出國報告（出國類別：其他）

赴法國參加第 18 屆歐洲生質能源研討會

服務機關：核能研究所
姓名職稱：許登傑
派赴國家：法國
出國期間：99 年 5 月 1 日~99 年 5 月 8 日
報告日期：99 年 7 月 7 日

摘要

本報告內容係說明核研所派員赴法國里昂參與18th European Biomass Conference & Exhibition，並受邀於會中發表本所纖維酒精計畫研究成果之壁報論文「Design of tailor-made process for converting total sugars to ethanol from lignocellulosic biomass」發表。藉由參加此研討會可了解，各國纖維酒精製程開發之成果，其中同步糖化及發酵程序、共發酵菌株和改良纖維水解酵素生產菌株所得之纖維水解酵素之研發進展，現階段已至噸級測試廠進行驗證測試的階段。另外，生質物精煉技術的開發爲各國下一階段研發重點項目，生質物精煉技術發展現階段研發重點爲將纖維酒精程序中所得之五碳糖與木質素產製不同類別之生質產品。目前本所纖維酒精計畫已建置完成每批進料10kg規模和噸級測試平台，可進一步將本所研發之共發酵菌株和纖維水解酵素生產菌株於測試平台中進行驗證。五碳糖和木質素爲本所纖維酒精研發製程中的主要產物之一，可作爲所內發展生質精煉技術研發之契機，達到生質物完全資源化利用之目的。

目次

一、目的

生質能源已成爲世界各國對抗氣候變遷、降低石油資源依存度和克服石油價格持續升高的替代能源策略之一，以歐洲爲例，歐盟即在 2009 年公布希望於 2020 年達到再生能源占歐洲總能源消耗的比重達 20%。然而，使生質能源的技術發展和經濟規模可與石化資源利用技術進行抗衡，已視爲現階段各國發展的挑戰，另外，生質物的取得來源爲使生質能源能永續發展必須注意的課題，以非糧食作物取代現行以糧食作物生產生質能源已成爲的發展目標。

核研所自 94 年起開始致力於纖維酒精技術之研發，目前已陸續由實驗室規模發展至小型纖維酒精程序單元系統，更進一步設置噸級纖維酒精測試運轉廠。除進行測試系統設置與程序開發研究外，仍積極與國內外生質能源研發團隊進行交流，藉此加速建立國內具國際競爭力之纖維酒精技術。本次公務出差即是秉持與國際技術交流和增加國際能見度的想法出國。本次研討會「18th European Biomass Conference & Exhibition 」於法國里昂舉辦，由 ETA-Florence Renewable Energies 和 WIP- Renewable energies 共同主辦，其爲國際知名生質能源相關之研討會，會議主要探討實驗室研究至工業化和產業化研究，因此，藉由此會議平台加強與國外學者與產業界意見交流，並且了解國際上纖維酒精技術和生質能源之研發現況，加強與加速核研所纖維酒精研發的能量與進程。同時，本次受邀於會議中進行論文「Design of tailor-made process for converting total sugars to ethanol from lignocellulosic biomass」之發表，展示本所纖維酒精研發成果與發展現況，進而提升核研所纖維酒精研發之國際能見度，後續主辦單位將於該研討會結束後修訂論文資料後彙集成論文集再寄送給研討會與會者。以下即分別詳述其個別參訪過程，最後並提出相關之心得與建議。

二、過程

第 18 屆歐洲生質能研討會舉辦於法國里昂國際會議中心，此研討會時間爲 5 月 3 日至 5 月 7 日，共計五日，里昂座落於法國的東部，爲法國第二大都市區，同時也爲世界遺產之都。其國際會議中心緊鄰法國最大公園「金頭公園」。

(一)行程概要

日期	行程
5 月 1 日（六）	搭機前往法國里昂 (Lyon)。
5 月 2 日（日）	抵達法國里昂。與會者報到與會議論文海報張貼。
5 月 3 日（一）	參加第 18 屆歐洲生質能研討會。
5 月 4 日（二）	參加第 18 屆歐洲生質能研討會。
5 月 5 日（三）	參加第 18 屆歐洲生質能研討會。
5 月 6 日（四）	參加第 18 屆歐洲生質能研討會。
5 月 7 日（五）	參加第 18 屆歐洲生質能研討會，整理資料。
5 月 8 日（六）	搭機前往法蘭克福機場
5 月 9 日（日）	搭機回國

(二)研討會講演及海報摘要說明

本次公務出國主要目的係爲參與於法國里昂市所舉辦之 18th European Biomass Conference & Exhibition，該研討會時間爲 2010 年 5 月 3 日至 5 月 7 日，共計五天，與會計有來自 72 國 1505 位參與者，其研討會議程包括 Biomass resources、Thermochemical conversion、Biological conversion、Biomass chemistry、Biomass torrefaction、Fuels from biomass、Industrial demonstration and market implementation 以及 Policies and ensuring sustainability 等多項研討主題，茲將與會所蒐集之生質能源研發資訊，依分類彙整如下：

(1) 國際纖維酒精研發計畫執行現況

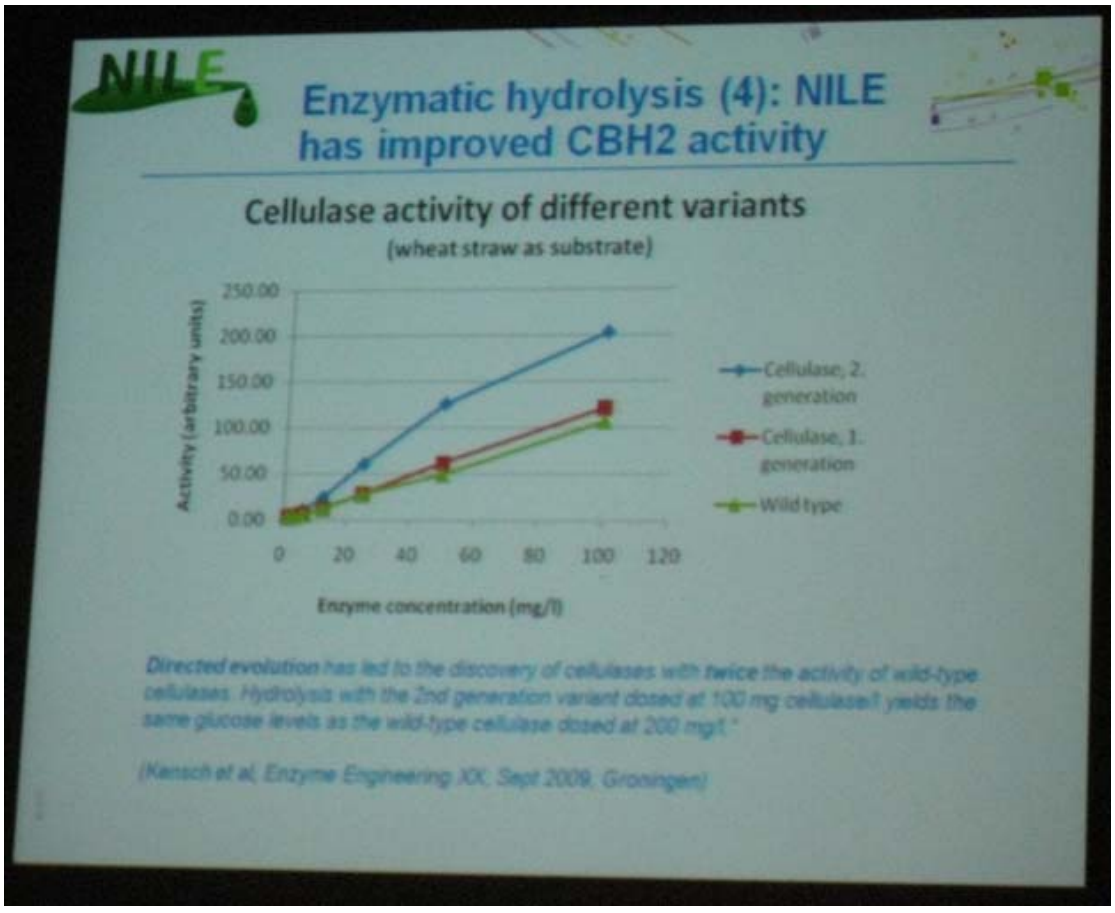
A. The NILE project

本次報告是由該計畫主持人 Frédéric Monot 博士在會議中介紹 NILE 計畫發展現況，該計畫由 12 個國家的 22 個不同研發單位所組成，其中計有 8 家廠商公司(如瑞典 Sekab)、5 座研究中心(如法國 IFP 和芬蘭 VTT 等)、7 所大學(如丹麥 Lund University)及 2 個協會(如 EUREC Agency，歐盟再生能源中心局)。其中，計畫以生物化學程序法作爲研發主軸，分爲三個主要研發項目：WP1 團隊負責水解系統最適化研究;WP2 團隊負責進行五碳糖發酵菌株與 SSF 的研發；WP3 團隊則執行實驗廠驗證。其研發成果分述如下：

（a） WP1 團隊: 水解系統最適化研究

該研究之纖維水解酵素來源以習知之 *Tricoderma reesei* 所生產爲主，其以 genome-mining 方法進行未特徵化酵素基因研究，並比較以前處理麥稈渣料作爲誘導受質時，該菌株所生產之纖維水解酵素組成差異性，其結果顯示誘導後部

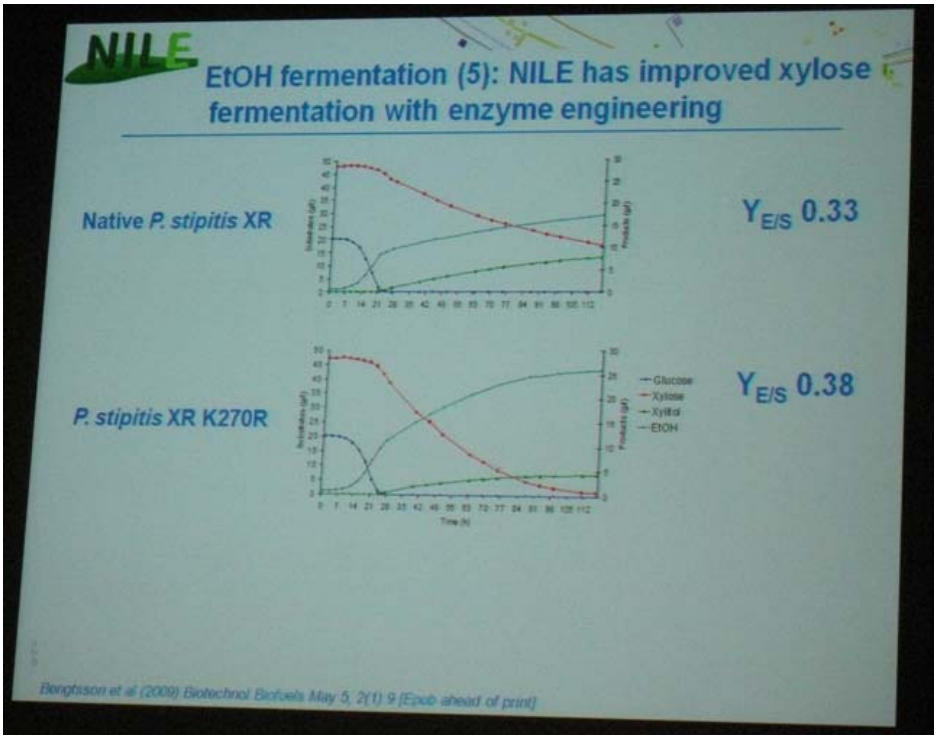
分的半纖維素水解酵素和木質素分解酵素並無被分泌出，然而，這些消失的酵素在 *Aspergillus* sp. 和 *Tricoderma* sp.真菌中其扮演著輔助水解木質纖維素的工作。整體而言，目前已有 36 種新酵素已被發現在木質纖維素分解中占有重要的角色，其中 15 種酵素輔助水解的功能，輔助酵素有一部分有效增加前處理生質物水解產率 15~20%。在此計畫中所使用進行酵素水解測試之纖維水解酵素混合液包含了來自 *Tricoderma* sp.、基因工程改良酵素和外來酵素，目前已利用定向演化方法提升 *Tricoderma reesei* CBH2 的活性，提升 CBH2 活性之酵素水解酵素稱爲第二代水解酵素，將產出之纖維水解酵素進行前處理麥稈渣料的水解測試，其結果顯示第二代纖維水解酵素添加劑量較原生種菌株生產之纖維水解酵素可降低 50%，且仍可得到相同葡萄糖產率。後續更將纖維水解酵素中增加 CBH2 含量或添加改殖後的 CBH2，並進行前處理原料之水解測試，其結果顯示其酵素水解轉化率較未添加約可提升 20%轉化率。



圖一　利用定向演化法增加 CBH2 活性之結果

（b） WP2 團隊: 五碳糖發酵菌株與 SSF 研發

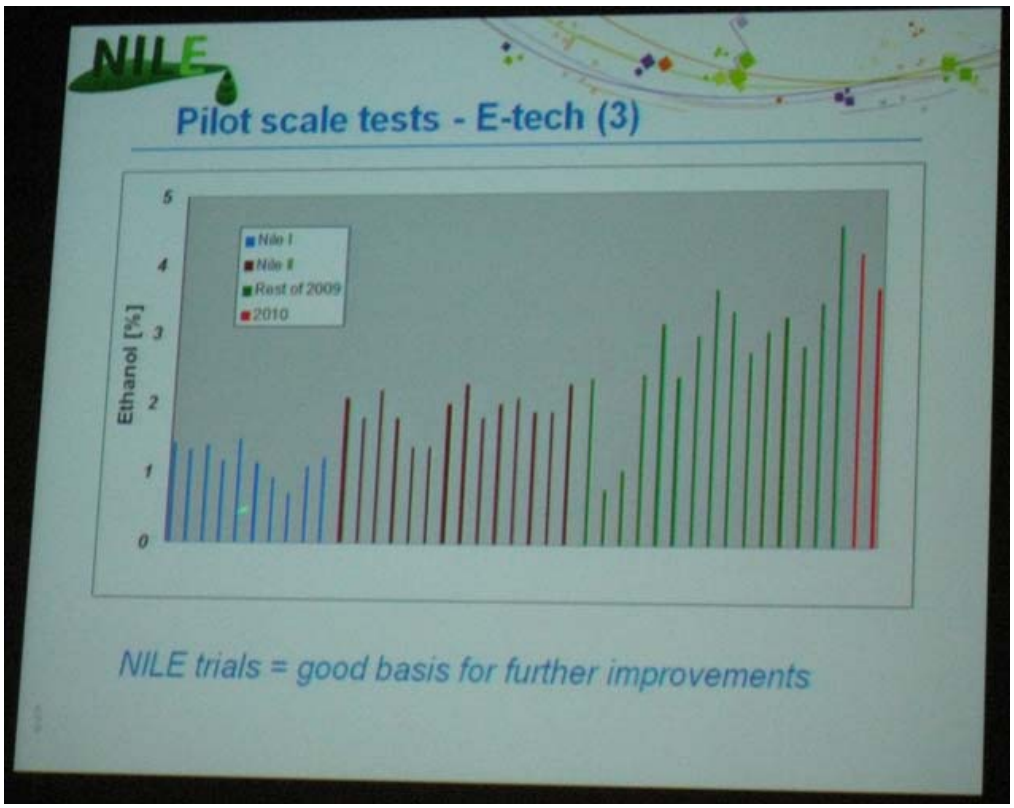
NILE 計畫正將 *Saccharomyces cerevisiae* 改殖可共發酵 glucose、mannose、galactose、xylose 以及 arabinose 等五種單糖產生酒精的發酵菌株。首先已將 *Candida* sp.的 xylose transport GXF1 木糖輸送通道蛋白選殖，並鑲嵌於 *Saccharomyces cerevisiae* 的細胞膜上，使 *Saccharomyces cerevisiae* 於低木糖（<5g/L）的環境下仍可進行木糖代謝利用。爲增加木糖發酵爲酒精之速率，利用酵素工程方法將 *Pichia stipitis* 的 xylose redutase 受質反應位 K270 進行點突變增加酵素活性，並同時選殖於 *Saccharomyces cerevisiae*，進行木糖發酵測試之結果，其木糖轉化酒精發酵產率由 0.33g/g 增加至 0.38g/g，如圖二所示。後續於 *Saccharomyces cerevisiae* 加入 arabinose 發酵爲酒精的代謝途徑。本計畫又將共發酵酵菌經由馴化方法增加對抑制物之耐受能力。另以饋料式 SHF 測試，木糖濃度爲 43g/L 以批次方式進行酒精發酵，接續以饋料添加六碳糖水解液進行發酵，最後酒精濃度達 43g/L，其木糖利用率大於 50%與木糖醇產率小於 18%，並相較於習知之 SHF 可提升約 40%酒精產率。



圖二 以點突變方法增加 *Pichia stipitis* XR 活性

（c） WP3 團隊: Pilot scale 測試廠驗証：

SEKAB's 噸級測試廠座落於瑞典 Örnsköldsvik，已於 2009 建置完成，以木片作爲木質纖維素原料測試，其轉運量爲日進料 2 噸，使用前處理方式爲兩階段稀酸水解法。此測試廠是以具有抑制物耐受性、木糖輸送通道蛋白、突變之 xylose reductase 木糖還原酶以及 xylose/arabinose 共發酵等能力之酵母菌進行 SSF 和 SHF 驗證測試。於 2009 年 3 至 6 月間，已進行連續 21 天運轉測試，測試期間木質纖維素水解反應是使用商業纖維水解酵素與商業酵母菌進行發酵測試，並且也以自產之纖維水解酵素和基因轉殖之共發酵之 *Saccharomyces cerevisiae* 進行 SSF 和 SHF 測試。其測試所得結果顯示自產纖維水解酵素已可於測試廠中驗證使用、共發酵菌株已可使用於測試廠中進行培養以及共發酵菌株確實可將木糖完全消耗和利用。於纖維酒精運轉廠測試結果顯示於圖三，其酒精濃度於在最佳條件下最高可達 4%以上。

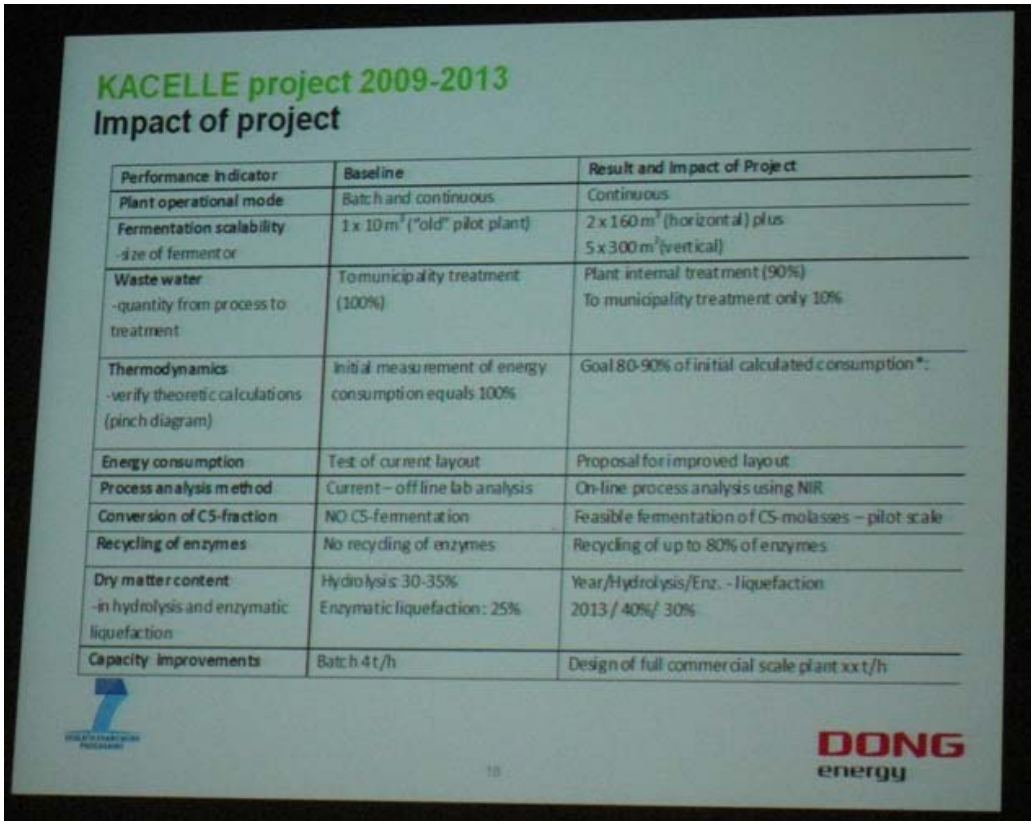


圖三　不同批次 Pilot sacle 測試運轉最終酒精濃度比較圖

B. Inbicon

Inbicon 主要由 Dong energy 出資進行開發建立，已於 2009 年 1 月開始建置纖維酒精示範廠，其每日可進料 100 噸，全年度總共進料 3 萬噸麥稈，纖維素水解使用之酵素來自於 Genencor 和 Novozyme 兩間商業纖維水解酵素生產公司，預計共可產出 5.4 百萬公升酒精作爲交通運輸工具使用；1 萬 3 千噸木質素進行電能產製和可提供作爲養殖、石油替代品以及化學品等之用的 1 萬 1 千噸五碳糖蜜。Dong 並規畫以此建置完成之示範廠作爲測試平台，由 2009 年開始進行爲期五年的 Kacelle 計畫，將驗証每小時 4 噸的連續運轉測試，提供降低酒精成本計算之數據，其計畫目標設定於降低能耗、增進水平衡循環使用、降低纖維水解酵素添加、擴充已有設備規模、五碳糖發酵程序建置以及進行生產廠之成本經濟和生命週期評估。如圖四所示，預計計畫成效能夠將目前運轉模式由批次和連續式提升至完全連續；並且現有運轉程序加入可彈性運轉之五碳糖發酵程序；回收 80%酵素；於 2013 年以前將前處理水解程序之固液比由 30%提升至 40%，以及酵素水解程序之固液比從 25%提高至 30%；由目前每小時 4 噸生質物前處理處理量提升至可商轉之處理量。

Dong energy 陸續規劃未來建立家庭生活廢棄物（廚餘）再資源化利用模式，將家庭生活廢棄物（廚餘）收集後，經由水解酵素液化爲液態產物，液態產物再製爲甲烷、乙醇、甲醇、丁醇和肥料等產物利，其餘固態產物的生質原料和液化殘渣則是進入電廠產生電能或生質氣體直接提供給家庭使用，或回收原料中所含之高價金屬和玻璃，建立永續不間斷再生能源循環鏈，如圖五。已於 2009 年 11 月已建置完成每小時進料 800 公斤家庭生活廢棄物處理量之連續處理噸級測試廠，其已建置完成的設施包含振動式固液分離系統、70 噸臥式酵素水解反應槽和蒸煮反應槽。由於台灣推行多年垃圾車進行收集生活廢棄物之收集系統，同時根據 2008 年行政院環境保護署統計資料指出台灣每年廚餘量約爲 56.6 萬公噸，因此，台灣具適用於 Dong energy 所建立之生活廢棄物再資源化利用模式之潛力。



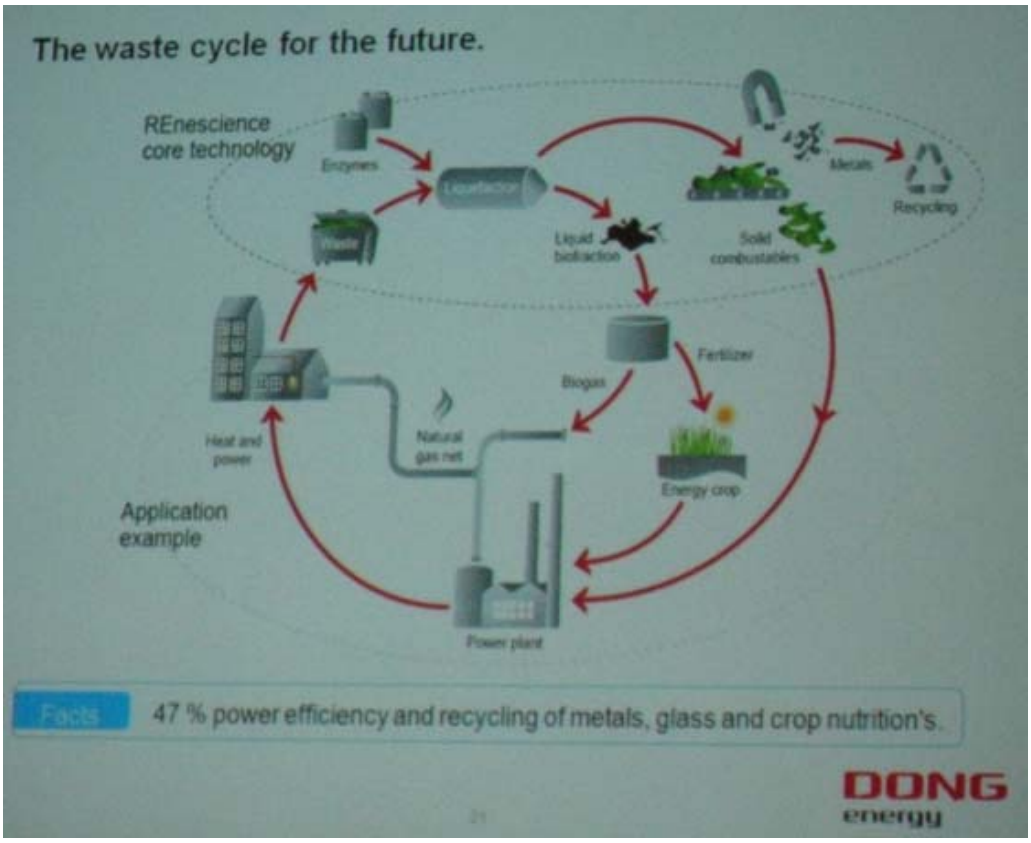
KACELLE project 2009-2013

Impact of project

Performance indicator	Baseline	Result and impact of Project
Plant operational mode	Batch and continuous	Continuous
Fermentation scalability -size of fermentor	1 x 10 m^3 ("old" pilot plant)	2 x 160 m^3 (horizontal) plus 5 x 300 m^3 (vertical)
Waste water -quantity from process to treatment	To municipality treatment (100%)	Plant internal treatment (90%) To municipality treatment only 10%
Thermodynamics -verify theoretic calculations (pinch diagram)	Initial measurement of energy consumption equals 100%	Goal 80-90% of initial calculated consumption*:
Energy consumption	Test of current layout	Proposal for improved layout
Process analysis method	Current – off line lab analysis	On-line process analysis using NIR
Conversion of C5-fraction	NO C5-fermentation	Feasible fermentation of C5-molasses – pilot scale
Recycling of enzymes	No recycling of enzymes	Recycling of up to 80% of enzymes
Dry matter content -in hydrolysis and enzymatic liquefaction	Hydrolysis: 30-35% Enzymatic liquefaction: 25%	Year/Hydrolysis/Enz. - liquefaction 2013 / 40%/ 30%
Capacity improvements	Batch 4 t/h	Design of full commercial scale plant xx t/h

DONG energy

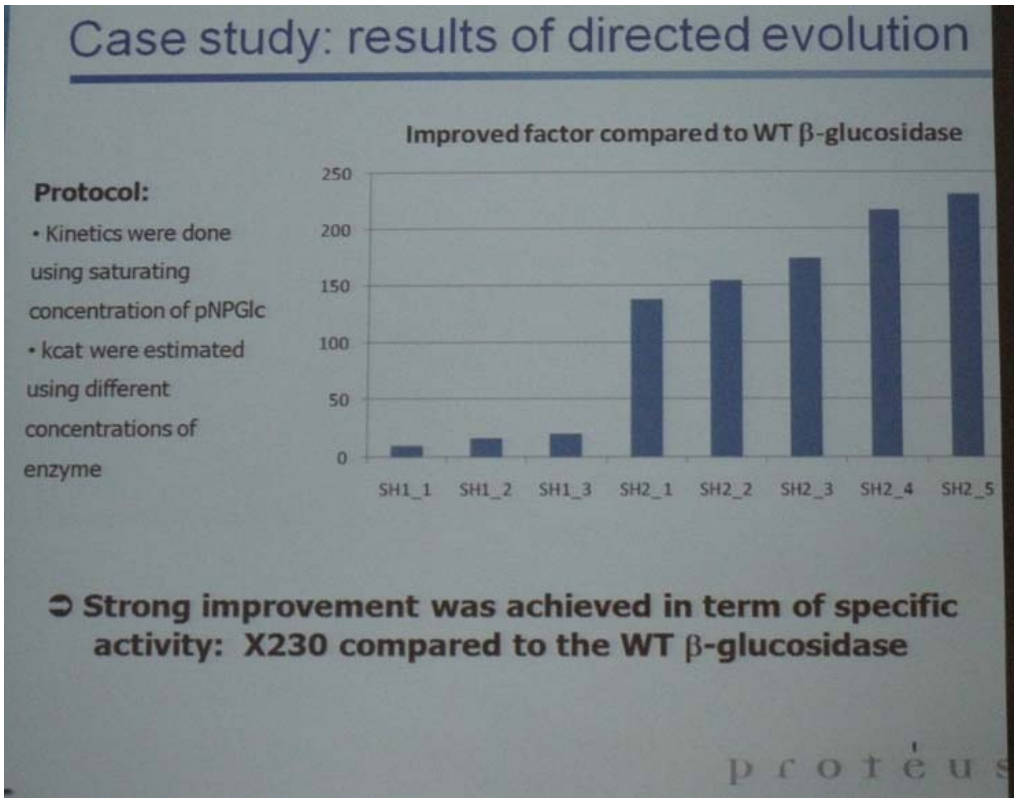
圖四　計畫預計成效



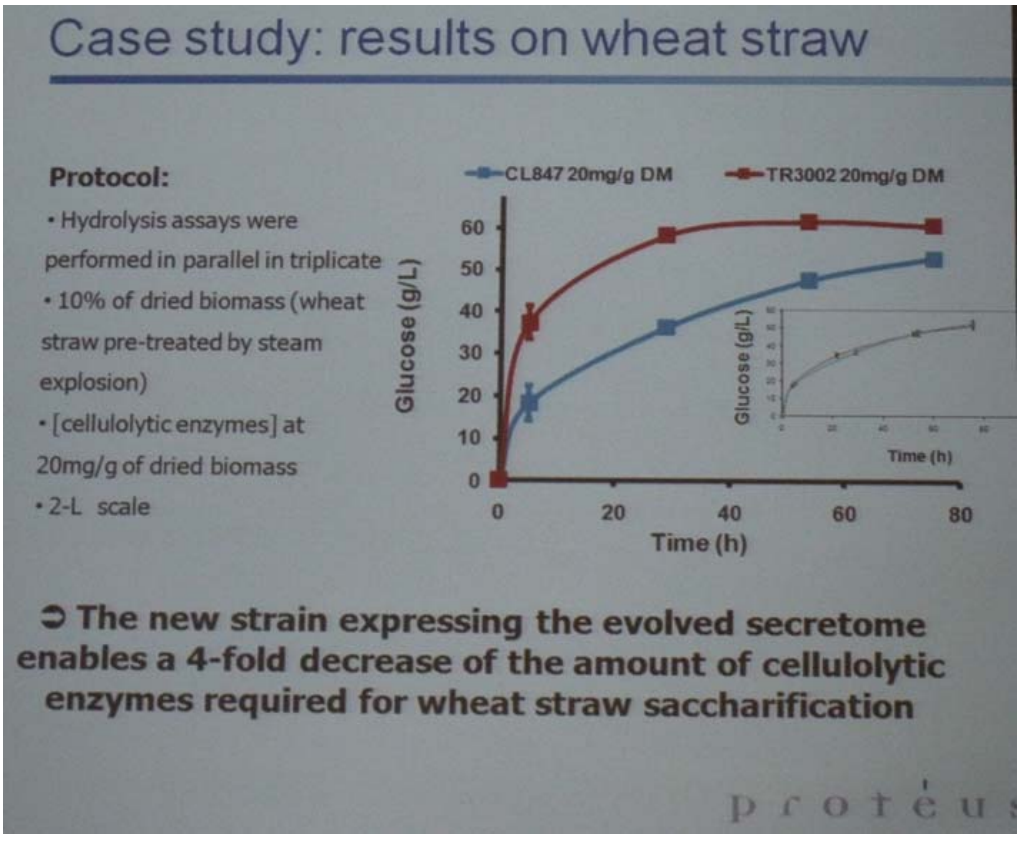
圖四　未來生活廢棄物再資源化循環利用

(2) 纖維水解酵素改良研究

Protéus 公司 Laurent Fourage 博士說明改良 *Tricoderma reesei* 之纖維水解酵素分泌系統提升麥稈渣料的水解效率，Protéus 係一家於生命科學與化學工業領域進行蛋白質改良研究開發的公司，具有高效率酵素篩選和改良平台、實驗室級表現系統和程序放大系統等平台。其纖維水解酵素改良模式爲以隨機點突變方法與基因置換方法(gene- shuffling)進行纖維水解酵素分泌系統的改良。目前已利用兩次基因置換方法改良 *Tricoderma reesei* 的纖維雙糖酶 glucosidase，利用 pNPGlc 爲受質進行水解測試，結果顯示改良後之雙糖酶活性相於原始雙糖酶增加約 230 倍（圖五）。針對於纖維水解酵素生產菌株之酵素外泌系統進行改良（圖六），所得到之新菌株(CL847)產出之纖維水解酵素添加濃度爲 20mg/gDM，於固液比 10%之蒸氣爆裂麥稈進行酵素水解測試，其結果顯示反應後葡萄糖濃度由 50g/L 增加至達 60g/L，以及達最高最葡萄糖濃度水解反應時間由 80 小時縮短至 50 小時；當 CL847 纖維水解酵素添加劑量降低 4 倍後，可得到接近與 TR3002 菌株使用酵素劑量 20mg/g DM 得到之反應趨勢，其結果顯示新菌株所生產酵素，其於酵素水解反應時添加使用量可明顯降低。



圖五　利用基因工程方法改良纖維雙糖酶活性的測試結果



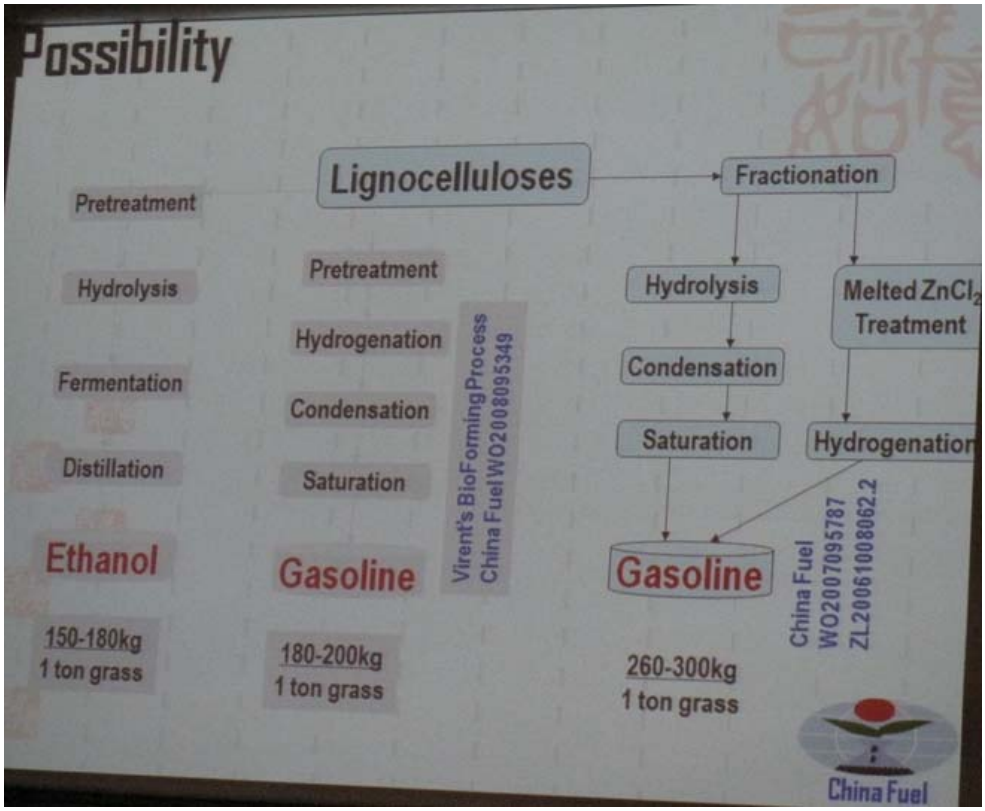
圖六　纖維水解酵素菌株經分泌系統改良後之水解反應測試

(3) 生質物精煉研究

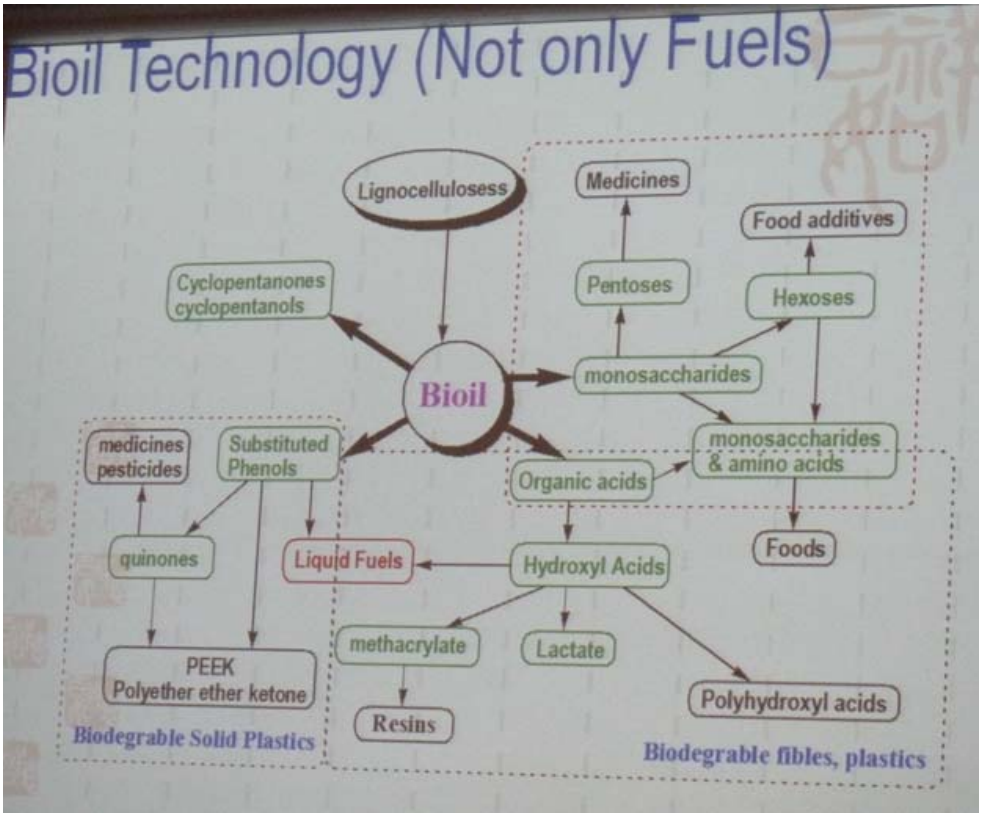
a.木質纖維素產製燃料

淮北中潤生物能源技術開發有限公司朱作霖先生說明第三代生質物精煉技術如何從木質纖維素產製汽油，朱作霖先生認爲將木質纖維素以生物化學方法經前處理、水解、發酵和蒸餾後每噸木質纖維素僅能得到 160~180 公斤酒精；然而，以催化法經前處理、氫化、縮合和飽和化後每噸木質纖維素可得到 180~200 公斤汽油；將木質纖維素先進行分餾後，以水解、縮合和飽和化程序，或是以融熔態氯化鋅進行處理接續氫化飽和作用，每噸木質纖維素可得到 260~300 公斤燃油，如圖七。從上述比較後，顯然利用化學催化反應法可得較多能源輸出，相對於生產酒精更具有發展之潛力。若將纖維酒精所得之木質素轉換爲生質燃油，其纖維酒精和木質素燃油的總量不亞於利用化學催化反應法所得之燃油。

朱先生認爲木質纖維素轉化成生質油不單單只是作爲燃料使用，更可分離出環成酮或醇、有機酸、多取代基的酚類以及單糖，如圖八，其中有機酸可轉換爲乳酸、PHA 和樹脂等產品，單糖可作爲藥品、食品添加劑和胺基酸等產品，酚類則可作爲藥品前驅物和生物可分解塑膠等產品。另外，朱先生提及國際認爲 ethyl lactate 是一種綠色化學溶劑，由於對環境有利、無毒、可食用等優點，已漸漸取代現有使用之有機溶劑，同時其具燃燒熱質與酒精相近($270x10^5 J/kg$)、較酒精不易揮發，可穩定存在 150℃以上、更易於蒸餾脫水、較無腐蝕性以及更易與汽油混合等優點，朱作霖先生認爲未來具有潛力作爲燃料使用。



圖七、生質物全利用之潛能分析

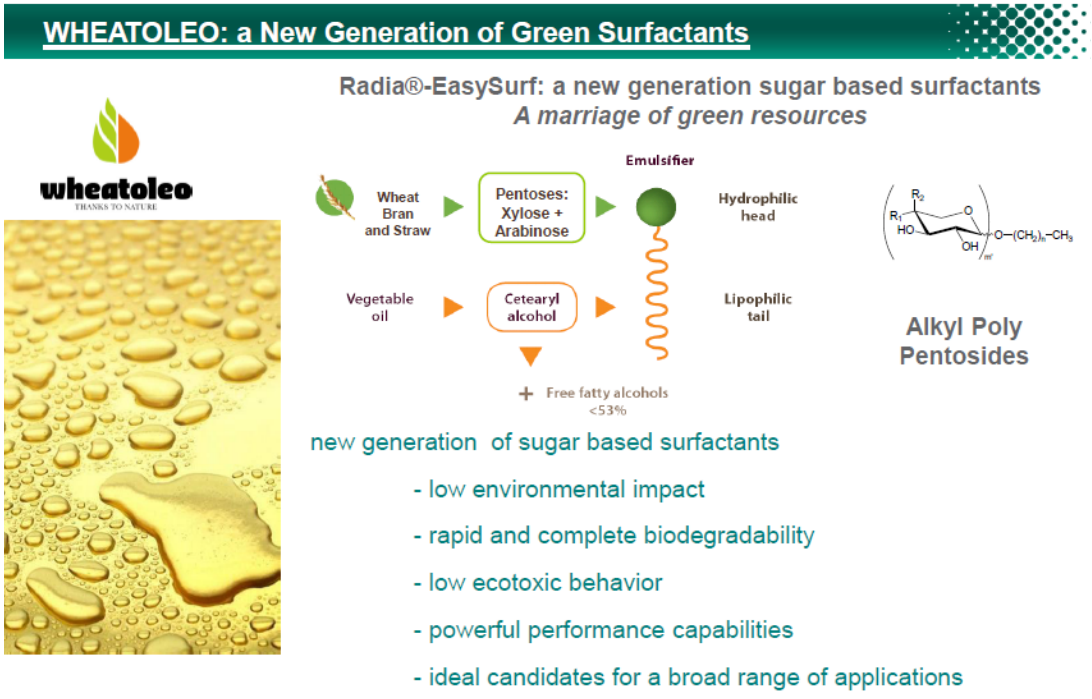


圖八、生質物精煉產物之應用

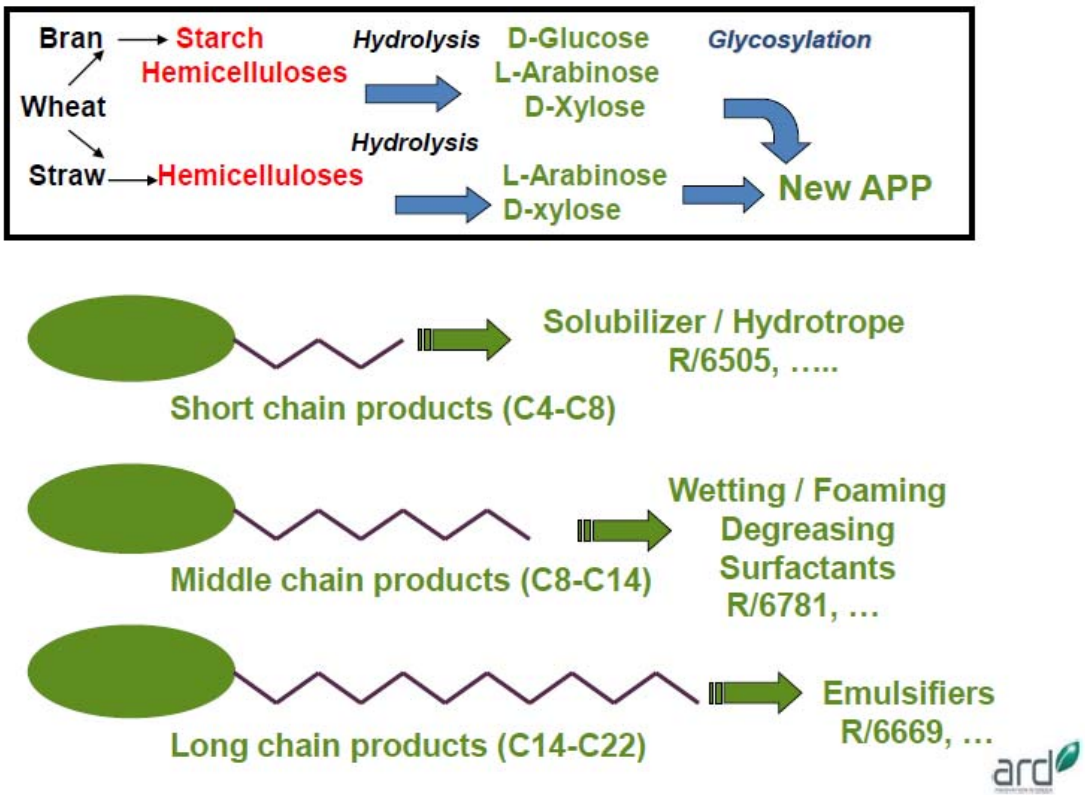
b.半纖維素生質物精煉之研發

(1)半纖維素用於生產界面活性劑

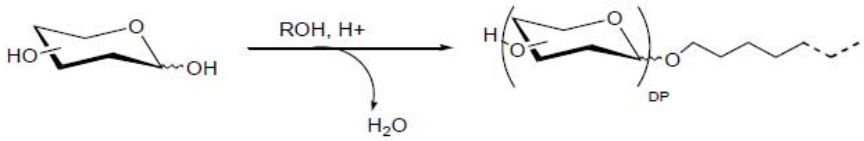
ARD (Agro-Industrie Recherches et Developpements)公司的綠色化學部門主管 Boris Estrine 博士說明以半纖維素作爲界面活性之原料，由於界面活性劑可作爲清潔、發泡、消泡和乳化等用途，同時也爲許多日常用品之原料如乳化劑、塗料、黏著劑、除草劑、殺草劑和護髮乳。界面活性劑的種類主要依其極性端作爲分類之基準，大致上分爲四類非離子型、陰離子型、陽離子型以及兩性離子型。界面活性劑全球市場需求量於 2008 年約爲 1 千 400 萬噸，其中以 alkyl phenol ethoxylate 爲最常使用之非離子型界面活性劑，然而基於健康安全考量下，目前在歐洲內部不再使用，漸由低毒化和對環境有益之低成本和多價性介面活性劑所取代，因此，利用結合不同的再生能源，以糖質爲基礎的綠色界面活性劑，從麥糠或麥稈取得之五碳糖(木糖和阿拉伯糖)與植物油的脂肪醇反應所得到 alky poly pentosides（如圖九），此新一代糖基介面活性劑具有可生物分解、低生態毒性和可廣泛性應用等優點。當增加脂溶性端(lipophilic tail)之支鏈長度，可產生不同功能之界面活性劑（如圖十），若以不同之糖基進行與醇類進行糖基化（glycoslyation）作用時，五碳糖反應性較葡萄糖反應性佳，且接合反應可易於 90℃以下進行反應，同時五碳糖較易控制界面活性劑的聚合程度，產生不同功能之界面活性劑。本所以稀酸前處理法水解生質物，所得水解液體主要成份爲木糖與葡萄糖，可爲界面活性劑原料來源，因此，可評估糖質界面活性劑爲本所生質精煉的選擇項目。



圖九　五碳糖界面活性劑之製造與特點



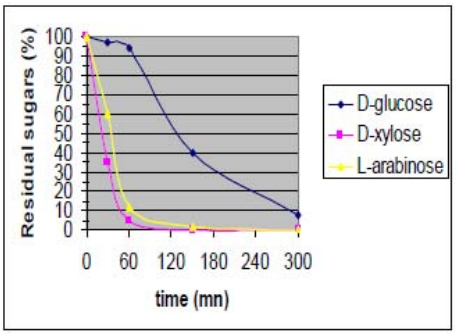
圖十　糖質界面活性劑之鏈長與其應用



✓Pentoses from hemicellulose are more reactive than glucose during glycosylation

✓Grafting occurs below 90 °C

✓Polymerization degree is easily controlled with pentoses



Process following the "green chemistry" guidelines

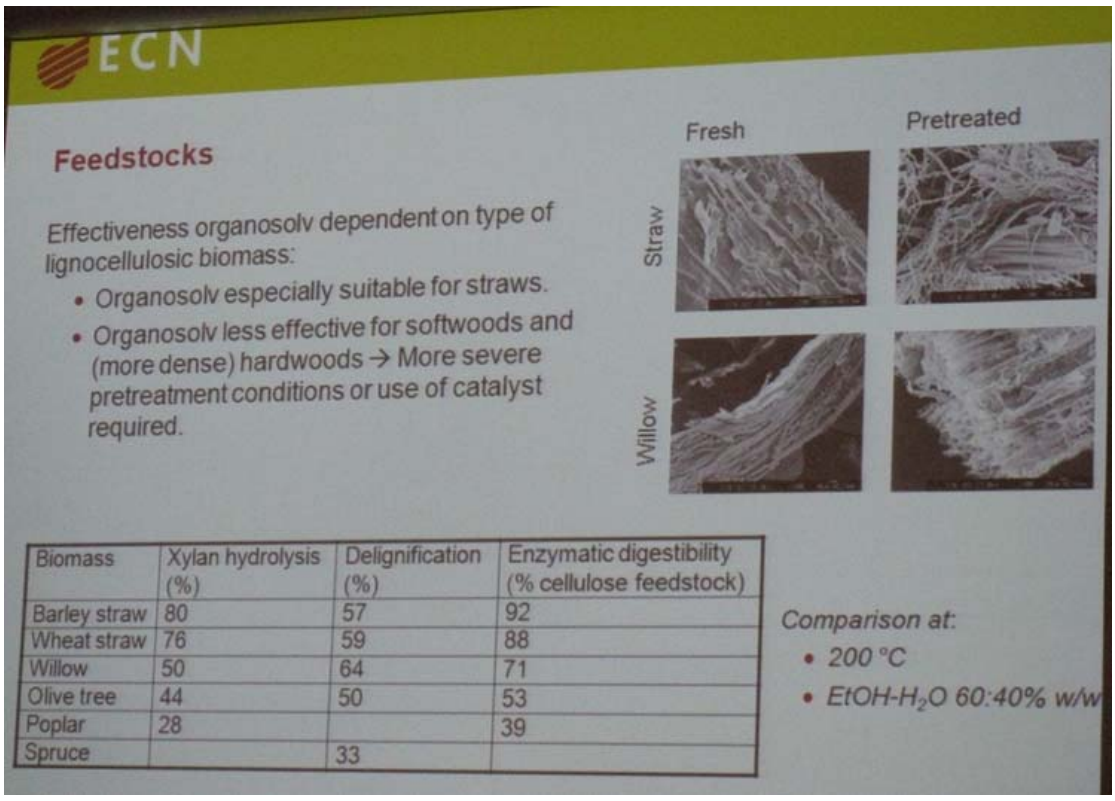
High quality products

圖十一　五碳糖與六碳糖爲界面活性劑原料之反應比較

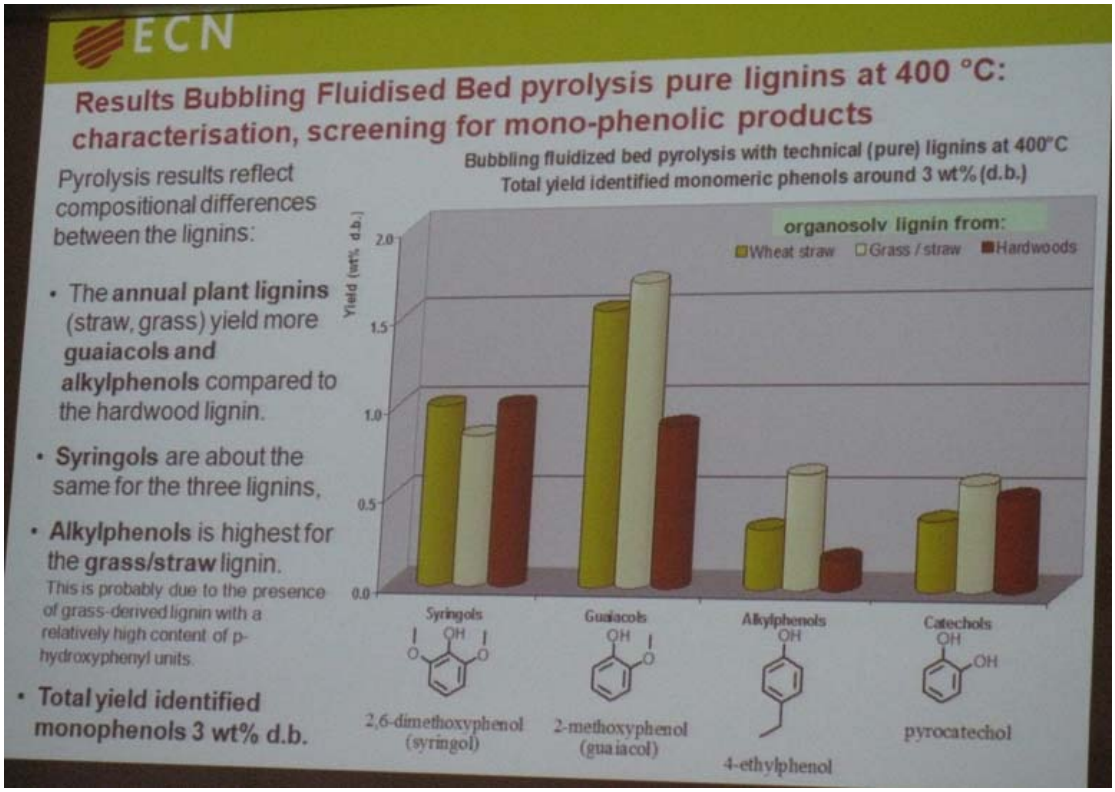
C.　木質素精煉技術

荷蘭能源研究中心 Hans Reith 在 Fractionation of lignocellulosic biomass by an organosolve process for co-production of fuels and chemicals within a biorefinery 中指出木質纖維素的纖維素被分解爲葡萄糖並轉換爲酒精，而木質素與五碳糖適合作爲在生質物精煉中化學品製造之來源。由於木質纖維素的天氣結構較不容易水解，需加入前處理程序進行其結構之破壞，因此，利用有機溶劑前處理法進行木質纖維素的破壞，目的在於將木質素、半纖維素與纖維素三者進行分離，使木質素萃取出進一步作爲生質物精煉之產物，另一方面增加纖維素水解產率。有機溶劑前處理法係以不同比例之有機溶劑與水添加混合木質纖維，於反應溫度 160-200℃下反應 30-120 分鐘，可在 50/50%(w/w)水與丙酮混合溶劑於 205℃下反應 60 分鐘可得到最佳酵素水解產率約 90%。利用以酒精與水混合之溶劑於 200℃下進行不同生質物之前處理反應，如圖十二，結果顯示大麥稈與麥稈生質物適合以此條件進行前處理，可得大於 75%木聚糖水解產率、大於 57%木質素移除率和大於 88%

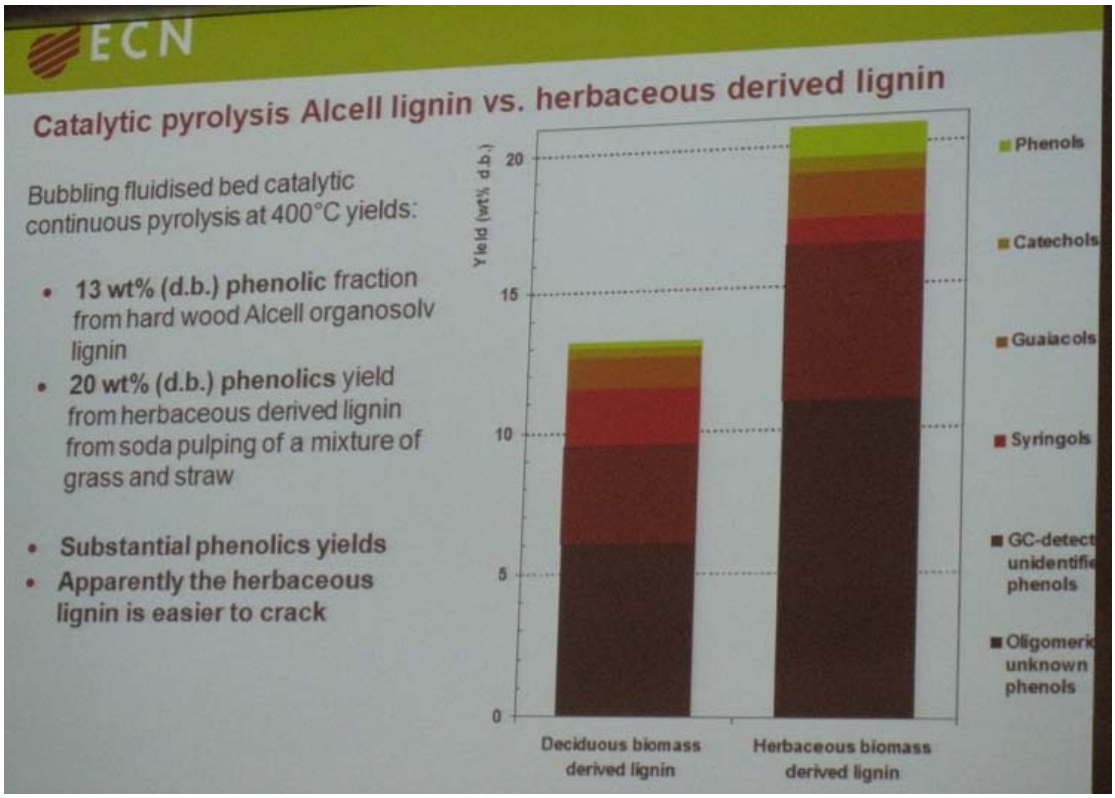
酵素水解產率。所移除之木質素，再以酒精和丙酮進行萃取，可得到大於 90%之木質素分離效率，即可得到木質素純度大於 90%和分子量介於 2000~3500 之木質素。而所得到木質素可應用於燃料添加劑、接著劑、合成樹脂或其他高單價之化學品如藥或香水，因此，將木質素以氣泡式流體化床裂解法(bubbling fluidise bed pyrolysis)生產單一酚類化合物（如圖十三），結果顯示相較於木類植物，一年生植物的木質素大多產生 guaiacols 和 alkyphenols 這兩類酚類，尤其從圖十四更可比較出，草本類生質物的木質素可分離出較硬木類生質素較多的酚類產物，故草本類生質物因其較不需嚴苛前處理條件與具高比例之酚類，其相較於木本科生質物更有潛力應用於木質素精煉產業。



圖十二　有機溶劑前處理法應用於不同生質物之比較



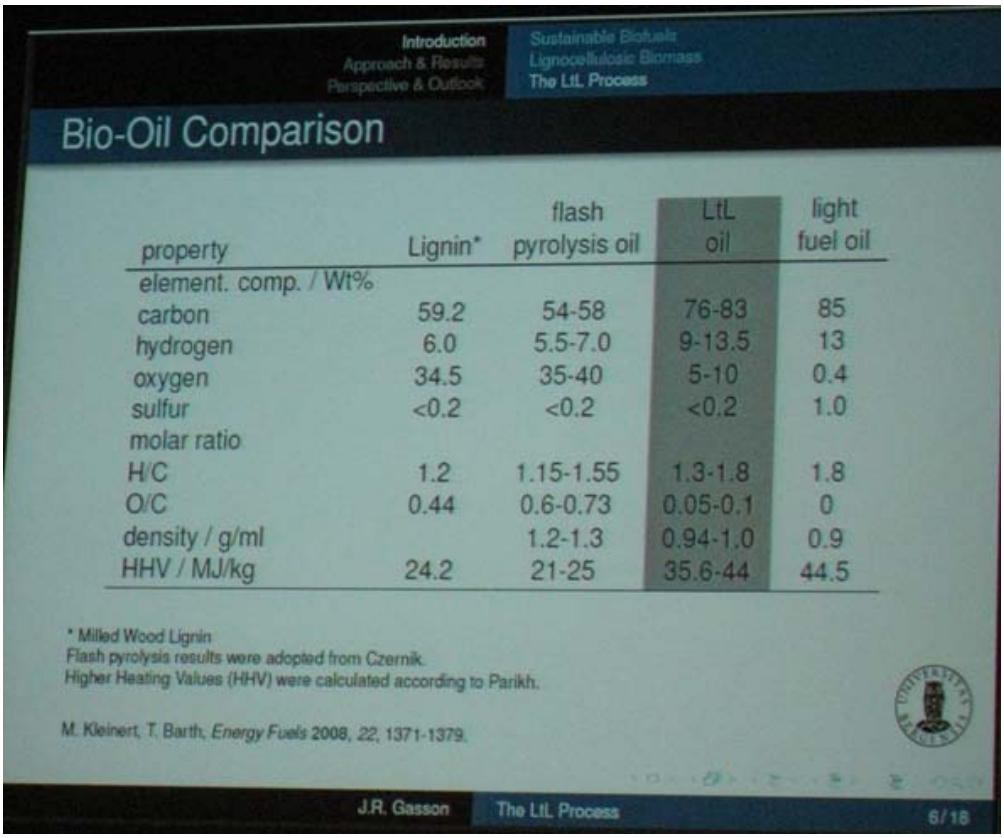
圖十三　木質素裂解後酚類化合物比較



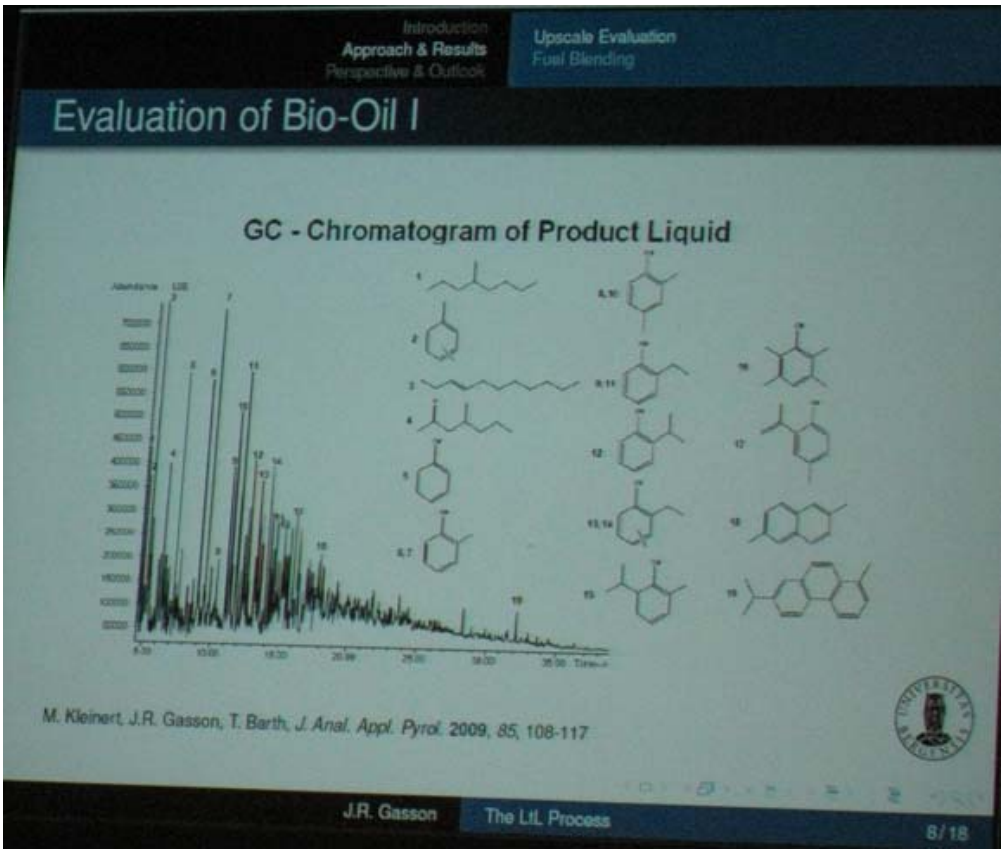
圖十四　木本植物和草本植物之木質素裂解產物比較

挪威 Bergen 大學化學系 J.R. Gasson 博士說明以溶劑分解方法將木質素液化，以一步反應將木質素、酒精和甲酸混合在 380℃下反應 4-24 小時，可得到高能量、低酸度和穩定的木質素分解產物，液化之木質素產物其化學組成和物理特性如圖十五所示，其碳氫和碳氧比例經處理後並無明顯改變，且其特性近似於目前所使用之石化產品，使其能夠與石化燃料混合使用，另外其低含氧量使得其具有較高之熱值，因此具有發展爲生物油之潛力，從圖十六中 GC 分析圖中可發現液化木質素多爲酚類所組成，未來可成爲除了作爲油品添加，可作爲酚類化合物產品之來源，可使得以木質纖維素生產酒精程序裡另一個生質物精煉之選擇。

針對上述木質素生質精煉技術之研發，由於本所纖維酒精已建置前處理系統與生質分析平台，因此應已具有木質素降解與產物分析之研發能量。



圖十五　液化木質素與木質素、閃化熱裂解油和輕燃油之物性與化性比較



圖十六　液化木質素之氣相層析法

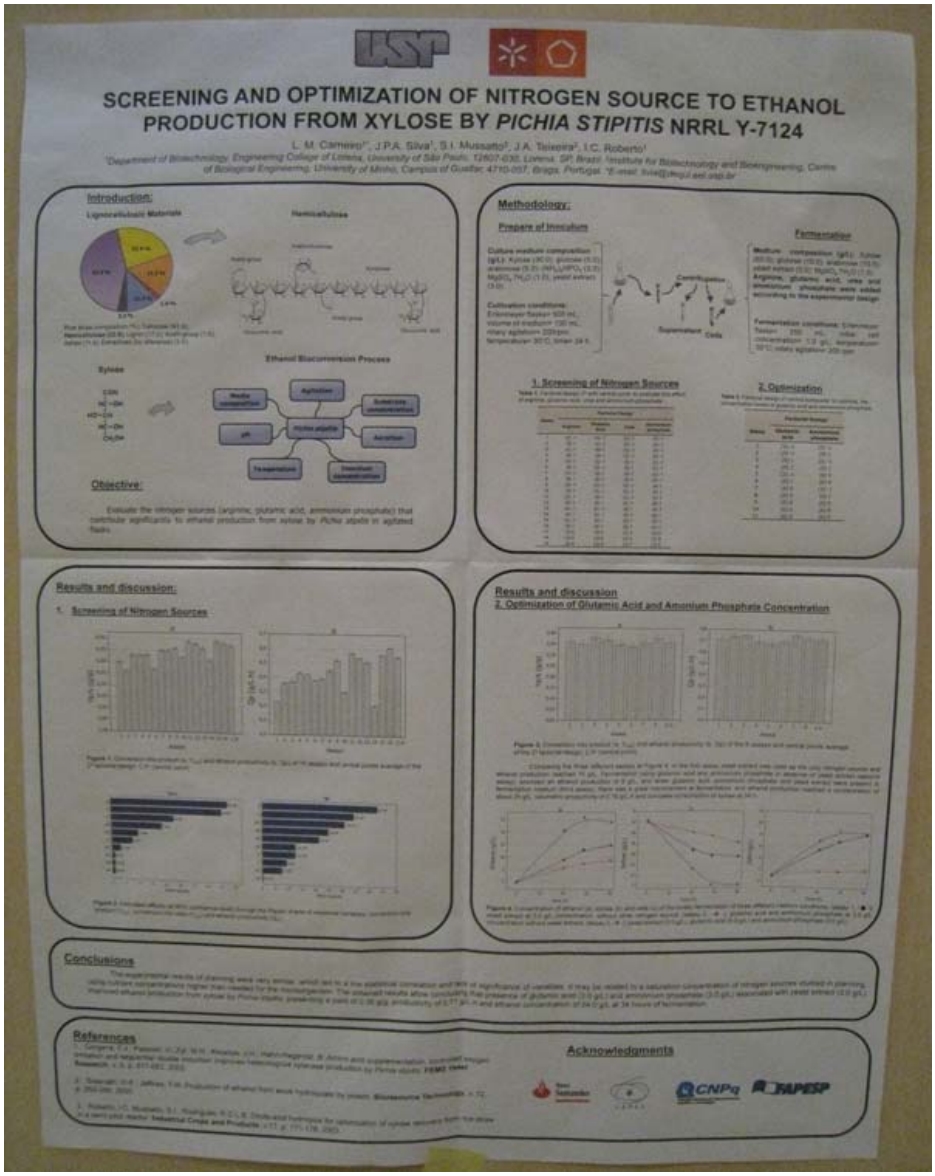
(4) 海報成果發表資料摘要

本次研討會議海報發表共計 600 篇，主題包含生質物的培養、運送和儲存，約占海報篇數的 20%；利用生質汽電共生、產電和合成氣之氣化、裂解和燃燒等研究，約占海報篇數的 35%；生質能源的環境評估、經濟效益、安全性和政策面等分析，約占 15%；以生物化學法產製生質能源和生質精煉等研究，約占海報篇數的 15%。以生物化學法產製生質能源與生質精煉等研究作爲摘要之主題，成果分述如下：

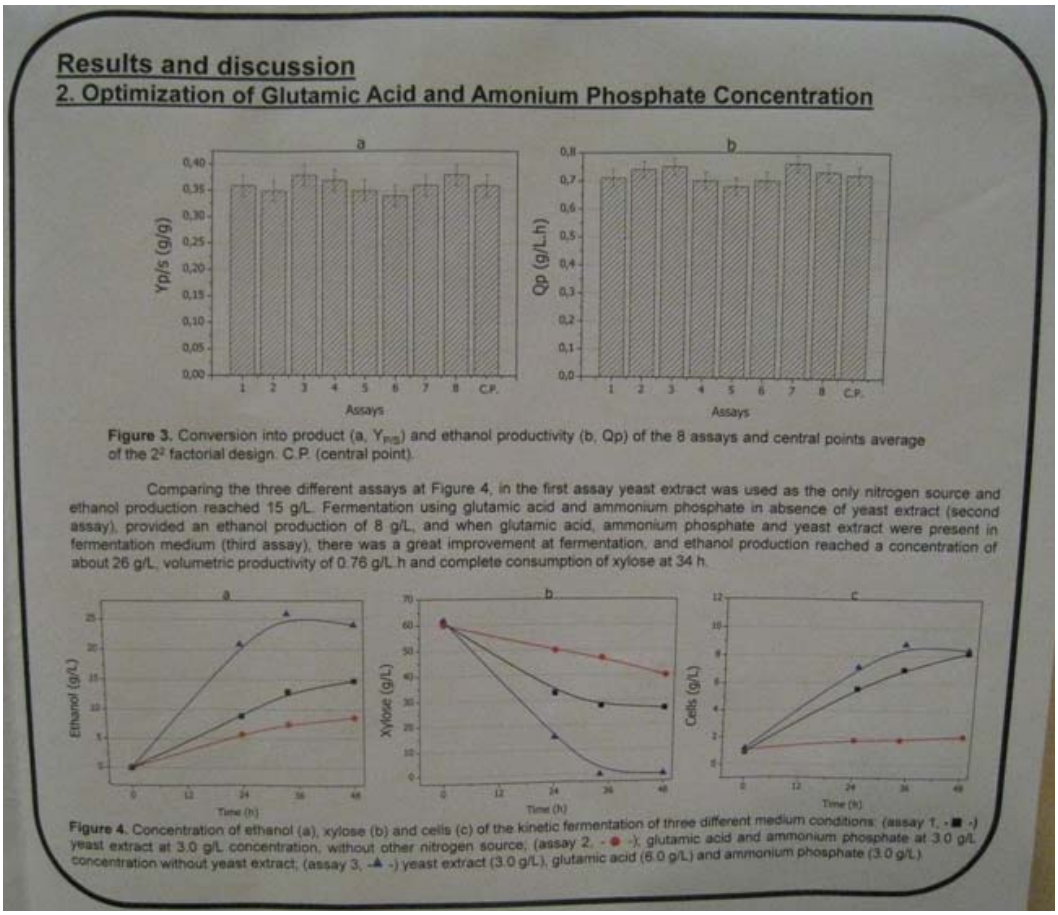
1. Screening and optimization of nitrogen source to ethanol production from xylose by *Pichia Stipitis* NRRL Y7124（如圖十七），由巴西聖保羅大學生物科技系 L.M.

Carneiro 等人所發表。

本文係主要目的在於探討添加四種氮源(arginine、glutamic acid、urea 和 ammonium phosphate) 對於 *Pichia stipitis* 發酵木糖產生酒精之影響， 以不同比例混合四種氮源添加至木糖發酵液中，其木糖發酵液組成爲 60g/L 木糖、10g/L 葡萄糖、10g/L 阿拉伯糖、3g/L 酵母萃取物和 1g/L 硫酸鎂，酵母菌接菌量爲 1g/L，於反應溫度爲 30℃和轉速爲 200rpm 下進行發酵，結果顯示在添加 3g/L 酵母萃取物、6g/L glutamic acid 和 3g/L ammonium phosphate 後，木糖發酵所得之最高酒精濃度爲 26g/L，遠高於只添加酵母萃取物條件下酒精濃度 8g/L，且於 34 小時 *Pichia stipitis* 可將木糖消耗完畢，如圖十八所示。由於其木糖發酵液組成添加物較本所發酵液組成爲複雜，無法將其發酵結果與本所之 *Pichia stipitis* 木糖發酵結果比較，後續可依其發酵條件進行發酵驗證比較。



圖十七　Screening and optimization of nitrogen source to ethanol production from xylose by *Pichia Stipitis* NRRL Y7124 之海報圖



圖十八海報中氮源添加之發酵結果比較

2. Superheat steam pretreatment and fermentation of wheat straw at 30% dry weight (如圖十九)，由荷蘭 TNO 公司 Johan van Groenestijn 所發表。

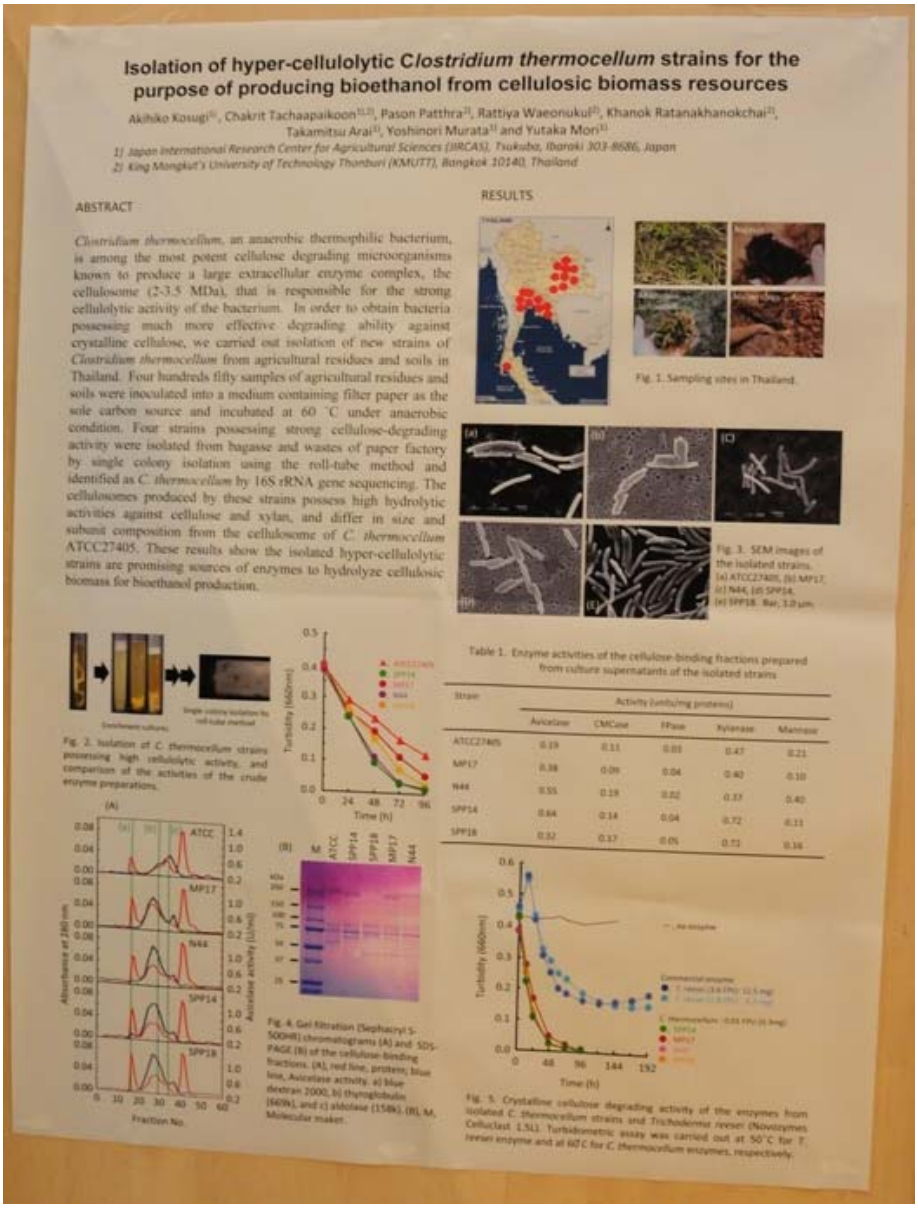
本文說明將混酸麥稈與過熱蒸氣於荷蘭應用科學研究院所設計之蒸氣乾燥設備中反應，其反應設備具快速加熱、冷卻和有效熱傳導三種特性，可將木質纖維素進行降解與乾燥麥稈的作用。此蒸氣前處理系統可有效處理固液比 30~60% DM，多數的半纖維素皆可從木質纖維素中水解，可產生 90%單糖形式的木糖，並且其酵素水解反應可將前處理渣料 95%的多糖水解爲單糖。另外，大部分 Furfural、HMF、acetic acid 和 levulinic acid 在前處理反應間已被蒸發而移除，因此，可利用此現象建立一套結合前處理與去毒化系統。將前處理所得到 185g 乾重渣料進行饋料式同步水解發酵，其反應體積爲 1 升，可得到酒精轉化率爲 91%，其酒精濃度爲 35g/L。其系統與本所發展之稀酸蒸氣爆裂系統皆有藉由蒸發現象使

發酵抑制物移除與 90%的木糖產率，但目前本所稀酸蒸氣爆裂系統仍以固液比25～30%持續進行測試中，後續可再收集本文前處理設備資料，與本所之蒸氣爆裂系統進行比對與探討，進行系統之改良。

圖十九 Superheat steam pretreatment and fermentation of wheat straw at 30% dry weight 之海報圖

3. Isolation of hyper-cellulolytic Clostridium thermocellum strains for purpose of producing bioethanol from cellulosic biomass resources (如圖二十)，由日本國際林水產業研究所森隆博士所發表。

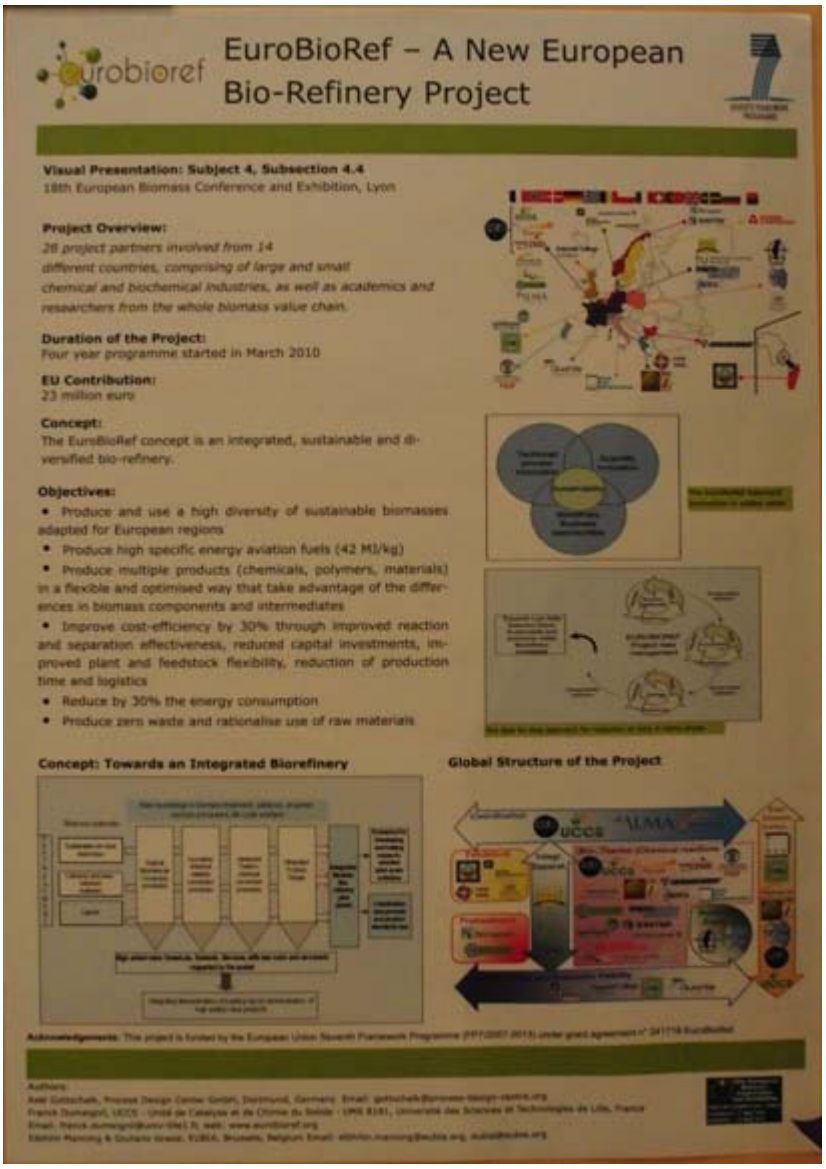
本文說明日本國際農林水產業研究所爲了得到更有效率的分解結晶性纖維素之酵素，因此，泰國境內的農業廢棄物與土壤堆肥中篩選出新 *Clostridium thermocellum*，同時從蔗渣和造紙工業廢棄物分離出四株具強分解纖維酵素菌株，篩選之菌株分泌出之具纖維素和聚木糖分解之纖維水解酵素質體，利用膠體過濾層析法分析與原生菌株 *Clostridium thermocellum* ATCC27405 比較後，篩選菌株之纖維水解酵素質體其次單位(subunit)分子量大小與組成不同於原生菌株，將篩選菌株分泌之纖維水解酵素進行結晶性纖維素水解測試，與商業酵素 Novozyme cellculast 1.5L 比較後，以濁度法分析結果顯示，篩選菌株之纖維水解酵素分解結晶性纖維素較快速，使結晶性纖維素的濁度快速下降，因此，具高活性纖維水解酵素菌株未來可作纖維酒精製程中酵素水解程序的酵素來源。



圖二十　Isolation of hyper-cellulolytic Clostridium thermocellum strains for purpose of producing bioethanol from cellulosic biomass resources 之海報圖

4. Eurobioref- A new European Bio-Refinery Project（如圖二十一），由德國程序設計中心 Axel Gottschalk 等人所發表。

Eurobioref 計畫已於 2010 成立，係由歐盟第 7 期科研架構型計畫提供 23 百萬歐元資助，進行四年期計畫，成員組成來自產、學、研共 28 單位，如表一所示，此計畫預計建立高度整合與多樣性的概念，其包含原料多樣性、程序多樣性和產品多樣性，更確切的目標在於整合不同研發單位所發展之生質物精煉技術，經由策略性整合方式設立精確的目標，使生質物精煉供應鏈更加完善與建立易於歐洲各地所使用之生質物精煉產品生產平台，此生產平台可生產多面相產品如化學品、聚合物或材料等，同時發展高效能之航空燃油，經由增加反應和分離效率、降低設備投資、增加種植和原料彈性以及減少生產時間和運輸的方式增進 30%成本效益，同時希望可達到降低 30%能源使用和零排放，以此整合串連模式下提供投資者低風險和完善建設。本所未來進行發展生質物精煉技術之評估與策略分析時，應對於 Eurobioref 計畫進行長期追蹤其所釋出之訊息，藉由此了解歐洲內部發展生質物精煉技術的走向。



圖二十一　Eurobioref- A new European Bio-Refinery Project 之海報圖

三、心得

本次出差出國參與 18th European biomass conference & exhibition，本次會議主軸在於如何將生質能源實驗室開發階段與工業化開發階段進行連結，加速再生能源可替代現有使用之石化能源。從本次研討會中，收集各國研究機構和產業發表成果可發現：

1. 各國發展木質纖維素產製酒精之研究，可發現經由整合性策略聯盟的模式快速發展各程序之技術，已由實驗室研發階段進行程序放大驗證之階段。值得注意是已有共發酵菌株於噸級測試廠進行驗證之結果，另外，改良之纖維水解酵生產菌株所產出之纖維水解酵素，同時也可使用於噸級測試廠中酵素水解測試，上述結果顯示共發酵菌株與改良纖維水解酵素皆可於噸級測試廠中操作具其可行性。本所共發酵菌株和纖維水解酵素之生產研發於實驗室階段已有初步之成果，建議可進一步於本所設置之每批次進料 10kg 測試系統和噸級運轉測試廠中進行同步水解共發酵程序之驗證及該程序參數之量測和評估。
2. 生質物精煉技術生產綠色產品逐漸成爲生質能源研發的另一重點項目，將生質原料全株充分轉換成精煉產物，國際上，目前纖維素轉化酒精程序所得之五碳糖和木質素作爲首要生質精煉發展標的，生產糠醛、木糖酸、酚類化合物等化學品，未來進一步整合纖維素轉化酒精程序和生質精煉系統。
3. 除了以生物化學法產製生質燃料與生質精煉主題外，熱化學轉化法製程爲此研討會另一重要之主題項目，針對生質物的氣化、焙燒或燃燒等程序研究，其產生的產物可作爲發電或氣體合成，從演講和海報資料中，歐美各國的焙燒和燃燒技術目前已有成熟之技術，尤以荷蘭已建置完成達示範廠之規模之生質焙燒產電廠。
4. 本次在會議過程中，與多位學者進行討論，討論結果如下：

(1) 天津大學環境學院生物能源與環境研究團隊劉廣瑞博士，爲海報發表者之

一，他的研究主題是以藻類生產生質柴油，現階段以結盟的模式，將學校、研究機構與產業端進行結合，其實驗室提供技術交給研究機構和產業進行放大開發，同時他提及中國有許多類似此合作模式。同時，他提到中國由於汽油添加酒精比例至 10%以上，由於車輛使用酒精汽油產生甲醇造成車輛嚴重損傷，因此中國重新對生質酒精政策將作調整增加生質柴油發展比例。

(2) 淮北中潤生物能源技術開發有限公司技術總監朱作霖博士，爲本研討會演講者之一，其公司於 2009 年完成纖維酒精廠建置和運轉。目前其公司開發熱裂解、重組與氫化程序爲其開發之新技術，利用催化裂解分離的方式可得約 60 種分解產物，但目前可從 60 種分解產物中分離出乳酸，後續仍針對其他分解產物進行分離純化，顯然由於裂解產物分岐度高，進而造成分離程序困難度增加。

(3) Protéus 公司小組負責人 Laurent Fourage 博士，爲本研討會演講者之一，其演講主題爲纖維水解酵素之開發，以分子生物學方法改良酵素活性與分泌系統。與 Fourage 討論後，其研究團隊是以稀酸蒸氣爆裂之麥稈進行纖維水解酵素之誘導，他認爲纖維水解酵素誘導物以欲水解之生質物最爲合適，並利用纖維素水解反應後現象進行酵素基因改良的評估依據。

四、建議事項

本次出差出國參與 18th European biomass conference & exhibition，在為期五天的議程中，除能蒐集國際間最新技術研發成果與趨勢外，同時可經由和與會人士會談交流的機會，進而建立與國外研究機構連繫管道。由於國際研討會中所發表之技術發展和研發策略現況有別於從網路上收集之資料，且研討會資料多為當年度之研發成果，因此建議每年應派員參加國際研討會，並且發展論文以增加核研所纖維酒程序發展之特色，進而增加國際能見度。

生質精煉技術為發展生質能源的另一個重要的里程，其發展可為纖維酒精程序帶來更完整發展，由於本所纖維酒精專案已建置完成稀酸前處理和水解發酵程序，木糖水解液與酵素水解後之木質素作為生質精煉技術開發的切入點，建議如下：

1. 木糖生質精煉可朝糖質界面活性劑研發作為評估項目，原因在於木糖由生質物中水解出，可直接作為界面活性劑生產之原料，不需再使用生物法再轉換為其他產品使用，可立即發展之技術，未來仍然是以生物精煉作為研究之主軸。然而，糖質界面活性劑研發技術面涵蓋領域化學和生物，建議可與本所具相關專長同仁進行合作研究。
2. 稻草為禾本科植物，其木質素適合作為酚類化合物生產之來源，可利用專案完整之前處理設備及其技術研發經驗，以增加前處理設備和技術應用性，另外，由於木質素為高分子網狀結構，大部分微生物無法直接利用，需經由木質素分解酶，將木質素分解為更小分子，但木質素分解酶取得不易且價格貴，因此，利用前處理技術將木質素降解為較小分子量之化合物，一方面微生物較易轉換利用，另一方分離化合物作為應用化學品之原料。

五、附錄

1. 本次於研討會發表論文內容

Design of tailor-made process for converting total sugars to ethanol from lignocellulosic biomass

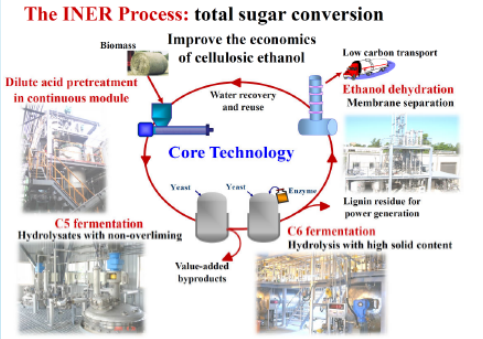
Teng-Chieh Hsu*, Ting-Hsiang Lin, Wen-Shiang Lin, Hung-Chang Huang, Gia-Luen Guo, Wen-Song Hwang

*Cellulosic Ethanol Project, Institute of Nuclear Energy Research (INER), Taiwan

*dchsu@iner.gov.tw

Institute of Nuclear Energy Research
Atomic Energy Council, Executive Yuan

INER was supported by government to build the pilot plant for cellulosic ethanol production with a capacity of one ton in dry biomass per day. The feedstock was focused on rice straw currently, but also flexible for sugarcane bagasse and hardwood. The innovative process for converting total monosaccharide content in lignocellulosic biomass is being developed to improve the economics of the second-generation bioethanol. The test-run operation for mass production was launched in early 2010 to provide significant information for the design of commercial production plant in Taiwan.



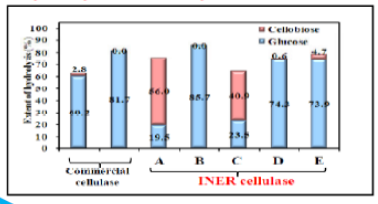
The goal of INER process
1. Total sugar conversion
2. Reducing water footprint
3. Reducing energy consumption for ethanol dehydration

Biomass

In-house cellulase produces by low- cost feedstock as inducible substrate

Cellulase

Hydrolysis efficiency of INER cellulase



Acid hydrolysis pretreatment

liquid

Xylose fermentation

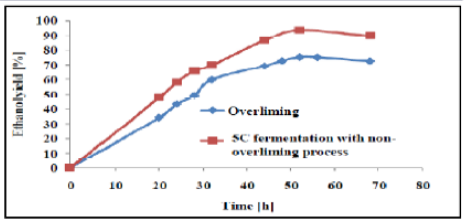
Ethanol broth mixed with pretreated solid residues

Pretreated solid residues

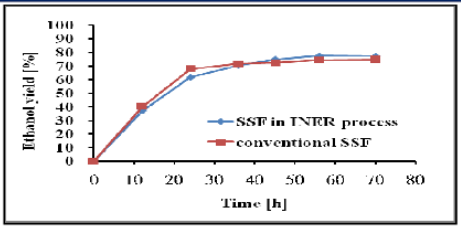
SSF or SSCF

Ethanol dehydration

hydrolysates condition with non-oveliming process



Parameters regulation in SSF or SSCF



The potential of INER process (in comparison with SHF)
1. Enhancing 2.0 times ethanol concentration (>40 g/L)
2. Saving 50% of process water
3. Keeping reasonable ethanol yield in C5 andC6 conversion process

INER's Orientation

2. 第 18 屆歐洲生質能研討會議程

CONFERENCE PROGRAMME

Please note, that this Programme may be subject to alteration and the organisers reserve the right to do so without giving prior notice. The current version of the Programme is available at ***www.conference-biomass.com****.*

(i) = invited

MONDAY, 3 MAY 2010

PLENARY SESSION PA1

08:30 - 09:30

Chairpersons:

K. Maniatis
European Commission, Brussels, Belgium

W. Haslinger
BIOENERGY 2020+, Wieselburg, Austria

PA1.1 U. Fritsche, K. Hennenberg
Oeko-Institut, Darmstadt, Germany
B. Kampman, G. Bergsma
CE Delft, The Netherlands
Better Use of Biomass for Energy - An IEA RETD/IEA Bioenergy Position Paper

PA1.2 R. Arjona Antolín
Abengoa Bioenergy, Spain
Overview of Ethanol

PA1.3 V. Bush, R. Knight, A. Basu
Gas Technology Institute, Des Plaines, USA
Renewable Natural Gas for Efficient Use of Biomass

BREAK 09:30 - 10:00

10:00 - 11:50 OPENING SESSION

Conference General Chairman:
Prof. Josef Spitzer
Joanneum Research Austria
Chairman of IEA Bioenergy Implementing Agreement

Opening Programme

- Welcome to the Conference by the Conference General Chairman
- Welcome Addresses by highranking personalities of the host country
- The Technical Programme Coordinator introduces the Conference Programme
- Highranking international personalities present their point of view concerning the role of Biomass from Research to Industry and Markets

Official Opening of the Conference

Please visit the Conference website for the latest information about the Conference Opening Event.

ORAL PRESENTATION OA1

11:50 - 12:40 Fundamentals and studies

Chairpersons:
W. Prins
University of Ghent, Belgium

S. Bordebeure *(i)*
ADEME, Angers, France

OA1.1 V. Wilk
Bioenergy 2020+ GmbH, Güssing, Austria
H. Hofbauer
Vienna University of Technology, Austria
Efficient Utilisation of Industrial Residues and Waste with High Biomass Content Using Gasification Technology

OA1.2 A. Fourcault, U. Michon
Europlasma, Bruges, France
F. Marias
Université de Pau et des Pays de l'Adour, France
Modelling of a High Temperature Plasma Reactor for Tar Removal

OA1.3 J. Judex, M. Wellinger, Chr. Ludwig, S.M.A. Biollaz
Paul Scherrer Institut, Villigen-PSI, Switzerland
Investigation of Grass Gasification in a Bench Scale Fluidised Bed Reactor Towards an IGCC Application

ORAL PRESENTATION OA2

11:50 - 12:40 **Process monitoring and control systems in large biomass combustion and co-firing plants**

Chairpersons:

E. Alakangas
VTT Technical Research Centre of Finland, Jyväskylä, Finland

J. Koppejan
Procede Biomass BV, Enschede, The Netherlands

OA2.1 N. Rossi, S. Lattanzi, C. La Marca
Enel Engineering & Innovation, Pisa, Italy
D. Dalle Mura
Enel Generation And Energy Management, Pisa, Italy
Advancements in Rdf Co-Firing Demonstration Project at Enel Fusina Power Plant

OA2.2 A. Gonzalez Cencerrado, B. Peña, A. Gil Martinez
Centre of Research for Energy Resources and Consump, Zaragoza, Spain
Biomass-Coal Flame Monitoring by Digital Image Processing in a Semi-Industrial Combustion Pilot Plant

OA2.3 R. Abrams
Babcock Power Inc, Worcester, USA
J. Irving
Burlington Electric Co., Burlington, USA
System to Reduce NOx, VOC, and CO Emissions from Biomass Boilers

ORAL PRESENTATION OA3

11:50 - 12:40 Sources for biological conversion

Chairpersons:

E. Langer
C.A.R.M.E.N., Straubing, Germany

C. Banks
University of Southampton, United Kingdom

OA3.1 *invited*

OA3.2 C. Salomoni, A. Caputo, M. Bonoli
Biotec Sys, Bologna
O. Francioso, M.T. Rodriguez-Estrada, D. Palenzona
University of Bologna, Italy
CO2 Capture and Conversion in Anaerobic Digestion of Organic Wastes for Enhanced Methane Production: Demonstration Project in Bologna Wwtp

OA3.3 T. Huegle, H. Kruchen
Demetrion AG, Bürstadt, Germany
Biomethane from Biowaste - Energetic Conversion of Organic Rubbish

VISUAL PRESENTATIONS VP T2.5

11:50 - 12:40

Detailed information on Session VP T2.5 is presented in the section entitled 'Visual Presentations'.

LUNCH BREAK 12:40 - 13:15

ORAL PRESENTATION OA4

13:15 - 14:40 Technology development

Chairpersons:

M. Bolhàr-Nordenkampf
AE&E Austria, Vienna, Austria

N.N.

OA4.1 M. Mun, J.-O. Kim, J.-W. Kim, J.-S. Kim
University of Seoul, Republic of South Korea
Production of Producer Gas with Low Tar and a High Heating Value from Construction Woody Waste by Air Gasification in a Two-stage Gasifier Using Activated Carbon

OA4.2 N. Boukis, M. Neumann, U. Galla, E. Dinjus
KIT, Karlsruhe, Germany
Gasification of Herbage in Supercritical Water, Experimental Results

OA4.3 G. Teixeira
CREED, Limay, France
L. Van de Steene, E. Martin
CIRAD, Montpellier, France
S. Salvador
EMAC, Albi, France
To the Description and the Optimisation of a Continuous Wood Char Bed Gasification Reactor

OA4.4 T. Elsenbruch
GE Jenbacher, Jenbach, Austria
Latest Developments in the Use of Wood Gas in Gas Engines

OA4.5 A. Nakamura, Y. Shimizu
The Chugoku Electric Power Company
Higashi-Hiroshima, Japan
Y. Matsumura
Hiroshima University, Japan
T. Minowa
National institute of Advanced Industrial Science, Kure, Japan
Y. Noda
Toyo Koatsu, Hiroshima, Japan
Y. Kawai
Chuden Plant, Hiroshima, Japan
Supercritical Water Gasification of Layer Poultry Manure, Swine Manure and Cattle Manure with Pilot Scale Plant

ORAL PRESENTATION OA5

13:15 - 14:40 **Prediction and abatement of corrosion and gas emissions in large biomass combustion and co-firing plants**

Chairpersons:
T. Nussbaumer
Verenum Research, Zurich, Switzerland

N.N.

OA5.1 M. S. Bashir, P. A. Jensen, F. Frandsen, S. Wedel, K. Dam-Johansen, T. Wolfe
Technical University of Denmark, Lyngby, Denmark
S.T. Pedersen, J. Wadenback
Vattenfall A/S, Copenhagen, Denmark
Characterization and Quantification of Deposits Buildup and Removal in Biomass Suspension-Fired Boilers

OA5.2 A. Saddawi, J.M. Jones, A. Williams
University of Leeds, United Kingdom
Kinetics of the Thermal Decomposition of Biomass and the Influence of Alkali Metals on These Kinetics

OA5.3 M. H. Piispanen, E. V. Rodriquez, M. E. Niemelä, M. S. Tiainen, R. S. Laitinen
University of Oulu, Finland
Simple Prediction of Ash-Related Problems Directly from Biofuels

OA5.4 B. Gudka, X.C. Baxter, L.I. Darvell, J.M. Jones, A. Saddawi, A. Williams
University of Leeds, United Kingdom
A. Malmgren
RWE Power International, Swindon, United Kingdom
P.J. Kilgallon, N.J. Simms
Cranfield University, United Kingdom
Combustion Properties of Two Imported Biomass Feedstocks for Co-Firing in the UK

OA5.5 B. Adouane
Batna University, Algeria
W. de Jong, J. van Buijtenen
Delft university of Technology, The Netherlands
G. Witteveen
Winnox b.v., Nijmegen, The Netherlands
Reducing the Fuel-Bound Nitrogen Conversion to No in an Air-Staged Combustion of a Synthetic Biomass-Derived Gas

ORAL PRESENTATION OA6

13:15 - 14:40 **Biochemistry and microbiological communities**

Chairpersons:

S. Esteves *(i)*
University of Glamorgan, United Kingdom

N.N.

OA6.1 *invited*

OA6.2 M. Delcourt, M. Anissimova, B. Desmazières, S. Mazaleyrat, R. Tallon, R. Chayot, P. Marlière
Global Bioenergies, Evry, France
V. De Bérardinis
Genoscope, Evry, France
V. Legros
LAMBE - Université d'Evry, France
Biosynthesis of the Gaseous Hydrocarbon Isobutene: a Disruptive Approach Toward Sustainable Production of Organic Fuels and Polymers

OA6.3 N. Osaka, T. Takahashi, Y. Koike
Tokyo Gas Co., LTD, Kanagawa, Japan
S. Morimura, K. Kida
Kumamoto University, Kumamoto, Japan
Y. Tang
Peking University, Beijin, Japan
Development of the Efficient Conversion System of Kitchen Waste to Bio-Ethanol and Biogas

OA6.4 J.-M. Sonet, C. Ayrinhac, C. Ullmann, L. Fourage
Protéus, Nimes, France
H. Mathis, A. Margeot, F. Monot
Institut Français du Pétrole, Rueil Malmaison, France
Improved Saccharification of Wheat Straw for Biofuel Production Using an Engineered Secretome of Trichoderma Reesei

OA6.5 M. Chauve, D. Casanave
Institut Français du Pétrole, Solaize, France
N. Lopes Ferreira
Institut Français du Pétrole, Rueil, France
S. Perez
CERMAV, Grenoble, France
Kinetic Modelling of Pure Cellulases Involved in Enzymatic Hydrolysis of Cellulose

VISUAL PRESENTATIONS VP T2.7

13:15 - 14:40

Detailed information on Session VP T2.7 is presented in the section entitled 'Visual Presentations'.

BREAK 14:40 - 15:00

ORAL PRESENTATION OA7

15:00 - 16:25 Gas cleaning

Chairpersons:

W.P.M. Van Swaaij
University of Twente, Enschede, The Netherlands

H. Hofbauer *(i)*
Vienna University of Technology, Austria

OA7.1 E. Fanelli, C. Freda, F. Nanna, A. Villone, G. Canneto, G. Braccio
ENEA, Rotondella (MT), Italy
Syngas Production by Steam-Oxygen Gasification of Biomass and its Cleaning by Bio-Diesel and Water Scrubbing

OA7.2 A. Gómez-Barea, G. Claro, D. Fuentes, P. Ollero
University of Seville, Spain
Investigation of Tar Properties for Tar Removal by Scrubbing

OA7.3 H. Egsgaard, J. Ahrenfeldt, U. B. Henriksen
Risoe National Laboratory for Sustainble Energy, Roskilde, Denmark
On the Significance of Methyl Chloride in Gasification Processes

OA7.4 G. San Miguel, M.E. Alvarez, M. Hernández, J. Sánchez-Caba
Universidad Politécnica de Madrid, Spain
Characterisation and Potential Applications of Soot Particulates Produced in a Commercial Biomass Gasification Plant

OA7.5 M. Stemmler, M. Müller
Forschungszentrum Jülich, Germany
In-Situ Chemical Hot Gas Cleaning in Fluidized Bed Steam Gasification of Biomass

ORAL PRESENTATION OA8

15:00 - 16:25 Modelling, monitoring and optimization of small biomass combustion and auxiliary equipments

Chairpersons:

J.E. Carrasco
CIEMAT, Madrid, Spain

N.N.

OA8.1 R. Mehrabian, R. Scharler, I. Obernberger
Graz University of Technology, Austria
A. Weissinger
KWB - Kraft und Wärme aus Biomasse, St. Margarethen, Austria
Optimisation of Biomass Grate Furnaces with a New 3D Packed Bed Combustion Model - On Example of a Small-Scale Underfeed Stoker Furnace

OA8.2 W. Haslinger, M. Schwarz, F. Figl, G. Friedl
Bioenergy 2020+, Wieselburg, Austria
M. Staudinger
Calimax Energietechnik, Altach, Austria
Development of a New State of Technology of Water Heating Stoves for Low and Passive Energy Houses

OA8.3 C. Schraube, J.-Y. Wilmotte, T. Jung, F. Castagno
EIFER European Institute for Energy Research EDF-KIT, Karlsruhe, Germany
Long-Term Monitoring of Small Pellet Boiler Based Heating Systems in Domestic Applications

OA8.4 T. Ulbricht, V. Lenz
German Biomass Research Centre, Leipzig, Germany
C. Schraube
European Institute for Energy Research, Karlsruhe, Germany
Monitoring of Precipitators

OA8.5 G. Hector
LERMAB LMSPC, Strasbourg, France
C. Courson, A. Kienneman
LMSPC, Strasbourg, France
Y. Rogaume, C. Rogaume
LERMAB, Epinal, France
J. Mendiboure, M.L. Rabot Querci
SUPRA SA, Obernai, France
Conception of a New System for Pollution Abatement for Small Scale Wood Appliance

ORAL PRESENTATION OA9

15:00 - 16:25 **Process engineering for biological conversion**

Chairpersons:

M. Vitolo
University of Sao Paolo, Brazil

A. Barakat *(i)*
INRA, Nancy, France

OA9.1 J. Pucker, G. Jungmeier, A. Stuhlbacher
Joanneum Research, Graz, Austria
S. Siegl, R. Kirchmayr
IFA Tulln, Austria
F.-J. Ebner-Ornig, E. Pötsch
LFZ Raumberg-Gumpenstein, Irdning, Austria
Key Factors for the Sustainable Use of Biogas - Life Cycle Assessment of Austrian Biogas Plants

OA9.2 *invited*

OA9.3 J. Born, H. Schneider
FH Flensburg - University of Applied Sciences, Germany
Mabr -A Fermentation Technology which Integrates Anaerobic Digestion, Separation and Purification of Methane, Hydrogen and CO2

OA9.4 B. Ruggeri, T. Tommasi
Politecnico di Torino, Italy
Energetic Valorisation of End-Liquid Products of H2 Fermentation

OA9.5 F. Malpei, G. Menin, R. Salvetti, E. Ficara, R. Vismara, R. Canziani
Politecnico di Milano, Italy
Thermolysis of Waste Sludges to Enhance Biogas Production

VISUAL PRESENTATIONS VP T2.2

15:00 - 16:25

Detailed information on Session VP T2.2 is presented in the section entitled 'Visual Presentations'.

BREAK 16:25 - 16:45

ORAL PRESENTATION OA10

16:45 - 18:10 Gas cleaning

Chairpersons:

D. Chiaramonti
University of Florence, Italy

C. Peacock *(i)*
Conversion and Resource Evaluation Ltd,
Northern Ireland

OA10.1 Y. Neubauer, R. Sun, N. Zobel, F. Behrendt
Technische Universität Berlin, Germany
Online-Monitoring of Tar with a Compact Tar-Analysis Device Based on Photon Induced Fluorescence

OA10.2 C.M. van der Meijden, P.C.A. Bergman, A. van der Drift, B.J. Vreugdenhil
Energy Research Centre of the Netherlands, Petten, The Netherlands
Preparations for a 10 Mwth Bio-Chp Demonstration Based on the Milena Gasification Technology

OA10.3 M. Strigl
MCI Management Center Innsbruck, Leutasch, Austria
G. Kreutner, J. Krueger, M.B. Huber
MCI Management Center Innsbruck, Austria
Separation of RME-In-WATER Emulsion Out of Producer Gas Scrubbers

OA10.4 P. Stoholm
DFBT Aps, Roskilde, Denmark
J. Cramer
FORCE Technology, Kgs. Lyngby, Denmark
J. Krogh
Anhydro, Søborg, Denmark
R.G. Nielsen
DONG Energy, Fredericia, Denmark
J. Ahrendtfelt, U. Henriksen
Risoe-DTU, Roskilde, Denmark
The Low Temperature CFB Gasifier -100 kWth Tests on Straw and New 6 MWth Demonstration Plant

OA10.5 S. Nilsson, J.G. Claro, A. Gómez-Barea, D. Fuentes, P. Ollero
University of Seville, Spain
Gasification Kinetics of Char from Dried Sewage Sludge in a Fluidized Bed: Measurements and Modelling

ORAL PRESENTATION OA11

16:45 - 18:10 **Measurement and reduction of sintering, corrosion and particles emissions of small biomass combustion equipments**

Chairpersons:
F. Cotana
Biomass Research Centre, Perugia, Italy

N.N.

OA11.1 A. Stanev
Fachagentur Nachwachsende Rohstoffe, Guelzow, Germany
Reduction of Finest Particle Emissions from Small Scale Combustion Plants with Solid Biofuels - Results of Pilot Joint Call Projects in Germany

OA11.2 A. Bologa, H.-R. Paur, H. Seifert, K. Woletz
Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany
T. Ulbricht
German Biomass Research Centre, Leipzig, Germany
Fine Particle Generation, Evolution and Control by Small Scale Biomass Combustion Devices

OA11.3 T. Nussbaumer, A. Lauber
University of Applied Sciences Lucerne, Switzerland
Formation Mechanisms and Physical Properties of Particles from Wood Combustion for Design and Operation of Electrostatic Precipitators

OA11.4 F. Ozil, F. Haas
Fondis SA, Thann, France
V. Tschamber, G. Trouve
Université Haute Alsace, Mulhouse, France
A Catalytic Solution to Reduce Pollutant Emissions Generated by Heating Wood: the "zero-Co" Domestic Fireplace

OA11.5 T. Brunner, J. Kelz, I. Obernberger
Graz University of Technology, Austria
M.-R. Hirvonen, P. Jalava
National Institute for Health and Welfare, Kuopio, Finland
PM Emissions from Old and Modern Biomass Combustion Systems and their Health Effects

ORAL PRESENTATION OA12

16:45 - 18:10 **Lignocellulosic biomass as source for chemicals**

Chairpersons:
G. Fiorenza
ENEA Research Centre of Trisaia, Rotondella, Italy

S. Le Bastard *(i)*
ADEME, Angers, France

OA12.1 J. Barbier, N. Charon, N. Dupassieux, M. Courtiade, A. Ducrozet, A. Fonverne, J. Ponthus
Institut Français du Pétrole, Vernaison, France
A. Loppinet-Serani, F. Cansell
ICMCB, Bordeaux, France
Lignocellulosic Compounds Decomposition in Subcritical and Supercritical Water

OA12.2 J.H. Reith, W.J.J. Huijgen, P.J. de Wild, H. den Uil
Energy Research Centre of the Netherlands, Petten, The Netherlands
Fractionation of Lignocellulosic Biomass by an Organosolv Process for Co-Production of Fuels and Chemicals within a Biorefinery

OA12.3 *invited*

OA12.4 E. Gonzalez, L. Mesa, M. Morales
University of Las Villas, Santa Clara, Cuba
C. Cara, I. Romero, M. Moya
University of Jaen, Spain
Production of Furfural and Ethanol from Sugarcane Bagasse

OA12.5 V. F. N. Silva, G. Amaral, A. R. Gonçalves, G. J. M. Rocha
University of Sao Paulo, Lorena, Brazil
Effect of Hydrothermal Pretreatment, Following by Alkaline Delignification, in Enzymatic Saccharification of Sugar Cane Bagasse

VISUAL PRESENTATIONS VP T2.3

16:45 - 18:10

Detailed information on Session VP T2.3 is presented in the section entitled 'Visual Presentations'.

WELCOME RECEPTION

18:30 - 20:00

TUESDAY, 4 MAY 2010

PLENARY SESSION PB1

08:30 - 10:10

Chairpersons:

K. Sipilä
VTT Technical Research Centre of Finland, Finland

A. Bridgwater *(i)*
Aston University, Birmingham, United Kingdom

PB1.1 I. Obernberger
Graz University of Technology, Austria
Trends and Opportunities of Micro-CHP Technologies based on Biomass Combustion

PB1.2 F. Monot, A. Margeot
Institut Français du Pétrole, Rueil-Malmaison, France
B. Hahn-Hagerdal
Lund University, Sweden
M. Edlund
SEKAB E-Technology, Örnsköldsvik, Sweden
R. Slade
Imperial College London, United Kingdom
A. Gerini
Centro Ricerche Fiat, Orbassano, Italy
G. Arrowsmith
EUREC Agency, Brussels, Belgium
The NILE Project - Advances in the Conversion of Lignocellulosic Materials into Ethanol

PB1.3 J.R. Gasson, M. Kleinert, T. Barth
University of Bergen, Norway
D. Forchheim, A. Kruse, E. Sahin
Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany
I. Eide
Statoil Research Centre, Trondheim, Norway
Lignin Solvolysis: Upscaling of the Lignin-to-Liquid Conversion Process Towards Technical Applicability

PB1.4 F. Broust
CIRAD, Montpellier, France
G. Mauviel
LSGC-CNRS, Nancy, France
A. Quignard
Institut Français du Pétrole, Lyon, France
G. Boissonnet
CEA, Grenoble, France
A. Bensakhria
UTC, Compiègne, France

C. Bellot
EDF, Chatou, France
M. Bourgogne
TOTAL, Harfleur, France
G. Martin
ATANOR, Irigny, France
Preconditioning of Biomass through Fast Pyrolysis for Different Biofuels Applications: Outcomes of the Project Precond

PB1.5 J. Bjerg
Dong Energy, Denmark
Developing Sustainable Biomass Refineries

VISUAL PRESENTATIONS VP T2.4/2.8

08:30 - 10:10

Detailed information on Session VP T2.4/2.8 is presented in the section entitled 'Visual Presentations'.

BREAK 10:10 - 10:40

ORAL PRESENTATION OB1

10:40 - 12:05 Syngas cleaning. Particles and inorganics

Chairpersons:
I. Obernberger
Graz University of Technology, Austria

N.N.

OB1.1 C. Bourgel, R. Boigelot, J. Poirier, M-L. Bouchetou, S. Brassamin, D. Zanghi
CNRS-CEMHTI, Orléans, France
F. Defoort
CEA DTN, Grenoble, France
C. Peregrina
CIRSEE Suez Environnement, Le Pecq, France
Volatility of Inorganics During the Gasification of Dried Sludge

OB1.2 F. Defoort, S. Thiery, P. Castelli, B. Grangier, S. Ravel, J. Guillaudeau, A. Puech, C. Verne-Tournon
CEA, Grenoble, France
O. Guerrini, A. Louvat
GDF Suez, St Denis La Plaine, France
Advances Gained During Anapur Project for Inorganic Trace Measurements in Biogas from Steam Gasification of Woody Biomass

OB1.3 S. Bihr, M. Rechulski, J. Schneebeli, S.M.A. Biollaz
Paul Scherrer Institut, Villigen, Switzerland
Sulphur Diagnostics in Product Gases at High and Very Low Concentrations: a Contribution to a Future "Sulphur Protocol"

OB1.4 C. Varga, S. Koppatz, C. Pfeifer, H. Hofbauer
Vienna University of Technology, Austria
Hot Gas Cleaning of Biomass Derived Syngas by Catalytic Filter Candles

OB1.5 H. Svensson, P. Tunå, J. Brandin
Lund University, Sweden
Soot Formation in Reverse Flow Reforming of Biomass Gasification Producer Gas

ORAL PRESENTATION OB2

10:40 - 12:05 **Microgeneration technology with biomass**

Chairpersons:

T. Fjällström *(i)*
Efokus AB, Solleftea, Sweden

Y. Schenkel *(i)*
CRAW, Gembloux, Belgium

OB2.1 E. de Martel, F. Castagno, L. Lelait
European Institute for Energy Research, Germany
C. Schoennenbeck, G. Trouve, G. Leyssens
Laboratoire de Gestion des Risques et Environnement, Mulhouse, France
Y. Rogaume
ENSTIB / LERMAB, University of Nancy, Epinal, France
G. Martin
ATANOR, Irigny, France
B. Chieze
Compte R., Arlanc, France
30 Years of External Fired Gas Turbine (EFGT) Fed with Biomass: What Next?

OB2.2 G. Riccio, A. Spadi, D. Chiaramonti, F. Martelli
University of Florence, Italy
Assembling, Commissioning and First Start-Up of a Micro Gas Turbine Chp Plant Supplied by Biomass (BIO_MGT)

OB2.3 S. Barsali, R. Giglioli, D. Poli
University of Pisa, Italy
M. Cellini
TEP, Italy
An Externally Fired Micro Gas Turbine Plant for Combined Heat and Power Generationfrom Solid Biomass: a Practical Experience

OB2.4 G. Friedl, A. McCarry, W. Moser, S. Aigenbauer
Bioenergy 2020+ GmbH, Wieselburg, Austria
Evaluating the Transient Behaviour of Biomass Based Micro-Chp Systems - Steam Piston Engine and Integrated Thermoelectric Power Generation

OB2.5 T. Theys, G. Fabry
SIL, Paris, France
Biomass Boiler Fuel Flexibility, Low Investment & Operating Cost Approach Successful for Decades

ORAL PRESENTATION OB3

10:40 - 12:05 Biomass torrefaction

Chairpersons:
J. Koppejan
Procede Biomass, Enschede, The Netherlands

D.J. Stevens
Pacific Northwest National Laboratory, Richland, USA

OB3.1 J.-B. Michel, C. Mahmed, J. Ropp
University of Applied Sciences Western Switzerland, Yverdon-Les-Bains, Switzerland
M. Schmid, M. Sattler
Center of Appropriate Technology and Social Ecology, Langenbruck, Switzerland
Combustion Evaluation of Torrefied Wood Pellets on a 50 Kwth Boiler

OB3.2 P. Fridström, M. Berglund
BioEndev, Örnsköldsvik, Sweden
U. Bojner
Torkapparater, Stockholm, Sweden
T. Lindgren
BRUKS Celltec, Örnsköldsvik, Sweden
M. Nordwaeger, I. Olofsson, K. Håkansson, A. Nordin
Umeå University, Sweden
Design and Status of the Industrial-Scale Torrefaction Plant in Örnsköldsvik, Sweden

OB3.3 K. Sipilä, C. Wilén
VTT Technical Research Centre of Finland, Espoo, Finland
E. Sipilä
Pöyry Management Consulting, Vantaa, Finland
J. Kiel
Energy Research Centre of the Netherlands, Petten, The Netherlands
Torrefaction Options for European Forest Industry by 2020 - Opportunities and Constraints

OB3.4 K. Håkansson, A. Nordin, I. Olofsson, M. Nordwaeger
Umeå University, Sweden
M. Svanberg
Chalmers University of Technology, Göteborg, Sweden
CE. Grip
Luleå University of Technology, Sweden
P. Fridström
Övik Energi, Örnsköldsvik, Sweden
Process and System Integration Aspects on Biomass Torrefaction

OB3.5 J. Celaya, I. Goni, J. Gil, I. Echeverría
CENER, Sarriguren, Spain
New Pilot Plant for Biomass Torrefaction

VISUAL PRESENTATIONS VP T4.4/4.5

10:40 - 12:05

Detailed information on Session VP T4.4/4.5 is presented in the section entitled 'Visual Presentations'.

LUNCH BREAK 12:05 - 13:15

ORAL PRESENTATION OB4

13:15 - 14:40 Syngas production. Reaction and technologies

Chairpersons:
W.P.M. Van Swaaij
University of Twente, Enschede, The Netherlands

R. Overend
Biomass and Bioenergy, Ottawa, Canada

OB4.1 B. Folkedahl, C. Zygarlicke, M. Swanson, D. Hajicek
Energy & Environmental Research Center, USA
Clean Biobased Syngas Using a Transport Reactor Integrated Gasifier

OB4.2 S. Czernik, R. French
National Renewable Energy Laboratory, Golden, USA
Production of Hydrogen by Autothermal Reforming of Biomass Pyrolysis Oil

OB4.3 G. van Rossum, R.J.M. Westerhof, R.P. Balegedde Ramachandran, W.P.M. Van Swaaij, D.W.F. Brilman, S.R.A. Kersten
University of Twente, Enschede, The Netherlands
Combined Optimization of Fast Pyrolysis and Catalytic Reforming to Produce Renewable Syngas from Biomass Waste

OB4.4 S. Rapagnà, M. Di Marcello
University of Teramo, Mosciano S. Angelo, Italy
K. Gallucci, P.U. Foscolo
University of L'Aquila, Italy
In-Situ Primary and Secondary Catalysts in Biomass Fluidized Bed Gasifier

OB4.5 S. Valin, S. Ravel, J. Guillaudeau, S. Thiery
CEA, Grenoble, France
Study of the Influence of Total Pressure on Products Yields in Fluidized Bed Gasification of Wood Sawdust

ORAL PRESENTATION OB5

13:15 - 14:40 Characterisation and modelling of pyrolysis processes

Chairpersons:
M. Costa
Instituto Superior Técnico, Lisbon, Portugal

R. Buliler *(i)*
Energie und Umwelt, Switzerland

OB5.1 G. Schrammel, R. Rauch
Bioenergy 2020+, Güssing, Austria
H. Hofbauer
Vienna University of Technology, Austria
Thermal Conversion of Biomass by Microwaves - First Results of Converted Wood

OB5.2 M. Halwachs, G. Kampichler, S. Kern, H. Hofbauer
Vienna University of Technology, Austria
Valorisation of Low Grade Biomass by Using Low Temperature Pyrolysis

OB5.3 A.R. Fernandez-Akarregi, J. Makibar, I. Alava, F. Cueva
IKERLAN IK-4, Miñao. Araba, Spain
M. Olazar
University of the Basque Country, Bilbao, Spain
Fluid-dynamic in IKERLAN IK4 Pilot Plant Spouted Bed Reactor at High Temperature

OB5.4 H. Lehtonen, A. Oasmaa, Y. Solantausta, C. Lindfors
VTT Technical Research Centre of Finland, Espoo, Finland
Fast Pyrolysis of Pre-Treated Wood: the Effect of Hemicellulose Removal on Pyrolysis Oil Quality

OB5.5 J. Giuntoli, J. Gout, A.H.M. Verkooijen, W. de Jong
Delft University of Technology, The Netherlands
Characterization of Fast Pyrolysis of Biomass Fuels Using a Heated Grid Reactor: Nitrogen Chemistry and Reactor Modeling

ORAL PRESENTATION OB6

13:15 - 14:40 Biorefinery: from R&D to market

Chairpersons:

E. De Jong
Avantium Technologies, Amsterdam, The Netherlands

W. Ortinger
Bavarian State Ministry of Food Agriculture & Forestry, Munich, Germany

OB6.1 G. Jungmeier, M. Mandl
Joanneum Research, Graz, Austria
H. Jorgensen, N.S. Bentsen
University of Copenhagen, Denmark
R. Van Ree
WUR Wageningen, The Netherlands
E. de Jong
Avantium Technologies, Amsterdam, The Netherlands
M. Dohy, J.C. Pouet
ADEME, Augers, France
C. Philips
Agriculture and Rural Development, Edmonton, Canada
I. Skiadas
Aalborg University, Denmark
P. Walsh
Galway-Mayo Institute of Technology, Ireland
M. Wellisch
Natural Resources Canada, Ottawa, Canada
T. Willke
vTI, Braunschweig, Germany
I. De Bari
ENEA, Italy
M. Klembara
12U.S. DOE, USA
G. Bullock
BioIndustry Partners, Australia
M. Georgiadou
European Commission, Brussels, Belgium
Towards a Common Approach for Comparing Biorefinery Systems to Conventional Systems - Findings of IEA Bioenergy Task 42 “Biorefineries”

OB6.2 J.H. Reith, P.J. de Wild
Energy Research Centre of the Netherlands, Petten, The Netherlands
R. van Ree, R.R. Bakker
Agrotechnology and Food Sciences Group, Wageningen, The Netherlands
R. Capote
Abengoa Bioenergía Nuevas Tecnologías, Sevilla, Spain
F. Monot
Institut Français du Pétrole, Rue-Malmaison, France

B. Estrine
Agro Industrie Recherches et Developpements, Pomacle, France
A.V. Bridgwater
Aston University, Birmingham, United Kingdom
A. Agostini
Joint Research Centre - Institute for Energy, Petten, The Netherlands
Development of Integrated Lignocellulose Biorefinery for Co-Production of Chemicals, Transportation Fuels, Electricity and Heat

OB6.3 P. Piot
Agro-industries Recherche et Développements, Pomacle, France
ARD, the Heart of the Biorefinery Innovation Platform

OB6.4 J. Holmgren, C. Bertelli
UOP, Des Plaines, USA
Pilot-Scale Biorefinery for Sustainable Transport Fuels from Biomass and Algal Residues via Integrated Pyrolysis and Catalytic Hydroconversion

OB6.5 L. Daadaoui, L. Sauvéee
Université Paris Dauphine, France
Knowledge Governance for Exploration in Bio-Based Activities: the Case a French Competiveness Cluster

VISUAL PRESENTATIONS VP T2.1

13:15 - 14:40

Detailed information on Session VP T2.1 is presented in the section entitled 'Visual Presentations'.

BREAK 14:40 - 15:00

ORAL PRESENTATION OB7

15:00 - 16:25 Emerging technologies for biomass use

Chairpersons:
Y. Matsumura
University of Hiroshima, Japan

I. Echeverría Goñi
CENER, Sarriguren, Spain

OB7.1 L. Crepy, P. Martin, N. Joly
IUT de Béthune, Université d'Artois, France
New Plastic Materials Starting from Renewable Resources - Synthesis and Properties

OB7.2 E. Jasiukaityte, M. Kunaver
National Institute of Chemistry, Ljubljana, Slovenia Republic
C. Crestini
Tor Vergata University, Rome, Italy
Liquefied Wood - Advanced Characterization of Lignin-Based Polymer

OB7.3 W. de Jong, G. Marcotullio
Delft University of Technology, The Netherlands
Selective Acid-Catalyzed Furfural Generation from C5-Sugars Contained in Biomass - A Reaction Kinetics Optimization Assessment

OB7.4 C. Jurischka, A. Peda, M. Smieszek, P. Ay, C. Stollberg
Brandenburg University of Technology Cottbus, Germany
M. Kay
Fraunhofer facility 'Polymeric Materials and Composites' (PYCO), Teltow, Germany
Innovative Technologies for Production of Highly Pure Substances and Bio Fine Chemicals from Plants

OB7.5 B. Holmelid, K. Mike, T. Barth
University of Bergen, Norway
Mechanistic Studies of the Lignin to Liquid (Ltl) Conversion Process

ORAL PRESENTATION OB8

15:00 - 16:25 **Catalytic upgrading and syngas cleaning**

Chairpersons:
M. Antal
University of Hawaii, Honolulu, USA

N.N.

OB8.1 E. Simeone, R. Pal, A.H.M. Verkooijen, W. de Jong
Delft University of Technology, The Netherlands
M. Nacken
Pall Filtersystems, Crailsheim, Germany
Tar Removal in a Catalytic Ceramic Candle Filter Unit at High Temperatures

OB8.2 L. Lin, E. Gustafsson, M. Strand
Linnaeus University, Växjö, Sweden
High-Temperature Kinetics of Fine Biomass Char Particles in Air and CO2

OB8.3 S.G. Gajjela, P. Steele
Mississippi State University, Starkville, USA
Catalytic Upgrading of Fast Pyrolysis Bio-Oil to Transportation Fuels

OB8.4 *invited*

OB8.5 M. Siedlecki, A. Litinas, W. de Jong
TU Delft, The Netherlands
Biomass Gasification for Syngas Generation in a 100 Kwth Steam-Oxygen Blown Cfb Gasifier - Gas Quality Optimization and Tar Reduction

ORAL PRESENTATION OB9

15:00 - 16:25 **Economics and benefits deriving from biomass integration**

Chairpersons:
C. Hamelinck *(i)*
Ecofys, Utrecht, The Netherlands

N.N.

OB9.1 C. Jamieson
London, United Kingdom
P. Howes, B. Pole, P. Mistry, H. Martinau, T. Palmer
AEA, Didcot, United Kingdom
Closing the Loop: Optimising Food, Feed, Fuel and Energy Production Opportunities in the UK

OB9.2 K. Kwant
NL Agency, Utrecht, The Netherlands
G. Bergsma
Centre for Energy Conversion, Delft, The Netherlands
Good Use of Biomass in the Netherlands

OB9.3 J. Lindstedt, Sune Wännström
SEKAB E-Technology, Örnsköldsvik, Sweden
BioFuelCombines - from Pilot to Businesscase

OB9.4 C. Cobdon
Forest Products Association of Canada, Ottawa, Canada
D. Roberts
CIBC World Markets, Ottawa, Canada
Biofuels Can Reshape Canada's Pulp and Paper Industry

OB9.5 C. Hennig, J. Witt
German Biomass Research Centre, Leipzig, Germany
Influencing Factors on the Wood Pellet Price Development on Selective European Markets

VISUAL PRESENTATIONS VP T2.6

15:00 - 16:25

Detailed information on Session VP T2.6 is presented in the section entitled 'Visual Presentations'.

BREAK 16:25 - 16:45

ORAL PRESENTATION OB10

16:45 - 18:10 Next-to-market applications

Chairpersons:

P. Holubar
University of Natural Resources and Applied Life Sciences BOKU, Vienna, Austria

D. Hudebine *(i)*
Institut Français du Pétrole, France

OB10.1 M. Malinconico
Consiglio Nazionale delle Ricerche, Pozzuoli, Italy
Waste Polysaccharides and Cellulose Fibres for the Realization of Biodegradable Nursery Pots and Sprayable Biodegradable Mulching

OB10.2 J.H. Wang, B. Shi
Kimberly-Clark Corporation, Neenah, USA
Converting Polysaccharide Biomass into Thermoplastic Bio-Based Materials for Value-Added Applications

OB10.3 A. Piccirilli, J. Magne
Valagro Carbone Renouvelable, Poitiers, France
C. Deneuvillers, S. Harnois
Colas, Magny-Les-Hameaux, France
Substitution of Mineral Solvents by Modified Vegetable Esters in Asphalt Industry: from the Research to the Market

OB10.4 T. Griessacher, J. Antrekowitsch, D. Offenthaler
University of Leoben, Austria
Bio-Char Respectively Bio-Coke from Agricultural Wastes for Metallurgical Uses

OB10.5 P. Evon, V. Vandenbossche, P.Y. Pontalier, L. Rigal
Université de Toulouse, France
The Twin-Screw Extrusion Technology, an Original and Powerful Solution for the Biorefinery of Sunflower Whole Plant

ORAL PRESENTATION OB11

16:45 - 18:10 Classical pyrolysis processes

Chairpersons:

S.R.A. Kersten
University of Twente, Enschede, The Netherlands

N.N.

OB11.1 A. Moriconi
TECNOFIN SpA, Terni, Italy
Pyrolysis of Organic Compounds for Energy Production, Materials Recovery and Environmental Safeguards

OB11.2 S. Kern, M. Halwachs, T. Pröll, H. Hofbauer
Vienna University of Technology, Austria
G. Kampichler
EVN AG, Maria Enzersdorf, Austria
Rotary Kiln Pyrolysis - First Results of a 3 Mw Pilot Plant

OB11.3 P. A. Brownsort, O. Masek
University of Edinburgh, United Kingdom
Pyrolysis Biochar Systems: Comparison of Climate Change Mitigation Effects of Slow, Intermediate and Fast Pyrolysis Processes

OB11.4 S. Adhikari, S. Thangalazhy-Gopakumar, H. Ravindran, S. Taylor
Auburn University, USA
Effect of Pyrolysis Temperature on Physical and Chemical Properties of Bio-Oil from Agricultural Residues and Woody Biomass

OB11.5 O. Masek, P.A. Brownsort, A.. Cross, S.P. Sohi
University of Edinburgh, United Kingdom
Influence of Biochar Production Conditions on its Structure, Properties and Stability

ORAL PRESENTATION OB12

16:45 - 18:10 Biomass from forest and other woody resources

Chairpersons:

P. Mitchell
University of Aberdeen, United Kingdom

N.N.

OB12.1 D. Schepaschenko, A. Shvidenko
International Institute for Applied Systems Analysis, Laxenburg, Austria
Biomass of Russian Forests: Assessment of Availability of Resources and Potential for Energy Production

OB12.2 C. Deleuze
ONF, Fontainebleau, France
M. Rivoire, F. Longuetaud, L. Saint-Andre, A. Genet
INRA, Nancy, France
F. Morneau
IFN, Nogent-sur-Vernisson, France
P. Vallet
CEMAGREF, Nogent-sur-Vernisson, France
A. Bouvet
FCBA, Paris, France
A. Gauthier
CNPPF, Orleans, France
Reliable Estimation of Biomass in our Forests?

OB12.3 F.X.J. Johnson
Stockholm Environment Institute, Sweden
F.R.C. Rosillo-Calle
Imperial College, London, United Kingdom
The Achievable Potential of Wood Fuels for Climate Mitigation at Regional and Global Levels: Reviewing the Scope for Technical, Economic and Financial Implementation

OB12.4 L.S. Esteban, J.E. Carrasco
CEDER-CIEMAT, Lubia, Spain
Bioraise: a Gis Tool for Biomass Resources Assessment in Southern Europe

OB12.5 M. Buchhorn, D. Thrän
German Biomass Research Centre, Leipzig, Germany
K. P. Günther
German Remote Sensing Data Center, Oberpfaffenhofen, Germany
New Approaches for Biomass Estimation and Monitoring

VISUAL PRESENTATIONS VP T3.1

16:45 - 18:10

Detailed information on Session VP T3.1 is presented in the section entitled 'Visual Presentations'.

WEDNESDAY, 5 MAY 2010

PLENARY SESSION PC1

08:30 - 10:10

Chairpersons:
V. Lightner
U.S. Department of Energy (DOE), Washington DC, USA

N.N.

PC1.1 S. Laberge, H. Oraby
Agriculture and Agri-Food Canada, Québec, Canada
Breaking Agricultural Barriers: the Cellulosic Biofuels Network (CBioN) a Multi-Disciplinary and Multi-Institutional Research Effort across Canada

PC1.2 A. Bacq, F. Bourgois
Xylowatt, Charleroi, Belgium
B. Berger, H. Jeanmart
UCL-iMMC, Louvain-La-Neuve, Belgium
Experimental and Numerical Investigation of the Air Ratio on the Tar Content in the Syngas of a Two-Stage Gasifier

PC1.3 H. Lehmann, K. Müschen, U. Wachsmann, C. Vollmer
German Federal Environment Agency, Dessau, Germany
100% Renewable Energy Supply - A Challenge for the German Power Production by 2050

PC1.4 M. Karlsson
UPM-Kymmene Corporation, Helsinki, Finland
Production of Second Generation Biofuels (Biodiesel)

PC1.5 M. Bolhàr-Nordenkampf, A. Wojik, F. Gartnar, I. Tschanun, S. Kaiser
AE&E-Austria, Vienna, Austria
Combustion of Clean Biomass at high Steam Parameters of 540°C - Results from a New 120 Mwth Unit

VISUAL PRESENTATIONS VP T5.3-5.5

08:30 - 10:10

Detailed information on Session VP T5.3-5.5 is presented in the section entitled 'Visual Presentations'.

BREAK 10:10 - 10:40

ORAL PRESENTATION OC1

10:40 - 12:05 **Environmental and socio-economic aspects for biomass resources**

Chairpersons:

N. Sharma
ENEA, Rotondella, Italy

G. Jungmeier
Joanneum Research Centre, Graz, Austria

OC1.1 P. Maupu, N. Nguyen The
FCBA, Grenoble, France
B. Gabrielle
AgroParisTech, Paris, France
Life Cycle Analysis of Short Rotation Coppice

OC1.2 *invited*

OC1.3 D.N. Bird, D. Frieden, N. Pena, A. Tuerk,
S. Woess-Gallasch, G. Zanchi
Joanneum Research Centre, Graz, Austria
A. Cowie
National Centre for Rural Greenhouse Gas Research, Armidale, Australia
K. Pingoud
VTT Technical Research Centre of Finland, Espoo, Finland
Emissions from Bioenergy: Improved Accounting Options and New Policy Needs

OC1.4 N. Rensberg, J. Witt
German Biomass Research Centre, Leipzig, Germany
Sustainable Biomass Resources and Outlook on the European Pellet Market until 2020

OC1.5 S. Marsac, C. Jacquin, C. Bordet, M.L. Savoure
ARVALIS - Institut du végétal, Paris, France
F. Labalette
ONIDOL, Paris, France
Socio-Economical Aspects of the Straw Removal at the Farmer Level

ORAL PRESENTATION OC2

10:40 - 12:05 **Economics/environmental effects for solid biofuels production**

Chairpersons:

D. Baxter
European Commission, Joint Research Centre, Institute for Energy, Petten, The Netherlands

J. Dahl
Danish Technological Institute, Aarhus, Denmark

OC2.1 M. Virkkunen, J Raitila, M Flyktman, V-P Heiskanen
VTT Technical Research Centre of Finland, Jyväskylä, Finland
Forest Fuel Availability, Harvesting Costs and Economy of Wood Fired CHP in Europe in the Light of Case Studies in Poland, Czech Republic, France and Western Russia (2005-2009)

OC2.2 O. Rakitova
The National Bioenergy Union, Saint-Petersburg, Russian Federation
The Development of the Pellet Production in Russia

OC2.3 M.B. Missagia, N.S. Narra, K.H.J. Krautz, A.P. Ay
Brandenburg University of Technology, Cottbus, Germany
Characterization of Brazilian Agricultural Residues aiming the Production of Energy Pellets

OC2.4 M. Kujanpää, H. Wessman, T. Helin
VTT Research Centre of Finland, Espoo, Finland
M. Lindner, J. Eggers
European Forest Institute, Joensuu, Finland
Carbon Balance of Forest Residue Collection and Combustion

OC2.5 A. Chouchene, M. Jeguirim, G. Trouve
Université de Haute Alsace, Mulhouse, France
A. Favre Reguillon, G. Le Buzit
Conservatoire National des Arts et Métiers, Paris, France
Agropellets Production from the Impregnation of Olive Mill Wastewater on Sawdust for Industrial Thermal Application

ORAL PRESENTATION OC3

10:40 - 12:05 Sustainability criteria of biofuels

Chairpersons:

J. Pels
Energy Research Centre of Netherlands, Petten, The Netherlands

S. Yeh
University of California, USA

OC3.1 K. Koponen, S. Soimakallio
VTT Technical Research Centre of Finland, Espoo, Finland
E. Sipilä
Pöyry Management Consulting, Vantaa, Finland
Testing the European Union Sustainability Criteria for Biofuels - Case Study of Waste-Derived Ethanol

OC3.2 M. Bentele
Deutsches Pelletinstitut, Berlin, Germany
The Implementation of New European Pellet Norm (14961-2) by a Pellet Certification Scheme Called ENplus

OC3.3 K. Kwant, J. Veerkamp, E. Lammers, M. op den Coul
NL Agency, Utrecht, The Netherlands
Support Program for Sustainable Biomass Production and Certification

OC3.4 A. Mason
Inspectorate Interenational Ltd, Witham, United Kingdom
C. Morgan
C4REM, Fishguard, United Kingdom
I. Waller
FiveBarGate Consultants, Yarm, United Kingdom
Biomass Sustainability Criteria: Case Study in Sustainability Auditing for Power Generation

OC3.5 F. Cherubini, O. Michelsen, A.H. Strømman
Norwegian University of Science and Technology, Trondheim, Norway
Lca of Biorefinery Systems: Investigation of Environmental Impacts, C Stock Dynamics, Allocation Issues and Biodiversity Implications of a Norwegian Wood-Based Concept

VISUAL PRESENTATIONS VP T4.1-4.3

10:40 - 12:05

Detailed information on Session VP T4.1-4.3 is presented in the section entitled 'Visual Presentations'.

LUNCH BREAK 12:05 - 13:15

ORAL PRESENTATION OC4

13:15 - 14:40 Biomass resources from agricultural land

Chairpersons:

M. Christou
CRES - Centre for Renewable Energy Sources, Athens, Greece

L. Pari
CRA-ING, Monterotondo, Italy

OC4.1 J. Sánchez, B. Esteban, M. Checa, F. Mosquera, L. Romero, M.D. Curt, J. Fernández
Universidad Politécnica de Madrid, Spain
Software Application to Characterize the Spanish Agrarian Counties with Respect to their Productivity Potential of Lignocellulosic Biomass from Dedicated Energy Crops

OC4.2 T. Pham Thi Mai, T. Kurisu, K. Hanaki
The University of Tokyo, Japan
Environmental and Economic Potential of Rice Husk Use in Angiang Province, Vietnam

OC4.3 R. Slade, A. Bauen
Imperial College London, United Kingdom
The UK Bio-Energy Resource Base to 2050: Estimates, Assumptions, and Uncertainties

OC4.4 J. Ponitka, J. Kretzschmar, D. Thraen
German Biomass Research Centre, Leipzig, Germany
Can Biomass Production on Urban Brownfields be a Viable Concept?

OC4.5 J Koppejan
Procede Biomass BV, Enschede, The Netherlands
W. Elbersen
WUR-AFSG, Wageningen, The Netherlands
M. Meeusen
LEI, Den Haag, The Netherlands
P. Bindraban
ISRIC, Wageningen, The Netherlands
Availability of Local Biomass for Production of Electricity and Heat in the Netherlands in 2020

ORAL PRESENTATION OC5

13:15 - 14:40 Pellet production processes

Chairpersons:

S. Capaccioli
ETA-Florence Renewable Energies, Florence, Italy

N.N.

OC5.1 S. Narra, C. Glaser, P. Ay
Brandenburg University of Technology, Cottbus, Germany
H.-J. Gusovius
Leibniz Institute for Agricultural Engineering, Potsdam-Bornim, Germany
Pelletisation of Cereal Straws as a Source of Energy after Specific Comminution Processes

OC5.2 N.P.K. Nielsen
Danish Technological Institute, Taastrup, Denmark
D.J. Gardner
University of Maine, AEWC, Orono, USA
C. Felby
University of Copenhagen, Faculty of Life Sciences, Copenhagen, Denmark
Differences in Pelletizing Properties between a Number of Softwood and Hardwood Species

OC5.3 N. Weller, T. Zeng, V. Lenz
German Biomass Research Center, Leipzig, Germany
Combustion Behaviour of Straw Pellets and its Potential Optimisation by Fuel Improvement

OC5.4 I. Mediavilla, L.S. Esteban
CEDER-CIEMAT, Lubia (Soria), Spain
J.E. Carrasco
CIEMAT, Madrid, Spain
Optimisation of Pine Sawdust Pelletisation Conditions

OC5.5 J. Dahl, P. Daugbjerg-Jensen
Danish Technological Institute, Aarhus, Denmark
Large Scale Utilization of Biopellets for Energy Applications

ORAL PRESENTATION OC6

13:15 - 14:40 Sustainability criteria of biofuels

Chairpersons:

R.A. Diaz-Chavez
Imperial College London, United Kingdom

N. Bird
Joanneum Research, Graz, Austria

OC6.1 S. Haye
Ecole Polytechnique Fédérale de Lausanne, Switzerland
The Roundtable on Sustainable Biofuels: the Generic Sustainability Standard for Biofuels

OC6.2 M. Faist Emmenegger, J. Reinhard, R. Zah
Empa, Dübendorf, Switzerland
V. Junquera, M. Guiramand, A. Kopse
RSB, Lausanne, Switzerland
Extension of the Sqcb for Red Ghg Calculations

OC6.3 K.J. Hennenberg
Öko-Institut Institute for Applied Ecology, Darmstadt, Germany
R. Herrera
Öko-Institut - Institute for Applied Ecology, Darmstadt, Germany
Experiences from the Implementation of the European Renewable Energy Directive (RED) in Germany

OC6.4 M. Otto, J. Malavelle, J. Metzler, P. Leagnavar
United Nations Environment Programme, Paris, France
The Bioenergy and Water Nexus

OC6.5 W. Siemers
CUTEC-Institut GmbH, Clausthal-Zellerfeld, Germany
GHG Emissions for Bioethanol Production Based on Cassava in Thailand

VISUAL PRESENTATIONS VP T1.2

13:15 - 14:40

Detailed information on Session VP T1.2 is presented in the section entitled 'Visual Presentations'.

BREAK 14:40 - 15:00

ORAL PRESENTATION OC7

15:00 - 16:25 Biomass supply, analysis and logistics optimization

Chairpersons:

S. Capaccioli
ETA-Florence Renewable Energies, Florence, Italy

N.N.

OC7.1 S. Sokhansanj, T. Sowlati
University of British Columbia, Vancouver, Canada
Integrated Biomass Supply Analysis & Logistics

OC7.2 M. Svanberg
Chalmers University of Technology, Gothenburg, Sweden
A Review Of Supply Chains Of Forest Residues

OC7.3 *invited*

OC7.4 M. Cocchi, L. Corbella, A. Grassi
ETA-Florence Renewable Energies, Florence, Italy
T. Laitinen, A. Lehtomäki
Jyväskylä Innovation, Finland
P. Rechberger
European Biomass Association, Louvain-la-Neuve, Belgium
T. Lötjönen, K. Pahkala
Agrifood Research Finland, Jokioinen, Finland
S. Xiong, M. Finell
University of Agricultural Sciences, Umea, Sweden
M. Salve
ESCAN, Madrid, Spain
W. Gabauer
Universität für Bodenkultur Wien, Austria
D. Dörrie, M. Köttner
German Society for sustainable Biogas and Bioenergy Utilization, Kirchberg, Germany
Opportunities and Barriers of Energy Crops at European Level

OC7.5 O.-J. Korpinen, E. Jäppinen, T. Ranta
Lappeenranta University of Technology, Mikkeli, Finland
J. Saranen
Lappeenranta University of Technology, Kouvola, Finland
Evaluating the Suitability of Long-Distance Railway Transportation of Forest Fuels in Finnish Circumstances

ORAL PRESENTATION OC8

15:00 - 16:25 Alternative feedstocks for solid biofuel production

Chairpersons:

J. Witt
German Biomass Research Centre, Leipzig, Germany

N.N.

OC8.1 R. Wirkner, J. Witt
German Biomass Research Centre, Leipzig, Germany
Woody Biomass from Short Rotation Coppice - An Option for Sustainable Feedstock Supply

OC8.2 L. Pari, V. Civitarese, A. Del Giudice
Agricultural Engineering Research Unit CRA ING, Monterotondo, Roma, Italy
Comparing of Poplar Chips Quality Harvested with Different Methologies: Direct Harvesting-Chipping Versus Cutting-Whole Trees and Subsequent Drying-Chipping

OC8.3 J. Poustis
HEXABIO, Pessac, France
Relative Profitability of Short Rotation Crop Resources for Biofuels

OC8.4 T. Paappanen, T. Lindh, J. Kärki, R. Impola, R. Taipale, T. Leino
VTT Technical Research Centre of Finland, Jyväskylä, Finland
S. Rinne
YTY-Konsultointi, Jyväskylä, Finland
T. Lötjönen
MTT Agrifood Research Finland, Ruukki, Finland
A-M. Kirkkari
TTS Work Efficiency Institute, Rajamäki, Finland
The Development of Production and Use of Reed Canary Grass in Finland

OC8.5 K. Reisinger, H. Hartmann
Technology and Support Centre, Straubing, Germany
Rapid Determination of Moisture Content in Wood Logs

ORAL PRESENTATION OC9

15:00 - 16:25 European Union projects and strategies

Chairpersons:

P. Helm
WIP - Renewable Energies, Munich, Germany

N.N.

OC9.1 C. Vogel, M. Herr, A. Lermen
German Energy Agency, Berlin, Germany
First the Plan, then the Implementation - Different Ways of Reaching Res Targets on the Basis of Reaps

OC9.2 C. Panoutsou, A. Bauen
Imperial College London, United Kingdom
H. Bottcher, S. Leduc
IIASA, Laxenburg, Austria
E. Alexopoulou, J. Eleftheriadis
CRES, Athens, Greece
U. Fritsche
Oeko, Germany
A. Uslu
ECN, Amsterdam, The Netherlands
B. Elbersen, K. van Diepen
Alterra, Wageningen, The Netherlands
C. Bowyer, H. By
IEEP, London, United Kingdom
P. Capros
ICCS, Athens, Greece
The Biomass Futures Project

OC9.3 J. Leppälahti
Tekes, Finnish Funding Agency for Technology and Innovation, Helsinki, Finland
T. Mäkinen
VTT Technical Research Centre of Finland, Espoo, Finland
Finnish Biorefine - New Biomass Products Programme - R&D on Biofuels and Biorefineries in Finland

OC9.4 E. Assoumou, G. Guerassimoff
Mines ParisTech, Sophia Antipolis, Greece
N. Nguyen-The
FCBA, Montpellier, Greece
Prospective Analysis of Biomass Resources and Technology Roadmap for France: Results from the VALERBIO Project

OC9.5 V. Borroni
Rhônalpénergie-Environnement, Lyon, France
The Rhône-Alpes Region, a Territory in Europe and an Actor in the Development of Wood Energy

VISUAL PRESENTATIONS VP T5.1/5.2

15:00 - 16:25

Detailed information on Session VP T5.1/5.2 is presented in the section entitled 'Visual Presentations'.

BREAK 16:25 - 16:45

ORAL PRESENTATION OC10

16:45 - 18:10 Tools for optimization of biomass

Chairpersons:
T. Ranta
Lappeenranta University of Technology, Finland

C. Rantien
ADEME, Angers, France

OC10.1 D. da Silva Perez, A. Guillemain
FCBA, Grenoble, France
F. Labalette
GIE Arvalis-Onidol, Paris, France
Feasibility of Near Infrared Spectroscopy to Assess the Quality of Agricultural and Forestry Biomass

OC10.2 D. Jackowiak, D. Bassard, T. Ribeiro
Institut Polytechnique Lasalle Beauvais, France
M. Nonus, A. Pauss
Université de Technologie de Compiègne, France
Improvement of Agricultural or Agri-Food Wastes Conversion into Biogas by Ozonation Pretreatments

OC10.3 H. Zuo
Beijing Academy of Agriculture & Forestry Science, P.R. China
J. Wu
Beijing Center for Grass & Environment, P.R. China
V. Sardo
Studio Sardo, Catania, Italy
Grasses for Sustainable Bioenergy Production in Northern China

OC10.4 E. Jäppinen, O.-J. Korpinen, T. Ranta
Lappeenranta University of Technology, Mikkeli, Finland
GIS and LCA Methods Combined for more Efficient Biowaste Transportation

OC10.5 A. Baky, M. Forsberg, N. Jonsson, M. Sundberg
Swedish Institute of Agricultural and Environmental Engineering, Uppsala, Sweden
H. Rosenqvist
Billeberga, Sweden
Harvest and logistics from Small Cultivations of Short Rotation Willow Coppice

ORAL PRESENTATION OC11

16:45 - 18:10 Agro-environmental assessments

Chairpersons:
P. Pizziol
European Commission - JRC/IPSC/MARS, Ispra, Italy

K.J. Hennenberg
Oeko-Institut, Darmstadt, Germany

OC11.1 L. Benini, C. Torri
University of Bologna, Italy
Soil Organic Carbon Enrichment and Carbon Sequestration from Residual Biomass through Pyrolysis and Bio-Char Application to Soils: Preliminary Assessment in the Ravenna Province Countryside

OC11.2 A. Gathorne-Hardy, J. Mercier
Imperial College London, United Kingdom
Biochar Allows Biomass Crops to be Grown on Saline Soils

OC11.3 J. Kozyra, A. Faber, K. Mizak, M. Borzecka-Walker, R. Pudelko
Institute of Soil Science and Plant Cultivation-National Research Institute, Pulawy, Poland
Modelling Impact of Climate Change on Willow Potential Productivity in Poland

OC11.4 D. Bradley
Climate Change Solutions, Ottawa, Canada
B. Hektor
First Bioenergy AB, Stockholm, Sweden
P. Schouwenberg
Nidera, Rotterdam, The Netherlands
A Bio-Trade Equity Fund: a Solution for Renewable Energy Targets and Socioeconomic Development

OC11.5 R. Bright, A. H. Strømman
Norwegian University of Science and Technology, Trondheim, Norway
Life Cycle and Economic Assessment of Fischer-Tropsch Diesel Production and Short-Term Deployment Policy Scenarios In Norway

ORAL PRESENTATION OC12

16:45 - 18:10 National strategies for bioenergy

Chairpersons:
E. Manning
EUBIA, Brussels, Belgium

N.N.

OC12.1 *invited*

OC12.2 W. Ortinger, R. Schäfer
Bavarian Ministry of Food, Agriculture and Forestry, Munich, Germany
The 5B: Biomass in Bavaria: Bioresources, Bioenergy and Businesses

OC12.3 J. Mercier, A. Gathorne-Hardy
Imperial College London, United Kingdom
Why Such Differences between the French and British Agrofuel Policies?

OC12.4 G. Geletukha, T. Zheliezna
Institute of Engineering Thermophysics, NASU, Kiev, Ukraine
Bioenergy in Ukraine: State of the Art and Prospects for Development

OC12.5 I. Voda, M. Bedreaga, A. Igant
Institute for Studies and Power Engineering, Bucharest, Romania
Biomass Role in the Romanian Energy Policy

VISUAL PRESENTATIONS VP T1.1

16:45 - 18:10

Detailed information on Session VP T1.1 is presented in the section entitled 'Visual Presentations'.

THURSDAY, 6 MAY 2010

PLENARY SESSION PD1

08:30 - 09:30

Chairpersons:

K. Kwant
NL Agency, Utrecht, The Netherlands

R. Bain *(i)*
Renewable Energy Laboratory, USA

PD1.1 *invited*

PD1.2 M. Christou, I. Eleftheriadis, I. Namatov
Center for Renewable Energy Sources, Pikermi, Greece
Availability and Cost of Resources; Technical and Logistical Issues; Environmental Impact

PD1.3 C. Rösch, J. Jörissen, M. Knapp
Karlsruhe Institute of Technology (KIT), Germany
Strategies to Reduce Land Use Competition and Increasing the Share of Biomass in the German Energy Supply

VISUAL PRESENTATIONS VP T3.2/3.5

08:30 - 09:30

Detailed information on Session VP T3.2/3.5 is presented in the section entitled 'Visual Presentations'.

BREAK 09:30 - 10:00

PLENARY SESSION PD2

10:00 - 12:00

Chairpersons:

G.F. De Santi
DG JRC - European Commission, Ispra, Italy

R. Liberali
DG RTD - European Commission, Brussels, Belgium

PD2.1 *invited*

PD2.2 K. Neumann
Borregaard Ind. Ltd., Sarpsborg, Norway
Creating Value from Wood - A Working Biorefinery

PD2.3 M. Braun-Unkhoff, P. Le Clercq, M. Aigner
German Aerospace Center, Stuttgart, Germany
A Review on the Possible Use of Alternative Fuels in Aviation

PD2.4 S. Yeh, P. Tittmann
University of California, Davis, USA
Implementing Performance-Based Sustainability Requirements for the Low Carbon Fuel Standard

PD2.5 G.F. De Santi
DG JRC - European Commission, Ispra, Italy
R. Liberali
DG RTD - European Commission, Brussels, Belgium
European Initiatives in the Frame of the Strategic Energy Technology Plan (SET-Plan)

VISUAL PRESENTATIONS VP T1.3

10:00 - 12:00

Detailed information on Session VP T1.3 is presented in the section entitled 'Visual Presentations'.

LUNCH BREAK 12:00 - 13:15

ORAL PRESENTATION OD1

13:15 - 14:40 New plants and equipment for biomass

Chairpersons:
J. Kiel
Energy Research Centre of Netherlands, Petten, The Netherlands

F.X.J. Johnson
Stockholm Environment Institute, Sweden

OD1.1 P. Perez, R. Barro, L. S. Esteban, J. E. Carrasco
Centro de Investigaciones Energéticas, Medioambientales y Tecnològicas, Lubia, Soria, Spain
Storage Effect on the Energy Properties of Brassica Napus Straw

OD1.2 P.P. Konstantakou, V.G. Papadakis
University of Ioannina, Agrinio, Greece
An Integrated Management and Exploitation of Agricultural Residues - Application to Olive Tree Lop

OD1.3 W. Yan, T. Acharjee, M. Reza, C. Coronella, V. Vasquez
University of Nevada, Reno, USA
Mass and Energy Balances for Wet Torrefaction of Lignocellulosic Biomass

OD1.4 H. Jeanmart
Université Catholique de Louvain, Louvain-la-Neuve, Belgium
N. Parmentier
Université catholique de Louvain, Louvain-la-Neuve, Belgium
F. Bourgois, M. Haube
Xylowatt, Charleroi, Belgium
Study of Air Convection Biomass Dryer for Biomass Gasification-Based Cogeneration Plant

OD1.5 E. Steinbeis, H. Roeder
Pöyry Forest Industry Consulting, Freising, Germany
M. Veringa-Niemela
Pöyry Industry Chemical Process Industry, Helsinki, Finland
G. Murray
Pöyry Montreal, Canada
Biomass Sourcing and Logistics: from Theory to Practice

ORAL PRESENTATION OD2

13:15 - 14:40 Biofuels from sugars and starch

Chairpersons:
M. Cocchi
ETA-Florence Renewable Energies, Florence, Italy

F. Labalette *(i)*
ONIDOL, Paris, France

OD2.1 T. Senn
Universität Hohenheim, Stuttgart, Germany
Sustainable Ethanol Production in Regional Plants from Grain

OD2.2 *invited*

OD2.3 J. Tolmie
Kings College London, London, United Kingdom
K. Maniatis, J. Tondeur
European Commission DG TREN, Brussels, Belgium
R. Vierhout, G. Gaupmann
European Bioethanol Fuel Association-eBio, Brussels, Belgium
A. O'Connell
European Biodiesel Board-EBB, Brussels, Belgium

N. Komioti, K. Georgakopulos
EXERGIA, Athens, Greece
L. Tomozei
Confederation of the Food & Drink Industries, Belgium
The BIOMAP - A Powerful Information & Dissemination Tool for Biofuels

OD2.4 *invited*

OD2.5 H. Brüschke
GFT Membrane Systems, Homburg, Germany
M. Heckmann
ACS/VAC ACS Agrochemische Systeme, Hamburg, Germany
M. Weyd
Hermsdorfer Institut für Technische Keramik, Germany
S. Jakob
FIMA Maschinenbau, Obersontheim, Germany
Technical and Economic Comparison of Distillation / Dehydration Concepts for Bioalcohol / Water Mixtures

ORAL PRESENTATION OD3

13:15 - 14:40 Security of biomass supply

Chairpersons:
D. Rutz
WIP - Renewable Energies, Munich, Germany

J. Domac *(i)*
North-West Croatia Energy Agency, Croatia

OD3.1 L. Pelkmans, D. Cuypers
VITO, Mol, Belgium
D.R. Bradley
Climate Change Solutions, Ottawa, Ontario, Canada
Future Deployment of Cellulose Based Biofuels: Effect on Worldwide Trade

OD3.2 M.W. Deutmeyer
CHOREN Biomass, Hamburg, Germany
Securing Reliable Long Term Solid Biomass Supply for Large Scale Users

OD3.3 J.E.J. Dakhorst, H.J.M.B. Pauwels, O.C. Costenoble
NEN, Delft, The Netherlands
M. Roks
TU Eindhoven, The Netherlands
Towards a Global System for Certified Sustainably Produced Biomass for Energy Applications

OD3.4 P. Thornley, P. Upham
University of Manchester, United Kingdom
J. Tomei
University College London, United Kingdom
R. Diaz-Chavez
Imperial College London, United Kingdom
Stakeholder Priorities for Safeguarding Sustainability of Bioenergy Systems: Perspectives from the UK

OD3.5 S. Meyer
Ecofys Germany, Cologne, Germany
J. van de Staaij
Ecofys Netherlands BV, Utrecht, The Netherlands
Responsible Cultivation Areas for Sustainable Bioenergy Feedstock Production

VISUAL PRESENTATIONS VP T3.3

13:15 - 14:40

Detailed information on Session VP T3.3 is presented in the section entitled 'Visual Presentations'.

BREAK 14:40 - 15:00

ORAL PRESENTATION OD4

15:00 - 16:25 Research on energy crops and algae

Chairpersons:
J.-F. Dallemand
European Commission, Joint Research Centre, Institute for Energy, Ispra, Italy

G. Facciotto
Consiglio per la Ricerca e la Sperimentazione, Casale Monferrato, Italy

OD4.1 W. Zegada-Lizarazu, A. Zatta, D. Matteucci, L. Barbanti, A. Monti
University of Bologna, Italy
Rooting Characteristics and Aboveground Biomass Development of Sweet Sorghum and Ethanol Maize under Water Deficit

OD4.2 D. Rutz, R. Janssen
WIP - Renewable Energies, Munich, Germany
S. Braconnier
Centre International en Recherche Agronomique pou, France
B. Reddy, S. Rao
International Crops Research Institute for Semi A, India

R. Schaffert, R. Parella
Empresa Brasileira de Pesquisa Agropecuaria, Brazil
A. Zaccharias
KWS SAAT, Germany
N. Rettenmaier, G. Reinhardt
Institut fuer Energie und Umweltforschung, Germany
A. Monti
University of Bologna, Italy
S. Amaducci, A. Marocco
Università Cattolica del Sacro Cuore, Italy
W. Snijman
Agricultural Research Council, South Africa
H. Terblanche, F. Zavala-Garcia
Universidad Autónoma de Nuevo León, Mexico
Sweet Sorghum - An Alternative Energy Crop

OD4.3 M.D. Curt, M. Sanz, P.L. Aguado, J. Fernández
Universidad Politécnica de Madrid, Spain
Performance of Cardoon Oilseed Cake in Soil Blends as Organic Fertilizer

OD4.4 L. Nikolaisen, K.S. Bech
Danish Technological Institute, Aarhus, Denmark
J. Dahl
Danish Technological Institute, Taastrup, Denmark
A. Bruhn, M.B. Rasmussen
National Environmental Research Institute, Silkeborg, Denmark
A.B. Thomsen, H.B. Nielsen
Risø DTU, Biosystems Division, Roskilde, Denmark
B. Sander
DONG Energy, Fredericia, Denmark
Energy Production from Sea Lettuce (Ulva Lactuca)

OD4.5 C. De Pace, F. Rossini, S. Del Puglia, D. Vittori
University of Tuscia, Viterbo, Italy
New Clones of Helianthus Tuberosus Enlarge Options for the Sustainable Integration of Bioenergy Crops in Current Farming Systems of Central Italy

ORAL PRESENTATION OD5

15:00 - 16:25 **Second generation biofuel production via biological processing**

Chairpersons:

J. Lindstedt
SEKAB E-Technology, Örnsköldsvik, Sweden

M. Ballesteros *(i)*
CIEMAT, Madrid, Spain

OD5.1 A. Johansson, K. Sipilä
Technical Research Centre of Finland, Espoo, Finland
A. Leponiemi
AALTO, Espoo, Finland
A Flexible Process for the Production of Ethanol, Biogas and Fibre from Annual Plants

OD5.2 F. Martel
PROCETHOL 2G, Pomacle, France
The Futurol Project: Second Generation Bioethanol French R&D Project

OD5.3 D. Chiaramonti
CREAR, Florence, Italy
A. Giovannini, A. Frattini, L. Oriani
Mossi&Ghisolfi/Chemtex, Tortona, Italy
Industrial Demonstration of Second Generation Bioethanol Production in Italy: the Biolyfe Project

OD5.4 J. Carvell, S. Taylor
Aber Instruments, Abersytwyth, United Kingdom
J. Gallagher, M. Morris
Ibers, Abersytwyth, United Kingdom
Using Dielectric Spectroscopy to Monitor in Real Time the Concentration of Micro-Organisms and the Enzymic Conversion of Biomass

OD5.5 D. Douay
INEOS Bio, Lyndhurst, United Kingdom
Biomass Based Advanced Bio-Fuels: Ineos Bio European Feasibility Study

ORAL PRESENTATION OD6

15:00 - 16:25 Biomass fuels for heat and CHP

Chairpersons:

D. Asplund
BENET Oy, Jyväskylä, Finland

G. Geletukha
Institute of Engineering Thermophysics, Kiev, Ukraine

OD6.1 E. Alakangas, P. Vesterinen
VTT, Jyväskylä, Finland
Prospects of Bioenergy in New Industrial Sectors

OD6.2 G. Thek, T. Brunner, I. Obernberger
Graz University of Technology, Austria
Externally with Biomass and Internally with Natural Gas Fired Micro Gas Turbine - System, Furnace and High Temperature Heat Exchanger Design as well as Performace Data from First Test Runs

OD6.3 T. Decker, K. Menrad, M. Zapilko
University of Applied Sciences Weihenstephan, Straubing, Germany
Buying Behaviour Related to Heating Systems in Germany

OD6.4 M. Kimming, C. Sundberg, Å. Nordberg, S. Bernesson, P.-A. Hansson
Swedish University of Agricultural Sciences, Uppsala, Sweden
A. Baky, O. Norén
JTI, Uppsala, Sweden
Life Cycle Assessment of a Straw-Based System for Self-Supply in Energy for an Organic Farm

OD6.5 M. Thomson, T. Tzanetakis, N. Farra, S. Moloodi, A. McGrath
University of Toronto, Canada
Spray Combustion Characteristics and Emissions of Fast Pyrolysis Oil (Bio-Oil)

VISUAL PRESENTATIONS VP T5.6/5.7

15:00 - 16:25

Detailed information on Session VP T5.6/5.7 is presented in the section entitled 'Visual Presentations'.

BREAK 16:25 - 16:45

ORAL PRESENTATION OD7

16:45 - 18:10 Research on energy crops

Chairpersons:
G. Venturi
University of Bologna, Italy

N.N.

OD7.1 L. Pari, V. Civitarese
Agricultural Engineering Research Unit CRA ING, Monterotondo - Roma, Italy
Developing of a Self-Propelled Prototype to Harvest Different Kinds of Ligneo-Cellulose Biomass

OD7.2 B. Formowitz
Technology and Support Centre (TFZ), Straubing, Germany
Biogas Digestates as Organic Fertilizer in Different Crop Rotations

OD7.3 S. Lanteri, E. Portis
University of Torino, Italy
A.M.G. Longo, R. Mauro, G. Mauromicale
University of Catania, Italy
Exploitability of Cynara Cardunculus L. for Biomass and Biodiesel Production in Mediterranean Environment

OD7.4 S. Soylu, B. Sade, H. Ögüt, F. Akinerdem, M. Babaoglu, R. Ada, T. Eryilmaz, Ö. Öztürk, H. Oguz
Selcuk University, Konya, Turkey
Investigation of Agronomic Potential of Switchgrass (Panicum Virgatum L.) as an Alternative Biofuel and Biomass Crop for Turkey

OD7.5 E. Alexopoulou, M. Christou
CRES, Pikermi Attikis, Greece
S. L. Cosentino
UNICT, Catania, Italy
R. Kozlowski
INFMP, Poznan, Poland
Future Non-Food Crops (Fuel and Fibre) in EU27: Yields and Raw Material Characteristics

ORAL PRESENTATION OD8

16:45 - 18:10 **Second generation biofuel production via thermochemical processing**

Chairpersons:

V. Pignatelli *(i)*
ENEA, Rome, Italy

M. Wörgetter *(i)*
BLT, Wieselburg, Austria

OD8.1 T. Marker, L. Felix, M. Linck, M. Roberts
Gas Technology Institute, Des Plaines, USA
The Production of Fungible Fuels from Biomass Via Integrated Hydropyrolysis and Hydroconversion (IH2)

OD8.2 G. Fogassy, G. Toussaint, Y. Schuurman, C. Geantet, C. Mirodatos
CNRS-UCBL, Villeurbanne Cédex, France
Pyrolysis-O Ils in Refinery Operations: Second Generation Biofuel Production in FCC and HDT Units

OD8.3 F. Basile, A. Albertazzi, D. Barbera, P. Benito, G. Fornasari, F. Trifirò, A. Vaccari
University of Bologna, Italy
J. Brandin
University of Vaxjo, Sweden
Syngas from Woody and Herbaceous Biomasses: Reforming Tests Downstream a Cfb Gasifier in the Chrisgas Project

OD8.4 D. Kazemekas, G. Tusel
ACS Agrochemische Systeme, Hamburg, Germany
M. Andreae-Jäckering
Altenburger Maschinen Jäckering, Hamm, Germany
MDM - The Modified Dry Milling Process - Economic and Sustainable Production of Food; Fodder and Bioalcohol by Multiproduct Conversion of Wheat

OD8.5 C. Chirat, D. Lachenal, L. Boiron, G. Pipon
Grenoble INP - Pagora, Saint-Martin d'Hères Cedex, France
J.A. Lloyd, I. Suckling
Scion, New Zealand Forest Research Institute, Rotorua, New Zealand
Hemicellulose Extraction from Softwood Chips for Bio-Ethanol Production in a Cellulosic Fibre Production Mill

ORAL PRESENTATION OD9

16:45 - 18:10 **Biomass fuels in the electricity sector**

Chairpersons:
P. Thornley
University of Manchester, United Kingdom

B. Krautkremer
IWES, Kassel, Germany

OD9.1 L. van de Beld, J. Vos, J. Florijn
BTG Biomass Technology Group, Enschede, The Netherlands
A. Kronberg, M. Glouchenkov, M. Sprenkeler
Encontech BV, Enschede, The Netherlands
D. Chiaramonti, A.M. Rizzo
University of Florence, Italy
V.A. Kirillov
Boreskov Institute of Catalysis, Novosibirsk, Russian Federation
N.A. Khripach, L. Lezhnev, B. Papkin
Central Scientific Research Automobile and Automotive Engine Institute, Moscow, Russian Federation

A.V. Bridgwater, A. Alcala, E. Wylde
Aston University, Birmingham, United Kingdom
S. Silin
AMO ZIL, Moscow, Russian Federation
Using Biomass-Based Fuels Including Pyrolysis Liquids for Power and Chp Production

OD9.2 K. Thuneke, P. Emberger
Technology & Support Centre of Renewable Raw Materials, Straubing, Germany
Pure Vegetable Oil Fuels for CHP - Technical, Economical and Sustainability Aspects under German Conditions

OD9.3 A.C. Almeida, J.H.A. Monteiro, B.R.P. Rocha
UFPA - Universidade Federal do Para, Belem-PA, Brazil
Electrification of an Isolated Amazonian Community Using Biomass Resources: a Case Study

OD9.4 M. Benmarraze, S. Benmarraze, M. Lefort, E. Robin
Solar Euromed, Genlis, France
Albanova Project: Solar Thermal Technologie Hybridization with Biomass Combustion

OD9.5 S. Cattaneo
Merloni Progetti, Milano, Italy
E. Cremonesi
Liquitech, Milano, Italy
Biogas Production Plant Based on Anaerobic Digestion of Zootechnical Biomasses

VISUAL PRESENTATIONS VP T3.4

16:45 - 18:10

Detailed information on Session VP T3.4 is presented in the section entitled 'Visual Presentations'.

FRIDAY, 7 MAY 2010

ORAL PRESENTATION OE1

08:30 - 09:55 **Research on energy crops and algae**

Chairpersons:

S. Kyritsis
Agricultural University of Athens, Greece

M.D. Curt
Universidad Politécnica de Madrid, Spain

OE1.1 C. Demay, S. Cadoux, H. Boizard
INRA, Peronne, France
C. Dürr
INRA, Angers, France
The Effects of Temperature and Water Potential on the Emergence of Miscanthus and the Germination of Switchgrass

OE1.2 N. Di Virgilio, A. Monti
University of Bologna, Italy
S. Fazio
Bologna, Italy
A.L. Fernando
Universitade Nova de Lisboa, Caparica, Portugal
A New Methodological Study to Allocate Energy Crops at Different Scale Levels: a Multidirectional Approach

OE1.3 M. J. Fernández, R. Barro, P Ciria, J. Losada, J. Pérez, J. E. Carrasco
Centro de Investigaciones Energéticas Medioambientales y Tecnológicas (CIEMAT), Lubia, Soria, Spain
Quality of the Biomass Produced in a Poplar Energy as a Function of Type of Clone, Fertilization and Harvest Alternative

OE1.4 L. Garcia Alba, J. de Weerdt, A.M. Verschoor, D.W.F. Brilman
University of Twente, Enschede, The Netherlands
Energy from Algae: Growth Optimization and Algae-to-Fuel Conversion Routes

OE1.5 G. Facciotto, L. Vietto, S. Bergante, L. Rosso
CRA-PLF, Casale Monferrato, Italy
J. Rakestraw
Forest Research & Technology International Paper, Bainbridge, GA, USA
SRC Poplar Clonal Trials in Poland and Italy

ORAL PRESENTATION OE2

08:30 - 09:55 **Liquid biofuels from oilseeds. Innovative production towards technical and environmental performance**

Chairpersons:

L. Pelkmans
VITO, Belgium

J. Saddler *(i)*
University of British Columbia, Vancouver, Canada

OE2.1 C. Guillot
FRCuma Rhone-Alpes, Saint-Genis-Laval, France
P. Pickel
John Deere Werke Mannheim, Germany
2ndvegoil-Demonstration of 2nd Generation Vegetable Oil Fuels in Advanced Engines

OE2.2 A. Piccirilli, J. Magne, J. Barbier
Valagro Carbone Renouvelable, Poitiers, France
J.P. Esterez
Bionergy Pilot, La Rochelle, France
Biodiesel Esters from Direct Transesterification of Oilseeds: from the Lab-scale Research to Industrial Plant

OE2.3 R Bailis, J Baka
Yale University, New Haven, USA
Greenhouse Gas Emissions of Jatropha-Based Jet Fuel Production

OE2.4 M. Laihanen, E. Jäppinen, T. Ranta
Lappeenranta University of Technology, Mikkeli, Finland
Biodiesel Greenhouse Gas and Energy Balances in Farm Scale Production

OE2.5 N. Castan
EPPOA, Foulayronnes, France
Virgin Oil Liquid Fuel (Volf) + a Full Harmless Chance for Europe

ORAL PRESENTATION OE3

08:30 - 09:55 Impacts of bioenergy policies on food and land

Chairpersons:

A. Walter
University of Campinas, Brazil

J. Woods *(i)*
Imperial College London, United Kingdom

OE3.1 R. Janssen, D. Rutz
WIP - Renewable Energies, Munich, Germany
R. Diaz-Chavez, J. Woods
Imperial College London, United Kingdom
E. Manning
EUBIA, Brussels, Belgium
Bioenergy Policies for Sustainable Development in Africa

OE3.2 B. Bersonnet
Chambre d'Agriculture, Chambray Les Tours, France
L. Lemesle, F. Froissard
ETL, Saint Cyr Sur Loire, France
Ecological Impact of Miscanthus Giganteus and Panicum Virgatum in Indre-Et-Loire County Fr. through Carabidaes

OE3.3 A. Bogdanski, O. Dubois
FAO, Rome, Italy
Introducing Integrated Food Energy Systems and their Challenges for Small-Scale Bioenergy Development

OE3.4 A. Kavallari, S. H. Gay
European Commission, Seville, Spain
EU's Biofuel Policies: What are the Effects on Agricultural Markets?

OE3.5 A. Gathorne-Hardy, J. Mercier
Imperial College London, United Kingdom
A Land Use Optimisation Model for Bread, Biomass, Biochar and Biodiversity

BREAK 09:55 - 10:25

ORAL PRESENTATION OE4

10:25 - 12:00 Research on energy crops

Chairpersons:

T. Richards *(i)*
Chalmers University of Technology, Gothenburg, Sweden

N.N.

OE4.1 M. Di Candilo, E. Ceotto
CRA-CIN, Bologna, Italy
Effect of Propagation Techniques on Crop Establishment of Giant Reed (Arundo Donax L.)

OE4.2 N. Nguyen Thé, F. Melun, D. da Silva Perez
FCBA, Grenoble, France
A. Bouvet
FCBA, Paris, France
Evaluation of the Biomass Production Potential, Mineral Export and the Quality of Wood Chips of Eucalyptus in a Perspective of Culture in Vsrc

OE4.3 C. Leonhartsberger, A. Bauer, T. Amon
BOKU University, Vienna, Austria
R. Krebs, H. Harling
KWS Saat, Einbeck, Germany
Optimisation of Energy Crop Production under Dry Climatic Conditions

OE4.4 S. Cadoux, H. Boizard, M. Preudhomme
INRA, Peronne Cedex, France
S. Marsac, S. Briand, M.L. Savoure
GIE Arvalis Onidol, Toulouse, France
F. Labalette, I. Felix
GIE Arvalis Onidol, Paris, France
A. Besnard
GIE Arvalis Onidol, Poitiers, France
Biomass Productivity of Different Energy Crops under French Conditions. Results of the Regix Experimental Network

OE4.5 S.V. Archontoulis, P.C. Struik
Wageningen University, The Netherlands
N.G. Danalatos, D. Barzogiannis, V. Savvas
University of Thessaly, Volos, Greece
The Effect of Nitrogen Fertilization and Supplemental Irrigation on Seed and Biomass Productivity of Cynara Cardunculus Growing in a Semi-Arid Environment in Central Greece

ORAL PRESENTATION OE5

10:25 - 12:00 Gaseous biofuels

Chairpersons:

F. Vogel
Paul Scherrer Institut, Villigen, Switzerland

E. Scoditti
ENEA, Rome, Italy

OE5.1 M.H. Rafiq, F. Owrang, J.E. Hustad
Norwegian University of Science and Technology, Trondheim, Norway
Catalytic Partial Oxidation of Model Biogas using Plasma Assisted GlidArc Reactor

OE5.2 T. Mayer, M. Url, H. Hofbauer
Vienna University of Technology, Austria
A Novel Process for Biogas Upgrading

OE5.3 *invited*

OE5.4 R.W.R. Zwart, A. van der Drift, B.J. Vreugdenhil, L.P.J. Bleijendaal
Energy Reseach Centre of Netherlands, Petten, The Netherlands
Comparing the Options to Produce Sng from Biomass

OE5.5 M. Brandenberger, J. Matzenberger, F. Vogel, C. Ludwig
Paul Scherrer Institut, Villigen, Switzerland
Sunchem - Techno-Economic Analysis of the Hydrothermal Conversion of Algae to Bio-Methane

ORAL PRESENTATION OE6

10:25 - 12:00 Biomass in developing countries and emerging economies

Chairpersons:

R. Janssen
WIP - Renewable Energies, Munich, Germany

C. Panoutsou
Imperial College London, United Kingdom

OE6.1 G. Grassi
EUBIA, Brussels, Belgium
Large-Scale Utilisation of Refined (Torrified) Biomasses for Cofiring and Synthetic Liquid Biofuels Production for Expanding Solid Biofuels Trading

OE6.2 A. Perimenis, J. Giersdorf, F. Mueller-Langer
German Biomass Research Centre, Leipzig, Germany
T. Breuer
German Technical Cooperation, Eschborn, Germany
Outlook for Sustainable Production of Future Generation Biofuels in Developing Countries

OE6.3 R. Diaz-Chavez, J. Woods
Imperial College London, United Kingdom
R. Janssen, D. Rutz
WIP - Renewable Energies, Munich, Germany
Sustainability of Bioenergy Crops Production and Use in Developing Countries

OE6.4 Y. Voytenko
Central European University, Budapest, Hungary
A. Israilava, P. C. Peck
IIIEE, Lund, Sweden
External Influences on Bioenergy Industries in Transition Economies

OE6.5 J.W.A. Langeveld
Biomass Research, Wageningen, The Netherlands
J. Dixon
ACIAR, Canberra, Australia
J.J. Jaworski
Canada
Perspectives of Biofuels and Biobased Products for Agricultural Populations in Developing Countries: a Review

12:00 CLOSING SESSION

Chairperson:
Prof. Josef Spitzer
Joanneum Research Austria
Chairman of IEA Bioenergy Implementing Agreement

Highlights of the Conference
The Conference Technical Programme Chair summarizes highlights of the Conference week

Award Ceremony for best Visual Presentations
The best Visual Presentations within all topics of the Conference will be presented and awarded

Concluding Addresses
Highranking personalities for the Biomass community conclude the Conference week

2010 EUBIA Award Ceremony
Laudatio for the EUBIA Award Winner
Honorary Lecture by the EUBIA Award Winner

Farewell by the Host Country

Official Closing of the Conference

Please visit the Conference website for the latest information about the Conference Closing Event.