

出國報告（出國類別：會議）

出席「2012 年第 10 屆生態平衡國際
研討會」及發表論文

服務機關：國立臺北大學/自然資源與環境管理研究所

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派赴國家：日本

出國期間：101 年 11 月 20 日至 11 月 24 日

報告日期：101 年 12 月 03 日

摘要

隨著環境變遷與資源消耗，環境與資源管理議題逐漸備受重視，故企業組織在進行產品設計與生產製造時，均需考量能資源使用與再利用情形，強調產品綠色設計、能源使用產品之環境友善化設計、危害物質限用等，以健全環境商品的發展及環境宣告，提昇企業永續競爭力，使商品競爭力增加與減少污染，並妥善管理資源的配置。

本次出國係參與「EcoBalance 2012-The 10th International Conference on EcoBalance (2012 年第 10 屆生態平衡國際研討會)」，於大會中進行海報發表，其論文題目為「Assessment of Energy Efficiency for Industrial Symbiosis – The Case in Southern Taiwan (整合工業區能源效率之評估-以南臺灣工業區為例)」。

本論文中，介紹臺灣地區對於能資源之利用率，強調能資源效率情形，並藉由南臺灣工業園區之案例，說明實際推動現況。因此，透過現場和與會學員進行廣泛討論與交換意見下，獲得許多不同觀點及想法，有助於後續相關研究支持續發展方向。

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一、目的

近年來，隨著全球環境變遷與資源消耗，環境與資源管理議題日益受到各界重視，故企業組織在進行產品設計與生產製造時，均需考量諸多國際規範，如：產品綠色設計、能源使用產品之對環境友善設計、危害物質限制指令之限制與要求等，以健全環境商品的發展及環境宣告，提昇企業永續競爭力，使商品競爭力增加與減少污染，並妥善管理資源的配置。

本次出國之目的係參與「EcoBalance 2012-The 10th International Conference on EcoBalance (2012 年第 10 屆生態平衡國際研討會)」，經大會摘要評核、全文審核等過程，予以進行撰寫論文。經大會確認，本次論文題目為「Assessment of Energy Efficiency for Industrial Symbiosis – The Case in Southern Taiwan (整合工業區能源效率之評估-以南臺灣工業區為例)」之海報發表。

「The International Conference on EcoBalance (生態平衡國際研討會)」係由 The Institute of Life Cycle Assessment, Japan (iLCAj/日本生命週期評估學會)策劃籌辦，於 1994 年在日本筑波市舉辦首屆大會以來，每兩年舉辦一次，前 7 屆均在筑波舉辦，第 8 及 9 屆於東京舉辦；今年在橫濱市舉辦第 10 屆大會，由日本 Keio University(慶應義塾大學)主辦，主題是「Challenges and Solutions for Sustainable Society(永續社會之挑戰與解決之道)」。

透過本次論文之發表，除介紹臺灣地區在工業生態園區之實際做法，說明整體能資源再利用之現況，並透過現場和與會學員進行廣泛討論與交換意見下，獲得許多不同觀點及想法，有助於後續相關研究支持續發展方向。

二、過程

本屆生態平衡國際研討會會議於 2012 年 11 月 20 日至 11 月 23 日在日本慶應義塾大學位於神奈川縣橫濱市日吉校區協生館二樓舉辦(主場地 A：藤原洋紀念廳、場地 B：第一多目標教室、場地 C：第二多目標教室、場地 D：第三多目標教室以及海報發表場地：活動大廳)。11 月 20 日主係大會歡迎晚會，11 月 21 日至 11 月 23 日則為正式大會期間；大會期間除邀請全球各地講者進行專題演講、各場次論文口頭發表外，並於 11 月 22 日下午舉辦研究成果海報發表活動。行政院環境保護署環檢所阮國棟所長亦受邀於 11 月 21 日場地 B(第一多目標教室)進行專題演講，講題是：「事業與工業廢水之磷回收技術：臺灣的觀點」，在 11 月 20 日大會歡迎晚會上，學生亦與阮所長暢談相關議題、並交換心得。

觀諸大會提供資料共有 139 篇口頭發表論文、近 200 篇海報發表研究成果或論文。

口頭發表論文區分 Special sessions(專題研討)與 General sessions(一般研討)，茲分述如下：

【Special sessions(專題研討)】

- S1: Sustainability Index and Case Study(永續指標與案例研討)
- S2: Recent Progress in Material Flow Analysis and Sustainable Resource Management(物質流分析和可持續資源管理的最新進展)
- S3: Renewable Energy for Sustainable Development(再生能源之永續進展)
- S4: Water Footprint(水足跡)
- S5: Sustainable agriculture and food toward globalizing Asia(邁向全球化亞洲的可持續農業和糧食)
- S6: Environmental Management Accounting(環境管理分析)
- S7: Sustainable Nutrient Management(永續資源管理)
- S8: Materials technology for resource sustainability(永續資源之材料技術)

【General sessions(一般研討)】

- G1: Input-output analysis(輸入輸出分析)
- G2: Impact assessment, risk assessment and interpretation(影響評估、風險評估和解釋)
- G3: Footprint methodology(足跡方法學)
- G4: Sustainable Management(永續管理)
- G5: Design and management for the environment(環境設計與管理)
- G6: International cooperation and LCA database(國際合作與生命週期評估資料庫)
- G7: Sociology, psychology and education(社會、心理和教育)
- G8: New challenges in management of supply chain(供應鏈管理之最新變化)
- G9: Waste management and recycling(廢棄物管理與再循環)

大會開幕式除由大會主席 Ikaga 簡介籌辦過程、生命週期評估大師級教授 Inaba 介紹大會歷史沿革，並安排兩場開幕演講；邀請日本內閣辦公室特別顧問 Dr. Hiroto Izumi、日產汽車公司 Mr. Youichi Kishimoto，分就"Future City Initiative"及"The Future Created by EV Comes in view-EV Marketplace Acceptance and its Future Prospects as Social System"為題進行演說。

本次學生海報發表之論文題目：「Assessment of Energy Efficiency for Industrial Symbiosis – The Case in Southern Taiwan (整合工業區能源效率之評估-以南臺灣工業區為例)」，在場除與國際知名學者交流心得外，全體參與大會人員數百人均蒞臨會場，與發表者熱烈討論及交換意見。

大會在 11 月 23 日傍晚於主場地 A(藤原洋紀念廳)舉行閉幕式，並相

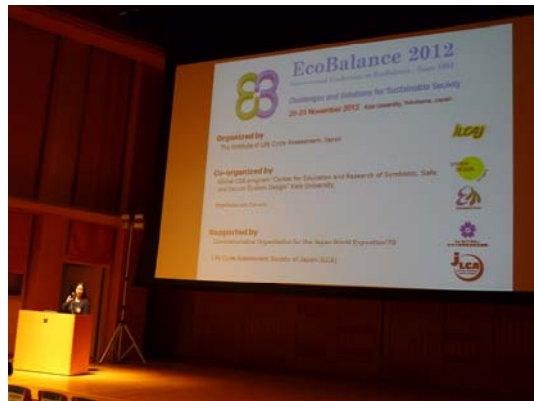
約兩年後再聚首，會後並有大會貼心舉辦之自費兩天一夜 city tour 行程，讓參與大會的學者專家得以一飽橫濱港灣美麗風光及享受在地美食。

三、心得及建議

學生參與本次會議，主軸為論文海報發表，其過程圓滿順利。本次大會會議地點選在較屬郊區的橫濱舉辦，但交通時間而言尚稱便利，卻可欣賞與東京不一樣的郊區風光，也對日本政府在落實公共工程品質及大學教育的努力，有更深一層的體驗。

此外，本所此行計有李育明教授、博士研究生(3名)及碩士在職研究生(5名)共9人一同與會，無論是入選口頭發表或海報發表之文章數，與國內其他大學(如：臺灣大學、成功大學、聯合大學或景文科大等)或國際機關單位相比，皆屬本次大會之最，日本與國內學者於大會期間不止一次探究及詢問本所團隊此一情形，實屬難得與倍感光榮，也為我校在國際及亞太地區進行了一次極佳的宣傳。

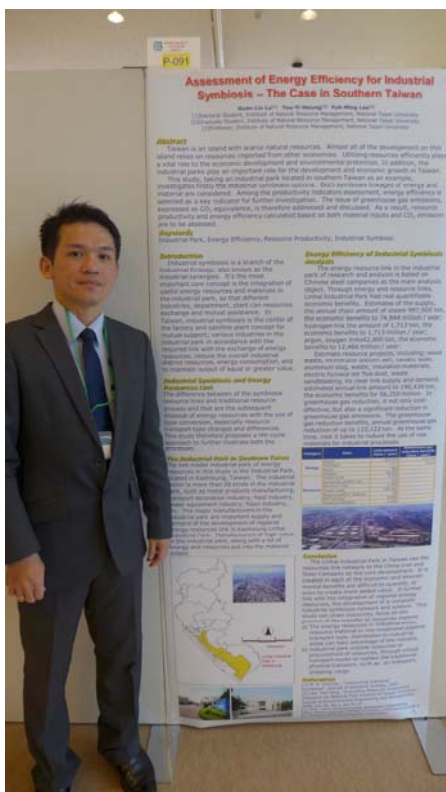
四、本次會議相關照片



開幕會議



海報發表



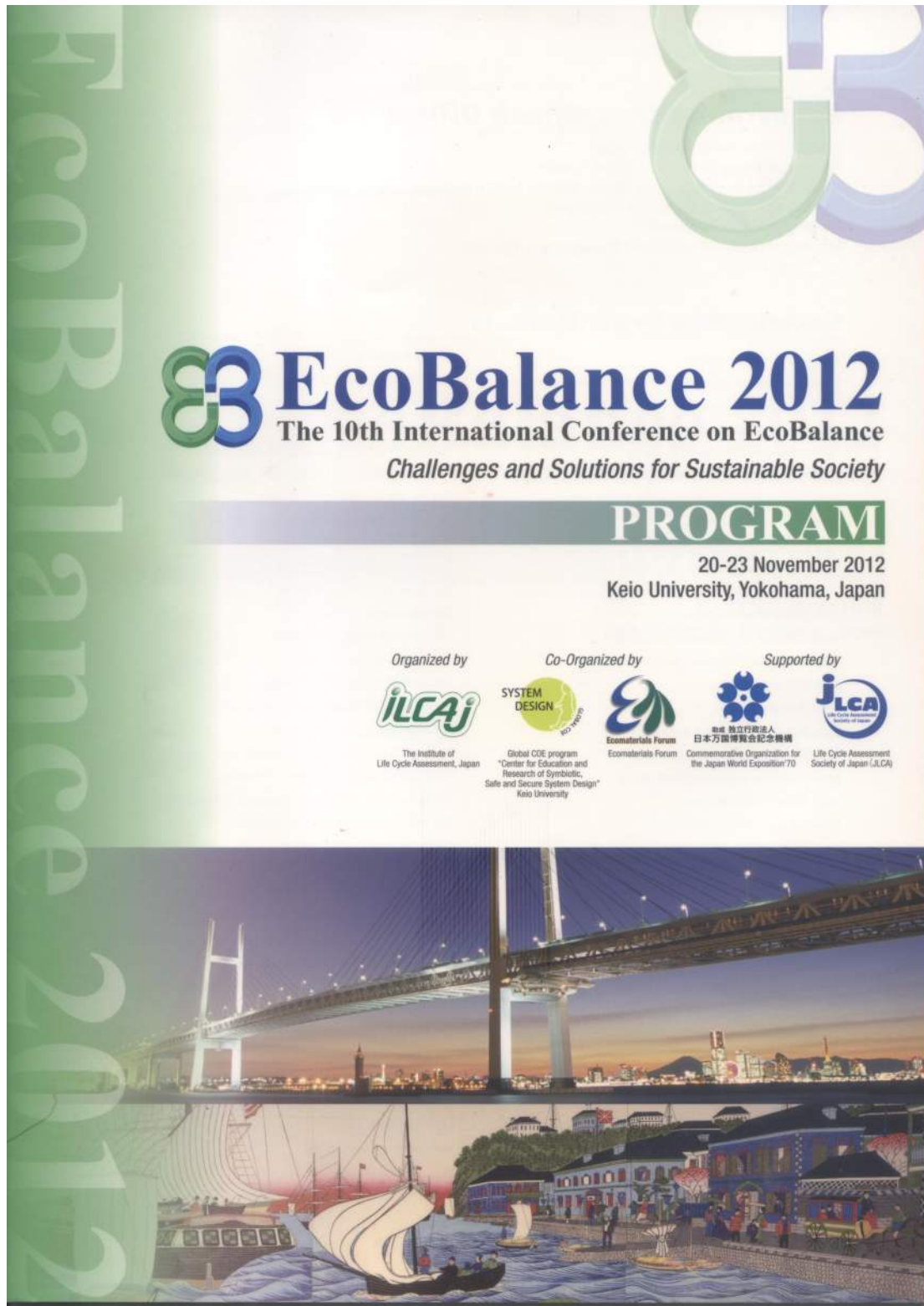
海報發表



李育明老師研究群合影

五、研討會相關資料

(一) 大會手冊



(二) 大會時程及地點安排



Conference Site

Keio University
Hiyoshi Campus
Kyosei-kan, 2nd Floor

One-minute walk from Hiyoshi Station by
Tokyu Toyoko Line,
Tokyu Meguro Line or
Yokohama Municipal Subway Green Line



Summary of Events

Event	Date		Time	Place & Other Information
Registration Desk Open Hours	Nov. 20	Tue	16:30 – 19:00	Raiosha 1F, Faculty Lounge
	Nov. 21	Wed	09:00 – 17:00	Fujiwara Hiroshi Hall foyer
	Nov. 22	Thu	08:00 – 17:00	Fujiwara Hiroshi Hall foyer
	Nov. 23	Fri	08:00 – 15:00	Fujiwara Hiroshi Hall foyer
Welcome Party	Nov. 20	Tue	18:00 – 20:00	Raiosha 1F, Faculty Lounge
Opening Ceremony	Nov. 21	Wed	10:00 – 10:30	Room A - Fujiwara Hiroshi Hall -
Plenary Session	Nov. 21	Wed	10:30 – 12:00	Room A - Fujiwara Hiroshi Hall -
Lunch	Nov. 21 ~ 23	Tue Thu	12:00 – 13:30	Event Hall (Lunch boxes are served)
Banquet	Nov. 22	Thu	19:40 – 21:30	Restaurant Ship 'Royal Wing' on board from Osanbashi International Port Terminal *Shuttle bus service from Kyosei-kan
Closing Ceremony	Nov. 23	Fri	14:50 – 16:10	Room A - Fujiwara Hiroshi Hall -
Farewell Party	Nov. 23	Fri	16:10 – 17:10	Event Hall
TOHOKU Excursion (Stay in Sendai)	Nov. 23 ~ Nov. 24	Fri Sat	17:45 leaves Kyosei-kan 17:56 back to Tokyo	Fare: ¥53,000 Apply to home page website: https://amarys-jtb.jp/ecobalance2012 Application deadline: Nov. 13 (Tue)

(三) 大會議程(11/21-11/23 三天議程，11/20 之歡迎晚會除外)

Nov.21	Room A (Fujiwara Hiroshi Hall)	Room B (Multipurpose Room 1)	Room C (Multipurpose Room 2)	Room D (Multipurpose Room 3)
10:00-10:30	Opening & Plenary (Room A - Fujiwara Hiroshi Hall) Keynote 1 "FutureCity" Initiative Hiroto IZUMI (Cabinet Secretariat) Keynote 2 The future created by EV cases in view -EV marketplace acceptance and its future prospects as social system- Masanori UEDA (NISSAN MOTOR CO., LTD.)			
10:30-11:15				
11:15-12:00				
12:00-13:30	Lunch			
	[B1-1] Sustainability Index and Case Study	[B1-1] Sustainable Nutrient Management	[B4-1] Water Footprint	[G5-1] Design and management for the environment
13:30-13:50	A1-01 Selecting the Environmental Indicator for Decoupling Indicators Marc-André WOLF (Germany) Mais Consulting	B1-01 Spatially Explicit Assessment of Nutrient Demands for Promoting Efficient Regional Fertilizer-Use Management in Vietnam Tien Minh TRAN (Vietnam) Soils and Fertilizers Research Institut	C1-01 ISO Water Footprint: Principles and Guidelines Sebastien HUMBERT (Switzerland) Quantis	D1-01 Symbiosis of Science and Application - LCA as Business Case Martin BAITZ (Germany) PE INTERNATIONAL AG
13:50-14:10	A1-02 Development and Implementation of Social Metrics in a Large Company Mark GOEDKOOP (the Netherlands) PFE Consultants	B1-02 Nutrient Flow on Food and Feed Production Shinichiro MISHIMA (Japan) National Institute for Agro-Environmental Sciences	C1-02 Review of Methods Addressing Freshwater Use in Life Cycle Inventory and Impact Assessment Anna KOUNIKIA (Switzerland) Quantis École Polytechnique Fédérale de Lausanne	D1-02 A CAD System for Product Life Cycle Design Yuki MATSUYAMA (Japan) Osaka University
14:10-14:30	A1-03 Comparison and Integration of Human Dimension's Indicators for Welfare and Happiness Bin-Chih WANG (Taiwan/R.O.C.) National Taipei University	B1-03 Phosphorus Recovery Technologies for Municipal and Industrial Wastewater: Taiwan's Perspective Gwo-Dong ROAM (China) Environmental Protection Administration	C1-03 Nexus between Water Withdrawal and Land Use in Water Footprint Masaharu MOTOSHITA (Japan) National Institute of Advanced Industrial Science and Technology	D1-03 Sustainability Communication in the Life Cycle: Gates and Gaps Benjamin Craig MCLELLAN (Japan) Kyoto University
14:30-14:50	A1-04 Social Impact Index for ICT Services - Case Study in Emerging Countries Julien BOISSEAU (Japan) France Telecom - Orange	B1-04 Novel Technology for Phosphorus Recycling Using Amorphous Calcium Silicate Hydrates Kenji OKANO (Japan) Osaka University	C1-04 Regionalized Cumulative Water Intensity: A Practical Approach to Corporate Water Accounting Bettina JOA (Germany) Pforzheim University	D1-04 Comparison of the CO2 Emission of Electric Vehicle and Fuel Cell Vehicle Using the Biomass Gasification System: Considering the Change of the Traffic Flow Aya ISHIGAKI (Japan) Tokyo University of Science
14:50-15:10	Break			
	[B1-2] Sustainability Index and Case Study	[B1-2] Sustainable Nutrient Management	[B4-2] Water Footprint	[G8-1] New challenges in management of supply chain
15:10-15:30	A1-05 Life Cycle Management of Timber Sawmill Wastes in Minna, Nigeria Ibrahim Olajunka JIMOH (Nigeria) Federal University of Technology	B1-05 Chemical and Biochemical Transformation of Phosphate Compounds to Produce and Recycle Biological Energy Aiko KURODA (Japan) Hitotsubashi University	C1-05 Comprehensive Database for Use in LCA-Based Water Footprinting: Results and Case Studies Sebastien HUMBERT (Switzerland) Quantis	D1-05 Carbon Footprint and Life Cycle Assessment of Organizations Matthias FRICKBENER (Germany) Technical University Berlin
15:30-15:50	A1-06 Mineral and Energy Futures: Implications for Technology and Policy in Producing and Consuming Countries Damien GIURCO (Australia) University of Technology	B1-06 Phosphorus Flow Analysis Based on Integrated Phosphorus Cycle Input/Output Model Kazuyo MATSUBAE (Japan) Tohoku University	C1-06 Expansion of Comprehensive Inventory Database (IDEA) to Water Footprint Kyotaka TAHARA (Japan) National Institute of Advanced Industrial Science and Technology	D1-06 Sustainable Pathways to Biofuel Development in the U.S. Sangwon SUH (U.S.A.) University of California
15:50-16:10	A1-07 Subcategory Assessment Method for Social LCA Application for Workers in Cocoa Soap Natura Paola Karina SANCHEZ RAMIREZ (Italy) G. D'Annunzio University	B1-07 Encouraging Innovation for Sustainable Phosphorus Management: Technology, Management, and Public Policy Masaru YARIME (Japan) The University of Tokyo	C1-07 Methodological Lessons Learned from Industrial Water Footprint Case Studies Markus BERGER (Germany) Technische Universität Berlin	D1-07 Sustainability Return on Investment: A Scenario-Based Multicriteria Assessment Tool for Policy-Making Lisa LAURIN (U.S.A.) EarthSRI, LLC
16:10-16:30	A1-08 Systematic Approach for the Comparison of Sustainability Assessment Methods in the Aviation Sector Robert ILG (Germany) University of Stuttgart	B1-08 Discussion	C1-08 Water Uses in the Life Cycle of Automobiles Hyung Chul KIM (U.S.A.) Ford Motor Company	D1-08 Design of Robust and Flexible Plastic Recycling System against Variation Risk Haruna ISHIIKAWA (Japan) The University of Tokyo
16:30-16:50	Break			
	[B4-3] Design and management for the environment	[B6] International cooperation and LCA database	[B4-3] Water Footprint	[G8-2] New challenges in management of supply chain
16:50-17:10	A1-09 The Impacts of Technology Innovation on WEEE Management: A Case study of Display Products Bin LU (China) Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences	B1-09 The UNEP/SETAC Life Cycle Initiative: Life Cycle Thinking evolution 2002-2012 and Phase 3 Sonia VALDIVIA (France) United Nations Environment Programme	C1-09 Spatialized Life Cycle Water Footprinting of U.S. Milk Lisey LESSARD (U.S.A.) Quantis International	D1-09 Rare Materials Used by Green Energy Industries - A Case Study of Taiwan Luyen CHEN (China) National United University
17:10-17:30	A1-10 Tracking the Impact of Environmental Regulations on Development and Diffusion of Innovations: Evidence from Waste Management Technologies in Japan Heinrich YABAR (Japan) University of Tsukuba	B1-10 Lessons Learned from Decades of LCAs: Value of a Life Cycle Approach in Evaluating the Environmental Impacts of Packaging for Food/Beverage Applications - A UNEP/SETAC Project Bruce VIGON (U.S.A.) Society for Environmental Toxicology and	C1-10 Water Footprint Assessment on Major Agricultural and Livestock Products Minjung SON (Korea) SMART ECO Co., Ltd.	D1-10 Study on Secondary Damages Caused by the Great East Japan Earthquake by Analyzing Industrial Supply Chains in Japan Yutaka GENCHI (Japan) National Institute of Advanced Industrial Science and Technology
17:30-17:50	A1-11 Practical Framework for Chemical Risk Management in Product Manufacturing Application to Process Design in Industrial Cleaning Emi KIKUCHI (Japan) The University of Tokyo	B1-11 Using Life Cycle Assessment for Implementing Multilateral Environmental Agreements Guise W. SONNEMANN (France) University of Bordeaux	C1-11 Water Footprint of Bioethanol Production Supply Chain in Thailand Sirinaphakorn PONGPINHYOPAP (Thailand) Kasetsart University	D1-11 Panel Discussion
17:50-18:10	A1-12 Rainwater Harvesting for Environmental Load Reduction Toshitomo KASAI (Japan) Fuku University of Technology	B1-12 Consistent Calculation of Multiple System Models and Improved Integration of Regionalized Data in a Background Inventory Database Gregor WERNET (Switzerland) Ecoinvent Centre	C1-12 Poster Spotlight C1-12-1 Yuya ONO C1-12-2 Sang-Hyun LEE C1-12-3 Shinya MATSUMOTO	D1-12 Panel Discussion

Nov.22	Room A (Fujiwara Hiroshi Hall)		Room B (Multipurpose Room 1)		Room C (Multipurpose Room 2)		Room D (Multipurpose Room 3)	
	[S1-3] Sustainability Index and Case Study		[S2-1] Renewable Energy for Sustainable Development		[S2-1] Recent Progress in Material Flow Analysis and Sustainable Resource Management		[G2-1] Impact assessment, risk assessment and interpretation	
9:00-9:20	A2-01 Invited	Evaluation of residential environment and its indicators Yasushi ASAMI (Japan) The University of Tokyo	B2-01	A Comparison of Life Cycle Inventory of Pre-Harvest, Production of Crude Oil, and Biodiesel Production on Jatropha Curcas and Palm Oil as a Feedstock for Biodiesel in Indonesia Himan SIREGAR (Indonesia) Bogor Agricultural University	C2-01	Forging a Low-Carbon Steel Cycle in Asia Tae WANG (Japan) Ritsumeikan University	D2-01	Global High Resolution Freshwater Eutrophication Impact Characterization: Application to Milk Andrew HENDERSON (U.S.A) University of Michigan
9:20-9:40	A2-02	Sustainability Assessment of Local Governments with the "CASBEE-City" Tool Using Public Statistical Information Shun KAWAHUBO (Japan) Keio University	B2-02	Evaluation on the PhilRices Up-Draft Rice Husk Gasification for Power Generation Elmer Granados BAUTISTA (Philippines) Philippine Rice Research Institute	C2-02	Material Flow Analysis on Ship Breaking and Recycling Industry in Bangladesh Mohammad SUJAUDDIN (Japan) The University of Tokyo	D2-02	Strategic Environmental Assessment of Taiwan's Development Policy for Science Parks Yu-Ling LEE (Taiwan/R.O.C.) National Taipei University
9:40-10:00	A2-03	A Study in Reconstruction Design of City Blocks by Low Carbon Performance Evaluation System Ryota GOTO (Japan) Nagoya University	B2-03	Optimization Analysis for Bi-LTL-Fuel Production Systems via Gasification of Biomass Kenji HOIDO (Japan) Tokyo University of Science	C2-03	Application of High Resolution SAR Data for Modeling Building Stock: Case Study of Sapporo, Japan Hanwei LIANG (Japan) Nagoya University	D2-03	The Day Spa Service Greenhouse Gas Emission Reduction Jittima PRASARA-A (Thailand) Mahasarakham University
10:00-10:20	A2-04	A Subjective-Objective Hybrid Model for the Assessment of Urban Quality of Life: Case Study of Shanghai, China Ji HAN (Japan) Nagoya University	B2-04 Invited	Waste to Energy: Kinetic Improvement and Clean-Up of Gases for High Efficient Gasifier and Fuel Cell Integration Radenka MARIC (U.S.A) University of Connecticut	C2-04	Estimation of Steel Use in Buildings by Night Time Light Image and GIS Yasunori MATSUNO (Japan) The University of Tokyo	D2-04	Estimating Marginal Willingness to Pay (MWTP) for Environmental Improvement by Co-Benefit of Global Warming Mitigation in Asian Countries Using Conjoint Analysis and Benefit Transfer Masahiro NISHIO (Japan) National Institute of Advanced Industrial Science and Technology
10:40-10:45	Break							
	[S1-4] Sustainability Index and Case Study		[S2-2] Renewable Energy for Sustainable Development		[S2-2] Recent Progress in Material Flow Analysis and Sustainable Resource Management		[G2-2] Impact assessment, risk assessment and interpretation	
10:40-11:00	A2-05	Sustainability Indicator System with Visualized Causal-Link Information - Application of Ontology and a Case Study Keishiro HARA (Japan) Osaka University	B2-05	The Blue Revolution: Oceans as Ultimate Sustainable Resource Patrick K. TAKAHASHI (U.S.A) Blue Revolution Hawaii, Inc.	C2-05 Invited	The Long-Term Availability of Copper: A Scenario Analysis Laura SCHNEIDER (Germany) Technische Universität Berlin	D2-05	Direct Consumer Exposure during Use of Personal Care Products, Plastics and Flooring Materials Alexi ERNSTOFF (U.S.A) University of Michigan
11:00-11:20	A2-06	Spatiotemporal Analysis of Sustainability Components - Application of an Indicator System for Chinese Provinces Michinori UWASU (Japan) Osaka University	B2-06	Assessing Long-Term Sustainability of District Heating Systems Erik O. AHLGREN (Sweden) Chalmers University of Technology	C2-06	Development of an Integrated Model to Estimate Long-Term Copper Demand Based on Sustainability Scenarios Yusuke KISHITA (Japan) Osaka University	D2-06	Evaluation of Regulatory Impact on Brominated Flame Retardants with Life-Cycle Risk Assessment Satoshi MANAGAKI (Japan) Yokohama National University
11:20-11:40	A2-07	Developing Sustainability Reporting in Real Estate Companies - Experiences from Finland Riikka Kaarina KYRO (Finland) Aalto University	B2-07	Exploiting Urban Energy Resource: Exploring Potentials and Challenges with Small Scale ToFu Production in Residential Area Yee Shee TAN (Taiwan) National Cheng Kung University	C2-07	Ore Grade Decrease as Indicator for Metal Scarcity in Life Cycle Assessment Marisa Diana Moura VIEIRA (the Netherlands) PRE Consultants	D2-07	Damage Assessment of Global Warming in LIMES Ryota Ii (Japan) Pacific Consultants Co., Ltd.
11:40-12:00	A2-08	Environmental Impacts of Norwegian Dwelling Sector: Life Cycle Assessment Rolf Andrew BOHNE (Norway) Norwegian University of Science and Technology	B2-08	PEMFC-Supercapacitor Hybrid Power Source System for Smartphone Using Multi-Port Bidirectional DC-DC Converter Noboru KATAYAMA (Japan) Tokyo University of Science	C2-08	Combined Application of MFA with Thermodynamic Analysis for Sustainable Resource Use Kenichi NAKAJIMA (Japan) National Institute for Environmental Studies	D2-08	An Assessment of Human Health Impact Caused by the Accident of Fukushima Daiichi Nuclear Power Plant Using a Methodology of Life Cycle Impact Assessment Norihito ITSUBO (Japan) Tokyo city university
12:00-12:30	Lunch							
	[G1] Input-output analysis		[S2-3] Renewable Energy for Sustainable Development		[S2-3] Recent Progress in Material Flow Analysis and Sustainable Resource Management		[G2-3] Impact assessment, risk assessment and interpretation	
13:30-13:50	A2-09	Estimation of GHG Emission Intensities for Food and Feed Sectors Using the 2005 Japanese Input-Output Table: Reflecting the Actual Conditions of Overseas Activities Eiji TAKAHASHI (Japan) Yokohama National University	B2-09	Realising the Potential in Providing Sustainable Renewable Energy from Malaysian Palm Oil Wastes Foo Yuen NG (Malaysia) Malaysian Palm Oil Council	C2-09	Estimation of Local Stocks and Discards of Small-Size Electric and Electronic Equipment and their Content Metals to Establish Efficient Collection Systems in Japan Seiji HASHIMOTO (Japan) Ritsumeikan University	D2-09	A New Quantitative Method of Evaluating the Impacts of Mining on Biodiversity Hirotaka WATANABE (Japan) Toshiba Corporation
13:50-14:10	A2-10	Bilateral Flow of Solid Waste between 47 Prefectures in Japan: A Multi-Region Waste Input-Output Approach Makiko TSUKUI (Japan) Tokyo International University	B2-10	Development of Well-to-Wheel Model to Evaluate Energy Consumption and Environmental Impact for Alternative Vehicle Fuels in Thailand Worayut SAIBUATRONG (Thailand) Kasetsart University	C2-10	Generation of Waste Mobile Phone in China: Modeling and Uncertainty Jianxin YANG (China) Chinese Academy of Sciences	D2-10	Investigation on the Functional Units of Energy and Steel Products in a LCA Tool for Buildings Yow-Jia HSUEH (Japan) Keio University
14:10-14:30	A2-11	A Time Series of Global Carbon Footprints at High Country and Sector Detail Keiichi KANEMOTO (Australia) The University of Sydney	B2-11	High Efficient Multi Fuel Solar Hybrid Power Plants to Ease the Access to Sustainable Energy in Remote Regions, the Case of Brazil Witold Roger POGANIEZ (Germany) Karlsruhe Institute of Technology	C2-11	International Material Flow Analysis on Green Technologies with a Global Link Input-Output Model Keisuke NANSAI (Japan) National Institute for Environmental Studies	D2-11	Variability-Based Optimal Design of Plastic Recycling Jun NAKATANI (Japan) The University of Tokyo
14:30-14:50	A2-12	Structural Understanding of Production Network by Visualizing Inter-Sector Carbon Flow: A Path-Based Matrix Decomposition Analysis Yasushi KONDO (Japan) Waseda University	B2-12	Global Warming and Bioenergy - Accounting for Geochemical and Geophysical Perturbations Anders Hammer STROMMAN (Norway) Norwegian University of Science and Technology	C2-12	Trade-Off Analysis between CO2 Emission and Other Environmental Burdens under Future Penetration Scenarios of Next Generation Vehicles Yusuke NAGATA (Japan) Osaka University	D2-12	Category Importance Aspects of Life Cycle Assessment: Survey Based Category Importance Andante Had PANDYASWARGO (Japan) Waseda University
15:10-16:10	Poster Session 1 (Event Hall)							
16:10-16:30	Break							
16:30-17:30	Poster Session 2 (Event Hall)							
19:40-21:30	Banquet at "Royal Wing"							

Nov 23	Room A (Fujiwara Hirose Hall)			Room B (Multipurpose Room 1)			Room C (Multipurpose Room 2)			Room D (Multipurpose Room 3)		
	[S5-1] Sustainable agriculture and food toward globalizing Asia			[S6-1] Environmental Management Accounting			[S8-1] Materials technology for resource sustainability			[G4] Sustainable Management		
9:00-9:20	A3-01 Invited	Life Cycle Assessment and Footprint in Agri-Food: Practical Experiences from Thailand Rattanasarn MUNGKUNG (Thailand) Director of VGREEN		BS-01 Invited	Controlling Resource Flows for a Sustainable Society Bernd WAGNER (Germany) University of Augsburg		C3-01 Invited	9:00-9:30 What is the Ecomaterial in this 21st century? Kohei HALADA (Japan) National Institute for Materials Science		D3-01	Quantitative Estimation for Value of Environmental Actions in Contrast to Technological Innovations Naoko MAE (Japan) Kyoto University	
9:20-9:40	A3-02	Development of the Greenhouse Gas Emissions (GHG) Accounting Tool for the Korean Dairy Cow Farm Chun-Youl BAEK (Korea) Ajou university		BS-02	Looking at Waste Differently: A Success Story of Material Flow Cost Accounting (MFCA) Implementation in Malaysia A Halim B SULAIMAN (Malaysia) University of Malaya			9:30-10:00 Recent progress in sustainable management of material resources Yuichi MORIOUCHI (Japan) The University of Tokyo	D3-02	A Novel Graphical Representation Method for Scenario Analysis: Application to the Design of Energy System I-Ching CHEN (Japan) The University of Tokyo		
9:40-10:00	A3-03	Greenhouse Gas Emissions in Sustainable Coffee Production Ampira CHAROENSAENG (Thailand) Chulalongkorn University		BS-03	Material Flow Cost Accounting in Supply Chain for Green Manufacturing Michiyasu NAKAJIMA (Japan) Kansai University				D3-03	Proposal of Dynamic LCI for Paprika Supply Chain due to an Environmentally Friendly Technology in Indonesia Eidewei's Annijnan PUTRI (Indonesia) Institut Teknologi Bandung		
10:00-10:20	A3-04	An Integrated Model of Sugarcane-Derived Ethanol Production by Interdisciplinary Analysis across Agriculture and Engineering Yasunori KIKUCHI (Japan) The University of Tokyo		BS-04	A Model for the Integrated Application of EMA, MFCA and CP Seaside GODSCHALK (South Africa) Environmental S&P, Sustainability Solutions		C3-03	For Whom and for What Ecomaterials are? Yoshikazu SHINOHARA (Japan) National Institute for Materials Science		D3-04	A Consideration of Bio-Fuels Supply from LCI and Cost Aspects Kiyoshi DOWAKI (Japan) Tokyo University of Science	
10:20-10:40 Break												
	[S5-2] Sustainable agriculture and food toward globalizing Asia			[S6-2] Environmental Management Accounting			[S8-2] Materials technology for resource sustainability			[G3] Footprint methodology		
10:40-11:00	A3-05	Proposal of a Unified Biodiversity Impact Assessment Method Jan Paul LINDNER (Germany) Fraunhofer IBP		BS-05	Development of an Integrated MFCA and CFP Model: Introducing Cost Information into CFP Calculation Katsuhiko KOKUBU (Japan) Kobe University		C3-05	Thermal Radiation Control Coatings at High Temperature for Efficient Energy Use Hideaki KAKISAWA (Japan) The University of Tokyo		D3-05	The Effectiveness of System Certification Scheme in CFP Communication Program Shoichiro TSURUTA (Japan) Japan Environmental Management Association for Industry	
11:00-11:20	A3-06	Characterizing Pesticide Residues and Related Health Impacts in Life Cycle Impact Assessment Peter FANTHE (Germany) University of Stuttgart		BS-06	Applying Material Flow Cost Accounting (MFCA) in Life Cycle Assessment Hongtao WANG (China) Sichuan University		C3-06 Invited	Highly functional bioplastic used for electronic products: poly(lactic acid) composites and cellulose-cardanol resin Masatoshi UJI (Japan) NEC Corporation		D3-06	Criteria of Carbon Footprint Inventory Data Selection from Software and Databases Jiahui Lewis CHEN (Taiwan/R.O.C) National Cheng Kung University	
11:20-11:40	A3-07	World Food LCA Database Jens LAUSCHE (Switzerland) Agroscope Reckenholz-Tänikon Research Station		BS-07	Life Cycle Costing (LCC) of Farm Milk Production: Cost Assessment of Environmental Impact Mitigation Strategies Olivier JOLLIET (U.S.A) University of Michigan		C3-07	The Impact of Land-Use Change for Bio-Based Plastics in Thailand Unchalee SUWANMANEE (Thailand) Srinakharinwirot University		D3-07	Carbon Footprint Offset Strategy for Township's Collection of Municipal Solid Waste - The Example of Pingxi District in New Taipei City Huan-Ling CHENG (Taiwan/R.O.C) National Taipei University	
11:40-12:00	A3-08	A Comparative Analysis of Different Assessment Methods for the Environmental Impacts of Agricultural Inputs Hiyotada HAYASHI (Japan) National Agriculture and Food Research Organization		BS-08	Resource Efficiency in Manufacturing Companies - Cost and Greenhouse Gas Emission Savings Mario SCHMIDT (Germany) Pforzheim University		C3-08	Integrated Indicator for Resource Dependency in terms of TMR Eiji YAMASUE (Japan) Kyoto University		D3-08	The Estimation of the CO2 Emission of the Menu in the Restaurant Atsushi INABA (Japan) Kogakuen University	
12:00-13:30 Lunch												
	[S6-3] Sustainable agriculture and food toward globalizing Asia			[S6-3] Environmental Management Accounting			[G8] Waste management and recycling			[G7] Sociology, psychology and education		
13:30-13:50	A3-09	Assessment of Rice Cultivation with Ecological Scarcity Japan Rolf FRISCHKNECHT (Switzerland) ESU-services Ltd.		BS-09	Development of Input-Output Inventory Data Base for GHG in China Hiroshi YAMAGUCHI (Japan) Tokyo City University		C3-09	Recycling of Lead-Acid Batteries in Taiwan and Its Substance Flow Analysis Wen-Hsin HUANG (Taiwan/R.O.C) National Taipei University		D3-09	Estimation of Outcomes of Consumer's Rebund Effect Kotaro KAWAJIRI (U.S.A) National Institute of Advanced Industrial Science and Technology	
13:50-14:10	A3-10	Evaluation of Mitigation Technologies and Footprint of Carbon in Uniruled Rice Production of Korea Deog Bae LEE (Korea) National Academy of Agricultural Science, Rural Development Administration		BS-10	Generic Business Strategies for a Sustainable Business Model - Based on the Korean Cases Yoon-Young CHUN (Korea) Ajou university		C3-10	E-waste Recycling and Environmental Impact in Asia Atsushi TERAZONO (Japan) National Institute for Environmental Studies		D3-10	Advances in Knowledge Organization Related to Sustainability Science: Prospects for Higher Education Harald Ernst OTTO (Italy) Polytechnic University of Marche	
14:10-14:30	A3-11	Life-Cycle Assessment of Ecologically Cultivated Rice Applying DNDC-Rice Model Naoki YOSHIKAWA (Japan) Ritsumeikan University		BS-11	Systematic Monetization of Environmental Impacts Hannes KRIEG (Germany) University of Stuttgart		C3-11	Closing the Loop for Industrial Wastes: a Multi-Objective Mixed-Integer Linear Program for Sustainable Industrial Waste and Resource Management Carl O. VADENBO (Switzerland) ETH Zurich		D3-11	Bridging the Gap of International Inter-city Environmental Cooperation: A Kitakyushu - Da Nang Survey Takashi KATO (Japan) The University of Kitakyushu	
14:30-14:50	A3-12	Visualizing the Influence of Weed Control Methods on Environmental Impacts of Organic Rice Cultivation in Japan Shingo HOKAZONO (Japan) National Agriculture and Food Research Organization		BS-12	Exploring the Use of MFA from a Company Perspective Steve HARRIS (Sweden) SKF-Chalmers University Technology Centre for Sustainability		C3-12	Scenario Planning of Waste Biomass Management in the Near Future Rokuts INABA (Japan) National Institute for Environmental Studies		D3-12	Environmental and Socio-Economic Aspects of Solid Waste Recovery and Recycling in Bangladesh: A Case Study of Dhaka City Mousumi ZAHUR (Japan) University of Kitakyushu	
14:50-16:10 Closing (Event Hall) Farewell Party (Event Hall)												

(四) 本所李育明老師擔任日本生命週期評估學會之國際諮詢理事會理事

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 **EcoBalance2012**
The 10th International Conference on EcoBalance
November 20-23, 2012, Yokohama, Japan

Oral Session

General session 3 (Room D) November 23, 2012 10:40-12:00

Footprint Methodology

Chair: Y.M. LEE

D3-05 10:40-11:00

The Effectiveness of CFP System Certification Scheme in the CFP Communication Program

Shotchiro TSURUTA, Kengo MINAMIYAMA, Masayuki KANZAKI

Japan Environmental Management Association for Industry

D3-06 11:00-11:20

Criteria of Carbon Footprint Inventory Data Selection from Software and Databases

Jiahui Lewis CHEN, Yi-Hsing WEN

National Cheng Kung University

✓ **D3-07** 11:20-11:40

Carbon Footprint Offset Strategy for Township's Collection of Municipal Solid Waste - The Example of Pingxi District in New Taipei City

Huan-Ling CHENG, Yuh-Ming LEE

National Taipei University

D3-08 11:40-12:00

The Estimation of the CO₂ Emission of the Menus in the Restaurant

Rio KAWAMA, Ryoko MORIMOTO, Atsushi INABA

Kogakuni University

Lunch (90min) 12:00-13:30

General session 7 (Room D) November 23, 2012 13:30-14:50

Sociology, Psychology and Education

Chair: Y. HONDO

D3-09 13:30-13:50

Estimation of Outcomes of Consumer's Rebound Effect

Kotaro KAWAJIRI¹, Tomohiro TABATA², Tomohiko IHARA³

¹MIT, ²AIST, ³Kobe University, ⁴The University of Tokyo

D3-10 13:50-14:10

Advances in Knowledge Organization Related to Sustainability Science: Prospects for Higher Education

Harald Ernst OTTO

Polytechnic University of Marche

D3-11 14:10-14:30

Bridging the Gap of International Intercity Environmental Cooperation: A Kitakyushu - Da Nang Survey

Takaaki KATO¹, Eri HIMESHIMA¹, Hai HOANG², Quang Van TRAN², Hidenori NAKAMURA³

¹The University of Kitakyushu, ²Da Nang University of Technology, ³Institute for Global Environmental Studies

D3-12 14:30-14:50

Analysis of Decision-Makers' Behavior and its Effects on Material Flows with Multi-Agent Simulation: A Case Study in E-Waste Recycling Systems

Kiyofumi SUGAWARA, Shinsuke MURAKAMI, Jiro YAMATOMI

The University of Tokyo

Closing Ceremony (Room A) 14:50-16:10

Farewell Party (Event Hall) 16:10-17:10

Program

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Poster Program

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P-002	S1	Recent Efforts to Promote Craftwork Design in Taiwan Chiu Hsueh LIU (Taiwan/R.O.C.) National Yunlin University of Science and Technology
P-003	S1	A Survey of Current Condition and Willing on Sustainable Product Design and Development under Corporate Social Responsibility Yu Chen HUANG (Taiwan/R.O.C.) National Yunlin University of Science and Technology
P-004	S1	Strategy of Sustainable Product Design under Green Supply Chain with the Energy-Using Product-Consumer Electronic Product as Example Jui che TU (Taiwan/R.O.C.) National Yunlin University of Science and Technology
P-005	S1	Strategy of Sustainable Product Design and Development from Environmental Life Style and Green Consumption Standpoint-MUJI as Example Yun-Sian JHANG (Taiwan/R.O.C.) National Yunlin University of Science and Technology
P-006	S1	<u>Strategic Environmental Assessment of Taiwan's Sustainable Energy Development Policy</u> <u>Ya-Hua YU</u> <u>(Taiwan/R.O.C.)</u> <u>National Taipei University</u>
P-007	S1	Life Cycle Assessment of End of Life of Personal Computer and Recycling Feasibility in Thailand Tatthap - VEERATAT (Thailand) Graduate School Chulalongkorn University
P-008	S1	Evaluation the Environment Impacts for End-of-Life (EOL) of E-Waste:Case Study Mobile Phones in Thailand Witthawin SANGPRASERT (Thailand) Chulalongkorn University
P-009	S1	<u>Development Strategy of Coastal Wetlands in the Perspective of Biodiversity Conservation-The Example of Fuyuang Wetland in Taiwan</u> <u>PO-JEN SHUAI</u> <u>(Taiwan/R.O.C.)</u> <u>National Taipei University</u>

P-010	S1	Comprehensive Life Cycle Assessment for Cheese and Whey Products in U.S. Greg J THOMA (U.S.A.) University of Arkansas
P-011	S1	<u>Revising Taiwan's Sustainability Development Indicator System with Incorporation of Vulnerability Assessment on Climate Change</u> <u>Wen-Chi YANG</u> (Taiwan/R.O.C.) <u>National Taipei University</u>
P-012	S1	A Study of Relationship between Green Product Recognition and Green Brand Marketing and Green Consumption Jui-Che TU (Taiwan/R.O.C.) National Yunlin University of Science and Technology
P-013	S1	A Study on the Methodology for Evaluating the Environmental Load of Rail Infrastructure Construction Yasutomo MORITA (Japan) Institution for Transport Policy Studies
P-014	S1	Advances in Knowledge Organization Related to Sustainability Science: Prospects for Research and Application Harald Ernst OTTO (Italy) Polytechnic University of Marche
P-015	S1	Sustainable Product Design Checklist: Integrating Sustainability into Early Stages of Product Development Ali MASOUDI (Korea) Pohang University of Science and Technology
P-016	S1	Development of Evaluation Tool for Life Cycle CO2 of Detached Houses Kosuke MEGURO (Japan) Keio University
P-017	S1	Estimation of TBL Indexes for Ark Shell Fisheries Industries in Sendai Bay -Toward Development of Evaluation Method for Sustainable Fisheries- Kazuhito WATANABE (Japan) Miyagi Prefecture Fisheries Technology Institute
P-018	S1	Impact of the Introduction of Biomass Energy to Environment, Economic and Rural Development in ASEAN Region Hendrawan - - (Japan) Tokyo University of Science
P-019	S1	Assessing the Environmental and Social Effects of Free Trade Agreement through Life Cycle Sustainability Analysis: A Case Study of Economic Cooperation Framework Agreement between Taiwan and China Chia-Wei CHAO (Taiwan/R.O.C.)

P-090	S8	WEEE Recycling Impact Assessment in Taiwan by Waste Input Output Analysis Model Pei Chieh HSU (Japan) Waseda University
P-091	S8	<u>Assessment of Energy Efficiency for Industrial Symbiosis-The Case in Southern Taiwan</u> <u>Lai Guan LIN</u> <u>(Taiwan/R.O.C.)</u> <u>Nation Taipei University</u>
P-092	S8	Development of End of Life Vehicle Recycling System for the Efficient Use of Steel Alloying Elements Hajime OHNO (Japan) Tohoku University
P-093	S8	Additionality Analysis of CDM Projects of Chinese Cement Industry Based on Life Cycle Assessment Wenyu ZHANG (Japan) Tohoku University
P-094	S8	Chemical Form of Metal in Landfills and its Temporal Change Manami OKUNO (Japan) Waseda University
P-095	S8	Clarifying Metal-Enriched Zones in Landfills, Using Resistivity and Induced Polarization Measurements Toshinori SAKURAMA (Japan) Waseda University
P-096	S8	Assessing the Recycling Technologies of Tomorrow Jan Paul LINDNER (Germany) Fraunhofer IBP
P-097	S8	An Appropriate Comminution Method for Recycling of Wasted Circuit Boards Kazuki TAHARA (Japan) Waseda university
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P-099	G01	Picturing a Multi-Sectoral Economy in terms of Iron Element Chen LIN (China) Shandong University

Assessment of Energy Efficiency for Industrial Symbiosis – The Case in Southern Taiwan

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Abstract

Taiwan is an island with scarce natural resources. Almost all of the development on this island relies on resources imported from other economies. Utilizing resources efficiently plays a vital role to the economic development and environmental protection. Among the indicators quantifying "resource productivity", energy efficiency defined as product per a unit of energy input, is one of the most important ones. In addition, the industrial parks play an important role for the development and economic growth in Taiwan. However, the activities in industrial parks, due to the depletion of natural resources and emission of pollutants, cause complex and severe impacts to the environment. This study is, therefore, intended to assess the energy efficiency through the accomplishment of industrial symbiosis within the boundary of an industrial park.

This study, taking an industrial park located in southern Taiwan as an example, investigates firstly the industrial symbiosis options. Both symbiosis linkages of energy and material are considered. Among the productivity indicators assessment, energy efficiency is selected as a key indicator for further investigation. The issue of greenhouse gas emissions, expressed as CO₂ equivalence, is therefore addressed and discussed. As a result, resource productivity and energy efficiency calculated based on both material inputs and CO₂ emission are to be assessed.

Keywords: Industrial Park, Energy Efficiency, Resource Productivity, Industrial Symbiosis

1. Introduction

In recent years, due to the availability of resources, the use of resources is restricted. In order to enhance industry performance and energy and resource use efficiency, the use of industrial symbiosis concept to combine production. Industrial symbiosis is a branch of the Industrial Ecology, also known as the industrial synergies. The most important core concept is the integration of useful energy resources and materials in the industrial park, so that different industries, department, plant can resources exchange and mutual assistance [1]. Overall, fewer resources are consumed and waste, and produce more or the same value and the number of products and services. In Taiwan, industrial symbiosis is the center of the factory and satellite plant concept for mutual support; various industries in the industrial park in accordance with the required link with the exchange of energy resources, reduce the overall industrial district resources, energy consumption, and to maintain output of equal or greater value.

2. Evaluating Energy Efficiency and Resource Productivity 2.1 Evaluating Energy Efficiency

Energy efficiency generally refers to using less energy while providing the same activities or services. There are many international indicators to evaluate the energy efficiency. The general indicators are multi-use energy intensity (Energy Intensity) or the unit energy consumption (Specific Energy Consumption). The Energy Intensity is defined as for per unit of economic output the amount of energy input required, while the unit energy consumption is defined as for each unit of energy input the amount of

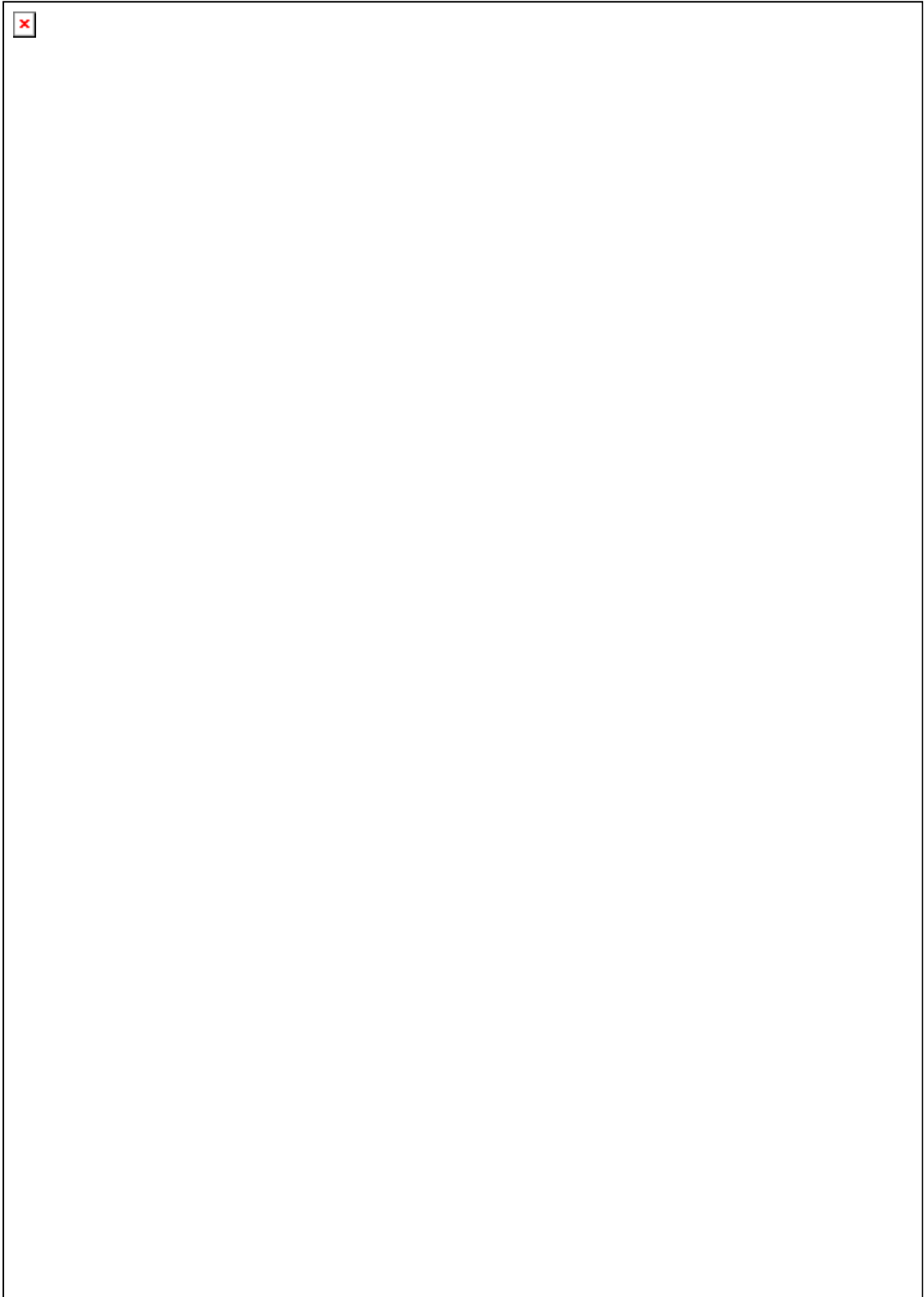
energy input required. Both indicators are widely used in industry because of simple, clearly defined and easy to understand.

The Economy of material flow analysis, in addition to grasp the material in the economy of investment, consumption and output characteristics, the traditional economic development of the index (such as GDP, etc.) can be defined assessment of substance use efficiency. In other words, environmental efficiency stressed that "with minimum capital investment, resulting in the largest service and production", material input and output can be used to define the ratio between the intensity of substance use (the material input per unit output) and resource productivity (unit of material input per output). Therefore, the energy productivity (EP) is preferable to the ratio of GDP and energy material input (mass units), but different from energy statistics of energy heat units [2].

2.2 Evaluating Resource Productivity

Resource productivity is the fundamental to environmental efficiency. The industry can improve resource productivity to reduce the use of energy resources during the process of production or providing services. The industry can improve the environmental efficiency by a multiple of at least four (Factor 4), that is, half of resources, profits double [3].

As stated in the report by Sustainable Europe Research Institute [4], the indicators that enable direct relation of material flows with economic performances can quantify resource productivity 'interlinkagely.' By calculating economic output (in monetary units) generated per material



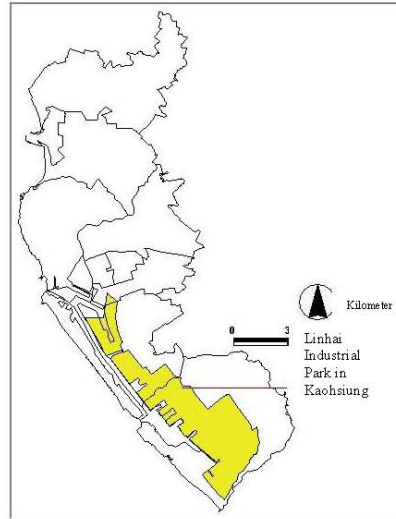


Figure 2 Linhai Industrial Park in Kaohsiung, Taiwan

4. Energy Efficiency of Industrial Symbiosis Analysis

The energy resource link in the industrial park of research and analysis is based on Chinese steel companies

as the main analysis object. For the study, the industrial park industrial energy resources supply and demand by the China Iron and Steel Company. The gas supplied by the Chinese steel companies, including: hydrogen, nitrogen, oxygen, natural gas, steam, etc.; resource material, comprising: waste, waste oil, waste acid, scrap metal and so on.

Through energy and resource links, Linhai Industrial Park had real quantifiable economic benefits. Estimates of the supply, the annual chain amount of steam 997,920 tonnes, the economic benefits to 74,844 million / year; hydrogen link the amount of 1,713 tonnes, the economic benefits to 1,713 million / year; argon, oxygen links 42,800 tonnes, the economic benefits to 12,466 million / year.

Estimate resource projects, including: wood waste, incinerator bottom ash, caustic soda, aluminum slag, waste, insulation materials, electric furnace set flue dust, waste sandblasting, its clear link supply and demand, estimated annual link amount to 190,430 tonnes, the economic benefits for 56,250 million. In greenhouse gas reduction, it not only cost-effective, but also a significant reduction in greenhouse gas emissions. The greenhouse gas reduction benefits, annual greenhouse gas reduction of up to 123,122 tonnes. At the same time, cost it takes to reduce the use of raw materials for industrial processes. By energy and resource links, resources to the needs of manufacturers, to reduce the procurement and use of a large number of resources, to further reduce the waste substances and greenhouse gas output. If consider the cost of pollution emissions equipment, the cost of processing technology to improve efficiency, and its effectiveness involving level quite extensive.

Table1 Linhai Industrial Park resources link current situation - reducing greenhouse gas emissions [6]

Category	Item	Link amount (tons / year)	Greenhouse gas reduction benefits (tons / year)
Energy	Steam	997,920	113,700
	Hydrogen	1,713	9,422
	Argon	800	-
	Oxygen	42,000	-
Resource	Waste wood	9,600	-
	Incinerator bottom ash	240	-
	Aluminum slag	5,000	-
	Caustic soda	165,000	-
	Waste insulation material	90	-
	EAF flue dust	6,000	-
	Waste sandblasting	4,500	-

5. Conclusion

The energy resources input-output of link industrial park, input part contains the procurement of raw materials, natural resources outside input; the outputs section contains products available to consumers, downstream manufacturers, and also includes the direct use of waste, emissions waste liquid. Such substances after appropriate treatment and management, through the way of energy and resource links, in the industrial park material recycling and reuse change in the output of the project is put into the project, reduce waste material clearance and disposal costs. This is a negative product benefits to a positive product benefits, so to enhance the efficiency of material use and energy efficiency.

The Linhai Industrial Park in Taiwan can the resources

link network to the China Iron and Steel Company as the core development. It is created in each of the economic and environmental benefits are difficult to quantify, or even to create more added value. It further link with the integration of regional energy resources, the development of a complete industrial symbiosis network and system.

This study can chain resources, focus on the process of the transfer of resources explore. The resources and products transportation is a very important one ring in traditional industries. The transport costs of the above stages of production and the exploitation of raw materials stage. In energy resources link industrial park, the industrial park system as a single individual, internal transport for internal pipeline flow. In the energy resource delivery program, derived the virtual transport concept of

resource transfer energy and resource links.

- a) The energy resources in industrial areas, resource material to non-traditional pipeline transport type, distribution to industrial areas can take advantage of the industry. The unused resources transported to the reusable manufacturers, to enhance the value of existing resources through the mode of transport.
- b) Industrial park outside resources or procurement of resources, through virtual transport model to replace the traditional physical transport, such as: air transport, shipping, cargo. Entity during transport directly reduce greenhouse gas emissions, air pollutants; reduce the associated transport equipment maintenance updates, fuel, personnel costs for, and indirectly reduce dependence on external shopping feed it takes to costs.

6. References

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