INDIAN CENTRE FOR PLASTICS IN THE ENVIRONMENT

Envis Eco-Echoes

Management of Plastics, Polymer wastes and Bio-polymers and impact of Plastics on the Eco-system

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Editorial

People in the early civilization era were conscious of the importance of creation of proper waste management systems in the area where they used to live in brick houses. Mahenjo Daro and Harappa civilization in the Indus Valley provides for such evidence. In modern world, with the rapid increase in material consumption, waste generation is also increasing at similar rate. Wherever the generated waste is not disposed of properly, it creates enormous impact on the people by way of polluting the environment in many ways and making living conditions on Earth more and more difficult.

Through ENVIS Eco-Echoes Newsletter and by way of other mode of communications, ICPE has been disseminating information on how Plastics as a whole are saving the Earth from various types of environmental pollutions by consuming lower energy and by releasing lesser VOC emissions to air and by keeping the BOD & COD level of water lower during its production. It was found that plastics packaging alone saved the Earth from 220 Million Tones of Green House Gases in the year 2005.

However there is a waste management issue created mainly by discarded packaging materials and thin carry bags and different types of disposals (one time use items). In a country like India this issue is created mainly due to the poor littering habit of general mass and for inadequacies in the waste management infrastructure especially in the urban areas. One of the most practical and scientific solutions of plastics waste management is recycling of the plastics waste. This ensures that the unwanted and discarded plastics waste does not remain in the road side nor is it (plastics waste) carried to the landfill. However, some types of plastics waste like multi layer laminates, EPS etc are not easily recyclable by conventional process (mechanical recycling). Some times when different types of plastics waste, which are otherwise easily recyclable individually, get mixed with different groups of plastics in the waste stream forming, what we call, commingled plastics waste, recycling becomes difficult. Such types of plastics waste generally is abandoned by the waste pickers creating waste management problems.

In this edition of ENVIS Eco-Echoes we have discussed different types of Plastics Recycling and Recovery processes by which ALL TYPES OF PLASTICS WASTE can be recycled or disposed of scientifically without causing any environmental problem. Plastics Waste Management issues as addressed by the European Plastics Industry are also included.

The Data Sheet includes information on composition of plastics waste in the MSW in select States of the USA.

Comments may be forwarded to ICPE ENVIS Centre.

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Plastics Waste Management
Recycling & Recovery Options

Due to its multifaceted benefits, use of plastics in variety of applications has been increasing at a galloping rate all around the world, including in India. Plastics contribute various benefits to the modern world from providing safe and hygienic packaging materials for food and pharmaceutical products, to conserving Land, Water, Forests and Energy resources to practically in all areas of our life. The list below gives a quick overview of major application areas of plastics:

- Agriculture
- Health care / Medical
- Education
- Pipes for Water, Gas and Sewerage
- Building & Construction – Flooring / Doors & Windows / Drainage Pipes, Water Storage Tanks, Construction Linings etc
- Cables
- Electrical & Electronics Equipments
- Thermal Insulation
- Automobile, Aviation & Railways
- Packaging
- Household
- Furniture
- Toys & Others

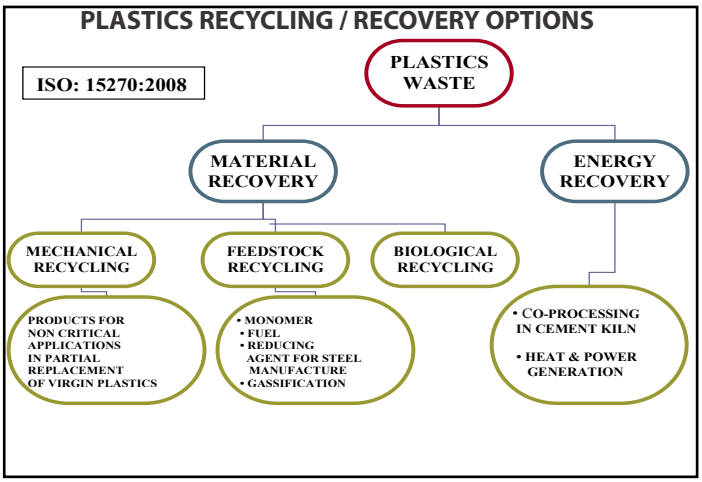
Some of these applications are for long time use and some for short term. Packaging is the single largest sector of applications of plastics which account for about 35% of consumption globally. Consumption pattern in India is similar. Flexible packaging applications are mostly for short term use.

Management of waste created by the discarded used plastics items, especially the ones used for flexible packaging applications has become a challenging task, more so in the developing countries of the world.

Developed countries have established effective infrastructure for the management of plastics waste of all kinds by adopting proper collection system and different recycling technologies. However in the developing countries the general trend is to opt for selecting its input (types of plastics waste) leaving a large chunk of plastics waste, which are difficult for recycling, for disposal in the landfills or simply to allow such waste to remain in the surroundings, creating an environmental issue.

New technologies and economics have come to play an important role in plastics recycling. When we talk about plastics recycling, it principally refers to 'Recovery', which is divided into 'Material Recycling' and 'Energy Recovery'.

Various options for plastics recycling / recovery have been described by the International Standards Organization in the International Standard.



The choice between Mechanical Recycling, Feedstock Recycling or Energy Recovery will depend on the types of plastics waste and the relative ease / difficulty in total or partial segregation of different groups of plastics materials from each other or from other waste materials / contamination.

Brief Description of the options

Mechanical Recycling

This process is adopted to manufacture products for similar or new areas of applications. Worldwide this is the most preferred and widely used Recycling Process due to its ease of conversion to useful products of daily use. The limitation of this process is that the process requires homogeneous and clean input. When the input is too much contaminated or when there are too many mixed plastics of different types, mechanical recyclers tend to abandon that waste as cost of segregation and cleaning exceeds marginal profit of operation.

NDTV media representative in front of a Mechanical Recycling Facilities near Mumbai

Mechanical Recycling includes a wide variety of processing techniques and a broad range of processing methods. Since the recycled plastics materials return to the plastics market where they partly replace virgin plastics materials, the price of recycled plastics products is oriented to the price of primary material with a certain reduction due to quality

standard. Nevertheless, recycled plastics save energy and other environmental emissions compared to that created during the production of virgin plastics.

Non critical, yet useful products from mechanical recycling process

Feedstock Recycling

This option is opted for converting plastics waste to different products:

1. Conversion to Monomer
2. Fuel
3. Reducing Agent in Blast furnace for production of iron
4. Gasification to constituent chemicals in reasonably purer form

1. Conversion to Monomer:

Some types of plastics waste have already been converted to its monomer for reusing the same as the base material for re- polymerization. At least 30 – 40% of PET waste has been re-polymerized to fresh raw material. This is a high technology process and is generally pursued by the basic plastics raw material manufacturers.

2. Fuel from Plastics Waste:

Waste generated out of mixed plastics, co-mingled plastics and plastics materials made out of a combination of different plastic materials are generally difficult for normal recycling (mechanical recycling) and are mostly abandoned in the waste stream as it is, and hence creates waste management problem.

A small Plastics Waste to Fuel plant (Hyderabad)

Success has already been achieved in converting such plastics waste in to industrial fuel in an environmental friendly technology in some countries in the world including in India. This option has the benefit of using mixture of different types of plastics waste, mixed together, without segregation. Elaborate cleaning / washing is also not required. Industrial Fuel made out of the plastics waste is substitute of fossil fuel.

Principles Involved

All plastics are polymers mostly containing carbon and hydrogen and few other elements like chlorine, nitrogen etc. Polymers are made up of small molecules, called monomers, which combine together and form large molecules, called polymers.

When this long chain of polymers breaks at certain points, or when lower molecular weight fractions are formed, this is termed as degradation of polymers. This is reverse of polymerization or de-Polymerisation. If such breaking of long polymeric chain or scission of bonds occurs randomly, it is called 'Random de-Polymerisation. Here the polymer degrades to lower molecular fragments. In the process of conversion of waste plastics into fuels, random de-Polymerisation is carried out in a specially designed reactor in the absence of oxygen and in the presence of coal and certain catalytic additives. The maximum reaction temperature is 350°C.

Although this process can convert all types of hydrocarbon polymers including thermo plastics and thermosetting plastics, rubber products including used automobile tyre, the limitation is the input cost, beyond which the process is economically viable of its own.

3. Reducing Agent in Blast furnace for production of iron

Successful examples are available for use of waste plastics as a reducing agent in the blast furnace for the manufacture of iron from its ore. Use of coke in the blast furnace provides only one type of reducing agent – Carbon Mono-oxide. In contrast, use of plastics waste provides one additional type of reducing agent – Hydrogen apart from Carbon Mono-oxide. The process also reduces generation of 'ash'. A steel manufacturing facility having production capacity of 3 million tons per annum, can consume 600, 000 MTs of plastics waste. Japan is the leader in the world for actually implementing such process in various steel plants in their country.

Energy Recovery

1. Co-Processing of plastics waste in Cement Kilns
2. Incineration for energy recovery / power generation

As the recovery option depends on many prevailing circumstances, Life Cycle Analysis (LCA) may be applied to decide, depending on the type and composition of the plastic wastes, which options are environmentally more favorable and sustainable.

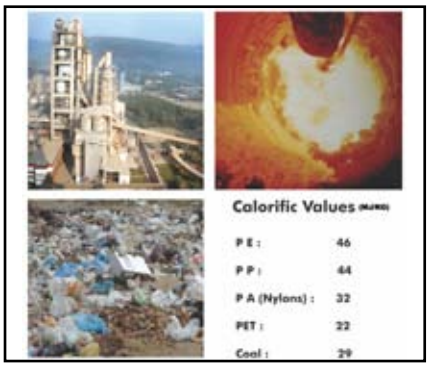
1. Co-Processing of plastics waste in Cement Kilns

One of the most effective methods of recycling of plastics waste for recovery of energy is its use as an alternative fuel in cement kilns. The list below gives a comparison of the calorific values of different plastic materials as compared to coal.

Calorific Values

Polyethylene	:	46 MJ/kg
Polypropylene	:	44 MJ/kg
Polyamide (Nylons):		32 MJ/kg
PET	:	22 MJ/kg
Coal	:	29 MJ/kg

The high temperature used in the cement kilns gives a scope for use of even some type of plastics waste contaminated with toxic chemicals like pesticides and some other hazardous materials without creating any increased emissions in the air or water. No segregation or cleaning is required for such type of disposal. Low-end plastics waste, which creates a waste management problem, may provide the vital energy to the cement industry.



Co processing of Plastics Waste in cement kiln

There are about 170 cement kilns in the country, in different zones. Even at the rate of 10 MTD of plastics waste per cement kiln, the total requirement of plastics waste for co-processing could be more than 0.5 million tons, a quantity which is more than the abandoned plastics waste in the MSW stream.

2. Incineration for Energy Recovery / Power Generation

After the selection of various types of plastic waste for mechanical recycling, there may still remain some types of plastic waste, heavily contaminated with various types of contaminants including different toxic chemicals or hazardous products. The best way of re-utilizing these wastes is to use the latent energy content of the plastics waste by co-processing in cement kilns or to incinerate them and recover the heat energy, instead of dumping them diffusely on landfills. This recovers their calorific values. The choice of incinerators is very important. Modern incineration technology has answers to tackle any incineration problem without polluting the environment and in many cases recovering the calorific value out of the waste being incinerated.

Heavily contaminated plastics waste collected from different waste stream can be utilized for energy recovery by waste incineration plants. Cost of this system of recovery is considered highest among all the other alternatives. When considering incineration as an option, it is to be remembered that waste incineration plants are not operated with the aim of producing energy. The main purpose is and remains to reduce the volume of waste to a considerable degree by means of incineration in an environment friendly manner.

Plastics waste contain calorific values equivalent to fuel. The list below gives the comparative energy values of different plastics vis-à-vis fuel oil and coal in Btu / pound.

Energy Values

Material	Btu/pound
Plastics	
PET	10,900
HDPE	18,700
Other Plastic Containers	16,400
Other Plastics	17,900
Rubber & Leather	12,800
Newspaper	8,000
Corrugated Boxes (paper)	7,000
Textiles	9,400
Wood	7,300
Average for MSW	5,900
Yard Wastes	2,900
Food Wastes	2,900
Heat Content of Common Fuels	
Fuel Oil	20,900
Wyoming Coal	9,600

(Recycling and Recovery of Plastics: Hanser/ Gardner Publications, Inc., Cincinnati)

There are 86 energy recovery facilities operating in the United States, with a designed capacity of nearly 97,000 tons of waste per day with the capacity to generate 2,700 MW of electricity (enough to power approximately 2 million homes), saving an equivalent of 30 million barrels of oil per year and preventing the release of 40 million tons of CO2 equivalents annually. At present more than 19 percent of the nation's MSW is processed by energy recovery facilities. A recent national survey found that 97 percent of opinion leaders support expansion of energy recovery in the United States and 89 percent would prefer remaining plastics to go to energy recovery facilities instead of landfills.
(American Chemistry Council – ACC, last updated March 1, 2011)

Similar information is also available from the European Countries. However in the majority of cases, it is the MSW from landfill that is incinerated to produce Energy (Waste to Energy) and plastics waste is a part of it to the extent of 7 to 12 %. Plastics waste helps generation of higher amount of energy due to the high calorific value attached to it.
Plastics are derived from petroleum or natural gas, giving them a stored energy value higher than any other material

commonly found in the waste stream. In fact, one pound of plastics can generate twice the energy as Wyoming coal and almost as much energy as fuel oil. When plastics are processed in modern waste-to-energy facilities, they can help other waste combust more completely, leaving less ash for disposal in landfills.

In principle, plastics waste that could be recycled through Mechanical Recycling process, are not sent to incinerators as mechanical recycling gives higher value. In principle, the calorific value of plastics, which in the case of polyethylene is as high as that of crude oil, can be fully recovered by burning (in incinerator). However, the useful energy that can be used is limited by several factors and is much less that its calorific value. Studies have shown that if polyethylene is burnt in an incinerator and that heat energy generated is used to produce steam for further use for central heating system or for other purpose, from the original 45 MJ of energy in the input polymer, only 15 MJ or 33% is available for heating, whereas 80% recovery has been reported in the case of fuel.
(Recycling and Recovery of Plastics: Hanser/ Gardner Publications, Inc., Cincinnati)

Use of plastics waste in the construction of asphalt road:

In a yet another innovative technology, use of plastics waste in the construction of asphalt road has been demonstrated by at least three technologies in the country in the past decade. There is scope of using all types of mixed flexible plastics packaging waste without elaborate cleaning, for the construction of asphalt roads by replacing bitumen to an extent of about 8 – 12 %. The quality of road is improved and cost of construction is reduced as the cost of processed waste plastics is less than that of bitumen. Government support can help in formalizing the technology for its adoption all over the country.

Use of Plastics Waste in the construction of Asphalt Road

The Process

Step 1: 10% bitumen of normal formulation is to be replaced by plastics waste. For a normal batch, if 20 kgs of bitumen is added to the required quantity of aggregates, then for the modified formulation 2 kgs of bitumen will be replaced by 2 kgs of plastics waste. These 2 kgs of plastics waste will be mixed with the aggregates before charging the aggregates into the hot chamber.

Step 2: Aggregates mixed with plastics waste will be rotated for about 2 to 3 minutes inside the hot chamber at around 160 – 180 deg C. Plastics should not char; it should form a coating on the aggregates as uniformly as possible.

Step 3: Hot bitumen of temperature around 160 – 180 degree C is to be charged into the 'hot aggregate – plastics mix'. Rotate for usual time – as done in normal formulation.

Step 4: Discharge temperature should be around 140 degree centigrade

After this the Bitumin Mix aggregate Plastics Waste Blend should be used as per normal procedure for laying the Road.

Care should be taken that, at the time of Road laying the Temperature of the blend remains at around 120 degree C

Note 1: For top layer (Seal Coat), replace not more than 5% bitumen with plastics waste. Use only plastics waste passing through 1 mm sieve.

Note 2: For lower layer, 10 – 15% bitumen can be replaced. Shredded plastics film waste (around 50 microns or less), not more than 3 to 4 mm square in size or grinded plastics waste passing through 1 mm sieve can be used.

(Plastics waste are from PE, PP or PS.)

Conclusion

Whichever form of recycling is chosen, the whole process can succeed only if an efficient solid waste collection mechanism is put in place at the first instance. The task again becomes much easier with segregation of waste at source. Massive public awareness programs with the help of NGOs and concerned citizen groups backed by a sound Municipal Waste Collection and transportation mechanism is of urgent necessity. The plastics industry, particularly the users of plastic materials such as retailers and packers, will have to share part of the burden in creating such sound solid waste collection and disposal infrastructure. The citizen's co-operation is vital in the success of this whole program of Solid Waste Management in general and Plastics Waste Management in particular. The virtues of the four Rs namely Reduce, Reuse, Recycle and Recover are needed to be re-emphasized.

WORKSHOP ON PLASTICS WASTE MANAGEMENT

On the advice of Government of Maharashtra, Department of Environment, ICPE had organized a One Day Workshop on "Plastics Waste Management" on the 27th September, 2011 at Yashwantrao Chavan Pratisthan Auditorium, Nariman Point, Mumbai. The Workshop was arranged especially for the Policy Makers and Ward Officials of the Municipalities. Maharashtra Pollution Control Board (MPCB) and Municipality Corporation of Greater Mumbai (MCGM) supported the Workshop.

Experts made presentations on how mixed and soiled plastics waste could be recycled by different processes apart from the conventional mechanical recycling of clean and segregated plastics waste. All the processes require a system for the collection of the plastics waste from the source of waste generation.

Shri K.G. Ramanathan in his welcome speech highlighted the purpose of organizing the Workshop as per the advice of Environment Secretary, Government of Maharashtra.

Shri Balchandra Patil Chief Engineer, SWM, and Shri Rajendra B. Bhosale, Dy. Municipal Commissioner (Special), represented Municipality Corporation of Greater Mumbai (MCGM). Shri Balchandra Patil appreciated ICPE for organizing the Workshop on such an important issue. He pointed out that plastics play an important role in the Society not only as a material for carry bags but for packaging of various essential food and pharmaceutical items as well as various other essential products like toiletries, cosmetics and other merchandise which are important for general mass in their day to day life activities. It is not possible to get rid of plastics. However, he said, it is required to manage the plastics waste intelligently and scientifically so that the waste created by plastic bags and packaging materials can be collected and recycled, thus avoiding their dumping in the landfill. After the presentations by Experts on various options of recycling of plastics waste into fuel, co-processing of plastic wastes in cement kilns, use of plastic wastes for road construction and use of mixed plastic waste for making useful items, he emphasized that collection of plastic wastes and diverting the same to the recyclers are the main challenges. He was convinced that if collected, all plastics waste can be recycled by one process or the other, avoiding their passage to the dump yards or to the city drains. There were some examples of model collection and segregation centres in some select Mumbai Wards in a limited scale. However, he invited suggestion from the NGOs and other stake holders on how a broad infrastructure for collection of segregated dry waste could be set up involving the waste pickers. He mentioned that although steps were taken against some commercial organizations / hotels for not segregating dry and wet waste at the source, societies and general public were not yet fined for violating the rule. He promised action against societies for non-adherence to source segregation rule widely after a mass awareness campaign.

Shri Rajendra B. Bhosale, Dy. Municipal Commissioner (Special), MCGM, who is in charge of implementing the plastics waste management rule, initially emphasized on how to stop production and use of thin plastic bags, which is prohibited under law. Industry representatives assured him that all possible assistance and information would be provided to MCGM and MPCB of any illegal activity by any errant plastic processors. The Government authorities were requested to take action against those errant plastic processors as per law.

Dr. Y.B. Sontakke remarked that plastics per se, are not harmful. Use of thin carry bags, which is prohibited by law, has to be stopped. He informed that more than 500 processing units in the State were punished for violating the law and about 40 units were ordered to close down after their repeated violation of the rules. He assured prompt and strict action against any errant processor if the department received any complaint.

Shri S. K. Ray, Hon. Secretary – ICPE made a presentation on **Plastics Waste – Issues and Solutions**.

Other Experts who made presentations were:

- Shri S. Sampath – Samki Teck Resources, Hyderabad, on **Energy (Fuel) from Plastics & Rubber Waste.**
- Shri P. V. Narayanan - Harita-NTI Ltd, Chennai, on **Polymer Energy Technology- Transverse flow Catalytic Conversion of Waste Plastics to Fuel.**
- Shri Ulhas Parlikar – ACC Ltd, Mumbai, on **Co-processing of non-recyclable Plastic Waste in Cement Kilns**
- Shri J. B. Suhag – Rainbow Papers Ltd, Udaipur, on **RECYCLED WASTE PLASTIC ROOF & PLAIN SHEET "FROM WASTE TO WEALTH".**
- Smt. Sunita Patil - Stree Mukti Sangathana, Mumbai, on **Dry Waste Segregation Projects in Mumbai.**
- Smt. Poonam Hudar - Environmental Greenliness, Mumbai, on **Plastics Waste Management**
- Shri T. K. Bandopadhyay – ICPE, on **Construction of Asphalt Road Using Plastics Waste**

Smt. Jyoti Mhapsekar, President of Stree Mukti Sanghatana (SMS) emphasized on the lack of facilities and recognition of service faced by the waste pickers, most of whom are women. She noted this as one of the major hindrance for achieving the desired goal in the waste collection efforts. She noted that although the waste pickers form the foundation of the waste management system pyramid, however, no recognition or benefits are offered to this community, who have to earn their livelihood on their own effort in the most unorganized and unhealthy conditions.

She remarked that, wherever civic authority provides support for collection vans, there are conflicts of interest in the waste collection system among the waste pickers and the

WORKSHOP ON PLASTICS WASTE MANAGEMENT

society sweepers. It was pointed out that if the dry waste was unclean (soiled) and comprise mainly of low value waste products, then these become the property (responsibility) of the common waste pickers whereas if the dry waste is clean and is segregated separately without any contamination of food etc. waste and if the dry waste comprise of higher value waste products, then these become the property of the society sweepers or even the house owners who choose to sell those type of waste products directly to the waste dealers.

This results in loss in income for the waste pickers. She noted that in absence of a comprehensive dry waste collection policy and suitable infrastructure, it is very difficult to achieve the desired goal of collection of segregated waste from the source of waste generation, even if the dry and wet waste are segregated, for forwarding to appropriate recyclers.

Shri K.G. Ramanathan summed up with the suggestion that the policy making process needs special discussion among the experts for further action. He requested the civic authority to constitute a small working group consisting of the Experts and implement such system at least in five or six wards in Mumbai on experimental basis and monitor the results over a period of time.

This system could be implemented within next 3 months and the outcome may be reviewed after a year or so when a final view could be taken for implementing in the whole city.

European Plastic Industry's Approach To Waste Management

Plastics Europe, the Association of Plastics Manufacturers in Europe had published in 2009 its position on various issues relating plastics in the environment.

The publication covered 5 key issues:

- the plastics industry's approach to waste management
- the challenge of dealing with the issue of marine littering
- facts about VCM and PVC manufacturing
- facts about the use of phthalate plasticizers in PVC
- facts about the chemical bisphenol A

In this edition of the ENVIS Eco-Echoes Newsletter, Plastics Europe's position on waste management is being reproduced from Plastics Europe's report.

The plastic industry's approach to waste management

Key Messages:

- Plastics offer society lots of helpful properties, and they are also eco-efficient in many ways - including when a product comes to the end of its useful life. This is when end-of-life management becomes necessary.
- Plastic is too valuable to waste. All plastics can either be recycled as material and or chemical feedstock for further use; or recovered as energy.
- The high calorific value of plastics is actually similar to that of fuel oil. Therefore, plastics waste can either be recycled into new products or it can partly substitute for fuel conserving primary resources.
- In order to achieve the economically and ecologically optimized management of plastics waste, society needs to learn how.
- To achieve the high level of waste recovery, which is already in evidence in several European countries (optimizing the value of plastics and diverting plastics waste from landfill), a combination of all end-of-life management techniques is required.
- Education is a key part of this. The plastics industry has invested, and continues to invest, in a widespread programme to transfer its knowledge about end-of-life waste management and share it with relevant stakeholders.

Plastics are too valuable to be just thrown away

In some regions significant quantities of end-of-life plastics are already being recovered, in others the industry is working extremely hard to help society understand that it needs to capture the value of plastics and avoid the negative impact of land filling. The plastics industry has developed its own long-term vision for waste management. The goal being to reduce the impact of plastics waste on the environment and at the same time to help society to reduce its environmental footprint and become more sustainable:

- Through diverting organic-rich waste streams (such as municipal solid waste or industry and commercial waste) from landfill as much as possible, thus conserving primary resources
- Through utilizing a mix recovery option in order to save material or energy resources, taking eco-efficiency into account
- By promoting the treatment and recovery of plastics waste streams under defined environmental quality standards
- By taking a comprehensive approach, at every stage of the life-cycle, to ensure that the largest environmental benefit, which can be achieved during the use-phase of the plastics products, is not impaired by too-detailed regulation of another stage in the life cycle.

How can the value of either material or energy be recovered at products' end-of-life?

There are different recovery options to recover the value from products that are made of plastics. In principal terms, an optimized eco-efficient recovery mix is required in order to divert plastics waste from landfill.

Mechanical recycling - This is the mechanical washing, sorting and grinding of used plastics and processing it directly back into granulates, so the material can be processed into useful new products.

Feedstock recycling - This is the breaking down of the chemical bonds within plastics into its chemical components,, using heat or shear; or a via a chemical reaction. The chemicals produced are mostly oils or gases. From which new plastics or other chemical feedstock can be manufactured. Feedstock recycling can be used where different materials are mixed together or soiled.

Energy recovery - This can be either using the plastics as a fuel substitute in industrial processes such as power, cement, lime or other furnaces; or using it in mixed-waste incineration plants such as municipal solid waste incinerators, or for industrial steam electricity production.

What can the plastics industry do?

Effective waste management requires intelligent solutions for both material recycling and energy recovery of plastics-rich waste streams. Plastics manufacturers have been:

European Plastic Industry's Approach To Waste Management

- Actively involved in advising European and national government bodies to optimize cost benefits of legislation, to help identify solution which meet the requirements of the market. As a consequence, over recent years, laws and standards have been introduced that begin to guide society towards more responsible management of its waste. Legislation and implementation guidelines are now in force for packaging, electrical and electronic equipment and automotive vehicles at their end-of-life; and there are also framework regulations with stringent environmental provisions that determine the basic principal for treating all kinds of waste.

- The industry has significant expertise in market economics, processing technologies as well as innovative waste management processes, gathered over years of experience, and has an in-depth plastics producing industry is active in supplying knowledge about the options, sharing best practices, developing concepts and providing information so that:

1. Efficient operations and infrastructures can be developed avoiding excessive costs

2. Environmental performance of waste management practices (with low emissions into air, water and soil) can be secured with high recovery efficiency for material and energy resources.

3. The industry also participates in voluntary commitments, like the Vinyl 2010 initiative, with millions of euros being invested each year into promoting and supporting plastics recycling systems and the development of innovative new technologies like the Vinyloop feedstock recycling plants in Ferrara, Italy.

For further information on the plastic industry's approach to waste management go to:

www.plasticseurope.org
www.plasticsconverter.eu
www.vinyl2010.org
www.kunststoffverwertung.ch
www.isopa.org

(Reproduced from Plastic Europe's Publication following the Publisher's guidelines)

DATA SHEET

MSW composition studies at various states (1-12)

State	Year	Paper	Glass	Metals	Plastics	Organic
California[1]	2008	17.30%	1.40%	4.60%	9.60%	32.40%
Connecticut[2]	2010	25.90%	2.10%	4.50%	14.70%	26.70%
Delaware[3]	2007	25.70%	2.40%	5.20%	11.10%	25.10%
Georgia[4]	2005	38.70%	3.70%	5.40%	15.80%	27.10%
Minnesota[5]	2000	34.30%	2.80%	5.10%	11.40%	25.70%
New York[6]	2010	27.00%	3.00%	6.00%	17.00%	24.00%
Iowa[7]	2005	26.17%	1.36%	3.74%	11.78%	17.46%
Maryland[8]	2006	27.00%	2.60%	3.80%	14.40%	45.90%
Oregon[9]	2009	16.99%	1.95%	5.45%	11.56%	50.21%
Pennsylvania[10]	2003	33.30%	3.00%	5.40%	11.30%	34.20%
Washington[11]	2009	19.20%	2.40%	6.30%	11.40%	27.20%

MSW generated, recycled, combusted and land filled in 2008

State	Population	Total tons of MSW	Tons MSW recycled	Tons MSW to WTE	Tons MSW land filled
California	36,756,666	**61,210,578**	24,724,726	627,039	28,216,903
Connecticut	3,501,252	**3,489,034**	607,691	2,190,873	387,542
Delaware	873,092	**1,032,201**	168,701	0	741,143
Georgia	9,685,744	**11,529,102**	682,266	41,350	10,765,486
Minnesota	5,220,393	**10,326,122**	2,589,954	1,187,600	6,530,938
New York	19,490,297	**16,925,888**	3,060,363	3,681,134	9,556,442
Iowa	3,002,555	**3,894,330**	924,364	69,537	2,652,855
Maryland	5,633,597	**6,551,880**	1,461,164	847,659	3,461,764
Oregon	3,790,060	**4,632,513**	1,421,850	181,666	2,689,119
Pennsylvania	12,448,279	**17,043,945**	4,677,083	1,951,447	9,666,692
Washington	6,549,224	**7,420,559**	1,461,403	332,301	4,986,236

Source: Earth Engineering Centre, Columbia University

The pouch that brings you milk and the bag you carry for shopping are made from the same material.

That's why plastic bags are not harmful.

For more information visit **www.icpeenvis.nic.in**

ICPE
REUSE • RECYCLE • RECOVER

Do not litter.
Plastics are recyclable.

Issued in public interest by Indian Centre for Plastics in the Environment.