Converting Waste Plastics into A Resource

Compendium of Technologies

United Nations Environment Programme

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Compiled by

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Preface

Economic growth and changing consumption and production patterns are resulting into rapid increase in generation of waste plastics in the world. In Asia and the Pacific, as well as many other developing regions, plastic consumption has increased much more than the world average due to rapid urbanization and economic development.

The world's annual consumption of plastic materials has increased from around 5 million tonnes in the 1950s to nearly 100 million tonnes; thus, 20 times more plastic is produced today than 50 years ago. This implies that on the one hand, more resources are being used to meet the increased demand of plastic, and on the other hand, more plastic waste is being generated.

Due to the increase in generation, waste plastics are becoming a major stream in solid waste. After food waste and paper waste, plastic waste is the major constitute of municipal and industrial waste in cities. Even the cities with low economic growth have started producing more plastic waste due to plastic packaging, plastic shopping bags, PET bottles and other goods/appliances using plastic as the major component.

This increase has turned into a major challenge for local authorities, responsible for solid waste management and sanitation. Due to lack of integrated solid waste management, most of the plastic waste is neither collected properly nor disposed of in appropriate manner to avoid its negative impacts on environment and public health and waste plastics are causing littering and chocking of sewerage system.

On the other hand, plastic waste recycling can provide an opportunity to collect and dispose of plastic waste in the most environmental friendly way and it can be converted into a resource. In most of the situations, plastic waste recycling could also be economically viable, as it generates resources, which are in high demand. Plastic waste recycling also has a great potential for resource conservation and GHG emissions reduction, such as producing diesel fuel from plastic waste. This resource conservation goal is very important for most of the national and local governments, where rapid industrialization and economic development is putting a lot of pressure on natural resources. Some of the developed countries have already established commercial level resource recovery from waste plastics. Therefore, having a "latecomer's advantage," developing countries can learn from these experiences and technologies available to them.

To raise the awareness and to build the capacity of local stakeholders, UNEP has started to promote **Integrated Solid Waste Management (ISWM) system based on 3R (reduce, reuse and recycle) principle.** This covers all the waste streams and all the stages of waste management chain, viz.: source segregation, collection and transportation, treatment and material/energy recovery and final disposal. It has been shown that with appropriate segregation and recycling system significant quantity of waste can be diverted from landfills and converted into resource.

Developing and implementing ISWM requires comprehensive data on present and anticipated waste situations, supportive policy frameworks, knowledge and capacity to develop plans/systems, proper use of environmentally sound technologies, and appropriate financial instruments to support its implementation.

Many national governments, therefore, have approached UNEP, [as reflected in the decision taken by the UNEP Governing Council/Global Ministerial Environment Forum during its 25th Session in February 2009 **(UNEP/GC.25/CW/L.3)**] to get further support for their national and local efforts in implementation of the Integrated Solid Waste Management (ISWM) programme.

In response to this decision and in line with the Bali Strategic Plan for Capacity Building and Technology Transfer, UNEP has developed a programme on integrated solid waste management. This programme includes support for capacity building and technology transfer for ISWM through a number of actions:

1. Guidelines to develop ISWM System: The four sets of guidelines on ISWM covering waste characterization and quantification, assessment of current waste management system, target setting and identification of stakeholders' issues of concern for ISWM, and how to develop ISWM Plan.
2. Pilot projects on ISWM and emerging waste streams including E-waste, waste agricultural biomass, waste plastics and so on
3. Regional and sub-regional training for policy makers and experts on ISWM and emerging waste streams
4. Interactive advisory support on ISWM and emerging waste streams

To raise the awareness and to build the local capacity for the design and implementation of projects on converting waste into material/energy source, UNEP has started a compilation of guidelines for the characterization and quantification of specific types of waste, the assessment of waste management systems and compendiums of technologies for various types of wastes.

This document is a compilation of technologies for the conversion of plastics into fuel which are in commercial use, under pilot implementation and under laboratory testing. This document is

aimed to raise awareness on the available options vis-à-vis technologies as well as to assist the policy –makers and managers in the identification of appropriate technologies with respect to local economic, environmental, social and technical characteristics.

This document can also be of interest to other interested parties/organizations that aim at supporting decision-makers. They may be:

- consultants working on urban services, recycling, or waste management;
- representatives or staff of other local stakeholders including community groups, NGOs, and the private sector;
- entrepreneurs wishing to expand or strengthen their solid waste portfolios;
- academicians and scholars in urban environmental management;
- the press, especially when seeking background materials;
- donors interested in supporting future waste management activities;
- local experts interested in using or replicating the results.

This document and the information available at the website is compiled through best efforts with purpose of creating an information-base with periodic updates based on the feedback from technology experts, providers, suppliers and users. This document is not aimed to advertise or support any specific technology and errors and omissions are not intentional.

Table of Contents

Acronyms

ABS	Acrylonitrile-Butadiene-Styrene copolymer
BTU	British Thermal Unit
DTIE	Division of Technology, Industry and Economics
GHG	Green House Gas
IETC	International Environmental Technology Centre
ISWM	Integrated Solid Waste Management
JIS	Japanese Industrial Standards
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
NGOs	Non-governmental Organizations
PE	Polyethylene
PET	Polyethylene terephthalat
PF	Phenol resin
PMMA	Polymethyl metacrylate
POM	Polyoxymethylene
PP	Polypropylene
PS	Polystyrene
PUR	Polyurethane
PVA	Polyvinyl Alcohol
PVC	Polyvinyl-Chloride
PVDC	Polyvinylidene chloride
RDF	Refuse Derived Fuel
RPF	Refuse-derived Paper and Plastic Fuel
3R	Reduce, Reuse and Recycle
SRF	Solid Recovered Fuel
UNEP	United Nations Environment Programme