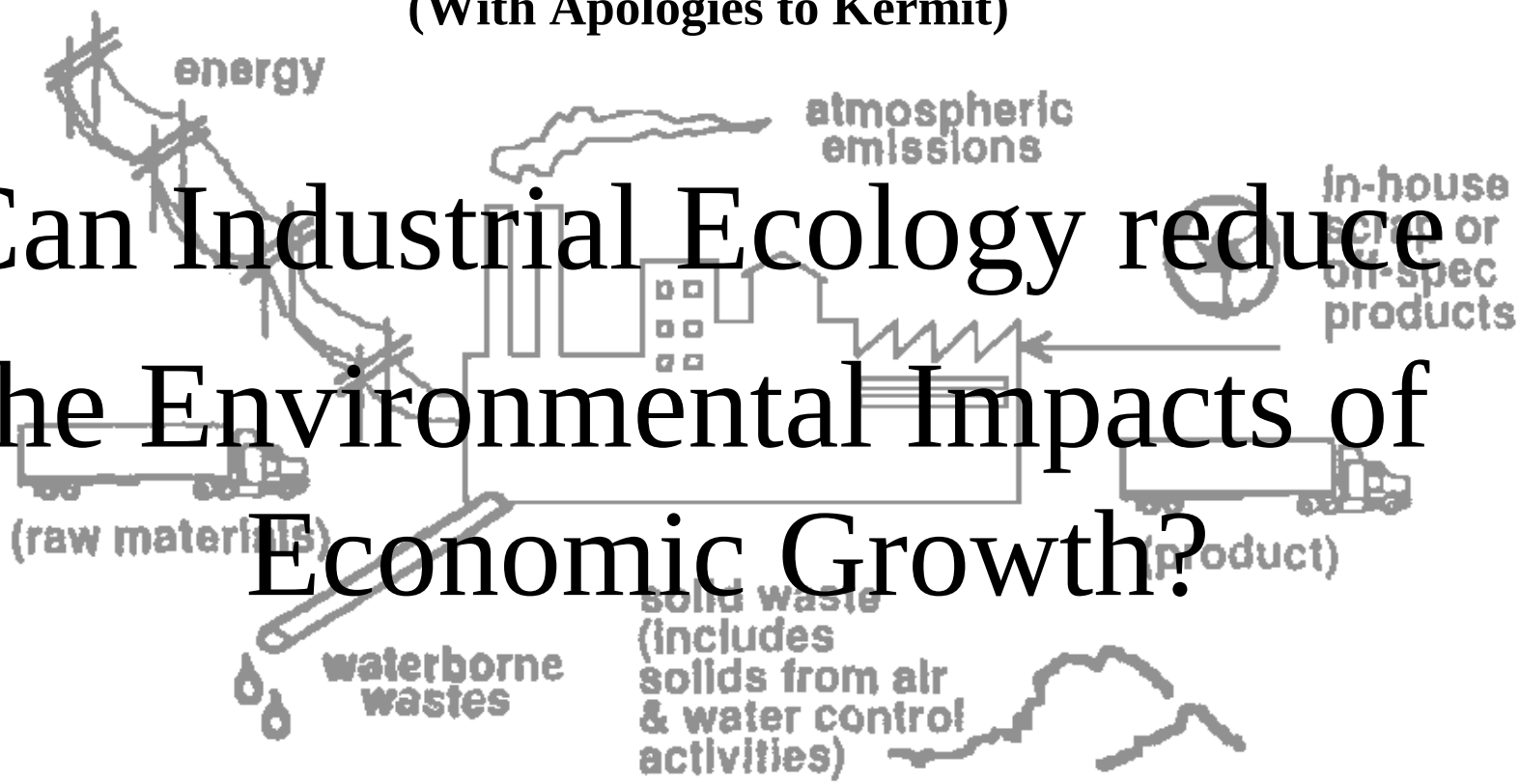
It ain’t easy being Green!

(With Apologies to Kermit)



Can Industrial Ecology reduce the Environmental Impacts of Economic Growth?

W. Smith 24-4-1998

Overview

- Background
- Industrial Ecology Described
- The Tool Kit
- A Challenge
- Eco-Accounting Project
- Corporate Buy-In

Background

- Environmental considerations must be integrated into industrial planning and decision making ... this will allow for a steady reduction in the energy and resource content of future economic growth by increasing the efficiency of resource use, reducing waste, and increasing resource recovery and recycling (Brundtland 1987)

Traditional Production Model

- Based on Cheap Abundant Resources
- Products of Limited Useful Life
- Cheap Waste Disposal
- End-of-Pipe or -Stack Pollution Controls
- Command and Control Regulations
  - Specify technology to be used
  - Permissable rates of discharge

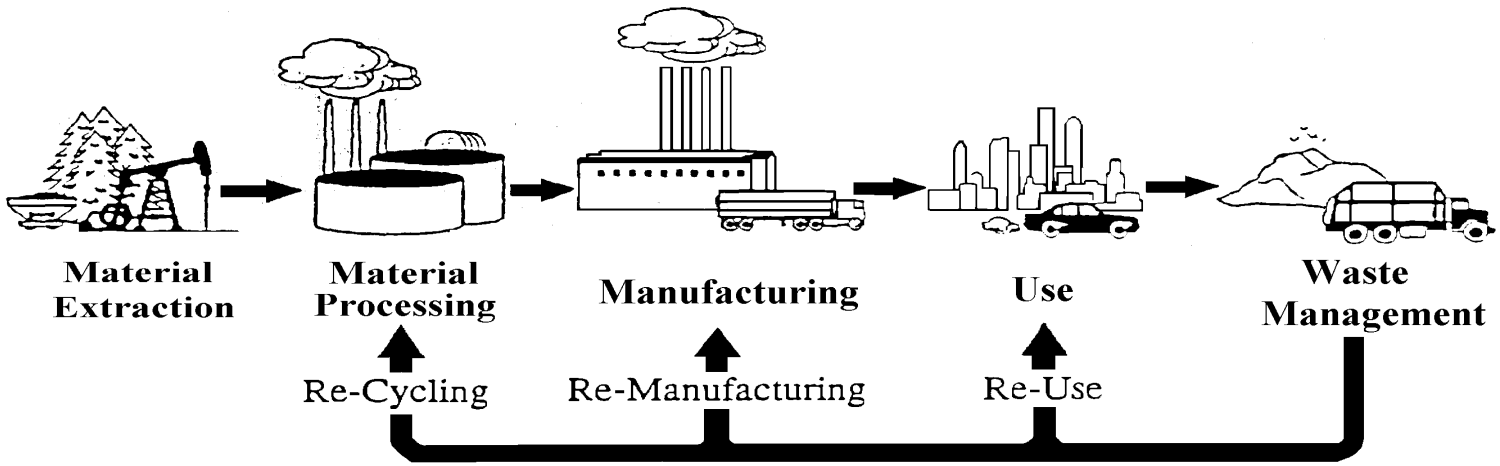
Industrial Ecology - A new approach

- **Integrate production systems & product cycles within constraints of natural ecosystems**
  - **Analytical -** to document energy, material and water flows through industrial systems
  - **Critical -** understand how these fluxes disrupt natural systems and cycles & affect background concentrations of toxic substances
  - **Prescriptive -** assigned primary responsibility for change to industry and consumers

Scope of Approach

- Manage product lifecycles in order to reduce energy consumption, water and resource use, and minimise waste
- Eliminate dissipative processes by which energy and materials are lost to economic use and toxic substances are released to the environment
- Design industrial ecosystems, in which waste from one process may be used as feedstock in other production processes.

Product Life Cycle Management



Extend producer responsibility outside plant gate:

- Supply Chain Management
- Product Stewardship

The Industrial Ecology Toolkit

- **Life-cycle Analysis** (LCA)
  - used to report progress
- **Design for the Environment** (DfE)
  - quality driven product and process development
- **Service Marketing**
  - sell solutions not products
- **Industrial Ecosystems**
  - zero emissions
- **Environmental Accounting**
  - identify opportunities to turn waste into profit

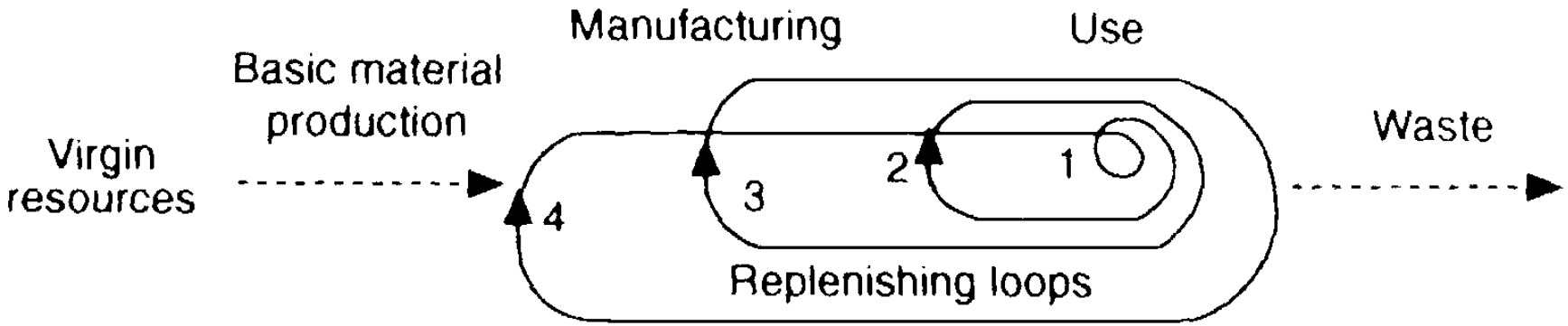
Life-Cycle Analysis

- Used primarily for relatively simple, low design, high-material products (e.g. chemicals)
- No bottomline - different methods give inconsistent results
- Most distance to target variety - don’t measure product/process greenness
- No common denominator - not comprehensive

Design for Environment

- Used in complex high design low -material content products (e.g. electronics)
- Discontinue the use of toxic or hasardous substances to avoid potential liabilities
- Reduce material content, size and weight of products and packaging because of concern about eventual waste disposal/land fills
- Reformulate products for durability, easy repair, eventual disassembly and recycling

Product Life Extension



Independence of the life-times of inter-compatible systems, products and components

Loop 1: Re-use of goods
Loop 2: Repairs of goods
Loop 3: Reconditioning/rebuilding of goods
Loop 4: Recycling of raw materials

so called Green Products

- Most Green Products are “green” simply because of what they do not contain - Often they are of the “less from less” variety
- They are sold in upscale markets to discriminating consumers who can afford to pay while existing polluting products are sold at a discount in cheap mass markets
- The challenge is to get more value and performance in products that use less energy and resources, and produce less waste

Service Marketing

- Growth no longer depends on volume of sales (products shipped) but value of services provided to the consumer
- Growth based on diversification of product line (e.g. repairs, leasing) and new applications for existing products
- Profit from service component of product line must offset increased overhead

Design of Industrial Ecosystems

- Waste, heat and energy from one process may be used as feedstock in other processes
- May involve closed loop recycling or
- Synergistic relationships where one process is dependant on the byproducts of another
- Success depends on the scale of local demand, efficiency of conversion of waste to useful byproduct and the dependability of supply

Environmental Accounting...

- Managers have an incentive to conceal poor environmental performance
  - when full cost attributed the product may no longer be profitable to produce
  - if product accounts for large % of revenue and discontinuance would mean loss of market share
  - such highly sensitive information would result in contingent liabilities or regulatory restraints

Path Forward

Industrial Ecology is most effectively implemented at two levels:

- **within a corporation** producing a diversity of products within one jursidiction
- **within an industrial park** where a diversity of businesses can be found with the potential for waste matching, input substitution, and local value-added

The Challenge of Industrial Ecology

- Find pollution and waste and you've found something you have paid for but can't sell... By striving to eliminate it we can grow a more efficient, competitive economy (Lowe 1993).

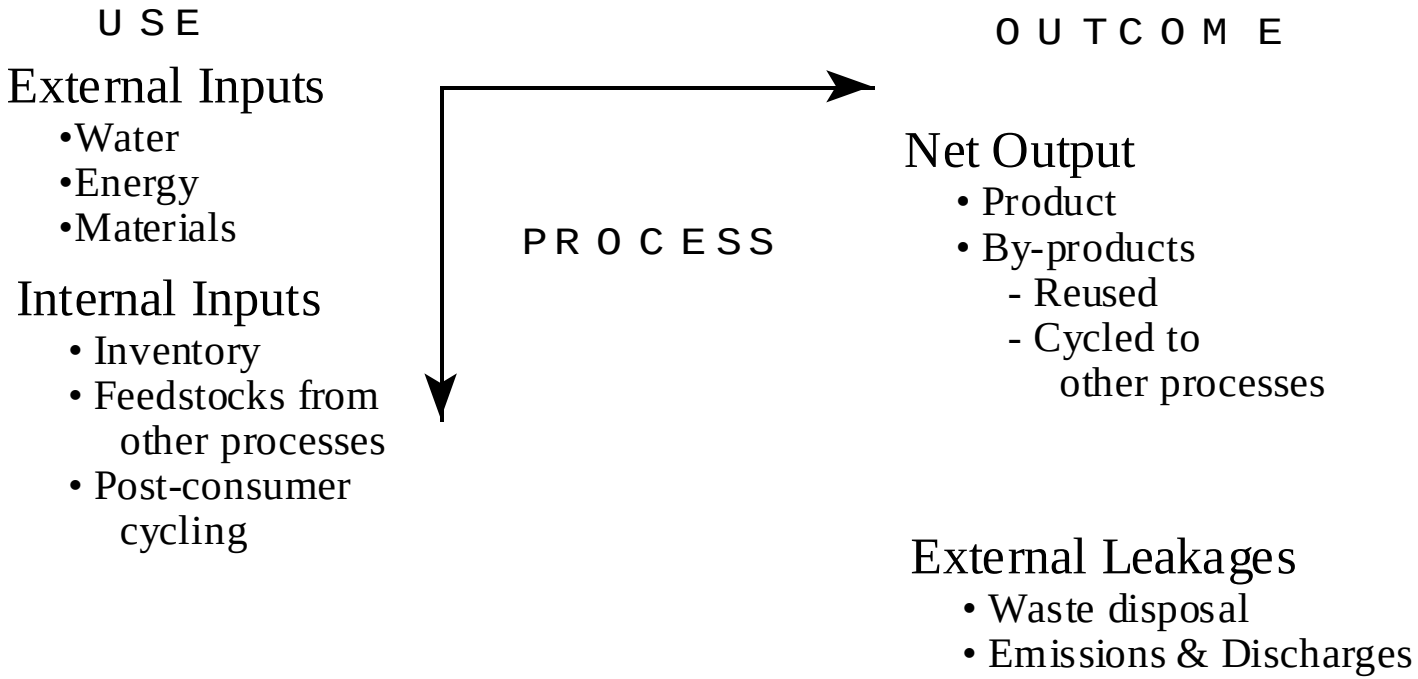
Eco-Accounting Project Goals

- Develop generic set of
  - ABC/ABM financial spreadsheets
  - Eco-performance indicators
- Simulate different types of analysis using synthetic data - linking reductions in energy, material, and waste intensity to unit costs, production volumes & profit margins

Industrial Eco-Accounting

- Industrial Ecology clarifys the relationship between the stocks and flows of resources and their fate in the environment
- The aggregate net impact, direct and indirect outputs and leakages from a series of industrial processes may be determined by the application of matrix algebra
- Simplifies task of creating a process-based map linking activities, inputs, costs, revenues, impacts and effects
- Environmental performance indicators based on product by process matrix could be developed for use in financial spreadsheets analysis

Product by Process Matrix



Advantages of Matrix Analysis

- Identifies key activity drivers (e.g. regulatory compliance)
- Easier to map material, energy and service flows
- Captures cost drivers (e.g. amount of waste)
- Accounts for eco-effects at each life-cycle stage
- Includes web of symbiotic relations between firms
- Develop performance measures (e.g. % recycled content)
- Helps identify value-added product attributes

Eco-Performance Indicators

- Reduced use of Energy and Material Inputs
- Increased Recycling of Waste
- Minimisation of Toxic Releases
- Minimisation of Throughput
- Improved Product Performance

Good Performance Indicators

- Measure Goal Achievement
- Balance Long run and Short term Interests
- Reflect Management Decisions & Employee Action
- Are Readily Understandable
- Can be Used to Evaluate & Reward Performance
- Reasonably Objective and Easily Measured
- Can be Used Consistantly Over a Period of Time

Use of Eco-Accounting in Decision Making

- Directs attention to issues and opportunities
- Siting and plant construction
- Product design
- Choice of inputs
- Evaluation of waste management options
- Product mix decisions
- Score keeping and financial evaluation

Corporate Buy-In

- Minimise regulatory compliance costs
- Minimise exposure to liability esp. if thresholds are unknown & consequences potentially catastrophic
- Increase productivity & reduce operating costs
- Reduce cost of credit & insurance
- Increase profit margin & market share
- Respond to new incentives & market opportunities
- Improve corporate image