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CANE COGEN INDIA

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Overview of Biomass Gasifier Dissemination Activity in India

Please fill in and send us the feedback form enclosed. Sugar mills are requested to also fill in their technical details. Thank you.

Introduction

The National Action Plan on climate change has been launched in the recent past. Under this plan, large scale utilization of solar energy is being envisaged, though a few ifs and buts still remain. The moot question is whether biomass energy, with a huge potential to meet decentralized energy needs, also needs a berth in the above scheme of things planned at the highest level. After all, it has the potential to ensure the much needed energy security apart from the well recognized merit of being affordable at the village level too. Biomass conversion technologies are one of the best suited for conversion to shaft power/electricity. According to some conservative estimates there is a potential for 17000 MW of power generation in India. This is apart from various other indigenous uses of biomass in the rural areas. The other advantages are its cheap year-round availability and easy transportation and storage, bereft of any serious environmental concerns.

A unique advantage of taking wholesome recourse to it is that it does not come in the way of the food production route as per the views echoed recently at a Workshop. This well attended workshop had been recently organized by MS Swaminathan Research Foundation, a well known organization based in Chennai. Following points of importance emerged during such deliberations:

- around 620 million tonnes of biomass reserve was available in the country during 2004-2005
- total biomass reserve is expected to be a little more than 700 million tonnes during 2010-2011 with the possibility of 1127 million tonnes in 2024-2025
- the existing cattle population stands at around 272 million as against a poultry population of nearly 374 million

With such biomass feedstock availability at our disposal, it could well be utilized to meet the growing needs of electricity in the following few areas:

- baking tiles
- silk reeling
- dyeing
- cooking
- drying in the rubber industry etc.

As per the experts, small plants in the capacity range of 10 kW-1MW may well be feasible to meet the electrification needs of a large number of villages. It may also help to provide power for running the small and medium scale industry there.

The Apex Level Support

The Ministry of New and Renewable Energy (MNRE) has been promoting the following few programmes in the area of biomass energy:

- biomass combustion based power generation
- bagasse cogeneration in sugar mills
- biomass co-generation (non-bagasse) in industries
- biomass gasifier in industries and rural areas

Consequent upon which, sizeable progress has been made with regard to development of small scale biomass

CONTENTS

gasification. Biomass gasifiers in the capacity range of 1 kW to 1 MW have been successfully developed in the country. A large number of small scale industries and villages have benefited from the biomass power availability so far. The biomass gasifier programme has been reoriented with a twin objective of attaining better quality and favourable economics. Biomass based power generation systems, linked to plantations on wastelands, simultaneously address the vital issues of wastelands development, environmental restoration, rural employment generation and power generation. It can be highly effective for decentralized generation of power with no distribution losses. Biomass production can be combined with production of other useful products, thus making it an attractive byproduct. Following is the state-wise mention of key biomass project activities.

Haryana

The government of Haryana has already notified a Renewable Energy (RE) power policy with a core objective of seeking private investment in generation of power from RE sources like biomass, wind and solar. A very good attribute of this policy is that RE based power projects have been accorded industry status under the new industrial policy 2005. That is not all, as a few more incentives are in place too. The tariffs declared by the Haryana Electricity Regulatory Commission (HERC) for these projects are the highest, more so for biomass power projects at Rs. 4 per unit and bagasse cogeneration at Rs. 3.74 per unit. As per the available reports, nearly 20 biomass based projects with an aggregated capacity of around 183 MW are scheduled to come up at Panipat, Karnal, Hissar, Fatehabad, Bhiwani and Sirsa. These projects are expected to catalyse investments of more than Rs. 7800 million at an average cost of Rs. 40-50 million, for setting up a megawatt capacity power plant. A biomass cogeneration power project of 2 MW capacity has just been commissioned in Yamunanagar district of Haryana.

Gujarat

The Gujarat Energy Development Agency (GEDA) has already approved an ambitious plan to set up biomass operated power plants with an aggregated capacity of 317 MW in about 25 districts of the state. It is expected to come through with active participation of private entrepreneurs. As is obvious, the proposed plants will be of varying capacities and will be set up by different private groups. The intention is to do away with any conflicting procurements of basic raw material.

The very first of such power plants is scheduled to come up by May 2010 in Amreli district of Gujarat State and will use around 300 tonnes of biomass per day in terms of fuel cotton stalks, sesame stalks and groundnut shells. To realize this objective, around 5.5 acres of land have been earmarked. Biomass based power generation has picked up really well in the states of Andhra Pradesh, Maharashtra and Karnataka. Nearly 46 projects using biomass as a fuel have been approved for implementation in Andhra Pradesh followed up by about 10-15 such projects in Karnataka.

Bihar

It offers an ideal setting for generating biomass power, being predominantly an agriculture based state. As per available reports, a good number of investors are lining up to set up biomass power plants in Bihar. These mainly include the Bermaco Green Energy System, Germany, and Gammon Infrastructure Ltd., which have planned to set up around 25 Joint Venture (JV) projects of 12 MW capacity each. The foreign based private enterprises are willing to source the best possible technology for this purpose. For example, the Gurgaon based Emergent Ventures India Pvt Ltd has received the approval from the State Investment Promotion Board (SIPB) to set up a 12MW biomass power plant in Konch in Gaya district. Likewise, the Astonfield Renewable Energy Resources Pvt Ltd, Kolkata, has been accorded the desired

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approval (in principle) for setting up 10 power plants of 10 MW capacity each in 10 districts of the state. Few other projects which have been approved recently include a 1 MW capacity biomass plant in Buxar industrial area.

West Bengal

A total capacity of around 55.105 MW has been installed so far mainly to cater to stand-alone applications. In fact, a 5x100 kW biomass gasifier installation on Gosaba island in the Sunderbans area of the state has been widely talked about. It is a successful commercial demonstration benefiting the island people, who are getting electricity via a local grid.

Karnataka

It is rated as one of the most potential states for tapping the biomass/cogeneration power on a large scale. Table-1 shows the number of grid interactive power projects allotted by the concerned goverment agency as against the projects actually commissioned so far:

Quite clearly, a huge potential is still waiting to be realized and efforts are underway to expand the utilization of biomass power for a variety of end use applications.

Miscellaneous Projects

Shriram EPC through its project implementation arm, i.e. Oriental Green Power, is embarking on a massive plan to invest Rs. 10-11 billion in setting up eight biomass based power plants at different locations in the states of Tamil Nadu, Andhra Pradesh, Maharashtra, Rajasthan and Punjab, within the next few years or so. The cumulative objective envisages a biomass power capacity creation of more than 200 MW thereafter. Similarly, the BEST Undertaking is planning to establish two biomass based power generating plants of 25 MW capacity each on a cost sharing basis with Green Energy Limited. In addition, 5 projects with a cumulative installed capacity of 300 MW are being proposed in the state of Punjab. The year end may well witness the commissioning of a total capacity of 68 MW. A biomass plant of 140 MW, under development by Green Planet Energy Limited, is currently taking shape with a few more such plants of varying capacities expected to be developed at locations like Hoshiarpur, Faridkot and Jalandhar etc. Finally, Turbo Atom TPS Projects Pvt. Ltd. is setting up three projects each with installed capacity of 40MW at Patti, Malerkotla and Ferozepur, bringing the tally for the Punjab region up to over 300 MW.

Case Study: Biomass Gasifier System of 250 kWe capacity in Karnataka

Karnataka Renewable Energy Development is the state nodal agency responsible for RE based programme promotion in tune with the policy directives issued from time to time. It encouraged the setting up of a 250 kWe biomass gasifier system with a 100% producer gas engine for use at Adichuchanagiri Institute of Medical Sciences located in Mandya district of the state. It has a continuous duty rating of 205 kWe while utilizing producer gas derived from the woody biomass. This plant is a novel case of effective technology demonstration cum utilization. In this case, biomass, in the form of wood, is fed to the gasifier unit at regular intervals. The equipment design enables it to take air in controlled quantities. The outcome is a partial oxidation of biomass into producer gas. Thus one kg of biomass gets converted into 2.5-3 Nm^3 of gas with a calorific value of 1000-1300 Kcal per Nm^3. It has the following measured composition as:

- Carbon monoxide 15-20%
- Carbon di-oxide 5-8%
- Methane 1-4%
- Nitrogen 45-55%

The useful yield from the gasifier i.e. the gas ejects at a temperature ranging between (200-250^{0}C). It is not clean and contains particulates and volatiles, which need to be cooled and cleaned prior to being fed to the generators. The cooling and cleaning system is made of scrubbers and associated accessories. The cold clean gas thus produced is fed to the engine along with air.

Economic Estimates

The woody biomass is found in large quantities within the surrounding area. Table 2 shows the economic estimates relevant to the study as under:

Table 1: Grid Interactive Projects Allotted

Sector	Available Potential (MW)	Projects allotted by the Government		Projects actually commissioned	
		Nos.	MW	Nos.	MW
Biomass	650	65	478.20	11	81
Cogeneration	1000	51	977.10	21	432.80

Table 2: Economic Estimates of Wood Based Gasifier System

Item	Description
Cost per tonne of woody biomass	Rs. 800
Cost of Gasifier unit	Rs. 69.52 lakh
Subsidy amount from MNRE	Rs. 37.5 lakh
Loan component	70%
Equity	30%
Hours of operation of gasifier	24
Per unit cost of generation (till the loan is repaid)	Rs. 2.46
Per unit cost of generation (after loan is paid back)	Rs. 1.92
Per unit cost of generation (with beneficiaries own investment) (taking 5% escalation in the fuel cost)	Rs. 2.68 (Ist year) Rs. 2.80 (2nd year) Rs. 2.92 (3rd year)
Tariff for power in case of educational institutions (in Karnataka)	Rs. 4.60 per unit
Miscellaneous information	
Biomass gasifier make	M/s Ankur Scientific Technologies
Total quantity of biomass consumed per day to generate about 3800 units of electricity	5300 kg
Biomass needed per unit of electricity generation	1.4 kg
Major end-uses	Energy needs being met in the hospital and hostels
Type of biomass used in the gasifier	Eucalyptus, Neem, Sababul, Pongamia, Fronds etc.
Number of labourers employed	Around 20 (direct) Around 100 (indirect) for collection and transportation of biomass

Source: KREDA

National Level Projects Commissioned

Table 3: State-wise/Year-wise List of Projects Commissioned in Biomass Power/Cogeneration (as on 30.11.2008) in MW

S.No.	State	Up to 31.03.2003	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	Total (MW)
1	Andhra Pradesh	160.05	37.70	69.50	12.00	22.00	33.00	9.00	334.25
2	Chhattisgarh	11.00	—	—	16.50	85.80	33.50	9.88	156.10
3	Gujarat	0.50	—	—	—	—	—	—	0.50
4	Haryana	4.00	—	2.00	—	—	—	—	6.00
5	Karnataka	109.38	26.00	16.60	72.50	29.80	8.00	12.00	274.28
6	Madhya Pradesh	0.00	1.00	—	—	—	—	—	1.00
7	Maharashtra	24.50	—	11.50	—	40.00	38.50	41.50	155.50
8	Punjab	22.00	—	—	6.00	—	—	—	28.00
9	Rajasthan	0.00	7.80	—	7.50	8.00	—	8.00	31.30
10	Tamil Nadu	106.00	44.50	22.50	—	42.50	75.00	18.20	308.70
11	Uttar Pradesh	46.50	12.50	14.00	48.50	—	79.00	172.00	372.50
	Total	381.30	129.50	136.10	163.00	228.10	266.00	270.50	1677.13

Source: MNRE

Table 4: Programme-wise Detail of Total Installed Capacity (as on 30.9.2008)

S.No.	Programme	Installed capacity (in MW)
1.	Biomass combustion based power generation	656.60
2.	Bagasse cogeneration in sugar mills	993.83
3.	Biomass gasifiers in industries	28.00
4.	Biomass cogeneration (non-bagasse) in industries	95.00
5.	Biomass gasifiers for rural areas	80.00
	Total capacity	**1781.43**

Small Scale Gasification for Power Generation: A Commercial Overview

Dr P K Balasankari

Mr Arul Joe Mathias

Introduction

Gasification is an old technology widely used during World War II for running vehicles. After World War II, this technology remained dormant for a long period of time. Today, because of increased diesel prices and environmental concerns, there is renewed interest in this technology. Serious R&D efforts were made only during the last ten years achieving some breakthrough. Small scale power generation is the main advantage of gasification technology, whereas steam turbine technology is not viable for capacity of less than 1 MW.

Gasification for power generation is often attractive when compared with diesel based electricity generation, and it is a big boon for very small scale power producers who are not connected to the grid, and depend upon diesel.

Gasification Technology

There are different types of gasifiers available in the market and the selection of the technology mainly depends on the type of fuel used, the equipment supplier's experience and credibility. The technology is used for several applications such as water pumping, thermal usage and power generation.

Although there are several suppliers who claim that their technologies are the best in the market, only very few suppliers have mastered the technology. Today, it remains a great challenge for the buyers to identify the right suppliers who have really mastered the technology. Though several electricity generation plants are in operation in Asia, not all projects are successful.

Gasifier Fuel

Gasification can be done with most of the biomass including rice husk, coconut shell, coconut husk, rice straw, sugarcane bagasse, sugarcane trash etc. Although most of these can be used, their form of usage varies with the manufacturers. For example, in the case of rice husk, some manufacturers produce gasifiers in which the rice husk can be directly used. For others the rice husk needs to be briquetted. Gasification plant with dual fuel engine (Biomass + Diesel) is also another option.

Plant Life

The life of the gasifier plant depends, to a large extent, on its operation. For a well operated and maintained gasifier, the plant life is around 20 years. However, the engine life is generally 10 years and the engine has to be overhauled after every 5.000 hours of usage.

Engines

Although the market is yet to come up with an engine exclusively designed for gasification, engines designed for natural gas and biogas are being used for gasification purposes. The capacity of the engine produced in India varies and the maximum is 250 kW. For higher capacities these engines are being used in multiple numbers as modules. For example, in a 1 MW gasification power plant, a single gasifier and four engines are used. In China, 500 kW units are newly produced. Though these units are being used in several plants already, they have not been tested for reasonable number of operating hours to validate the performance.

A few engine manufacturers supply gas engines with higher efficiencies even at low load operation, but the price is also high as compared to the other gas engines.

Plant Operation

Gasification plant requires highly trained people who have the passion to operate the gasifier. For a 1 MW gasification plant, for each shift, 2 engineers, 6 skilled labourers and 6 unskilled labourers are required. However, this may vary depending on the fuel, site condition and the manufacturer.

Auxiliary Power Consumption

In general, around 120 kW of power is required to operate a 1 MW gasification power plant i.e. out of a 1 MW gasification power plant, only 880 kW will be available for usage. When the size of the gasifier reduces, the auxiliary power consumption becomes higher. For example in a 500 kW gasifier, 15% (75 kW) is needed to operate the power plant.

Project Implementation Period

One of the main advantages of the gasification power plants is the lowest project implementation period. A 1 MW gasifier

plant can be implemented within 6 months. Very small capacities may often be available off-the-shelf and can be implemented within a period of 2 months.

Project Cost

In the last 10 years, while developed countries were making serious R&D efforts in large scale gasification technologies, India and China made considerable efforts in small scale gasification, especially on investment cost reduction. Today the costs of Indian and Chinese make small scale gasification power plants are less than plants based on steam thermal technology.

Although the investment cost of gasification power plants depends on so many factors such as country, fuel, site conditions, etc., in general, it is possible to implement gasification plants with 1 million USD/MW or even less. However, this cost is subject to change with market conditions.

Present Issues

One of the major problems faced by gasification power plants is the removal of tar. Though considerable success has been reached in tar removal, this area still needs development to achieve 100% success with the technology. Several suppliers are still making R&D efforts to further fine-tune their systems to increase the reliability and availability and thus reduce tar removal problems. Some engine manufacturers are also working on their engines to enable them to handle tar.

Significant R & D efforts are still going on in countries like Europe, USA, India, Japan, and China. In the coming years, this technology is going to be a big boon for industries, which require low power demand, from 100 kW – 1 MW, where steam thermal technology is not feasible. Proven gasification technology with good reliability and availability is ideal for rural electrification.

Gasification Project Development

Gasification project development is more of an art than a science. There are some cases where the buyers pay a very high price for lower quality and sometimes select unqualified equipment suppliers who have no adequate experience and track record. For the successful operation of gasifiers throughout their life time, enough attention should be given for their maintenance. All these aspects are quite tricky for gasification power plants and buyers are strongly recommended to use knowledgeable, qualified, non-biased gasification experts for the project development and implementation.

For certain site conditions, a few days of expert study is enough to conclude whether the site has potential enough to implement the gasification project or not. In some cases, where the investment options are attractive, a feasibility study can be conducted straight away. However, in complex cases for which the feasibility is doubtful, a pre-feasibility study can be conducted.

Biomass Fuel Price

Until the mid nineties, biomass wastes such as rice husk, wood waste, palm shells, EFB etc. were considered as waste in Asia. But today, in several parts of Asia, it is difficult to get these fuels at a reasonable price.

Although, biomass fuel prices are at the high end in several places of South East Asia and India even today, yet in some parts of many South East Asian countries rice husk, wood wastes, EFBs, etc. are either dumped or open-burnt. Rice husk is either burnt in the fields or dumped along the sides of paddy fields or roads. Open burning and dumping of rice husk and wood wastes are very common in several parts of Asia.

Project developers should carefully consider the expected biomass fuel price increase in the future and availability throughout the plant life.

Financial Modelling

A financial model is the most important aspect of a feasibility study to figure out the financial viability of the project and key risks involved. It follows a proven technical feasibility; if the technical study is not done properly, then the financial model is meaningless.

A good financial model should use some practical technical assumptions. For example, it is not practical to use operating hours of gasification power plant as 8,600 hrs. Other aspects are assuming the acceptable level of plant power consumption, efficiencies and fuel consumption, etc.

Costing can be done very carefully (total investment cost and annual operating cost), with due provisions for necessary contingencies; insurance cost can also be considered. Proper exchange rate, discount rate, interest rate and escalation rate can be used wherever applicable.

Finally, the most important aspect of a financial model is the sensitivity analysis. Sensitivity analysis can be done mainly for equipment cost, investment cost, fuel cost, operating

hours, electricity sales revenue, etc. To a certain extent, sensitivity analysis will figure out the key risks, as long as the right technical and financial assumptions are made.

Project Due Diligence

If the credibility and capability of the consultant/supplier, who does the feasibility study is not known, it is better to conduct a project due diligence on technical and financial aspects. From the technical point of view, it is always better to recheck the selected technological option, fuel supply, associated risks, proper matching of gasifier & engine system.

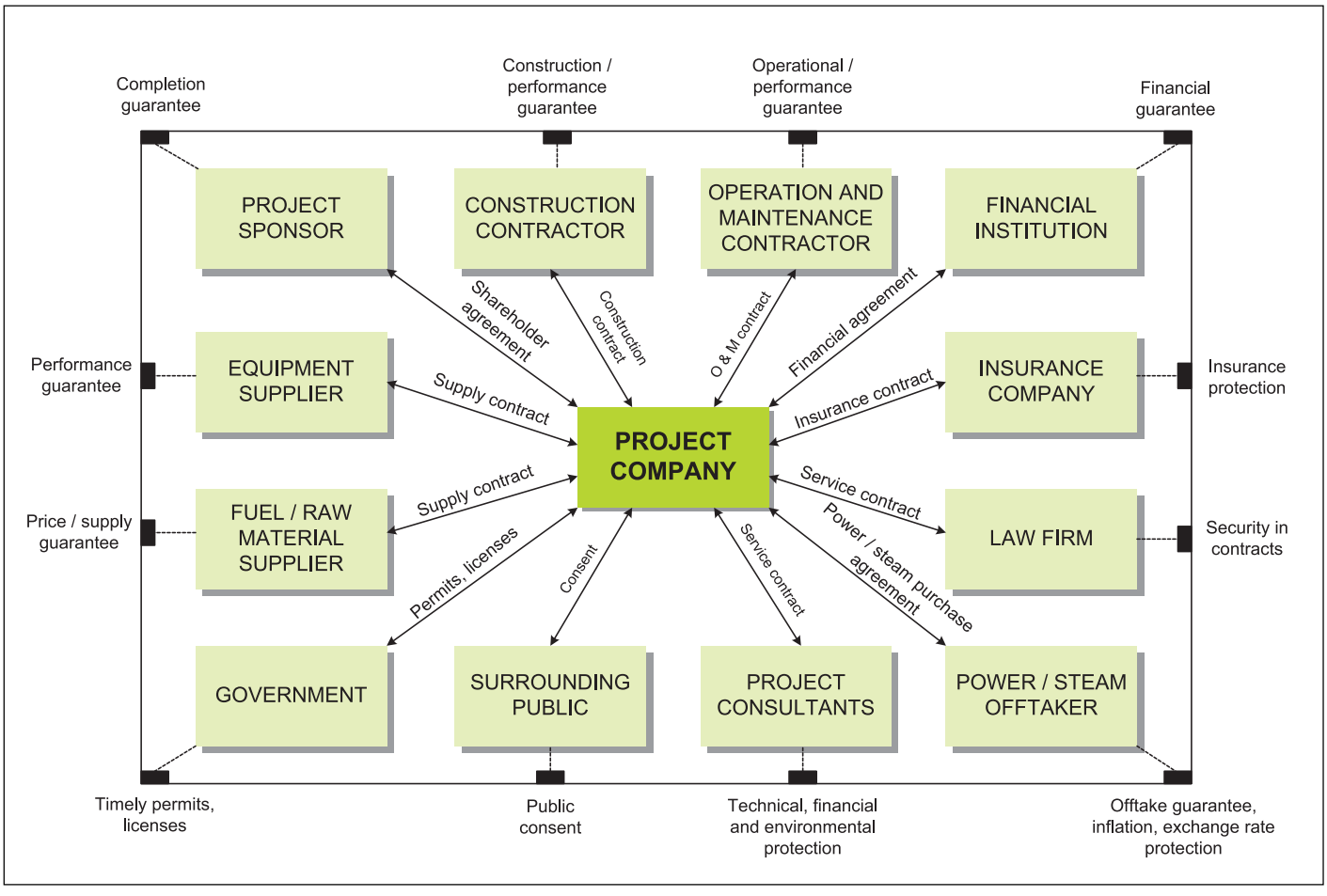
A technical due diligence will give answers to several technical aspects and sometimes results in considerable savings by avoiding costly mistakes. The due diligence can also be used to check whether the equipment or EPC cost is reasonable. The ideal time to conduct due diligence is before signing the equipment supply contract.

Also, a financial due diligence will help to validate all assumptions and calculations. There may be some errors while doing complex calculations in financial models. It is worth spending money on project due diligence to save money.

Potential Revenue from Clean Development Mechanism

For gasification projects of reasonably good size, there is also a good potential to get additional revenue from Clean Development Mechanism (CDM). The revenue stream depends on the electricity generation and usage, previous use of biomass, etc. If the electricity generated from gasification plant replaces diesel generators, then the potential revenue is higher as compared to replacement of grid based electricity.

CER (Certified Emission Reduction) prices were high in the market 6 months ago, touching 23 Euro/CER. Currently, the CER value is very low (around 8 Euro/CER). But the situation is expected to improve, although no one can guarantee that. For some complex situations, when the CDM applicability is in question, Voluntary Emission Reduction (VER) is yet another option.



Security Arrangement for a Project

Large Scale Gasification

Gasification based on large scale power generation has also progressed to the advanced stage of commercialization. Several such plants have been installed in the developed countries. Efforts are being made to reduce the investment cost, which is presently on the higher side.

For the implementation of large scale gasification/biomass power generation/cogeneration, the following security system is recommended.

Risk Assessment

Large scale gasification/power generation/cogeneration also requires thorough risk assessment. Following are some of the important risks to be studied in detail:

- Technology risk
- Operation & Maintenance (O&M)
- Investment cost overrun
- Operating cost overrun
- Fuel supply and competition for the fuel
- Fuel Price
- Interest rate
- Cash flow risk
- Environmental risk
- Management performance

Financing

Though the current financial situation is not very exciting due to the credit crunch, it is only temporary. The situation is likely to improve within a year. There are so many equity funds, investors, banks, financial institutions and venture funds available in the market, looking for good projects to finance.

Investors are mainly looking for credible, trustworthy project owners who are fair with their dealings. They also prefer to join hands where project development is done in a professional way. Some investors also join hands from the early stage itself, bearing the cost of the initial assessment and feasibility study. Equity investors expect a higher rate of return than the lenders.

Normally financing can be obtained from commercial banks, multilateral financing institutions, development financing institutions and export credit agencies. Generally, it is easy to get corporate loans from the banks as against acceptable collateral. Though it is easy, project owners can take extra care to check the projects thoroughly, conducting necessary due diligence, as banks may not give adequate attention. Their risk is already covered by the security given by the company. In project finance scheme, banks normally do a through due diligence.

Contracts/Legal Aspects

Project owners and developers can focus more attention on contracts for equipment supply, fuel supply agreement, electricity sale agreements, etc. for the benefit of the project. We have studied several biomass projects on contractual aspects and have found that not enough attention is being paid.

Insurance

Insurance is one of the most important aspects of biomass power generation to protect the project owner from several risk aspects. Problems can arise at any time during transportation of equipment, construction and operation of the power plant. It is recommended that comprehensive insurance be taken during transportation and construction stages.

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Procedural Requirements for Biomass / Bagasse based Cogeneration Projects

The Indian Renewable Energy Development Agency (IREDA) is the financing arm of the Ministry of New and Renewable Energy (MNRE). It came into being in 1987 and has been offering soft loans to promote a variety of renewable energy products and systems. The following steps/stages are indicated for the purpose of obtaining various clearances/ approvals. These are subsequently needed to avail loans for setting up projects in the fast emerging areas of sugar cogeneration/biomass power.

Steps/Stages for obtaining clearances/ approvals

- Company registration with main objectives clause for doing business of sugar cogeneration/biomass power
- A company has to be incorporated and duly registered and certificate of incorporation obtained. In case of Public Limited Companies, certificate of commencement of business is required
- It has to be ensured that an in-built provision with the main objects to be pursued by a company clause-A of the Memorandum of Association (MOA) to set up project and in Clause-B of MOA, objects incidental to the attainment of main objects, to borrow loan etc.
- Approval/recommendation of State Nodal Agency & State Government
- Independent & detailed biomass/cane/bagasse survey report along with supporting documents and photographs
- Local body/gram panchayat NOC/clearance for setting up the project
- Pollution/environmental clearances by state/central governments for the projects
- Electricity Regulatory Commission clearance/approval for setting up of project and sale of power
- Power purchase agreement
- Grid connection and electrical layout approval
- Alternative fuel linkage agreements
- Sale/lease deed for project land
- Obtaining sanction for water allocation
- Project development agreement/support agreement, in case of bagasse IPP cogeneration
- Approval for building plan as per local laws
- Industrial license requirement as per applicable government notification
- Import license for import of equipment
- Shareholders agreement for equity infusion into the project
- Collaboration agreement for transfer of technology
- Letter of sanction of power by electricity board
- MRTP clearance for fair trade practices
- RBI clearance for foreign equity investment, if any
- Capital goods clearance for import of equipment, if any
- SEBI approval/clearance for public issues, if planned
- Land availability & land conversion certificate in case of agricultural land
- Appointment of geologist for water yield assessment & water availability
- Civil aviation clearance for chimney height as per safety act
- Boiler inspectorate for safety aspects as per statutory laws
- Appointment of agency for soil investigation work & for site contour surveying
- Appointment of project consultants
- Procurement of plant and machinery as per the procedures prescribed by the respective financial institutions/agency

Source: IREDA News

ABB Automating the Bagasse Cogeneration Units in India

India's sugar mills are investing in bagasse cogeneration plants and turning to ABB for complete automation and electrical balance of plant (eBOP) solutions that help generate new revenues and provide reliable carbon-neutral power and process steam at near-zero fuel cost. India, the world's second largest sugar producer, is encouraging its sugar mills to reap the multiple benefits of investing in bagasse-fueled cogeneration plants. ABB is playing a crucial role in supplying the automation systems and electrical balance of plant that help make these benefits possible.

Bagasse is a fibrous residue that remains after the sugarcane has been crushed and the juice extracted. It is a biomass fuel with a carbon-neutral rating because it absorbs CO_2 during growth and eliminates the use of fossil fuels in power generation.

ABB is the world's leading supplier of both distributed control systems (DCS) and electrical balance of plant to the power generation industry, and has received a number of recent orders to equip bagasse cogeneration plants for sugar mills in India.

Source: ABB Communication

Salient features of New Village Electrification Scheme 2009

Introduction

The Ministry of Power (MoP) has just released the Guidelines in respect of village electrification via the Decentralised Distributed Generation (DDG) mode under the ambit of Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY), in the XIth Plan i.e. during 2007-2012. A significant objective of this scheme is to attain the goal of offering electricity access to all the households; electrification of about 1.15 lakh un-electrified villages and electricity connections to a whopping 23.4 million Below the Poverty Line (BPL) households by 2009. The approval has been accorded for the capital subsidy of Rs. 5400 million for DDG during the above plan period. This is included in the capital subsidy of Rs. 280,000 million available for RGGVY in the same period.

Technology Choices

The plain intention is to have as many effective choices for rural electrification as becomes possible from several end-use considerations. Accordingly, the DDG can be from the conventional or renewable energy sources such as Biomass, Bio-fuels, Biogas, Mini-hydro and Solar.

It is pertinent to mention here that these energy sources will be for villages where grid connectivity is either not feasible or not cost effective.

Programme Implementation

This scheme, meant for countrywide outreach, needs a well managed setup with some prior experience in village electrification, which is precisely the reason for having chosen Rural Electrification Corporation (REC). The capital subsidy for the eligible projects under the existing scheme would be routed through REC. As for the ownership of these DDG projects, these would be owned directly by the State government implementation agencies like the State Renewable Energy Development Agencies (SREDA's) or the Departments promoting RE or the state utilities or even the selective few Central Public Sector Units or simply the CPSU's.

Type of Other Activities Planned

Field performance monitoring is an essential part of these DDG projects, for which a nominal 1% of the total outlay has been committed. These activities would basically be in the following form:

- Capacity building
- Awareness generation
- Franchisee development
- Initiation of pilot studies, etc.

Site Identification

It has been planned that the following approach be adopted while selecting the villages for electrification purposes:

- The list of villages/hamlets to be electrified via DDG is to be finalized by the State RE development agency/ departments, in consultation with the state utilities and the Ministry of New and Renewable Energy (MNRE)
- The villages/hamlets will be chosen in a cluster based manner so as to get the maximum possible advantage
- The closeness of villages/hamlets would be a key parameter in deciding between the choice of a central power plant or individual based plants

Biomass Technologies Recommended

As mentioned above, the DDG projects may make use of either conventional or renewable forms of energy. However, specific technology may be more suited to a particular set of villages/hamlets in comparison to the others. Preference will be given to the following few options, which have either reached a stage of commercial maturity or their technical viability is well proven under the actual field operating conditions:

- Diesel generating sets powered by Producer gas generated via Biomass Gasification (100% producer gas engines)
- Diesel Generating sets powered by biofuels (non-edible vegetable oils like Jatropha, Pongamia etc)

However, a dedicated energy plantation is a pre-requisite to ensure a sustainable biomass supply.

Conclusions

This newly framed scheme is expected to give a good boost to an increasing deployment of the biomass gasifier systems. These systems have a very low initial capital cost and therefore low cost of power generation too. It may also help to overcome an increasing gap (to an extent possible) between the potential of Biomass energy and its actual realization. This may also lead to a better quality of rural life.

Source:Abridged version of the Policy released by MoP

The Growing Opportunities in Bagasse Cogeneration

Renewable Energy (RE) technologies are currently finding an increasing acceptance for a variety of end-use considerations. The Ministry of New and Renewable Energy (MNRE) has been implementing a nation wide programme on biomass power/cogeneration programme for more than 15 years. So far, a total of 203 biomass power and cogeneration projects aggregating around 1677 MW capacity, have been put up across the country. This is with a purpose of supplying power to the grid. Presently, around 171 biomass power and cogeneration projects, with a cumulative capacity of 1850 MW of electricity, are under different stages of implementation. Cogeneration projects in sugar mills include 82 projects with a total installed capacity of 690 MW. That is not all, as around 107 projects with a cumulative capacity of 1280 MW are being implemented now.

These projects are spread across different geographical regions in the country. However, the frontline states in the area of cogeneration projects specific to sugar mills include the following few:

- Uttar Pradesh
- Tamil Nadu
- Karnataka
- Andhra Pradesh

In traditional terms, the Indian sugar industry has been adopting cogeneration by using bagasse as a fuel option. Over the last few years, there has been a sea change in the technology vis-à-vis the generation and utilization of steam at high temperature and pressure. This has enabled the sugar industry to produce electricity and steam for its captive use. In fact, a few sugar mills have started producing enough surplus electricity which they sell to the grid from within the same quantity of bagasse. For example, more than 80 kWh of additional electricity can be produced for each tonne of cane crushed, by increasing the steam generation temperature/pressure from 400°C/33 bar to 485°C/66 bar. This results in a twin advantage of improving the economic viability of the sugar mills and adding to the power generation capacity of the country as well.

Incentives Available

The Ministry of New and Renewable Energy has drawn an ambitious target to make a capacity addition of 1700 MW through biomass and bagasse cogeneration during the ongoing 11th plan period i.e. 2007-2012 in states with high potential for both these resources. MNRE has made available Central Financial Assistance (CFA) for the bagasse cogeneration projects too. In addition, the following few fiscal incentives are available to encourage this promising route of power generation:

- 80% accelerated depreciation benefit (as per Income Tax Act 1961)
- concessional import duty
- excise duty
- tax holiday for 10 years
- preferential tariffs
- Renewable Purchase Standards (RPS)
- Soft loan from IREDA

The above stated developments and financial measures have prompted many sugar mills in the high potential states to set up bagasse based cogeneration facilities. One such sugar mill is Dwarikesh Sugar Mills, which is profiled here briefly.

Case Study-Dwarikesh Sugar Mills

Dwarikesh Group is a fast expanding industrial entity with a strong presence in fields as diverse as sugar manufacturing, financial services and information technology. The company's plants are located in Bijnor district of Uttar Pradesh at Dwarikesh Nagar and Dwarikesh Puram. The third plant which has come up in the recent past is situated at Dwarikesh Dham in District Bareilly. Bagasse is an abundant biomass residue at these sites and is obtained from processing of the sugarcane.

Dwarikesh Nagar (Bundki) Plant

The cogeneration plant of the company was commissioned in 1996 with an initial capacity of 6 MW. It was later expanded to 9 MW in 2002 and was further increased to 26 MW. Exportable power capacity of the plant is 24 MW. The company commissioned 36 MW power plant in Dwarikesh Dham and 24 MW cogeneration plant in Dwarikesh Puram in December 2007. Thus, as of now, the total power capacity of DSIL is 86 MW. The company possesses state-of-the-art facility to crush around 21,500 metric tonnes of sugarcane on a daily basis. It uses 30 MW for captive consumption and the balance power is supplied to Uttar Pradesh Power Corporation Ltd (UPPCL).

The plant uses bagasse (solid residue after crushing of sugarcane), as raw material for the generation of power. In order to generate power, bagasse is burnt in boilers to generate steam. Steam generated through bagasse-fired-water-tube boiler is fed to turbines for generation of power and exhaust is used for the sugar manufacturing process. The power generated from this source is renewable and carbon-neutral. Thus it qualifies for carbon credits under the UN Framework Convention on Climate Change (UNFCCC). The company has executed a Power Purchase Agreement (PPA) with UPPCL for additional power, which the company expects to produce.

Performance Parameters

As per the available information, the cogen plant of the company was able to utilize nearly 87% of its capacity during the fiscal year 2007. It exported a surplus power of 26177020 units of electricity to the state utility i.e. Uttar Pradesh Power Corporation Limited (UPPCL). This was as per the Power Purchase Agreement (PPA) signed for a period of 10 years by the company. The table below sums up the various important parameters:

Period under consideration	2006-2007	2007-2008
Number of electricity units generated	51027636	77612565
Growth rate in generation	52.19%	
Revenue from power (Rs in lakh)	758.36	534.38
Growth rate in revenue collection	41.97%	

The increase in both the power generation and revenue collection has been attributed to enhanced number of crushing days as well as efficiency improvements. The company has been intensely targeting power co-generation keeping in view an increasing gap between the demand and supply of power across the country.

Source: Company Website

Bagasse Cogeneration Marching Ahead

Bagasse, which is formed as a fibrous byproduct when sugarcane is crushed to extract juice, is economically used as boiler fuel to generate both electric power and steam that is further used in mill operations. This process of cogeneration uses a single fuel to produce two forms of energy, one of which is heat and the other may be electrical or mechanical energy. While use of bagasse makes sugar mills self-sufficient in addressing their power requirements, in some cases surplus electricity is also produced, which is sold to the power grid. This is achieved by efficient combustion of bagasse during the harvest season and by use of alternate fossil fuels or biomass during off-season.

This process, which was initially adopted by sugar mills as a cost-cutting measure, is now turning into a lucrative option. Cogeneration is relatively inexpensive as compared to the use of expensive fossil fuels for captive power generation. Further, by exporting surplus power to the grid, sugar mills are able to claim Clean Development Mechanism (CDM) benefits. However, seasonal variations in the sale price of bagasse in the market may affect the viability of cogeneration.

DCM Shriram Consolidated Limited (DSCL) currently exports 27.5 MW of surplus power to the Uttar Pradesh Power Corporation Limited (UPPCL). DSCL currently has a cogeneration capacity of 70.5 MW and aims to add another 24 MW this year. The company received its full claim of $335,000 in CDM benefits last year. UPPCL also receives 20 MW of surplus power from the Deoband Bagasse Cogeneration Power Project. Sri Chamundeswari Sugars is setting up a 26 MW bagasse-based cogeneration unit at its plant in Karnataka and expects to generate 18 MW of surplus power that will be exported to state utilities. Several leading power equipment giants, including ABB, are looking to bag contracts for supplying automation systems to upcoming cogeneration plants in India.

In view of the increasing popularity of cogeneration, the Central Electricity Regulatory Commission (New Delhi) has directed state regulators to facilitate alliances between distribution utilities and cogeneration unit owners to ensure smooth supply of surplus power from such plants to the grid. The government is aggressively promoting the development of cogeneration units by providing incentives in the form of capital subsidy, relief from taxes and duties, accelerated depreciation, and term loans from the Indian Renewable Energy Development Agency, New Delhi.

India is the second-largest sugarcane producer in the world. This sector also ranks as the second largest agro-industrial segment of the country. In 2007-08, sugar production reached a record 28 million tons, resulting in high bagasse production from 322 million tons of stalk harvested. It is estimated that sugar mills in Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Tamil Nadu and Uttar Pradesh with a crushing capacity of more than 2,500 tons per day can generate up to 5,000 MW of surplus power.

Conservative estimates suggest a huge potential of over 20,000 MW from cogeneration units in India. As per the Integrated Energy Policy Report prepared by an expert committee constituted by the Planning Commission, renewable sources may contribute to nearly 6% of India's energy mix by 2032.

Source: Industrial Info Resources, 2009

New National Action Plan for Biomass in China

REEEP supported National Action Plan for Biomass in China shows that 30% of rural energy demand can be met through bioenergy. The Chinese Academy of Agricultural Engineering (CAAE) and Environmental and Energy Development Consulting Ltd. (EED) have released a REEEP-funded report "National Action Plan for Rural Biomass Renewable Energy Development in China". It provides detailed measures to enable China to achieve its biomass development target in the medium and long term.

The REEEP supported report and the proposed National Action Plan for Biomass were submitted to the Chinese Ministry of Agriculture (MOA) in October 2008 for government ratification. Implementation of the National Action Plan will promote the development of biomass related industries with the aim to increase the incomes of rural farmers. Using biomass to produce electricity and heat is expected to improve water and air quality in rural areas.

"The report shows that Chinese biomass energy has great potential, with rural household energy demand expected to increase to 300 M tce in 2020. Clean biomass energy should be able to provide more than 30% of rural energy demand. The rural agricultural sector will provide ethanol and biodiesel from high-yield energy crops and support the national strategic goal of producing alternative fuel products to substitute 10 million tons of fossil fuel products by 2020," stated Dr. Liu Xin, Managing Director of EED Ltd.

Measures in the REEEP supported National Action Plan will be replicated at the provincial and regional levels under the instruction of Ministry of Agriculture, thus encouraging provincial governments to produce Provincial Action Plans for rural biomass development according to local conditions. The provincial plans will also establish regional targets for biomass energy development.

The REEEP project worked together with several other important Chinese renewable energy initiatives, including the National Large and Medium Scale Biogas Project, the Energy Crop Utilization Development Plan, and the GEF-funded Integrated Renewable Biomass Energy Development Project, in order to provide a comprehensive account of the National Action Plan's impact on sustainable energy utilization.

Courtesy: The Renewable Energy and Energy Efficiency Partnership (REEEP)

Addition of 1700 MW Biomass Cogeneration Power by 2012

A target for addition of 1,700 MW capacity, consisting of 500 MW of biomass power projects and 1,200 MW of bagasse cogeneration projects has been proposed during XIth plan period i.e. upto 2012. A cumulative biomass power potential of about18,000 MWe from the surplus agro residues have been estimated in the country. This has been stated in the National Biomass Resource Atlas prepared by Indian Institute of Science, Bangalore, under a project sponsored by the Ministry,. The States of Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal have the potential for setting up biomass based power projects of 100 MW or above. The biomass power potential in the identified districts of the above States ranges from 10 MW to 100 MW.

Sugar mills with a crushing capacity of 2500 tonnes of cane crushed per day in the States of Maharashtra, Uttar Pradesh, Tamil Nadu, Karnataka, Andhra Pradesh, Bihar, Gujarat, Punjab and Haryana have an estimated potential of about 5000 MW surplus power generation through optimum bagasse based cogeneration.The Government is providing incentives for setting up of power generation projects based on biomass and bagasse cogeneration in the form of capital subsidy and fiscal incentives such as accelerated depreciation, relief from taxes and duties, term loans from Indian Renewable Energy Development Agency (IREDA). This apart, policies have been introduced in potential states for wheeling, banking and buy-back of electricity generated from commercial biomass power and bagasse cogeneration projects.

Source: Ministry of New and Renewable Energy

SIDBI Financing Scheme for Energy Saving Projects in MSME Sector

The Japan International Cooperation Agency (JICA) has extended a Line of Credit to the Small Industries Development Bank of India (SIDBI) for financing Energy Saving projects in the Micro, Small and Medium Enterprises (MSMEs) Sector. The project thus seeks to encourage MSME units to undertake energy saving investments in plant and machinery to reduce energy consumption, enhance energy efficiency, reduce CO_2 emissions, and improve the profitability of the units in the long run.

The Sikai Bhatti or Muffle Furnace in glass bangle making operation initially used to be coal fired and highly polluting. Figure shows a modified furnace after switching over to cleaner fuel

The financial assistance to MSMEs will be provided through SIDBI, as well as through refinance to banks / State Finance Corporations (SFCs) and Non Banking Financial Companies (NBFCs). The project also seeks to provide technical assistance to these financial institutions and MSME units for the successful implementation of this Scheme resulting in energy saving in the MSME Sector, and thereby contributing to environmental improvement and socio-economic development in the country and addressing climate change concerns.

Eligible Sub-projects/Energy Saving Equipment List

Energy saving sub-projects under this initiative mean–

- Acquisition (including lease and rental) of energy saving equipments/facilities, including newly installing, remodeling and upgrading of those existing
- Replacement of obsolete industrial furnaces and/or boilers or burners etc., or introduction of additional equipment which would improve performance
- Installation or improvement or adoption of such manufacturing machinery and equipment that meets the specific requirements for energy performance standard,

Financial Parameters

The financial parameters for appraising the projects are:

Parameter	Norms
Minimum assistance	Rs.10 lakh
Minimum promoters contribution	25% for existing units 33% for new units
Debt Equity Ratio	Maximum 2.5 :1
Interest Rate	The project expenditure eligible for coverage under the Line will carry a rate of interest of 10.5–11% p.a., payable monthly
Upfront fee	Non refundable upfront fee of 1% of sanctioned loan plus applicable service tax
Security	First charge over assets acquired under the scheme; first/second charge over existing assets and collateral security, as may be deemed necessary
Asset coverage	Minimum Asset Coverage should be 1.4 : 1 for new units and 1.3 : 1 for existing units
Repayment period	Need based. Normally, the repayment period does not extend beyond 7 years. However, a longer repayment period of more than 7 years can be considered under the Line, if necessary

Foundry operation in Kolhapur cluster - Energy audit study revealed majority of installed Cupola are suboptimal kind, leading to higher fuel consumption

provided by the related Energy Conservation Act/code in India (e.g. Top Runner Equipment, Energy Labels etc.)[1]

- Installation of building envelopes, equipments, heating systems, lighting and electrical power/motors in compliance with the energy performance standard provided in the Energy Conservation Building Code (ECBC)[2]
- Introduction of equipments that utilize alternative energy sources such as natural gas, renewable energy, biogas etc. instead of fossil fuel such as oil and coal etc., to help reduce GHG emissions
- Clean Development Mechanism (CDM) projects at cluster level that involve a change in the process and technologies as a whole, duly supported by technical consultancy will be eligible for coverage.

The equipments eligible for financing under this initiative are available at the SIDBI offices. The equipment list would be continuously revised and updated by the consultants, Winrock International India (www.winrockindia.org) appointed by JICA. The List shall be used for screening the sub-projects for deciding their eligibility for coverage under the JICA Line of Credit and the List would be the primary criteria for the sub-projects. Please contact the nearest SIDBI Branch Office or refer to SIDBI web site (www.sidbi.in) for the updated list.

Eligibility Criteria for Units (Direct Assistance)

- New / existing MSME units, as per the definition of the Micro, Small & Medium Enterprises Development (MSMED) Act, 2006 (www.Laghu-udyog.com; www.Smallindustryindia.com). However, units graduating out of the medium scale will not be eligible for assistance.
- Existing units should have a satisfactory track record of past performance and sound financial position.
- Energy saving projects will be screened as per the Energy Saving List, which is available on the SIDBI website.
- Units should have the minimum investment grade rating of SIDBI.
- Sectors such as the arms industry, narcotics industry or any unlawful businesses are not eligible. Similarly, projects which may result in negative social and environmental impacts are also not eligible under this scheme.

Application for Loan Assistance

The prospective borrower is required to submit the duly filled in application form along with the supporting documents as per the prescribed format, to the nearest SIDBI branch office. In addition to the information requested for in the application form, *it may be ensured that the prospective borrower explicitly provides details of the energy saving potential of the project.* This will be an important parameter for deciding the eligibility of the project financing under the Line of Credit.

Disbursement

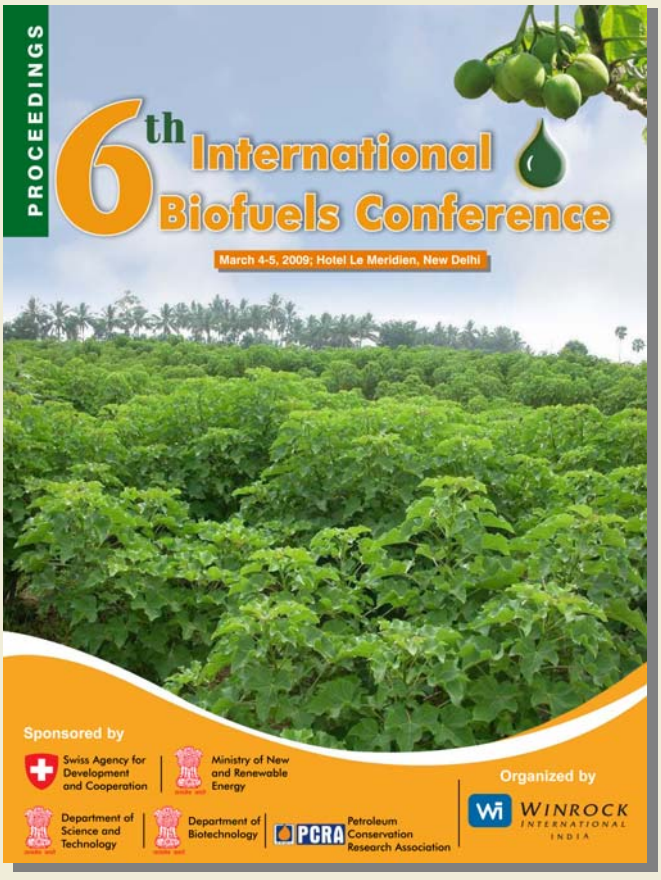
Disbursement would be carried out after compliance of the terms of sanction.

Futher information on the Financing Scheme is available on www.sidbi.in or at the nearest branch of SIDBI.

[1] *Guidance in these parameters would be provided by the technical consultant for the project.*
[2] *Guidance in these parameters would be provided by the technical consultant for the project.*

Proceedings of the

6th International Biofuels Conference



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   Ms Jane Romero, *Policy Researcher, IGES, Japan*
3. Key Challenges & Issues: Indian Automotive Industry Perspective
   Mr K K Gandhi, *Executive Director (Technical), Society of Indian Automobile Manufacturers*
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