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Proceedings of Workshop on Promoting Adoption of Biomass Power Technologies and Identification of Pipeline Projects

April 3-4, 2013 at Surya Place Hotel, Vadodara, Gujarat

Prepared by - Zenith Energy Services Pvt. Ltd, Hyderabad

In association with - M/s CREWA, New Delhi and M/s RSA Low Carbon Services Pvt. Ltd, New Delhi

Supported by - UNDP

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The Workshop Organizers, M/s Zenith Energy Services Pvt. Limited, Hyderabad in association with M/s RSA Low Carbon Services Pvt. Ltd, New Delhi and CREWA, New Delhi would like to express their earnest gratitude to UNDP/India, MNRE and GEDA for their valuable suggestions and inputs in successfully organizing the workshop at Vadodara during 3–4 April 2013.

The organizers wish to convey their special thanks to M/s Ankur Scientific Technologies Pvt. Limited, Vadodara, for allowing the workshop participants to visit their 1.20 MW Biomass Gasifier Power Plant at Sankheda, near Vadodara, Gujarat.

M/s Zenith Energy Services Pvt. Ltd
M/s RSA Low Carbon Services Pvt. Ltd
M/s CREWA

Place: New Delhi
Date: 15 May 2013

Acronyms

CDM	Clean Development Mechanism
CERC	Central Electricity Regulatory Commission
CREWA	Centre for Rural Energy and Water Access (an NGO)
CO_2	carbon dioxide
crore	1 crore = 10 million
CSP	Concentrated Solar Power
CST	Concentrated Solar Thermal
DPR	Detailed Project Report
EOI	Expression of Interest
FI	Financial Institute
GEDA	Gujarat Energy Development Agency
GEF	Global Environmental Facility
GHG	Green House Gases
INR/Rs	Indian rupees
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency Limited
K Cal	kilocalories
kW	kilowatt
kWh	kilo watt hour
LCOE	Levellized cost of energy generation
MIP	Model Investment Project
MNRE	Ministry of New and Renewable Energy
MT	Metric Tonne
MU	million units
MW	mega watt
NCEF	National Clean Energy Fund
PCB	Pollution Control Board
PLF	Plant Load Factor
PPA	Power Purchase Agreement
PRESPL	Punjab Renewable Energy Systems Pvt. Ltd.
PT	Parabolic Trough
PV	Photo Voltaic
RE	Renewable Energy
REC	Renewable Energy Certificate
RPO	Renewable Energy Purchase Obligation
SNA	State Nodal Agency
TPD	tons per day
tph	tons per hour
UNDP	United Nations Development Programme
USD	United States dollars
VLE	Village Level Entrepreneur

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BRIEF SUMMARY OF THE WORKSHOP

A workshop on 'Promoting adoption of biomass power technologies and identification of pipeline projects' under the project 'Removal of barriers to Biomass Power Generation in India' was organized by Zenith Energy Services, Hyderabad, RSA Low Carbon Services and CREWA, New Delhi at Vadodara during 3–4 April 2013. About 100 people participated on the first day and 50 on the following day.

Beginning with the inaugural session on the first day, there was also a session on the success stories of biomass projects in India. A site visit to 1.20 MW Biomass Gasifier Plant at Sankheda near Vadodara was organized thereafter during the afternoon. The complete description of the site visit details is presented in Section 5 of this report. The second day revolved around discussions on policy, regulatory and financial aspects of Biomass projects. Quick analysis since the second day of the workshop revealed the following distribution in participation—22 participants sought information/knowledge; 3 wanted Model Investment Projects (MIPs); 10 were resource providers; 10 involved in policy/regulatory interface; 1 was associated with a financial institution; and 3 were technology providers. The site visit to 1.2 MW gasifier-based power generation at Sankheda appeared useful. The plant initiated third party sale through open access, and this, along with its REC (Renewable Energy Certificates) benefits perhaps proved to be its unique feature at this scale. The workshop identified low tariff as the single most problem, which acted as a major constraint for the growth of biomass power. As an urgent relief, generation-based incentive was requested from the Ministry of New and Renewable Energy (MNRE) since without it many existing projects would close down and no new projects would emerge especially at the small capacity and grid evacuation. It was also felt that the biomass power producers are underrepresented in advocating appropriate policy unlike the wind and solar associations. Hence, it was felt that there was an urgent need for biomass producers to get together to form an advocacy group. Some even requested support from the UNDP-GEF project for such advocacy. The workshop was well attended, but the number of actual promoters seemed to be low. Only three to four clear expressions of interest (EOIs) emerged (*see* Annex-3). Key follow-up actions included:

a) The three MIPs, who have shown expression of interest, to be pursued by Zenith;
b) MNRE/UNDP to be pursued to agree on the short-listing criteria for MIPs;
c) a special window of GBI to projects in the scale of 1:3 MW to be considered;
d) tariff supporting platforms/advocacy groups to be revised;
e) from the project beginning to commission, appropriate analytical studies such as advantages/limitations of scale of biomass power plants, impact and risks of competing uses of biomass as fuel, need and rationale for differential tariffs to be done;
f) compendium of technology packages, specifications, investments, cost-benefits (including tangible and intangibles) to be developed.

Issues and Solutions

The following issues were raised by the biomass promoters during the workshop held at Vadodara during 3–4 April 2013. The issues were addressed by experts who attended the workshop, suggesting the following solutions.

Price escalation of biomass fuels

Some of the promoters of biomass power plants mentioned that the projects are becoming unviable due to substantial price escalation of biomass partly due to competing use from other sectors like pulp and paper, cement, onion dehydration units, hotels, and so on, who have also started using biomass as fuel.

Reply: Experts suggested that encouraging the establishment of fuel supply linkages or depots besides plantation could lower the risk of price escalation of biomass. Accurate/real assessment of surplus biomass availability during the assessment study and DPR preparation will also avoid the price escalation risk to some extent. There was also a strong case for considering fuel pass -through mechanism on price escalation of biomass fuels as it is allowed for power plants run on fossil fuels.

Policy and regulatory issues

Couple of biomass promoters expressed their concern that due to insufficient tariff for biomass-based power generation, it has become unviable.

Reply: The suggested solution is that government policies should be supportive and policy rectification particularly with respect to tariff should be undertaken annually or as situation demands to attract investments into biomass power generation.

Suitability of the technology

A section of biomass promoters expressed their inability in the selection of technology for the generation of power from biomass. They mentioned that bio-methanation seems viable and cost effective for the generation of power from biomass rather than combustion/cogeneration.

Reply: Experts suggested that technology selection depends on the nature of the project. A detailed analysis should be conducted before selecting the technology for projects to become viable.

Delays in getting approvals/clearances

It was discussed that delays that took place in getting approvals from various departments like Pollution Control Board (PCB) or State Nodal Agencies (SNAs) is likely

to create disinterest in promoters to set up the biomass power plants.

Reply: Experts suggested that the government may create a single window (may be by SNA) for getting approvals for the setting up of biomass power plants.

Management and logistics of the biomass power plants are cumbersome and expensive

Some of the promoters mentioned that managing the economics and logistics of biomass power plants is so expensive and cumbersome that the government often refrains from providing any support. They mentioned that running costs are increasing due to various constraints like land, fuel, and so on, which involves the arrangement of huge funding from one's own sources.

Reply: Experts suggested that proper planning like sustainable fuel supply linkages, energy plantation, economics of fuel management and support from government can lower the risks of the projects.

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BACKGROUND OF THE WORKSHOP

India's growing energy requirements have put immense pressure on the existing natural resources. The demand for electrical energy is growing at a rate of 7%–8% annually, and remains largely dependent on fossil fuel. This trend has significant environmental implications including greater greenhouse gas (GHG) emissions, deforestation, land degradation, and rising water and air pollution.

Against this backdrop, there is a growing emphasis on the use of cleaner energy sources, particularly renewable energy, to meet growing energy demand and complement fossil fuels. In such a context, the importance of biomass cannot be underscored. Estimates suggest that close to 21,000 MW of electricity can be generated through biomass as against less than 4,500 MW, which has been harnessed till date. This 4,200 MW includes Biomass Power (Rankine Cycle), Bagasse-based Cogeneration, Non-Bagasse-based Cogeneration, Biomass Power through Biomass Gasifier (Otto Cycle), and so on. Several constraints such as weak institutional and financing mechanisms, policy framework and technical capacities are currently restricting this potential. Of late, to establish sustainable fuel linkages, the focus is being shifted to small size biomass plants in the country.

The objective of the assignment is to mobilize at least five 'Pipeline Projects of 1–5 MW size' to generate biomass power. This will start with a workshop inviting interested and potential promoters. It is also expected that the consulting firm carrying out the task handholds at least five interested 'biomass promoters' develop bankable proposals, provides technical assistance to receive required approvals to install and commission projects. As a part of the workshop, a field visit to a working biomass power plant is also envisaged.

Zenith Consulting along with CREWA (Centre for Renewable Energy and Water Access) and RSA Low Carbon Services Pvt. Ltd was awarded the contract from UNDP/India titled 'Organizing workshop on promoting adoption of biomass power technologies and identification of pipeline projects under the project "Removal of barriers to Biomass Power Generation in India"'. Zenith and consortium identified Vadodara for conducting the workshop to generate interest from potential investors in biomass power. Vadodara was chosen as so that a field unit to 1.2 MW gasifier-based power plant at Sankheda could be organized for the participants.

The main objective of this assignment is to promote small size (1–5 MW) Biomass Power and Cogeneration Projects (Rankine Cycle or Otto Cycle) and identify entrepreneurs interested to set up biomass-based power projects. These promoters will be facilitated in installing biomass-based power plants, to develop the Detailed Project Reports (DPRs) and providing them with technical and financial assistance for the implementation of these projects.

In this regard, a workshop on 'Promoting adaption of biomass power technologies

and identification of pipeline projects' has been organized with a half-day field visit to a biomass gasifier plant at Vadodara on 3 and 4 April 2013 to identify interested entrepreneurs who are willing to set up biomass-based power projects.

The workshop has been organized for one and a half days with a half- day field visit to a nearby biomass gasification-based power plant. About 100 delegates on the first day and 50 delegates on the second day participated in the workshop. During the workshop various aspects on biomass power generation, that is, its power potential, sustainable fuel supply linkages, success stories of existing biomass power plants, various statutory clearances and approvals required, and various financing mechanisms and suppliers perspectives were discussed. The workshop generated four interested entrepreneurs who wish to implant biomass power plants and submitted their expression of interest (EOi) to participate under this project.

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INAUGURAL CEREMONY

The workshop was inaugurated on 3 April 2013 at 10 a.m. by the lighting ceremony conducted by D.P. Joshi, IAS, Director, GEDA; V.K. Jain, Director, MNRE; Srinivasan Iyer, Asst Country Director-UNDP/India; B.C. Jain, Chairman, Ankur Scientific Technologies Pvt. Ltd; A. Mohan Reddy, Director, Zenith Energy Services Pvt. Ltd; and P.R. Reddy, Managing Director, RSA Low Carbon Services Pvt. Ltd. Subsequently, the workshop has been started with welcome address by A. Mohan Reddy.

Lighting of lamp, from left to right - Dr J R Meshram –MNRE;
Shri V K Jain –Director, MNRE; Shri. Sharma IVS, Zenith Energy;
Mr. DP Joshi, Director- Gujarat Energy Development Agency;
Shri Srinivasan Iyer, Asst Country Director, UNDP/India;
Shri B C Jain, Chairman, Ankur Scientific Technologies Pvt Ltd; and
Shri. A Mohan Reddy, Director, Zenith Energy

Welcome Address by A. Mohan Reddy, Director, Zenith Energy Services Pvt. Ltd

On behalf of Zenith Energy Services Pvt. Ltd and organizers of the workshop, A. Mohan Reddy welcomed all the guests, speakers, media personnel and delegates of the workshop. The main message conveyed was that the event was designed to promote biomass power technologies and to arrive at solutions to identify the barriers associated with biomass-based power generation and its related policy issues and convey the same to the concerned authorities.

Address by V. K. Jain, Director, MNRE

V.K. Jain highlighted the importance of biomass power generation for rural electrification and associated benefits like environmental as well as employment opportunities in rural areas. The MNRE is making continuous efforts to promote biomass power technologies in India and also assured that the same will be continued in future. He wished that the workshop would be useful for sharing information among

promoters of the biomass power and remove the various barriers associated with biomass power generation.

Address by Srinivasan Iyer, Asst Country Director, UNDP/India

Srinivasan Iyer stated that modern energy to workplaces is essential and biomass is one of the largest global energy which is carbon neutral. He mentioned that decentralized power generation is the need of the hour to meet the energy requirements of rural masses and the UNDP is committed to promote biomass power generation in India. He outlined the major challenges of the sector, such as sustainable fuel supply linkages, economics of fuel management, differential tariff scale and lack of transparency in pricing of biomass fuel. He affirmed that the management and logistics of biomass power plant are cumbersome and its success depends if the PPA terms, fuel supply linkages, tariff and the required time lines of clearances and transactions are favourable. He also mentioned that adequate information to the biomass promoters need to be provided to ensure success of biomass sector projects. Srinivasan concluded his speech with a positive hope that the workshop will create interest among biomass promoters and lead to generation of MIPs. He wished them success in their future endeavors.

Inaugural Address by D.P. Joshi, Director, GEDA

D.P. Joshi, IAS, highlighted the importance of energy in our day-to-day lives and its access to common man which is the main concern today. He mentioned that there exist many limitations in using conventional energy sources and in this scenario, Renewable Energy provides hopes and some sort of assurance in present day situations. He agreed that biomass sector projects in the state are facing some kind of difficulties due to the low tariff fixed some years ago and that for the success of biomass power generation, government policies need to be supportive and policy rectification to be undertaken urgently. He concluded that the Gujarat government is keen to remove existing policy related barriers at the earliest so that the estimated biomass capacity comes up on the ground. He wished for a successful workshop and fruitful deliberations during the two-day workshop.

Vote of Thanks by P.R. Reddy, Managing Director, RSA Low Carbon Services

P.R. Reddy presented the vote of thanks to MNRE, UNDP India, GEDA, speakers, delegates and media personnel and mentioned that the workshop is happening at an important juncture wherein the biomass sector projects are facing several chal-

lenges. He concluded by explaining the programme schedule [enclosed as Annexure 1] and desired that the workshop will generate prospective developers for MIPs. He also highlighted that a handbook has been prepared to help the participants further on biomass power generation.

4

PRESENTATIONS BY SPEAKERS ON DAY 1

(Success Stories of Biomass Power Generation in India)

After the inaugural session and subsequent tea break, the technical session titles 'Success Stories in Biomass Power in India' was conducted which was chaired by D.P. Joshi and J.R. Meshram, Former Director, MNRE. The following speakers made their presentations (see Annexure 4).

Potential of Biomass Power in India by G.C. Datta Roy, CEO, Development Environergy Services Limited, New Delhi.

G.C. Datta Roy through his excellent presentation explained how biomass is the most versatile Renewable Energy (RE) resource whereby over 50% of the revenue flows back to the local community. According to him, biomass with 10,000 MW Decentralized Generation potential, can provide energy accessibility to over 80% of the unserved/underserved rural households. According to his assumption, the biomass potential from a surplus availability of about 63 MT of agro residues was around 7,000 MW. He predicted that the future fuel for biomass IPP would be straw and stalks of the agricultural residues. He emphasized that by improving harvesting and logistics efficiency the available surplus can be augmented twice its quantum, and with the present level of harvesting efficiency the aggregate capacity of power plant should remain within 10% of the overall availability. While marking improved technology for successful burning of biomass, innovative fuel logistics systems, energy plantation and availability of gasifiers with a wide range of capacities are pointers of the achievements of the biomass sector, he mentioned tariff, financing of projects and biomass supply chain management are challenges that need to be coped up by the industry. His suggestions regarding the ways that can enable the sector to move forward include: creation of harmonized tariff principles, innovative or improved project financing, robust Renewable Energy Purchase Obligation (RPO)/REC mechanism and quarterly review of policy and regulatory issues by MNRE, CERC and other regulators. He advocated leveraging the National Clean Energy Fund (NCEF).

12 MW Rice Straw-based Biomass Power Plant in Patiala–Fuel Supply Linkages by Lt Col Monish Ahuja, Director, Bermaco Energy Ltd, Navi Mumbai

Lt Col Monish Ahuja explained the essential features of the 12MW rice straw-fired Biomass Power Plant at Ghanour, Punjab. It is the only plant in the world which runs on 100% rice straw, showcasing the reduced effect of paddy straw burning in Punjab.

The project, though had set off in 2006, started its operation in 2010. However, it was only after fuel management and technology adjustments were made that stable operation could be established. He explained a few hurdles in establishing/operationalizing the plant: (i) the state government's imposition of a penalty for the 14-months delay; (ii) bailers for which they should have got import duty exception could not be leveraged despite MNRE intervention. However, he reassured that the unit is now under stable operation and burns about 120,000 tonnes of straw per year, i.e., 400 tonnes per day, a movement of 40–45 trucks. He explained that this plant got Fortune group instituted award on RE. Renewable Watch, a magazine, is initiated by them. Bermaco group has generated about 70 MU till now. He also explained that the running capacity is lower than the installed capacity, with 60%–70% plant load factor (PLF) being achieved. Other renewable energy is paid at Rs 6.50/kWh. He pointed out that Indian companies have adopted international tariff policy where it is favourable. One example is Tanzania where a 15 MW plant has been committed. He explained that despite other issues, BMP is advantageous. Except for technical expertise, BMPs are run by locals and are likely to be located only in rural areas. He also suggested that where relevant authorities have given their approval, providing fiscal incentives, the advice of MNRE should be followed, which at present is missing. Plant cost should be revised to about Rs 6.5–Rs 7 crore per MW from the present Rs 4.5 crore per MW rate which, in turn, would help revising tariff.

He presented the benefits of the project—enhanced productivity of crops facilitating extra income to farmers and increase in the water level due to energy plantation and developed Village Level Entrepreneurs (VLEs) in the location. He also marked the establishment of M/s Punjab Renewable Energy Systems Pvt. Ltd (PRESPL)—a fuel management company—for a secure and cost-effective supply of biomass fuel to this biomass power plant. He explained that PRESPL has proposed to develop an alternate source of biomass fuel to the power plant which can mitigate the risk of non-availability of fuel to biomass power plant. He said PRESPL has been involved in energy plantation and produces approximately 700MT of biomass on a daily basis through its different collection centres. He stated that this biomass power plant has provided 150 direct and 500 indirect employment in Ghanour/Patiala, Punjab.

13 MW Crop Residues-based Biomass Power Plant in Aurangabad–Fuel Supply Linkages by Sanjay Joshi, Vice President, IL&FS, Mumbai

Sanjay Joshi explained the performance of 13 MW biomass power plant at Aurangabad. In his presentation, he explained how fuel procurement strategy ensures successful and continuous operation of a biomass power project. He mentioned that for a secured fuel supply for a biomass power plant it is essential to have continu-

ous focus on collections of major biomass agro residues, establish a network of collection centres within 30–50 km radius, develop dedicated infrastructure for fuel processing and , involve VLEs and local NGOs in fuel collection and creating awareness amongst farmers. He highlighted the success of the 13 MW biomass plant in Aurangabad which has been successful in procuring a total biomass collection of more than 70,000 MT, ensuring self sustainability to many small farmers, employment to more than 4,000 labourers during peak collection period and providing additional revenue to farmers. Social benefits given by a biomass power plant is humungous—700,000 man days in 6 months. He assured that biomass power generation is the highest potential of livelihood generation amongst all the RE sources. He highlighted the difficulty of poor tariff which has caused 10 out of 14 biomass power plants in Maharashtra to close down. In the absence of good fiscal support, technical upgradation is also becoming unviable. He concluded by recommending that support should be given by creating a separate tariff policy, and providing generation-based incentives for biomass power plants.

4.25 MW Pellet-based Cogeneration/Captive Power Plant in Ahmadabad by Avinash Gupta, Senior Manager, Abellon Clean Energy Limited, Ahmadabad

M/s Abellon Clean Energy Ltd was recently awarded by Fortune Group for their work in RE. Abellon have established a 4.25 MW pellet based cogeneration at village Chancharvadi Vasna, Dist Ahmadabad, Gujarat, for their steam as well as captive power consumption.

Avinash Gupta presented the details and operations of 4.25 MW Pellet-based Cogeneration/Captive Power Plant having a capacity of 37.23 MU/annum. Gupta explained that 23 MT surplus biomass is available in Gujarat [National Biomass atlas]. He mentioned the highlights of the project which is in continuous operation for the past seven years with an average PLF of 75% and can be operated with different biomass materials. The auxiliary consumption of the plant is about 15%–18% .He mentioned that castor stalk and saw dust are the main fuels for the power plant and operates with a fuel requirement of 140 TPD. The fuel is collected from industries within 50 km radius, with collection centres created at different locations. The optimum collection radius for Abellon is about 50 km, and any biomass procurement made from more than 50 km would lead to increase in the cost of biomass significantly. The project was registered for Clean Development Mechanism (CDM) and REC benefits. Gupta concluded his presentation with the following recommendations for promoting biomass power:

- Scheduling to be exempted
- Cross Subsidy surcharge to be exempted

- Transmission and distribution charges to be made sustainable to promote de-centralized generation
- Pooled power/multiple consumer points to be encouraged
- RPO: emphasis on fulfilment of biomass RPO and share to be increased
- Open burning field must be strictly prohibited to promote collection
- Waste land development rights to be given to promote local employment and increase land utility
- Concessional duty to be imposed on imported pre-processing equipment
- Capital cost to be calculated considering pre-processing equipments

Biomass Solar Hybrid Plant in Pune by R.R. Sonde, Executive Vice President, M/s Thermax Limited, Pune

R.R. Sonde, in his presentation, explained the characteristics and advantages of India's first solar biomass hybrid power plant called 'Shive'. It is a hybrid of CST and biomass. He assured that the distributed concept using solar & biomass is very relevant for India. He said that for Thermax, one of the indicators of success has been reverse migration, i.e., from cities to villages. About forty-eight people returned as the project had aimed to create opportunities in the village by providing reliable power. At present, biomass is sourced from outside, as with the improvement of agriculture, economy will be improved and biomass procured from village could be used.

He presented the Comparison b/w Conventional Concentrated Solar Power (CSP) Plants and the Unique Shive Concept as follows

With Euro Trough		With Thermax SolPac™ P60	
Large size power PT >> Super Heated Steam		Medium size PT >>200° C solar steam	
Cost of trough	Rs. 21000/ sq.m.	Cost of trough	Rs. 7200/ sq.m.
Optical efficiency	73%	Optical efficiency	63%
Net efficiency	71%	Net efficiency	53%
Net Generation @ 1000 W/m^2 DNI	0.71KW/sq.m	Net Generation @ 1000 W/m^2 DNI	0.53 KW/sq.m
Cost per KW	Rs. 29577/Kw	Cost per KW	Rs. 13584 /Kw

The hybrid unit has produced 1.8 MU in one year with the solar providing 50% energy. Approximately 4 acres of land is required per MW for installing the solar unit. A hybrid can be decided based on the space and biomass available. He provided a comparative overview of different combinations of solar units as follows

	Solar PV	Solar CSP	Solar + Biomass Hybrid
Cost	8 crore /MW	12 crore /MW	14 crore/MW
Generation	1.6 MU/MW @ solar radiation 550 – 900 w/sq mtr	2 MU/MW	6.5 MU /Mw @ solar hybrid concept
LCOE	12.14- 12.74	9.2- 9.5	10.88-10.15

1.2 MW Power Plant based on Gasification of Biomass in Sankheda, Dist. Vadodara, Gujarat by B.C. Jain, Chairman, Ankur Scientific Technologies Pvt. Ltd, Vadodara

B.C. Jain explained the success of the 1.2 MW power plant based on gasification with two gasifiers and three Chinese gensets at Sankheda established under MNRE-UNDP-GEF project. He mentioned that the plant uses biomass fuels such as cotton stalk, tuver stalks, maize cobs, mango seeds, castor husk. He also indicated that the plant has the state of art technology with upgradation from time to time. He highlighted the use of bio-char (charcoal generated from biomass), a by-product sold to farmers at a low price as a fertilizer. He explained the difficulties associated with the processing of biomass fuel and mentioned that the operation and management of the plant becomes more challenging with these problems. He pointed that dull REC market and non-serious implementation of RPO are some of the hurdles for growth of biomass power generation. He highlighted the benefits of the project as income and employment generation, elimination of fuel burning in the field and reduction in line losses.

He informed that M/s , Ankur Scientific Technologies Pvt. Ltd has tried Chinese gensets for the first time and the engines are good, but service is poor. Moreover, language is a barrier. He highlighted the choice of Sankheda as a location for the plant since it is a tribal belt. He described the regulatory issues being faced due to Gujarat Electricity Company as

a) Providing the information on power delivery in advance with 15 min scheduling
b) No provision of payment for extra power supply to the grid there by restricting to fixed power supply of 1200 units per hour (Ankur has signed agreement for supplying 1200 units in one hour.)

To limit the power supply to 1200 kWh in gasifier plant, certain adjustments are required. Ankur plant is perhaps the first third party sale at this scale. He also explained that bio-char has given very good results. In the last 2 months, 200 ton has been sold at Rs 1 per kg. When the project had started, the REC price was Rs 3

per kWh and now it is Rs 1.5 per kWh. The plant has attracted 400 visitors from 35 countries.

Questions and Answers' Session

Following questions were posed to the technical panel and the responses are described below.

- Is there a future for biomass power projects? We have 100 MT biomass surplus– this is a good note. But on the other hand, 20–25 MT petroleum fuels are used for thermal applications. Many of them started using biomass, and they can give extremely stiff competition to the biomass power sector—1 kg of petroleum fuel costs Rs 40, it can be replaced by 3 kg of biomass. Thus they can go up to a price of Rs 10 per kg. How can biomass power projects compete under this scenario?
- We are confounded with what we should focus on—small or large? The cost of power production is higher when the installed capacity is low. Hence, these smaller plants need higher tariff to survive, in which case, should we be promoting small power plants or large ones. Why?

Answer: Despite the constraints to biomass power plants, the panel felt there is scope for growth of biomass power in India based on the present surplus availability and potential to grow biomass. They also felt different capacity plants have their own advantages/disadvantages and hence needs to be promoted on case-to-case basis.

5

VISIT TO 1.2 MW BIOMASS GASIFIER-BASED POWER PLANT

During the afternoon of 3 April 2013, the delegates of the workshop visited the 1.2 MW Biomass Gasification Power Generation Project set-up by Ankur Scientific Energy Technologies Pvt. Ltd at Sankheda, Vadodara District, about 60 km from Vadodara city. During the field visit, the plant officials led by B.C. Jain, Chairman, demonstrated the various aspects of biomass power generation, i.e., biomass fuel collection, preparation, handling and storage, biomass gasifier technology, major equipments and their working principles, O&M methods, financial aspects of biomass power plants, major constraints and other related topics associated with biomass power projects to the delegates of the workshop. The delegates of the workshop interacted very actively with the officials of the plant, went around the plant and gained sufficient plant knowledge with respect to its operation and maintenance.

Biomass Power plant visit by participants of the workshop

Ankur Scientific Pvt. Ltd, developers of indigenous gasifiers, is in the business of manufacturing and sale of gasifiers. To test the business model, they decided to become developers themselves. They established a 1.2 MW gasifier-based power-generating unit in the cotton belt of Sankheda. It consists of two gasifier units, each developed by them and capable to generate producer gas to run 600 kW, three 100% producer gas engines, imported from outside the country of capacity of 400 kW each. Ankur has entered into long-term purchase agreements with farmers to supply cotton stalk and other biomass. This agreement has helped Ankur to get a stable supply of biomass as well as the farmers dispose their residue more profitably, enhancing their income. Approximate requirement of biomass is 11,200 tonnes annually. Ankur has a power purchase agreement with Aditya Birla Insulation which is located at a distance of 25 km from the biomass power plant. The agreement is for an electricity price of Rs 5.25 per kWh with escalation every year for a period of

ten years. Further, Ankur is expected to deliver 8 million units of power annually. However, they have been able to deliver about 3.6 million units, just about 40% of the estimated. However, when it reaches the full potential, it is expected to reduce 6600 tonnes of carbon dioxide annually. The electricity from the generating unit to the location of consumption is transported by making use of the grid of Gujarat Electricity Corporation. Ankur has invested about Rs 7.2 crore. The expected turnover when the plant is performing optimally is over Rs 4 crore. With the biomass cost Rs 2 per kg, the biomass cost itself would be Rs 2.2 crore. Accounting for operation, maintenance and troubleshooting expenses, fee for wheeling, and capital recovery and interest on capital, the profit margin is precarious. Thus, the support from MNRE and technical assistance under UNDP-GEF project is very valuable. In addition, the project also is generating bio-char which serves as an excellent fertilizer.

Key issues from the project:

- Chinese engines are not working as per expectations.
- The company is going to procure two additional new engines to replace the three Chinese engines.
- The project is helping local farmers and villagers in creating local employment and income from their biomass. Thus, the project helped local farmers to have additional income from their biomass.
- REC benefit significantly fills the gap. REC prices have dropped from Rs 3 per kWh to Rs 1.5 per kWh, which has created a gap. Ankur planned to develop two more projects, but owing to this issue, they have not proceeded.
- Gujarat Policy peculiarities of scheduling and related penalties if the capacity exceed 1.20 MW generation are doing harm to biomass sector.

6

PRESENTATIONS BY THE SPEAKERS ON DAY 2

(Development of Pipe Line Projects)

Setting up of a Biomass-based Power Plant–Step-by-Step Approach by A. Mohan Reddy, Director, Zenith Energy Services Pvt Ltd., Hyderabad.

Mohan Reddy mentioned that biomass power generation is the only *firm* power amongst all renewable source of energy that can claim over 80% PLF and support rural employment. He outlined the process of approval for new projects. He highlighted there are about 8 steps and mostly they are followed for approval sequentially. He explained the various statutory clearances, required for setting up of a biomass project viz., State Nodal Agency, Pollution Control Board and Village Panchayat, and the steps involved in setting up a biomass projects. He further explained the documentation procedures, fees required and time lines taken in setting up of biomass power projects in detail. He shared the procedures and requirements of the major funding agencies in lending finance to biomass power plants and informed that all the processes require about 18 months duration. Single window was attempted in the state of Punjab. However, as per experience, it only created another window and did not help reducing the burden on the developer. A broad list of approvals, needed from any state government, for setting up a biomass project are indicated below:

S. No.	Description of the Activity	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1	State Nodal Agency	●	●								
2	Gram Panchayat			●							
3	State Pollution Control Board			●							
4	Land	●	●	●	●						
5	DISCOM/ Transmission Co.			●	●						
6	Town Planning			●	●						
7	Factories and Labour Laws				●						
8	Chief Electrical Inspector			●						●	
9	District Industries Centre			●							
10	PPA Signing			●	●						
12	Loan Sanction and Loan Agreement Signing			●	●						
13	Plant Construction				●	●	●	●	●		
14	Project Commissioning										●

Selection of a Model Investment Project by P.R. Reddy, Managing Director, RSA Low Carbon Services Pvt. Ltd, New Delhi.

P.R. Reddy, in his presentation, provided the details of UNDP-GEF–MNRE project for Removal of Barriers for Biomass Power Generation in India and the main features of the projects sanctioned under the programme. He informed that the focus under this programme will be given to small size biomass power projects or cogeneration projects or gasifier-based power plants for providing support to project developers in terms of preparing Detailed Project Reports (DPRs), obtaining approvals from the state government, assistance in obtaining loan from banks/FIs, and so on. He explained the significance of organizing the workshop and explained details of financial as well as technical assistance that will be provided for MIPs along with requirements of MIPs under this collaborative programme. He further detailed the MNRE's usual subsidy schemes and UNDP/GEF project's special subsidies if the project is sanctioned as an MIP.

Financing and Project Appraisal Procedure of Biomass Power Plant by B. V. Rao, Chief General Manager (Technical), IREDA, New Delhi

B.V. Rao has presented the financing and appraisal procedures of IREDA for biomass power projects in India. He mentioned that IREDA's main objective is to extend financial support to Renewable Energy, Energy Efficiency and Conservation projects across India for the promotion of RE as well as energy efficiency projects. Rao highlighted the impacts of funding RE projects as they created jobs for rural masses, awareness in the country towards renewable energy, encouraged entry of private sector investments in RE sector and catalyzed market development by showcasing success stories. He also highlighted that IREDA is supporting biomass power generation-based projects by way of direct combustion and bagasse cogeneration for promotion of biomass power. He explained the requirements of projects in terms of financial indicators and the rates of interest charged by IREDA. He indicated specific advantages (viz., longer repayment tenures, moratorium) of availing loans from IREDA over other FIs/banks For further development of biomass sector, he highlighted on development of organized market, increasing realization among policy makers, innovative financing, and so on as way forward. He suggested that long-term consistent tariff policy, financial support for fuel procurement , capacity building programme, providing adequate working capital, realistic estimation of biomass potential and increased energy conservation will remove large portions of barriers associated with biomass power.

Rao concluded by saying that IREDA is different from other FIs as it allows higher number of years for repayment. On some schemes, they are able to provide credit at less than the prime lending rates.

Policies of the States for Promotion of Biomass Power by A.K. Chauhan, Senior Project Executive, GEDA

A.K. Chauhan in his presentation explained the power potential of Gujarat as 2,360 MW and the various biomass power conversion methods like gasification, combustion and bio-methanation, and so on. Chauhan mentioned that GEDA has achieved about 4000 MW cumulative installed capacity of RE mostly driven by wind and solar energy. However, the progress with biomass is limited. He pointed out that till date GEDA had issued in-principle approval to total 47 developers with aggregate capacity of 488.60 MW. Out of these as on date only 31.2 MW has been commissioned due to various issues/barriers prevalent in the state of Gujarat for biomass power generation.

Experiences of UNDP in Promoting Biomass-based Power Generation, S.N. Srinivas, Programme Officer (Energy for Development), UNDP India

S.N. Srinivas, UNDP, explained the hard lessons in biomass in specific and RE in general. Though the installed capacity is 12% of the total actual generated units of power, it accounts to 5.55%. Amongst the renewable only biomass has showed PLF of 70% while solar, wind are in the range of 20%–30% and conventional coal is about 80%. The cost of production of biomass power at 100 kW scale is Rs 9.73 per kWh (BERI under IISc supervision) and the PLF (best over 1000 hours' operation) was 70%. However, most experiences show 35%–65% for biomass at scale of 1 MW. He also outlined set of action points as given in box below:

What are the key next steps required for the sector?

- Urgent tariff revision: Support biomass support groups, pilot gap funding to make case for tariff revision
- Analyse the need and rationale for differential tariffs
- Analysis of advantages and limitations of scale of operation: large (above 5 MW), medium scale (1 MW–5 MW); small scale/sub-megawatt (100 kW–1 MW); micro scale (10 to 100 kW)
- Compendium of technology packages, specifications, investments, cost-benefits (tangible and intangible)

- Accelerate biomass based captive power generation, which can bring in market pull (establishes supply chain, overcomes stable biomass power operation)
- Analyse the need for parity in fiscal support to biomass electricity when compared to other RE
- Analyse and advocate - Can Cost of power delivered should be the yard stick for fixing fiscal incentives?
- Support model projects in different potential sectors which have large replication potential

Worldwide experiences of General Electric (GE) in the Development of Small-Scale Biomass Power Generation Projects, Prashant K. Patil, Programme Manager, GE India Technology Centre Pvt Ltd., Bangalore

Prashant K. Patil, GE, explained their interest in providing complete solutions of engine, gasifier, biomass processing, O&M, finance, and so on. They provide engines of Jenbacher (recently acquired) and add IISc gasifier as per their package. The first plant is expected to come up in early 2015. He further explained that GE has come up with a product that can generate electricity from hot engine exhaust or any other heat applications. It is ready for demonstration.

Cummins Experience in India in the Development of Small-Scale Biomass Power Generation Projects, Herat Trivedi Sr. Manager - Business Development, Cummins India Ltd. Vadodara

Heart Trivedi enlightened the experiences of Cummins in biomass power generation across India. Trivedi explained that they have initiated producer gas engine series; many of which have been installed in field and are working satisfactorily. They are also keen to provide turnkey solutions for gasifier-based biomass power. He elaborated the installation of 7 x 240kW of 100% producer gas gen sets in Tamil Nadu with coconut shell and woody biomass as fuel operated for 5000 hours, which is a good example for successful generation of power from biomass. He explained different range of products (gas engines) with microprocessor-controlled and protective functions provided by Cummins in biomass power applications. He also explained the range of solutions provided by Cummins as project design and integrator, suppliers of gasifiers and O& M expertise for biomass power plants.

SNAPSHOTS OF THE WORKSHOP

Workshop participants

Closing remarks of technical session by Shri P Ramana Reddy, RSA Low Carbon

Presentation by Dr G C Datta Roy, CEO, Development Environergy Services Limited, New Delhi- 1st day

Presentation by Shri. BV Rao, IREDA- 2nd day

Question and answers session

Mr. DP Joshi, Director- Gujarat Energy Development Agency, addressing the media

Question and answers session

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FEEDBACK FROM THE WORKSHOP PARTICIPANTS

The following is the feedback collected from participants of the workshop at the end of Day 2.

S. No	Name and Details	Suggestion/Expectation/Purpose
1.	Shilpa Nishesh Shelat, farmer	Owns and operates a small-sized biogas plant and has come here to know about the prospects of biomass technologies and their feasibility. She is willing to opt for biomass power projects in future.
2.	Suneeta Patel, farmer	Looking for new avenues of investing and gathered a lot of information from the workshop; which would not have been possible from other sources
3.	Vijay (geothermal specialist)	Participated to learn about the possibilities of power generation from biomass.
4.	G. N. Patel (entrepreneur)	Attended to share knowledge on biomass power technologies
5.	Nitin Baruah (consultant)	Attended to know on what can be done in biomass sector and to explore the prospects of establishing a unit near Vadodara; to generate electricity with cogenerating steam and providing refrigeration, etc.
6.	G.R. Yadav (executive engineer, UGVNL)	After attending the workshop, he felt that better tariff should be provided to make biomass power generation projects as viable projects. He suggested that SERCs should organize such seminars which will help biomass power generation.
7.	Parekh Viral	To study about business prospects in the biomass sector in the western part of India.
8.	D.A. Patel, GSECL (Gujarat State Energy Corporation Ltd.)	GSECL is trying to move for biomass project and wishes to know the trends of this sector and the technology providers.

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S. No	Name and Details	Suggestion/Expectation/Purpose
9.	Anjali Zariwala (Sr. electrical engineer)	She had no major knowledge about this field prior to the workshop and she felt that this workshop has been an eye-opener for her in knowing the possibilities in biomass field.
10.	Sujoy Mitra, CDO, A to Z Group	Looking for a model investment project of 2MW biomass gasification plant. He expressed that they are open to entrepreneurs to build a model project.
11.	Vijay S shah , M/s Padmavathi Enterprises	The workshop is very informative and he got in close contact with various agencies to achieve his goals of attending this workshop.
12.	Bhupendra Pandya, ex-GEDA Officer	A national level monitoring mechanism should be established to get experiences of biomass projects.
13.	Mahesh, Nasik	Attended to understand the barriers and limitations, especially w r t. - power tariff - role of state nodal agencies
14.	Vishal Kumar A. Dhage , M/s Europian Business and Technology centre	Attended to know the play of policy, technology, financing and economics in biomass power generation in India
15	Malay Pandya, RNB Filters	Participated to explore the use of biomass for power generation from an environmental standpoint. He requested the audience to meet them with their requirements from infiltration point of view in biomass sector projects
16.	Monish Gupta, Abellon Clean Energy	We are already operating relatively bigger plants. We are here to learn about small-size biomass technologies, 1MW–3 MW capacity range
17.	P. Patel	He has presented pre-feasibility reports to GEDA and is here to learn how to proceed forward with biomass projects
18.	J.A. Jani	Suggested to spread awareness among the common man

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S. No	Name and Details	Suggestion/Expectation/Purpose
19.	Ashok Chaudhuri, Ankur Group	Suggested that there should be favourable policies for biomass power generation and Ankur is ready to support to any extent in capacity building
20.	Priscilla Kim, Global energy Pvt Ltd., Mizoram	To learn various challenges, advantages and feasibility study of installing a plant in the north-eastern part of India. Ms Kim suggested more workshops of this kind to be organized all over India, especially in the north-eastern states
21.	Harish Khiya, GEDA	He mentioned that previous tariff control is over by March 2013. New tariff is being determined/under process. New tariff dictates, the profusion of newer power generating plants and biomass sector should be kept in view while deciding upon the new tariff
22	Vishal Jadeja	To verify the prospects of going for energy plantations and detailed understanding of biomass power generation
23	Mukesh Sonaga, M/s Sagacious Infrastructure Pvt.Ltd.	To evaluate various technology options available for the setting up of biomass power plant and decided the optimum size of the project viable
24	S.P. Trivedi	His objective of attending the workshop is to understand issues related to biomass power fuel collection systems
25	Vipin Surana , Ankur scientific	His objective of attending the workshop is to understand issues related to biomass power generation

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BROAD CONCLUSIONS FROM THE WORKSHOP

Given the current status of biomass sector in the country, the workshop was well attended and was well received by the participants.

The workshop identified low tariff as the singlemost problem, acting as a major constraint to the growth of biomass power. As an urgent relief, generation-based incentive was requested from MNRE without which many existing projects may close down, and no new projects may come up especially at the small capacity and grid evacuation.

It was also felt that the biomass power producers are underrepresented in advocating appropriate policies unlike the wind and solar associations. Hence, it was felt that there is an urgent need for biomass producers to get together as an advocacy group. Some even requested support from the UNDP-GEF project for the above advocacy. The workshop was well attended, but the number of actual promoters seemed to be low. Only three to four clear expressions of interest [EOI] emerged.

Key follow-up action that is needed upon completion of the workshop includes:

a) Zenith to pursue the three MIPs who have shown expression of interest,
b) MNRE/UNDP to agree on the shortlisting criteria for MIPs
c) Project to consider a special window of GBI to projects in the scale of 1MW–3 MW;
d) Project to consider supporting platforms/advocacy groups to revise tariff;
e) Project to commission appropriate analytical studies such as advantages/limitations of scale of biomass power plants; impact and risks of competing uses of biomass as fuel, analyse the need and rationale for differential tariffs;
f) Develop compendium of technology packages, specifications, investments, cost-benefits (including tangible and intangibles).

Brief Summary of the Issues and Solutions

The following issues were raised by the biomass promoters during the workshop held at Vadodara during 3-4 April 2013. The issues were addressed by the experts who attended the workshop with suggested solutions.

Price escalation of biomass fuels

Some of the promoters of biomass power plants mentioned that the projects are becoming unviable due to substantial price escalation of biomass partly due to competing use from other sectors like pulp and paper, cement, onion dehydration units, hotels, and so on, who also started using biomass as fuel.

Reply: Experts suggested that encouraging the establishment of fuel supply linkages or depots besides plantation could lower the risk of price escalation of biomass.

Accurate/real assessment of surplus biomass availability during the assessment study and DPR preparation will also avoid the price escalation risk to some extent. There was also a strong case for considering fuel pass through mechanism on price escalation of biomass fuels as it is allowed for power plants run on fossil fuels.

Policy and regulatory issues

A couple of biomass promoters expressed their concern that due to insufficient tariff for biomass-based power generation, biomass-based power generation has become unviable.

Reply: The suggested solution is that the government policies should be supportive and policy rectification particularly with respect to tariff should be undertaken on annual or as situation demands to attract investments into biomass power generation.

Suitability of the technology

A section of biomass promoters expressed their inability in selection of technology for the generation of power from biomass. They mentioned that bio-methanation seems viable and cost effective for generation of power from biomass rather than combustion/cogeneration.

Reply: Experts suggested that technology selection depends on case-to-case basis. A detailed analysis should be conducted before selecting the technology for projects to become viable.

Delays in getting approvals/clearances

It was discussed that delays that took place in getting approvals from various departments like Pollution Control Board (PCB) or SNAs is likely to create disinterest in promoters to set up the biomass power plants.

Reply: Experts suggested that government may create single window (may be by SNA) for getting approvals for setting of biomass power plants.

Management and the logistics of the biomass power plants are cumbersome and expensive

Some of the promoters mentioned that managing the economics and logistics of biomass power plants are becoming expensive and cumbersome for which the government is not providing any support. They mentioned that running costs are

increasing due to various constraints like land, fuel, and so on that involves arrangement of huge funding from own sources.

Reply: Experts suggested that proper planning like sustainable fuel supply linkages, energy plantation, economics of fuel management and support from government shall lower the risks of the projects.

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ANNEXURE

Annex-1: Agenda of the Workshop

Day 1 : 3rd April 2013 (Wednesday)	
Inaugural Session	
09:00 – 10:00 hrs	Registration
10:00 - 10:05 hrs	Welcome Address by ***A. Mohan Reddy, Director, Zenith Energy Services***
10:05– 10:15hrs	Address by ***V.K. Jain, Director, MNRE***
10:15 – 10:25 hrs	Address by ***Srinivasan Iyer, Asst Country Director, UNDP/India***
10:25–10:35hrs	Address by ***D.P. Joshi, Director, GEDA***
10:35– 10:40hrs	Vote of Thanks by ***P.R. Reddy, MD, RSA Low Carbon Services***
10:40– 11:00hrs	***Tea Break***
Session-I : Success Stories in Biomass Power in India	
	Session Chair : D.P. Joshi and J.R. Meshram
11:00– 11:15hrs	Potential of Biomass Power in India by ***G.C. Datta Roy, CEO, Development Environergy Services Limited, New Delhi***.
11:15– 11:30hrs	12 MW Rice Straw-based Biomass Power Plant in Patiala–Fuel Supply Linkages by ***Monish Ahuja, Director, Bermaco Energy Ltd, Navi Mumbai***
11:30– 11:45hrs	13 MW Crop Residues-based Biomass Power Plant in Aurangabad–Fuels Supply Linkages by ***Sanjay Joshi, Vice President, IL&FS, Mumbai***
11:45–12:00hrs	4.25MW*Pelletbased*Co-Generation/Captive Power Plant in Ahmadabad by ***Avinash Gupta, Senior Manager, Abellon Clean Energy Limited, Ahmadabad***
12:00–12:15hrs	Biomass Solar Hybrid Plant in Pune by **R.R. Sonde, Executive Vice President, M/s Thermax Limited, Pune**
12:15– 12:30hrs	1.2 MW Power Plant-based on Gasification of Biomass in Sankheda by ***Dr B C Jain, Chairman, Ankur Scientific Technologies Pvt. Ltd, Vadodara***
12:30– 13:00hrs	***Q & A***
13:00– 14:00hrs	***Lunch***
14:00 – 18:00 hrs	***Visit to 1.2 MW Power Plant Power Plant-based on Gasification of Biomass in Sankheda***

Day 2 : 4th April 2013 (Thursday)	
Session – II : Development of Pipe Line Projects	
10:00 – 10:15hrs	Setting up of a Biomass-based Power Plant–Step-by-Step Approach by ***A. Mohan Reddy, Director, Zenith Energy Services Pvt. Ltd., Hyderabad***
10:15– 10:30hrs	Selection of a Model Investment Project by ***P.R. Reddy, Managing Director, RSA Low Carbon Services Pvt. Ltd, New Delhi***
10:30– 10:45hrs	Financing and Project Appraisal Procedure of Biomass Power Plant by ***B.V. Rao, CGM (Technical), IREDA***
10:45-11:00 hrs	***Tea Break***
11:00 – 11:15 hrs	Gujarat State Policies for Promotion of Biomass Power by ***A.K. Chauhan, Senior Project Executive, GEDA***
11:15–11:45hrs	Feedback from Workshop Participants
11:45 – 12:00 Noon	Experiences of UNDP in Promoting Biomass-based Power Generation, by **S.N. Srinivas, Programme Officer (Energy for Development), UNDP India**
12:00 – 12:15 hrs	Worldwide experiences of General Electric (GE) in the Development of Small-scale Biomass Power Generation Projects, by **Prashant K. Patil, Programme Manager, GE India Technology Centre Pvt Ltd., Bangalore**
12:00 – 12:15 hrs	Cummins Experience in India in the Development of Small-scale Biomass Power Generation Projects by **Herat Trivedi, Senior Manager, Business Development,Cummins India Ltd., Vadodara**
12:15 - 1300hrs	Q&A and Discussion and Closure of the Workshop
1300 -1400 hrs	***Lunch***

Annex-2: List of Workshop Participants

S No	Name	Designation	Organization	Contact No	E-mail Address	Category
1	Shri D.P. Joshi	Director	GEDA	79 23257250	director@geda.org.in	Organizer
2	Shri V.K. Jain	Director	MNRE	99112 38061	jainvk@nic.in	Organizer
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9	Shri B.V. Rao	CGM (Technical)	IREDA	98105 62552	bvrao@ireda.gov.in	Speaker
10	Shri A. Mohan Reddy	Director	Zenith Energy	98494 08485	Mohan@zenithenergy.com	Speaker
11	Shri T. Sampath	Dy Manager	Zenith Energy	98856 48609	sampath@zenithenergy.com	Organizer
12	Shri P.R. Reddy	Managing Director	RSA Low Carbon Services	98107 09188	prreddy100@gmail.com	Speaker
13	Shri Adithya Dahagama	Project Manager	RSA Low Carbon Services	99596 23139	adithya.31@gmail.com	Organizer
14	Shri Monish Ahuja	Director	Bermaco Energy Ltd, Navi Mumbai	88980 57100	monishahuja@bermacoenergy.co.in	Speaker
15	Dr G.C. Datta Roy	CEO	Development Environergy Services Limited, New Delhi	95829 40363	gdr@deslenergy.com	Speaker
16	Shri Sanjay Joshi	Vice President	IL&FS, Mumbai	98337 37857	sanjay.joshi@ilfsindia.com	Speaker

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17	Shri Avinash Gupta	Sr. Manager – Projects (Power)	Abellon Clean Energy Limited, Ahmedabad	99099 71868	avinash.gupta@abelloncleanenergy.com	Delegate
18	Dr R.R. Sonde	Executive Vice President	Thermax Limited, Pune		rsonde@thermaxindia.com	Speaker
19	Dr B.C. Jain	Chairman	Ankur Scientific Technologies Pvt Ltd		bcjain@ankurscientific.com	Speaker
20	Shri Prashant K Patil	Programme Manager	GE India Technology Centre Pvt Ltd., Bangalore	96866 85291	Prashant_patil@ge.com	Speaker
21	Shri Herat Trivedi	Sr Manager – Business Development	Cummins India Ltd., Vadodara	97372 99421	herat.trivedi@cummins.com	Speaker
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36	Shri Mukesh Sonagra	Director	Sagacious Infrastructure & Projects Pvt. Ltd		mukeshsonagra@yahoo.com	Developer
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46	Shri G.R. Yadav	UGVCL	UGVCL			Delegate
47	Shri V.L. Parekh	Kinc group	Director			Developer
48	Shri Mahesh Patil		Self			Participant
49	Shri Sanjay Patel	CMD SPRESPL	Self			Delegate
50	Shri Harish	J.P.D	GEDA			Delegate
51	Shri Asit J.					Delegate
52	Shri Sunil Patel		Self			Delegate
53	Shri S.P. Trivedi	Exe Engineer				Delegate
54	Shri Dhiraj	All India Radio				Media
55	Shri Sagar Nair		Hallam			Delegate
56	Shri Dinesh		Sandesh			Delegate
57	Shri P.B. Patel	ICSE (PMI)	GSECL			Delegate
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59	Shri P.K. Pandy	AGM	IREDA			Delegate
60	Shri K.C. Gapope	ICSE (PMI)	GSECL			Delegate
61	Shri D.A. Patel	Dy Engr	GSFCC			Delegate
62	Shri Viaai Kumar	Energy Sector	EBTC			Delegate

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64	Shri S.K. Duthar	DE(T)	MAVCL Bodel			Delegate
65	Prakesh V	DESL	Principal			Delegate
66	MR Parim	DE(T)				Delegate
67	Satish	Director				Delegate
68	Shri Malay Pandya	Director	RTB Filter	9099929730	malay.pandya@rbfiller.com	Delegate
69	AIR	Media			Media	
70	EZEE TV	Media			Media	
71	V S TV	Media			Media	
72	Shri T.R. Bhatt	Media			Media	
73	GTR	Media			Meida	
74	ITV	Media			Media	
75	Shri G.K. Pandey	Media			Meida	
76	KB	Media			Media	
77	Shri S.J. Mishra	Asst. Director				Meida
78	SMEMHAL	Regional Head		98258 75295		Media
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81	Shri Asim K. Joshi	Sr Scientist	SPRERI			Delegate
82	Shri ShajleshPandya					Delegate
83	Shri Rakesh		Self			Delegate
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88	Shri Bhart	VNM TV	Repoter			Media
89	Shri Ruchi T	VNM TV				Media
90	Shri P.P. Lalahami	FRR	AIR-Radio	94263 86609		Media
91	Shri Arvind			0265-2585681		Delegate
92	Shri Kalpesh		Omint			Delegate
93	Shri R.R. Patel		Royal exta			Delegate
94	Shri Ramanadha			9898676003		Delegate
95	Shri Snehal Patel	Forum Biomass Materials		90991 19791	scpatel2227@gmail.com	Delegate

Annex-3: List of Promoters who expressed their interest to set up MIPs

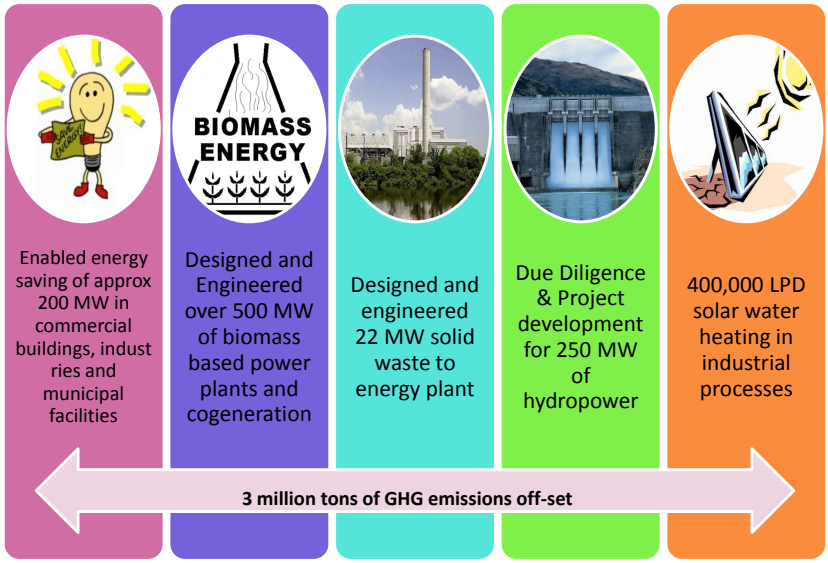
S.No	Organization	Contact Person	Contact Info	Email Id	Purpose of EOI
1	M/s Apex Enertech Pvt. Ltd, Gandhidham (Kutch), Galpadar-370201	Shri Vishalsinh Jadeja - Director	09979622666, 02836-237966,	vishalsinhdjadeja@gmail.com, appexengineer@gmail.com,	Wish to set up 2 MW Biomass power plant at Katch, Gujarat
2	Gujarat State Electricity Corporation Ltd, Vidyut Bhavan, Race Course, Vadodara-390 007	Chief engineer (P&P) / Shri P.B. Patil - S.E (Planning)	9925208794	cepnp.gsecl@gebmail.com	Explore the possibility for setting up integrated/ independent biomass power projects in Gujarat
3	M/s Sagacious Infrastructure & Projects Pvt. Ltd	Shri Mukesh Sonagra , Director	9974711997	mukeshsonaga@yahoo.com	Wish to set up biomass power plant in Gujarat and Rajasthan of 5 MW and 3 MW, respectively
4	M/s Swaraj Poly Plastpvt. Ltd, B/H, Hotel Triveni, Jetpur road Dhoraji	Shri Pravinbhai Sudani / Shri Vivek P. Sudani-Manager	9510319092	sudani.vivek@gmail.com	Wish to set up biomass gasification project and contacted the suppliers for working out the model.

Annex-4: Presentations of the Workshop

Presentation 1

Title of Presentation	Presenter	Brief details of the presentation	Category
Potential of Biomass Power in India	**Dr G. C. Datta Roy**, CEO, Development Environergy Services Limited, New Delhi.	The presentation described the current scenario and importance of the biomass sector with a few statistics on power generation capacity and rural employment. The presentation highlighted the various mechanisms like improving harvesting and logistics management, innovative fuel logistics system and energy plantation for the growth of the biomass sector. The presentation also provided suggestions in policy matters as way forward for improving the biomass sector.	Policy and Supply Chain

DESL in CEM Market



DESL

Content of Presentation

- Why Biomass Power
- Availability of resources
- Competitive use of biomass
- Surplus availability & potential
- Progress to date
- Achievements
- Challenges
- Moving ahead

DESL

Why Biomass Power

- Rural energy access -10000 MW DG can provide access to over 80% of the unserved/underserved rural household
- Rural income & employment generation -Estimated potential of 200 Million man-days generating Rs 4000 Crs annual salary income- overall potential of Rs 15000 Crs/year of rural direct income (Biomass sale plus direct employment)
- Diesel saving -Estimated at about 3 MnTOE
- Environment benefit -local & global- annual reduction of close to 30 MnT GHG
- Utility benefit -improved PLF of T&D infrastructure developed under RGVVY

Most versatile RE resources from rural energy perspective
Only RET, where over 50% of the revenue flows back to the local community

ODESL

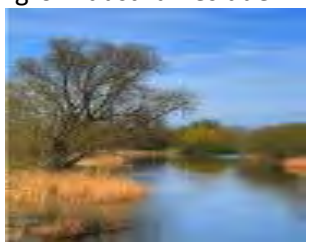
Biomass Resources-Diverse Sources


Agro residue


Agro-Industrial residue


Forest residue

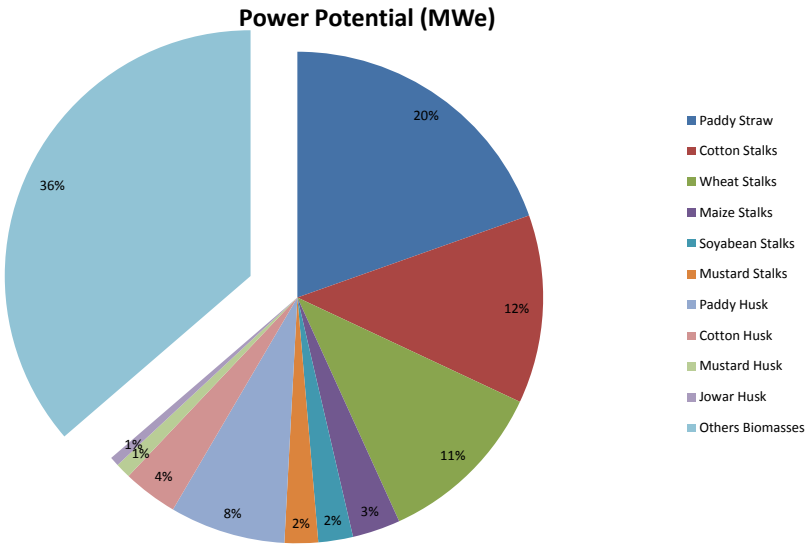

Energy Plantation


Riverside green


Habitat refuses

ODESL

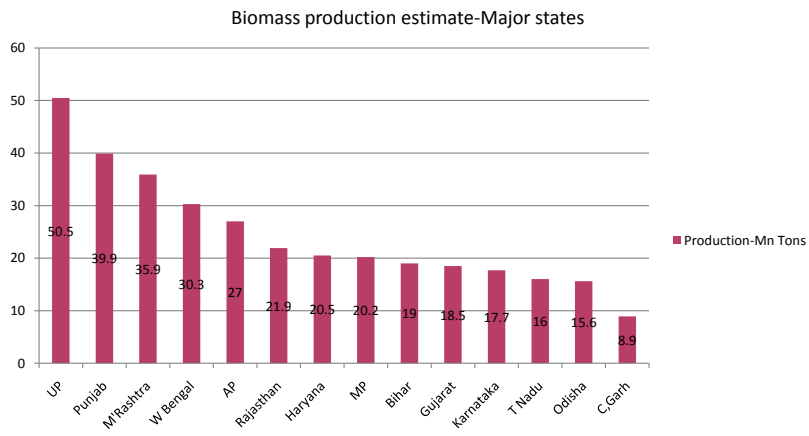
Straw & Stalks-Fuel for Immediate Future



ODESL

The future fuel for biomass IPP would be Straw and Stalk.

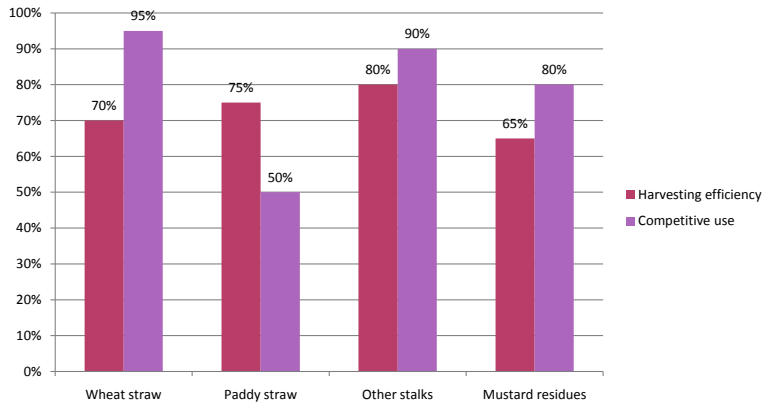
Estimated Production of Agro-residue



Total-342 Million Tons

ODESL

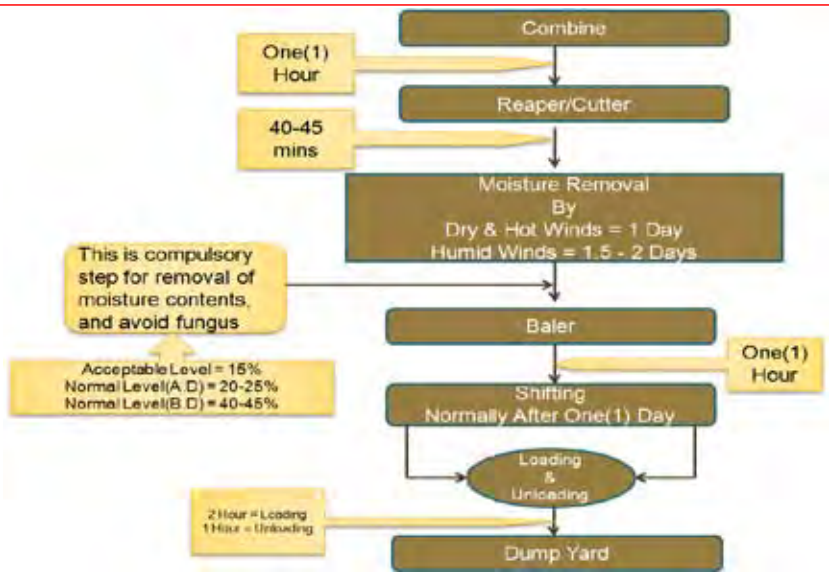
Surplus Availability



Surplus estimated at about 63 Million Tons
Estimated power potential-7000 MW
Improving harvesting & logistics efficiency can double the available surplus

DESL

Impact of Farmers Priority on Harvest Efficiency



DESL

Increased Mechanization-Lower Effciiency

ODESL

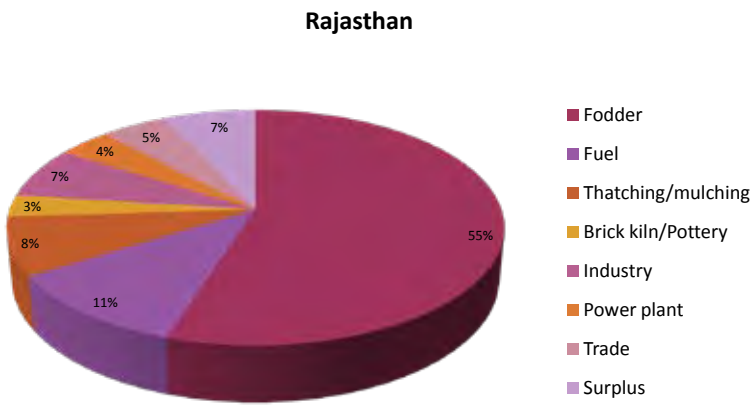
Baling post Harvest

ODESL

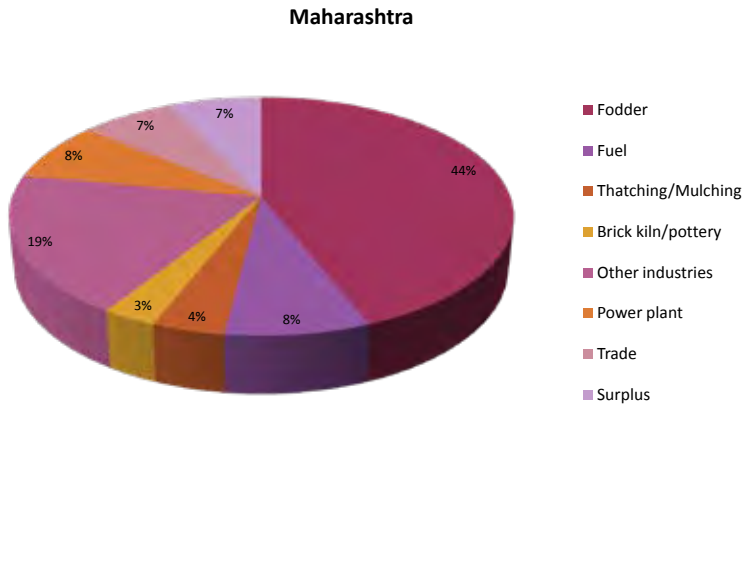
Leftovers Field Burnt

Result if biomass harvesting not completed in a week post crop harvest

Competitive use of biomass - Rajasthan



Competitive use of biomass - Maharashtra



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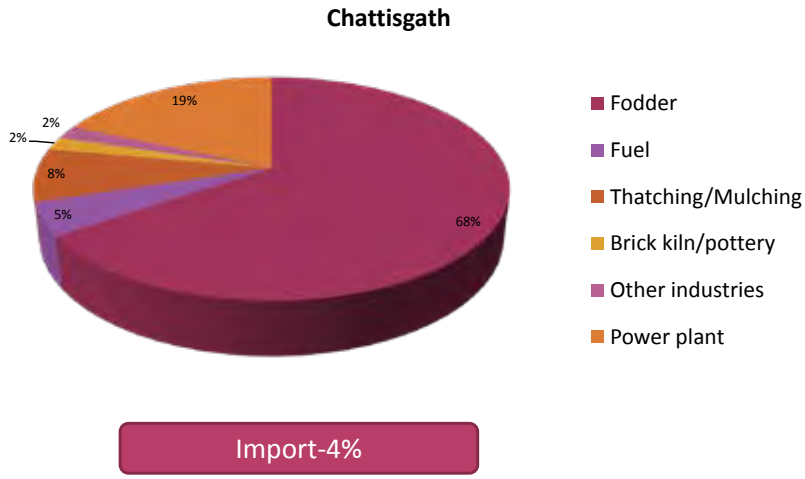
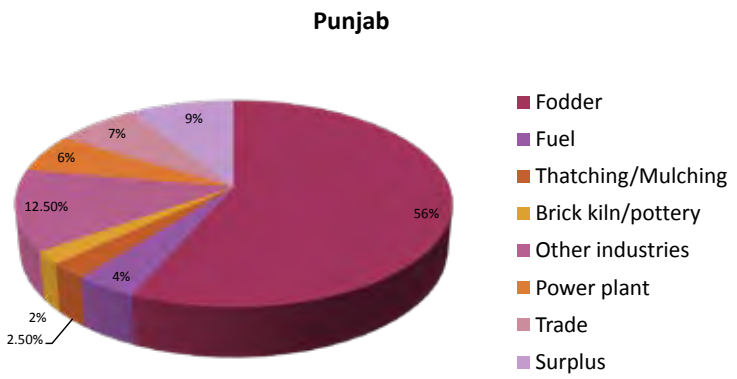
Competitive use of biomass - Chhattisgarh



Import-4%

DESL

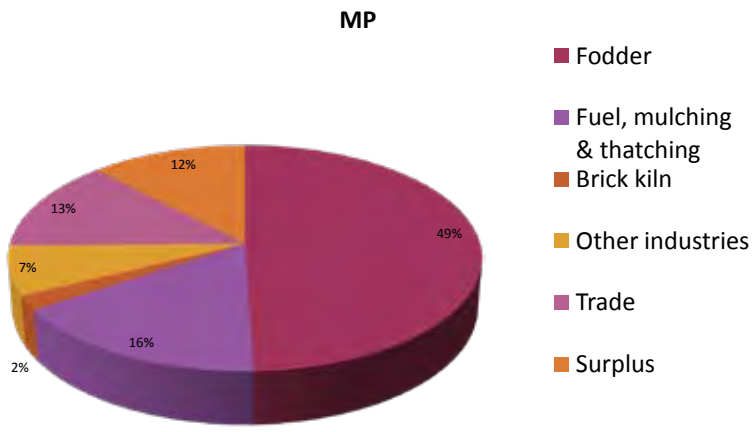
Competitive use of biomass- Punjab



Haryana has similar pattern

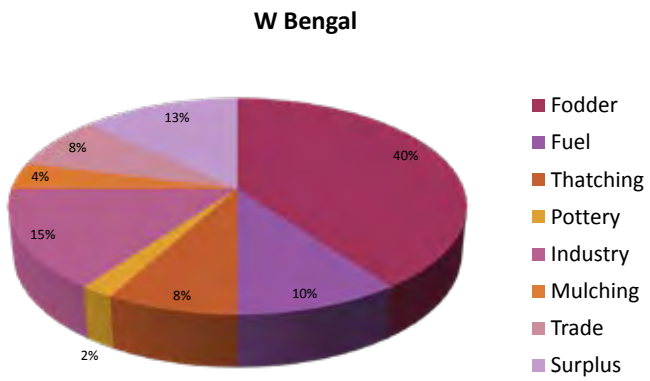
DESL

Competitive use of biomass- MP



DESL

Competitive use of biomass- W Bengal



Bihar & Odisha have similar situations

ODESL

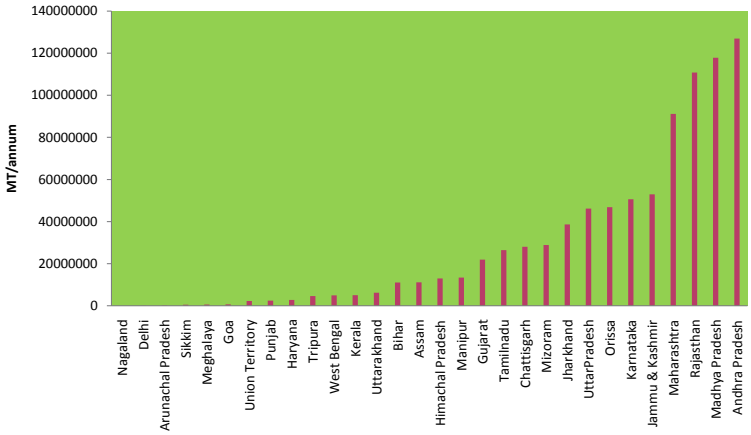
Summary

Usage	Bihar/WB	C'Garh	Maharashtra	MP	Punjab	Rajasthan
Fodder	40	68	44	49	56	55
Fuel	10	5	8	16	4	11
Thatching/Mulching	12	8	4	2	2.5	8
Self use	**62**	**81**	**56**	**67**	**62.5**	**74**
Brick kiln/pottery	2	2	3	2	2	3
Other industries	15	2	19	7	12.5	7
Power plant	0	19	8	0	6	4
Trade	8	(-) 4	7	12	8	5
Surplus	13	0	7	12	9	7

At present level of harvesting efficiency, aggregate capacity of power plant should remain within 10% of overall availability

ODESL

Energy Plantation in Wasteland-Huge Potential



DESL

Availability of Resources-Present & Potential

Resources	Potential-MW		Data source
	Current	Future	
Agro-residue	7000	18700	IISC BAS atlas & DESL field study
Plantation	1000	20000	BAS & WAS & DESL analysis
Municipal wastes	2600	5200	MNRE sub-group findings & DESL analysis
Animal wastes	8165	10000	
Industrial cogen	1300	1600	
Total	20065	55500	

Overall potential comprises of both thermal & electrical energy

DESL

Biomass IPP-Development Status

Scenario-Agro-residue					
State	Potential MW	Allocated capacity MW	Installed MW	% Potential	% Allocated
Andhra Pradesh	281	404	220	78*	54
Haryana	521	195	4	1	2
Karnataka	210	558	87	41*	16
Madya Pradesh	370	314	32	9	10
Maharashtra	359	328	181	50	55
Punjab	929	260	40	4	15
Rajasthan	284	364	86	30	24
Tamil Nadu	67	419	131	196*	31
Total	3021	2842	781	26	27
Another 500 MW capacity has since been added-current installed capacity is close to 3500 MW. * AP, Karnataka and TN allocated capacity includes additional potential from plantation.					

DESL estimates that about 1000 MW capacity has also been installed as captive facilities by the industry mainly on rice husk

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Achievements

- Technology for difficult to burn biomass successfully deployed
  - Paddy straw-PBPL (1st commercial plant in the world)
  - Mustard residue-Kalpataru, the pioneer-number of projects in Rajasthan
  - Multi-fuel CFBC-Under operation-technological challenges getting addressed
- Innovative fuel logistics system developed
  - PBPL
  - Malwa
- Innovative fuel business model under development-BESL/GAP
- Energy plantation
  - Abellon, Gujarat
  - Varietal development-Growmore
- MW capacity gasifier-Ankur
- Waste to Energy Projects
  - 16 MW TOWML Project successfully operating since Feb, 2012
  - 10 MW gasifier project under trial operation in Pune

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Challenges

- Revival of the existing plant
  - Tariff
  - Biomass supply chain management
  - T&D-Fuel storage, feeding & combustion
- New projects
  - Financing
  - Policy & regulatory issues
  - Energy plantation

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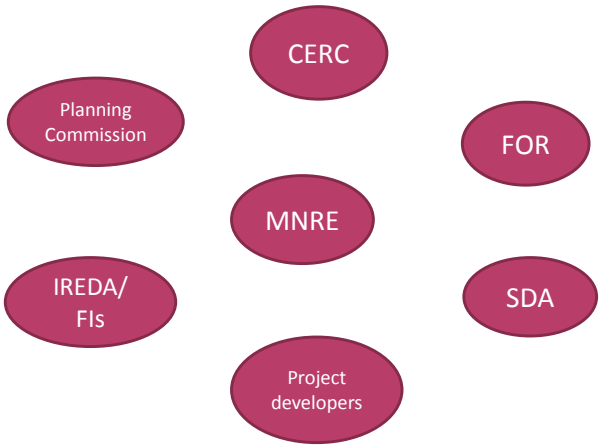
Way Forward

- Harmonized tariff principles
  - Higher capital cost for straw & stalk fired plants
  - Lower SHR for difficult fuel
  - Fuel cost pass through
- Project Financing
  - Improved incentives from MNRE (GBI)
  - Credit enhancement
- Robust RPO/REC mechanism
- Reduced project & other clearances cycle time
  - MNRE Processes
  - State Processes
  - Financial closure
- Energy plantation-Different Organisation & business model
  - Wasteland availability & allocations
  - Financing
  - Few Pilots

DESL

Monitoring-Regular Stakeholders Consultation



Recommend Quarterly Review-Policy & Regulatory Issues

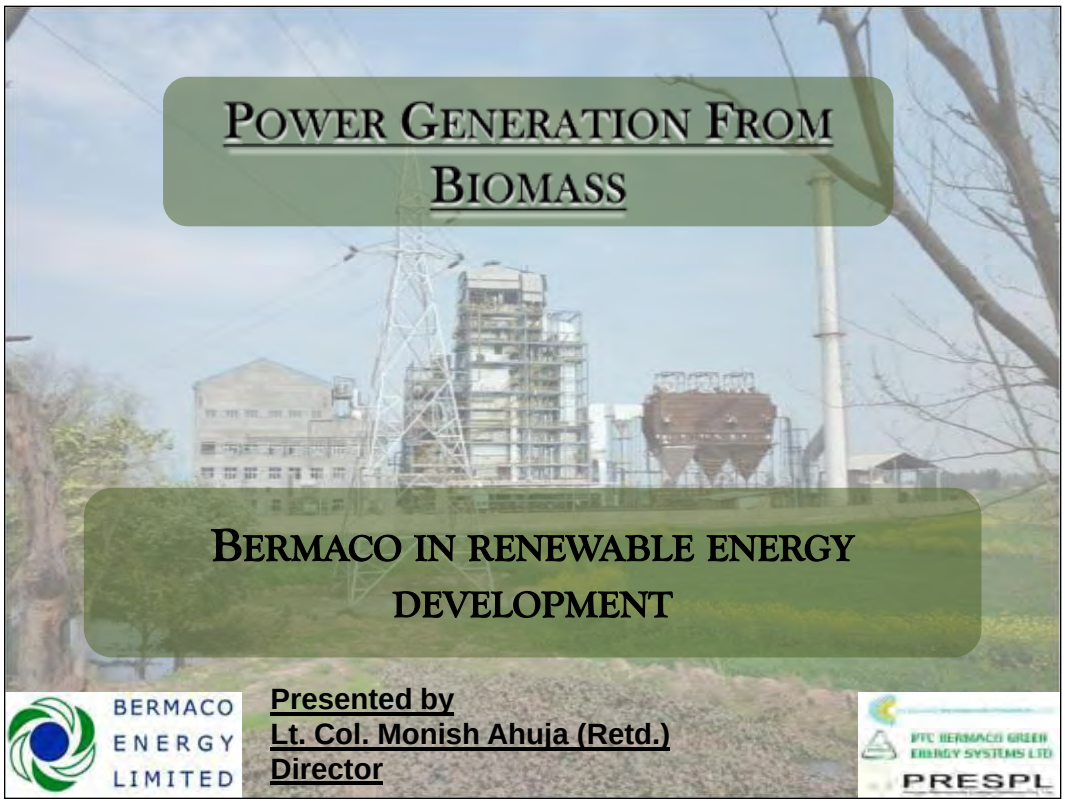
DESL

Thank You

DESL

Presentation 2

Title of Presentation	Presenter	Brief details of the presentation	Category
12 MW Rice Straw-based Biomass Power Plant in Patiala– Fuel Supply Linkages	**Shri Monish Ahuja**, Director, Bermaco Energy Ltd, Navi Mumbai	The presentation presented the highlights of 12 MW Biomass Power plant at Patiala. It provided details like procedures for procurement of fuels, power generation details, benefits of the project along with issues faced in power generation. The presentation clearly presented the effective way of fuel management system adopted for continuous operation of a biomass power plant.	Supply Chain



Bermaco Energy limited

State	SPV with Partners	Power Generation
Punjab	Punjab Biomass Power Ltd	108MW
Bihar	PTC Bermaco Green Energy Systems Ltd	312MW
Total		420MW

Bermaco has implemented a 100% Paddy Straw fired 12 MW Biomass Power Project at Ghanour, Patiala for its SPV Punjab Biomass Power Limited (PBPL).
The Project Details are as follows-

Location: Village : Ghanaur, Patiala, Punjab
Plant Capacity : 12 MW, Condensing STG
Plant Configuration : 60 TPH Boiler
Fuel : Paddy Straw

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PRESPL

Bermaco Energy limited

Subsidiary Companies	Activity
Punjab Renewable Energy Systems Ltd PRESPL	Biomass Fuel Supply and Energy Plantation
PRESPL –Fuel Supply and Aggregation, BAS	
• GAPS Power & Infrastructure Pvt. Ltd. (Aurangabad, Maharashtra) – 13MW	Cotton Stalk, Maize Cob, Bagasse
• Punjab Biomass Power Ltd. (Ghanour, Punjab) – 12 MW	Paddy Straw, Sugarcane Trash & Energy Plantation
•AA Energy Ltd. (Gadchiroli, Maharashtra) – 10 MW	Paddy Straw
• Radico Khaitan (Aurangabad, Maharashtra) – Process Industry	Cotton Stalk, Soya Husk, Juliflora
• Tata Power Ltd. (Kundli, Maharashtra)	100 acres of Energy Plantation
•Oleander Farms Pvt. Ltd.	200 acres of Energy Plantation
• Simbhaoli Sugar Ltd. (Brijnathpur, Chilwaria – Uttarpradesh)	Biomass Assessment Survey, Sugarcane Trash
• Auro Mira Energy	Biomass Assessment Survey

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Biomass Power

Potential	:	**17000 MW**
Achievement	:	**1227 MW**
11th Plan Target/ Achievement	:	**500 MW/ 626 MW**
Deployment target 12th Plan	:	**500 MW.**
Strategy	:	**Promotion of small capacity biomass projects with biomass linkage and captive plantations.**

Source : MNRE

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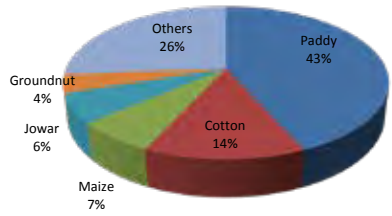
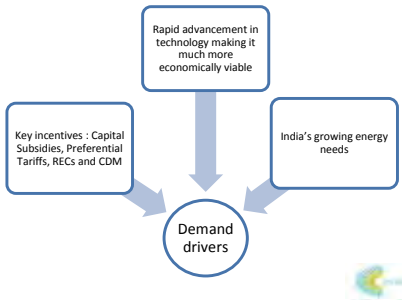
Biomass Power

India Agri Biomass Production Profile (%)





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Biomass Power - Benefits

- INCOME TO THE RURAL POPULATION.
- RURAL EMPLOYMENT.
- SOCIO-ECONOMIC DEVELOPMENT AND SOCIAL INTEGRATION.
- AGRICULTURAL DEVELOPMENT.
- FOREIGN EXCHANGE SAVINGS.
- AFFORDABLE CLEAN POWER COMPARED TO OTHER RE POWER.
  - LESS CAPITAL COST
  - HIGHER PLF
  - EVACUATION AND INFRASTRUCTURE CHALLENGES RELATIVELY LESS THAN OTHER RE POWER
  - CHEAP POWER FOR CONSUMPTION RATHER THAN TAX SAVINGS AS COMPARED TO OTHER RE POWER
- POVERTY ALLEVIATION.
- ENERGY SECURITY.
- CLIMATE CHANGE MITIGATION.
- DECENTRALIZED BASE-LOAD POWER.

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Punjab Biomass Power Ltd. (PBPL) - A UNIQUE 12MW BIOMASS PADDY STRAW FIRED BIOMASS POWER PROJECT

Burning of Paddy Straw in Field by Farmers

Baling in paddy field | Transportation of baled straw to one of the Collection Center | Trolley being weighed | One of the Fuel Storage Depot at one of the Collection Center

12 MW Paddy straw-fired Power Plant at Ghanour, Patiala, Punjab | Fuel Handling System | Turbine & Generator | O&M Team

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Punjab Renewable Energy Systems Pvt. Ltd (PRESPL) – The Fuel Management Company

•One of the principal challenges facing developers investing in a biomass project is to ensure that a secure and cost-effective supply of biomass fuel is in place. The larger fraction of cost in biomass energy generation originates from the logistics and storage operations. PRESPL is optimizing fuel purchasing through analysis, processes, technology and integrated networking.

•PRESPL has been investing more in people, processes and technology to solve fuel management challenges.

PRESPL – Aggregation and supply of biomass fuel

PRESPL -

- **Mitigates the risk of non-availability of fuel to Biomass Power Plant and de-risk the IPPs, making lending to the project easier for financial institutions.**
- **Handling a supply of approx. 700MT of biomass on a daily basis.**
- **Supplying**
  - **Paddy Straw**
  - **Cotton Stalk**
  - **Maize Cob**
  - **Sugarcane Trash**
  - **Bagasse**
  - **Mustard Stalk, Soya Husk**

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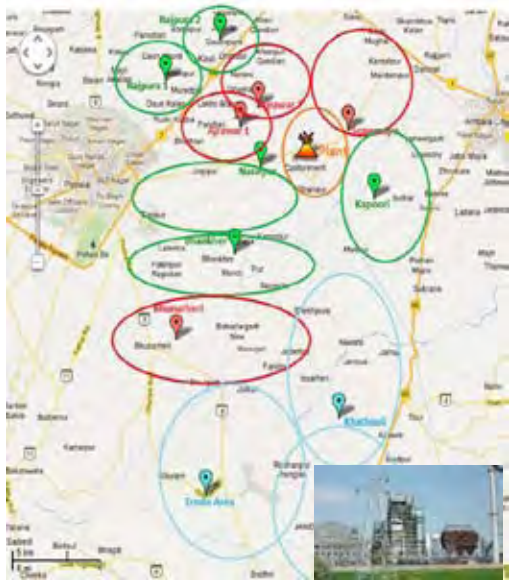
PRESPL – Fuel Collection Centers

Collection Centers for 13MW GAPS Power Plant



Collection Centers for 12MW PBPL Power Plant

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PRESPL – Energy Plantation

The Biomass power projects which are designed to operate on agricultural-waste biomass (like paddy straw, wheat straw, rice husk, cane trash etc) has following risks-

- Dependence on monsoon and other natural factors
- Very low density requiring very high volume of feed to be handled
- Availability of feed-stock for limited period during harvest period
- Uncontrolled pricing of feedstock

PRESPL has proposed to develop alternate source of Biomass Fuel. PRESPL has made strategic tie-ups with Biotech companies to develop special plant species that can be grown in 'Cultivable Waste Land' and 'Fallow Land'.

India has huge extent of degraded wastelands.

PRESPL has been doing Energy Plantation for Punjab Biomass Power Ltd., Oleander Farms Pvt. Ltd. and Tata Power Ltd.

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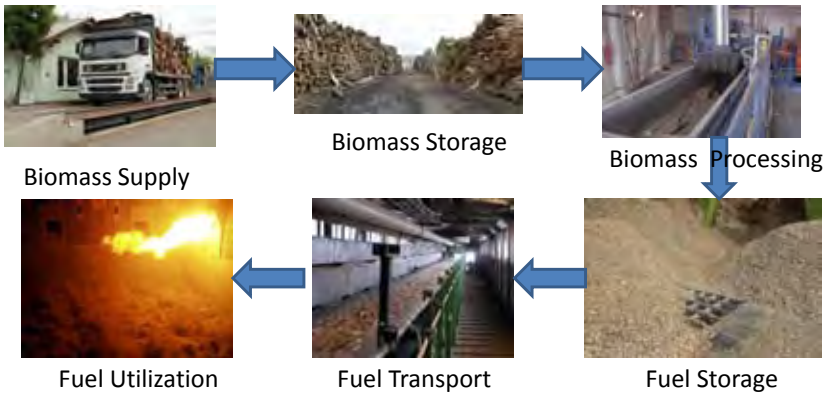
PRESPL - Energy Plantation



In addition to this technology being carbon neutral, there will be further improvement of the environment.

- Improvement of Wasteland Soil physical and chemical characteristics
- Improvement in underground water quality
- Firing Wood in power plant will reduce NOx and SOx emission levels in addition to reduction in CO_2
- Generation of rural employment

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Bermaco – International Acknowledgement

THE HIGH COMMISSION OF THE UNITED REPUBLIC OF TANZANIA

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF ENERGY AND MINERALS

Acting High Commissioner
High Commission of India,
P.O.Box 2684, 82 Kazanchi Road,
Dar es Salaam, Tanzania.

RE: BERMACO ENERGY LIMITED PROPOSAL ON FIRED BIOMASS BASED POWER PLANTS

Reference is made to the above heading.

We wish to acknowledge receipt of your letter Ref. No. DAR /COM/201/5/2012 dated 31st May, 2012 regarding the above subject.

We are pleased to note that your office is in full support of the Ministry's initiatives to develop the energy sector. Linking the Ministry of Energy and Minerals with BERMACO, an energy Company in India is a commendable move that shows your commitment in supporting the Ministry's effort to ensure sustainable power supply in the country through Public Private Partnership (PPP).

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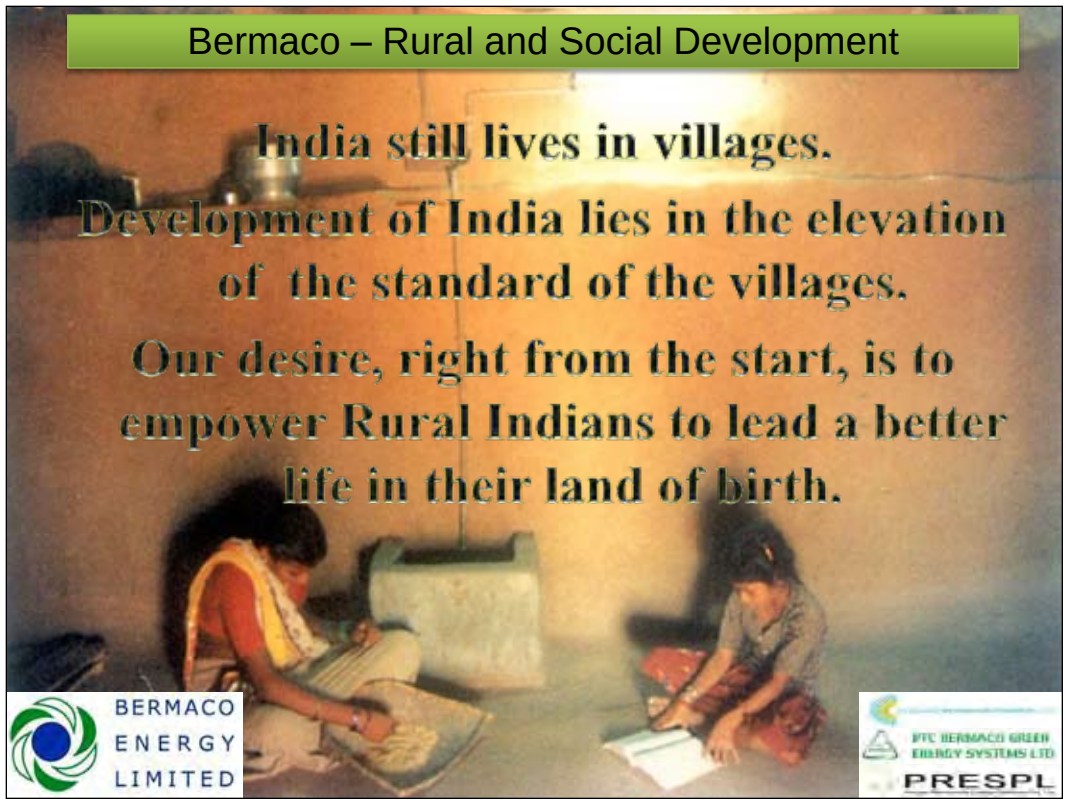
Bermaco – Rural and Social Development



Bermaco – Effects of 12MW Biomass Power Plant at Ghanour, Patiala

- Agriculture education program enhances the productivity of crops.

- Extra income to farmers by way of purchase of biomass, hiring of tractors, trolleys and employment.
- 65% of the income from generation is returned directly to the rural community.
- Electricity to rural household as the Plant is located in the village area.

- Instrumental in Opening of ITI and shops
- Extremely low emission of greenhouse gases compared to fossil fuels
- Effective waste management practice.

- Curbs stubble burning and reduces environment pollution.
- Energy Plantation increases water level in the area.

- Saving Foreign Exchange indirectly

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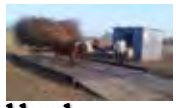
Bermaco – Effects of 12MW Biomass Power Plant at Ghanour, Patiala

- Developed Village Level Entrepreneurs (VLEs) in

  - Ghanour, Aurangabad, Karjat and Gadchiroli
  - Empowered the village youth to become VLEs
  - Provided equipment like balers, cutters etc.



  - Encouraged the VLEs to invest on Paddy Straw cutters and local transport vehicles.

  - Impart regular education program of Management to VLEs
  - Impart regular education program to increase the productivity of crops.
  - Impart and showcase to VLEs that village and agriculture is important

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Bermaco – Effects of 12MW Biomass Power Plant at Ghanour, Patiala

- **Effects of Power availability in rural India :**
  - **Social inclusion of the rural community**
  - **Poverty Alleviation**
  - **Taking Industry based on agriculture into rural parts of the country.**
  - **Effects of Power availability in rural India**
- **Access to Power ensured the following:**
  - **Increased Education program**
  - **Access to Television, Media, Computers**
  - **Charging of mobiles**
  - **Setting up of shops, rural industries and cold storages**

BERMACO ENERGY LIMITED

PTC BERMACO GREEN ENERGY SYSTEMS LTD
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Bermaco – Milestones (2011-12)

- **Setup up of Regional Office and employed 6 persons including 1 VP level person in Patna, Bihar.**
- **Acquired land for power plant site at Jagdishpur, Bihar and Purkhali, Punjab.**
- **EPC discussions finalized for 5 project sites (2 in Punjab and 3 in Bihar).**
- **Generated 60 million units in 2011-12.**
- **Employed 150 direct employment and 500 indirect employment in Ghanour / Patiala, Punjab.**
- **Employed 35 direct employment and 500 indirect employment in Aurangabad, Maharashtra.**
- **Employed 35 direct employment and 200 indirect employment for Energy Plantation in Karjat, Maharashtra**

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PRESPL

Bermaco – Milestones (2011-12)

- **Instrumental in restricting the migration from villages and channelizing the village youth energy positively as the employment given to them at there place since the plants are located near to villages.**
- **Opened nearly 750 Bank Accounts of Federal Bank Ltd. in Aurangabad district of Maharashtra for Farmers, contractors, employees, contract workers etc.**
- **Opened nearly 800 Bank Accounts of United Bank of India in Patiala district of Punjab for Farmers, contractors, employees, contract workers etc.**
- **Opened 600 Bank Accounts in Karjat district of Maharashtra for Farmers, contractors, employees, contract workers etc.**
- **Opened 100 Bank Accounts of UCO Bank in Jagdishpur, Bhojpur district of Bihar for Farmers, contract workers in the process of acquiring land for the power plant site there and employing security staff there.**

BERMACO ENERGY LIMITED

PRESPL

Bermaco – Milestones (2011-12)

- **Ministry of New and Renewable Energy, Central Electricity Regulatory Commission, Punjab and Central Govt., Punjab State Electricity Regulatory Commission, Bihar Electricity Regulatory Commission officials visited the 12 MW Ghanour Plant as it is the only Plant in the world running on 100% Paddy Straw.**
- **The 12MW Paddy Straw fired Ghanour Plant was showcased to the Bhurelal committee set up by Supreme Court for reducing the effect of Paddy straw burning.**
- **Bermaco has been advocating for the biomass movement at various levels of State and Central Government, seminars and forums as Bermaco believes that biomass movement will give maximum benefits to the rural community.**

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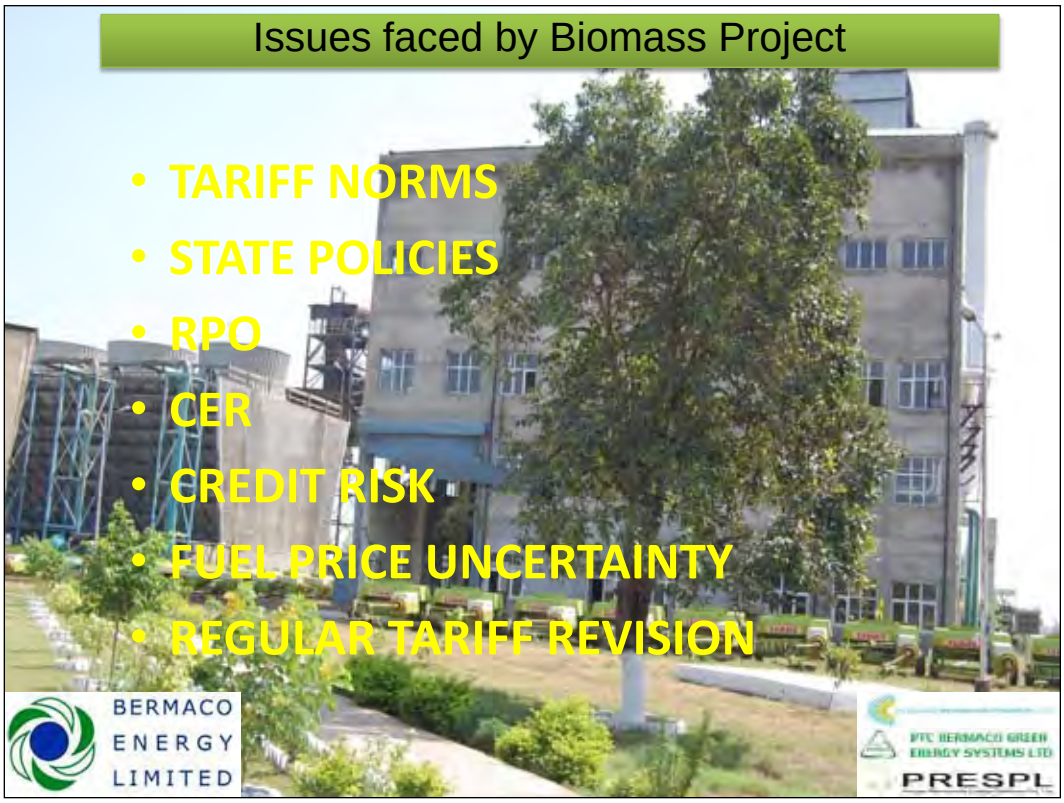
PRESPL

Issues faced by Biomass Project



- TARIFF NORMS
- STATE POLICIES
- RPO
- CER
- CREDIT RISK
- FUEL PRICE UNCERTAINTY
- REGULAR TARIFF REVISION

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Thank You

We acknowledge the importance of rural growth and will endeavor to improve lifestyle of the rural population of the country.

BERMACO ENERGY LIMITED

www.bermacoenergy.co.in

PRESPL

Presentation 3

Title of Presentation	Presenter	Brief details of the presentation	Category
13 MW Crop Residues-based Biomass Power Plant in Aurangabad – Fuels Supply Linkages	**Shri Sanjay Joshi**, Vice President, IL&FS, Mumbai	The presentation briefed the performance of 13 MW biomass power plant at Aurangabad and fuel procurement strategy adopted for successful and continuous operation of the project. The presentation brought suggestions like establishing proper tariff policy , supportive schemes for fuel collection and providing generation-based Incentive for biomass power plants will improve the biomass sector.	Supply Chain

Shendra Green Energy Limited
(Formerly GAPS Power)

Fuel Supply Chain

April 3, 2013

1 IL&FS Renewable Energy

Background

Location	MIDC Shendra, Aurangabad
Installed Capacity	13 MW
COD	December 7, 2008
Holding Structure	Wholly-owned subsidiary of IL&FS Renewable Energy Limited
PPA	With MSEDCL
Fuel Requirement (@80% PLF)	1.3 Lakh MT

- Acquisition by IREL in December 2010
- Prior to acquisition main fuel was Bagasse and supply was mainly through traders
- Abundant amount of cotton stalk available in the region with no alternate use; however no supply chain mechanism was established

2 IL&FS Renewable Energy

Fuel Procurement Strategy by IREL

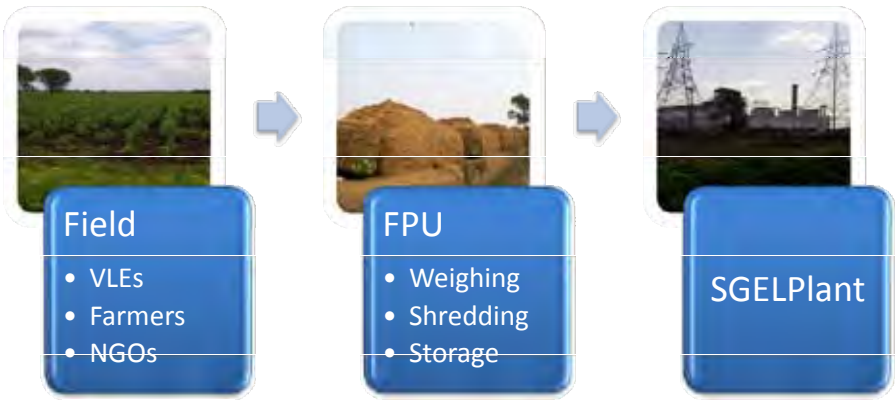
- Bagasse to be supplementary fuel instead of main fuel in view of growing competition for same and increasing cogeneration capacity
- Focus on collection of major agro residues in the area such as Cotton Stalk, Maize Cob and soya husk etc. supported by Bagasse
- Established a network of about 15 collection centers around 30-50 km radius from the plant for collection of cotton stalk
- Development of dedicated infrastructure at these centers for weighment and payment
- Involvement of more than 60 Village Level Entrepreneurs (VLEs) and local NGO's (3 Nos) in fuel collection
- Creating awareness amongst the farmers about availability of market for cotton stalk through Radio and various agricultural exhibitions
- Supply of cotton chipping machines to the VLEs and NGOs for processing of cotton stalk
- Community linkage through various social inclusion schemes - Completed detailed baselines studies for need assessment

3 IL&FS Renewable Energy

Mapping of Collection Centers

4 | IL&FS Renewable Energy

Fuel Process Diagram



5 | IL&FS Renewable Energy

Key Results

- Succeeded in collection of 25,000 MT of cotton stalk in first season during previous year (earlier maximum collection was in the range of 3000 MT) – total biomass collection more than 70,000 MT
- During this season covered more than 22,000 acres of cotton field
- Succeeded in propagating the message to the local villages about the benefits of supply of cotton stalk
- Self sustainability to many small farmers, VLEs, self help groups
- Employment to more than 4000 labours during the peak collection period
- Additional revenue to cotton growing farmers thereby suppressing the shocks of cotton prices
- Additional support through social inclusion schemes - launched purified water supply scheme in one of the Taluka in command area

6 IL&FS Renewable Energy

Social Benefits

Parameter	**For a 12 MW Plant**	**25 GW capacity (potential in India)**
Biomass Requirement per annum	130,000 MT	27 Cr Tonnes
Cultivated area cleaned up	1 lakh acres	20.8 Cr acres
Direct livelihood Generation per year (@ 6 manday required to pluck and chip the cotton per acre)	**7 lakh Mandays in a period of 6 Months (i.e 3,900 labours per day)**	**146 Crore Mandays in a period of 6 Months (i.e 81.25 lakh labours per day))**
Total income generation for the workers in the field (6 months period per annum @ Rs. 250 per day)	**Rs. 17 Crores per annum**	**Rs. 36,562 Crores per annum**
Additional Income to farmers (@ Rs. 1000 per MT)	**Rs. 13 Crores per annum**	**Rs. 27,000 Crores per annum**

Highest potential of livelihood generation amongst all the RE sources

7 IL&FS Renewable Energy

Challenges

- Tariff inadequate to recover costs of fuel collection, processing and storage (No fuel processing equipments considered in the capital cost of Project by Regulator Commissions)
- Huge requirement of working capital due to limited period of availability of fuel
- Normative performance parameters set by Regulatory Commissions are much higher than the norms suggested by Central Electricity Authority – resulting in substantial under-recovery
- Fixed tariffs to be aligned with actual capital costs, which are much higher than normative considering investment in power plant and fuel equipments
- Inadequate tariffs leading to accumulated losses and erosion of Net worth
- Technical challenges for multi fuel handling – both in fuel feeding system and in combustion
- Technology upgradation may lead to higher capex and should be pass through

8 IL&FS Renewable Energy

Support Required

- Biomass projects should be viewed as a means to create large number of rural employment
- Inclusion of fuel collection chain as a part of Mahatma Gandhi National Rural Employment Guarantee Act
- Generation Based Incentive Scheme to support the projects as a cost towards *socio – economic benefits flowing to masses*
- Separate Tariff Policy to be promulgated by MNRE for biomass based projects with operating norms *relatable to past performance and capability of achievement*
- Tariffs to be viable for sustainable operations and scaling up of the installed capacity to its potential
- Efforts by OEMs to overcome technical challenges

Biomass industry should not be allowed to collapse due to inadequacy of tariff

9 IL&FS Renewable Energy

Involvement of local community





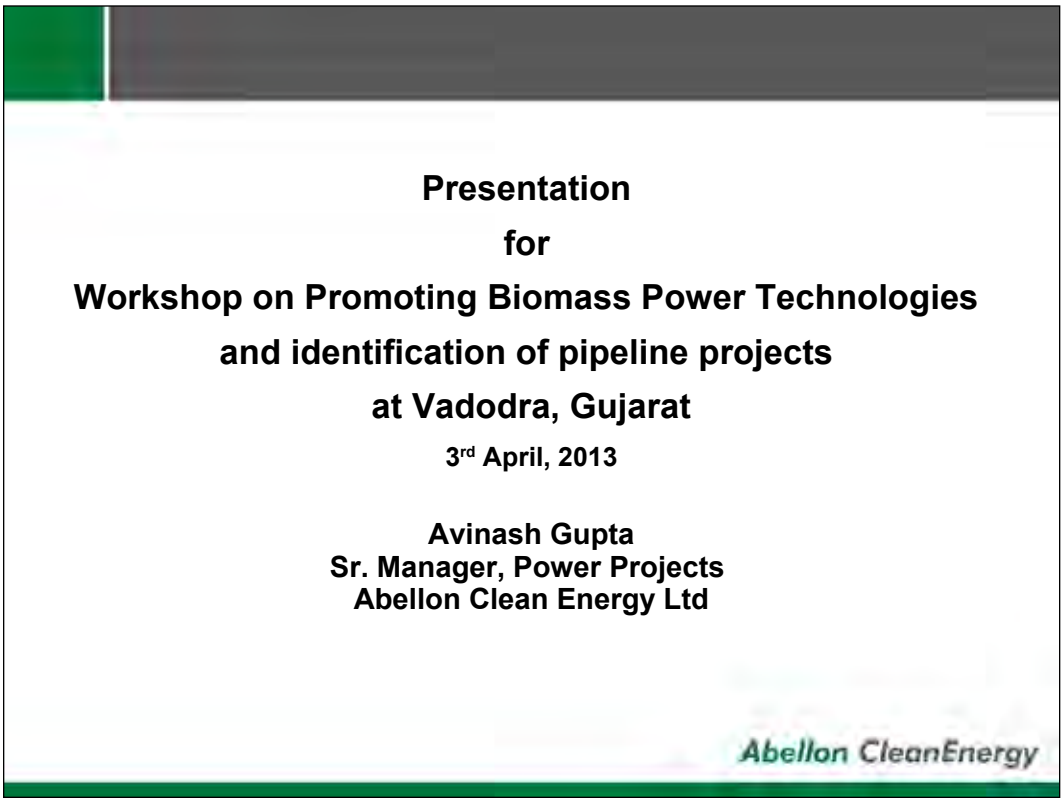
10 IL&FS Renewable Energy

Thank You

11 IL&FS Renewable Energy

Presentation 4

Title of Presentation	Presenter	Brief details of the presentation	Category
4.25 MW Pellet-based Cogeneration/ Captive Power Plant in Ahmedabad	**Shri Avinash Gupta**, Senior Manager, Abellon Clean Energy Limited, Ahmadabad	The presentation highlighted the details and operations of 4.25 MW Pellet-based Cogeneration/Captive Power Plant in Ahmadabad. The presentation clearly provided the effective fuel management systems adopted for continuous operations and electricity generation along with some suggestions for improving the biomass sector.	Supply Chain



4.25 MW
Pellet based Co-generation / Captive Power Plant at Ahmedabad, Gujarat

Abellon CleanEnergy

Power Scenario of India

India	
Population	124.1 Cr
GDP	$1.85 trillion
Installed Power Capacity	2,11,766 MW
Renewable Power	25,856 MW
Thermal	141714 MW
Nuclear	4780 MW
Hydro	39,416 MW

Source: Ministry of Power
As on 31-01-2013

Abellon CleanEnergy

Power Scenario of Gujarat

Gujarat	
Population	60 lakhs
GDP	$0.07 trillion
Installed Power Capacity	23887 MW
Renewable Power	3715 MW
Solar Energy	824 MW (As on 31-12-12,GEDA)
Wind Energy	3009 MW (As on 31-12-12,GEDA)
Thermal	18841 MW
Nuclear	559 MW
Hydro	772 MW

Source: CEA
As on 31-01-2013

4

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Biomass Availability & Potential for Power in Gujarat

Feed Stock	Available Biomass in million MT
Cotton Stalk	18.9
Rice Husk	0.37
Castor	1.08
Mustard	0.56
GN Shell	0.44
Sugarcane	1.88
Total	23.26

Potential for Biomass based Power in MW	2900
Co2 Emission Reduction in Million Tonnes	15.7

Abellon CleanEnergy

Project Profile

1)**Installed Capacity**: 4.25 MW (Extraction Condensing Turbine)

2)**Power Generation:** 37.23 million units / annum

3)**Location**: Village: Chacharvadi Vasna, District: Ahmedabad, State: Gujarat

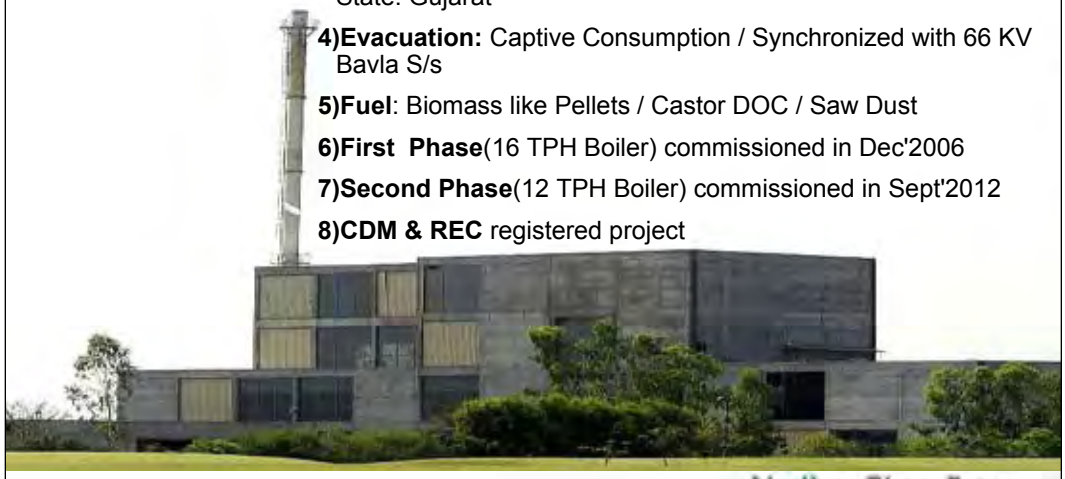
4)**Evacuation:** Captive Consumption / Synchronized with 66 KV Bavla S/s

5)**Fuel**: Biomass like Pellets / Castor DOC / Saw Dust

6)**First Phase**(16 TPH Boiler) commissioned in Dec'2006

7)**Second Phase**(12 TPH Boiler) commissioned in Sept'2012

8)**CDM & REC** registered project



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Highlights of Plant

- 7 years of operation
- Stable operations team
- Experimentation with 50 different biomass
- First user of Castor DOC in high pressure boiler in the country
- Provision of Over bed feeding for more diversity of biomass
- Installation of ESP for better environment
- Full Indoor installation
- Targeted steam to fuel ratio 4.8
- Condensate recovery: 75%
- PLF: 75%
- Auxiliary Consumption: 15-18%

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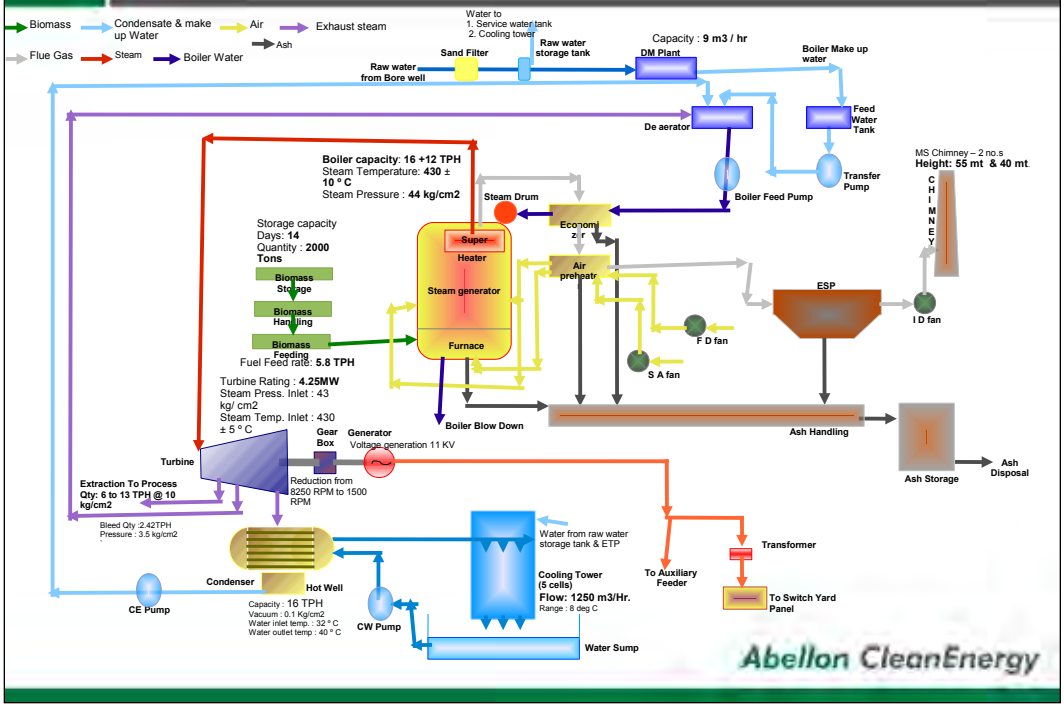
Process Flow - 4.25 MW CO-GENERATION PLANT



Captive consumption of Power

- Power requirement for campus 5 MVA
- 4.25 MVA is being feed by the captive plant
- Better steam / power flexibility, connected to Grid / FO boiler
- Better economic use: Priority to steam
- Process steam requirement is met by the Extraction Condensing Turbine.

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Biomass Assessment Study

- Ravi Energie has done a biomass assessment study in year 2009 & found that Castor Stalk & Saw dust are available in surplus

Fuel	Castor DOC	Saw Dust
Total Generation in Lakh Tons / annum	5	2
Total Consumption in Lakh Tons / annum	3.6	1.4
Total Surplus in Lakh Tons / annum	1.4	0.6

- 87% of total production of castor in country is contributed by Gujarat and Rajasthan

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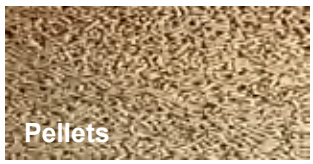
Biomass requirement

Fuel Requirement: 140 TPD

Fuels Used:

- Castor De-oil cake, Saw Dust, Pellets – Under bed feeding
- Prosopis – Juliflora – Over bed feeding (30%)
- Sustainable use of other waste biomass: trimmed grass inside the Campus
- Shredded waste cartons from campus



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Biomass Collection Model

- Castor-DOC is sourced from industries surrounding Ahmedabad
- Optimum radius for collection of biomass: 50 kms
- Hub and spike model for collection of cotton stalk prosopis
- Collection centers are created to collect the biomass and transferring it to the plant

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Storage Area

Fuel Storage: 14 days

•Biomass Storage Yard – 50mt x 20mt x 7mt

•2000 tons of Biomass

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Land usage pattern for Biomass

- Yield of biomass: 1 Tons / Acre / annum
- This will mean that to feed biomass for a 4.25 MW co-generation plant we will need around 40,000 Acres of land for cultivation.

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Water Usage

- Ground water after treatment in SRO plant and ETP treated water is being utilized for the Cooling Tower.
- Condenser tubes are SS 304 seamless for more corrosion resistant & optimum cost.
- Ground water after treatment in DM Plant is being used as water for Boiler makeup.

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Improvements / Innovations

1)Compressed Air for cleaning

2)Ultra sonic Blower (bank Zone & Economizer) / Steam Soot Blower (Super-heater)

- The Ultrasonic Soot Blower woks on a principle of travel of sound

Advantages

- Minimizes fouling and slagging
- Decreased Ash deposition = Increased heat transfer
- Reduced shutdown frequency = Increased plant availability

Sonic Horn Installed in Economizer.

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Economic uses of Ash

Uses of Ash from Plant

- Fly Ash bricks
- Construction material

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Learnings

- Preventive maintenance of Boiler is done every month for cleaning of Boiler surfaces.
- Ultrasonic Soot blower
- Over-bed feeding is provided in second Boiler to accommodate over size fuel
- Maintaining steam parameters at Boiler will give a good life of Boiler tubes and overall availability of plant
- Better realization in Captive Co-generation plants than IPP

Abellon CleanEnergy

CDM & Emission Reductions

- CDM registration was done on 21st February 2009.

Year (Period)	Emission reductions (tCO2/year)
Aug 2006 – Dec 2007	22,812
Jan 2007 – Dec 2007	42,954
Jan 2008 – Nov 2008	36,000
Feb 2009 – Feb 2010	30,602
Feb 2010 – Feb 2011	37,648
Feb 2011 – Feb 2012	37,384
Feb 2012 – Feb 2013	49,860
Total Till Feb'2013	257,260

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Major Challenges

1) Managing fuel supply

2) Conservation of Water

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Support for promoting biomass power

1) Scheduling should be exempted
2) Cross Subsidy Surcharge should be exempted
3) Transmission & distribution charges should be sustainable to promote decentralized generation
4) Pooled power / multiple consumer points to be encouraged
5) RPPO: emphasis on fulfillment of biomass RPPO & share should be increased
6) Open burning field must be strictly prohibited hence promoting collection
7) Waste land development rights to be given to promote
    - Local employment
    - Increase land utility

1) Concessional duty on imported pre-processing equipment
2) Capital cost should be calculated considering pre-processing equipments

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Snap shots

Boiler House

Control Panels

Turbine-Generator

Switch yard

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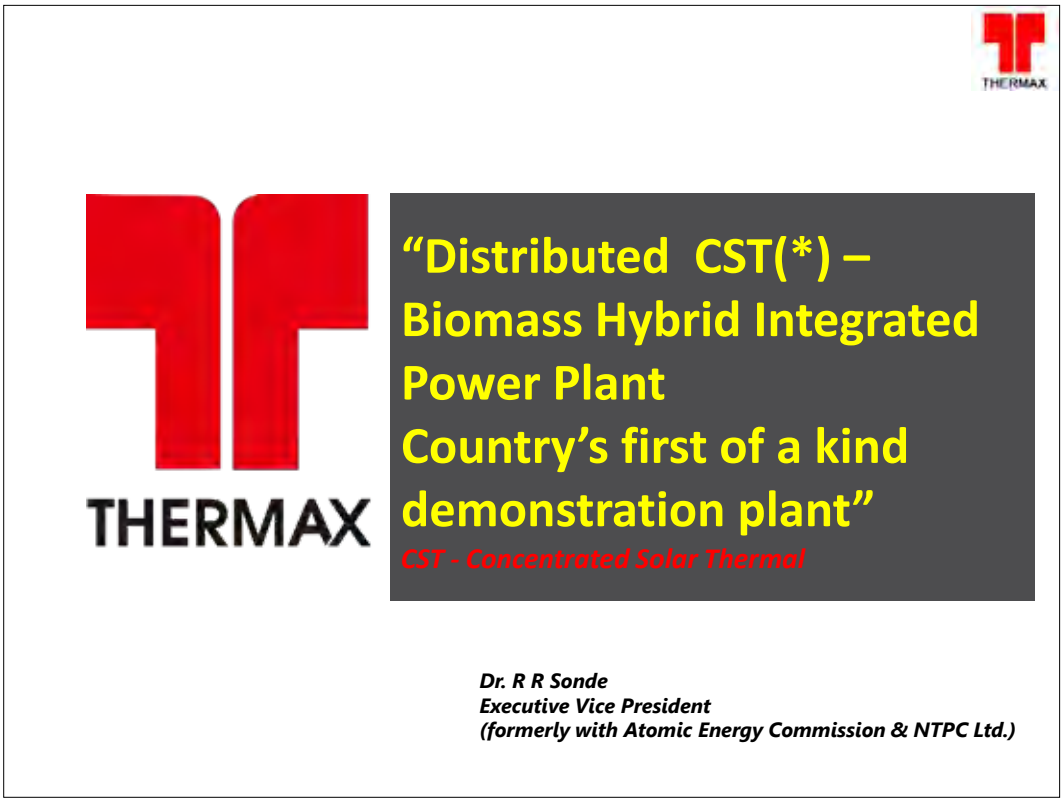
THANK YOU

Abellon CleanEnergy
The Future is Green...

Presentation 5

Title of Presentation	Presenter	Brief details of the presentation	Category
Biomass Solar Hybrid Plant in Pune	**Dr R.R. Sonde**, Executive Vice President, M/s Thermax Limited, Pune	The presentation highlighted the characteristics and advantages of India's First Solar-Biomass Hybrid power Plant 'Shive' in Pune. The presentation provided the expected outcomes .i.e. generation of power through hybrid Solar & Biomass Power Plant, expected PLF and installation cost s of proposed project .	Technology



India's solution to energy challenge at most fundamental level

Shive
is the quintessential Indian village in Khed taluka, Maharashtra, 57 kms from Pune

The project is funded by the Department of Science and Technology, Govt. of India

Population : 3500, 500+ households

Agricultural Economy

Water Availability

Abundant radiation

Grid is available
Daily blackouts of up to 14 hours

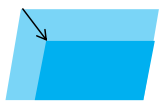
Scarce industry
Labour migration

No Cold Storage
Wastage of agricultural produce

Advantages of a Solar-Biomass Hybrid System

A hybrid solar-biomass system is inherently superior as it utilizes the best features of both renewable forms of energy

Optimum Land Area Utilisation
A hybrid system, by design uses land more optimally than conventional solar renewable energy sources

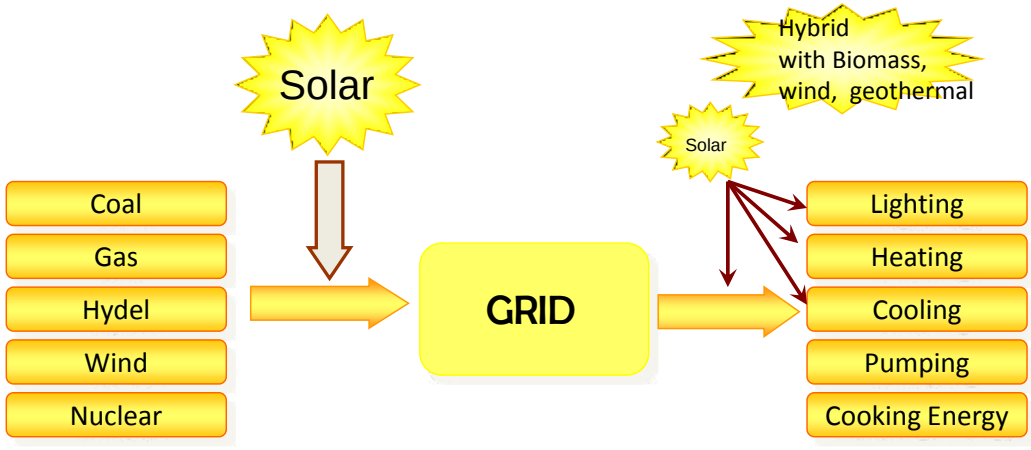


Less Capital Intensive
Than conventional solar systems with similar autonomy

A Solar-Biomass hybrid plant has easier vistas for integration into other processes that use hot water/ pressurized steam
Cold Storage | Comfort Cooling | Space Heating | Waste Water Management

Better Energy Security
Flexibility in Electricity Generation
Creation of Job Opportunities

Solar in Central and Distributed mode….



Feed solar to Grid using technology developed globally & develop India centric technology for Point of Use

Shive Project : Unique "Model" Project

- Cost effective solar collectors
- Direct steam generation
- Low cost agro waste based biomass boiler
- Organic Rankine Cycle
- Hybrid STG-ORC
- Free open access: Use of existing grid
- Local skill development: Social engineering

Shive Site Photo

Turbine Building

Waste Biomass Boiler

The Technology Firsts

India's First
Solar-Biomass Hybrid Power Plant

- ***Linear Axis Common Drive Parabolic Trough***
- ***First IBR approved Solar Boiler system for power generation***
- ***Remote pump operation using mobile technology recognized by DST/Lockheed Martin***

3 Patents filed to date

Shive project's other notable achievements...

- *Non-evacuated receiver tube technology*
- *Thermal Storage built-in*
- *Pioneering serial arrangement of turbines*
- *Direct Steam Generation/ Recirculation*

8

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Concept of Decentralized Distributed Generation (DDG)

Conventional
Concentrated Solar Power (CSP) Plants

VS

The Unique Shive Concept

Euro Trough

Large size power PT >> Super Heated Steam

Cost of Trough	21000	Rs/sq.m
Optical efficiency	73	%
Net efficiency	71	%
Net generation @ 1000 W/m2 DNI	0.71	KW/sq.m
Cost per KW	29577	Rs/KW

Thermax SolPac™ P60

Medium size PT >>200° C solar steam

Cost of Trough	7200	Rs/sq.m
Optical efficiency	63	%
Net efficiency	53	%
Net generation @ 1000 W/m2 DNI	0.53	KW/sq.m
Cost	13584	Rs/KW

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The Vital Statistics

18,00,000 kWhr
Capacity to generate electricity and generated for one year.

Our system has been proven to reliably run anything from ..

Upto 500+ Rural Homes	100+ Agricultural Pumpsets	Up to 50 Small Buildings
Note: 1 fan and 2 bulbs for each home at 150 W for an entire year	Note : At 750W per pump set run for 6 hours daily, for an entire year	Note : At 2000W load run for 18 hours daily, for an entire year

Effectively, in one year..

1100+
tonnes of coal saved from being used for electricity generation

Source: CERC, New Delhi Report
Specific Coal Consumption: 0.63kg/Kwh

750+
tonnes of CO_2 displaced

Source : British Gas
CO_2 displaced : 0.422 kg/kWh

Finally, a sustainable, reliable & robust Rural DisGen alternative

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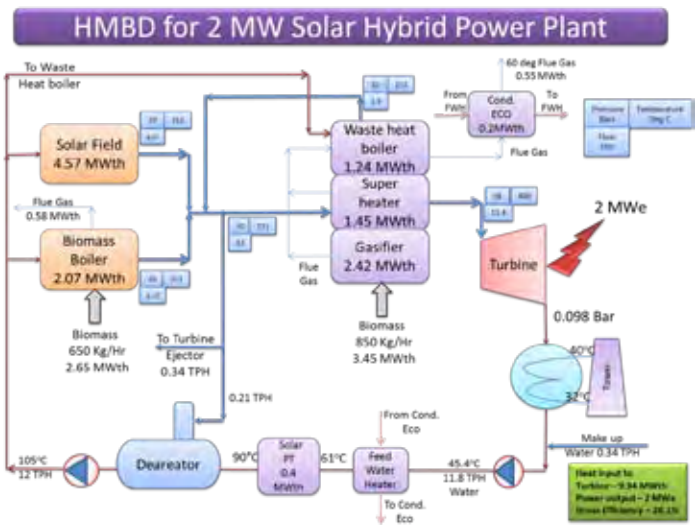
Shive Project way forward

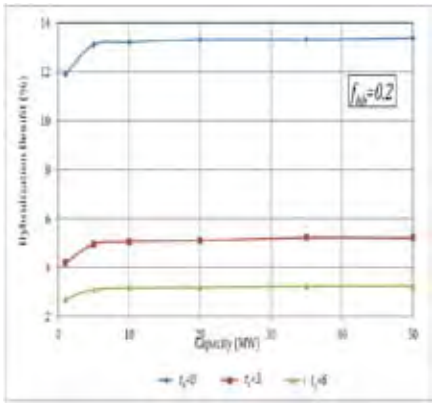
- Continue to operate and improving the system performance and reduction in costs.
- Training to local manpower through O&M
- Form committee and handover O&M to the committee
- Govt. level interaction to make 24X7 feasible
- Feed in the grid to keep peak capacity utilization

Improved CST-Biomass hybrid flow scheme



1. Overall efficiency can be pushed beyond 20%
2. Solar+Biomass proportion can be vary from 80% solar to 20% solar
3. The HMBD shown is for 50:50%
4. Biomass can be used in series parallel manner
5. Gasification process can be further integrated in the entire flow sheet

Impact On Economy of Rural Sector – from Thermax-Shive Project



Hybridization Benefit for LCOE

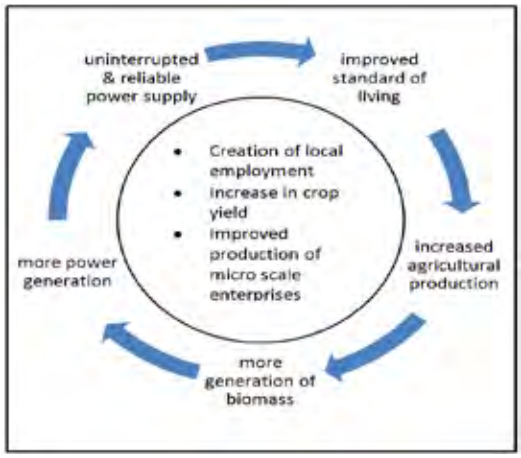


Fig. 3: Impact on economy of rural sector

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Future Directions

For the optimum plant size of 1 MW, the comparision is as follows.

Photo Voltaic (PV)	Solar + Biomass hybrid
Project Cost – 8 crore/MW	Project Cost – 14 crore/MW
1.2 – 1.6 million units @ solar radiation 550 – 900 w/sq mtr	6 – 6.5 million units @ solar biomass hybrid concept
LCOE = 12.74 to 12.04	**LCOE = 10.88 to 10.15**
Auxiliary Consumption : 0%	Auxiliary Consumption : 10%
Interest : 10 %	Interest : 10 %
Debt: Equity : 70:30	Debt: Equity : 70:30
Return on Equity	Return on Equity
1st to 10th year : 19 %	1st to 10th year : 19 %
11th year onwards : 24 %	11th year onwards : 24 %
	Fuel Cost : INR 2500 /ton

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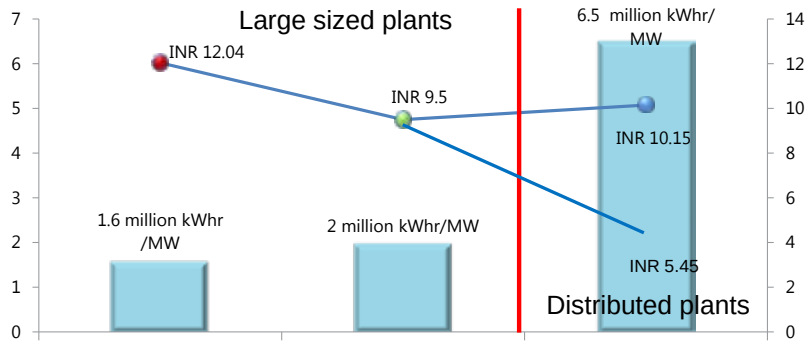
The Comparison



Solar PV	Solar CSP (Standalone)	Solar Hybrid Disgen (1-2 MW)
8 Crore/ MW	12 Crore/ MW	14 Crore/ MW

Peak power deficit of 13-14% - expected to continue
DG power cost ~ Rs 17/kWh
Govt. support for grid solar power ~ Rs. 10/kWh
Rural power – A long gap to bridge !!!

Solar biomass hybrid – A viable option & infact with CHP option makes it even more attractive

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SOLAR-BIOMASS COLD STORAGE PROJECT

India – Australia CSIRO – AP 6 PROJECT

AP6 SOLAR BIOMASS COLD STORAGE PROJECT – 'CONCEPT TO COMMERCIALIZATION'

Globally first-of-a-kind demonstration project - a sustainable cold storage system for remote rural applications

सत्यमेव जयते
MINISTRY OF NEW AND RENEWABLE ENERGY
GOVERNMENT OF INDIA

teri

THERMAX

SEC
Solar Energy Centre

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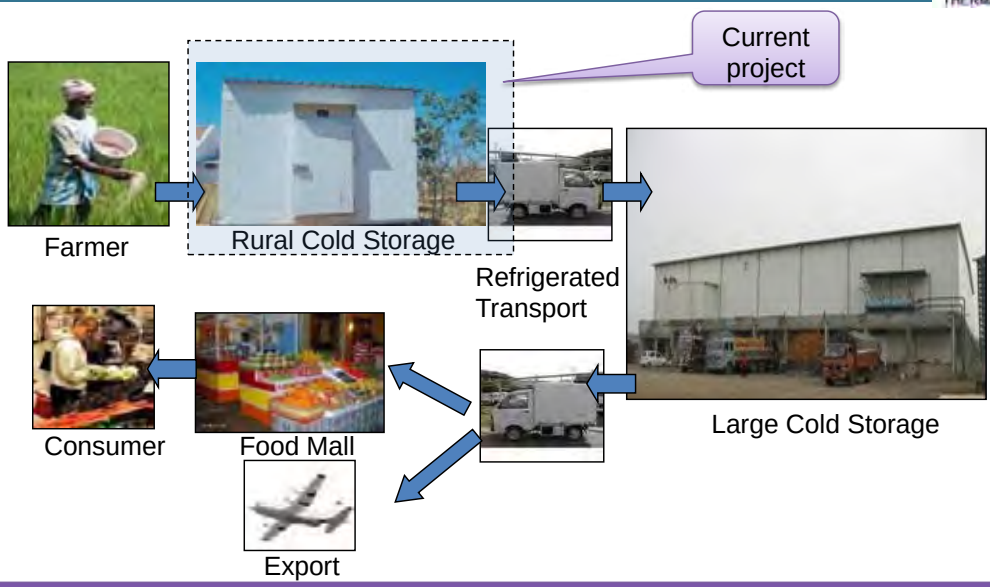
Cold Chain



Sustainable solution to the problem of agricultural produce losses simultaneously ensuring optimal return to the farmers at the bottom of the value chain

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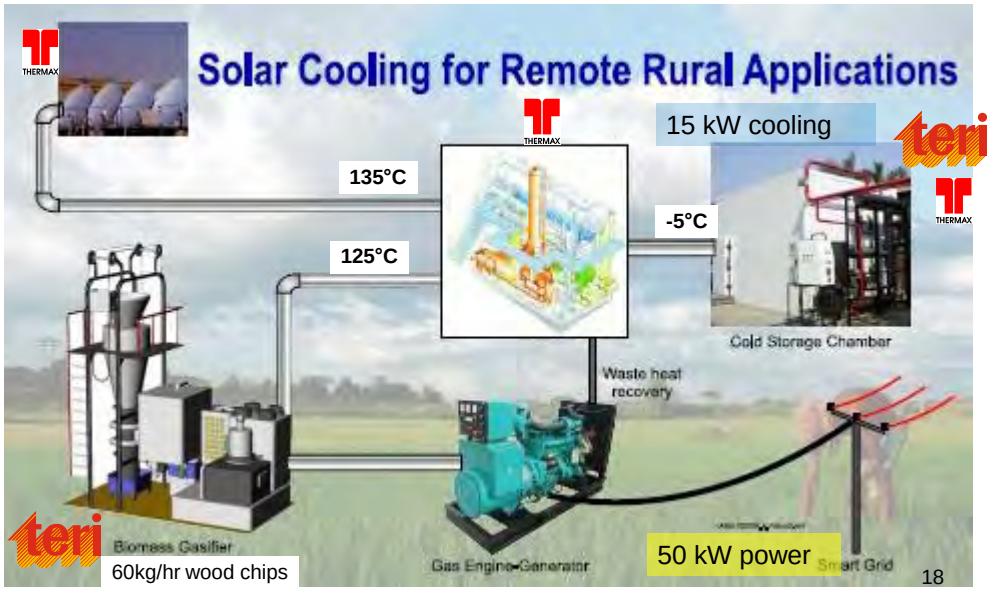
Solar Cold Storage Project Scheme



Project Schematic Layout

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Way Forward : Dissgen

With 600,000 villages in India and 300 million population, meeting local energy needs from available resources will be game changing for India

Solar-biomass from 250 kW to 3 Mw scale will be an ideal choice

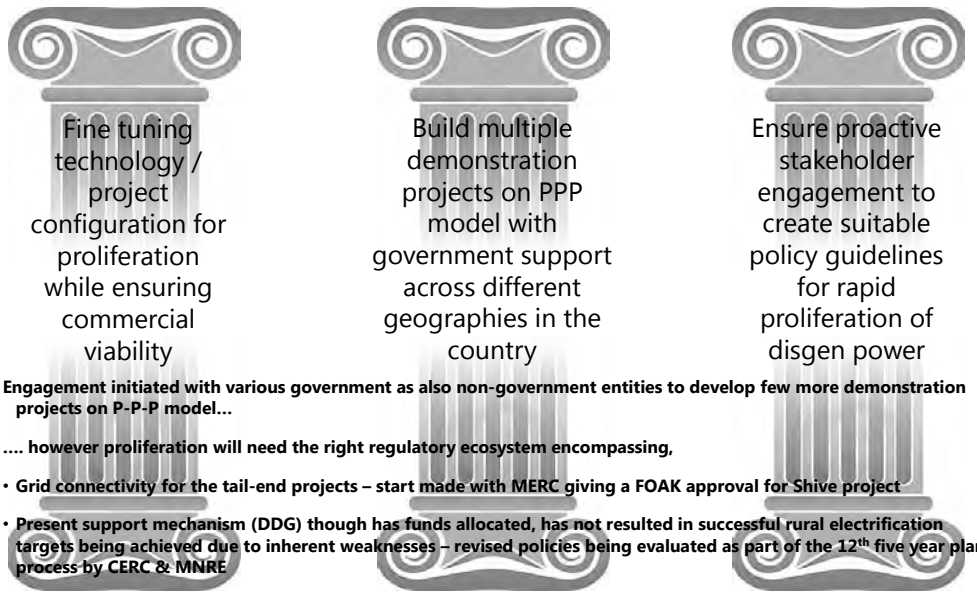
The solar-biomass proportion can be based on the local resource potential

The Thermax-Shive model is scalable, indigenously built, cost effective technology

The multiple energy generation and connectivity to grid can make this technology further very attractive and meet the RPO obligations as well

We need a new model of implementation

Way Forward : Dissgen

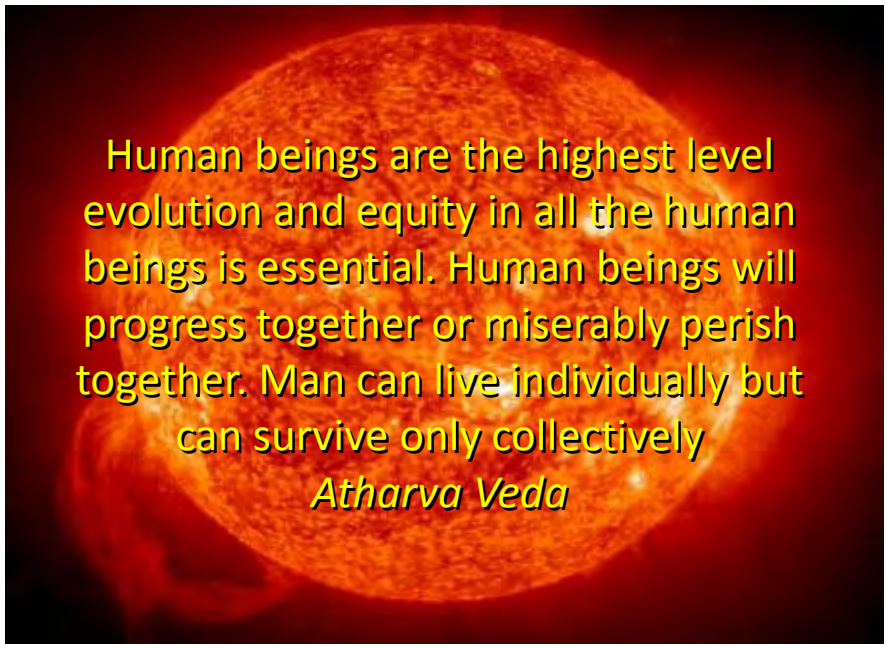


Engagement initiated with various government as also non-government entities to develop few more demonstration projects on P-P-P model…

…. however proliferation will need the right regulatory ecosystem encompassing,

- **Grid connectivity for the tail-end projects – start made with MERC giving a FOAK approval for Shive project**
- **Present support mechanism (DDG) though has funds allocated, has not resulted in successful rural electrification targets being achieved due to inherent weaknesses – revised policies being evaluated as part of the 12th five year plan process by CERC & MNRE**
- **SNA's engagements to promote renewable power within the state is an imperative & needs to be catalyzed**

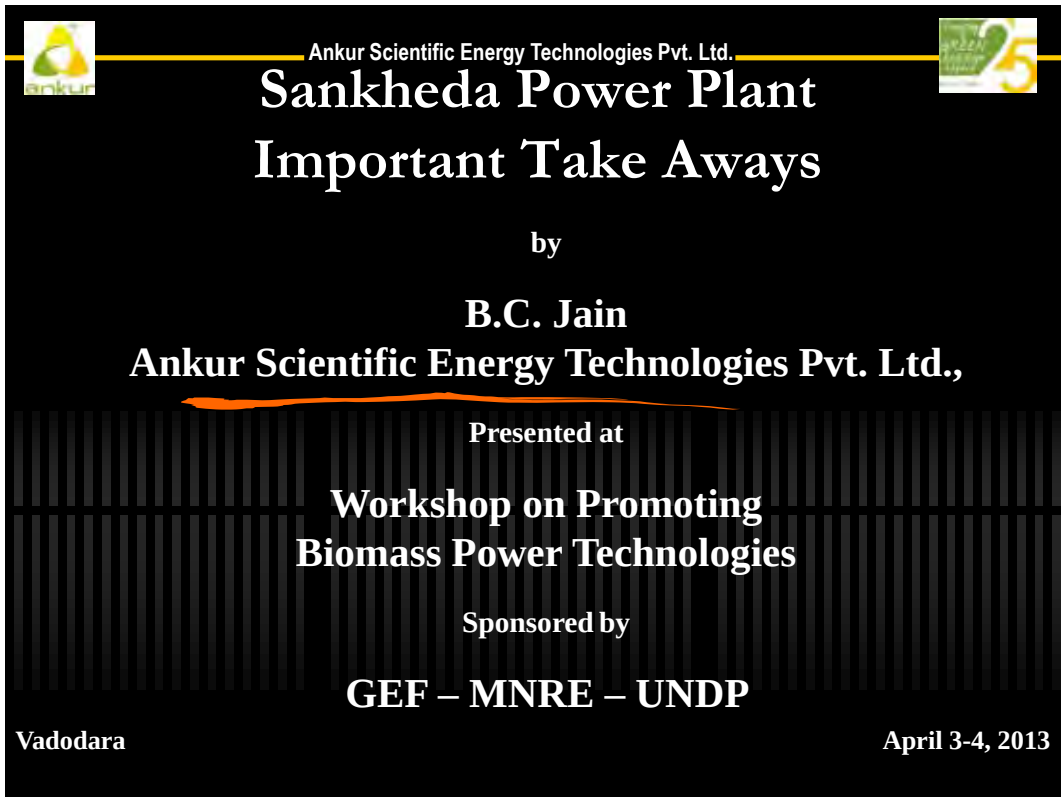
Thank You!



THERMAX - CONFIDENTIAL

Presentation 6

Title of Presentation	Presenter	Brief details of the presentation	Category
1.2 MW Power Plant-based on Gasification of Biomass in Sankheda	**Dr B.C. Jain**, Chairman, Ankur Scientific Technologies Pvt Ltd, Vadodara	The presentation explained the details and operations of 1.2 MW gasification plant established under MNRE-UNDP-GEF project at Sankheda. The presentation highlighted the benefits offered by the power plant to rural households in the regions and achievements in terms of electricity generation. The presentation explained the issues faced in operation of power plant and usage of different biomass fuels in the plant. It also provided the fuel procurement procedures followed for continuous supply of fuel to the power plant.	Technology and Supply Chain



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Sankheda Power Plant

Some Basics

- ✓ 1.2 MW with two gasifiers and three Chinese Gensets.
- ✓ Major Focus on Agri-Residues.
  - Cotton Stalk
  - Tuver Stalks
  - Maize Cobs
  - Mango Seeds
  - Castor Husk
- ✓ State-of-Art technology with upgradation from time to time.
  - Use of High Temperature bag houses.
  - Installation of a Waukesha Genset as stand-by
- ✓ Biochar Promotion.
- ✓ Plant visit planned for the afternoon.

Ankur Scientific Energy Technologies Pvt. Ltd.

Criticality of Biomass

- ✓ Multi-feed, agri-residues need effective and detailed planning.
- ✓ Each residue requires different preparation.
- ✓ Moisture and Monsoon related issues.
- ✓ Drying related issues.
- ✓ Seasonality
- ✓ Storage – need for greater investment.

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Biomass Supply Chain

- ✓ Castor Husk – de-husking in fields – associated soil related issues.
- ✓ Needed separate sieving stream.
- ✓ Cotton Stalk – Drying & Sizing – Inter-related issues.
- ✓ Best is field drying but intentional/un-intentional problems.
- ✓ Quality vs. Quantity / Relationship Issues.

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Equipment & Vendor Selection

- ✓ Biomass Handling and Preparation Systems frequently need custom-development.
- ✓ Engine Selection is crucial (we did not have to make gasifier vendor choice!).
- ✓ Casual approaches could create big problems – *the matter of cabling.*
- ✓ Vendor Involvement and Support as critical as the equipment.

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The Case of Chinese Engines

- ✓ Reasonably standard product.
- ✓ But very poor support.
- ✓ Communication & Language.
- ✓ Very poor documentation.
- ✓ Bureaucratic and Slow Response.
- ✓ Failure of Un-expected components.
- ✓ Critical deliveries take about a month even with air freight.

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Human Resources

- ✓ Tribal Belt with almost no industrial exposure.
- ✓ Insistence on maximum local employment.
- ✓ Training needs and learning-by-mistakes.
- ✓ Frequent holidays and abstentions.

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Regulatory Peculiarities

Just a Few Examples:

- ✓ No payment for power feed above the plant rating.
- ✓ Given the nature of the plant, average operation has to be at a lower level.
- ✓ Difficulties of scheduling (15 minute interval and two days ahead), UI charges and impact on financials.
- ✓ Confusion on many issues as it is first case of third party sale.

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CSR – Biochar as An Example

- ✓ Scientific trials and demos at Sankheda.
- ✓ Extension activities to encourage farmers to use bio-char.
- ✓ Approximately 200 tons sold to farmers at a nominal rate of one rupee per kg.
- ✓ Another 300 tons stocked for the upcoming monsoon sowing.

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Positive Socio-Environmental Impact – Negative Financials

- ✓ Income and Employment Generation.
- ✓ Input of close to Rs.4 crores in the local economy so far.
- ✓ Sixty full time employees and indirect / part-time employment to another hundred persons.
- ✓ Elimination of burning in the field.
- ✓ Bio-char Innovation.
- ✓ Reduction in line losses, improved power supply (more relevant for other states).

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Positive Socio-Environmental Impact – Negative Financials (Contd..)

- ✓ However, plant operation and management becomes more challenging and expensive.
- ✓ The socio-environmental benefits do not lead to better financials for the entrepreneur.
- ✓ Conflicting interests of involved organizations etc.
- ✓ In effect, a total 'disconnect' between socio-environmental benefits, required efforts and investments vs. low tariffs and stringent conditions.
- ✓ To top it all, very dull REC market due to lack of implementation of RPO obligations.

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In Closing … …

Let me close on a very positive note. We have learnt a lot, made further progress on technology and above all, helped promote India as Technology Leader in the field of Gasification through 400 very appreciative visitors from over 35 countries!

Ankur Scientific Energy Technologies Pvt. Ltd.

Thank You

Presentation 7

Title of Presentation	Presenter	Brief details of the presentation	Category
Setting up of a Biomass-based Power Plant – Step by Step Approach	**Shri A. Mohan Reddy**, Director, Zenith Energy Services Pvt. Ltd., Hyderabad.	The presentation explained the procedures required for setting up of biomass power plants in terms of approvals/ learances required, documentation required and timelines taken for different activities. The presentation also shared the procedures followed by different FIs for grating fiancé for biomass power plants.	Policy

Workshop on promoting Biomass Power Technologies and Identification of Pipeline Projects
3rd & 4th April, 2013 at Vadodara

Presentation on

Setting up of a Biomass based power plant : Step by step approach

Presented by

ZENITHENERGY

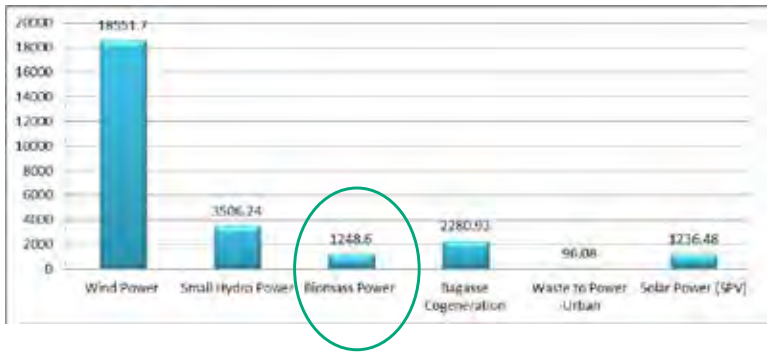
Zenith Energy Services (P) Limited, Hyderabad

BIOMASS POWER – THE ADVANTAGES

- The only FIRM Power amongst all Renewable source of energy that can generate over 80% PLF.
- Current potential of 18000 MW in India
- Only Renewable energy that supports rural employment by:
  - Direct Local employment
  - Indirect employment
  - Generates additional income to the farmers by the sale of agri waste and wood to the Biomass industry to use as Fuel
  - Put to use Arid land and generates additional income for Farmers
- Creation of green cover through the Energy Plantation developed by the Biomass Industry

ZenithEnergy

Growth of Biomass compared to other Renewables



Though the installed capacity of wind is over 18500 MW as on date, the actual generation would be only 4500 MW based on the average PLF of 25 % as against possible 80 % in the case of Biomass. Cogen & Biomass as on date stands at 3530 MW.
With adequate support from Govt. Biomass can significantly add capacities, complementing Wind with Firm Power in great measure.

ZenithEnergy

Setting up of Biomass power plants requires clearances form various agencies, departments etc as below.

State Nodal Agency	• Letter of intent for in-principal approval • Final clearance from State Nodal Agency
Gram Panchayat	• Local area clearance
State Pollution Control Board	• Approval for Consent to Establish (CTE) • Approval for Consent to Operate (CTO)
Land	• Approval for "Bonafide Industrial Purpose" • Approval for conversion of Land to Non Agriculture
DISCOM/Transmission Co.	• LT Connection, HT Connection, Feasibility Study for evacuation, Approval of PPA by DISCOM
Town Planning	• Approval of Site layout and Map
Factories & Labour Laws	• Plan approval & factory License
Chief Electrical Inspector	• Approval for setting up of Power plant • Final approval for commissioning
DIC	• Registration with District Industries Centre (DIC) under MSME Act, 2006

ZenithEnergy

Steps involved in implementation

- Selection of project location
- Selection of plant size and technology
- Feasibility study
  - Preliminary estimates on resources
  - Preliminary estimates on investments
  - Preliminary estimates on revenues
- Resource Assessment Survey -
  - Ensuring required quantity of biomass
- Licenses, Approvals and Clearances
- Detailed project report (DPR)
- Financial closure
- Engineering, Construction and Commissioning

ZenithEnergy

Documentation required:

- Each State Nodal Agency follows their own process
- Initially the developer will approach SNA and will submit application/ know the requirements for necessary clearances and approvals.
- As informed by SNA, the Developer will submit their ***proposal form / prescribed application form*** (with all attachments) to concerned officer of the SNA for approval.
- The proposal form will inform the developer the necessary documents required for clearance of the project.

ZenithEnergy

The following documents will be required to submit in getting approval from SNA

- Pre feasibility study report of the location of the plant
- Detailed Project Report
- Promoters credentials
- project finance structure and approval from banks
- Other if any as required by SNA
- Once the proposal has been approved , in next phases the promoter enters into an MOU with the State Utility for power purchase agreement. AT this stage, The promoter submits the documents as required by Utility.

ZenithEnergy

Fees / Payments

The fee/payment structure differs from state to state, as per the rules approved by different SNAs.

- Broadly the fees/payments that have to be deposited for a Biomass Power project fall under
- Processing fee,
- Earnest Money Deposit (EMD),
- Fees for extension of timelines, and
- Security deposit to SNAs and other Govt. Departments.
- The fees vary depending on the capacity of the power plant, wherein quantum of payments is higher for larger capacity power plants.

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Time lines of the Projects:

- The timelines for approval /clearances are different for different SNAs / States and may vary from 3 months to 6 months.
- The time lines for other requirements like procurements of equipments and other construction requirements will depend on supplier. On an average these installations take 1 to 1.5 years.
- Apart from these, other requirements like clearance for evacuation of power to the grid and MoU with State Utility can be done parallelly, but the timelines depends on both Utility and project promoter.
- Experiences says that on an average, the installation of biomass power plant take a time period of 1 to 1.5 years.

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Guidelines of Financial Institutions

The major Financial Institutions engaged in funding the projects based on Biomass technologies are

1) IREDA,
2) PFC,
3) REC and
4) PTC. Etc..

The procedures for funding are similar.

- Every financial Institution has a predetermined format for submitting proposals for financial assistance
- Guidelines to fill & Submit the application are available respective websites of the financial Institutions.

ZenithEnergy

- Along with the prescribed application the project developer is required to furnish the licenses and approvals received As per the previous table
- Documents like Detail Project Report, profile of the promoters, net-worth certificates of promoters and power purchase agreements are need to be submitted

- Then, FIs will take the following appraisals for sanctioning Loan

1. Technical Appraisal
2. Financial Appraisal

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Technical Appraisal

- The major focus of the technical appraisal is a detailed scrutiny of the biomass resource availability, the technology proposed, sources of technology, competency of the technology suppliers, and details of plant and machinery proposed for the project.
- The financial institutions also undertake site visit to examine the suitability of site, the availability of infrastructure facilities and in case of grid interactive project, the access to grid etc.

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Financial Appraisal

The Financial appraisal of the project follows after a satisfactory technical appraisal.

- In the financial appraisal, the parameters that are examined are the cost of project, means of finance, assumptions and risks, return on investments, fund and cash flows as well as the credibility of the developers.
- Once the financial viability is found to be as per the satisfaction , the loan is sanctioned to the developer.
- All financial institutions closely monitor the projects for compliance and accuracy of records, during the project implementation, till the loan is paid off. The procedure is outlined in the form of a flow chart.

ZenithEnergy

INDUSTRY CAN ACHIEVE . . .

- ADDRESSING THE KEY CONCERNS OF THE SECTOR AND ADEQUATE POLICY SUPPORT IS THE NEED OF THE HOUR FOR ITS EXISTANCE AND GROWTH OF BIOMASS POWER IN INDIA

WITH SUPPORT FROM MNRE/GOI/CERC and STATE GOVERNMENTS/SERCs 18000 Mw POTENTIAL CAN BE FULLY HARNESSED

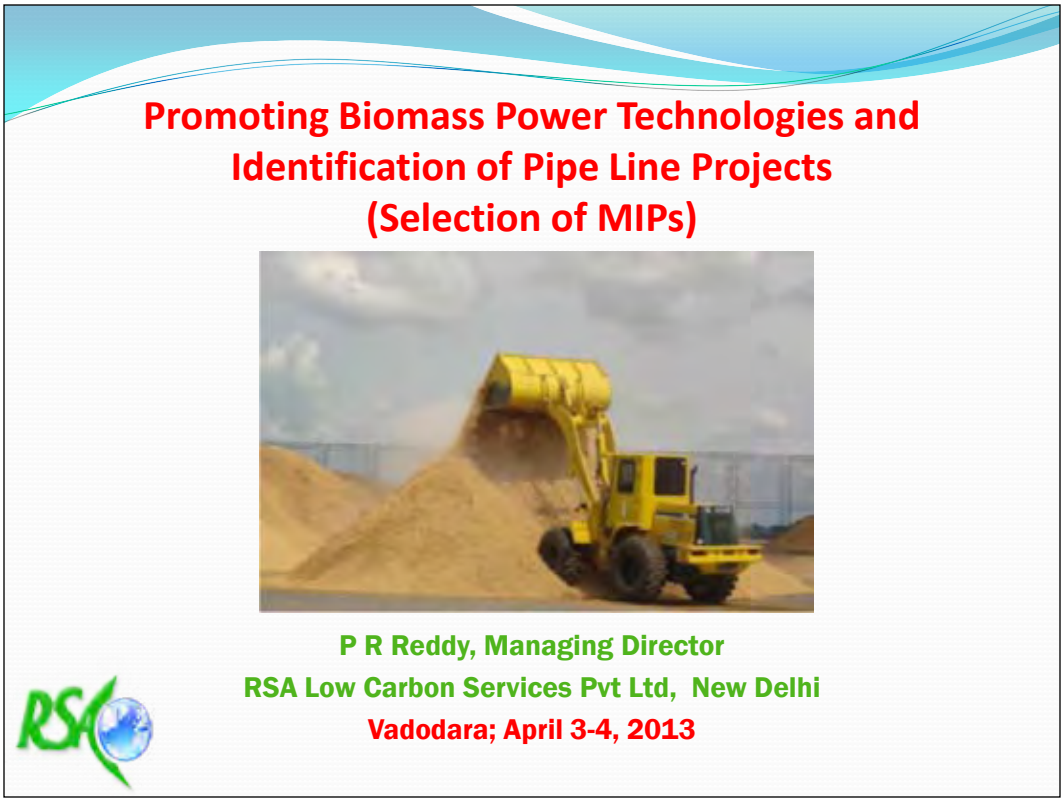
ZenithEnergy

Thank you

ZenithEnergy

Presentation 8

Title of Presentation	Presenter	Brief details of the presentation	Category
Selection of a Model Investment Project	**Shri P. R. Reddy**, Managing Director, RSA Low Carbon Services Pvt Ltd, New Delhi.	The presentation explained the details and benefits of UNDP-GEF –MNRE programme for the Removal of Barriers for Biomass Power Generation in India. It also elaborated on the main features, i.e., financial and technical assistance to be provided for the projects selected under the programme. The presentation explained significance of workshop and expected outcome of the workshop.	Policy



Biomass Power Potential in India

Biomass – Renewable in Nature, Carbon Neutral and has the Potential to provide Large Productive Employment in Rural Areas.

Potential

- **Estimated Production of Crop - 540 MT / yr**
  - **Agro industrial & Forest Residues**
- **Estimated Surplus Availability - 120-150 MT / yr**
- **Power Generation Potential - 16,000 MW**
- **Cogeneration in Sugar Mills - 5,000 MW**

Status of Biomass Power in India

– Achievements as on 31st January 2013

		31/01/2012	31/01/2013
– Biomass Power	-	1,142 MW	1,249 MW (↑ by 107 MW)
– Bagasse Cogeneration	-	1,952 MW	2,281 MW (↑ by 329 MW)
– Non-Bagasse Cogen	-	**347 MW**	**438 MW (↑ by 91 MW)**
– Biomass Gasifier	-	**152 MW**	**157 MW (↑ by 5 MW)**
– Total		**3,593 MW**	**4,125 MW (↑ by 532 MW)**

(Source: MNRE)

Major Barriers

Major Barriers Impending Accelerated Deployment

- Inadequate Site Specific Information on Biomass Availability.
- Existence of Non-Formal Biomass Market and Trading.
- Problems associated with Management of Collection, Transportation, Processing and Storage of Biomass.
- Non - Versatility of Boilers to simultaneously take a variety of Biomass and cost effective sub MW systems.
- Availability of Finances.
- Existence of Conducive Policy and Regulatory Framework

GEF-MNRE-UNDP Project

- GEF-MNRE-UNDP signed an Agreement to execute a Project titled “Removal of Barriers to Biomass Power Generation in India”
- Removal of Technical / Financial / Regulatory / Institutional barriers
- Setting up of MIPs (Model Investment Projects)
- Focus: Small size Biomass Power projects or Co-generation Projects or Gasifier based Power Plants

GEF-MNRE-UNDP Project

- GEF/UNDP : USD 5.65 m (Rs 28.25 Cr)
- MNRE : USD 5.24 m (Rs 26.2 Cr)
- Debt from FIs : USD 24.82 m (Rs 124.1 Cr)
- Equity from Pvt Sector : USD 3.44 m (Rs 18.2 Cr)
- **Total : USD 39.15 (Rs 195.75 Cr)**

Biomass Power generation and co-generation project

- **Project Components**
  - **Identification of Barriers for Large Scale Deployment of Biomass Power through Technical Assistance.**
  - **Setting up of MIPs to act as the Best Practices for faster Replication of Biomass Power in the Country.**
- **Model Investment Projects (MIPs)**
  - **Supporting Implementation of different type of MIPs to address removal of barriers related to Technology, Sizing and Sustainability.**

Biomass Technologies considered

- Biomass based Power Generation (Rankine Cycle)
- Biomass based Co-generation Power Generation (Rankine Cycle)
- Biomass based Gasifier based Power Generation (Otto Cycle)

Financial Assistance under MNRE and UNDP - GEF Biomass Power Programme

Details of financial support for establishment of Model Investment Projects (MIPs) based on Combustion, Gasification and Cogeneration for Power Generation -:

Biomass Combustion

- Rs 10 lakh / MW against CFA as per scheme on "Grid Interactive Biomass Power & Bagasse Cogeneration".
  Partial financial support towards verifiable additionality / innovation inbuilt in the project.

- Establishment of Fuel Supply : Rs150 Lakhs for capacity above 5 MW and up to 7.5 MW
  Linkages & depots : Rs 200 Lakhs for capacity above 7.5 MW and upto 10 MW

Note: The said financial assistance with matching contribution from the promoter would mainly be for creating the infrastructure which include procurement of plant & machinery and associated civil works.

- Installation of Air Cooled Condenser : upto Rs 9 Lakhs / MW

- Rs 5 lakh per MW for other innovations (such as energy efficient equipment, technology innovation - improvement in combustion system, reduction in particulate emissions etc.).

Contd..

Biomass Gasification

- Grid connected power projects with 100% producer gas engine : Rs 150 lakh / MW
- Fuel Supply Linkage and AMC for 5 yrs : Rs 30 lakh / MW
- Partial financial support towards additionality
- 50% cost of the plant and machinery subject to max. of Rs 20 lakh towards installation of Vapor Absorption Machine (VAM) for cooling / chilling and steam generating system from waste heat.

Note: *Cost towards Purchase of land, its development, fencing / boundary wall, administrative building, retrofitting and refurbishing of the existing Plant & Machinery and/or any other such item will not be considered as part of the project cost for financial support from the Ministry for the above mentioned projects.*

Rural Electrification / Cogeneration Projects

Features

- Max installed capacity - 2 MW
- Captive use by industry - <50 % of installed capacity
- Local distribution / fed to grid - Balance Power

Financial Support – Rs. 200 lakh / MW

- For setting up plant – Rs. 150 lakh
- For Fuel Linkage, Distribution Network, Distribution Franchise, Awareness Creation etc. – Rs. 50 lakh

Infrastructure for Fuel Supply Linkages at M/s Malwa Power, Muktsar, Punjab

Fuel Supply Linkages at Cogeneration Plant at M/s SSK Pandurang, utilizing Sugar Cane Trash

1.2 MWe, Grid connected Power Plant using Agri-Residues as Biomass

Sankheda, near Vadodara, Gujarat

gef MNRE UNDP

Promoting Biomass Power Technologies and Identification of Pipe Line Projects

ZENITHENERGY

Our Scope of Work

- Preparatory work for conducting the Workshop(s).
- Conducting workshop, generate expression of interest from some of the participants (at least 5 nos of > 1 MW capacity each); and
- Hand hold them to develop bankable DPRs

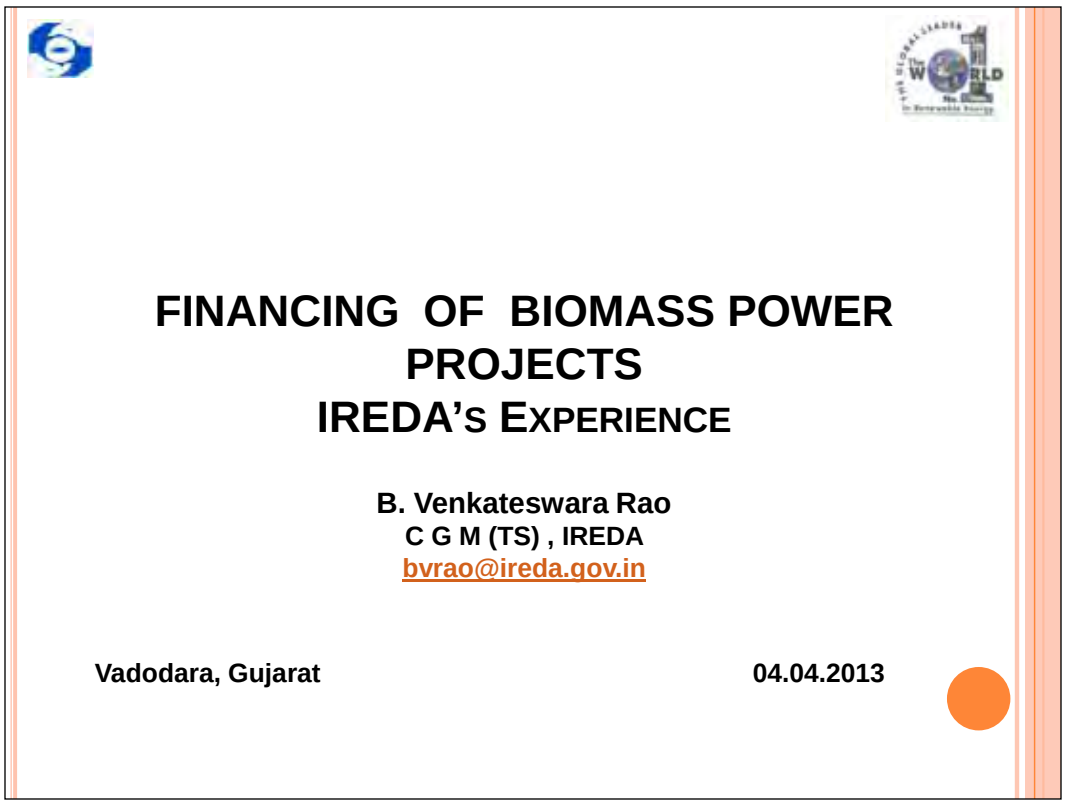
  (Preparing DPR, helping in getting approvals, Finance, etc. 50% of the DPR cost to be borne by the Promoter)

Thank you!

P R Reddy
Managing Direcotr
RSA Low Carbon Services Pvt Ltd
New Delhi
prreddy100@gmail.com
Mob: +91 98107 09188

Presentation 9

Title of Presentation	Presenter	Brief details of the presentation	Category
Financing and Project Appraisal Procedure of Biomass Power Plant	**Shri B.V. Rao**, CGM (Technical), IREDA.	The presentation highlighted the financing and appraisal procedures of IREDA for grant of loan and benefits of approaching IREDA over other FIs for biomass projects. The presentation briefed the benefits of renewable power generation along with way forward as development of organized market, increasing realization among policy makers and innovative financing, etc., for improving the biomass sector.	Policy



POWER SCENARIO IN INDIA

- Total Installed Power Capacity – 214.63 GW(as on 28.02.2013)
- Per Capita Consumption – 779 units
- RE Installed Capacity – 25.85 GW
- GW Share of RE in Installed Capacity – 12.5%
- Share of RE in Power Generation – 3.5%
- Annual CO2 Emissions Contribution – 3rd Largest
- Energy Generation *(p.a.)* – 855 BU during 2011–12
- Supply Demand Gap – 13.8 % Peak
– 10.9 % Energy
- Access to Electricity (Rural) – 43% households

Target for Capacity Addition during XII Plan (2012 – 2017) : 76000 MW

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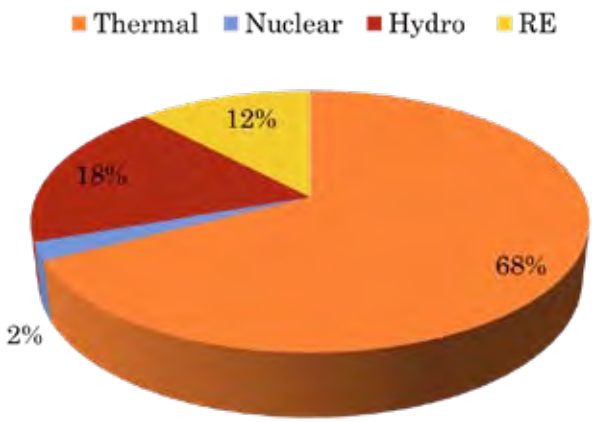
POWER SECTOR AT A GLANCE



Total Installed Capacity in India: 214.63 GW

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POTENTIAL & ACHIEVEMENTS OF RE IN INDIA

Sector	Approx. Potential (MW)	Cumulative up to 28.02.2013 (MW)	% Achieved
Wind	45195	18635	**41.23**
Small Hydro	15000	3552	**23.68**
Bagasse Cogeneration	5000	2301	**46.02**
Biomass	16881	1264	**7.49**
Waste to Energy	2700	96	**3.56**
Solar Power	4-7 kWh/Sq.M/Day)	481.48	**-**
Total	**84776**	**23129.40**	**32**

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ABOUT IREDA

INCEPTION

Incorporated under the Companies Act on 11th March, 1987 to promote, develop and extend financial assistance for Renewable Energy and Energy Efficiency/ Conservation Projects.

OBJECTIVE

Extend financial support to Renewable Energy, Energy Efficiency & Conservation projects

MOTTO

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CUMULATIVE PERFORMANCE

- No. of Projects :2066
- Loan Sanctions :Rs. 22458 Cr
- Loan Disbursements :Rs. 11847 Cr
- Sanctioned Power Capacity : 11397 MW
- Commissioned Capacity : 3479 MW(approx.)

As on 31.03.2013

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IMPACT OF IREDA FUNDED PROJECTS

- **Created awareness in the country.**
- **Encouraged entry of private sector investments in RE sector.**
- **Catalyzed market development by showcasing success stories - encouraging other lenders to support the sector.**
- **Helped in creating manufacturing, design & engineering, operation and maintenance capabilities.**
- **Encouraged several states to declare policies and incentives to encourage private investments in RE sector.**
- **Assisted in policy shift from technology demonstration to commercialization making RE development demand driven.**
- **Helped in creating direct and indirect employment generation, economic development and improving living conditions.**

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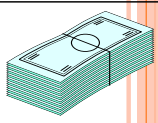
RESOURCE BASE



As on 2011-12 *(Rs. in crores)*

Authorized Share Capital	-	**1000.00**
Paid up Capital	-	**639.60**
Net Worth	-	**1457.99**
Domestic Borrowings	-	**1187.77**
International Borrowings	-	**2945.55**

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SECTORS BEING FINANCED

Sectors being financed:

- Wind
- Small & Medium Hydro
- Biomass Power & Cogeneration
- Solar
- Waste to Energy
- EE & Conservation
- Bio Fuels/ Alternate Fuels

Other Activities

- Intermediary for providing financing facilities for various MNRE Schemes.
- Implementing Agency for GBI Scheme – Wind & Solar

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FINANCING SCHEMES

- Project Financing Schemes
- Equipment Financing Schemes
- Financing Through Intermediaries

Quantum of Assistance - Upto 70% of Project Cost
Rate of Interest - 11.50% to 13.50%
Repayment Period - Upto 13 Years

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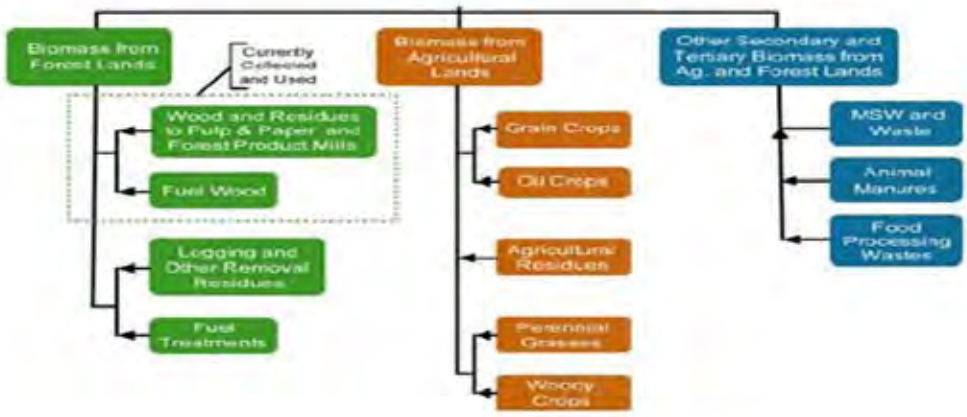
BIOMASS ENERGY

BIOMASS RESOURCE CATEGORIES



IREDA - GRID CONNECTED BIOMASS ENERGY PROGRAMMES

- Biomass Cogeneration & Industrial Cogeneration (including sugar Industry)
- Biomass Power Generation (Direct Combustion mode up to 10 MW)
- Biomass Gasification/Bio-gas (through Biomethanation)

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BIOMASS /COGENERATION SECTOR
(INCLUDING SUGAR INDUSTRY)
MARKET DEVELOPMENT PROGRAMME

OBJECTIVES

- To provide financial assistance to the developers to set up the projects which have techno-economic viability.
- Adoption of high efficiency Co-Gen scheme.
- To facilitate development of indigenous capability and capacity for high efficient cogeneration plant.

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Biomass / Cogeneration (Including Sugar Industry) Market Development Programme

OUTLINE OF THE SCHEME

- Small Scale Co-generation (except sugar industry) upto 5.0 MW installed capacity (Minimum applicable boiler pressure will be 42 kg/cm^2)
- Above 5.0 MW installed capacity (Both for sugar and Non- Sugar industry) (Minimum applicable boiler pressure will be 63 kg/cm^2)
- Eligible capacity of Biomass plant – 10MW & below.
- Use of energy efficient equipment in Sugar/Paper mills.
- Minimum size of sugar plant should be 2500 TCD, to establish Co- Gen plant.

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FINANCING NORMS

Sector	Interest Rate	Repayment Period (Max)	Term Loan
PROJECT FINANCING			
Biomass Cogeneration & Industrial Cogeneration (including sugar Industry)	12.25%-13.00%	10 years with 3 years moratorium	Up to 70% of project Cost (90% In case of SDF supported projects- existing and Profit making for last 3 years)
Biomass Power Generation (Direct Combustion mode up to 10 MW)	12.50%-13.25%	• 10 years with 3 years moratorium	Up to 70% of project Cost
Biomass Gasification/ Bio-gas(through Biomethanation)	13.50%	10 years with 2 years moratorium	Up to 70% of project Cost

Source: http://ireda.gov.in/pdf/Financing%20Norms.pdf

SPECIFIC ADVANTAGES WITH IREDA OVER OTHER FI/BANKS

- **Repayment period 10 years with grace period of 1 year after commissioning**
- **Implementation period of 3 years**
- **Quantum of Assistance is up to 70%-90% (for SDF supported projects)**
- **Knowledge/ Experience sharing with respect to best process of Project Implementation including Technical Guidance.**

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GENERAL ELIGIBILITY

- Profit making companies
- Debt-equity ratio up to 3:1
- No erosion of paid-up
- No refinancing/second hand project, equipment and machinery
- No default to IREDA, other FIs/ Banks
- No cost over run financing
- Minimum loan amount – Rs. 50 Lakhs

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FINANCIAL INDICATORS

- Financial IRR - 12.0-20.0%
- Break Even Point – 40.0%-60.0%
- Payback Period – 5-8 years
- Debt Service Coverage Ratio- 1.3-1.5

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STATUTORY CLEARANCES & APPROVALS REQUIRED

- **Project specific DPR covering risk and sensitivity analysis**
- **Independent Bio-mass survey report**
- **Approval / clearance from State Government / State Nodal Agencies for setting up of Bio-mass Power Projects**
- **PPA with SEB / Third Parties**
- **State Pollution Control Board clearance.**
- **Water drawl approval from State Irrigation department / Ground water authority**

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SECURITY

- Mortgage of immovables by way of deposit of title deeds
- Hypothecation of movable assets
- Guarantees by Promoters Companies/ Promoter Directors
- Post Dated Cheques
- Pledge of FDR, Securities
- Escrow/ TRA Account
- Additional, as may be required

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Name of the Project	**: M/s Green Elephant India Pvt. Ltd.**
Sector	**: Waste To Energy**
Capacity	**: 28000 m3/Day**
Project Cost	**: Rs. 1082 Lakhs**
Loan Amount	**: Rs. 541 Lakhs**
Status	**: Commissioned**

Energy for Ever

HIGHLIGHTS OF PROJECT

- **The Company has developed a 28,000 m3/day Bio-gas project.**
- **Raw material for the biogas is spent wash from the Distillery which is one of the most potent substrate to generate biogas.**
- **The company has entered into an agreement with distillery to purchase 600 m3/day spent wash @ Rs. 50/m3 for 20 years as per the agreement.**
- **The Company will sell the entire Biogas to the M/s. KVSSSK for 10 years @ Rs.6.41/ m3 with 3% escalation after each 3 years.**
- **Biogas will be used in the boiler of Distillery Plant.**
- **The project was commissioned in June,2011**

Energy for Ever

Name of the Project	**: M/s Yashwant Energy**
Sector	**: Waste To Energy**
Capacity	**: 0.625 MW**
Project Cost	**: Rs. 439Lakhs**
Loan Amount	**: Rs. 307 Lakhs**
Status	**: Commissioned**

Energy for Ever

HIGHLIGHTS OF PROJECT

- **M/s. Yashwant Energy Pvt. Ltd. has proposed to develop a 0.625 MW BIO-GAS POWER PROJECT**
- **The project envisages treating industrial waste generated in the process of manufacturing glucose by M/s Yashwant Sahakari Glucose Karkhana Limited**
- **It is envisaged that the proposed project will generate 4208 MWh/ year at 80 % PLF.**
- **Recently Company has completed the trial Runs and has submitted the Commissioning Certificate.**

Energy for Ever

Name of the Project	**: Chanderpur Renewal Power Com. Pvt. Ltd.**
Sector	**: Waste To Energy**
Capacity	**: 1 MW**
Project Cost	**: Rs. 390 Lakhs**
Loan Amount	**: Rs. 582 Lakhs**
Status	**: Under Implementation**

Energy for Ever

HIGHLIGHTS OF PROJECT

- **The Company has proposed to set up a power plant based on biomass gasification.**
- **The Project will generate 100% producer gas which will be used as fuel for the gas engine to generate electricity. Wood is used as raw material for producer gas.**
- **It is envisaged that the proposed project will generate 59.4 Lakhs unit in the first year at 75 % PLF and 63.4 Lakhs unit from second year onwards at 80 % PLF.**
- **The plant is a continuous process plant and would be operational for 24 hours for at least 330 days during the year.**
- **The promoter of the project is an approved manufacturer of Gasifiers from MNRE.**

Energy for Ever

LESSONS LEARNT IN FINANCING BIOMASS / BAGASSE BASED COGENERATION PROJECTS

LESSONS LEARNT IN FINANCING BIOMASS / BAGASSE BASED COGENERATION PROJECTS BY IREDA

POLICY/ REGULATORY:

- Absence of consistent and long term policy at state level.
- Non uniform tariff without linking to fuel prices/ fuel procurement cost.
- Non availability of strong grid / evacuation facilities.
- Mismatch between capacity of biomass power plant and realistic fuel supply position.
- Payment delays from DSICOMs.

LESSONS LEARNT IN FINANCING BIOMASS / BAGASSE BASED COGENERATION PROJECTS BY IREDA

TECHNICAL:

- Improper assessment of biomass resources without considering likely competitive uses.
- Non availability of consistent quality of adequate biomass
- Vide fluctuation in fuel cost in relation to seasons.
- Lack of proper fuel handling/transportation facilities.
- High plant down time due to frequent break down of boilers/turbines due to fuel quality.
- Frequent power tripping/fluctuations in rural areas.
- Limited availability of qualified technical manpower for operations.
- Improper assessment of characteristics of biomass fuels leading to lower PLF.

LESSONS LEARNT IN FINANCING BIOMASS / BAGASSE BASED COGENERATION PROJECTS BY IREDA

FINANCIAL:

- Higher working capital requirement & Limited accessibility of working capital for biomass procurement.
- Non availability of low cost funding.
- Lack of information exchange on operational performance of biomass projects amongst FIs/Banks
- Improper operation of Trust and Retention Account by the promoters/likely diversion of funds

LESSONS LEARNT IN FINANCING BIOMASS / BAGASSE BASED COGENERATION PROJECTS BY IREDA

MANAGERIAL:

- First generation entrepreneurs & Inadequate experience of developers in management of power plants.
- Low capacity to raise equity/working capital in time.
- Improper long term planning on biomass procurement.
- Non implementation of new methods/techniques in biomass collection/storage/handling systems
- Mismanagement of funds.

LESSONS LEARNT IN FINANCING BIOMASS / BAGASSE BASED COGENERATION PROJECTS BY IREDA

GENERAL:

- Delays in conversion of land from agriculture to non-agriculture.
- Absence of single window clearances in many States.
- Delays in getting approvals from Banks/FIs and State Agencies.
- Lack of professional management with promoters.

SUGGESTIONS FOR REMOVAL OF BARRIERS / RISKS IN DEVELOPMENT / FINANCING OF BIOMASS POWER

- To announce long term consistent policy for biomass power development at both central and state levels.
- To conduct detailed survey on realistic biomass availability and restrict new project licenses based on practical fuel supply position.
- To provide single window clearance at state level to reduce project implementation delays.
- To strengthen the existing grid and to provide proper evacuation facilities.
- To fix biomass power tariff linked to increase in fuel costs.

SUGGESTIONS FOR REMOVAL OF BARRIERS / RISKS

- To encourage biomass plantation to supplement the existing fuel sources.
- To consider realistic Capital cost based on the cost of equipment for fuel preparation/transportation.
- To provide low cost funds for biomass sector through national and international agencies.
- Need to provide adequate working capital from the Banks.
- Frequent exchange of information from Banks and FIs on biomass power plants performance.
- Need for proper assessment of promoters capability to raise adequate WC. .

SUGGESTIONS FOR REMOVAL OF BARRIERS / RISKS

- To consider financial support for fuel procurement, transportation equipment with latest technology.
- To encourage setting up of fuel depots and transportation systems as business entity.
- Strict monitoring of TRA accounts to avoid mismanagement of funds.
- To take up capacity building programm to train manpower.

SUGGESTIONS FOR REMOVAL OF BARRIERS / RISKS

- To assess the realastic potential for cogeneration in existing sugar mills under expansion and also under the cooperative sectors.
- To insist on Energy Conservation practices in biomass power plants.
- To encourage biomass gasifiers on off-grid mode based on the local resources on entrepreneurship basis.

WAY FORWARD FOR BIOMASS POWER DEVELOPMENT

- Development of organized market for biomass energy resources.
- Level Playing ground (implicit environmental subsidy allowed to fossil fuels).
- Increasing realization among policy makers about positive externalities for biomass to make inroads into energy market.
- Reliability and cost competitiveness of Modern Biomass technologies.
- New financing models for funding cogen in cooperative sugar plants (state government/ private)
- Innovative financing for new Biomass gasification plants and Industrial cogeneration units.

Energy for Ever

THANK YOU

Presentation 10

Title of Presentation	Presenter	Brief details of the presentation	Category
Policies of States for the Promotion of Biomass Power	**Shri A.K. Chauhan**, Sr. Project Executive, GEDA	The presentation explained the biomass power potential and achievements of biomass power in Gujarat. The presentation highlighted the barriers that existed in the biomass power sector and suggested recommendation for the minimization of barriers for improving it.	Policy

Biomass Potential of Gujarat

- Gujarat Land Area : 19.60 Million hectare
- Land under Agriculture/ Forest/Wasteland : 17.20 Million hectare
- Crop Production : 23.33 Million tonnes
- Biomass Available : 40.3 Million tonnes
- Surplus Biomass available : 16.9 Million tonnes
- Power Potential : 2360 MW

2

2

Biomass Conversion Technologies

- Gasification:
  - Using Internal Combustion engine -Genset
  - Feasible for 1 – 5 MW
- Combustion:
  - Using Steam Turbine
  - Feasible for 6 -15 MW
- Bio-methanation:
  - Using Bio-reactor, Engine Genset
  - Feasible for 1 – 2 MW

In Principle approval for installation of BBPP

- GEDA had issued in principle approval to 20 companies for setting up of Biomass based Power Plant (Direct Combustion Technology) with total capacity of 317 MW in 2008.
- Till date GEDA has issued in-principle approval / LOI for in-principle approval to total 47 nos. of Developers with aggregate capacity of 488.60 MW.

4

Final Clearance issued to Biomass Based Power Projects

- GEDA has given the Final clearance to total 7 nos. of projects with total capacity of 61.20 MW.
- Out of seven projects total 31.200MW has been commissioned till date.

5

Final Clearance accorded by GEDA to the following projects

Sr. No.	Name of the Company	Capacity in MW	Village / Taluka / Dist.
1	Junagadh Power Projects (P) Limited, Hyderabad	10	Vanthali, Dist: Junagadh
2	Bhavnagar Biomass Power Projects Pvt. Ltd., Hyderabad	10	Village: Vavdi Gajabhai, Taluka: Shihor, Dist: Bhavnagar
3	M/s. Amreli Power Projects Ltd., Hyderabad	10	Vill & Tal: Savarkundla, Dist: Amreli
4	Abellon CleanEnergy Limited, Ahmedabad	10	Village: Khas, Taluka: Ranpur, Dist: Ahmedabd
5	Abellon Clean Energy Limited, Ahmedabad	10	Village: Sugariya, Taluka: Anjar, Dist: Kutch
6	Abellon Clean Energy Limited, Ahmedabad	10	Vill: Vithlapara, Tal: Dasada, Dist: Surendranagar
7	Ankur Scientific Energy Technologies Pvt. Ltd.,Vadodara	1.2	Taluka: Sankheda, Dist: Bhavnagar
	**Total ----------> **	**61.2**	

6

List of commissioned projects.

Sr. No.	Name of the Company	Capacity in MW	Village /Taluka/ Dist.	Date of commissioning
1	Junagadh Power Projects (P) Limited, Hyderabad	10	Vanthali, Dist: Junagadh	22.05.2011
2	Bhavnagar Biomass Power Projects Pvt. Ltd., Hyderabad	10	Village: Vavdi Gajabhai, Taluka: Shihor, Dist: Bhavnagar	19.03.2012
3	M/s. Amreli Power Projects Ltd., Hyderabad	10	Vill & Tal: Savarkundla, Dist: Amreli	01.03.2011
4	Ankur Scientific Energy Technologies Pvt. Ltd.,Vadodara	1.2	Taluka: Sankheda, Dist: Bhavnagar	20.10.2011
	Total ---------->	31.2		

7

Generation of Biomass Based Power Projects

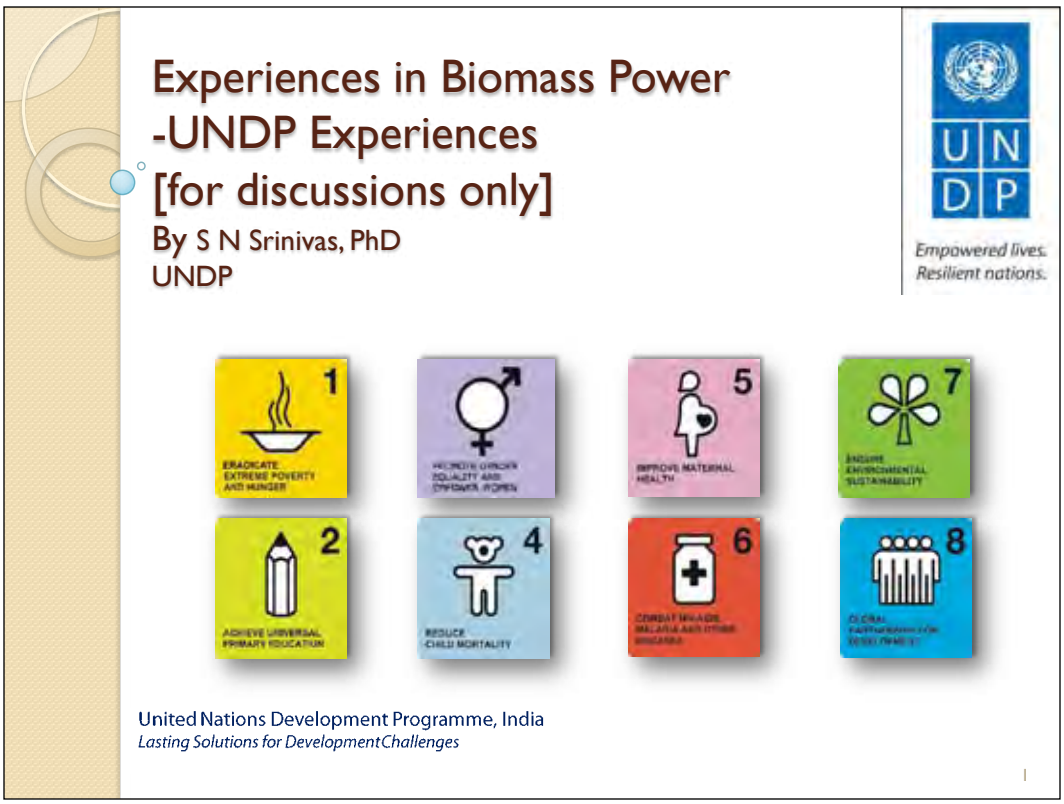
Sr. No.	Name of the Company	Cap in MW	2010-11		2011-12		2012-13 (till Feb-2013)	
			Gen.	PLF	Gen.	PLF	Gen.	PLF
1	Junagadh Power Projects (P) Limited, Hyderabad	10	2995828	21.16%	27234796	31.09%	5566900	6.94%
2	Bhavnagar Biomass Power Projects Pvt. Ltd., Hyderabad	10			26147300	32.52%	24105820	30.07%
3	M/s. Amreli Power Projects Ltd., Hyderabad	10			573500	19.91%	13911232	17.35%
4	Ankur Scientific Energy Technologies Pvt. Ltd.,Vadodara	1.2					1300000 (till March - 12)	-
	Total --->	**31.2**						

8

Thank you

Presentation 11

Title of Presentation	Presenter	Brief details of the presentation	Category
Experiences of UNDP in Promoting Biomass-based Power Generation	**Dr S.N. Srinivas**, Programme Officer (Energy for Development), UNDP India	The presentation brought the experiences of UNDP in biomass projects in specific, RE in general. The presentation highlighted facts and figures of the UNDP Biomass projects in terms of power generation cost and PLF achieved, and so on. The presentation concluded with the detailed recommendation in terms of policy and technology for improving the biomass sector.	Policy

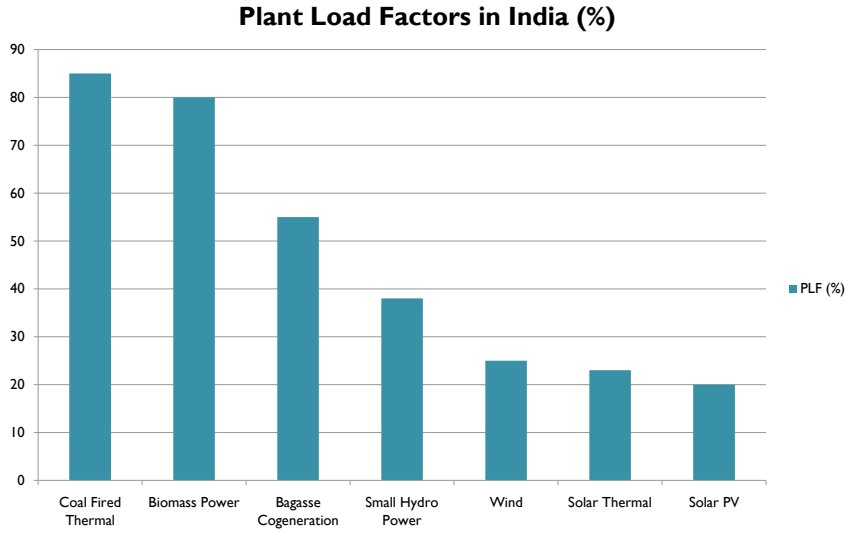


Installed capacity and generation of electricity from different sources of energy

SN	Source of energy	Installed capacity – as on March 2012 in MW	Percentage of installed capacity of total	Annual generation – FY 2011-12 Billon Units	Percentage of annual generation
1	Coal	112022	56.05	584.58	63.38%
2	Large hydro	38,990	19.51	130.43	14.14%
3	Nuclear	4,780	2.39	32.27	3.50%
4	Gas and others	19,581	9.80	123.87	13.43%
5	Renewables[µ]	24,504	12.26	51.23	5.55%
	Total	199,877	100.00	922.38	100.00%

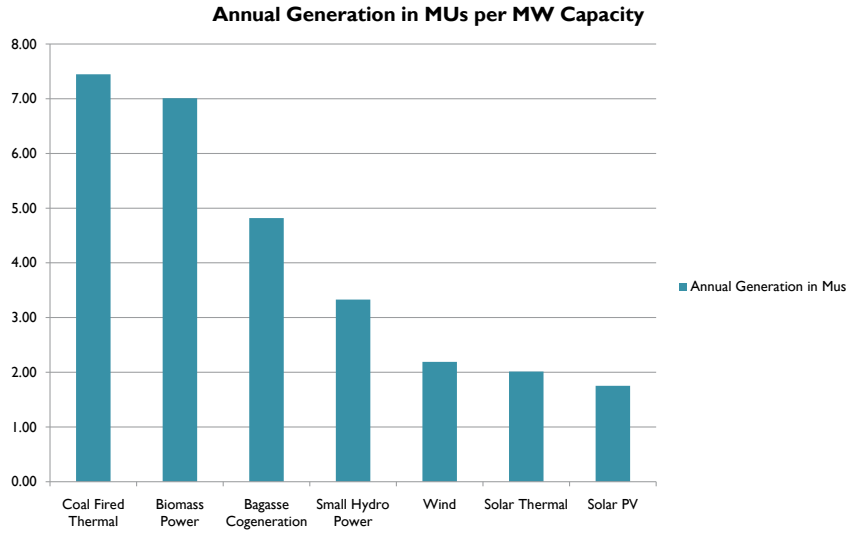
2

Typical plant load factors of RE plants and coal fired plant



3

Annual electricity generated [MU] per MW of installed capacity



4

Potential for RE based electricity generation and achievement till Jan 2012

SN	Source of energy	Potential MW	Achievement MW	Potential available to be explored in MW and (%)
	Grid Connected			
1	Wind	48,500	16,179	32,321 (66.64%)
2	Small hydro	15,000	3,300.13	11,700 (78%)
3	Solar*	20,000	481.48	19,519 (97.59%)
4	Biomass Cogeneration (Bagasse)	5,000	1,952.53	3047 (60.95%)
5	Biomass Combustion (Rankine Cycle)	18,000	1,142.60	16,857 (93.65%)
6	Waste to Energy – Urban & Industrial	3,000	73.66	2,926 (97.54%)
7	Sub-total (Grid Power)	109,500	23,129.40	86,371 (78.88%)
	Off Grid / Captive Power			
8	Biomass Cogeneration (Other than Bagasse)	-	347.85	-
9	Biomass gasification (Rural & Industrial)	-	148.26	-
10	Waste to Energy (Urban & Industrial)	-	92.93	-
11	SPV Systems (> 1 kW)	-	81.01	-
12	Aero-generators / hybrid systems	-	1.45	-
	Sub-total (Off-grid / Captive Power)		671.50	-
	Total (Grid & Off-grid)		23,800.90	-

5

Technology Options

- Combustion
  - Size range from 1 to 100 MW, currently installed in India 5 to 15 MW
  - Plant efficiency 30%
  - Smaller plants have higher investments, higher cost per kW and O & M costs
- Gasification
  - Indigenous – India is leading
  - 10 kW to 1to 2 MW
  - Efficiency 20 to 30%
- 1 to 3 MW is in tricky situation. For gasifier limited experience; for combustion it is not highly optimal!

6

BIOMASS POTENTIAL

National Biomass Atlas provides district-wise assessment of biomass

Step 1. First go to the link given below;
http://cgpl.iisc.ernet.in/site/BiomassAtlas/tabid/91/Default.aspx

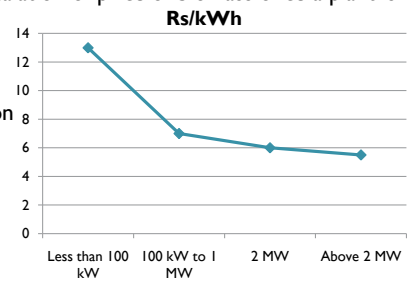
Step 2: Click on the line
Click here to visit National Biomass Atlas of India

Step 3: Login appears, Register yourself

Step 4 Click on
Regional Biomass Tables.

CHALLENGES

1. Proven technologies on the anvil (BERI), bankable technology packages, and revenue models (Sankheda, MPPL)
2. Lack of credible suppliers and a competitive market for RE products
3. Dependable and stable cost Raw material supply
4. Issues related to evacuation of power to grid (tariff, active power)
5. Issues related to off grid power systems (generation, O&M, supply, price setting, revenue collection), parity in pricing (weighted average of power in rural village is about 0.8 Rs/kWh, best price from RE is about Rs 5/kWh)
6. Competing uses of biomass and sudden escalation of price of biomass once a plant is established
7. Cost of generation
8. Costs and complexities of scale of operation
    1. less than 100 kW,
    2. 100 kW to 1 MW,
    3. 2 MW, and
    4. above 2 MW



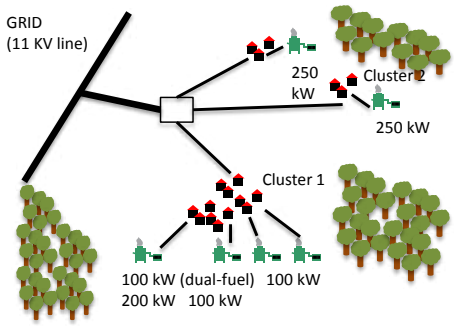
Lack of investor interest

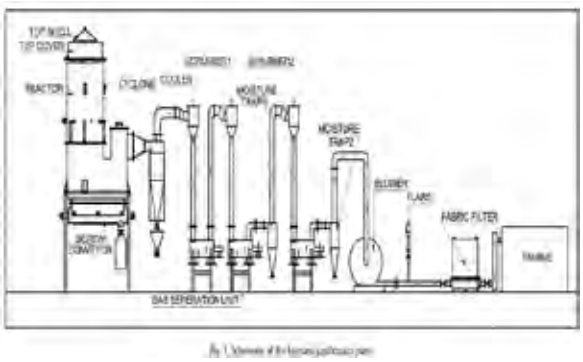
BERI Experience

- Benchmarking performance
- Cost of power
- Energy plantation
- PPP [Public-Panchayat Partnership]
- Tariff
- Community involvement
- Business opportunities for biomass power

9

Achievements till now - Biomass Energy for Rural India India





Sub-megawatt scale power, BERI

- 100% producer gas,
- 1 MW [200 kW x1, 100 kW x 3, 250 kW x2]
- 200 kW unit [as on 30 June 2012]
  - 951,000 kWh
  - 780 tCO2
  - 26,580 tCO2 annually including plantations
- Performance Guarantee
  - 1.25 kg/kWh
  - 95% of the rated capacity
  - 300 hours of continuous operation
  - None of the suppliers could meet this requirement
- 1000 hours benchmark operation
  - 1.36 kg/kWh
  - 85 kW = 85% of rated capacity
- Set realistic targets

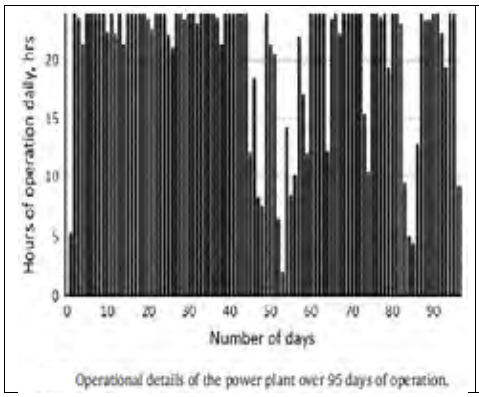
11

Performance details of BERI's 100 kWe biomass gasifier

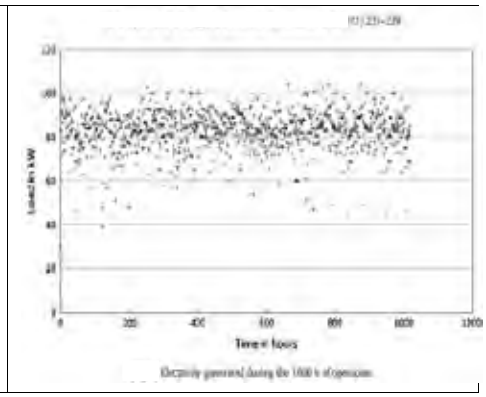
SN	Parameter	Details
1	Gasifier operation	1035 h
2	Engine Operation	1022 h
3	Grid Synchronisation	951 h
4	Total biomass consumption	111 t
5	Average	107 kg/h
6	Specific Energy Consumption (calorific value 15 MJ/kg)	1.36 kg/kWh
7	Best recorded SEC	1.2 kg/kWh
8	Total energy generated	80,600 kWh
9	Net energy exported to grid	56,500 kWh
10	Average load factor	85 kWe
11	Peaking load factor	100 kWe
12	Rated Capacity of Engine	120 kWe
13	Overall efficiency biomass to electricity	18%
14	Overall efficiency producer gas to electricity	25%
15	Cold gas efficiency	77%
16	Estimated efficiency for 500 kWe	25 to 30%
17	Efficiency of 100 MWe coal plant	34%

12

Performance over benchmark period



Operational details of the power plant over 95 days of operation.



Cost per kWh based on BERI [100 kW system]

	Cost per kWh		
1	Specific fuel consumption	kg/kWh	1.36
2	Cost of dry processed biomass	Rs/kg	2.75
3	Cost of dry processed biomass per kWh	Rs/kWh	3.74
4	Operation, Consumables, maintenance cost per kWh (estimate)	Rs/kWh	1.5
5	Repairs, replacement and contingency costs (estimate)	Rs/kWh	0.5
6	**Operation and Maintenance Cost**	**Rs/kWh**	**5.74**
7	**Operation and Maintenance Cost (for export), 15% auxiliary loss**	**Rs/kWh**	**0.86**
8	**Net O & M Costs (Considering loss due to auxiliary consumption**	**Rs/kWh**	**6.60**
9	**Capital cost (@ INR 7,000,000 for 100 kW installed capacity, 12.25% interest on capital, 20 years life, 68.5% PLF) Source: a recent DPR prepared for one of UNDP projects**	**Rs/kWh**	**3.25**
	Total cost (Rs per kWh)	**Rs/kWh**	**9.85**

Learnings based on Biomass Energy for Rural India

- Business model: Panchayat-BERI PMU/Society–BESCOM agreement to evacuate power
  - Established feasibility of Decentralized Rural Biomass Power System with involvement of Panchayat
  - Sold about 1 of power to BESCOM at a tariff of Rs 2.85/kWh earning about 2.85 millioMillion Units n Rs
  - Can evolve as business model for entrepreneur run, GP governed biomass power generation providing employment, electricity for income generation to rural areas
- Plantation:
  - Plantation in about 3000 hectares of land yielding about 4 to 5000 tonnes (against estimate yield of 12000 tonnes) annually
  - Gram Panchyat h
  - 240,000 tCO2 reduced/sequestered till now (about 26,000 tCO2 annually);
  - 100 men and 100 women employed in power plant operation and plantations management
- All basic data procured from BERI gasifier plant are uploaded on the website – perhaps one of the unique feature
  - www.bioenergyindia.in or www.berisociety.com

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Learnings

- Social benefits
  - 57% of the fuel cost, 10% on labour is ploughed in village
  - 18% on fixed cost, 15% maintenance may be from outside
- Project benefits
  - 7 Crore /MW investment
  - Provides turnover of 2 crore when fully operational
  - Assuming 12,000 Rs per capita income, total income of 4 panchayats is about 36 Crore.
  - Thus, it can result into 6% increase in overall income.

OTHER INITIATIVES INVOLVING BIOMASS POWER

PROGRAMME	HIGHLIGHTS	REMARKS/ISSUES
Decentralized Distributed Generation – Ministry of Power. To support supply of electricity and indirectly facilitate power requirement of agriculture, small & medium industries	25,000 villages not covered under MNRE's RVE programme are eligible. 15 projects have been sanctioned with committed amount of Rs 77 million. NTPC is implementing 14, WBREDA is implementing 1. Expected to achieve 2 to 5 MW.	1. Lack of access to competent, effective and responsive affordable technical back-up 2. Inadequacies in community management, O& M 3. Uncertainties in modalities of funding support
Remote Village Electrification (RVE) – electrification of (not feasible or not cost effective for grid extension) unelectrified villages and hamlets through RE	8,033 villages and hamlets have been covered.	1. Largely meets lighting requirements.
Village Energy Security Programme (VESP)	About 90 projects implemented in different villages (mostly 10 to 20kW biomass gasifiers). 30 projects were functioning as per an evaluation	1. Inadequate commissioning and training. 2. No technical and service back up. 3. Cost of power generation were as high Rs 13 to 20 per kWh.
SUTRA (UNDP supported, IISc implemented)	Demonstrated 50 kW biomass gasifier systems	1. No institutional arrangement 2. Higher costs of power to end user
LIBERA (SDC supported)	Demonstrated less than 50 kW biomass gasifier systems	1. Found difficult to source biomass 2. No institutional arrangements

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Business opportunities for sub-megawatt scale power generation

- Gap in electricity availability in the country
  - 300 to 400 million people do not have electricity
  - Over 140 million kerosene lamps/lanterns are still used for lighting burning 3000 million liters of kerosene
- Economic and environmental advantage over diesel option
  - Over 25,000 MW diesel based system in operation.
  - Diesel based electricity costs Rs 15 to 18 per kWh [Cost of diesel is Rs 41.50 to 44.50 Rs/liter]
- Appropriate for village/panchayat
  - 238,054 gram panchayats in India
  - Electricity loads requirement range from 100 kW to 1 MW & above in each panchayat
- Biomass based power for agriculture pumpsets [typical 10 kW]
  - 11 million electric pumps
  - 6 million diesel pumpsets
  - Lift irrigation systems [100 to 1000 kW]
- Unorganised enterprises
  - Brick kilns approx. 50000 units, they have been doing hand moulding, but many are converting to wire cut bricks require 100 to 300 kW. Even 20% of these convert, 10,000 MW
- Telecom sector
  - Over 700,000 telecom towers, 200,000 require RE urgently

What are the key next steps required for the sector?

1. Urgent tariff revision: Support biomass support groups, pilot gap funding to make case for tariff revision
2. Analyse the need and rationale for differential tariffs
3. Analysis of advantages and limitations of scale of operation: large [above 5 MW], medium scale [1 to 5 MW]; Small scale/sub-megawatt [100 kW to 1 MW]; micro scale [10 to 100 kW]
4. Compendium of technology packages, specifications, investments, cost-benefits [tangible and intangible]
5. Accelerate biomass based captive power generation – which can bring in market pull [establishes supply chain, overcomes stable biomass power operation]
6. Analyse the need for parity in fiscal support to biomass electricity when compared to other RE
7. Analyse and advocate - Can Cost of power delivered should be the yard stick for fixing fiscal incentives?
8. Support model projects in different potential sectors which have large replication potential

United Nations Development Programme, India
Lasting Solutions for Development Challenges

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Website: www.undp.org.in

Thank You!

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Presentation 12

Title of Presentation	Presenter	Brief details of the presentation	Category
Worldwide Experiences of General Electric in the Development of Small-scale Biomass Power Generation Projects	**Shri Prashant K. Patil**, Programme Manager, GE India Technology Centre Pvt Ltd., Bangalore	The presentation provided the experiences of GE in biomass power generation across India and presented innovative ideas in power generation. It also explained the range of solutions, equipments provided by GE for biomass power plants.	Technology

GE Power & Water

GE's Integrated Biomass Solution

Business Presentation

Prashant K Patil
In Country For Country Leader

GE's portfolio

Employees: ~300,000+ • '12 revenue: $147B • '12 earnings: $16.1B

Energy	Healthcare	Aviation	Transportation	H&BS	Capital
					
• Power & Water • Energy Services • Oil & Gas	• Healthcare Systems • Life Sciences • Molecular Diagnostics • Healthcare IT	• Commercial • Military • Service • Avionics/Systems	• Locomotives • Services • Propulsion • Systems	• Appliances • Lighting • Intelligent platforms	• Commercial • Consumer • Real Estate • GECAS • EFS

GE Energy...Products in Energy Domain

Employees: 90,000 • '12 revenue: ~$50B • Operating in 140 countries*

Power & Water

- Aero
- Gas Engines
- Nuclear
- Power Generation Services
  - Parts & Repair Services
- Renewables
- Thermal
  - Environmental Services
  - Gasification
- Water

Oil & Gas

- Drilling & Surface
- Global Services
- Measurement & Control Solutions
  - Dresser
  - Wayne
- PII Pipeline Solutions
- Subsea Systems
- Turbo machinery

Energy Management

- Digital Energy
- Industrial Solutions
  - Lineage Power

Energy is a global scale business

GE in India

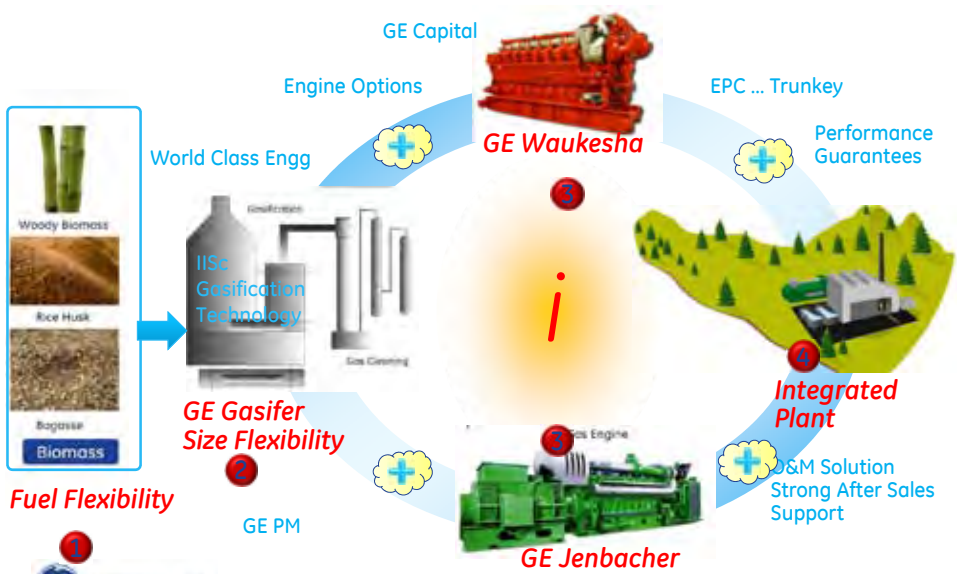
- **1902: First Hydro Project in Karnataka**
- 1969: First Nuclear Power Plants in India
- 1989: JV with Wipro: Healthcare
- 1991: Indian market opens up
- 1992: Collaboration with NCL
- 1993: JV with Godrej: Appliances
- **1997: BPO Operations**
- 1998: JV with Satyam: Industrial
- **1999: JFWTC: Research Operations**
- 1999: JV with TCS: Aviation & Energy
- 2002: IP Operations at JFWTC
- 2004: BPO Operations sold
- **2010: India P&L formed**

GE imagination at work

4

April 2013

GE offer...Integrated Biomass solution



GE imagination at work

5

April 2013

Why GE product ?

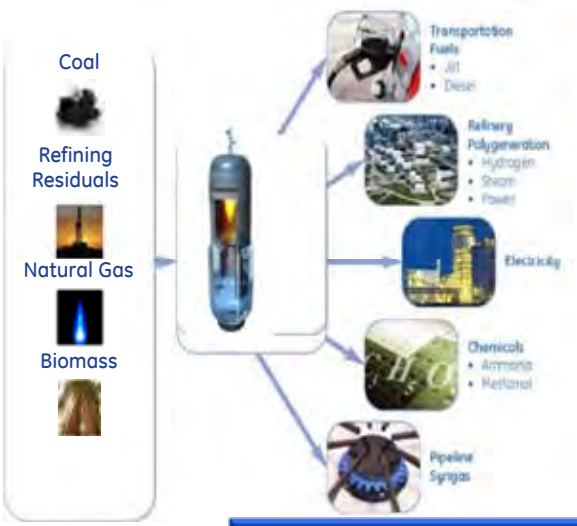
GE Advantage

- ✓ Market leader in Gasification + Gas Engine
- ✓ World Class Engineering
  - ✓ Better Engine Integration
  - ✓ System Optimization
  - ✓ Higher Availability
  - ✓ Safety & Automations
- ✓ Proven High Engine efficiency
  - ✓ Impact on ROI
- ✓ Wrap up guarantees
  - ✓ Single Point of Contact
- ✓ Integration expertise
  - ✓ Seamless Project Execution
- ✓ Strong Post Sale Service
  - ✓ CSA & O&M
- ✓ EPC Responsibility
  - ✓ Detailed Engg ...owner's Engg cost
  - ✓ No Interface /surprises during Commissioning
- ✓ GE Finance Option

6

April 2013

GE –Energy... Gasification: Cleaner Approach



Duke Energy
Edwardsport site construction, January 2009

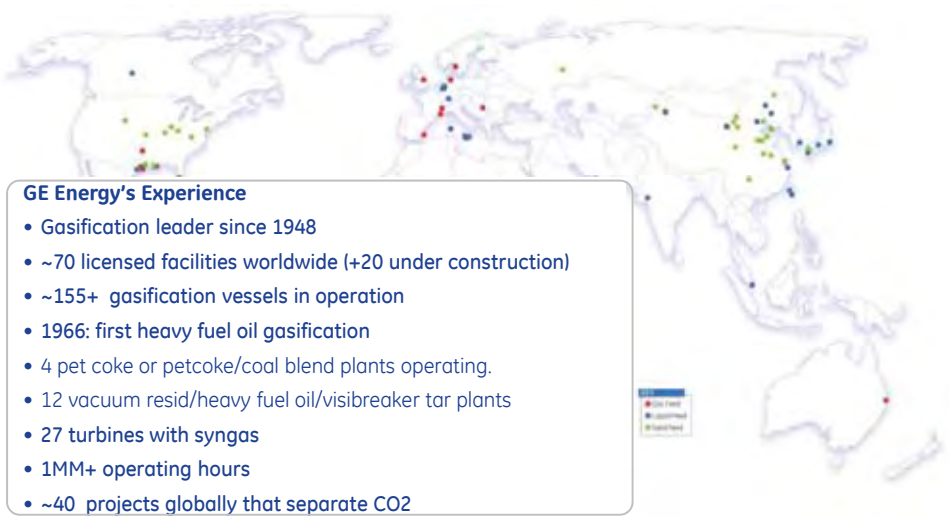
Duke Energy operating plant 2013

GE Brings Largest Gasification Knowledge to Biomass customers

7

April 2013

GE Power & Water: Gasification leadership



GE Energy's Experience

- Gasification leader since 1948
- ~70 licensed facilities worldwide (+20 under construction)
- ~155+ gasification vessels in operation
- 1966: first heavy fuel oil gasification
- 4 pet coke or petcoke/coal blend plants operating.
- 12 vacuum resid/heavy fuel oil/visibreaker tar plants
- 27 turbines with syngas
- 1MM+ operating hours
- ~40 projects globally that separate CO2

GE Brings in global Foot Print to support Customer in Global Locations

8

April 2013

GE's Gas Engines business

Employees: ~ 2,800 • Operating in 100+ countries*

Power Generation Jenbacher, Waukesha	Gas Compression Waukesha	Heat Recovery Clean Cycle™
		
• Electrical output: 120 – 9,500 kW • Electrical efficiency up to 48.7%, overall efficiency over 90% • 19,500+ engines delivered, 18,200 MW power globally • Natural gas and CHP, a leader in special gas applications (biogas, LFG, CMG, BFG), oilfield power	• Output: 160 bhp – 4,835 bhp (119 kW – 3,605 kW) • 12,000+ compression engines delivered, over 13.2 million bhp power globally (9,850 MW) • Wellhead, gathering, storage/ transmission	• 125 kW_e generator for waste heat-to-electricity • For engines, biomass boilers, other heat-wasting applications as low as 121°C (250°F) • No additional emissions in operation

* figures as of 31.12.2010

9

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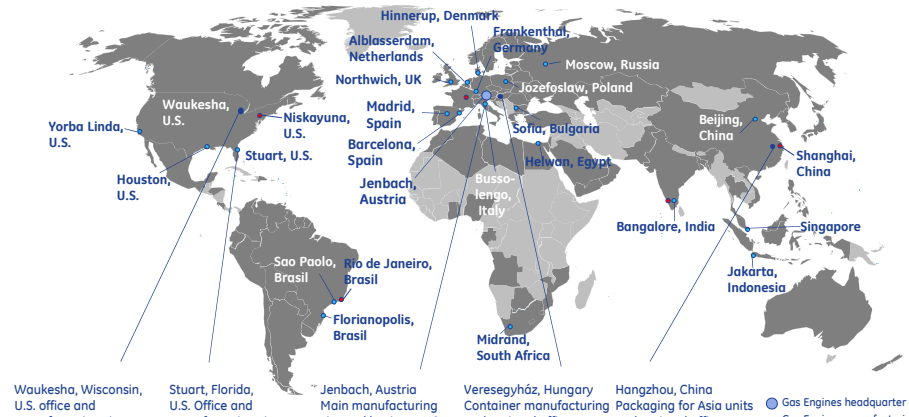
Everywhere in the world

Benefitting from the overall GE network, GE Energy's Gas Engines business interacts with more than 100 Independent Third Parties and can be found almost everywhere in the world



Waukesha, Wisconsin, U.S. office and manufacturing site

Stuart, Florida, U.S. Office and manufacturing site

Jenbach, Austria Main manufacturing site and business HQ

Veresegyház, Hungary Container manufacturing and regional office

Hangzhou, China Packaging for Asia units and regional office

- Gas Engines headquarter
- Gas Engines manufacturing facilities
- Gas Engines subsidiary/ GE office
- GE Global Research Center
- Countries with sales and service providers

GE imagination at work

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GE Jenbacher ...special gas Experience

- 150+ MWe installed
- 2+ Million oph experience with
  - Woodgas
    - 50+ units Sold/delivered to 10 Countries
    - 5 units AUT, 4 units CH, 15 units UK, 2 units Japan
  - Steelgas
  - Waste gasification
  - .....

GE imagination at work

GE JB is leader in Special gas Applications

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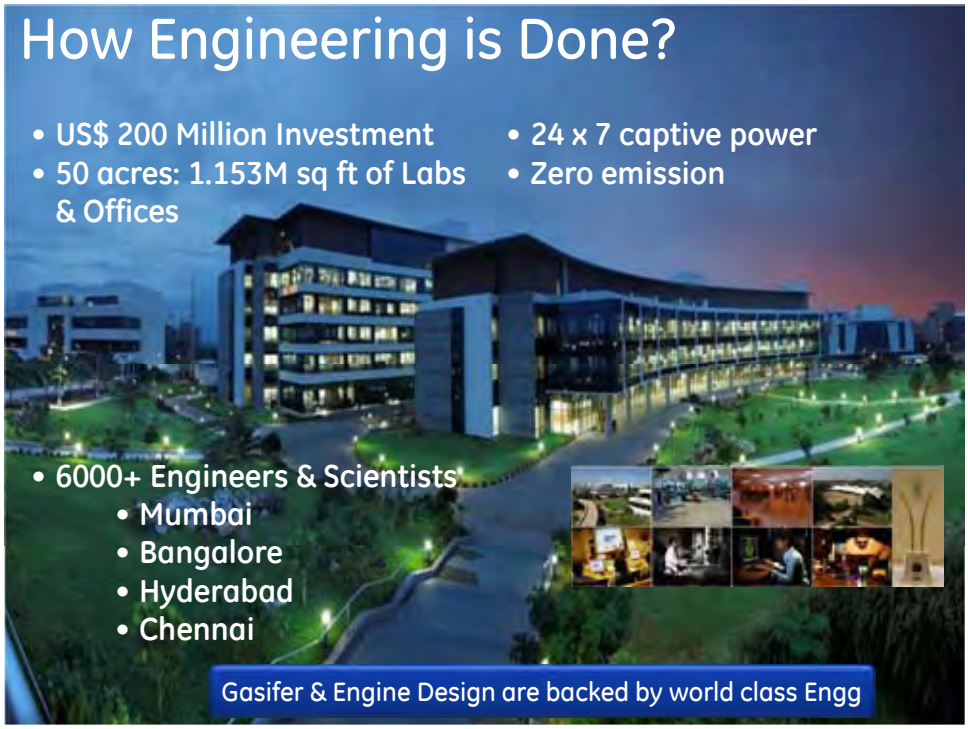
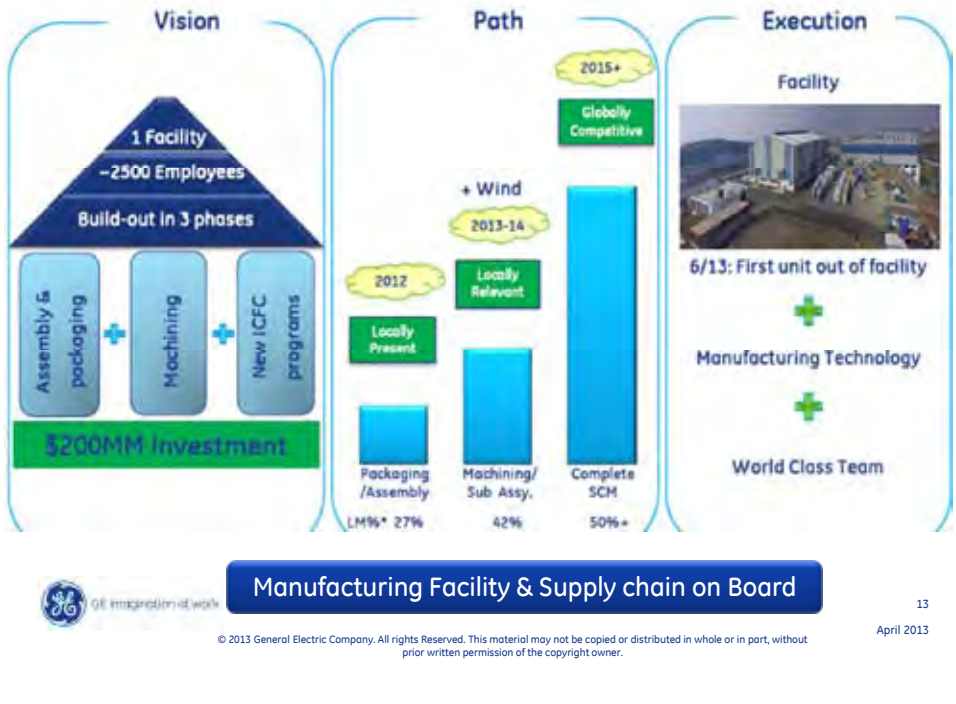
April 2013


How Engineering is Done?
• US$ 200 Million Investment
• 50 acres: 1.153M sq ft of Labs & Offices
• 24 x 7 captive power
• Zero emission
• 6000+ Engineers & Scientists
• Mumbai
• Bangalore
• Hyderabad
• Chennai
Gasifer & Engine Design are backed by world class Engg


GE India- Local Manufacturing
Vision
1 Facility
~2500 Employees
Build-out in 3 phases
Assembly & packaging
Machining
New ICFC programs
$200MM Investment
Path
2015+
Globally Competitive
+ Wind
2013-14
2012
Locally Relevant
Locally Present
Packaging /Assembly
Machining/ Sub Assy.
Complete SCM
LM%* 27%
42%
50%+
Execution
Facility
6/13: First unit out of facility
Manufacturing Technology
World Class Team
Manufacturing Facility & Supply chain on Board
13
April 2013
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Summary

- "One GE Solution" for various configuration based on rich experienced and proven technology
- High Engine efficiency, wrap up guarantees, Integration expertise & Strong Post Sale Service
- GE is committed to continuing Biomass Gasification technology development

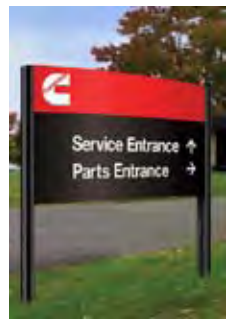
Presentation 13

Title of Presentation	Presenter	Brief details of the presentation	Category
Cummins Experience in India in the Development of Small-scale Biomass Power Generation Projects	**Shri Herat Trivedi** Sr. Manager - Business Development, Cummins India Ltd, Vadodara	The presentation briefed the experiences of Cummins in biomass power generation across India along with success stories of installations. It also explained the latest technologies existing in the market and a range of solutions provided by Cummins as project design and integrator, suppliers of gasifiers and O& M expertise for biomass power plants.	Technology

Bio-Mass based Power Generation

Herat Trivedi
Cummins India Ltd,
herat.trivedi@cummins.com
+91 9737299421



Worldwide Manufacturing Facilities

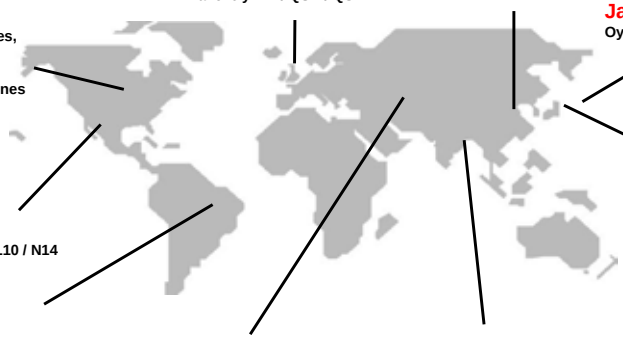
United States
Columbus – ISB
Seymour – K19 / V903 / QSK19 & QST30 (JV)
Jamestown – ISM / ISX
Rocky Mount – B / C series, ISB / ISC / ISL, QSB / QSC / QSL
Charleston – Marine Engines
Clovis – CNG

United Kingdom
Darlington – B / C series, ISB / ISC / ISL, QSB / QSC
Daventry – K / QSK / QSV

China
Chongqing – M / N / K (JV)
Xiangfan – B / C series (JV)
Beijing – 2.8/3.8L (JV)

Japan
Oyama – B / C series (JV)

South Korea
Chungbuk – A series



Mexico
San Luis Potosi – L10 / N14

Brazil
Sao Paulo – B / C series, N14, ISB / ISM

Turkey
Izmir – B / C series (Lic)

India
Pune – C / N / K19 / V28 / K38/50 / QSK60
Jamshedpur – B-series (JV)

190 Countries, 5000 Support locations, 35000 employees, US $ 17.3 Bn

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Gas Markets Served

Automotive

Westport

Industrial

Power Generation

Cummins Power Generation

Products	Range
Diesel Generator Sets	7.5 KVA to 3000 KVA
Natural Gas Generator Sets	50 KVA to 2500 KVA
Producer Gas Generator Sets	
Bio Gas Generator Sets	

- Microprocessor based controls
- Protective functions (Engine, alternators, battery)
- Warranty Support

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Cummins Power Generation

Products	Range
Diesel Generator Sets	7.5 KVA to 3000 KVA
Natural Gas Generator Sets	50 KVA to 2500 KVA
Producer Gas Generator Sets	25 , 70, 120, 240 KW 500 KW and above : to be released soon
Bio Gas Generator Sets	36 KW – 2000 KW

- Microprocessor based controls
- Protective functions (Engine, alternators, battery)
- Warranty Support

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Case Study – Tamil Nadu

- 7 X 240 kW 100% producer gas gensets
- Fuel : Coconut shells and other woody biomass
- Total 50000 + cumulative hours till date

Feedstock……..

Biomass Preparation……

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Biomass cutter for feedstock sizing……..

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Typical Feedstock…..

Feedstock drying

Feedstock charging in gasifier……..

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Power Plant shed

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Cooling System…….

Genset Bank

Genset Control Room

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Switch Gear Room

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Control Desk……

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Cummins as Solution Provider

Sultanpettai, Coimbatore

Installation	1.2MW (5 x 240 KW)
Fuel	Coconut Shell
Commissioned	Aug 2005

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Cummins as Solution Provider

Tamil Nadu

Installation	0.7 MW (3 x 240 KW)
Fuel	Woody Biomass
Commissioned	Aug 2010

Cummins as Solution Provider

Gadag, Karnataka : Under construction

Installation	1.7MW (5 x 240 KW + 1 x 500KW)
Fuel	Bamboo (Dedicated Plantation
Commissioning	Awaited

Cummins as Solution Provider

Cummins Cogen – Site Under Construction

Installation	1.0 MW (2 x 500 KW)
Fuel	Woody Biomass
Commissioning	Awaited

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Cummins as Solution Provider

Other Projects

- Over 15 installations of size 25KW & 70KW for REC application
- 6 Installation from 50KW to 500KW for Captive application

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Cogeneration

- JV : Cummins USA and Gentec UK
- Biomass + Cogen and Trigen
- 1 MW plant at Suttur, TN
- $ 100 Mn of Investments lined up

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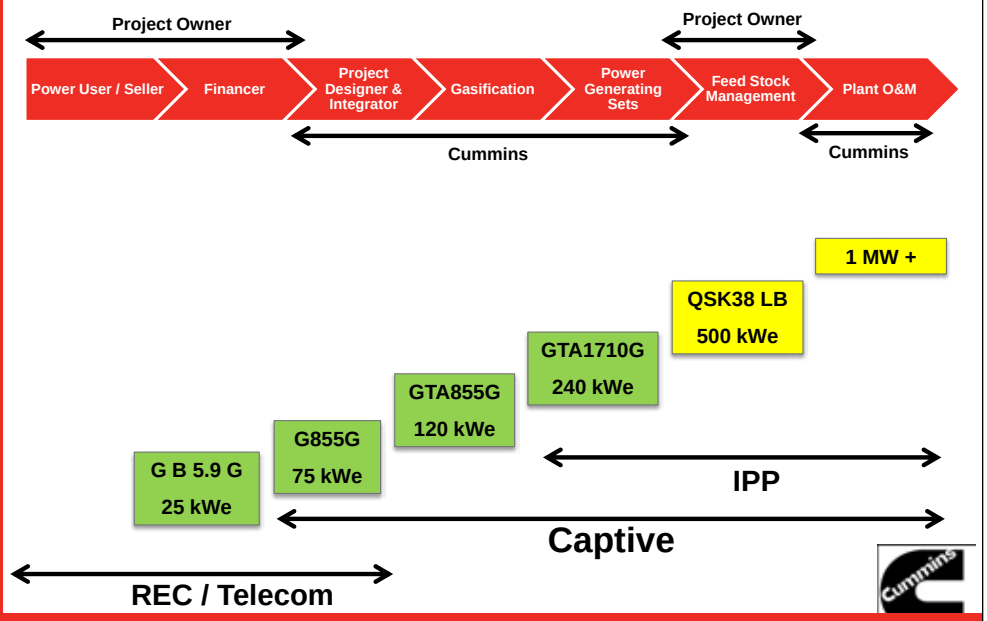
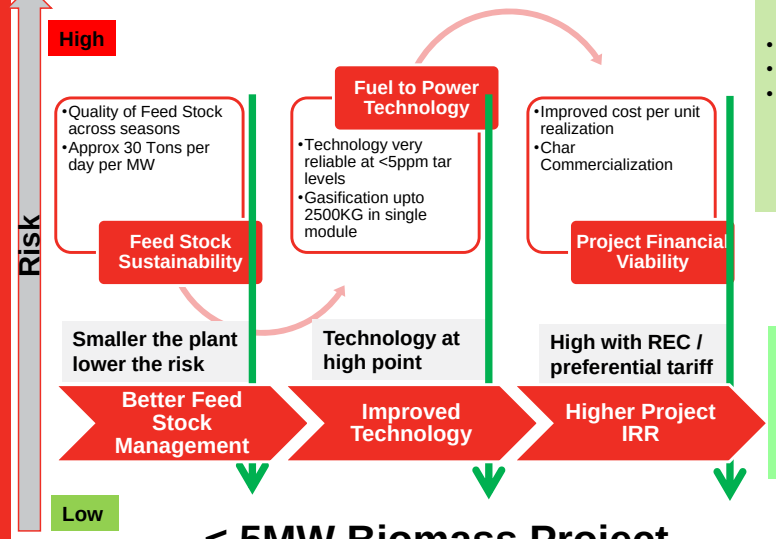
Cummins as Solution Provider



Continuous Output Power Cummins Confidential

Sustainability Challenges

Biomass Based Power Generation through Gasification



Other benefits like
- Fast turnaround time
- Modular scalability
- High efficiency
- Char commercialization etc adds up to gasification benefits

Right Time to look at Gasification for BioPower

< 5MW Biomass Project

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THANK YOU

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A two-day workshop on ***'Promoting adoption of biomass power technologies and identification of pipeline projects'*** – under the project 'Removal of barriers to Biomass Power Generation in India' supported by ***UNDP-GEF-MNRE*** – was organized by the consortium of Zenith Energy Services, Hyderabad; RSA Low Carbon Services; and CREWA, New Delhi at Vadodara during 3–4 April 2013. The main objectives of the workshop were to promote small-size (1 to 5 MW) biomass power and cogeneration projects (Rankine Cycle or Otto Cycle) and to identify interested entrepreneurs who wish to set up biomass-based power projects. The entrepreneurs would get technical and financial assistance for implementation of their biomass projects under the UNDP-GEF-MNRE project.

A half-day field visit to a 1.2 MW biomass gasification-based power plant at Sankheda near Vadodara was organized through the workshop to demonstrate the working of a biomass power plant to the participants. The workshop was well attended by experts from the biomass field, promoters, eminent institutions, consultants, and biomass technology suppliers. As an outcome of the workshop, four entrepreneurs submitted their expressions of interest (EOIs) to participate in the project.

During the workshop, the biomass experts focused on success stories of existing biomass power plants. They brought to light various regulatory and statutory developments, current issues, its associated risks and mitigation measures. The technical sessions showcased existing technologies, their financial aspects, and related management and logistics of biomass power plants. The proceedings document carries the discussions held during the workshop, including presentations, and the queries and feedback received from the participants.

Empowered lives.
Resilient nations.

United Nations Development Programme
Energy and Environment Unit
55, Lodhi Estate, Lodhi Road, New Delhi – 110 003