

# TOWARDS SUBSTANTIAL GREEN ENERGY SUPPLY IN KARNATAKA 2020/2050

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Biomass Energy has tremendous potential to meet rural energy demands & only partial potential to meet urban energy demands.

Biomass Energy 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, biomass energy carries a capital cost of Rs 5 crores to Rs 7 crores per MW, for Rankine technology & gasification technology, respectively.

The State of Karnataka has the potential to generate nearly 5000 MW of electricity from biomass, using both woody biomass & agricultural residues. Biomass energy generates nearly Rs 2 crore incomes per 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 5 to Rs 7 crores, that can generate Rs 2 crore income per annum, perpetually, to the rural economy.

Ideally, biomass power plants are to be located at the Gram Panchayat level, to meet the villages entire energy demand, & should ideally be of a capacity of 1MW to 5 MW, depending on the energy load demand & the biomass availability in the vicinity of the village. Proximity to biomass catchment areas & the villages reduces the C footprints & cost of transport of biomass & facilitates availability of manpower from the village for O&M of the plant. Wind, sun & hydel being site specific, are located far away from inhabitations, limiting the easy availability of manpower to man the systems. In addition, since the transmission & distribution of biomass generated power is for short distances, for meeting the local rural loads only, the T & D losses are minimal. Ideally, the catchments & the distribution is to be in a radius of 25 kms from the power plant. In an event, if adequate biomass is not available, it can be grown in sufficient quantities, if feasible, based on availability of land. Alternately, generation capacity is to be limited to biomass availability, to ensure sustainability. If there is surplus biomass & generation, it can be sold to the grid or to third party under open access. Biomass & biomass energy can be produced perpetually. Biomass energy is C neutral helping mitigation of global warming & climate change.

Biomass energy in a decentralised manner, can provide good quality, reliable, dependable electricity services, 24x365, to 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. When self sufficient electricity is generated by biomass energy, for village use, the central grid system can be relieved of the burden of the rural load, using the base load electricity for urban applications.

There are 3434 Gram Panchayats covering 33026 electrified villages / hamlets in Karnataka. A biomass power plant of 1MW to 5MW capacity, for each Gram Panchayat, can provide round the clock, 24x365 electricity, to all the 33026 villages/hamlets in Karnataka. These villages / hamlets are suffering from acute power cuts due to power shortages in the State. The biomass power plants are to be managed by the Gram Panchayats, with adequate training to local youths in the O&M, if established with Government funding, or by the private party if plants are established with private investment.

Ideally, the capacity for the entire village load is to be established in three or four phases, over a period of 12-15 years, to enable development of management skills in the Gram Panchayats 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 upgradation, over a period of time.

Any biomass having a density of more than 250 kgs per cubic meter can be used for gasification. Rankine technology requires biomass of high calorific value. Often times coal to the extent of 30 % is to be blended with biomass to get the desired calorific values, reducing the C neutrality of the Rankine process. Besides, in the Rankine method, 7 MW capacity is found to be economically most feasible. 4 MW capacity is being tried out in two places in India. 2 MW capacity Rankine process is now just coming out into the Indian market.

Gasification technology, enables power generation even at sub MW levels, starting from 5 kw levels. The technology has developed very well since the last 25 years, & capacity to build gasifiers of upto 1.2 MW is now available in the country. Producer gas engines of indigenous manufacture of 250kw & 644 kw are now available in India. Gasification power plants of 1MW to 5MW can be set up under one roof in a modular design. If one engine / reactor is shut down for maintenance, the other reactors/engines can continue generation in the modular design, thereby maintaining the supremacy of despatchability. Gasification is 100 % C neutral. Even saw dust, paddy husk, peanut shell etc can be used for gasification by briquetting. Briquetting generates cottage industries in the rural areas. The 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, which can be cultivated on farm lands, can be used for gasification. There is no dearth of woody biomass or agri residues, in the country, for power generation. Biomass power is mis understood as causing deforestation & is poorly marketed as it is not a multinational industry as yet, unlike wind & sun energy.

Biomass can be raised in plantations also. 15000 tonnes of biomass is required for generating 1MWyear of electricity. It is more economical & environmentally benign to harness the sun energy into biomass plantations & generate electricity than generate electricity directly from sun through solar panels. The benefits of afforestation in soil, water, food, environmental & ecological security are legendary. Afforestation also captures C & helps mitigate climate change & global warming. 1500 hectares of tree plantations are required to generate biomass for 1MWyear power production.

For the urban areas, captive biomass gasification power plants are appropriate. An industry in Hosur has set up a 250 kw gasification power plant for meeting grid power shortages. This plant is operated for 8 hours a day, 6 days a week. They purchase woody biomass @Rs 1.90 per kg. The SFC for gasification is about 1.30 kgs per kwh. Similar plants of 1.2 MW capacity, modular design, are in operation in Tamilnadu for captive generation of electricity for their industry during grid failure, which is common due to energy shortages. A ferro alloys industry in Andhra Pradesh has shown interest in gasification power plant & have consulted BERI & visited BERI sites.

A diesel generator set consumes 350 ml of diesel per kwh, costing nearly Rs 14/- per kwh, at subsidised diesel prices. A diesel genset costs about Rs 1.25 to Rs 1.50 crores per MW. A gasification plant costs about Rs 7 crore per MW. The operating cost in gasification is about Rs 4.50 per kwh where scope for multi tasking labour is feasible, as in an industry. The cost of biomass power is not of much importance to the industry, as the cost is absorbed in increased productivity & in the end product of the industry. However, there is still savings in costs vis a vis diesel generation. The industries are benefiting from their gasification electricity, with increased productivity, due to availability of biomass electricity at will. Wind & sun cannot provide electricity at will. Biomass energy is also a CDM for the industry, eligible for C credits. 1 kwh of biomass energy reduces 0.79 kgs of C emissions that would be generated by using coal, gas, oil energy. Industries have to invest in biomass gasification captive power plants on their own. There are subsidies from the GOI MNRE & availability of loans from the IREDA for biomass power. Large farmers can also set up similar plants as biomass is available to them almost free of any cost. However, since electricity is given free for up to 10 hp IP sets, most farmers will not be inclined to invest. However, C conscious farmers, may invest in biomass power, for voluntary reduction of emissions.

It is, however, the responsibility of the State to provide adequate power to the rural & urban areas, at costs, subsidised prices or free, in a welfare State. The industries will step in & set up gasification power plants for meeting rural load if adequate profit margins are available in the tariffs. At present, there is no separate tariff for gasification power in Karnataka. Rankine cycle tariff is applied to gasification power, which is not viable. Various groups are presently working on determining tariffs for gasification power. BERI experience indicates that a tariff of Rs 6.00 per kwh leaves a reasonable margin in O&M gasification plants. Major costs are on biomass & labour. It remains to be seen whether the industry shows interest in setting up small sized biomass power plants in a distributed /decentralised manner.

BERI has setup with GEF-UNDP, ICEF, GOI & GOK funding, a 1MW gasification power plant in Tumkur district, in three locations. At Kabbigere, 3x100 kw & 1x200 kw system has been established. At Boregunte & Seebanayanapalya, 1x250 kw system has been established, in each locations. One 100 kw system at Kabbigere is presently operational 24x7, with the technological support & guidance from the CGPL IISc. The power is evacuated to the 11 x 66 kv grid. The other 100 & 200 kw system will become operational, 24x7, in mid Jan2011, after maintenance & after installation of an improved filtration system (to reduce filter down time), developed by the CGPL IISc, Bangalore. The CGPL IISc are the technology providers for the BERI systems. The operation of the 1x100 kw system, 24x7, was possible because of the back up support & the training given by the CGPL IISc to local village youths, to O&M the plant. The 250 kw system at Boregunte is planned to become 24x7 operational in Apr/May 2011 & the Seebanayanapalya system in Dec

2011. The works of operationalisation of all the above systems is with the technical support & guidance from the CGPL IISc.

Out of the 400 kw power proposed to be generated from the Kabbigere systems, by Jan 2011, 300 kw is proposed to be transmitted off grid, to five villages in the Kabbigere cluster, for meeting the villages power supply for domestic lighting, street lighting, drinking water, community irrigation & milling. By virtue of this mechanism to go off grid from grid, whenever there is grid load shedding, the cluster villages would be getting round the clock biomass power, when rest of the villages suffer load shedding. This is proposed to be demonstrated in the summer of 2011.

BERI uses woody biomass for gasification. BERI has established 3000 hectares of plantations on forest land & common lands & has also encouraged farm forestry in the jurisdiction, to meet the woody biomass requirement. The woody biomass from these very plantations is used for generating power. The charcoal & ash residue from gasification is ploughed back into the soil in plantations /farmlands, thereby completing the C sequestration cycle. Charcoal & ash have excellent mulching properties, enabling increase in soil productivity.

Till date, the BERI gasifiers have generated 441765 kwh of green energy & has thus contributed to the reduction of nearly 350 tonnes of C emissions. The plantations established by BERI, has mitigated nearly 10000 tonnes of C by sequestration.. The UNDP has engaged a Consultant to study & determine the C mitigation /sequestration by IPCC methodology. The report is expected soon. The Consultant is also working on a paper on gasification tariffs. The CGPL IISc is making a report on the performance of the 100 kw Kabbigere system, for publishing in scientific journals.

The urban & the urban industrial demand for power has to be met from base loads alone. Transporting biomass over long distances & in large quantities for meeting urban requirement is not feasible. Nuclear power will eventually have to replace power from fossil fuel like coal, oil & gas, in the distant future. Wind, sun & biomass has only decentralised applicability. The suitability of roof top harnessing of wind & sun in urban areas, is to be assessed vis a vis the costs, site specificity, dispatchability & the C footprints in the manufacture & disposal of the required machinery & equipment. Hydel power plants submerge valuable biodiversity & wild life areas. Run of the river power plants, are seasonal, & generate power when hydel power is in surplus,& when the agriculture load is minimal, due to monsoons. Wind & solar farms also require large areas of biodiversity & wild life habitats.

Biomass Energy is energy for all seasons & for all reasons.

CONCEPT NOTE III  
DATED 22-10 – 2010

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The views expressed in this note are the views of the author alone & do not reflect the views of the Governments or the views of the BERI Project financing agencies.