Industrial Engineering and Management in Sustainability Development

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IE 與綠能/永續發展論壇

101 年度國科會工工學門成果發表會

2013/11/9

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."
(Brundtland Commission of the United Nations, 1987)

"Sustainability requires the reconciliation of **environmental, social equity** and **economic demands** - also referred to as the "three pillars" of sustainability (3 Es)." (2005 World Summit on Social Development)

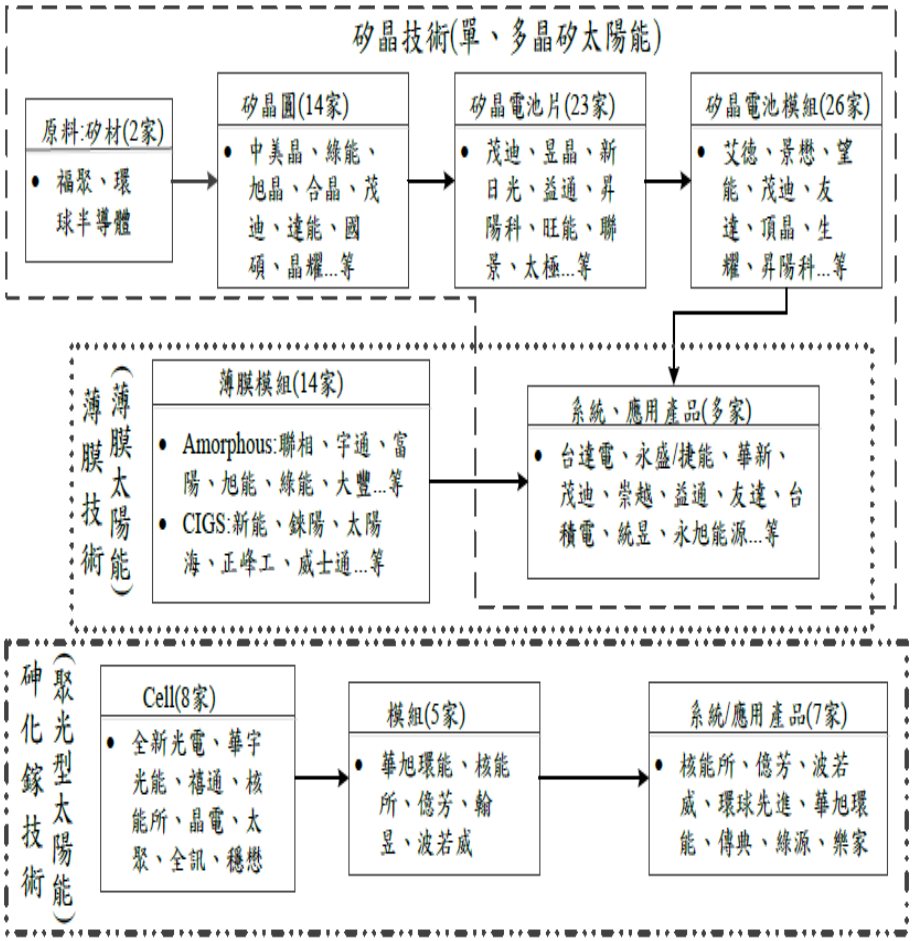
Some Research Scopes and Topics

- ✓ **Renewable and Sustainable Energy**
- ✓ Green Product Development
- ✓ **Green Innovation – Patents and Intellectual Properties**
- ✓ Green Accounting – ISO14051 Material Flow Cost Accounting
- ✓ **Policies - Feed-in Tariff , Carbon Tax, Eco-Tax, Government Incentives and Subsidies**

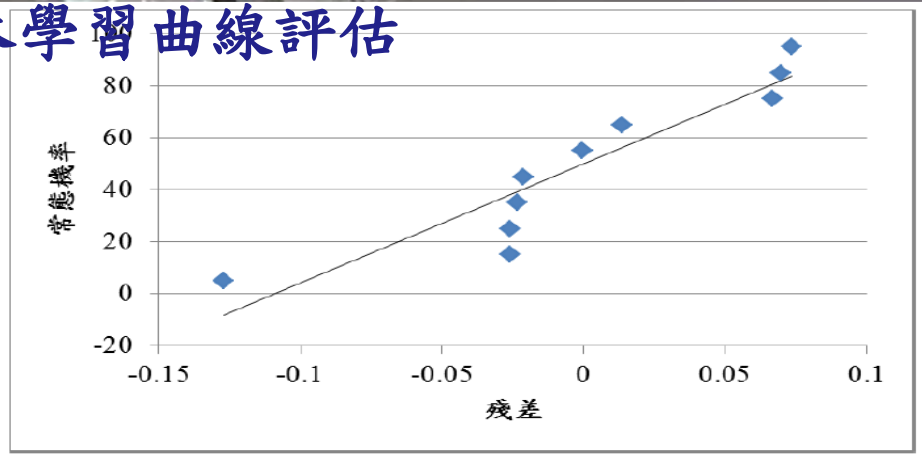
Renewable and Sustainable Energy

1. The Evaluation and Analysis of the Carbon Footprint of the Renewable Energy Living（再生能源生活圈碳足跡評量方法建立與分析，工研院綠能所）
2. Construct the Cost Learning Curve Model of Installing Renewable Energy（建構再生能源建置成本的學習曲線評估，工研院綠能所 ）
3. Analyzing Renewable Energy Policy Using Data Mining Techniques（利用資料採礦方法建構再生能源政策分析模式，工研院綠能所）

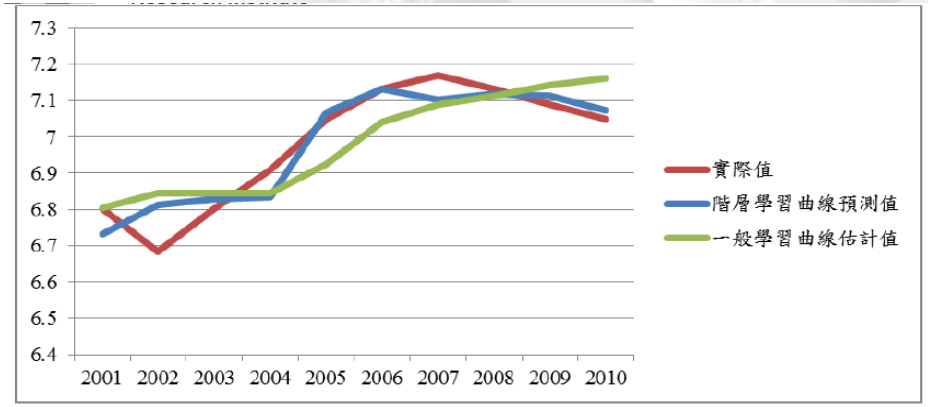
再生能源建置成本學習曲線評估



圖一、國內太陽能產業鏈示意圖



圖二、、風力學習曲線模型的殘差常態機率圖



圖三、階層學習曲線、一般學習曲線與實際建置成本之比較

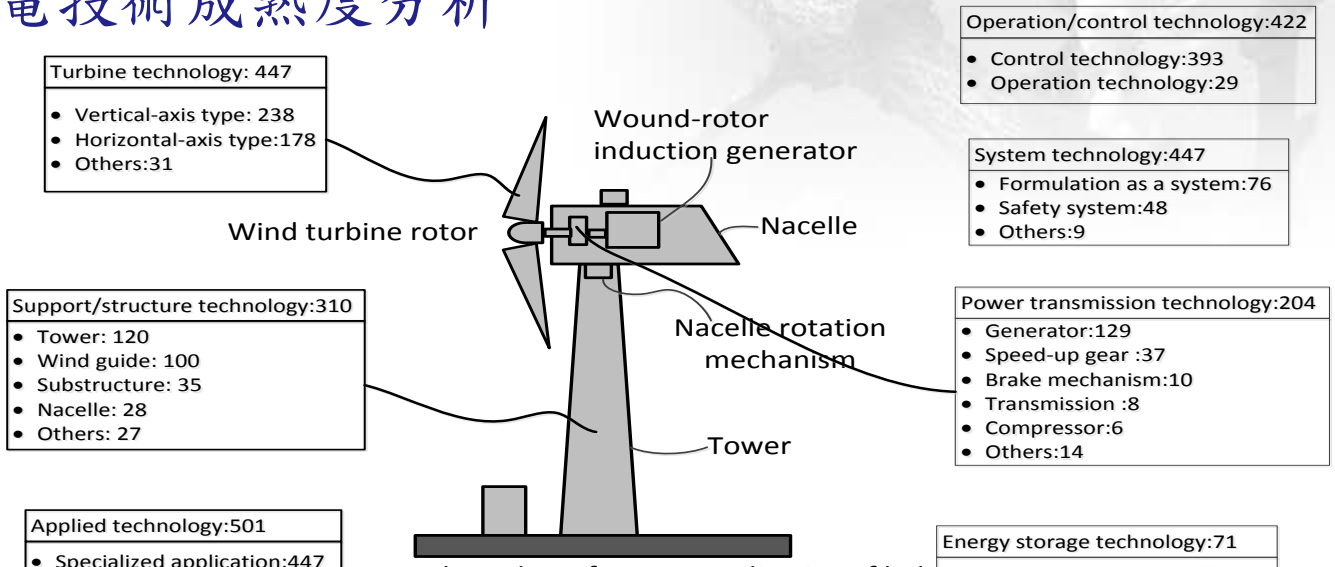
Refer to Trappey, et al., "A Hierarchical Cost Learning Model for Developing Wind Energy Infrastructures," *International Journal of Production Economics*, 2013, URL:

Green Innovation - Patents and Intellectual Properties

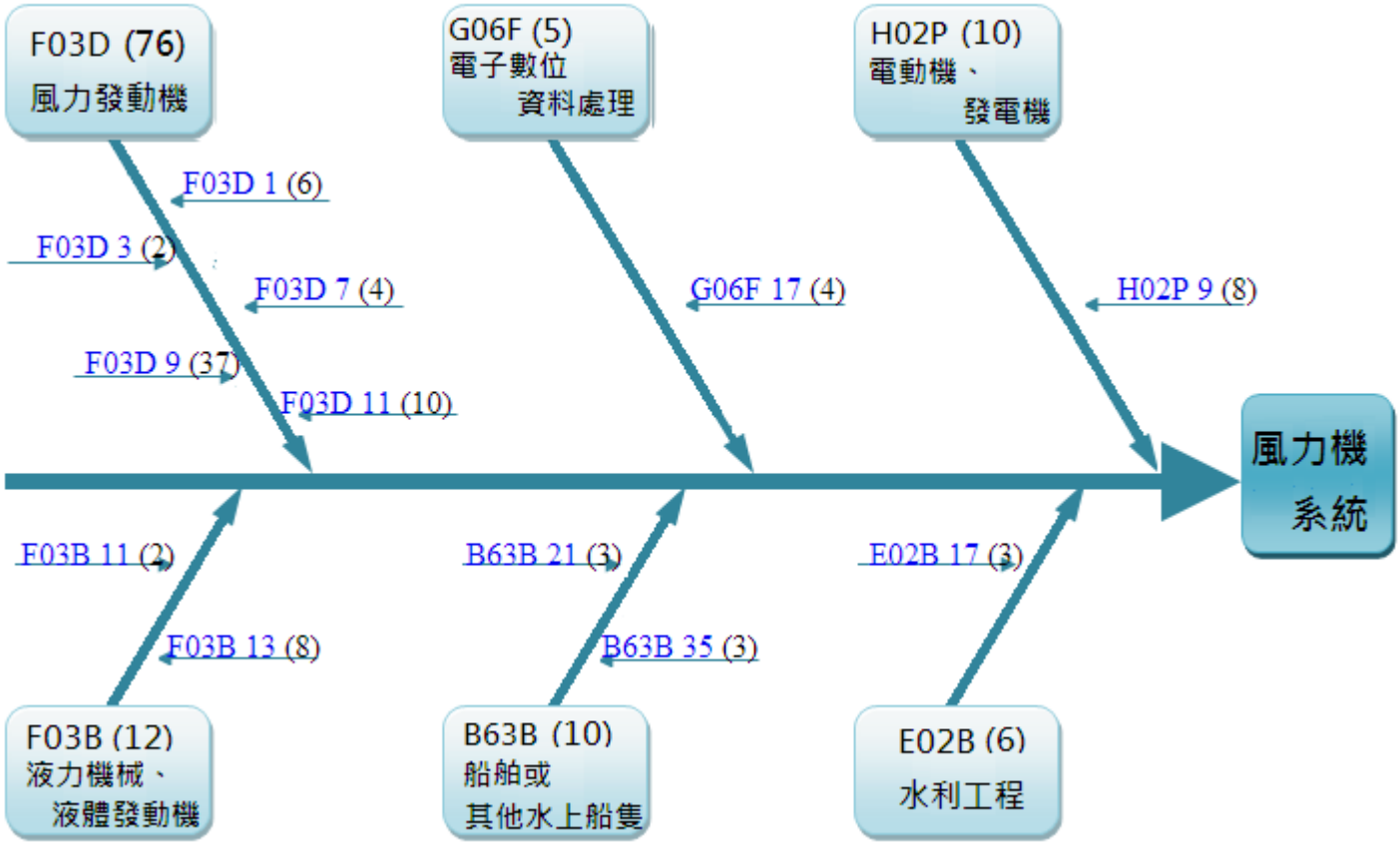
- 基於離岸風電關鍵技術開發與推動政策支援之動態專利分析及觀測平台建構（能源國家型計畫）
- 綠能產業技術資產盤點與智財攻防分析方法論及E化平台（邁頂計畫）

基於離岸風電關鍵技術開發與推動政策支援之動態專利分析

- 離岸風力發電技術知識本體論之推演與建構
- 離岸風力發電動態專利之檢索
- 離岸風力發電動態專利分析與觀測 Web 平台建置
- 離岸風力發電技術成熟度分析



OWP專利蒐集 ➡ 關鍵技術 ➡ 子技術分支 ➡ 國際分類碼 IPC



converter
routes
converting
onopole
nd park
conveying
ements
on
paths
collision

electronic and digital data processing

motor, generators and converter

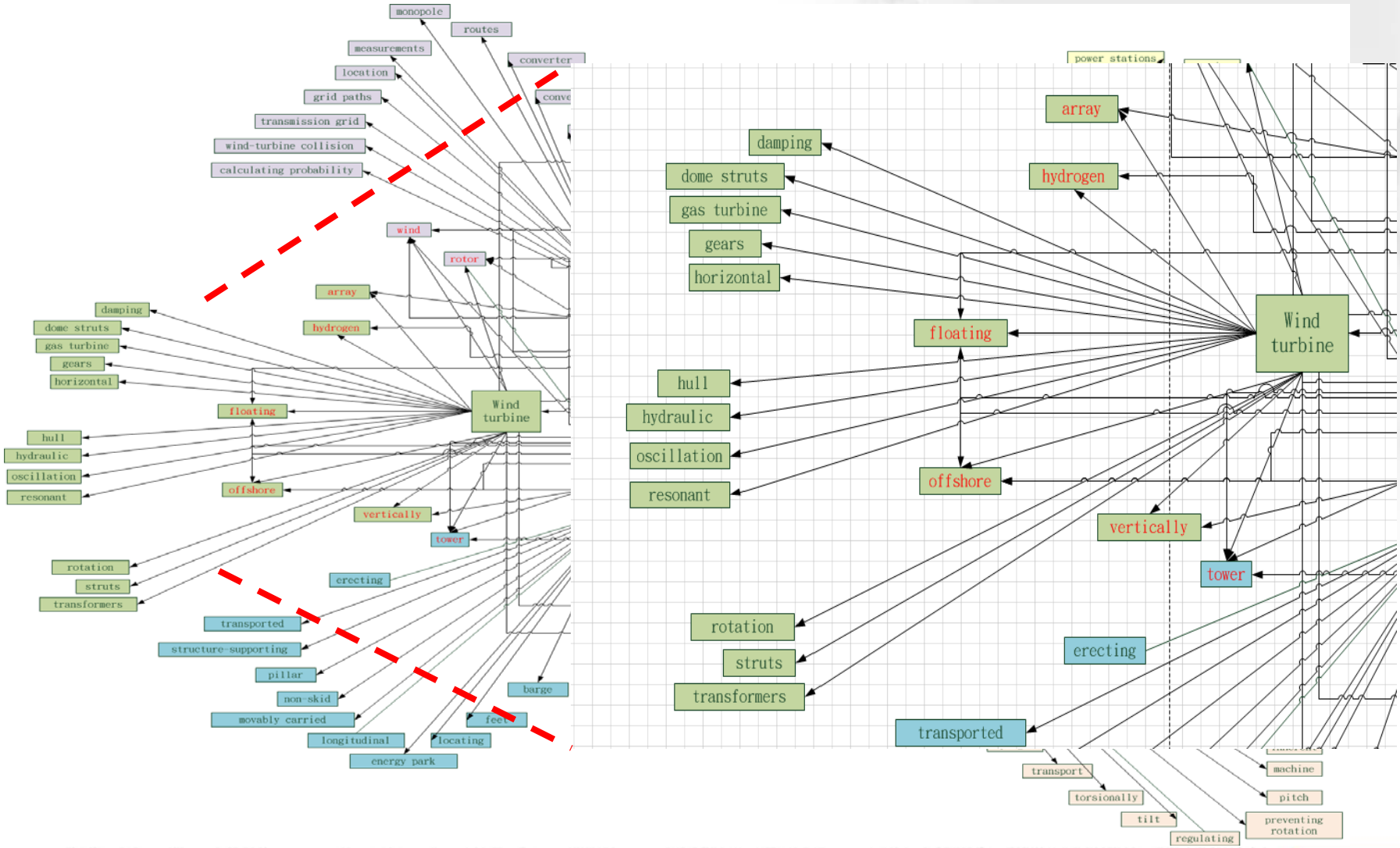
wind turbine

wind turbine system

hydraulic machine

hydraulic engineering

ships and vessels


monopole
routes
measurements
converter
location
grid paths
transmission grid
wind-turbine collision
calculating probability
wind
rotor
array
hydrogen
damping
dome struts
gas turbine
gears
horizontal
floating
Wind turbine
hull
hydraulic
oscillation
resonant
offshore
vertically
tower
rotation
struts
transformers
erecting
transported
structure-supporting
pillar
non-skid
movably carried
longitudinal
energy park
locating
barge
power stations
array
hydrogen
damping
dome struts
gas turbine
gears
horizontal
floating
Wind turbine
hull
hydraulic
oscillation
resonant
offshore
vertically
tower
rotation
struts
transformers
erecting
transported
transport
machine
torsionally
pitch
tilt
preventing rotation
regulating

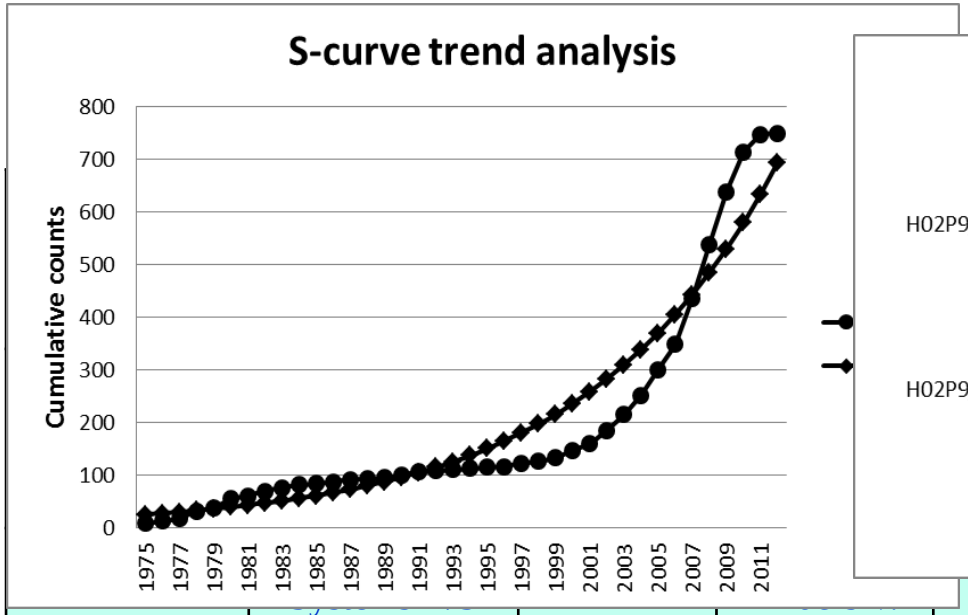
專利清單之搜尋

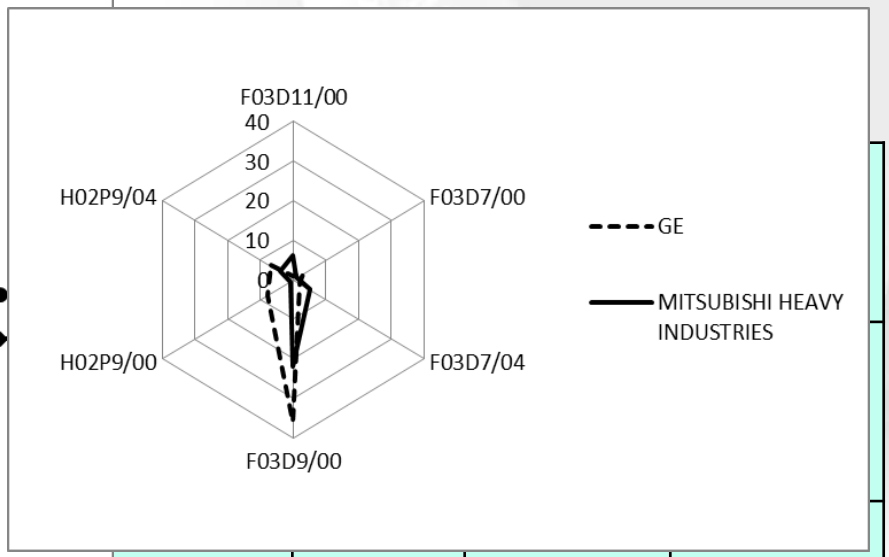
turbine	
專利號	名稱
6520737	Offshore wind turbine with liquid-cooling
6891280	Method for operating offshore wind turbine plants based on the frequency of their towers
6993965	Horizontal axis wind turbine and method for measuring upflow angle
7075189	Offshore wind turbine with multiple wind rotors and floating system
7100438	Method and apparatus for determining a site for an offshore wind turbine
7112010	Apparatus, systems and methods for erecting an offshore windturbine assembly
:	

tower	
專利號	名稱
6891280	Method for operating offshore wind turbine plants based on the frequency of their towers
7317260	Wind flow estimation and tracking using tower dynamics
7365446	Wind power plant having power module mounted on towerfoundation and method for use in constructing same
7663263	Wind turbine power module mounted on the tower foundation
7735290	Wind turbine assembly tower
7786612	Wind turbine power module mounted on the tower foundation
:	

generator	
專利號	名稱
6911126	Electrolytic regenerator
7238009	Offshore windmill electric generators
7443066	Methods and apparatus for cooling wind turbine generators
7728450	Generator output circuitry for twin turbine wind power generating system
7821147	Rapid response portable hybrid emergency energy generator
7880335	Power backup system for offshore wind generators

Technology Maturity and Competitive Analyses

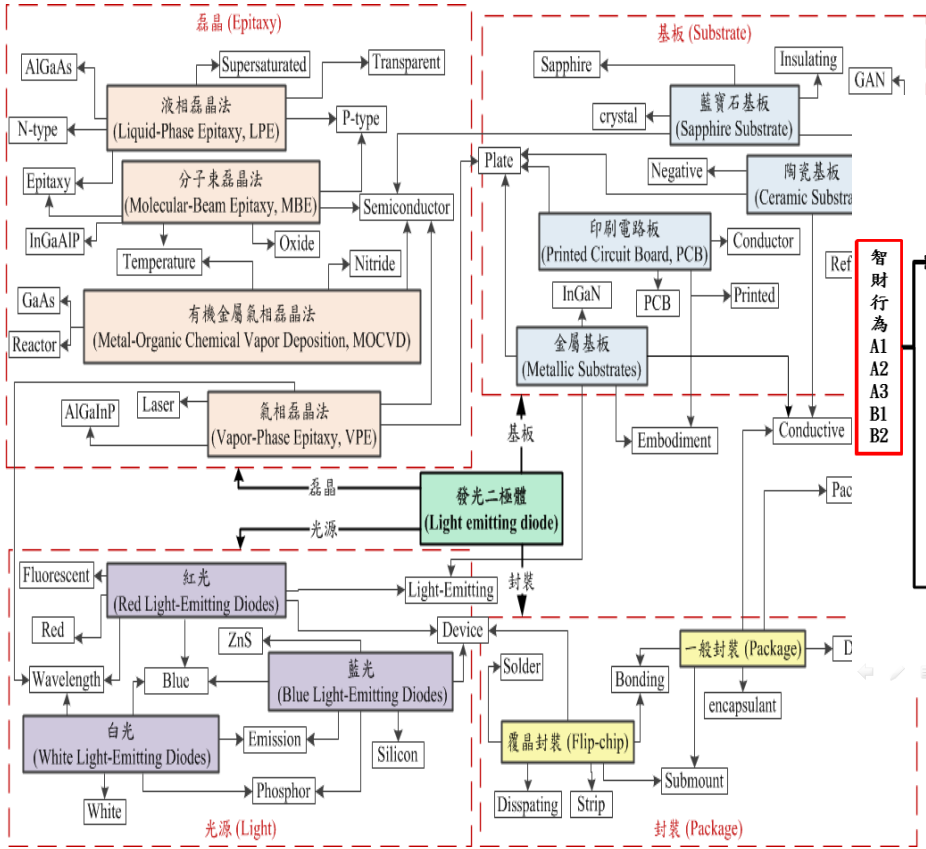




US5225712	U.S. Windpower, Inc.	Canada	Erdman; William L.	F03D7/04	22	161	7.31

Refer to Trappey, A.J.C., et al, "Dynamic patent analysis of wind power systems and engineering asset development," Proceedings, 8th World Congress on Engineering Asset Management (WCEAM 2013), Hong Kong, Oct. 30-Nov. 1, 2013.

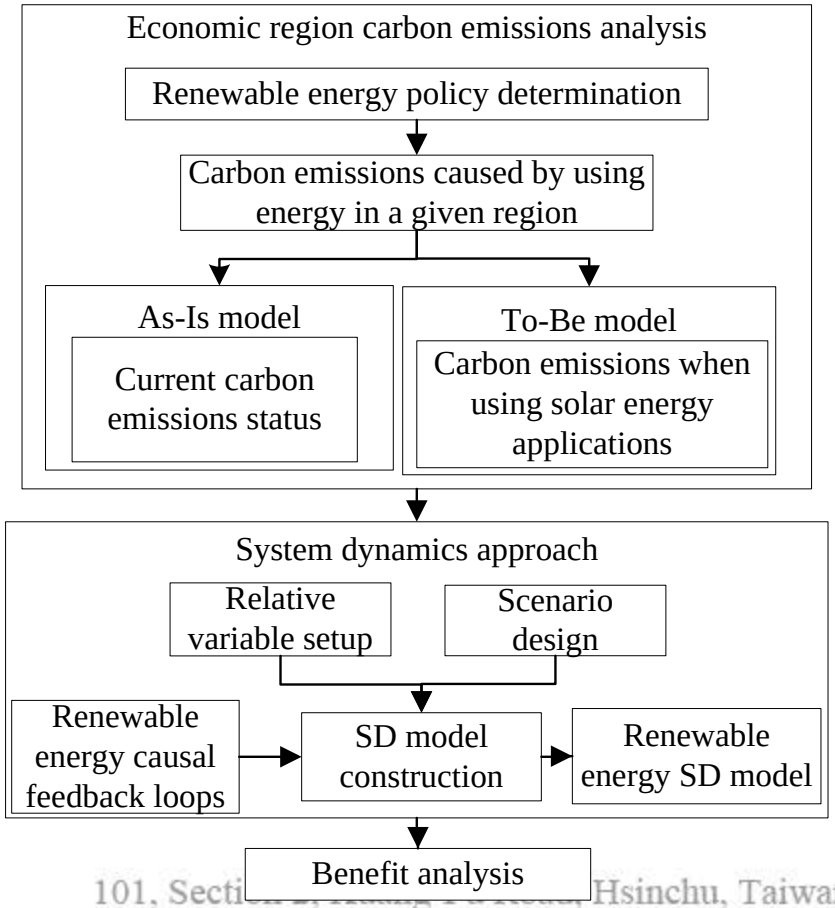
綠能產業技術資產盤點與智財攻防分析方法論及E化平台



智財策略支援法則第二階流程圖

Refer to Trappey, et al, "Ontology-based Patent Licensing and Litigation Strategic Knowledge System for the Light Emitting Diode Industry," *International Journal of Automation and Smart Technology, 2013.*

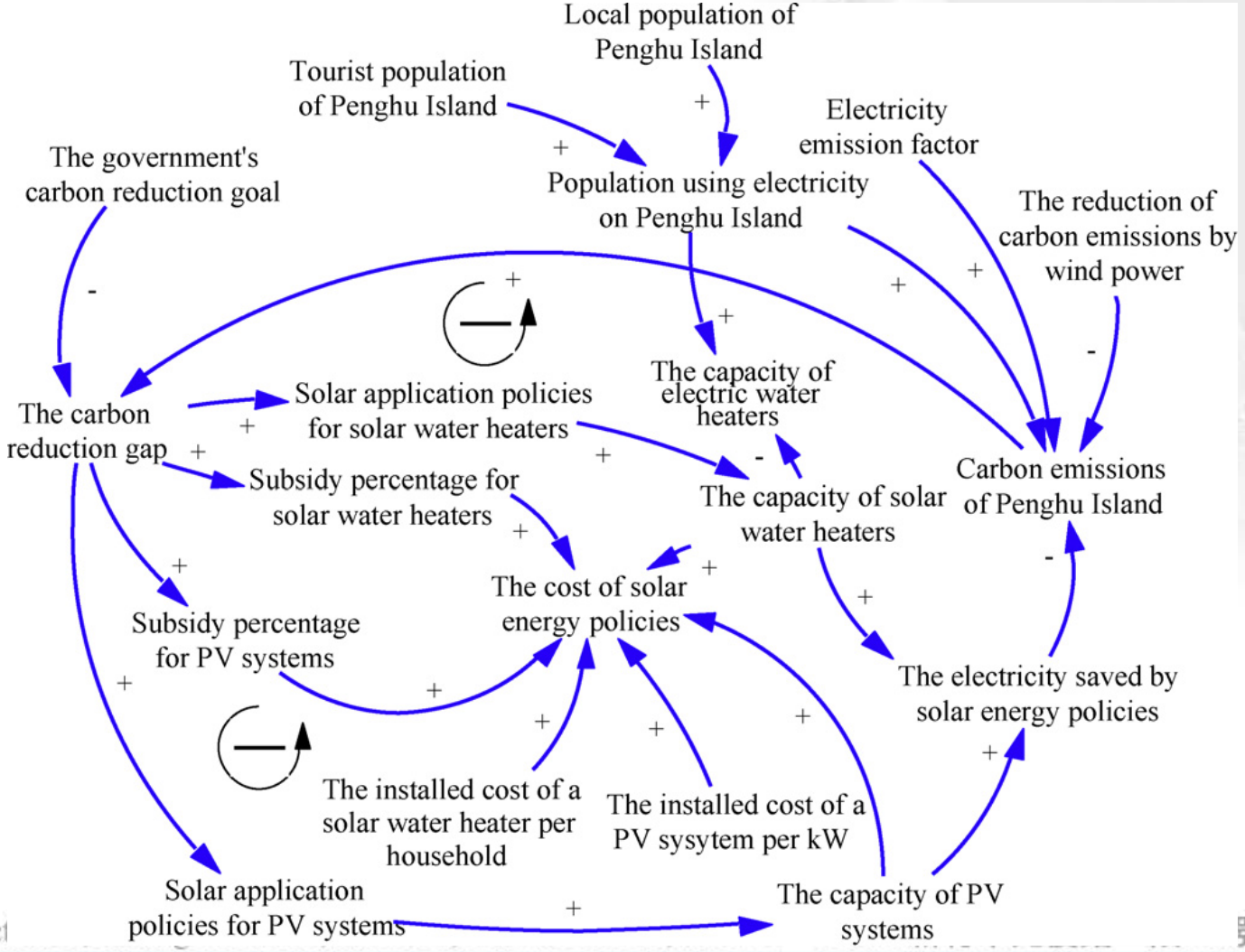
System Dynamics Evaluation of Renewable Energy Policies



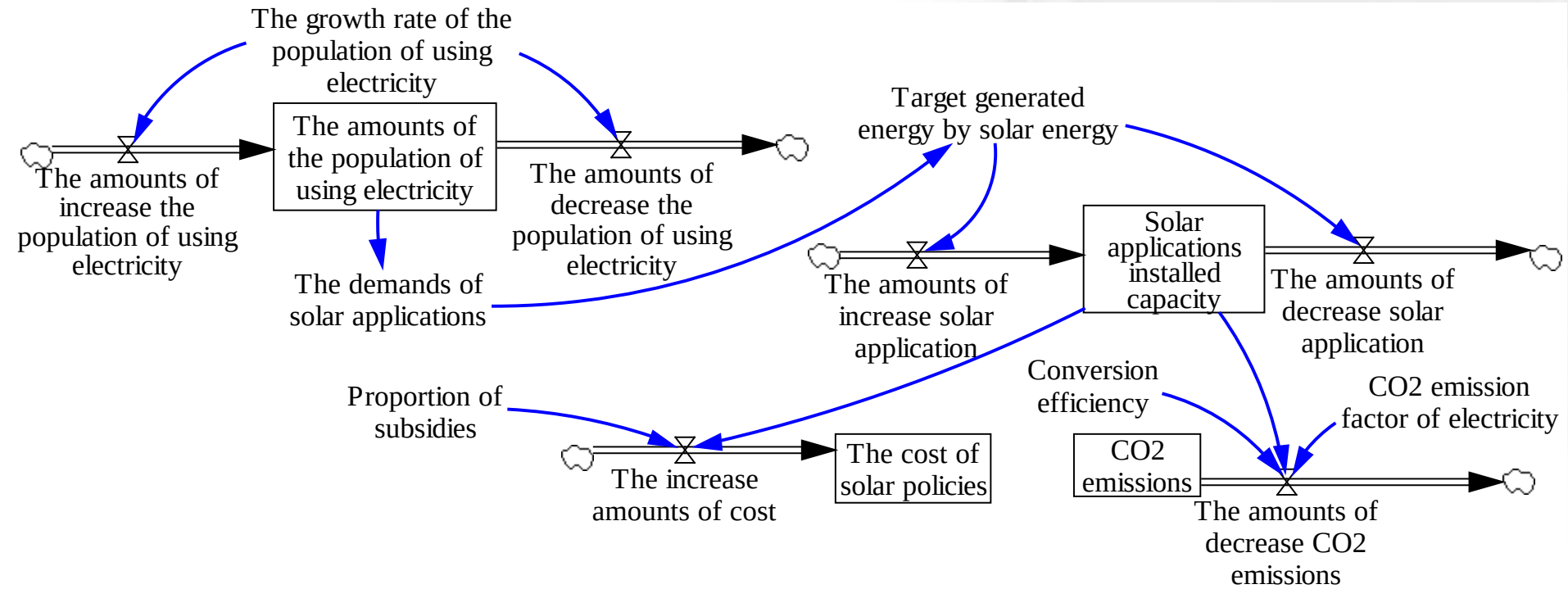
Methodology in three parts:

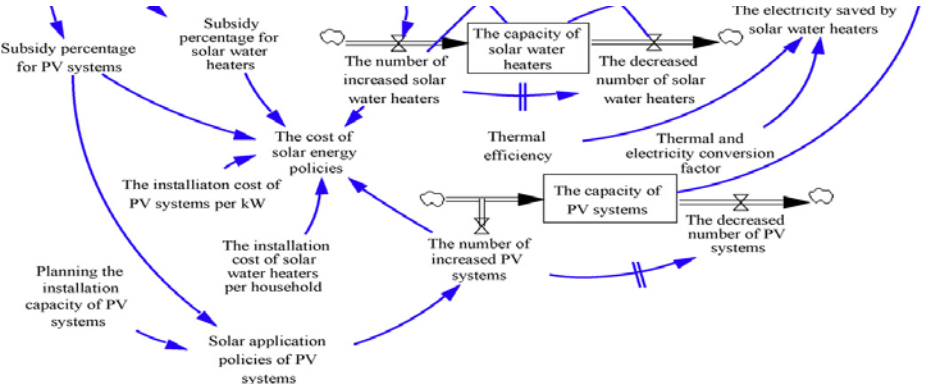
- Economic region carbon emissions analysis
- System dynamics approach
- Benefit analysis

- The Renewable Energy Policies Causal Feedback Loops



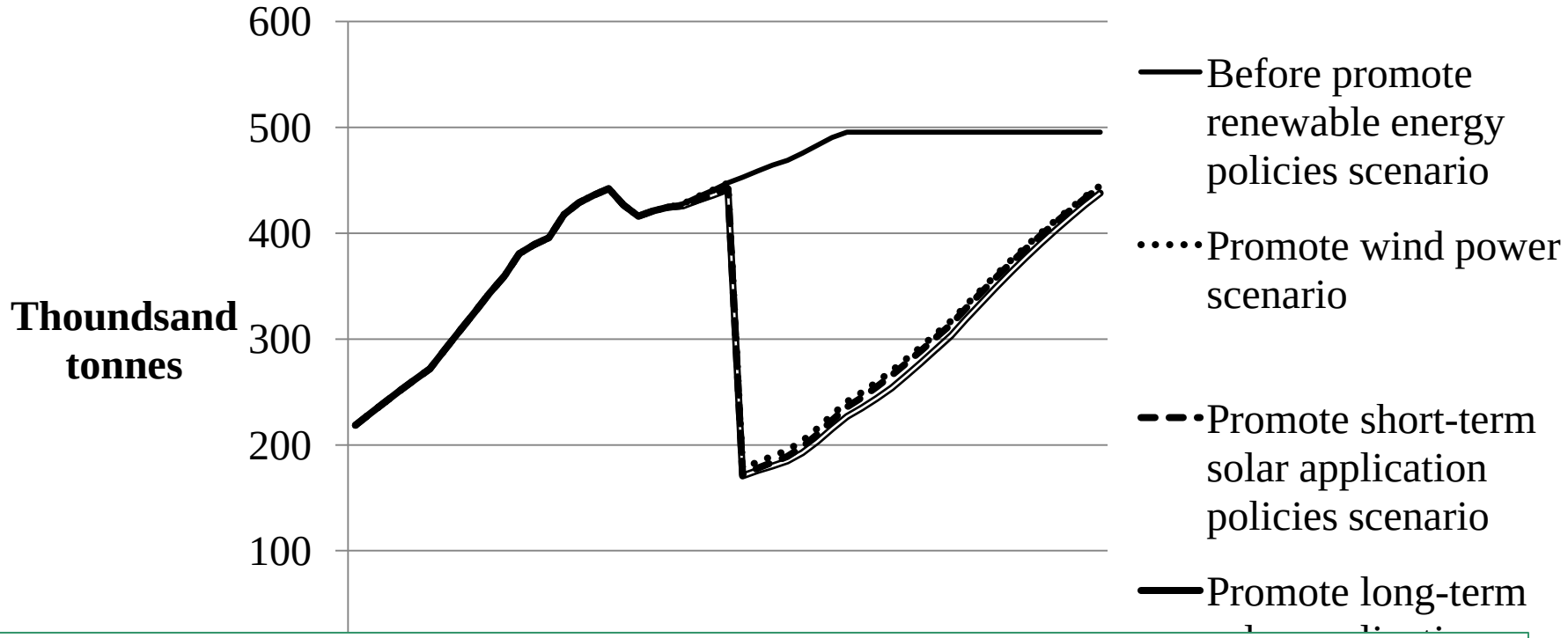
- The Renewable Energy Policies SD Model





- Simulation results - The Save electric generation by PV systems

- Simulation results - The carbon emissions



Refer to Trappey, *et al*, "The analysis of renewable energy policies for the Taiwan Penghu island administrative region," *Renewable and Sustainable Energy Reviews*, Vol. 16, No. 1, pp. 958-965, 2012.

Commentary

Using a small pilot plant approach to analyze low-carbon emission policies

- **“ …each country’s situation is unique and the problem of implementing low-carbon emission policies must be dissected into logical parts … for analysis, experimentation and then step-by-step implementation. ”**

Carbon Management (2013) 4(3) ***future science group***

Call for Papers

The 2014 18th IEEE International Conference on Computer Supported Cooperative Work in Design (CSCWD 2014)

May 21-23, 2014, National Tsing Hua University, Hsinchu, Taiwan

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- Important Dates
  - November 15, 2013 Full paper submission due
  - January 15, 2014 Notification of acceptance
  - February 15, 2014 Final papers due
  - February 15, 2014 Author registrations due
- Scope of Conference: The scope of CSCWD 2014 includes the research and development fields of collaboration technologies and their applications to the design of processes, products, systems, and services in industries and societies.
- Journal Publication Opportunities: Authors of selected papers will be invited to submit their revised and expanded papers for possible publication in special issues of well-known international journals.