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**A Rural
Energization
Project**

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**Enhancing Fuel
Efficiency of Stoves
in road side hotels /
dhabas of Andhra
Pradesh**

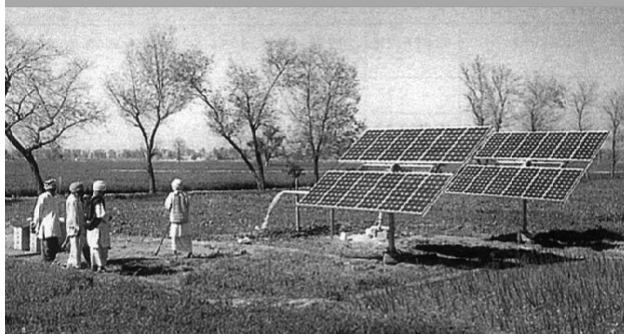
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MESSAGE FROM THE EDITOR



Renewable Energy technologies (RET) are amenable to adoption at different scales viz. a few hundred Megawatts to a few kilowatts and can be matched with end use requirements enabling their decentralized deployment. They can help promote sustainable development through increased opportunities for local employment, particularly the rural people and environmental improvement through reduced GHG emissions.

Primary biomass combustion has been the main source of energy for India. According to the Integrated Energy Policy Report (2006), about 80 mtoe is currently used in the rural households. The Ministry of New and Renewable energy has estimated state-wise gross and net availability of agro residue for power generation through Biomass Resource Atlas. Projects based on both biomass combustion and biomass gasification technologies are promoted by the Ministry. Biomass based renewable energy has the potential to be at the forefront in India with the large amount of varied kinds of feedstock available, especially agricultural residues. Such projects will be sustainable with a viable business model. The lessons learnt from DESI Power project has been included in this issue.

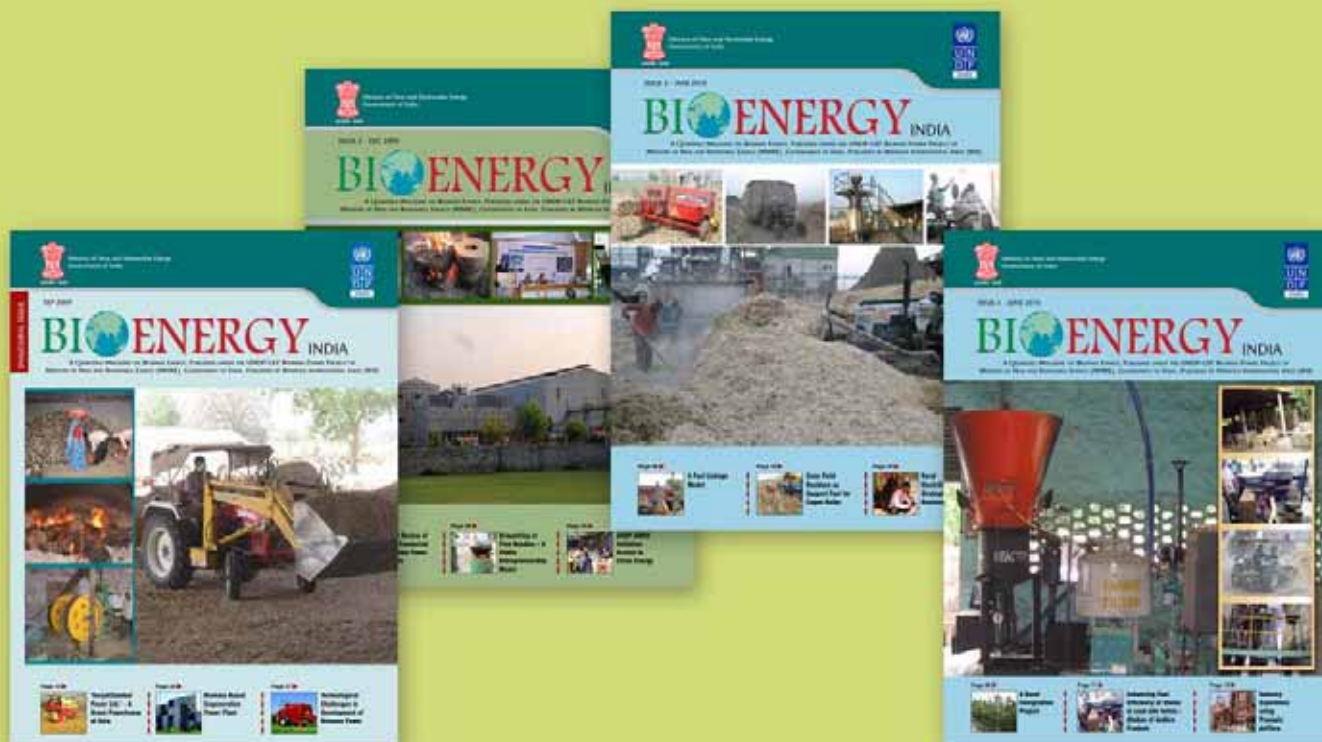
The recently launched Renewable Global Status Report 2009 is also featured here, which offers an optimistic picture about the global renewable energy industry, including the biomass sector and especially covers India's Remote Village Electrification program that has been successful and continues to progress steadily. A brief of the Chinese Renewable Energy Policy, including the Biomass Energy Policy is contained in this Issue. A prospective on the future of biomass energy in India, analyzing the barriers and way forward has been presented. Besides agricultural residues, biomass power projects can be made sustainable by linking them with different types of biomass plantation. Details of such a project to use *Prosopis juliflora* are given in an article.

Fuel efficient wood burning stoves have tremendous potential for saving fuel and simultaneously to improve the cooking environment. Results of such a project undertaken in Hotels and Dhabas are available in this Issue along with the outcome of a Workshop conducted recently on improved cook stoves. The use of biogas technology as a sustainable energy option using non-edible oil seeds for producing bio-fuel and biogas has been presented in an article with details of the operational structure involving village cluster approach.

I hope you enjoy reading this issue and as always we look forward to your feedback and comments. So do keep sending them in. Your valuable responses and suggestions will help us in ensuring that the magazine continues to meet your expectations, while reflecting the progress and changing scenario of bio-energy in India and in other countries across the world.

(K.P. Sukumaran)

*National Project Manager
(UNDP Project on Access to Clean Energy), and
Former Adviser, MNRE*



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DESI Power – An Evolutionary Perspective of Rural Energization Project

Conception of the idea

Dr. Shyam Sharan, who is now the Chairman of DESI Power (Decentralised Energy Systems India Private Ltd), is considered among the pioneers for bringing in renewable energy to forefront in India. Switching career path as founding director of NTPC which is “fossil fuel” based nation’s largest power generating entity to non conventional energy arena led to the creation of DESI Power. DESI Power’s first experiment in this realm started with Development Alternatives, a not-for-profit based in Delhi. First biomass based power plant came up in Orchha district of Madhya Pradesh in 1999 and was based on *Ipomoea* (besharam) as 100% feedstock.

DESI Power’s key strength is on feedstock and load management. Subsequent sections of the case-study will bring these aspects into fore.

Business model

DESI Power, essentially aims at supplying electricity and energy services to two distinct decentralized electricity markets:

- Independent Rural Power Producers (IRPPs) for villages and semi-urban areas
- Captive power plants for small-scale industries which depend upon diesel generators because of unreliable grid supply.

IRPP: Desi Power’s business model in villages is based on providing electricity and energy services jointly with

local partners who establish local small-scale industries, businesses and agro-forestry for value addition and job creation. For ensuring that the enterprises become self-reliant and profitable within a reasonable time, the “Business Plans” of the Independent Rural Power Producer (IRPP) and the village organization (which may be the village

DESI Power office in Araria, Bihar



*“Besharam ka bhagya bahute badhiya aache,
ab tractor ape chadte”*

(Luck of “besharam” plant is at best, see it will now ride a tractor) came a comment from a old man walking past the field where workers were cutting the Besharam (*Ipomoea fistulosa*) plant as feedstock for the gasifier. Recalling this fondly, “Bhulluji”, Dr Sharan’s younger brother shared the story of how DESI Power got started and its journey till now.



Panchayat, a company, a co-operative, or an NGO) are evolved jointly and simultaneously. For commercial success, the power plant has to sell as much electricity as it can generate and the villagers have to produce and sell their products profitably. The IRPP provides the reliable and affordable supply of electricity and energy services based on locally available renewable energy resources such as agricultural residues and other biomass. The local partner organization, on its part, enables the supply of the biomass and the purchase of adequate amounts of electricity at mutually agreed prices.

For industries: While the technology and the management of the engineering, procurement and construction (EPC) activities are practically the same for the two business sectors, the business model for each of them is tailor made to the specific conditions of the load and financing in each market segment. The current grid electricity price has also gone up considerably due to the removal of subsidies from industrial and commercial power and DESI Power’s supplies are therefore

Secretary, Ministry of New & Renewable Energy visits DESI Power, Bihar

Mr Deepak Gupta, Secretary, Ministry of New & Renewable Energy, Government of India visited Araria and Purnia district in Bihar on June 3-4, 2010 to review four project sites where biomass gasifier based electrification projects have been initiated by Decentralized Energy System India Power (Kosi) Pvt. Ltd. (DESI Power). DESI Power had initiated activities to create local sustainable markets for decentralized electricity supply linked to job creation and development of village industries in rural Bihar. The gasifier systems for electrification have been operating for last two years on a viable business model. Under the project, electricity is provided for 6-8 hours daily for domestic lighting in the night and for 6-8 hours for other commercial applications including water pumping for irrigation purposes and to microenterprises and telecom towers.



Gasifier system installed at Gasifier in Baharbari Village, Dist Araria, Bihar



Electricity used for irrigation



Mr Deepak Gupta, Secretary, MNRE with officials during the visit



Paddy processing business

During his visit, the Secretary also had discussions with villagers; microenterprises, energy service companies, consultants, manufacturers etc associated in promotion of biomass gasifier based distributed electricity projects for rural areas. DESI Power has planned to develop such systems in about 100 villages in next 1-2 years.

The Secretary also visited a rice mill at Kashba village in Purnia district, Bihar where a biomass gasifier system is being operated successfully for meeting entire electricity and thermal needs of the rice mill since last two years. He had discussions with other rice mill owners also who are planning to install such systems.

Representatives from West Bengal Renewable Energy Development Agency, Kolkatta, UP NEDA and Bihar Renewable Energy Development Agency, Patna, gasifier manufacturers, and consultants were also present.

competitive with grid supply in many states. In an industrial plant, where an existing diesel set is being used with a newly installed retrofitted gasification plant, the pay back periods in typical cases can be as low as 2 to 3 years.

Feedstock supply-chain management: DESI Power principally does not promote biomass based power plants unless a sustainable source of supply is available from agricultural or plantation residues and/or energy plantations and/or agro-forestry. Feedstock management in three power plants of Araria, Bihar has evolved on this philosophy. DESI Power started its operation with *Ipomoea* and hardwood in “Baharbari” village in the year 2001. This was the second plant in India using *Ipomoea* as feedstock. Characteristics of *Ipomoea* are presented in Table 1.

Table 1: *Ipomoea* characteristics

Parameters	Value
Calorific value	3,800 kcal per kg
Bulk density	160 kg per cubic metre
Yield per hectare	160 tonnes of green biomass which is equivalent to 64 tons of useful feedstock for gasifier
Alternate use	It gives foul odour on direct combustion, so not used as cooking fuel
Availability	It's a weed naturally found near nullahs and moist areas
Feedstock consumption	With a full load, the gasifier consumes about 70 kg per hour of feed stock (for a 100 kW plant)
Fuel cost	Average ₹2 per kWh at PLF 80% (Ranges between ₹1.5-3.5)

Within a year, DESI Power diversified the biomass base to maize residue after a mutual agreement with farmers over price. However, the management realized that it still needs to add a substitute biomass to fulfill the increasing demand of electricity by the people. Araria used to be a major jute producing belt, however over a period of time with low cost poly-bags coming in market, jute-bag demand dwindled and farmers reduced the cultivation of jute. The apparent losing base of jute was the opportunity at hand. Locally people in Araria used to grow “Dhaincha” (*Sesbania bispinosa*) which is a leguminous plant and can be easily grown without much investment. This was essentially used as a material for

backyard contour wall by the villagers. Through Combustion, Gasification & Propulsion Laboratory (CGPL) in Indian Institute of Science (IISc) Bangalore, DESI power tested the potential of Dhaincha as a biomass fuel and it was found that Dhaincha, not only had good calorific value but was also found to be a nitrogen fixing plant with a small production cycle (four months). Thus cultivation of Dhaincha as an energy crop emerged as a win-win situation for both farmers and DESI Power.

The current feedstock calendar in all three plants of Araria is presented in Table 2.

Table 2: Feedstock calendar

Months	Feedstock
January-May	Dhaincha/ <i>Ipomoea</i> (along with hardwood)
June-August	Maize residue (along with hardwood)
September-December	Only hardwood

DESI Power is now promoting the concept of captive forestry exclusively for biomass plant feed. They are about to start cultivation of fast growing bamboos as a third substitute for biomass.



One of the feedstocks used in the plant

Load management

DESI Power as a part of its strategy has focused on productive load applications instead of lighting load. Productive loads are more predictable, of higher intensity and makes collection of revenue easier. Along with this, the strategy has given the organization an upper hand in terms of managing the feedstock, operation of engines and supply of power.

A summary sheet of DESI Power project's in Araria is presented in Table 3 (next page).

Strategy of evolution and expansion

This section briefly describes the evolution and expansion strategy of DESI Power using Baharbari village as base. Baharbari, which is ancestral village of Dr Sharan, the founder of DESI Power, was the first project area of DESI Power in Araria. The village has about 250 households. As shared in the business model section, DESI Power before initiating the power plant project in any area develops a partnership with a local institution. In Baharbari, no local NGO was working therefore DESI Power facilitated the formation of a co-operative “BOVS” which now has 19 members. The co-operative owns water pumps, chura mill and paddy mill.

The power plant was commissioned after a basic survey and the power requirement from co-operative was taken as the base load. Gradually, demand for the power picked up and in the year 2004, household connections on fixed monthly rental (current rental ₹150/month/100 W) were

given. Simultaneously, in order to give boost to the local economy and thereby substantiate the effective load demand, the co-operative was facilitated to open a fertilizer shop on an unused land. The strategy worked out and as a result in the vicinity of the fertilizer shop there are now 35 shops, all deriving power from the project.

Thus, DESI Power didn't limit itself to existing load, but created suitable conditions for evolving other small enterprises which became prospective users of the power.

Cost economics

Much in sync with most of the Indian villages, in Baharbari also, diesel generators were often the only source of power but experience and cost calculations of Dual Fuel system (Figure 1) installed in Baharbari reveals that power from biomass gasifier based plants are considerably cheaper. Even for dual fuel operation where

Table 3: Summary profile of DESI Power in Araria

Place	Year of Installation	Installed Capacity & Equipment make	Connected Load	Power Supply Duration	Feedstock	Number of Staff	End User profile
Baharbari village	2001	61 kW (50 kW at the installation time)	60 kW	5 PM to 10 PM	Hardwood, husk, Maize residue, Dhencha	3	Water pumps, Chura mill, Battery charging, Paddy mill, Welding, Evening lighting for the households
Vebra village	2007	61 kW (11kW at the installation time) (DF- 50 kW installed later)	60 kW	1 PM to 9 PM	Hardwood, husk, Maize residue, Dhaincha	3	Rice mill, Aata chakki, chuda mill and water pumps
Gaiyari village/ Zero Mile	November 2008	250kW (2PG-75 kW, 2DF-50 kW) Engine from Cummins, Gasifier	125 kW	10 AM to 5 PM	Average feedstock consumption 800 kgs/day. Hardwood (70%), Dhencha (15%), Maize/ Ipomoea (15%)	5	15 micro enterprises

CASE STUDY

From Home to Market...

Village Baharbari would have been 25 kms from the market, if Desi Power had not started a revolution in the form of regular power supply there. It is a classic example to see how one intervention leads to another and thus, to the holistic development of the village. It has been a decade since the biomass gasifier plant was set up in this village in 1999. It was earlier used only to cater productive load, after which in 2004, the evening lighting supply to the village was started between 5 to 10 pm. In the same year, Dr. Sharan, the founder of Desi Power thought of setting up a shop at the central location in the village where the electricity can be supplied through the biomass plant. This shop was addressing the fertilizer and manure needs of the farmers there.



Later in the same year, this place developed into the hub of the village with over 25 shops within a stretch of 500 metres. The shops now range from normal grocery to computer repairing and provide all the items of daily requirement to the village people. This has also provided livelihood opportunities to many unemployed youths in the village who otherwise would have to run till the nearby town of Araria to earn a living. One of the shopkeepers, Taranand Yadav, who had a grocery shop in the area, mentioned that the shop acts as a very good medium for him to earn and support his family. People from the village are of the opinion that the evening lighting and the setting up of a proper market place has transformed the lifestyle of the village.

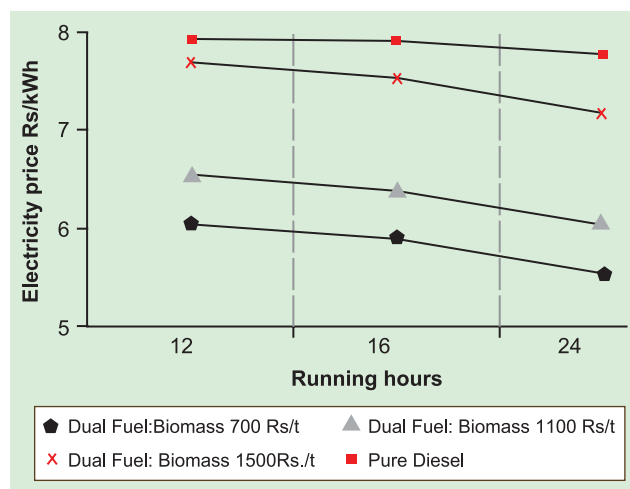


Figure 1: Dual fuel operation: Generation cost vs running hours

20 percent diesel is used, the generation costs are lower, especially with high running hours and loads.

Since plants of DESI Power are standardized, and the financing and O&M costs vary only marginally from site to site, the financial performance of each plant depends essentially on the biomass cost and the plant load factor (PLF). Experience of three projects in Araria shows that the industry linked DESI Power plants are providing a commercially acceptable ROI and IRR over a 10 or 15 year financial evaluation period, with a short stabilization period. The profitability of retrofitting gasifier to existing IC engines is even better. The IRPP's located in villages will need a longer period than the industry linked power plants to become profitable, depending upon the built-up of the local electric loads and energy services.

Conclusion

DESI Power has been instrumental in creating a change in socio-economic development of the project area. About 70 percent of the total revenue of operations gets pumped back to the village in the form of payment for feedstock and salary to the local staff. Indirect benefits entail higher farm productivity due to low cost of irrigation and sustained profits in the local enterprises because of assured power supply. Summarily, with the evidence of three current projects, Empower project appears promising for bringing a positive impact in the chosen 100 villages. However, as against envisaged in the 100 Village Empower Partnership Project, achievement rate is much slower and is a cause of concern.

Courtesy: WII Editorial team with support from DESI Power

Enhancing Fuel Efficiency of Stoves in Road Side Hotels/dhabas of Andhra Pradesh

Background

There is an estimate of 4,000 small road-side hotels operating in rural and semi-urban areas of Andhra Pradesh in India, which consume approximately 0.1 million tonnes of fire wood annually. A typical small hotel consumes around 100 to 150 kg of firewood every day. Majority of these hotels have installed traditional, highly polluting, and inefficient stoves for cooking of various food items and operate continuously for 8 to 10 hours a day. These stoves are characterized by very low thermal efficiency which is below 10 percent in most cases. Inefficient and excessive usage of firewood results in emission of toxic gases like carbon monoxide and damages the indoor air quality adversely which affects the health of the workers. Sample studies conducted by Winrock International India (WII) indicated a dangerously high level of more than 4,200 g/m³ of carbon monoxide concentration in the ambient near the cooking area. The surveys conducted by WII in some selected small hotels in Andhra Pradesh revealed that there is a tremendous potential for enhancing the productivity by replacing existing inefficient stoves.

Hence, WII took up a project funded by Waterloo Foundation, United Kingdom to replace 100 in-efficient stoves with fuel efficient and smoke-free improved stoves in small hotels / dhabas in Andhra Pradesh. The project activities were started in June 2009 and completed in May 2010. The article discusses the activities and the impact of the project in the region.

Project activities

Baseline development and awareness creation

The study on existing stoves has been conducted by an extensive survey of dhabas and hotels in ten districts of Andhra Pradesh. The baseline has been developed using the data collected such as average fuel consumption, indoor air quality, duration of cooking, thus calculating the efficiency of the stove. The analysis showed that the average fuel consumption is in the range of 150 to 200 kg per day; the daily operational hours of the hotels are 8 to 10 hours; efficiency is in the range of 8 to 9%; and the expenditure on account of fuel consumption is about

₹300 to 400 per day. After baseline development, awareness was created among stakeholders through distributing one page flyer highlighting the benefits of the stove, organizing exposure visits to implemented project locations, and display of banners in all important locations of the town.



Cooking on traditional stove



One of the awareness banner in display in local market

Capacity building and training

Suitable designs of stoves have been developed based on the user's requirement without changing the basic designs of the stove. Masons and fabricators were identified and provided training in constructing and fabricating the stove components. There were 80 masons and 12 fabricators trained during the project tenure.



Masons and fabricators during the training program

Construction and performance monitoring

One hundred stoves were installed in various locations of Andhra Pradesh in dhabas, hotels, sweet shops, and hostels. Figure 4 shows the distribution of fuel efficient (FE) stoves in various districts.

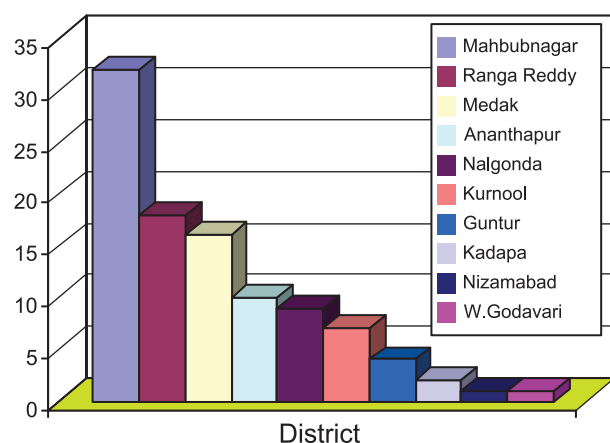


Figure 4: Distribution of FE stoves in Andhra Pradesh

After completing the construction of stoves, performance evaluation was conducted after 8-10 days of commissioning. Water boiling test was conducted to check the efficiency of the stove. The efficiencies of the improved stoves ranged from 20 to 22 percent as compared to 7.5 to 8 percent in case of the conventional

The fuel efficient stoves that WII installed have been able to conserve about 50 to 60 percent of fuel (fire wood) as compared to traditional stoves. Each stove is able to save about 75 to 100 kilograms of wood per day which works out to a cumulative saving of about 3,600 tons of wood per year for hundred stoves

stoves. Hence, saving in fuel consumption calculated is more than 50% as compared to traditional stoves being used earlier.

Impacts of the project

After implementation of hundred stoves, the project team conducted an impact assessment study on the stoves using participatory tools. The results of the study is summarized below:

Economic impacts

As expected, the fuel efficient stoves that WII installed have been able to conserve about 50 to 60 percent of fuel (fire wood) as compared to traditional stoves. Each stove is able to save about 75 to 100 kilograms of wood per day which works out to a cumulative saving of about 3,600 tons of wood per year for hundred stoves. This translates into a saving of ₹72,000 for each dhaba on fuel costs and ₹72 million per annum on a cumulative basis for all the hundred stoves put together. The figures are a result of interviews conducted with the dhaba owners after one month of commissioning of improved stove. The owners felt happy with the performance of the stoves in terms of savings in wood and smokeless kitchen. One of the hotel owners expressed that as the kitchen is free from smoke and there is a reduction in fuel usage, it has increased the productivity to a large extent.

Environmental impacts

The improved stoves resulted in substantial improvement in Indoor Air Quality (IAQ) by driving out all the toxic emissions through the chimney thus minimizing heat radiation from the stove body. The carbon monoxide (CO) level inside the kitchen has been reduced from 4,260 g/m³ (before implementation) to 480 g/m³ (after

implementation), which is quite a substantial improvement. Also, the temperatures inside the kitchen came down nearly by 8 °C after the implementation. The use of fuel efficient stoves have also resulted in saving of 3,600 tons of fuel wood per annum which is equivalent to reduction of 3,402 tons of carbon-di-oxide (CO₂) emissions in turn having a positive impact on deforestation and environment.

Social impacts

The improvement in IAQ due to the use of fuel efficient stove translates into many health benefits as well. Improvement in IAQ has effectively improve the health of the workers and people who eat inside the hotel reducing their medical expenditure, thus improving their overall economics. There are about 80 masons and 12 fabricators who were trained in construction and fabrication of the metal components respectively, who also benefited through additional income and are expected to work for the replication of this project in other potential areas of the state.

Way forward

The enthusiastic response from the hotel / dhaba owners in eight districts during project implementation has reinforced our belief that the potential in the state for the installation of fuel efficient stoves is enormous. It is now an established fact that the beneficial effects of an improved stove are multidimensional and this stove has the potential to impact the economics, health and environment at large in a very positive way. The estimated potential is to save about 0.1 million tonnes of firewood per annum and generate livelihood to masons and



Dhaba kitchen before and after replacement of FE stove

fabricators by replacing 4,000 traditional stoves into improved fuel efficient smoke free stoves. WII would continue to disseminate the positive impacts of this project through their outreach efforts like advertisements in print and visual media, distribution of product brochures / flyers, and awareness creation in grassroot level NGOs through a state level workshop.

Courtesy: Sobhanbabu PRK, Program Manager and CK Kumarswamy, Program Officer Winrock International India, Hyderabad, AP Email: sobhan@winrockindia.org

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Workshop on New Initiative for Development and Deployment of Improved Cook Stoves: Recommended Action Plan

A large percentage of world's population continues to depend on biomass for their cooking needs. The cooking devices used by majority of them have very poor thermal efficiency and serious health impacts due to incomplete combustion. While past few decades have seen a lot of interest in development of better cook stoves for burning biomass, the magnitude of the problem is still a major cause of concern. To initiate the process of formulating a new programme, a brainstorming session was held by the Government of India in March 2009 involving various experts, from both within India and abroad. Subsequently, Ministry of New and Renewable Energy (MNRE), Government of India, launched a new initiative for Development and Deployment of Improved Biomass Cookstoves. It has supported a programme implemented by Indian Institute of Technology (IIT), Delhi and The Energy and Resources Institute (TERI) who worked on details of the above components. A national workshop was held at IIT Delhi on May 19, 2010 to present the recommendations of the team. The event got a huge participation by the various concerned sectors like government agencies, private organizations, industry, academic, and social sector among others.

The recommendations have been prepared for five different aspects of cookstoves which the new initiative should address and these are:

- Technical aspects including R&D and various issues related to testing and standards
- Delivery of improved cookstoves
- Fuel processing and supply
- An innovation contest for next generation of cookstoves
- Community stoves.

Moreover, to address the need for a different structure of the new programme vis-à-vis National Program on Improved Cookstoves (NPIC), the project team has also made recommendations for management and implementation strategies for the new initiative.

The expert team suggested that any cookstoves initiative would need to address the technical needs of the program

which can be categorized under two broad categories: (a) Research and development (R&D) covering fundamental as well as applied research and development of new products (b) Testing and Standards – addressing the issues related to testing protocols, setting up of testing facilities and development of standards for certification. It also suggested that a more rigorous, research oriented approach be adopted to develop protocols which are more suited to the new designs and give greater importance to emissions measurements. The team also recommended that this work could be taken up as a coordinated project by a group of institutes with technical expertise as well as field experience in testing and the process for awarding such project should be initiated immediately after the interim protocols are in place. Among many other things, the team also advised a strong need for developing standards to enable certification and is preferable to have a star-rating for various stoves considering the thermal efficiency as well as emissions.

In order to do research on the fundamental scientific principles underlying the design and operation of cookstoves, the group recommended that coordinated projects involving research groups across the country should be funded and some of these groups could graduate into R&D centres for stoves on the basis of their commitment. In the first phase, Expression of Interests (EOIs) followed by open Requests for Proposals (RFPs) can be invited to form consortia to work on different fundamental aspects as identified by the committee. For supporting stove developers in conducting fundamental analysis of the new designs, technical support centres possibly linked to any of the R&D centres could be facilitated to operate in commercial consultancy mode.

It was suggested that the cookstoves program should have a dual thrust, on technological improvement in stoves as well as establishment of an assured fuel supply chain. The latter is critical to large-scale dissemination of end-user devices with rural household applications. The field

contd on pg 30

Industry Experience using *Prosopis juliflora*

Depletion of fossil fuels is catching up very fast and the need of the hour today is to use renewable sources of energy for power generation. The rapidity at which the climate is changing, it has also become a Government priority to promote various renewable sources of energy. The power policy and the five year plan has set aside a target of 10% of the total generation from renewable energy, which at present is quite lesser than the same and thus requires a massive thrust.

There are different renewable energy sources for generating power like solar, wind, hydro and biomass, all operating under the policy guidelines of Ministry of New and Renewable energy, Government of India. Apart from attractive policies under renewable energy generation, all renewable energy projects are covered under the International Kyoto Protocol and qualify for earning Clean Development Mechanism (CDM) benefits in foreign exchange, which is a matter of pride in the eyes of international community. It is a recognition for reducing carbon into the atmosphere.

Transtech Green Power (P) Ltd. has been formed for implementing green energy power projects. The promoters are already running successful infrastructure projects of telecom, IT and fertilizer manufacturing with a PSU. The vision of this company is to promote the usage of renewable energy in the country in the next 3 to 5 years time.

Transtech operation and experience

Biomass sector

Transtech Green Power (P) Ltd. is an independent company and is presently executing a 12 MW biomass based power project in Sanchore, district Jalore, Rajasthan. The plant is under commissioning with commercial production slated to start in July 2010. It is also planned to expand the capacity by another 5 MW at this site. Transtech has built in-house experienced technical team to take care of all power plant operations.

The total cost for this project is ₹67.2 crores and the power policy ensures 16 percent ROI to the power developer. The estimated energy generation for the project is $12 \times 1000 \times 24 \times 300$ days = 8.64 crore unit per annum, out of which 10% is auxiliary and balance is all

exportable to grid. The project is planned with an integrated approach where cultivation of energy plantation of *Prosopis juliflora* is integral part of company's operation. It is planned to plant almost 5,000 hectares of *Prosopis juliflora* in 2010 for the captive use, which will give the plant wood after 24 to 28 months with an average 15 to 20 tons per hectare every year. The state biomass policy of Rajasthan is very proactive and supportive to power developers, which allows development of energy plantations on barren government land. The organization has already raised 20 lac saplings, which would be planted in 2010 during monsoon season.

Additionally, in order to maintain smooth fuel linkages, setting up of regional collection centers is must, which would have collection, briquetting, chipping and compacting facility, so that volume of the produce can be reduced and transportation cost of material, which is a major cost component of fuel can be controlled.

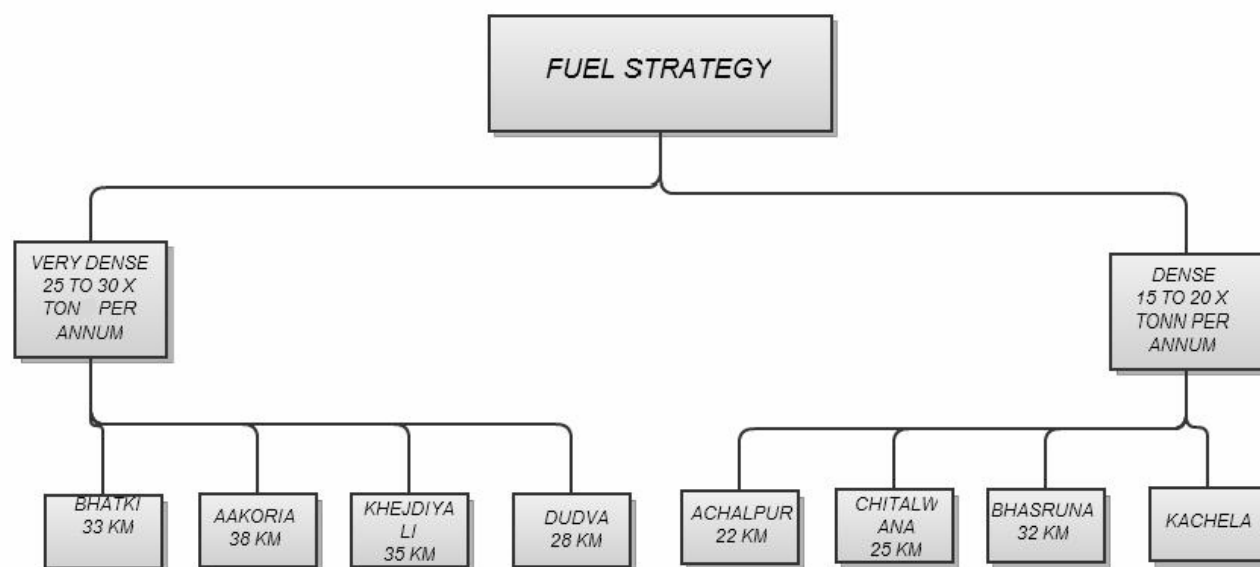
Biomass availability

The primary biomass selected for the plant is *Prosopis juliflora*. This area has abundance of *Prosopis juliflora* because of the extensive plantation done to stop desertification, as it is a very hardy plant that grows very fast even in very less water and is ready for harvest in 2-3 years. The harvested plant grows back to its original size in 16 to 18 months and has a caloric value close to 3,600 to 4,000 kcal/kg making it the most suitable biomass fuel.

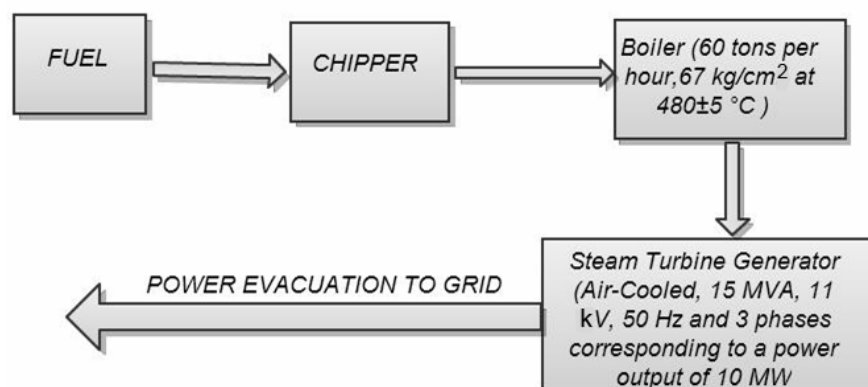
The total biomass requirement for a 12 MW plant on 100% PLF is 360 tons per day. This assessment is based on the burning caloric value of 3,000 kcal. However, from a single farm in Bhavatra (Sanchor) itself, one is able to get required biomass for 12 MW power plant and top of it, the supplementary fuel such as mustard husk and jeera husk is also available in large quantities.

Technology

The major equipments in the power plant are the boiler, the steam turbine generator and the air cooled condensing system. In addition to these, the plant is also having necessary auxiliary systems such as fuel storage and handling system, ash handling system, recirculating



Main fuel stations from Kachela (Power Plant)



Flow chart of the functioning of the plant

water system, compressed air system, electrical system and other utilities required for the plant.

Boiler: The boiler used is of Traveling Grate type with capacity to produce 60 tons per hour of steam at a pressure of 67 kg/cm² at 480±5 °C

Steam turbine generator: The generator used is rated for 15 MVA, 11 kV, 50 Hz and 3 phases corresponding to a power output of 10 MW. The generator is of air cooled design with brushless type excitation system.

Air cooled condensing system: Fin tube bundles are used as heat exchanger, each bundle of two sections, primary and secondary. The steam condenses mainly in the primary section and the balance in the secondary section. The non-condensable steam is extracted from

the secondary section through air extraction line. The steam manifold is located at the top of the air cooled condenser and is welded to the bundles. Exhaust steam is distributed through steam distribution ducts to tube bundles.

Power evacuation: Power generated from the plant will be evacuated to the RRVPN grid at the nearest 220/33 kV substation at 33 kV level in Sanchor tehsil. For this, the company has signed a Power Purchase Agreement (PPA).

A 20 year PPA is signed, under which one can get the tariff in RERC tariff order on biomass, which is available on their website. The registration for CDM is under process. The target is to get around 50,000 Certified Emission Reductions (CER's) per annum from 12 MW generated.

Biomass power operation and rural development

A biomass power plant operation has the most positive effect to rural development and creation of additional employment in the rural sector. A successful operating biomass power plant would take the adjoining rural economy upward. Additionally, it generates green power, which is also a necessity in our country. Majority of Transtech's focus, schemes and support is to make rural India stronger and create employment opportunities in it, which are in a way by-products of

a biomass power plant operation. Hence, amongst all the sources of renewable energies, top priority, support and cooperation is required in this segment of renewable energy.

Environmental impact

The operation of power plant produces emissions, waste water and solid wastes such as boiler ash. The release of pollutants, if unchecked, can lead to negative impact on environment. Hence, it is planned to minimize the impact of the plant.

Snapshot of Transtech's plant site at Sanchore (Rajasthan)



2 lacs planting material already raised for planting.

Transtech's 12 MW Power plant at Sanchore



Front view of the Power plant at Sanchore



Air cooled condensing system over water cold condensing system



Biomass coming at the power plant at Sanchore

Air

Boiler flue gas: Electrostatic precipitator will be installed at the exit of boilers to limit the suspended particulate matter. Control of ground level concentration of SO₂ emitted will be achieved by providing a stack at sufficient height of 65 m for dispersion.

Water

Effluent disposal: The acidic effluents generated during regeneration of cation and mixed bed exchangers and alkaline effluents generated during regeneration of anions and mixed bed exchangers of dematerialized water plant will be led into a neutralization pit. These effluents are self neutralizing but provisions have been made for final pH adjustment before disposal.

Ash

Based on preliminary estimates, the maximum annual generation of ash from boiler operation is 2.5 tons/hr, based on 100 percent rice husk firing. Fly ash constitutes the major part, accounting for 75 percent of total generation, the balance being bottom ash. The fly ash will be utilized for land filling of mines which is located 5.6 km away from the plant site.

Noise

Major noise-producing equipments such as turbo generator, compressor are to be provided with suitable noise abatements.

Transtech's unique approach in biomass power

Having adopted an integrated approach in the biomass power project, there is an incorporation of agriculture, forestry into power generation. It is proposed to develop barren areas adjoining to the power plant sites with captive energy plantation like *Prosopis juliflora* and Tamarix. Both these plantations are perennial, having life of more than 50 years and provide woody biomass for power generation. It is a hardy plant and can be developed in alkaline and saline environment, where nothing was cultivable earlier. An equitable development of energy plantation would further improve the environment, provide biomass for power generation and create thousands of new employment opportunities in the rural sector.

In the biomass power plant operation, development of captive plantation is a critical aspect of the strategy

followed. Looking at the operation of biomass power plant, there is an integration of agriculture into power. There would also be regional collection centers at different places to establish fuel linkages. These collection centers are being set up at strategic locations as per local biomass mapping which would collect biomass and *Prosopis juliflora* from farmers and local people and would be transported to the plant site by vehicles. This would provide an alternative source of earning to the rural population. The 12 MW biomass power plant would infuse approximately ₹16 to 17 crores annually into the rural economy towards fuel supply to the organization and has capability to provide self employment to around 500 people in the rural area.

The social impact and sustainable development are natural by-products of a successful biomass power plant. Majority of the contributions to the power plant operation is done by local people. The mere fact that every year the biomass power plant would pump crores in the rural economy towards biomass integration speaks the sustainable impact that the project provides.

Transtech is looking forward to expand the biomass power plant operation on similar operating concepts and have registered more sites in Rajasthan with Rajasthan Renewable Energy Corporation (RREC). The sites include Marwar junction, Pali, Dhaulpur, Jaisalmer, Rajsamand, Phalodi, Bundi and Raila.

The company also has a vision of working in an integrated model with the government for development for *Prosopis juliflora*, which would be used as fuel for power generation and also work towards creating self employment opportunities for the rural people.

The company is also looking at developing similar models in Gujarat and has signed a MoU with the Gujarat Government to set up a 200 MW capacity biomass power plant in a collaborative approach at different locations in the state.

Courtesy: Mr Amitabh Tandon (Director)
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Email: amitabh.tandon@mtsindia.in

Biogas for Sustainable Development

Achieving “Sustainable Development” is a formidable challenge in the present world. It concerns technologies that can help manage growth while considering economic, social, and environmental sustenance of the society. In fact there is an urgent need to solve the present problems faced by the society without creating any long-term negative impact, which could become a critical issue to resolve for the future generations.

Energy need is an important ingredient in the modern economy and modern energy services must be evolved and deployed in all aspects of the development process – e.g., energy and communications, energy and industry, energy and the environment, energy and agriculture, energy and education, energy and public health and safety.

Biomass is one such source that can be used to provide sustainable supply of the required energy through biogas, vegetable oil, biodiesel, producer gas, and by directly burning the biomass (refer Figure 1). Notwithstanding whether the biomass is “waste” of some process or is cultivated specifically as fuel for energy generation, it is considered a “green” technology, since:

- The life cycle of the fuel is short (could even be less than three months)
- The net carbon-dioxide emission from the fuel is zero as the CO₂ emitted is generated by burning the carbon that the plant had fixed by taking CO₂ from the atmosphere and converting it to food (glucose) with the help of photosynthesis
- The cycle can be water neutral as well

- If biogas or biodiesel is produced from biomass, the left overs can be put back into the field as high quality manure
- The remaining biomass could also be used with a gasifier to make producer gas. The ash could be spread in the fields as micro-nutrient, completing its cycle as well.

The solution of sustainability lies in the meeting point of technical feasibility, environment friendliness, economic viability and social acceptance. Thus continuous endeavor needs to be expanded in the intersection zone by undertaking innovative projects involving leading edge technologies.

While applying the criteria for sustainability to evaluate various options for harnessing energy from biomass, biogas route turns out to be the promising option. From Figure 1, it can be seen that sugar, starch, cellulose, protein and lipid can be readily converted to biogas however, conversion of lignin is considerably difficult. Perhaps, further research is required to economically convert lignin to biogas.

Recent developments in the technology have opened the possibility of using food grain and vegetable waste other than dung for biogas generation. Even the waste cake that is left after extracting oil from seeds can be used to generate biogas. Interestingly, the gas output of this starch or protein based feedstock is multi-fold than that of the cow dung which can actually result in a smaller size digester as compared to the conventional one, tilting the economics favorably.

Biogas for rural energy

Biogas is a product of anaerobic degradation of organic matter. It contains methane, carbon dioxide, hydrogen, ammonia, hydrogen sulphide and some traces of other gases along with water vapor. When the methane content in the biogas reaches close to 50%, the gas becomes easily combustible and delivers a clear blue flame when burnt with sufficient supply of air. It can safely be used as fuel for cooking or for process heating.

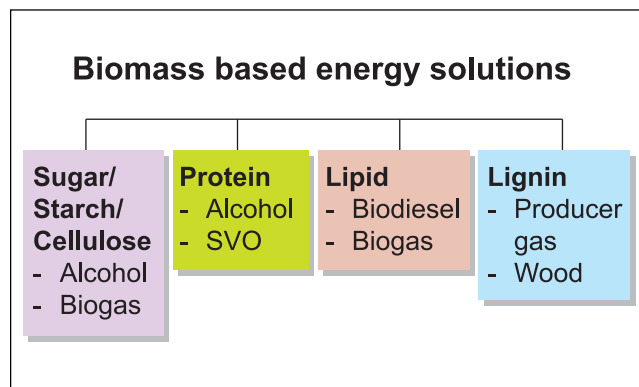


Figure 1: Options for biomass based energy

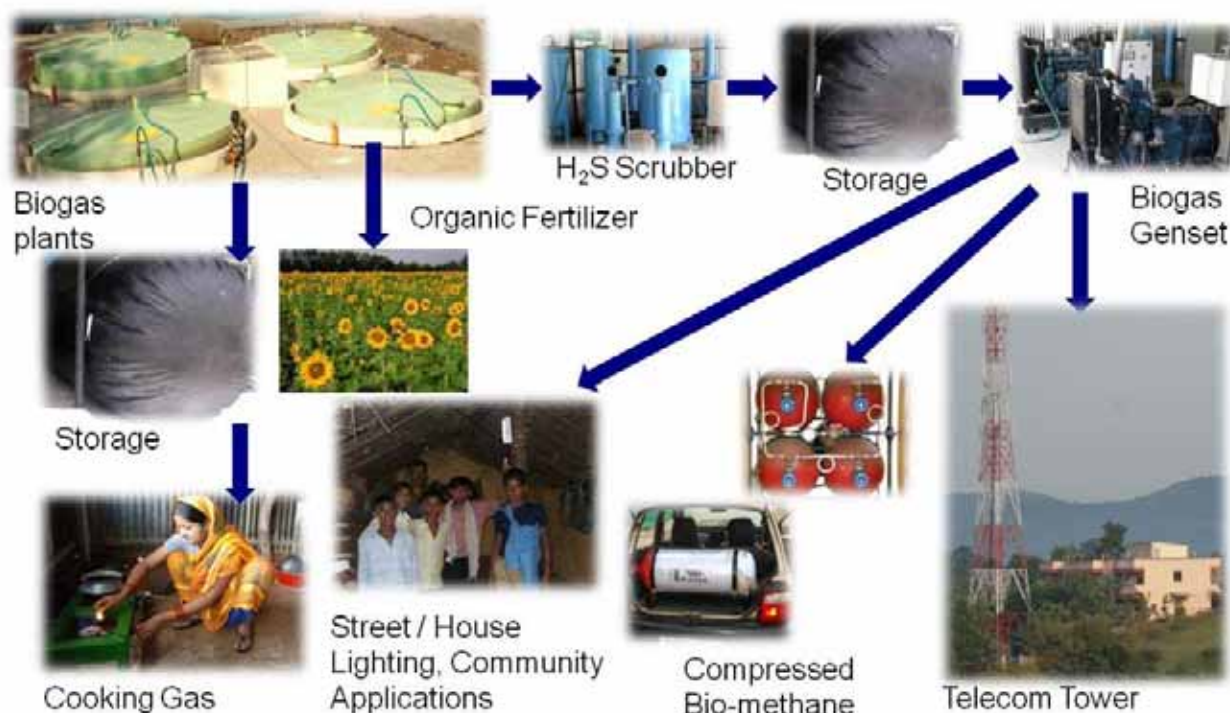


Figure 2: Biogas can provide a complete solution for energy needs

Typical substrates, i.e. raw materials that can be used for biogas production in rural areas are:

- Agricultural waste: Maize, jawar, bajara, rice, sorghum, etc
- Food processing waste
- Sugar factory: Molasses, spent wash, and press mud
- Industrial waste: oil cakes and de-oiled cakes, maize husk, starch effluent, etc
- Other waste: Kitchen and hotel waste, organic waste in municipal solid wastes
- Cultivated substrate: Napier grass, elephant grass, safflower, etc.

As seen in Figure 2, after removing the unwanted impurities, biogas can be used as engine fuel to generate electricity. If purity of methane can be increased to over 90% then the gas can be compressed to high pressures of over 200 bar and stored in cylinders. It can then directly replace CNG, even for vehicular application.

The effluent from the biogas plant known as digestate is in the form of slurry which can be further separated by processes such as decantation or using simple techniques like a sand-bed filter. It could then be recycled into the biogas plant or can be used as nitrogen rich liquid

fertilizer. The solid mostly consists of completely composted biomass which can be used as manure. When minerals and micronutrients are mixed with the manure, it could further be converted into fertilizer, which is a value added product.

Organic fertilizer

Balanced nutrition is the base for a healthy plant. At present this need is fulfilled across the globe by using chemical phosphates. However, depending on the pH of the soil, water soluble part of the conventional chemical phosphatic fertilizers gets converted into insoluble form soon after it comes in contact with substances like Fe, Al, or Ca, Mg salts in the soil. The process is known as phosphate fixation.

It's here that the organic fertilizers help in overcoming the phosphate fixation problem. The organic fertilizer provides phosphorous to the plant over an extended period in smaller doses as necessary for healthy growth. Eventually 90-95% of the total phosphorus can be utilized by the plant for its nutrition. It is also observed that continuous use of organic fertilizer leads to considerable improvement in yield.

Pilot project in Chhattisgarh

German Technical Cooperation (GTZ) is in the process of setting up biofuels based decentralized power plants in 24 villages of Korba district in Chhattisgarh state under the project of “Renewable Energy Supply for Rural Areas” (RESRA), in technical collaboration with Kirloskar. Most of these villages are totally un-electrified; while some of them have grid power supply only for the home lighting, which is also inadequate. In order to improve livelihood of the inhabitants, this project aims to supply renewable energy based power in all these villages for their community based, domestic, irrigation and microenterprises electricity demand. These villages are surrounded by the forest where the tree borne oilseeds (TBS) of Kussum, Jatropha, Mahua, Sal and Pongamia (Karanj) are abundantly available. These non-edible oilseeds can become primary source of raw material to produce renewable biofuels like straight vegetable oils (SVO) and biogas. The concept of the project is shown in Figure 3.

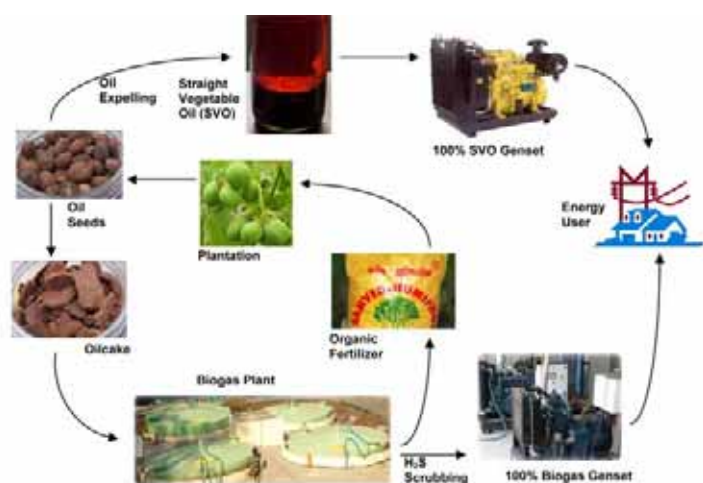


Figure 3: Concept of RESRA Project in Korba district of Chhattisgarh

The project envisages collection of oilseeds from the forest. In order to simplify the logistics of oilseed collection and their effective usage as raw material for maximum energy production, the 24 villages are divided into six clusters. After studying the electrical load demand data of each village, the SVO and biogas gensets are accordingly allocated to different villages. One village in every cluster is then identified to accommodate electrical demand of each of the equipments like oil

expeller and degumming unit in addition to its own electricity demand. As a result, each cluster gets the facility to produce degummed SVO and oil cake for biogas generation. While the indentified village is then considered as the nodal village of that cluster, the remaining villages in the cluster are called as satellite villages.

To optimize the usage of degummed SVO and oilcake, biogas plant and biogas genset are installed in every indentified village from each cluster. Only two ratings each are selected for capacity of the SVO and biogas gensets. This further will reduce variations in the installations as well as operation and maintenance instructions. While the SVO gensets use air-cooled engines, for biogas gensets, water-cooled engines are used. Heat exchangers are incorporated in the engine cooling circuit to generate hot water, which is then used for feed preparation for biogas digesters.

A sustainable energy supply model for the purpose of generating income from renewable sources and byproducts is proposed and is demonstrated on paper as realizable. The pilot projects, therefore, would serve as a display model for creating future energy policies for rural regions in India.

It may be noted that such projects for supply of rural energy will not add to CO₂ emissions. Moreover, it will provide opportunities for income generation to the village entrepreneurs. The essence of the project lies in the fact that the project not just provides electricity to the villages, but actually “empowers” them to ember economic growth.

Sustainable and multipliable solution

The proposed biogas based energy solution holds good on all the criterias of sustainability. The solution is “technically feasible”. Various substrates given herein before have been tested at Kirloskar Integrated Technologies Limited (KITL) for their biogas potential and consistency of biogas quality and quantity.

Biomass based biogas energy is “environment friendly” as well as there is no net CO₂ addition, no harmful effluents and it does not pose any other environment related risks either. In fact, it has potential to recover damaged saline infertile land. It also reduces methane emissions that would have taken place due to rotting

of the substrate, which is typically, “waste” from some process.

Since the Government has heavily subsidized fertilizers and electricity, the products of the biogas plant have to compete with the subsidized price. Phosphatic chemical fertilizer is available around ₹9.5/kg in the market. The organic fertilizer manufactured by processing the manure from the biogas plant can be retailed at the same price. In such case, it can replace the chemical fertilizer completely and reduce the subsidy burden. It will also save foreign exchange outflow as most chemical phosphates are imported in India.

Similarly, electricity produced from biogas can be retailed at differential prices. Corporate’s like a telecom company, for example, present in the rural area can afford to purchase electricity at ₹12 to 18 per kWh. The rural businesses could pay around ₹7 to 8 per kWh, while the common amenities like street lights and drinking water schemes could get it at a subsidized rate of ₹3 per kWh.

A rural enterprise would run the biogas energy project as a business. For this business, the return on investment could come in less than four years. The project therefore helps in employment generation, directly and indirectly. Hence, it is not just “economically viable”, but is attractive.

Involvement of the community is the key to the success of such schemes. With the help of some Self Help Group or a grassroots level NGO working in the area, a local

entrepreneur is identified as a result of which the money generated by the business is recycled in the region itself. The cycle further creates business opportunities for local individuals through need for procurement of raw material and sale of products and services. The project also considers supply to common infrastructure of the community. All these factors would make the project “socially acceptable”.

Conclusion

Thus to conclude, it can be said that given the benefits that the supply of energy generating out of biogas would assist rural businesses and enterprises to grow and prosper, production and use of organic fertilizers which would improve soil and increase yields and the project would also help employment generation by creating local job opportunities, it would not be a questionable fact to say that biogas based energy could provide sustainable solution for rural areas. And the benefits emerging out of such projects do not stop there. Considerable savings in subsidy bills and foreign exchange outflow could be further achieved through such projects. Moreover, through availability of fuel and energy, the overall health and hygiene in the region will improve and most importantly, the project promises “empowerment” of the rural community which makes it appropriate to become a multipliable and scalable model.

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Request for Articles

Bioenergy India is intended to meet the updated information requirements of a diverse cross-section of stakeholders from various end-use considerations, be it biomass combustion, gasification or cogeneration. To meet such an objective in a timely manner, the editorial team of the magazine invites articles, features, case studies and news items, etc., from academicians, researchers and industry professionals.

The contributions should be of about 2,000-2,500 words (approximately 5-6 pages, which would include relevant graphs, charts, figures and tables). The two lead articles would be given an honorarium of ₹1,500 each. Please send in your inputs along with relevant photographs to:

Ashirbad S Raha (ashirbad@winrockindia.org)

Winrock International India: 788, Udyog Vihar, Phase V, Gurgaon-122 001; Phone: 0124-4303868

Chinese Biomass Policy – From Indian Perspective

China is currently in a phase of rapid industrialization and integration into the world economy. Although endowed with large quantities of fossil fuel sources, China's per-capita energy resources, which are lesser than half of the world's average, is low due to the large size of its population. This deficiency has become a factor constraining the sustainable development of the Chinese economy. Furthermore, as about 80 percent of the primary energy supply still comes from fossil fuels, there are clear environmental pollution issues. Rising oil import costs and concerns about rapidly growing demands for energy (growing at 15 percent annually) in a context of fluctuating world oil prices, are driving the government to seek alternative indigenous sources of energy. Concerns about energy security along with clean fuel wave, led the government to design separate policy instruments for renewable energy. A comparative analysis of objectives behind the policy design in India and China is presented in Table 1.

Policy design

The approach used by the Chinese government for the development of renewable energy in general and biofuels for transportation in particular focuses on establishing a market through government support and participation of state companies.

Table 1: Main Objectives¹ of Bioenergy Development

Country	Objectives						
	Climate Change	Environment	Energy Security	Rural Development	Agricultural Development	Technological Progress	Cost Effectiveness
China	√	√	√	√	√		
India			√	√		√	√

¹ Global Bio-energy Partnership (GBEP) report, 2008

Renewable energy law

The first national law dedicated for promoting the development and use of renewable energy sources, came into effect on 1 January 2006. The "Renewable Energy Law" draws particular attention to energy derived from biomass, confirms the importance of renewable energy in China's national energy strategy, encourages investment in the development of biomass, removes barriers to the development of the renewable energy market, and sets up a financial guarantee system for the development of renewable energy.

Precursor to the Renewable Energy Law, China's bioethanol development history has evolved in three phases:

- *Research and development* of relevant technologies for bioethanol production, accompanied by a period of demonstration (1986-2001)
- *Legislative infrastructure* (2001-2004)
- *Enforcement*, accompanied by pilot programs that gradually expand, if successful (2004-present)

While the Chinese government has been addressing ethanol for the past twenty years, it only began including biodiesel in 2006 in its energy mix.

National climate change program

In June 2007, China took a significant step towards addressing the risks of climate change with the formulation of a new National Climate Change Program. The new program gives significant importance to bioenergy based power generation, marsh gas, biomass briquette and biomass liquid fuel. It foresees preferential measures in favour of bioethanol and other biomass fuels to promote biomass energy development and utilization to a considerable level.

Main policy instruments

The policy design discussed in the previous section, encompass two major policy instruments viz. establishing renewable energy targets and setting compliance mechanisms to achieve those targets. This section gives the operational perspective of these policy instruments. Establishment of renewable energy targets, including both

Table 2: Bioenergy targets of China

Energy sources	by 2010	by 2020
Total primary energy supply (TPES)	79,131 PJ	97,008 PJ
Renewable Energy Share of TPES	10%	16%
Biomass generation	5.5 GW	30 GW
Biogas	19 billion m ³	48 billion m ³
Solid biomass fuel	10 million tons	50 million tons
Bioethanol	2.0 million tons	10 million tons
Biodiesel	0.2 million tons	2 million tons

Source: Xinhua news Agency, October 2006, Zhong Guo Dian Li bao (China Electric Power news), June 2006

economy-wide and technology specific are the basis for policy instrument. On the basis of medium and long-term targets and national renewable energy (RE) development and utilization plan set at central level, and according to the economic context and availability of resources, each regional authority in China is obliged to set a RE plan for their own administrative regions. Mandatory RE targets for individual utilities under a quota system are placed on generators, although these are yet not operational. Bioenergy targets are summarized in Table 2.

Heating and transport

The Renewable Energy Law provides regulations for gas and heat sourced from biomass. However, no official heat targets exists in China. The “Renewable Energy Law” obliges petroleum distributors to supply fuel generated from biomass resources into the distribution system only if it complies with relevant technical and quality standards, in accordance with applicable laws and regulations. Although these regulations have yet not been implemented, E10 blending mandates are on a trial period within a National Fuel Ethanol Program. A target of replacing 15 percent of its transportation energy needs through the use of biofuels has been set for 2020. The value corresponds to 12 million tonnes and has been announced by the government together with the plan of setting aside \$101.1 billion by 2020 for promoting biofuels.

Electricity

The Renewable Energy Law provides for the compulsory connection of renewable energy generators to the grid, and a regulation has been enacted to this effect². Under the regulation, a power generation project must be established upon obtaining the relevant license or complying with relevant filing procedures with the

department-in-charge. According to the new Renewable Energy Law, power grid operators (in addition to fuel and heat network operators and petroleum distributors) who fail to perform the above obligation may incur liability and may even be penalized. Under the “Power Generation Regulation”, power generating enterprises, especially large scale power generating enterprises, are also urged to invest in and fulfill the quota requirements

for generating electricity using renewable energy as imposed by the government (but not yet implemented).

Moreover, in areas not covered by a power grid, the Government will fund the construction of independent renewable energy electricity generation systems to provide electricity locally. The *price support mechanism*³ established by China’s central government, designed to encourage investors to participate in the market, is based on feed-in tariff systems. The government - NDRC Department of Price - establishes fixed prices at which energy utilities must buy all energy produced by renewable energy enterprises, significantly reducing the time necessary to negotiate power purchase agreements and gain project approvals from government authorities, thus decreasing transaction costs.

A comparison of bioenergy targets for the three sectors between India and China is presented in Table 3 (next page).

Financing instrument

A *cost-sharing system* has been established targeting all consumers and power grid operators to collectively share the extra costs resulting from the development of renewable energy. The additional cost that power grid operators have to pay to purchase electricity generated from renewable energy at the tariff set by the government, may be added to the price of electricity sold to end-users, by means of a tariff surcharge. The other component of the excess cost is shared by all energy utility companies nationwide and cannot be passed down

² Power Generation Regulation, NDRC Energy, 2006

³ Established through regulation on “Pricing and Cost Sharing for Renewable Energy Power Generation” - NDRC Price No.7, 2006)

Table 3: Bioenergy targets⁴ for electricity, heat and transport fuels

Country	Targets		
	Electricity	Heat	Transport Fuel
China	China is finalizing a revised target for 16% of primary energy from renewables by 2020, including large hydro, plans include a target for 30 GW of biomass power by 2020	No targets	15% of its transportation energy needs through use of biofuels by 2020
India	No targets	No targets	Development of biofuels with a target of 20 percent blending by 2017

Table 4: Key policy instruments⁵

Country	Energy Policy							
	Binding targets/Mandates ₁	Voluntary Targets ₁	Direct Incentives ₂	Grants	Feed in Tariffs	Compulsory Grid Connection	Sustainability Criteria	Tariffs
China		E,T	T	E,T	E,H	E		NA
India	T, (E*)		E	E,H, T	E			NA

E: electricity, **H:** heat, **T:** transport, **Eth:** ethanol, **B-D:** biodiesel, *****target applies to all renewable energy sources, policy instrument still under development/awaiting approval, ¹ blending or market penetration, ² publicly financed incentives: tax reductions, subsidies, loan support/ guarantees

to consumers. Table 4 presents the comparative picture of the key financial policy instruments adopted by India and China.

Renewable energy projects that fall within the description of the Catalogue on Renewable Energy Industrial Development⁶ may be entitled to preferential tax treatment and upon satisfying other requirements, funding is designated. Summary for legal and regulatory instruments is presented in Table 5 (next page).

Status of bioenergy

By end of 2010, electricity generation from bioenergy is expected to reach 5 GW, and 30 GW by 2020. The annual use of methane gas is expected to be 19 cubic kilometers by 2010, and 40 cubic kilometers by 2020. China is the world's third-largest producer of ethanol, after Brazil and the United States.

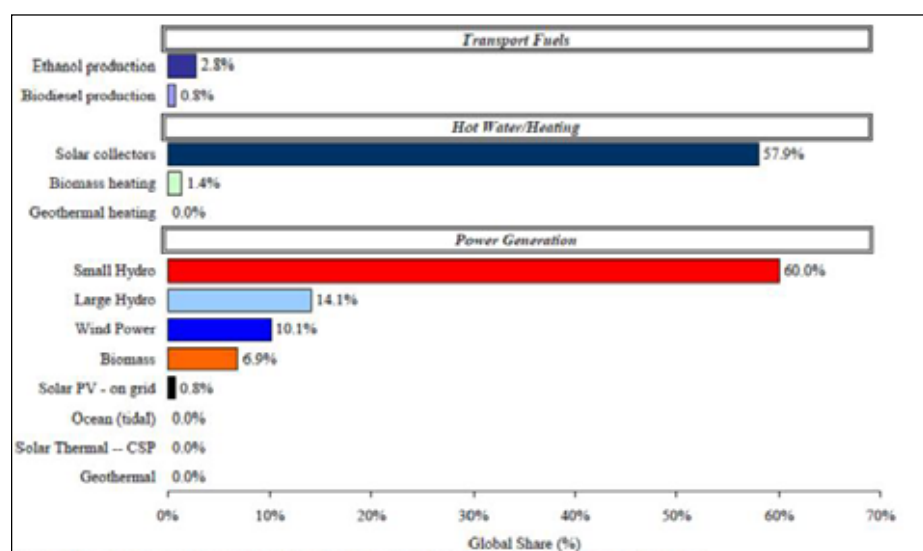


Figure 1: China's share of global renewable energy capacity / production in 2008

Source: REN21, Renewable Global Status Report: 2009 Update (May 13, 2009) and UNEP, Global Trends in Sustainable Energy Investment 2009 (July 2009).

⁴ As stated in country summaries and key policy documents

⁵ Global Bio-energy Partnership (GBEP) report, 2008

⁶ Circular on the Catalog Issue for the Guidance on Industrial Development of Renewable Energy by the National Development and Reform Commission (NDRC), promulgated and implemented on November 29, 2005 the Guidance Catalog)

Table 5: Policy summary⁷

Implementing Agency	Policy / Activity Name	Legal and Regulatory Instruments		
		Policy / Activity Type	Existing Legislation	Policy / Activity Target Area
National Development & Reform Commission (NDRC)	Renewable Energy Law (adopted on 28/02/2005)	Policy-target, incentive, R&D and education	Yes	Industry, bioenergy producers, bioenergy suppliers
NDRC	National Renewable Energy Planning	Activity-targets	No	Industry, bioenergy producers, bioenergy suppliers
Ministry of Finance and NDRC	Bioethanol Programme	Activity-incentives	No	Bioethanol producers
Ministry of Finance	Special Fund for Renewable Energy development	Policy-incentive, R&D	Yes	Industry, bioenergy producers
NDRC	Climate Change Programme (June 2007)	Activity-target, Education	No	Industry
NDRC	Renewable Energy Law (adopted on 28/02/2005)	Policy-target, incentive, R&D and education	Yes	Industry, bioenergy producers, bioenergy suppliers
NDRC	National Renewable Energy Planning	Activity-targets	No	Industry, bioenergy producers, bioenergy suppliers
Ministry of Finance and NDRC	Bioethanol Programme	Activity-incentives	No	Bioethanol producers
Ministry of Finance	Special Fund for Renewable Energy development	Policy-incentive, R&D	Yes	Industry, bioenergy producers
NDRC	Climate Change Programme (June 2007)	Activity-target, Education	No	Industry

Conclusion

Chinese experience in developing a renewable energy policy is recent and therefore the formulation and implementation of appropriate regulations will take time. The first official government review of the Renewable Energy Law was carried out by the NDRC in early 2007. The review suggested the following policy measures:

- Implement a renewable portfolio standard as soon as possible, to increase market confidence about prices

- Accelerate the formulation of preferential tax and other fiscal policy
- Accelerate the formulation and publication of national renewable energy targets and the long-term plan for renewable energy, and formulate and publish specific plans for wind energy, biomass, solar energy and other technologies. The purpose of the plan is to provide a 'roadmap' for development of all sectors in the renewable energy industry and align policy mechanisms with long-term targets

⁷ Global Bio-energy Partnership (GBEP) report, 2008

The Future of Biomass Energy in India

India is a power starved country with a larger share of its population without electricity. About 75 percent of India's power generation is currently coal based¹. Though India has one of the largest reserves of coal² and it can be assumed that India's power sector will always be principally coal dependent, however, it is very much a fact that this reserve will not last forever. In a world with changing climate, India is certainly one of those countries which will have to confront severe energy shortages. And energy insecurity not just increases a nation's vulnerability to climate change but also limits its ability to adapt to the impacts. It goes without saying that coal based energy in India will supplement global carbon emissions and moreover fossil fuel based power generation in centralized manner results in lot of losses in transmission and distribution which means wastage of precious power which is already in short supply. And on top of that, many remote villages are still not connected with centralized grids and meeting their power requirement needs decentralized and distributed power generation options.

Energy insecurity not just increases a nation's vulnerability to climate change but also limits its ability to adapt to the impacts. It goes without saying that coal based energy in India will supplement global carbon emissions and moreover fossil fuel based power generation in centralized manner results in lot of losses in transmission and distribution which means wastage of precious power which is already in short supply

The obvious solution to all these problems is renewable energy. Given the potential that India has, sources like solar, wind, and biomass can be prospective sources of power in times to come, that too without leaving negative impact on the environment.

Why biomass?

The currently installed renewable energy capacity of India is nearly 17,000 MW. The lion's share of renewable

power generation is of wind power having a current installed capacity of about 11,807 MW³. India has also been endowed with vast solar energy potential. About 5,000 trillion kWh per year energy is incident over India's land area with most parts receiving 4-7 kWh per sq. m per day⁴. Although most of this potential is still untapped, Government of India is making enormous efforts in this direction through its Jawaharlal Nehru National Solar Mission. With large power potential, these two renewable sources seem to stand at the forefront of our future energy supply. However, these have limitations, both spatial and temporal in nature. Their spatial limitation makes them commercially feasible only in some parts of the country while the temporal nature of these resources results in power generation only during some parts of the year, resulting in low capacity utilization factors (CUFs) of 10 to 30 percent.

Biomass, the third resource in consideration presents an interesting proposition. India is a farmer dominated country and agriculture is the main source of livelihood for a major part of the population. Thus, biomass in form of agro residues is available in all parts of the country, thereby overcoming the regional limitations as in case of other renewable resources. The temporal limitation is also overcome as there is no complete dependence on natural resource like wind or sun. In case of biomass power, fuel is either available throughout the year or can be stored and used throughout the year to give high CUFs of up to 85%. Thus, biomass emerges as an ideal solution for powering the remotest parts of the country with least wastage and highest efficiency.

Types of biomass

Biomass fuel can either be solid or liquid. Solid fuels include agro residues, woody biomass, municipal organic waste etc., while the liquid fuel refers to fuels like ethanol, biodiesel etc. As far as usage of biomass for

¹ Budget 2010-2011, Speech of Pranab Mukherjee, Minister of Finance: <http://indiabudget.nic.in/ub2010-11/bs/speecha.htm>

² World Coal Institute: <http://www.worldcoal.org/resources/coal-statistics/>

³ MNRE: <http://mnre.gov.in/achievements.htm>

⁴ National Solar Mission: <http://mnre.gov.in/pdf/mission-document-JNNSM.pdf>

⁵ Ministry of Rural Development, Department of Land resources: <http://www.dolr.nic.in/fwastecatg.htm>

State	Paddy husk	Paddy straw	Wheat straw	Wheat pod	Maize stalks	Maize cobs	Mustard husk	Castor seed	Groundnut stalk	Groundnut shell	Bajra stalks	Bajra cobs	Soyabean stalks	Arhar stalks	Jowar stalks	Jowar pods	Tapioca stalks	Cotton stalks, bollshells and husk	Tea sticks	Areca nut fronds and husk
Andhra Pradesh																				
Arunachal Pradesh																				
Assam																				
Bihar																				
Chhattisgarh																				
Goa																				
Gujarat																				
Haryana																				
Himachal Pradesh																				
Jammu & Kashmir																				
Jharkhand																				
Karnataka																				
Kerala																				
Madhya Pradesh																				
Maharashtra																				
Manipur																				
Meghalaya																				
Mizoram																				
Nagaland																				
Orissa																				
Punjab																				
Rajasthan																				
Sikkim																				
Tamil Nadu																				
Tripura																				
Uttar Pradesh																				
Uttarakhand																				
West Bengal																				

Figure 1: Biomass available in various states across India⁶

power generation in power plants across the country is concerned, mostly there are two types of solid biomass fuels that are currently being used in majority of the plants. They include agro residues and woody biomass from dedicated wasteland plantations.

The main agro residues available across India are given in Figure 1. Other than this, India has about 5,52,69,226⁵ ha of wasteland which is about 17.45 percent of the total geographical area. This un-utilized resource can also be used productively for producing woody biomass fuel to supply to power plants.

Biomass potential: highly untapped

The Ministry of New and Renewable Energy (MNRE) sponsored project, Biomass Resource Atlas of India assessed the biomass potential of India based on agri residues as 18,601.5 MW⁷ in 2000-04 and MNRE puts it at about 16,000 MW⁸. Out of this, according to the recent data released by MNRE, an installed capacity of about 1,220 MWe⁹ has been achieved until March 30, 2010. This is a mere 7.6 percent of the total potential of 16,000 MW thereby leaving an untapped potential of about 14,700 MW to be explored.

As seen from Figure 1, there are 20 major types of agri biomass residues available in India. Out of these currently

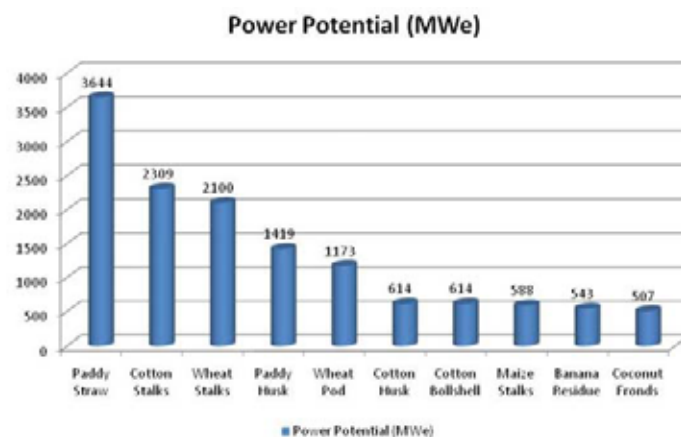


Figure 2: Main biomass residues according to potential for power generation¹⁰

only paddy husk, mustard crop residues and cotton residues are being widely used. This means that out of the main biomass residues (with potential of 500 MW and above) plotted in Figure 2, only two (paddy husk

⁶ Based on Biomass Resource Atlas of India

⁷ Biomass Resource Atlas of India

⁸ Ministry of New and Renewable Energy: <http://mnre.gov.in/>

⁹ New and Renewable Energy, cumulative achievements as on 31.03.2010: <http://mnre.gov.in/achievements.htm>

¹⁰ Based on Biomass Resource Atlas of India

and cotton residues) are being currently used which cover only about a quarter of the potential. Major sources like paddy straw, wheat straw and wheat pods covering about 40 percent of the potential are still left untouched. It is estimated that if only about 50 percent of the wasteland available in the country can be put under energy plantation for biomass power, an additional 30,000 MW power can be produced. In nutshell, it can be said that an untapped potential of 40,000 MW is waiting to be harnessed all across the country without any spatial or temporal constraint. The figures clearly reflect the fact that biomass energy indeed has a great potential to meet the energy demands of India.

The future of biomass energy

The ascent of biomass energy in India has been slow and full of ups and downs. This has been partly due to less attractive policies and tariffs and partly due to the physical and chemical properties of the various biomass. Some reasons for the slow rise of biomass power in India have been shown in Figure 3. Although many states have come up with preferential tariffs for biomass power in the past, they in many cases fell short of breaking the investment barriers for investors. In some other cases, initially feasible looking projects turned into loss making ventures due to rapid rise in fuel (biomass residue) prices. The reason behind this is the two-fold rise of fuel price. First reason for uncontrolled fuel price rise has been the lack of a sturdy fuel strategy which has led to dependence on some fuel suppliers inevitable, thus leading to cartelization and price rise. The other important reason has been the emergence of other biomass power projects in the close vicinity which has led to mutual competition for the power projects and rapid fuel price rise rendering both projects unviable.

As discussed in the earlier section, until now only a handful of biomass types have been used in power production. The major reason behind this has been the

lack of appropriate technology. Most of the biomass, due to their high alkali content pose a problem to the boiler and have led to frequent shutdown of plants in the past. Hence, the project proponents have until now been concentrating on the residues with least harmful characteristics. Biomass is also a high bulk density fuel whose collection, management and storage issues requires great attention thereby increasing the need of a strong fuel strategy and supply chain to make the project viable.

The way forward

Many of these barriers are now being understood widely by project proponents and the government alike which has led to some new developments in the industry. This is evident from the spike in the graph (Figure 4 on next page) showing the development of biomass/bagasse projects. The spike in the last few years is the evidence of the development of new policies, technologies and strategies.

However, going forward considering the enormous potential for biomass power in India, a lot still needs to be done so that this sector can take big leaps in the future. Some states like Rajasthan, Punjab, etc. have developed policies for area reservation while others like Bihar, UP, etc. still need to join the party. Many states have recently revised their tariffs for purchase of biomass power which has raised interest in the sectors.

Other than this, new technological solutions are also coming up and now many private power producers are planning to use rice straw (high alkali content), the residue with highest potential across India. Similar new solutions are now required to use other fuels like maize residues, coconut residues, coffee residues, etc. Therefore if use of the various crop residues is made possible technologically, it will act as a major boost for development of biomass power across the country.

The most important piece of the puzzle is the fuel procurement strategy which is now being taken very

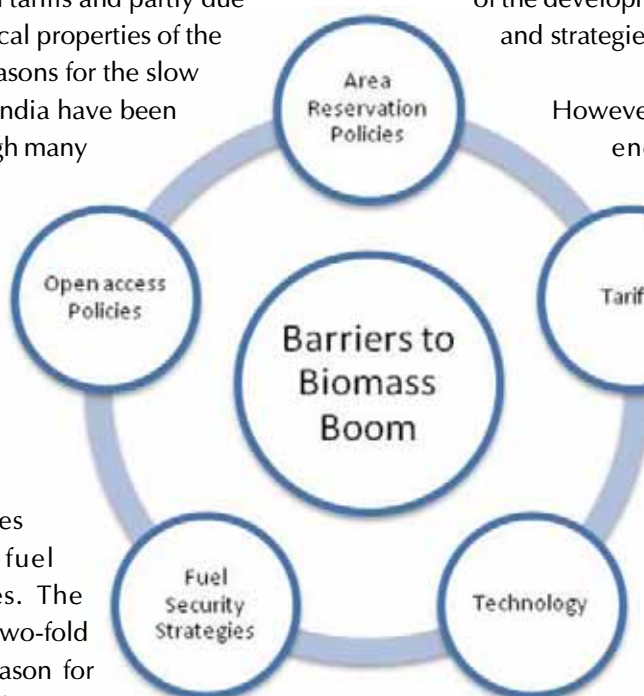


Figure 3: Barriers to Biomass Boom

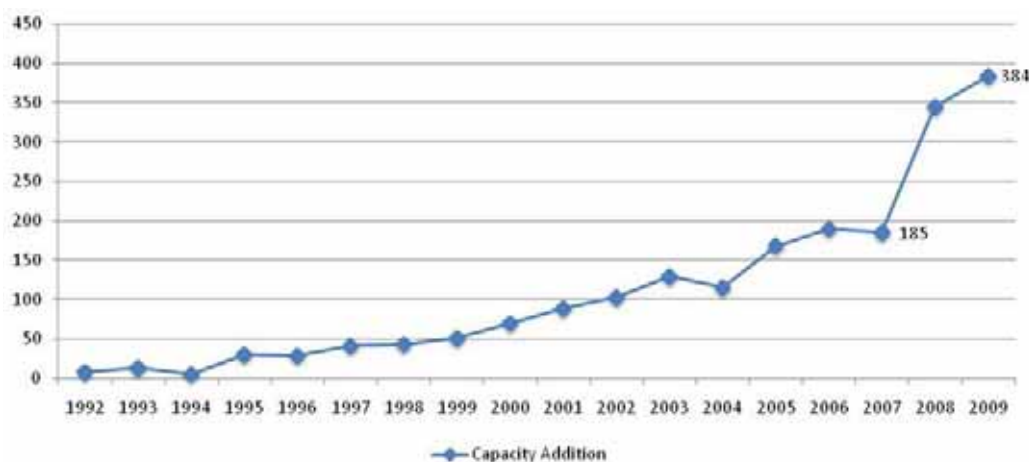


Figure 4: Capacity addition of biomass/bagasse projects in India

seriously by project developers. Innovations like baling, briquetting, etc. are making procurement, storage and management of the fuel easier and the availability of dependable indigenous technologies for these purposes is helping lower the capital as well as maintenance costs. Considering the favorable developments happening in the biomass sector, the strategy now should also include promotion of the biomass production itself through provision of irrigation facilities, integrated energy plantation programs, watershed treatment, harvesting facilities, etc. Institutional partnerships with local self help groups (SHGs), Primary Agriculture Cooperative Societies

(PACS), Panchayats, etc. which can then further ensure sustainable operations of the projects.

Thus, looking at the trends as well as new developments in the sector, it can be said that biomass power is going to become bigger in terms of capacity as well as spread in the coming years. However, to harness the full potential it is imperative that the barriers described and solutions discussed earlier in the document should be considered.

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deployment and testing of these fuel processing units in varied regions will allow a detailed assessment of their socio-economic performance. Involving the local community in the various operational aspects of the biomass processing unit will integrate and embed this initiative deep into the context of the field area's energy environment, also offering immense possibilities for fostering women's participation and entrepreneurship.

All the recommendations made above had the domestic cookstoves at their focus. It has been recognized that community stoves also require development of new designs, testing protocols, testing centres, standards and fuel supply like the domestic stoves. While some aspects can be integrated with the activities to be carried out for domestic stoves, it is desirable to have a different approach for pilot studies for various reasons.

Instituting the activities and programs emerging from the National Biomass Cookstoves, initiative in the public-private partnership (PPP) model at all levels will ensure that all the stakeholders including government, industry, academic, and social sector entities can leverage each other's expertise and resources. The PPP needs to be established by an initiating agency, comprised of a network of stakeholders and led by a Governing Council. The team suggested that the project management group be identified in the beginning of the first phase itself to facilitate the execution of various activities in the first phase of other components enumerated above.

Courtesy: Prof. Rajendra Prasad, Centre for Rural Development and Technology, Indian Institute of Technology (IIT), New Delhi
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BOOT Model for Bagasse Cogeneration Projects at Co-operative Sugar Factories

Background

Development of bagasse cogeneration projects on Build, Own, Operate & Transfer (BOOT) model at the co-operative / public sugar factories in India has been acknowledged by all the stakeholders, as the most viable solution to achieve the large untapped potential from over 300 and odd factories in India in this sub-sector.

The distinct barriers associated with the co-operative / public sector sugar factories related to delayed decision making, inability to raise equity and debt and limited manpower capacity, are expected to be overcome through such model with private sector intervention. Despite sporadic and even focused efforts over the last 15 years, this model has not become successful till date due to certain factors which are mentioned further in this write up.

Lack of trustworthy relations between the BOOT developer and the Host Sugar Factory (HSF), is mainly due to specific clauses in the Project Development Agreements (PDAs). They relate to committed supply of bagasse by HSF, design cane crushing rates, penalties for HSF for excessive steam and power consumption than agreed targets, BOOT period, quantum of investment for modernization and financing thereof, quantum of royalty, delays in approvals from competent authorities and subsequent delays in signing PDAs, which are the basis for project execution.

There is a non availability of low cost Supper Development Fund (SDF) funds, low interest term loans and higher Distributed Energy Resource (DER) for cogen power plants. Also, concurrent modernization which is being developed by the BOOT developer, limits the profit margins and sharing of higher royalties expected by the HSF. Sharing of CDM benefits and capital grant benefits with transmission utilities mandated in some of the Electricity Regulatory Commission (ERC) tariff orders further pressurize profit margins of the BOOT developers.

Central Electricity Regulatory Commission (CERC), most of the SERC's and even financial institutions for cogen

power plants consider the plant setup at ₹4 crore / MW which is lower than the actual capital costs (₹4.5 – 4.8 crore / MW), which in a way also becomes a reason of low promotion of this technology. Non consideration of modernization cost while determining tariffs by most of the SERCs is the reason for lower tariffs declared by them which further puts pressure on the profit margins of the BOOT developer. Transmission losses and wheeling charges leviable for open access power sale also increase limitations of the BOOT developer for getting commercial returns on the investments made. Divergence of opinions and mindsets on BOOT development has delayed and almost stalled the development.

Status of BOOT model in some states

Despite specific reasons indicated above, some development has taken place in the states of Maharashtra and Tamil Nadu, which is elaborated in the further sections.

Maharashtra

There have been sporadic efforts between the period of 1995-2006. Also, there has been a focused effort through Urjankur Trust from 2006 till date. Currently, there are two projects with 80 MW under construction at Shree Datta SSKL and Warana SSKL under Urjankur Trust. There were 40 MoUs signed after kick off meeting in July 2006, 20 projects evaluated and PDAs signed with five sugar factories. Out of three projects under development through Renuka Sugars Ltd., only one at Panchganga SSKL is under actual construction. One project from Enmass is under construction at DY Patil SSKL. There are 39 sugar factories out of 55 which were identified by Government of Maharashtra for equity support that have progressed with implementation on own investment or BOOT basis. Out of 39 sugar factories, seven plants are commissioned, while 32 are under various stages of development / erection. For the remaining 16 sugar factories, the projects have not been conceived till date. Out of balance 145 sugar factories (over and above 55 targeted by GoM), many have excellent cane potential and can be targeted for BOOT development.

Tamil Nadu

The Tamil Nadu Electricity Board (TNEB) model, runs with TNEB as the BOOT developer and by appointment of single EPC contractor for cogen power plants and concurrent sugar factory modernization at 17 co-operative / public sector sugar factories. It has 234 MW installed capacity and 154 MW exportable power. Standardized plant sizes here is between 7 MW – 18 MW and the pressure configuration ranges from 72 kg/cm² – 110 kg/cm². There is a total capital investment of ₹1,498 crore (₹1,176 crore for cogen power plants and ₹322 crore for concurrent sugar factory modernization). It is financed by PFC (cogen power) and IREDA Limited and is also eligible for MNRE capital grant. EPC contracts were signed in March 2010 for 12 projects. The commissioning is expected between May-September 2011. There is also a PDA signed between TNEB and TASCO (an individual sugar factory). TNEB will develop, finance, implement and operate for two years and hand over O&M to individual sugar factories.

Other states

The BOOT projects through private companies are under development stage in Punjab, Haryana and Gujarat. The process of outright sale / lease transfer is happening in states like Karnataka, Andhra Pradesh and Bihar. There has been no development in Uttar Pradesh.

Steps for accelerated development

There are certain recommendations for accelerated development of BOOT model in the co-operative / public sector sugar factories in India mentioned here. The situation can improve by ensuring SDF funding for BOOT model, both for cogen power plant and concurrent sugar factory modernization, as the ultimate beneficiary will be the HSF. Additional interest subsidy for term loan under MNRE scheme (over and above recently announced capital grant scheme) or contingent fund support under UNDP-GEF-MNRE project for minimizing the risks of BOOT developers will also give a boost to the sector. Certain promotional incentives are required for BOOT models by state utilities (like Tamil Nadu) in other states (Maharashtra, Karnataka, AP, UP, etc). Convincing CERC / SERCs for consideration of higher capital cost for cogen power plants for tariff determination (due to air cooled condensers, RO and long transmission lines / bay equipment, etc), as well as consideration of essential concurrent sugar factory modernization equipment (for optimization of power generation / export) and upward revision of tariffs (beyond ₹5.5 / kWh) is also one of the major steps for accelerating the growth.

Courtesy: SC Natu, Sr Vice President, MITCON Consultancy Services Ltd., Pune, Maharashtra
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- Clarify responsibilities for implementation of renewable energy strategies and policies, both nationally and within each province
- Clarify responsibilities for resource assessment and initiate data collection projects as soon as possible (with wind and biomass as a priority)
- Increase funding for research and development into high-tech and industrial equipment technology projects in the renewable energy sector
- Streamline government approvals process to minimize the administrative burden of new project development on project participants.

Under the institutional framework of China, the central government is responsible for the formulation of

national regulations which guide individual provinces. However, as is the case in India, since there are great disparities between various states in terms of resource availability, industrial capacity and demand, in some cases state governments need to formulate detailed provisions for their area, within the central government's general policy provides the framework. Implementation of these regulations will also need to take into account existing support measures at a provincial level, and how the implementation of a national framework law will affect their continued operation.

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Review of MNRE supported Biomass Projects in Maharashtra

Ministry of New and Renewable Energy (MNRE) recently carried out a review of three major biomass power projects commissioned in the last two years in Maharashtra to explore challenges and the way ahead for the projects in the region. The write up here aims to explore the summary of the outcomes of the visit of subject matter specialists from MNRE who explored various aspects of the projects ranging from location, capacity of plant, problems faced during operation, power purchase tariff and socio-economic development in the region etc.

8 MW biomass power project of Yash Agro Energy Ltd., Chimur, Chandrapur, Maharashtra

The first out of the three reviewed plants was the 8 MW biomass power project of Yash Agro Energy Ltd. which was commissioned on September 15, 2008. Located in Kolari village of Chandrapur district of Maharashtra and spread over 10.6 acres, the power plant operates using rice husk as main fuel and sawdust as subsidiary fuel. The power plant has a capacity of 8 MW with a generation capacity of about 63.36 million units annually. For the financial year 2009-10, the total generation was 60.86 million units and 52.72 million

units was evacuated by state grid to Reliance Energy Trading Ltd. (RETL); from which the income was accrued at ₹6.67/kWh.

About 195 tons of rice husk rice husk is required per day to generate electricity in this plant. The rice husk price varies from ₹2,250 to ₹2,450 per ton depending on the type, wetness and season and it also includes paddy husk, saw mill, piece wood, etc. Generally around 10-12 traders are in the operation for supply of rice husk throughout the year. However there are several problems that need to be tackled - such as procurement of biomass feedstock at a higher price by brick kiln owners and other process industries. Moreover, the moisture content increases during the monsoon season due to lack of proper and safe covered storage at the rice mills. There are also problems faced during operation such as grid disturbances to export the generated power with the following reasons, problems of ash disposal etc. The good thing however is the fact that the company is getting themselves registered with Voluntary Carbon Standards (VCS) Association.

The plant under review employs about 107 people on continuous basis for plant operation and maintenance. They also employ about 100 people in their rice husk logistics and collection activity. Further about 100 people in the villages find employment in loading/unloading rice husk and thus the enterprise such as this one helps provide employment/income especially in rural set ups.

The review team found out that the power plant with capacity of 8 MW was functioning with excellent PLF (around 86%) and had sold about 52.72 million units of power in 2009. The team also appreciated the online monitoring of the performance of the plant as a good monitoring tool.

10 MW biomass power project of Varam Bioenergy (P) Ltd., District Bhandara, Maharashtra

The second out of the three reviewed plants was the 10 MW biomass power project of Varam Bioenergy (P) Ltd. Located in Bhandara Tal district of Maharashtra, the plant



A team of specialists headed by Dr J R Meshram reviewing one of the Biomass plants in Maharashtra.

is being run on rice husk as main fuel, soybean, bagasse pith, saw dust, fuelwood as subsidiary fuel and is spread over 12 acres. The power plant has a capacity of 10 MW with a generation capacity of about 80.00 million units annually of which 21 million units were evacuated (by Maharashtra State Electricity Board) and the rest 10% of the total consumed in auxiliary power requirement within the plant.

About 300 tons of biomass which includes mainly paddy husk and waste wood, saw dust, wheat husk, soybean husk etc is required per day to generate electricity in this plant. The biomass price varies from ₹2,400 to ₹2,800 per ton depending on the type, wetness and season. In 2009, the biomass used included rice husk (23,290 tons) soybean husks (1,290 tons), bagasse pith (2,403 tons), wheat husk (84 tons) and others such as saw mill waste piece wood from plantation, etc. contributed to 6,576 tons.

The problems faced by the plant during fuel collection in this plant were quite the same as in the first plant (discussed above). In this case also, the brick kiln owners and process industries were involved in raising price of biomass by offering higher price. Moreover, there were also issues related to risks of fire due to storage in open yard. The review also threw light on problems faced by the plant during operation which included a fire accident in the plant in the month of April in 2009, wherein huge quantity of fuel got burnt in the accident. The percentage of auxiliary consumption was also found to be on the higher side.

On the other hand, the plant management has reported that the biomass power project has been registered as a CDM project with UNFCCC and accordingly data is being collected for getting verification certificate from UNFCCC through a listed advisory service agency.

The plant currently employs more than 100 people on continuous basis for plant operation and maintenance. Further about 25 people in the villages find employment in sourcing the feedstock. Initially the project was given under EPC contract basis. However, the labourers who were engaged by the contractor during construction has been taken as casual labour after the commencement of project commercial operation and few of them have even been trained and placed as operators. The promoters have also worked towards spreading awareness among

the farmers about the project objectives which has resulted in collecting waste wood from the agricultural fields. This waste wood is being chipped through wood chipper and mixed with other biomass fuels. Therefore in more than one way, the project has generated means of livelihood and contributed towards upliftment of the economic conditions of the villagers.

10 MW biomass power project of Shalivahana Green Energy Limited (SGEL) Power Plant Ltd., Chanaka, Vani District, Maharashtra

The third plant to be reviewed was Shalivahana Green Energy Ltd. (SGEL) located at Chanaka village. The plant that was commissioned on January 17, 2008 is spread over 20 acres and is being run mainly on rice husk supplemented by soybean husk, cotton and red gram stalks, bagasse, firewood, saw dust etc. The power plant has a capacity of 10 MW with a generation capacity of about 72 million units annually of which 63.36 million units was evacuated (by Maharashtra Electricity Board) and the balance was consumed in auxiliary power requirement within the plant.

About 310 tons of agricultural waste comprising mainly rice husk and soybean husk, cotton and red gram stalks, bamboo dust, saw dust and bagasse, fire wood is required per day to generate electricity. The total biomass required per year is about 92,468 tons. The problem faced by the plant during fuel collection was quite in sync with the other two case studies discussed above. However, in this case evacuation problem was faced by the power plant due to voltage fluctuations during the timings of the load shedding. The report submitted by the expert team also said that the plant management has reported of their biomass power project to have been registered as a CDM project with UNFCCC.

The plant currently employs about 120 people on continuous basis for plant operation and maintenance. Further, about 400 people in the nearby villages find employment in sourcing biomass.

*Courtesy: Dr JR Meshram, Director, Biomass and Cogeneration, Ministry of New and Renewable Energy
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Snapshot of Renewables Global Status Report 2009

The recently launched Renewables Global Status Report 2009 provides an integrated picture of the global renewable energy situation. Although the future is unclear, there is much in the report for optimism. Indeed, the modern renewable energy industry has been hailed by most analysts as a “guaranteed growth” sector, and even “crisis-proof,” due to the global trends and drivers underlying its formidable expansion during the past decade. Policymakers have reacted to rising concerns about climate change and energy security by creating more favorable policy and economic frameworks, while capital markets have provided ample finance for development and deployment. The recent growth of the sector has surpassed all predictions, even those made by the industry itself. However, the political pledge made in 2002 at the World Summit on Sustainable Development (WSSD) to substantially increase the share of renewables in the global energy mix is still a far fetched dream.

The report has categorically highlighted the existing scenario of all the renewables, one among them is biomass. The report says that the biomass power generation (and cogeneration) continued to increase at both large and small scales, with an estimated 2 GW of power capacity added in 2008, bringing existing biomass power capacity to about 52 GW. The biomass power generation has continued to grow in several European Union (EU) countries during 2007-08, including Finland, France, Germany, Italy, Poland, Sweden, and the United Kingdom. China has found a special mention for increasing its power generation from industrial-scale biogas (i.e., at livestock farms) and from agricultural residues, mainly straw. The sugar industries in many developing countries have also continued to bring new bagasse power plants online, including leaders Brazil and the Philippines, and others such as Argentina, Columbia, India, Mexico, Nicaragua, Thailand, and Uruguay.

The report also says that the biodiesel growth rates have been even more dramatic than ethanol, although absolute production is still much less than ethanol. Biodiesel production increased six fold from 2 billion liters in 2004 to at least 12 billion liters in 2008. The EU is responsible for about two-thirds of world biodiesel

production, with Germany, France, Italy, and Spain being the top EU producers. The report mentions that by the end of 2008, EU biodiesel production capacity reached 16 billion liters per year. Outside of Europe, top biodiesel producers include the United States, Argentina, Brazil, and Thailand.

Putting emphasis on the industry trends, the report says that the ethanol and biodiesel industries expanded in North America and Latin America, and to a lesser extent in Europe. During 2008, 31 new ethanol refineries were commissioned in the United States, bringing total production capacity to 40 billion liters per year, with additional capacity of 8 billion liters per year under construction. There were also about 1,900 E85 ethanol refueling stations in the United States, mostly in the Midwest. In Brazil, the biofuels industry expanded dramatically during 2007-08, with over 400 ethanol mills and 60 biodiesel mills operating by the end of 2008. About 15 percent of Brazil's ethanol production was exported in 2008. Argentina became a major biodiesel producer in 2008, with 18 commercial plants in operation, all producing for export; another 16 plants were expected during 2009 to bring capacity to 1.8 billion liters per year. In Europe, more than 200 biodiesel production facilities were operating, and additional ethanol production capacity of over 3 billion liters per year was under construction.

Throwing light on the Biofuels Policies, the report has pointed out that compared to the frenzy of new biofuels policies, tax exemptions, and targets enacted in 2006-07, the year 2008 was relatively quiet for biofuels policy however a number of countries adjusted price regulation, modified tax incentives, or adjusted targets, and national biofuels targets and blending mandates continued to evolve. The report specifically talks of approval of a new target of 20 percent biofuels blending in both gasoline and diesel over 10 years, along with tax incentives for growers of biofuels crops in India. The report says that the initial mandate was for E5 blending in 2008 but ethanol supply issues may have delayed that mandate. Countries with new biofuels targets identified in 2008 in the report include Australia (350 million liters by 2010),

Indonesia (3 percent by 2015 and 5 percent by 2015), Japan (500 million liters by 2012), Madagascar (5 percent by 2020), and Vietnam (300 million liters by 2020). Several blending mandates were enacted or modified in 2008, including in Brazil, India, Jamaica, Korea, and Thailand.

The report said that rural electrification policies and programs using renewable energy continued to emerge and progress across globe. It has particularly mentioned

about India's Remote Village Electrification Program that has continued to achieve steady progress. The report said, by early 2009, a cumulative total of 4,250 villages and 1,160 hamlets had been electrified using renewable and the fact that India recently proposed to augment cooking, lighting, and motive power with renewables in 600,000 villages by 2032, starting with 10,000 remote unelectrified villages by 2012.

Courtesy: WII Editorial team

Major Events

XXIII IUFRO World Congress

August 23-28, 2010

Seoul, Korea

The Congress title for the XXIII IUFRO World Congress, "Forests for the Future: Sustaining and the Environment," will explore many themes including Forests and Climate Change, Biodiversity Conservation and Sustainable Use of Forest Resource, Forest Environmental Services, Asia's Forests for the Future and Forest Products and Production Processes for a Greener Future.

Forest Bioenergy 2010 Conference

August 31– September 4, 2010

Tampere and Jämsä, Finland

The conference aims at providing updated and concrete knowledge about the forest bioenergy fuel supply chains and about the modern biomass-based power, heating and CHP plants and technologies from farm scale up to the world's biggest construction.

Biogaz Europe 2010

September 29-30, 2010

Region Rhône-Alpes

Lyon, France

The conference will assemble key international, national and regional stakeholders to debate the opportunities and challenges for the French biogas sector with a particular focus on determining how to move the market forward towards wider implementation.

European Bioenergy Expo & Conference 2010

October 6-7, 2010

Warwickshire, UK

With over 150 Exhibitors in 2009 EBEC 2010 promises to be the largest Bioenergy event in the UK, covering biodiesel, biomass, biogas and fuel from waste exhibitors. In partnership with the REA the conference will cover all aspects of the growing Bioenergy market in the UK.

3rd Algae World Asia 2010

October 19-20, 2010

Singapore

Algae World is recognized as an important platform for productive exchanges among the academic, commercial and investment communities and this year the conference focuses on the entire algae production chain and the commercial viability of its multiple co-products.

DIREC 2010

October 27-29, 2010

Greater Noida, National Capital Territory of Delhi

The Delhi International Renewable Energy Conference (DIREC) 2010, organized by MNRE will bring together the world's leaders in the field of renewable energy from governments, civil society, and private sector and provide an interactive forum for them to discuss and exchange their visions, experience, and solutions for accelerating the global scale up of renewable energy.

Biomass – Fast Track to Clean & Green Power

Although the Indian government is taking urgent action to accelerate its power production, power demand continues to grow at an exponential rate. India's past reliance on coal based thermal power is also a serious environment concern with the increasing global awareness about global warming so the Government is actively encouraging green power and one of them with immense potential is Biomass..

Biomass potential

The most widely available and also the most wasted energy source are a wide variety of agricultural wastes. While some of it is used for cattle fodder, huge amounts of paddy straw, cane trash and other farm wastes are simply burnt in the fields unlike wheat straw that is completely utilised as fodder. After China, India is the world's largest producer of paddy. India now produces 98 million tonnes of paddy with roughly 130 million tonnes of straw of which only about half is used for fodder. India also produces about 350,000 tonnes of cane that yields about 50 million tonnes of cane trash that is also an excellent biomass fuel. Other agro wastes are maize, cotton, millets, pulse, sunflower and other stalks, bull rushes (sirkanda), groundnut shells, coconut trash, etc., all make good biofuels. The farmers with time constraints to their crop cycles have to burn huge quantities of biomass that contributes to great haze and global warming.

It has been estimated that if all these agro wastes were collected and used for power generation, it could

potentially generate over 50,000 MW of power while simultaneously giving very valuable extra income to farmers. About 120,000 tonnes of paddy straw that each 12 MW plant typically needs, if collected from roughly 15,000 farmers who stand to earn an incremental income of about ₹500 an acre. And therefore or for an average Punjab farmer with about 5 acres, his income can go upto ₹2,500. Recognizing the huge potential of biomass the Indian government has enacted several new initiatives to accelerate biomass power production offering higher tariffs than for thermal projects. As biomass projects are also carbon neutral they are eligible to earning valuable carbon credits.

Another big advantage of biomass power projects is that they are relatively small, in the 10 – 25 MW range, and have to be located in widely scattered rural areas. Thus the power they generate can be fully consumed in nearby areas resulting in much lower transmission losses. With modest investments of ₹50 – 100 Crores, a number of biomass power plants therefore can be set up in as little as 12 months from first brick to first unit of generated power.

Fuel collection is however a serious issue and a fleet of 100 tractor towed balers costing nearly ₹7 Crores are needed to collect the broken straw dropped by the combine harvesters in a short period of 6 – 8 weeks between the Kharif (paddy) harvest and the Rabi (wheat) sowing.



Farm wastes that were earlier burnt, now have become a source of income for the farmers



Each plant requires about 120,000 tonnes of biomass per year (Roughly 350 tonnes per day). Therefore the collected straw has to be stored in a number of stockyards rented from farmers within the 15km radius of the plants. Each fuel centre has a weighbridge and fire management systems. A fleet of 30 tractors and trailers are also needed to transport about 100 loads of straw daily from the fuel depots to the plants which however increase the fuel costs but they are still quite attractive as viable sources of green energy.

Bermaco Group biomass power projects

Bermaco Energy Systems has been in the power sector for over three decades as a supplier of boilers and other power plant equipment. In the biomass area, it had earlier leased an existing 10 MW biomass plant in Punjab for several years. Although the old plant had several technological deficiencies, still it proved the viability of a project based on paddy straw.

Bermaco Group and Gammon Infrastructure Projects Limited, has just completed a 12 MW plant (an joint venture on equal sharing basis) near Ghanaur village in the Patiala district of Punjab. The financial closure was facilitated by the Power Finance Corporation. This project mainly uses paddy straw (not paddy husk that is already widely used as an expensive commercial fuel).

The furnace and boiler has had to be especially modified to be able to generate steam at the high temperatures necessary for making the plant more energy efficient. The feeding of fuel is done by a long belt conveyor after a set of small machines cut open the bales and shred the straw into small pieces to ensure uniform combustion. The turbine is conventional as also the water treatment, evacuation and other plant elements. An electrostatic precipitator ensures minimal atmospheric pollution.

Bermaco Group has also initiated several projects in developing green fuel with fast growing varieties of trees and high yielding bamboos to create energy farms that can augment biomass sources.

Although there will be some emissions from the burning process itself, the project will earn substantial carbon credits as the complete carbon cycle is calculated from the oxygen generated by the rice, or other plants, while it is growing until it is finally burned.

This will be the first of nine similar projects in Punjab. Bermaco–Gammon Consortium plans to also set up six similar projects in the Haryana. The Bermaco Group also plans to set up 26 similar projects in Bihar to be followed by a number of projects in other states in a number of joint ventures with Power Trading Corporation, IL&FS and other corporate entities.

Thermal power from coal, gas and oil currently accounts for about 70 % of India's power generation of nearly 150,000 MW. The rest of power generation is shared between hydro, nuclear, wind and solar.

As compared to these, biomass power plants however have modest capital costs and are much quicker to commission. Their fuel costs are manageable but huge human management effort is needed to collect, store, transport the fuel from farms to the depots and then to the plants. As India has huge agro wastes these medium sized projects certainly look like an answer to quickly augment India's power generating capacity in most rural areas of the country.

Courtesy: Murad Ali Baig, Bermaco Group, Navi Mumbai, Maharashtra, Email: baig.murad@gmail.com

News Snippets on Biomass Power

1

GERC fixes tariff for biomass plants

In a bid to encourage project developers to take up biomass-based power generation in the state, Gujarat Electricity Commission (GERC) has finalized tariff at which power distribution companies will have to procure electricity generated from biomass power plants.

In its recently issued order, the state power regulator has decided to fix tariff for biomass-based power project at ₹4.40 per unit for the first 10 years of supply and ₹4.75 per unit

for the period from 11th year to 20th year.

"The newly fixed tariff will be applicable to biomass-based power projects to be commissioned before March 31, 2013," sources in GERC said.

Earlier in a discussion paper on determination of tariff for power generated from biomass-based power projects, the commission had proposed a tariff of ₹4.25 per unit for the initial ten years starting from the

date of commercial operation of the project and ₹4.50 per unit from the eleventh year to twentieth year.

However, it has fixed higher tariff in its order after hearing various stakeholders, so that more and more project developers could be encouraged to start their plants in the state.

Source: <http://www.business-standard.com/india/news/gerc-fixes-tariff-for-biomass-plants/395339/>

2

Contract farming of Jatropha in Tamil Nadu

Allied Carbon Solutions of Japan, a biofuel company with a multinational presence, has launched



a contract farming programme for Jatropha cultivation in South India.

The company's Indian subsidiary, ACS Alternative Fuels Pvt Ltd will set up a Jatropha oil mill in Aruppukottai, Tamil Nadu, with a capacity to produce about 10 tonnes of crude Jatropha oil daily. That is about 40 tonnes of seed to be crushed daily, according to its India representative, and Chief Project Manager, Mr S.A. Alagarsamy.

The company plans to export the

biofuel to the US and Japan for which it has ready orders on hand, he said.

ACS Alternative Fuels will source Jatropha seeds from farmers through contract farming of Jatropha in Tamil Nadu and Andhra Pradesh. In Tamil Nadu where it has first launched the project, it hopes to bring under contract farming about 10,000 acres.

Source: <http://www.thehindubusinessline.com/2010/04/26/stories/2010042650451500.htm>

3

Biomass could provide electricity for 30 million rural residents of China

The People's Republic of China (PRC) needs US \$60 billion over the next decade to harness its biomass energy potential in rural areas.

If livestock manure and crop stalks were converted into clean fuel, it could provide electricity to 30 million rural people in the PRC who are still

dependent on kerosene lamps for lighting, and to millions who rely on firewood and other agricultural wastes to heat their homes and cook their meals.

"Biomass energy is a sensible renewable energy option for rural areas and it can be cost-effective at

community and industrial scales if governments support and effectively guide its development," explains Klaus Gerhaeusser of ADB.

Source: <http://biofuelsdigest.com/bdigest/2010/06/21/biodiesel-facility-ready-to-open-in-andhra-pradesh/>

4

Southern Online to open 75K tonne biodiesel project in India

In India, biodiesel producer Southern Online Biotechnologies is getting ready to fire up its newest facility in Andhra Pradesh. The facility will produce 75,000 metric tonnes of biodiesel annually, in addition to its

current 10,000 tonnes facility—also in Andhra Pradesh—that is currently running at 90 percent capacity. The Jatropha-based biodiesel is supplied primarily to the domestic market but the company is looking to divert more

supply to exports, with deals already done with Europe and Australia.

Source: <http://biofuelsdigest.com/bdigest/2010/06/21/biodiesel-facility-ready-to-open-in-andhra-pradesh/>

Delhi International Renewable Energy Conference 2010

27–29 October 2010 • Expo Centre and Mart, Greater Noida (National Capital Region of Delhi, India)

Upscaling and Mainstreaming Renewable Energy for Energy Security, Climate Change and Economic Development



India shall be hosting Ministerial-level Global Conference on Renewable Energy titled: “Delhi International Renewable Energy Conference (DIREC)” on 27-29 October, 2010 at New Delhi/NCR. The conference is a part of an initiative taken at the 2002 World Summit on Sustainable Development in Johannesburg, acknowledging the significance of renewable energies for sustainable development especially for combating poverty and for environmental and climate protection.

The Delhi conference is the fourth in the series, following events at Washington in 2008, Beijing in 2005 and Bonn in 2004 and is expected to be the premier all-Renewables gathering in India ever, with an attendance of over 9,000 delegates, over 250 industry leading speakers, experts, academicians, Government leaders, financial institutions and around 500 exhibitors from all over the world, which will make it the largest event of its kind.

DIREC 2010 aims to showcase India as an investment destination for renewable energy; to provide a platform for technology displays, new applications and innovations; to display global research & development with respect to climate change and green environment; to demonstrate the

sectoral strength of the global renewable energy industry; and to facilitate: (i) buyers and sellers matching (ii) one to one meetings for setting up of joint ventures in the renewable energy sector and (iii) to provide an opportunity to Indian renewables manufacturers to benchmark their products against the best in the world and enhance their competitiveness. The Conference will ultimately lead to renewed commitment, with concrete proposals in support of activities at the country level.

The DIREC 2010 will build on the success of the previous conferences and have as its main theme “Upscaling and Mainstreaming Renewables for Energy Security, Climate Change and Economic Development”. REN21- the Renewable Energy Policy Network will be a key partner in the DIREC 2010. Cabinet-level government functionaries from a number of countries will join civil society partners and private sector leaders to discuss the opportunities and challenges of a global, rapid deployment of renewable energy. The conference will bring together ministers, high-level decision makers and policy level thinkers from a number of participating countries. DIREC 2010 offers industry leaders the ability to share their insights, strategies, technologies, new products and staff capabilities with their audiences.

For further details, visit

www.direc2010.gov.in

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