I Research Journal of Environment Sciences ________________ I Res. J. Environment Sci.
Vol. 1(1), 54-57, August (2012)

Review Paper

Biomass: Energy and Environmental Concerns in Developing Country

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Available online at: www.isca.in
Received 27th June 2012, revised 11th July 2012, accepted 13th July 2012

Abstract

There is a realization on the need to search for decentralized and renewable energy-based options to meet the rural energy needs in a sustainable way. Among all the renewable energy sources, biomass is the largest, most diverse and readily exploitable resource. Biomass is generally and wrongly regarded as a low-status fuel and in many countries rarely finds its way into statistics. Bioenergy can be modernized through the application of advanced technology to convert raw biomass into modern, easy-to-use carriers. This could bring very significant social and economic benefits to both rural and urban areas. In developing countries biomass fuel is dominant energy source providing one third of their total energy demand. The fulfill of the demand of energy is only by the beneloped of biomass sources. The promotion of biomass energy in the country is being encouraged through favorable policy regimes. Biomass has been used for energy purposes ever since man discovered fire. Today, biomass fuels can be utilized for tasks ranging from heating the house to fuelling a car and running a computer.

Keywords: Biomass, environment, energy, conversion, renewable energy source, bio-energy programmes.

Introduction

Biomass has been one of the main energy sources for the mankind ever since the dawn of civilization, although its importance dwindled after the expansion in use of oil and coal in the late 19th century [1].

The energy situation in rural India is characterized by low quality of fuel, low efficiency of use, low reliability of supply and limited access leading to lower productivity of land, water and human effort, ultimately leading to low quality of life and environmental degradation.

First, dependence on biomass (fuel wood, crop residue and cattle dung) and traditional cook stoves with low efficiency which emit smoke into kitchen, leads to low quality of life for most rural women. Secondly, dependence on kerosene and wick lamps, for lighting with uncertain supply of the fuel leads to low quality and intermittent lighting. Thirdly, dependence on centralized grid electricity supply to low-load rural situation is characterized by fluctuating voltage, unreliable supply and shortage of power in most parts of rural India.

There is a realization on the need to search for decentralized and renewable energy-based options to meet the rural energy needs in a sustainable way[2-4]. Among all the renewable energy sources, biomass is the largest, most diverse and readily exploitable resource [5].

In developing countries biomass fuel is dominant energy source providing one third of their total energy demand. Developing world is having 75% of the total world population whereas they're consuming only about 25% of the energy in the world. The fulfill of the demand of energy is only by the beneloped of biomass sources. The availability of biomass in India is about 1,249 mt, (energy equivalent of biomass as 4,400 kilo calories per kgm). The total latent energy is about $5{,}496 \times 10^9$ kilocalories. This can be increased by improved developing species and photosynthesis[6-10].

Biomass Conversion: Different technology routes such as gasification, combustion and cogeneration are being actively developed to promote conversion of biomass materials such as agricultural, forestry and agro-industrial residues into electric power. The promotion of scientifically designed models of wood/biomass fired efficient cook stoves will have a direct impact on the welfare of women as well as of domestic households in the villages. The pressure for the use of kerosene and LPG might also be reduced. The promotion of biomass energy in the country is being encouraged through favorable policy regimes. A package of financial incentives such as concessional customs duties, exemptions from excise duty, tax holidays and accelerated depreciation, is available for commercial biomass projects [11, 12].

Biomass has been used for energy purposes ever since man discovered fire (table-1). Today, biomass fuels can be utilized for tasks ranging from heating the house to fuelling a car and running a computer.

Table- 1
Share of Biomass on Total Energy Consumption

S.No.	Country	Energy Consumption
1	Nepal	~ 95%
2	Malawi	~ 94%
3	Kenya	~ 75%
4	India	~ 50%
5	China	~33%
6	Brazil	~25%
7	Egypt	~20%

Table- 2
Energy Value: Energy Contents Comparison

S. No.	Types of Biomass	Content of Water %	MJ/Kg	Kw/Kg
1	Oak-tree	20	14.1	3.9
2	Pine-tree	20	13.8	3.8
3	Straw	15	14.3	3.9
4	Grain	15	14.2	3.9
5	Rape oil	--	37.1	10.3
6	Hard oil	4	30.0-35.0	8.3
7	Brown coal	20	10.0-20.0	5.5
8	Heating oil	--	42.7	11.9
9	Bio methanol	--	19.5	5.4

Table- 3
Energy Value: Energy Contents Comparison

S. No.	Types of Biomass	MJ/ Nm^3	KWh/Nm^3
1	Sewer gas	16.0	4.4
2	Wood gas	5.0	1.4
3	Biomass from cattle dung	22.0	6.1
4	Natural gas	31.7	8.8
5	Hydrogen	10.8	3.0
6	Hydrogen	10.8	3.0

Environmental Benefits: The use of biomass energy has many unique qualities that provide environmental benefits. It can help mitigate climate change, reduce acid rain, soil erosion, water pollution and pressure on landfills [figure], provide wildlife habitat and help maintain forest health through better management.

Climate Change- Biomass energy technologies can help to minimize the emission of green house gases. Although both methane and CO_2 pose significant threats. CH_4 is 20 times more potent (through shorter-lived in the atmosphere) than CO_2. Capturing methane from landfills, wastewater treatment and manure lagoons prevents the methane from being vented to the atmosphere and allows the energy to be used to generate electricity or power motor vehicles.

Acid Rain- Acid rain is caused primarily by the release of S and N oxides from the combustion of fuels. Acid rain has been implicated in the killing of lakes, as well as impacting humans and wildlife in other ways. Since biomass has no S content and easily mixes with coal, "Co-firing" is a very simple way of reducing S emissions and thus, reduces acid rain. Co-firing refers to burning biomass jointly with coal in a traditionally coal-fired power plant or heating plant.

Soil-Erosion and Water Pollution- Biomass crops can reduce water pollution in a no. of ways. Energy-crops can be grown on more marginal lands, in floodplains, and in between annual crop areas. In all these cases, the crops stabilize the soil, thus reducing soil erosion. Furthermore, because energy crops tend to be perennials, they do not have to be planted energy year. Since farm machinery spends less time going over the field, less soil compactness and soil disruption takes place.

Another way biomass energy can reduce water pollution is by capturing the methane, through anaerobic digestion, from manure lagoons on cattle, hog and poultry forms. These enormous lagoons have been responsible for polluting rivers and streams across the country. By utilizing anaerobic digesters, the farmers can reduce odour, capture the methane for energy, and create either liquid or semi solid soil fertilizers, which can be used on-site, or solid[13-23].

Bio-mass/ Bio-energy Programmes: Biomass based co-generation programme has been taken up for generation of power in sugar industry. Programme on biomass gasification and biomass combustion based power has been further strengthened. Under this programme financial incentives capital subsidy and interest subsidy are being provided for installation of these projects. Another large scale use of biomass is the firing of biogas, waste from the sugarcane industry in congeneration plants to supply all the required heat and power needed for sugar production, leaving enough power to sell to the national grid. A potential of 3500 MW has been estimated while only 171 MW have been installed, with an additional 230 MW under construction. India is investigating the potential to make use of more and more of its waste. As an example a 2.75 MW rice-husk fueled power plant has been commissioned in Tanaka, Andhra Pradesh and a 10,000 m^3 per day biogas plant using slaughterhouse waste is in operation in Hyderabad. On 3rd April 2006, India signed onto the Future Gen Project- a zero emission coal power project to be built in the US by 2013 and by committing Rs. 45 carores, became the first country in partnering this American initiative. As a member of the Carbon Sequestration Leadership Forum (CSLF), India is set to implement a pilot project to assess the possibility of carbon sequestration. Titled, the demonstration of capture, injection and geologic sequestration of CO_2 in basalt formations of India, this project will develop the technology and demonstrate the viability for deep bed injection of CO_2 in sedimentary rocks underlying India's widespread basalt formations [24-29].

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Figure- 1
Agricultural Residue

Figure- 2
Forestry Residue

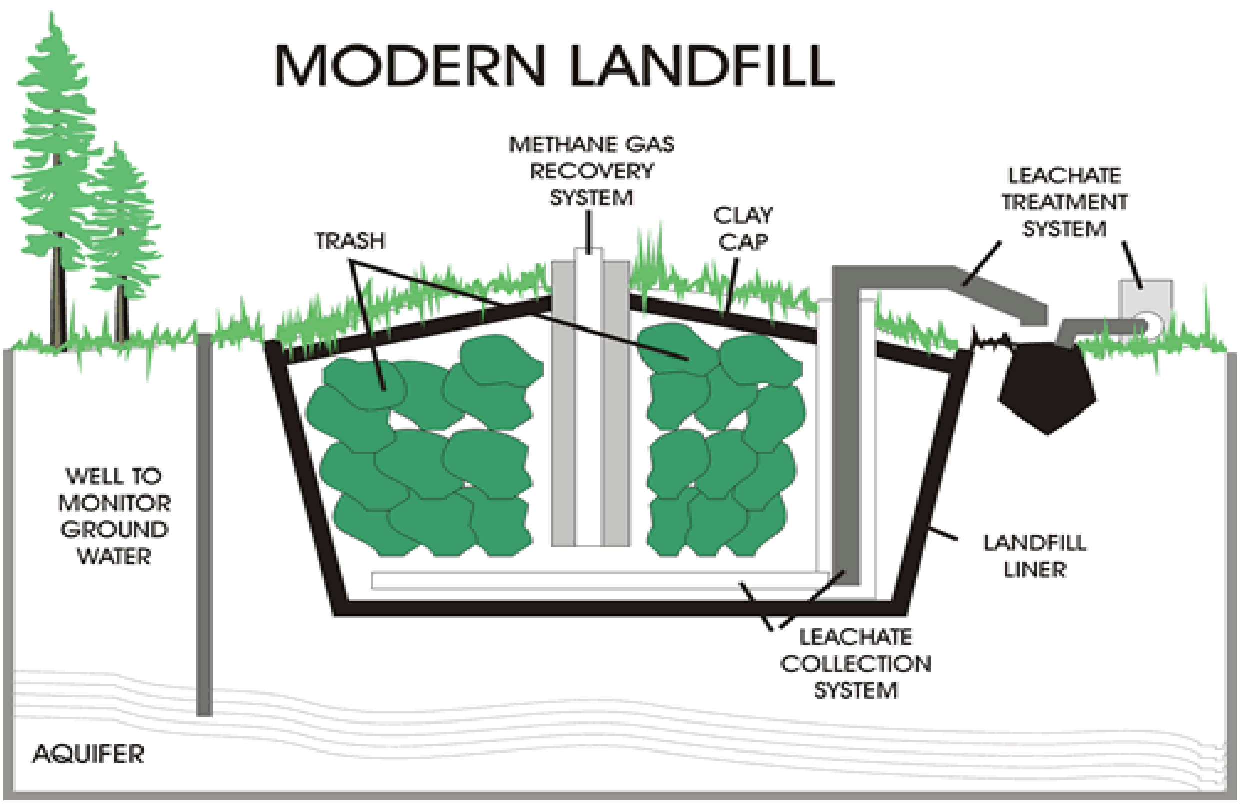

Figure-3
Modern Landfill

Conclusion

Biomass can reduce environmental damage and provide feedstock's to the chemical industry. Therefore wider use of biomass for development would after minimal ecological imbalance and provide the means to recycle nutrients and carbon dioxide from the atmosphere. Hence, different nodes of biomass utilization have the critical role to control the environmental abatement and hence it helps in maintaining sustainable development.

References

1. www.indiaenergyportal.org, Accessed on **24**, 2010

2. Ravindranath N.H. and Hall D.O., Biomass: Energy and Environment: A developing country perspective from India, Oxford University Press, **(1995)**

3. Reddy A.K.N., Goals, Strategies and Policies for rural energy. *Eeon Polit Wkly*, 3435-3445 **(1999)**

4. Ravindranath N.H., Usha Rao K., Natarajan B. and Monga P., Renewable Energy and Environment, A Policy Analysis for India, Tata McGraw-Hill, New Delhi, **(2000)**

5. World Bank, World Development Report 1999/2000, Oxford University Press. **(1996)**

6. Suzaki S. and Karube L., Energy Production with Immobilized Cells *Apl. Biochem. Bioeng*, **4,** 281-310 **(1983)**

7. Choudhuri S.K. and Lovely D.R., Electricity Generation Cells, *Biotechnol,* **21,** 1229-1232 **(2003)**

8. Robert H.W. and Eric D.L., Advanced Gasification Based Biomass Generation, Published in *Ren. for Fue. and Ele*, **(1992)**

9. Roediger H., Roediger M. and Kapp H., Amaerabe Alkaische Schlammfaulung Minchen, Oldenburg, **(1990)**

10. Rose J., Biofuel Benefits Questioned. *Emu. Scie. Tec.*, **28,** 63 A **(1994)**

11. www.inderscience.com, Accessed on **24,** 2010

12. Meshram J.R., The recent development of biomass energy in India: an overview, *Inter. Jou. of En., Tech. and Po.*, 1 **(4),** 413–431 **(2003)**

13. TERI, Energy Directory, Database and Yearbook (TEDDY) 1990-1991 (New Delhi, Tata Energy Research Institute), **(1991)**

14. Campbell C.A., The potential of a range of short rotation tree species for fuel wood and pulp production. A dissertation submitted in partial fulfillment of the requirements of the degree of agricultural science with honors. Department of Agronomy, Massey University, Palmerston North, New Zealand. **(1991)**

15. World Bank, Tanzania-wood fuel/forestry project, activity completion report no. 086/88 (Washington*, D. C.*; Joint UNDP/World Bank Energy Sector Management Assistance Point) **(1988)**

16. Bowersox T.W., Schubert T.H., Strand R.F. and Whitesell C. D., Coppicing Sources of Young Eucalyptus Saligna in Hawaii. *Biomass* **23**, 137-148 **(1990)**

17. FAO. Eucalyptus for Planting. FAO Forestry Paper No. 11, Food and Agricultural Organization, United Nations, Rome, **(1979)**

18. Hillis W.E. and Brown A.G. (Eds), Eucalyptus for Wood Production. Commonwealth Scientific and Industrial Research Organization. East Melbourne and Academic Press, North Ryde NSW, Australia, **(1984)**

19. Renewable Energy Report, Financial Times Energy, April **(1999)**

20. Smith K.R., Biofuels, Air Pollution and Health: A Global Review (New York, Plenum Press*)*, **(1987)**

21. http://journeytoforever.org/biofuel.html (Biofuels: how to make your own clean-burning biofuel, biodiesel from cooking oil, fuel alcohol, renewable energy, glycerin, soap making. Accessed on **(2010)**

22. http://www.biofueloasis.com/html/basics.html (BioFuel Oasis), Accessed on (**2010)**

23. http://www.seps/zp/fond/direct/biomass.html (Biomass), Accessed on 25 July (**2010)**

24. Dr. Atiqur Rahman, Non Conventional Energy Sources: An Appraisal of Policies, Goals and Achievements in India, AMU, India, **(2010)**

25. Nimawat D. and Namdev V., An Overview of Green Supply Chain Management in India, Res. J. Recent Sci*.,* **1(6)**, 77-82 **(2012)**

26. Mostafa M. R. and Maybelle S.G., Improving Barley Wild Yield Grown Under Water Stress Condition, *Res. J. Recent Sci.,* **1(6),** 1-6 **(2012)**

27. Pathak C., Mandalia H.C. and Rupala Y.M., Biofuels: Indian Energy Scenario, *Res. J. Recent Sci.,* **1(4)**, 88-90 **(2012)**

28. Dhanalakshmi S.V. and Ramanujam R.A., Biogas Generation in a Vegetable Waste Anaerobic Digester: An Analytical Approach, *Res. J. Recent Sci.,* **1(3),** 41-47 **(2012)**

29. Shrivastava N. and Lodhi S.S., Overview of Non-redundant Association Rule Mining, *Res. J. Recent Sci.,* **1(2)**, 108-112 **(2012)**