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Plastics for Infra-structure and Environment protection

(Theme: Plastics never become waste)

IPI Seminar – Chennai

27/04/2018

A.Thayumanavan,

General Manager, RIL- Chennai

Indian plastics industry:

- Indian plastics industry made a promising beginning in 1957 with the production of polystyrene.
- A CAGR of 10% in volume terms from 8.3 MMTPA in FY10 to 13.4 MMTPA in FY15
- Projected to grow at a CAGR of 10.5% from FY17 to FY20 to reach **22 MMTPA**.
- Employs about 4 million people and comprises more than 30,000 processing units
- Major strengths is the local availability of raw materials
- Thus, plastic processors do not have to depend on imports.

Development activity in 2017-18

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Infra structure development with Polypropylene

- Break through in using **Geo - textiles** with southern railway
- **Drainage composite** for Highways/ Railways/RE walls etc.,
- Sands in Raffia bags like cement

Environment protection with Polyethylene

- GEO **membrane** for River, Coastal, land fills
- Shrimp pond lining (**Aqua-Culture**)

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GEO SYNTHETICS SECTOR:

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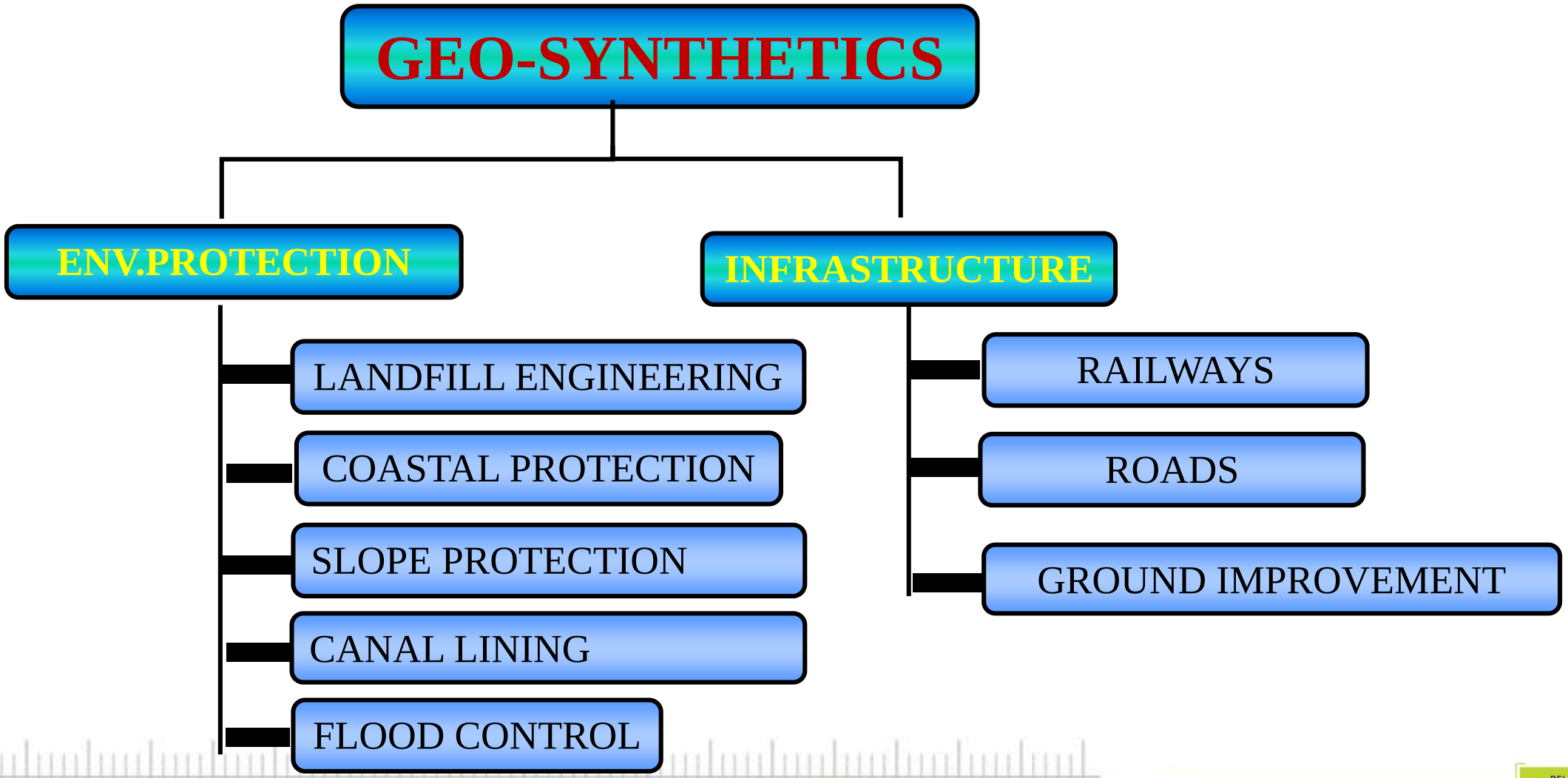

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Geo Textiles: Southern railway

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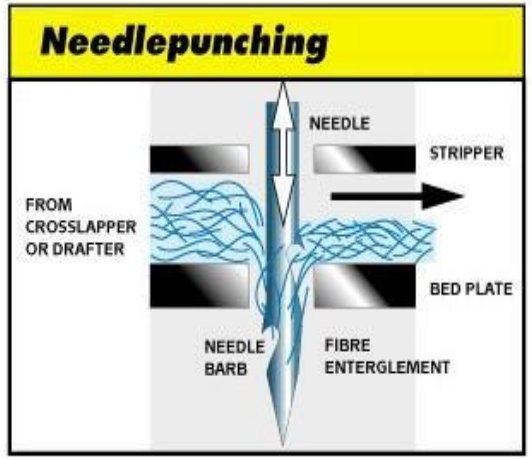
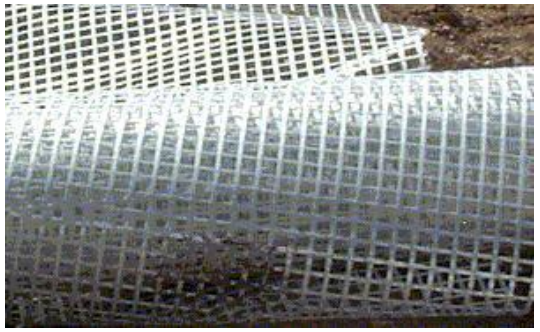
Breakthrough in Southern Railway for Geo synthetics (**PP Needle punched Nonwoven and PP Geo grid**)

Tenders were released for the supply of Geo-grid/ Geo – textile for Formation treatment -**18 KM Stretch**

- **Chennai Central-Gudur section**

- **Villupuram-Tiruchchirappalli chordline section**





Huge potential exists for Geo Textiles

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Geo-synthetics Sector: All India

- Approvals/Tenders floated across **6 more new** railway zones
- Introduced the concepts across **11 out of 17** Indian Railway Zones
- First Rural Road Stretch in the State of **Odisha** stabilized with Geotextiles @ 5 KM
- First Tender from the **State of Bihar** floated for PP Geo-bags for erosion control
- **BIS Standard** on Geotextile Bags for Flood & River Bank Protection Works Published

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BULK PKG SECTOR

: Sand filled in Geo bags

: Packed sand for B& C

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Geo (sand)bags:

- It is used with permeable fabrics have the ability to
  - **Separate,**
  - **Filter**
  - **Reinforce,**
  - **Protect, or**
  - **Drain.**
- Typically made from polypropylene or polyester, geotextile fabrics come in three basic forms:
  - Woven (resembling mail bag sacking),
  - Needle punched (resembling felt)
- Most common one is polypropylene woven bags

Sand in Raffia bags:

100 square feet of built-up area requires, 33 bags of cement of 50kg each and 117 cubic ft of sand

- Estimated sand requirement is **1.4 Billion MT** of sand by 2020 in the country , compared to 700 million tonnes in 2015 . (Cement 270 MMT)
- Karnataka started importing sand from Malaysia and started distributing in 50 kg PP raffia bags . Plans further to import **14 million MT** in 2018-19
- **Tamilnadu -2 MMT , Kerala-1 MMT and Pondy-1MMT** are also planned to have imported source
- **I- Sand, M-Sand ,P – Sand** are the latest classification

20 MMT to be packed in 28 KT of PP Raffia bags

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Development Activity with Polyethylene

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MSW:

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EFFECTS OF MUNICIPAL SOLID WASTE

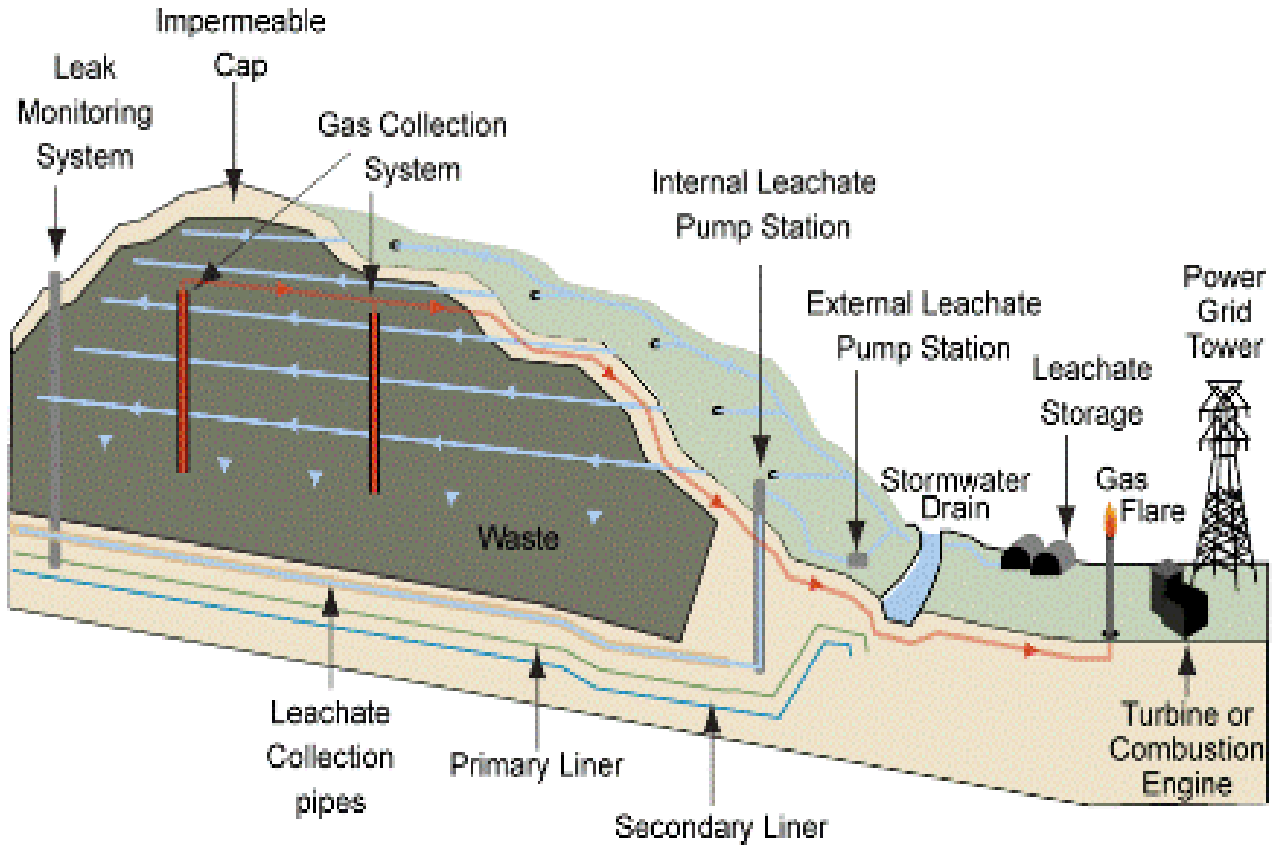
Municipal Solid Waste if disposed improperly will cause the following impacts on the environment

- Ground water contamination by leachate generated by waste dump.
- Surface water contamination by the run-off from the waste dump
- Bad odour, pests, rodents and wind blown litter in and around the waste dump.
- Release of green house gas
- Fires within waste dump
- Epidemics through Stray Dogs
- Acidity to surrounding soil


Your Home
The Landfill Gas to Renewable Energy Cycle
produces
Garbage
that goes to
Landfill
produces methane
Generator
burns methane
Electricity
delivered on the wires

BIO-REACTOR LANDFILL - INTRODUCTION

- An innovative technology for bio-stabilisation of MSW
- A controlled land fill where liquid and gas are managed to enhance the process
- Controls , monitors and optimises the process rather than simply contain the waste
- Waste stabilisation process requires aerobic/ anaerobic , Temperature, PH and nutrient level



Land-fill Comparison:

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Conventional land fill

- To Contain and store the waste
- Called as Dry Tomb
- Talk 30-40 years for decomposition
- Environment risk due to leachate and release of gases

Bio reactor land fill

- To treat the waste for decomposition
- To have shorted decomposition period as early as 5-6 years
- Tackle some of the environment problems

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Geo membrane (HDPE Sheet) :

- For waste management M/s Ramky Infra Hyderabad had used imported 9 meter HD sheet.
- Last year they did12 crore business in solid waste management covering area of 72 lakh sq meter : 50% HDPE sheet, 50% Geo filter fabric
- Installed India's largest waste (solid municipal waste) to power energy plant at Narela , generating 26 KW electricity.

Looking for domestic suppliers & specified their requirement

HDPE GEO-MEMBRANE – SMOOTH 1.5 mm

Sr. No	Parameter	UNIT	Specifications	
			Test method	Value
1	Brand name		HDPE Smooth Geo membrane	
2	Thickness (min individual thickness value)	mm	ASTM D 5199	1.5
3	Width	m		9.4/7.1
4	Density	g/cm^3	ASTM D1505 ASTM D 792	0.942
5	Tensile Strength at Yield	N/mm MPA	ASTM D 6693	25 16
6	Elongation at yield	%	ASTM D6693	12
7	Tensile strength at break	N/mm MPA	ASTM D 6693	45 >26
8	Elongation at break	%	ASTM D 6693	700
9	Carbon black content	%	ASTM D 1603	2
10	Carbon black dispersion	Category	ASTM D 5596	1-2
11	Cold bending at -20^{0}C	-	ASTM D 2136	passed
12	NCTL-Test* Stress Crack Resistance	Hours	ASTM D 5397 App	>400
13	OIT	Min	ASTM D 3895	100
14	Puncture Resistance	N	ASTM D 4833 EN ISO 12236	500 4000

HDPE GEO-MEMBRANE – TEXTURED 1.5 mm

Sr. No	Parameter	UNIT	Specifications	
			Test method	Value
1	Brand name		HDPE Texture Geo membrane	
2	Thickness (min individual thickness value)	mm	ASTM D 5994	1.5
3	Width	m		5.1
4	Asperity height	Mm	ASTM D 7466	≥0.9
5	Density	g/cm^3	ASTM D1505 ASTM D 792	0.942
6	Tensile Strength at Yield	KN/m	ASTM D 6693	23
7	Elongation at yield	%	ASTM D6693	12
8	Tensile strength at break	KN/m	ASTM D 6693	24
9	Elongation at break	%	ASTM D 6693	300
10	Carbon black content	%	ASTM D 1603	2-3
11	Carbon black dispersion	Category	ASTM D 5596	1-2
12	NCTL-Test* Stress Crack Resistance	Hours	ASTM D 5397 Appendix	>400
13	Oxidation Induction Time (OIT) a)Standard OIT	min	ASTM D 3895	100
14	Puncture Resistance	N	ASTM D 4833	600

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Pond lining: Shrimp

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- Total area under shrimp cultivation is **6 lakhs acre**
- Many shrimp ponds were affected with viral that led to closure of existing ponds
- **As per HC order it became mandatory to adopt modern technique including the use of Pond liners.**
- **HDPE sheet requirement is @ 2.5 MT/ acre (**500 micron to 1mm thick sheet),

New *investment is 15 lakhs/ Ha.*

Advantages of shrimp pond liner :

- Reduces **water seepage & the leaching of potentially stressful compounds** into the ponds
- Helps in reducing the **time and costs to clean the ponds** between cycles.
- High intensive cultivation is possible (10 lakhs shrimp seeds/Acre)
- PH level can be monitored with liner & corrected to suit the growth
- Almost **5-6 % shrimp mortality vs 40-50% without liner**, Higher yield, Good revenues (Per kg of shrimp is sold as high as Rs 300-340/kg)

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Demolition Blast Wrap

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Blast Wrap is used to achieve a satisfactory and safe end result to demolition projects.

- It is for safely containing the resulting debris and dust from contaminating surrounding areas and minimizing the risk of flying concrete causing damage.
- Blast wrap is a cost-effective, strong and durable material constructed for optimum strength and puncture resistance.
- Blast Wrap continues to be in regular use on demolition projects providing blast screen.

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Plastics – The Environmental angle

World Environment Day - June 5

- **World Environment Day** (WED) occurs on **5 June** every year. India to host the **World Environment Day 2018**.
- With "**Beat Plastic Pollution**" as the **theme** for this year's edition, the **world** is coming together to combat **single-use plastic pollution**.

All our efforts are required from all levels to mitigate the major issues by:

- **Reusing ,**
- **Recycling**
- **Land filling along with municipal waste**
- **Incineration along with medical waste**
- **Fuel to Industries including Kiln of cement Industries**
- **Power generation**

A Look at Plastics: Uses and Benefits

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Plastic products improve our daily lives and have made vast improvements in areas such as:

- **Transportation - Automotive, Aerospace, Space Exploration**
- **Medicines - helping us all live longer, healthier lives**
- **Electronics - information, communication, and entertainment**
- **Building and Construction - durability, aesthetics, and high performance**
- **Personal protection - children, athletes, police and firefighters**
- **Innovative packaging - freshness, storage stability, and protection from bacteria**

Recyclability and reuse

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Plastics Recycling

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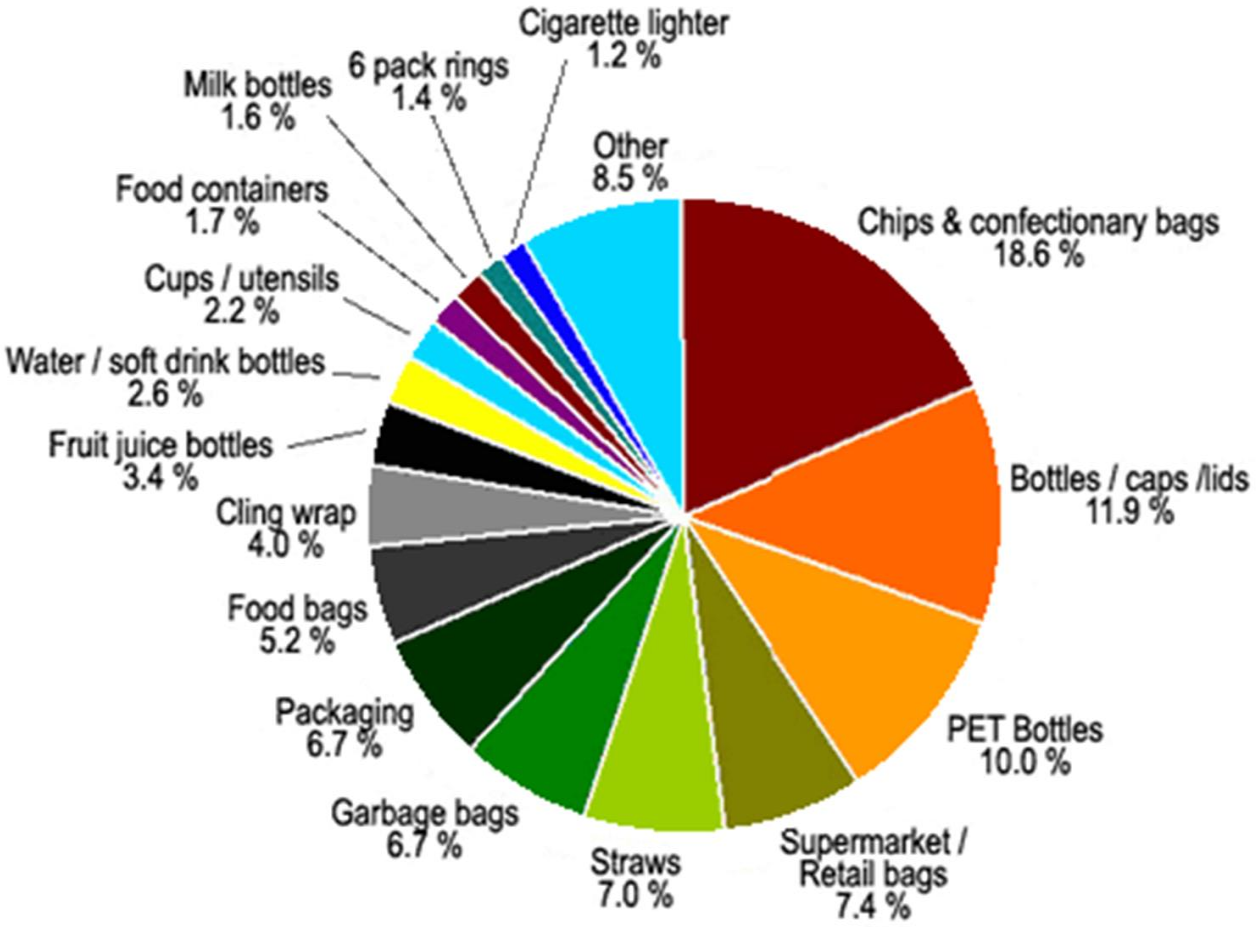
Industry response

- One of the key counters is the Recycling of Plastics:
- ❑ Industrial waste management
- ❑ Solid waste management
- ❑ Post consumer waste management



Plastics Recycling Industries:

- Number of organised recycling units: 7000
- Number of unorganised recycling units: 12000
- Major types of plastics recycled: PET, HDPE, PVC, LDPE/LLDPE, PP, PS & others like ABS, PMMA etc.
- Manpower directly involved in plastics recycling: around 5, 00,000
- Manpower indirectly involved in plastics recycling: around 12, 00,000
- **Quantum of plastics recycled per annum: 6 MMT.**

Estimation based on following facts :

- Almost 100% of rigid packaging products is recycled except EPS
- 90% of PET bottles are recycled
- Waste generated by plastic industry, industrial plastic waste are 100 % recycled
- Recycling including plastics from household, furniture etc
- Plastic products going into municipal solid waste

Source: ICPE

Reproduction of recycled Plastics:

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Virgin products	Recycled items
Milk Pouches	Carry bags
Packaging Film, Carry bags	Water proof Sheets
Foot wear, Bottles	Foot wear
Bucket, Crates, Luggage	Bucket, Luggage
PP Film , Thermo ware, Tooth brush, Pens	Combs, Pen , Toys
Cement bags	Thin ropes
Battery boxes, Industrial products, Thermo ware	Luggage,
Cups, TV cabinets, cassettes	Cassettes cover , Novelty items

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Numbering system for plastic recycling

Recycling No.	Abbreviation	Polymer Name
	**PETE or PET**	Polyethylene Terephthalate
	**HDPE**	High-Density Polyethylene
	**PVC or V**	Polyvinyl Chloride
	LDPE	Low-Density Polyethylene
	PP	Polypropylene
	PS	Polystyrene
	OTHER	Other plastics, including acrylic, polycarbonate, polylactic acid , nylon and fiberglass.

Globally even after introduction of recycling Symbol only 14% of plastics is recycled and then balance is either :

- **Buried**
- **Burned or**
- **Dumped into natural Environment**

Plastic

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Five 2-liter recycled PET bottles provide enough fiberfill for a ski jacket.

Recycling plastic saves twice as much energy as burning it in an incinerator.

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PET Recycling in India

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India recycles 90% of its PET waste

Waste Collectors

- Collects all recyclable waste
- Gets Rs 14-15 per kg of PET bottles

Kabadiwallah

- Segregates the plastic waste into PE, PP, milky PP, HDPE, LDPE, PET etc.
- Receives Rs 25/kg of PET waste

Trader

- Receives PET waste in bulk, processes, sorts, bales, and sends to recyclers
- Receives Rs 30/kg of PET

Recyclers

- Removes labels, aluminum caps, rings, other plastic parts, articles, washes, flakes, spins into fiber
- Sells at Rs 55-100+

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Wonderful use for thin plastic road-waste

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- Discarded thin-plastic carry-bags are a menace
- In town they clog drains, cause flooding, choke animals that eat them and are unsightly
- Strewn across fields, they block germination and prevent rainwater absorption by soil
- Recycling plastic by melting releases fumes, and is only possible to use 3-4 times
- Toxic contents might leach into recycled water-pots or water-pipes

But it can be used for road construction

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Advantages: waste plastic in asphalt road

- Reduce need of Bitumen by around 10%
- For 1 Km X 3.75 m road , one ton of plastic (10 lakhs carry bags) is used
- Strength & performance of road increased by 100 %
- 100% improvement in fatigue life of roads.
- No effect of radiation like UV
- Better resistance to water, water stagnation,
- No potholes and No leaching of plastic

How Much Plastic? How Many roads?

- Each 5-member family's use of 5 gm plastic bags a week, all-India = 52,000 tons a year
- Assume 50% of this is available for roads

  1.5 tons plastic goes into avg 1 km road.
- So resurfacing just 39,000 km of roads a year will absorb all this littered waste. This is just
- 3.5 % of India's 1 million km surfaced roads. (1.1 million km more roads are unsurfaced).

Will is the Missing Factor!!!!!!!!

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- Plastic bags disposal need never be a problem:
- A street price of Rs 5 per kg will reduce litter.
- State and Central PWDs and National Highway Authority must incorporate waste-plastic modified bitumen into all road specifications.

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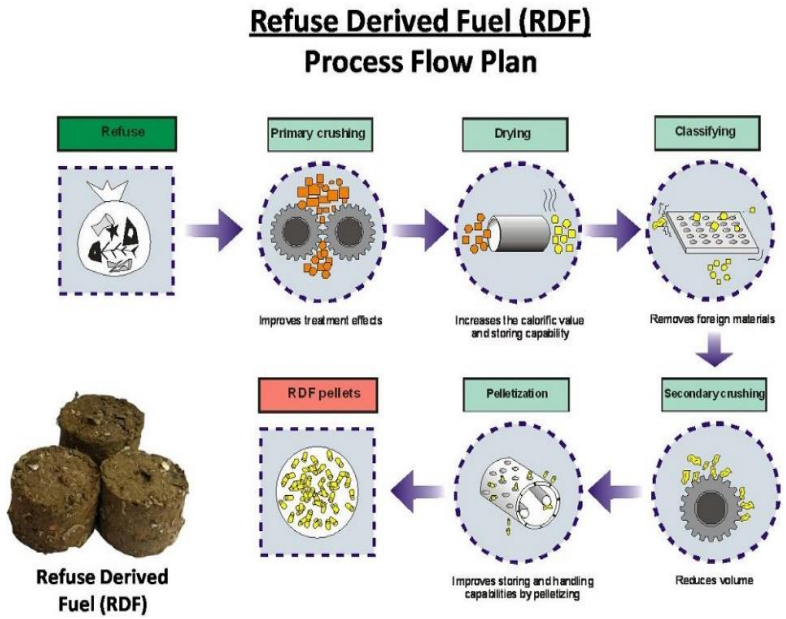
Refuse Derived Fuel (RDF)

- Solid waste can be utilized to produce electricity by converting it to a fuel that can be used to power furnaces and generators.. To produce refuse derived fuel, MSW is first processed to remove hazardous and non-processible materials.

  - Recyclables are collected with large magnets and separators.
  - The remaining material is shredded and dehydrated to a maximum of 15% moisture content so it will process well.
  - The resulting refuse-derived fuel can be processed to produce steam, powering a turbine and producing electricity.



Incineration of Medical disposables

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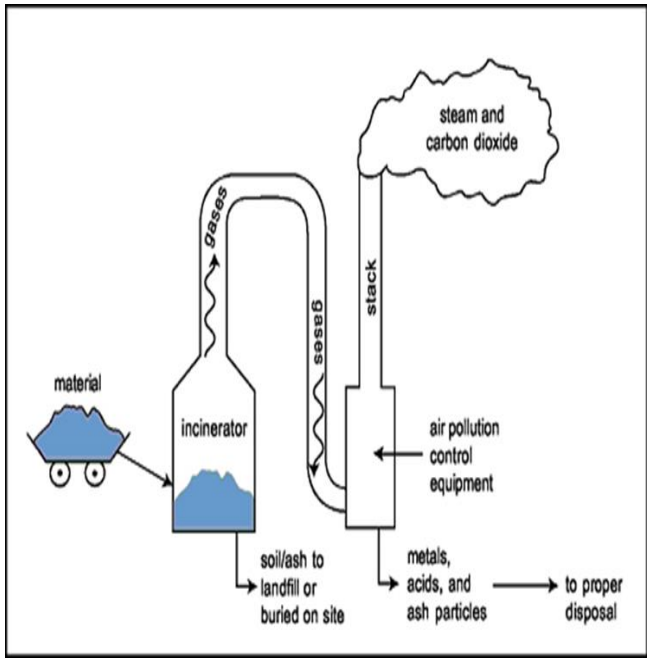
Material	Energy value : KJ/KG
PET	25353
HDPE	43496
RUBBER	29772
NEWSPAPER	18609
WOOD	16979
YARD WASTE	6745
FUEL OIL	48613
COAL	22329

- Incineration or controlled burning is another option for disposing of large percent of solid waste & medical disposables
- **The most common purpose of burning is to generate electricity**.



Energy content of various solid waste materials is much higher

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Fuel oil from Plastic waste

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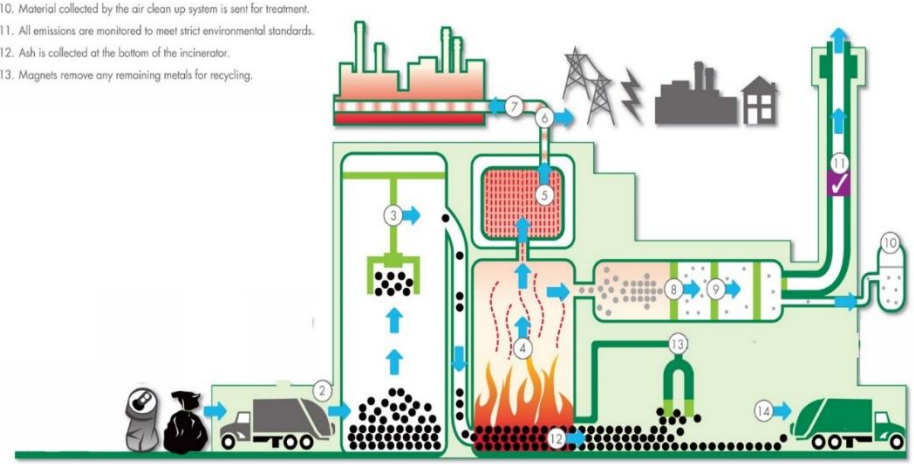
1. We all recycle and compost as much as we can.
2. Waste can be pre-sorted to collect any recyclable materials left over.
3. The waste is fed into the incinerator.
4. It burns at temperatures over 850°C.
5. Heat enters a boiler to produce steam.
6. Steam powers a turbine that generates electricity for homes and businesses.
7. Excess heat can be piped to neighbouring buildings for heating.
8. Harmful gases are removed.
9. Particles are filtered.
10. Material collected by the air clean up system is sent for treatment.
11. All emissions are monitored to meet strict environmental standards.
12. Ash is collected at the bottom of the incinerator.
13. Magnets remove any remaining metals for recycling.

Recovering energy from waste



Now, low viscosity fuel oil from plastic waste

Prolonged pyrolysis at 300-400 degree C in inert conditions yields high calorific value oil

ASWATHI PACHA

Certain plastic wastes can soon help fuel your cars. Researchers from IIT Guwahati have successfully converted packaging plastic waste to plastic-derived oil (PDO), which has characteristics similar to diesel.

Low- and high-density polyethylene (LDPE, HDPE) and polypropylene are commonly used as packaging materials and end up in the waste stream. According to a 2016 Central Pollution Control Board report, almost 15,000 tonnes of plastics waste is generated per day in India.

The researchers collected the waste (biscuit wrappers, shopping bags, food containers, shampoo bottles) from houses, cleaned and segregated them according to the resin identification code. These codes on plastics indicate the type of plastic resin it is made of.

Next step: "We hope to create ideal operating conditions to provide high-quality oil with less pollution," says Pankaj Tiwari (left).

Using a semi-batch reactor, the different wastes were heated for six to seven hours at 300-400 degree Celsius. "Heating at very high temperatures in inert conditions caused the plastic to convert into wax, so we chose this particular temperature range in which the plastic turned to plastic-derived oil and stayed in its oil state," explains Pallab Das, PhD scholar at the institute and first author of the paper published in *Resources, Conservation and Recycling*.

But burning plastic waste generates pollution, particularly dioxins which are toxic to humans. "There is no oxygen in the three plastic wastes that is heated that we are also not supplying any oxygen. Pyrolysis is done under inert conditions. Only hydrocarbon gases such as methane, ethane and propane were produced and there was negligible amount of carbon dioxide and carbon monoxide produced," says Das.

Further research

"More experiments need to be carried out to get a trade-off between the quality of the oil and the environmental pollution caused by the pyrolysis process. We are working on this and hope to create an ideal operating condition which can provide high-quality oil with less pollution," says Dr. Pankaj Tiwari, Assistant Professor, IIT Guwahati, and corresponding author of the paper. "Compared with combustion, pyrolysis causes less pollution."

The researchers then studied the properties of the new plastic derived oil. One of the oil samples from polypropylene showed a high research octane number of approximately 92. Octane number indicates the quality of the gasoline range fuel. Premium petrol has research octane number of 98 to 100.

The oil also showed low viscosity and had high calorific value. Calorific value denotes the amount of heat generated when unit amount of sample was burnt with oxygen supply. The new oil had calorific value greater than 45 MJ per kilogram. Calorific value of petrol and diesel is 46-48 and 44-46 MJ per kilogram, respectively.

"We are yet to carry out engine tests. Once tested, these oils can soon find application in transport and industrial sectors," says Dr. Tiwari.

Urban Waste Stream Trends in India

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Waste Stream	Current Generation	Projection	% diverted/recycled
Municipal Solid Waste[1]	68 million tons/year	> 200 million tons by 2040	Less than 10% (of collected waste)
C&D waste[2]	10-15 million tons/year	5x by 2030?	10-30% (often for illegal/harmful uses)
E-waste[3]	1.8 million tons/year	5.2 million tons/year by 2020	2%
End-of-Life Vehicles[4]	8.7 million	21.8 million by 2025	Less than 10%

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Recent Successes and Encouraging Trends

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Waste Stream	Success/Positive Trend
MSW	Solid Waste Management Rules, 2016 Swachh Bharat Mission funding and targets
C&D waste	C&D Waste Management Rules, 2016 (3 year targets) Delhi and Ahmedabad operating successful plants Buyback of C&D derived products by Delhi/Ahmedabad
E- waste	E-waste Management Rules, 2016 Extended Producer Responsibility mandate
ELVs	Guidelines for Environmentally Sound Management of ELVs NATRIP pilot facility, Chennai First commercial facility (JV with Mahindra) in 2018

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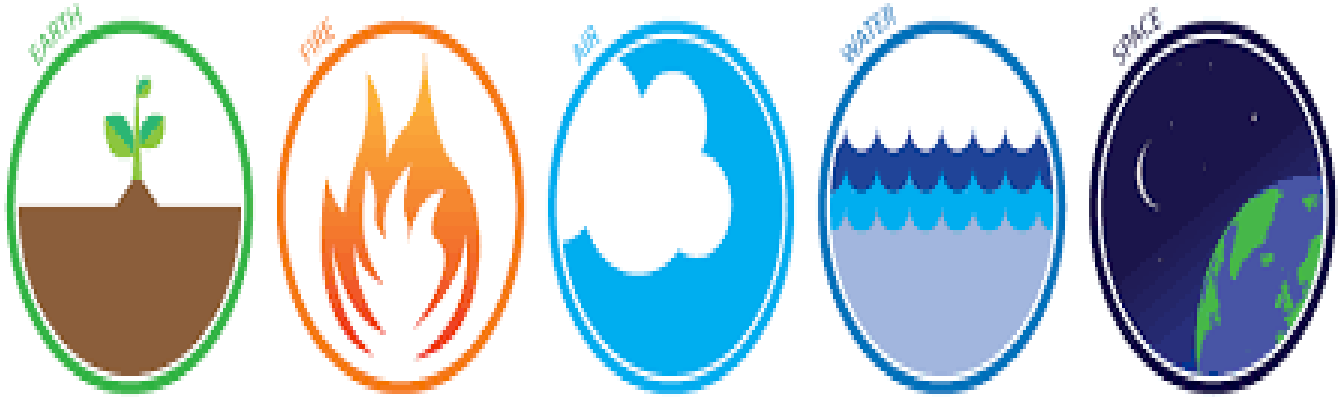
6TH ELEMENT ON EARTH IS PLASTIC



Earth Fire Air Water Sky Plastic

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