Industrial Ecology

A Policy Brief By

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Outline

Industrial Ecology

5 Industrial Ecology Components

Policy Implications

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Policy Implications

Industrial Ecology

- An evolving framework that examines the impact of industry and technology on the biophysical environment
- Part of ecological modernization
  - Integration of environmental issues into production and consumption practices
- Seeks to eliminate waste
- Offers government agencies design policies and regulations to improve environmental protection while building business competitiveness

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Policy Implications

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1. Industrial Metabolism
2. Dematerialization
3. Life Cycle Assessment
4. Eco-Design
5. Eco-Industrial Parks

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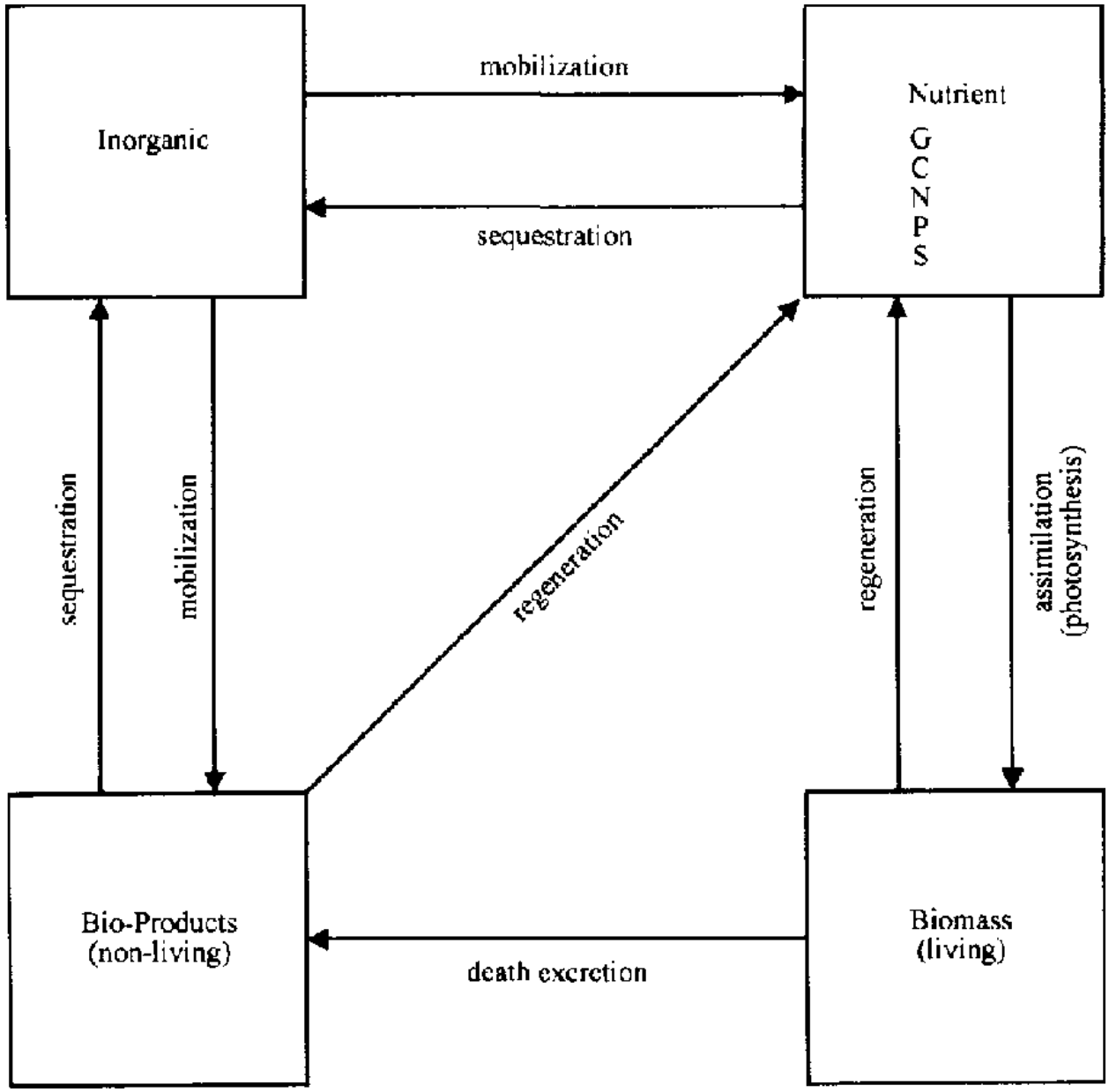
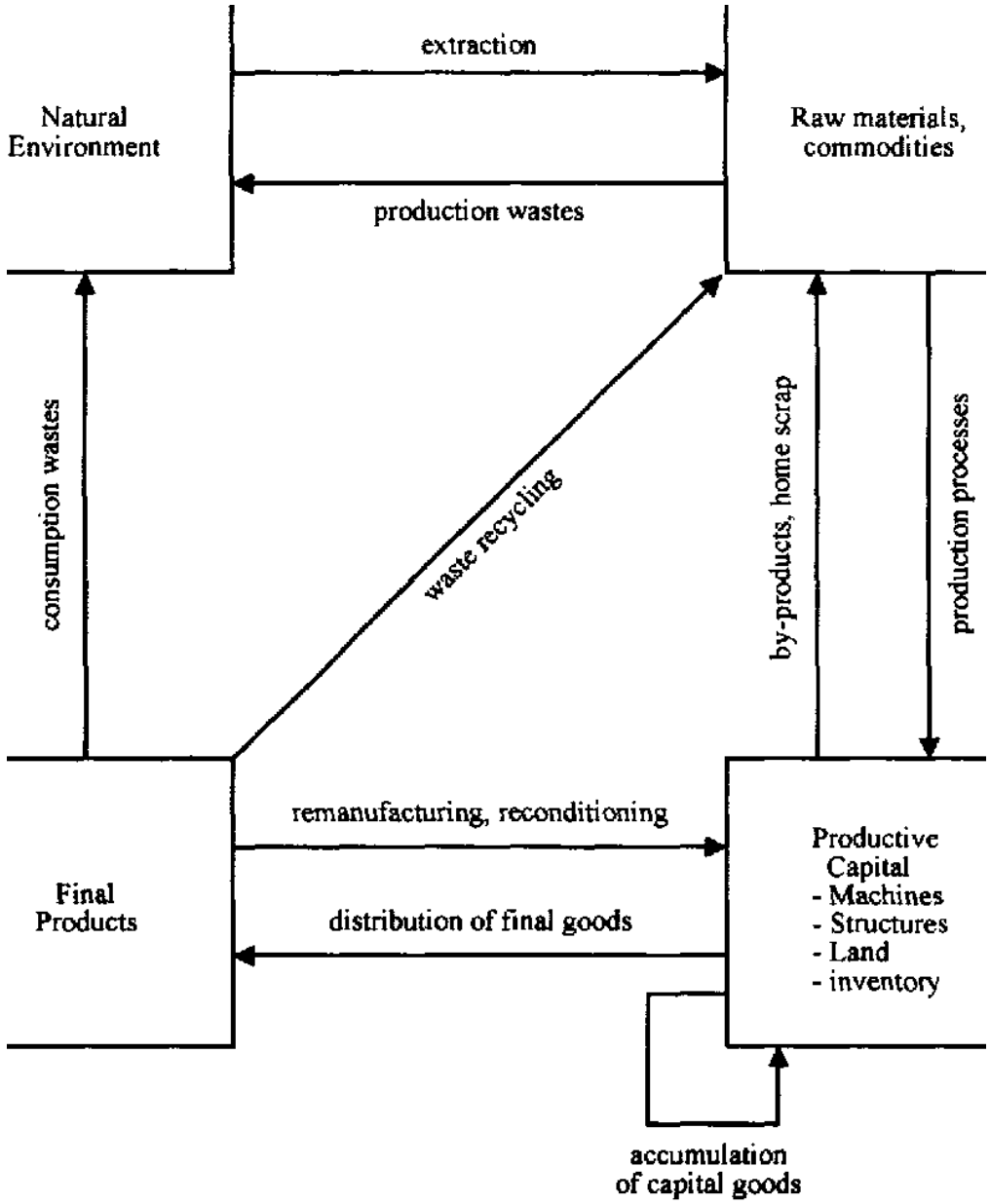
1 Industrial Metabolism

- Study of a material from start to finish
- Compares the economy and industry to a living system
  - Energy input needed to survive
  - Consumed materials converted to useable form
  - Byproducts released
- Focuses on recycling, a closing of cycles
- Analyzes the rate of change of energy and material to different forms
  - Industries imitate natural processes



http://www.unu.edu/unupress/unupbooks/80841e/80841E02.htm#What%20is%20industrial%20metabolism



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1 Industrial Metabolism

Interface, A Case Study

- Largest producer of floorcoverings – America's first free-lay carpet tiles
- Attempt to close the metabolic cycle
  - Considers using natural vs. oil based synthetic raw materials
    - Polylactic acid fibers from corn, potatoes, alternative starch-based agricultural waste product
- Mike Bertolucci, President of Interface Research Corp.
  - "Reduce, reuse, and recycle is the key element to companies that look to become more sustainable. The design of products facilitates dematerialization of the products and ease of their recycling."

5 Industrial Ecology Components

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2 Dematerialization

- The "*de-coupling*" of economic growth and resource use

- The reduction of:
  - Raw materials (production)
  - Energy and material (use)
  - Waste (disposal)

2 Dematerialization

Implementation in Production & Consumption

1. Resource savings in material extraction
2. Improved eco-design of products
3. Technological innovations in the production process
4. Environmentally conscious consumption patterns
5. Recycling of waste

2 Dematerialization

Revenge Theory

- "Human societies face unintended and often ironic consequences of their own ingenuity." (Tenner 1996).
  - Mechanical
  - Chemical
  - Medical
  - Social
  - Financial

2 Dematerialization

Is dematerialization Taking Place?

- Paper Consumption
  - Gain: recycled paper incorporated
  - Loss: paper consumption per capita doubled since 1950
- Automobiles
  - Gain: increased use of plastics and composites
  - Loss: cars have increased in size (SUVs)

2 Dematerialization

Policy Directives

- Governance must provide:
  - Regulations
    - Mandatory recycling and reuse of primary material inputs
    - Incorporation of waste-minimizing technologies
  - Incentives
    - Cap-and-trade markets for emissions

"Broad-based implementation requires the involvement of the market, and synergism of economic, social, and environmental benefits, should be used as much as possible." (Bartelmus 1997).

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3 Life Cycle Assessment

- LCA is a technique for assessing the environmental aspects and potential impacts associated with a product
- It looks at →
- Criticism of LCA:
  - Too cumbersome
  - Unrealistic for complex issues

INPUT

↓

Where is it from?

Where is it going?

What will it be doing?

How will it be disposed of?

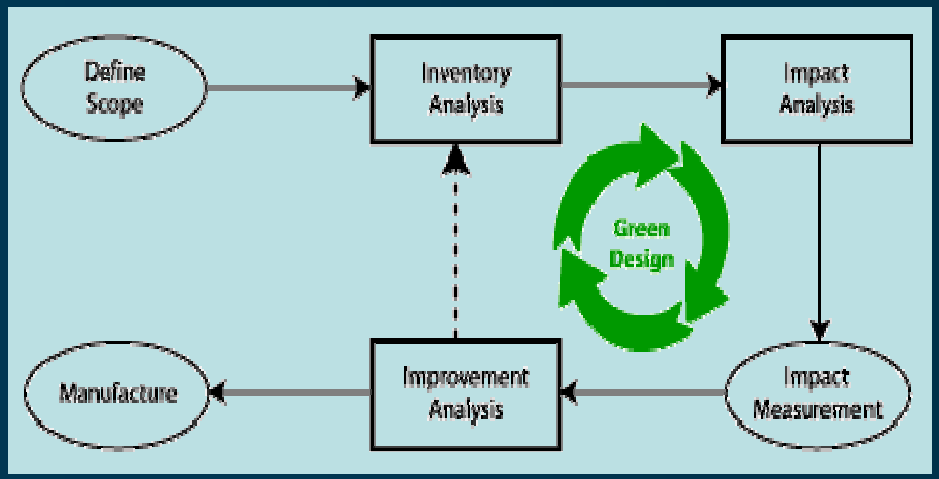
↓

OUTPUT

3 Life Cycle Assessment

- Three basic stages in the structure of LCA
  - Inventory analysis
  - Impact analysis
  - Improvement analysis

- Policy Implications
  - No precise definition of 'waste' by a legal entity



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4 Eco-Design

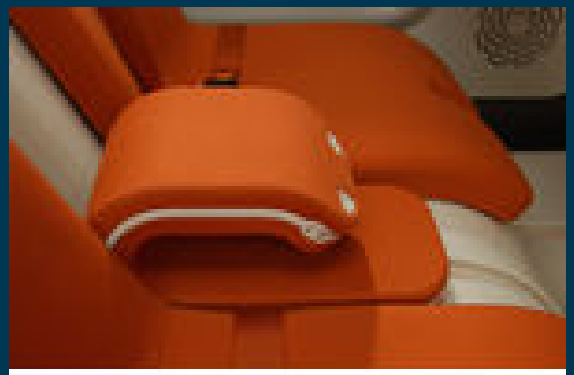
- Is a way of incorporating sustainable features into every day products
  - Building designs
  - Manufacturing Processes

- Current Eco-Design Examples
  - MBDC
  - AT&T Cell Phones

- Products made from sustainable resources that contain the maximum recyclable content and recyclability are the future of achieving ecological sustainability

4 Eco-Design

MBDC Teams up with Ford Model 'U' Design



Technical nutrient polyester upholstery and potential biological nutrient PLA top.

http://www.mbdc.com/features/feature_feb2003.htm

4 Eco-Design

AT&T Cell Phone Recycling

- AT&T Wireless is helping EPA and all Americans reduce the electronic waste stream and protect the environment through cell phone recycling

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5 Eco-Industrial Parks (EIPs)

"Focus on symbiotic relationships in which companies utilize the waste materials or energy of others."
-GAIA 2004

What are they?

- Model of contemporary governance: public and private sectors and the community
- Vision of sustainable community development: "closed loop"

5 Eco-Industrial Parks (EIPs)

Where are they?

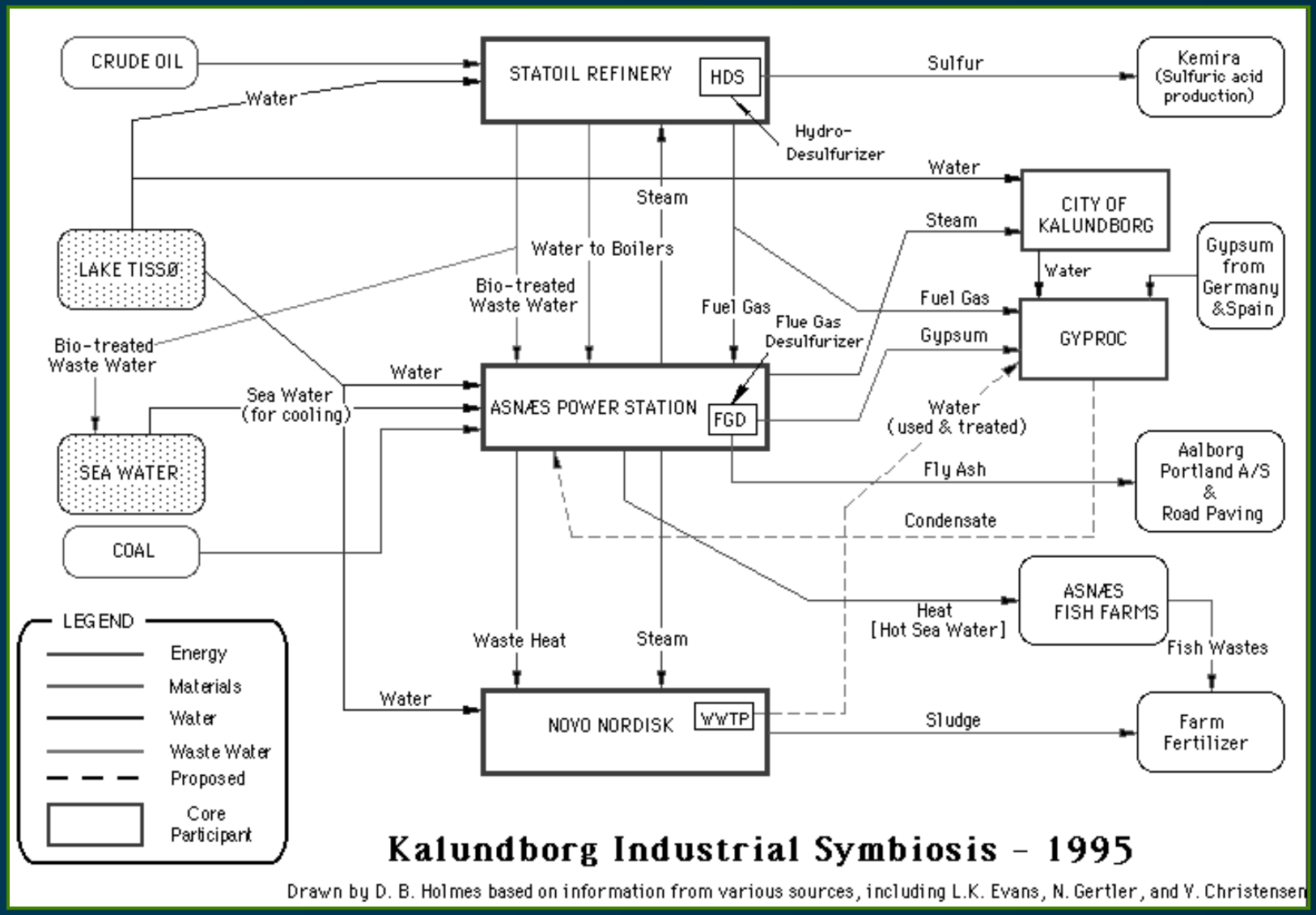
- United States, Europe, Asia, Africa, and Australia
  - The Green Institute, Minneapolis, Minnesota
    - Green jobs for low-income residents
    - Ecological design
    - Waste and material reuse, energy conservation
    - PEEC

5 Eco-Industrial Parks (EIPs)

Where are they?

- Kalundborg, Denmark
  - Industrial Partners, exchanging energy and material flows to recycle & reuse waste materials:
    - Assnaes Power Station, Statoil oil, Gyproc, Novo Nordisk, the City of Kalundborg
    - Original motivation: reduce costs by seeking income-producing uses for 'waste' products
  - But … transactions were generating environmental benefits in addition to economic benefits

5 Kalundborg, Denmark



Indigo Development, 2003

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- Current lack of presence in environmental policy arena
- Proactive → Japan , EU
- Reactive → US
- Scientific uncertainty
  - Limitations and range of applicability of Industrial Ecology

Policy Implications

The State

- US Government as actor
  - Environmental regulator
  - Primary consumer (I.e. purchaser of goods)
  - Secondary consumer (I.e. modifies market demands via policy instruments)

- US EPA
  - Forefront of research and development program

Policy Implications

- Important question = Time Frame
- Role of government is to encourage leaders in industry
- Incentives
  - Tax incentives favor eco-unfriendly use of virgin materials
  - The final say ultimately rests in the hands of a select few