Creating Innovative Solutions for a Sustainable Future

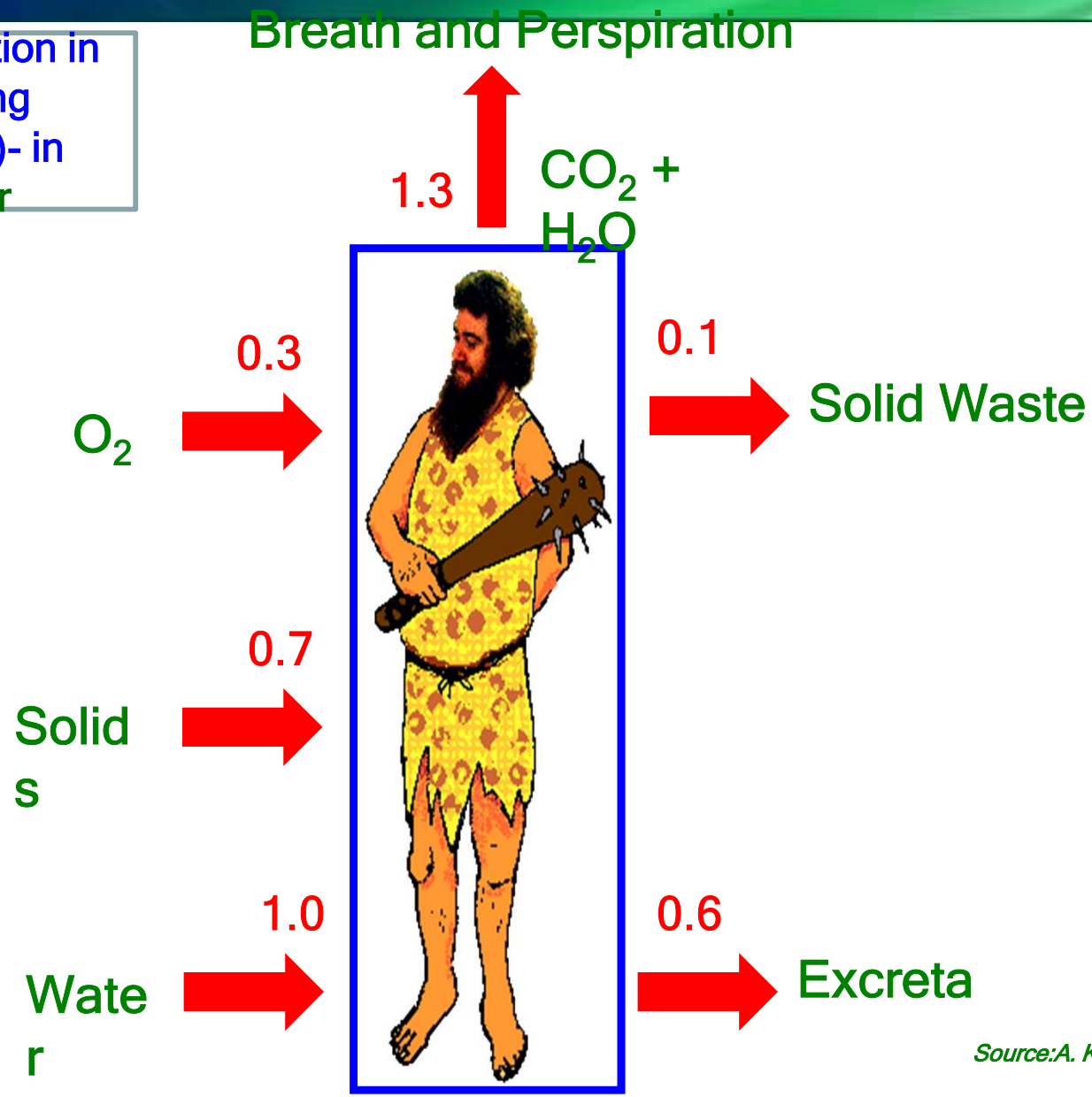
Effective waste management leading to circular economy

Suneel Pandey

6th May 2022

Minimalistic Consumption = Less Waste Output

Material Consumption in Neolithic Hong Kong Person (1992 B.C.)- in tonnes/person-year

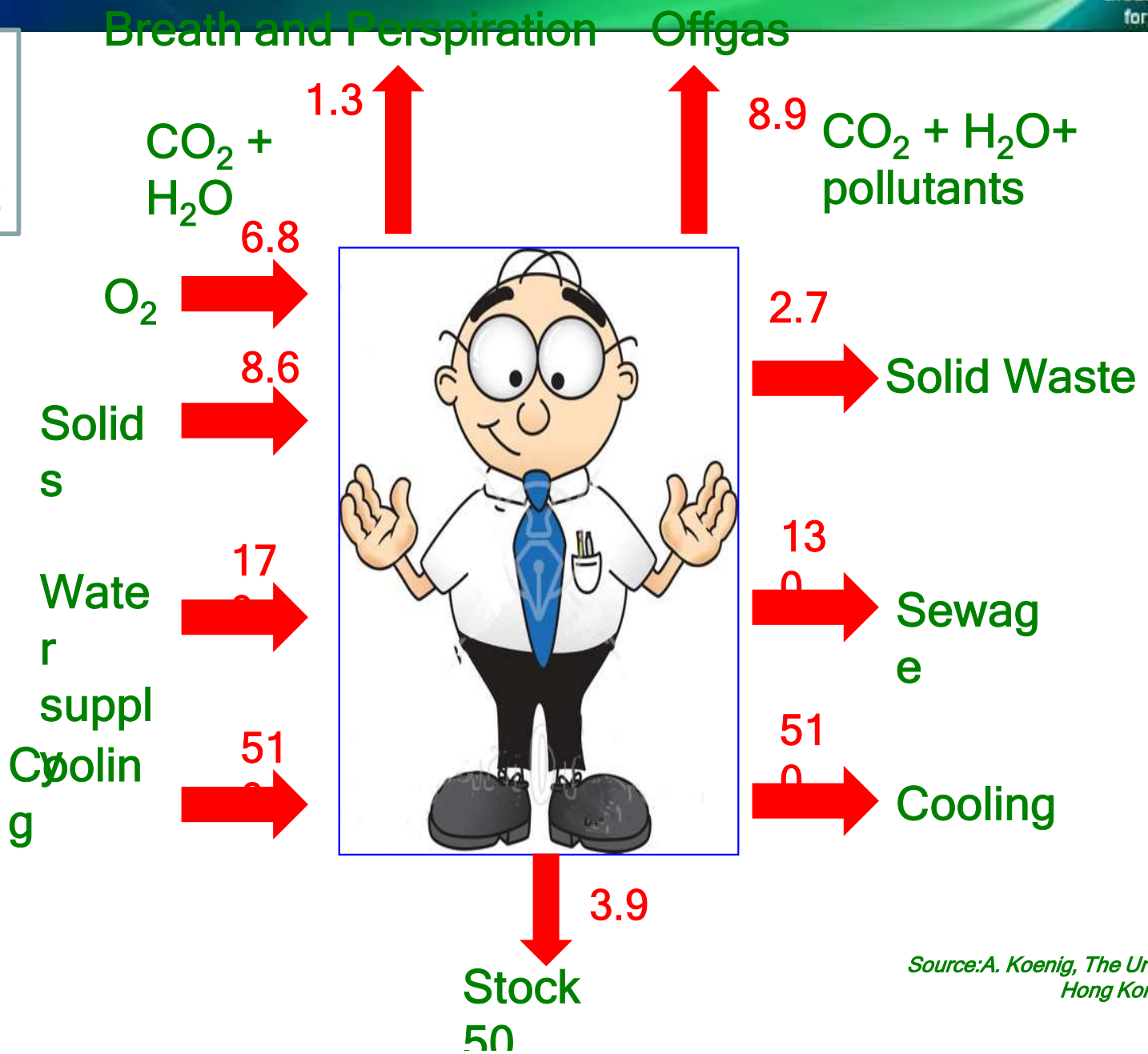


Source:A. Koenig, The Urban Metabolism of Hong Kong

More Consumption = More Waste Output

Creating Innovative Solutions for a Sustainable Future

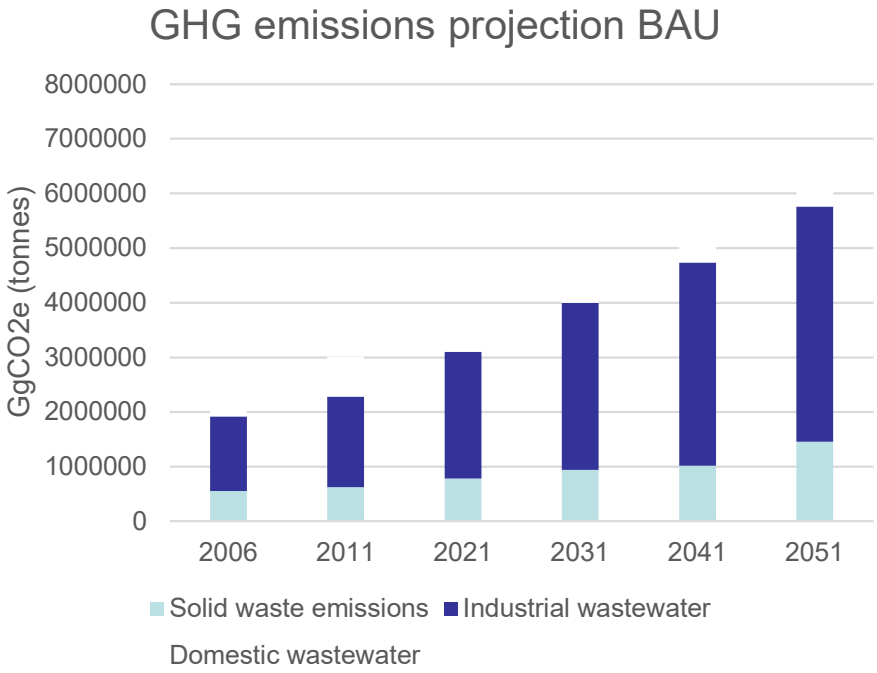
Material Consumption of modern Hong Kong man (1992 A.D); tonnes/person-year

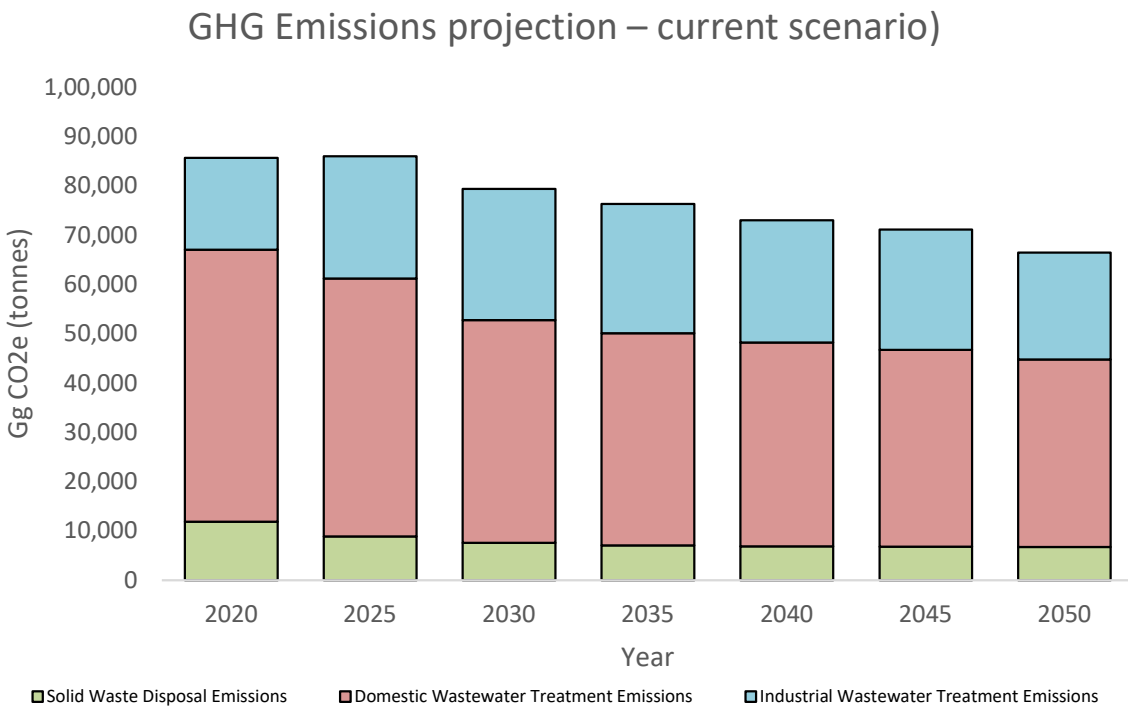


Source:A. Koenig, The Urban Metabolism of Hong Kong

GHG Emissions for Waste Sector in India

Creating Innovative Solutions for a Sustainable Future



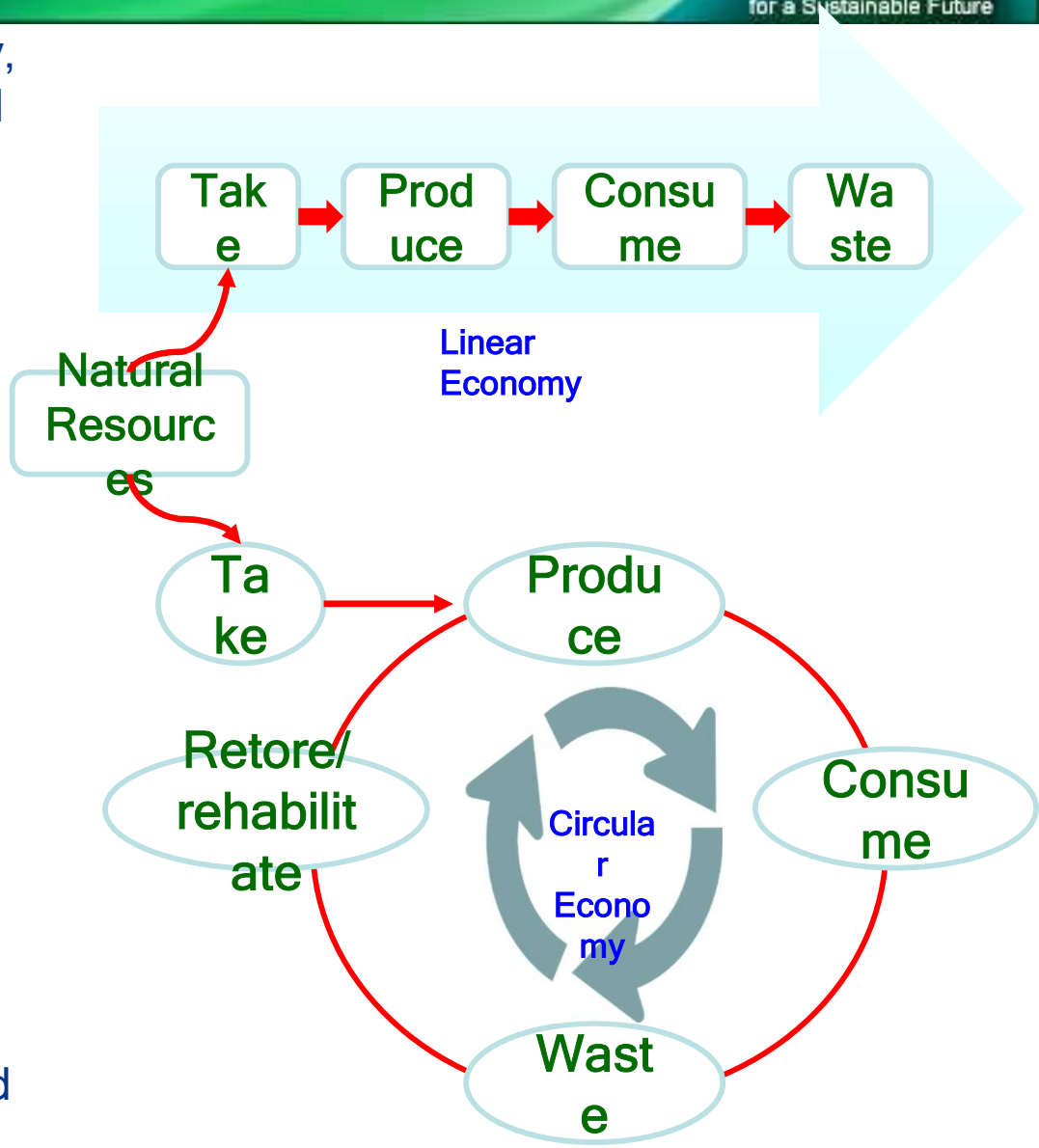


TERI estimates based on IPCC;
Reduction largely due to recent Government Initiatives

GHG: Greenhouse Gas Emissions

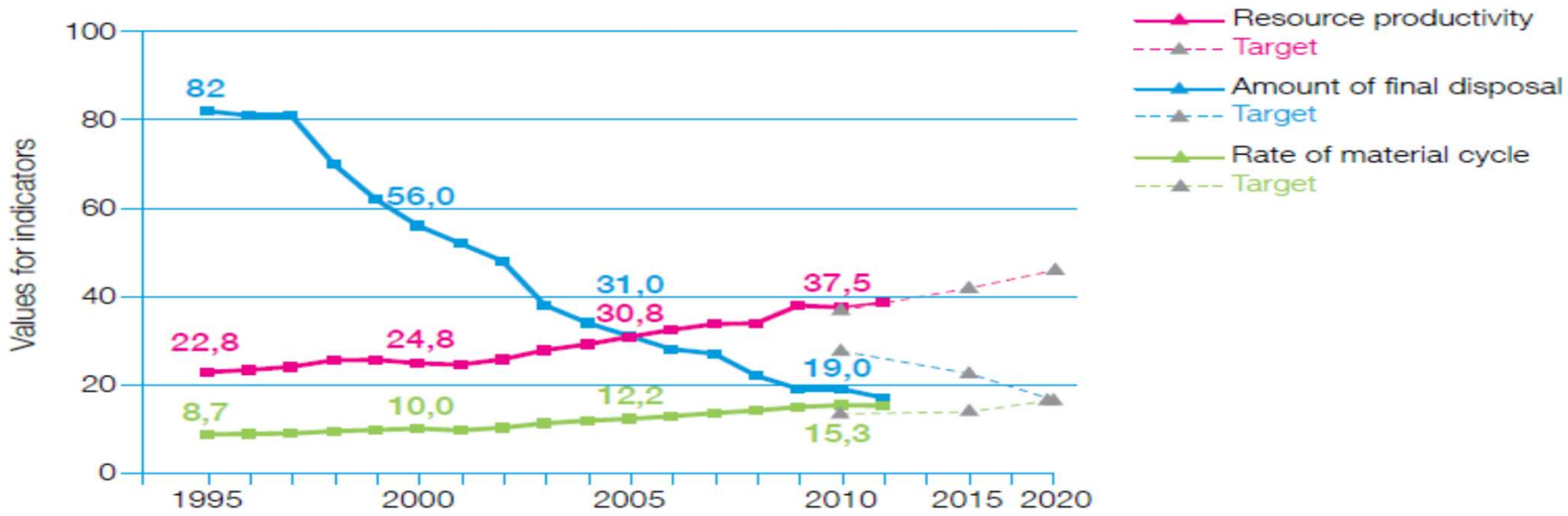
Defining the Circular Economy

- A close loop of material flow in an economy, based on a circular concept was introduced by Pearce and Turner in 1990
- CE refers to restorative system through a careful management of materials flows
- "CE is designed to efficiently recirculate the raw material and used to produce goods through
  - **Product-life extension;**
  - **Eco-design;**
  - **Long-life goods;**
  - **Reconditioning, reuse activities;**
  - **Renting service system instead of owning product;**
  - **Waste prevention**
  - **Industrial Symbiosis**
- CEfocuses on three objectives; economy (accelerate growth), social (job creation and employment) and environment (reduce pollution and GHG emission).



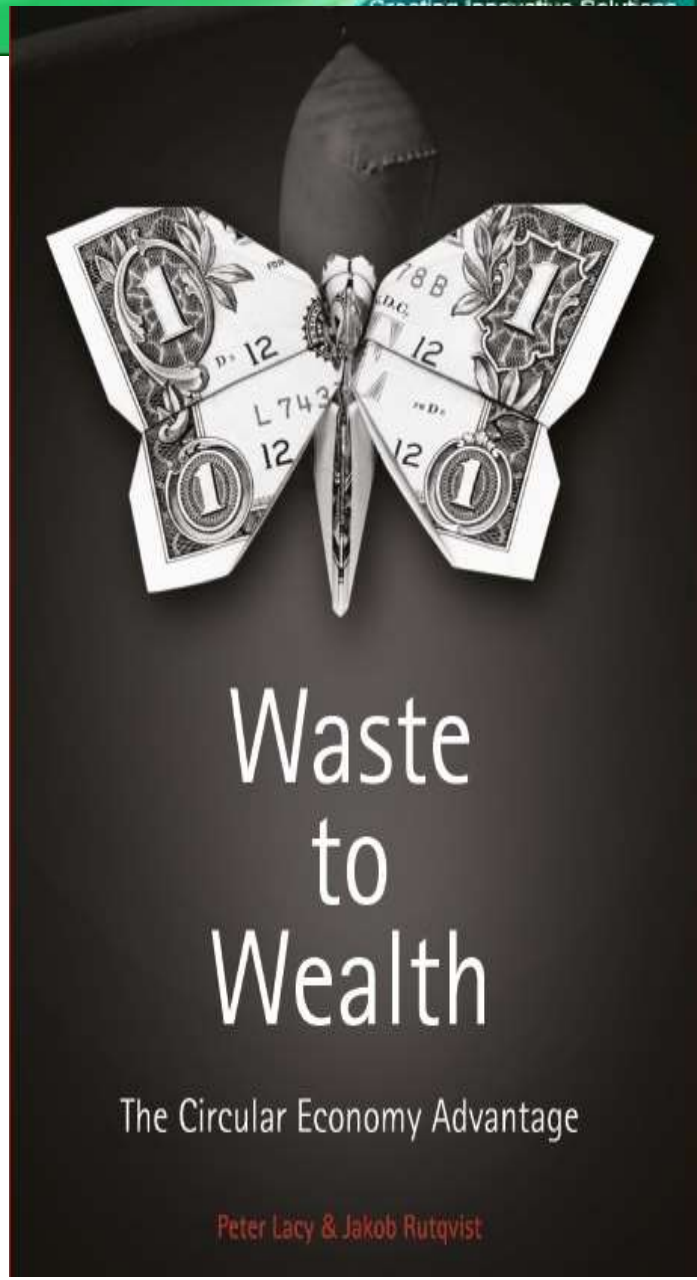
Adapted from Sempels and Hoffmann (2013)

Enhancing Resource Recovery – Case of Japan



Circular Economy Potential

- According to the Waste to Wealth from Accenture Strategy (NYSE: ACN) research, the CE could generate US$ 4.5 trillion of additional economic output by 2030
- Various circular business models will help decouple economic growth and natural resource consumption while driving greater competitiveness



https://newsroom.accenture.com/news/the-circular-economy-could-unlock-4-5-trillion-of-economic-growth-finds-new-book-by-accenture.htm

Circular Economy: New Business Models

Creating Innovative Solutions for a Sustainable Future

1. Product Transformation: if not the entire products be reconditioned in their entirety but certain components that carry a high value, and with the right design and remanufacturing capabilities, they can be put together to form new products

Example: Mobile phone containing precious metals

2. Sharing Platform: is centered on the sharing of products and assets that have a low ownership or use rate

Examples: sharing transportation (Lyft, RelayRides, BlaBlaCar), lodging (Airbnb), and neighbors helping neighbors (TaskRabbit, NeighborGoods)

3. Resource Recycling: Recycling the waste produced in product's supply chain and use as secondary raw materials (ex. Coca Cola recycling their PET bottles)

http://www.greenbiz.com/article/5-business-models-put-circular-economy-work

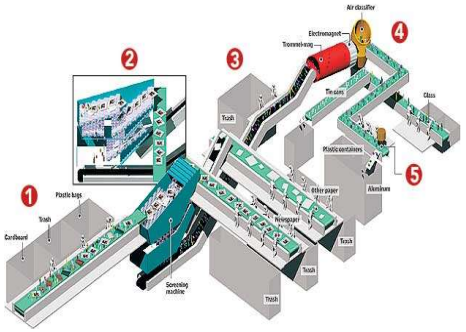
http://www.fastcoexist.com/1681904/5-business-models-that-are-driving-the-circular-economy

Recycling and Job Creation…

Creating Innovative Solutions for a Sustainable Future

Dumping 10,000 tons of waste in a landfill

6 Jobs



recycling Of 10,000 tons of waste

36 Jobs

Recycling generates more jobs (at higher income levels) than other forms of waste management

http://www.all-recycling-facts.com/recycling-benefits.html

World's Recycling Industry and Market

Creating Innovative Solutions for a Sustainable Future

- Approximately 1.6 million people worldwide are active in the recycling industry
- Together, they handle more than 600 million tonnes of recyclables every year
- Annual turnover of more than $200 billion, similar to the GDP of countries such as Portugal, Colombia and Malaysia
- About 10% of this amount is spent on new technologies, R&D that contribute to creating high-skilled jobs and making recycling more efficient and environmentally sound
- Recycled Materials supply 40% of the global raw material needs

"Bureau of International Recycling" http://www.bir.org/industry/

Waste is Wealth: Billion Dollar WM Companies

Creating Innovative Solutions for a Sustainable Future

- Businesses everywhere generate trash, but trash also generates new businesses

VEOLIA ENVIRONMENTAL SERVICES

Market Cap $10.9 Billion (as of May 2015)

#723 Global 2000

€ 14.324 Billion (2014)

WASTE MANAGEMENT

Waste Management Market Cap $19.49 billion (As of May 2014)

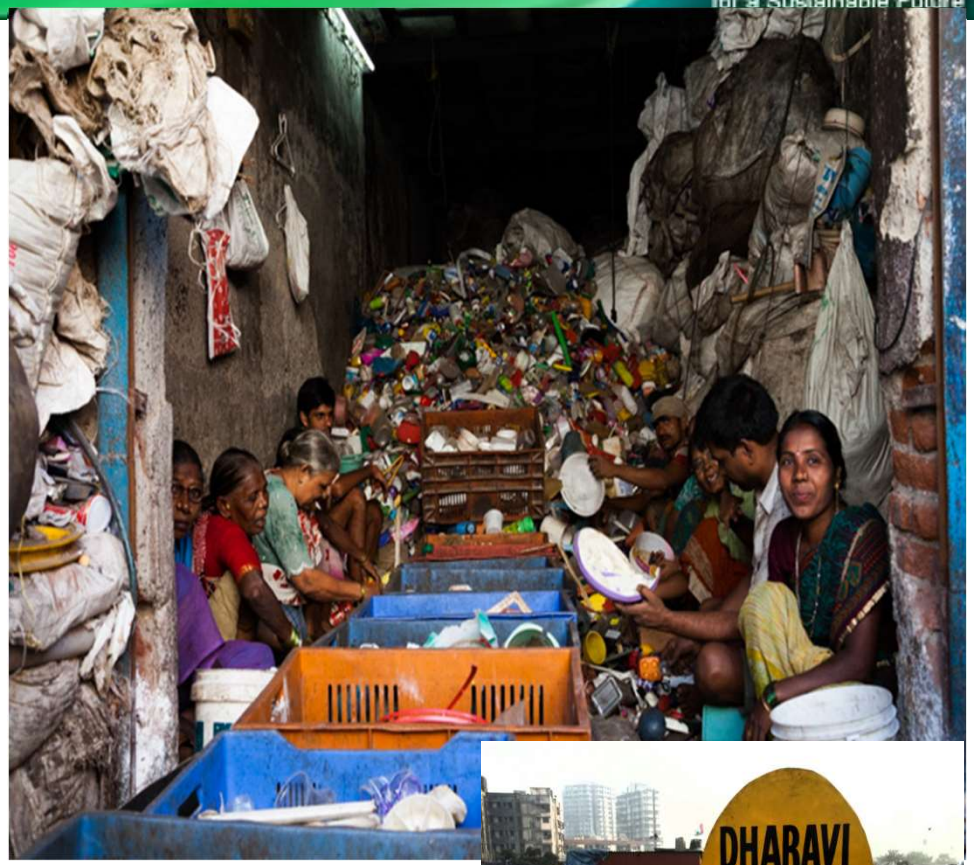
Fortune 500 Companies

India's Dharavi Recycling Slumdog Entrepreneurs

Creating Innovative Solutions for a Sustainable Future

- Dharavi- Asia's largest slums is now labelled as the recycling centre of India with an estimated 15,000 single room factories, employing around a quarter of a million people and turning over a staggering £700 million ($US 1 billion) each year
- Over 80% of Mumbai's waste is given a new lease of life by recyclers
- Wages in Dhavari are in range of 3,000 to 15,000 rupees per month

http://www.sustainablebusinesstoolkit.com/dharavi-indias-recycling-slumdog-entrepreneurs/



Some Indian examples

Example 1: PET waste pre-processing

Creating Innovative Solutions for a Sustainable Future

The earlier in the process foreign substances are removed, and the more thoroughly this is done, the more efficient the process is.

Polyethylene terephthalate

Possible commercial products from PET waste

Creating Innovative Solutions for a Sustainable Future

Ganesha Ecosphere

Do you know that Indian cricket team' uniform, made by Nike, is produced from recycled PET bottle

Example 2: Refuse derived fuel co-processing in cement kilns

Creating Innovative Solutions for a Sustainable Future

Advantages of co-processing

Creating Innovative Solutions for a Sustainable Future

- High flame temperature (1500^{o}C) – ensures complete destruction of harmful pollutants
- High residence time >5 sec in oxygen rich atmosphere - ensures complete destruction of organic compounds including dioxins and Furan
- Total neutralization of acid gases, SOx and HCl - by the active lime in the kiln load
- The biggest advantage is that co-processing leaves no residue to be land-filled.

Example 3: Use of plastic in road making

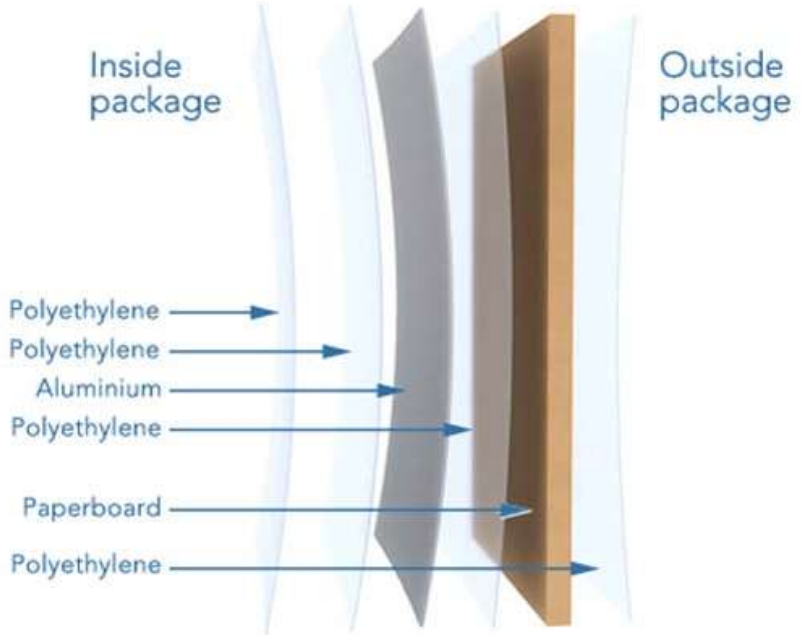
Creating Innovative Solutions for a Sustainable Future

The implementation of plastics in roads also opens a new option for recycling post consumer plastics

Example 4: Tetra Pak PCC Recycling

Creating Innovative Solutions for a Sustainable Future

- Tetra Pak cartons are primarily made from paper. 75% of the Tetra Pak carton is made from paperboard, 20% of polyethylene and 5% of aluminum.



Reprocessed product

Creating Innovative Solutions for a Sustainable Future

Landfill free cities

Organic waste

Biogas Plant

Bio CNG

Customized manure

Benefits

- Reduction in uncontrolled methane emission
- Reduction in landfill fires
- Minimizing waste to landfills
- Resource recovery from waste
- Creation of green jobs

- In fact, filled up dumpsites need to be characterised for combustibles including plastics, rags, leather, etc.
- These can be mined and used for RDF preparation while organic degradable portion can be composted and inerts can be used in construction
- This would free up valuable space which can be used for developing integrated waste management project

Thank you