BIOMASS ELECTRIFICATION
V/S
OTHER ELECTRICAL ENERGY SOURCES

BIOMASS

The term biomass generally refers to renewable organic matter generated by plants through photosynthesis in which the solar energy combines carbon dioxide and moisture to form carbohydrates and oxygen.

BIOMASS SOURCE:-

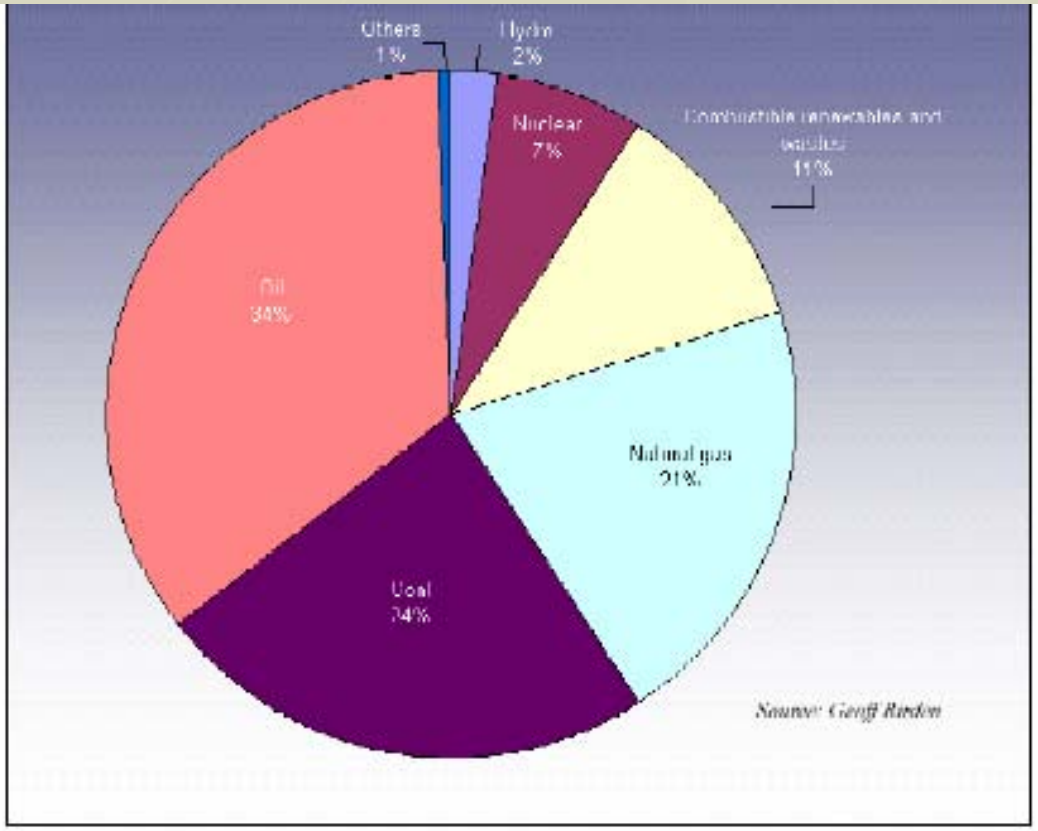
- **Wood, Sawdust.**
- **Wastes**
  - Municipal Solid Waste (MSW)
  - Paper, food and yard wastes, plastics, wood, and tires
  - Livestock Waste
  - Sewage
- **Agricultural Residues.**
- **Aquatic and Marine Biomass.**

IMAGES OF BIOMASS

CHARACTERISTICS OF BIOMASS:

- High moisture content
- High volatile matter
- Low bulk density
- Low calorific value

WORLD ENERGY CONSUMPTION PATTERN:

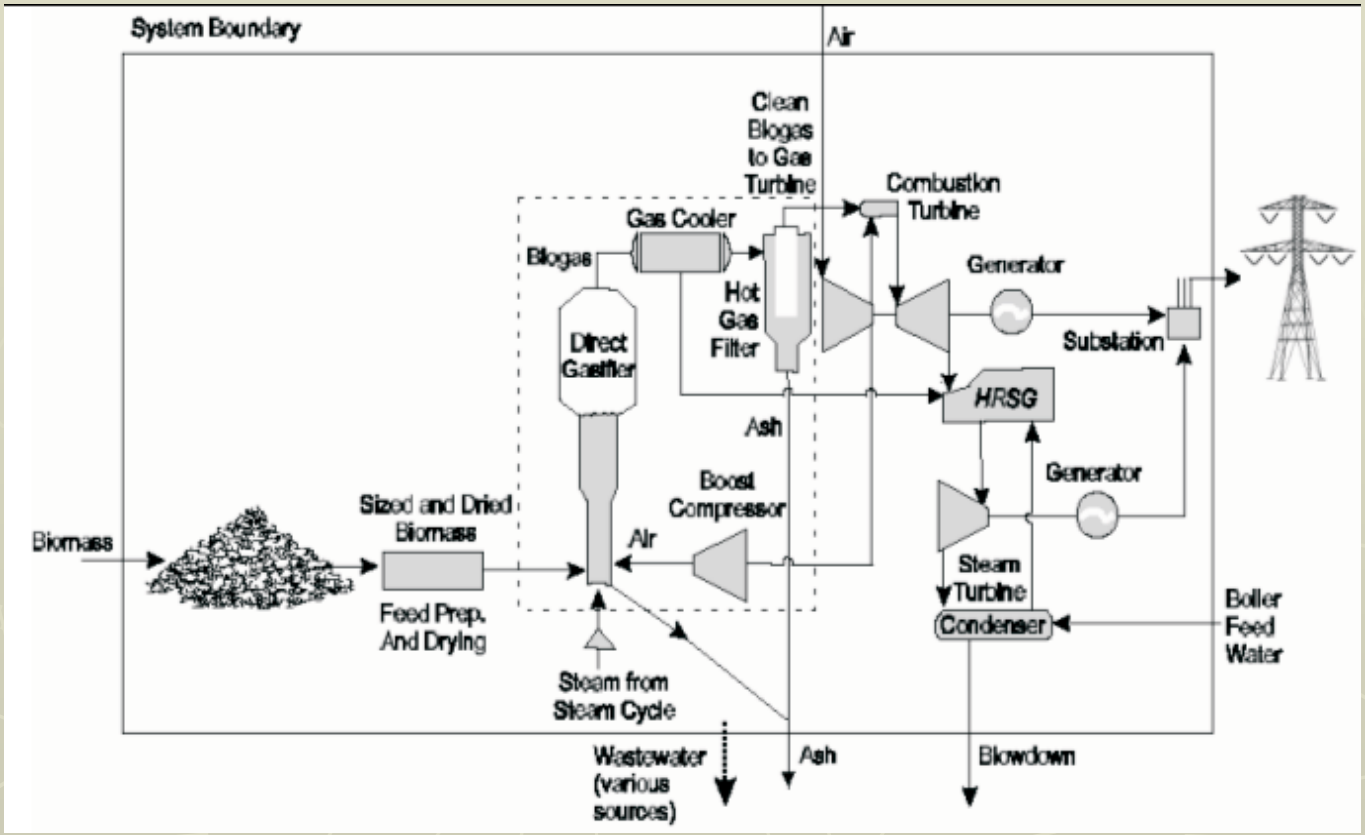


ENERGY DEMAND OF INDIA

- India produces about 2.4% of the world's total annual energy and accounts for about 3.3% of the world's total annual energy consumption.
- 31 % (major portion of energy) of total energy requirement of India is for agriculture based works and it is well known that Agriculture itself produces biomass and also it's a village based practice hence we can fulfill this 31 % of energy requirements of country using biomass gasification, along with this we can also fulfill a portion of domestic and other energy needs .
- we have a potential of 19500 MW and we are harnessing only 2.75% of that.

BIOMASS ELECTRIFICATION PROCEDURE

Biomass Integrated Gasification Combined-Cycle System Schematic



Burn Fuel → heat water to make steam → steam turns turbines → turbines turn generators → electrical power sent around country

How it works

The fuel is burned, which heats water into steam, which turns turbines, which in turn drive generators, just like in a fossil-fuel power stations.

Biomass-gasifier power plant

Biomass power plant in Tamil Nadu

ADVANTAGES OF BIOMASS POWER

- Biomass fuels are sustainable in nature.
- Renewable Sources are commonly available and locally produced
- Helps in green house gas mitigation
- Reduced dependence on foreign oil .
- Improved rural economy.
- Results in major new Indian industry.
- Uses low-cost waste products .
- Recycling waste materials can be a solution to the problems with disposing of waste products.

DISADVANTAGES OF BIOMASS POWER

- Availability of some biomass round the year and Collecting the waste in sufficient quantities can be difficult.
- Over-collecting wood results in deforestation which causes soils erosion, depleting moisture content, Increased run-off that can cause flooding at downstream.
- When plant and animal wastes are used as fuel, they cannot be added to the soil as fertilizer. Soil without fertilizer can be depleted of nutrients and produce fewer crops.
- Biomass has less calorific value than a similar volume of fossil fuels.
- Greenhouse gases produced by burning .
- Extra costs of installing technology to process and recycle wastes.
- Expensive to collect, harvest and store raw materials .

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- Maintaining a supply of the waste product in sufficient quantities to maintain *energy* production can be difficult.
- Biomass energy's universal disadvantage is its high land requirement. An efficient biomass power plant (33 %) will require between 200 and 400 ha of land in energy crops per MW of base load power.

Comparing Biomass Energy with Other Energy Sources

Comparing Biomass Energy with Other Energy Sources

Coal

- Biomass releases 1/10 to 1/20 of greenhouse gases per unit of power compare to coal
- A recent analysis calculated that using the wood from 1 ha of short rotation woody energy crops instead of coal would displace 5.2 t (metric tons) of fossil C in CO2
- Biomass burns cleanly, with much lower SOx and somewhat lower NOx emissions.
- Two additional environmental benefits come from the reduction in coal mining and the avoidance of coal ash disposal.
- Wood combustion produces much less ash than does coal, and the ash can be returned to agricultural soils.

GASOLINE

- The CO2 benefit of using ethanol made from biomass to displace gasoline is estimated to be about half as great as when it displaces coal.
- Ethanol has air pollution benefits over gasoline as fuel. It emits less CO, SO2, and hydrocarbons, but slightly more NOx.
- It emits acetaldehyde, which is less reactive and less toxic than the formaldehyde produced by the combustion of gasoline .

Natural gas

- The environmental advantages of displacing natural gas with biomass derived electricity are less than for displacing coal, oil or gasoline.
- Natural gas contains twice as much energy as coal per unit of carbon. Also, natural gas power plants are more energy efficient than coal-fired plants
- Through biomass we can generate Producer gas .A reaction between the biomass and the hot sand-air mixture produces flammable gases. The process also generates its own heat to sustain the reaction. It's a system that's reliable, produces few emissions and can be efficiently integrated into a plant's existing natural gas boilers and dryers.

Nuclear and renewable energy sources (hydro, wind, photovoltaic).

- Biomass energy avoids the safety and waste disposal problems of nuclear power.
- It does not impose the loss of land and the damage to fisheries that occur with dams and hydropower
- It's a versatile fuel in its commercialization and final use like we can use biomass as liquid , gas and solid fuel.
- But both solar and wind power have certain limitations regarding the kind of energy they produce, that is electricity, mechanical power or heat .
- Biomass technologies use combustion processes to produce electricity so it can generate electricity at any time, unlike wind and most solar technologies, which only produce when the wind is blowing or sun is shining.

PHYSICAL AND SOCIO-ECONOMIC IMPACTS OF BIOMASS ENERGY

PHYSICAL IMPACTS

Air Quality and Acid Precipitation

- Biomass feed stocks contain little sulfur compared with oil and coal, and varying amounts of nitrogen.
- SOX emissions from biomass combustion are negligible compared to SOX emissions from coal and oil combustion,
- NOX emissions can be comparable depends on the conversion process and nitrogen content of the biomass.
- Biomass power plants also divert wood waste from landfills, which reduces the productions and atmospheric release of methane, another potent greenhouse gas.
- Hence biomass is less polluting , and there are less chances of acid precipitation compare to fossil fuel use.

Land Use Change

- The ecological effects of growing large quantities of biomass for energy effects on :

  *wildlife habitat and biodiversity.

  *On soil fertility and erosion, and on water infiltration and its quality.

- The ecological implications of displacing more natural land cover (such as forests and wetlands) with energy crops would very likely be negative.
- The ecological implications of this land use change would very likely be positive as long as perennial biomass crops displaced annual agricultural crops.

Soil Erosion and Water Quality

- It has been projected that displacing annual crops with perennial biomass crops results in

  *Reduces runoff

  *Decreasing soil erosion and improving water quality .

  *Increase infiltration of water.

- Displacing annual crops with perennial biomass crops would significantly reduce net pesticides, fertilizers and herbicides use.

SOCIO-ECONOMIC IMPACT

EMPLOYMENTS

It can be run locally by local people as opposed to other energy resources which often need highly trained operators. This means It creates jobs and business opportunities for people which can boost the economy of the area.

HEALTH AND HYGIENE

Biomass uses organic matter, fuelling biomass generators means that waste products from a community; anything ranging from food scrapes, fibers or surplus waste from agriculture, can be used to create energy .This cleans the local environment .

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SAVINGS AND CREDITS

This minimizes cost involved with waste disposal and it also reduces waste going to landfill. This can generate money for the community.

SELF DEPENDANCE

As a community becomes more reliable on biomass, it can loosen any dependence on fossil fuels and their outside operators; making the society more self sufficient and forgoing possible future debt.

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IMPROVEMENT IN LIVELIHOOD

Since it provides job opportunities and electricity (pumping water) which results in increase crop productions. Hence income level of people increases which results in improving livelihood.

REDUCTION IN MIGRATION

Since it generates jobs locally, people stops migrating distant places for doing jobs.

AWARENESS

Since livelihood rises , education level increases this will results in awaring the peoples for their rights and surroundings.

Cost of Electricity Generation by Biomass-based Power Stations:

- The actual per unit cost of electricity generated by biomass energy technologies higher than electricity generated by fossil fuel sources, but it is no longer valid for the rural areas of rural India. In most of the Indian villages diesel generators are often the only source of power but power from biomass gasifier based plants are considerably cheaper where ever biomass is available.
- Even when grid power is available, the actual cost of power at the point of consumption is very high largely due to line losses in transmission and distribution. High subsidies and financial losses keep the power price low for agricultural works.

- The financial implications for developing countries of increased reliance of imported energy has a great impact on their economies.

COST – BENEFIT ANALYSIS OF BIOMASS ELECTIFICATION FOR SELECTED INDUSTRIES IN UDAIPUR (RAJASTHAN)

- The cost economics of biomass electrification system at individual level in terms of saving in use of biomass electrification is calculated and presented in table .The cost incurred is include the cost of total unit consumption of electricity for production (drying , processing , motors, exhaust fan , etc.) as well as other activities like lighting , to run the AC, fan , cooler , computers etc.

NAME	PRESENT OPERATING COST (Rs /Day)	COST RESULT AFTER BIOMASS ELECTRIFICATION INSTALLATION (Rs /Day)	SAVING (Rs /Day)
Laxmi food products	3290	1914	1286
Suman food products	5040	2840	2200

- It is found that when we consider all the cost such as installation, running , transmission , labour etc. the per unit cost of electricity is 2.70 Rs. And per unit cost due to thermal electricity which they are using at present is 4.0 Rs.
- And also the percentage saving for Laxmi & Suman food products industries are 32.80% & 43.65% respectively

OUR VIEWS REGARDING BIOMASS ELECTRIFICATION

Village Energy Security:- Biomass will provide a quantum jump to:

- Rural economy and contribute to growth
- Achieve gender equality
- Better health
- Create job opportunities at village level
- Modernization of rural infrastructure. Electrification of all villages and households

Community participation:- It involves the community (No technology can be successful unless the community is taken into confidence statement given by Bunker Roy's Barefoot College) which empower the women and farmers to strengthen their economy.

Suitability:- Biomass is best suited to provide energy access and security in a sustainable and environment friendly manner.

Economically viable:- as we have calculated the per unit cost of electricity from both biomass as well as thermal electrification we found that biomass is economically viable for this small scale industries.

CONCLUSIONS:

As we have seen biomass electrification is viable from socio-economic and physical aspects but still we have to focus on:

From future point of view:-

There should be a great deal of research required in the field of cost-effective integrated approaches from biomass collection to electricity production and use .And also Sustainable biomass should be taken into account in any future development. A great investigation should be require for socio-economic and environmental impacts of biomass energy and also the results of this research should be dissimated among community and make them aware of overall benefits of biomass electrification.

Development of a stronger market for biomass technology

- At present there is lack of adequate infrastructure in order to assure a steady supply of biomass for electrification only significant residues are available.
- Biomass energy financiers and planners need to know where best to direct investment and the public need to be aware of and accept the benefits of energy from biomass energy schemes.

THANKS

- Total air emissions as viewed from the stack exiting into the surrounding air are expected to be in the range as follows:
- Particulates Less than 5 tons per year Carbon Monoxide (CO) Less than 10 tons per year Nitrogen Oxides (NOx) Less than 15 tons per year Sulfur Oxides (SOx) Less than 5 tons per year Hydrocarbons (THC) Less than 5 tons per year Total Emissions @ 45 MW generation is approximately 40 tons per year.