

GRAM

Business Models for conversion of waste plastic to fuel

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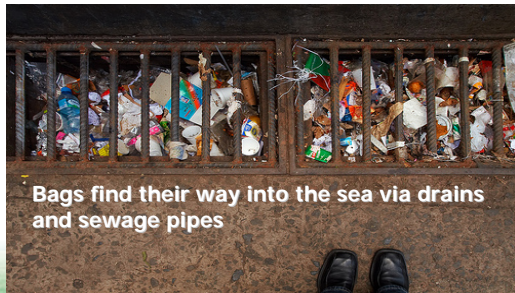
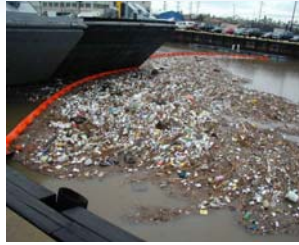
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Waste is Resource at wrong place

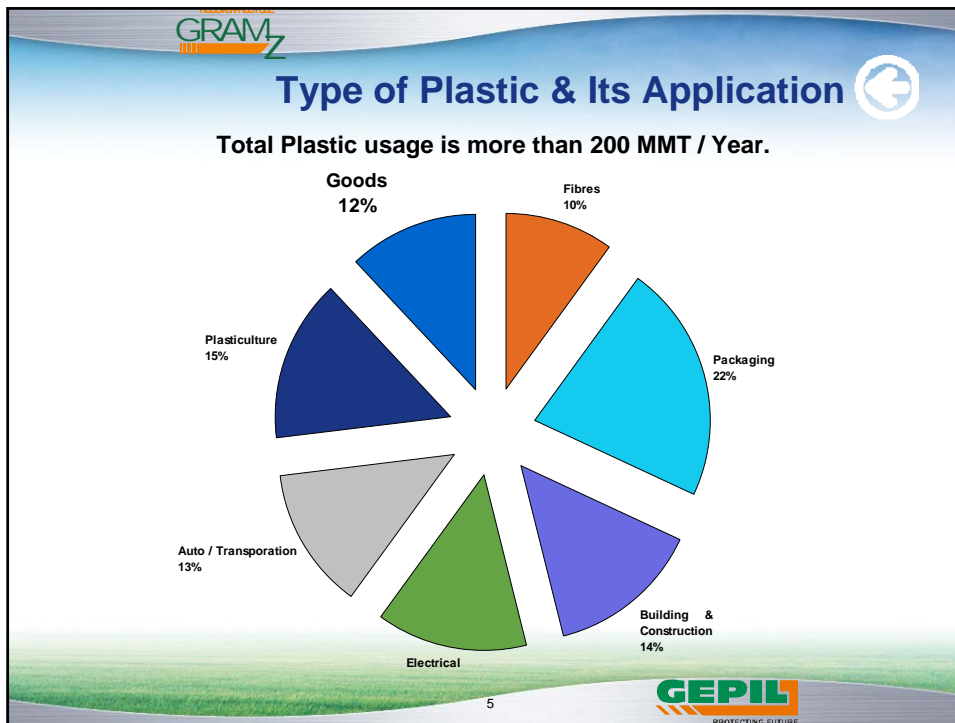


Bags find their way into the sea via drains and sewage pipes



Importance of Plastic

- ❖ From practically zero consumption during the beginning of the 20th century, human kind today consumes more than 200 million tons of plastic per year.
- ❖ Replacement of
 - Wood
 - Metal
 - Paper
- ❖ Quality
 - Versatility & Durability
 - Lighter weight
 - Good Resistance to chemicals , water and weather impact.
 - Good safety and hygiene properties
 - Relatively inexpensive to produce.



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- ## Future Potentials of Plastics
- ❖ **Thin wall molding / Bottles making for**
 - Dairy products
 - Disposable glasses
 - ❖ **Gas assist molding for**
 - Furniture
 - Automobile
 - ❖ **PVC calendared Film**
 - Life style products
 - Interior Decoration items
 - Pharma Packaging
 - ❖ **Technical Blow molding**
 - Automobile applications
 - Industrial application
 - Electronic components
 - ❖ **Geo-textiles**
 - Road Building
 - Canal Embanking
 - Landfill covers & lining
 - Dredging Operations
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Global consumption of Plastics

| Rank | Country | 1988 MMT | Country | 2000 MMT | Country | 2010 MMT | 2010/ 2000 |
|------|---------|-------------|---------|-------------|---------|-------------|---------------|
| 1 | USA | 16.6 | USA | 27.3 | USA | 38.9 | 3.6 % |
| 2 | Germany | 6.4 | China | 14.4 | China | 31.3 | 8.1 % |
| 3 | Japan | 4.3 | Japan | 9.1 | India | 12.5 | 14 % |
| 4 | China | 3.7 | Germany | 6.4 | Japan | 11.5 | 2.3 % |
| 5 | Italy | 3.1 | Korea | 4.7 | Germany | 9.4 | 3.9 % |
| 6 | CIS | 2.4 | Italy | 4.7 | Korea | 7.4 | 4.8 % |
| 7 | France | 2.4 | France | 4.1 | Italy | 6.8 | 3.8 % |
| 8 | UK | 2.2 | UK | 3.5 | Brazil | 6.7 | 7.0 % |
| 9 | Taiwan | 1.9 | India | 3.4 | CIS | 6.2 | 9.1 % |
| 10 | Korea | 1.8 | Brazil | 3.4 | France | 6.1 | 4.1 % |
| 16 | India | 1.6 | Taiwan | 3.3 | UK | 5.2 | 4.0 % |

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Waste plastic scenario in India

- ❖ Total plastic waste generation is 36 to 40 MMT/Annum
 - 60 % segregated wastes is Recycled
 - 40 % is Disposed by indiscriminate land disposal (About 10 % of MSW is plastics)

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Plastic waste - Source

- ❖ **Institutional**
 - Packaging
 - CDs and DVDs/ computers
 - Discarded spare parts / components
 - Storage Containers
- ❖ **Domestic**
 - Water bottles
 - Plastic dinnerware
 - Toys
 - Packing containers & Bags
- ❖ **Medical**
 - Pharmaceutical packing
 - Blood Bags & Accessories
 - Syringes
 - Injection vials
- ❖ **Industrial**
 - Advertising Materials
 - Storage Pellets
 - Packing & Insulation items
 - Pipes
 - Broken containers and linings

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Plastic waste - Present Recycling / Reuse Practices

- ❖ A finished end product – Based on recycled waste.
- ❖ The re-processors will use the pellets for manufacturing.
- ❖ Use in road making
- ❖ Energy Generation
- ❖ Land fill (2010-2.00 MMT/ Annum – India)
- ❖ **Conversion to fuel**

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Plastic Recycling -Challenges

Challenges

- Waste Collections /Unauthorized Waste collectors
- Other Uses of Plastic Waste
- Appropriate Technology for conversion
- Stable End product Quality related
- Government Policies & Assistance
- Marketing & Market Competition
- Human Psychology / Acceptance

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Waste Collections / Unauthorized Waste collectors

Challenges

- Non segregated collection leading to contamination of clean waste
- Geographic spread of waste requiring numerous labour for collection & transportation
- Unorganised collection/ Rag picking leading to health risk
- Indiscriminate disposal leading to contamination of land & ground Water

Enabling Measures

- Segregation at source to avoid cross contaminations
- Provision of bins with colour coding to segregate waste
- Creation of public awareness
- Regional collection / satellite centre
- Developing organized work force and proper training
- Public awareness on proper disposal

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Other use of Plastics Waste

Challenges

- Illegal use of contaminated plastics as fuel leading to toxic gas emission and serious health issues
- Uncontrolled / unorganized supply chain
- Use of unsafe technologies for lack of knowledge by unauthorized recyclers

Enabling Measures

- Stronger enforcement of rules regulation on illegal uses
- Public and media campaign / awareness
- Intermediate collection and distribution of waste from source
- Organizing supply chain

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Appropriate Technology for Conversion

Challenges

- Absence of proven and established technology in the country
- Low scale of economy leading to non viability
- Low volume of plastics & scattered geographically

Enabling Measures

- Demonstration of established technology for non segregated contaminated plastics in various regions
- Establishment of large scale plants at regional levels
- Scattered establishment of collection centers

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Stable End Product Quality Related

Challenges

- Inconsistent waste mix (Inputs)
- Probability of inconsistency in end product quality leading to lack of confidence and non acceptance by end users
- Risks of reverse engineering process

Enabling Measures

- Prepare a proper input mix to achieve consistent output quality (Larger batch sizes)
- Proper segregation and preparation of input feed mixture
- Larger scale operations, with pre-mix, equalization storage of finish products.
- Certification of product quality

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Government Policies and Support

Challenges

- Weaker control on other illegal uses of plastic wastes.
- Formalizing the informal collection mechanism.
- Absence of promotional schemes for promoting recycling of plastics and use of fuel produced from Recycling

Enabling Measures

- Framing new rules prohibiting illegal use of plastic wastes
- Stronger enforcement of Rules
- Schemes for promoting Demonstration of plants and R & D
- Tax benefits on recycling based production and sales
- Viability gap finding.

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Marketing & Market Competition

Challenges

- Lack of confidence on consistent product quality by customer
- Absence of established data on its full proof end use
- Cost competitiveness with normal fuel
- Competing against other use of waste plastic
- Subsidies on Diesel / Electricity

Enabling Measures

- Accreditation of product quality and its safe use by Government
- Certification and recommendation by major automobile companies & other research agencies.
- NGO campaign
- Favorable government policies
- Mass public awareness
- Viability gap finding & acceptance in CDM

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Human Psychology / Acceptance

Challenges

- Non acceptance / rejection by users being a product from waste
- Lack of confidence
- Fear of equipment / engine damage on use of recycled diesel

Enabling Measures

- Image building of "Recycled Product"
- Confidence building through series of demonstration
- Recognition by consumer forums
- Creating hype for social value
- Showing economical advantages

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Plastic Recycling -Probable Technologies for conversion to fuel

- ❖ Pyrolysis & Catalytic Breakdown, Ozmotech (Japan / Australia)
 - Diesel from contaminated plastics
- ❖ Random De-Polymerizations, Dr. Zadgaonkar (Nagpur, INDIA)
 - Furnace / crude oil form from contaminated plastics
- ❖ Catalytical De polymerization, Eco KAT (Germany / USA)
 - LDO / Diesel from plastics & bio mass material

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Plastic Recycling -Possible Business Options

Waste plastic

Conversion to diesel

- Furnace fuel (furnace Oil)
- Sell as fuel (like Diesel)
- Convert & sell as Electrical energy
- Captive power plant with Converted fuel

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Furnace fuel (Furnace oil)

Opportunity

- Wider applicability
- Lower production cost
- Less stringent quality norms
- Easy storage regulations / norms
- Bulk Use
- Industry spread throughout the country

Threats

- Low profit Margins
- Stricter pollution control requirement at end use.
- Quality is affected by climatic conditions

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Sell as fuel (Like Diesel)

Opportunity

- Larger, well established and fast growing market
- Better Margins as compared to furnace oil applications
- Good existing Distribution Network

Threats

- Stricter quality specifications
- Non acceptance by government and end users
- Competition with fresh fuel price, which is highly fluctuating & subsidized by Government of India
- Part of essential commodity act

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Convert & sell as Electrical Energy

Opportunity

- Easy or no marketing efforts of product
- Well controlled business
- Fuel quality control and engine tuning in owner's control

Threats

- Poor conversion efficiency
- Wheeling Charges
- Subsidized electricity in India
- Power policy & Distribution Challenges

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Captive Power plant with converted Fuel

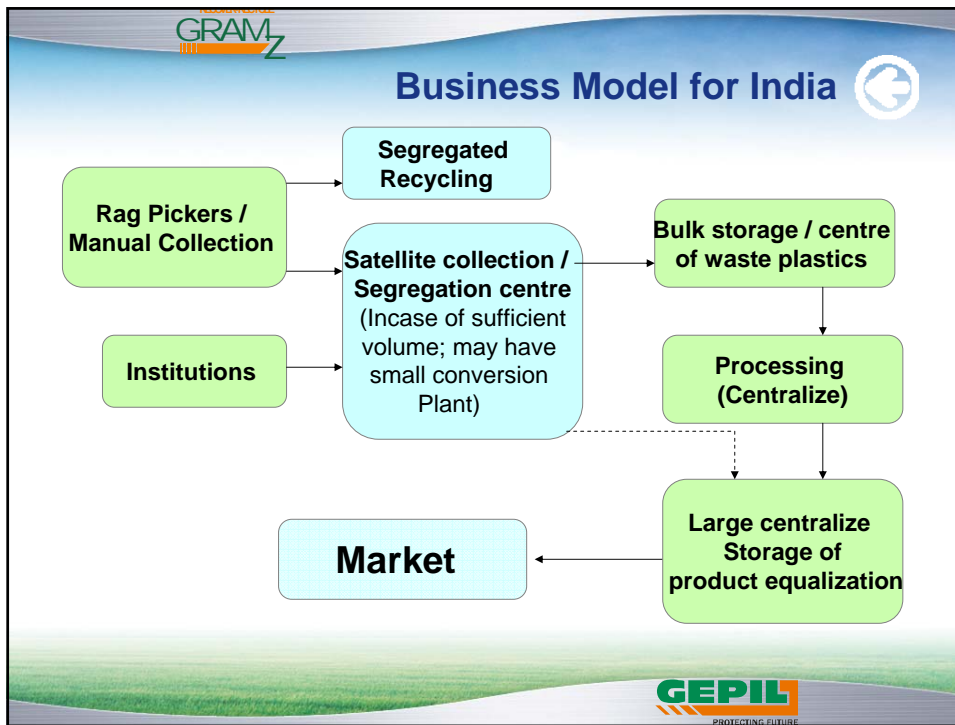
Opportunity

- Smaller operations at individual levels, so lower investments, scattered investments
- Easy to controls
- Built & Operate model can work

Threats

- Discomfort : too dependent on one recycling supply chain
- Competing with other renewable energy options
- Poor conversion efficiency

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Example Plastic to Diesel (Thermo fuel)

Financials

Input Raw Materials Specification

| SN | Feed Stock Mix | | Indicative Conversion Ratio | % Total Feed Stock | Yield - Weight to Volume |
|----|----------------------------|------------|-----------------------------|--------------------|--------------------------|
| 1 | High Density Polyethylene | HDPE | 1.0400 | 30.00% | 0.3120 |
| 2 | Low Density Polyethylene | LDPE | 1.0400 | 30.00% | 0.3120 |
| 3 | Polypropylene | PP | 1.1500 | 20.00% | 0.2300 |
| 4 | Polystyrene | PS | 0.8500 | 10.00% | 0.0850 |
| 5 | Polyvinyl Chloride | PVC | - | 2.00% | - |
| 6 | Polyethylene Terephthalate | PET Code 1 | - | 2.00% | - |
| 7 | Other Plastic Types | - | 0.5000 | 6.00% | 0.0300 |
| | Average Yield | | | 100.00% | 0.9690 |

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 **Example Plastic to Diesel (Thermo fuel)** 



Financials

Key Assumptions

| | | |
|---|--------------------|-----------------------------------|
| 1 | Installed Capacity | Input 6800 MT Per Annum |
| 2 | Output Capacity | Diesel Yield 4979.62 KL Per Annum |
| 3 | Location | India |
| 4 | Project Cost | 6.25 Million USD |
| 5 | Days of Operation | 340 |

| SN | Particular | Unit | Rate (USD) |
|----|-------------------------------|-------|------------|
| A | Feed Stock | MT | 67.08 |
| B | Labour | Annum | 80,208.33 |
| C | Electricity / Power | KWH | 0.11 |
| D | Natural Gas | Gj | 7.50 |
| E | Caustic Agent | Litre | 0.63 |
| F | Fuel Additives | Litre | 15.31 |
| G | Transportation Cost on Output | KL | 27.56 |

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 **Example Plastic to Diesel (Thermo fuel)** 


Financials

Key Assumptions

| SN | Financial Parameter | Amount(Million USD) |
|----|------------------------------|----------------------|
| A | Share Capital | 0.63 |
| B | Unsecured Loan | 0.94 |
| C | Secured Loan from bank/FI | 4.69 |
| D | Interest Rate - Secured Loan | 6.00% |
| E | Depreciation Rate - SLM | 10.00% |

Tax Outlook

| SN | Tax Rates in India | Rates | Remark |
|----|----------------------------|-------------------|------------------------------|
| A | Excise Duty | | |
| | Diesel | 6.18% + 0.026 USD | |
| B | Gujarat VAT | | |
| | Diesel | 24.00% | (Entry No.1 of Schedule III) |
| | Other kind of Motor Spirit | 26.00% | (Entry No.6 of Schedule III) |

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Examples Plastic to Diesel (Thermo fuel)

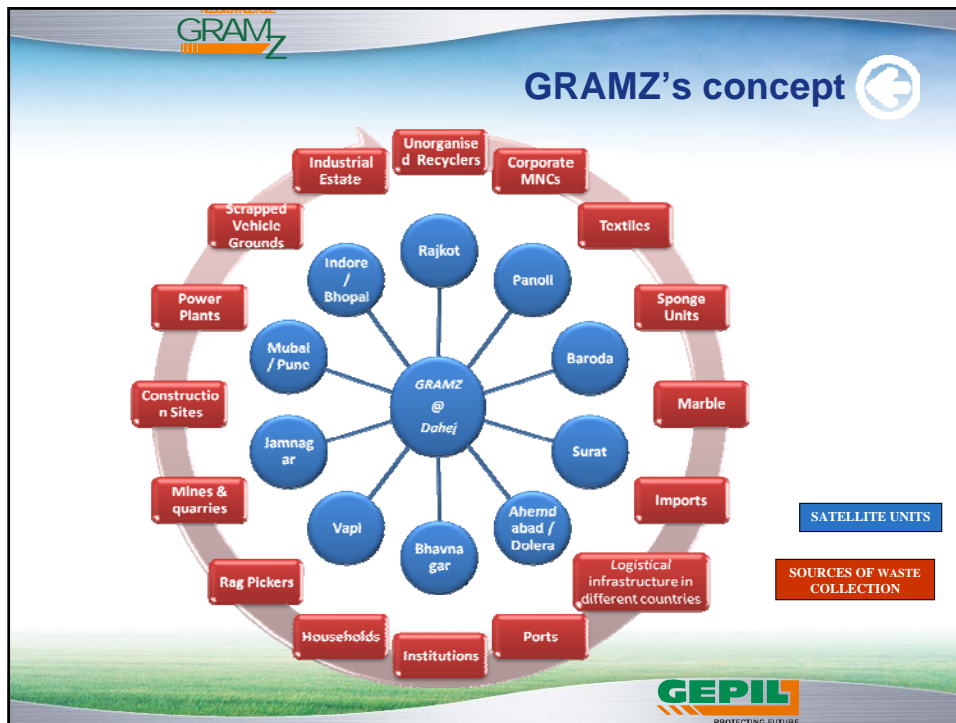
Financials

Results

| SN | Particular | Unit | Indicator |
|----|-------------------|------------------------|-----------|
| A | Equity Pay Back | Months | 83.89 |
| B | Equity IRR | % | 7.59 |
| C | DSCR | Ratio | 1.39 |
| D | Net Profit Margin | % - Average - 10 Years | 13.51 |

GRAMZ's concept

“ GRAMZ is combination of centralized and decentralized recycle and reuse facility in the State of Gujarat. Where economy of scale and knowledge driven recycling mechanism is of key importance. Spread over 500 acres of centralized facility at Dahej, Gujarat, INDIA. It is planned to have state of art Recovery, Recycle, Reuse facilities. “




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GRAMZ's Vision & Mission

- Waste is a Resource
- Convert **Tons** of Waste **To Grams** of Waste
- Integrated Knowledge Driven Eco Solutions
- Excellence in Environmental Infrastructure
- Gujarat to be Landfill free state by 2021
- Ensure Better Quality of Life to Gen Next

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GRAMZ's Objective 

- ❖ Promote environmental sustainability through resource recovery and recycling plants
- ❖ Demonstrate integrated approach at regional scale for recycle / recovery and safe disposal concepts
- ❖ Act as role model for further multiplication
- ❖ Showcase recycling methods & techniques
- ❖ Serve as venue for public awareness & environmental education on recycling

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