Waste management

Intro to Sustainability

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Design of things to be thrown away

- The transition to throwaway containers started before WWII and was completed in the 1980s.
- Started with soda/ beer containers
- By 1970's other goods such as razors, diapers, pens, cigarette lighters.

What was it like back in the day?

- We returned milk bottles, soda bottles and beer bottles to the store. The store sent them back to the plant to be washed and sterilized and refilled.
- Grocery stores bagged our groceries in brown paper bags that we reused for numerous things. Most memorable besides household garbage bags was the use of brown paper bags as book covers for our school books. We were able to personalize our books on the brown paper bags.
- We washed the baby's diapers because we didn't have the throw away kind.
- We dried clothes on a line, not in an energy-gobbling machine burning up 220 volts. Wind and solar power really did dry our clothes.
- Kids got hand-me-down clothes from their brothers or sisters, not always brand-new clothing.

Back in the day…

- When we packaged a fragile item to send in the mail, we used wadded up old newspapers to cushion it, not Styrofoam or plastic bubble wrap.
- We drank from a fountain when we were thirsty instead of using a cup or a plastic bottle every time we had a drink of water.
- We refilled writing pens with ink instead of buying a new pen
- We replaced the razor blade in a razor instead of throwing away the whole razor just because the blade got dull.

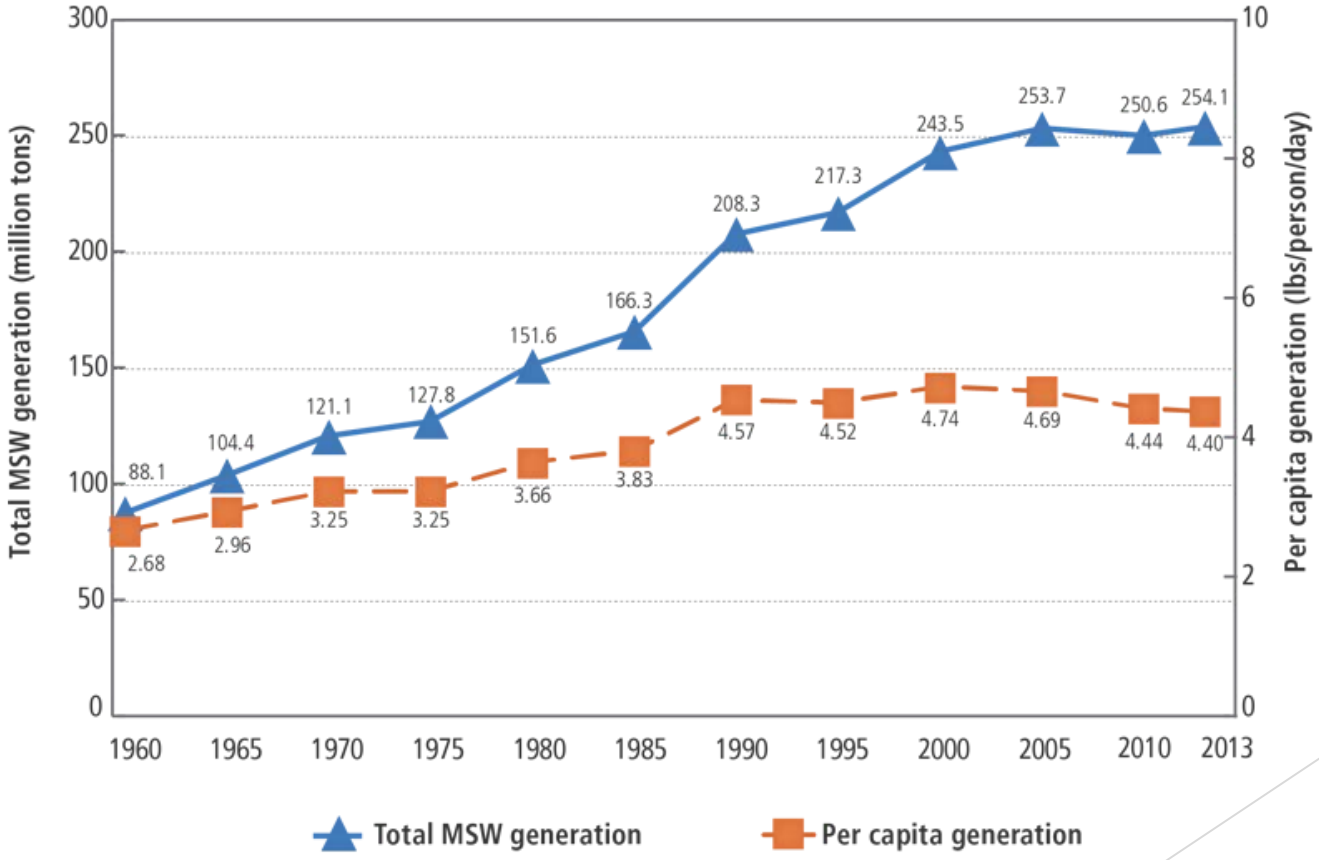
Definitions

- Solid Waste – garbage or refuse, sludge from water or wastewater treatment plants, or air pollution control facilities, and other discarded material including solid, liquid, semi-solid or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities.
- Can be hazardous or non-hazardous

What is in municipal solid waste?

- 27% Paper and paperboard
- 14% yard trimmings
- 13% food waste
- 13% Plastics
- 9% metals
- 9% rubber, leather, and textiles
- 6% Wood
- 5% glass

MSW generation rates 1960 to 2012
Yellow is per capita, green is total



Waste Management Hierarchy

Where does Municipal Solid Waste go?

- Discard – 54%
- Recycle – 35%
- Incinerate (with heat recovery) -12%

How much is recycled?

- 51% Paper and paperboard
- 22% yard trimmings
- 2% food waste
- 9% Metals
- 4% glass
- 3% plastic
- 3% wood

trends

- Since 1990, the total amount of MSW going to landfills dropped by over 11 million tons, from 145.3 million to 135.0 million tons in 2012
- The net per capita discard rate to landfills (after recycling, composting, and combustion for energy recovery) was 2.36 pounds per day, lower than the 3.19 per capita rate in 1990
- In 2012, over 29 million tons of materials, or 11.7 percent, were combusted for energy recovery.
- MSW combustion for energy recovery has decreased from about 34 million tons in 2000 to 29 million tons in 2012.

Waste to energy

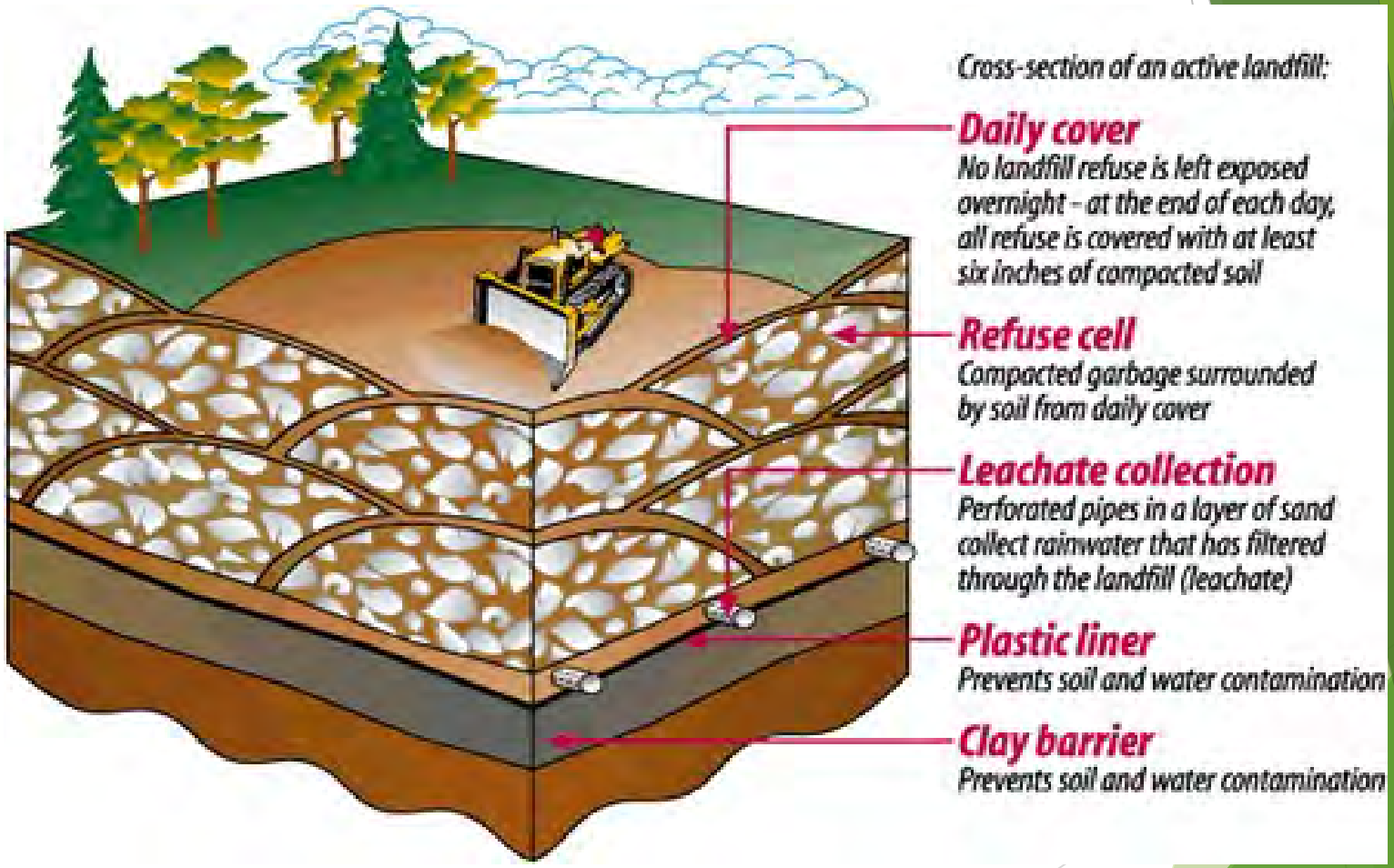
- Energy recovery from waste is the conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolization, anaerobic digestion, and landfill gas (LFG) recovery.
- Energy recovery from waste is part of the waste management hierarchy. Converting non-recyclable waste materials into electricity and heat generates a renewable energy source and reduces carbon emissions by offsetting the need for energy from fossil sources and reduces methane generation from landfills.

Characteristics of open dumps

- widely dispersed uncovered waste
- open fires and/or waste periodically on fire
- no recording or inspection of incoming waste
- no control of waste placement
- no compaction of waste
- no application of cover soil, or minimal cover (often associated only with forming access roads)
- scavenging at site
- no security
- vermin, dogs, birds and other vectors often present
- poor or no leachate management
- no provision for the management of landfill gas.

1960s Meadowlands were on fire

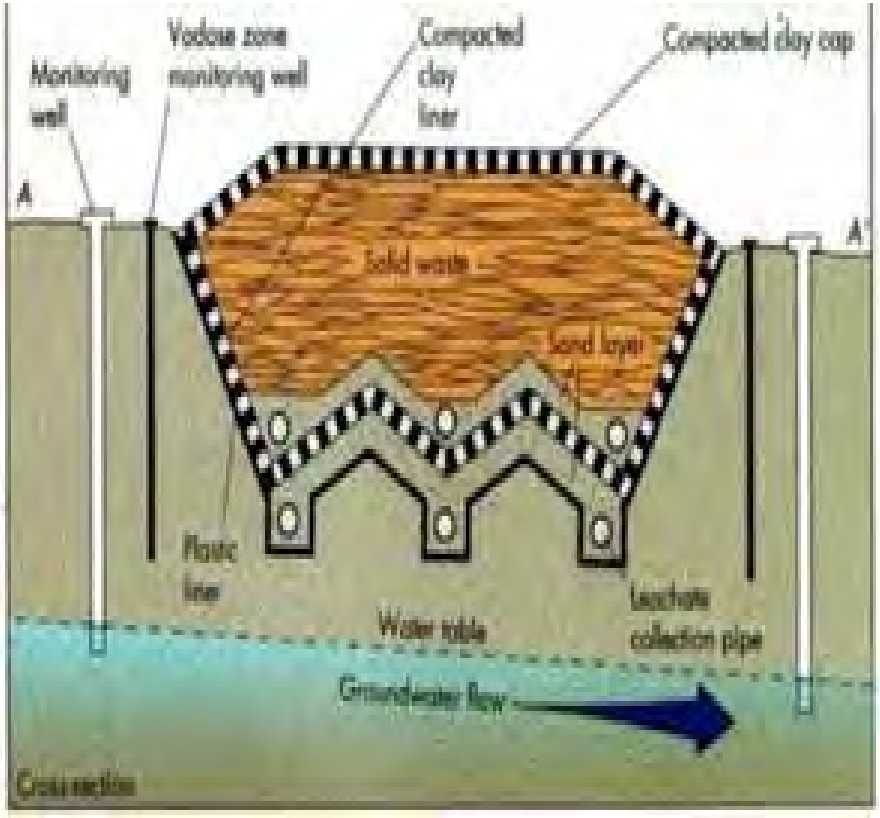
Modern sanitary landfills



Laws

- 1965 – Solid Waste Disposal Act
- 1970 – Resource Recovery Act
  - encouraged waste reduction and resource recovery
  - created national disposal criteria for hazardous wastes
- 1976 - Resource Conservation and Recovery Act (RCRA)
  - Concept of “cradle to grave” regulation
  - includes the generation, transportation, treatment, storage, and disposal of hazardous waste
  - also set forth a framework for the management of non-hazardous wastes.

Landfills



- Liner
- Leachate collection system
- Compaction of waste
- Daily cover
- Monitoring wells
- Venting for methane
- No contact with groundwater

Siting restrictions for landfills

- Airport
- Floodplain
- Wetland
- Fault
- Unstable areas

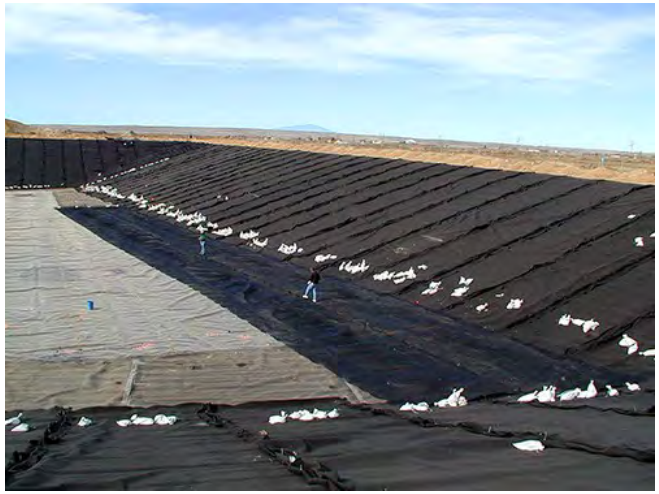
What do you do with old landfills?

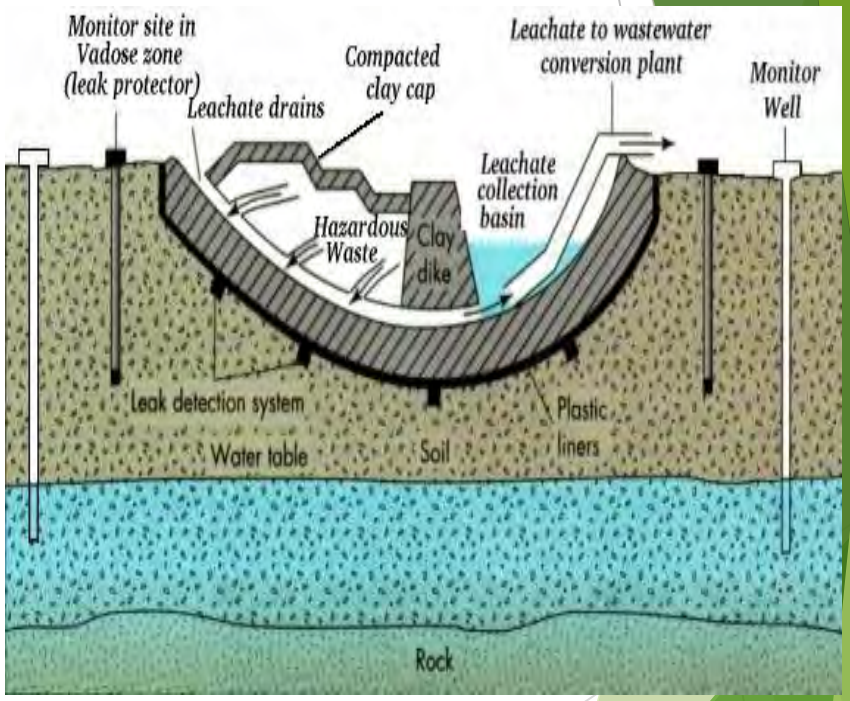
- Solar energy systems on landfills

Hazardous Waste regulation

- Lists of wastes
  - Solvents
  - Petroleum refining waste
  - Sludge from industrial processes
  - Waste from specific sources
  - Discarded chemical products and spill residue
- Characteristics of hazardous wastes
  - Ignitability
  - Reactivity
  - Corrosivity
  - Toxicity

Hazardous waste landfill (RCRA C)





Medical Waste

- Regulated by EPA, OSHA, CDC, and ATSDR
- 1987-88 – syringes washed up on beaches in NJ
- Medical Waste Tracking Act passed
  - Microbiological waste
  - Human blood and blood products
  - Pathological waste
  - Contaminated animal waste
  - Isolation waste
  - Contaminated sharps
  - Uncontaminated sharps

Medical Waste disposal options

- Incineration
- Irradiation
- Microwaving
- Autoclaving
- Mechanical alternatives
- Chemical disinfection

Is recycling mandatory?

1987

- NJ Statewide Mandatory Source Separation and Recycling Act
- Set goals
- NJ still only at 44% municipal solid waste recycling – goal was 50%
- Total recycling is only 54% - goal was 60%

Recycling

- Public attitudes
- 22% of Americans say they always or often look for information on whether or not the product was made from recycled materials
- willing to spend an average of 10% more for a product if they knew it was made of recycled materials
- 62% of Americans say that if a product is not easy or convenient to recycle, they probably would not recycle it.
- 94% of Americans say they ever recycle
- 40% say they always recycle

- http://www.isri.org/docs/default-source/recycling-analysis-(reports-studies)/harris-survey-on-america's-attitudes-and-opinions-about-reycling-2014.pdf?sfvrsn=4

NYC recycling

- 2003, Mayor Bloomburg stopped recycling in NYC because it cost more to recycle than to discard
- Sims Metal Mgmt – signed 20 year contract with NYC in 2013
- Built 2 MRFs (Brooklyn and Jersey City)
- Transport by barge to minimize trucks on NYC streets

Public/ private partnership

- NYC gave the land in Brooklyn and spent $75M cleaning it up
- Sims built the recycling facility but in 20 years will give it to NYC
- NYC pays operating cost of recycling
- NYC and Sims share the profits
- http://www.businessinsider.com/recycling-facitilty-new-york-2014-2

Key to recycling - markets

- Plastic market – resin is cheaper than recycled material
- HDPE – black pipes – prices down in winter, but go up in spring – used in irrigation
- Used beverage containers – aluminum prices down, but more cars using aluminum…
- Glass – prices are stable – clear glass good price, green and amber, not so good
- Plastic bags – low value or negative value

Sustainable Jersey – beyond required actions

- Prescription Drug Safety and Disposal
- Recycling
  - Bulky Rigid plastics
  - Carpet and Foam Padding
  - Commercial and Institutional Recycling
  - Community Paper Shredding Day
  - Construction and Demolition Waste Recycling
  - Food Waste
  - Non-Mandated Materials Recycling
  - Recycling Depot
  - Recycling Education and Enforcement
  - Shrink Wrap

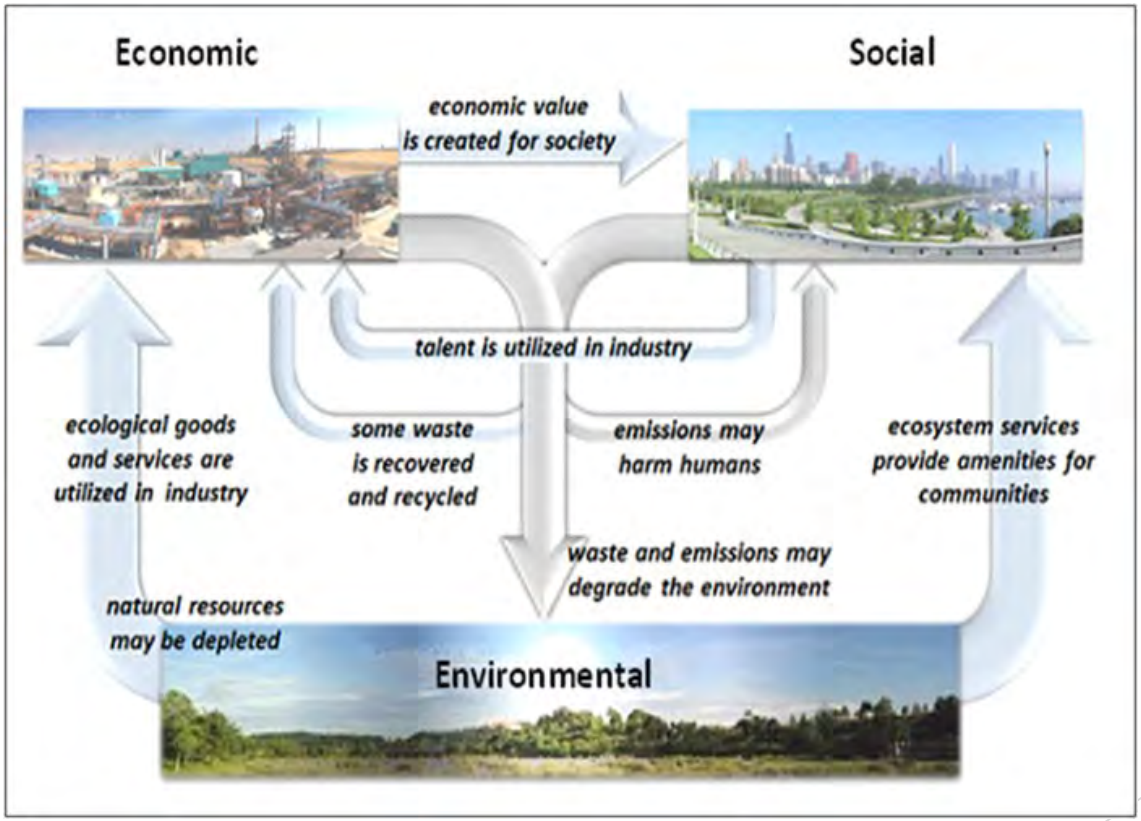
Sustainable Jersey – waste continued

- Backyard Composting
- EPA WasteWise Partner
- Grass – Cut it and Leave it program
- Materials Reuse Program
- Pay-As-You-Throw program
- Waste Audit of Municipal Buildings and Schools
- Reusable Bag Education Program

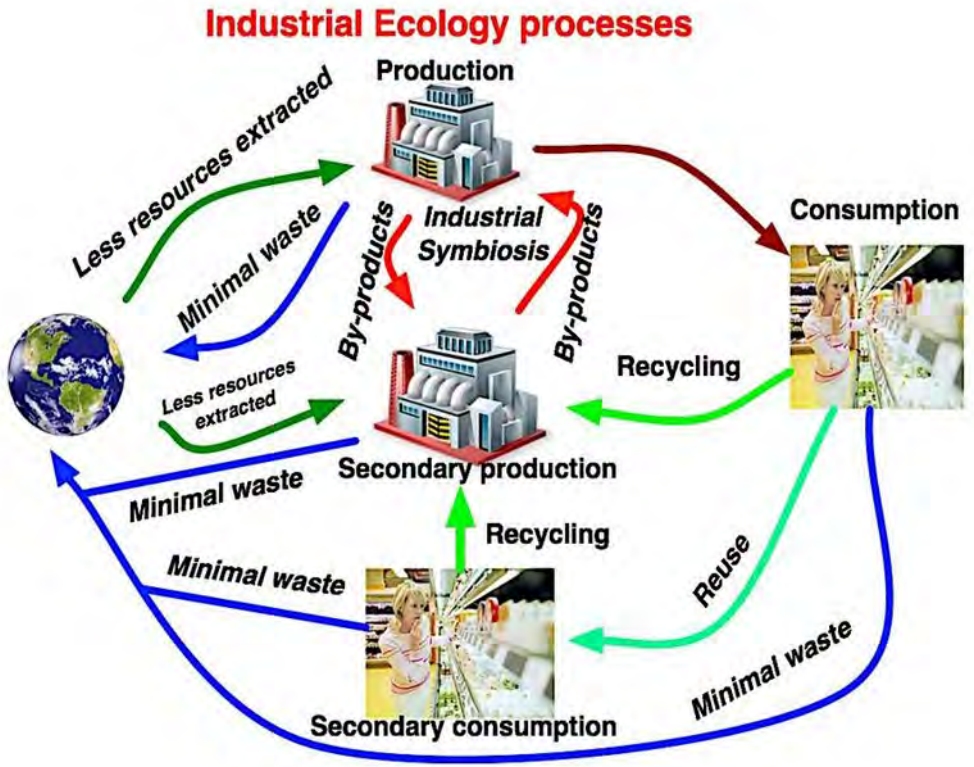
New thinking – Sustainable Materials Management

- Start with extraction of natural resources and material processing through product design and manufacturing then the product use stage followed by collection/processing and final end of life (disposal).
- By examining how materials are used throughout their life cycle, an SMM approach seeks to use materials in the most productive way with an emphasis on using less; reducing toxic chemicals and environmental impacts throughout the material's life cycle; and assuring we have sufficient resources to meet today's needs and those of the future.

Systems thinking



Industrial ecology



Circular Economy

- https://www.youtube.com/watch?v=yPZFNvrnO4E
- Ellen MacArthur Foundation

J&J - Sterilmed

- Reprocess single use medical devices
- Patient bed monitors, ultrasound catheters, chisels, bits, saws, laproscopic instruments, scissors tips, and more
- 50% savings compared to new device
- **2.5 million** pounds of medical waste diverted from landfills in 2012
- held to the same standards for cleanliness, sterilization and functionality as the original equipment manufacturer