

# INNOVATIVE WASTE MANAGEMENT FOR SUSTAINABLE GLOBE

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## ABSTRACT

This paper reflects on the extensive report on innovative waste management practice in global sustainability and proposes a new approach for waste management policy that goes beyond the cost-benefit analysis that has proved so difficult to implement for non-marginal issues. This approach combines the Safe Minimum Standard approach, with the concepts of environmental functions and ecosystem goods and services, which have been developed much more recently. It is shown that this approach provides the basis for a robust calculation of sustainability across different environmental themes, following which a 'sustainability gap', showing the extent to which, this standard is not being met, may be computed. Countries like Germany, Australia and USA have set examples of innovative waste management and India can take inspiration from these and implement some of these practices.

## INTRODUCTION

Generating almost 62 million tonnes of garbage every day, India has been among the top 10 countries generating the highest amount of Municipal Solid Waste. Out of the total waste generation, more than 45 million tonnes of waste remain untreated, which is a whopping 72%. Waste management is the foremost value India needs to adopt if it must achieve the goal of 100 per cent cleanliness by October 2019. Countries like Germany, Australia and USA have set examples of innovative waste management and India can take inspiration from these and implement some of these practices.

**United States of America:** Robot's Act of Collecting Waste: Powered by sun and strong river current, the eco-friendly robotic machine picks up garbage and debris from the Baltimore River and deposits the waste into a dumpster barge which is built into this machine. Within a period of 3 years, Mr. Trash Wheel has successfully removed 1.1 million pounds of garbage.

**Australia:** Bins that help in Segregation, Recycling and Composting: Smart Belly bins treats most of its garbage by segregating the waste at the collection point and then undergoes

process of composting, treating most of its waste. Big belly (Smart Belly or Big Belly) bins automatically create extra space for garbage when the bin is full. More garbage space means fewer collection trips, lower costs and fewer emissions. One of the major advantages of these bins is that they connect individual bins to garbage collectors that results in a more efficient management of waste.

**Germany:** Biodegradable 'Leaf Plates' Curbs Plastic Pollution: Inspired by India's traditional custom of eating on leaves, Leaf Republic, a company in Germany is into stitching creeper leaves that come in from India. These cost-effective plates serve as an alternative to plastic plates cutting down on plastic pollution. There are eco-conscious companies in India too who are trying to make such eco-friendly and biodegradable plates, but the trend is yet to catch on.

**Brazil:** Use Plastic to Decorate Your House: Did you know a plastic bottle can take up to 1000 years to decompose? A design studio Rosenbaum in Brazil helps and motivates people to reuse their plastic waste in beautifying people's houses. Brazil is also educating people on how to effectively reuse plastic.

**Columbia:** Rewards to Recycle Plastic: The country produces around 28,800 tonnes of solid waste per day, with 10,000 tonnes of this waste being generated in the main cities of Bogotá, Cali, Medellín and Barranquilla. To tackle the plastic waste, authorities installed ECOBOT-Vending Machines in shopping malls, institutions and other public spaces. Every time someone deposits a plastic bottle or the bottle caps, they receive restaurant coupons or movie tickets or simply shopping dollars.

## WASTE MANAGEMENT IN INDIA

According to the three RRRs of environmental solid waste management, some plastics can be "Reduced", "Recycled" and "Re-used", but this has not been enough to clear them out of sight. Rapid population growth, urbanization, and industrial growth have led to severe waste management problems in cities around the world. Simultaneous development in economic prosperity and industrialization often conflict with sound environmental considerations. Globally, nearly 140 million tons of plastics are produced each year. In India, around 4-5% of municipal solid waste (MSW) material are post-consumer plastics in comparison to 6-10% in the US, Europe and other developed countries. India recycled 47% of its total plastic waste in contrast to China (11%), the US (3.5%), South Africa (15%), and UK (7%). There are around 20,000 plastics recycling industries in India with a daily capacity of 1,500 tons.

The easiest way to reduce the volume of solid waste is to burn it in a process called 'incineration'. The basic advantages of a municipal waste incinerator are that they require less land and also be effectively used for energy generation. However, incineration of plastics in MSW also generates toxic gas emissions that contain heavy metals, dioxins, and other

volatile organic compounds (VOCs). Heavy metals viz. zinc, cadmium, arsenic, lead, and mercury are parts of the waste stream and therefore, when incinerated, they reach the atmosphere and also persist with soot particles and generated ash.

The energy content of MSW depends on its composition as well as its moisture content. Plastics have a high calorific value since they are derived from petrochemical sources (36,500 kJ/kg) and they are very much comparable with coal (28,500 kJ/kg) and fossil fuel (42,500 kJ/kg). On an average, the production of plastic uses 5% of the world's oil as feedstock compared to 85% used for heating and transport. Most of this energy is recoverable in the form of heat, which can then be converted to electricity.

In order to reduce the plastic waste management problem, we need to adopt the principles of waste prevention. The use of durable plastics need not be reduced, but we need to promote judicious use and reuse of single-use plastics. If plastic compounds are made more durable and if the general perception of consumers regarding the reuse of plastic and reduced disposal is changed, then the waste plastic problem can be sorted out. However, there are several constraints for proper plastic waste management in India such as proper collection, segregation, and transportation of the discarded plastic material. Increase in public awareness coupled with changes in individual behaviour can be an effective way to reduce the environmental repercussions of waste plastics.

### **YOUNG ENTREPRENEURS IN INDIA BELIEVE IN “GO GREEN” CONCEPT**

Go Green, is what India is saying to the world!

With multiple innovative business ideas, Indian entrepreneurs are fast moving to the green revolution in their businesses. From organic farming to e-cigarettes, and hemp and cannabis industries, they are all out to experiment their ideas into the start-up ecosystem. Not just start-ups, but the country is witnessing a strong growth in the established businesses accepting the need to go green. Several companies are now more aware of the ways in which their working often affect the ecosystem, and therefore, have taken a greener path to success.

Here we take a look the entrepreneurs who are making people believe in their right execution by the simple business green ideas:

### **REUSING WASTE FLOWERS FROM LOCAL TEMPLES**

Ankit Agarwal and Karan Rastogi are using waste flowers from local temples into the making of organic incense, vermicompost and, most importantly, the world's first non-toxic thermocol called Florafoam. Hailed from Kanpur, Agarwala and Rastogi are childhood friends who rejoined their paths to carve out this venture. The duo is selling Florafoam under the brand name “Phool”. Both Agarwal and Rastogi will be presenting their idea to UN

Assembly as they have been nominated for a UNICEF award this month by the Bill and Melina Gates Foundation.

## **CURBING AIR POLLUTION IN A RECYCLABLE WAY**

When the three IITians Arpit Dhupar, Kushagra and Prateek Sachan left their corporate jobs to launch the Chakra Innovation, they had no idea how far it would go. But in just a few years, the duo marked success with their innovative idea. Launched in 2016, Chakra Innovation aims to curb air pollution in a recyclable way with its patented technology Chakra Shield. The technology takes diesel soot from generators and converts it into inks and paints.

## **RECYCLING PACKAGING WASTE INTO WEARABLES**

Founded in 2013 by Dinesh Parikh, Sachin Sharma, and Aditya Parikh, GEM ENVIRO collects pre- and post-consumer packaging waste from factories, offices, hotels, motels, and institutes. The waste is then recycled into products such as T-shirts, caps, and bags, selling the products under its brand 'Being Responsible'. The company also organizes various programmes to raise awareness about environmental sustainability and the importance of recycling incorporates, universities, and institutes.

## **REUSING PLASTIC IN CONSTRUCTION OF ROAD**

Bengaluru-based KK Plastic Waste Management was started in the year 2002. The company is the founder and commercial promoter of the technology — "Reuse of plastic waste in asphaltting of roads" (reusing plastic waste as an additive in construction of road) and has been patented and certified by the Centre for Transportation Engineering ("CTE") and the Central Road Research Institute ("CRRI"). The company operates a plastic reuse/recycling plant in Bangalore that can process up to 30 metric tons of plastics per day.

## **SOME OF THE DIFFERENT TECHNOLOGIES USED FOR RECYCLING PLASTIC WASTES ARE:**

Substitution of primary fuel and raw material offers advantages for cement industry as well as for the Municipal Authorities responsible for waste management. By co-processing of plastic waste with primary fuel, cement producers or power plants can save fossil fuel and raw material consumption, contributing to more energy-efficient production. A major advantage of this recovery method is by using an existing facility, the need to invest on other plastic waste processing or to secure land filling is eliminated.

Conversion of plastic waste into liquid Refuse-Derived Fuel (RDF) oil through catalytic pyrolysis whereby it is segregated mechanically from solid waste and processed. This separation method is not fool-proof, other lighter waste material is also segregated along with plastic waste. Then the segregated waste is sent through a conveyor belt fixed with optical segregation device for 100% source segregation of plastic waste. This mixed plastic waste is converted into a useful fuel, i.e. liquid RDF oil through catalytic pyrolysis. The

entire feed material is converted into: Liquid RDF, gases and some sludge. There is no effluent generated in the process and the unused gases from the reactor are released through chimney.

Plasma Pyrolysis is a state-of-the-art technology that integrates the thermo-chemical properties of plasma along with the pyrolysis process. Plasma pyrolysis is the thermal disintegration of any carbonaceous material in an oxygen-starved atmosphere. When optimized, the most likely compounds formed are methane, carbon monoxide, hydrogen, carbon dioxide and water vapour. The process conditions are maintained such that it eliminates any possibility of formation of toxic dioxins and furans (in case of chlorinated waste). The conversion of organic waste into non-toxic gases is more than 99%. The extreme conditions of plasma kill stable bacteria and the pyrolysis process helps reduce carbon dioxide emissions and landfills.

Gasification of waste plastic is another way to reduce landfill space and incineration costs of waste plastic. The gasification process' main advantage is that it uses inert air containing nitrogen instead of oxygen, making it a simpler process and also reduce the cost. This is a vertical fixed bed gasification system, where a thermo-chemical process converts carbon-based material into gases such as carbon dioxide, carbon monoxide, and hydrogen and methane gas, which can be used for heat or power generation. Gasification technique using air as a gasagent has proven to be an eco-friendly way of converting biomass and plastic waste refuse into fuel gases. Direct gasification has advantages of simple technique and cost-effective operation, but the presence of nitrogen in the inert air could reduce in the calorific value of resulting fuel gases due to dilution. Waste plastic includes polyethylene, polypropylene and polystyrene, which are softened by a heat process to 100-150 degrees C.

Innovations in plastic recycling include increasingly reliable chemical detectors and sophisticated software that collectively increase the accuracy and productivity of automatic sorting. The recycling process uses minimal water to recycle the plastic, where water is used only as a coolant. The water-less method results in recycled plastic pellets that are better than others, which can be useful in construction of roads.

## CONCLUSION

Government must take necessary steps to protect environment and waste management. New technologies must be motivated. Waste water discharge from industrial units into rivers and other water bodies should be reduced to zero and stringent civil penalties to strengthen enforcement of environment-related acts were among recommendations of the NITI Aayog's comprehensive national strategy for 2022-23. Sewage treatment plants of adequate capacity should be installed at suitable locations to make rivers pollution free. The other recommendations include global funds for strengthening resilience against climate change in sectors like agriculture, forestry, infrastructure and others and scientific and analytical capacity for climate change related assessments should be strengthened.