Toxics Link
for a toxics-free world

Waste to Energy-Public Lecture

6 June 2014
India International Centre

Waste to Energy – Public Lecture

Introduction

Waste management is one of the most challenging issues of our times, especially in India - which is home to over a billion people - and has a fast growing economy and an extremely high rate of urbanization. According to various estimates, about 55 million tonnes of municipal solid waste (MSW) and 38 billion liters of sewage are generated every year in urban areas of India, and this is expected to increase rapidly. An estimate puts the increase of waste generation in India at the per capita rate of approximately 1-1.33% annually. This has significant impacts on the amount of land needed for disposal, economic costs, and the environmental consequences.

Currently, most of the wastes that are generated find their way into land and water bodies without treatment, causing severe water pollution. They also emit greenhouse gases like methane and carbon dioxide, and add to air pollution.

The problems caused by such wastes can be significantly mitigated through the adoption of environment friendly waste-to-energy technologies. As has been tested in other countries, these technologies reduce the quantity of wastes, generate a substantial quantity of energy from them, and greatly reduce environmental pollution. With these possibilities the Indian government is keen on generating energy from waste, even though the cost of it somewhat higher than other renewable sources.

Waste to Energy Potential in India

The Ministry of New and Renewable Energy (MNRE) states that there exists a potential of about 1700 MW from urban waste (1500 from MSW and 225 MW from sewage) and about 1300 MW from industrial waste. The ministry is also actively promoting the generation of energy from waste. Reportedly, the Indian Renewable Energy Development Agency (IREDA) estimates indicate that India has so far realized only about 2% of its waste-to-energy potential.

Even though there is immense potential, laws, and guidelines, collection and treatment is inadequate in India. Landfills are overflowing, and unscientifically designed. Waste to Energy has been one proposal, and in fact many cities are in the process of installing such technologies. The most popular seems to be combustion technologies, while bio-methanation is also being considered. Many of these come with high costs of technology as well as systems infrastructure, which includes regulation, segregation, energy distribution, and financing models. To further streamline the usage of waste to energy technologies, the recently released Kasturirangan Committee Report touches on many aspects of the governance of these technologies using PPP models, however it is silent on the cost of environmental regulation and other related issues.

To discuss all these aspects, Toxics Link with India International Centre organized a Public Lecture on Waste to Energy, on 6 June 2014.

Public Lecture Session

Mr Ravi Agarwal, Director, Toxics Link

Mr Ravi Agarwal opened the lecture session with a brief introduction on waste management. Speaking on the challenges of urban waste he emphasized upon the fast rate of urbanization, which will keep on increasing in the next 20 years and further intensify waste management challenges. About 20 years back waste management was not that important issue, however now several interventions have been started by the courts and the government. These interventions however, can change the whole thing positively as well as negatively. They can change the look of the city, at the same time they may negatively impact the environment, and put the rag pickers and informal waste processors out of business.

Highlighting the Kasturiranjan Committee Report that has come recently, Mr Agarwal said that the committee was set up by the planning commission to examine waste to energy after Mr Chidambaram announced subsidies in his budget on waste to energy technologies. He further said that the Kasturangan Committee Report largely talks about governance, but little on the environmental issues.

Waste to Energy: Technology Options
(Source: various waste management websites)

Energy can be recovered through thermal, thermo-chemical, biochemical and electrochemical methods.

(i) Thermal Conversion: The process involves thermal degradation of waste under high temperature. **The major technological option under this category is incineration.**

(ii) Thermo-chemical conversion: This process entails high temperature driven decomposition of organic matter to produce either heat energy or fuel oil or gas. **The main technological options under this category include Pyrolysis and Gasification.**

(iii) Bio-chemical conversion: This process is based on enzymatic decomposition of organic matter by microbial action to produce methane gas, and alcohol etc. **The major technological options under this category are anaerobic digestion (bio-methanation) and fermentation.**

(iv) Electrochemical conversion: **Electrochemical conversion in the context of waste to energy refers typically to microbial fuel cells (MFC).** These systems are developed to trap energy from wastes, where the reduction-oxidation machinery of immobilized microbial cells is catalytically exploited.

After a brief introduction to the topic Mr Agarwal introduced all the panelists to the audience, and requested Dr Mazumdar to present his views on waste to energy.

Dr Nirod B. Mazumdar: Waste Management Expert

Dr Majumdar initiated by providing a broad perspective to waste management issues. He gave examples on how it was done in India in the past; for instance in the year 1902 a biogas plant was set up in "laper ashram"; and again in the 1950s the Khadi Village Industry Commission that developed gobar-gas plant, which is also called the Indian bio-gas plant. Dr Majumdar also pointed out that "waste to energy" has three broad options: Bio-methanation, RDF (Refused Derived Fuel), and Incineration.

Following are some of the issues highlighted by him during the lecture:

- Every city should decide by itself what kind of waste management plant it wants to adopt. This can be done through interactive debates on whether they need centralized/decentralized systems, to what extent, which technology, etc. Normally in the developed countries the process starts from the bottom. There are some actions, then there are policies and finally some rules are made. In India we do the opposite; we make the rules and policies, we set targets and then we implement them. What is important is to make the citizens responsible for examining what their city needs, and plan on long-term basis.
- Practical understanding on the ground realities is important among all the stakeholders. There is a serious lack of understanding on how to use the technology, where the waste is coming from, kinds of waste that is coming, etc. Orientation and extensive capacity building exercise at all levels including the technocrats, is essential.
- Municipal waste needs pre-sorting otherwise the technology will just not work in large scale power generation. Biomethanation is very much dependent on the material that is fed into it. In India most of the plants are not fed by Municipal waste, and even those that are, are not running successfully. The successful ones are running at only some places such as canteens, or in very specific niche areas. For example in Vijayvada, there was a plant that had a fairly good design, and after 2 years it was closed. At Coimbatore there is a plant – it had support from MNRE and it was running well; after 2-3 years it started malfunctioning. One of the main reasons for these malfunctioning is improper pre-sorting.
- Power generation can be done from many sources for instance from sewage treatment plants - Compressed Biogas (CVG) which is like CNG. Some of the European countries for instance Sweden is coming up with a solution to the automobile fuel. Though this technology is coming to India, but very gradually.
- While adopting a technology it is essential to think about availability of land. If composting is done for 2000 tonnes of waste, it takes about 15-20 hectares, which is very difficult to get. In such cases Biomethanation plant will take lesser space; however, if the space crunch is not there then one can go for composting and the combined RDF.
- Bids for contracts play an essential role. During bids more weight should be given to the technical aspects; only seeking for the lowest bid is not going to help. Additionally, Euro-norm should also be adopted for emissions from the initial phase.

Dr Dieter Mutz, Director, Indo-German Environment Partnership Programme, GIZ

Dr Mutz brought in his rich experience from Germany to the audience. He initiated by cautioning against the blatant use of incinerators. According to him incenators do not work everywhere, and therefore simply to think it will work in India will be a misnomer. Citing examples from Germany he said the country does not have land-fillings any more, and the only treatment of waste is through incineration and RDF.

Following are some of the highglights from his lecture:

- One of the challenges in waste management is over filling of landfill sites. In Germany, in the 80s there was a crisis due to opposition against land-fills and incineration plants. The opposition was against exporting waste from Germany's "Hessen" to the neighbouring state, and this crisis may come up in India as well. Very soon the Delhi

government will face the same crisis if it is not able to find any more waste dumping ground.

- In India people are to some extent unaware of recycling and segregating. They generally mix waste, which reduces its quality. In order to maximize the efficiency of incinerators one has to minimize the bad quality of waste that is going into the incinerators because the amount of waste put into incinerators also cost a lot of money. In Germany the cost is 200 Euro per ton, and it is difficult to recover the cost by selling energy through incineration. Germany according to Dr Mutz started incineration only due to sanitary reasons and nothing else.
- The government should not subsidize waste management cost. The producers/generators (such companies/organizations or the consumers) of such waste should be made accountable.
- If India goes for the incinerators, they should follow international standards. Additionally, the people who operate must have their capacity built and there should be no compromise with the quality of air pollution.
- Conversion of plastic into oil requires energy to produce energy. One does not gain much if one uses energy to produce energy.
- India is yet to solve "energy-to-waste" problem. One of the recent discussions is on substituting petrol and diesel with methane. According to Dr Mutz we should not substitute it with methane; rather we should change the transport system.

Mr Vinod Babu, Scientist D, Central Pollution Control Board

Mr Vinod Babu gave examples of the government initiatives on incineration that have already been undertaken, and highlighted the challenges ranging from technical, managerial to financial and capacity building. He said that in India we have a large number of options such as - landfilling, waste to energy, composting and bhiomethanation, and recycling option. Additionally, we are lucky that most of the technologies are tested by other countries, and so we are in a better position to choose suitable ones.

Following are some of the highglights:

- Waste to energy scenario is not very enthusastic in India. Around 130 thousand metric tonnes of waste is generated per day in the country; only 90 thousand tones of waste is collected; 40 thousand is not even collected and the quantity processed is just 15 thousand. The constructed landfills are only 61. We have started the RDF plants and the success has not been so encouraging so far. We have good number of vermi composting plants; but these are in isolation.
- Common people should be made aware on waste segregation. Inert wastes such as glass, metals require heating for a long time and therefore heat value is lost in the process.
- Management of dumpsites is not done properly. Occurance of fire is one of the major challenges at the dumpsites. These fires occur because of methane emission; which has global warming potential 21 times more than the Co2. Each kg of methane released is 22 kg of Co2. Alongside, sanitation is not taken care of at the dumpsites.
- The process inside waste to energy plants start with waste reception and waste storage. Delhi plant has the storage capacity of 11000-12000 MSW, so even if waste is not coming to the plant, they can operate for some days. Then comes pre-treatment—all the

waste as such cannot go into the boilor, so waste has to be segregated and made suitable to the boilor – this is called pre-processing. There are some kind of manual segregation as well, for instance debris has to be removed, chlorianated plastic has to be removed, and there should be no metals – they are not good for incenration. Then comes the loading of waste into the furnace and then energy recovery.

- Waste incenaration also leads to unwanted flue gases. According to Mr Babu the challenge is - we do not know what kind of gas is coming out by burning waste. The main culprit however is the dioxins, that are extremely toxic. Only solution so far to dioxin is putting carbon into it. Activated carbon is a good absorbant to the pollutants, but activated carbon is 70 rupees a kilo and one has to inject 40 kilo every hour.
- The infrastructre to monitor and regulate these technologies is not really easy and should be taken care of, starting from the bidding process.
- Residue management is another important thing. If the residue coming from the boilor bottom are not controlled, it may get to the chimney and affect it. These residue can be effectively used in making bricks. As for leachate treatment—we should have technical evaporators.
- According to Mr Babu it is difficult to have profit making waste management plants. There are five plants in the country and out of these only 1 is operating since 2012 and producing 16 megawatt. The investment is 282 crores; which is nearly more than 7-8 times coal based plants. It may become profitable if the 2 components - tipping fee and the revenue from selling power – are taken into account. Citing example of Okhla plant, Babu said that it is commercially not viable because it is based on a zero tipping fee and the cost of the power is 2 rupees 35 paise, which is quite low. At Bawana however, the tipping fee is 600 rupees per truck; and they are selling 7 rupees power per unit.
- Mr Babu also explained the difference between RDF and mass buning. In mass burning waste is brought from waste collectors, some segregation is done and waste is put in the boilor. It contains every thing—clothes, plastics, paper. RDF route is a step in between. With RDF the power plant can run with better efficiency and consistently.
- In the end Mr Babu highlighted some other challenges. By giving example of Delhi waste plant he said that the major operation challenges come up in the winter. Moisture content is high and waste is cold. Other challenges/solutions are non uniformity of waste, unsuitable location, reducing dioxin emissions, and capacity building at all levels.

Dr Suneel Pandey, Associate Director, Green Growth & Resource Efficiency Division TERI

Dr Pandey brifely touched upon the challenges in recycling and profitability, and the role of capacity building, and how waste is seen in other countries.

- According to Dr Pandey to make waste to energy plants profitable, is really a big challenge. There are several issues that need to be taken care of: such as emissions, regulations, etc., that reduce its chances of making it profitable. Agreeing to Mr Babu he said that waste to energy plants should be seen as waste management projects and not compared with thermal power plants. Citing an example of 350 ton plant at Pune, he said that the plant produces around 2-2.5 megawatt of power, and if it succedds it may open the door for many more such plants.
- Capacity buidling is required at all levels including the state level boards, central boards, and also the municipal authority.

- A major impact of waste to energy plant will be on the rag pickers and others involved informally in this sector. They may lose their job; countries such as Argentina and Brazil have tried to streamline this in an efficient way.
- In Japan the 3-Rs—reduce,. reuse, recycle are popular. At the policy level they are trying to design their products with more life time -- to avoid recycling.

Q&A

Q: What are the various recycling options for platsic?

A (Dr Mazumdar)**:** Plastic wastes have several options. For instance, you can use for road construction, you can produce oil from it, and recycle it if it is clean enough. It all depends upon the quality and quantity of plastic, and on the situation.

Q: Why in the medical waste incenarotrs we have two chambers, while for others just one—why is the regulation not uniform.

Ans (Mr Babu)**:** (Answer to the first part) For the reduction of unwanted gases 850 degrees is scientifically proven. In the hazardeous waste (biomedical waste too) however, we have very complex molecules of nox. Additionally, there are so many kinds of waste in them such as—pesyticide waste, paints orgonochlron waste; that we stepped it up from 850 to 1100. When we come to the MSW – no toxin is present, there are no metals, no complex hydro carbon like orgonochlorine; that is why 850 is kept scientifically.

Cross Question: Biomedical waste does not have pesticide, no metals, etc, it has pure anatomical waste which has blood in it. Strangely there you are insisting 1100 degree celcius; in fact the municiapl solid waste has much more hazardeous waste than the medical waste—it has much more heavy metals than the bio-medical waste.

Ans (Mr Babu)**:** We will take it up in our official discussions, since it is a technical matter.

Q: There are about 32 lakh people involved in waste/rag pivcking in India; what will we do about them. In 1990 there was a vast plant established and it failed compeletly --- what are the learnings from there. Why are we thinking waste of energy to be the only option; why are we not looking at the other options.

Ans (Dr Mazumdar)**:** Personally I feel that ragpicking should be abolished. This I am saying with my 30 years of experience. They should be converted into small business units by linking them to the SHGs—so that they do not remain poor ragpickers – they become a buisiness entity. And they get the strenth and they grow and they install waste plant and grow even further. And this has happened and I have seen it. In Ghazipur there is a diumpsite and – and this heat they pick up waste and they stay there all day – why this should happen. The second thing is they have very strong instruments—one is they have a very efficient eye—and a very efficient hand – at any unit where waste sorting takes place—no one can do the work as is done by the waste pickers. They should use the strength – if they collect 10-12 people in the form of a group and get themselves registered and they start taking contracts like that and make a plan on that basis – I am doing this for paper recycle and we will do it then we will make kmore profit – and then they will grow up step by step.

Q: In India we do not have strong implementation plans and our agencies are not that efficient. Do you think such technologies can be implemented in India.

Ans (Dr Mazumdar & Dr Pandey)**:** Every city and the citizens have to decide how they want to do it, and what technologies need to be used. Normally, what happens here is that - from the government side and the Municipality side something is made - and then they put up the bid which is not properly structured. Competitive open bid is the only channel wherein you can come into the public doamin – the bid also has to be very carefully done.

Any large plant should operate commercially; or at least for five years; because a lot of public money is involved. Other things whatever comes as new technology –definately they should be installed; but consciously as pilot demonstration plants and they should be very thoroughly monitored. At least 5 years of commercial operation should be mandated – there should be at least an unwritten law.

Concluding Remarks

Mr Satish Sinha concluded the session by emphasizing on the costs involved in waste management. According to him it will be wrong for any country/citizen to think that someone else can pay for the waste they generate. He also added that it is difficult to compare waste management costs in India and abroad, and people should be made aware of waste segregation. With these end-notes, he finally concluded the public lecture.

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