplier effect for rural population, launched several promotional policies for biomass-based power projects during the 10th Plan.

However, in spite of the overall potential of about 23 GW, the sector has witnessed the installation of only about 1 GW. This puts the sector as one of the least harnessed renewable energy (RE) sources of India. Though most of these installations flourish in a span of three to four years, most of them could not realize the necessity of creating sustainable fuel supply linkages at an affordable price (a price at which state electricity regulators desired to balance consumer and industry interests) for a thermal power plant. This has its own consequence of higher cost of generation while operating at lower plant load factor (PLF).

It is a fact that no efforts were made to create organized markets exclusively for providing agro wastes for the biomass-based plants both by the industry and policy and regulatory authorities. However, of late, cognizance is being given by both MNRE and the Central Electricity Regulatory Commission towards recognizing ground realities facing biomass projects. That apart, the emergence of other competing industries in the last few years owing to shortages in the domestic coal supply (for the competing industries) led to a crisis in the availability of biomass at a sustainable price. Further, the absence of large organized industry groups in this sector failed to create pressure for promulgating the supporting policy directives by the Government. All this contributed to sub-optimal operations of the plants and the industry soon rippled into deep crisis.

Challenges for sourcing of biomass

Most of the biomass-based power plants were set up envisaging use of multiple biomass sources such as rice husk, cotton stalk, bagasse, other woody biomass, and mustard husk. However, sourcing of biomass as per the design requirements of the plant and, more importantly, at a price expected by the power producers and regulators has always been a challenge due to the following factors:

a) The very nature of biomass is its seasonal availability with short durations of the collection window, but the target PLFs are set in line with the conventional thermal power plants based on coal, gas, etc. and accordingly the tariffs are set by the Central Electricity Regulatory Commission/ state electricity regulatory commissions (CERC/SERCs). Most of the biomass projects today face this challenge of seasonality, resulting in sub-optimal operations at lower PLF and significant under-recovery.

b) Seasonal availability creates challenges for collection and storage of biomass, which also requires huge working capital.
c) Cyclical swings in the agricultural produce.
d) Absence of organized markets for sourcing of agro-waste.
e) Though many of the states have restrictions for setting up multiple biomass power plants in a specified command area, it did not have restriction for use of biomass by other industries.
f) Shortages in the domestic coal supply market resulted into use of biomass by other competing industry whose output is not regulated (e.g. distillery, oil mills, particle boards, and cement plants) leading to prices of rice husk, bagasse, mustard husk, etc. beyond the affordability range of the biomass industry.
g) The emergence of cogeneration plants leading to short supply of bagasse.
h) Variation in moisture levels in the biomass from month to month compared with the design parameter.
i) The dependence on traders for supply of biomass leaving the industry at price risk.
j) Huge requirement of labour for collection of agro residue such as cotton stalk.
k) Non-availability of cheap land for captive plantation.
l) Last but not least is the higher requirement of biomass due to the higher heat rate than the normative heat rate envisaged by various regulators, leaving substantial under-recovery of energy charges.

In spite of many of the above challenges, entrepreneurs owning biomass-based power plants attempted various means for sourcing biomass. However, most of the above means did not have any sustainable solutions to source biomass as per the design requirements of the plant and also did not have direct involvement of the local farmers/ labourers with the industry as an attempt to establish sourcing biomass as a means of livelihood for them.

Efforts need to be made to issue directives to regulators for using the normative parameters as close to ground realities as possible.

Potential for livelihood generation in biomass-based power projects

As stated earlier, the biomass industry has the highest potential for creating livelihood opportunities amongst all the RE sources. This alternative means of income can support the efforts of the Government policies for creation of employment in rural areas and more importantly can also avoid the cyclical price pressures of agro commodities through a sustainable stream of income to the farmers for agro–waste especially during drought years.

An example based on the experience of the author in one of the biomass-based power plant is enumerated hereunder to show the ultimate potential of livelihood opportunities if we can reach the ultimate capacity of 23 GW for the biomass-based power projects.

a) A typical 12 MW biomass-based power project can be commissioned with a capital investment of Rs 80 crore and has the multi-fold potential in terms of livelihood generation as given in Table 1.
b) Thus there is an opportunity of creation of jobs to the tune of 150 crore man-days and income generation of Rs 36,500 crore every year, if the entire biomass potential of 23 GW is harnessed and also an income of Rs 27,000 crore to 4 crore farmers (assuming an average land holding of 5 acres per farmer).
c) It may also be noted that there are many agro wastes such as cotton stalk, paddy straw, and juliflora, which has no other competing use in the form of cattle feed and farmers are facing immense challenge in uprooting these agro waste to clear the fields for the next cropping season. Farmers are, therefore, burning these wastes in the farms resulting into environmental hazards.

TABLE 1 Multi-fold potential and benefits of a large biomass-based power plant

Parameter	Value
Installed capacity	12 MW
Gross generation per annum (80% PLF)	84 million units
Annual biomass requirement	1,30,000 MT
Cotton stalk requirement (80% of total biomass)	100,000 MT
Yield of cotton stalk	1 MT per acre
Period available for collection of cotton stalk	6 months (from November to May)
Daily collection of cotton stalk	550 MT per day
Labours required for uprooting and chipping of cotton stalk	6 labours per MT
Total labours and supervisory persons required per day	3,900
Total direct livelihood generation	3,900 labours per day
Total direct employment generation in 6 months per plant	7,00,000 man-days
Income generation in rural economy	Rs 17 crore
Additional income to farmers (@ Rs 1000 per MT)	Rs. 13 crore
Potential of biomass power in India	25,000 MW
Installed capacity	1000 MW
Possible livelihood income generation only by installed capacity of 1000 MW	Rs. 1,462 crore
Possible income generation to farmers from installed capacity of 1000 MW	Rs. 1,083 crore
Possible livelihood income generation from potential 25 GW	Rs. 36,562 crore
Additional Income for the farmers from potential 25 GW capacity	Rs. 27,000 crore

Source: This table is based on the actual data for the 13 MW biomass-based power project of IL&FS in Maharashtra (Dist Aurangabad), wherein cotton stalk is the primary fuel and the same is being sourced through farmer groups, non-governmental organizations, traders, etc. and figures are for the livelihood generation during its collection.

d) Further these biomass power projects can also generate a number of other entrepreneurial opportunities for rural youth through their participation in the fuel supply chain.

Institutionalizing fuel supply linkages

It is imperative to institutionalize the fuel supply mechanisms for the biomass power plants for establishing sustainable fuel supply linkage which is a key for the success of any power plant and the same can be done with the steps enumerated hereunder:

a) A detailed survey of the surplus biomass in real sense to understand the trend of farming in the recent past along with the assessment of the present use of agro residue in the region.

b) Assessment of design suitability of the boiler for the use of multiple biomass with due analysis of combustion characteristics of the fuel proposed to be used.

c) Establishment of various farmer groups, self-help groups, etc. for becoming part of the fuel supply chain.

d) Assessment of infrastructure support required for these groups in terms of providing various equipment for collection and processing of biomass such as chippers, bailers, tractors, etc. and the logistics for transportation of fuel. It is to note that decentralization of the fuel supply chain is key to the success of this framework and it is necessary to avail the best available resources in the region. But availability of power in terms of both quality and cost for collection/processing of fuel on decentralized basis is a challenge and would need necessary regulatory support and in the interim tractor-driven technology will have to be used.

e) Support from banks and/or financial institutions such as NABARD for providing the necessary infrastructure to these groups without entailing any financial guarantees by biomass-based power plants.

f) Upfront establishment of strong and reliable payment mechanism is one of the critical factors for the success of the fuel supply chain, especially considering the economic situation of marginal farmers and labourers involved in this chain. We all are aware of the fact that these marginal farmers and labourers are habitual of operating on cash basis for day-to-day living, which necessitates the industry to have intermediaries for making such cash transactions. Therefore, in order to avoid the intermediaries and giving direct benefit to the farmers and labourers, various financial inclusion schemes in the form of direct cash transfer need to be created with the help of power plant owners/lending banks for the power plants/local co-operative banks/ lead banks in the region and even various micro-financial institutions operating in the region. Such financial inclusion schemes will ultimately help in the uplift of the rural economy and also help in increasing the savings economy along with consumption-based economy.

g) Establishment of a transparent pricing mechanism for the purchase of biomass (up to the gate of power plant) considering all the costs involved and giving reasonable profits to these groups. Any financial support provided by power plant owners can be adjusted against the fuel supply on per-tonne basis.

h) Once the basic framework is established, the fuel supply agreements with only basic terms (without any jargon of conventional fuel supply agreements) of 100% buyback guarantee of fuel collected by these groups as per the requirement of power plant and payment for such fuel in the designated account in accordance with the financial inclusion framework provided above.

i) In addition to such farmer groups, the platform at the Agricultural Producers Market Committees (APMCs) can also be provided for those who do not want to participate through the groups. The purchase price by APMCs is to be matched with the price evolved with the groups. APMCs need to enter into contracts with power plant owners for supply of fuel wherein the logistics for transport of such biomass is to be arranged by power plant owners. It is, however, necessary to have some restrictions on these APMCs for giving first priority to biomass-based power plants in the command area and only after meeting the requirement of these power plants it can be sold to other entities.

However, this institutionalization cannot happen without the policy intervention of various line ministries such as the Ministry of Rural Development (MoRD), the Ministry of Finance (MoF), and the Ministry of Agriculture (MoA). Also, the SERCs will be essential in terms of the activities listed below.

- Inclusion of collection/processing of agro-residue for supplying to biomass-based power plants as an

Source: http://www.ilfsindia.com/projects.aspx?prid=7&catid=1&slnk=173&cid=5

approved activity under MNREGA by MoRD.

- MoF to approve financial inclusion schemes for supply of biomass and lending for associated equipment under priority lending schemes for agricultural activities.
- MoF to approve participation of micro-finance institutions (MFIs) in this fuel supply chain.
- MoA to approve framework for participation of APMCs.
- In addition, SERCs to cover use of power for the processing of biomass in the fields under the agricultural category; however, necessary metering may be made compulsory. This will also help in increasing the metered agricultural consumers, which will ultimately help state discoms.
- SERCs to evolve transparent normative parameters for gross station heat rate, calorific value of various biomass taking into account the actual moisture levels and, of course, the annual adjustment cost of purchase of fuel with suitable indexation.
- MNRE to come out with a transparent generation-based incentive scheme because in many cases the SERCs may find it difficult to provide suitable framework in view of the ramifications of the costs on the tariff for sale of power.

Special dispensation for biomass-based power projects

It would not be out of place to mention here the necessity of some special dispensation to be considered for biomass-based power projects for sustainable operations:

a) Considering the seasonal availability of the biomass, these projects should be considered as 'Seasonal Projects' and accordingly tariffs should be set with target PLF of not more than 50% instead of the current practice of 80%, which seems to be extremely challenging considering the history. Once the fuel supply chain mechanisms as proposed above are established, then the target PLF can be increased progressively.

b) It also needs to be considered that biomass-based power plants are necessarily agro-waste processing plants rather than merely power projects. The challenges associated with processing of agro-waste (such as high moisture levels and degradation) need to be considered. In the absence of these power projects, the farmers would only burn the residue thereby creating enormous harm to the environment. Some of the states like Punjab and Haryana face similar hazards due to burning of paddy straw in the fields.

c) Presently, most of the villages in rural areas are grappled by load shedding and supply to agricultural sector is also restricted. It would, therefore, be useful to create a conducive framework for supply of power (could be in islanding mode) from these power projects to the nearby rural areas (command area of the power plant, which supplies biomass), including community loads such as schools, hospitals, and streetlights. This will ensure a different bonding between the power plants and the community and will also ensure reliable fuel supply for the plant. In such situations, these power plants can be given the treatment of a minigrid project.

Conclusion

In view of the immense livelihood potential of biomass-based power plants, it is in the interest of the Government to see that full potential of the sector is exploited. However, unless there is revival of the existing power plants and or suitable framework is not created for the sustainable fuel supply chain, large organizations will neither get its shareholders' support nor its Board's approval for investing in this sector. The fact remains that participation by such large industry groups with strong financial capabilities is inevitable.

Many large industrial groups are already keen to enter into the sector. To make this happen, a paradigm shift is necessary on the part of the Government of India as it should see the biomass sector as a means for generating livelihood opportunities rather than a mere power generator.

The policy framework for establishing the fuel supply chain and some special dispensation stated above will ensure sustained operations of biomass-based power projects and the sector will attract manifold investment. ■

BRIEF PROFILE

SANJAY JOSHI

Vice President, IL&FS Energy Development Company Limited

Sanjay Joshi has been working with IL&FS, Mumbai, the premier infrastructure financial institution, since June 2006. He handles all major initiatives of IL&FS in the energy sector. He is currently working as Vice President, IL&FS Energy Development Company Limited (IEDCL). He has been actively involved in the biomass initiative of IEDCL, especially in establishing the sustainable fuel supply chain for their power plant in Maharashtra.

India Clean Cookstove Forum 2013

The India Clean Cookstove Forum 2013 was held in New Delhi on 25–26 November 2013 with the aim of enhancing the use of improved cookstove technologies. It was organized jointly by the Ministry of New and Renewable Energy (MNRE) and Deutsche Gessellschaft fur Internationale Zusammenarbeit (GIZ) GmbH operating on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). The forum aimed at identifying potential solutions to the challenges that hinder a large-scale adoption of improved cookstoves in India and to bring together practitioners with long experience in the field of clean-cooking to provide inputs on best practices and lessons learned.

The Minister for New and Renewable Energy, Dr Farooq Abdullah inaugurated the forum. He conveyed that the forum was most appropriate as it coincided with the Ministry's plan to launch the National Biomass Cookstove Programme (NBCP) in the current financial year. He articulated that both India and Germany share a long-standing and successful cooperation in the energy sector, including renewable energy; and that under the joint declaration signed by both the countries in April this year, Germany will provide technical assistance for forecasting, balancing, market design, and network management in connection with grid integration of renewable power under Indo-German Technical Cooperation through GIZ. He drew his speech to an end by exhorting the importance of placing the improved cookstove in each rural household through the combined efforts of the governments, international, national and local organizations.

The welcome address was delivered by Manfred Habig, Deputy Country Director, GIZ India and Michael Blunck, Project manager, Indo-German Energy Program, GIZ India, introduced the forum and GIZ's cookstove initiatives. Blunck noted, however, that most of the innovative technologies have not penetrated the way they would have liked it to. Alok Srivastava, Joint Secretary to the Government of India, MNRE, spoke about biomass cookstove initiatives in India. He preferred to use the word 'chulha' instead of 'cookstoves', "People in villages don't understand the term 'cookstoves'. So we'll have to change our language to their language." He said that in the last 3-4 years, test centres to improve the standard of chulhas have been set up and that there is active research and development on in the area. He further said that the government has tried to reduce subsidies to less than 40% of the total cost and is trying to make the cookstove industry micro-finance enabled.

A special address was given by Heiko Warnken, Head of Development Cooperation, Embassy of the Federal Republic of Germany, New Delhi. He highlighted the importance of cooperation between India and Germany in the field of renewable energy and emphasized on the importance of sustainable energy for cooking and participation of the private sector, in an environment where supplying biomass cookstoves is a viable business.

On 26 November 2013, the panel discussions were preceded by a summary provided by Santosh Singh, Technical Expert, IGEN-RE, GIZ of the Cookstove Practitioner Workshop organized on 25 November 2013 and experiences of Shell Foundation in creating market for improved cookstoves shared by the Foundation's regional director, Anuradha Bhavnani. Health, environment, livelihood and gender impacts of cookstoves were touched upon by Bhavnani, who spoke of Carbon

Finance, a pre-finance facility for cookstoves initiated by Shell Foundation recently, and how the Foundation is working on last-mile distribution that is cost-effective. She pronounced the merit in Shell Foundation's multiple partnership and interventions approach in addressing barriers to the large-scale adoption of improved cookstoves.

The first panel discussion was on 'Finding Solutions for Challenges in creating Demand for Improved Cookstoves', moderated by Anuradha Bhavnani and participated by Anurag Bhatnagar, CEO, Grassroot Trading Network for Women; Sakshi Varma, who works for IFC's Access to finance Advisory services in South Asia; Sameer Mishra, a financial service professional with more than 17 years of experience in retail banking and rural business; Supriyo Gupta, Managing Director, Torque Communications and Digilogue Communications; Svati Bhogle, co-founder of Sustaintech India Pvt. Ltd (SIPL) and working as Secretary and Chief Executive of TIDE for the past 18 years; and Vinay Jaju, founding COO of Onergy and the founding head of innovation incubator at Switch ON.

Some of the points that came up during the discussion include the strengthening of awareness creation campaigns at a mass sustained level like the Pulse Polio Programme; involvement and sustained efforts of awareness creation at the ground level by NGOs, corporate, enterprises, etc. The session also touched upon the need for micro-finance in the area and good service providers; and that convincing people to buy these cookstoves is a behavioral challenge.

The second panel discussion on 'Improving Supply of Appropriate Cookstove Technologies' was moderated by Hari Natarajan, Senior Technical Expert, Renewable Energy Component of the Indo German Energy Program (IGEN-RE), GIZ. The panelists were Ankit Mathur, co-founder and CTO, Greenway Grameen; Dr BS Negi, Director (R&D Coordination and Cookstove), MNRE; Gaurav Mehta, CEO, Project Dharma; Santosh Kumar, Technical Expert, IGEN-RE, GIZ; and Prof. Rajendra Prasad, who has retired from IIT, Delhi and is now currently involved with MNRE on testing and evaluation of improved cookstoves. The panelists, among a host of other points around the issue of standards, talked about the need for field testing because often products successfully tested in the labs did not go well with user experience. Attention was also brought to the area of good packaging for efficient distribution without breakage.

The third panel discussion on 'Developing the Market Ecosystem' was moderated by senior journalist Paranjoy Guha Thakurta and the panel included Pinal Shah, Director, Sewa Urja Avaran Company; Rekha Krishnan, who currently leads policy research projects of the Ashden India Renewable Energy Collective; Sujatha (Mukundan) Srinivasan, Director, Servals Automation Pvt. Ltd; T L Sankar, whose contributions to the energy sector has fetched him several accolades besides the Padma Bhushan by the President of India in 2004; T Pradeep, institutional advisor to SAMUHA and chief executive of iSqaureD; and Dr Veena Joshi, Senior Advisor-Energy, Swiss Agency for Development and Cooperation, New Delhi. The panel deliberated upon issues like would MNRE be willing to buy carbon credits from rural households in place of subsidies? Could the country move to induction cooking if it succeeds in rural electrification based on biomass, etc.? Suggestions advocated tax exemptions for catalyzing the market, clearer and more defined policies, consultations with women's representatives before drawing these policies, and that the media should participate in taking this cause forward. ■

Contributed by Academic and Development Communication Services (ADCS)

contd. from page 27

The ordinance specifically pronounces the importance of avoiding environmental pollution. For this, it mentions that the public law provisions applicable for the respective technical processes and for the use of the relevant substances should be complied with.

EEG 2012 tariff rates

Sections 27, 27a and 27b of Erneuerbare-Energien-Gesetz – EEG 2012 outline the tariffs for electricity from biomass. Table 1 (*p. 27)* shows the tariff structure for electricity from biomass and Table 2 (*p.27)* shows basic tariff for installations generating electricity from biomass. These tables outline the minimum tariffs, bonuses and annual degression rates for electricity generation from biomass pursuant to the latest version of the EEG. They apply to installations commissioned from 1 January 2012. Except for some transitional provisions, the current legal situation, it is stated, shall continue to apply to installations commissioned prior to 2012.

Duration of tariff payment

As per EEG 2012, the minimum tariffs are to be paid, from the time of commissioning, for a period of 20 years plus the year in which the installation was commissioned. Following the commissioning of an installation, degression of the tariffs does not come into effect for that installation: Which means, the tariff rate remains unchanged for a period of 20 years once an installation is commissioned. ■

Note: The article is a consolidated version and non-binding. Only the version published in the Federal Law Gazette (Bundesgesetzblatt – BGBl.) is binding. Further information is available at HYPERLINK "http://www.bmu.de"www.bmu.de and HYPERLINK "http://www.erneuerbare-energien.de"www.erneuerbare-energien.de.

Sub-Group on Renewable Energies under Indo–German Energy Forum

The Indo–German Energy Forum (IGEF) was initiated by German Chancellor Dr Angela Merkel and Indian Prime Minister Dr Manmohan Singh in April 2006. The Forum provides a platform for high-level policy makers and representatives from industry, associations, financial institutions, and research organizations from both India and Germany to deliberate and discuss key issues pertaining to the renewable energy sector. The main objectives of the Forum are (1) rehabilitate and modernize the thermal power plants; (2) encourage the use of clean energy sources; and (3) disseminate climate-friendly technologies. The Forum provides a unique opportunity for constructive dialogue between decision makers in government and industry to develop a common understanding of the most promising fields for Indo–German Cooperation in the energy sector.

The following Sub-Groups have been constituted under IGEF to look into specific issues concerning the sector:

- **Sub-Group I** Efficiency Enhancement in Fossil Fuel-based Power Plants;
- **Sub-Group II** Decentralized Distributed Generation based on Biomass and other Renewables;
- **Sub-Group III** CDM Projects in Energy Sector and Demand Side Energy Efficiency; and
- **Sub-Group IV** Research Cooperation in the Energy Sector.

The IGEF Sub-Group II on Decentralized Distributed Generation based on Biomass and other Renewables has been rechristened 'Renewable Energies' in the Sub-Group meeting held on 12 February 2013 at Berlin, Germany. The meeting was jointly chaired by Alok Srivastava, Joint Secretary (International Relations), Ministry of New and Renewable Energy (MNRE), India, and Dr Martin Schoepe, Head of Division E III 3, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Germany.

The second meeting of the Sub-Group was held on 13 November 2013 and was attended by representatives of the Indian and German governments, finance institutions, industry, as well as research and development organizations. Discussions were focused on joint activities in the fields of renewable energy grid integration, biomass use for energy, off-shore wind policy, rural electrification, and innovative business models such as Renewable Energy Service Companies (RESCOs).

In the field of bioenergy, it was decided to cooperate on 'reassessment of surplus potential of biomass for power generation'. The current potential for power generation from biomass in India has been estimated at 16 GW. MNRE supports several progammes for the promotion of biomass power and has developed a web-based 'Biomass Resource Atlas' using Geographic Information System (GIS) and field-level surveys, which can be viewed at http://lab.cgpl.iisc.ernet.in/atlas. The assessment of surplus availability of biomass is dynamic and depends mainly on change in cropping pattern and increased competing uses, which are directly linked to the increase in the price of fossil fuels. In view of this, there is a need for periodic review and development of necessary methods and/or factors for corrections and updating in respect of availability of surplus biomass, which will be useful in fine-tuning the targets of the Ministry.

Under the cooperation, it is proposed to undertake a study in select states to assess the availability of resources and develop tools to decide on a correction factor with the support of German experts to be applied in the existing resource atlas. A Task Force is proposed to be constituted in the near future to develop the proposal for cooperation including the involvement of key experts and institutions from Germany. ■

Contributed by the Ministry of New and Renewable Energy (MNRE), Government of India

BIOMASS POWER IN NORTHEASTERN STATES

The Independent Power Producers Association of India (IPPAI) organized a conference on 24 October 2013 at the Aijal Club City Centre, Aizawl, Mizoram. The conference was organized to resolve the problem of power cuts in Mizoram and the other northeastern states of the country through an innovative scheme that promises to change the economics of rural/urban power supply and provide affordable and reliable power supply to villages and urban areas. The event saw participation of the Ministry of Power and the Ministry of New and Renewable Energy (MNRE), Government of India, and was supported by Joint Electricity Regulatory Commission (Manipur and Mizoram) and the Zoram Energy Development Agency (ZEDA).

Harry Dhaul, Director General, IPPAI stated in the conference that the power sector should be consumer focused and provide reliable and affordable electricity supply to drive development in villages, agro-industry, education, health care, sanitation, industrialization; set up a sophisticated services sector and consequently have growth in employment opportunities. He announced an innovative scheme using biomass-powered decentralized distributed generation with Electricity Credit Notes (a new concept) and Renewable Energy Certificates (RECs) that can be used by Mizoram and other states of northeast India. The components of the scheme involve:

1. Addressing the total energy demand of a village based on local resources with energy production and distribution by involving local communities, including a 'Golden Share' for the village council/Church/youth organization for them to invest money in local infrastructure and skill development
2. Biomass power plants
3. Rural electrification schemes
4. Electricity Credit Notes as a concept unveiled for the first time in Mizoram
5. Business and Employment Potential envisaged for a 5 MW biomass plant:
   a. Direct employment of nearly 50 people in areas of fuel logistics and plant operations
   b. Indirect employment of nearly 500 people – small retailers (tea / food); building and maintaining roads and transport to service plant and personnel requirements; accommodation; water, health, food, education, shopping

Dr Pramod Deo, former chairman, Central Electricity Regulatory Commission, said, that, as per the Electricity Act 2003 the utility should supply power to all consumers, while in reality this

wasn't happening. Where the state utility was unable to supply power, the private sector stepped in. For example: to address the issue of huge power deficit in Bihar, biomass power was generated by private sector players and rural consumers paid Rs 10 per unit of power for 4 hours of electricity in the night.

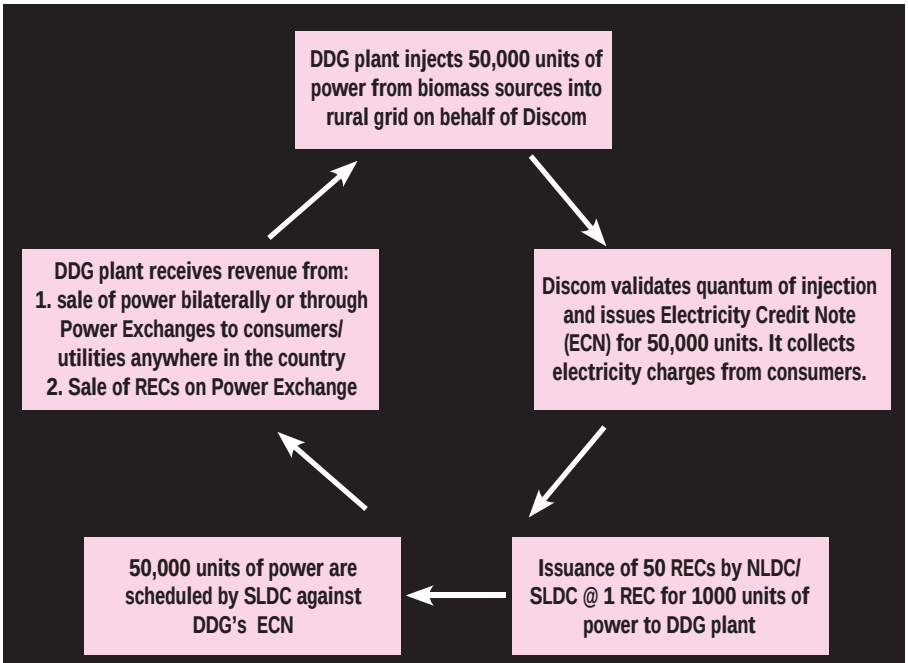
Dr G C Dutta Roy, CEO, DESCL Services, and an international expert, emphasized that innovations can catalyze economic transformation; like the innovation New Land Use Policy (NLUP) implemented in Mizoram in 1985, which boosted economic development. Now, it is time for another innovation, which could transform life in rural areas of North East India – this time in the energy sector, such as the Electricity Credit Notes mentioned by Harry Dhaul.

V P Raja, former chairman, Maharashtra Electricity Regulatory Commission, pronounced that we should learn from past failures and successes. For instance, the 'gobar gas plant' concept of using gas from animal dung was widely implemented in the 1970s but it did not take off; whereas 'Operation Flood' and the Milk Revolution started by Dr Verghese Kurien in Gujarat became a grand success in many other parts of India. He said that Technology–Human interface is very important and that projects can be successful only if operations and maintenance over the long run are planned for. Further, he articulated that the success of Renewable Energy Certificates (RECs) depends on how strictly the State Electricity Regulatory Commission enforces the Renewable Purchase Obligations. Strict enforcement, therefore, is required.

V K Jain, Director, Ministry of New and Renewable Energy (MNRE), Government of India, spelled out the latest MNRE policies incentivizing biomass power generation in the country.

Er Dunglena, former Secretary (Power), Government of Mizoram, highlighted that grid power system in interior hilly areas is too expensive and extremely difficult to maintain. There is a transmission and distribution loss at 40%, which is too high. Therefore, he stated that decentralized distributed generation appears to be the only solution. And that one good option is biomass generation. Mizo traditional Village Safety Reserve, a forest around the villages maintained by the community for meeting their needs can be of great advantage for biomass production, which can make use of bamboo plantations. And the traditional social systems of Mizo people HNATLANG (Voluntary service) prevalent in Mizo society seems to be ideal for operations and maintenance of biomass power. All this can ensure long-term power supply. Er Dunglena also emphasized on the importance of awareness so that villagers are involved directly from initial planning, implementation and maintenance. Awareness will also help drill a sense of ownership in the village. He said that a Village Energy Committee comprising the Village Council and the representatives of the local NGOs may be entrusted to look after the power supply. Winding up, he noted that what is needed today is a change of mindset: Thinking of the people in general and the Government departments in particular need to change to accept that 'small is beautiful'. ■

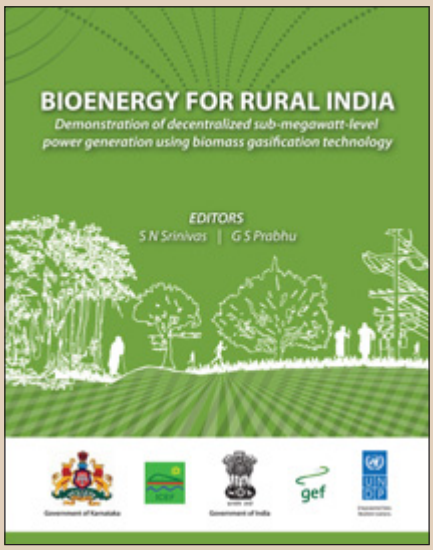
Contributed by the Ministry of New and Renewable Energy (MNRE), Government of India



An overview of the Decentralized Distributed Generation (DDG) Model using Electricity Credit Notes (ECNs) and Renewable Energy Certificates (RECs) proposed by Harry Dhaul, Director General, IPPAI, at the conference.

IPPAI or Independent Power Producers Association of India (www.ippai.org) is a not-for-profit association setup initially with the idea of providing a neutral forum for facilitating private sector investments in the Indian power sector through the IPP model. The forum enabled discussions and debates on various issues faced by private investors as the power industry moved from command to market economy. It presently functions as an independent body providing a neutral platform for the discussion and examination of issues critical to the sustainable development of the power sector in India.

ON THE BOOKSHELF



This book, titled *Bioenergy for Rural India*, narrates the implementation and impact of a unique energy project that focused on decentralized, bottom-up power generation using biomass gasification technology. BERI or Biomass Energy for Rural India project was implemented in Tumkur district of Karnataka between 2001 and 2012. The Global Environment Facility, the United Nations Development Programme, the India Canada Environment Facility, and the governments of Karnataka and India came together to support the agendas of environmental sustainability, poverty reduction, and inclusive growth that the BERI project stood for.

Overall, the project was unique in three respects. First is that the project ensured supply of biomass resources through a dedicated plantation to run a 1 MW cumulative biomass gasifier plants on a continuous basis. Second, it strengthened grid interaction at the tail end with continuous power supply to the 11-kV transmission line, which, in turn, ensured sustained operation of the grid-connected sub-megawatt plants located in the villages. And third, the project established operational benchmarks for sub-megawatt biomass-based gasifier plants on the field. These achievements and benchmarks are significant in that they can be effectively used for similar projects not only in the country but also in countries where biomass resources are available in plenty.

The project is also a model of sustainable rural development through biomass energy, introducing to project villages group biogas programmes, women's self-help groups, and a landmark community irrigation programme, which included landless households in water users associations, the first such instance in any integrated watershed management programme.

This book offers valuable insight and lessons for development professionals, policy makers, researchers, and students on the implementation and management of renewable energy-based sub-megawatt power projects in rural areas. ■

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