

BIOMASS POWER FOR RURAL ENERGY AND SUSTAINABLE DEVELOPMENT IN INDIA – ROLE OF IREDA

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In order to cater to the ever-increasing electricity need for the rural sector, an appropriate mix of decentralised energy generation sources such as solar, wind and biomass can be adopted. Currently, biomass helps to meet 70% of the basic energy needs of the rural areas almost covering 70% of the population in India. The total power generation potential from surplus biomass resources of the country is estimated to be 19,500 MW. The Government of India has set an exclusive financing organization viz., Indian Renewable Energy Development Agency Ltd., (IREDA), under the administrative control of Ministry of Non-Conventional Energy Sources (MNES) in the year 1987 to support various renewable energy projects including Biomass Power projects. IREDA has so far financed 69 nos. biomass / bagasse based power projects, which are located in rural areas. These projects have led to positive impacts on grid availability, growth in economic activities resulting in income generation at different levels of community in rural areas. Further, these projects have also contributed in conserving fossil fuel resources and reduction of GHG emissions. In this paper, the role of the Indian Renewable Energy Development Agency Limited (IREDA) in promotion of biomass power projects for rural energy by suitable financing mechanisms and its socio-economic impacts in India are highlighted.

Indian Energy Scenario

India's energy development programme has been put to severe pressure with the ever increasing demand supply gap and mismatch of resources coupled with non-uniform growth curve. The challenges faced by India in the management and development of the power sector are multi-dimensional and they stem fundamentally from the following :-

- Increase in demand for energy due to rapid industrialization and growing population.
- Constraint of financial resources for enhancing this infrastructure facility
- Limited reserves of coal and fossil fuels and consequent burden on foreign exchange due to increasing imports

In response to these challenges, the energy policy of the country focuses on:

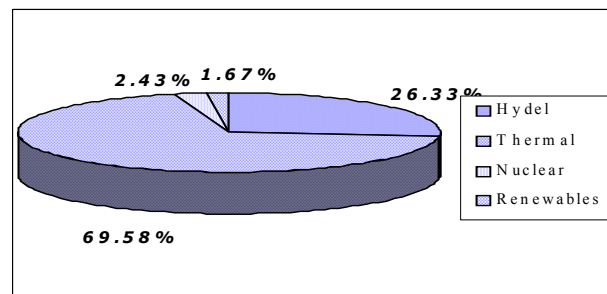
- Rapid development of all forms of energy, both conventional and non-conventional (renewables).
- Promoting energy conservation and efficient management of demand
- Environment conservation and sustainable development
- Development of decentralized energy systems based on renewable sources especially for use in rural areas.

The installed capacity in India as on 31st March, 2004 is 112,058 MW including Thermal, Hydel, Nuclear and Renewables. However, there is a supply-demand gap of 8 to 10% and peak load demand of 18 to 20%. This has also accentuated by non-decentralized nature of power

generation with vast area in the rural segment which are not connected by the grid for reliable and quality power

The newly enacted Electricity Act, 2003 harmonizes and rationalizes the provisions in the Indian Electricity

Act 1910, the Electricity (Supply) Act, 1948 and Electricity Regulatory Commission's Act, 1998. The



Electricity Act, 2003 focuses on creating competition, protecting consumers, rationalizing tariffs and providing reliable power supply. The Act provides for delicensing of generation, providing open access in transmission. The Act also allows generating companies to take up distribution for rural areas and stand-alone systems for generation and distribution have been permitted as well as decentralized management of distribution.

The Electricity Act, 2003 also specifically encourages promotion of generation of electricity from renewable sources and directs the regulatory bodies to specify a percentage of total consumption of electricity from such sources.

The Government of India has also announced a programme for Accelerated Electrification of 100000 villages and 10 million households by the year 2012. This is expected to lead to 100% electrification at household level by the year 2012 as compared to the existing level of 31%.

Biomass Potential

India is a tropical country blessed with abundant sunshine and rains, thus offering an ideal environment for Biomass production. Further, the vast agricultural produce, also makes available large quantities of agro-residues which can be used to meet energy needs. With an estimated production of about 350 million tonnes of agricultural waste every year, residual biomass is capable of mitigation of GHG emissions to the extent of 300 million tonnes / annum.

The estimated potential of Biomass based renewable energy options in India are as follows:

Biomass Energy	16, 000 MW
Bagasse Co-Generation	3, 500 MW
Total	19, 500 MW

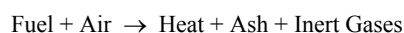
Biomass Energy Conversion - Processes

Biomass can be utilized through following different processes for energy conversion:

Gasification: Gasification is the thermo-chemical process of obtaining energy from solid matter in a gaseous form. In principle, the process is a thermal decomposition of organic matter in the presence of limited supply of air or oxygen to produce combustible gases thus converting calorific value of organic material into a gaseous energy carrier.

Pyrolysis: In contrast to complete combustion of solid carbonaceous material, the process of pyrolysis refers to combustion in a deficient supply of air / oxygen. The process gives out carbon-mono-oxide and methane, which are condensed to form tar and aqueous liquor. The latter is then distilled to give methanol and other organic substances.

Direct Combustion: Thermal decomposition of organic matter is carried out in the presence of excess air, liberating heat and leaving behind incombustible ash.



Direct combustion of Biomass is an important route for generation of grid-quality power by efficient use of agricultural, agro-industrial and forest residues, which are either being wasted or are being sub-optimally utilized in the country.

Biomass Power for Rural Energy sector:

Biomass power is an important alternative for providing energy in the rural sector. The inherent advantages in utilization of biomass are that employment opportunities are created even for cultivation, collection, transportation and storage of biomass.

Realizing the enormous potential for power generation available from Biomass, the Ministry of Non-Conventional Energy Sources (MNES) of the Government of India has been promoting productive and efficient utilization of Biomass for energy generation through all the process options briefly outlined above.

The National Programme on Biomass Power Generation has been initiated by the Government of India through the Ministry of Non Conventional Energy Sources (MNES). It aims at optimum utilization of variety of biomass materials including dedicated energy plantation for power generation through the adoption of latest conversion technologies. These include combustion, incineration, pyrolysis, gasification etc. using gas turbine, steam turbine, dual fuel engine, gas engine or a combination thereof either for power generation alone or cogeneration or more than one energy forms viz steam

and power of minimum 1 MW capacity connected to the grid.

Biomass Resource Assessment Programme : Availability of biomass is of great relevance to the National Programme on Biomass Power / Cogeneration. According to an estimate made by some experts, only 16 million hectares of land are required, if there is a need to grow wood separately for power generation, i.e. lighting and meeting stationary power needs of villages, as compared to 100 million hectares of degraded land available for planting. The Programme was launched covering all the States and Union Territories in order to provide inputs for preparing a Biomass Resource Atlas for India, which seeks to integrate the data obtained from field level studies under National Biomass Resource Assessment Programme and provide specific information, which would be useful to the project promoters in preparing feasibility studies of specific biomass based power generation projects.

The Ministry has supported establishment of first two demonstration projects of size 6 MW each in the year 1998 & 2000 by extending capital grant to the extent of 15% of the capital cost. Private entrepreneurs were encouraged to set up further biomass power projects through suitable interest subsidies. The interest subsidy rates were linked to the boiler pressures so as to encourage setting up of projects with higher boiler pressures leading to higher efficiency and consequently higher generation capacities. The interest subsidy (for biomass power projects and bagasse cogeneration projects) varies from 1% - 6 % corresponding to boiler pressures of 40 to 80 bar. Due to the dedicated and sustainable efforts over the last decade, the biomass power programme in the country has reached a commercial take off stage.

A target of 700 MW has been proposed for the 10th Five-year plan (2002-2007), comprising 450 MW from bagasse / biomass co-generation and 250 MW from biomass power generation. Also included are plans to promote technologies of cogeneration, biomass combustion, megawatt scale gasification and industrial cogeneration, to develop Biomass Resource Atlas, to support District-wise resource assessment studies and also to support R&D for development of technologies.

IREDA's Role and Initiatives in Biomass Power Projects

Indian Renewable Energy Development Agency Limited (IREDA) with its motto "ENERGY FOR EVER" is a Public Sector Undertaking under the administrative control of the Ministry of Non-conventional Energy Sources (MNES), Government of India, engaged in the promotion, development and financing of renewable energy and energy efficiency projects in India. IREDA's mission is "Be a pioneering, participant friendly and competitive institution for financing and promoting self-sustaining investment in Energy generation from Renewable sources, Energy Efficiency and Environment technologies for sustainable development".

The objectives of IREDA are to operate revolving fund for promotion, development and commercialisation of New and Renewable Sources of Energy (NRSE), to assist upgradation of technologies and to extend financial support to Energy Efficiency and Conservation projects / Schemes.

IREDA has been supporting Biomass based power generation as a part of its objectives by offering term-loans for setting up of projects. The programme has gained momentum with the launching of MNES national programmes. Commercial projects based on cost recovery principles are supported by IREDA, predominantly in the private sector.

IREDA's Financing Norms for Biomass Power / Cogeneration Projects

IREDA supports biomass power projects having installed capacity ranging from 1 MW to 7.5 MW with the boiler pressure from 63 bar to 100 bar. The interest rates are linked to the boiler pressures and varies from 10.75% to 11.50% p.a.. Interest subsidies offered by the MNES is over and above IREDA's lending rates. The project promoters therefore are able to access financing at substantially lower cost than prevailing market rates. Projects designed around higher boiler pressures get benefit of lower interest rates as an indirect encouragement for building in generation efficiency. IREDA extends financial assistance upto 70% of the project cost with 10 years repayment, which includes moratorium of upto 3 years.

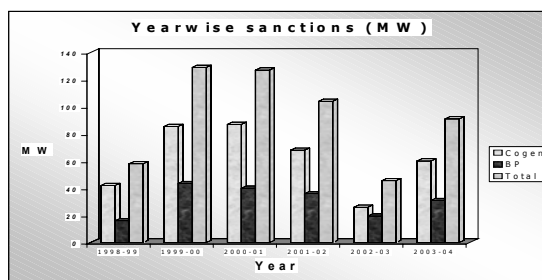
IREDA's Contribution to Biomass Power / Cogeneration Sector

As on 31/03/2004

	Biomass Power	Cogeneration
Total Project Sanctioned	35 Nos.	34 Nos.
Loan Committed	118 Million US\$	165 Million US\$
Installed Capacity	211.75 MW	490.60 MW
Commissioned Capacity	121.25 MW	369 MW

Socio-Economic benefits of IREDA funded projects:

Biomass power projects funded by IREDA have resulted in direct and indirect socio-economic impacts in and around the project site. The biomass power projects are generally located in outskirts of the town particularly in rural areas where sufficient biomass is available in different forms. Therefore, by setting up these power projects there is an positive impact on irrigation and



agricultural pattern and resulting in revenue generation to the farmers in that region.

A major local challenge for the biomass power plant lies in the coordination of the inflow of biomass fuel supplies from farmers and outflow of ash. Small cooperatives comprising of the local farmers have sprung up for supply and transportation of biomass and these are playing vital role in ensuring smooth availability of biomass to the power plant. Apart from this small commercial establishments have also come up for trading / use of the ash in making bricks or further processing as fertilizer for supply back to the farmers. This has led to local increased level of economic activity and in turn better quality of life.

In some cases, the project promoters had to improve the local infrastructure facilities in terms of roads, and bridges for ensuring smooth access to the project site for heavy machinery and equipment during the project implementation stage. This has indirectly benefited the local residents.

The projects have also strengthened the grid and improved the quality and availability of power in the local area. This has triggered the growth of small establishments and entrepreneurial activities for catering to the peripheral needs of the power plant such as machine shops for maintenance of biomass processing equipment, minor engine repairs / vehicle maintenance for transporters, tea / snacks shops etc.,

In some areas, seeing the demand for biomass fuel, farmers have, with the support the project promoters, taken up wasteland development for energy crop plantations..

It is expected that during 10th five year plan (2002-2007) about 87000 persons will have employment opportunities with an revenue generation of about 27 million US\$ per annum under Biomass power sector based on the estimations of the Special Group on Employment, Planning Commission of India.

Conclusions

IREDA has demonstrated the viability of commercial investments in Biomass Power generation projects and shown that these projects can cater to the rural energy needs for sustainable development. By demonstrating success, IREDA has become a role model for other Commercial Banks and Financial Institutions in the country who have now also started exploring similar financing of biomass based power projects. This success could also serve as an example to other developing countries for promotion and commercialisation of biomass power projects for sustainable development. However, there is no single solution or institutional

model that can serve as an universal solution for commercialisation of biomass power technologies for rural energy needs. Solutions have to be devised based on the local needs and conditions, carefully integrating the socio, politico, economic and cultural factors prevalent in the region is necessary.

References:

1. Ministry of Non-Conventional Energy Sources (MNES) annual report for the FY 2002 – 2003.
2. Indian Renewable Energy Development Agency Ltd (IREDA) annual report for the FY 2002 – 2003.
3. Report of the Special Group on Employment by Planning Commission.
4. Overview of Indian Renewable Energy programmes, TERI Report No. 2000RT45.