

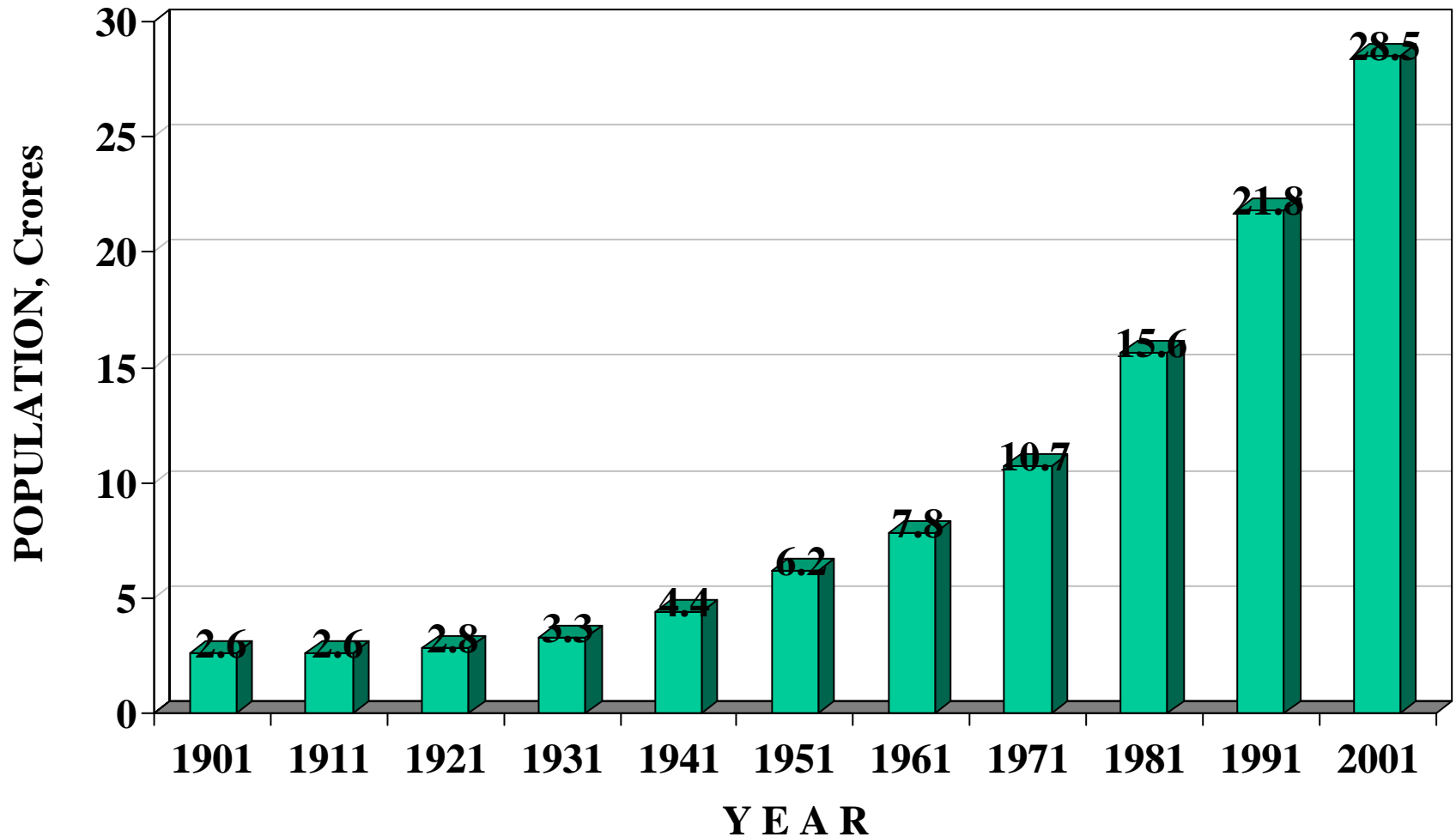
Initiatives for Recycling and Reuse of Municipal Solid Waste in India

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Status of Solid waste generation and management

- 70% of India' population is rural
 - Solid wastes: agriculture residues, cattle wastes, other domestic wastes: almost all SW is reused either as compost or as fuel
- 30% population is Urban
 - Steep growth in waste quantity due to growth in population and economy

Increase in Urban Population



Fast Economic Growth

- It is fourth largest economy in the world as measured by purchasing power
- GDP – 3.611 Trillion US\$ (tenth largest in the world)
- It is second fastest growing major economy in the world with GDP 8.9% at the end of last quarter
- This has led to fast increase in consumption pattern and waste generation

Present Status of Management

- Estimated waste generation is 1,00,000 MT/day
- Per capita waste generation ranges between 0.20 to 0.60 kg.
- Waste collection efficiency in bigger sized cities ranges from 70 to 90% and in small sized towns it is upto 50-60%.
- Local authorities spend less 5% of their budget on waste disposal and maximum cost is incurred on street sweeping and collection and transportation of waste.

Initiatives on Recycling and Reuse

- National Policies
 - The National Conservation Strategy and Policy Statement on Environment and Development, 1992
 - Indian National Policy for Abatement of Pollution, 1992
- Regulatory measures
 - The Municipal Solid Wastes (Management & Handling) Rules, 2000
 - Recycled Plastics Manufacture and Usage Rules, 1999 (as amended 2003)
- Institutional Provisions
 - CPCB and SPCBs, local bodies, Solid Waste Commission (WB)
 - Involvement of local bodies, NGOs, Research Institutes, education institutes, public
 - Demonstration projects
 - Mass awareness programmes – electronic media, documentaries, news papers

Regulatory frame work

- Enacted “Municipal Solid Wastes (Management and Handling) Rules, 2000
- Rules lay emphasis on seeking participation of citizens in waste segregation, prohibiting littering of garbage, proper storage of waste and efficient transportation of waste for its processing and final disposal.
- Specifications to be followed for landfilling to protect environmental pollution and adoption of appropriate waste processing technologies has been emphasized.
- The Rules are applicable to each town irrespective of its population.

Gaps and Constraints in Implementation

- Lack of adequate financial resources to implement specified provisions of the rule.
- Slow progress in ensuring segregation of waste.
- Inadequate infrastructure to meet the requirements for collection, storage and transportation of waste.
- Local bodies not conversant and exposed with intricacies of application of appropriate waste processing technologies.
- Comprehensive specification on landfills are difficult to meet due to 'high cost of construction and operation' including non-existence of adequate number of indigenous firms to undertake the jobs.

Future course of action

- Cities having population > 1 million targeted for ensuring compliance with the rules
- Set up reasonable number of demonstration facilities with Government financial support for the benefit of other local bodies
- Re-set the “simplified” specifications on landfilling particularly for smaller local bodies with due regard to prevention of pollution
- Creating awareness on adoption of appropriate technologies for waste processing considering quality and composition of waste
- Encourage private entrepreneurship in setting up of waste processing and reuse facilities

Characteristics of MSW

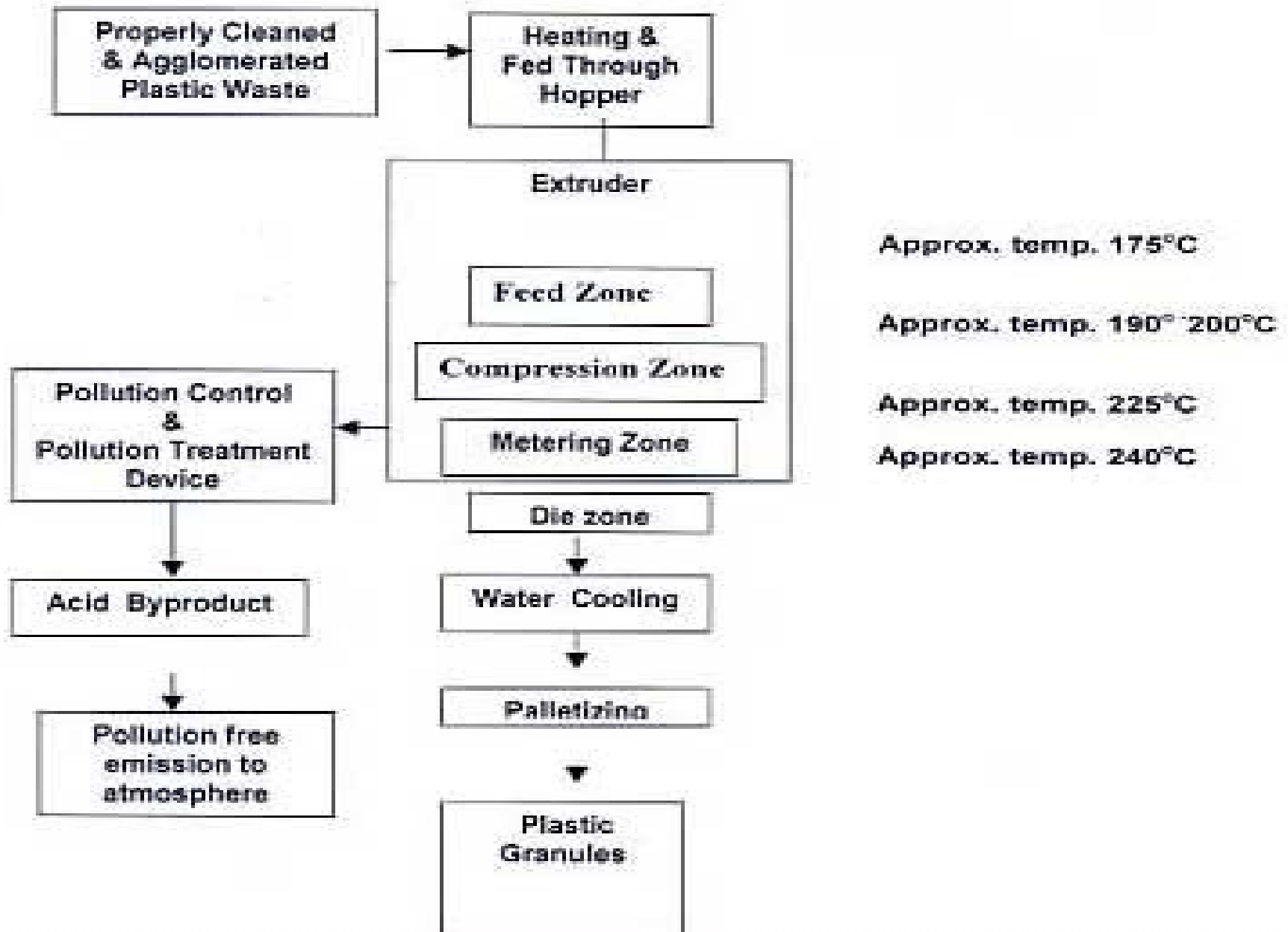
- Generation: 0.12 kg to 0.60 kg/ capita/day
- Compostable: 40 to 60% (avg 51%)
- Recyclable: 10 to 25% (avg 17.5%)
- Moisture: 30 to 60% (avg 47%)
- Calorific value 700 to 3800 Kcal/Kg (1750 Kcal/Kg)
- LFG 0.57 to 16.5 mg/m²/sec

Segregation of Plastic Wastes

- About 4000-5000 tonnes of plastic waste every day
- Rag pickers pick the plastic wastes and sell it to recyclers mostly composed of PET, LDPE, PVC, HDPE, PP, PS
- About 2090 recycling units are existing



Flow-Chart of the "Green Recycling Process" – The Pilot Plant



Reuse of plastics waste in Road Construction

- **Process of Road laying using polymer-aggregate – Bitumen mix**
 - Plastic waste (bags, cups, Thermocole) made out of PE, PP, & PS are separated, cleaned if needed and shredded
 - The aggregate (granite) is heated to 170°C in the Mini hot Mix Plant and the shredded plastic waste is added
 - Immediately the hot Bitumen (160°C) is added and mixed well
 - As the polymer and the bitumen are in the molten state (liquid state) they get mixed and the blend is formed at surface of the aggregate
 - The mixture is transferred to the road and the road is laid

Bitumen
(60/70 & 80/100)

Polymer waste
(carry bags, cups & thermocol)

Segregation

PE, PP & PS

PVC

Study of properties &
Waste plastics
blending with bitumen

Characterization

Process for road
laying

Road laying

Monitoring the road

Waste plastics blending with
aggregate + bitumen

Salient features of the polymer-waste-bitumen mix Road

- Road strength is twice stronger than normal roads
- Resistance towards water stagnation i.e. no potholes are formed
- Less bleeding during summer
- Burning of plastics waste could be avoided
- It doesn't involve any extra machinery
- It doesn't increase cost of road construction
- It helps to reduce the consumption of bituminous mix vis-à-vis reduce cost

Salient features of the polymer-waste-bitumen mix Road

- It is observed that addition of plastics waste upto 10-15% by weight of bitumen resulted into higher values of softening point and lower values of penetration, which are appreciable improvements in the properties of the binder.
- This has resulted and withstood higher traffic load and high temperature variation.
- Several experimental stretches have been laid in more than 15 locations in Tamilnadu using both Mini hot-mix and Central mixing plants

List of roads laid using waste plastics

	Process	Blend	Area	Date	Nature of Road
		Composition			
TCE	Polymer Blending with Bitumen	5% PE	60'x 5'	23 nd March -02	Concrete
Kovilpatti	Polymer Blending with Metal and the Mixing with Bitumen	10% PE	600'x12'	4 th October-02	WBM road
Madurai	Polymer Blending with Metal and the Mixing with Bitumen	15% PE	180'x10'	5 th October-02	Concrete
Salem	Polymer Blending with Metal and the Mixing with Bitumen	10% PE	1000'x12'	15 th October-02	Concrete
Komara-palayam	Polymer Blending with Metal and the Mixing with Bitumen	10% Mixture *	300'x12'	15 th October-02	Concrete
Chennai **	Polymer Blending with Metal and the Mixing with Bitumen	12%	600'x18'	22 nd November-02	Concrete
Trichy	Polymer Blending with Metal and the Mixing with Bitumen	10% Mixture *	600'x18'	10 th January-03	Concrete
Salem #	Polymer Blending with Metal and the Mixing with Bitumen	10% Mixture *	5000'x 18'	17 th April-03	WBM
Erode	Polymer Blending with Metal and the Mixing with Bitumen	10% Mixture *	1500'x 24'	7 th May-03	Bitumen road
Theni	Polymer Blending with Metal and the Mixing with Bitumen	10% Mixture *	300'x18'	10 th May-03	WBM
Nagercoil	Polymer Blending with Metal and the Mixing with Bitumen	10% Mixture *	1500'x18'	16 th May-03	WBM
Madurai-Kombadi	Polymer Blending with Metal and the Mixing with Bitumen	10% Mixture *	1.4 km		WBM ¹⁸

Thank You