

國立臺北大學自然資源與環境管理研究所
104 學年度第二學期『清潔生產與工業生態』

課程進度(12)：工業生態學分析工具－工業生態系統
 Analysis of Technological Systems: Industrial Ecosystem

● **SYSTEM ANALYSIS (G&A, Chp.15, p.233)**

- The Systems Concept
 - ⇒ A system may be thought of as a group of interacting, interdependent parts linked together by exchanges of energy, matter, and/or information, and subject to a common plan or serving a common purpose.
 - ⇒ Linear vs. Complex systems => Butterfly effects => System Dynamics
- The Adaptive Cycle => Evolving Systems
- Holarchies and Adaptive Management of Technological Holarchies

TABLE 15.1 Distinctions Between Unitary Systems and Holarchies

Area	Unitary system	Holarchy
Focus	Single complex system	Multiple complex integrated holons
Objective	Achieve a purpose	Optimize holarchic functions
Expectation	Solution	Appropriate response to situation
Boundaries	Fixed	Fluid
Problem	Defined	Emergent
Goals	Unitary	Pluralistic
Approach	Intellectually rigorous	Intellectually adaptive

Source: Adapted from C. Keating, et al., System of systems engineering, *Engineering Management Journal*, 15 (3), 36-45, 2003.

● **INDUSTRIAL ECOSYSTEMS (G&A, Chp.16, p.245)**

- The Ecosystems Concept
 - ⇒ Hierarchy, Food Chains and Food Web
 - ⇒ Exchange of Materials, Energy, and Information
- Industrial Food Chain and Industrial Food Web
- Industrial Symbiosis
 - ⇒ Category 1: Through Waste Exchanges
 - ⇒ Category 2: Within a Facility, Firm, or Organization
 - ⇒ Category 3: Among Co-Located Firms in a Defined Industrial Area
 - ⇒ Category 4: Among Nearby Firms Not Co-located
 - ⇒ Category 5: Among Firms Organized across a Broader Region
- Design and Develop Symbiotic Industrial Ecosystems
- Uncovering and Stimulating Industrial Ecosystems
- Island Biogeography and Island Industrogeography

● **INDUSTRIAL SYMBIOSIS (Chertow, 2004, Industrial Symbiosis, Encyclopedia of Energy)**

- Definition and the Kalundborg Model

- Elements and Tools of Industrial Symbiosis
 - ⇒ Embedded Energy and Materials
 - ⇒ Life Cycle Perspective
 - ⇒ Cascading and Loop Closing
 - ⇒ Tracking Material Flows, Industrial Inventories
 - ⇒ Input /Output Matching and Materials Budgeting
 - ⇒ Stakeholder Processes
- Spatial Scale of Industrial Symbiosis: 5 Types

● ECO-INDUSTRIAL PARKS, ENVIRONMENTAL SCIENCE AND TECHNOLOGY PARKS

- Categories of Eco-Industrial Park (蔣本基 , 2007)
 - http://estp.epa.gov.tw/Document/eco_training_prof.Jan960402.pdf
 - ⇒ Green Industrial Park
 - ⇒ Integrated Eco-industry Parks
 - ⇒ Networked Eco-industrial Park System
 - ⇒ Building green supply chains in eco-industrial parks towards a green economy: Barriers and strategies ([link](#))
- Eco-Industrial Park and Eco-Town
- Environmental Science and Technology Parks
 - ⇒ Recycling and Resource Recovery Technology
 - ⇒ Pollution Prevention Technology
 - ⇒ Energy related Technology
- 環保科技園區的「美麗與哀愁」
 - ⇒ [10 年成果回顧](#) [監察院糾正](#) [立法院凍結預算](#)
- Industrial Symbiosis of Existing Industrial Parks

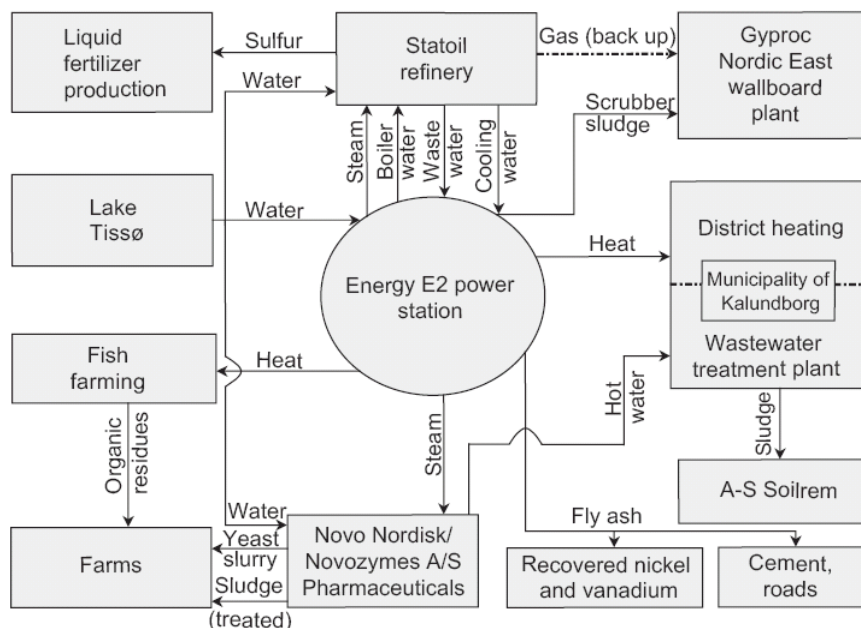


FIGURE 1 The industrial symbiosis at Kalundborg, Denmark.

(Chertow, 2004, Industrial Symbiosis, Encyclopedia of Energy)