RURAL ENERGY FROM BIOMASS

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BIO ELECTRICITY

Biomass has tremendous potential to meet rural electricity demands 24 x 365. Bio electricity has distinctive advantages over other renewables like wind ,sun & hydel, in terms of costs, despatchability & decentralisability. While wind , sun & hydel has a capital cost of Rs 17 crores, Rs 22 crores & Rs 55 crores, respectively, per MW, bio electricity generated by gasification technology developed by the CGPL IISc, Bangalore, carries a capital cost of Rs 7 crores per MW.

Ideally, one biomass power plant is to be established in each Gram Panchayat jurisdiction, to meet the jurisdictional villages entire electricity demand, & should ideally be of a capacity of 1MW to 2 MW , as the electricity demand in a typical Karnataka GP villages is 1.50 MW with an estimated growth rate of 5% per annum. Proximity to the villages reduces the T&D losses to less than 3% as the biomass generated power is distributed to a short distance in a radius of maximum 25 kms, (typical in a Karnataka GP jurisdiction) , for meeting only the local rural loads. Proximity to villages also ensures availability of manpower to O&M the biomass power plants.

The corner stone for the sustainability of biomass electricity is decentralised generation & distribution, at the rate of one power plant of 1 to 2 MW capacity for each Gram Panchayat jurisdiction. In gasification technology, Small & Decentralised Generation is Beautiful . Small Decentralised Generation collectively becomes Substantial & Sustainable.

15000 tonnes of woody biomass is required per year, to generate 1 MW year of bioelectricity. It is possible to generate this quantity of woody biomass per year in the lands in a Gram Panchayat jurisdiction from Farm Forestry, from plantations in Reserved Forests & from plantations on Common Lands. Woody biomass is better than agri residue as the gas quality & hence electricity generation is better. In addition, it is easier to source & handle as it is available en mass/ en bloc. Based on the availability of biomass & the capacity to raises higher volumes of biomass, the power plant capacity can be scaled up to 1+ MW. Shorter the distance of biomass transport, lesser is the C footprint & the cost of biomass & lesser is the cost of bioelectricity production. Surplus bioelectricity can be sold to the ESCOM or third party.

Biomass can be raised in plantations perpetually. Captive plantations are necessary to be raised for the sustainable supply of biomass for electricity generation. The benefits of afforestation in soil, water, food, environmental & ecological security are legendary. 1500 hectares of tree plantations are required to generate 15000 tonnes of biomass for 1MWyear power production. With good tree breeding & tree improvement & biotechnology, higher volumes of biomass can be grown in a lesser area & in a shorter time. As there are ever increasing competitive & conflicting uses

of the scarce resource of land & biomass, it is necessary that higher volumes are produced in lesser area & shorter time with bio technology, tree breeding & tree improvements.

Species like Prosopis juliflora, Lantana camera etc. which grow wild on wastelands & unutilised lands can be used for gasification. Even bamboo, which is the fastest growing plant/grass in the world & Soobabul, Glyricidia etc which can be cultivated on farm lands, can be used for gasification. There is no dearth of woody biomass for power generation. Biomass can be raised perpetually & permanently.

Biomass energy in a decentralised manner, can provide good quality, reliable, dependable electricity services, 24x365, to all our villages, for lighting, drinking water supply, irrigation, milling & cottage industry etc. Good quality, reliable & dependable electricity supply, 24x365, to villages, uplifts the rural economy. PURA villages can be developed through biomass energy.24x365 reliable & quality electricity supply to villages is the start up for PURA villages. The Decentralised Generation & Distribution model is the manner in which the electricity security for rural areas, is to be built up. Most villages are un served & under served with electricity. In a developing economy, there will always be electricity shortages. Available generation is rationed to urban & industrial uses at the cost of rural requirements. With demand outstripping supply& the price of fossil fuels peaking, the chances of rural loads being met from base loads from the grid are dim. Rural energy security has to be built up with DG&D. Biomass energy is most suitable in view of costs, decentralisability, despatchability & perpetuality.

Ideally, the capacity for the entire village load is to be established in three or four phases, over a period of 12-15years, to enable development of management skills as well as capacity building among the local youth for O&M of the plants. In addition, it will enable the accurate determination of the availability & the potential for growing biomass, for maintaining sustainability. It also enables setting up improvised systems which come up with technology up gradation, over a period of time.

Gasification power plants of 1MW to 2 MW can be set up under one roof in a modular design. If one engine / reactor is shut down for maintainence , the other reactors/engines can continue generation in the modular design, thereby continuing power supply to the jurisdictional villages.

Biomass energy generates nearly Rs 2 crore incomes per MW year to the rural agrarian economy, through the purchase of biomass alone. In addition, there are other incomes to the rural economy in the growing, harvest & transport of biomass. There is no other capital investment of Rs 7 crores, that can generate Rs 2 crore income per annum, perpetually, to the rural economy. Biomass growers, suppliers & the bioelectricity users are the stake holders in the DG&D model of building up rural electricity security. As stake holders, they are best suited operate, maintain, manage & administer the power plants, fix prices for the biomass, labour costs, power productions targets as well as tariffs from the bioelectricity users. Social engineering requires to be done in the Gram Panchayat & the jurisdictional communities to build up their capacity to administer & manage the power plants & also to trade in surplus renewable energy.

Bioelectricity is C negative & is eligible for tradeable C credits & Renewable Energy Certificates. These credits & certificates will absorb production costs. 1 kwh of bioelectricity reduces 0.79 kgs of C emissions. The present price of a non solar REC ranges from Rs 1500/- to 3900/- per MWH & is likely to be revised in April 2012. The current cost of a CER is 16 Euros.

ACTION PLAN FOR SUPPLYING 24 x 365 BIO ELECTRICITY TO ALL VILLAGES BY GASIFICATION TECHNOLOGY DEVELOPED BY THE CGPL IISc BANGALORE

Option I : Establishing 2MW biomass gasification power plants @ one power plant in each of the 3434 Gram Panchayat involves a capital investment of Rs.48076 crores on the power plants (@Rs 7 crores per MW) plus an investment of Rs 103020 crores (@ Rs 10302 crores per year for 10 years) for raising captive plantations of biomass (@ Rs1,00,000 /- per hectare) (it will cost Rs 30,906 crore per year, if biomass raised by farmers under farm forestry is purchased) & administrative expenses. With this capacity, 24 hours power supply can be maintained in all villages of Karnataka. The ESCOM supply is not required.

Option II: Establishing 1MW as above will involve an investment of Rs.24038 crores & Rs 51510 crores respectively. With this capacity 6 hours power supply can be maintained, in all villages of Karnataka, during the ESCOM scheduled/unscheduled load shedding.

Option III : Establishing 500 KW as above will involve an investment of Rs 12019 crores & Rs.25755 crores respectively. With this capacity 3 hours power supply can be maintained, in all villages, during ESCOM load shedding.

Option IV : Establishing 250 KW as above will involve an investment of Rs 6010 crores & Rs 12878 crores respectively. With this capacity
1 ½ hours power supply can be maintained, in all villages, during ESCOM load shedding.

Option II,III &IV is the model of providing tail end support to grid load. Load shift mechanisms have to be put into place to evacuate the generated bio electricity to the jurisdictional villages during the ESCOM load shedding.

Limitation : 1. It will be a massive task to establish power plants in all GP' in one go. It will have to be done in a phased manner.

2. It has to be decided in how many GP per district are the power plants to be established per year, & of what capacity, 250 KW or 2 MW ?

3. If 250 KW is to be established in each GP & 5 GP' are selected per district, the total capacity is 37.5 MW. The investment will be Rs.262.50 crores for the power

plants & Rs.1125 crores (@ Rs112.50 crores per year for 10 years) for captive plantations.(If biomass is purchased from farmers the cost will be Rs.168.75 crores per year).(It is to be examined whether the agency raising captive plantations, ie the Karnataka Forest Department, will be able to deliver the required biomass at costs at least in par with the costs indicated by farmers in view of VAT & FDT levied by the forest department).

4. Biomass costs can be reduced to 50% in Options II, III & IV by operating the power plants for 12 hours only.

Operating Costs : The bioelectricity generation cost is Rs 5.20 per kwh with an SFC of 1.28 kgs per kwh. With evacuation to grid, the cost increases to Rs 8.20 per kwh. & an SFC of 2.03 kgs per kwh This is because of poor grid availability due to opening of the 11KV,66KV & at times 220 KV lines, scheduled on account of maintainance or non availability of base loads, warranting rationing by opening some 220 or 66 KV lines or non scheduled load shedding due to breakdowns. In such circumstances , the biomass power plant operates in auxillary mode, which is a wasteful operation. With load shift mechanisms ,the generated load can be evacuated to jurisdictional villages even during the opening of 11, 66 & 220 KV lines, thereby lowering the cost of bio electricity evacuated to the villages to near generation costs.

36% of the operation costs are on labour.4% on maintenance, 50% on biomass procurement & 10% on processing biomass into smaller sizes for feeding the gasifier reactor.

In base loads from hydro & thermal although the generation costs are low, the T&D losses are around 35% & when these losses are factored in, the generation costs is around Rs 15/- per kwh ! The price of coal in thermal generation is administered / subsidised to keep generation costs at Rs 3.50 per kwh. Bio electricity is the cheapest to generate & deliver even without any administered costs/prices. It is also the cleanest technology available to mankind, is C negative & helps mitigates global warming & climate change. Biomass plantations sequester enormous amounts of atmospheric C.

The indigenously manufactured producer gas engines are capable of working at 95% of the rated load, continuously without any problems. Engine oil only has to be regularly changed after 500 hours of operation. The indigenously manufactured gasifier systems are sturdy & robust, working heavy duty continuously, without any problems.

Note : Individually, 2MW per GP appears small. However 2 MW collectively by 3434 GP is 6868 MW ! 3 MW generation per GP amounts to a substantial 10302 MW ! If the surplus generation is synchronised simultaneously to the grid, visualize the quantum of bio electricity available in the grid pool to urban & industrial uses. Visualize the incomes & leverage that the GP /stake holders will / can earn from bio electricity generation & trading ! Evacuating 1 or 2 MW to the grid in isolation will not contribute to the energy pool as the 1 or 2 MW dissipiates itself in the transmission & distribution as losses. Visualize a scenario where 10302 MW of bioelectricity is collectively pumped into the State Electricity Grid & simultaneously

the generation of thermal energy from the polluting coal is reduced. This is the road map for any Action Plan on Climate Change. The expensive clean coal technology only cleans up Peter but pollutes Paul. Paul will not be able to take all the C, perpetually & permanently.

(The views contained in this article are the views of the author alone & does not necessarily reflect the views of the government or the agencies funding BERI Project.)

14-10-2011
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