國立臺北大學自然資源與環境管理研究所

112 學年度第二學期『清潔生產與工業生態學』

課程進度(14)：工業生態學－系統分析與情境模擬
Thinking Ahead: Systems Analysis and Scenario Simulation

- INTRODUCTION TO SYSTEMS ANALYSIS (G&A, Chp.15)
  - □ Industrial Ecology = Systems Analysis + Life Cycle Assessment
    Industrial Ecology Programme (IndEcol) - NTNU
  - □ The Systems Concept (G&A, Chp.15, pp.211-213)
    - ⇨ A General Definition of a System: A Group of interacting, interdependent parts linked by exchanges of energy, matter, and/or information
    - ⇨ Simple Systems vs. Complex Systems => "Context"
    - ⇨ Linear Systems vs. Nonlinear Systems => Circularity?
    - ⇨ The "Butterfly Effect"
  - □ The Adaptive Cycle (G&A, Chp.15, pp.213-215)
    - ⇨ Adaptive Management => Adaptation vs. Mitigation
  - □ "Holarchies"=> Holistic Hierarchies? (G&A, Chp.15, pp.215-217)
    - ⇨ Holon and Holarchy
    - ⇨ Adaptive Management of Technological Holarchies

- MODELING IN INDUSTRIAL ECOLOGY SCENARIOS (G&A, Chp.22)
  - □ Industrial Ecology Model
    - ⇨ Conceptual Models vs. Mathematical Models
  - □ Building the Conceptual Model
    - ⇨ Class 1 Industrial Ecology Model: "Sequential Process"

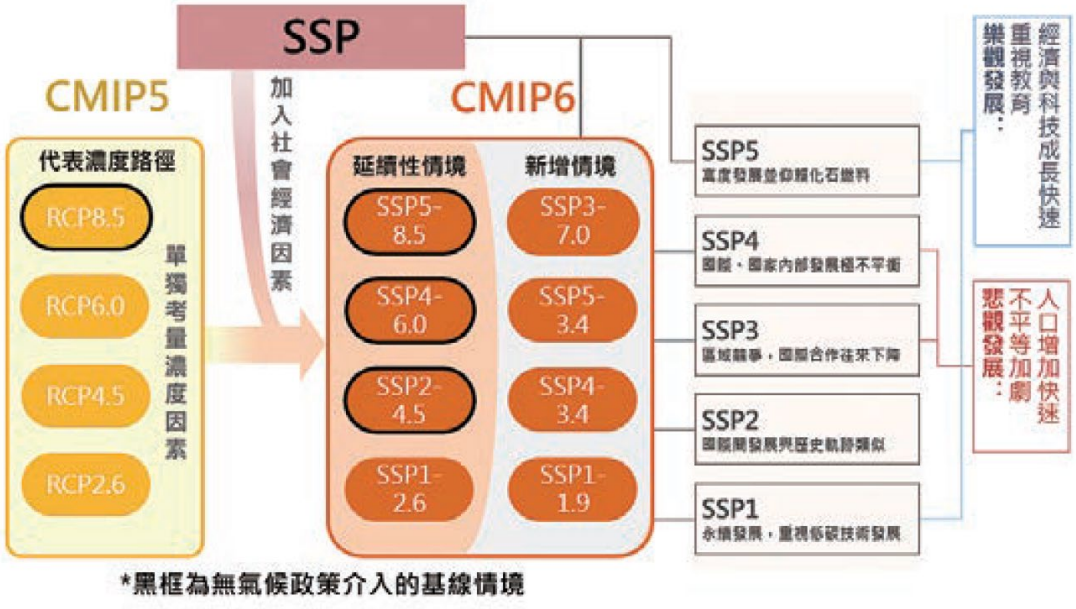
TABLE 22.1 Definitions of Terms Related to Model Building and Data Acquisition

Term	Definition
Scales	The spatial, temporal, quantitative, or analytical dimensions used to measure and study an object or process of interest.
Extent	The size of a scale dimension.
Resolution	The precision used in measurement.
Levels	The units of analysis that are located in the same position on a scale. Many conceptual scales contain levels that are ordered hierarchically, but not all levels are necessarily linked to one another in a hierarchical system.

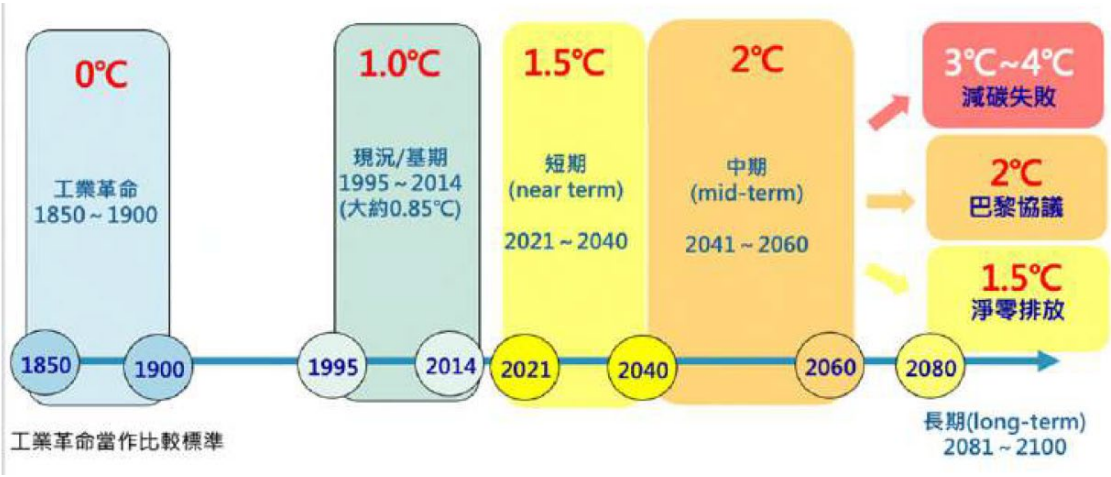
Source: Adapted from C.C. Gibson, E. Ostrom, and T.K. Ahn, The concept of scale and the human dimensions of global change: A survey, *Ecological Economics*, *32*, 217–239, 2000.

  - ⇨ Class 2 Industrial Ecology Model: "Multifold Considerations?"
  - ⇨ Class 3 Industrial Ecology Model: "System Dynamics Model?"
  - □ Running and Evaluating Industrial Ecology Models
    - ⇨ Implementing the Model
    - ⇨ Model Validation vs. Parameter Verification
      => Accreditation, Certification, Validation, Verification (認證 驗證 確證 查證)

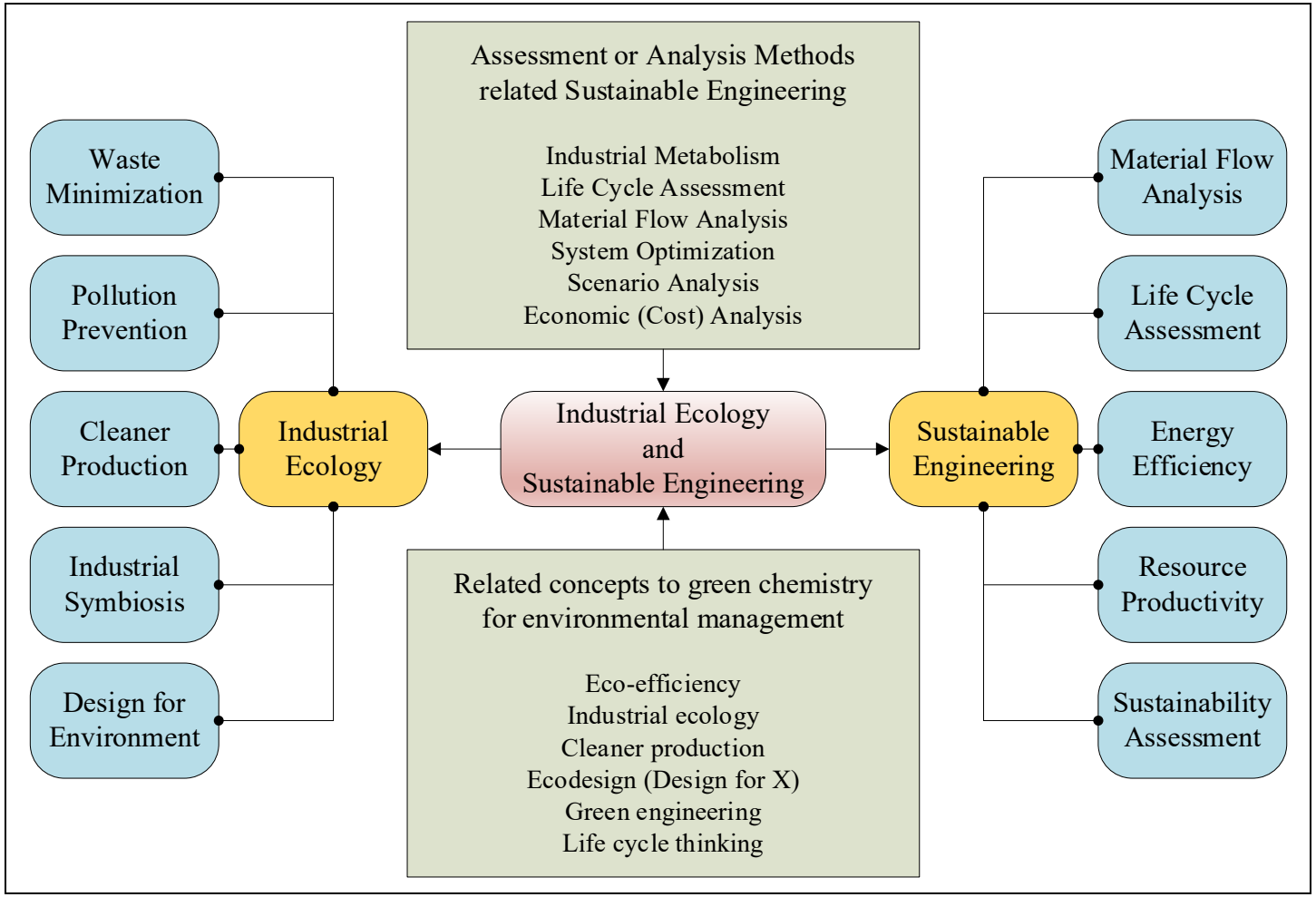
- INDUSTRIAL ECOLOGY SCENARIOS (G&A, Chp.23)
  - □ Industrial Ecology Scenario
    - ⇨ Conceptual Scenarios vs. Mathematical (Quantitative) Scenarios
  - □ Building the Scenario
    - ⇨ Evolutionary Behavior vs. Disruptive Behavior
    - ⇨ BAU – Business as Usual => Baseline
    - ⇨ Decision Support vs. Decision Making
  - □ Examples and the Status of Industrial Ecology Scenarios
  - □ Describing Possible Future
    - ⇨ "Prediction" Models and Utility of Scenarios
    - ⇨ The IEA Scenarios (NZE, Announced Pledges Scenario, and Stated Policies Scenario)
      Understanding GEC Model scenarios – Global Energy and Climate Model – Analysis - IEA
    - ⇨ Scenarios Analysis of TCFD => Related Scenarios of Climate Change
    - ⇨ IPCC AR6 Scenarios SSPx-y:
      SSPx-y => (Shared Socioeconomic Pathway)x + (Representative Concentration Pathways)y
      :::氣候變遷科學報告-第一章 https://www.moenv.gov.tw/File/9388ACC59F140034



    - ⇨ 國家氣候變遷調適行動計畫（112-115 年）：固定暖化情境



  - □ Scenario vs. Pathway



Topics and Context of Industrial Ecology and Sustainable Engineering