Industrial Ecology

CSD-19 Learning Centre

"Synergizing Resource Efficiency with Informal Sector towards Sustainable Waste Management"

Co-organized by UNCRD & UN HABITAT

Turning Waste to Resource -

Case Studies and Enabling Frameworks

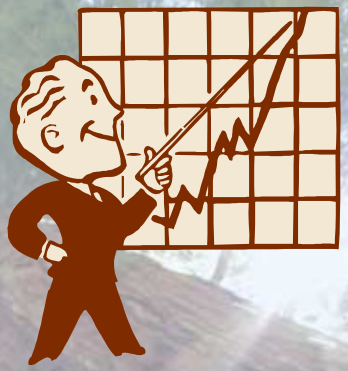
Anthony SF Chiu

De La Salle University, Philippines

Chair, Asia Pacific Roundtable for SCP

anthony.chiu@dlsu.edu.ph

Outline of Presentation



- Urban Eco-Development
- Framework and Tools
- UED initiatives and cases

Urban Eco-Development & Metabolism

"System-oriented study of the physical, chemical, and biological interactions and interrelationships both within urban systems and between urban

and natural ecological systems."

- Urban metabolism aims at finding strategies and methods to minimize the negative impacts of urban systems on surrounding systems.
- Urban metabolism as a framework tries to give guidance towards the transformation of urban systems.

"Natural systems = model of highly efficient use of resources, energy, and waste"
(Lifset, 1997)

UED Operationalization

"A community of residential, commercial / service businesses seeking enhanced environmental economic, and social

performance through collaboration in managing environment and resource issues including information, energy, water, materials, infrastructure, and natural habitat. By working together, the community seeks a collective benefit that is greater than the sum of the individual benefits each entity would realize if it optimized its individual performance only."

Revised from Lowe

Upstream Production / Vein

CLOSE THE LOOP

«Re-use

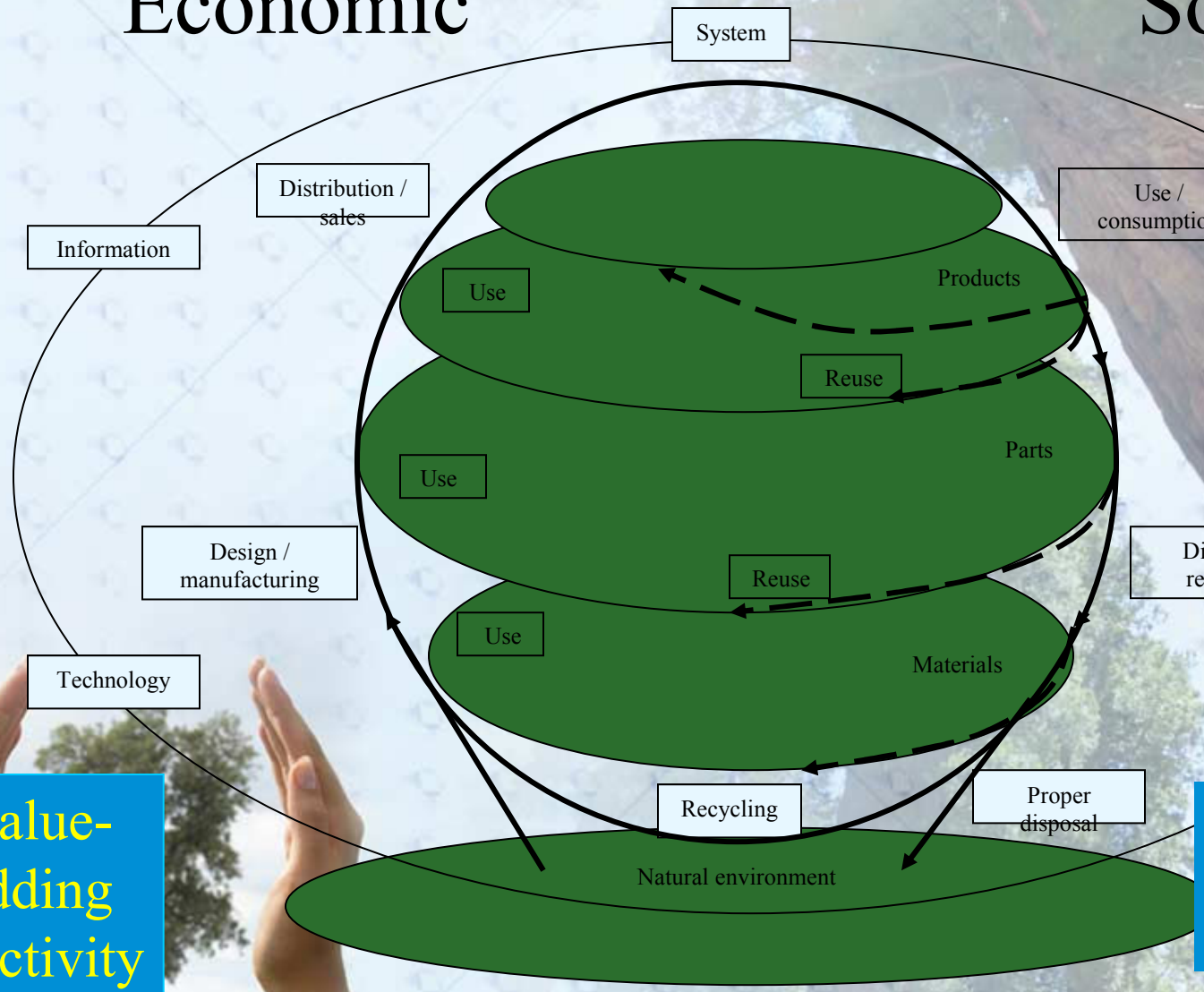
«Recycle

«Re-manufacture

Downstream Production / Artillery

Lowe, Indigo

Conceptual Diagram of a Recycling-Oriented Economic Society



Value-adding Activity Society

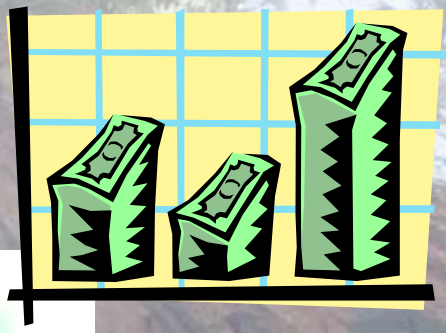
Re-use – Recycle – Remanufacture - Reprocess

anthony.chiu@dlsu.edu.ph

Source: Kitakyuchu Ecotown, 2001

Urban Eco-Development

- Urban system in harmony with nature
- for example, TBL goal in an eco city …



Two Important Components

- **Primary Hardware: Metabolism**
  - energy and material flow
  - product and system design
  - information management
- **Supportive Software: Inter-relationship among the elements in the industrial system**
  - Stakeholders participation (government, citizen, NPO, academe, researchers, etc.)
  - Shared infrastructure, facilities, and service

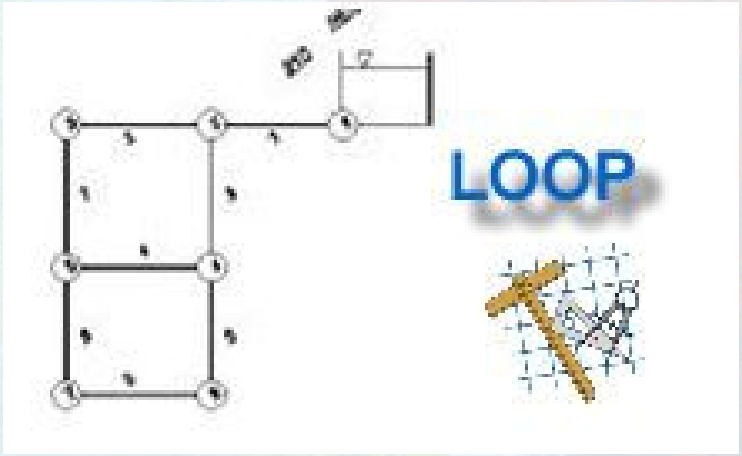
Primary Component

- Energy use
  - Renewable energy?
- Water use
  - Waterless operation design
  - Water recycle / reuse
  - Water harvest via catchments or pipe net
- Material use
  - CP mgt & technology (LHF)
- Information flow
  - Technical information for industrial symbiosis to take off

[can refer to Cohen Rosendal's nine categories as well]

Primary Component

- City-level Facilities and Services
  - Infrastructure Design
    - Landscape
    - Sun and wind pattern design
  - Transportation Design
- By product chain
- Resource Recovery
  - Regional hub functionality
  - Value-added approach
  - Co-valued approach
  - Value-downgraded approach



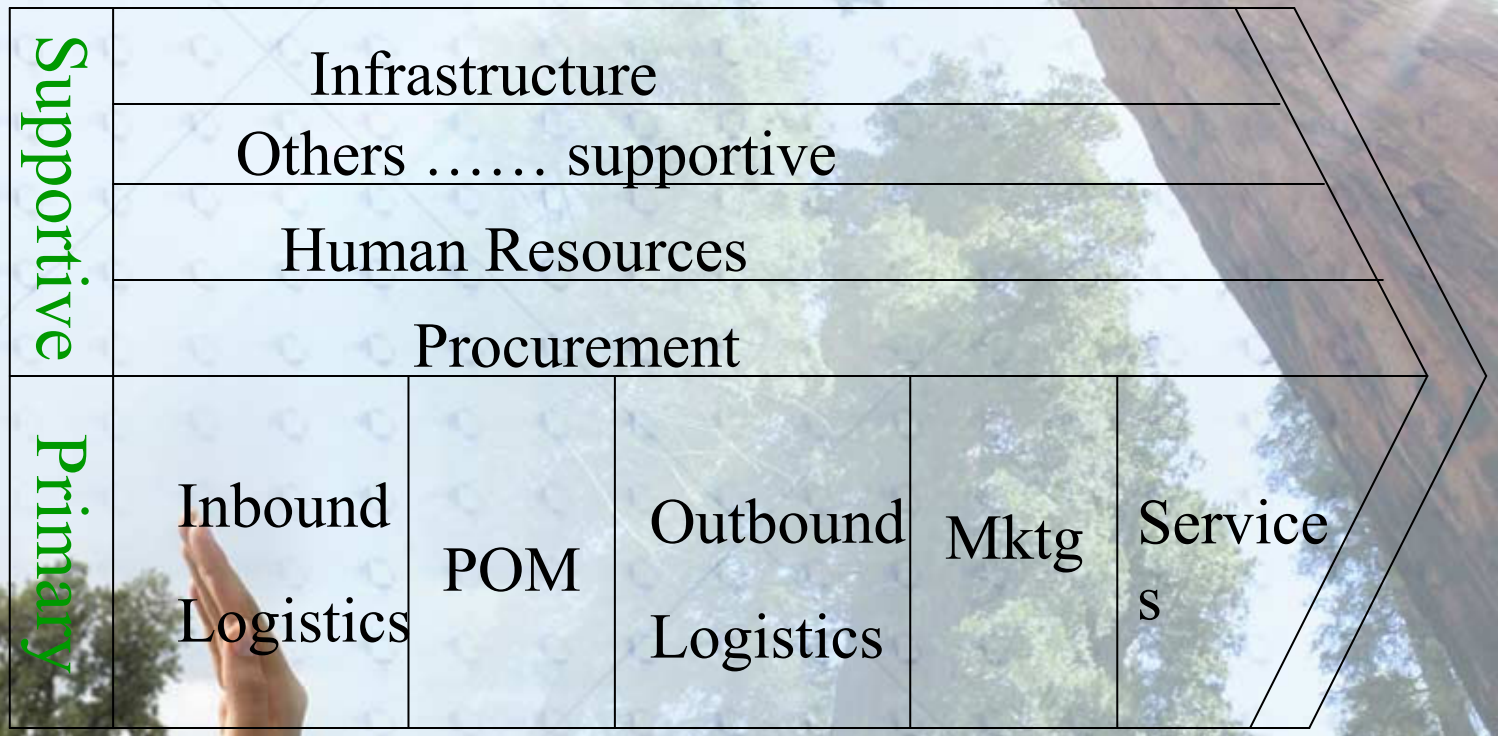
Supportive Component

- Aligned planning
  - Urban and rural plans
  - Health, economic, and environment planners
  - Current economic sector structure
- Strong R&D
  - Priority items
  - Urgent items (e.g. energy substitute … agri subs)
- Stakeholder education
  - Information exchange and education for consumerism

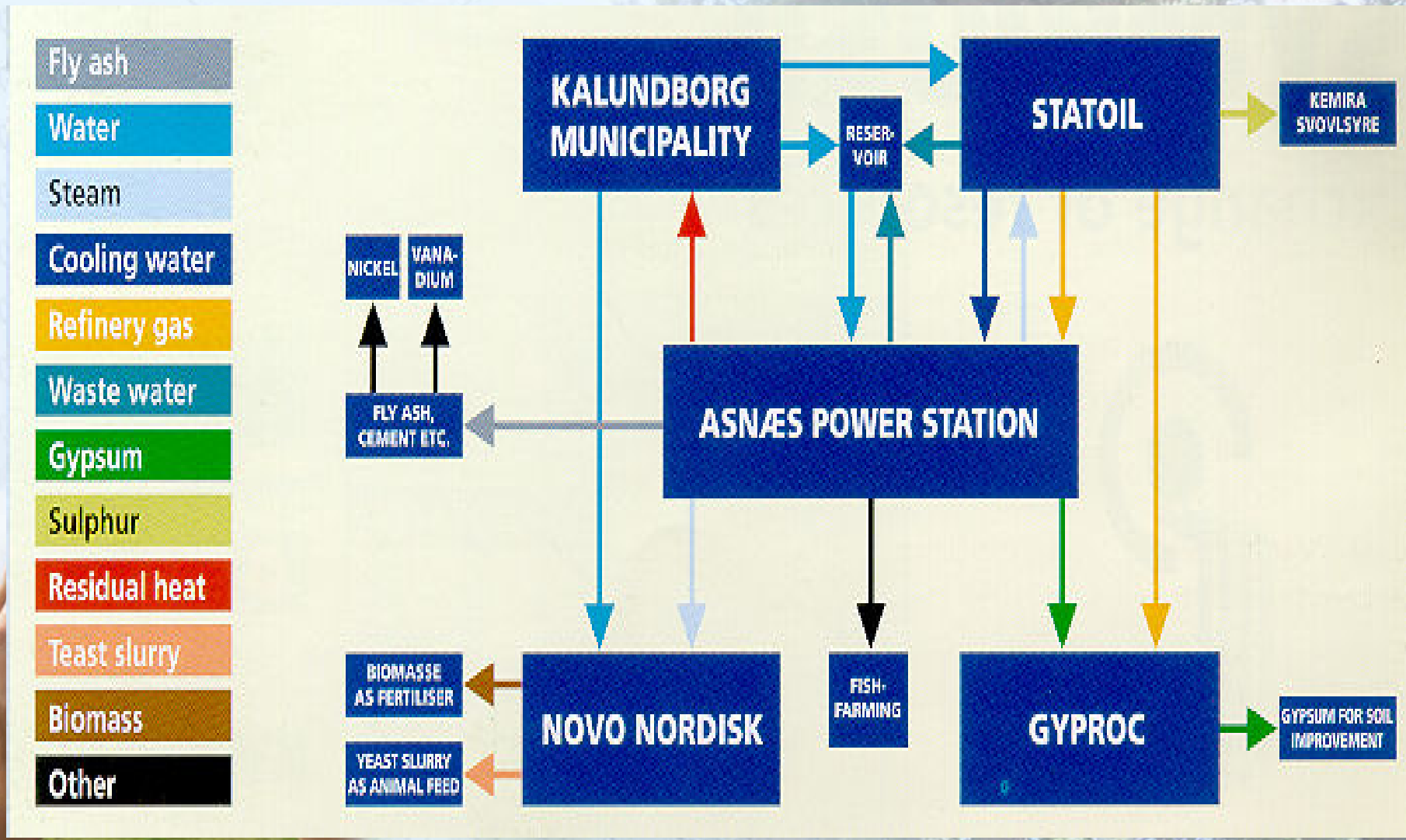
- Policy
  - Universal guidelines, local enforcement
  - autonomy
- Finance
  - Incentives, tax holiday
- Management structure
  - Single entity, e.g. programmatic EIA, IEAT model
  - Business incubation
  - UED management style
  - Capacity building

A significant component if the IEAsia 7 issues were revisited

Value Chain in an UED "System"

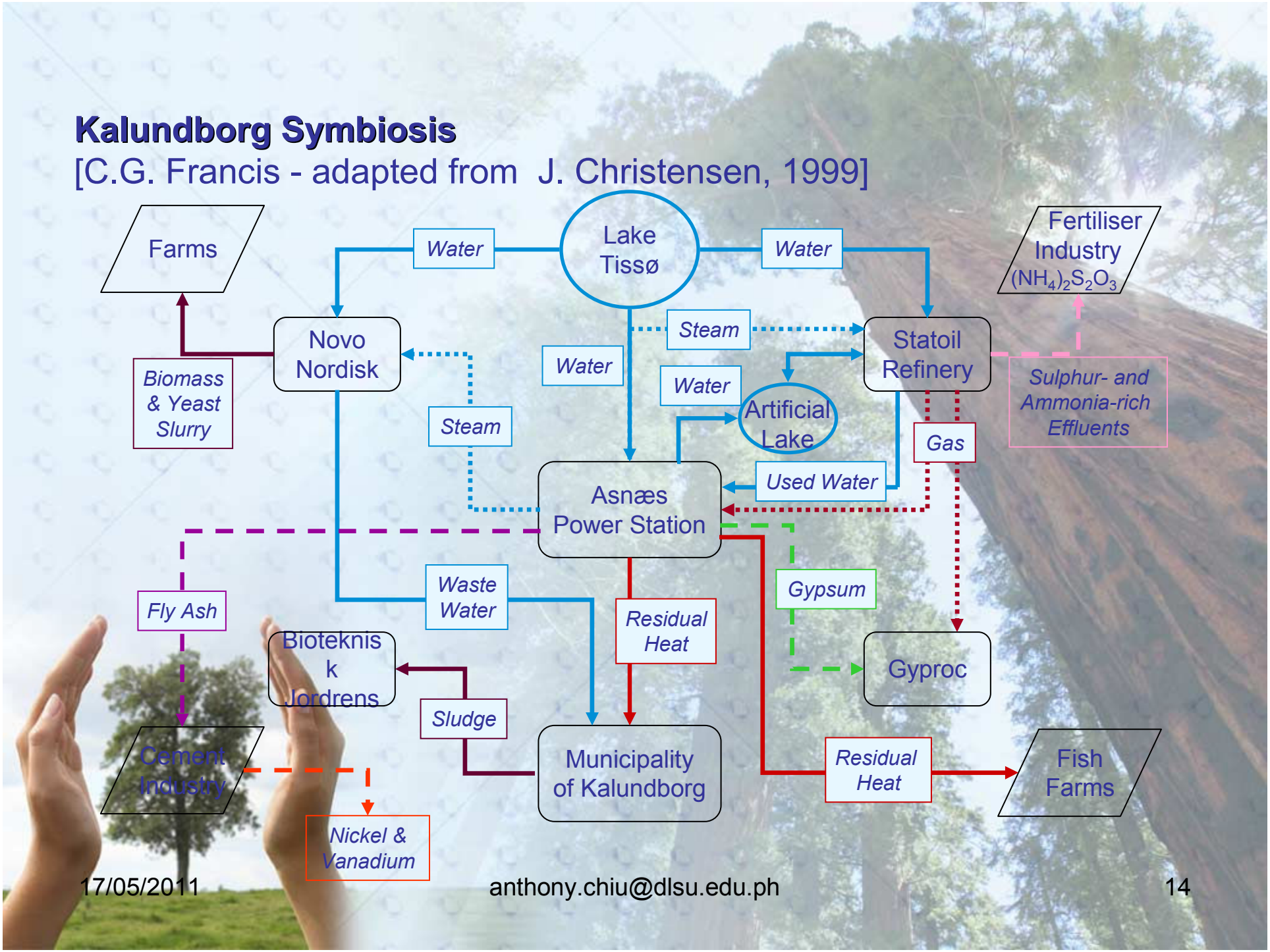


Kalunborg City Symbiosis

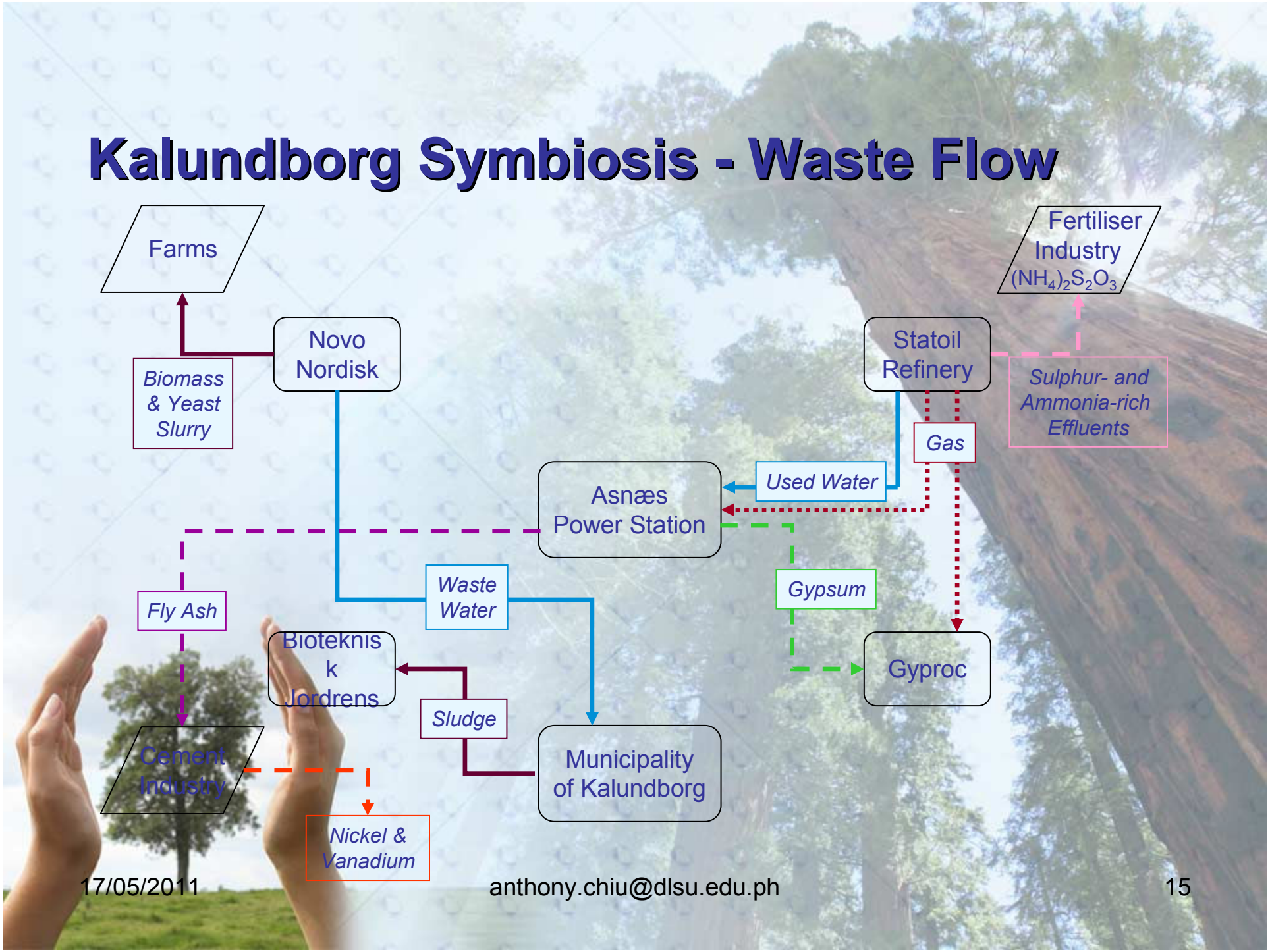


Kalundborg Symbiosis

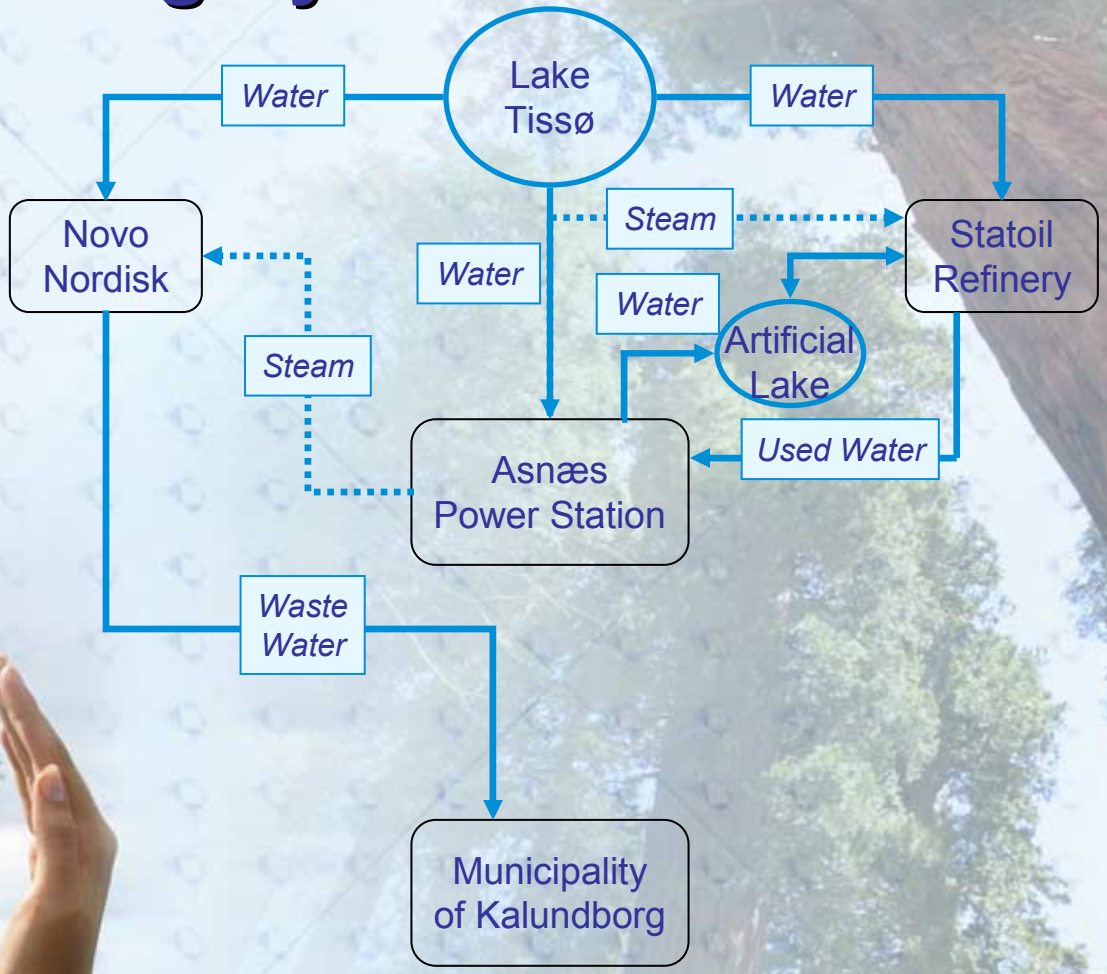
[C.G. Francis - adapted from J. Christensen, 1999]



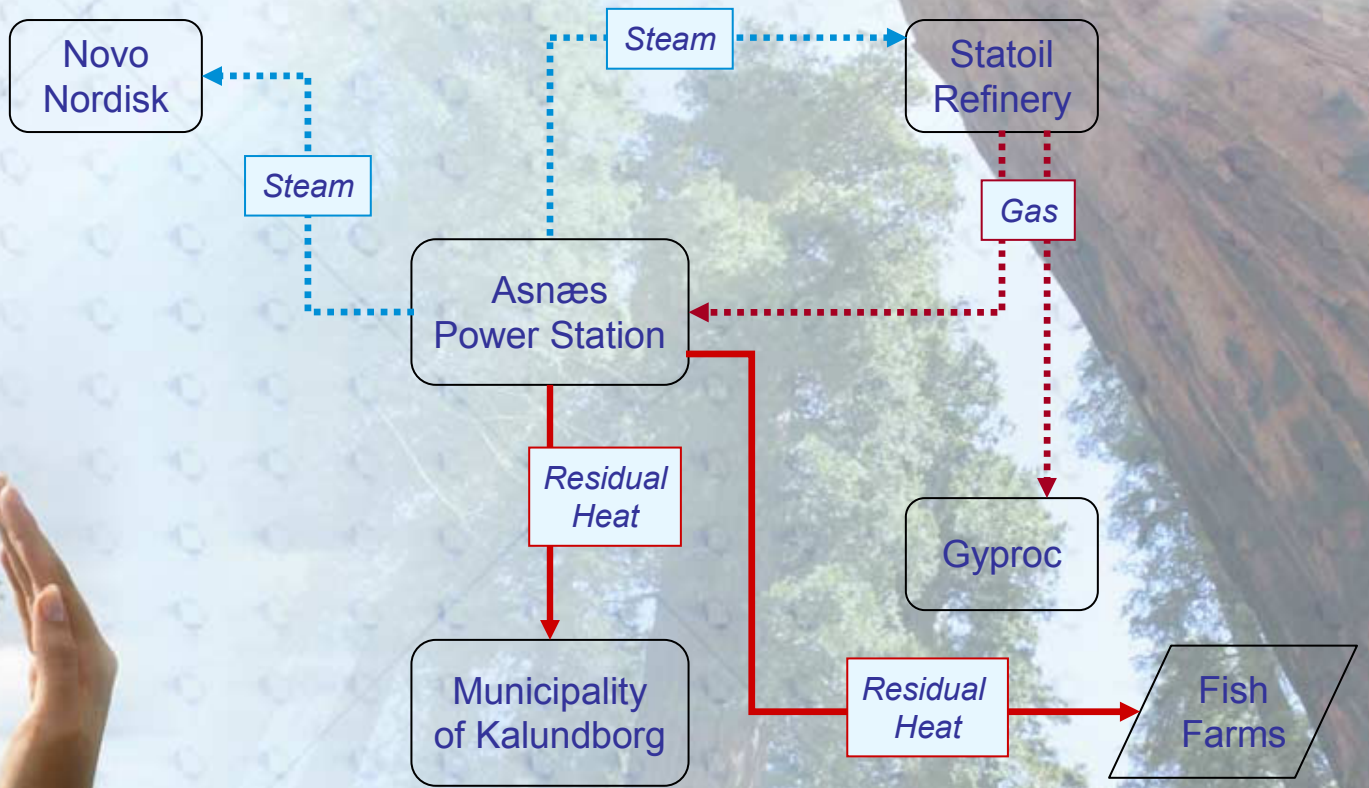
Kalundborg Symbiosis - Waste Flow



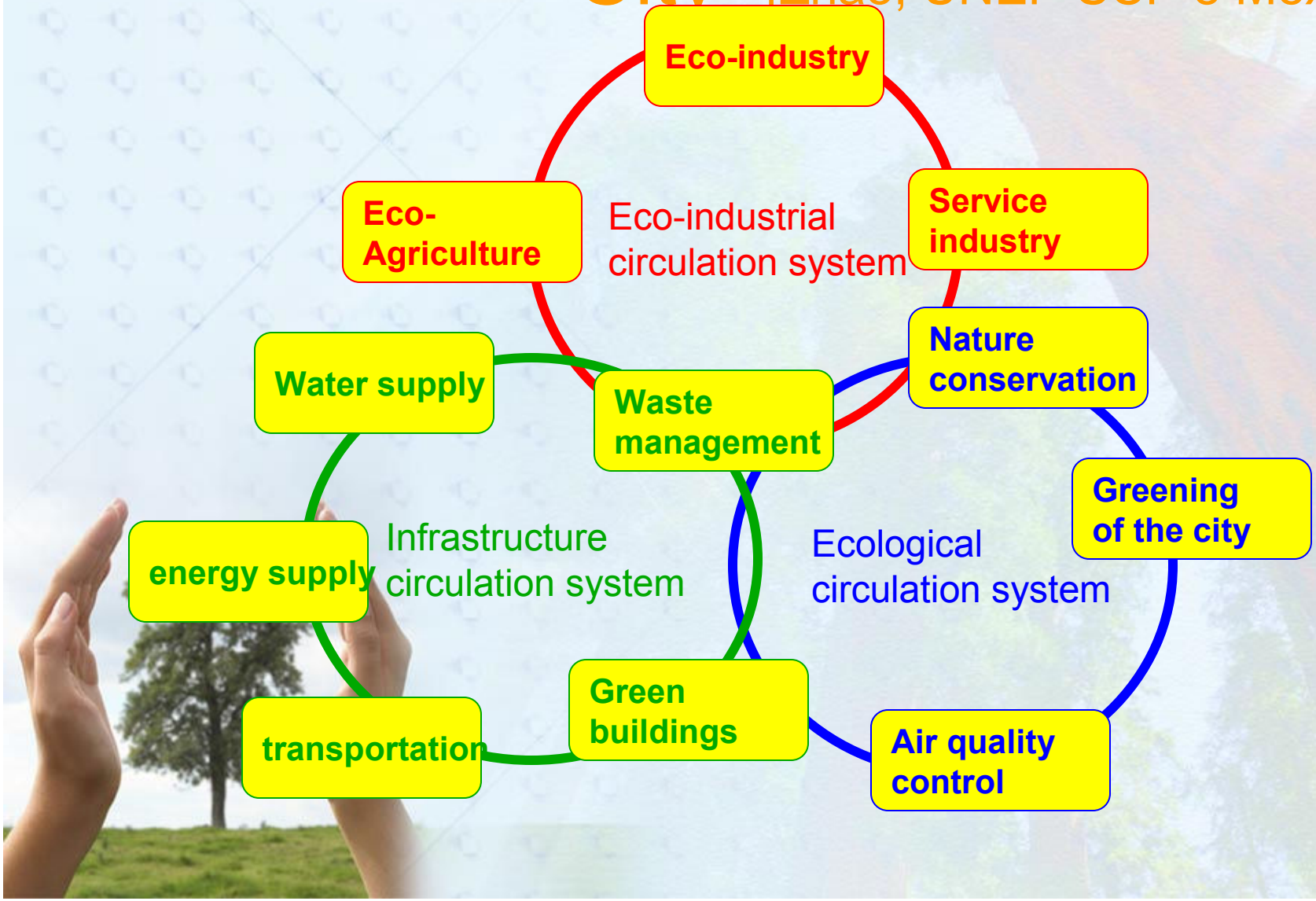
Kalundborg Symbiosis - Water Flow



Kalundborg Symbiosis - Energy Flow



Overall framework for Circular Economy development at Guiyang City [Zhao, UNEP SCP 8 Mexico]



Used Tires for Alternative Fuel

- The Used Tire Retrieval project by Holcim Cement
- Retrieved more than 600,000 used tires dumped at the disposal facility alternative fuel in the production of cement
- Used by Holcim Cement as alternative fuel in the production of Cement

Creative Recycling in Pasig City

- Plastics are recycled into hollow blocks
- Doy packs to Ecobags.

Central America: NASCENT RECYCLING INDUSTRY

- hundreds of tonnes of paper, plastic, tyres and other products are now being marketed through innovative initiatives.
- the Industrial Waste Exchange of Central America and the Caribbean (BORSICCA), which began operating in August 2009 facilitates trade in waste through an electronic marketing system for the use and reuse of the materials in the countries' production chains.

- Ten months after its creation, BORSICCA had traded 8.2 tonnes of waste, mostly paper, cardboard and plastic. Promoting the endeavour is the Central American Commission on Environment and Development (CCAD).

- The advantages of recycling go far beyond saving the environment, to the extent that it has become a major generator of cash and jobs for Central America.


MIMAT


Reciclados De Centro
America

- Founded in August 1995 as a solution to the environmental pollution problem. Its objective is to recycle plastic waste, generated by the industries and consumers of the region, transforming them into raw materials, used to manufacture products that are useful to society.

- It was the first industrial plastic recycling plant in Central America. Its production is destined for the worldwide industry. The recycling processes: grinding, pelletizing and pulverizing use leading edge technology that guarantees quality and the chemical and physical homogeneity of the materials.

EXPORTS

- North America
  - Canada and the United States
- Central America
  - Belize, El Salvador, Honduras, Nicaragua, Costa Rica and Panamá.
- South America:
  - Brazil and Chile
- Europe
  - Italy and Germany
- Asia:
  - China, Japan and Hong Kong

Raw Material

- PET: POLIENTILEN-TEREFTALATO. Milled, Compact.
- HDPE POLYETHYLENE OF HIGH DENSITY: Milled, Pelet.
- LDPE POLYETHYLENE OF LOW DENSITY: Pelet, Pulverize.
- PP POLIPROPILEN: Pelet.
- PS POLIESTIREN.:
- Policarbonat PC: Milled, Compact.

SIGMA

- Sistemas de Gestion Ambiental (SIGMA), (known as CLEAN in English), was one of four components under the USAID sponsored Central American Program for the Environment (PROARCA).
- Assist municipalities and private industries to access financing by demonstrating the economic benefits of self-financing and/or assisting entities to prepare investment packages.
- Directories for solid waste recycling in Guatemala, Nicaragua, Costa Rica, Honduras, and Panama;

Project Description ...

Landfill Waste

Municipal Solid Waste

Waste is Shredded

(Recyclables) Transfered

Waste is Shredded

Compost is Produced

Mulching Process

(Recyclables) Sold to Vendors

Waste is Dehydrated

Compression Process

Waste is Sorted

VersuTech Process

Herhof Process

Building Materials

Extrusion Process

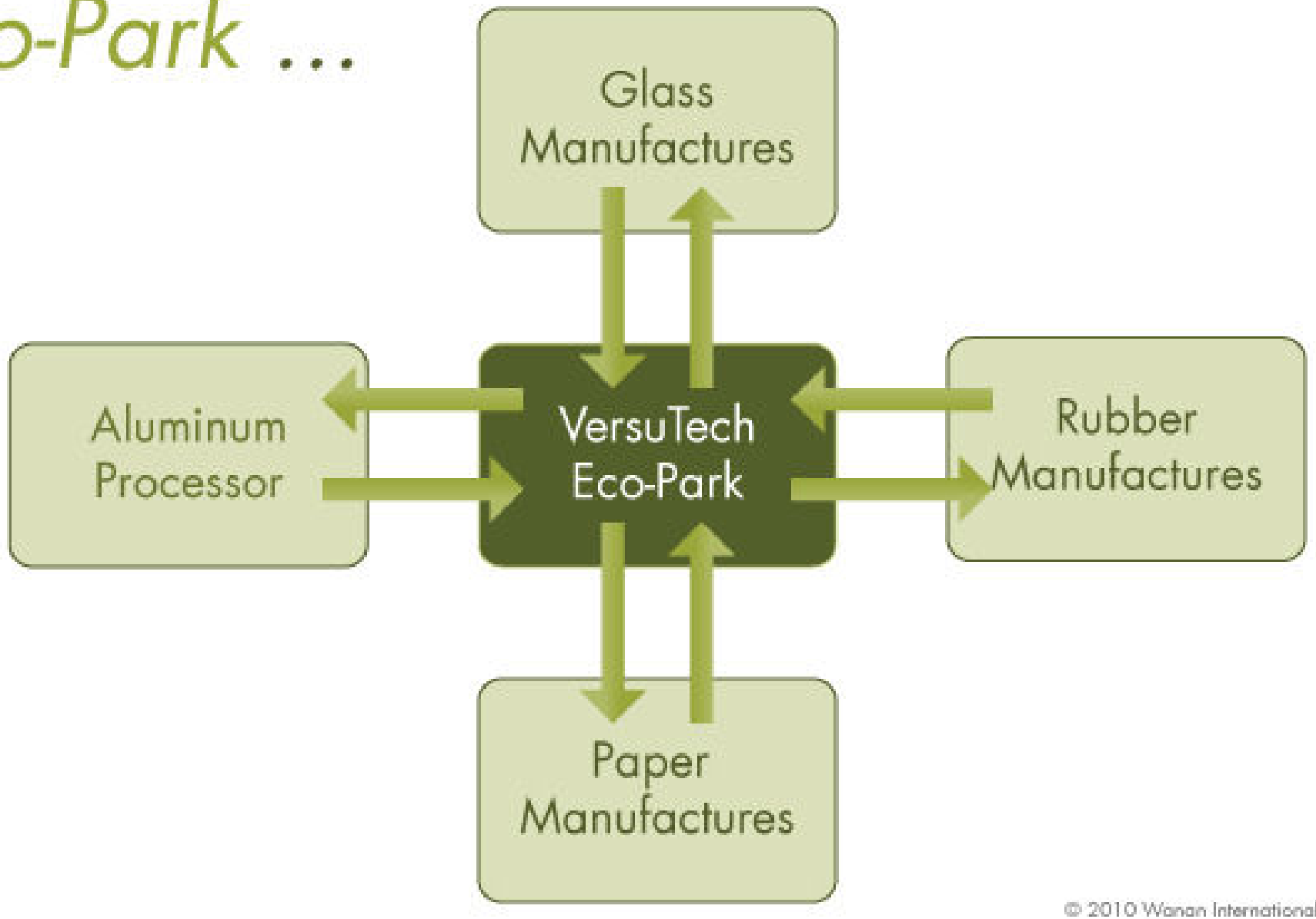
(Combustables) Stabilate Process

*Stabilat Sold to Cement

*Stabilat Sold to Elec.

Wanan Park (California and Puerto Rico)

Eco-Park …



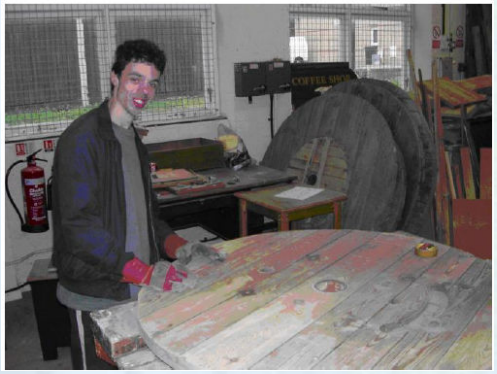
Above: Plywood boards are collected by NCWRP

Laing ORourke is the largest construction company in UK and they are initiating and implementing waste management for their help for the environment. With the help of NISP South Eastern, they make a solution for unused plywood board in Pumbury Hospital Redevelopment site.

Construction waste to community resource, UK

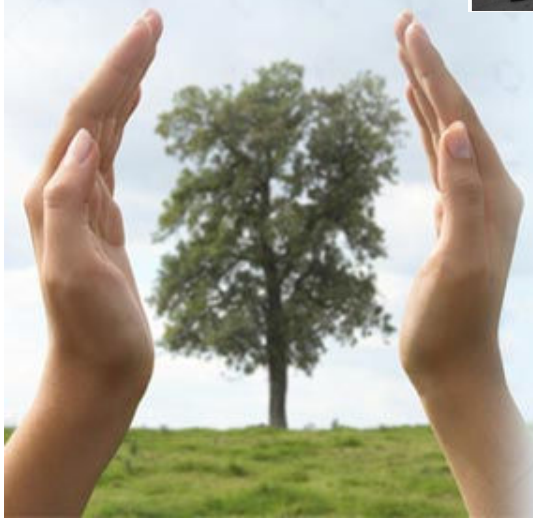
Collection

Denailing of Woods



Cleaning and Recycling

Finish Product

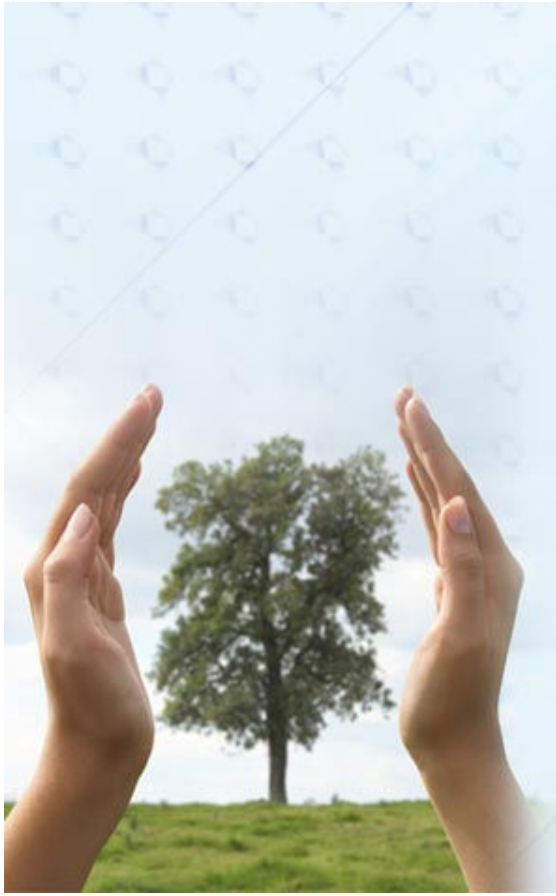


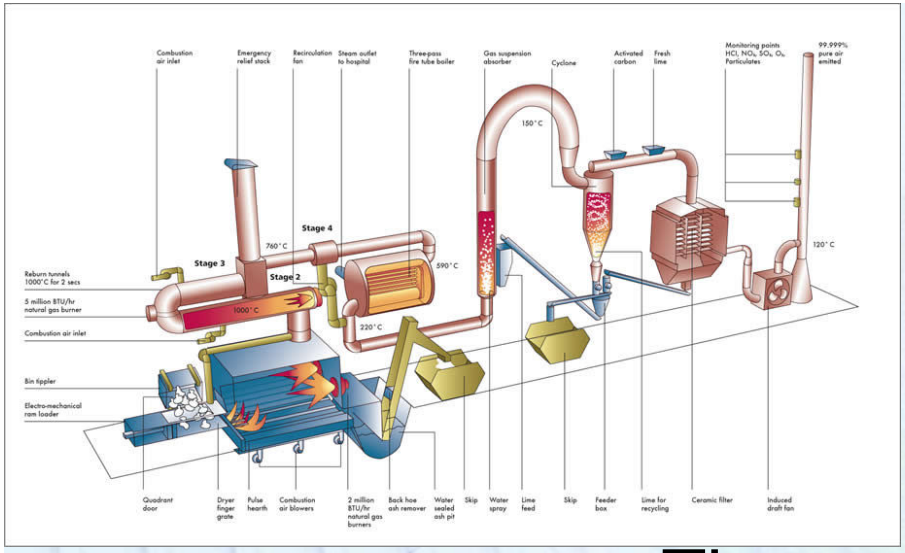
- CO_2 Reduction: 3 tonnes
- Landfill Diverted: 9 tonnes
- Virgin Materials: 9 tonnes

Freshly caught scampi, whose heads and claws have presented diposal problems until now.

Incineration of Scampi Shells

- Scampi contains flesh that is cannot be put in landfill legally (particularly the claws and head part). That is why producers plan to transport them in France and made it as a soup but the environmental and economical cost of it would be high. The area is not yet capable of composting in a high temperature.





Incinerator Process

Incineration of Scampi Shells

- They are also studying that with the use of lime, crustacean shells can also be incinerate. There is a lime industry in Scotland that can be reawakened and can be used as a sustainable alternative to common concrete because of the introduction of recycled aggregates.

Incineration of Scampi Shells

Following are the achievements for this project

- Diversion of 260 tonnes per annum of scampi shells from landfill
- Scampi shells transported in a back-hauling agreement
- Elimination of 13,000 road miles per annum (by not transporting the shells to France)
- Reduced CO2 emissions from improved transportation
- Reduced energy consumption
- New revenue stream for the incinerator
- Reduced disposal costs
- Regulatory compliance

E-waste Material Recovery

- Materials such as gold can be recovered from e-waste
- In developing countries, this is done by the informal waste sector like the e-waste site in Guiyu, China

The Problem of Informal Waste Sectors

- Methods for transforming waste to resources are primitive and done without protective measures
- Causes both environmental and health risks

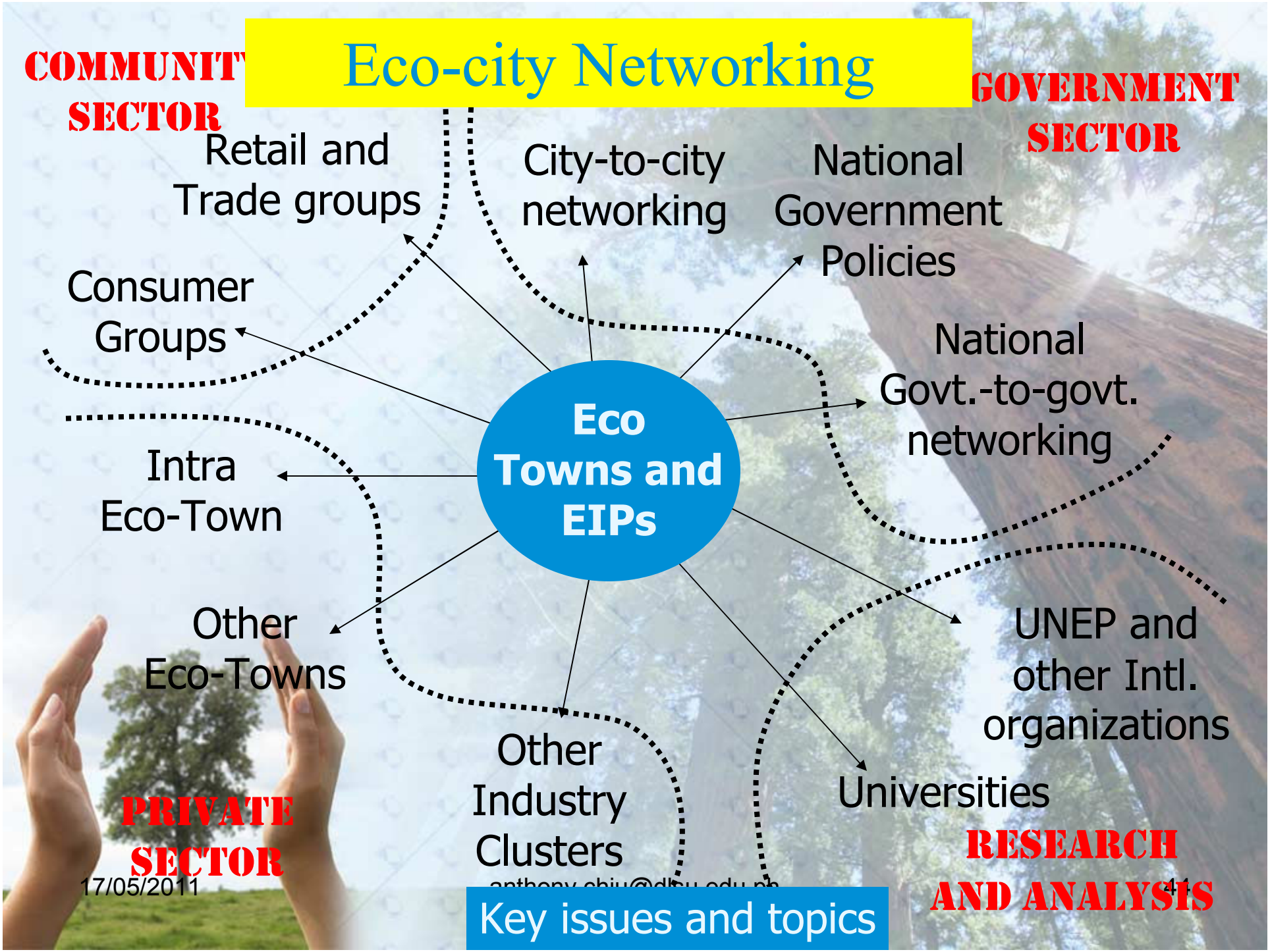
The Importance of the Informal Waste Sector

- Although their methods are primitive, the informal waste sector in developing countries cannot simply be eliminated
- A theoretical study on the incorporation of the informal waste sector in e-waste material recovery showed that eliminating the informal waste sector may not necessarily be beneficial for the environment and for the human health (Tee & Li, 2011)

	Without IWS Site Treatment	With IWS Site Treatment
ECO objective ($)	**6,305,836.474**	**4,348,724.277**
GHG objective ($)	80,618.459	83,777.741
LEAD objective ($)	**1,631,735.548**	**1,637,813.691**
WASTE objective ($)	**605,612.388**	**579,508.605**
Minimized Max Deviation ($)	581,127.747	568,173.617
Deviations from Demand (Lead in kg)	262.899	252.818
Deviations from Demand (Zinc in kg)	1.382	none
Monetary penalty for deviation	2,187,003.892	1,921,420.143
Greenhouse Gas penalty for deviation ($)	53,271.023	50,563.688
Lead penalty for deviation ($)	1,317.260	1,264.092
Waste Penalty for deviation ($)	549,650.419	521,716.133
Economic Transportation Cost ($)	910,171.333	247,512.667
GHG emissions during transportation (kg)	193,918.578	29,899.996
GHG emissions during treatment (kg)	537,000.794	1,144,537.792

The Importance of the Informal Waste Sector

- Enhancing labor skill capability, in combination with the knowledge of grabbing advanced technology, is a value-added asset developing countries wish to achieve
- With better technology and proper training, the informal waste sector may continue to aid in attaining sustainable development without greatly affecting the environment and the human health


Eco-city Networking
COMMUNITY SECTOR
GOVERNMENT SECTOR
Retail and Trade groups
City-to-city networking
National Government Policies
Consumer Groups
National Govt.-to-govt. networking
Eco Towns and EIPs
Intra Eco-Town
Other Eco-Towns
UNEP and other Intl. organizations
Other Industry Clusters
Universities
PRIVATE SECTOR
RESEARCH AND ANALYSIS
Key issues and topics

Eco-city Networking

COMMUNITY SECTOR

GOVERNMENT SECTOR

Consumption patterns

Policies

Strategies

Eco-Town Baseline Database

Demand

Finances

Eco Towns and EIPs

TBL Reporting

Criteria and indicators

Guidelines

Mgmt Tools

Input-Output Tables

Best Practices

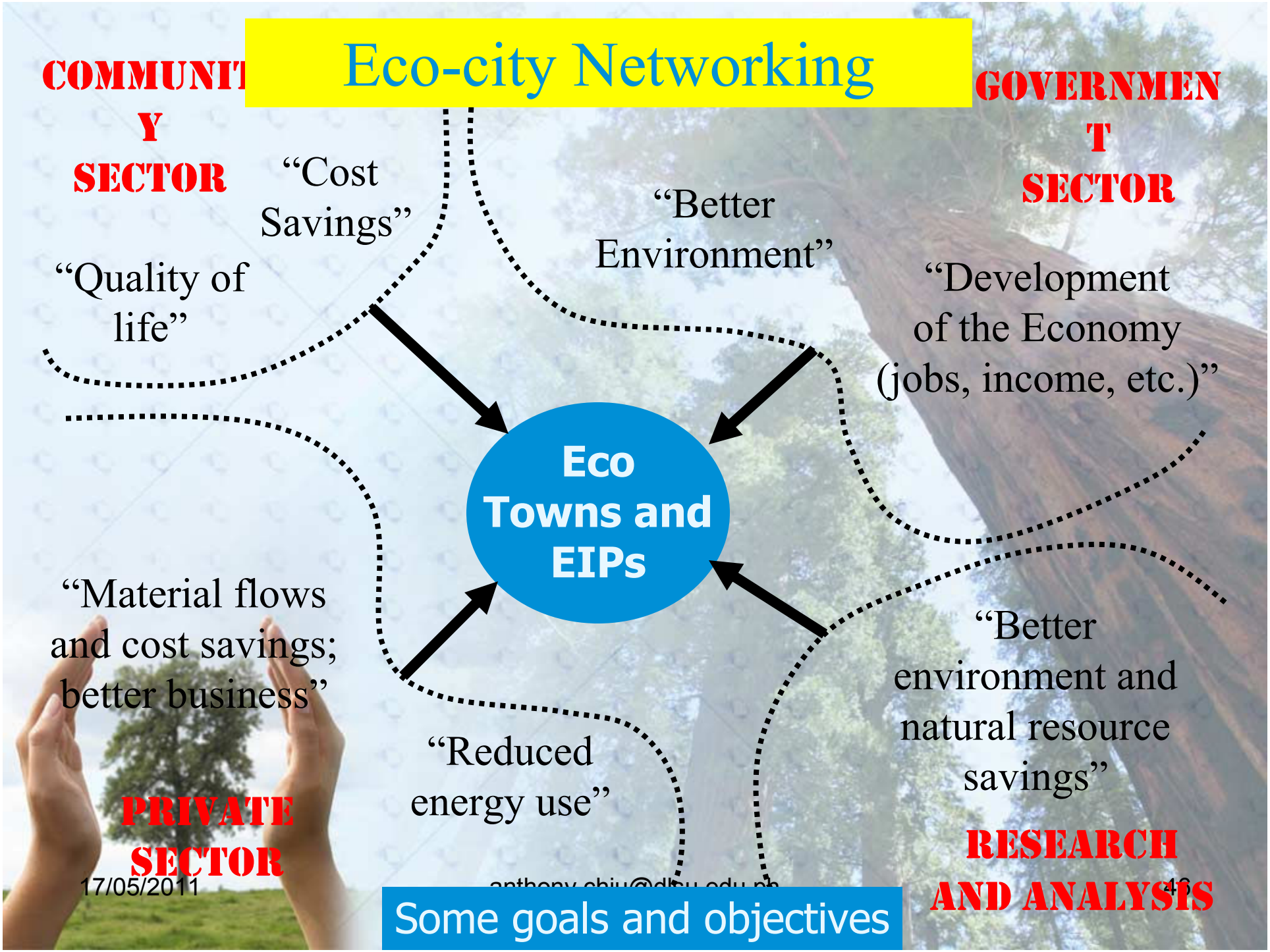
Just do it!

PRIVATE SECTOR

RESEARCH AND ANALYSIS

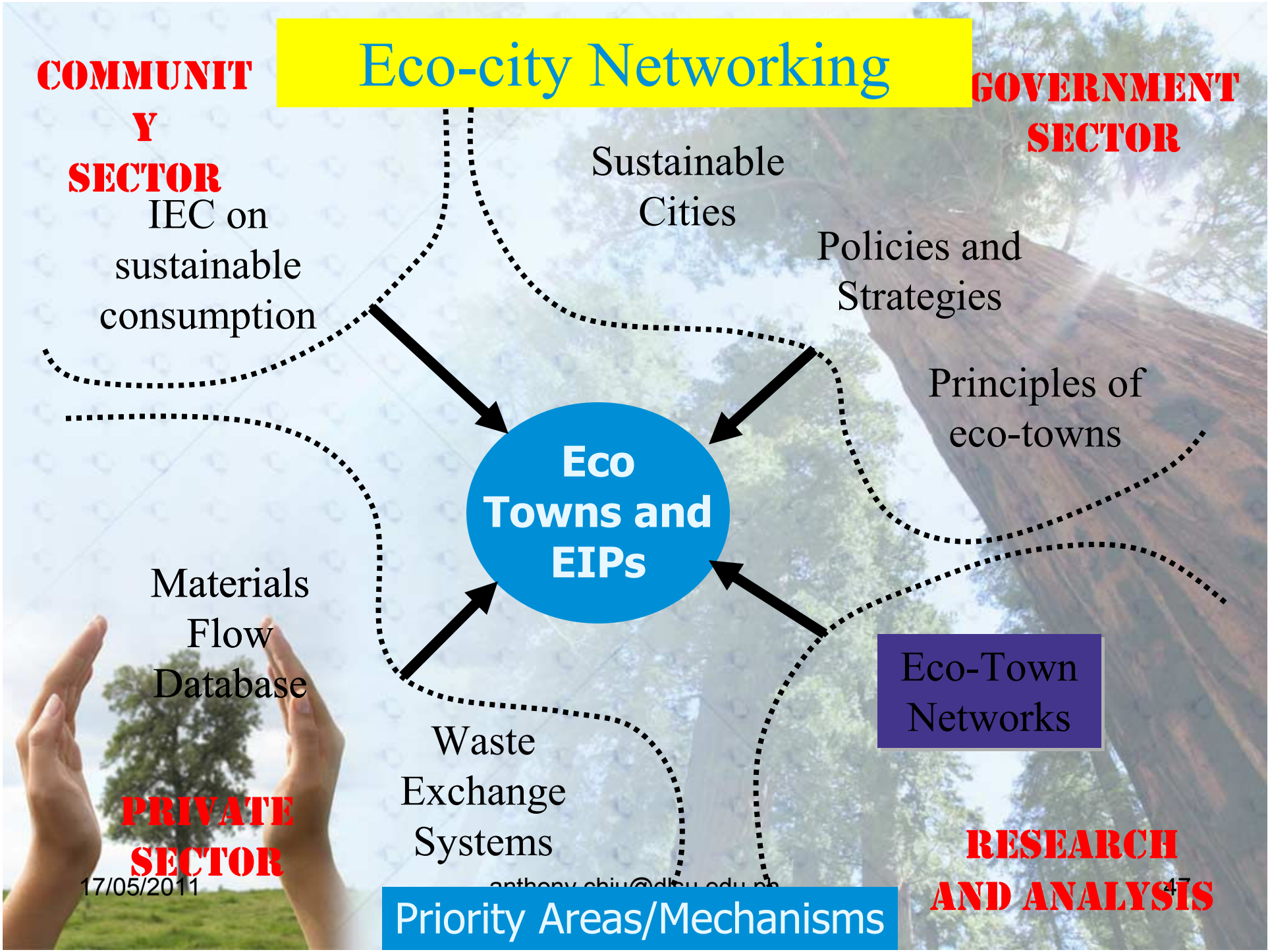
What can we do?

Eco-city Networking



Some goals and objectives

anthony.chiu@dlsu.edu.ph


Eco-city Networking
COMMUNITY SECTOR
GOVERNMENT SECTOR
Sustainable Cities
IEC on sustainable consumption
Policies and Strategies
Principles of eco-towns
Eco Towns and EIPs
Materials Flow Database
Eco-Town Networks
Waste Exchange Systems
PRIVATE SECTOR
RESEARCH AND ANALYSIS
Priority Areas/Mechanisms

Thank you very much for your attention!

Anthony SF Chiu

anthony.chiu@dlsu.edu.ph