行政院所屬各機關因公出國人員出國報告書
（出國類別：研究調查）

建置節約能源、再生能源與前瞻能源產業產品標準、檢測技術及驗證平台先期研究及導入計畫子計畫 5
植物性替代燃料
美國出國考察報告

服務機關：經濟部標準檢驗局

姓名職稱：陳瓊蓉技士

出國地點：美國

出國期間：中華民國 97 年 10 月 18 日至 10 月 26 日

報告日期：中華民國 97 年 12 月 28 日

行政院研考會/省（市）研考會編號欄

摘　　要

”Accelerating Innovation in the 21st Century Bioscience: Identifying the Measurement Standard and Technological Challenges”研討會能源小組的工作會議結論：主要對於未來的生物能源的願景, 包括永續性的維持、公共建設的建立、政府長期的承諾、及整合式生物精煉程序等項目；而會面對的挑戰包括政治領導人的思維、大眾的接受程度、法規、標準的建立、經濟效益的考量、方法和標準(指 Life Cycle Analysis ,LCA 的評估)及技術的突破(提高轉化率、整合生物精煉程序)；在量測需求方面包括線上檢測方法、物化性質檢測、燃料性質檢測、環保公約要求需承諾的測量(例如溫室氣體量測 (Greenhouse Gas ,GHG)；障礙方面包括快速分析方法、熱力學及物化性質(Standard Reference Material ,SRM、Database 的建立)、文件標準的建立(即規範標準、GHG 的達成共識、永續性的定義等)、各國標準的調和等；方法方面包括 SRM 的建立、GHG 及永續性計量單位的共識、纖維素轉化技術的進步、正確快速及安全的檢測方法開發、各類料源依性質而訂定的檢測方法建立。

關鍵字：

生質能 Biomass energy or Bioenergy

生質燃料 Biofuel

生質柴油 Biodiesel

酒精汽油 Fuel Ethanol

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表目錄

一、前言與目的

能源是人類生存發展的重要保障，也是國家經濟發展的基本動力，全球因能源因素所引發的戰爭已不勝枚舉，21 世紀隨著經濟的快速發展人類正面臨經濟發展、環境保護、能源耗擷等多重的矛盾與壓力。專家估計，近 30 年來石油、天然氣等石化燃料的消耗量等同與此之前整個歷史時期所消耗之能源，同時釋放出的總碳量每年已達 60 億噸，造成全球暖化問題加劇，因此積極尋找替代能源是全球各經濟體首要關注的問題。

生質能是人類最早所利用的能源之一，由於分布廣、產量大、成本低、且可再生等優點，在目前能源短缺的世代，是被優先考慮的項目。生質能（biomass energy 或 bioenergy）指的是利用生質物為原料，經轉換所產生之可利用能源。主要如植物、藻類以太陽光進行光合作用而生長，而能量是將太陽能以化學能形式儲存在生物體內。在這過程中會吸收大氣中的二氧化碳，而這些植物再經由轉化製成「酒精」或「生質柴油」來當作燃料，燃燒之後再釋放出二氧化碳，由於並不會增加二氧化碳的淨排放，因此被視為再生能源的一種。相較於使用石油煤炭等化石燃料，因沒有增加二氧化碳排放，因此視為一種「消極的」二氧化碳減量。而所謂生質物（biomass），是泛指由生物產生的有機物質，例如農作物、木材與其廢棄物如黃豆、玉米、蔗渣，木材、木屑等，畜牧業廢棄物如動物屍體、廢水處理所產生的沼氣，工業有機廢棄物如有機污泥、廢紙等。

目前已成熟的生質燃料（biofuel）包括生質柴油（biodiesel）及燃料酒精（fuel ethanol）（還有 biogas 也有部分的應用），混於一般石化柴油或汽油中，且美國及歐盟也都有相對的品質規範，目前國內生質能源政策目標在生質柴油部分 97-98 年全面實施 B1，99 年開始全面實施 B2；酒精汽油部分 98-99 年實施都會區 E3 計畫，100 年全國實施 E3 計畫。依照本局業務分工，需專責於

檢測技術及驗證部分，且美國是主要生質燃料的生產與使用國，相關之研究也極為豐富，因此藉由本期導入計畫赴美參加 NIST 所舉辦”Accelerating Innovation in the 21st Century Bioscience: Identifying the Measurement Standard and Technological Challenges”研討會，並拜會 NIST 相關部門，以了解目前國際生質能之發展趨勢及研發方向。

二、行程與拜會人員

本次出國主要任務是參加 NIST 所舉辦”Accelerating Innovation in the 21st Century Bioscience: Identifying the Measurement Standard and Technological Challenges”研討會，並拜訪 NIST 相關部門，原規劃由能源局人員擔任領隊，但因該局業務繁忙無法派員，因此除了本局第六組陳瓊蓉技士以外，還有工業技術研究院量測技術發展中心馬先正博士、蘇峻民博士等三位共同前往。此次行程共有九天，除例假日外，前三日參加 Bioscience 研討會，接著拜會 NIST 六個實驗室，其詳細的行程及拜會單位如表 1、2。

表 1、美國行程表

日期	行程
2008/10/18 (六)	台北 - 底特律　0730 出發 1145 抵達　NW70　西北航空
	底特律 - 華盛頓雷根 1350 出發 1524 抵達　NW230 西北航空
2008/10/19 (日)	1700 Pre-Registration and Reception (Conference hotel)
2008/10/20 (一)	Conference Day 1 (agenda 如附表 3) **Administration Building (101)** **Auditorium and Lecture Rooms, NIST** 100 Bureau Drive Gaithersburg, MD USA
2008/10/21 (二)	Conference Day 2 (如附表 3)
2008/10/22 (三)	Conference Day 3 (如附表 3) 拜訪 NIST, 討論主題： 1. Flow measurement
2008/10/23 (四)	拜訪 NIST, 討論主題： 2. Biofuel SRM 3. Hydrogen flow 4. Hydrogen measurement standard 5. Residential fuel cell test standard
2008/10/24 (五)	拜訪 NIST, 討論主題： 6. Neutron Image Facility: water flow inside fuel cell channel
2008/10/25 (六)	華盛頓雷根 - 底特律 1239 出發 1419 抵達　NW231 西北航空
2008/10/26 (日)	底特律 - 台北 1540 出發 2225+1 抵達 NW69 西北航空

表 2、拜訪單位及主要訪談人

機構名稱	National Institute of Standards and Technology (NIST)		
主要任務	1. 參加”Accelerating Innovation in the 21st Century Bioscience: Identifying the Measurement Standard and Technological Challenges” 2. 參訪 NIST		
主要洽談人	John Wright	職務	Project leader, Flow Laboratory
主要洽談人	Maria Uhle	職務	International Affairs Officer, Office of International and Academic Affairs
主要洽談人	Michele Schantz	職務	Research Chemist, Organic Analytical Methods Group, Analytical Chemistry Division
主要洽談人	Franklin Guenther	職務	Group leader, Gas Metrology, Analytical Chemistry Division
主要洽談人	George Rhoderick	職務	Research Chemist-VOC Gas standards, Gas Metrology and Classical Methods, Analytical Chemistry Division
主要洽談人	Juana Williams	職務	Physical Scientist, Weights and Measures Division
主要洽談人	Mark Davis	職務	Mechanical Engineer, Building and Fire Research Laboratory
主要洽談人	David Jacobson	職務	Physicist, Neutron Interactions and Dosimetry, Physics Laboratory

三、過程

第一天(10/20)

上午第一場為生物科學政策會議，圓桌小組成員皆為一時之選，包括：澳洲國家量測實驗室主任 Dr. Laurence Besley、美國總統科技政策辦公室 Dr. Chavoda Jacobs-Young、EC Directorate General for Research, Dr. Timothy Hall、巴西 INMETRO 主席 Dr. Joao Jornado 及 Nature 雜誌編輯 Dr. Mitch Waldrop。本次會議共同主席馬里蘭大學教授 Jennie Hunter 在開場致詞中提到，生物科技發展至今，一直為人所詬病的就是投入了大筆的經費，至今卻遲遲未創造出新的工作機會，也沒有真正形成一個蓬勃發展的產業，其中的原因和障礙希望能夠利用這次會議集思廣益找出答案；Dr. Waldrop 指出，生物科技、奈米科技及資訊科技在哲學上都是相關的，生物科技利用奈米科技製成生物晶片，也需要資訊科技的輔助來完成基因解碼；在談到現今全球經濟邁入衰退期，研發預算跟著減少，負責美國科技政策的 Dr. Young 指出，大家要學習如何利用小錢來做大事，預算申請本來就有贏家和輸家，這是一個預算的循環(budget cycle)，目前研發經費 78%來自政府、22 來自民間；巴西計量院的 Dr. Jornada 指出，這個會議是個類似 bottom up 形式的建言會，在 workshop 中作出的建議將成為未來的政策前進方向，他也提到生物科技不容易追溯，希望未來能開發出纖維酒精的參考物質。此外，有人提到生物科技的研究結果常因測量單位不同而有無法比較的情形，有人提出要加入新的 SI 單位，亦有人認為在現在的莫耳基礎上已經足夠，現場討論意見分歧，莫衷一是。

上午第二場圓桌會議是 NMI 領導者會議，圓桌會議成員更是一時之選，包括：韓國計量院主席 Dr. Kwang Hwa Chung，NIST 代理院長 Dr. Patrick Gallagher、EC JRC-IRMM 主席 Dr. Alejandro Molina、NPL 的 Dr. Anna Hills、加拿大國家計量院院長 Dr. James McLaren、荷蘭 NMi 的 Dr. Marc Pieksma 及國際度量衡會議秘書 Robert Kaarls 等人。會議中再次提到現有 SI 單位不敷生

物科技使用, 要創造新的單位；有人打趣的說量測不確定性若能改成量測確定性會比較合理；也有人提到生物科技的性質較容易有量測標準, 但功能則不易有量測標準；有人建議要回歸到最基本的量測方法, 用算數目的方式一個一個算。

第一天下午則是針對各工作小組的主題進行專題演講, 包括有能源、農業、製造、環境、醫學等, 其中能源組的講員是美國能源部的 Anna Palmisano, 講題是 "Obtaining Sustainable energy from biological sources", 其中提到 biofuel 的目標是達到大於 15 ton/acre/year 的產量、低 input(減少肥料、農藥)、高轉化率及永續性, 此外提到美國 Biological and Environmental research (BER)共有三個, 經費佔 USD 400M, 微生物是主要研究重點, 三個研究單位分別是 BESC (Bioenergy Science Center)、JBEI (Joint Bioenergy Institute)、GLBRC (Great Lake Bioenergy Research Center)。

第二天(10/21)上午開始進行工作小組的討論, 工作小組分成能源、農業、製造、環境、醫學及其他熱門議題等六大組, 除了熱門議題組的形式為專題演講外, 其餘各組皆為腦力激盪的進行模式, 各分組由事前指定的幾位資深專家組成技術小組, 其他與會者為觀察員, 技術小組成員於第一階段輪流針對能源的未來提出願景、目標和各種可能, 同行工研院量測中心馬先正博士被指定為技術小組成員之一, 與此領域的頂尖專家共同討論真是與有榮焉, 在座其他成員包括巴西計量院主席 Dr. Jornada, 還有前 NIST CSTL 主任 Hratch Semerjian、馬里蘭大學教授王南新、Zymetis 公司董事長 Steven Hutcheson、Aspen 技術總監 Suphat Watanasiri、USDA 森林部門經理 Harold Thistle 及 ADM 公司酒精技術經理 Charles Corr、Solazyme 公司 director Mathew Frome 及 John Hopkins 大學應用物理實驗室資深研究員 Terry Purkable 等人, 小組第一階段討論目的是為了釐清未來能源的特性、可能的改變、組成的元素及各種發展方向。

上午第二階段則是更進一步討論在發展未來能源的過程中可能會面對的挑戰及障礙, 並依重要程度列出先後順序, 包括政策、法規、經濟、社會及區域發展等面向, 例如大眾對生質燃料和糧食問題的疑慮, 不同料源對燃料性質造成的

影響, 標準參考物質的需求, 政府政策所給予的承諾, 溫室氣體生命週期分析(GHG Life cycle analysis)及永續性的評估等。

第三階段則是要激盪出哪些量測是未來可能需要的, 又為什麼需要, 目的要找出未來在量測領域中重要的量測技術開發方向, 會面對哪些挑戰。

第四階段則是針對量測及標準的挑戰和障礙依重要程度依次排序, 以 technical member 投票的方式決定大多數人最認同的先後順序。

會議第三天(10/22)上午則是將前一天排序出先後順序的議題, 以小組討論的方式, 每個組針對一個議題進行包括議題描述、目的、合理性、社會衝擊、解決方案、風險、各組織團體所應扮演角色的討論。各小組在討論完畢後由分組會議主持人將各小組的成果彙整, 製作成簡報格式, 以備下午的成果發表。

下午則是將所有分組, 包括能源、農業、醫學、製造、環境及重要議題所做的成果報告, 這些成果將成為 NIST 未來工作方向的重要參考, 而 NIST 預計於 2008 年 12 月將本次會議的資料在經過講員的同意及工作成果的再次整理後公佈於網站供與會者下載。

研討會結束後則是前往 NIST 流量試驗室進行參訪, 拜訪包括計畫主持人 John Wright、Dr.葉賜田等人並參觀液體及氣體流量校正系統, 包括 PVTt 法、秤重法及大型風洞實驗等設備。

第四天(10/23)進行 NIST 參訪行程, 上午第一場為 NIST 國際事務部主管 Dr. Maria Uhle 說明 NIST 的定位、目前組織規模、主要任務、經費來源, 包括 NIST 目前有 2800 位員工、1800 個客座研究員、2 個園區(Gaithersburg, MD; Boulder, CO)、3 個諾貝爾獎得主、10 個主要實驗群、50%具有博士學位、每年預算約 300 億台幣等, NIST 非標準制定的單位, 但當標準制定前, NIST 所做的研究往往具有重要的參考價值。

上午第二場則前往化學實驗室(CSTL)與 Dr. Michelle Schantz 討論生質柴油標準參考物質的相關問題。NIST 和巴西計量院(Inmetro)正在合作開發生質燃料的標準參考物質, 其中 NIST 負責生質柴油(包括 soy-based 的 2772 及 animal

fat-based 的 2773)，Inmetro 負責生質酒精。由委外廠商製造的標準參考物質目前正在進行 NIST 與 Inmetro 實驗室進行測試比對，NIST 這邊的量測除密度及黏度由 Boulder 院區的專家負責外，其餘由 Dr. Schantz 及 Gregory Turk 負責，目前正在等待 Inmetro 的測試數據，預計年底才會有比對結果，生質燃料標準參考物質正式公佈應該在 2009 年。生質柴油標準參考物質除了 NIST 的 2772 及 2773 外，歐盟的 IRMM(Institute for Reference Materials and Measurements)也打算開發以菜籽油為主的參考物質，除此之外目前並無其他生物燃料標準參考物質的計畫被公佈。而美國 ASTM 對於生質柴油的品質已訂定 B100 的標準 D6751-08，而燃料生質柴油（石化柴油添加生質柴油）也訂定 B20 標準 D7467-08，其適用範圍為 B20－B6；若添加量低於 B6，則適用一般柴油標準 D975-08a；生質酒精部分的品質標準，E10 以下之標準為 D 4814-08b，Ed75－Ed85 之標準為 D5798-07。

下午第一場則是前往 CSTL 分析化學組與 Dr. George Rhoderick 及 Dr. Franklin Guenther 討論氫氣純度的問題，由於氫氣使用涉及安全性的問題，他們仍在評估使用氫氣前置作業，包括洩漏及建築物內所能容許的最大量及濃度，在規劃完全前仍是以氦氣最為主要工作氣體。

下午第二場則是與 Ms. Juana William 討論氫氣純度量測，Ms. William 目前正全職專注於美國氫氣量測標準的開發，於 2008 年 10 月成立美國國家工作小組(US National Working Group, USNWG)，討論開發氫氣測量的標準，目前已有草案提出，主要是參考 OIML R139 及 R81，包括氫氣品質規範及量測設備規範未來將進行制訂量測方法的規範，其中幾個較關鍵的包括：壓力、測試用氫氣流向(回流或排放大氣)、正確性、安全性、買賣方法(單位)及純度等。

下午第三場則是與建築及火災實驗室的 Mark Davis 進行拜訪，Mark 於 2001 年起開始進行定置型燃料電池的測試工作，所使用的三種燃料電池包括 Plug Power 公司的 PEMFC 5kW 系統、Acumentric 的 SOFC 系統及 IdaTech 的 PEMFC 系統，量測其功率、電壓、電流、溫度、溼度及流量並討論電的效率，由於並沒有熱回收，故效率僅有 20~30%(若有熱回收預期可達到 80%)。在其測試系統中，環

境溫度及溼度可控制，藉此模擬各種不同地區氣候的變數，該設備皆使用天然氣為燃料，經重組器來產生氫氣，其中 Plug Power 的系統很快就毒化了，最終完成了定置型燃料電池性能評估及測試方法的提案。

第五天(10/24)參訪中子影像實驗室(Neutron Image Facility)，由統計部門的朋友 William Guthrie 帶領前往拜訪 NIF 的 Dr. David Jacobson，Dr. Jacobson 正在進行以中子束撞擊氫原子以顯像燃料電池內水流動的研究，利用中子對氫原子的高敏感度可穿透金屬的特性，完成 X-ray 無法達成的任務，同時 Dr. Jacobson 亦說明接下來要進行質子交換膜內水分布的研究。NIF 如同一個中型的核能設備，人員進出都需要嚴格的管制，包括身份確認、進出前後的輻射殘留量檢測、出實驗室前的輻射量檢測、禁止拍照等。安全設計亦是 Dr. Jacobson 強調的重點，雖然在輻射設備內進行有關氫氣的研究，氫氣的危害相較於輻射較小，不過一旦氫氣事故發生，危害的程度還是和在其他地區一樣重要，實驗設計前 Dr. Jacobson 已做了完整的氫氣使用安全評估，包括工作空間大小 、高度、氫氣使用時完全洩漏後造成的影響、氫氣偵測器的設置及點火裝置等。NIF 的設備及管理是此行印象最深刻的部份。

四、參加 Conference 感想

在這次”Accelerating Innovation in the 21st Century Bioscience: Identifying the Measurement Standard and Technological Challenges”研討會的與會者極大部分是民間企業的老闆級人物及各國計量單位的重量級人物，在5大議題中，包括能源、農業、製造、環境、醫學等項目，在每一場的專題演講中參與發言都極為踴躍，顯示其重視的程度；在專題講演中，以生物醫學場中討論的最為熱烈且爭議也最大，包括幹細胞（Stem-cell）治療研究、生物威脅（包括新感染性疾病、醫療等)、基因工程等項目都受到諸多的挑戰；而農業政策部分仍以美國境內的發展討論為主，環境及製造議題一直也都在各式的研討會中討論，並不在我們此行的重點，在此不作深入研究。其實上述5大議題是

環環相扣的大議題，撇開生物醫學不談，其他四項互相間雖有矛盾但也有互相協助的關係，但研討會中並無綜合性的討論及政策，是美中不足的地方。此外能源的討論還是著重在生質柴油及酒精汽油部分，這兩項目前不論是美國或歐盟都有通用的規範，且ISO及EN也都做成標準，討論的也是偏重政策面的部分；其實除了生質柴油及酒精汽油外，生質燃料比較有發展性的是油脂藻類（或稱微生物油脂microbialoils）或工程微藻，由於微生物油脂具有油脂含量高（一般微生物細胞含油脂2-3%，若一定條件培養下油脂含量可達60%）、生產週期短、生產成本低等優點，且兩項生質燃料的料原都牽涉到與糧爭地的問題，若造成糧荒及經濟動盪都是大家所不樂見的情況，若工程藻類或油脂藻類的技術能有所突破，未來勢必確實能有效解決與糧爭地的問題。

五、心得感想

1. NIST 的人普遍和善

此行感謝很多人的居中幫忙，包括馬慧中經理的先期連絡，量測中心同仁的後置行程安排、在美的諸多照顧，以及 NIST 幾位工作人員的行程安排，其中 NIST 國際事務部的 Joy Foster 負責安排第一天的主要參訪行程，此外任職於統計部門的 William Guthrie 是以朋友的名義協助安排部份的拜會行程，包括定置型燃料電池實驗室、流量實驗室及中子影像實驗室，也多虧有了 Will 的安排，才得以使此次參訪行程更加充實。此外在 NIST 也見到了一些同樣來自台灣的研究人員，包括來自中華電信研究所及工研院電光所的同仁，以及長期定居在美國的台灣同胞劉弘軌（任職於統計部門）及葉賜田（任職於流量校正試驗室）等人。每個人皆表現出十分友善且熱心的態度，使我們有賓至如歸的親切感。

2. NIST 注重安全

在參觀流量實驗室及分析化學實驗室時，二實驗室的人員同樣都準備進行有關氫氣的研究，雖然分屬不同部門，但同樣都強調實驗前安全規劃的重要性，由於氫氣有其一定的危險性，雖然部分危險來自於人們對於氫氣易自燃的迷思，但

安全的考量有絕對的重要性，事前思考可能發生的最大危害情形，進行判斷氫氣使用的方式及用量，並設計安全措施，因為 NIST 向來有良好的安全紀錄，維護良好的工安紀錄也是 NIST 人心中的重要任務。

3. NIST 為政府部門，經費由上而下

NIST 為隸屬美國商業部的單位之一，每年經費由政府編列預算經議會通過後使用，沒有預算目標達成的壓力，能進行一些政府支持但短期產出有限的研究，NIST 也以美國標準甚至全球標準領導者自居，從事符合尖端科技需求地相關標準或量測活動，NIST 研究員穩定性相對很高，很多研究員均長期在該領域專研，貢獻其豐富的研究知識，甚至做到退休，因此穩定的人員素質水平及專精的研究成果，這也是 NIST 能維持高水平的原因之一。

4. 工作小組、集思廣益

此行參加”Accelerating Innovation in the 21st Century Bioscience: Identifying the Measurement Standard and Technological Challenges”以工作小組形式的會議，讓與會者實際參與整個腦力激盪，集思廣益，以解決特定問題為目的的工作流程模式，從來自各領域小組成員的意見表達、辯論、主持人針對不同討論階段的先前引導、小組投票決定重要議題的先後順序、以及將各種不同意見隨著會議進行流程以邏輯思維引導出最後重點並做成結論，形成報告並在最終團體大會中向其他會議成員報告，整個過程結果是結合了所有參與者的智慧結晶，著實令人印象深刻，且提出的項目需求亦是業界的需求，不僅可作為 NIST 未來的的研究發展重點以符合產業要求，也可提供給該國政府部門作為未來的施政重點。

5. 標準參考物質的製作

在此行前對於標準參考物質的認知僅限於使用的層面，對於如何製作標準參考物質並沒有一個系統的了解，此行在與 Dr. Schantz 討論生物燃料標準參考物質開發進度時才間接知道標準參考物質製作的大致流程，包括要符合 ISO Guide 31 方法提供 Certified property value 及 uncertainty value、

expiration/period of validity等資訊, 實驗室需要符合ISO 17025及ISO Guide 34 for reference material producer的要求等項目。

6. 能源分組結論重點

能源小組的工作會議最終所做的結論, 主要對於未來的生物能源的願景包括永續性的維持、公共建設的建立、政府長期的承諾、及整合生物精煉程序(integrated bio-refinery)等項目；而會面對的挑戰包括政治領導人的思維、大眾的接受程度、基礎的建立(包括法規、標準)、經濟效益評估、方法和標準(指Life Cycle Analysis, LCA的評估)及技術的突破(提高轉化率、整合生物精煉程序等)；在量測需求方面包括線上檢測方法、物化性質檢測、燃料性質檢測、線上檢測方法、物化性質檢測、燃料性質檢測、符合環保承諾之檢測(例如GHG量測)；障礙方面包括快速分析方法、熱力學及物化性質(SRM、Database的建立)、文件標準的建立(即規範標準、GHG的達成共識、永續性的定義)、各國標準的調和等；方法方面包括SRM的建立、GHG及永續性計量單位的共識、纖維素轉化技術的進步、正確快速及安全的檢測方法開發, 不論料源為何依性質而訂定的檢測方法建立。(相關投影片如附件2)

7. NIST中/長期研習將收穫更多

NIST現有1800位客座研究員（2007依排名前五名分別為中國大陸（140)、韓國（83)、法國（75)、印度（66)、德國（52)), 超過NIST正式人員的一半, 協助NIST研究的進行同時汲取NIST的尖端技術, 工研院量測中心與NIST之間一直有此類形式的技術交流, 而本局針對本身的業務性質, 其定位當為行政幕僚、技術幕僚或技術研發單位, 其實需進一步釐清, 若認定本身為技術研發單位, 則長期的技術養成及與國際知名部門作技術接軌是有其必要性, 畢竟扎實的技術根基是建築在每一個實驗操作的小細節及正確觀念的培養之上, 短期參訪雖對技術的全貌有大致的瞭解但卻無法深入, 唯有中/長期的實地參與才得以抓住其中的精髓, 掌握每一個細節。

六、建議

由於長期使用石化燃料已造成地球的嚴重暖化，再加上資源耗盡的能源危機連帶造成全球性境經濟危機，全球就籠罩在環境浩劫以及能源危機的陰影中，接踵而至的就是替代能源的開發，而生質柴油及酒精汽油是優先被考慮的燃料替代品，但由於生質燃料的料原不外乎是高油脂豆類及醣類，而造成糧食與燃料之間的拉鋸戰，因此再次的料原選擇是有其必要性。

在可用耕地大的地區種植草本或木本生質燃料植物是可行的，但在地小人稠耕地面積有限的地區發展生質植物的種植其效益是有限的；由於本國一直就處於資源匱乏的窘境，絕大部分能源都需仰賴進口，必定受限國際經濟的箝制，若要改善燃料受限的問題，並能扶植產業轉型，全力發展油脂微生物，並鼓勵研發及發展能源工業作為我國生質能源的原料，不失是一種轉機，尤其該項產業可促進農、魚、工業另項發展、製造就業機會，並可解決部分燃料自給以降低能源進口的依存度，對我國未來的競爭力應當較有發展潛力。

表 3、Conference Procedure

Day 1 - October 20, 2008 Plenary: Agriculture, Energy, Environment, Manufacturing, Medicine			
7:00am 7:30am	Meet bus outside hotel for transportation to NIST Meet bus outside hotel for transportation to NIST		Washingtonian Marriott Hotel Front Entrance & Courtyard Marriott Boardwalk Place Entrance
7:00-8:00am	Registration/Coffee		Bldg. 101 Red Auditorium Lobby
8:00-12:00pm	Exhibit Setup		Exhibit/Poster Hallway
8:00-8:15am	Welcome and Introductory Remarks	**Willie May**, Director, CSTL/NIST Conference Co-Chair **Jennie Hunter-Cevera**, President, UMBI; Conference Co-Chair	Red Auditorium
8:15-10:00am	Science Policy Roundtable	**Chavondra Jacobs-Young** , Office of Science and Technology Policy, USA **Timothy Hall**, Directorate General for Research, EC **Laurence Besley**, Department of Innovation, Industry, Science and Research, Australia **Joao Jornada**, Department of the Development, Industry and Exterior Commerce, Brazil Moderator: **Mitch Waldrop** Nature and the Nature Journals	Red Auditorium
10:00-10:30am	A.M. Break		Exhibit/Poster Hall
10:30-12:00pm	NMI Director ' s Roundtable	**Pat Gallagher**, NIST **Alejandro Herrero**, EC JRC-IRMM **James McLaren**, NRC INMS, Canada **Kwang Hwa Chung**, KRISS, Korea **Marc Pieksma**, NMi, The Netherlands **Anna Hills**, NPL, UK Moderator: **Robert Kaarls,** Secretary of CIPM	Red Auditorium
12:00-12:30pm	Discussion		Red Auditorium
12:00-5:30pm	Exhibits Open		Exhibit/Poster Hallway
12:30-1:30pm	Lunch		West End Cafeteria and Lunch

			Club
1:30-5:30pm	Plenary Symposium	Moderators: **Gary Brooker,** Johns Hopkins University Microscopy Center **Helen Parkes,** LGC	Red Auditorium
1:30-2:15pm	Medicine Plenary Lecture	**Lee Hood**, ISB	Red Auditorium
2:15-3:00pm	Energy Plenary Lecture	**Anna Palmisano**, US DoE	Red Auditorium
3:00-3:45pm	Environment Plenary Lecture	**Stephen Weisberg**, So. Calif. Coastal Water Research Project Authority	Red Auditorium
3:45-4:00pm	P.M. Break		Exhibit/Poster Hall
4:00-4:45pm	Manufacturing Plenary Lecture	**James Thomas**, Amgen	Red Auditorium
4:45-5:30pm	Agriculture Plenary Lecture	**Pamela Ronald and Raoul Adamchak**, UC Davis	Red Auditorium
5:30pm	Reception at NIST		Exhibit/Poster Hall Courtyard
6:30pm 7:00pm	Meet bus outside Bldg. 101 for transportation to Hotel Meet bus outside Bldg. 101 for transportation to Hotel		Bldg. 101 Lobby

Day 2 – October 21, 2008 **Technical Panels: Agriculture, Energy, Environment, Manufacturing, Medicine**			
8:00am 8:30am	Meet bus outside hotel for transportation to NIST Meet bus outside hotel for transportation to NIST		Washingtonian Marriott Hotel Front Entrance & Courtyard Marriott Boardwalk Place Entrance
8:30-9:00am	Registration/Coffee		Bldg. 101 Red Auditorium Lobby
9:00-5:00pm	Exhibits Open		Exhibit/Poster Hallway
9:00-9:55am	-- Summary of Plenary Session – J. Hunter-Cevera -- Charge to the Working Groups – W. May -- Technical Panel Process Agenda – J. Pellegrino		Red Auditorium
10:00-11:00am	Parallel Technical Panel and Hot Topics	Technical Panel Leaders w/Facilitator	Lecture Rooms A, B, C, D, Employees Lounge and Red Auditorium

11:00-11:15am	Break		Exhibit/Poster Hall
11:15am-1:00pm	Parallel Technical Panel and Hot Topics	Technical Panel Group Leaders J. Hunter-Cevera and C. Jackson	Lecture Rooms A, B, C, D, Employees Lounge and Red Auditorium
1:00-2:00pm	Lunch		West End Cafeteria and Lunch Club
2:00-3:15pm	Parallel Technical Panel and Hot Topics	Technical Panel Group Leaders J. Hunter-Cevera and C. Jackson	Lecture Rooms A, B, C, D, Employees Lounge and Red Auditorium
3:15-3:30pm	Break		Exhibit/Poster Hall
3:30-5:30pm	Parallel Technical Panel and Hot Topics	Technical Panel Group Leaders J. Hunter-Cevera and C. Jackson	Lecture Rooms A, B, C, D, Employees Lounge and Red Auditorium
5:30pm 6:00pm	Meet bus outside Bldg. 101 for transportation to Hotel Meet bus outside Bldg. 101 for transportation to Hotel		Bldg. 101 Lobby
6:15pm 6:30pm	Meet bus outside Hotel for transportation to Smokey Glen Farm Meet bus outside Hotel for transportation to Smokey Glen Farm		Washingtonian Marriott Hotel Front Entrance & Courtyard Marriott Boardwalk Place Entrance
6:30-7:00pm	Social Hour		Smokey Glen Farm
7:00-8:30pm	Smokey Glen Farm Barbequers * Casual Dress		Smokey Glen Farm
8:30pm 9:00pm	Meet bus for transportation to Hotel Meet bus for transportation to Hotel		

Day 3 – October 22, 2008 Technical Panels: Agriculture, Energy, Environment, Manufacturing, Medicine			
8:00am 8:30am	Meet bus outside hotel for transportation to NIST Meet bus outside hotel for transportation to NIST ** Bring luggage to NIST for departure		Washingtonian Marriott Hotel Front Entrance & Courtyard Marriott Boardwalk Place Entrance
8:30-9:00am	Registration/Coffee		Bldg. 101 Red Auditorium Lobby
9:00-2:30pm	Exhibits Open		Exhibit/Poster Hallway
9:00-10:45am	Parallel Technical Panel	Technical Panel Group Leaders	Lecture Rooms A, B, C, D, Employees Lounge and Red Auditorium

10:45-11:00am	Break		Exhibit/Poster Hall
11:00-12:00pm	Parallel Technical Panel	Technical Panel Group Leaders	Lecture Rooms A, B, C, D, Employees Lounge and Red Auditorium
12:00-1:00pm	Lunch		West End Cafeteria and Lunch Club
1:00-1:20pm	Report Out – Panel 1	Technical Panel Group Leaders	Red Auditorium
1:20-1:40pm	Report Out – Panel 2	Technical Panel Group Leaders	Red Auditorium
1:40-2:00pm	Report Out – Panel 3	Technical Panel Group Leaders	Red Auditorium
2:00-2:20pm	Report Out – Panel 4	Technical Panel Group Leaders	Red Auditorium
2:20-2:40pm	Report Out – Panel 5	Technical Panel Group Leaders	Red Auditorium
2:40-3:00pm	Report Out – Panel 6	Technical Panel Group Leaders	Red Auditorium
3:00-3:30pm	Wrap-up	W. May and J. Hunter-Cevera	Red Auditorium
3:30pm	Adjourn		

附件 1

Preliminary Participants' List

Accelerating Innovation in 21st Century Biosciences: Identifying the Measurement Standards & Technology Challenges

October 19-22, 2008

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October 19-22, 2008

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October 19-22, 2008

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Accelerating Innovation in 21st Century Biosciences: Identifying the Measurement Standards & Technology Challenges

October 19-22, 2008

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附件 2

Energy Technical Panel

Facilitated Session Results

October 22,2008

Energy：Future Characteristics/Vision

・What the Future holds

・Transportation biofuels are derived from sustainable, domestically produced feedstocks to provide economic and energy security, and reduced environmental impacts

・Robust national infrastructure to promote expanded use of biofuels

・Long-term public commitment to biofuels that transcends economics as the sole driver of its development and deployment

・Integrated biorefineries which biochemically and thermochemically utilize a variety of feedstock to produce a variety of products

Energy: highlights of broad challenges and barriers

- Broad Challenges to Reaching our Vision

- Political Leadership
  - Long-term public commitment to biofuels
  - Long-term research and development funding
- Public Acceptance
  - Public awareness of key issues based on strong science
- Infrastructure
  - Infrastructure for the distribution, storage, and transmission future

Energy: What We Need to Measure and Why

- Process Monitoring
  - On-line chemical composition measurements of process streams to improve quality control, higher yield, efficiency, and profit
- Evolving Thermochemical and Physical Properties
  - Measuring fundamental thermochemical properties- heat of combustion, vapor pressure, vapor- liquid equilibrium, viscosity, etc to provide rational design and optimization
- Finished Fuel Properties
  - Inexpensive and accurate measurements which work in the field to ensure the quality of biofuels at the customer level
- Compliance Measurements
  - Consensus sustainability, land-use, and greenhouse gas methods and standards for comparisons of various fuels

Energy: Selected Priority Measurement & Standards Barriers

- Analytical Measurements
  - Faster, simpler, less expensive field techniques to measure product characteristics
  - Standard reference materials for various forms of biomass
  - Understanding measurement needs of future biofuels (e.g. biodiesel , renewable diesel, and third generation fuels)
- Thermochemical, Physical, and Biological properties
  - Understanding of the molecular events associated with the breakdown of the cellulosic materials

Energy: Selected Priority Measurement & Standards Barriers

- Documentary Standards
  - Standards based on performance measurements, irrespective of feedstock
  - Consensus metrics for GHGs, landuse, and sustainability
  - Definition of sustainability on biofuel production
- Harmonization
  - Certified reference materials to ensure accuracy of chemical measurement through international collaboration
  - Development of the pervasive infrastructure for measurements and association techniques(e.g. accredited laboratories and certification schemes)

Energy: Approaches to Selected Priority Measurement & Standards Barriers

- Standard Reference Data for Bioenergy Technologie
  - Objectives: Produce comprehensive and reliable tables of property data
  - Rationale: Process design, optimization, and policy
  - Impacts: Highly important to innovation, competitiveness, society, and energy security
- Consensus Metrics for GHG, Landuse, and Sustainability
  - Objectives: An objective and measurable approach to sustainability
  - Rationale: Allows for marketplace acceptance, business and development planning, land management approach to sustainability
  - Impacts: Provides societal benefits and important for environmental protection.The impact on innovation, competitiveness, and energy security is time dependent and relative to which organizations embrace the guidelines

Energy: Approaches to Selected Priority Measurement & Standards Barriers（cont..）

- Accurate, Quick, affordable, retail Inspection Test Kit
  - Objectives: Development of screening device, providing results within minutes that would test for compliance with finished fuel standards
  - Rationale: Timeliness of inspection is important for compliance, and overcoming this barrier is importance for consume protection and economics
  - Impacts: Economic, compliance, fair competition, consumer protection, safety, reduce dependence on foreign fuel ,consumer pricing, quality product
- Standards Based on Performance Measurements Irrespective of Feedstock
  - Need ultimately from end-use consumers
  - Input is required from engine manufacturers to determine the parameters of the fuel