Economical and Social Aspects of Waste Management

From the waste management point of view, it is the human habit to generate wastes, it is them to actively participate within the implementation stage (which should be a continuous activity, with improvements based on gained experience) and support the correct and safe waste systems. Recent developments and analysis do prove that any waste management system that does not consider the social aspect does not have a high chance of success. In such cases the decision making process focuses upon technical characteristics, economical aspects and legal compliance. However, public participation in all stages of waste management, from informal status until the acceptance, including behaviour upgrading, is just as significant as the technical, economical and legal criteria. People do not, generally, realise the risks posed by the bad practice of waste management. There are not always available and well disseminated clear and focused studies to demonstrate the connection between the impact of wastes and waste management to human health and the wider environment. These risks can be direct or indirect, either direct on humans or indirect as the last link of the food chain, either on today's basis (today's immediate effects) or on tomorrow's outlook. It is often easier to associate the degradation of our landscape due to bad management of wastes (e.g. either through fly tipping, improper landfilling, and the dumpsite etc).

The participation of people in a waste management system takes two sides:

Impact – what is the impact that the participation has upon the implementation of waste management.

Input – what people do in order to actively participate at waste management.

Waste is not something that should be discarded or disposed of with no regard for future use. It can be a valuable resource if addressed correctly, through policy and practice. With rational and consistent waste management practices there is an opportunity to reap a range of benefits. Those benefits include:

1. Economic – Improving economic efficiency through the means of resource use, treatment and disposal and creating markets for recycles can lead to efficient practices in the production and consumption of products and materials resulting in valuable materials being recovered for reuse and the potential for new jobs and new business opportunities.
2. Social – By reducing adverse impacts on health by proper waste management practices, the resulting consequences are more appealing settlements. Better social advantages can lead to new sources of employment and potentially lifting communities out of poverty especially in some of the developing poorer countries and cities.
3. Environmental – Reducing or eliminating adverse impacts on the environmental through reducing, reusing and recycling, and minimizing resource extraction can provide improved air and water quality and help in the reduction of greenhouse gas emissions.
4. Inter-generational Equity – Following effective waste management practices can provide subsequent generations a more robust economy, a fairer and more inclusive society and a cleaner environment.

Factors to be considered in waste management system

1. Justifications for initiatives to augmenting renewable energy solutions:

The government polices of recent years face a strong critique from social activists stating that bio fuel are to blame for the shortage of grains and the inflation forthwith. To counter this argument and to find an efficient alternative to corn ethanol, a few firms have begun to build and develop ethanol plants that use household wastes to produce the fuel. This brings a double dividend cutting down on wastes volume going to landfills thereby, reducing the negative impact on environment; bringing economic benefits to individuals and the economy. Household waste is inherently putrescible and it can be decomposed with the help of methane bacteria. It may ferment naturally in a landfill, which even when lined is at comparatively low cost. But, the landfills cause considerable safety and environmental hazards. The technologies that help to produce energy out of wastes prevent the release of green house gases in the form of carbon dioxide, methane, nitrogen oxides along the volatile organic compounds from entering the atmosphere. They avoid the release of methane that otherwise would be emitted when the waste decomposes, and the release of CO_2 that would be emitted from generating electricity from fossil fuels.

2. Cost-effectiveness and sustainability issues

An increase in the use of renewable energy should significantly reduce the burden on conventional sources of energy. The economic feasibility of renewable sources can be reaped when their production is extended to a large scale and cost effective sources of renewable energy should be supported irrespective of their size of operation.

3. Economic evaluation and viability of waste management systems

Economic aspect of solid waste closely connected with the overall economic efficiency of recycling and provides facilitate productivity and urban development by providing effective waste management. In addition, it aims to provide an environmentally safe collection and disposal of waste, including hazardous industrial waste production, ensuring the overall economic efficiency of treatment of waste, promote waste minimization, conservation, restoration and reuse of waste.

Economic sustainability in municipal waste management can be defined as such integration of waste management options as to operate them at the lowest possible cost – acceptable to the community, local government and a municipal waste treatment facility itself. Sample indicators for the economic sustainability in waste management are the investment costs, the annual maintenance costs, personnel employment costs and finally revenues from recovered materials and energy.

- **Economic viability of integrated waste management:**

The question of implementing a concept of Integrated Waste Management should assign priority to appropriate reduction and reuse strategies, complemented by recycling activities. Of course, all these strategies and activities have to be technically and economically viable or "reasonable", given the framework conditions of a particular country. For the practical implementation one would have to conduct a Benefit-Cost-Analysis on the basis of the available information to single out the best strategy or the best alternative.

- **Economic viability of an investment on waste treatment facility:**

The financial analysis of a project revolves around the monetary aspects of the project and the return on the investment to the investors. It includes the payment transfer of taxes, duties and subsidies in this regard. The economic analysis, on the other hand, evaluates whether the project brings benefits to the whole economy apart from the region it serves. It takes into account the socio economic aspects of the benefit that emanates from the project. It takes, also, into account the prices of the traded goods as well as the shadow prices of the non traded good and services. The economic viability of a project can be calculated on the basis of the net benefit the project produce. The payback period is the length of time between the initial investment and recovery of the investment from the annual cash flow into the project. The shorter the payback period the more attractive it is for investors to choose the option. The financial analysts usually begin with estimating the capital cost of the project along projected power output, annual revenues, expenses, and deductions to arrive at the net benefit. A simple payback period is calculated without regard to the time value of money.

The pay back period of an investment on a project can be calculated as follows:

$$\text{Pay back period is} = \frac{Total investment\ cost - subsidy amount}{annual revenue - annual\ expenditure}$$

4. Optimality of waste treatment strategy

An optimal strategy of waste treatment is the one that will either maximise the fossil primary energy savings or minimise the costs per unit of fossil primary energy savings achieved by the utilisation of available biomass residues and wastes. According to general understanding, the concept of integrated waste management is based on the strategy of the three "R": Reduce, Reuse, and Recycle. Material production, cost and energy could be saved by using less and reusing or recycling more. The problem is then to identify the "optimal" level of the three R with optimality respecting the individual situation of each group of relevant stakeholders.

The stakeholders are

- Individual households, who as consumers benefit from a clean environment and "green" energy, but also from a sufficient supply of packaging material;

- Individuals, who profit directly from collecting discarded materials for reuse or recycling purposes;
- Companies, which profit from recycling activities, but also from the production or usage of packaging material

5. Practicability considerations

The practical implementation of the concept of Integrated Waste Management is not an easy thing to do. It is the missing information on preferences of households, on markets for recycled material, on possible technological innovations, which matters the most. Therefore, the question of a practical concept for Integrated Waste Management is essential and should be handled with great care. As environmental commodities with characteristics of public commodities play a substantial role in this context the market mechanism alone cannot be expected to provide an optimal solution. Modifications to the framework conditions are necessary; in addition to that we could use some plausibility considerations to approximate an optimal solution. The three R "Reduce", "Reuse", "Recycle" are interpreted to give priority to the reduction of waste. Waste which cannot be avoided should – if feasible – be reused and the rest should be recycled, which includes combustion to generate energy from renewable sources.

6. Free market – a prerequisite

Renewable energy options may have to be supplemented by reserve capacity, storage or increased trade with the neighbouring areas. The electricity markets of the future need to provide consumers with a highly reliable, accessible and flexible power supply.

7. Benefit considerations

- **Energy empowerment – a sure way to poverty eradication**

The quality of life is represented as being proportionally related to the per capita energy use of a particular country. The awareness, literacy level, information dissemination and a change in the life style contributing to the shift from non-commercial to commercial energy source should be used for the shift from non-renewable to renewable sources of energy, as well.

- **Employment benefits**

Biogas and the renewable energy production are labour intensive and they can provide employment to people. The additional employment will, however, vary with trends in the labour markets of the countries. The jobs created thereby, may be low value jobs but in periods of high unemployment the positive job creation will be viewed with less scepticism. These options suit the developing countries as most of them have younger population and a large work force. On the other hand, if the community is involved in the production then the workers can be drawn from the community where the project serves. This can improve the income distribution among the rural population and different income brackets. A significant population shifting to urban centres one of the typical issues the developing countries have to tackle in the past few years, can be reduced. This removes the additional burden on the resources at the urban centres. In the case of biogas, the conventional fuels not utilised are conserved and this improves their value. The employment effects of renewable energy projects can be such as the direct employment in construction, operation and maintenance; **indirect employment** of job creation in the supply chain supporting the projects; **induced employment** created because of the wages earned through direct and indirect employment spent in goods and services thus creating jobs. But, the renewable energy projects may create job losses too in the non renewable energy sector. Job losses may also be due to support-mechanisms which result in lower spending elsewhere in the economy.

- **Macro level effects**

The regional and the national economy where an economic activity of producing energy from renewable sources operates may have to take into account the cost and benefit of the operation of that project.

Any project whether it produces biogas or energy from renewable resources is expected to produce some economic effects. Such projects create external economies where the outcome influences the utility function of the consumers and the social welfare function in the economy thereby creating better living conditions and improved quality of life along less spending on health aspects. On the whole, only the energy needs of the regions or nations can not justify the cause of the move from non

renewable to renewable sources of energy. Such projects should ensure for an improved living conditions of the community apart from their environmentally benign move.

The economy benefits from balance of payments as the project output substitutes imports of fossil fuel options of the country. If the country exports renewable energy to the neighbouring nations it benefits the country additionally. If the plant is fully invested by the sources from inland with the least import content of not only the investment but the materials for the plant, the nation may have to face less external diseconomies arising due to fluctuations in the exchange rates.

If the transmission network are installed afresh in the case of renewable sources of energy or biogas or if there is any incremental cost of investment in providing additional networks, they should be calculated taking into account the costs of losses occurring due to distance of the production unit and the customers. In many developing countries, under monopolistic practices, the energy suppliers sell the energy at a higher rate than under a competitive structure. If the renewable energy supply operates under competitive market conditions, it can function without creating any market distortions.

8. Impact considerations

- **Economic impact**

The downside of generating energy from biomass has been the reason behind the shift to fermenting waste to create biogas option. It was argued that if the land is used to producing maize and grain for generating heat and energy will it not have negative impact on food production; will not more fertilisers and pesticides be needed to grow more renewable raw materials; if the raw materials are imported will it not amount to contributing to further deterioration of endangered tropical eco-systems. However, these queries will not be raised if the bio gas which is climate-neutral and energy-rich is processed by fermenting waste especially bio wastes from households

- **Improved health conditions and enhanced economic growth**

The sanitary and health conditions can be fairly improved if the issue of waste management issues are not ignored by people and government. Setting priorities in waste management through recycling the waste either via any energy recovery method or through getting treated biologically could reduce the negative impact of the wastes to a large extent. The biogas treatment for example, may improve the hygiene conditions of the community. This will have an overall positive impact on the health conditions of the community the biological treatment plant serves. A reduction of impact on such intestinal diseases can be taken as a benefit of the organised waste treatment facilities.

- **Use of by-product of biogas**

The by product i.e. the fertiliser, of biogas generation can replace the commercial fertilisers. The biogas plants produce a rich organic waste which can be dried and used as a fertiliser.

9. Financing considerations

The financial aspect is aimed to creating a system of budgeting and cost accounting in the field of waste management, to provide transparency regarding costs in the industry, providing a basis for planning and improving the efficiency of operators, and mobilize the necessary investment resources.

- **Requirements**

For the biogas production or renewable energy generation project to be funded from lending institutions, they should fulfil certain requirements.

From the perspective of lender:

A feasibility study giving a brief description of the project; summarising history of the group, cooperative or company that is proposing the project; mentioning the findings of the feasibility study on technical, management, marketing and financial characteristics of the project proposed and the most important aspect of socio-economic implications of the proposed project, is necessary at the first instance. The feasibility study should describe the location of the project, climatic conditions of the region, the infrastructure facilities like the communication network, roads, ports, airports, banks, schools, electricity and so on. The technical aspects of the project like the size, capacity, efficiency; purpose of the project; raw material requirements; equipment and other fixed asset requirement; life expectancy of the machinery newly acquired and existing machinery, land, buildings and other movable and immovable assets should also be detailed (Arnott, 1985). The feasibility study has to give some details of marketing like supply and demand conditions for the output and the raw

materials to produce the product; production costs, price policies, marketing policies and strategies for methods of the product distribution. It should elaborate the contribution of the project towards the regional, provincial and national economy. The annual volume and value of the sales expected and the net savings should also be mentioned. On the financial front, the study should project details of its expected loans, grants and investments and the sources the investor opted for. The amount and terms of selected or proposed financing including security offered schedules of repayment and interest rates. Any lending institution will find the project feasible and viable if the feasibility study offers some valid information on logistics information like the transport and storage and access to the raw material and market are taken into consideration. The lender may also be interested in knowing whether the project can be a low cost producer; whether the project will be supportive and stable under the existing regulatory framework of the region and the nation; whether it will survive technology risk factors; how the by-products have been valued and included; how it is going to make impacts, positive as well as negative, on environment; other considerations specific to the operation of the plant.

- **The role of the government**

The human impact through energy consumption directly influences the global climate and producing and using renewable energy sources can reduce the impact to a great extent. A combination of governmental polices can improve the incentive mechanism towards an efficient use of existing non renewable resources and switching to renewable sources of energy. Renewable energy from one or two sources can also be clubbed to make a hybrid system and this can serve regions that are off-grid or those regions having limited power. The government polices can favour increased use of renewable sources by fostering collaboration, removing market barriers for renewable energy sources and developing markets for the products of renewable sources. The political structure of many developing countries does not extend a vivid support to projects who can contribute substantially to meet their energy needs. The industrial lobby of these countries contribute a major share in meeting the election campaigns expenses and party funds and therefore, they have a major say in the political decisions of these Asian countries. There is not adequate transparency in the political decisions of these countries. The decision makers also, are apprehensive that the shift from non renewable to renewable sources of energy may hurt their countries' competitiveness in the global arena. Nevertheless, they extend their willingness, verbally, under some circumstances, for the move. The initiatives of the government allocating a certain quota of funds in their respective, national budgets can only affirm their real interest in such move. Sometimes, when the profitability of biogas plants are viewed with scepticism by the private investors the government will have to invest in such plants so as to alter the investment decisions of the private entrepreneurs. The government can also grant subsidies to the private and community owned biogas plants through grants and soft loans. If the investors fear an uncertain demand conditions for the energy produced at their plants, the government can assure them through demanding certain share of energy for use in the government offices and biogas can be used in the canteens of the government offices and in the public utilities of the municipalities. The government can give some tax exemptions to those households who shift from the use of non renewable sources of energy and fuel use to renewable sources. The hurdles for the move are overcome, if the investors could get grants and credits from the financial institutes, from the national banks thereby assuring the project initiator of sufficient funds.

Socio-cultural aspects of waste management

The essence of the social component may be reduced to the development of mechanisms of interaction of the public and institutions working in the field of recycling, awareness raising and public awareness on issues of waste management, promotion of public participation in planning, implementation and operation of systems for collecting waste.

Social sustainability in municipal waste management can be defined as provision of appropriate level of waste services to meet health and comfort requirements of participants. Sample indicators for the social sustainability in waste management are the convenience of use, visual impact, odour, noise, and traffic nuisance.

- **Factors influencing waste management**

There are clear differences in the attitudes towards waste recycling and managing among diverse cultural groups. These attitudes vary depending on the religious, cultural beliefs, gender and generational differences. In many developing countries the people who work in waste management

have a different socio-cultural background than the rest of the population. The socio-economic status of the workers of waste management system is usually, very low. People who belong to the economically rich group believe that their littering practice is the right thing, in that it offers employment for some one. Low education levels and unhealthy working conditions of the poor in combination with their status lead to a negative self-perception and lack of self-confidence. Their occupation is usually, considered to be of the lowest status in the society. Historically, outcasts and marginal groups such as slaves, gypsies and migrants have performed waste collection and recycling activities in developing countries. While ascertaining the support and participation of the community for a shift in the waste management system the socio-cultural attitudes of the population towards wastes and their attitudes to gender roles relating to waste management in and outside their homes; their openness to integrated approaches involving recycling and composting; their ability and willingness to pay for an improved waste management system should be considered.

- **Factors affecting the waste composition**

The physical and chemical characteristics contribute toward the composition of household waste. They are directly influenced by the food habits, cultural and socio-economic, seasonal and climatic conditions of the community generating the waste. The components of municipal solid waste may vary from urban and rural community and also from one country to another and may vary within a country of vast expanse with diverse cultures, like India. In fact, the composition of wastes differs in two localities that differ considerably due to the socio-economic status of the residents in these areas. Wastes from food constitute a major component of solid waste stream generated in developing countries

	Short term	**Long term**
Economic Aspects	Investment cost, net operation, total net cost per collected ton, net annual total cost	Long term viability of collection and sorting operations and final disposal
Environmental Aspects	Quantity, quality of material recovered, local and regional health effects, residues, pollution, noise, landfill usage, natural resources used	Global impact: bio-diversity, global warning, acid rain: landscape, electricity consumption, waste produced, water usage
Social Aspects	Public acceptance, participation, employment	Welfare, natural resources availability
Technical Aspects	Scale, flexibility, market potential	Potential for future development