



## Integrated Solid Waste Management - towards Green Economy

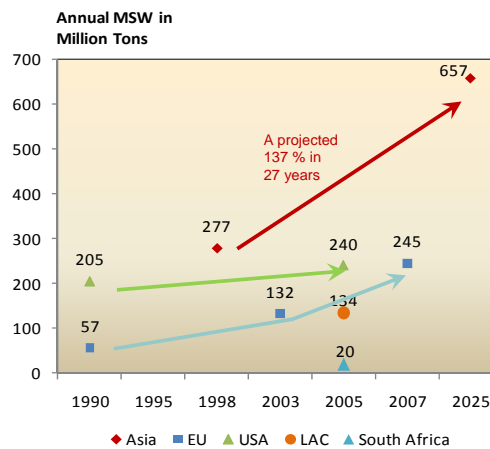
Prasad Modak, Executive President  
Environmental Management Centre, India

### Globally, 2.5 to 4 billion tons of waste was generated in 2006

Waste generation is on the rise.

New waste streams have emerged

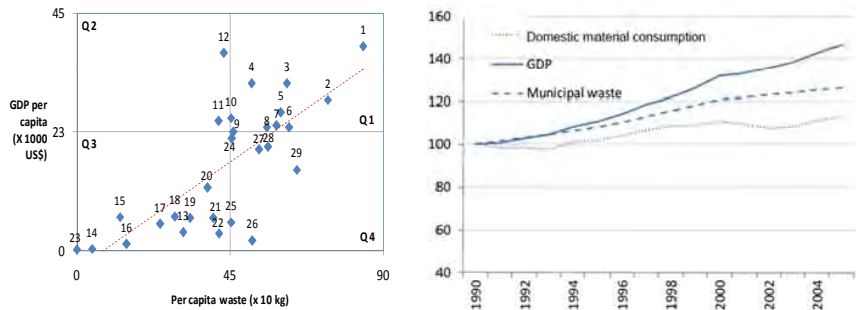
Industrial Hazardous/Non-hazardous, E-Waste, Plastic, Biomedical, Construction and Debris



Data compiled from various sources

## Waste Generation is linked to Economy

Currently, a strong link observed between GDP and waste generation in many countries



A decoupling is observed in OECD countries but it is weak..

Source: Mountford 2010

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## Waste, Resources and Sustainability

### Intensity of Resource Consumption gone up

Global resources are being exploited with material use going up by **eight times** in the last century (Krausmann and others 2009).

### Resource Use Efficiency still poor

According to Wuppertal Institute in Germany, average European consumes about 50 metric tonnes of resources a year, out of which **only 20 per cent is utilized** in various development processes and 80 per cent becomes waste in a year

### Wastes contaminate resources

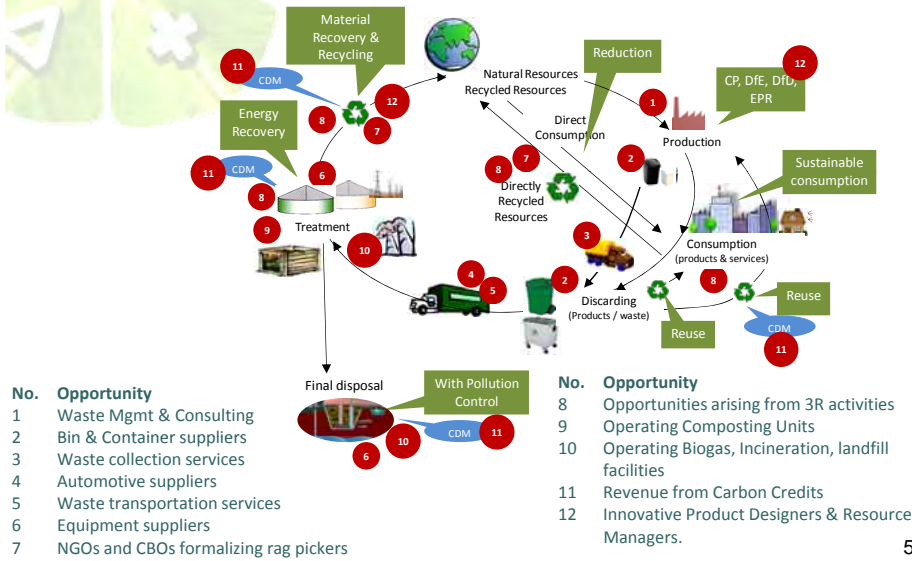
Waste generation must be avoided.

### Waste is a Resource

Wastes must be reduced, reused and recovered to **substitute demand on virgin resources**. This shift in the waste-resource paradigm will lead us to **sustainability**. Achieve **security** of our ecological resources

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## Waste-Resource Linkages – The Opportunities



## ISWM – Definition & Concept

*“...the strategic initiative for sustainable management of solid waste through use of a comprehensive integrated format generated through sustained preventive & consultative approach to the complementary use of a variety of practices to handle solid waste in a safe and effective manner.”*

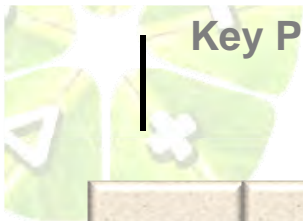




## The Integration

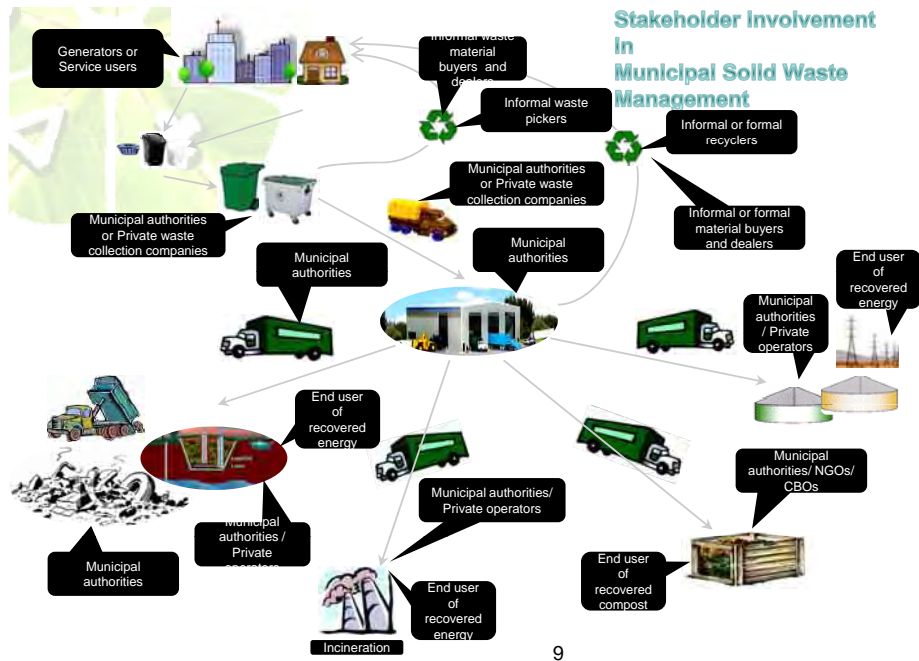
- Life Cycle thinking
- All types of waste streams
- Multi-stakeholder involvement and Partnership
- Policy-Plan-Program-Projects – A rounded approach

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## Key Principles of ISWM





## Stimulating Markets through ISWM

World's waste market is worth  
US\$ 410 bn

2 -2.84 million  
additional jobs by  
2050 in formal sector

Average yearly  
**US\$ 83 to US\$141**  
billion of investment to  
green waste sector

Recycling market : US\$ 160 bn  
MSW market : US\$ 125 bn  
Non-hz Industrial waste : US\$ 147 bn

Waste to landfill to  
reduce from 22% to  
5% by 2050

VEOLIA  
ENVIRONMENTAL  
SERVICES

MILLENNIUM INSTITUTE

In addition, there are significant investments needed for remediation and rehabilitation of contaminated sites. These investments not only reduce risks but **create assets** of economic value

Most of the green investments focus on **waste avoidance and 3Rs**. These investments would trigger innovation

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## New Business Opportunities

- **Materials Recycling with Added Value**

*Typical energy saving (Aluminum-95%, Copper-85%, Paper -62%, Glass-20%, Plastic-10%)*

- **Compost Production**

*Use of waste derived compost in place of chemical fertilizer could save 10-20 % of the production costs*

- **Energy Production**

*UK's WtE market is estimated at US\$ 19.9 billion in 2008 and the market is expected grow by 30 per cent in the year 2014.*

*Use of Agro-residues for Distributed Power Generation – providing access to power, adding employment and income to rural population is another big opportunity – pursued now by Governments and Multilateral FIs*

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## Practising ISWM – Industries Innovation in Design

### DESIGN FOR DISASSEMBLY

- Automobiles
- Household appliances
- Office equipments
- Airliner disassembly
- Cell phones that virtually disassemble themselves



### DESIGN FOR ENVIRONMENT

- Green buildings
- Lead-free solders
- Safer flame retardants



Photo Courtesy:

## Macro economic co-benefits

Type of Operation	Jobs*
Computer Reuse	296
Textile Reclamation	85
Misc. Durables Reuse	62
Wooden Pallet Repair	28
Recycling-based Manufacturers	25
Paper Mills	18
Glass Product Manufacturers	26
Plastic Product Manufacturers	93
Conventional Materials Recovery Facilities	10
Composting	4
Landfill and Incineration	1

\* Shows Jobs per 10,000 metric tonnes of waste every year  
Source: ILSR 1997

Green Employment – New sectors have emerged like GIS/IT enabled services

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## Macro economic co-benefits

- Reduced public costs for waste management through private sector involvement

*Private sector involvement has reduced the waste service cost by at least 25% in UK, US & Canada and at least 20% in Malaysia.*



Contracting of selected services such as night sweeping, primary collection & transportation to private parties has increased the collection coverage to >90 % & reduced the no. of road side garbage containers by 36 % in the city of Surat, India.



Image Courtesy: [www.edugreen.teri.res.in](http://www.edugreen.teri.res.in)

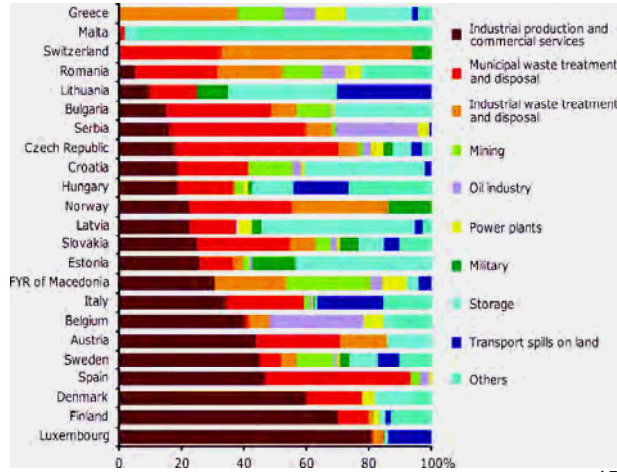
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## Macro economic co-benefits

- Avoided costs of Contaminated Sites Clean-up and Remediation

*Countries in Europe spent up to 1.8 % of their GDP on reclamation of contaminated sites.*

*India has identified more than 80 contaminated sites where priority investments are necessary for cleanup*



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## Macro economic co-benefits

### Health related benefits

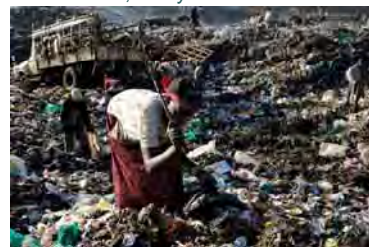
- Health impacts of inadequate waste management in UK

Particulars	Recommended Estimates (US\$)
Deaths brought forward	5157 - 183018
Respiratory Admissions (Casualty and Hospitalization)	915 - 2096
Cardiovascular hospital admissions	2224 - 6673
All Cancers	1913370 - 3760188
All birth defects	150573 - 703787

Source: DEFRA 2004

### Poor are most vulnerable

- A young woman collects food left overs to feed pigs in Dandora dump spreading 30 acre in Nairobi, Kenya



- 50% of examined children & adolescents near the dump have respiratory ailments
- 30% have red blood cell abnormalities and heavy metal poisoning

Photo Courtesy:

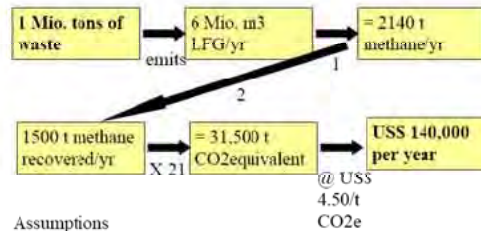
[www.philip-photos.com/photos-en-kenya-13-17.html](http://www.philip-photos.com/photos-en-kenya-13-17.html)

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## Macro economic co-benefits

### Monetizing GHG Emissions

- Potential annual carbon finance revenues per million residents (World Bank 2007):
  - US\$ 2,580,000 for landfill gas recovery
  - US\$ 1,327,000 for composting
  - US\$ 3,500,000 for recycling,
  - US\$ 115,000 (plus the fuel savings) for transfer stations
- Carbon Revenue from landfill gas recovery and methane destruction



Assumptions  
1 – 1 m<sup>3</sup> LFG contains 357 g methane  
2 – 70% collection efficiency

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## Barriers to realize economic opportunities

### Investment Barriers

- Investments on Waste Management Infrastructure & Services are low. Presently, global averages– less than 0.5% hovering close to 0.1%
- Economic returns on practicing 3Rs not still understood and widely demonstrated and shared
- Public-Private-Partnership (PPP) is the best approach to infuse private sector capital. Weak regulatory frameworks and poor institutional capacities deter private sector investors

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## Barriers to realize economic opportunities

### Engaging with informal sector

- The largely informal nature of the sector in many parts of the world undermines much of the work to establish safe and modern waste management systems.
- Why informal trade is dominant in developing countries?

No "baggage" of bureaucracy  
No taxes to pay  
Exploitation of the Poor

**Need for recognition, partnerships.  
Technical/financial assistance and  
community involvement**

**Gender considerations important**

*Photo Courtesy:  
GYSD 2009  
Basel Action Network 2001*



Children picking waste in India



Women sorting wires in China

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## Barriers to realize economic opportunities

### 3R – Economics & other issues

- Market for recycled products is highly volatile.
- The recent economic downturn affected the recycling market
- In countries such as India and China, the value of municipal scrap has dropped by up to 45% on an average
- Resistance in industrial & public attitude to view waste as a resource
- Public concerns emerging on health & safety issues in using a recycled product



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## Enabling conditions

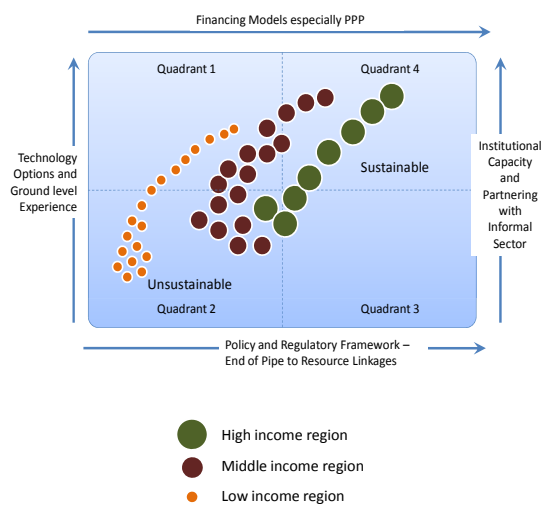
- Central Budget – Resource-Waste Linkages
- Cost recovery economic instruments
- Public Private Partnerships
- Micro financing especially in partnering with Informal sector
- Demonstration for Adaptation of Technologies
- Modern and Comprehensive Policy and Regulatory Frameworks – covering 3Rs
- Institutional Capacities

Strategy of ISWM provides the opportunity

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## There is no one size to fit all

- High income countries should aim to support innovative mechanisms for increased resource efficiency and remanufacturing among others
- Middle income countries should look to leapfrog to integrated waste and resource management through policy reforms, economic instruments and by increasing investment flows
- Low-income countries should focus on basic waste management infrastructure and services focusing on 3Rs, informal sector and community involvement



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## Is Decoupling Possible?

### Material Flow indicators of Japan's Sound Material Cycle Society

Indicator	Calculation	Status as on 1990	Status as on 2000	Target for 2010
Resource Productivity (yen/ ton)	GDP ÷ amount of natural resources, etc., invested	210,000	280,000	390,000
Cycle Use Rate	Cyclical use amount ÷ [cyclical use amount + amount of natural resource input]	8%	10%	14%
Final Disposal Amount (tons)	Amount of waste landfilled	110 million	56 million	28 million

Circular Economy approach in China; Green Growth Strategy in Korea

There are thus signs of hope!

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## Key Indicators for ISWM

- Waste generation
- Waste diverted to landfill
- Waste conversion to material resource and energy
- Investment in the waste sector
- Employment

There could be more sub-indicators

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## Key Messages

- Waste generation and management has **huge costs to national economies**
- **Waste and resources must be interlinked** and positioned so in the macro-economic context.
- **Delinking economic growth with waste generation** can happen **if ISWM strategy is followed**
- The **global waste recycling potential is large** and yet to be fully exploited

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## Key Messages

- Waste handling is source of significant **employment**, but the bulk of it is informal and unsafe
- Focus more on the **3R** segment of ISWM with explicit linkages with the **informal sector** and ensure **community involvement**.
- There are promising opportunities for **carbon market**. These must be exploited. Requires significant **institutional capacity building** and data mining
- National dialogues, regional and international cooperation needed to **modernize** waste management policies, **share knowledge and experiences** critical especially in the developing countries.

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