INTERVIEW
Shri Upendra Tripathy
Secretary, MNRE

LEAD STORY
Possible Strategies and Policies for Formalizing Biomass Trade

CASE STUDY
10 MW Biomass Power Plant that Runs on Coconut Tree Waste

OTHER STORIES
- Ren21Report: Overview of Global Biomass Scenario
- Should Biomass Supply Chain be Managed by Plant Developers: Opinions of Experts
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 <biopowerindia.mnre@gmail.com>.

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.

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For details, please contact <biopowerindia.mnre@gmail.com>.
We are pleased to bring forth the third issue of BioPower India and I would like to thank our readers for their interest and encouragement.

The main highlight of this issue is the interview of Shri Upendra Tripathy, Secretary, Ministry of New and Renewable Energy. Shri Tripathy shares his views, ideas and the endeavours being made at the Ministry level to boost the biomass power sector in the country.

As for other stories, this issue focuses on the challenges and opportunities that exist in the biomass supply chain. All players across the industry identify the supply of biomass as a major problem that plagues the sector. As the supply of biomass is an unorganized sector, the supply volumes cannot be regulated to control the volatility in the market procurement price. In such a scenario, policy-driven steps to reduce the impact of fuel prices to the extent possible seem to be a better option. However, you will find a contrary view on this in the story ‘Would formalizing the trade of biomass stabilizes the biomass power sector: Possible strategies and policy support?’.

A few states have amended their biomass tariff regulations in line with the revised tariff guidelines issued by the Central Electricity Regulatory Commission. In our Policy and Regulatory section, we present the latest amendments in regulations by the electricity regulatory commissions of Bihar, Rajasthan, and Jammu and Kashmir. These amendments are expected to bring much required relief to the industry. In addition, we are sharing with you the gist of the discussion papers prepared by the electricity regulatory commissions of Karnataka and Tamil Nadu. Apart from these, we are starting a new segment from this issue onwards. The section ‘Expert Speak’ will bring to you opinions from the industry and experts on various issues and challenges in the biomass power sector.

The biomass power industry has reasons to rejoice with the tariff amendments that are being made by various state regulatory commissions; however, to sound a word of caution, it is extremely important that the efforts for reviving the industry do not slack at this moment. The momentum has to be maintained for taking affirmative actions across the entire supply chain of the sector so that the solutions are sustainable.

Best wishes to all our readers for the festival season.

(V K Jain)
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In a one-on-one with BioPower India, Shri Upendra Tripathy, shares his views, ideas, and efforts taken by the Ministry, to boost the renewable energy sector, especially biomass power, in the country.

Shri Upendra Tripathy, Secretary, Ministry of New and Renewable Energy (MNRE), Government of India, is an Indian Administrative Service officer of the Karnataka cadre with 34 years of service at various levels in the government.

Before taking over as Secretary, MNRE, Shri Tripathy was Additional Secretary in the Cabinet Secretariat. He was Adviser (Trade) in the Indian Embassy in Brussels and held various positions in the state of Karnataka in the areas of Revenue Administration, Agriculture and Horticulture, Rural Development, Environment, and Transportation.

Shri Tripathy has done his Masters’ Degree in Political Science from Jawaharlal Nehru University, New Delhi, and in Public Administration from Carlton University, Ottawa, Canada. He was awarded the Prime Minister’s Award for Excellence in Public Administration in individual category in 2009.
From the perspective of India’s energy security and environmental concerns, renewable energy (RE) has a big role to play in future. What has been your experience in promoting RE?

Energy is a key driver for economic development in the country. It enables greater productivity, prosperity, and living comforts. Renewables emerged as a mainstream energy source for the global community, besides contributing to climate mitigation efforts. According to the ‘Renewables 2014 – Global Status Report’ published by REN 21, the estimated global RE power capacity added in 2013 is over 1560 GW, up more than 8% over 2012; and renewables, other than hydropower (>50 MW), collectively grew nearly 17%.

In 2013, new investments in renewable power and fuels globally, excluding hydropower, was to the tune of USD 214.4 billion. Further, by the end of 2013, India emerged as one of the top 6 countries in terms of total installed non-hydro renewable power in the world. The other countries are China, the United States, Germany, Spain, and Italy.

Today, over 14% of the total installed power generation capacity of the country comes from renewable resources, which is around 32.50 GW. Of which, over 22 GW comes from wind, taking India to the 5th position in the world.

Over the years, RE has also emerged as a tool for addressing the problem of access to clean energy in rural areas. RE-based decentralised and distributed applications have benefitted millions of people in villages, mainly off the grid, for meeting their cooking, lighting, and other energy needs in an environmentally benign manner, contributing to the inclusive growth of the rural economy.

To counter climate-related concerns, RE has been given an important role in India’s National Action Plan on Climate Change with National Solar Mission as one of the key missions. The mission has a current target of 20,000 MW grid power by March 2022 out of which 10,000 MW grid power is planned to be added by March 2017. The total RE power is expected to be 55,000 MW by March 2017; in other words, it would take the share of RE in the total installed capacity to 15% from 12% at present.

As regards my experience in the Ministry, I really enjoy working in this emerging sector. Although the Ministry has been able to lay a sound framework for the development and deployment of RE in the country, there exist a few challenges and barriers. We are addressing these issues with a view to develop an investor-friendly regime for accelerated growth of RE in the country.

What are the new initiatives you have taken or planning to take to make India a global leader in the RE sector?

Under the leadership of the Hon’ble Minister, the Ministry has taken a number of initiatives to expand RE in the country and to put India on the global map as a leader in the RE sector. Some of the key steps taken in this direction are: (1) enhancing the annual budget of the Ministry for the year 2014/15 to Rs 2519 crore from Rs 1519 crore; (2) organising the 1st Renewable Energy Global Investment Meet (RE-INVEST) in February 2015 in New Delhi to attract investment in RE in India as a follow up to the ‘Make in India’ initiative launched by the Prime Minister of India; (3) planned to revise the target to achieve 100,000 MW of solar power by 2020; (4) launched two new schemes in the area of solar energy – establishment of solar parks and canal top solar PV; (5) signed memoranda of understanding (MoUs) with consortium of partners, namely, NTPC, PGCIL, IREDA, PFC, PTC, GPCL, and NIWE for setting up a joint venture company for undertaking the first off-shore wind power project of 100 MW capacity along the Gujarat Coast; (6) rechristen the three autonomous institutions under the administrative control of the Ministry to National Institute of Solar Energy (NISE), Gurgaon; National Institute of Wind Energy (NIWE), Chennai; and National Institute of Bioenergy (NIBE), Kapurthala; and initiated actions to link these institutions to the National University for Renewable Energy proposed to be set up soon; (7) established Association of State Nodal Agencies working on renewable energy; (8) proposed to set up a World Museum on Renewable Energy at NISE, Gurgaon; (9) developing a framework for Renewable Energy Act; (10) proposed to launch a National Mission on Wind Energy and National Mission on Small Hydro Power; and (11) working on the expansion of green energy corridors (Phase - II).

The Ministry has four national programmes on energy generation from biomass, which underline the importance of the sector. What are the achievements of the biomass power sector over the past 15 years of implementation?

Biomass is renewable, carbon neutral, and has the potential to provide large-scale productive activities and employment specially in rural areas. It is one of the promising resources for generation of energy/power in rural areas using commercially available thermal and biological conversion technologies. The Ministry is currently implementing a wide range of programmes to support projects to generate grid-interactive power, decentralised distributed generation of electricity for rural electrification, and for captive use in the industry.

India is one of the top markets for biopower with an aggregated installed capacity of over 4000 MW. Annual addition of biopower capacity is over.
400 MW mostly by bagasse-based cogeneration in sugar mills. Most of this capacity addition has been realised through the private sector, which testifies to the effectiveness of the Ministry’s efforts.

Today, biomass power is a home-grown industry, which has facilities for manufacturing of requisite plant and machinery, capacity to build, operation and maintenance of the power plants, and absorption of new technologies/processes. Indian gasifier manufacturers are exporting their systems to both developed and developing countries. Biomass-based boilers are also exported by the Indian industries to a number of countries.

In spite of the achievements, the sector has witnessed a slowdown in the past couple of years. What are the main challenges faced by the sector today?

I agree. In spite of the inherent benefits and potential for power generation in the country, the growth in this sector is static. In the case of biomass power, there is price of fuel unlike solar, wind, and hydro. The compelling barriers and challenges faced by the sector are (a) biomass fuel prices; (b) binding long duration power purchase agreements; (c) cumbersome processes followed by the states for granting statutory approvals/clearances, and allotment of the projects; and (d) non-availability of low-cost financing and unviable tariff offered by the states.

Moreover, increasing prices of conventional fuel, mainly coal and furnace oil, have made biomass a very viable option for use in furnaces and boilers in small and medium industries. This has resulted in steep and fast escalation of biomass prices. At the same time, revision of tariff by state electricity regulatory commissions has not kept pace with the increasing cost of biomass, making large capacity power plants commercially unsustainable. Hence, change in tariff based on prevailing fuel cost is emerging as one of the key barriers to the faster growth of the sector.

The Central Electricity Regulatory Commission (CERC) has recently announced revised guidelines for tariff determination for biomass plants. Are you satisfied with these revised guidelines? What is the significance of these revised guidelines?

The revised regulations notified by CERC in May 2014 for biomass is a very welcome and timely step in our efforts to resolve various problems faced by biomass developers in the sustained operation of their power plants.

A few key steps taken by the Ministry…

Increase in the annual budget 1st Renewable Energy Global Investment Meet (RE-INVEST) in February 2015

Revised the solar power target to 100,000 MW by 2019–20

Launched two new schemes in the area of solar energy

Memoranda of Understanding (MoUs) with a consortium of partners for a 100 MW offshore wind project

Established Association of State Nodal Agencies

I am happy that the Commission has acknowledged and recognised the issues and collected actual field-level information/data from various stakeholders and performed systematic analysis of various technical, financial, and operational parameters before approving normative values to these parameters critical for determination of generic tariff for biomass power. The parameters considered were (a) capital cost, (b) O&M cost, (c) auxiliary consumption, (d) station heat rate, and (e) calorific value. Another important recommendation was to revise the fuel price annually based on an independent survey.

Most of the states have already revised their tariff for biomass or they are in the process of revising the same. This will give the required impetus for revival of the existing plants and further growth of the sector.

What are the additional steps taken by the Ministry to steer the biomass power sector in testing times to achieve accelerated and sustained growth?

For the sector to move forward, it requires conducive and investor-friendly policy and regulatory frameworks, alternate means for ensuring required quantity of fuel supply for sustained operation of plants, and revives the confidence of financial institutions in the sector. To achieve some of these, the Ministry has constituted a Working Group under the chairmanship of Advisor (Biomass) and representatives of the Indian Biomass Power Association (IBPA) as members to identify key barriers and challenges in the sector and to take appropriate actions to address the same.

Apart from interaction with regulatory commissions, the Working Group is also in close dialogue with financial institutions for their support in extending debt at reasonable rate of interest to the existing as well as new developers and with state nodal agencies for reassessment of biomass potential and review of procedures for granting statutory approvals for establishment of projects.

Under the ongoing MNRE–UNDP/GEF Biomass Power Project, studies/pilot demonstration projects for (1) creating infrastructure for harvesting, collection, processing, and transport of biomass from the field to plants site (decentralised biomass depots); (2) dedicated energy plantation on wastelands; and (3) integration of solar thermal with existing biomass power plant have also been taken up to develop best practices for strengthening biomass supply/sustainability of the power plants.

I am confident that these measures will not only help accelerate new investments in the sector but also deploy more biomass power plants in the country.
INTRODUCTION
The rationale for utilising biomass for electrical power generation, in India as well as in other countries, has been based on concerns for sustainability, regional growth prospects, and availability of biomass locally at low prices. However, almost all such projects have run into problems of managing a sustainable supply of biomass over long periods. Several projects/programmes had to be restructured or closed. The dendro thermal projects in the Philippines in the early eighties, recent dendro thermal projects in Sri Lanka, and several demonstration programmes of the Ministry of New and Renewable Energy (MNRE) are some examples. Even in programmes designed for cooking (biogas) and decentralised power (through biomass gasification), making biomass of desired quality available at the plant site at low prices has been an indomitable hurdle. Some examples in this category are the Community Biogas Programme (CBP) and the Village Energy Security Programme (VES/P) of MNRE. The loans given to project developers by Indian Renewable Energy Development Agency (IREDA) had remained largely unrecovered, pushing up the non-performing assets (NPAs) of IREDA substantially. The common reasons given for failure or under-performance of the plants had been: seasonal variation of biomass availability, high transportation costs for biomass, greed of suppliers (farmers and contractors), low tariffs given to biomass power or wrong design of the project/programme itself.

On the other hand, all estimates made for availability of biomass show that the potential is indeed very large. This article attempts to review existing knowledge of biomass markets and supply chains and examines the possibility of formalising biomass trade through appropriate policy measures.
REVIEW OF BIOMASS MARKET STRUCTURES/Mechanisms

It is well known that there exist informal and local/regional biomass market networks in India. But they have not been well researched or documented. A large number of small and micro enterprises such as silk reeling, textile dyeing, khoya making, cardamom curing, tobacco curing, food processing, brick/tile making, etc. continue to rely on firewood and agro residues for their process heat requirements.

Interactions with many of these industries revealed that informal biomass trade was quite active. While some of the trade practices are probably based on illegal forest clearings, many are based on procuring biomass from wastelands and private lands. There is also a flourishing trade in residues such as rice husk. It is not clear what the trade nodes are or how the price of biomass is fixed. A large number of existing biomass power plants also seem to rely on these local networks.

The problem, however, is that unlike the small and micro enterprises that may operate seasonally (e.g., cardamom curing), or use commercial energy sources like fuel oil or LPG (dyeing, food processing) when biomass is not available at the desired price, the profits of a biomass power producer depend heavily on operating the plant at a high plant load factor (PLF), which means that biomass should be available on a 24x7 basis.

I once met a biomass power producer who had to contend with using 17 different biomass fuels in a year, based on their availability and price. He had to make continuous adjustments to the grate system in order to change over to each different biomass type. Naturally, the biomass power plant became a costly experiment rather than a profitable venture.

Another power producer based in Haryana tried several ingenious methods of procuring biomass. These included daily auctions of biomass at the plant site and providing soft loans to unemployed rural youth to purchase tractor-trailers for transporting the biomass.

The pulp and paper industry also relies on biomass. It is worth studying how the industry manages to procure biomass. Ballarpur Industries Ltd seems to have successfully created a supply chain consisting of small and marginal farmers for growing and supplying pulp wood for the factory. It had a goal of procuring 87,500 tonnes of wood from 5000 small and marginal farmers in three different states. This amount of firewood consumption is equivalent to running a biomass power plant of capacity 8.3 MW at a PLF of 80%. An experiment such as this is probably unaffordable and impractical for a biomass power producer. Also, it is doubtful that a programme like this could benefit the small farmer.

Take a power producer operating a 10 MW plant that sources fuel wood or biomass from 5000 small and marginal farmers. The wood supplied by each farmer would be about 21 tonnes per year. Assuming that the wood is procured at Rs 2000/tonne, the turnover of each farmer would be Rs 42,048 per year, and if the farmer has to make a decent profit of 15%, his annual profit would be Rs 5485 per year, which does not seem to be attractive.

Let us now see what would be the number of farmers needed to support a 10 MW power plant and their probable incomes from selling biomass if the plant is based on agro residues. Assume that the plant is based on mustard stalks produced in Haryana. The average yield of mustard stalks can be calculated to be about 2.3 tonnes/ha. The average land holding in Haryana is about 2.23 ha. Based on these numbers, the number of small/marginal farmers needed to be integrated into the stalk supply chain will be a whopping 20,500. The average income to the farmer, without taking into consideration the collection and transportation costs, will be about Rs 10,300 per year. If some agents are involved in the procurement of biomass, there will be some commissions. Hence, the actual income for the farmer can be realistically calculated as about 50% of the above number, or about Rs 5150 per year, which is again not very attractive.
RELATION BETWEEN SCALE, BIOMASS VARIATION, AND BIOMASS COLLECTION/TRANSPORTATION ISSUES

The numbers worked out in the above section show one thing: there is not much money to be made by the small farmer. This means that it does not make much sense to build a complex network for biomass collection and transportation, as the small farmer making such low income may or may not be inclined to continue to supply biomass. Of course, if the selling price of biomass is increased, there would be higher profits and thus higher incentives for the farmers. But then the biomass power could become unviable with the existing tariffs. This argument points out that relying on a large number of small biomass suppliers does not seem to be a sustainable option for the power producer. A logical conclusion is that the power producer will have to depend on a small number of large producers. These can either be large farmers or large producers of biomass such as rice mills.

Even if the small farmers are integrated into the biomass supply chain, they would most likely be supplying different biomass materials, which can pose a severe technical problem for the plant operation. Also, several field residues like rice straw and sugar cane leaves have a low bulk density, so the transportation becomes expensive. This points out the desirability of fixing a narrow range of biomass fuels for trouble-free operation of the plant. The big question is: What should be the rationale for determining the prices of different biomass materials? Considering that biomass has a large variation of bulk densities, calorific values, ash contents, etc., how does one decide the prices? This aspect is considered in the next section.

RATIONALE FOR FUTURE BIOMASS PRICE STRUCTURES

In 2012, the Central Electricity Regulatory Commission (CERC) constituted a committee to visit several biomass power plants and examine various issues, including biomass prices. The prices of biomass considered in the tariff order at that time were as follows:

<table>
<thead>
<tr>
<th>State</th>
<th>Price (Rs/tonne)</th>
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<tbody>
<tr>
<td>Andhra</td>
<td>2315</td>
</tr>
<tr>
<td>Haryana</td>
<td>2635</td>
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<tr>
<td>Maharashtra</td>
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<td>Rajasthan</td>
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<tr>
<td>Tamil Nadu</td>
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</tr>
<tr>
<td>Uttar Pradesh</td>
<td>2355</td>
</tr>
<tr>
<td>Other states</td>
<td>2476</td>
</tr>
</tbody>
</table>

It can be seen that a single price has been assigned to all biomass materials in a given state irrespective of type, ash content, bulk density (which affects cost of transportation), etc. These figures seem to be averages based on available information. The committee also observed that:

‘After detailed examination, the Committee felt that the challenges being faced by the biomass plants primarily stem out of fuel related issues, viz.: lack of availability of surplus biomass, poor quality of biomass fuel, inadequate fuel collection, distribution and supply mechanism, competitive buyers of biomass and price rise, resulting into usage of waste biomass and lower plant load factor.’

The committee, however, did not revise the biomass prices nor recommended a way of deciding on the prices. Instead, it recommended that the biomass price ‘be decided annually by a committee to be formed at the state level representing State Commission, Nodal Agency, Government.’

There seems to be a strong case for developing a rational method for assigning biomass prices. One can argue that the local biomass be priced at the same rate as, for example, the costly imported coal, on a kcal to kcal basis. The formula for the price would then be:

\[ FC1 = FC2 \times \left( \frac{CV1}{CV2} \right) \]

where \( FC1 \) is the price of biomass, \( FC2 \) is the price of imported coal, \( CV1 \) is calorific value of biomass and \( CV2 \) is the calorific value of imported coal.

\( FC2 \) is about Rs 5520/tonne and \( CV2 \) is about 5600 kcal/kg. Mustard stalks have a calorific value of 3470 kcal/kg. The price of mustard stalks can then be calculated as Rs 4140/kg. Similarly, paddy straw, which has a calorific value of 3470 kcal/kg would then be priced at Rs 3420/kg.

The heat rate of a biomass power plant, however, is higher than that of a conventional coal thermal plant. This is because the efficiency of a conventional thermal power plant is higher than that of a small biomass power plant. If one
India Likely to be World’s Fastest Growing Coal Importer

- 2011 coal-fueled generation up 9%; Thermal imports +35%
- Thermal demand expected to outpace production by >150 MTPY within five years
- 70 GW of new coal generation expected to start in five years
  Required additional ~250 MTPY of thermal coal use over time.
- Infrastructure in 12th five Year Plan doubles prior plan to $1 million in investment

Source: Peabody Global Analytics and other industry sources

Coal imports in India are increasing steadily

Machine for harvesting field biomass residues

argues that the differences in heat rates have to be accounted for, the biomass price can be decided so as to yield the same fuel cost per kWh produced. The formula for fixing the biomass price would then be:

\[ FC_1 = FC_2 \times \left( \frac{CV_1}{CV_2} \right) \left( \frac{HR_2}{HR_1} \right) \]

where HR1 is the heat rate of the biomass power plant and HR2 is the heat rate of a conventional coal thermal power plant. CERC has fixed HR1 as 4200 kcal/kWh. The operating heat for the coal thermal plants (average) was 2861 kcal/kWh. The corresponding prices for mustard stalk and rice straw would then be Rs 2820/kg and Rs 2329/kg, respectively.

It is a matter of discussions and negotiations to arrive at suitable numbers for all the above parameters.

DENSIFICATION AS A MEANS OF WIDENING AND STABILIZING BIOMASS MARKETS: LESSONS FROM THE EUROPEAN PELLETIZATION EXPERIENCE

One of the major problems faced by biomass power producers is to cope with non-standard fuel in otherwise standard machinery and equipment. The grate, air supply mechanism, boiler, recuperators, etc. would have been designed for firing a particular fuel. If the fuel quality changes widely throughout the year, it can cause a huge problem in the operation and maintenance of the entire plant. Hence, having a very wide range in the biomass grades is not a good idea from the plant engineer’s perspective.

One way of avoiding this problem is to promote pelletisation in a big way. In the late 1980s and early 1990s, briquetting machines operating on a ram and piston mechanism, or a screw press mechanism had been developed and promoted. Several briquette manufacturers had come on the scene and at one time, the total amount of briquetted biomass sold was about 1 million tonnes per year. However, briquetting as an enterprise could not grow, mainly because of severe operation and maintenance problems owing to rapid wear and tear of the machine parts.

The European biomass pelletisation programme, however, had been a phenomenal success. Pellet use for residential heating, cooking, and power generation is now well integrated into the energy infrastructure of several European countries. As the fuel got standardised, a large range of equipment (for conveying, burning, ash handling, pollution control, etc.) also got standardised, leading to substantial market growth in this sector. Pellet sales reached about 10 million tonnes in 2011 and Europe’s first exchange for
trading biomass pellets was launched in November 2011 in the port of Rotterdam. A similar programme in India will probably be very different, as the biomass suppliers would be very large. There would be a need to develop decentralised, small-scale pelleting equipment to cater to the large number of rural biomass suppliers. However, if such a programme could be initiated and supported, biomass markets could grow very fast.

**CONCLUSIONS**

To sum up, efforts to create a free trade in biomass would not only alleviate the problems of the biomass power producers, but could also release the untapped biomass potential of the country. Actions such as formulating different grades of biomass, evolving a rational basis for fixing the price of biomass of each grade, announcing MSPs for different grades, facilitating the formation of biomass cooperatives, and promoting biomass pelletisation would go a long way in integrating biomass into the energy mix of the country.

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**23rd European Biomass Conference and Exhibition (EUBCE) 2015**

1–4 June 2015, Vienna, Austria

The EUBCE is Europe’s largest international conference focused on biomass combining a highly-respected international scientific conference with an industrial exhibition and gathers participants from research, industry, policy and business of biomass. It highlights progress in research, technological development and production processes. It brings together all key specialists to make it the most important international platform for dialogue between research, industry, research and industry, and policy in the biomass sector.

**Submit your abstracts by 27 October 2014**

Covering the entire range of the biomass value chain, including research, technologies and applications, the Conference Programme is focusing on the most recent scientific, technological and market-related developments. The Conference will be structured along the following main subjects:

1. **Biomass Resources**
2. **Biomass Conversion Technologies for Heating, Cooling, and Electricity**
3. **Biomass Conversion Technologies for Liquid and Gaseous Fuels, Chemicals, and Materials**
4. **Biomass Policies, Markets, and Sustainability**
5. **Bioenergy in Integrated Energy Systems**

All professionals from biomass and related industries are invited and encouraged to submit their abstracts. For more details, please visit [www.eubce.com](http://www.eubce.com).
INTRODUCTION
Orient Green Power Company Limited (OGPL) is a leading independent renewable energy-based power generation company focused on developing, owning, and operating a diversified portfolio of renewable energy power plants. Currently its portfolio includes biomass, biogas, and wind energy projects at various stages of development.

As of April 2014, our total portfolio of operating assets included 510.355 MW of aggregate installed capacity, which comprises 424.355 MW of wind energy projects and 86 MW biomass projects. We have a diverse customer base with a mixture of off-take arrangements. Our customers include state electricity boards (SEBs), distribution companies, and private, commercial, and industrial consumers.

This case study provides a brief description of a 10 MW biomass-based power plant that uses coconut fronds as the primary fuel with details of its location, capacity, biomass sourcing, fuel collection strategy, incorporated improvements, problems faced during operation, cost of power generation and power purchase tariff, employment, and socio-economic development in the region. OGPL has the credential of constructing and operating the world’s first biomass power plant with coconut tree wastes as the predominant fuel.
Location
The 10 MW biomass power plant is located in Kariyanchettipalayam Village, Pollachi Taluk, Coimbatore District of Tamil Nadu. The biomass storage yard is spread over 10 acres.

Capacity of the plant
The power plant has a capacity of 10 MW with a generation capacity of about 75 million units annually, of which 67.5 million units can be evacuated; the rest (10% of the total) gets consumed as auxiliary power requirement within the plant.

Commissioning date
The plant was commissioned and synchronised with the grid during the month of July 2011, with 110 kV connectivity.

Investment
The total investment of the project was Rs 6638 lakh with the loan availed from the State Bank of India to establish the plant. As of FY 2014, the debt is about Rs 2400 lakh. The Ministry of New and Renewable Energy (MNRE) provided capital subsidy assistance of Rs 88.5 lakh.

Biomass sourcing
As per the biomass assessment done in June 2009, coconut residues were found to be the major form of biomass available in the district of Coimbatore. Coconut residue generation is estimated to be 1,285,536 MT per annum, and after local consumption the estimated surplus is 385,661 MT, which is about 300% of our annual requirement.

About 450 tonnes of agriculture waste is required per day to generate electricity for the 10 MW power plant. The biomass price varies from Rs 800 to Rs 2800 per tonne depending on the type, moisture wetness, and season. The average biomass price last year was Rs 1880 per tonne. The total biomass required per year is about 140,000 tonnes. Last year the biomass used included juliflora (40,000 tonnes); coconut waste (60,000 tonnes); and agro industrial waste like saw mill waste, plywood waste, sawdust, bagasse, wood bark, paddy husk (40,000 tonnes). Biomass stock was stored in the covered and uncovered storage yard. The covered storage yard is 80 x 65 x 15 m. Although a large quantity of biomass is stored in the open, storage

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<th>Fuel cost (Rs/MT)</th>
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<td>2500</td>
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Coconut frond collection
under cover helps to reduce decay and avoids getting wet, especially in rainy season. Appropriate storage of biomass is important to ensure good plant load factor (PLF).

Biomass is sourced directly from farmers and through suppliers. For example, coconut fronds are sourced by small trucks with a holding capacity of 5 to 10 quintals. About 20 small truckloads of biomass are procured in this mode. The families who collect and transport the biomass earn about Rs 400 to 500 per truckload. A few families also pick up one to two quintals and transport them in small carts to the plant and get paid according to weight.

We are also planning to source a share of our biomass from captive energy plantations. We estimate that plantation intercropping (Gliricidia in coconut groves) in about 5000 acres of coconut farms (yielding 7.5 tonnes per acre per year) can supply 30% of our annual biomass requirement. This is expected to earn additional revenue for farmers from their lands.

**Problem faced by the plant during fuel collection**

- Brick kiln owners and process industries are availing the available biomass by offering higher prices; they can afford to pay more since the marginal increase in the price of biomass is still lower than the cost of coal.
- Moisture content increases during the monsoon season so the transportation costs increase.
- Lack of proper and safe covered storage at the site for the large quantity of biomass.
- Risk of fire due to storage in open yard.
- Higher insurance cost due to open storage.

**IMPROVEMENTS EMPLOYED IN THE OPERATION OF BIOMASS POWER PLANT**

**Fuel mix optimisation**

The fuel mix is continually improved so as to achieve the most appropriate mix taking into consideration the availability and acceptability of the fuels. Cheaply available fuel contains more moisture, sand, etc., while fuels with high gross calorific value as received are costly. Levelling the floors and providing a roof in the processed fuel areas have
helped to ensure more or less uniform characteristic fuel feed to the boiler. The addition of proper sized equipment for fuel preparation has also helped to maintain a uniform fuel feed to the boiler, and has helped to increase the use of inexpensive and available dirty fuels such as coconut fronds.

**Modifications made**

1. The following modifications at the design stage have been carried out and have resulted positively in extending the operating hours of the boiler. 
   - Change of material of construction for super heater - T11/T22 with TP 347 H
   - Increased clearances between the gooseneck and the coil
   - Increased pitch and provision of additional soot blowers
   - Interchanging position of primary and secondary super heater coils
2. The material for construction of the super heater coil was experimentally changed with one that contains more chromium and nickel. This was expected to extend the mean time between failures and has proved successful due to increased resistance to corrosion and to ash deposits on its surface. Because of this, the mean time between failures of super heater coils has increased, which resulted in increased PLF.
3. Arrangements to drain the build-up of ash in the gooseneck area and increase the frequency of soot blowing also helped to increase the performance of the boiler.
4. Variable frequency drives introduced for major equipment like FD, ID, and SA fans to reduce home load.
5. Dedicated shredders were developed and the lengthy coconut fronds were chopped uniformly to 2” lengths for better feeding into the boiler.
6. Accurate online measurement was introduced in the feeding belt for fuel.

**Employment and socio-economic development in the region**

The project has generated employment for the rural poor. They work in the collection, processing, and supply of the biomass fuels used. The plant employs about 45 people on a continuous basis for plant operation and maintenance. We also employ about 120 people in our biomass processing/feeding and in fuel yard management. About 500 people in the villages also find employment in sourcing biomass. It may be noted that a manufacturing enterprise with similar turnover may provide employment to only about 80 people in total.

**Lessons learned**

Though the plant was designed to use maximum quantity of coconut wastes, during the initial years of operation the plant had to be operated with more wood and juliflora. Because of this, the average fuel cost spiralled up to Rs 2500 per MT and the moisture content was 40%. The operation at this level of moisture neither yielded good efficiency nor economic viability and the plant continued to run at a loss. The fuel cost was almost Rs 5.00 per unit, and the tariff for sale was only Rs 6.50 per unit.

Because biomass fuels like juliflora, waste wood, and plywood wastes were being used by other industries, predominantly the dyeing units in the garment belt of Tirupur, the availability of biomass was an issue. Hence the decision was made to maximize the use of coconut fronds with proper chipping equipment installed. Currently the plant consumes almost 60% of its fuel requirement from coconut fronds.

The average cost of the fuel mix with 60% chipped coconut fronds is around Rs 1800 per unit with specific fuel consumption of 2.2 kg/unit. With this, the fuel cost per unit has been brought down to Rs 4.00–4.25 per unit, so the plant is now at least breaking even.

The typical problem of super heater coil scaling/corrosion of a biomass power plant was faced with minimum down time with elongated mean time between failures, even after the usage of coconut tree wastes, which normally has higher alkali and chloride content when compared with other biomass. The plant could be operated at more than 80% PLF using 60% coconut fronds. With the energy crops in place along with the current fuel mix with the same moisture content at 40%, it would be possible for us to make the project viable.

R Kulothungan, Senior Vice President (Biomass Business), Orient Green Power Company Ltd, Sigappi Achi Building, 4th Floor, No. 18/13, Rukmani Lakshmipathi Road (Marshalls Road), Egmore, Chennai - 600 008. Tel.: +91-44-4901 5678. Email: <kulothungan@orinigreenpower.com>.
Overview of Global Biomass Power Scenario

(Extract from REN21 2014 report)

INTRODUCTION

The Renewables 2014 Global Status Report documents advancements in the uptake of renewables, its transition, and the sustained efforts made to achieve ambitious targets to double the share of renewables in the global energy mix. The report also analyses the adoption of innovative policies for renewables to facilitate more rigorous share and access to clean and sustainable energy for all people. Over the past decade, continuing technology advances and rapid deployment of many renewable energy technologies (RETS) have demonstrated that their potential can be achieved.
GLOBAL RENEWABLE ENERGY SCENARIO

Renewable energy provided an estimated 19% of global final energy consumption in 2012 and continued to grow in 2013. Of this total share in 2012, modern renewables accounted for approximately 10%, with the remainder, estimated at just over 9%, coming from traditional biomass.

Traditional biomass is currently used primarily for cooking and heating in remote and rural areas of developing countries. The combined and modern renewable energy share remained about the level of 2011, even as the share of modern renewables increased. The breakdown of modern renewables as a share of total final energy use in 2012 was as follows: hydro-power generated an estimated 30.8%, other renewable power sources comprised 12.2%, heat energy accounted for 4.2%, and transport biofuels provided about 0.8%. Modern renewable energy is increasingly being used in four distinct markets: power generation, heating and cooling, transport fuels, and rural/off-grid energy services.

In 2013, renewables faced declining policy support and uncertainty in many European countries and in the United States (US). However, markets, manufacturing, and investment expanded in developing countries, and it became evident that renewables are no longer dependent on a handful of countries. As markets have become more global, renewable energy industries have responded by increasing their flexibility, diversifying their products and developing global supply chains.

The most significant growth occurred in the power sector, with global capacity exceeding 1560 GW, up more than 8% over 2012. Hydro power rose by 4% to approximately 1000 GW, and other renewables collectively grew nearly 17% to more than 560 GW. For the first time the capacity share of solar photovoltaics (PV) grew more than wind power.

Investment in India in 2013 fell to just under half of the peak recorded in 2011 (USD 12.5 billion). Almost the entire decline was due to a slowdown in asset finance, which was particularly apparent in the solar power market. Thailand, Hong Kong, and the Philippines dominated investment in renewable energy. The largest investors are South Africa, Kenya, Mauritius and Burkina Faso, followed by Australia, Italy, Denmark, France, Greece, the Netherlands, Sweden, and Switzerland.

THE GLOBAL BIOMASS SCENARIO

Biomass demand and consumption continues to grow steadily in the heat and electricity, power and transport sectors. Approximately 60% of total biomass used for energy purposes is traditional biomass—fuel wood (some converted to charcoal), crop residues, and animal dung. The remaining biomass used for modern bioenergy is produced from a variety of biomass resources, including organic wastes, purpose-grown energy crops, and algae. They are used for energy services such as lighting, communication, heating, cooling, and mobility.

The report estimates the total primary consumption of biomass to be approximately 57 exajoules (EJ) in 2013, including approximately 13 EJ to supply heat in the building and industry sector, and 5 EJ converted to produce around 110 billion litres of biofuels and a similar amount used to generate an estimated 405 TWh (terawatt-hours) of electricity.

The report states that global biopower generation has exceeded 400 TWh, including power generated in combined heat and power plants. Demand for modern biomass is driving increased international trade in solid

**Some Highlights of 2013**

- India announced plans to more than double its renewables capacity from 25 GW in 2012 to 55 GW by 2017.
- The top countries for non-hydro capacity were again China, the US, and Germany, followed by Spain, Italy, and India.
- In the European Union, renewables represented the majority of new electric generating capacity for the sixth consecutive year.
- Even as global investment in solar PV declined nearly 22%, relative to 2012, new capacity installation increased by about 32%.
- China’s new renewable power capacity surpassed new fossil fuel and nuclear capacity for the first time.
- Variable renewables achieved high levels of penetration in several countries.
- Wind power was excluded from one of Brazil’s national auctions because it was pricing all other generation sources out of the market.
- Denmark banned the use of fossil fuel-fired boilers in new buildings as of 2013 and aims for renewables to provide almost 40% of total heat supply by 2020.
- A growing number of cities, states, and regions seek to transition to 100% renewable energy in either individual sectors or economy-wide.
biofuels, including wood pellets and chips. Liquid biofuels met about 2.3% of global transport fuel demand. Biodiesel rose to about 11% and hydro-treated vegetable oil rose by 16%. New plants were commissioned for making advanced biofuels produced from non-food biomass feedstock.

**BIOENERGY INDUSTRY AND MARKETS**

Use of modern biomass is spreading rapidly, particularly in Asia. Europe remained the world’s largest consumer of modern bioheat, produced for district heating networks, and sale into networks. The use of biomass, including pellets, for heat production is increasing in North America. In the US, the northeastern states are the largest domestic market for consumption of wood pellets for heating. Biomass is meeting a growing share of energy demand in many countries and accounts for a significant portion of total energy in some countries (Sweden, Finland, Latvia, and Estonia).

The US is the top producer of electricity from biomass (they added nearly 15.8 GW of biopower capacity in 2013) followed by Germany (8 GW), China (6.2 GW, excluding 2.3 GW of waste to energy combustion), and Brazil (11.4 GW), followed by India, the United Kingdom, Italy, and Sweden. India was also one of the top markets in 2013, adding about 0.4 GW of biopower capacity, mostly by bagasse-based combined heat and power plants to reach a total of 4.4 GW by year end. However, India’s capacity additions were around 40% below those in 2012 and around 10% below the national target.

Global biofuel consumption and production increased 7% in 2013. North America remained the top region for production and consumption of ethanol, followed by Latin America. Once again Europe produced and consumed the largest share of biodiesel. In Asia, production of both ethanol and biodiesel continues to increase rapidly, and Thailand continues its rapid expansion of biofuel production. Global ethanol production was dominated (once again) by the US and Brazil and accounted for 8% of the global total. The European Union has been the largest regional biodiesel producer for years.

Biogas is increasingly being used for heat production. In developed countries, it is used primarily in combined heat and power plants with relatively small amounts used in heat-only plants. In Europe most of the biogas is used on-site or traded locally. The small remainder is used by the transport sector, but is first upgraded to biomethane, with limited volumes being traded among European Union member states through the natural gas grid. A large number of large-scale plants that run on biogas are also operating across Asia and Africa for industrial heat process. Biogas is produced in small domestic-scale digesters mainly in China, India, Nepal, and Rwanda, and is combusted directly to provide heat for cooking. An estimated biopower capacity of 88 GW is in operation.

The bioenergy trade is based on a variety of potential feedstock suppliers and processors, firms delivering biomass to end users, manufacturers and distributors specialising in biomass

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Biomass resources and energy pathways

*Source: REN21 Report 2014, p. 31*
Average annual growth rates of renewable energy capacity and biofuels production end 2008–2013

Source: REN21 report 2014, p. 22

INVESTMENT FLOW
Bioenergy accounted for a large share of total renewable energy investments, representing 29% in 2007. By contrast, in 2013 it made up only 6% with biomass and waste to energy seeing their lowest investment level since 2005 and biofuels the lowest since 2004. Developing and developed countries alike saw relative reduction in investment in 2012. The exception were the Americas, excluding the US and Brazil, and Asia-Oceania excluding China and India where annual investment in renewable energy continued its uninterrupted rise. Notably, global research and development investment was up slightly for biopower and stable for biofuels.

POLICY LANDSCAPE
For the first time, the report presents a brief overview of the new policy developments but does not give much assessment or analysis of specific policies relating to bioenergy. This sector still lags far behind, requiring much more attention from policy-makers. There is a relative slow policy adoption in the heat sector. Few countries enacted new standards for renewable heat or in the transport sector, with the focus being to support the production and promotion of biofuels. Use of fiscal incentives and public financing for the biofuels industry continues to expand; for example, Brazil offered tax credits and provided low interest loans for ethanol producers, Poland and the US supported advanced development of algae-based biofuels. Widespread acceptance and dissemination of biogas technologies are yet to materialise in many countries mainly due to high capital cost, which made even small-scale units unaffordable for poor households. However, domestic-scale biogas installations have surged in some countries in recent years driven by a number of international programmes. A number of countries revised existing targets for biomass power harvesting, handling, and storage equipment, including manufacturers of appliances and hardware components designed for converting biomass to energy. Many companies are actively engaged in supplying equipment and bioenergy plants that convert biomass—mainly of wood pellets and chips—for heating and electricity.

Global new investment in renewable energy by technology, Developed and developing countries, 2013

Source: REN21 Report 2014, p. 70
capacity and generation during the year with most targets increasing. Most of the renewable energy support policies that were enacted or revised during 2013 focused on the power sector, as in the past year. Thailand increased its existing long-term targets for electricity from solid biomass agricultural waste to energy, solar, and wind power.

In Europe, Portugal enacted a number of technology-specific targets for cumulative electric capacity by 2020, including 769 MW of biopower from solid biomass. Modern biomass among other renewables represents a major portion of the energy produced with non-hydro renewables and offer vast potentials for meeting the world’s residential, commercial, and industrial heating and cooling needs.

Most policies to increase the use of renewable energy in the transport sector focus on support for the production, promotion or use of biofuels. During 2013, such policies continued to be enacted or revised by a number of countries that are using a mix of fiscal incentives and regulations. Common policies include biofuel production subsidies, biofuel blend mandates, and tax incentives. As of early 2014, blend mandates existed in 33 countries with 31 national mandates and 26 additional mandates at the state/provincial level. At the same time, biofuel support policies in Europe and the US continued to be challenged by concerns about the impacts of cultivating crops on food production, land use, biodiversity, and water.

The use of fiscal incentives and public financing for the biofuels industry continued to expand during 2013. Brazil offered a tax credit and provided low-interest loans for ethanol producers at an estimated cost of USD 480 million. In a blow to biodiesel, China instituted tax and trade duties on imported biodiesel in an effort to support domestic petroleum diesel refineries.

As local governments transform their buildings, they also seek to use renewable energy for space and industrial heating and cooling purposes. In 2013, Sydney launched a plan to achieve its 100% renewable energy targets for electricity, heating, and cooling with solar and wind power accounting for 30%. For the remainder, the city will use co- and tri-generation gas engines at the building or city block level, to be fuelled initially by natural gas but then progressively by syngas and biogas from biomass. Johannesburg, South Africa, announced plans to purchase some 175 new buses to be fuelled by biogas and biodiesel, and London, UK, announced plans to fuel city buses with biodiesel processed from used cooking oil.

**DISTRIBUTED RENEWABLE ENERGY IN DEVELOPING COUNTRIES**

This report provides a status of distributed clean biomass energy as well as financing models and supporting policies. Various actors shape the markets, including international and regional development agencies support and fund programmes. Country-level programmes planned and implemented by national governments and community-level business and practitioners who work with households directly represent most innovative operational level of distributing biomass energy and market. The installation and use of distributed renewable energy technologies in remote and rural areas for electricity, cooking, heating, and cooling increased during 2013. Thus far, most policy frameworks developed for improving energy access have emphasised electrification, with only limited focus on clean cooking, heating, and cooling. Brazil, China, India, and South Africa have taken the lead in developing large-scale off-grid renewable energy programmes that are making significant inroads into addressing the dual challenges of energy access and sustainability.

The rural heating and cooking sector has progressed due to advances in technology of clean cooking devices that rely on traditional biomass (forest fuel wood, crop residue, and animal dung), increased efficiency of the combustion process, simple anaerobic digesters technology to produce clean biogas fuel for cooking, as well as the increasing popularity of programmes that educate rural populations about the benefits of using modern biomass systems for clean cooking and water and space heating.

For example, clean cooking energy solutions are being disseminated and adopted in sub-Saharan Africa; China is a leader in the use of small-scale biogas plants; and India has supported the dissemination of clean cookstoves and revisited its national programme on improved cookstoves. Nepal has more biogas plants in use due at least in part to a multiyear government consumer subsidy. Similarly, Kenya had more biogas units in place, best suited for households and commercial farms.

In many parts of the world, lack of access to modern energy services continues to impede sustainable development. Recent assessment suggests that as many as 1.3 billion people still do not have access to electricity and more than 206 billion people rely on traditional biomass for cooking and heating. However, during 2013 people in remote and rural areas of the world continued to gain access to electricity, modern cooking, heating and cooling as the installation and use of distributed renewable energy technologies increased. Furthermore, increased use of mini grids supports the spread of renewable energy-powered electrification in unelectrified peri-urban and rural areas.

There is a growing awareness that standalone cooking and electricity systems based on renewables are often the most cost-effective options available for providing energy services to households and businesses in remote areas. As a result, an increasing number of countries are supporting the development of decentralised renewable energy-based systems to expand energy access. New companies have become active across Africa, Asia, and Latin America, selling household-level renewable energy systems and devices. Commercial lenders, social venture capitalists, local and international development entities, governments, and others are actively engaged in the financing of distributed renewable energy.

In a rising number of countries vegetable oils from coconut, jatropha and other sources are being used to displace diesel in fuel engine-powered generators. In India, Vietnam, and
elsewhere biogas produced from dry wood, weed, and rice husk is used increasingly to fuel engines, driving generator sets to supply electricity to mini grids. As part of India’s programmes to increase access to electricity, over 80 villages had operating mini grids using gasifier and locally available biomass residues (including mustard stems, corn cobs, and grasses procured from local farming by mid-2013.

To date, however, there have been very few successful cases of international large-scale deployment of improved cookstoves. Clean cookstove designs are tremendously diverse and new ones are still emerging. Biomass cookstove designs that can achieve high levels of performance include forced air and gasifier stoves, which lower emissions significantly and reduce fuel use by 40%–60% relative to an open fire. Such efficient biomass cookstoves are being sold for as little as USD 5–25 each.

Simple anaerobic digester technology can produce clean biogas fuel for cooking from animal manure, crop residue, and other organic waste feedstock. Widespread acceptance and dissemination of biogas technologies have yet to materialise in many countries; however, domestic-scale biogas installations have surged in some countries in recent years, driven by a number of international programmes.

India has supported the dissemination of clean cookstoves and revisited the programme in 2013 to find that the national programme had some success at the state level but it faced challenges nationally due to lack of consumer awareness, a dearth of sustainable financing sources, and issues related to stove quality and upkeep. India has a new clean cookstove initiative that has been well received even at the national level.

**IN CONCLUSION…**

Globally, biomass accounts for the largest portion of renewable energy production. Scenarios from early 2000 showed upward trends in investment, capacity, and integration. The share of traditional biomass in global primary energy has held steady while modern biomass has gained ground.
Renewables 2014, Global Status Report

A review of the *Renewables 2014 Global Status Report* published by the Renewable Energy Policy Network for 21st Century (REN21) reveals that renewables are becoming a mainstreamed energy resource for the global community. This report contains a comprehensive overview of the growth of renewable energy markets, industries, investments and the evolving policy development in the renewable sector worldwide.

The report also necessitates the need for changes in the ‘status quo’ of a patchwork of sometimes-contradictory policies and actions. The report has sections on:

1. Global Overview;
2. Market and Industry Trends;
3. Investment Flows;
4. Policy Landscapes;
5. Distributed Renewable Energy in Developing Countries; and
6. Tracking the Global Energy Transitions.

Sections of the report reflect views that call for essential technology and market development, improved financial models and predictable energy policies. These must be systematically linked across public and private sectors of renewable energy, in order to support and drive the transition process of mainstreaming modern and traditional renewable energy. Notably, the report advocates for policy makers to play a role in provisioning of energy services and to increase the current pace of deployment to achieve a 100% renewables future with full energy access to all.

The report covers the biomass energy scenario, especially in the Market and Industry Trends and Distributed Renewable Energy in Developing Countries sections. Input from local experts, primarily from developing countries, illustrates how renewables like biomass are providing needed energy services like cooking, heating/cooling, and electricity technologies and contributing to a better quality of life.

It highlights global perspectives of increased interest on biomass consumption for provision of heat and electricity with focus on bioenergy industry. The report raises concerns about sustainability and having to define new guidelines and regulations for bioenergy. Industries have responded by adopting a number of initiatives by the sector (e.g., for solid biomass in the EU), for power and heat through the Sustainable Biomass Partnership; by feedstock (e.g., the Roundtable for Sustainable Palm Oil); and by fuel (e.g., the Renewable Fuels Association).

The report underscores India’s lead in the market for solar thermal heating and cooling, share in demand of renewable heat for industrial purposes, biogas production for heat and cooking and developing off-grid renewable energy programmes. These sectors are making significant inroads to address dual challenges of energy access and sustainability by inclusion into long-term rural electrification programmes that are supported politically and backed by substantial public resource allocations.

The report has highlighted new and different challenges of how renewable energy markets and industries are to mature and how the manufacturing sector of modern and traditional renewable energy is to expand further if the renewable energy industries are serious about ensuring access to clean and sustainable energy, targeted by 2030.


**About REN21**

REN21, an international non-profit association, is the global renewable energy policy multi-stakeholder network that connects a wide range of key actors from governments, international organizations, industry associations, and science and academia as well as civil society. REN21 facilitates knowledge exchange, policy development and joint action towards a rapid global transition to renewable energy. It promotes renewable energy to meet the needs of both industrialized and developing countries that are driven by climate change, energy security, development and poverty alleviation.

The REN21 Secretariat operates from offices in Paris, France, that are located at the United Nations Environment Programme (UNEP) and is headed by REN21’s Executive Secretary.
CERC/SERC determined tariff applicable for biomass power plants (combustion, cogeneration, gasification, and biogas-based system) in various states of India (updated as on 31 October 2014)

State-wise tariff determined by CERC

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State-wise tariff determined by respective Sercs

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CERC/SERC determined tariff applicable for biomass power plants (combustion, cogeneration, gasification, and biogas-based system) in various states of India (updated as on 31 October 2014)

<table>
<thead>
<tr>
<th>State</th>
<th>Tariff Order</th>
<th>Year of Commissioning</th>
<th>Biomass Power</th>
<th>Biomass Cogen</th>
<th>Gasification</th>
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Tamil Nadu Electricity Regulatory Commission had issued the third tariff order (No. 8 of 2012) with regard to Biomass, dated 31 July 2012, with validity for the control period of 2 years till 31 July 2014. As the time of expiry neared, the TNERC issued a concept paper seeking the views and suggestions of stakeholders vis-à-vis tariff for the next control period. A brief summary of the same is presented below.

**Applicability of the Order/Tariff period**
The ensuing tariff order would be applicable for a period of 2 years from the date of issue and the tariff period would be for 20 years; and it would continue with ‘Cost Plus Two Part Tariff’.

**Capital cost per MW**
The Commission in its earlier Order had assumed Rs 4.45 crore/MW as the capital investment based on the capital cost specified by the Central Electricity Regulatory Commission (CERC). Considering the general increase in capital cost, it suggests that the capital cost be Rs 4.80 crore/MW. The Commission also apportions the capital costs on machineries, land and civil works at 85% and 15%, respectively.

**Plant load factor**
The Commission seeks to retain the plant load factor (PLF) at 80%.

**Debt–equity ratio**
Following the established norm, the Commission proposes to continue with the debt–equity ratio of 70:30.

**Term of loan**
It has been proposed to retain the tenure of term loans at 10 years with a moratorium of one year.

**Interest rate on loan**
The Commission had adopted an interest rate on term loan of 12.5% p.a. in its earlier Order. As the interest rates have increased in the market, it proposes to adopt 12.7% as specified by the CERC for the next control period.

**Return on equity**
The Commission, in its Orders issued during 2009, considered 19.85% (pre-tax) return on equity (RoE). In its 2012 Orders, it adopted RoE of 19.85% (pre-tax) without linking it to MAT and IT. It now proposes to adopt RoE of 20% p.a. (pre-tax) without linking it to MAT and IT.

**Life of plant and machinery; depreciation**
The Commission proposes to continue with 20 years as life of the plant and machinery, as specified in its earlier Order. It also proposes to continue with depreciation at 4.5% p.a. The SLM on plant and machinery by considering 85% of the capital cost, while the accumulated depreciation would be limited to 90% of the plant and machinery.

**Operation and maintenance expenses per year**
The Commission suggests that the operation and maintenance (O&M) expenses be increased from the previous 4.5% to 5% of the capital cost, with
escalation of 5.72%, from second year, on plant and machinery by considering 85% of the capital cost as the cost of plant and machinery. As regards land and civil works, which constitutes 15% of the capital investment, 0.90% of 15% of capital cost would be allowed as O&M expenditure every year, with annual escalation of 5.72%.

Station heat rate and gross calorific value of the fuel
The Commission proposes to retain the station heat rate (SHR) at 3840 kcal/kWh and the gross calorific value (GCV) at 3200 kcal/kg as specified in its earlier Order.

Specific fuel consumption
The specific fuel consumption for the next control period has been proposed at 1.2 kg/kWh.

Fuel cost
Currently, the CERC in its Order of 15 May 2014 revised the fuel cost to Rs 2706.03 with 5% escalation. Considering the rise of fuel cost in the market, the Commission seeks to go by the revised figures of the CERC.

Components of and interest on working capital
The Commission proposes to continue with the same norms for working capital: one month each for fuel stock, O&M expenses, and receivables. Also, the Commission seeks to adopt the interest rate at 13.2%, specified by the CERC in its Order dated 15 May 2014, for the next control period.

Auxiliary consumption, transmission and wheeling charges, scheduling and system operation charges
The Commission seeks to retain auxiliary consumption at 10% and proposes to continue with 50% of the transmission charges and 50% of the wheeling charges of conventional power to the non-conventional energy sources.

As regards scheduling and system operation charges, the Commission proposes to adopt 50% of the applicable conventional power charges.

Cross-subsidy surcharge
It has been proposed that 50% of the applicable cross-subsidy surcharge for biomass-based power generating projects would continue.

Clean development mechanism benefits
Clean development mechanism (CDM) benefits, as before, would be shared on gross basis starting from 100% to developers in the first year and thereafter reducing by 10% every year till the sharing becomes equal (50:50) between the developer and the consumer in the sixth year. Thereafter, the sharing of CDM benefits would remain equal till the benefits accrue.

Reactive power charges
The Commission has decided to adopt the reactive power charges for biomass power plants as specified in its Order on Open Access charges issued from time to time.

Grid availability charges
The charges for start-up power of generators are proposed as per the Commission’s Grid Connectivity and Intra-State Open Access Regulations 2014.

Adjustment of generated energy
The Commission proposes to continue with the adjustment of generated energy as per the Commission’s Open Access Regulations and related orders in force.

Application fees and agreement fees; Billing and payments; payment security and security deposit; power factor; metering; connectivity and evacuation of energy; energy purchase and wheeling agreement; scheduling of power
The Commission proposes to retain the charges and procedures specified in its Order dated 31 July 2012 for the next control period.

Tariff (variable cost/fixed cost)
The variable cost for the financial year 2014/15 has been proposed at Rs 3.61 per unit and that for the financial year 2015/16 at Rs 3.79 per unit. The total cost, inclusive of fixed and variable charges, for the first year has been proposed at Rs 5.47/unit and for the second year at Rs 5.67/unit.

Tariff for the plants commissioned before 15 May 2006
The Commission has reserved its judgment regarding tariff for the plants commissioned before 15 May 2006.

(This is a summary of TNERC’s “Consultative Paper on power procurement by distribution licensee from Biomass based power plants and allied issues relating to captive use and third party sale”, 2014; and is non-binding.)
**Karnataka Electricity Regulatory Commission**


The Karnataka Electricity Regulatory Commission (KERC), in its Tariff Order dated 11 December 2009, had determined the tariff for biomass projects ranging from Rs 3.66 per unit in the first year to Rs 4.13 per unit in the tenth year. While determining this tariff, the Commission had considered fuel price at Rs 1280 per metric tonne with an escalation of 5% per annum. The above-mentioned tariff for the first year was applicable from the commercial operation date (COD) for a period of 10 years, irrespective of the date of signing the power purchase agreement (PPA); and was applicable to all PPAs submitted to the Commission on or after 1 January 2010. The tariff thus determined was subject to review after five years and is due in December 2014.

In the meantime, the Commission issued the KERC (Power Procurement from Renewable Sources by Distribution Licensee and Renewable Energy Certificate Framework) Regulations, 2011 repealing the 2004 Regulations, which specified that the Commission may determine at any time the tariff for the purchase of electricity from renewable energy sources by distribution licensees.

**Status of biomass-based power plants in the state**

Karnataka has an estimated biomass power generation potential of 1000 MW, out of which power projects of only 90 MW have been commissioned and over 300 MW has been allocated to prospective developers. Therefore, less than 10% of the potential for power generation by biomass has been realised so far in the state. A few biomass units that were set up as early as 2006 have stopped operations either due to non-availability of fuel or because of the high cost of generation owing to increased fuel costs.

The KERC commissioned The Energy and Resources Institute (TERI) in 2013 to conduct a study of the operation of biomass-based power generation projects in the state. The study revealed that out of the nine plants which were commissioned, only six plants are in operation at present. Five out of these six plants are situated in paddy growing areas and are primarily using paddy (rice) husk as the major fuel. As rice husk is subjected to alternative uses by industries (like brick kilns), the price is reported to have increased from Rs 1800 in FY 2009 to Rs 2500 per metric tonne in FY 2013.

TERI also reported that in Karnataka, the biomass fuel price varied from Rs 1400 per metric tonne for chilli stalks to Rs 2500 per metric tonne for rice husk. It also stated that fuels like *Prosopis juliflora* cost less than Rs 1000 per metric tonne. TERI further recommended a two-part tariff for biomass projects, keeping in view the variability of the fuel cost.

**Appeal for revising existing tariff for biomass plants in the state**

Depending upon the date of signing of the PPA and the COD, the tariff for biomass plants now being paid varies from Rs 3.58–5.13 per unit in the state of Karnataka. The biomass-based power plants, Koppal Green Power Limited and Poweronics Limited, with an installed capacity of 6 MW and exportable capacity of 5.4 MW each, supplying power to GESCOM under the approved PPA route, have filed petitions for revision of the tariff. Among other things, they have requested the Commission to revise the cost of fuel, including transportation costs, to Rs 3000 per metric tonne from Rs 1280 per metric tonne with 5% escalation every year as specified in the Tariff Order dated 11 December 2009. Going by Rs 1280 per metric tonne with 5% escalation every year; the fuel cost for the current year 2014/15 works out to Rs 1634 per metric tonne.

**Need for revising fuel cost for existing biomass power generation plants**

In a public hearing conducted by KERC on 15 May 2014, while determining tariff for biomass-based power generation plants using air-cooled condensers, a few stakeholders pointed out that biomass (cotton/Prosopis juliflora/Jowar stalks) was being supplied by farmers to a biomass-based unit near Haveri at Rs 1800–2000 per metric tonne. Keeping in view this situation, it was noted that the sustainability of the existing biomass plants in Karnataka appears to depend upon a viable price for biomass fuel. In this context, KERC notes that the fuel cost approved by the Commission in its Order dated 11 December 2009 seems to require revision for the existing biomass-based electricity generation projects.

Thus, the Commission, through the Discussion Paper, invited comments, suggestions, and views from stakeholders on the following issues:

• Whether the biomass fuel price needs to be revised upwards for all existing biomass power projects?
• If the price has to be revised, what should be the base price in FY 2015?
• Whether the existing annual escalation of 5% is to be continued or revised?
• Whether biomass fuel price has to be indexed as specified by CERC instead of giving a flat rate of annual escalation? If so, what parameters need to be considered for indexation?
• Whether the tariff for biomass power plants should be two-part instead of the existing single-part tariff to account for variability in fuel cost?

(This summary has been drawn from the “Discussion Paper on Revision of Fuel Cost for Existing Biomass Power Generation Plants in Karnataka” by KERC, dated 23 July 2014; and is non-binding.)
A. NORMS FOR BIOMASS-BASED PLANTS

Operation and maintenance cost
The revised rate as per amendment in CERC Regulation of 18 March 2014 has been considered and it amounts to Rs 42.28 lakh/MW for 2014/15 considering Rs 40 lakh/MW for 2013/14 and escalation of 5.72%.

Capital cost
The revised capital cost as per the amended March 2014 CERC Regulation and capital indexation formula amounts to Rs 544.187 lakh/MW for biomass-based projects (other than straw and juliflora) with water-cooled condenser; Rs 584.497 lakh/MW for biomass-based projects (other than rice straw and juliflora) with air-cooled condenser; and Rs 594.575 lakh/MW for biomass-based projects (rice straw and juliflora-based) with water-cooled condenser; and Rs 634.885 lakh/MW for biomass-based projects (rice straw and juliflora) with air-cooled condenser for 2014/15.

Plant load factor
Sixty per cent plant load factor (PLF) during stabilization (6 months); 70% during remaining first year; 80% from the second year.

Auxiliary energy consumption
As per amended CERC Regulation, auxiliary energy consumption of 11% during first year and 10% from second year onwards have been considered for biomass power projects with water-cooled condenser; and 13% during first year and 12% from second year onwards have been considered for projects with air-cooled condenser.

Station heat rate
Station heat rate of 4125 kcal/kWh as per new amendment in CERC Regulation dated 18 March 2014 has been considered.

Use of fossil fuel
As per amended CERC Regulation dated 18 March 2014, the use of fossil fuels is not allowed and should be substituted.

Working capital
- Fuel stock of four months equivalent to normative PLF.
- Operation and maintenance (O&M) expenses for one month.
- Receivable equivalent to two months of fixed and variable charges.
- Maintenance spares at 15% of O&M expenses.

Fuel price
Rs. 2476/MT for 2012/13 with 5% price escalation per year; Rs 2730/MT for 2014/15.

Gross calorific value
As per amended CERC Regulation dated 18 March 2014, a gross calorific value of 3100 kcal/kg is considered.
B. NORMS FOR BAGASSE COGENERATION PLANTS

Operation and maintenance cost
Rs 17.89 lakh/MW for 2014/15.

Capital cost
Rs 440.708 lakh/MW for 2014/15.

Plant load factor
PLF of 53%.

Auxiliary energy consumption
Auxiliary energy consumption of 8.5%.

Station heat rate
Station heat rate of 3650 kcal/KWh.

Gross calorific value
A gross calorific value of 2275 kcal/kg.

Fuel price
Fuel price of Rs 1745/MT for 2014/15.

Working capital
• Fuel stock of one month equivalent to normative PLF.
• O&M expenses for one month.
• 15% of O&M for spares.
• Receivable equivalent to two months of fixed and variable charges.

C. NORMS FOR BIOMASS GASIFIER-BASED PLANTS

Operation and maintenance cost
O&M cost of Rs 44.71 lakh/MW for 2014/15.

Capital cost
After taking into account the capital subsidy of Rs 150 lakh/MW, the net capital cost is Rs 427.118 lakh/MW for 2014/15.

Plant load factor
PLF of 85%.

Auxiliary energy consumption
Auxiliary energy consumption of 10%.

Fuel-related assumptions
Specific fuel consumption at 1.25 kg/kWh.

Fuel price
Fuel price of Rs 2730/MT for 2014/15.

D. ACCELERATED DEPRECIATION
For availing the benefit of accelerated depreciation applicable, income tax rate at 33.99% (30% + 10% surcharge + 3% education cess) has been considered for the purpose of determining net depreciation benefit. Depreciation at 5.28% as per straight-line method (Book depreciation as per Companies Act, 1956) has been compared with depreciation as per income tax rate, i.e. 80% of the written-down value method. Additional 20% depreciation in the initial year is proposed to be extended to new assets acquired by power generation companies vide amendment in section 32, sub-section (1) clause (ii-a) of the Income Tax Act.

E. FIXED COST FOR BAGASSE COGENERATION PLANTS TO BE COMMISSIONED IN 2014/15
The generic levellised fixed cost determined on the basis of capital cost and parameters specified in para 12(a) comes to Rs 2.47/kWh for bagasse-based cogeneration plants to be commissioned in 2014/15. The leverlised benefit of accelerated depreciation, if available, is Rs 0.20/kWh and the leverlised fixed cost after adjustment for accelerated depreciation arrives to Rs 2.27/kWh.

F. VARIABLE COST OF BAGASSE-BASED COGENERATION PLANTS TO BE COMMISSIONED IN 2014/15
The variable cost of bagasse-based cogeneration plants to be commissioned in 2014/15 is determined as per para 12(a) of the CERC RE Regulation, 2012. Depreciation and loan tenure have been taken similar to the norms of the Commission for biomass-based projects. The proposed leverlised fixed cost comes to Rs 2.44/kWh for biomass gasifier-based power plants to be commissioned in 2014/15. The leverlised benefit of accelerated depreciation, if available, is Rs 0.12/kWh and the leverlised fixed cost after adjustment for accelerated depreciation shall be Rs 2.32/kWh.
L. VARIABLE COST OF BIOMASS GASIFIER-BASED PLANTS TO BE COMMISSIONED IN 2014/15
The variable cost of biomass gasifier-based plants to be commissioned in 2014/15 is proposed at Rs 3.79/kWh taking fuel cost of Rs 2730/MT for 2014/15, considering an escalation of 5% per annum on the fuel price of Rs 2476/MT fixed in 2012/13.

M. EFFECTIVE TARIFF FOR BIOMASS GASIFIER-BASED PLANTS TO BE COMMISSIONED IN 2014/15
The effective tariff for biomass gasifier-based plants to be commissioned in 2014/15, on the basis of variable costs, determined above shall be Rs 6.11/kWh, if accelerated depreciation is available. Other terms and conditions will remain the same as stipulated in the Order dated 30 November 2012 in suo-motu proceeding no. 31/2012.

(Rajasthan Finalises Biomass Tariff)
The Rajasthan Electricity Regulatory Commission (RERC) has finalised the tariff for biomass plants through its Order on 23 July 2014. The tariff would be applicable for the plants commissioned during FY 2014/15. The RERC has finalised the tariff on the basis of comments and suggestions it had invited earlier from stakeholders.

Tariff for biomass power plants with water-cooled condenser
The levellised fixed cost without Accelerated Depreciation (AD) is Rs 2.62/kWh; and that with AD is Rs 2.41/kWh. The variable cost for FY 2014/15 is Rs 3.48/kWh. Tariff without AD benefits is Rs 6.1/kWh; and tariff with AD benefits is Rs 5.89/kWh.

Tariff for biomass power plants with air-cooled condenser
The levellised fixed cost without AD is Rs 2.86/kWh; and that with AD is Rs 2.63/kWh. The variable cost for FY 2014/15 is Rs 3.76/kWh. Tariff without AD benefits is Rs 6.62/kWh; and tariff with AD benefits is Rs 6.39/kWh.

It has been observed that the percentage increase in biomass tariff is more than 12% compared to the previous year, which may be due to the rise in fuel cost and total plant operation cost.

(Jammu and Kashmir Finalises Biomass Tariff)
In a historic development, the Jammu and Kashmir State Regulatory Commission (JKSERC), in its Order dated 18 July 2014, has determined the biomass tariff, which happens to be the first tariff determined by JKSERC after notifying the Renewable Energy (RE) Tariff regulation in May 2013.

Tariff for biomass
The levellised fixed cost is Rs 2.11/kWh. The variable cost for FY 2014/15 is Rs 3.73/kWh. The levellised total tariff for FY 2014/15 is Rs 5.84/kWh. The benefit of Accelerated Depreciation (AD) (if availed) is Rs 0.16/kWh. The net levellised tariff with AD is Rs 5.68/kWh.

Tariff for non-fossil fuel-based co-generation
The levellised fixed cost is Rs 2.48/kWh. The variable cost for FY 2014/15 is Rs 3.1/kWh. The levellised total tariff for FY 2014/15 is Rs 5.58/kWh. The benefit of AD (if availed) is Rs 0.22/kWh. The net levellised tariff with AD is Rs 5.36/kWh.

Tariff for biogas
The levellised fixed cost is Rs 3.04/kWh. The variable cost for FY 2014/15 is Rs 2/2kWh. The levellised total tariff for FY 2014/15 is Rs 5.04/kWh. The benefit of AD (if availed) is Rs 0.35/kWh. The net levellised tariff with AD is Rs 4.69/kWh.

(Rajasthan Finalises Biomass Tariff)
The levellised fixed cost without AD benefits is Rs 6.1/kWh; and tariff with AD benefits is Rs 5.89/kWh. Tariff without AD benefits is Rs 6.62/kWh; and tariff with AD benefits is Rs 6.39/kWh.

(Jammu and Kashmir Finalises Biomass Tariff)
The levellised fixed cost is Rs 2.11/kWh. The variable cost for FY 2014/15 is Rs 3.73/kWh. The levellised total tariff for FY 2014/15 is Rs 5.84/kWh. The benefit of Accelerated Depreciation (AD) (if availed) is Rs 0.16/kWh. The net levellised tariff with AD is Rs 5.68/kWh.

(Tariff for non-fossil fuel-based co-generation)
The levellised fixed cost is Rs 2.48/kWh. The variable cost for FY 2014/15 is Rs 3.1/kWh. The levellised total tariff for FY 2014/15 is Rs 5.58/kWh. The benefit of AD (if availed) is Rs 0.22/kWh. The net levellised tariff with AD is Rs 5.36/kWh.

(Tariff for biogas)
The levellised fixed cost is Rs 3.04/kWh. The variable cost for FY 2014/15 is Rs 2/2kWh. The levellised total tariff for FY 2014/15 is Rs 5.04/kWh. The benefit of AD (if availed) is Rs 0.35/kWh. The net levellised tariff with AD is Rs 4.69/kWh.

This summary of BERC’s ‘Suo-motu Proceedings No. 11/2014’; and is non-binding.

(This write-up has been drawn from the regulatory update provided by Open Access, Vol. 44, August–September 2014 Issue, p.3; and is non-binding.)
Ensuring continuous supply of biomass, its quality, and stability of price has been an issue for biomass plant developers in the country. BioPower India sought the opinions of experts on whether the biomass supply chain be managed by the plant developers or not. Here, we present the views of three experts and their takes on this issue. Read on...

**EXPERT SPEAK**

**Should the biomass supply chain be managed by plant developers?**

Ensuring continuous supply of biomass, its quality, and stability of price has been an issue for biomass plant developers in the country. BioPower India sought the opinions of experts on whether the biomass supply chain be managed by the plant developers or not. Here, we present the views of three experts and their takes on this issue. Read on...

**Balwant Joshi**

With biomass availability in excess of 500 million metric tonnes per annum, and estimated power potential of 19,500 MW, the country has always encouraged establishment of biomass-based power plants. However, it has been noticed that as soon as a power plant is established, the cost of biomass increases manifold jeopardising the viability of the project. In some cases, the plants have shut down due to non-availability of biomass. In the absence of formal established markets, the procurement of biomass is considered as a formidable challenge by the project developers. Consequently, power plant developers are feeling the need to have tight control over the biomass supply chain to ensure regular biomass supply at predictable and acceptable prices.

However, it should be noted that biomass has several uses, from cooking fuel to roof hatching, from brick kiln to industrial boilers, from cattle fodder to power generation. Similarly, biomass suppliers vary from farmers to agricultural industries. With multiple suppliers and buyers, biomass is a perfect commodity. Of course, issues exist with standardisation of biomass as a commodity. However, these issues existed for several products such as milk, vegetable products or even commodities such as coal and can be taken care of. The government should develop the market for biomass products on the lines or as part of agriculture produce markets. Efforts should be made for creation of standard biomass products, which could be distinguished by size and heat content. Transactions of these biomass products should lead to ‘Biomass Price Index’ or BPI, which could be used as indicator of biomass price.

With regard to assurance of supply of biomass to power plants, organised players may be permitted to enter into long-term contracts that would be settled in the market. This will ensure that electricity regulators will have benchmark cost while approving the tariff for the power plant. Due to the absence of such a benchmark, biomass prices are currently linked to coal prices. This will help take care of the interests of both power plant operators and electricity consumers without hurting the interest of biomass suppliers.

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**G C Datta Roy**

The market for biomass is quite heterogeneous and as such the answer to the question has to be biomass specific. Market for rice husk is fully matured with established trade and supply chain. It would be practically infeasible for individual power plants to control the supply chain. Similar situation is fast developing for some...
more agro residue such as mustard husk and cotton stalk.

Market for straw (wherever it is not used as fodder) and some more minor biomass on the other hand is quite immature. Skill competency requirement for management of biomass logistics is quite different from what is required for operation of power plants. An argument could be made about how sugar mills are able to successfully control the sugar cane supply chain. There is almost a symbiotic relationship between the sugar mill and sugar cane farmers. Moreover, harvesting period for sugar cane lasts about six months. As such, a comparison between the two cases is not valid.

There is also the regulatory angle. It would be a lot easier for regulators to approve the variable component of the tariff if the prices paid by the biomass power plant for fuel can be established over arm length.

As such I feel the entry of dedicated biomass supply companies for managing supply chain would be in the best interest of the power developers. This would also improve the investment scenario as the bankers would feel more comfortable to lend to projects backed up by independent and reputed biomass supply companies.

G C Datta Roy is the CEO of Dalkia Energy Services Ltd. He has more than 40 years of experience in the renewable energy and biomass sectors. As member of the Confederation of Indian Industry (CII), Roy played a significant role in the development of India’s Energy Conservation Act and in the subsequent development of a work plan for India’s Bureau of Energy Efficiency. As member of the CII Committee on Climate Change, he was involved in development of a strategy paper recommending India’s position on the Kyoto Protocol from industries’ perspective.

A specialised biomass fuel management company would help a biomass power plant function better

Lt Col. Monish Ahuja (Retd)

Biomass supply chain management (SCM) is the key to the sustainability of a biomass-based industry, especially biomass power plant. Typically the biomass plant developers are from industrial houses, financial institutions, first-time entrepreneurs who are not able to cope with the day-to-day nuances of biomass SCM. Operations and maintenance of biomass power plant in itself is a big challenge as dealing with various types of biomass, its processing, feeding and associated problems do take most of the time. If this is further compounded with the biomass fuel aggregation and SCM challenges, then the focus shifts towards biomass fuel aggregation only and the key aspects of plant operations are hampered.

Biomass SCM entails the following aspects.

- **Biomass aggregation:** Aggregation of biomass from the fields during the harvest season has a limited time frame.
- **Equipment:** For this aggregation, there is a need for specialised equipment and investment, which is generally not done by the biomass plant developers.
- **Land for storage:** There is a need to develop and manage storage collection centres and typically, about 500 MT of biomass can be stored per acre of land.

- **Processing equipment:** The stored biomass needs to be further processed to the desired size, which can be fed into the boiler.
- **Manpower:** All the operations are manpower-intensive and have to be done within a specified time frame. Protocols for biomass quality: It is not possible for a biomass power plant to deal with hundreds of farmers and reject the biomass for quality, as they have invested in an asset that is based on biomass.
- **Management information system (MIS):** A full skill set of MIS has to be developed and managed for the biomass SCM.
- **Rural banking and financial inclusion:** Most of the farmers/VLEs who work in the biomass SCM are not part of the rural financial system and seek cash payments. It is a big challenge to get them included into the financial system and devise a robust mechanism for payment for the biomass.
- **Working capital:** A power plant has working capital available only after collection of the biomass and making payment to the farmers. There is always a cash-flow shortfall. Better management by a fuel supply company results in innovative cash-flow management, which is a win–win situation for all concerned parties.

All the above points are specialised operational activities needing manpower that has a separate skill set. This is not catered for by the biomass power plants, which generally have technical manpower. So for a more efficient and better-managed system, it is necessary to have a biomass fuel management company that specialises in this and is able to give a biomass fuel supply contract to the biomass power plant. This de-risks the power plant and also establishes a very sound system of biomass SCM.

Overall, it is better for a specialised biomass fuel management company to handle the biomass SCM and the biomass power plant should work on a higher plant load factor of operation, as is the case with coal and gas-fired power plant stations.

Lt Col. Monish Ahuja (Retd) is the Managing Director of Bermaco Green Energy Systems Ltd and is responsible for the day-to-day functioning of the joint-venture company, which is implementing biomass-based independent power project. He manages all project-related activities including planning, execution, besides all activities related to biomass projects. Besides, he has formed for the first time in India, a unique biomass fuel management start-up company (a 100% owned subsidiary of Bermaco group), which integrates supply chain management with local understanding to handle agriculture residue.
Pine trees are abundant in altitudes ranging from 1000 m to 2000 m in the Himalayan region, including the state of Uttarakhand. They are found in both the Garhwal and Kumaon regions of Uttarakhand, covering over 3.4 lakh hectares (or 16.36%) of reserve forest area. Needles that fall from the pine trees have traditionally been used by local communities for carpeting cattle sheds, for cooking purposes during monsoons, and as fertiliser. However, pine needles also pose a significant risk, given their highly combustible nature, which results in frequent forest fires that cause losses to biodiversity, human life, and wildlife. In order to address the problem of recurrent damage due to forest fires, there have been several attempts to identify alternate uses for pine needles.

Recently, the Government of Uttarakhand has permitted large-scale collection of pine needles for industrial uses such as bio-briquette manufacturing and, to some extent, for power generation (through gasification). Pine needles have also been recognised as an important resource for promoting...
Based on the initial efforts of organisations such as AVANI to utilise pine needles as a feedstock for energy generation, the Uttarakhand Renewable Energy Development Agency (UREDA), in cooperation with GIZ, has decided to introduce a policy within the state to promote the use of pine needles as a source of energy generation. As a first step, GIZ conducted a study to assess the social impact on local communities due to large-scale collection of pine needles from the forest floors. In addition, another study was commissioned to assess the technical viability of pine needles as a feedstock for power generation through biomass gasifiers. Outcomes of the studies have served as inputs for drafting the policy document.

A stakeholder meeting was organised in Dehradun on 8 September 2014 in order to obtain feedback on the draft policy from the various stakeholders. The workshop was well attended with representatives from MNRE, forest department, UREDA, van panchayats, NGOs, industry, and research/academic institutions. The key issues discussed were:

- The need for a comprehensive policy for promoting the use of pine needles, as well as other biomass such as lantana and agriculture crop residues.
- The policy should be framed such a way that the local communities/van panchayats, who are the legal owners of the resources (pine needles and other biomass), are compensated adequately and benefit to a significant extent through their direct involvement in the collection process.
- The policy document should highlight all the incentives available, at the central and state levels, for project developers.
- The need for time-bound clearance of submitted projects at different government levels.
- The need for gender proofing the policy document.
MNRE extends scheme for promoting Grid Interactive Biomass Power and Bagasse Cogeneration in Sugar Mills

Source: Energetica India

The Ministry of New and Renewable Energy (MNRE), Government of India, has sanctioned the continuation of the Plan scheme "Promotion of Grid Interactive Biomass Power and Bagasse Cogeneration in Sugar Mills" during the 12th Plan period at a total cost of Rs 310 crore. The Scheme is applicable from 1 April 2014 and would continue up till the end of the 12th Five-Year Plan, i.e., 31 March 2017.

This scheme provides for the grant of Central Financial Assistance (CFA) for setting up biomass combustion based power projects and bagasse cogeneration projects in private, cooperative and public sector sugar mills. MNRE will continue to provide financial support for research and development activities, organisation of seminars and workshops, strengthening of technical institutions, testing facilities, etc. on case-to-case basis.

Central Financial Assistance will be applicable for projects that started on or before 31 March 2013, the old rate of CFA applicable during the 11th Five Year Plan and extended to 31 March 2013 will be applicable.


Biomass Manager ERP system to augment the sector in India

Source: Biomass Manager Workshop, New Delhi, 24 September 2014

ARBUTUS, Pune, and MHG Systems, Finland, organised the workshop "Meet MNRE promotes generation of electricity from paddy husk

Source: Energetica India

The Ministry of New and Renewable Energy (MNRE), Government of India, is promoting the generation of electricity from agro-residues including paddy husk through biomass gasifier system for meeting the unfulfilled demands of electricity in rural areas. Till date, about 70 biomass-based gasifier systems of 32 kilowatt each have been supported for providing electricity to about 200 villages, mainly in Bihar. Each system is capable of providing electricity to about 200-250 households and other small commercial loads for 5-6 hours daily with an average total load of 25-30 kilowatt.


World’s first bus running on biofuels, in Japan

Source: EAI

The world’s first bus, running on biofuels using green evgenovych algae, has begun operating in the Japanese city of Fujisawa. The fuel is being jointly developed by the Japanese manufacturer of buses and trucks, Isuzu and company Euglena. However, the downside of this biofuel is that it makes for a high load on the engine.

Read more at <http://www.eai.in/360/news/pages/12785>
Symposium on Thermal and Catalytic Sciences for Biofuels and Biobased Products
2–5 September 2014
Denver, Colorado

The Symposium on Thermal and Catalytic Sciences for Biofuels and Biobased Products 2014 will focus exclusively on thermochemical processing of biomass into fuels and chemicals and is aimed at academic, government, and industry researchers. The program features discussions on recent scientific developments in pyrolysis, solvent liquefaction, gasification, and catalytic upgrading.

Source: Biomass Magazine

International Bioenergy & Bioproducts Conference
17–19 September 2014
Washington, DC

The International Bioenergy and Bioproducts Conference (IBBC) will include technical presentations, expert panels, case studies, and reports from projects that address feedstock and harvesting improvements to increase yield and quality of biomass; bioconversion technologies for wood and biomass; production of chemicals and transportation fuels from wood and biomass; commercial bioenergy projects utilizing woody biomass; and tools for evaluating bioenergy projects.

Source: Biomass Magazine

International Biomass Conference & Expo
20–22 April 2015
Minneapolis, Minnesota

The International Biomass Conference and Expo, is being organized by BBI International and produced by Biomass Magazine. Over the years, this event has brought together current and future producers of bioenergy and bio-based products along with waste generators, energy crop growers, municipal leaders, utility executives, technology providers, equipment manufacturers, project developers, investors and policy makers. It provides great opportunities as a premier educational and networking junction for all biomass industries.

Source: Biomass Magazine
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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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First Renewable Energy Global Investment Promotion Meet and Expo (RE-INVEST)
15–17 February 2015
New Delhi

The Ministry of New and Renewable Energy (MNRE), Government of India, has announced that the First Renewable Energy Global Investors Meet and Expo (RE-INVEST) will take place in New Delhi on 15–17 February 2015. The Indian Renewable Energy Development Agency (IREDA), jointly with the Confederation of Indian Industry (CII) and the Federation of Indian Chambers of Commerce and Industry (FICCI), has been given the responsibility to organize the Meet. The country's other leading industrial and sector-specific associations, ASSOCHAM and PHDCII, will also be closely associated with organizing the Meet.

Objectives
The main objectives of RE-INVEST are to showcase India as an investment destination for renewable energy (RE) and to encourage investors to set up projects and manufacturing facilities for RE equipment and products in India. The intent is to provide a platform to the global investor community to connect with stakeholders in India; and to enhance the growth of RE and energy efficiency in India by attracting large-scale investments in the sector.

Agenda
The plenary session is expected to be inaugurated by the Prime Minister of India and addressed by high-level dignitaries at Vigyan Bhawan, New Delhi. The breakout sessions and the exhibition will be held at Pragati Maidan, New Delhi. Over 200 global investors from various countries, international financial institutions, bilateral and multilateral financial institutions, Indian banks, non-banking financial companies, state governments, concerned Public Sector Undertakings, renewable power developers and manufacturers, state renewable energy nodal agencies and other stakeholders are expected to attend the Meet.

RE-INVEST is designed to showcase investment opportunities across key RE sectors in India and to highlight Central and State Government initiatives in promoting the environment for investors. Sessions will include sector-specific discussions on policies, incentives, compliance norms, etc. The Meet is expected to serve as a global platform for mutual dialogue and interaction among investors and stakeholders from the industry and governments across countries.

Visit <www.re-invest.in> for more information on the event vis-à-vis schedule, agenda, subjects, registration procedure, pricing for exhibition space, accommodation, etc.