

## Biomass based Decentralized Power Generation

The country produces about 1000 million tonnes of biomass per annum, derived mainly from agriculture and forestry. Large quantities of crop residues (more than 70 million tonnes) are burnt in the field after harvest, which create environmental problems and also result in loss of soil organic matter. Biomass gasification offers a vast potential to convert surplus crop residues into gaseous fuel i.e., producer gas for power generation. The biomass gasification technology can generate electricity in a decentralized mode at reasonable cost. The assured power availability at rural sector enhances agro-industrial and production activities which would lead to higher farm income and better rural life.

Central Institute of Agricultural Engineering, Bhopal under National Agricultural Innovation project has developed and demonstrated the technology for conversion of crop residues into electricity by establishing fuel supply chain, feed stock preparation for gasification and conversion of crop residues into gaseous fuel for electricity generation in different capacities (20-100kW) at two villages; Mana (soybean growing area) for supply of electricity for water pumping stations in Raisen and Udaipura (pigeon pea growing area) for energizing various operations of Dall Mill. The biomass based power plants established in the villages are being run by local rural youth after receiving training at CIAE, Bhopal.

### Technology:



The crop residues are grounded and converted into briquettes for use as fuel for the gasifier. The gasifier has been developed for generation of producer gas from briquettes of crop residues. Further, wood based gasification technology has been refined for use of briquettes as feed stalk for gasification. The generated gas is filtered and used to run gas engine based electricity generating set. The technology requires 1.2-1.3 kg briquettes for production of one unit of electricity. The raw materials used for production of briquettes for generation of producer gas are soybean stalk, pigeon pea stalk, cotton stalk, mustard stalk, sunflower stalk, groundnut shell, etc.

### Fuel Supply Chain:

The fuel supply chain for different capacities of power plant has been studied and established in the field for operation of power plant 12 hrs/day for 300 days of annual operation. The estimates were made considering different levels of biomass collection. A 100 kW power plant requires 500 tonnes of crop residue and would require a catchment area of less than 2km radius. The crop residues are collected using tractor operated bailer, transported to briquetting plant and converting into briquettes. The bailers can collect 800 to 900 kg of crop residue in one hour. The cost of biomass collection is

about Rs 500 per tonne and transportation cost varies from Rs 600-800 per tonne for lead distance of about 10 km.

### **Feed Stock Preparation:**

Any biomass can be used for gasification provided it is in uniform shape and size to have proper flowability in gasifier reactor. The existing briquetting technology has been adopted after grinding of crop residue into smaller particles. The die used in commercial briquetting technology, suitable for saw dust, has been modified to produce the briquettes from crop residue. The briquetting plants are available in different capacities ranging from 500 to 1500kg/h. The production cost of briquettes varies from Rs 600 to 800 per tonne. The briquetting of surplus crop residue has also emerged as one of the agro enterprises to replace the coal and wood used as fuel for boilers and furnaces in various industries. The details of briquetting of crop residues are given below

Cost of Biomass:	Rs. 1000-1500 per tonne
Cost of Briquetting Machine:	Rs. 12-14 lakhs
Capacity of Plant:	500-1000 kg/h
Cost of briquette:	Rs. 1600- 2300 per tonne
Market price of briquettes:	Rs.3500-4000 per tonne

### **Electricity Generation:**

The CNG engine available in the market has been adapted to run on producer gas generated from crop residue. The gas engine is coupled with matching AC generating set to produce the electricity. The economic feasibility of power generation from briquettes of crop residues indicates that the cost of electricity generation is at par with the cost of electricity from grid. The cost for production of one unit of electricity at present is Rs 6.0 where as the cost of electricity from diesel electricity generating set is Rs 16.0 per kW.

### **Details of Cost of Power generation system:**

<b>System Capacity (kW)</b>	<b>Market price, Rs in lakhs</b>	<b>Subsidy, Rs in lakhs (@Rs15000/kW)</b>	<b>Net price, Rs in lakhs</b>
<b>20</b>	12	3	9
<b>50</b>	23	7.5	15.5
<b>100</b>	45	15	30