行政院及所屬各機關出國報告

（出國類別：研習）

赴「日本能源經濟研究所亞太能源研究中心」出國研習報告

出 國 人：　服務機關：台灣中油股份有限公司
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赴「日本能源經濟研究所亞太能源研究中心」研習出國報告

摘要

亞太能源研究中心(Asia Pacific Energy Research Center, APERC)係附屬於 IEEJ（Institute of Energy Economics, Japan）下的研究機構，於西元 1996 年 7 月在日本首都東京成立。APERC 每年邀請台灣派一位人員赴該中心進行研究訪問。本次依往例，透過經濟部能源局請各單位與機構推薦人選，經 APERC 遴選，職得以於 96 年 1 月赴該中心，進行為期一年之研究訪問。

APERC 主要的任務是促進 APEC 各會員體對於全球及該區域的能源供需趨勢以及亞太地區所面對的能源議題的了解。APERC 係以亞太地區能源議題進行研究，因此職得以從整體能源觀點瞭解油氣在其中所扮演之角色，並從 APEC 區域市場中明瞭台灣能源市場的地位。

職在 APERC 期間撰寫了”APEC Energy Overview: Chinese Taipei”、參與”Urban Tranpsport Energy Use in the APEC Region Phase I & Phase II”與” Economy Review of China”兩個研究案，並協助 APERC 舉辦三場研討會。在該期間並參加了第八屆在澳洲舉行的能源部長會議(EMM8)、分兩次赴中國大陸廣州、長沙、西安與成都等四個城市調研以及回台北參加了第一屆 IAEE 亞洲年會暨第二屆海峽兩岸海峽能源經濟學術研討會。

派員參與亞太能源研究中心有以下心得與建議：

- 參與 APERC 之研究計畫，針對 APEC 地區經濟體之能源議題與來自個會員國研究員共同進行研究，由各經濟體對議題不同角度的思維出發，不僅可擴充能源領域的見識視野，研究員間亦建立了良好互動，對未來在能源領域的交流上有莫大的助益。
- 國際能源市場瞬息萬變，對於相關資訊的掌握與經驗的學習自然非常重要。為因應未來能源市場之發展，本公司有必要積極加強與國外機構合作研究及參與國際能源合作研討會，並加強雙邊交流機制，讓本公司與國際機構的交流奠立持續發展的基礎。

- 油氣產業為全球性產業，儘管台灣受限於國際政治外交局勢，無法參與各國政府間之合作，然從業者立場對這些影響國際油氣產業發展之重要情境變數亦須密切觀察，並仍可以民間業者立場透過與本公司有業務來往之各國油氣公司發揮影響力，加強商業投資合作機會。

- 日本政府贊助亞太能源研究中心，提供亞太地區各會員國派員參與合作研究，得以促進各國能源產業研究之交流。APEC 會員國經濟狀況與能源資源各有不同，進行能源政策比較與分析有其價值。

- APERC 成立以來完成多項研究，值得相關研究業務上借鏡參考。國際性合作組織與資源之運用，有助於本公司對國際能源市場發展資訊之掌握。為提升本公司研究能力與水準，值得本公司持續派員赴亞太能源研究中心進行研究訪問。

目錄

第一章　出國目的與行程

壹、出國目的

日本能源經濟研究所(Institute of Energy Economics, Japan. IEEJ)之亞太能源研究中心(Asia Pacific Energy Research Centre, APERC)每年邀請我國派一位人員赴該中心進行研究訪問。本次依往例，透過經濟部能源局請各單位與機構推薦人選，經亞太能源研究中心遴選，職得以於 96 年 1 月赴該中心進行為期一年之研究訪問。

日本政府透過日本能源經濟研究所，在國內業界部份，扮演業界與日本政府之橋樑，在國際部分，替業界扮演與其他國家政府之橋樑。日本政府贊助日本能源經濟研究所轄下之亞太能源研究中心，邀請各 APEC 會員國派員至日本研習以增進各國對日本之瞭解及加強日本與各國之交流。亞太能源研究中心提供亞太地區各會員國派員參與合作研究，得以促進各國能源產業研究之交流。

全球及區域的能源供需、能源安全、資本投資以及環境議題，都是能源研究的重要方向。油氣產業為全球性產業，儘管中華民國受限與國際政治外交局勢無法參與各國政府間之合作，然從業者立場對這些影響國際油氣產業發展之重要因素必須掌握，並可由民間業者之立場與本公司有業務來往之各國油氣公司發密切聯繫，加強合作投資機會。

在各項能源種類之間彼此有替代效應，發電部門及交通部門間之燃料競爭，對油氣產業有重大影響。職本次赴日本能源經濟研究所亞太能源研究中心進行研究，可從整體能源發展之觀點就油氣產業趨勢進行瞭解並明瞭台灣油氣市場在整個亞太地區能源產業所扮演之角色。

在研究訪問期間，所蒐集之亞太地區石油及天然氣市場資訊除提供公司相關業務參考外，經研究分析之石油及天然氣市場發展趨勢，亦可尋求本公司國際投資與合作機會。因此本公司派員至日本能源經濟研究所亞太能源研究中心，進行訪問研究，有助提昇本公

司研究國際油氣市場能力。

貳、出國行程

職出國時間自 96 年 1 月 11 日至 97 年 1 月 10 日，為期一年。

起迄日期	天數	到達地點	詳細工作內容
96.01.11.	1	臺北-東京	啟程
96.01.12-97.01.09	363	APERC	日本能源經濟研究所亞太能源研究中心研究
97.01.10.	1	東京-臺北	返程

第二章　亞太經濟合作會與亞太能源研究中心簡介

壹、亞太經濟合作(APEC)

一、亞太經濟合作(APEC)背景

亞太經濟合作(Asia Pacific Economic Cooperation, 簡稱 APEC）成立於 1989 年，係由澳大利亞前總理霍克(Robert Hawke)所倡議成立之亞太區域主要經濟體高階代表間之經濟諮商論壇，希望藉由亞太地區各經濟體政府相關部門官員的對話與協商，帶動該區域經濟成長與發展，成立時共有 12 個創始成員。目前有美國、加拿大、新加坡、澳洲、紐西蘭、香港、中國、俄羅斯、越南、韓國、日本、我國、泰國、菲律賓、馬來西亞、印尼、墨西哥、祕魯、汶萊、巴布亞幾內亞、以及智利等環太平洋兩岸共 21 個會員體。APEC 係政府間組織，各會員體以經濟體身份加入，我國以「中華台北」（Chinese Taipei）名義於 1991 年成為 APEC 的一員。

我國係於 1991 年加入 APEC，當時經 APEC 主辦會員體韓國居間協調，我勉予同意以"Chinese Taipei"名稱與中國及香港在該年同時加入 APEC 成為會員體(Member Economies)。各會員體均係以「經濟體」(Economy)身分參與，此為 APEC 之特殊設計。另尚有「東南亞國家協會」(ASEAN)、「太平洋經濟合作理事會」(PECC)及「太平洋島國論壇」(PIF)3 個國際組織為其觀察員。

APEC 是亞太地區最重要的多邊官方經濟合作論壇之一，以其成員涵蓋之地理區域(包括東北亞、東亞、東南亞、大洋洲、北美及中南美地區共 21 個全球重要經濟體)、整體經濟力量(總人口約 26 億人，國內生產毛額佔全球近 6 成，貿易總額佔全球近 5 成)及組織活動(最高決策層級達各經濟體元首，所涉議題幾涵蓋各會員體大部分行政部門之業務)而言，APEC 均可謂為我國目前實際參與之最重要國際多邊機制之一，APEC 所形成的共識對全球經貿政策及規範具有極大影響力。

二、APEC 之運作及組織架構

APEC 體制屬「論壇」性質，其日常運作係以「共識決」(Consensus)及「自願性」(Voluntary)為基礎，以互利及公開對話與共識決為原則，體認各會員體間經濟發展程度，以及社會、政治制度均有相當差異，並經由各成員間相互尊重及開放性政策對話達成尋求區域內共用經濟繁榮。APEC 工作的三大支柱分別為：「貿易暨投資自由化」(Trade and Investment Liberalization)、「貿易暨投資便捷化」(Trade and Investment Facilitation)以及「經濟暨技術合作」(Economic and Technical Cooperation，ECOTECH)。其目標為：1.促進亞太地區經濟成長與發展；2.增進亞太地區商品、勞務、資本與技術的流通；3.加強開放性的多邊貿易體系，提升亞太地區與世界的福祉；4.降低區域內貿易與投資障礙。

(一) APEC 經濟領袖會議 (Leaders' Meeting)

APEC 經濟領袖會議是由美國前總統柯林頓於 1993 年倡議後召開，自該年起，APEC 會議主辦會員體皆在部長級年會之後召開經濟領袖會議，會中均採納部長級年會通過的重大決議，經由發佈領袖宣言的方式，揭示 APEC 未來發展的政策方向。1991 年兩岸三方入會時，APEC 尚未有召開經濟領袖會議之機制，我國於當年入會時自無可能對我方出席經濟領袖會議乙節有任何承諾，然而自首次領袖會議於 1993 年召開以來，中國均強烈反對並阻撓我 總統親自與會，故歷次會議均由我 總統選派領袖代表出席。2001 年因中國阻撓以致我領袖代表未能出席在上海舉辦之經濟領袖會議；2002 年領袖會議由墨西哥主辦，經過充分之協調，並獲得 APEC 主要會員體之支援，由中央研究院李院長遠哲代表 陳總統順利出席；2003 及 2004 年之領袖會議，我國均由李院長擔任領袖代表，2005 年我國則改由總統府林資政信義擔任領袖代表，林資政傑出之表現廣獲各方肯定，成功提昇我國在國際社會之能見度。

(二) APEC 部長級年會及專業部長會議 (Ministerial Meeting and Sectorial Ministerial Meeting)

部長級年會主要任務為決定 APEC 活動的大政方針，並討論區域內的重要經貿問題。此外，若各工作小組在推動業務上認為有提

高協調層次之必要，或有特殊共同問題需要處理，可建議召開專業部長會議(Sectoral Ministerial Meeting)，例如財政、運輸、教育等專業部長會議。有些專業部長會議為每年舉行，例如貿易部長會議及財政部長會議，有些則為不定期召開，例如，2003 年 SARS 爆發，臨時召開第一屆 APEC 衛生部長會議。2007 年係於澳洲達爾文舉行。

(三) APEC 企業諮詢委員會 (Business Advisory Council)

自 1995 年起，APEC 亦設立企業諮詢委員會，由各會員體各遴派該國 3 名企業界代表組成，共計 62 位，直接將民間部門的意見提交 APEC 領袖參考，以加強公私部門間之合作。

(四) APEC 資深官員會議 (Senior Officials' Meeting)

資深官員會議為 APEC 運作的核心機制，出席該會議之代表為各會員體主管部會的次長級或司長級官員，主要任務除向領袖及部長們提出建議，並執行部長級會議的決議外，亦指導及監督協調 APEC 各委員會、工作小組及任務小組之工作，我國 APEC 資深官員（APEC Senior Official）由本部國際組織司司長擔任。

依據 APEC 運作規則，各會員體的各項提案與年度工作事項首先應送交各委員會、工作小組與次級論壇初步討論與研議，經由資深官員會議認可後，再由資深官員送交部長會議及領袖會議採認，做為該年 APEC 成果，因此，資深官員可說扮演承上啟下的角色，APEC 各項工作，都少不了資深官員的參與。

(五) APEC 秘書處 (Secretariate)

APEC 秘書處位於新加坡，係 APEC 主要行政支援機制，為各會員體提供技術性協助及諮詢服務，並負責資訊管理、通訊及外展公關等相關工作。APEC 各會員體均可指派人員駐於秘書處擔任計畫主任(Program Director)，秘書處最高職務為執行長(Executive Director，ED)與副執行長(Deputy Executive Director，DED)，分別由該年 APEC 主辦會員體及次年 APEC 主辦會員體指派大使級官員出任。

(六) 委員會、工作小組、及資深官員會議特別任務小組

資深官員會議之下設有 4 個委員會、11 個工作小組、及 8 個資深官員會議特別任務小組，負責推動貿易暨投資自由化與便捷化、經濟技術合作、人力資源發展、能源、工業科技、運輸、海洋資源保育、電信暨資訊、觀光、漁業、農業、中小企業、性別整合、電子商務、社會安全、反恐、文化交流、急難預防及衛生等領域的合作。

三、能源工作組(Energy Working Group, EWG)

能源工作組成立於 1990 年，其目的在於尋求能源部門對於亞太地區之經濟與社會福祉的最大貢獻，同時減少能源供給與使用對於環境的衝擊。EWG 活動的重點在於提供有效率及可靠的能源與能源服務以符合 APEC 各會員經濟體的需求。其透過以下運作方式來形成決策：

- 各會員體以坦誠及開放的方式討論彼此的能源政策與規劃重點；
- 分享彼此關於資源需求與供應展望的基本資料，並考慮區域性能源政策的可能影響；
- 回應廣泛的能源相關議題。

EWG 未來方向策略規劃依照漢城及茂物（Bogor）宣言、大阪行動綱領、馬尼拉行動綱領（Manila Action Agenda）、APEC 領袖宣言與部長聲明的指示，勾勒出能源工作組之願景為提倡經濟成長、能源安全與環境保護（economic growth, energy security and environmental protection, 3Es），進一步增進能源對於亞太地區經濟、社會與環境的貢獻。能源工作組將透過政府立法者、技術專家、企業與管理者，在能源工作組的領導下進行會員經濟體間的合作以達成此目標。未來方向策略規劃顯示 APEC 能源工作組各會員體將於未來五年間共同合作，透過已考量各會員經濟體之個別差異的自

願性協定，提倡能源工作組的願景。同時為致力於亞太地區之永續發展，能源工作組將透過營運計畫追求下列目標：

- 目標一：加強亞太地區可負擔能源的安全性與可靠性。
- 目標二：提倡潔淨與有效率的技術與有效的使用能源，以達成經濟成長與環境改善。
- 目標三：改善亞太地區能源生產、使用及礦物開採的環境衝擊。
- 目標四：匯集能源工作組中所有可資運用的專業能力以達成上述目標。

能源工作組營運計畫倡導並採用上述四個目標與未來方向策略規劃所規範的七個策略主題下之政策措施、倡議與工作規劃。此七個策略主題如下：

- 孕育對區域性能源課題的共同瞭解;
- 改善各會員體在（能源）分析、技術、營運及政策方面的能力;
- 促進以對環境及社會負責的態度開發能礦資源;
- 促進能源效率與節約;
- 改善能源供應的可靠性與穩定性以符合需求;
- 促進能源技術的發展、交流、應用與展開;
- 促進多元且有效率的能源供應組合

在組織上，能源工作組透過五個技術專家分組研提計畫與合作方案，以研究並解決能源工作組五大能源主題，即能源供需、能源與環境、能源效率與節約、能源研究/開發/技術移轉、以及探勘開發相關問題。另外成立能源企業網路以協調能源企業對 EWG 的參與，以及能源管理者論壇，以吸納電力和瓦斯能源管理者的貢獻。

四、專家分組（Expert Groups）

能源工作組下設有各個專家分組：

1. 能源資料與分析專家分組（Expert Group on Energy Data and

Analysis, EGEDA）

能源資料與分析專家分組的任務在於推動能源供應與需求議題(Energy Supply and Demand Theme)下的工作，其工作核心在於建立亞太地區一致性的能源資料報告與預測架構，目前由日本 Mr Kenichi Matsui 擔任主席。其主要的出版品為自 1992 年出版以來的 APEC 能源統計（APEC Energy Statistics），以及與亞太能源研究中心（Asia Pacific Energy Research, APERC）共同合作出版之 APEC Energy Overview。EGEDA 同時亦負責監督 APERC 的運作。

2. 潔淨化石能源專家分組(Expert Group on Clean Fossil Energy, EGCFE)

潔淨化石能源專家小組的主要任務在於推動能源與環境主題(Energy and Environment Theme)下的工作。其角色為在增進經濟發展的同時降低因製造、準備、運輸、儲存與使用化石能源及其衍生物所導致的地方性、區域性甚或全球性的環境衝擊。目前主席由美國 Mr. Scott Smouse 擔任。此專家分組目前最新的計畫為在原油與天然氣計畫（Oil and Gas Program）下之能源安全倡議（Energy Security Initiative）。

3. 能礦探勘與開發專家分組（Expert Group on Minerals and Energy Exploration and Development, GEMEED）

於 1994 年成立，主要在推動亞太地區有關能源與礦物的探勘、開發及貿易機會的合作業務。目前最重要的工作為建置能源與礦物探勘開發資料庫，另外也舉辦系列的永續礦業開發環境研討會，推動礦業的永續經營技術合作。目前由智利 Mr Tomas Astorga 擔任主席。

4. 新能源及再生能源技術專家分組(Expert Group on New & Renewable Energy Technologies, EGNRET）

新及再生能源技術專家分組的任務在於推動能源研究發展與技術轉移主題(Energy Research, Development and Technology Transfer Theme)下的工作。該小組的工作重點在於藉由增進各會員體在評估、營運、維護及適應現有與新技術的能力，增加各會員體吸收新及再生能源技術的程度。目前由美國 Ms. Cary Bloyd 擔任主席。

5. 能源效率與節約專家分組（Expert Group on Energy Efficiency and Conservation, EGEE&C）

能源效率與節約專家分組負責推動能源效率與節約主題下的工作。該小組的工作重點在鼓勵各會員體實施節約能源的政策與計畫與應用能源效率技術。我國工研院能資所曹芳海博士於 2001 年 9 月第十九屆能源效率與節約專家分組會議中獲選為主席，連任兩期，於今年屆滿。

貳、日本能源經濟研究所(Institute of Energy Economics, Japan, IEEJ)與亞太能源研究中心(Asia Pacific Energy Research Center, APERC)

一、日本能源經濟研究所

(一)日本能源經濟研究所成立背景

日本能源經濟研究所是日本國際貿易與工業部(Ministry of International Trade and Industry, MITI)於 1966 年成立，以國家經濟觀點進行能源研究。在 1999 年，日本國際貿易與工業部將其 1981 年所設立之石油情報中心 (Oil Information Center)併入日本能源經濟研究所。1984 年成立能源資料與模式中心(Energy Data and Modeling Center, EDMC)，該中心之任務係進行能源模式建立與計量經濟分析。在 1996 年成立亞太能源研究中心(Asia Pacific Energy Research Centre)。2005 年成立中東研究中心(Middle East Research Center)。

(二)與日本能源經濟研究所合作之機構

目前與日本能源經濟研究所合作的機構包括印度(The Tata Energy Research Institute)、越南(The Energy Research Institute of Vietnam)、沙烏地阿拉伯(Ministry of Petroleum and Mineral Resources)、伊朗(The Institute of International Energy Studies)、蘇俄(Energy Systems Institute, Siberian Branch of the Russian Academy of Sciences 與 International Institute for Fuel and Energy Complex)、美國(Baker Institute of Public Policy、Massachusetts Institute of Technology Energy and Environmental Research Institute、Institute for the Future)、韓國(Korea Energy Economics Institute)、中國大陸(Energy Research Institute National Development and Reform Commission)、中國大陸(Tsinghua University)與台灣(Energy and Resources Laboratories, ITRI)。

(三)日本能源經濟研究院石油情報中心

石油情報中心(Oil Information Center)的主要業務為

- 調查月報：汽油、煤油與柴油零售價格
- 調查週報：汽油、煤油與柴油零售價格趨勢
- 柴油調查月報：貨運用柴油價格調查
- LPG 價格趨勢月報：住宅與商業部門 LGP 價格與批發商價格調查
- 住宅部門 LPG 市場調查月報

二、亞太能源研究中心(Asia Pacific Energy Research Center)

日本能源經濟研究所於 1996 年成立亞太能源研究中心(APERC)，該中心係根據 1995 年亞太經濟合作領導人高峰會議之結論，由日本國際貿易與工業部(MITI)提供財務贊助而設立。APERC 的主要任務為加強各經濟體對 APEC 區域與各會員國能源供需趨勢與能源基礎發展之瞭解並研擬合理能源政策與市場自由化機制以促進區域繁榮。APEC 能源資料與分析專家分組監督該中心之研究業務，而研究計畫由 APEC 能源工作小組(EWG)所認可。

APERC 經濟體共有 21 個成員，包括：澳洲(Australia);汶萊(Brunei Darussalam);加拿大(Canada);智利(Chile);中國(the Peoples' Republic of China);香港(Hong Kong, China);印度尼西亞(Indonesia)日本(Japan);南韓(the Republic of Korea);馬來西亞(Malaysia);墨西哥(Mexico);紐西蘭(New Zealand);巴布亞新幾內亞(Papua New Guinea);秘魯(Peru);菲律賓(the Philippines);新加坡(Singapore);中華台北(Chinese Taipei);泰國(Thailand);美國(the United States of America) and 越南(Viet Nam); 俄羅斯(Russia)等。

APEC 能源工作小組(EWG)同意 APERC 職權範圍，其中闡明 APERC 主要活動內容如下：

－每兩年出版 APEC 能源供需展望（APEC Energy Supply and Demand Outlook）

－研究區域能源市場發展、能源政策及相關議題

－促進能源研究成果移轉至 APEC 會員體

－透過與 APEC 各會員體的網路聯繫，維護區域能源資料庫

－與 APEC 會員體合作以執行能源工作組的能源政策倡議

此外，職權範圍中亦指出確認 APERC 活動應依照以下程式：

－APERC 應於每年的第一次 EWG 會議接連舉辦研討會，與會者包括 APERC、各會員體代表、專家分組主席及能源企業網絡。EWG 秘書處將於會中告知與會者能源工作組的優先事項，並進行討論。

－研討會討論的結果將提交能源工作組會議中供 EWG 會員體代表討論。

－EWG 會員體將於會期外同意 APERC 次一年度將執行的活動清單。此一程式由 EWG 秘書處協助進行。

－APERC 主席應針對如何因應 EWG 會員體所指出的優先活動提出規劃案。此外，APERC 主席亦可獨立提出活動。在

研擬規劃案的過程中，APERC 應諮詢能源數據與分析專家分組及 APERC 諮詢委員會的意見，並提供至少四週的審查與回覆的時間。

－APERC 的規劃案應於第一次能源工作組會議結束後四個月內遞交 EWG 會員體參酌並於會期外通過。對於特殊的議題則於第二次能源工作組會議中討論。

－APERC 主席應向能源工作組、APERC 諮詢委員會及能源數據與分析專家分組報告活動的進展及成果。

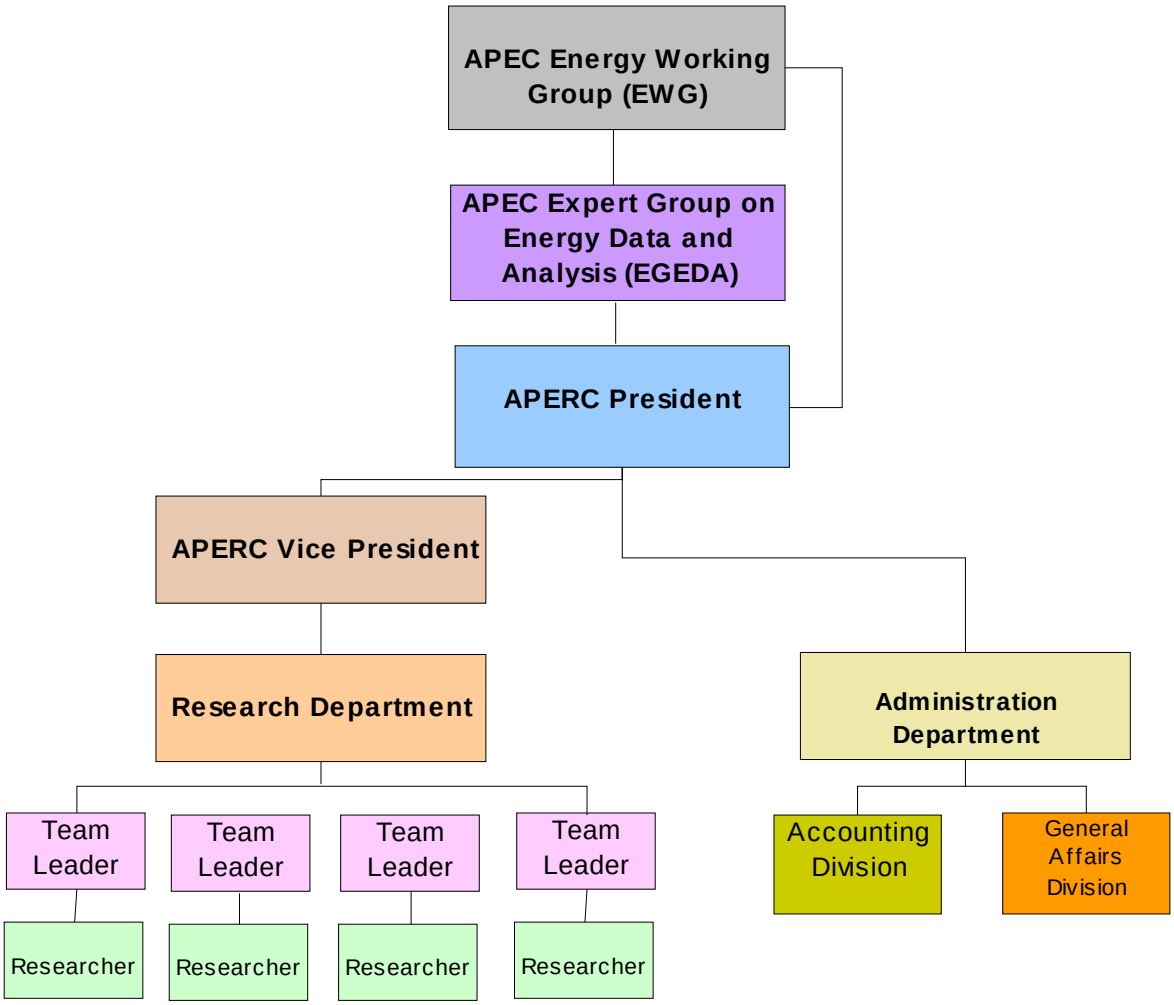
APERC 之主要功能在進行能源研究以加強對 APEC 區域與各會員國能源議題之瞭解。研究之主題係依據大多數會員國之優先需求所訂定，包括下列各個方向並已完成相關之研究報告：

- 能源資料庫
  - APEC Energy Database
- 亞太地區能源供需展望
  - APEC Energy Demand and Supply Outlook, 2006, 2002, 1998
- 亞太地區能源市場分析
  - Urban Transportation Energy Use in the APEC Region, 2007
  - Understanding International Energy Initiatives, 2007
  - A Quest for Energy Security in the 21st Century－Resources and Constraints, 2007
  - APEC Downstream Oil Market Study, 2005
  - Renewble Electricity in the APEC Region: Externalities in Poower Generation, 2005
  - Energy in China: Transportation, Electric Power and Fuel Markets, 2004
  - New and Renewable Energy in the APEC Region: Prospects for Electricity Generation, 2004

- Electric Power Grid Interconnections in the APEC Region, 2004
- Nuclear Power Generation in the APEC Region, 2004
- Gas Storage in the APEC Region
- Industrial Sector Natural Gas Use
- Energy Efficiency Indicators and Potential Energy Savings in APEC Economies, 2002

- 永續能源發展
  - Energy Security Initiative: Some Aspects of Oil Security, 2003
  - Alternative Development Scenarios for Electircity and Transport, 2002
- 能源基礎建設之投資
  - Energy Investment Outlook for the APEC Region, 2003
  - Energy Efficiency Programs in Developing and Transitional APEC Economies, 2003
- 能源政策分析
  - Natural Gas Market Reform in the APEC Region, 2003
  - Energy Security Initiative: Emergency Oil Stocks as an Option to Respond to Oil Supply Disruptions, 2002

下圖為 APERC 運作的組織架構:



第三章　研習工作紀要

壹、工作業務概要

職於 96 年 1 月赴 APERC 進行訪問研究為期一年。當時 APERC 正進行三項研究計畫為：”Urban Transportation Energy Use in the APEC Region”、”Understanding International Energy Initiatives”與”A Quest for Energy Security in the 21st Century – Resources and Constraints”。 職至該中心後即協助”Urban Transportation Energy Use in the APEC Region”研究計畫之執行，主要負責 Chinese Taipei 資料的整理與分析。

每年 APERC 亦出刊”APEC Energy Overview”研究報告。在每年上半年與下半年分別例行舉辦兩場研討會，邀請 APEC 各會員國派員參加研討。日本之預算期間於每年三月開始，在新一年度需提出新之研究計畫。在 96 年度 APERC 提出四項新研究計畫，分別為：”Urban Transportation Energy Use in the APEC Region Phase II”、”Understanding International Energy Initiatives Phase II”、” Economy Review of China” 與“Energy Efficiency in the APEC Region” 等四個議題。

完成 Urban Transportation Energy Use in the APEC Region Phase I 之後，職接著參與該計畫 Phase II 與 Economy Review of China 研究計畫。在 APERC 期間因業務需要參加了第八屆在澳洲舉行的能源部長會議 (EMM8)、分兩次赴中國大陸調研了廣州、長沙、西安與成都等四個城市以及回台灣參加了第一屆 IAEE 亞洲年會暨第二屆海峽兩岸海峽能源經濟學術研討會。

除參與 APERC 研究計畫外，在該期間所參加較重要的會議包括 International Biofuel Conference 2007、 韓國 KOGAS and APERC Workshop 與第五屆台日能源會議。

茲按季整理在 APERC 一年中所進行之各項工作如下表：

第一季(2007 年 1 月 12 日-3 月 31 日)
- 參與 Urban Transportation Energy Use in the APEC Region Phase I 研究計畫，提供 Chinese Taipei 相關資料與分析(Scoping Paper 如附件一;完整報告請參閱 APERC 網站。) - 參加 International Biofuel Conference 2007(2007.2.1~2.2) - 協辦 APERC Annual Conference(2007.2.14~2.16)
第二季(2007 年 4 月 1 日- 6 月 30 日)
- 參與 Urban Transportation Energy Use in the APEC Region Phase II 研究計畫，提供 Chinese Taipei 相關資料(Scoping Paper 如附件二;完整報告尚未完成。)以及 Economy Review of China 研究計畫(Scoping Paper 如附件三, 完整報告尚未完成) - 參加第八屆 APEC 能源部長會議(2007.5.25~5.31;出國報告如附件四) - 協辦 6 月 21 日 APERC 與韓國 Kogas 公司合作之天然氣市場研討會
第三季(2007 年 7 月 1 日- 9 月 30 日)
- 參與 Urban Transportation Energy Use in the APEC Region Phase II 研究計畫，並以台北捷運與汽油消費量關係為題撰寫 Case Study - 參與 Economy Review of China - 赴中國大陸廣州與長沙調研並參加在廣州舉辦之 APEC Natural Gas Utilisation Workshop (2007.8.26~9.1;出國報告如附件五)
第四季(96 年 10 月 1 日- 97 年 1 月 10 日)
- 參與 Urban Transportation Energy Use in the APEC Region Phase II，並以台北捷運與汽油消費量關係為題撰寫 Case Study - 參與 Economy Review of China 研究計畫 - 赴中國大陸西安與成都調研，並參加在西安舉辦之 APEC 清潔化石能源專家組清潔化石能源技術研討會(2007.10.14~10.23;出國報告如附件六) - 協辦 11 月 29-30 日 APERC 舉辦之年中 worshop 研討會 - 參加第一屆 IAEE 亞洲年會暨第二屆海峽兩岸海峽能源經濟學術研討會，並於 IAEE 亞洲年會中發表論文(2007.11.4~11.12; 出國報告與論文分別如附件七與附件八) - 撰寫 APEC Energy Overview 2007 研究報告中有關 Chinese Taipei 部分(附件九)

APERC分別在2007年2月與11月舉辦年度研討會(APERC Annual Conference)年中研討會(APERC Workshop)，另於6月21日與韓國Kogas公司合辦天然氣市場研討會。APERC年度與年中研討會係每年例行舉辦，邀請各國能源界之專家學者發表專題演講並對APERC之研究方向提出建言。研討會部分各會員國均獲邀參加，台灣能源局亦派員與會。茲將主要研討會概要如下，APERC 年度與年中研討會在APERC網站(http://www.ieej.or.jp/aperc/)則有議程與論文集等相關詳細資料：

一、 International Biofuel Conference 2007(2007.2.1~2.2)

2007 年之 International Biofuel Conference 係由 NEDO(The New Energy and Industrial Technology Development Organization)在日本東京台場 Big Sight 所舉辦之國際大型生質燃料研討會，由日本 Agency for Natural Resources and Energy 贊助, EGNRET(APEC Expert Group on New and Renewable Energy Technologies)協辦。

會議目的係由與會專家探討生質燃料在生產與使用上所面臨的各種挑戰與機會，以期使與會人士瞭解各國在生質燃料之發展技術現況，並促進彼此之實質合作。

詳細資料請閱

http://www.ibc2007.jp/en/index.html及

http://www.nedo.go.jp/english/archives/190305/190305.html

二、APERC 年度研討會(APERC Annual Conference)(2007.2.14~2.15)：

研討主題包括:

Session 1: Urban Transport Energy Use in the APEC Region

- Urban Transport Energy Use in the APEC Region
- Consequences of Urban Transport on the Environment and Energy Consumption
- Bus Rapid Transit Oriented Development: A Vision for Sustainability

Session 2: A Quest for Energy Security in the 21st Century –

Resources and Constraints

- Quest for Energy Security in the 21st Century – Resources and Constraints
- Oil Resources: Estimates and Uncertainties
- Russia's Energy Resources: A Significant Factor in Ensuring Energy Supply Security of APEC Economies
- Nuclear Energy for Sustainable Development
- Australia's LNG Industry

Session 3: Understanding International Energy Initiatives

- Understanding International Energy Initiatives
- Asian Energy Cooperation: International Initiatives and Problems
- Making Climate for Change

詳細資料請參閱:

(http://www.ieej.or.jp/aperc/Annual_Conferemce2007.html)

三、APERC 與 Kogas 研討會(2007.6.21)：

研討主題包括:

- Asia-Pacific LNG Market from the Viewpoint of Climate Policy
- APEC Energy Demand and Supply Outlook
- Climate Change and its Impacts on Gas Demand
- Japan's Gas Supply System
- LNG Terminals and Public Perception on the American Pacific Coast
- International Energy Initiatives: Supply Security and Minimal Environmental Impacts
- Stance on Post-Kyoto: Market vs. Regime
- Urban Transport Energy Use in Asia
- Environmental Regulation and Fuel Competition in the Transport Sector

LNG 之市場隨著現貨量之增加，使其價格似有全球化之趨勢。預期未來在 2010 年後，隨著美國大量進口 LNG，價格全球化之趨勢將更為明顯。中國大陸與東南亞各國國內天然氣價格各部門交互補貼之情況能存在，在偏遠地區住宅部門及肥料部門尤其嚴重。全球能源需求之成長主要來至經濟成長、都市化與工業化三項因素。在能源供給面，未來天然氣供應量將超過煤，惟發電部門中，煤仍將佔主要之地位。而再生能源與燃料電池在未來三十年之能源結構比重中比率仍偏低。

四、第 5 屆台日能源合作研討會 (2007.9.13)：

配合經濟部能源局，推動台日雙方為加強彼此間之能源資訊交流及合作，民國 90 年 6 月初於上海亞太經濟合作(APEC)貿易部長會議期間，進行台日雙邊會談時，由日本前產業大臣平沼赳夫與我方經濟部林前部長信義初步達成「加強台日能源合作」之共識。在以上基礎下，台方由經濟部能源局委託工研院能資所，日方由經濟產業省資源能源廳委託日本能源經濟研究所(IEEJ)，雙方於民國 90 年 10 月 5 日在台北共同召開第 1 屆「台日能源合作研討會」，並由工研院能資所與日本能源經濟研究所分別代表台日雙方政府單位簽訂「台日能源合作備忘錄」。第 2 屆、第 3 屆「台日能源合作研討會」則分別於民國 91 年、93 年在日本東京舉行，第 4 屆於 95 年 2 月在台北召開，第 5 屆則於日本東京召開。

會議內容主要有下述之幾個重點:

1. 由於地球之能源有限且日益枯竭，因此未來對能源的使用必須就能源安全保障及地球環境保護二方面探討，因此台日雙方可就節省能源、新能源之利用及技術開發等方面作為合作的議題，台灣與日本都是大幅進口能源的國家，雖然台灣不是京都議定書之一員，但台灣為地球上之一份子，因此有義務盡一份對維護地球之責任，台灣計劃 2010 年新能源以 10%為目標，計劃於 2025 年提高能源效率 30%為目標，此目標較今年 APEC 會員國會議所訂 2030 年目標 25%更積極。
2. 節能是符合世界之潮流，各國依自己國家之經濟狀況會有不同標準，使用能源之安全，需大家互相合作，不能閉門造車。在發展核電、開發新能源上都是必需的，尤其太陽光電技術

日本與台灣都有合作之空間與領域，更有發展之遠景。

3. 日本能源之政策推動兼顧 3S 目標，即能源供應的安全、持續性解決全球的環境問題以及能源市場的穩定性值得借鏡。另節約能源措施、節能技術與未來規劃等也值得參考。

五、APERC 年中研討會(APERC Workshop)(2007.11.29~30)：

Session 1: Economy Review of China

- Energy Review of China
- China's Role in the Asia's Economy
- China's Energy Giants, More good times ahead
- Primary Energy Imbalance and China's Responses: with Special Reference to Oil Industry

Session 2: Energy Efficiency in the APEC Region

- Energy Efficiency in APEC, A Focus on the Power Sector
- Energy Efficiency in the Electricity Sector in Australia
- Energy Efficiency Policies around the World: Review and Evaluation
- Load Growth and Vampire Slaying: The Long-Term Outlook for U.S. Electricity Demand in the Building Sector

Session 3: Understanding International Energy Initiatives

- Understanding International Energy Initiatives: Way Forward
- Asia-Pacific Partnership on Clean Development and Climate
- Our Challenge for Clean Development and Climate
- Improving International Energy Initiatives

Session 4:Urban Transport Energy Use in the APEC Region – Phase II

- Urban Transport Energy Use in the APEC Region
- Urbanization, Spatial Structure, and Transport Energy Consumption
- Powertrain and Fuel Sustainability
- Urban Transport Infrastructure Development and Financing for Bangkok Region

貳、 研究報告與出國報告摘要

茲就職在亞太能源研究中心所參與撰寫之研究報告內容摘要於後，完整之英文研究報告請參閱APERC網站http://www.ieej.or.jp/aperc/。

一、Urban Transport Energy Use in the APEC Region(Phase I)

- Dependence on oil products in the APEC region is projected to rise, driven primarily by the transport sector, which will account for nearly 70 percent of the incremental oil demand growth by 2030.
- Road transport is projected to account for about 80 percent of total transport energy demand through 2030 and oil products will remain the primary energy source within this sector.
- Increasing transport energy demand may pose challenges to APEC economies because of declining domestic oil production and rising oil import dependence (projected to increase to 52 percent by 2030 from its current level of 36 percent).
- Local and global environment is another challenge posed by the transport energy demand growth, as the transport sector leads both air pollutant and carbon dioxide emissions.
- Continued urbanisation, high income growth (3.5 percent per annum), expansion of the domestic automobile industry within economies, and sustained industrialisation are the major drivers affecting the growth in oil products demand for road transport.
- Transport energy demand reflects diverse factors, such as economic development, urban form, and industry structure. A holistic approach tailored to meet the needs of each APEC economy is essential to enhance transport energy efficiency and security.
- Transport issues concern various government agencies; trans-agency coordination, at both the central and local levels, is

thus recommended to enhance the effectiveness of policy implementation.

- Continued efforts are necessary to develop technologies. Such efforts should focus on technologies to improve vehicle efficiency and those for alternative fuels.
- APEC economies may need to increase traffic demand management to enhance energy security through the transport sector. Two options are to enhance public education to shift lifestyles away from vehicle dependence and to develop mass transit systems to facilitate this change.
- Timely investment in mass transit systems is necessary to reduce people's vehicle dependence. City planners need to assess their future transport requirements and plan appropriate timing in investment towards mass transit systems.

二、APEC Energy Overview: Chinese Taipei(詳見附件九)：

- 台灣 2005 年人口 22.69 百萬，每人 GDP(PPP)所得為 25,228 美元(2000 US$)，初級能源達 106.6 百萬公噸油當量，結構中 42%為石油、37%為煤、10%為核能與 12%為天然氣。能源進口依賴度為 98%。
- 在最終能源消費中，在 2005 年為 64.2 百萬公噸油當量，以工業部門之 56%居首，交通部門 23%次之。如以能源類型區分，以油品之 60%最高，電力及其他 26%次之，煤為 10%，天然氣為 3%。(該資料係根據 IEA 資料庫與台灣官方資料有差異)。
- 能源產業政策概要：
  - 能源委員會於 2004 年改制為能源局負責能源政策之規劃與執行。於 2005 年 6 月召開全國能源大會並發表能源政策白皮書。
  - 依據石油管理法執行油品安全存量規定。

- 採行浮動油價機制，促使能源價格合理化
- 推動溫室氣體自願性減量措施，建立能源產業盤查、登錄、查核、驗證體系
- 鼓勵天然氣與再生能源之使用以降低CO_2排放量。

另將四次出國報告摘要簡略如後，詳細內容請參閱附件。

一、第八屆能源部長會議(EMM 8)(2007.5.29)

第八屆能源部長會議於 2007 年 5 月 29 日於澳洲達爾文舉辦，會議主題為「透過效率、節約和多樣性，達成能源安全和永續發展（Achieving Energy Security and Sustainable Development through Efficiency, Conservation and Diversity）」。會議主席由澳洲工業觀光資源部部長 Ian Macfarlane 擔任，議程包含「APEC 執行長報告」、「IEA 執行長報告」、「政府與私部門對話」、「推動一般能源部門潔淨及有效率的能源生產和使用」、「強化運輸部門的石油安全」、「加強 EWG 的貢獻」、「能源部長聯合宣言」等各項重要議題。因正逢全球面臨高能源價格與全球暖化衝擊之挑戰，故本屆會議特別邀請國際能源總署(IEA)執行長 Claude Mandil，就區域能源安全與永續發展之課題進行演講，並與各會員體部長對話。

APERC 所長 Mr. Kimura 在會議中針對”The APERC’s APEC Energy Demand and Supply Outlook 2006”與”Urban Transport Energy Use in the APEC Region.” 兩議題代表 APERC 作了簡報。

二、 赴中國大陸廣州與長沙調研(2007.8.26~2008.9.1)

除了參加在廣州舉辦的 APEC NATURAL GAS UTILISATION WORKSHOP 外，拜訪的單位包括

1. 廣東發改委能源處
2. 廣東省技術經濟研究發展中心
3. 湖南省發展和改革委員會和湖南省電網公司
4. 湖南省發展和改革委員會和湖南省煤炭工業管理局規劃處

詳細調研內容請詳見附件五

三、 赴中國大陸西安與成都調研(2007.10.14~2008.10.23)

除了參加在西安舉辦的 APEC 清潔化石能源專家組 清潔化石能源技術研討會(HARMONIOUS AND SUSTAINABLE COAL POWER GENERATION" APEC CLEAN FOSSIL ENERGY SEMINAR)外，拜訪的單位包括

1. 西安市建設委員會
2. 長安大學
3. 陝西發展和改革委員會
4. 美亞電力有限公司與綿陽三江美亞水電有限公司

詳細調研內容請參閱附件詳見附件六

四、 參加第一屆 IAEE 亞洲年會暨第二屆海峽兩岸海峽能源經濟學術研討會

1. 第一屆 IAEE 亞洲年會(2007.11.5~11.6)

第一屆國際能源經濟學會（International Association for Energy Economics, IAEE）亞洲年會，於 96 年 11 月 5 日在中油大樓國光廳舉行開幕典禮，由大會主席、中華民國能源經濟學會理事長暨中油董事長潘文炎主持，並邀請經濟部謝發達次長及跨政府氣候變遷專家小組（Intergovernmental Panel on Climate Change）副主席 Mohan Munasinghe 博士與會致詞。

IAEE 每年定期舉辦全球年會、歐洲年會及北美年會，在亞洲並無年會。中華民國能源經濟學會經過多年努力爭取，於 2006 年正式向 IAEE 提出申請，首創 IAEE 亞洲年會並獲得主辦權。

此次年會有世界各地近 19 個國家相關政府部門代表及專家學者與會，參與大會的國際代表約 80 人，國內代表約 270 人。並邀請到跨政府氣候變遷專家小組副主席 Mohan Munasinghe 博

士擔任本屆亞洲年會之主題演講人，演講題目為「Energy, Climate Change and Sustainable Development」。該組織與美國前總統高爾共同獲頒 2007 年諾貝爾和平獎，以表彰他們為改善全球環境與氣候所作的努力。透過國際會議，我國將有更多機會與國際學者專家進行討論與交流，可提高我國在此一領域之國際學術地位。

全球能源需求持續升高，各個區域間的經濟、社會、環境等因素牽一髮而動全身，使得能源及環境的問題不再是單一地區的努力就可以解決的，必須跨區域國家共同研討解決方案，並且落實執行。本屆年會廣邀亞洲各國專家學者，以高油價時代的亞洲能源安全與經濟發展為主題，內容涵蓋：亞洲能源安全；中東、東南亞與蘇俄的能源供給；區域能源市場與需求；環境保護；節約能源與新能源科技展望；能源政策與油價控制；亞洲發展中國家能源與貧窮問題；以及亞洲新興國家的能源策略等重要能源議題。從能源市場、科技發展、及永續發展的角度，討論現在與未來能源供需的全球化議題。

APERC 所參與的部分包括

1. Ms.Alicia Altagracia Aponte 發表論文 “Oil Supply Security Risk & Offset Potential in the APEC Region: An Initial Perspective”
2. 職發表論文 “MRT Ridership Behavior and the Impact on Gasoline Consumption in Taipei”
3. Ms.Naoko Doiz 發表 “Evaluation of Urban Transport Energy Use in Asia”.
4. Dr.Kenichi Matsui 主持 plenary session “International Energy Regimes and Initiatives in Asia” ,與會者包括 Dr.Serguei Popov 與 Dr.Yonghun Jung.

2. 第二屆海峽兩岸海峽能源經濟學術研討會(2007.11.7~11.8)

超過 20 位來自中國大陸的學者專家與 100 多位台灣人士與會。除了台灣經濟研究院洪德生院長專題演講「台灣能源價格合理化的檢討」與美國東西方中心張中祥博士專題演講「中國大陸能源和環境政策」外，專題討論包括「能源經濟」與「能源供需與市場」、「能源與環境保護議題」、「新能源科技與節約能源」與「能源與公共政策」等議題。

第四章　心得與建議

APEC 是亞太地區最重要的多邊官方經濟合作論壇之一，亦為我國目前實際參與最重要之國際多邊機制機構，APEC 所形成的共識對全球經貿政策及規範具有極大影響力。日本政府贊助亞太能源研究中心，邀請各APEC會員國派員至日本研習以增進各國對日本之瞭解及加強日本與各國之交流。亞太能源研究中心提供亞太地區各會員國派員參與合作研究，得以促進各國能源產業研究之交流。

經一年在 APERC 的研究交流有以下心得與建議:

一、 參與 APERC 之研究計畫，針對 APEC 地區經濟體之能源議題與來自各會員國研究員共同進行研究，由各經濟體對議題不同角度的思維出發，不僅可擴充能源領域的見識視野，研究員間亦建立了良好互動，對未來在能源領域的交流上有莫大的助益。

二、 國際能源市場瞬息萬變，對於相關資訊的掌握與經驗的學習自然非常重要。為因應未來能源市場之發展，本公司有必要積極加強與國外機構合作研究及參與國際能源合作研討會，並加強雙邊交流機制，讓本公司與國際機構的交流奠立持續發展的基礎。

三、 油氣產業為全球性產業，儘管台灣受限與國際政治外交局勢無法參與各國政府間之合作，然從業者立場對這些影響國際油氣產業發展之重要情境變數亦須密切觀察，並仍可以民間業者立場透過與本公司有業務來往之各國油氣公司發揮影響力，加強商業投資合作機會。

四、 日本政府贊助亞太能源研究中心，提供亞太地區各會員國派員參與合作研究，得以促進各國能源產業研究之交流。APEC 會員國經濟狀況與能源資源各有不同，進行能源政策比較與分析有其價值。

五、 APERC 成立以來完成多項研究，值得相關研究業務上借鏡參考。國際性合作組織與資源之運用，有助於本公司對國際能源市

場發展資訊之掌握。為提升本公司研究能力與水準，值得本公司持續派員赴亞太能源研究中心進行研究訪問。

附件一

SCOPING PAPER

URBAN TRANSPORTATION ENERGY USE IN THE APEC REGION

BACKGROUND

Economies in APEC have been the key drivers for global oil demand growth. Between 2000 and 2004, APEC economies accounted for as much as 90 percent of the incremental growth of the world's oil demand. Despite some signs of slow down in 2005, long-term prospect for oil demand in APEC remains resilient as rising income and improvements in living standards would further accelerate oil demand growth. APERC's recently released outlook projects that a thirty-year oil demand of APEC economies will envisage a robust growth at an annual rate of 1.7 percent, a faster pace than the world average.

Much of the increase in oil demand for APEC would come from transportation sector, accounting for 70 percent of the thirty-year increments. As alternative fuels have not become economically viable options, transportation sector, including road, air and marine, would continue to depend on oil products for quite some time, unless major technological break through takes place.

In some economies of APEC, urban transportation energy demand is growing at the faster rate than the average rate of economy as a whole. Rising income of urban population is boosting the level of automobile ownership, which translates into substantial increase in demand for gasoline and diesel. Air quality of major cities in APEC has been deteriorating, largely because of the increasing emissions from automobiles.

Future oil demand in the APEC economies, excluding Brunei, Canada, Mexico and Russia, would have to be met increasingly by imports, rendering a greater concern over oil supply security. Responding to the looming oil supply security concern, APEC Energy Ministers in 2005 in Gueonju, agreed that the continued growth in oil demand should be reduced through improvement in energy efficiency in transportation sector. Ministers of APEC economies also noted that use of alternative transport fuels would enhance energy source diversification.

APERC proposes to conduct a research study on transportation energy in APEC, with the focuses on the use in city level and their potential use of alternative fuels. For the

purpose of considering options to reduce oil dependency, study of the urban transportation energy use would be of broader interest across the region as cities are the centre of economic development, population increase, and transportation oil products demand growth.

PROPOSED CONTENT OF THE STUDY

APERC will start with developing several indicators concerning transportation energy demand in the major cities of APEC. For the indicators to be established, it is necessary to collect wide range of data that include (1) gasoline and diesel consumption, (2) the number of car stock for different size, (3) passenger km, and tonne km, (4) modal split among different types of modes, (5) macro indicators such as population, and Gross Regional Product and (6) air pollution data such as SOx, NOx and particulates.

With those indicators, APERC will analyse historical trend for transportation energy demand in the major cities in the Asia-Pacific region and identify key factors affecting modal choice for both passenger and freight transport. The report also evaluates the impact of urban transportation energy demand growth on energy security and environment.

As the options for transportation energy demand management, the report analyses (1) policy instruments such as land use regulations, infrastructure design and investment, and (2) economic instruments such as energy pricing, taxation and road pricing at the urban level.

The report assesses potential for alternative transport technologies with the focus on their use in the major cities of APEC. Assessment of resource and infrastructure requirements for alternative technologies will be conducted to identify potential/bottlenecks to wider application of alternative transport technologies. By presenting successful cases of the use for alternative transport technologies, APERC will consider how they have effectively improved air quality of cities, and how they contributed to the enhancement of energy supply security in APEC.

TIME SCHEDULE

APERC will propose to conduct a two-year project on the study of urban transportation energy use in the APEC region. First phase will focus on the analysis of the pattern of urban transportation energy use, and the second phase will focus on the assessment of

potential for alternative fuel use in urban cities. APERC will complete writing of the first draft report by the end of December 2006, and finalise the final draft report of first phase in February 2007. Second phase of the report will be conducted in the next fiscal cycle between 2007 and 2008.

附件二

SCOPING PAPER

Urban Transport Energy Use in the APEC Region
Phase II: Costs and Benefits

Study Background and Objectives

Continued urbanisation poses challenges to APEC member economies. Insufficient urban mass transit infrastructure combined with the growth in urban population income has driven motorisation trends in developing economies of APEC. Similarly, cities of some developed economies face transport challenges due to difficulties in changing lifestyle – urban dwellers of developed economies travel longer distances by heavier vehicles, leading to a steady increase in oil consumption. Together, these phenomenons drive concerns for energy security and sustainable development.

Towards the enhancement of energy security, the first phase of the study identified the need for timely investment in mass transit infrastructure. Mass transits, including rails, subways and buses, consume less energy per unit of mobility compared with that of passenger vehicles. Furthermore, it serves as a means to reduce vehicle dependence in urban life. However, due to the high upfront investment requirements, development for urban mass transit systems tends to face difficulties. To capture the appropriate timing for the investment, city planners – especially at the early stage of development – need to asses future trajectory for urban transport demand growth.

In addition, the study found that many transit systems, particularly with large ones in some developed economies, have greater potential to improve energy intensities compared with smaller ones. Ultimately, how to increase system ridership is the key to improve overall energy intensity of urban transit systems.

Building on the findings from the first phase, the second phase of this study further tries to layout the options that can improve urban transport energy intensities. The study also will offer analytical tool to design an optimal mix of urban transport mode in some rapidly developing economies of APEC in order to consider costs and benefits from mass transit development. The study will examine the potential for fuel replacement in the urban areas of developed APEC economies, and identify the conditions to facilitate its implementation. By examining those cases with promising outcomes, and un-intended consequences, the study will offer insights and policy implications into how economically, and environmentally sustainable urban transport systems can be designed and implemented.

Urban Transport Energy Use in the APEC Region – Phase II

Key Questions

- How can we reduce vehicle dependence in urban life?
- How can we reduce costs of developing mass transit systems?
- How much potential do the major APEC cities have to replace oil products by cleaner energy sources?

Outline

1. Introduction
   - Urbanisation, transport energy use and environment (in APEC)
     - An overview of recent developments
     - Explanation on the need for modal shift
2. Factors to urban transport energy intensities in APEC
   - Analysis of urban transport energy intensities (passenger vehicles, buses, and rails) and factors contributing to them
     - An overview of energy intensities for passenger vehicles, buses, and rails in the major cities of APEC
     - Costs of vehicle ownership vs costs of mass transit
     - Urban form, densities and travel pattern
       - CBD, residential area, suburbanization …
3. Financing mass transit systems
   - Discussion on the costs of mass transit infrastructure development
     - Bus, subway and rail
     - Financial performance of mass transit systems
   - Discussion on financing methods for urban mass transit systems
4. Optimal mix of urban transport systems in developing APEC economies
   - Projections for future urban transport demand (**Hanoi or Bangkok or Manila**)
   - Modelling exercise to analyse optimal mix of urban transport system
   - Policy implications towards improvement in urban transport energy intensities
     - How can we reduce costs of developing mass transit systems?
5. Potential for fuel replacement in urban transport in APEC (if possible)
   - Analysis on the expanding the use of alternative fuels (in urban area)
   - Identifications of the barriers for increasing alternative fuel use
     - Costs of alternative fuels – from production (in rural area) to consumption (in urban area)
     - Technology
     - Infrastructure
       - Issues on infrastructure development, and resources availability
   - Policy implications
6. Methods to reduce urban transport energy use in APEC
   - An overview of those transport methods implemented throughout the major cities of APEC

- Analysis on those measures implemented in the major cities of APEC
    - **Edmonton** – bus timed-transfer service and decentralisation
    - **Seoul** – efforts to reduce passenger vehicle dependence
    - **Taipei** – MRT and vehicle dependence
    - **Jakarta** – Bus way programme

Timeline

July
- Data collection and information gathering

August
- Start analysis – Chapter 2 and Chapter 3

September
- EWG 34: 2-6 September
- Continuation of the analysis – Chapter 2 and Chapter 3

October - December
- Start analysis – Chapter 4 and Chapter 5
- Start documentation

January - March
- Review

附件三

SCOPING PAPER

ECONOMY REVIEW OF CHINA

Purpose and Scope

Thoughts towards the People's Republic of China should be region-specific. With current Chinese patterns of development and natural geographic variability, any one energy policy, initiative, or business venture might succeed in one region yet struggle in another. Informed decision-making, therefore, depends on appreciation for regional characteristics and interplay.

The APERC *Economy Review of China* leverages both numeric and descriptive data analyses of six geographic regions (representing 22 provinces, 5 autonomous regions, and 4 municipalities) at the sub-sector level as a basis to develop clear yet nuanced narratives of plausible energy development across China through 2030. The goal in creating such narratives is to highlight the comparative advantages, opportunities, and challenges which are currently present or are likely to arise in each region's energy ecosystem.

Through this process, and by drawing region-specific implications thereupon informed by the energy developmental experiences of other APEC member economies, the *Economy Review of China* offers insightful perspectives to specifically-target decision making audiences both within China and in those APEC member economies that are influenced by Chinese development. Describing such regional energy diversity for APEC region China-watchers has value in itself: the member economy is vast and complex, so a regional framework helps interested outsiders to clarify their approach to the economy. Within China, however, the importance of regional diversity is already well known to decision makers. The study contributes to these and other readers' understanding by describing which regional opportunities and challenges are most likely to influence development of energy supply and demand with respect to the energy-related needs and aspirations of China's APEC neighbors.

The APERC *Economy Review of China* distinguishes itself from other studies on

China in that it undertakes a hybrid insider-outsider objective exploration of the member economy; an English-language publication that embraces ideals of “compassion”/仁 and “awareness”/知/ to enhance mutual understanding and sharing of perspectives on harmonious development among the APEC energy community both within China and beyond.

Methods and Data

The APERC *Economy Review of China* includes forecasts to 2030 (based upon a set of models) for final energy demand, primary energy demand, electricity generation mix, energy efficiency/intensity, and pollutants both local and global by sector in each of six commonly-used geographic regions in China:

Dongbei	(Liaoning, Jilin, Heilongjiang)
Huabei	(Beijing, Hebei, Tianjin, Shanxi, Nei Menggu)
Huadong	(Jiangsu, Zhejiang, Shanghai, Fujian, Anhui, Jiangxi, Shandong)
Huanan	(Hunan, Hubei, Henan, Guangdong, Guangxi, Hainan)
Xinan	(Sichuan, Chongqing, Yunnan, Guizhou, Xizang)
Xibei	(Shaanxi, Gansu, Ningxia, Qinghai, Xinjiang)

Outlooks are made from unique models for each of the 31 individual administrative regions, and results are then aggregated and presented according to the above six geographic regions. Yearly historical data inputs at the administrative region level for these regional outlooks are based upon official sources and expert opinion.

These quantitative outlooks are then animated and enhanced through non-numeric regional description and analysis of relevant development trends in policy, energy, and the environment by members of Chinese academia, business, affiliated organizations, and government as well as the views of other experts in the APEC region. Finally, a similar outlook, augmented by issue-based trend analysis, is also presented for the member economy as a whole (using economy-level figures).

Initial data collection and modelling will focus on demand-side at the regional level. Later, according to data availability, supply-side and related constraints

will be considered, possibly at a wider (economy-level) scale. Topical issues to be discussed for each region will be identified through the process of this modelling. Depending on circumstances, the APERC *Economy Review of China* may be extended into a two year study, with a published report offered in both study years.

Format

The study format is similar to that of the APERC *APEC Energy Demand and Supply Outlook and Economy Review.* Following a brief introduction and overview of Chinese energy development and projections as a whole, similarly-structured individual chapters are presented for each of the six regions. Charts and tables are used in each of these region chapters to display the results of outlooks to 2030, while text is used to create a narrative of energy development for each region, drawing from the projections and other quantitative data to enforce descriptive, issue-based analyses (~2 issues per region). If feasible judging from the resolution and accuracy of quantitative outlooks, a list of “encourage/ avoid” options, tailored to decision makers of varying sectors, policy levels, and APEC regions (inside/ outside China) can be offered in each chapter, with likely results described for action taken or not taken. The final chapter offers a series of thematic maps depicting and describing regional energy development trends and issues.

1. China as a Whole

-brief background and projections (graphic heavy)

-major issues (listed and explained according to different audience viewpoints, CO2 special issue)

-opportunities (implications, comparative advantages, opportunities for development/ investment)

-policy background timeline and recent policy developments

2. Six Regions

-brief background and outlook
-issues
-opportunities

3. Thematic Atlas

-one thematic map per page showing various energy-related data from each region (e.g. SOx emission, per capita electricity consumption, income, etc.), followed by a half-page explanation of important flows and trends related to the particular theme being depicted in the map.

As a general philosophy, the study's final ~100 page report should be short, clear, accessible, and dense with novel insight. Repetition of common historical knowledge and what others have said is unnecessary and should be avoided.

MISSION TRIPS AND ADMINISTRATIVE SUPPORT

Mission trips will be sought as needed for team members to visit the geo-economic regions covered by the study. It is likely that such mission trips will focus on gathering local knowledge and perspectives from those involved in Chinese energy development rather than data, though not exclusively.

Financial assistance from the administration department will be sought regarding the purchase of books, software, data, and other materials contributing to the study. Team members are encouraged to suggest such materials as needed.

CURRENT PARTNER ORGANIZATIONS IN CHINA

Energy Research Institute, National Development and Reform Commission of the People's Republic of China, ERI/ 國家發展和改革委員會能源研究所- 能源所;National Bureau of Statistics of China/ 中華人民共和國國家統計局/ ;China Coal Industry Development Research Center of the National Research Center of State Administration of Work Safety /國家安全生產監督管理總局研究中心的中國煤炭工業發展研究中心;SINOPEC Economics & Development Research Institute, EDRI/ 中國石化集團公司經濟技術研究院;China Electricity Council/ 中國電力企業聯

合會/

TEAM MEMBERS

Leader: Yonghun Jung

- *Contributors:* Naoko Doi, David Fedor, Li Ji, Shu-chuan Lin, Sergey Popov, Kenny Wan

Depending on circumstances, the study period may be extended beyond April 2008.

附件四

APEC ENERGY MINISTERS MEETING (EMM8)

MISSION REPORT

Destination:	Darwin, Australia
Persons on Mission:	Mr Kotaro KIMURA, Dr Yonghun JUNG, Ms Naoko DOI, Ms Shu-Chuan LIN, Mr David FEDOR
Period of Mission:	May 25-31, 2007
Purpose of Mission:	To participate as a delegation to the Eight APEC Energy Ministers Meeting (EMM8) and APEC Energy Business Network's Energy Business Forum (EBN Forum), present APERC urban transportation energy use research to APEC energy ministers and delegations, and distribute current APERC research reports.
Related APERC proj:	*APEC Energy Demand and Supply Outlook 2006, Urban Transport Energy Use in the APEC Region* (2007), *Understanding International Energy Initiatives in the APEC Region: Scope and Elements* (2007), and *A Quest for Energy Security in the 21st Century* (2007)

OVERVIEW

Schedule/ Venues:

27 May 2007: EBN Preparatory Meeting (morning), and EMM8 Preparatory Meeting (afternoon)

28 May 2007: Energy Business Forum

29 May 2007: EMM8 Plenary Meeting

30 May 2007: Site Visit

APEC ENERGY BUSINESS NETWORK FORUM

The APEC EBN Forum was held in morning and afternoon sessions in Sky City, Darwin on Monday May 28, 2007. The forum, hosted by the Australian Energy Alliance, was held in a conference style, with a slate of speakers primarily from large Australian and international energy companies giving presentations with an industry perspective on the conference theme, "coping with the double jeopardy of high energy prices and climate change," and accepting questions from an audience made up of other energy representatives, government ministries, academics, NGOs, and media. The two morning sessions were entitled, "The impact of high energy prices and climate change on stationary energy forms" and "The impact of high energy prices and climate change on

transportation". The afternoon session featured a panel of energy ministers/vice-ministers from approximately 9 APEC member economies, who took audience questions regarding energy policy.

The general mood of the EBN was one of well-informed business representatives from large, established industries (primarily power generation), expressing their acceptance of and recognition of the need for broad carbon limitation policies at the national or international level (with various warnings regarding proper implementation) and also, to some degree, showing their frustration and impatience with energy policy makers who they perceive to have not strongly considered previous EBN proposals to APEC energy ministers, and who have moved very slowly in establishing carbon limitation schemes in APEC, or even in laying out roadmaps, so that business could begin planning and limiting their investment risks under such systems once they (necessarily) become realty. Additionally, much was made of the potential for technology to reduce the carbon intensity of electricity generation and other fuel use from traditional, established fossil fuels in the medium to long-term. No representatives from renewable energy or conservation-oriented industries spoke at the conference.

The forum resulted in a two page document, the *APEC EWG EBN response to the leaders Hanoi declaration and recommendations to the EMM8 ministerial plenary*, which urged APEC ministers and leaders to "commit to a new resolve on effective regional action and reform of institutional arrangements to progress their Hanoi declaration and the address the duel challenge of energy security and climate change," and covering four primary categories: (1)mature energy supply and end-use technologies, (2) new energy technologies, (3) puplic and private investment, and (3)energy policies.

ENERGY MINISTERS MEETING PLENARY

The 8th Meeting of APEC Energy Ministers (EMM8) was held in Darwin, Australia on 29 May 2007. The EMM8 was held within the context of an increasing global consensus that energy security is fundamentally linked to our economic, social and environmental well-being. More than 230 delegates from member governments, Lead Shepherd of Energy Working Group (EWG), Executive Director of IEA, President of PECC, Chair of EBN, Chair of APGAS and President of APERC attended the meeting. Under the theme "Achieving Energy Security and Sustainable Development through Efficiency, Conservation and Diversity", Ministers discussed two issues regarding the energy security and sustainable development: (1) Promoting Clean and Efficient Energy Production and Use in the Stationary Energy Sector, and (2) Achieving Oil Security, with the Emphasis on the Transport Energy Sector.

On the stationary energy sector issues, Mr. Ryan, Lead Shepherd of the APEC made a presentation based an ABARE study. Mr. Ryan started presentation by identifying the challenges facing APEC economies in meeting growing energy demand in a secure and sustainable manner. Those challenges include the rising import dependency of oil, coal and natural gas, and worsening environmental quality at both local and global levels. He further presented the policy options for the enhancement of energy security, with the special emphasis on the needs for improving the energy

market operation, facilitating investment in cleaner energy technologies, and encouraging energy efficiency. In addition to the policy options, he identified the technology options for electricity generation, and the end use sectors. After identifying the barriers for investment in the advanced technologies, he emphasized the importance of regional cooperation through APEC Energy Working Group, and collaboration with other international organisations, including the IEA, APP and EAS.

On the transport energy sector issues, Mr. Kimura, President of APERC made a presentation based on the APERC's *APEC Energy Demand and Supply Outlook 2006*, and *Urban Transport Energy Use in the APEC Region*. As the major challenges facing the APEC region, Mr. Kimura presented two issues: (1) continued dependence on oil for the transport sector, and (2) rising oil import dependency across the region. As for the drivers to the transport energy demand, Mr. Kimura identified the four factors, including rising income growth, expansion in automobile industry, rapid urbanisation and accelerating industrialization. Showing several cases in the Asian cities, he also discussed the importance in introducing mass transit systems as a means to reduce passenger vehicle dependence. He further presented challenges to change the course of growth in transport energy demand. Those challenges include high const of infrastructure development, weak policy coordination, slow pace in technological development and difficulties in changing lifestyle. Finally, he emphasized that holistic approach should be taken to address the challenges for the transport energy sector in a manner meeting the needs of each APEC economy.

In response to those presentations, Ministers discussed a wide range of issues. They discussed the importance in continued efforts in developing advanced technologies for coal-fired power generation, and natural gas-fired power generation. They also discussed the expected significant role played by the nuclear power generation to enhance energy security, and to mitigate impacts in environment. A suggestion was made to increase regional cooperation on nuclear power generation in order to share information and promote its utilization. In view of the rising import dependence, and expected increase in the inter-dependence for energy supply among APEC economies, some Ministers encouraged the EWG to study the trade and investment practices of oil and gas companies and to examine how partnership and cooperation can improve the value chain. On the transport energy issues, several Ministers presented their progresses and plans in introducing alternative fuels, including LPG, electricity, natural gas and biofuels. Some Ministers identified that the continued efforts are necessary to share oil information, and to jointly prepare for the emergency situation such as oil supply disruption.

Representatives from the private sector made a presentation, and sought Ministers' attention on the several options that can enhance energy security and achieve sustainable development goals. They proposed Ministers to consider promotion of new energy technologies, such as carbon capture and storage, gas-to-liquids, coal-to-liquids, renewable energy and biofuels. They further sought Ministers' attention on the need to increase in energy investment using the both public and private sources.

SOME OBSERVATIONS

Ministers endorsed the Darwin declaration, which confirms the continuation of EWG's efforts towards the Energy Security Initiative (ESI). The basic element of the ESI consists of two: (1) short-term measures such as data transparency, and joint efforts to the emergency preparedness, and (1) long-term measures such as technological development and policy implementation. Aside from the continuation of ESI, Ministers endorsed the implementation of energy peer-review mechanism. This is an attempt to support the member economies' establishment in energy policy towards achieving the energy security and sustainable development goals. As an initial step, it was decided that the member economies would introduce peer-review mechanism for energy efficiency improvement in the interested economies.

APEC has been dealing with a number of policy agenda, among which energy security and sustainable development now emerges as the main policy issue. Due to the significance, a number of forums have tackled with this issue in addition to the Energy Ministers Meeting. Those include the Financial Ministers Meeting, Transport Working Group, Senior Officials Members Committee on Trade and Investment, and Leaders' Meeting in Sydney. At the 2007 Leaders' Meeting, for example, Leaders agreed upon an energy intensity improvement target, and noted that the peer-review mechanism could serve as a means to review progress in energy intensity improvement, and support energy policy making in particular in developing member economies. Reflecting those new developments taking place in the APEC forums, the role of EWG will be increasingly important to coordinate with the other forums, turn the agreed plans into reality, and to see real outcomes in terms of enhancing energy security and achieving sustainable development goals.

SITE VISIT

Date: 30 May, 2007

Site visit: ConocoPhillips Wickham Point LNG Plant

The Wickham Point LNG Plant was developed by the ConocoPhillips, which is an integrated petroleum company with interests around the world. As of March 31, 2003, ConocoPhillips, headquartered in Houston, had approximately 56,600 employees and US$80 billion of assets.

The Wickham Point LNG Plant — the second Australian LNG export facility after the North West Shelf LNG Plant – is the biggest LNG export facility in Northern Territory, with total investment on infrastructure development around AUS$2.3 billion (US$ 1.53 billion). The plant utilized ConocoPhillips' proprietary Optimized Cascade LNG Process, which is also used at a company-operated LNG plant in Kenai, Alaska, and in other projects around the world. The plant currently has a storage tank with 188,000m3 capacity and has the liquefaction capacity at 3 mtpa. The natural gas is produced from the Bayu-Undan gas field in the Timor Sea, where produces 3.5 million tons of natural gas per year. Bayu-Undan is a world-class gas condensate field that has been fully appraised and contains estimated recoverable hydrocarbons of 400 million barrels of condensate and liquefied petroleum gas (LPG) and 3.4 trillion cubic feet of natural gas. The plant

has started operation in 2006 and the first LNG cargo was delivered in the early 2006.

附件五

***APERC Energy Review of China* (2008)**

MISSION REPORT

Destination:	Guangzhou, China and Changsha, China
Persons on Mission:	Dr Yonghun JUNG, Ms Ji LI, Ms Shu-Chuan LIN, Mr David FEDOR
Period of Mission:	August 26- September 1, 2007
Purpose of Mission:	Guangzhou: to attend the USTDA-sponsored APEC Natural Gas Utilisation Workshop Guangzhou: to meet with officials from the Development and Reform Commission of Guangdong Province, Division of Energy and General Office for the Leading Group of Energy Affairs of Guangdong Province Guangzhou: to meet with researchers from the Guangdong Techno-economy Research and Development Center Changsha: to meet with officials from the Hunan Development and Reform Commission Changsha: to meet with officials from the Hunan Provincial Electric Grid Company Changsha: to meet with officials from the Hunan Coal Bureau, Planning Division

Related APERC proj: *APERC Energy Review of China* (2008)

Delegate Meetings

APEC NATURAL GAS UTILISATION WORKSHOP

Sponsored by the United States Trade and Development Association (USTDA), organized by Taylor-DeJongh. Hosted by the Guangdong Oil and Gas Association (Helen Liang 梁海珊, Secretary General). Guangzhou White Swan Hotel.

Most speakers and participants were from the United States from business or business-government bodies (some higher-level government representatives from developing economies outside the US) and had limited experience in the Chinese energy sector. The purpose of the workshop, in a sense, was for these foreign business representatives to better understand what sort of natural gas investment opportunities to expect in and around China in the near- to mid-term. Dr Jung spoke on natural gas market development in the APEC region with special reference to demand and supply balance, pricing mechanisms and trends, and possibilities for future development in China.

DEVELOPMENT AND REFORM COMMISSION OF GUANGDONG PROVINCE, DIVISION OF ENERGY AND GENERAL OFFICE FOR THE LEADING GROUP OF ENERGY AFFAIRS OF GUANGDONG PROVINCE

廣東省能源領導小組辦公室， 廣東省發展和改革委員會能源處

Mr XIE Zhuoqun, Deputy Director of the General Office for the Leading Group of Energy Affairs of Guangdong Province and Division Director of the Division of Energy of the Development and Reform Commission of Guangdong Province/ 謝卓群，副主任 廣 東省能源領導小組辦公室，處長 廣東省發展和改革委員會能源處

Mr Xie offered a comprehensive overview of the current energy development situation in Guangdong Province. He began by noting the rapid an early economic development of the province—since 1979 annual growth rate has averaged 13%, with rates exceeding 14% in the past two years. This has contributed to large demand gaps, relatively low utilisation of clean and efficient energy, and fairly prominent environmental damage. He also introduced the large share that Guangdong represents of the Chinese total energy consumption, economic activity, and population. Specifically, he noted that Guangdong consumes 8.7% of all energy used in China (approx 200 million tonnes of standard coal equivalent), receives ¼ of all foreign investment, sees 1/3 of all imports and exports, collects 1/7 of all provincial tax revenues, and expects a provincial population increase from 90 million currently (over 100 million including the migrant population) to 110 million.

He went on to identify five main energy strategies (能源發展規劃) within Guangdong's energy development: (1) energy conservation (節約優先); (2) diversification (多元化發展); (3) optimizing and adjusting energy structure (優化和調整能源結構); (4) "power development as the core" (電力發展爲中心); and (5) environmental protection (保護環境).

Mr Xie went on to detail major measures taken in Guangdong corresponding to each energy strategy.

With regards to energy efficiency/intensity, Mr Xie noted that Guangdong has a history of advanced energy efficiency and intensity in relation to the rest of China. As a result, its share of reductions in order to meet the national target of 20% intensity reduction by 2010 is among the lowest in China—only 16%. So while Guangdong's intensity is already relatively good, Mr Xie expressed optimism that the goal for 2010 would be met without too much difficulty. In 2005, the reduction was 0.79%, and in 2006 the reduction was 2.93%.

In terms of local environment, however, Guangdong has not faired as well. Because of its relatively high levels of SOx emissions, its reduction target assigned from the centre is 15%, well above the 10% average [other sources say 11.9%] for all of China.

Other points of interest included:

-Regarding the strategy to optimize energy structure, Mr Xie spoke of adjusting industrial and economic structures, optimizing energy structure, and carrying out/ enforcing efficiency measures.

-Regarding environmental protection, Mr Xie focused on four strategies: (1) curbing the

development of highly polluting industries from the beginning; (2) undertake efficiency measures in currently existing industries; (3) strengthen government policies and management; (4) requiring that thermal power plants add desulphurization equipment before 2008, and that all new power plants install the equipment by 2010.

-Regarding diversification of energy supply, Mr Xie stated that although Guangdong's energy supply is already relatively diverse, there is still desire to improve. Energy diversification of course must be coordinated with energy structure optimization, so there are choices in how to proceed and so it is desirable to increase the share of clean energy. Natural gas and nuclear power are points for future emphasis. The Guangdong natural gas market is well developed, so there is potential for future natural gas imports through a second or third LNG terminal as well as possible pipelines from Sinopec and CNPC. Nuclear power should also be developed along with the strategy of "West-East Power Transmission" (from both hydro and thermal sources) and increasing the use of clean coal technology.

-Regarding "power development as the core": previously, Guangdong was the province with the highest level of power shortage in China and often was in a position of experiencing shortages over the past 20 years, so power development is emphasized. In the future, Guangdong will continue to develop large scale coal power along the coast, installing desulphurization equipment and NOx scrubbers, using 1000MW plants. Regarding NRE, wind was seen as the most promising for future development from a cost perspective (though recent great increases in cost have stifled its development) as Guangdong's hydro potential is at the highest level of development in China. Regarding natural gas, Mr Xie expressed his apprehension over fuel cost (for LNG)—with LNG natural gas prices tracking the rise in oil prices, it is uneconomical for Guangdong to continue to develop it as a fuel. Currently, 50% of Guangdong LNG is used for power generation, but with prices so high, this situation really cannot be further developed.

-A feeling that coal would continue to be the main component of power supply expansion, to be purchased from within China (Dalian, for example) or on the international market (from Vietnam, for example) without discrimination. Mr Xie mentioned that IGCC technology has the potential to reduce CO2 emission , but Guangdong has no plans to implement it because of high cost.

-Regarding the agreement with Hong Kong not to improve local air quality by not building coal thermal power plants within the PRD region before 2012(?), it seems uncertain if Guangdong will be able to honour this agreement—at least, it doesn't seem like it has steered Guangdong away from coal in general, though there is a strategy to improve central coast and urban area air by shifting power plants into more rural areas to the east and west "wings" of Guangdong.

- In regards to natural gas development, Mr. Xie introduced reasons on utilizing natural gas in Guangdong: (1) optimizing the energy supply mix; (2) diversifying energy supply mix; (3) environmental protection. In addition to Dapeng LNG receiving terminal, the 2nd and 3rd LNG receiving terminal would be constructed. The progress of new terminal construction depends on the NG price and negotiation with the gas suppliers. Besides, Guangdong will receive pipelined natural gas from two sources, one from the 2nd pipeline of West-East pipeline; and one from Sichuan

Basin. Natural gas from Sichuan Basin is planned to receive by 2010 [川氣入粵 from CNPC and/or Sinopec].

-Mr Xie mentioned a general preference to use natural gas for city gas rather than power production.

-For power, imports from Western China were identified as being important components of near- to mid-term supply. Currently (?), approximately 25% of Guangdong power is imported from the "West".

-"Investment [for energy infrastructure] is not an issue, everyone wants to provide funds, we have more money than we know what to do with"

- Guangdong has recently established an "Office of Climate Change" to deal with this issue.

-Responding to a question from Dr Jung, Mr Xie explained how the state can influence the actions of industry regarding energy use by implementing economic measures such as adjusting energy prices, levying taxes, through financial instruments, and so on. Administrative tools include the creation of industrial policies, penalty measures, and so on.

GUANGDONG TECHNO-ECONOMY RESEARCH AND DEVELOPMENT CENTER

廣東省技術經濟研究發展中心

Mr ZENG Lemin, Deputy Director (Center), Chief (Institute For Energy Technoeconomic), Professor, Certified Consulting Engineer/ 曾樂民，中心副主任，能源技術經濟研究所所長，研究員，註冊諮詢工程師
Mr CHEN Maohao, Assistant Engineer, Institute for Energy Technoeconomic/ 助理工程師, 能源技術經濟研究所
YU Wenyi, Institute for Energy Technoeconomic/ 能源技術經濟研究所

The Guangdong Techno-Economic Research and Development Center consists of five main institutes: the rural strategic scientific development research institute, the sustainable development research institute, the energy techno-economic research institute, the technology and economics development research institute, and the bureau of technology assessment.

Mr Zeng outlined the rapid and early capitalistic growth of Guangdong Province, calling it Chna's "window" on the world. The rapid growth period began in 1978 and reached a peak in 1992 Average GPP growth rate between 1986 and 1995 was 16.2%. Current energy consumption is 177.6939 million tonnes of standard coal equivalent and GDP is 1.7321 trillion RMB (2000 prices). Regarding power development, it is predicted that all Guangdong power plants will employ sulphur treatment by 2008. Consumption in the Pearl River Delta area of Guangdong is 70% of the provincial total, and future infrastructure development plans include construction transmission lines of various voltages and possibly 4-5 LNG receiving terminals (at Zhuhai/ 珠海、Eastern Gugandong/粵東、Western Guangdong/粵西、Pearl River Delta/珠三角、and Huizhou or

Yangjiang 惠州或揚江).

Mr Zeng repeated the five-point Guangdong energy development strategy explained earlier by Mr Xie.

He also explained residential energy use developments. Urban residential electricity use comes primarily from coal, nuclear, "western", and natural gas power. To increase lighting efficiency, the PRD region is encouraging the use of second-generation LEDs (?). The 15th five year plans specifies the closure of 900 small power generating units. Currently, 87% of coal is used for power production in Guangdong (?), but in the future, coal will be used less and other sources of power will be used more.

By 2020, GDP energy intensity is projected to fall .062 standard tonnes of coal equivalent per 1000 RMB, a decrease of approximately 40%. SO2 emissions will fall 25% from 1 million tones to 0.75 million tonnes. 60% of energy supply will come from domestic sources, 40% will come from foreign sources.

Overall, as Guangdong lacks power, "western power" will be a very important source in the future, of which approximately half is thermal power and half is hydro. Western power pricing is set by government adjustment and standards. Surrent price is 0.4 RMB per 1000 kWh, somewhat cheaper than coal power produced inside Guangdong.

HUNAN DEVELOPMENT AND REFORM COMMISSION AND HUNAN PROVINCIAL ELECTRIC GRID COMPANY

湖南省發展和改革委員會和湖南省電網公司

Mr Li Bin/ 李賓 (Hunan DRC)
Mr Chen / 陳主任 (Grid Company)

-Total Hunan power consumption in 2006 was 76.877 billion kWh, an increase of 13.94% over the previous year. GPD growth over the same period was 12.1%. At the end of 206, electrical generation capacity was 19.1 million kW, of which thermal was 10.60 million kW and hydro was 8.50 million kW. Of 74.5 billion kWh transmitted power, 47.5 billion kWh was thermal and 27.5 billion kWh was hydro. 5.0 billion kWh were imported, mainly from Hubei and Guizhou (the Guizhou and Hunan grids are not connected—imported power is directly transmitted).

-Forecast that provincial power consumption will increase to 110 TWh by 2010 and 190 TWh by 2020, which is approximately 6-8% yearly growth through 2020, followed by 4-5% growth from 2020-2030 (growth rate in Hunan power consumption for 2006 was 13.94%, so this would be significant slowing of growth in consumption).

-缺煤沒油汽– Now most of coal rely on local supply, in future the incremental coal demand will mostly come from outside.

-Different from other provinces, Hunan province currently do not have trade commission.

Therefore, responsibilities of Hunan provincial NDRC is different from other provinces. Agency staffing is light compared with the norm for developed economies, but is not necessarily perceived as being understaffed within China.

-electricity use per capita is only 60% of national average

-strong preference for nuclear power development, but currently Hunan has not been included in the mid-term National Nuclear Power Development Plan, where coastal provinces have been preferred instead, but discussions are ongoing between Hunan DRC and NDRC. Unsure prospects [Environmentally, there is also a concern of polluting Donting Lake during construction]. In term of regulation, only two companies can currently own nuclear plants in China [meaning that only these two companies can control stock share (控股) of nuclear power plant]. One is China Nuclear Industry Company (中核總), another is Guangdong Nuclear Power Company（中廣核）. In response to Dr Jung's inquiry regarding the possibility of foreign investment or cooperation in Chinese nuclear development, from Korea for example, it was replied that China does not have foreign investment in nuclear power [However, it seems that existing nuclear power stations such as Daya Bay and Qingshan etc, did involve foreign investment—this is partly an issue of semantics, as foreign investment is allowed, but possibly not foreign control/ stock share—this issue is currently under further investigation, see Lin san for details].

-as a result, imports from the south and west will be important to meet short- to mid-term power demand, as well as increased reliance on hydropower, though resources are essentially all developed and year-to-year variations in rainfall make hydro supply unpredictable.

-Hunan does not offer yearly statistical summary yearbooks online, offering monthly data for power online instead

HUNAN DEVELOPMENT AND REFORM COMMISSION AND HUNAN COAL BUREAU, PLANNING DIVISION

湖南省發展和改革委員會和湖南省煤炭工業管理局規劃處

Mr Li Bin/ 李賓 (Hunan DRC)
Ms ZHAO Xiaoyu/ 趙筱毓， 處長(Director, Coal Bureau)
Mr QIN Qihui (Coal Bureau)

-Hunan is aware that the province is lack of energy resources, in particular not having a good condition for coal exploration and production. In order to meet coal demand, it is necessary to import coal from other provinces. Currently, Hunan power plants sometimes contract with specific coal mines in Guizhou, for example, for exclusive coal supplies. In the short- to mid-term, Hunan power companies might actually locate their plants inside resource-rich areas such as Guizhou and then send power produced directly to Hunan consumers off-grid. Electricity import from other

provinces would be one of the methods to meet the future electricity demand of Hunan province.

-Mostly small mines in Hunan, with coal in small pockets rather than seams, but coal is low in sulphur (<1%) and generally "high quality". Mining is only half-mechanized and still requires much manual labour, but recovery rates are high, at 60-70%. Current production capacity is approximately 50 million tons, but 60 million tons is certainly possible with continued development, though not all resources will likelyl be exploited.

-most coal imports to Hunan come by rail, far less by truck, even less by canal (primarily imported from Shanxi, Henan, Nignxia, Shaanxi, Guizhou, Yunnan, Sichuan), with some exports/re-exports to Guangdong)

-Hunan total coal consumption is roughly 70-80 million tonnes, of which 40% of coal is used for power.

-coal price ranges from 300 RMB (bituminous) to 500 RMB (anthracite) per ton, with rapid price increases since 2005 as a result (in part) of increased demand from newly-built power plants

-Representatives brief on the closure of small coal mines within Hunan. Mines with production less than 30,000 tons are combined with other mines so that production exceeds 60,000 tons (2163 mines total in Hunan in 2005, only 1120 now in 2007).

-Future coal consumption for all Hunan, tons (total/amount for power): 2006 (62 mil/ 24 mil), 2007 (68 mil/ 29 mil), 2008 (72 mil/ 32 mil), 2009 (76 mil/36 mil), 2010 (78 mil/37 mil), 2020 (100 mil/ 60 mil) [notice increasing share of coal for power generation]

-Estimates that 2010 thermal power capacity in Hunan will be 82 million kW, reaching 300 million kW by 2020.

-by 2020, 40% of coal consumption is projected to come from outside Hunan (unclear if this includes direct power transmission to Hunan from coal resources)

-most mine ownership is private in Hunan—only 1/5 are state owned mine, 1/3 are local state owned mine (by production).

-freight capacity for coal imports is (by rail, for example) is a bit of a problem currently, but this is expected to be addressed with the current focus on freight rail construction across China (following a previous focus on expanding and upgrading the passenger rail network)

- Opening new coal mines in Hunan requires passing through environmental assessment before exploration and production. Current environmental concerns focus on subsidence and water treatment. To address this, with regard to coal storage requirement, coal could not store close to the agriculture area. If any coal mines has water outflows from the mining process not up to standard requirement, they demand to stop operation.

-Other Hunan coal industry environmental strategies include: using coal primarily for power production; recovering coal bed methane for power production or coal mine own use (currently constructing two 500kW units for coal bed methane); following national environmental standards.

Publications Acquired

APEC Natural Gas Utilization Workshop informational materials, including speaker bios, participant contact lists, and presentation materials.

MISSION REPORT

Destination:	Xi'an (Shaanxi Province), and Chengdu (Sichuan Province), China
Persons on Mission:	Dr Yonghun JUNG, Ms Naoko DOI, Ms Shu-Chuan LIN, Dr WAN Sau Yi, Mr David FEDOR
Period of Mission:	October 14-23, 2007
Purpose of Mission:	*Xi'an:* to attend the "Harmonious and Sustainable Coal Power Generation" APEC Clean Fossil Energy Seminar" jointly organized by APEC Expert Group on Clean Fossil Energy (APEC EGCFE) and the Thermal Power Chapter of Chinese Society for Electrical Engineering (TPC/ CSEE) *Xi'an:* to meet with officials from the Xi'an Municipal Construction Commission and academics from Chang'an University *Xi'an:* to meet with officials from the Shaanxi Development and Reform Commission *Chengdu:* to meet with representatives from Meiya Power Company Limited and the Mianyang Sanjiang Meiya Hydropower Company Limited Sino-Foreign Cooperative Joint Venture and tour facilities in Mianyang, Sichuan
Related APERC proj:	*APERC Energy Review of China* (2008), *Urban Transport Energy Use in the APEC Region Phase II* (2008)

HARMONIOUS AND SUSTAINABLE COAL POWER GENERATION: APEC CLEAN FOSSIL ENERGY SEMINAR

APEC 清潔化石能源專家組 清潔化石能源技術研討會

In recent years, coal demand is growing at the faster pace than the other fossil fuels due to the price competitiveness and resources availability. This trend is in particular pronounced within the Asia-Pacific region in order to fuel energy needs of rapidly developing economies, while excessive use of coal poses greater concern for environmental quality both at local and global levels. In recognition of the important role that coal can play into the future of the Asia-Pacific region, Expert Group on Clean Fossil Energy organised this symposium to discuss (1)coal demand and supply outlook, (2)coal transportation issues, and (3)energy efficiency improvement and pollutant emissions reduction in power generation technologies.

The below includes some of the interesting insights that were obtained from the experts' presentation and discussion with them.

- Expert speakers from China shared the view that coal will remain as the main fuel for power generation in future due to its resources availability and price competitiveness. However, an expert identified bottlenecks for coal transport, in particular for the shortage in rail transport, which should be eased not only through investment in new rail capacity but also by changing coal supply structure such as increasing the mine mouth installed generation capacity and transmission capacity.

- Another expert addressed the issues of safety in coal production as it is estimated in China alone more than 6,500 workers annually are killed due to accidents in mining. Chinese government tries to strengthen coal production capacity and increase safely in coal production. One of the measures includes a change in tax collection measure whereby 80% of the collected tax revenue would be allocated to the local government for them to upgrade backward technologies, and ensure safety in production.

- Regarding power generation technology, several experts presented China's manufacturing capacity for ultra super critical and super critical power generation technologies. At the same time, a number of experts identified need for efficiency improvement in power generation technologies through applying technologies from other developed economies. Recognisant of the need for efficiency improvement, Chinese government provides incentive to the electricity generation companies (0.15 yuan/kWh). A speaker from Japan presented an interesting framework that JBIC proposes to apply CDM scheme for plant upgrades in close cooperation with electricity commission of China.

- Experts from Japan, Korea, Malaysia and Viet Nam presented the power generation outlook, and shared their view that coal will remain as one of the important sources for power generation. An expert from Thailand presented their recently revised outlook which assumes small share of coal for power generation at 15% by 2020 compared with their previous outlook of near 70% share in generation mix. The Thai's rather conservative view reflects strong opposition by environmental NGOs against coal-fired power generation. The expert stressed the importance to increase public awareness on coal-fired generation.

- Experts from coal producing economies such as Australia, Indonesia, Russia and Viet Nam presented their future prospects in coal export. An Australian expert discussed their need for strengthening coal export infrastructure capacity, and a Russian expert presented there are sufficient resources available in Russia to meet domestic demand as well as to increase expert. It was in particular interesting to observe Russia's plan to expand coal export to the Asia-Pacific region (30% of total export will be sent to the Asia-Pacific region by 2020). Viet Nam's expert presented that the economy will become net coal importer in 2015 if it maintains current

production level, and he identified the need for geological survey through mobilising finance from abroad.

The presentation materials from the workshop are available in hard copies and the electronic version of presentation materials will be made available.

THE XI'AN MUNICIPAL CONSTRUCTION COMMISSION AND CHANG'AN UNIVERSITY

Mr MAO Zhongan, Deputy Division Chief, Department of Planning and Investment of the Xi'an Municipal Construction Commission
Prof WANG Yuanqing, Director, BRT Research Centre of Chang'an University/ 王元慶教授，長安大學交通工程研究所
Ms Li Na Research Assistant, BRT Research Centre of Chang'an University /長安大學交通工程研究所

- Transport project expenditures in Xi'an account for 70% of total expenditures on infrastructure.
- Of city revenue (off land taxes, fees, sales): 20% goes to the central government; 15% goes to the province; 50% goes to infrastructure development.
- Of city revenue off of urban construction fees: 100% goes to infrastructure development.
- There is currently a plan to charge RMB 800-1000 per car per year within Xi'an, which will displace road tolls.
- Xi'an's Gross Regional Product currently has 13% growth rate, city finances are growing at 20%, and provincial government finances are growing at 40-50% (coal)
- Urban/ traffic planners in Chinese cities have until very recently preferred a "wider is better" approach with regard to designing transport corridors (4-6 lane thoroughfares, flanked on both sides by 5m bike lanes/ medians, flanked on both sides by wide sidewalks, with a recent trend of allocating bike lane space to buses); this mentality, however, has started to fade.
- There has been a detectable policy shift in Xi'an in the past year (2006-2007) towards preferring "sustainable" transportation (encouraging biking, walking, bus use). (Sustainable development and energy conservation takes the central part in China's 11th five-year plan, which translates into the Xian's policy shift towards the promotion of sustainable transport system development through mass transit and promoting the CNG-powered taxies.). In fact, to a nation-wide campaign called "car free day", 108 Chinese cities participated – this represents the China's strong awareness towards energy conservation and improvement in environment at both central and local levels.
- In order to encourage the use of buses, an IC card fare system was introduced at the beginning of September 2007 for Xi'an buses, reducing fares 50% for those IC card holders (bus companies are being subsidized 20million RMB this year by the city for lost revenue.

- There are 11,000 CNG-powered taxies in Xian, and they are generally dual fuels (gasoline-CNG). Due to the price differential, natural gas is the more preferred option than gasoline. With the subsidy, natural gas is between 10% and 20% lower than gasoline.
- Over the past 10 years, the central government has increased the amount of consultation with local government when drafting regulations and developing policies (asking for comment, making modifications, etc.).
- There are a number of different agencies within Xi'an that deal with the transportation system and urban planning in general. Coordination among these agencies is an issue, as they generally must go through the mayor or vice mayor for inter-agency coordination rather than direct consultation. Moreover, there are multiple vice-mayors with jurisdiction over different areas and with different transport development priorities/ visions who must also coordinate among themselves. Reorganization of this government bureaucracy is therefore a major issue. (As a means to enhance coordination among various agencies at the local level, issue specific committees have been formed.) Related agencies include: Construction Commission (acts as somewhat of a coordinating office, and was a half-level higher in position than most other offices until a few years ago, at which point it was lowered to equal status); Urban Planning Administration; Transport Bureau (in charge of roads outside of the urban area); Traffic Police; Subway Office; Landscaping Office; Urban Management Bureau (in charge of "implementation"—covers sidewalks, advertising, etc.); Land Bureau; Housing Administration Bureau.; Environmental Bureau.
- The urban construction area of Xi'an is 261.4 sq km, and the urban area is 306 sq km.
- The major work, shopping, and hotel districts are inside the city wall. The old (1990) urban plan called for new commercial and technology employment centres to be developed outside the wall to reduce congestion and bottlenecking in the city centre.
- Since 2000, no motorbikes have been allowed within the 2nd Ring Road of Xi'an, mostly due to safety considerations (compare with recent Guangzhou anti-motorbike policy). In addition, during the day-time (until 11 in the evening), no trucks are allowed inside the 2nd Ring Road of Xi'an to improve air quality and reduce traffic congestion.
- parking is 3RMB per hour in downtown Xi'an (considered quite high)
- 300 new cars are registered everyday in Xi'an
- air quality has improved greatly over the past 10-15 years. NAAQS2 improved to 289 in 2006 compared with 160 in 1990 (a higher score is cleaner—Beijing's 2006 number was 200). TSP level was reduced significantly from 560 in 1997 to 200 in 2006.
- Currently, there are 6 planned subway lines for Xi'an, the first of which will be completed in 2011.
- Excavation/ construction for the subway with regards to preserving historical artefacts buried beneath the surface is not a problem, as the archaeology of historic city ruins in Xi'an is now quite well understood.
- There is persistent poor coordination/ mis-coordination between subway and BRT planning

owing in part to differing personal views concerning the overall suitability of each among those in charge.

- Funding for subway construction comes mostly from the municipal government, with some additional funds from the province (no funds come from the central government—this apparently occurs only for subway construction in Beijing).
- Additionally, the city plans to subsidize the operation of the subway for 10-15 years.
- Xi'an transport financing structure: over the three years 2005-2007, 10 bil RMB per year provided by "people's government" (city and provincial), of which 30% is financed through loans from banks, including ADB, WB, etc. These loans for transportation development accounted for approximately half of Xi'an city government's 22 bil RMB maximum approved debt. Differing from the past where city governments could essentially provide free letters of guarantee for such a large amount of borrowing, local banks now get access to city finances before approving loans.

- Generally, such loans to the government are not backed by collateral.
- Land development rights will be given to the subway operating company, based on the Hong Kong model.
- Territorial infrastructure development by private companies in Chengdu, Tianjin, and Shanghai have provided good lessons for Xi'an.
- Xi'an has 3.2 million urban population, not including 0.5 million *liudong renkou*/ 流動人口. By 2020 the urban population is estimated to reach 8 million.
- TDM is a "new concept" in Xi'an—more in the realms of academia than practice for at least the short term.
- Priorities from a planning viewpoint are, in order: (1)preserve the historic area; (2)reduce congestion, lower the population density; (3)other issues such as total energy use and environment, are less important.

SHAANXI DEVELOPMENT AND REFORM COMMISSION

陝西發展和改革委員會

Mr Mu Xi, Chief Engineer, Energy Office, Shaanxi Provincial Development & Reform Commission / 穆西，總工，陝西省發展和改革委員會能源處

Ms Zhao Xiao-hua, Deputy Division Chief , Industry Department, Shaanxi Provincial Development & Reform Commission / 趙小華，副處長，陝西省發展和改革委員會工業處

Mr Wang Jia, Shaanxi Provincial Development & Reform Commission / 王嘉，陝西省發展和改革委員會

Mr Ye Li-gong, Environment and Resources Department, Shaanxi Provincial Development & Reform Commission / 葉立工，陝西省發展和改革委員會環資處

Mr Wei Li-Feng, Transportation Department, Shaanxi Provincial Development & Reform Commission / 魏立峰，陝西省發展和改革委員會交通處

Shaanxi DRC firstly gave an overview of Shaanxi province regarding the social economic and energy development. Then, we discussed on the role of local DRC and issues related to energy development.

Overview of Shaanxi province

- Area of Shaanxi province is about 210 thousand square km, which composed by the regions of Guanzhong (60000 km^2), South of Shaanxi (70000 km^2) and North of Shaanxi (80000 km^2). Due to the difference of climate and terrain between the three regions, they have their own speciality. Guanzhong has developing as culture region; South of Shaanxi has developing ecological area; and North of Shaanxi represented as revolutionary base and has developing energy chemical industry. North of Shaanxi is the main income area.
- GDP of Shaanxi province: 2006 is 480.36 million RMB; 2007 estimated at 547 million RMB; 2008 estimated at 650 million RMB
- Population of Shaanxi province at 2006 is 37.57 million
- Estimated financial income of Shaanxi province: 2007 is 87 billion RMB; 2008 is 100 billion RMB

Role of local DRC

- Regarding to the economic and energy development planning, NDRC provided overall objectives and directions. Based on the central planning, local DRC will submit their objectives and corresponding development programs for approval. Basically, the local DRC is acting as planning department under the NDRC.

Energy development

- As Shaanxi province is one of the major energy supply provinces in China, half of the energy produced (in in coal standard equivalent) in 2006 is transferred to other provinces. In 2006, coal production was 160 million tons, of which 45 million tons of coal used domestically. In addition, Shaanxi province is the main province of electricity transmitting from West to East.
- It is forecasted that in 2030 the share of energy use between domestic and transferring out of province is 30% and 70% respectively. Energy transferring out of province will mainly focus on primary energy, i.e. raw coal and crude oil.
- Energy efficiency improvement target of Shaanxi is consistent with the national target, i.e. reduce 20% of energy demand at 2005 by 2010.
- Emission reduction target is targeted to reduce 10% of emissions level at 2005 by 2010.

Energy transportation

- Four transport hubs in Shaanxi: Sui De, Xi'an, An Kang, Bao Ji
- Two levels of discussion on transportation, human resource, and energy resource in particular export of products
- Air transport:

    - Xian Yang Airport (Xi'an) is the 4th biggest airport in China, after Beijing, Shanghai and Guangzhou; with 15 international routes and flight would stop over Beijing and Shanghai.
    - Freight transport to Europe and America, such as electronic products and high value added goods
- Railway:
    - Railway transport is strained and only reached 40% of satisfaction rate
    - Planned to expand transportation rate, such as developing separated rails for freight and passenger transport
- Financial support of transportation development:
    - 30% from local government – provides land and construction management
    - 70% from central government - construction

Pricing mechanism

- Coal:
    - basically depended on market and also associated with the electricity price
    - cost plus method for pricing – production cost and transportation cost
- Oil
    - Set by the central government
    - Each province may have their set of oil and petroleum products prices

Change of industrial structure

- Based on the 11th 5-year plan, energy demand per GDP of Shaanxi will reduce 20% in 2010 compared with 2005 level, which decrease from 1.48 tce/10000GDP at 2005 to 1.18 tce/10000GDP at 2010.
- Four major measures to reduce the energy demand intensity:
    - Change of economic structure
    - Technology improvement
    - Enhance management
    - Measures reform
- Currently, the share between heavy and light industrial in Shaanxi is 84% and 16% respectively.
- In 2006, GDP from the enterprise-scale industrial companies (profit 5000 thousand/year) was 450 billion RMB, which value added 183 billion RMB compared with 2005 level.
- Regarding the change of industrial structure, central government released a guideline on "Industrial structure adjustment catalogue" to divide the industrial into three categories including "Encouragement class", "Limit class", and "Elimination class". The detail of the guideline could be found from the NDRC website.
- Industries under "Encouragement class" would have tax incentives and financial fund support their development. Detail on tax exemptions and fund application could be found from the NDRC website.

MEIYA POWER COMPANY LIMITED AND THE MIANYANG SANJIANG MEIYA HYDROPOWER COMPANY LIMITED SINO-FOREIGN COOPERATIVE JOINT VENTURE

美亞電力有限公司與綿陽三江美亞水電有限公司(中外合作)

Mr Daniel CHAN, Deputy Director - Hydro Projects, Meiya Power Company/ 陳嘉宇，水電專案副總監，美亞電力有限公司
Mr Wenwen GONG, Deputy General Manager, Mianyang Sanjiang Meiya Hydropower Company/ 宮文文，副總經理，綿陽三江美亞水電有限公司
Ms Ping JIANG, Plant Manager, Mianyang Sanjiang Meiya Hydropower Company /蔣蘋，廠長，綿陽三江美亞水電有限公司
Ms Jie SHEN, Business Supervisor, Mianyang Sanjiang Meiya Hydropower Company /沈潔，業務主任，綿陽三江美亞水電有限公司

- Mianyang Sanjiang Hydropower Station is 45MW (3 units x 15MW)
- Annual average capacity factor is 40%, and the break-even point is brought at around 35% of capacity factor.
- Depending on water availability, the plant operates at 100% capacity factor during the summer peak.
- The company is a joint-venture with the Municipal Investment Company (75% owned by Meiya, and 25% owned by Municipal Investment Company)
- The plant started operation in 2003.
- Plant design, turbines, and most other equipment is domestically supplied by the 東方電機/ *Dongfang Dianji* company, based in the nearby town of Deyang, Sichuan Province (this company also designs and supplies components for thermal power station, including supercritical). Equipment provided domestically by this company is mature, and roughly speaking, offers less than 50% capital equipment cost for a generator such as Mianyang Sanjiang when compared to foreign suppliers. Monitoring and control software is provide by the Ruilian company, based in Nanjing.
- The standard tariff for this class hydro (in this area, of this size) is 0.28 RMB/ kWh.
- Approval for licensing for plant capacity upgrades (even minor—5-10% of total capacity for example) must come from NDRC/ SETC – in addition to provincial approval – and is a fairly difficult process largely because of bureaucratic issues. Generators need to submit technical details of new plant operation.
- Referring to the commonly-heard concept that annual rates of returns had previously been guaranteed to power operators in the 1990s, for example, this was never really the case—it was more like a take-or-pay system at the time.
- For a hydro operator like this one, a negotiated PPA will generally guarantee 3000 hours per year,

but there might be a 15% or so margin of production capacity above that guarantee. To deal with this, there are often various schemes for the generator to make money on this extra capacity such as swaps with fossil generators (who might lose money for every hour they generate themselves because of perverse price differentials), direct sales, or other similar tactics.

- The "Western Development Incentive" provides tax benefits for power producers in western China, but this benefit was removed in 2006 for foreign enterprises. Foreign investors currently are required to pay 16% of income tax, compared with that for Chinese firms at 33%, while by 2012 foreign investors would have to pay 25% income tax.
- Regarding 西電東送/ West-East Power Transfer: a generator such as Mianyang Sanjiang might be required to sell ~20% of its annual PPA quota (as part of the PPA) for this program, at 0.16-0.17 RMB/ kWh, lower than the standard tariff/ market price.
- The city of Mianyang constructed the dam (mostly with local financing) used by the generator for a number of reasons, and then auctioned the rights to construct and operate generation capacity created by the dam. The power station was constructed mainly with loans from local banks to avoid currency risk.
- Repatriation of equity is allowed. Debt-service coverage ratio of this project was about 20-30%.
- Intra-annual variability in production capacity for Mianyang Sanjiang is quite high—in the winter months, production will generally only be about 10-15% that of the peak summer months. However, the city plans to build a second damn with additional generation capacity upstream of this project, which will help to smooth out this differential.
- Even though this hydro power plant is small in scale and tariff level is lower than the international standard, Meiya considers this business as an important stepping stone for the future business expansion.
- In view of the shortage of coal reserves, Shichuan province plans to build more hydro power generation plants. Information for opening to the foreign investment at this small scale project is generally posted at the local level rather than the central level. Therefore, Meiya considers building the strong basis for business is important for exploitation to the future business opportunities.

Publications Acquired

- Printed agenda (with speaker list) and bound collection of abstracts for papers presented at the Beijing "International Symposium on Circum-Pacific Petroleum and Alternative Energy Resources" [Mandarin and English]
- Printed packet of materials giving an overview of Sichuan Province energy supply and demand information with a focus on electric power, including demographics, relevant energy policies, pricing, and business information provided by Meiya Power *[Mandarin]*
- Printed collection of presentation material from the "Harmonious and Sustainable Coal Power Generation" workshop in Xi'an *[Mandarin and English]*
- [currently awaiting electronic access to both workshops' presentation materials]

附件七

1st IAEE Asian Conference ＆2nd Cross Strait Energy Economics Conference

MISSION REPORT

Destination:	Taipei, Taiwan
Persons on mission:	Kotaro Kimura, Kenichi Matsui, Yonghun Jung, Naoko Doi, Alicia Aponte, Shu-Chuan Lin, Sergey Popov
Period of Mission:	04 November - 07 November 2007 (Yonghun Jung & Shu-Chuan Lin : 04 November – 12 November 2007)
Purpose of Mission:	To attend 1st IAEE Asian Conference To attend the 2nd Cross Strait Energy Economics Conference To meet with Mr. Yeh Huey-Ching (the Director General of Bureau of Energy of Chinese Taipei) Dr. Jung gave a presentation in Chinese Petroleum Corporation (CPC), Taiwan headquarters on "The APEC Energy Outlook & Environment"

Related APERC projects: Transport project, Understanding International Energy Initiatives, Energy Review of China

MISSION SUMMARY

1. 1st IAEE Asian Conference

Presentations were made by Alicia Altagracia Aponte "Oil Supply Security Risk & Offset Potential in the APEC Region: An Initial Perspective"; Shu-Chuan Lin "MRT Ridership Behavior and the Impact on Gasoline Consumption in Taipei", Naoko Doi "Evaluation of Urban Transport Energy Use in Asia".

Organiser & Presiding for plenary session "International Energy Regimes and Initiatives in Asia" was Kenichi Matsui, speakers at that session Serguei Popov and Yonghun Jung.

2. 2nd Cross Strait Energy Economics Conference

Theme of the 2nd Cross-Strait Energy Conference is "Cross-Straits Energy Economy and Science & Technology Cooperation". The conference is an unique energy economic forum between Chinese Taipei and China. More than 20 officials and scholars from Mainland China were invited to give presentations. The conference attracted more than 100 local scholars and experts to attend. The conference discussed six major topics, namely "Energy Economics", "Energy Demand/Supply and Market", "Energy and Environmental Protection Issues", "New Energy Science and Technology and Energy Saving" and "Energy and Public Policy".

Recently, the rapid energy demand growth in China has already affected the prices of crude oil, petroleum products, and manufacturing products such as cement and steel domestically and internationally. Also, China experienced insufficient electricity and oil supply. Therefore, energy supply in China is no longer a local problem, but also raises international concerns and looks for cooperation to solve it.

In order to develop a healthy and well-off society, the Chinese government planned to increase two-folds on GDP in 2020 from 2005 level, and to increase double on the energy demand.

The materials from the workshop are available in hard copies.

3. Meeting with Mr. Yeh Huey-Ching (the Director General of Bureau of Energy of Chinese Taipei)

Dr. Jung visited Director General of Bureau of Energy (BOE) Mr. Yeh on Nov. 19. The BOE of Chinese Taipei guides the operations of energy enterprises and carries out tasks such as the evaluation of energy supply and demand, the establishment of an energy database system, the promotion of energy conservation programs, the implementation of research and development of energy technology, and the promotion of international energy cooperation.

Dr. Jung & Mr. Yeh exchanged their views regarding recent energy development trends including high oil prices, climate change, new & renewable energy, energy saving, energy efficiency & new energy technology and sustainable development and so on issues.

Mr. Yeh mentioned that Chinese Taipei will promote the development of green energy and enhance the efficiency of energy utilization in accordance with the conclusions of the National Energy Conference held in July, 2005 including:

1. Popularization of renewable energy
2. Development and popularization of energy conservation technology
3. Guidance for the development of the green energy industry

Chinese Taipei endeavours to develop new & renewable energy and to focus on solar, wind, geothermal, ocean, biomass, and energy from waste etc, and hopes to cooperate with international organizations through sharing of knowledge, ideas, results of research and practical experiences. Mr. Yeh & Dr. Jung both agreed that cooperation between international organizations on energy security, climate change and other environmental challenges is essential for each to make a valid contribution through their specific areas of expertise.

They also discussed the possibility of expanding the existing seminar of "Japan-Taiwan Joint Energy Seminar" to include Korea. After the expansion, more experts and representatives would be involved to discuss the energy security, impact of high energy price, energy efficiency improvement, options for clean energy supply and climate change.

4.Dr. Jung gave a presentation in CPC headquarters on "The APEC Energy Outlook & Environment"

Publications Acquired

The 1st IAEE Asian Conference: Book of slides.

附件八

MRT Ridership Behavior and the Impact on Gasoline Consumption in Taipei

Shu-Chuan Lin and David Fedor***

With the increasing importance of energy management and planning for developed global city-regions, it is imperative to more fully grasp the relationship between urban transportation and energy consumption. This study builds an ARIMA-type model with high forecasting accuracy to describe both ridership behavior on the Taipei Mass Rapid Transit urban rail system and Taipei passenger vehicle gasoline consumption, using intervention analysis to explore the effect of the Nali Typhoon and SARS epidemic on these variables. Results suggest that particular sections—but not all-- of the Taipei MRT have significantly reduced urban gasoline consumption and also highlight the importance of urban transportation mode diversification in dealing with sudden transport system disruptions.

1. INTRODUCTION

Like other major cities around the world, the Taipei metropolitan area in recent years has faced a number of transportation challenges. The construction and successful operation of the MRT Metro (subway) system has helped to extricate Taipei from many of these longstanding challenges—including congestion and energy use-- as well as revitalize and further advance the development of both the city and its satellite communities. Operations began in March 1996 with the Muzha line, and the system has since grown to seven lines with a total length of 67 kilometers. Generally viewed as fast and convenient, its service is now an everyday part of life for many Taipei residents, with weekday riderships exceeding one million person-trips.

Though casual inference and census-type personal mobility interviews suggest that successfully-operating a rail-based urban mass transit system such as the Taipei MRT should reduce the relative consumption of gasoline used in urban-area passenger vehicles, a direct quantitative affirmation or rejection of such conclusions is nevertheless illuminating. As such, this study aims to measure the significance of the effect on Taipei gasoline consumption by each line of the Taipei MRT. Furthermore, by exploring the effect on both MRT ridership and gasoline consumption by sudden transportation demand- and supply-disruptive events, the study helps to describe the cross-mode dynamics of the Taipei urban transportation system as it reacts to such shocks. The ultimate goal in carrying out such analysis is to provide for transportation planners a modeling tool that might aid in characterizing the MRT-gasoline relationship, both in Taipei and other energy-dependent Asian urban areas.

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2. METHODOLOGY AND DATA

This study leverages two analytical perspectives in order to better understand the behavior patterns of urban mass transit ridership and its impact on urban aggregate gasoline consumption: using a 3,931-point dataset of Taipei MRT daily ridership from March 28, 1996 through December 30, 2006, (1) an ARIMA-type model was created to reflect seasonal MRT ridership patterns, using a dummy-variable to incorporate calendar effect-response and two-week-previous observations to evaluate the model's forecasting accuracy; (2) next, using monthly average MRT ridership and Taipei metropolitan gasoline sales volume data to build the ARIMA model, intervention analysis is applied to evaluate the causal impact on aggregate gasoline consumption by the operation of the four primary MRT lines (Muzha, Danshui, Zhonghe, and Banqiao), the 2001 Nali Typhoon flooding incident (which resulted in the temporary closure of a major MRT line), and the 2003 SARS event.

Methodology

The modeling technique employed in this study has been well-established by previous works, the ARIMA (Auto-Regression Integrated Moving Average Model) having been published by Box and Jenkins in the early 1970s. Since then, this analytical method has been widely applied in the fields of economics, engineering, and both natural and social sciences.

Specifically, Box and Tiao (1975) proposed that if intervention factors are known during the observation period, these factors can be brought into the time series model to assess the interference or effect of these factors. Such intervention variables are expressed in dummy forms-- known intervention periods are expressed with 1 and non-intervention periods are expressed with 0. The time series intervention method is widely applied in areas such as analysis on the effects of sales promotions or the impacts of certain event, policy, or regulation changes to a commercial or economic time series.

The general form of dynamic intervention function can be written:

$$Z_t = C + \sum f(k,\xi,t) + N_t$$

$f(k,\xi,t)$ = The fixed effect given by exogenous variable, the time function with parameter k .

N_t = The random interference series

Where the dynamic model of effect of ξ can be written:

$$f(\delta, w, \xi, t) = \sum_{j=1}^{k} Y_{tj} = \sum_{j=1}^{k} \{\frac{w_j(B)}{\delta_j(B)}\}\xi_{tj}$$

(1) Y_{tj} = The dynamic transformation from ξ_{tj}

(2) k = Replaced by δ and ω

(3) $\delta_j(B) = 1 - \delta_{1j}B - ... - \delta_{rij}B^{rj}$ and $\omega_j(B) = \omega_{0j} - \omega_{1j}B - ... - \omega_{sij}B^{sj}$

B Polynomials of r_j and s_j

(4)Assumption: the root of $\omega_j(B)$ resides outside of the unit circle, and the root of $\delta_j(B)$ resides on or outside of unit circle.

In this article, dummy variables are used in the intervention model for intervention analysis to evaluate the causal impact on Taipei aggregate gasoline consumption by the operation of the four primary MRT lines (Muzha, Danshui, Zhonghe, and Banqiao), the 2001 Nali Typhoon flooding incident (which resulted in the temporary closure of a major MRT line), and the 2003 SARS epidemic event.

In general, Autocorrelation Functions (ACF) or Partial Autocorrelation Functions (PACF) are used for model identification in time series signal analysis and can be classified into the following models: Auto-Regression (AR), Moving Average (MA), Auto-Regression Moving Average (ARMA), or Auto-Regression Integrated Moving Average (ARIMA). For this study, SCA (Scientific Computing Associates) time series software is used to assess the coefficients and statistical significance of intervention variables. The software's built-in Intelligent Auto-Regression Integrated Moving Average function (IARIMA) can efficiently solve the problem of the above model identification and deal with both external interferences and outliers in the data. Using this auto-detection, the modified prediction models are established.

Data Description

As outlined above, we used a 3,931-point dataset of Taipei MRT daily ridership from

March 28, 1996 through December 31, 2006 (Figure 1) for ridership behavior analysis. To measure the impact of individual MRT lines on urban aggregate gasoline consumption, we used monthly average MRT ridership and Taipei metropolitan gasoline sales volume data to build the ARIMA model (Figure 2 & Figure 3).

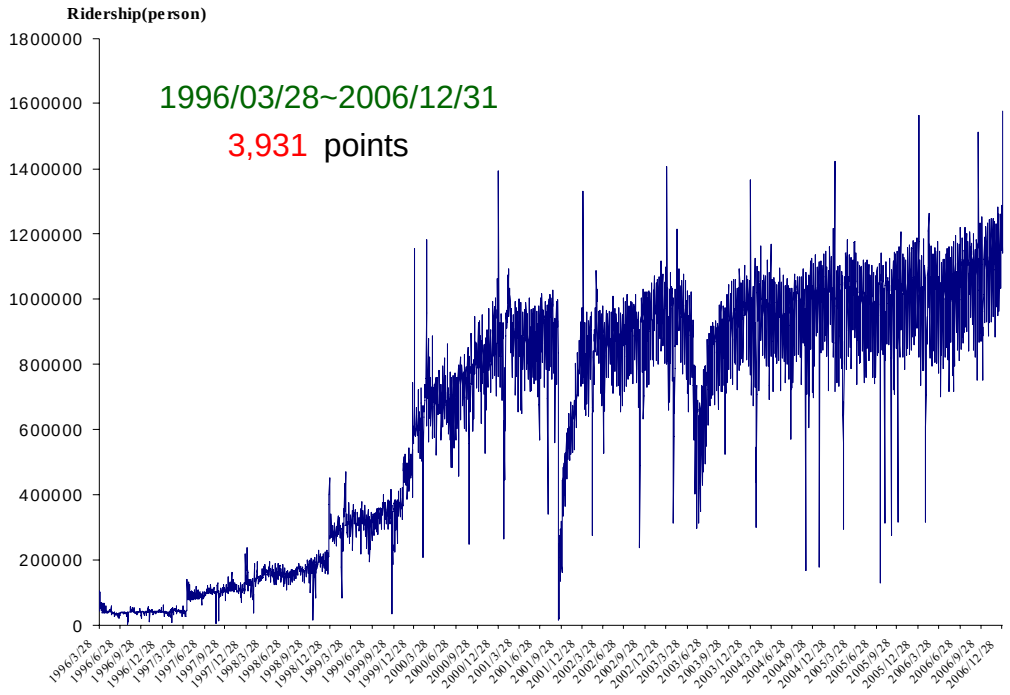

Figure1: The daily MRT ridership

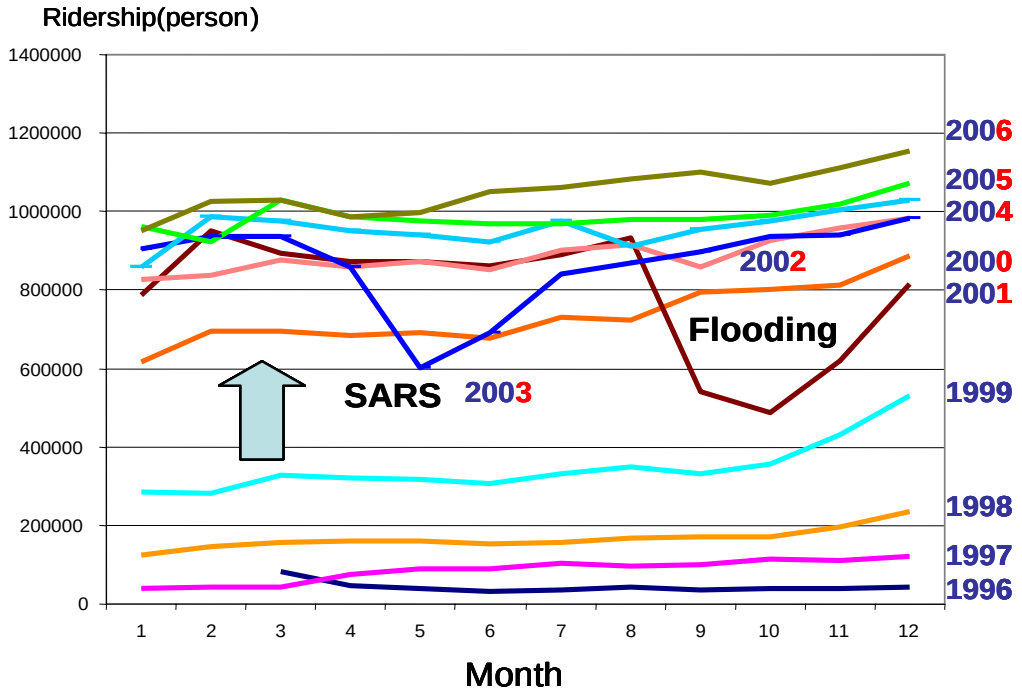

Figure2: The monthly average MRT ridership

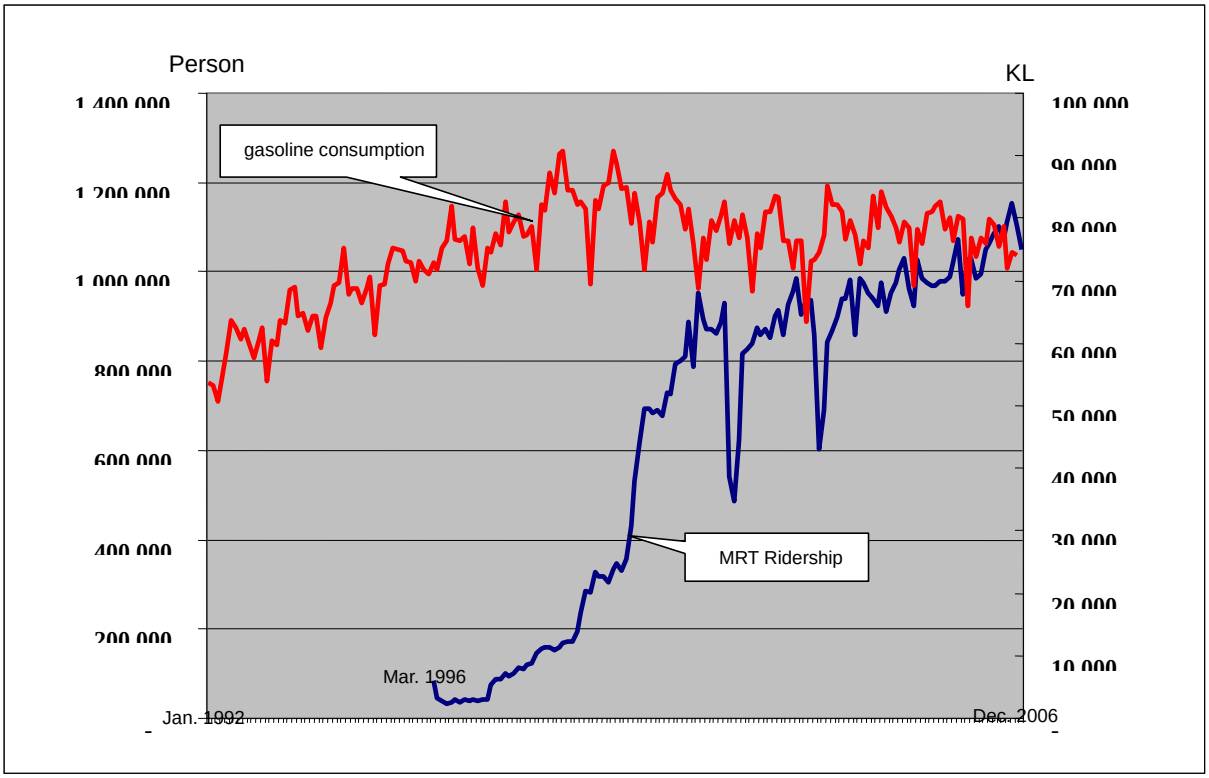

Figure3: The monthly average MRT ridership & gasoline consumption in Taipei

3. ESTABLISHMENT OF THE TIME SERIES MODEL: MRT ridership behaviour

ARIMA Model

According the model construction sequence of Box and Jenkins, daily MRT ridership data are defined as Z_t (t=1,2,…,3931). When examining the ACF (Figure 4) and PACF (Figure 5), it was found that Z_t needed to be differentiated for stabilization. After reviewing graphic outputs of the first and the seventh order of differentiation, the following equation was established:

$$(1-B^7)Z_t = 1940.5666+(1-0.4761B)(1-0.8749B^7)/(1-0.9067B)\,a_t \quad \ldots\ldots\ldots\ldots (1)$$
$$(4.50) \qquad (24.38) \qquad (154.17) \qquad (89.75)$$

$$\hat{\sigma}_a = 0.738232E+05 \qquad \overline{R}^2 = 0.963$$

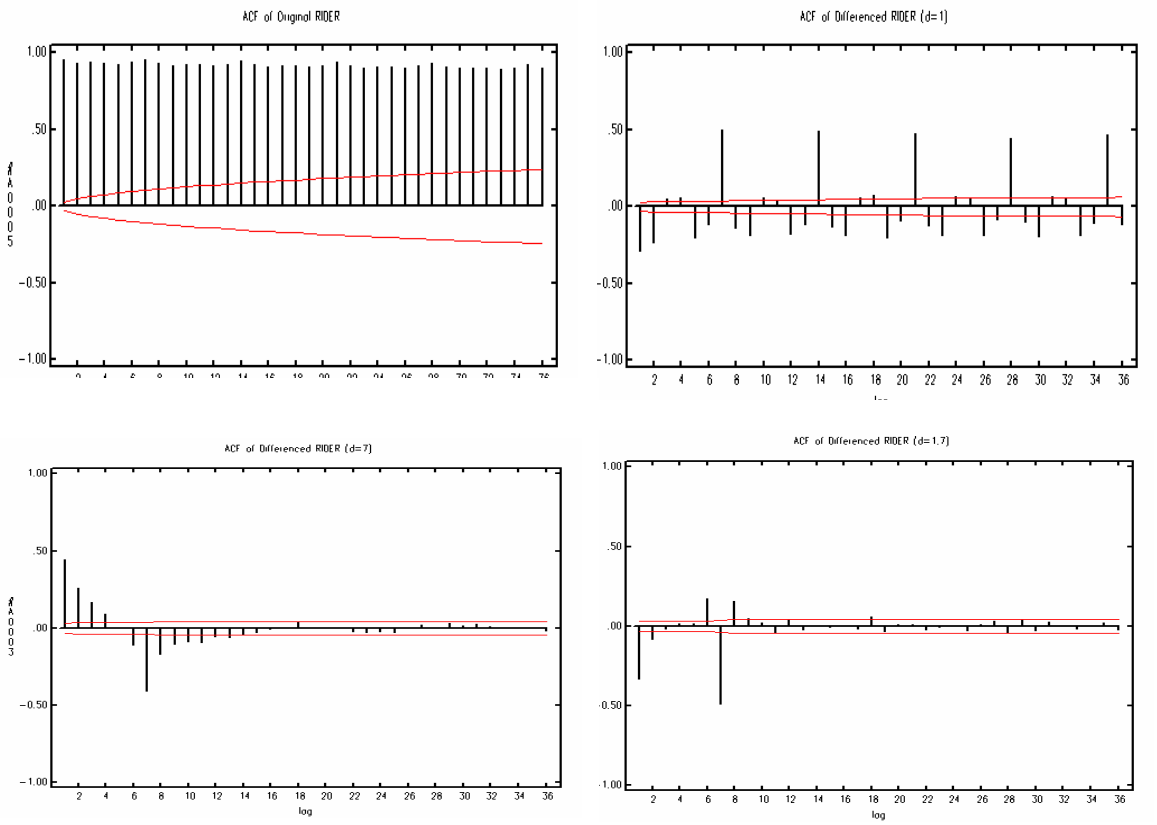

Figure 4: The ACF of MRT ridership in Taipei

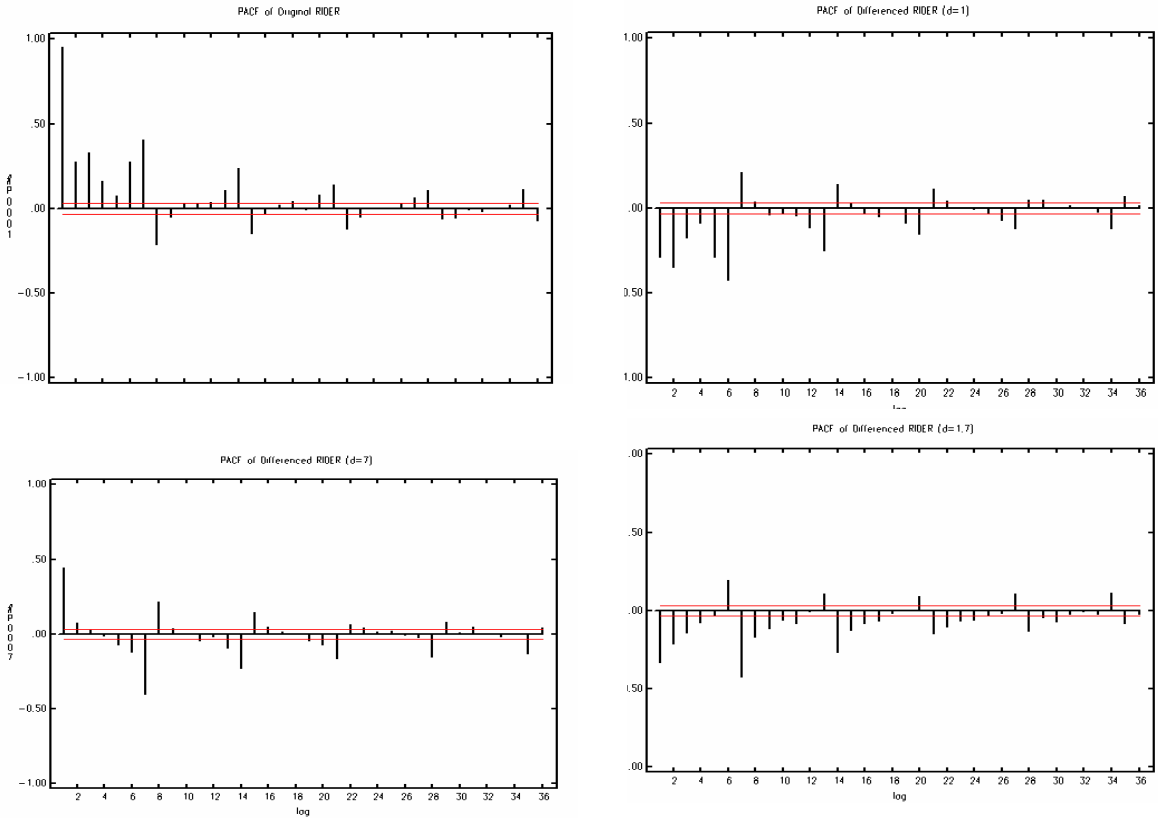

Figure 5: The PACF of MRT ridership in Taipei

Calendar Effects

The behavior of MRT riders is largely habitual, and is influenced by the location of one's home, the route taken to work, the time of the office hours, as well as weekday/weekend splits, among other factors. Here, a calendar day effect is analyzed to describe this habitual ridership pattern:

α_i , i=1,2…7 to represent the calendar day effects of Monday, Tuesday, … to Sunday

Wi , i=1,2…7 to present the dummy variables for individual weekdays, for Monday W_1=1, otherwise 0

The total trading day effects can be written as:

$$f(\alpha_1,\ldots\ \alpha_7, W_1,\ldots\ W_7) = \sum_{i=1}^{7} \alpha_i W_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

In order to avoid the problems of highly correlation tendency and the multi-co linearity for α_1 to α_7, only α_1 to α_6 were used in the model.

$$Z_t = C + \sum_{i=1}^{6} \alpha_{it} W_{it} + a_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

The estimations are as follows:

Coef.	C	α_1	α_2	α_3	α_4	α_5	α_6
Est.	540047.1	99850.4	105531.5	116321.8	114752.3	166353.9	111154.7
t test	33.64	4.40	4.65	5.12	5.05	7.33	4.90

From the estimation, we found the coefficient α_5 of W_5 is the biggest among α_1 to α_6. The constant, "C" represents the ridership volume on Sunday, while α_1 to α_6 is the difference from Monday to Saturday relative to Sunday. Modeling of weekly calendar effects indicates that Friday MRT ridership is the highest while Sunday is lowest. Complete rankings are, accordingly, Friday, Wednesday, Thursday, Saturday, Tuesday, Monday and Sunday. One reason for high ridership on Fridays is that commuters coming into the city for work who might normally drive a passenger vehicle often instead opt for the MRT on Friday mornings so that they may more conveniently leave the city by plane or long-distance train for weekends spent outside of Taipei.

Also, the MRT is a popular form of transportation within the city to fulfill Taipei residents' Friday evening recreational transportation demand.

As we take a first order of differentiation in the final integrated model, it is worth noting that we can also arrive at the calendar day result given above by using a dummy variable-based analysis, as well. For a series with seven dummy variables (W1, W2, W3, W4, W5, W6 and W7):

$$Y_t = ß_0 + ß_1 D_{1t} + ß_2 D_{2t} + ß_3 D_{3t} + ß_4 D_{4t} + ß_5 D_{5t} + ß_6 D_{6t} + \varepsilon_t$$

$$u_1 = ß_0 + ß_1$$

$$u_2 = ß_0 + ß_2$$

$$u_3 = ß_0 + ß_3$$

$$u_4 = ß_0 + ß_4$$

$$u_5 = ß_0 + ß_5$$

$$u_6 = ß_0 + ß_6$$

$$u_7 = ß_0$$

Assumption: $u_1+u_2+u_3+u_4+u_5+u_6+u_7 = \mathbf{0}$

$u_7 = -u_1-u_2-u_3-u_4-u_5-u_6$ (In our case $W_7 = -1$)

$$Y_t = u+u_1D_{1t}+u_2D_{2t}+u_3D_{3t} + u_4D_{4t}+u_5D_{5t}+u_6D_{6t}+\varepsilon_t$$

W1 $E(Y) = u+u_1$

W2 $E(Y) = u+u_2$

W3 $E(Y) = u+u_3$

W4 $E(Y) = u+u_4$

W5 $E(Y) = u+u_5$

W6 $E(Y) = u+u_6$

W7 $E(Y) = u-u_1-u_2-u_3-u_4-u_5-u_6$

u = The mean of the whole time series

The original series of dummy variables of W1-W6 are transformed from:

Time	W1	W2	W3	W4	W5	W6
.	.	.	.	.	.	.
.	.	.	.	.	.	.
Mon.	1	0	0	0	0	0
Tues.	0	1	0	0	0	0
Wed.	0	0	1	0	0	0

Thurs.	0	0	0	1	0	0
Fri.	0	0	0	0	1	0
Sat.	0	0	0	0	0	1
Sun.	0	0	0	0	0	0
Mon.	1	0	0	0	0	0

Into:

Time	**W1**	**W2**	**W3**	**W4**	**W5**	**W6**
.	.	.	.	.	.	.
Mon.	1	0	0	0	0	0
Tues.	0	1	0	0	0	0
Wed.	0	0	1	0	0	0
Thurs.	0	0	0	1	0	0
Fri.	0	0	0	0	1	0
Sat.	0	0	0	0	0	1
Sun.	**-1**	**-1**	**-1**	**-1**	**-1**	**-1**
Mon.	1	0	0	0	0	0

Using this transformed dummy variables series, estimation of calendar day effect is as follows:

Coef.	C	α_1	α_2	α_3	α_4	α_5	α_6
Est.	642029.7	-2118.1	3562.8	14352.8	12783.3	64383.5	9185.8
t Test	105.77	-.14	.24	.96	.86	4.33	.62

The constant is set as the total mean of the series, 642029.7. α_1 to α_6 is the difference from Monday to Saturday relative to the total mean. From this, we can calculate the mean of each date of the week as follows:

Actual Means

Monday： 642029.7+(-2118.1) = 639911.6
Tuesday： 642029.7+(3562.8) = 645592.5
Wednesday： 642029.7+(14352.8) = 656382.5
Thursday： 642029.7+(12783.3) = 654813.0
Friday： 642029.7+(64383.5) = 706413.2
Saturday： 642029.7+(9185.8) = 651215.5

These estimations from these calculations are consistent with direct averaging from the raw data as follows:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
639911	645592	656383	654813	706413	651215	539880

The ridership volume on Friday increases about “10%” on average daily basis, and Sunday decrease about “16%” on average daily basis.

Forecasting Error (MAPE)

To evaluate the performance of the model, we used the MRT ridership of Jan.1 2005 to Dec. 17, 2006 (716 observations) to build the model as in equation (1) and then used this model to forecast daily ridership estimates for the last two weeks in Dec. 2006. The forecast results were then compared to actual recorded ridership volumes. Forecasting error was as follows:

OBS/Date	Actual	1-Step	Error	Error % (before outlier adjustment)
717(2006/12/18)	1115761	1114490	1271	0.11%
718(2006/12/19)	1138281	1122000	16281	1.43%
719(2006/12/20)	1161669	1142337	19332	1.66%
720(2006/12/21)	1156308	1137233	19075	1.65%
721(2006/12/22)	1259953	1229184	30769	2.44%
722(2006/12/23)	1191897	1117740	74157	6.22%
723(2006/12/24)	1033580	946051	87529	8.47%
724(2006/12/25)	1156411	1151827	4584	0.40%
725(2006/12/26)	1148801	1146366	2435	0.21%
726(2006/12/27)	1154456	1152315	2141	0.19%
727(2006/12/28)	1163830	1137304	26526	2.28%
728(2006/12/29)	1288915	1232962	55953	4.34%
729(2006/12/30)	1141820	1130983	10837	0.95%
730(2006/12/31)	1576361	930801	645560	40.95%
MAPE	5.09%			
MAPE_OUTLIER	1.42%			

The model's forecasting error (MAPE) for daily rider volume is about 5.09%. After outlier adjustment, the forecasting error is only 1.42%. It is worth mentioning that Dec. 31 2006, the final forecast date and last day of the year, can be viewed as an outlier. On this day, many people in Taipei attend a firework performance launched from the Taipei 101 building downtown,

and so MRT riderships spike. Because this event only affects the series at one time, the day is classified as an Additive Outlier (AO). Correcting for this value in the forecast accounts for the difference in MAPEs presented above.

4. ESTABLISHMENT OF THE TIME SERIES MODEL: Impact on gasoline consumption

ARIMA Model

The monthly data of gasoline consumption and ridership of MRT are defined as $Gasoline_t$ (t=1,2,…,180) and MRT_t (t=1,2,…,130). After examining the ACF and PCF, and using the procedure of SCA: IARIMA, we derived the following equation:

$$(1-B)\,(1-B^{12})\,Gasoline_t$$

$$= -0.0068+(1+0.0095B+0.0039B^{4})\,(1-B)\,(1-B^{12})\,MRT_t$$
$$\qquad (2.45) \qquad\quad (-3.44) \qquad\quad (-1.52)$$

$$+\,(1+0.5313B)\,(1-0.7578B^{12})\,a_t$$
$$\qquad\qquad\qquad\qquad\qquad\qquad (6.91) \qquad\quad (12.19)$$

$$\hat{\sigma}_a = 0.193361E+04 \qquad \overline{R}^2 = 0.841$$

Intervention Function: The Effect of each MRT line

The Taipei MRT was constructed and opened for operation one line at a time. Because of this piecemeal implementation, we can use intervention analysis to attempt to measure the (additive) significance of each line on the city's gasoline consumption. MRT line operation beginning dates were Mar. 1996 (Muzha Line), April 1997 (Danshui Line), Dec. 1998 (Zhonghe Line), and Dec. 1999 (Banqiao Line). Dummy variables for each line were introduced as follows:

$$\text{Muzha: } \begin{cases} 1 & t = \text{after Mar. 1996} \\ 0 & t = \text{Others} \end{cases}$$

$$\text{Danshui: } \begin{cases} 1 & t = \text{after April 1997} \\ 0 & t = \text{Others} \end{cases}$$

$$\text{Zhonghe: } \begin{cases} 1 & t = \text{after Dec. 1998} \\ 0 & t = \text{Others} \end{cases}$$

$$\text{Banqiao: } \begin{cases} 1 & t = \text{Dec. 1999} \\ 0 & t = \text{Others} \end{cases}$$

It is important to note that the entire length of the Zhonghe Line was opened for operations all at once. Due to the gradual nature of their expanse in over time, the other three lines commenced operations segment by segment over these line's construction period.

Intervention Function: Flooding Event

The Nali Typhoon flooding incident occured in September 2001, which shutdown segments of the MRT system for up to four months. MRT commuters were forced to take other means of transportation to work, such as passenger vehicles. Here, we introduce the dummy variable $flooding_t$:

$$Flooding_t = \begin{cases} 1 & t = \text{Sep. to Dec. 2001} \\ 0 & t = \text{Others} \end{cases}$$

Intervention Function: SARS Epidemic

During the first half year of 2003, Asia fell under the shadow of the SARS epidemic. Not only international travel, but also domestic traffic, was greatly dampened. In particular, people avoided taking the Taipei public transportation system, including the MRT, and other economic activities were depressed. Here, we analyze the impact of SARS event on consumption of gasoline during the period from March to June of 2003 using the dummy variable $SARS_t$:

$SARS_t$ = { 1 t = March to June, 2003
0 t = Others

The Integrated Model

The integrated ARIMA model, including the individual intervention factors described above, is presented below:

$$(1-B)(1-B^{12})\,Gasoline_t = C + (\omega_1)(1-B)(1-B^{12})\,I_{1t} + (\omega_2)(1-B)(1-B^{12})\,I_{2t}$$
$$+ (\omega_3)(1-B)(1-B^{12})\,I_{3t} + (\omega_4)(1-B)(1-B^{12})\,I_{4t}$$
$$+ (\beta_1)(1-B)(1-B^{12})\,Flooding_t + (\beta_2)(1-B)(1-B^{12})\,SARS_t$$
$$+(1-\theta_1 B)(1-\phi_{12} B^{12})\,a_t$$

Coefficients Estimation and t Values

Coef.	C	ω_1	ω_2	ω_3	ω_4
Esti.	-47.5372	-1879.1875	-1332.0835	-2946.8139	-2363.3610
T Test	-3.03	-1.29	-0.94	-2.08	-1.66
Coef.	β_1	β_2	θ_1	ϕ_{12}	
Esti.	374.5432	-2471.1658	0.6768	0.7863	
T Test	0.33	-2.00	11.69	17.64	
$\hat{\sigma}_a$ =0.201453E+04 $\quad \bar{R}^2$ = 0.936					

From the coefficients of the integrated ARIMA model above, we find that operation of the four primary MRT lines was found to reduce Taipei gasoline sales volume, though only the Zhonghe MRT line with significance. The relative weakness in signal from the other three lines, as noted above, is due in part to the gradual nature of their expanse in operations over time. Another explanation for the Zhonghe Line's significance is that population density (and therefore, service population) in the areas along the Zhonghe Line are higher than the other lines, and, in turn, it is reasonable to believe that its ridership is higher than that of other lines.

Of course, the operation of the Taipei MRT lines is not the only factor which can explain relative reductions in the urban area's gasoline sales. Another important

factor during the sampled period was a higher oil price-- when many taxis drivers, for example, switched to using LPG rather than gasoline. A more complete analysis, therefore, would include modeling the effect on not only gasoline but all substitute transportation fuels. Despite this deficiency, however, the above model nevertheless indicates that the Taipei MRT has played an important part in reducing the consumption of gasoline in Taipei.

Moreover, the sudden urban transport disruptive events described above were found to have had effects on both MRT ridership and gasoline consumption. The 2001 Nali Typhoon flooding incident, which shutdown segments of the MRT system for up to four months, appears to have caused Taipei gasoline sales to temporarily rise as MRT commuters were forced to take other means of transportation to work, such as passenger vehicles. The effect of the closure on gasoline consumption, however, was not found to be statistically significant. The 2003 SARS event, which caused a reduction in Taipei resident's public activities, was found to have softened transportation demand significantly in terms of both lower MRT ridership and lower gasoline consumption.

5. SUMMARY & CONCLUSIONS

From the research, we have the following findings:

-Modeling of calendar effects indicates that Friday MRT ridership is the highest while Sunday is lowest.

-The model's forecasting error (MAPE) for daily rider volume is about 5.09% and after outlier adjustment, the forecasting error is 1.42%.

-Operation of the four primary MRT lines was found to reduce Taipei gasoline sales volume, though only the Zhonghe MRT line with significance.

-The 2001 Nali Typhoon, whose flooding shutdown segments of the MRT system for up to four months, appears to have caused urban gasoline sales to temporarily rise as MRT commuter ridership dropped.

-The 2003 SARS event, which reduced public activities, was found to have softened transportation demand significantly in terms of both lower MRT ridership and lower gasoline consumption.

In a broader perspective, this study validates the ARIMA tool-choice in modeling urban mass transit ridership patterns and support an intervention-based approach to understanding the system effects of disruptive events in urban transit. Moreover, from

a policy perspective, the findings support the value of urban investment in mass transit infrastructure-- not only for its ability to lessen oil-dependence in personal mobility, but also for its inherent mitigation of risk regarding large-scale sudden disruptions to the urban transport system as a whole. For example, in the disruptive events explored above, though the MRT itself was the mode most effected by the Nali Typhoon and passenger vehicles were the mode to absorb some of this shock, it is equally plausible that such cross-mode transfer could flow the other way (towards the MRT) in the case of massive disruption to the Taipei road or fuel system, helping to ensure the economic and social vitality of the urban area in a time of distress. In this sense, urban transport diversification, such as that offered by an MRT system, has important hidden value beyond the daily rush.

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附件九

APEC Energy Overview

CHINESE TAIPEI

INTRODUCTION

Chinese Taipei, consisting of the islands of Taiwan, Penghu, Kinmen, Matsu, and several islets is strategically located in the middle of a chain of islands stretching from Japan in the north to the Philippines in the south, and only 160 kilometres off the south-eastern coast of China, is a natural gateway to East Asia. It has an area of about 36,188 square kilometres. Only one quarters of the land is arable and the subtropical climate permits multi-cropping of rice and the growing of fruit and vegetables all year round.

There was still an increase of population in Chinese Taipei in recent years, but the speed is relatively mild. As one of the most densely populated areas in the world, the population of Chinese Taipei was about 22.88 million in 2006 and grew at a rate of 0.47 percent between 2005 and 2006, slower in comparison with the 0.66 percent annual growth rate between 1995 and 2005. The rate of urbanisation growth has been seen to slow down as well, the percent of urban population increased to 70% from 69% in 2005.

Driven by rapid economic development in the past decade, the economic structure of Chinese Taipei has substantially changed. In the structure of domestic production, the service sector was 71.3 percent, industrial was 27.1 percent and the agriculture sector was 1.7 percent in 2005. The GDP of Chinese Taipei reached US$572.41 billion, the GDP per capita was US$ 25,228 in 2005 in 2000 PPP term. In addition, the unemployment rate fell from 4.13 percent in 2005 to 3.91 percent in 2006.

Chinese Taipei has very limited domestic energy resources and relies on imports for most of its energy requirements. No oil and coal reserves in Chinese Taipei, and gas reserves are around 7.7 BCM. In 2006, electricity generation installed capacity totalled 43,162 MW.

Table 1 Key data and economic profile (2005)

Key data		Energy reserves**	
Area (sq. km) *	36,188	Oil (MCM) – Proven	-
Population (million)	22.69	Gas (BCM)	7.7
GDP Billion US$ (2000 US$ at PPP)	572.41	Coal (Mt) - Recoverable	-
GDP per capita (2000 US$ at PPP)	25,228		

Source: Energy Data and Modelling Centre, IEEJ

* Directorate General of Budget, Accounting and Statistics, Executive Yuan, Taiwan

** US Energy Information Administration

ENERGY DEMAND AND SUPPLY

Primary Energy Supply

Chinese Taipei's total primary energy supply (TPES) was 106.6 Mtoe in 2005, up 2.2 percent from the previous year. By fuel, oil represented the largest share at 42 percent; coal was second (37 percent), followed by natural gas (10 percent), and others (12 percent). With the exclusion of nuclear fuel Chinese Taipei has limited indigenous energy sources and had to import around 98 percent of its required energy needs.

Chinese Taipei imports almost all its crude oil requirement, with the Middle East being the major supply source accounting for 80 percent of total imports. West African countries also are important suppliers. In 2005 Chinese Taipei imported 54.5 million ton of crude oil. As the refining capacity of the economy exceeds the domestic demand, Chinese Taipei is a net exporter of petroleum products, which amounted at about 10 million ton in 2005 . To ensure against a supply disruption, Chinese Taipei's refiners are required by the Petroleum Administration Law to maintain stocks of no less than 60 days of sales volumes.

The total refining capacity of Chinese Taipei has reached 1.23 million barrels per day (B/D), of which 58.5 percent is operated by CPC Corporation, Taiwan (CPC) and the rest is operated by Formosa Petrochemical Corporation (FPCC). CPC – Taiwan's state-owned oil company – is the dominant player in all sectors of the economy's

petroleum industry, including exploration, refining, storage, transportation, and marketing. FPCC is a subsidiary of the private Taiwanese petrochemical firm Formosa Plastics Group. In August 2006, FPCC completed an upgrade of the refinery facility at Mailia, increasing their refining capacity from 450,000 B/D to 510,000 B/D. Although current refining capacity in Chinese Taipei exceeds domestic consumption of petroleum products, both CPC and FPCC are considering constructing new additional refineries or expanding their existing plants. In the end of 2006, there were 2,592 gas stations in Chinese Taipei. CPC directly operates 661 gas stations, while 1,253 gas stations are jointly operated or franchised (privately operated). FPCC runs 678 gas stations.

As natural gas resources are also limited in Chinese Taipei, domestic demand is met almost entirely by imports of LNG, which mostly come from Indonesia and Malaysia. LNG imports in 2005 stood at 10 million toe, a 4 per cent increase from the previous year. CPC operates Chinese Taipei's only LNG receiving terminal at Yungan, Kaohsiung, with a handling capacity of 8.56 million tons per year. To meet the increasing demand for natural gas, CPC has already started building its second terminal at Taichung Harbor, with a design capacity of 3.00 million tones per year. This terminal will start partial operation with a handling capacity of 690 thousand tons in 2008 and is due to be completed by the end of 2009.

Coal is used for power generation as well as for the steel, cement and petrochemical industries. Coal has been totally imported from foreign countries, mainly from Indonesia (39 percent), Australia (36 percent) and Mainland China (21 percent). In 2005, primary coal supply was 39.2 million toe or 7.5 percent higher than the previous year. In order to secure a stable supply of coal, joint ventures to undertake exploration and development overseas are being pursued.

Chinese Taipei has 43,162 MW of installed generating capacity and generated about 227 TWh in 2005. By fuel type, the generation is broken-down as thermal at 76 percent, nuclear at 17.6 percent, and hydro at 3.5 percent and geothermal, solar and wind making up the remainder. Taipower, the state-owned electric power utility, dominates Chinese Taipei's electric power sector, with Independent Power Producers (IPPs) accounting for about 17 percent of the total capacity. The IPPs are required to sign power purchase

agreements with Taipower, which distributes power to consumers. To expand foreign participation, the government decided in January 2002 that foreign investors are permitted to own up to 100 percent of an IPP. Currently, two 1,350 MW advanced light water reactors in the Fourth Nuclear Power Project are under construction. In Accordance with the "Nuclear-Free Homeland" Policy, Chinese Taipei has no plans to build any additional nuclear plants in the future.

In order to effectively promote renewable energy and respond to the requirements of the private sector for institutionalised incentive measures, Chinese Taipei has proposed a "Renewable Energy Development Bill". With the Bill, it is hoped that electricity from renewable resources will be able to make up over 12 percent of the total electricity generation capacity.

Table 2 Energy supply & consumption for 2005

Primary Energy Supply (ktoe)		**Final Energy Consumption (ktoe)**		**Power Generation (GWh)**	
Indigenous Production	13,152	Industry Sector	35,873	Total	227,449
Net Imports & Other	96406	Transport Sector	14,701	Thermal	175,001
Total PES	106,638	Other Sectors	13,677	Hydro	7,909
Coal	39,183	Total FEC	64,251	Nuclear	39,972
Oil	44,343	Coal	6,706	Others	4,567
Gas	10,476	Oil	38,737		
Others	12,635	Gas	1,986		
		Electricity & Others	16,822		

Source:Energy Data and Modelling Center, IEEJ (see http://www.ieej.or.jp/egeda/database/database-top.html)

FINAL ENERGY CONSUMPTION

The final energy consumption in Chinese Taipei was 64.2 million toe in 2005, or 0.6 percent higher than the previous year. Elasticity of energy requirement was 0.57 in

2005. The industrial sector consumed 56 percent of the total, followed by transportation (23 percent) and the other sectors mainly residential/services (21 percent). By energy source, petroleum products accounted for 60 percent of total final energy consumption, followed by electricity (26 percent), coal (10 percent) and city gas (3 percent).

The industrial sector has been the primary energy consumer, but its share in total consumption has been declining, as a result of the industrial structure change and increased motorisation of the economy. Due to the rise in national income and improvements in the transportation system, the energy consumption in the transportation sector has increased significantly, reaching 14.7 Mtoe in 2005 from 13.8 Mtoe in 2004, 6.8 percent increase. The consumption in the commercial and residential sectors showed an increase of 0.8 percent.

By energy source, petroleum accounted for 60 percent of total consumption, electricity and others 26 percent, coal 10 percent and gas 3 percent. With improvement in living standards, technological progress and diffusion of electrical appliances, electricity consumption has steadily increased over the past 25 years at 6.9 percent per year on average.

POLICY OVERVIEW

The Bureau of Energy is responsible for formulating and implementing Chinese Taipei's energy policy. Also, it is charged with carrying out the Energy Management Law and the Electricity Law. It regulates natural gas utilities, petroleum and LPG filling stations, and the importation, exportation, production and sale of petroleum products. It maintains an energy database, evaluates energy demand and supply, and promotes energy conservation. Further, it implements research and development programmes and promotes international energy cooperation.

The fundamental goal of the Chinese Taipei Energy Policy is to promote energy security, supported by secure import of oil, natural gas and coal as well as the development of domestic energy resources including nuclear, fossil fuels and new and renewable energy. Two National Energy Conferences were convened in Taipei on May

26th and 27th, 1998 and June 20th and 21st, 2005, to formulate strategies and measures in response to the impact of the United Nations Framework Convention on Climate Change and to seek a balance among economic development, energy supply, and environmental protection in Chinese Taipei. In December 2005, the Bureau of Energy released an Energy Policy White Paper addressing the current worldwide trends, the short-term and long-term energy security challenges as well as the corresponding measures to be taken. The future energy policy will focus on: (a) Stabilizing energy supply to increase energy independence; (b) Increasing energy efficiency and reinforcing management of energy efficiency; (c) Further promoting liberalization of the energy market; (d) Coordinating the development of 3E (energy, environment, economy); (e) Reinforcing research and development; (f) Promoting education campaigns and expanding public participation. The aims of Chinese Taipei energy policy are to establish a liberalized, orderly, efficient, and clean energy supply and demand system based on the environment, local characteristics, future prospects, public acceptability, and practicability.

Oil

As Chinese Taipei is almost completely dependent on oil imports, the government has been trying to secure supplies. To stabilise the oil supply, private oil stockpiling could replace 60 days of supply, which is defined as the average domestic sales and private consumption over the past twelve months. The LPG stockpile should replace no less than 25 days of supply. Using the Petroleum Fund to finance the storage of oil, the government is responsible for stockpiling 30 days of oil demand, which is defined as the average domestic sales and consumption of the previous year.

Nuclear Energy

In 2001, the Government announced the “Nuclear-Free Homeland” policy, which is aimed primarily to help end the threat of nuclear weapons, and to review the various uses of nuclear power for peaceful civilian purposes, eliminate nuclear waste pollution and develop renewable energy. In order to realise no nuclear homeland, the government currently will not support the construction of any new additional nuclear power plants in the future.

New and Renewable Energy

The government plans to increase the share of new and renewable energy to 10 percent of total installed electricity generation capacity by 2010. In order to promote the use of new and renewable energy, the government has selected some major areas with viable market potentials: solar, wind power, geothermal energy, small hydro and bio-gas power generation. To advance the development of new and renewable energy technologies and to establish a legal basis for promoting them, the government has drafted the "Renewable Energy Development Bill" and submitted to the Legislative Yuan.

NOTABLE ENERGY DEVELOPMENTS

RATIONALIZATION OF ENERGY PRICE THROUGH IMPLEMENTATION OF A FLOATING PRICING MECHANISM FOR OIL

Chinese Taipei modified its oil products pricing mechanisms twice in 2007 so as to better reflect not only the fuel cost in the short run but also the external cost in the mid and long run, improve transparency of the adjustment procedure, and respond to the high oil price.

First, in January 2007, weekly price adjustments were recalibrated to be benchmarked against NYMEX WTI crude oil price rather than PLATTS, as used previously. Furthermore, gasoline and diesel price adjustment parameters were reduced from 100% to 80% of changes in crude oil cost to account for other, non-crude costs inherent in such oil products.

Chinese Taipei further modified the oil pricing system in September 2007 to link domestic wholesale prices to Dubai and Brent crude oil prices rather than WTI. The new formula is calculated monthly rather than weekly and is based on the change in the average price for Dubai and Brent crude over the previous two months. As for price adjustment of fuel oil, the average price change of HSFO180 between current month and preceding month posted by Platt's is used for reference.

Gasoline and diesel now join LPG and natural gas in receiving monthly price adjustments. However, because of differences inherent in the distribution, sales systems, and marketing channels of LPG and natural gas, these fuels will not adopt the crude floating mechanism in the short term.

CO_2 EMISSION VOLUNTARY REDUCTION PROGRAM AND ENERGY INDUSTRY AUDITING

In order to address the conclusions of the 2005 General Energy Conference, Chinese Taipei hopes to work with the energy industry to handle the impact from CO_2 emission control. In 2006, the Ministry of Economic Affairs (MOEA) conducted four projects including establishing the "auditing, registry, verification, and certification systems of energy industry", "the emission reduction capacity building of energy industry and promotion program of CO_2 emission voluntary reduction", "the environmental accounting system of energy sector," and "greenhouse gases emission management system". Main achievements of these and related activities included:

1. Establishment of a domestic GHG emissions auditing tool
2. Selection of forty energy industry companies to participate in demonstration projects
3. Provision of education and training to demonstration companies
4. Assistance for five demonstrative companies to obtain international certification

DEEPENED LIBERALIZATION OF THE PETROLEUM MARKET

In late 2006, Chinese Taipei formulated a draft revison of the Petroleum Administration Act in order to further liberalize the petroleum market and is now coordinating their implementation. Key proposed revisions include:

1. Relaxation of the threshold of statutory oil security stockpile for oil importers, reducing requirement from 50,000 kilolitres to 10,000 kilolitres. Such relaxation is expected to attract more enterprises, both domestic and international, to enter into the market, thereby benefiting consumers and further promoting industrial competitiveness.
2. Limitation of oil exports so as to first ensure the demand of domestic industries and people's livelihood under situations in which oil exports might otherwise threaten the security of the domestic energy supply.
3. Inclusion of ethanol gasoline and bio-diesel under the petroleum management mechanism so as to promote their development.
4. Extension of the scope and utilization of the Petroleum Fund so as to further enhance energy security of oil and natural gas, promote reasonable and effective energy use, stabilize oil supply, and maintain market order of oil products.

DRAFT REVISION OF THE ENERGY MANAGEMENT ACT

Furthermore, in 2007, Chinese Taipei also proposed revision of the Energy Management Act so as to strengthen the tools available to future energy management. Key proposed revisions are as follows:

1. Formulation of guiding principles on energy development, establishment of an evaluation mechanism for energy utilization, and implementation of preliminary management on energy utilization for large energy users.
2. Formulation of related regulations on energy conservation and energy efficiency aimed at specific energy users.
3. Establishment of a mandatory energy efficiency labelling system to provide complete information for consumers so as to prompt manufacturers to produce products with higher energy efficiency.

BIO-DIESEL FUEL STRATEGY AND IMPLEMENTATION

To decrease the use of fossil fuel and thus reduce carbon and other GHG emissions, Chinese Taipei has actively promoted bio-diesel development policies. Current projects include encouraging the planting of energy crops, regulating and implementing regulations on the use of biofuels, providing technical training and transfer assistance, strengthening biofuel education and awareness among the public, and popularizing the use of biofuels.

Four stages have been identified for the promotion of bio-diesel fuel use in Chinese Taipei:

1. Implementation of the "*Green Bus*" promotion plan and to encouraging public-operated buses to switch to bio-diesel fuel. Presently, a total of 507 buses in Kaohsiung City and Chiayi County are participating in this activity (428 buses in Kaohsiung City and 79 buses in Chiayi County). These two cities are the second and third cities, behind Kyoto, Japan, to adopt bio-diesel fuel for all of their municipal buses.
2. Development of the "*Green County*" promotion and application plan so as to integrate resources across government sectors (including the Council of Agriculture, the Environmental Protection Administration, the Ministry of Economic Affairs, and others). This program calls for the establishment of a "dirt-to-tank" B1 regional supply system through subsidies and counselling services, ranging from the production of raw materials and bio-diesel fuel to sale and distribution. Taoyuan County and Chiayi County and City have been selected for demonstrative of the program, which was established in July 2007. The

approximate expected consumption of bio-diesel fuel is 1,700 kilolitres in Chiayi County and City and 4,800 kilolitres in Taoyuan County from a total of 392 gas stations.

3. Exclusive sale of B_1 economy-wide by 2008. 289 gas stations and 3,000 passenger vehicles joined in 2007.
4. Increase the proportion of the bio-diesel fuel to 2% by 2010 so as to reach the 100,000 kilolitre bio-diesel target, advancing development of the bio-diesel fuel industry.

NATURAL GAS BUSINESS ACT

For enhancing the administration of public gas utilities as well as to provide a general legal basis for gas production and importation, the Natural Gas Business Act has been drafted and was approved by the Executive Yuan on February 22, 2006. Coordination with the Legislative Yuan for the passage of the Natural Gas Business Act is being carried out.

EXPANDING DOMESTIC NATURAL GAS CONSUMPTION PROJECT

Under this project, Chinese Taipei has developed a roadmap for increasing natural gas consumption to 10.50 million tonnes in 2010, 16 million tonnes in 2020, and 20 million tonnes in 2025.

ELECTRICITY MARKET REFORM

In order to stabilise the power supply, the Chinese Taipei electricity market first opened to Independent Power Producers (IPP) in 1995 through three stages. However, in recent years, due mainly to environmental reasons, some of TaiPower's new power plants were unable to meet construction schedules. As a result, the proportion of reserve capacity has remained at about 10 percent since 1990-- below the desired 15-20 percent reserve level. To prevent power outages and supply limitation, MOEA released the *Fourth Stage of Opening Electricity Market to IPPs* in June 2006, aiming to encourage IPP investment in 1,980 MW new generation capacity between 2011 and 2013. It is hoped that such investment might help to enliven the private sector, stabilize electricity supply, enhance operating efficiency, and generally promote the liberalization of electricity supply.

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