

“Making A Great Lake Superior Conference Economic and Environmental Sustainability”

Duluth – October 29, 2007

**Timothy Nolan
Sustainable Development Strategic Initiatives**

www.pca.state.mn.us



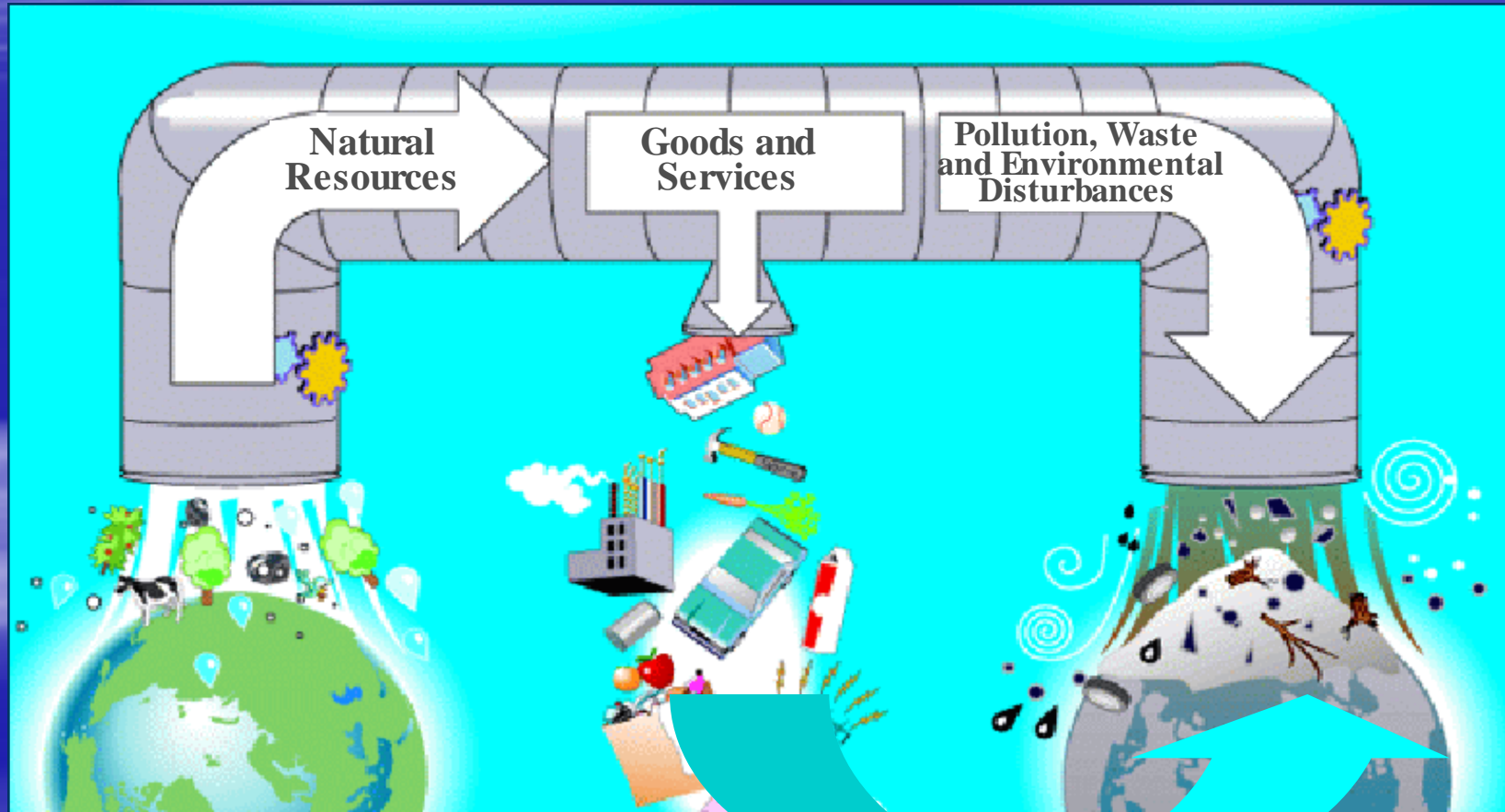
Minnesota Pollution Control Agency

The Need for Transformation to Sustainable Industrial Systems

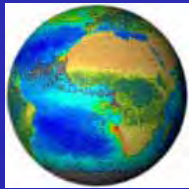
- Humanity's footprint is already moving beyond the carrying capacity of the earth
- Effects will burden generations to come
- Upheaval in our market-based economy will force major changes in industrial production patterns
- Innovation and new solutions are necessary
- Lake Superior region is primed to adopt solutions that can capture opportunities from growing demand for environmentally benign goods and services
- Transformation of the industrial sector is paramount to significantly diminish non-sustainable patterns

Today's Material Flow

Vast amounts of natural resource “stocks” are consumed in the production system. Approximately 25% of what goes ‘in the pipe’ comes out as goods and services. The rest ends up as waste, emissions, and often pollution.



Outcome: We will need four earths in 2100



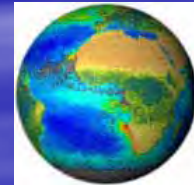
1900



2003



2050

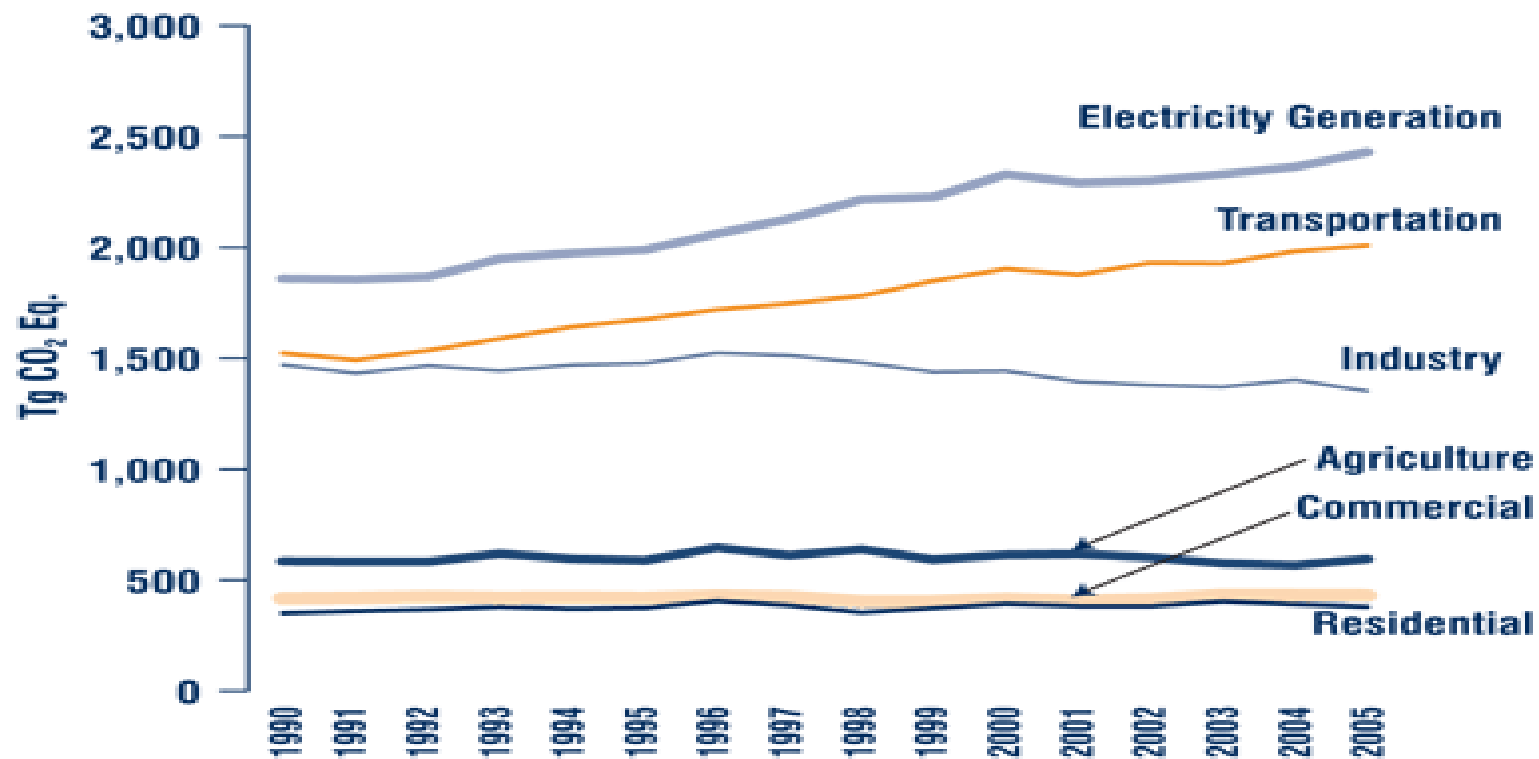


2100



Figure 4. U.S. flow of raw materials by weight, 1900–98. The use of raw materials dramatically increased in the United States throughout the 20th century (modified from Metos and Wagner, 1998, fig. 3).

Emissions Allocated to Economic Sectors











































Note: Does not include U.S. territories.

*Inventory of U.S. Greenhouse Gas
Emissions and Sinks:
1990-2005, USEPA #430-R-07-002*

Not Just Climate Change but Multiple Problem Areas are Drivers

progressive companies, governments, and communities, have begun to take significant actions to devise more sustainable systems.

Source	Consensus on Problem Areas							
	Water Quality and Access	Climate Change	Biodiversity	Indoor Air Quality	Air Pollution	Food Production, Soil Degradation	Over-Fishing	Deforestation
World Resources 2000-2001: People and Ecosystems (WRI) ¹								
OECD Environmental Outlook ²								
World Development Report 2003 (World Bank) ³								
Global Environment Outlook 3 (UNEP) ⁶								
Global Trends 2015 (CIA) ⁷								
The Environmental Future Emerging Challenges and Opportunities for the EPA (NACEPT) ⁸								

- : Problem is a serious threat to the global environment and continued economic development.
- : Problem is a threat to the global environment.

We can no longer avoid the need for
major change!

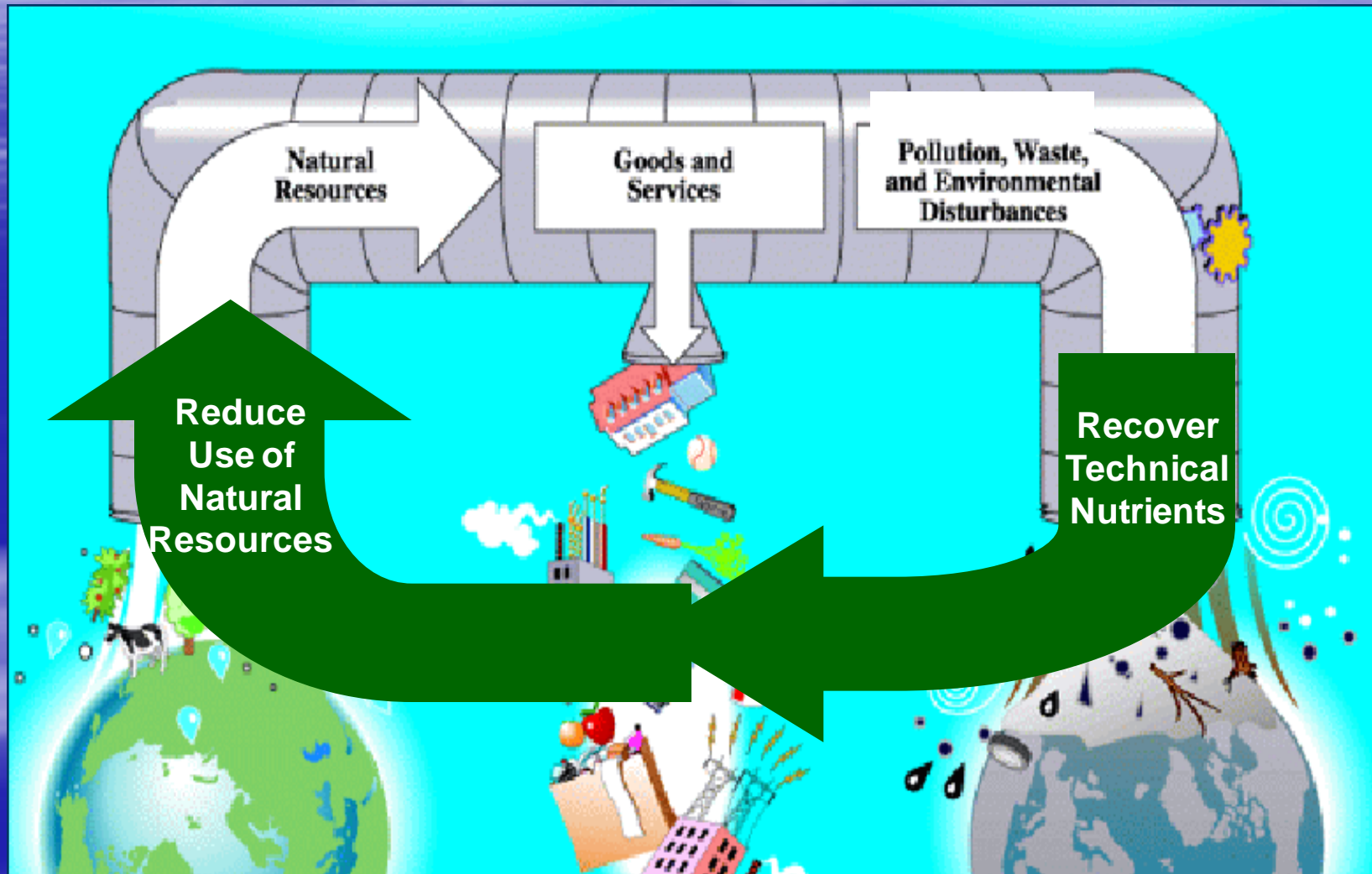


작품명	삶 - 지구
Title	Life Earth Beer
작가명	최승권
Sculptor	Cha Seung Gwon
제작년도	1992
Date	

How do we get there?

Tomorrow's Material Cycle

Tomorrow's profit will come from design, not matter



Need for a Systems Approach

Systems thinking considers the “big picture” and widens the focus beyond narrow issues to discover the source of a problem and design solutions accordingly.

- Short and long-term perspectives are balanced
- Recognizes the dynamic, complex, and interdependent nature of systems while accounting for measurable and non-measurable costs and benefits
- Acknowledgment of how people are influenced by and how we influence systems is fundamental

“Laws” of Systems Thinking adapted from The Fifth Discipline by Peter Senge, Currency/Doubleday 1990 and Pegasus Conference 2004

- Major Companies and others want to make progress integrating social & environmental factors as strategic way to address organizations
- We need to develop new ways of thinking and acting together that we can't do on our own
- We need to welcome to have our convictions challenged to change
- Must address problems as highly interrelated versus fragmented
- Shift from individual consciousness to systemic consciousness
- Begin by recognizing what we already know “*Tacit Knowledge*”
- Determine what it will take to function at a level of wholeness

Framework is Industrial Ecology ...



**looks at industrial systems in the
context of their natural surroundings**

Industrial Ecology Applies a Systems Wide Approach and Innovation

“In an industrial ecosystem, the consumption of energy and materials is optimized, waste generation is minimized, and the effluents from one process serve as the raw material for another”

Frosch and Gallopoulos, *Strategies for manufacturing, Scientific American*, 1989.

Eco-Industrial Development

Where Industry Meets Ecology

How do we transition from the past to the future?

Definition

“Networks of businesses that work with each other and in conjunction with their communities to improve resource productivity, expand markets, eliminate pollution, and catalyze economic growth through enhanced profits, wages, and local investment.”

**North American Eco-Industrial Development Council
2003**



Eco-Industrial Development Can Include

- Industrial Symbiosis
- Eco-Industrial Parks
- Cleaner Production
- Cyclical vs Linear Production Systems
- Green Manufacturing
- Green Chemistry
- Dematerialization

EID Environmental Benefits

- **Less waste – emissions – pollution**
- **More efficient use of energy and resources – high levels of clean production**
- **Higher performance – go beyond regulatory thresholds - potential for streamlined regulatory processes**
- **Replacement of fossil based energy and materials**
- **Increased use of renewable energy**
- **Industrial system and supply-chain pollution prevention vs. facility-based**

EID Business Benefits

- **Greater resource efficiency = decreased operating costs**
- **Enhanced competitiveness - potential for revenue generation**
- **Increased return on capital investments & asset value - potential for new investment**
- **Energy security and independence**
- **Improved worker health = higher productivity & loyalty = lower costs & higher revenue**
- **Stronger connections with suppliers/customers/community**
- **Access to eco-product markets - capitalizes on the growing consumer demand for environmentally preferable products**
- **Reduced future costs to business/community (e.g. clean-up liabilities)**

EID Community Benefits

- **Socially responsible brand identity**
- **Can strengthen existing businesses and enhance recruiting**
- **Reduced infrastructure development costs**
- **Reduced emissions = improved community health**
- **Improved community-industry relations, quality job creation/retention, workforce attraction**
- **Community identity – eco-region, values, distinction**
- **Local import substitution – access to markets with locally/regionally produced feed stocks-products-services**

Kalundborg, Denmark

Reduction in consumption of primary resources

- oil 45,000 tons/year
- coal 15,000 tons/year
- water 600,000 m³/year

Reduction in waste emissions

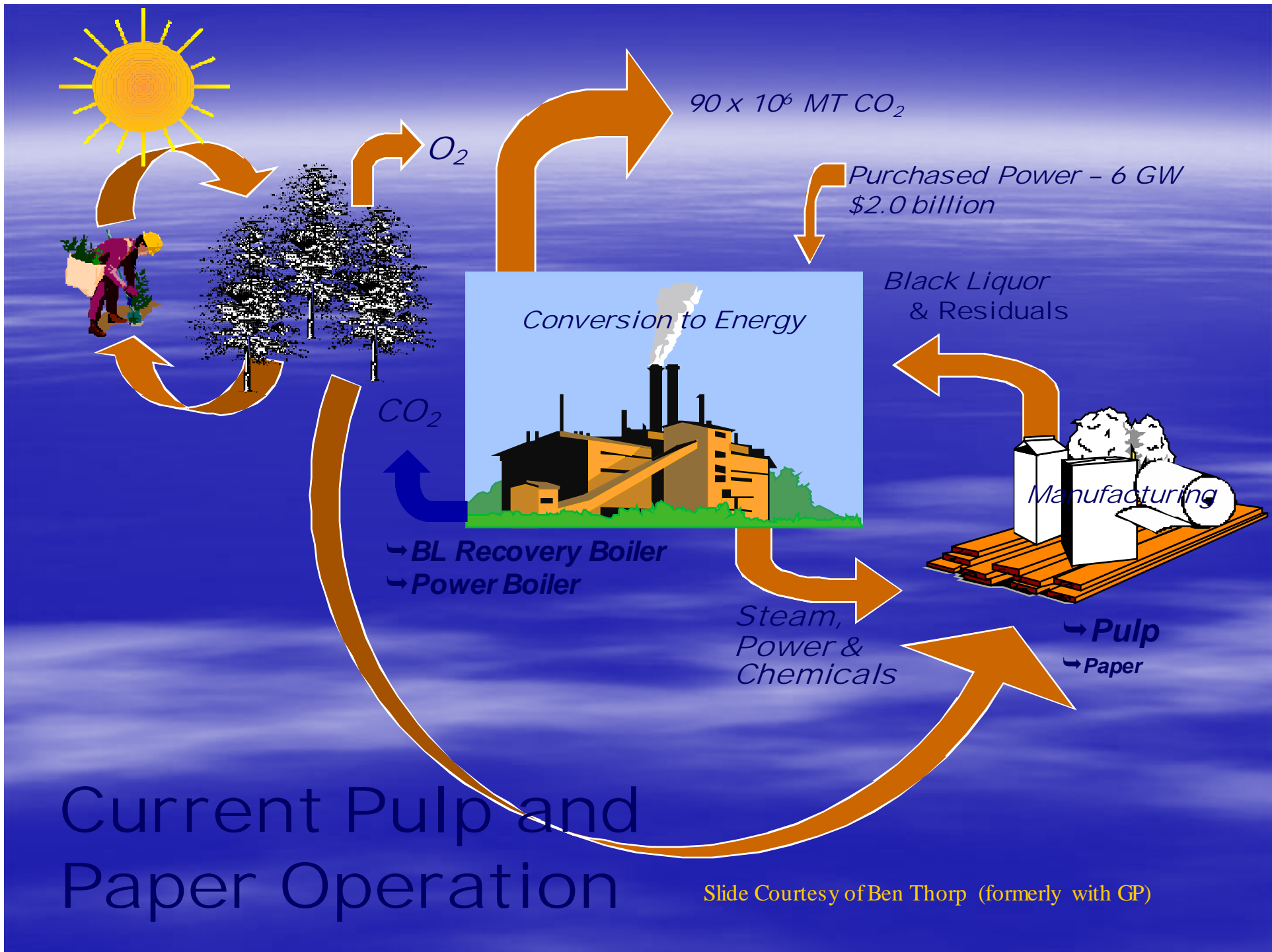
- carbon dioxide 175,000 tons/year
- sulfur dioxide 10,200 tons/year

Valorization of "wastes"

- sulfur 4,500 tons/year
- calcium sulfate (gypsum) 90,000 tons/year
- fly ash (for cement etc) 130,000 tons/year

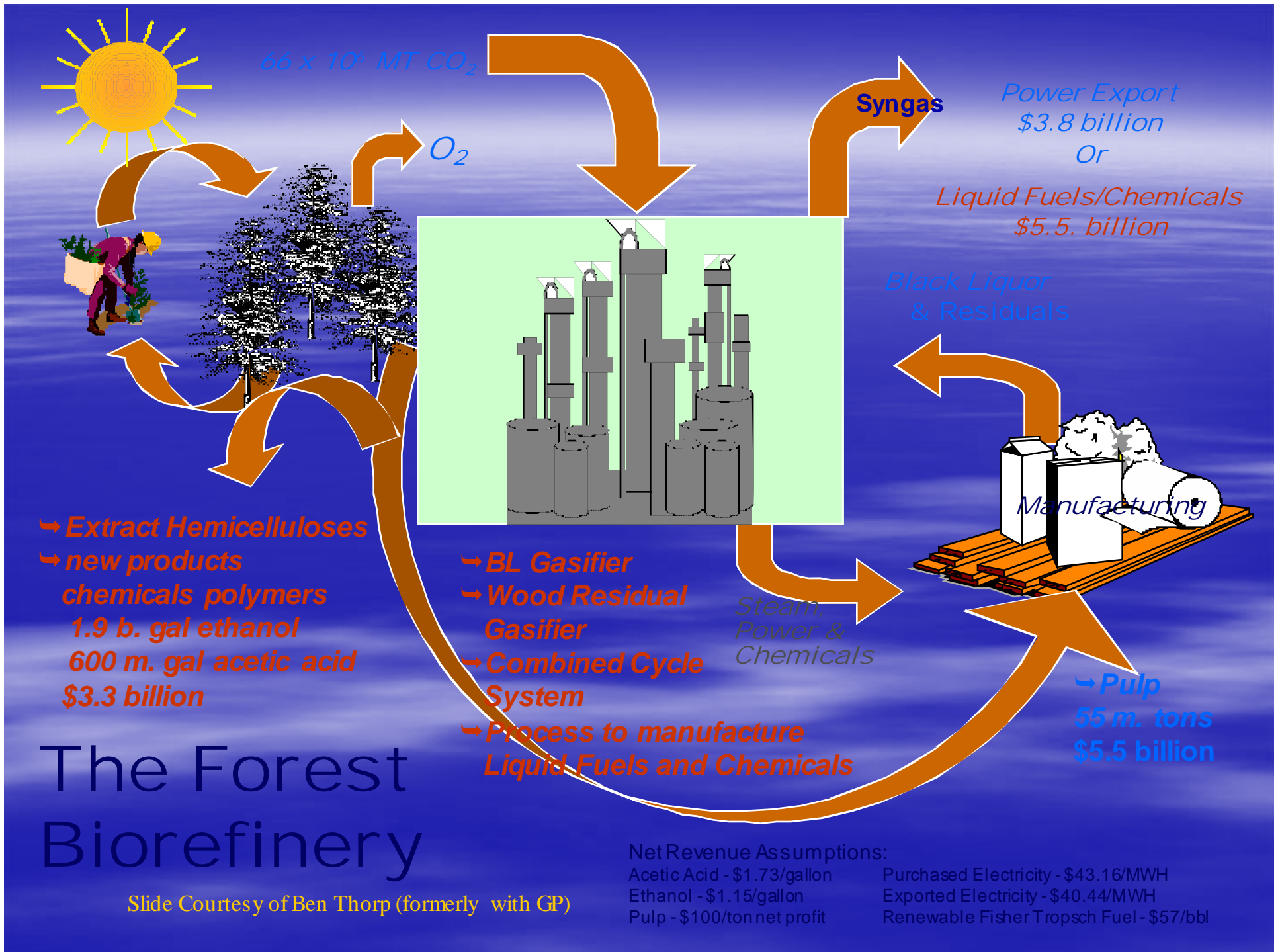


Transformation of industrial sectors will not be easy but major reductions in resource consumption and emissions from “redesigned” production systems can lead to a new level of sustainable economic growth.



Current Pulp and Paper Operation

Slide Courtesy of Ben Thorp (formerly with GP)



EID is beginning to happen in other countries. Those who effectively adopt wide spread applications of industrial ecology will not only solve environmental challenges but will gain competitive advantages in the global economy.

Industrial Complexes for EIP in Korea

Banweol-Shihwa National Industrial Complex
(Medium & Small companies)

Cheongju local Industrial Complex
(Electric & Electronic)

Yeosu National Industrial Complex
(Petrochemicals)

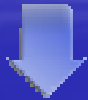


Pohang Steel Industrial Complex
(Steel industry)

Ulsan-Mipho-Onsan National Industrial Complex
(Petrochemicals & Automobile)

Master Plan of EIP Project

1st Stage ('05~'09)
Pilot project for EIP



2nd Stage ('10~'14)
Propagation of EIP



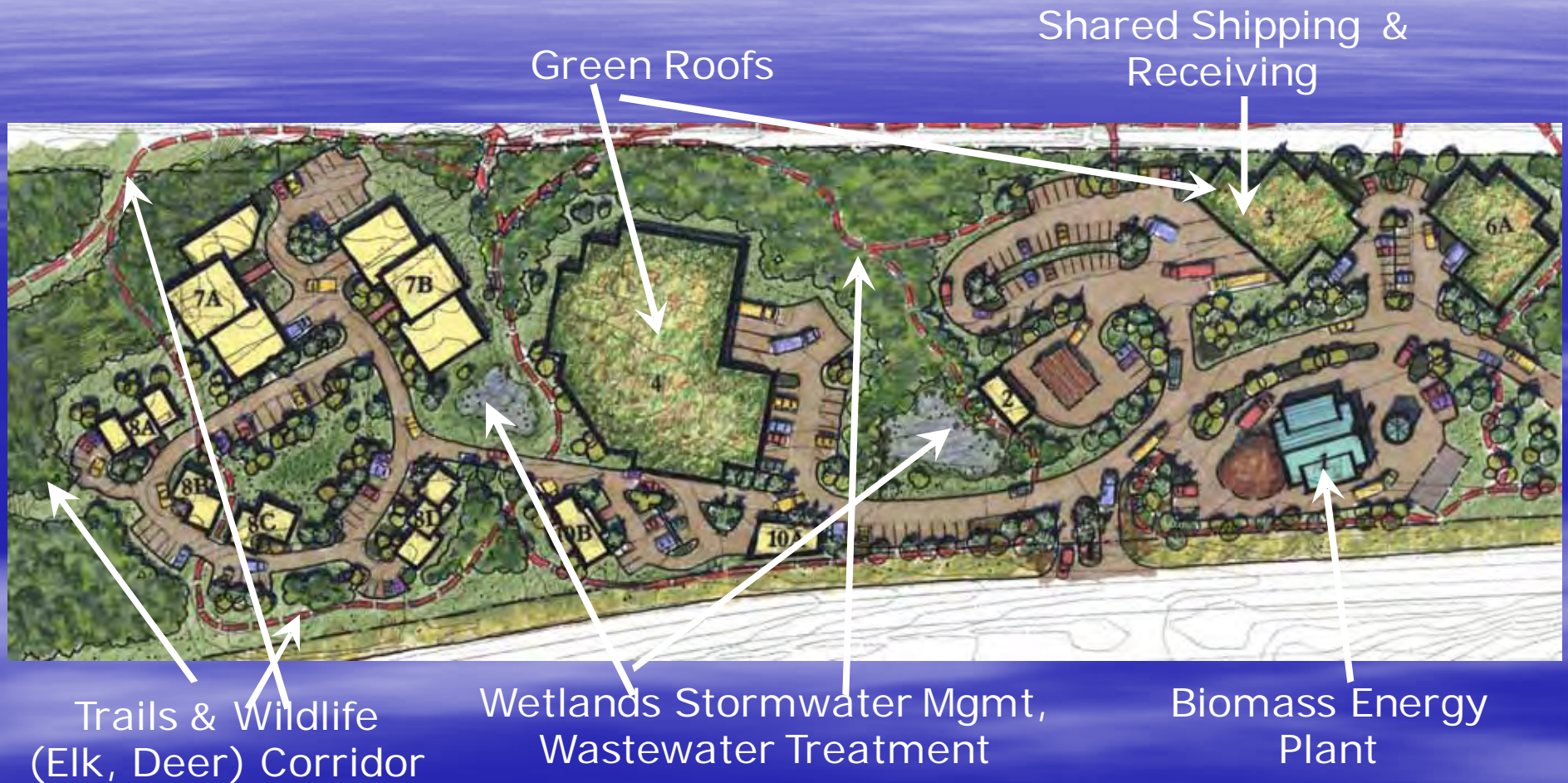
3rd Stage ('15~'19)
**Establishment of
Korean EIP Model**

Networking for the exchange of materials, energy and by-products between companies located in the same industrial complex

Propagation of 1st stage's experiences and successful networking cases into other industrial complex

Establishment of closed-loop industrial complex based on industrial symbiosis

Hinton EIP – Some Ideas



Artist's Rendering – Consultation, Refinement, Approval Pending

Elkhorn Industries Site – Transformation from abandoned press board mill to Eco-Park.



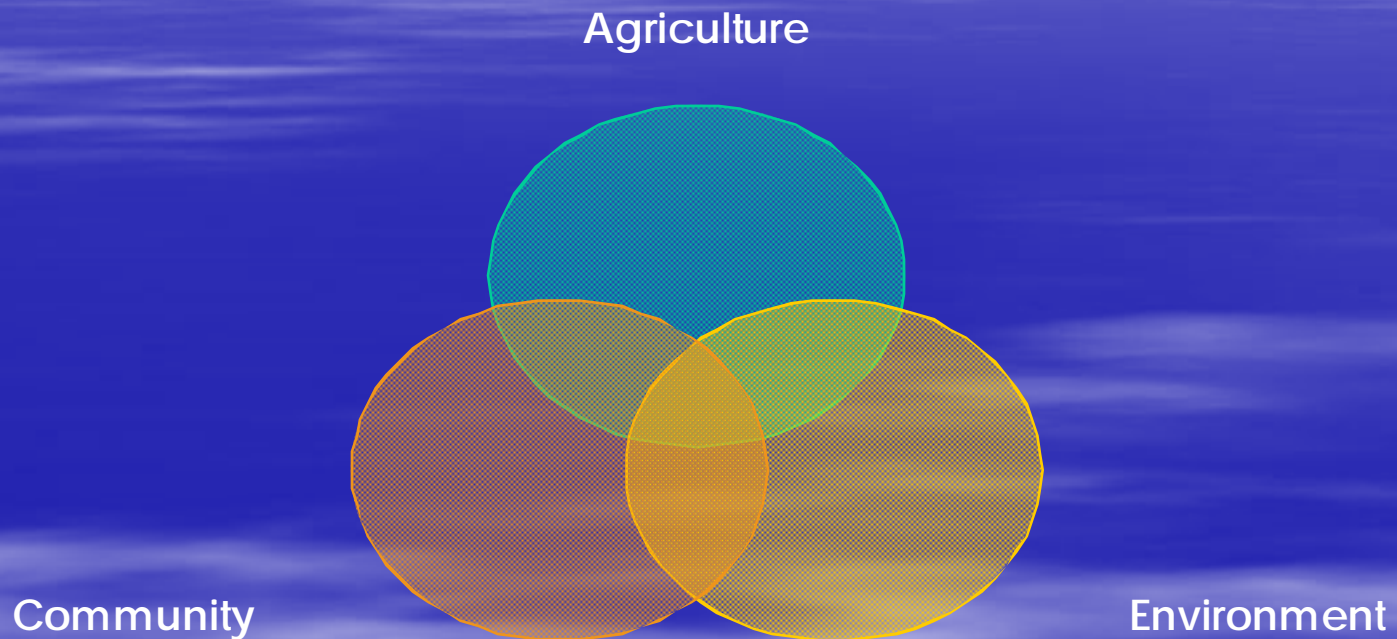
The Madelia Model

- Concept
- Within a 25 mile radius of a community you can grow, or collect from natural or industrial sources, enough biomass to 'fuel' your community and support bio-based processing.



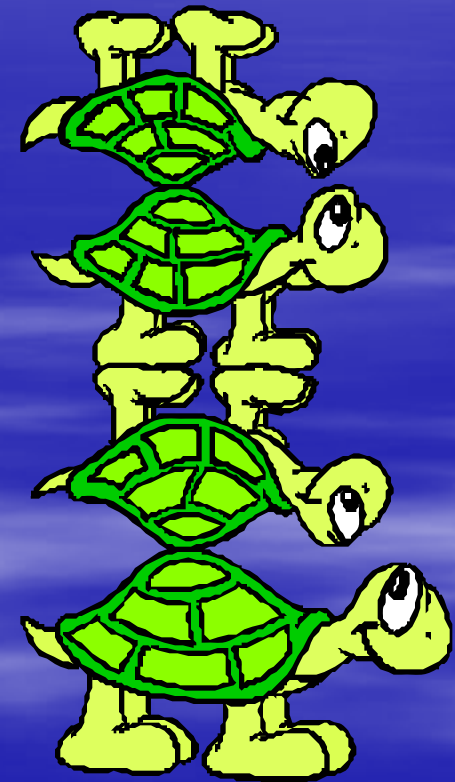
PS. This creates a market for third crops 😊.

Capitalize on the Synergies Between Issues



In Return: Multiple Benefits

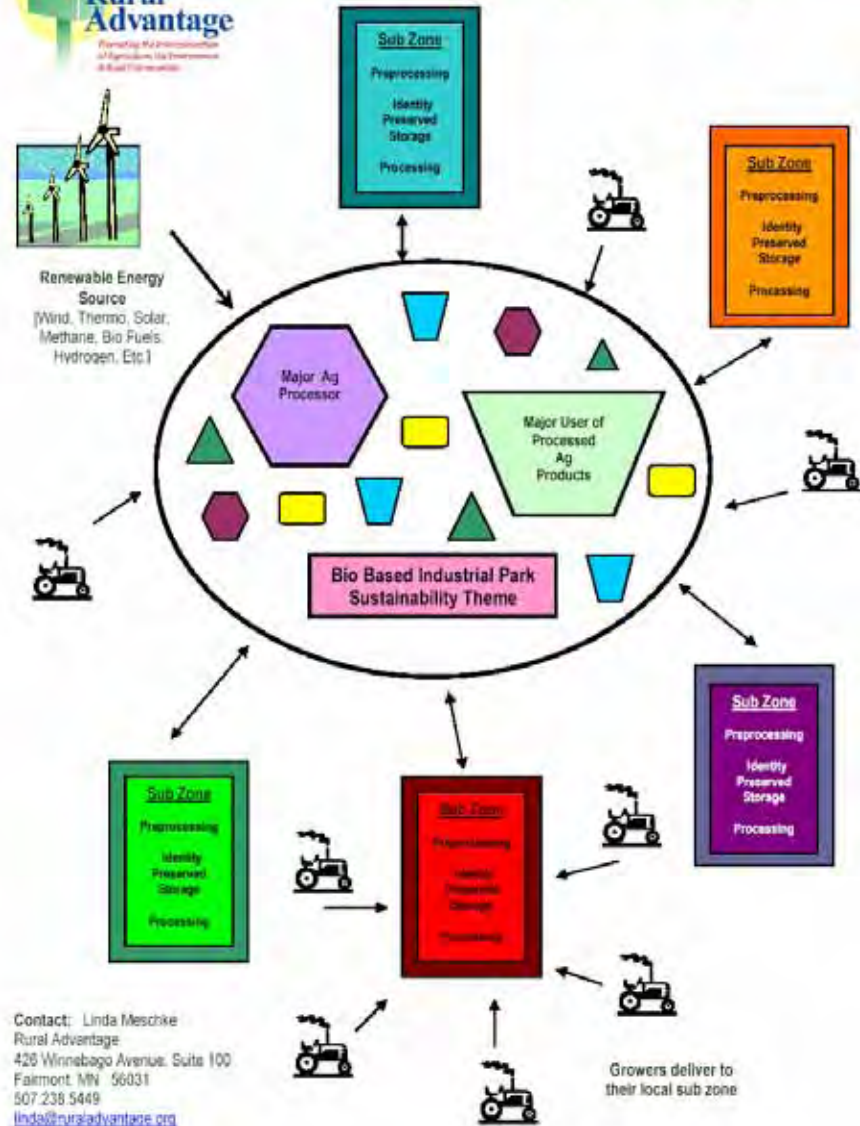
- Renewable Energy
- Local Bio-Processing
- Jobs
- Sustainable Family Farms
- Multiple Revenue Streams
- Clean Water
- Retains Rural Wealth
- Vibrant Communities



Greater Blue Earth River Watershed



Rural Economic Development Concept



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**“Don’t let the perfect
be the enemy of the good”**

**“The good is the greatest rival of
the best”**

Nellie McClung

"There is nothing more difficult to carry out, more doubtful of success, nor more dangerous to handle, than to initiate a new order of things. For, those who would institute change have enemies in all those who profit by the old order, and only lukewarm defenders in all those who would profit by the new order (Machiavelli)."