INER-F0953 **INER-F0953**

出國報告（出國類別：其他）

赴大陸參加 IFC 2015 與發表論文出國報告

服務機關：核能研究所
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派赴國家：大陸
出國期間：104 年 6 月 6 日~104 年 6 月 11 日
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摘　要

為推動國家減碳政策，政府積極建構低碳能源發展藍圖；鑑於有效掌握國際潔淨能源議題，本次公差主要係赴大陸參加 The 7th International Freiberg Conference on IGCC & XtL Technologies (IFC 2015)，並發表會議論文。

IFC 2015 是由德國 TU Freiberg 主辦，主題涵蓋煤轉換技術、氣化技術、合成氣處置、二氧化碳捕獲等，尤其強調國際合作。本案之心得及建議簡要說明如下：大會主題契合**核研所科專計畫主要內容**，對實現永續發展將發揮著重要作用，為掌握低碳能源發展最新研發現況之重要場合；**氣化技術**與**煤轉換技術**議題可謂是大會的重點項目，**有望成為未來永續能源轉換的重要技術平台**，顯示**本所淨碳技術開發計畫符合國際主流趨勢**，值得推動；大會主題為淨煤技術之重點研究範疇，具備未來性與競爭力；本所**應積極參與**後續活動。

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摘　要

一、目　的

為推動國家減碳政策，政府積極建構低碳能源發展藍圖；同時，透過國際共同研發，引進淨煤技術及發展碳捕捉與封存，降低國內能源系統的碳排放。核能研究所（以下稱本所）目前亦積極進行能源國家型科技計畫領域之「淨碳技術發展」研究計畫，冀望從永續發展觀點推動自主性潔淨能源技術之建立。有鑑於為有效掌握國際潔淨能源議題，本次公差主要係赴大陸參加 The 7th International Freiberg Conference on IGCC & XtL Technologies (IFC 2015)，並發表會議論文。

IFC 2015 是由德國弗萊貝格工業大學 (TU Bergakademie Freiberg) 主導，澳洲 CSIRO 與大陸 Synfuels China 等產煤大國協助舉辦之淨煤技術領域國際盛會，第七屆大會於 2015 年 6 月 6 日至 11 日於大陸內蒙古自治區呼和浩特市 (Huhhot, Inner Mongolia) 舉行；會議主題涵蓋煤轉換技術、氣化技術、合成氣處置、二氧化碳捕獲等多項主題，為掌握低碳能源發展最新研發現況之重要場合。依據大會資料，參與今年 IFC 2015 大會者共計有來自全世界多國在低碳潔淨能源、淨煤技術等重點研究領域之學者、專家超過 160 人，顯見會議之國際參與性。

本所目前正積極進行「淨碳技術發展」相關研究計畫，本年度計畫成果論文 “**Comparison of iron-, nickel- and copper-based oxygen carriers for chemical-looping combustion**” 已被 IFC 2015 大會接受。故派員參與會議，發表論文，並與國際學者專家討論、分享核研所近年來在淨碳技術的研究成果；藉以掌握國際間化石燃料之使用、燃燒與氣化、氣體淨化以及煤炭轉化技術之發展與趨勢，拓展與國際學者專家之關係及國際合作。

另外，經由與國際研究人員交流，可望拓展與各國能源學者專家之人脈及國際合作。故本所此次派員赴大陸公差乃為拓展國際人脈、推動國際合作及實務驗證專業工程技術之甚佳機會。

二、過　程

（一）公差行程

本次公差自民國 104 年 6 月 6 日至 6 月 11 日止，共計 6 天 (圖 II-0)。

06 月 06 日(星期六)　自台灣桃園機場 (TPE) 出發，抵達呼和浩特市 (Huhhot) 機場

06 月 07 日(星期日) ～ 06 月 10 日(星期三)　停留呼和浩特
辦理會議註冊，出席第 7 屆 IFC 國際會議 (International Freiberg Conference on IGCC & XtL Technologies)，發表論文、技術參訪

06 月 11 日(星期四)　呼和浩特市 (Huhhot) 機場搭機，返回台灣

（二）第 7 屆淨煤技術國際研討會議 (The 7th International Freiberg Conference on IGCC & XtL Technologies, IFC 2015)

IFC 是由德國弗萊貝格工業大學 (TU Freiberg) 主辦，為淨煤技術領域國際盛會，第七屆大會於 2015 年 6 月 7 日至 11 日於大陸內蒙古自治區呼和浩特市 (Huhhot, Inner Mongolia) 舉行 (圖 II-1)；會議主題涵蓋煤轉換技術、氣化技術、合成氣處置、二氧化碳捕獲等多項主題。今年 IFC 2015 大會共計有來自全世界多國家在低碳潔淨能源、淨煤技術等重點研究領域之學者、專家超過 160 人參與；其中 60% 來自海外地區，顯見會議之國際參與特性。

IFC 2015 之議程如表 II-1 所示，會議自 6 月 7 日（星期日）開始註冊，並於當天晚上舉行歡迎茶會。在星期一早上舉行開幕典禮，隨後進行全體會議 (Plenary Session) 之開幕演講；另外，安排兩場 Keynote 演講。其他時段則為口頭論文發表場次，上、下午各分為兩個時段，同時各有三個平行場次之口頭論文發表。壁報論文則自星期一早上 8:00 起開始展示，到星期二下午 - 16:00。而閉幕典禮安排在星期二下午，當天傍晚則安排前往大召寺古蹟參訪。

大會涵蓋的技術領域列舉如下：

1. Fundamentals of coal conversion (e.g. characterisation, reaction kinetics),
2. Mineral matter characterisation and behaviour,
3. Fuel preparation and upgrading (e.g. drying, feeding and deashing),
4. Low temperature conversion processes (e.g. extraction, torrefaction and pyrolysis),
5. Upgrading of low-temperature conversion products (e.g. tar reforming),
6. Gasification technology: status/development/co-gasification (for solid, liquid and gaseous feedstock),
7. Synthesis gas treatment: status/development,
8. Carbon dioxide capture, storage and utilisation,
9. Synthesis technologies and synthesis gas applications: status/development,
10. Combined cycle and gas turbine developments for IGCC and polygeneration,
11. Entire concept evaluations,
12. Integration of coal and renewables for chemical storage,
13. Numerical modelling of high-temperature conversion processes,
14. Coke production,
15. Direct liquefaction of coal,
16. Underground coal gasification,
17. Potential of global coal reserves for energetic and/or non-energetic chemical utilisation,
18. Public acceptance, trends and global boundary conditions (economic, regulatory and political) for fuel conversion to chemicals, transportation fuels and electricity.

筆者在大陸的公差行程於 6 月 10 日告一段落，次日即自呼和浩特市 (Huhhot) 機場搭機返回台灣，結束本次公差行程。

§II　有關 2015 CN 公差行程之圖表

表 II-1：IFC 2015 之議程

Sunday 7 June 2015			
18:00 – 20:00	Registration		
18:00 – 20:00	Welcome Evening, Shangri-La Hotel, Huhhot		

Monday 8 June 2015			
09:00 – 17:10	Registration, Posters and Exhibition		
09:00 – 09:10	Opening Ceremony: Bernd Meyer		
09:10 – 10:10	Plenary Session		
10:10 – 11:00	Coffee Break + Poster Session		
11:00 – 12:20	Session 1: Global status CtX	Session 2: Mineral matter I	Session 3: Fuel preparation & upgrading
12:20 – 13:20	Lunch		
13:20 – 14:40	Session 4: Syngas treatment	Session 5: Reactor simulation	Session 6: Tar upgrading
14:40 – 15:10	Coffee Break + Poster Session		
15:10 – 16:50	Session 7: Gasification technologies I	Session 8: Gasification kinetics & experiments	Session 9: Synthesis technologies
18:30 – 21:30	Conference Dinner		

Tuesday 9 June 2015			
08:30 – 16:00	Registration, Posters and Exhibition		
08:30 – 09:50	Session 10: Gasification technologies II	Session 11: New technologies	Session 12: Mineral matter II
09:50 – 10:20	Coffee Break + Poster Session		
10:20 – 11:40	Session 13: Gasification technologies & plants	Session 14: Entire concepts I	Session 15: Gasification kinetics
11:40 – 12:40	Lunch		
12:40 – 14:00	Session 16: Microscopic phenomena in gasification	Session 17: Entire concepts II	Session 18: CFD modelling
14:00 – 14:30	Coffee Break + Poster Session		
14:30 – 15:30	Session 19: New technologies & components	Session 20: Underground coal gasification	
15:30 – 16:00	Closing Ceremony		
17:00 – 19:00	Visit to Dazhao Temple		

Technical Tours	
Wednesday 10 June 2015	
08:30 – 17:00	Technical Tour 1 – Yitai Dalu Coal-to-Liquids Plant
Thursday 11 June 2015	
08:30 – 17:00	Technical Tour 2 – OMB Plant in Inner Mongolia Rongxin Chemical Industry Co., Ltd.

圖 II-0： 公差行程示意圖（底圖取自 https://maps.google.com.tw/）

圖 II-1：IFC 2015 會場地點

三、心　得

本次公差主要係赴大陸參加 The 7th International Freiberg Conference on IGCC & XtL Technologies (IFC 2015)，並發表會議論文。本報告將依序分別選擇重點摘要於下文中。

（一）IFC 2015 大會

第 7 屆 IFC 於 2015 年 6 月 7 日至 11 日於大陸內蒙古自治區呼和浩特市 (Huhhot, Inner Mongolia) 舉行，由德國弗萊貝格工業大學 (TU Freiberg) 主辦，與澳洲 CSIRO 共同主辦；並聯合大陸當地產學機構協助舉辦，包含 Synfuels China, East China Univ. of Science and Technology (ECUST) 等。這個聯合活動的目的是提供工程師、科學家、研究人員、技術人員、學生和其他人的平台，展示他們的最新成果、交換想法、建立新的聯繫、建立新的合作關係等。大會議題涵蓋淨煤領域的技術和工程實務，包括目前的發展趨勢和未來的規畫與需求。

IFC 2015 會議排程自 6 月 7 日（星期日）揭開序幕，與會者於當天開始報到，晚上並進行歡迎茶會。開幕典禮在 6 月 8 日（星期一）早上舉行，本屆大會開幕典禮由 TU Freiberg 前校長 Prof. B. Meyer 擔任主席；流程包括開幕演講、全體會議等 (圖 III-1 ~ III-6)。在開幕典禮中，主席亦介紹了大會之歷史沿革、主辦與贊助單位 (圖 III-7 ~ III-8)；隨後於休息時間依傳統進行團體照拍攝與相關活動 (圖 III-9 ~ III-10)。依據統計資料，今年 IFC 2015 大會之參與者共計超過 160 人，來自歐、美、亞洲十餘個國家在低碳潔淨能源、淨煤技術等重點研究領域之學者、專家；其中 60% 來自海外地區，顯見會議之國際參與特性 (圖 III-11)。其次，大會亦安排了市區古蹟參訪與技術參觀之行程 (圖 III-12~ III-14)。

IFC 2015 的議程分為全體會議 (Plenary Session) 、論文口頭發表、及壁報論文展示三部分，將分章節依序描述於本報告中。

1. Plenary Sessions

大會在星期一早上開幕典禮的全體會議 (Plenary Session) 中，共安排兩場 Keynote 演講；各應邀講員之資料與講題列舉如下：

Plenary Presentations

00-1: Gasification Technology Development under Changing Constraints
Bernd Meyer, Institute of Energy Process Engineering and Chemical Engineering, TU Bergakademie Freiberg - Germany

00-2: A Critical Evaluation of the Current Gasification Technologies and Future Directions for an Advanced Coal Based Energy Complex – the Hard Topic
Yong-Wang Li / China / Synfuels China Technology Ltd.

本報告將選擇較屬策略性、概觀性之演講依序分別摘要重點於下文中。

(1) **Gasification Technology Development under Changing Constraints** (圖 III.1.1-1；圖 III.1.1-2 ~ III.1.1-18)

六月八日早上大會演講 (Plenary lecture) 的首位演講者 Prof. Bernd Meyer 為德國 TU Bergakademie Freiberg, Institute of Energy Process Engineering and Chemical Engineering 的所長 (圖 III.1.1-1)。該演講之內容主要係闡述在變動的大環境下氣化技術之發展，其重要資料摘要如圖 III.1.1-2 ~ III.1.1-18 所示，而重點主要涵蓋下列議題：

A. Outline of fuel research (圖 III.1.1-3)；

B. Impact on Gasification Technology Development (圖 III.1.1-4 ~ III.1.1-5)；

C. Cost reduction (圖 III.1.1-6)；

D. Gasifier Development timeline (圖 III.1.1-7)；

E. Demands on R&D (圖 III.1.1-8 ~ III.1.1-9)；

F. Advanced experiments (圖 III.1.1-10 ~ III.1.1-12)；

  a. Material properties (圖 III.1.1-10)；

  b. Databases and models (圖 III.1.1-11)；

  c. In-situ measurement (圖 III.1.1-12)；

G. Advanced modeling (圖 III.1.1-13 ~ III.1.1-17)；

  a. Advanced CFD modeling (圖 III.1.1-14).

  b. Advanced Flow-sheet modeling (圖 III.1.1-15).

  c. Coupled modeling (圖 III.1.1-16).

d. Reactive flow modeling (圖 III.1.1-17).

H. Summary (圖 III.1.1-18).

(2) **A Critical Evaluation of the Current Gasification Technologies and Future Directions for an Advanced Coal Based Energy Complex – the Hard Topic** (圖 III.1.1-19；圖 III.1.1-20 ~ III.1.1-35)

六月八日早上大會演講 (Plenary lecture) 的第二場演講者 Yong-Wang Li 現為大陸 Synfuels China Company Limited. 的 General Manager (圖 III.1.1-19)，其演講議題如圖 III.1.1-20 所示。該演講之內容主要係評估目前氣化技術與未來先進煤基能源之趨勢，其重要資料摘要如圖 III.1.1-21 ~ III.1.1-35 所示，而重點主要涵蓋下列議題：

A. Background (圖 III.1.1-21 ~ 22)；

B. Industrialized gasifiers (圖 III.1.1-23 ~ 29):

a. Moving bed (圖 III.1.1-24).

b. Water slurry (圖 III.1.1-25).

c. Dry feed (圖 III.1.1-26 ~ 27).

d. Balance analysis (圖 III.1.1-28 ~ 29).

C. Future efforts: (圖 III.1.1-30 ~ 34)

a. Dry feeding sysem (圖 III.1.1-30).

b. Syngas conditioning (圖 III.1.1-31).

c. Water management (圖 III.1.1-32 ~ 33).

d. What is great? (圖 III.1.1-34)

D. Conclusion (圖 III.1.1-35)

2. Technical Paper Sessions

IFC 口頭論文發表議程每天上、下午各分為兩個時段，同時各有三個平行場次之口頭論文發表。各場次排定四至五場專題演講 (Lecture)，另外上、下午各有一段中場休息以為區隔。技術議題涵蓋前述十八項領域，其論文篇數共計近八十篇。在這些平行場次中，不乏時間相互衝突之重要演講；然而，在無法兼顧之情況下，筆

者只能擇要參與一些關鍵場次。

(1) Global status;
(2) Syngas treatment;
(3) Gasification technologies;
(4) New technologies;
(5) CFD Modelling;

本所淨碳團隊在此次 IFC 大會中投稿之論文係以口頭宣讀方式發表，被安排在 6 月 9 日（星期二）上午的場次，屬於 Session 11: New technologies 領域。演講內容摘要如圖 III.1.2-1 ~ III.1.2-18 所示。筆者之簡報獲得在場與會者不錯之回應，如澳洲 CSIRO、德國 TUF 之與會者。澳洲 CSIRO Energy Flagship 的 Senior Research Scientist, Dr. **Alex Ilyushechkin** 於會後特別寫 E-mail 向筆者致意，表示本所之研發議題與彼等契合，未來或有合作可能；並主動邀約，於未來擔任他們投稿 SCI 論文之審查委員。

另基於篇幅考量，本報告中僅摘錄了數場相關的代表性論文加以陳述之。

論文＃D1A_01-1：本論文由 IEA [UK] 的研究人員發表，演講主題為 **Coal for fuels and chemicals: Worldwide challenges and opportunities**，屬於 Global status 領域。演講內容摘要如圖 III.1.2-19 ~ III.1.2-36 所示。

論文＃D1A_01-2：本論文由 CSIRO [Australia] 的研究人員發表，演講主題為 **Overview of drivers and status of coal-to-liquids developments in Australia**，屬於 Global status 領域。演講內容摘要如圖 III.1.2-37 ~ III.1.2-58 所示。

論文＃D1A_01-3：本論文由 Department of Energy [USA] 的研究人員發表，演講主題為 **Evolution of coal conversion technologies and their applications**，屬於 Global status 領域。演講內容摘要如圖 III.1.2-59 ~ III.1.2-78 所示。

3. Poster Session

類似於一般國際研討會，壁報論文在 IFC 大會中主要係扮演輔助角色；其壁報論文總數並不多，佔大會論文的比例僅約兩成。大會議程安排自第一天起，即從早上 10:00 開始展示到第二天下午 - 16:00。筆者抽空參閱了壁報論文發表，以瞭解彼等在未來之研發努力及現況成果。本報告中摘錄了數篇較具相關性的論文展示於後(圖 III.1.3-1 ~ III.1.3-6)。

4. Technical Tours

今年 IFC 大會於論文發表研討議程結束後，安排了一些技術參訪路線；筆者選擇參加前往 Yitai Dalu Coal-to-liquids 石化廠之行程 (圖 III.1.4-1 ~ III.1.4-6)。該石化廠位於大會地點（呼和浩特）西南方二百公里左右之鄂爾多斯地區，車程逾兩個多小時；沿途行經黃土高原，並跨越河套區之黃河大橋。當天參訪團抵達後，廠方首先安排簡報議程，分別以全廠鳥瞰模型、公司沿革、與各類產品生產流程等進行該公司現況簡介。而在隨後之實廠參觀則分乘數部導覽車，分別實地走訪廠區內各操作單元廠房。

§III.1　有關 2015 CN 公差 IFC 之圖像

IFC 2015 Opening Ceremony

圖 III-1 大會主席開幕致詞

圖 III-2 開幕典禮

圖 III-3 開幕典禮

圖 III-4 開幕典禮會場內景象

圖 III-5 開幕典禮會場內景象

圖 III-6 大會會場報到處景象

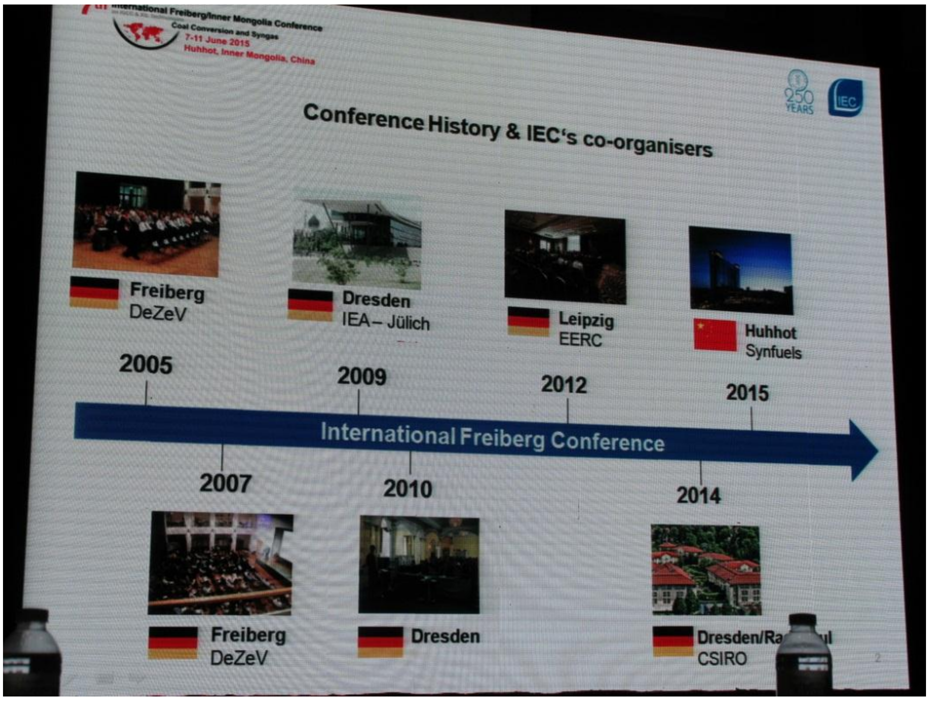


圖 III-7 大會歷史沿革

圖 III-8 大會主辦與贊助單位

圖 III-9 大會團體照拍攝

圖 III-10 大會中場休息景象

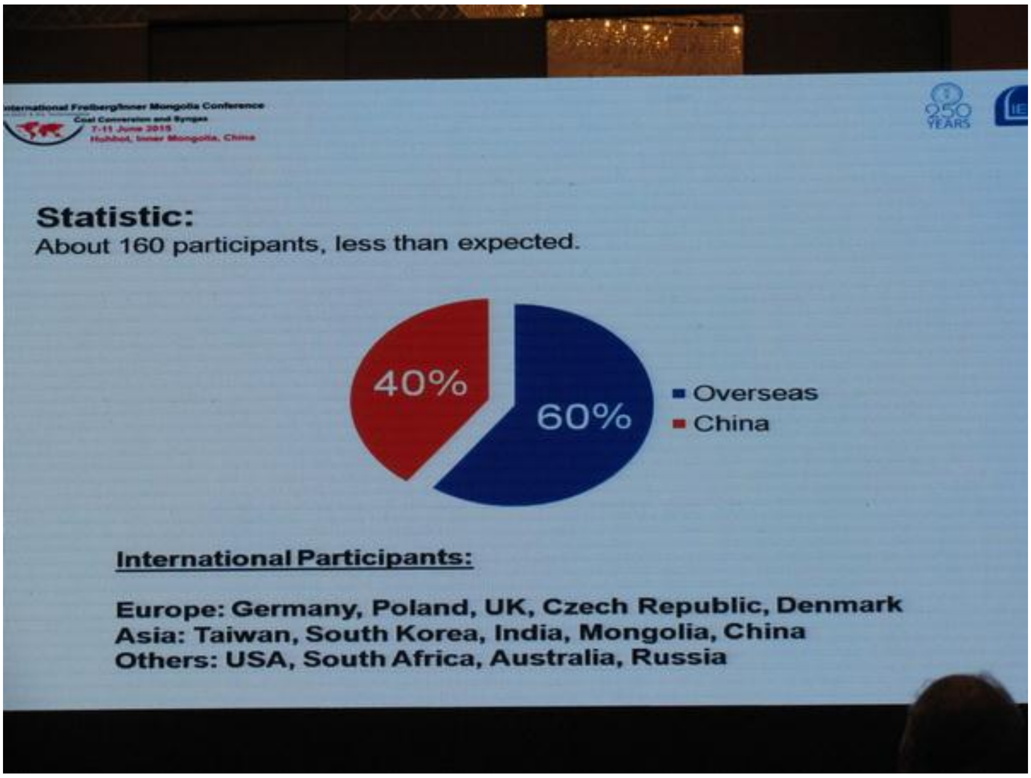


圖 III-11 今年 IFC 2015 大會之統計資料

圖 III-12 大會安排之市區古蹟參訪行程

圖 III-13 大會安排之技術參觀行程一

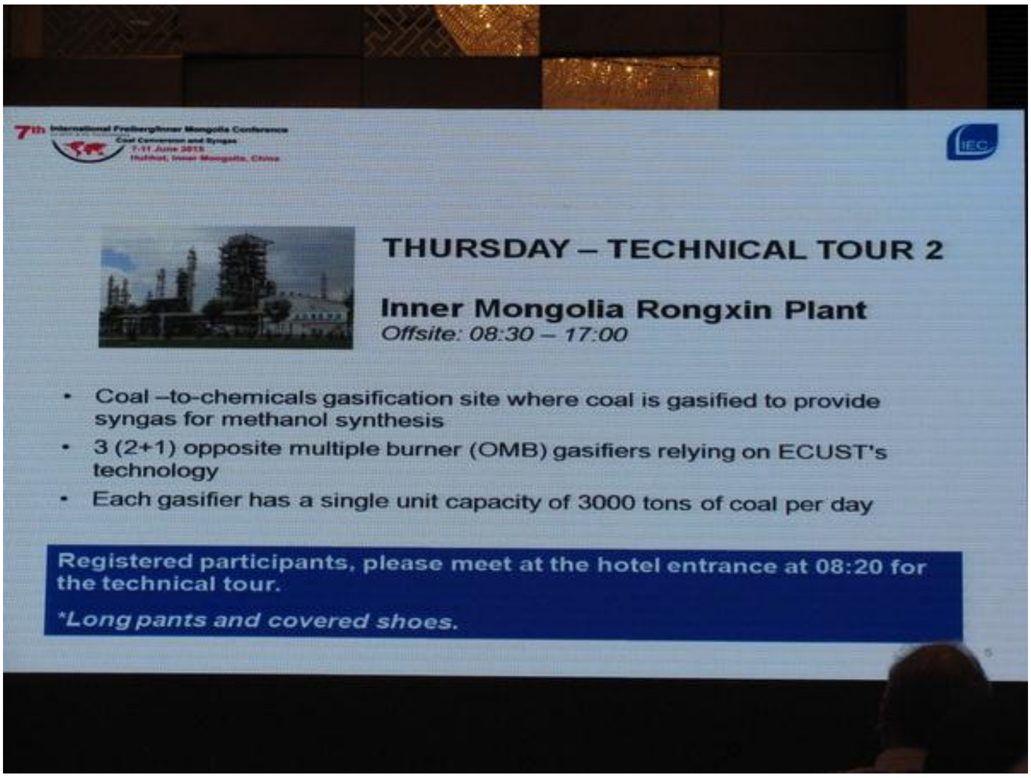


圖 III-14 大會安排之技術參觀行程二

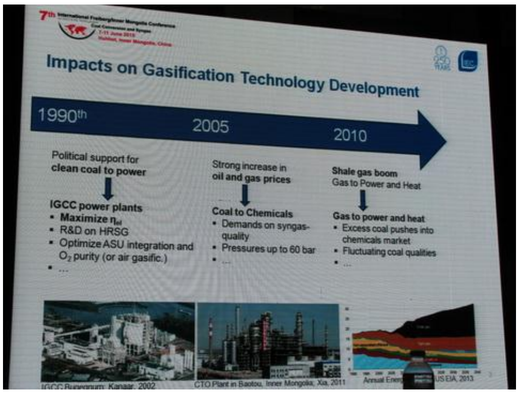
1. Plenary Sessions

P1

圖 III.1.1-1

圖 III.1.1-2

圖 III.1.1-3



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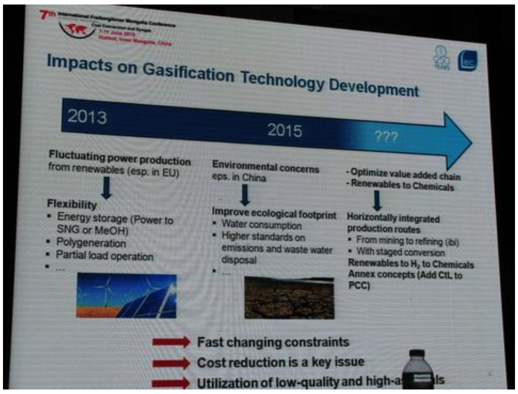

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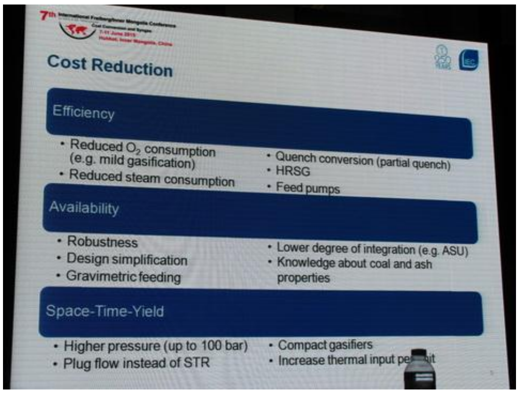

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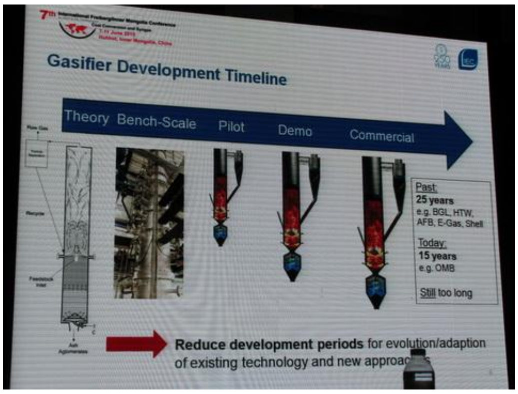

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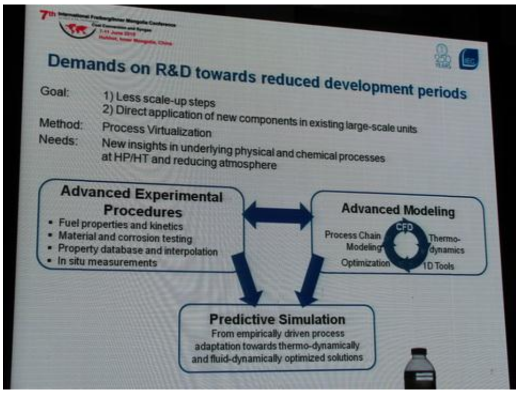

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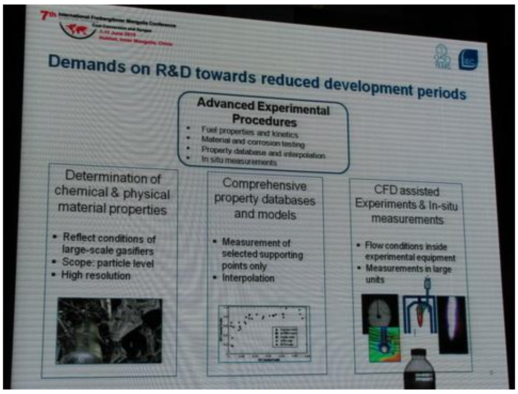

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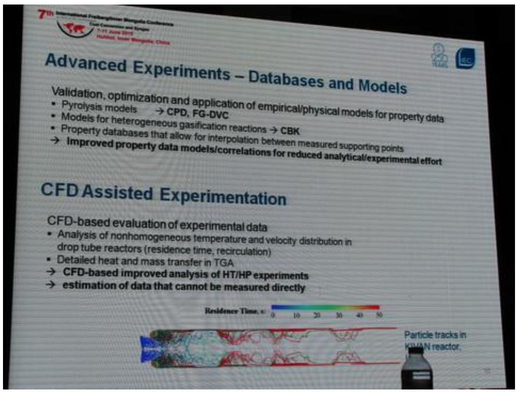

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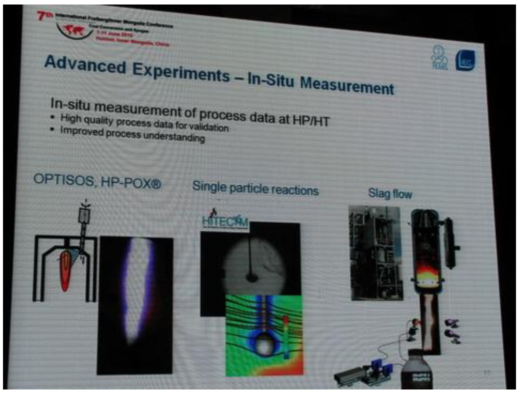

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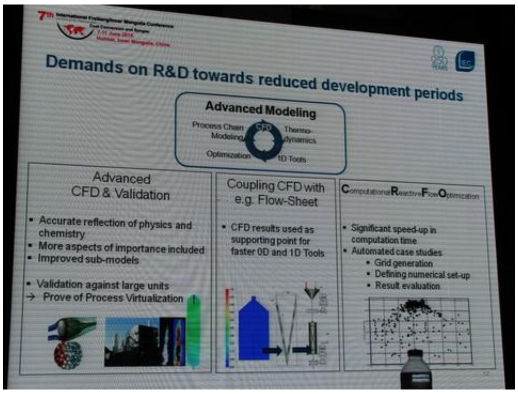

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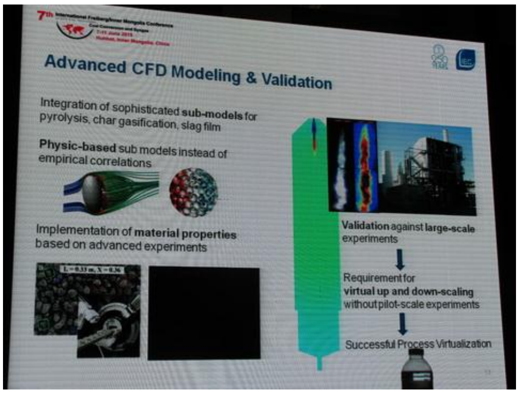

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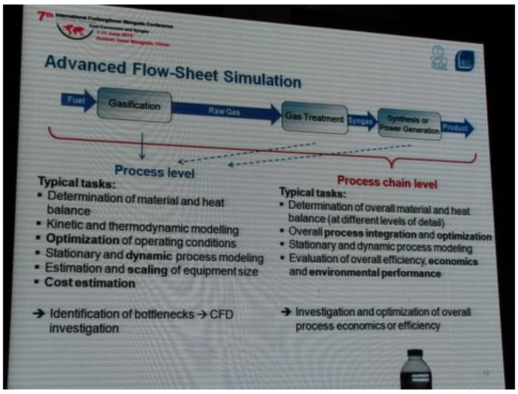

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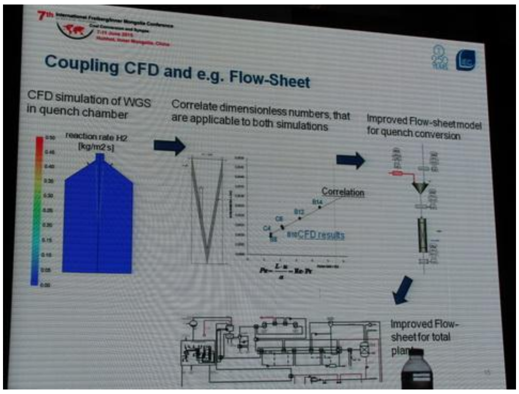

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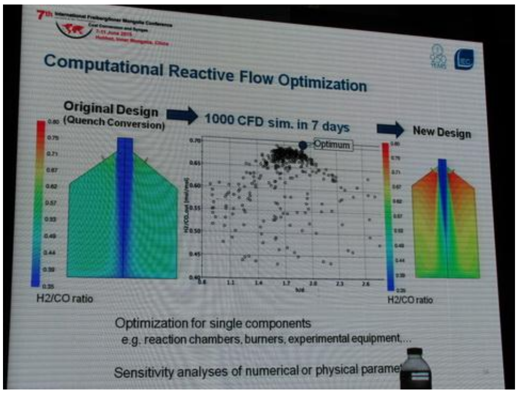

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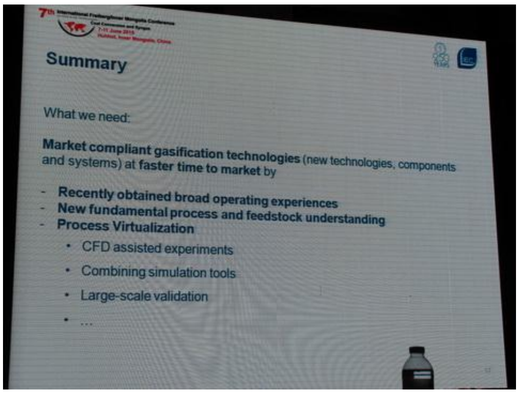

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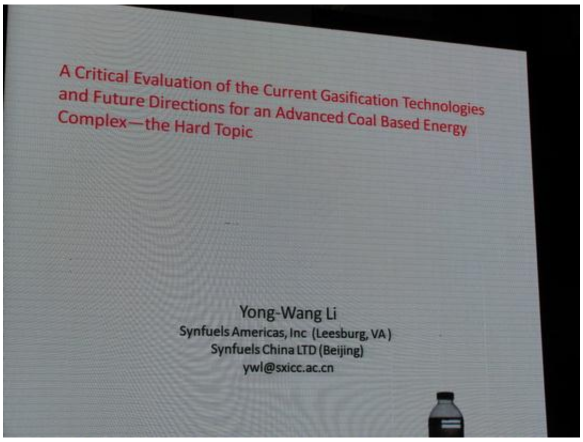

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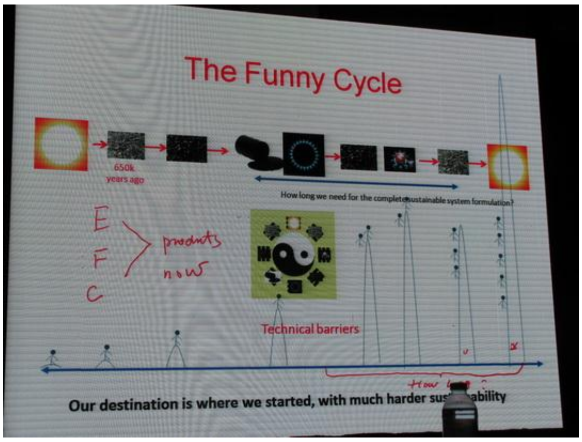

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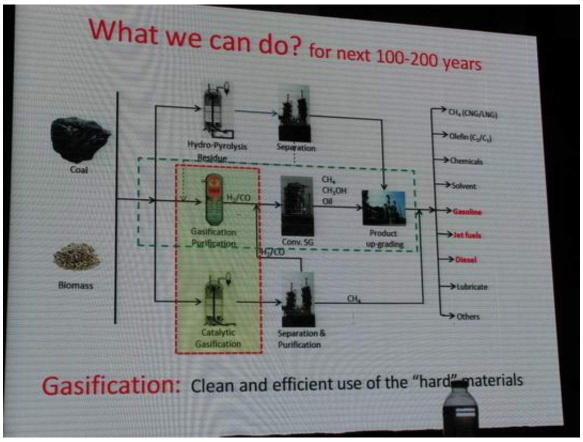

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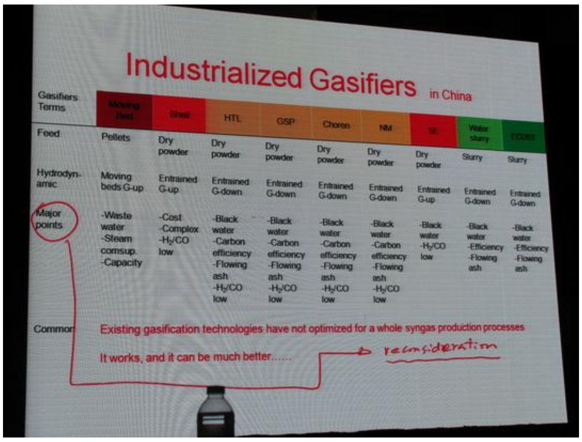

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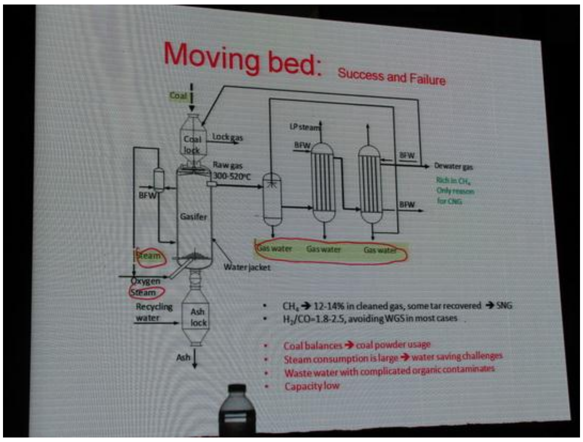

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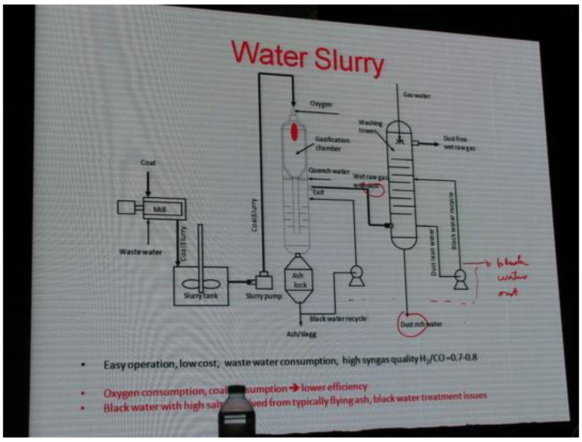

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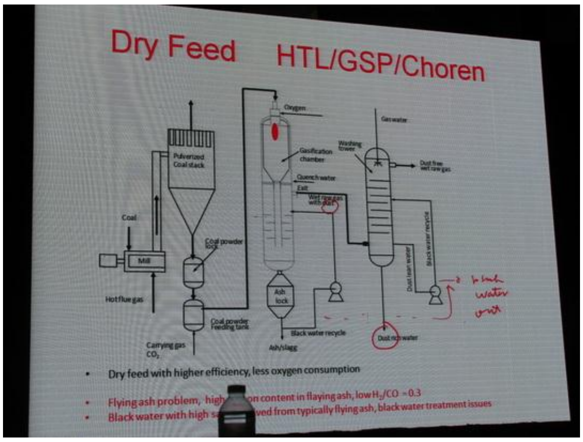

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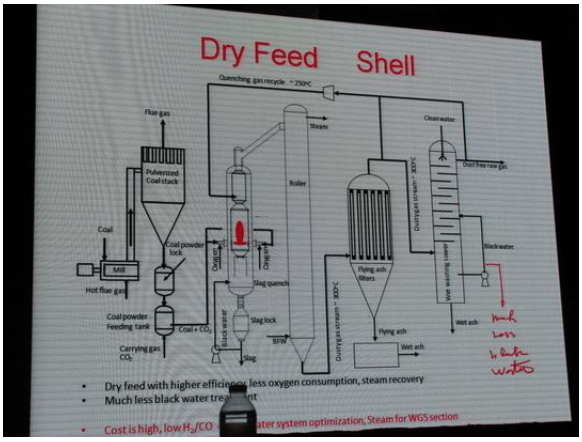

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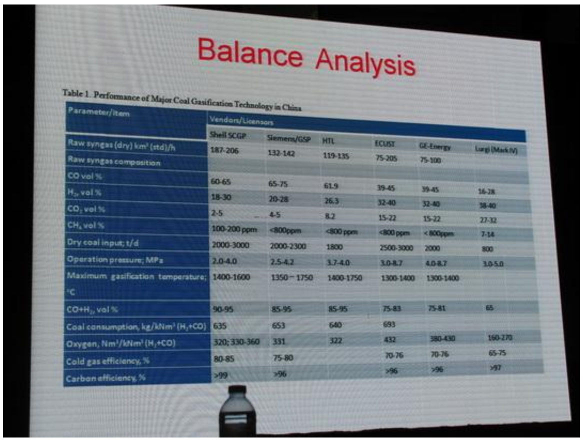

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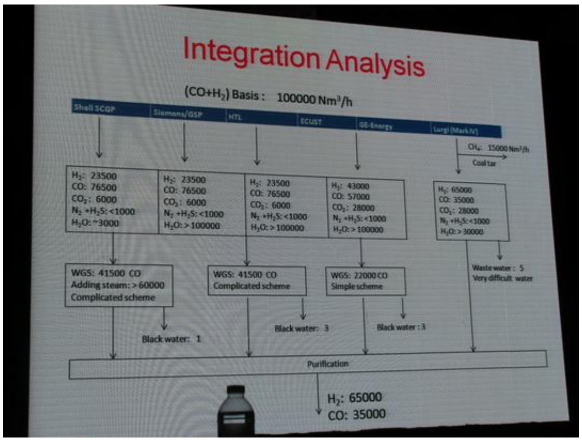

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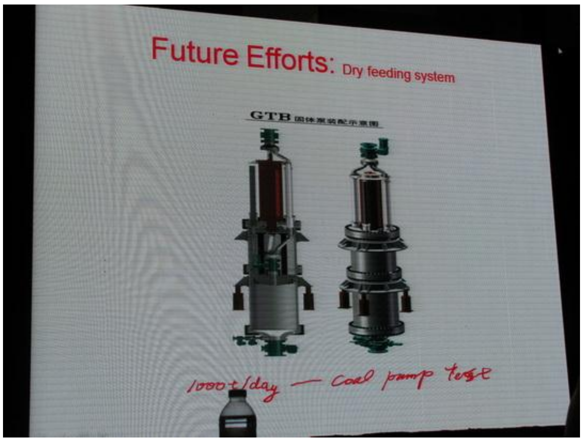

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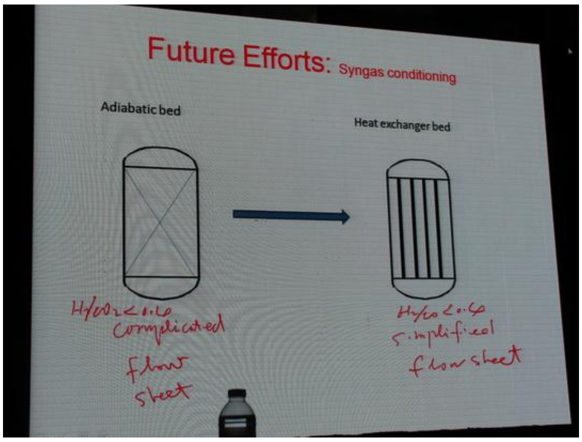

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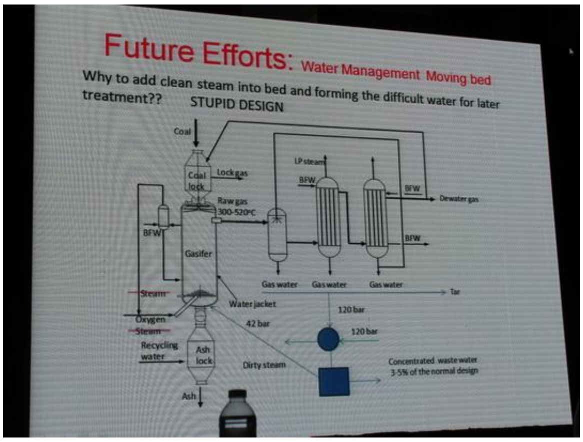

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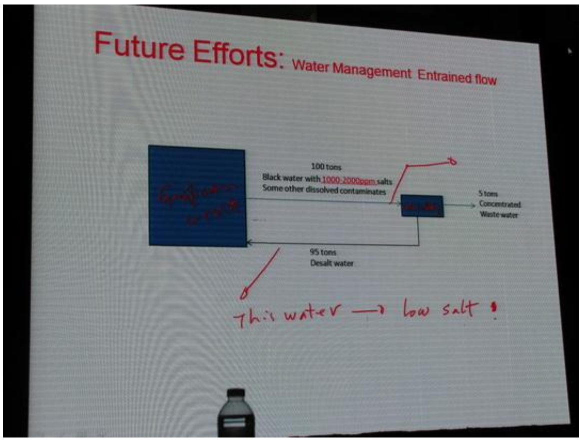

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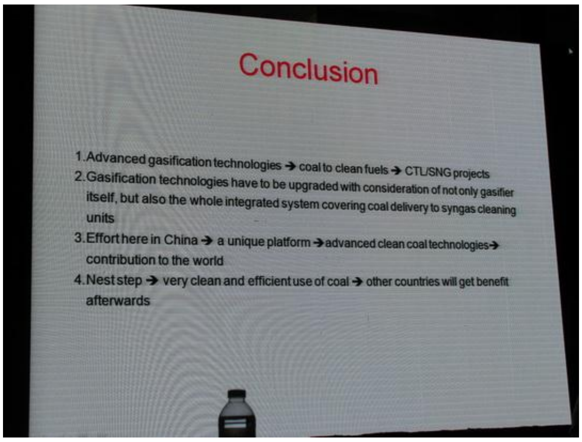

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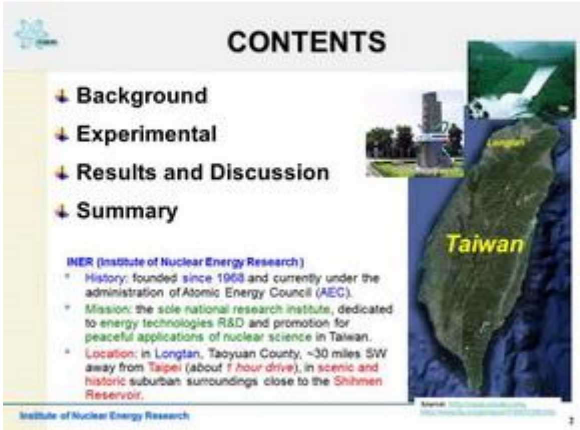
2. Technical Paper Oral Sessions

INER 發表論文之口頭簡報

圖 III.1.2-1



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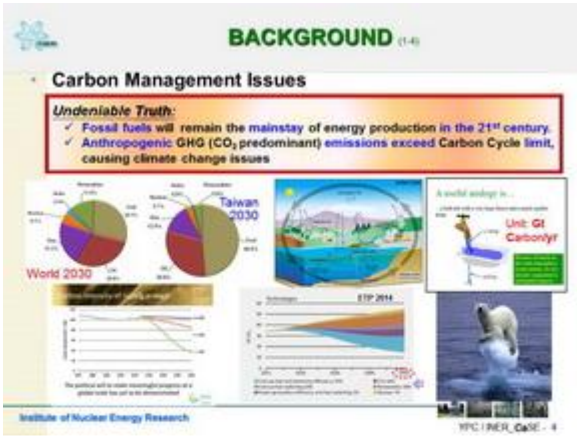

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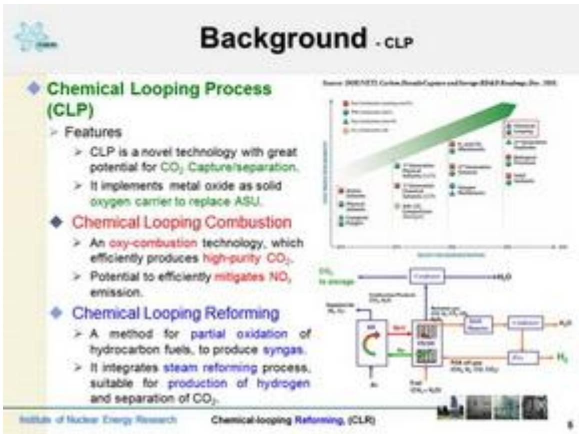

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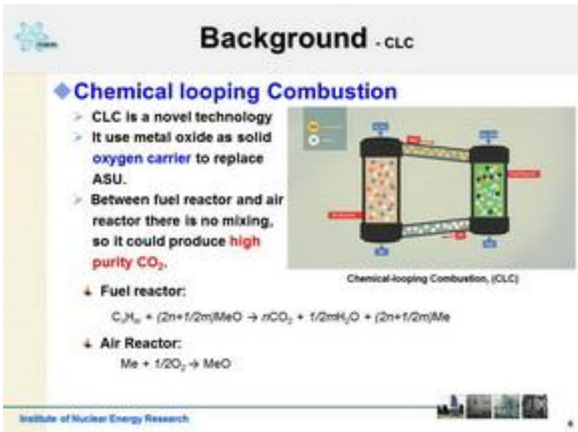

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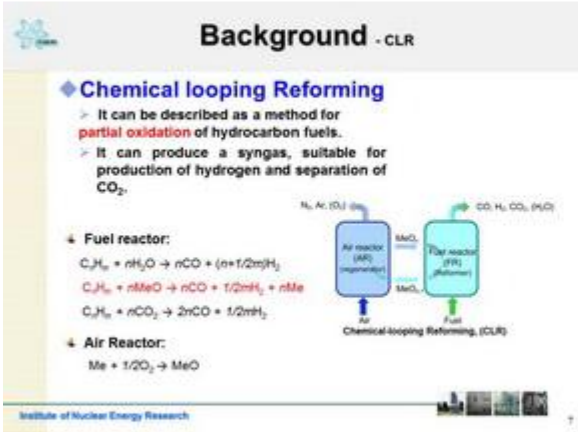

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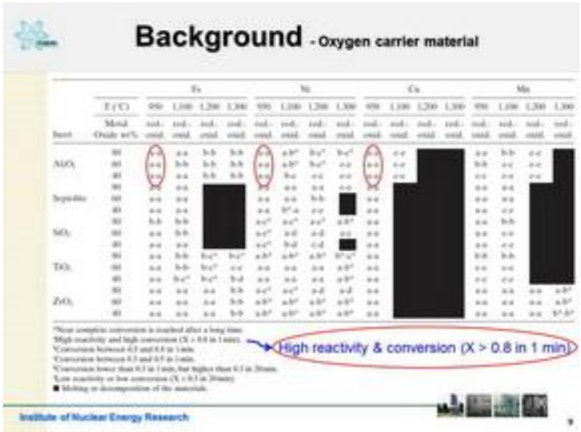

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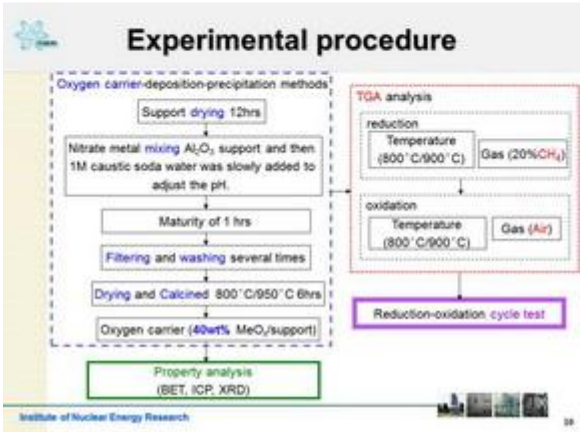

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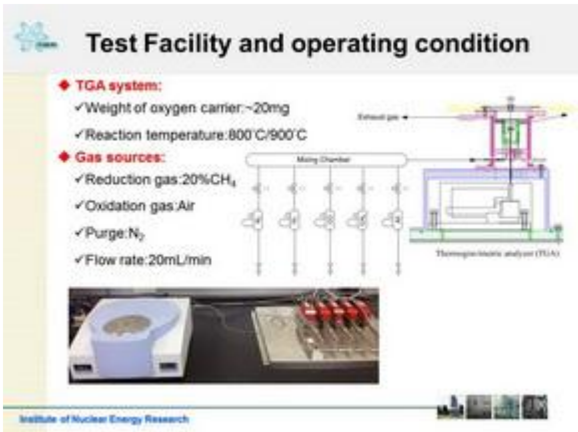

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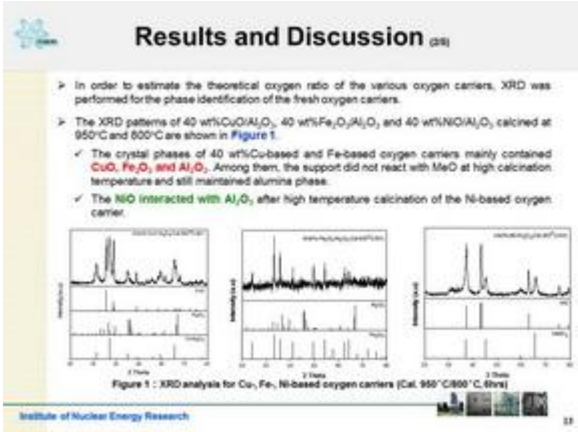

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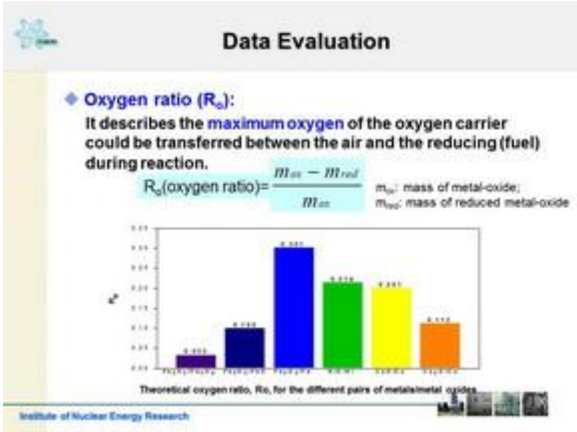

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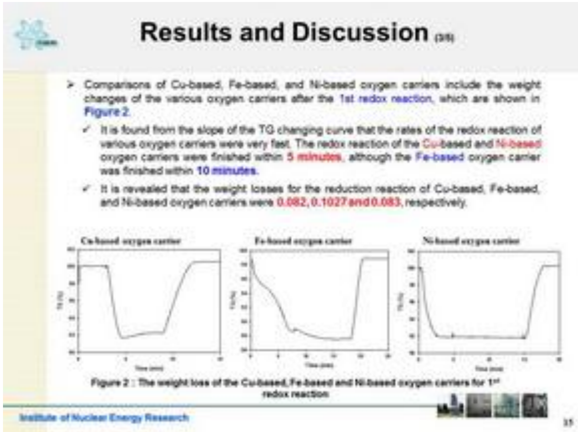

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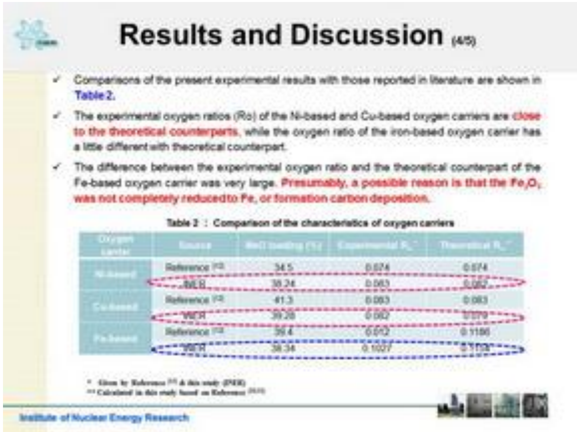

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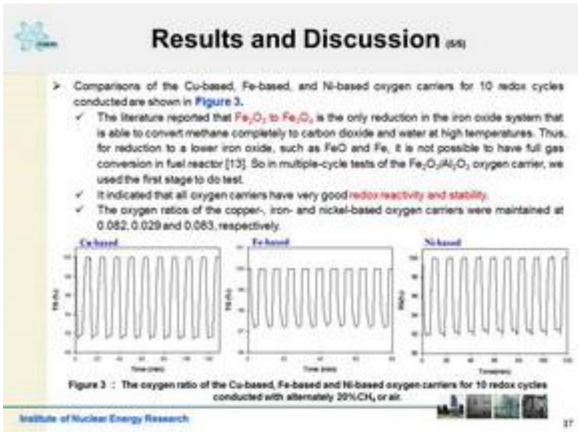

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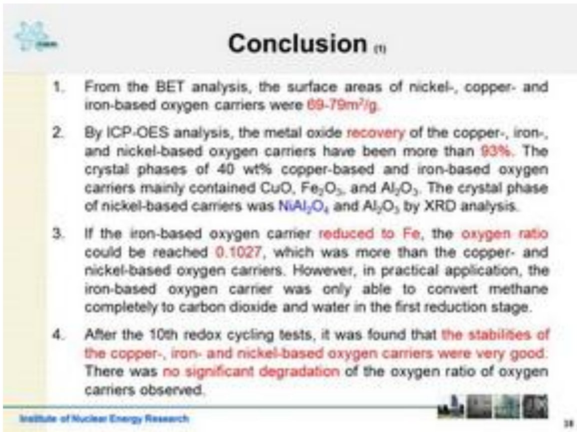

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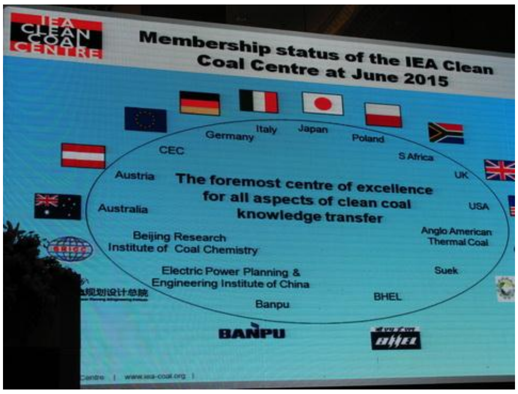

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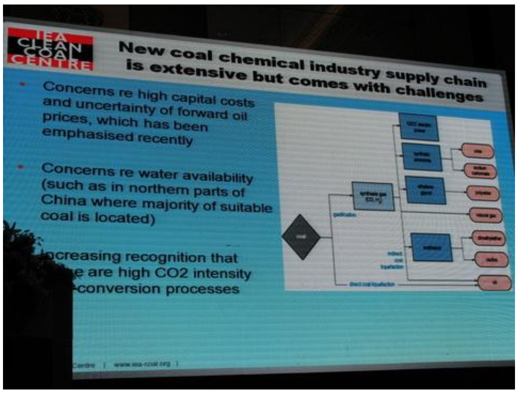

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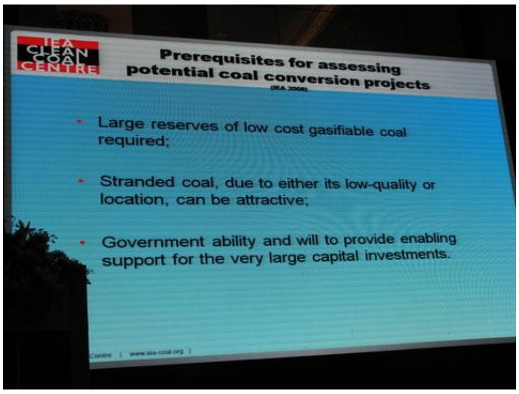

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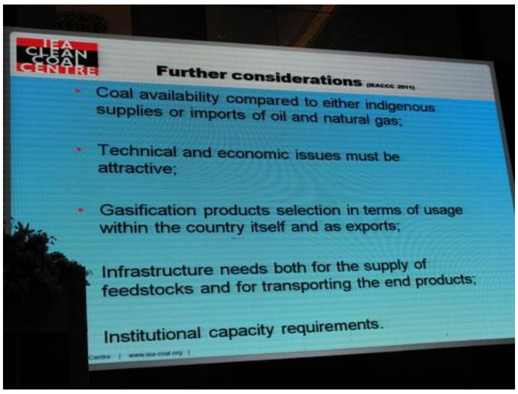

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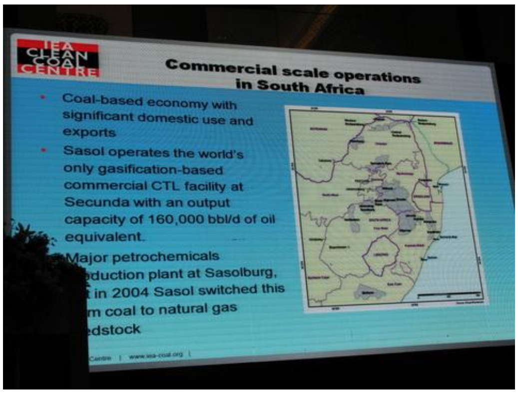

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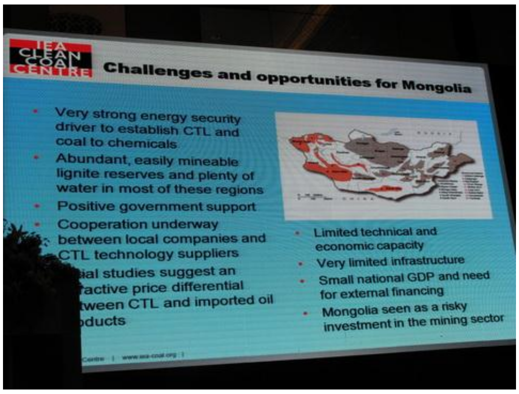

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圖 III.1.2-29

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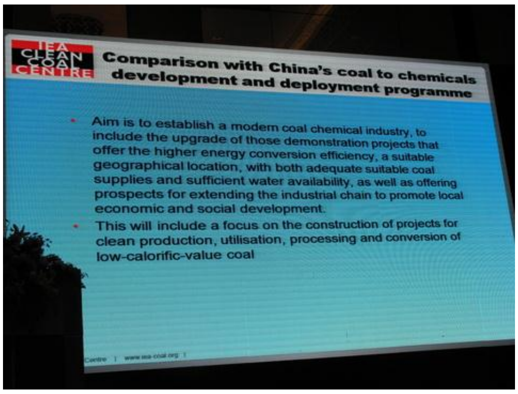

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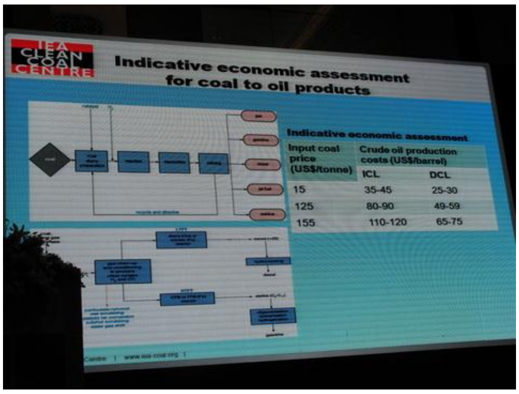

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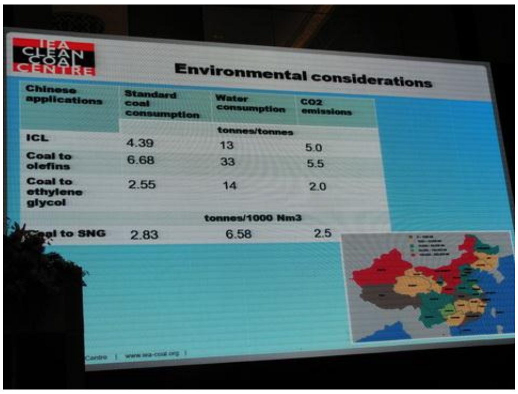

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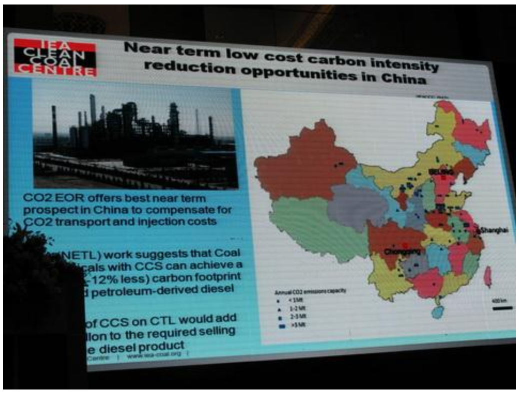

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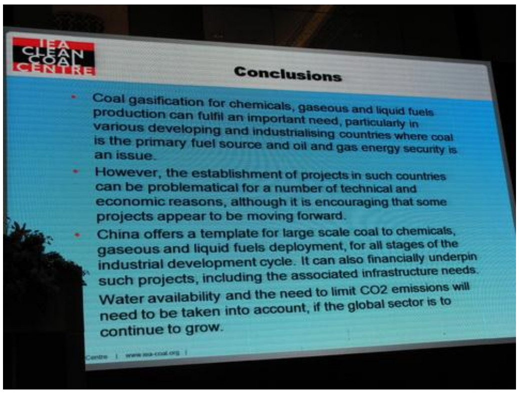

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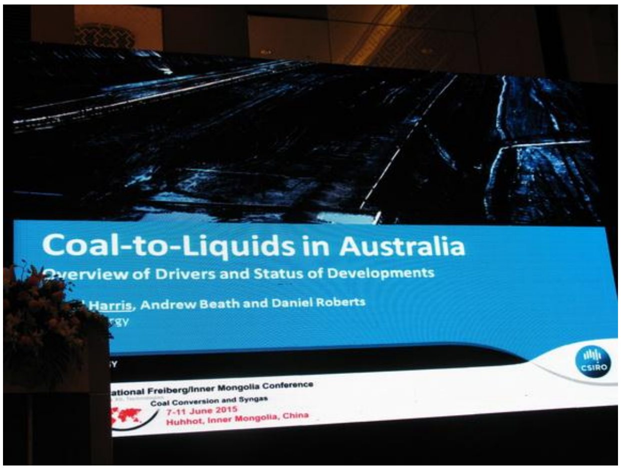

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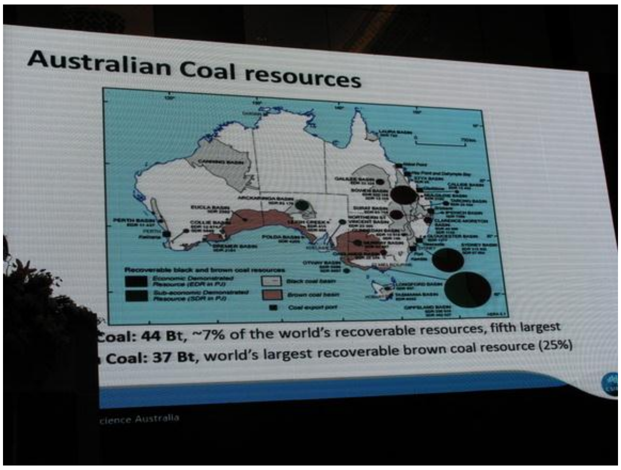

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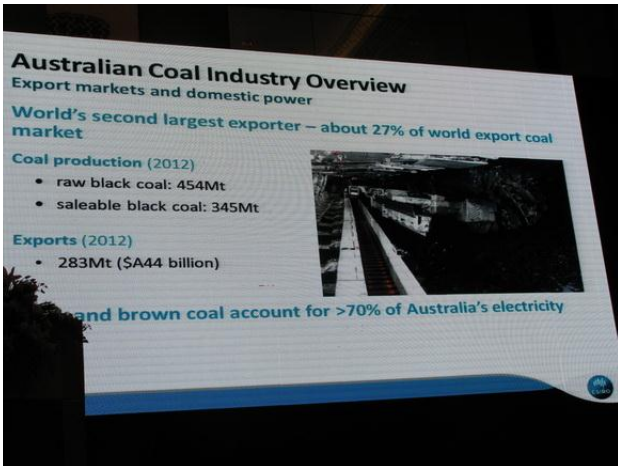

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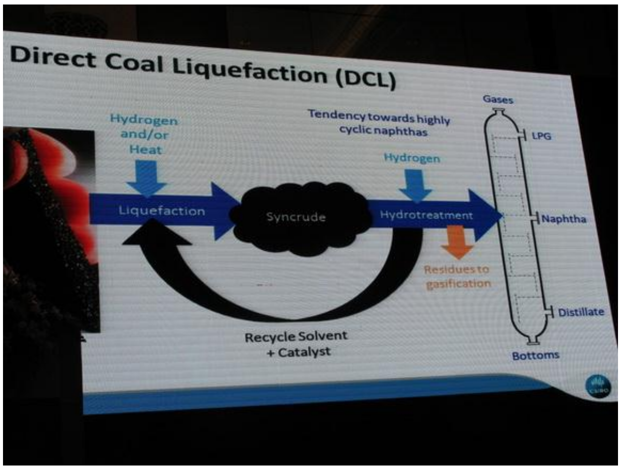

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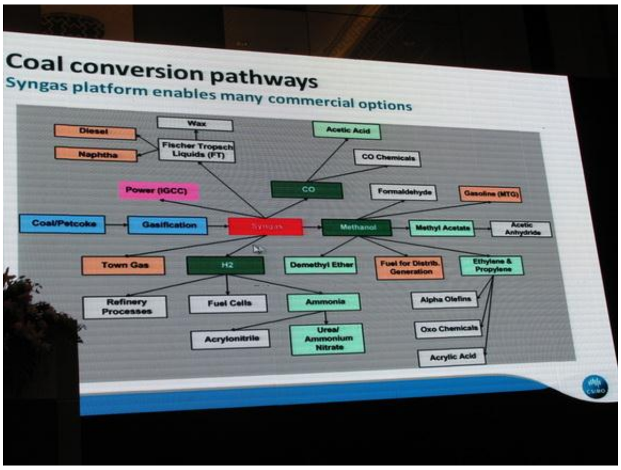

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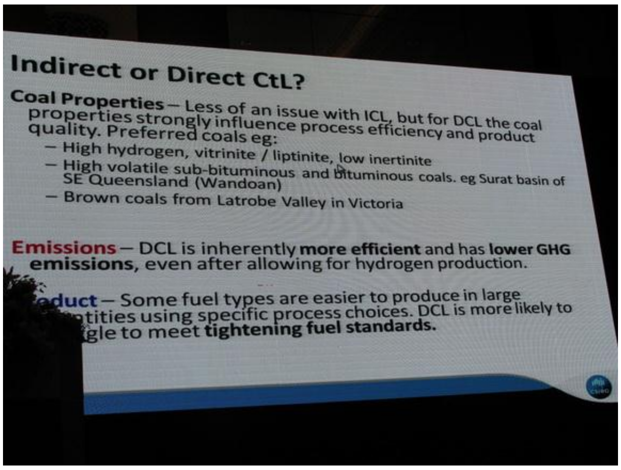

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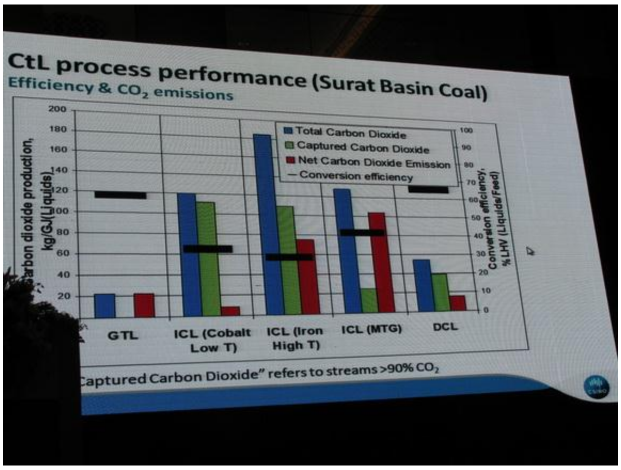

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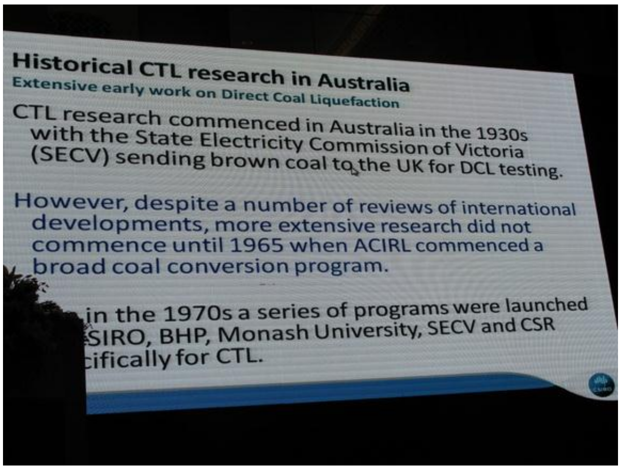

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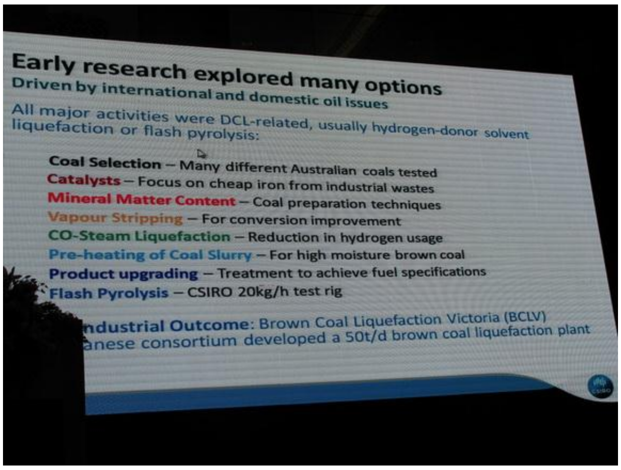

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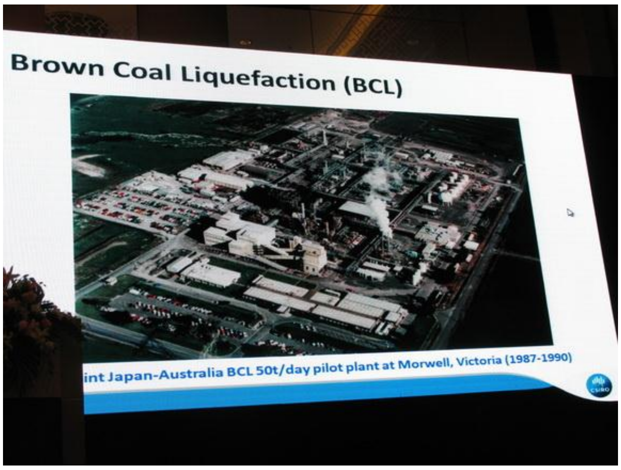

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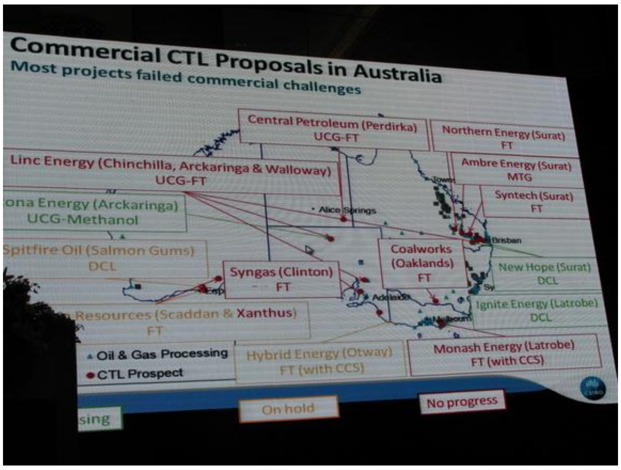

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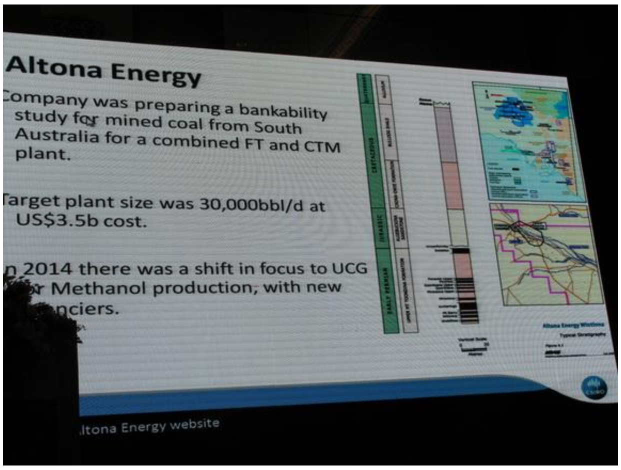

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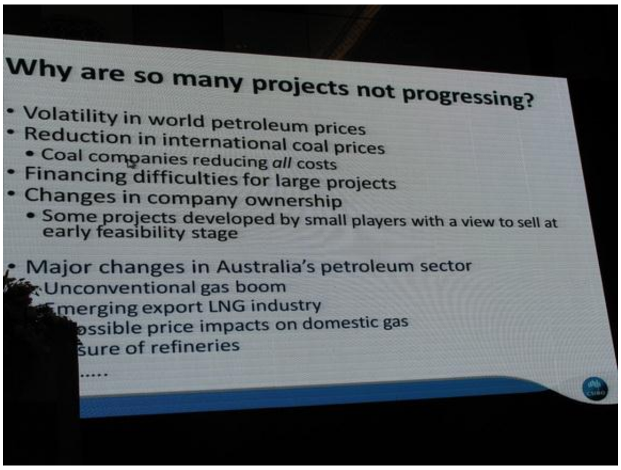

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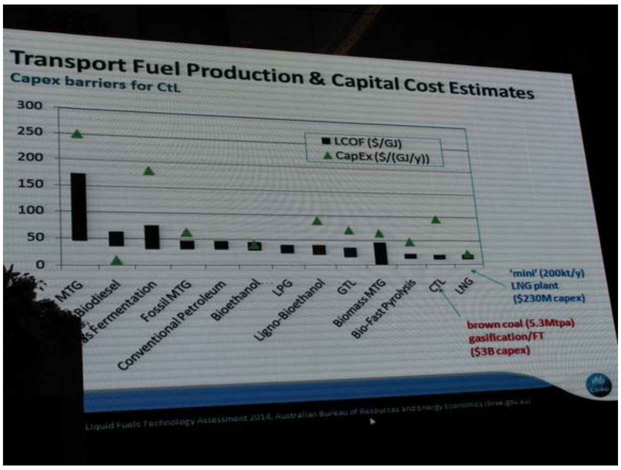

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圖 III.1.2-52

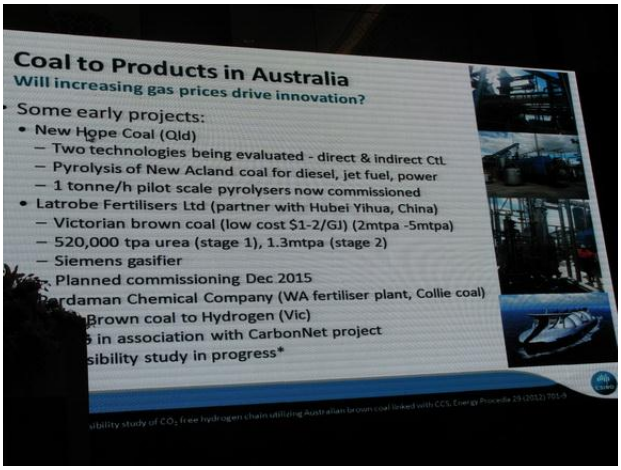


圖 III.1.2-53

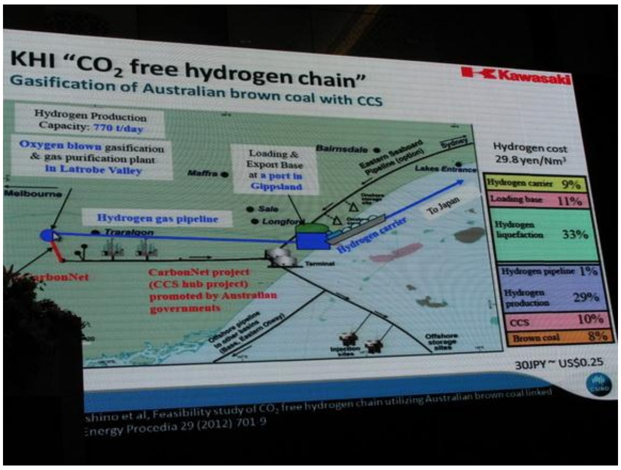


圖 III.1.2-54

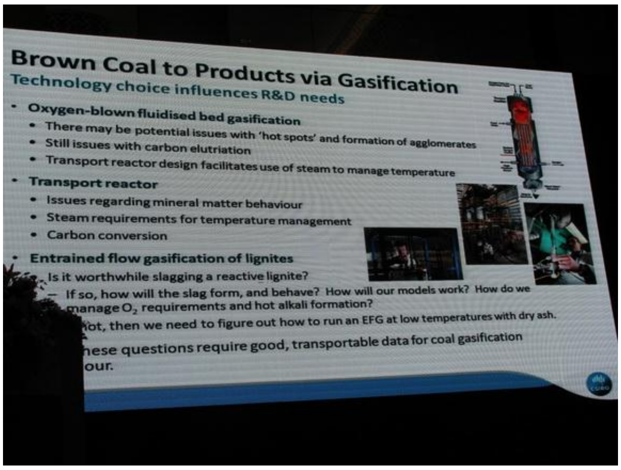
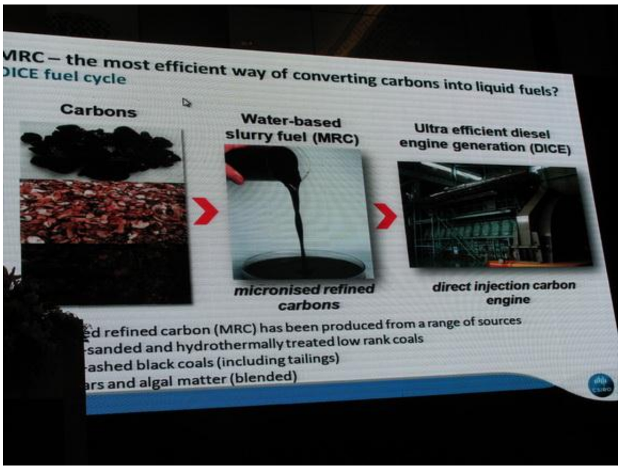


圖 III.1.2-55



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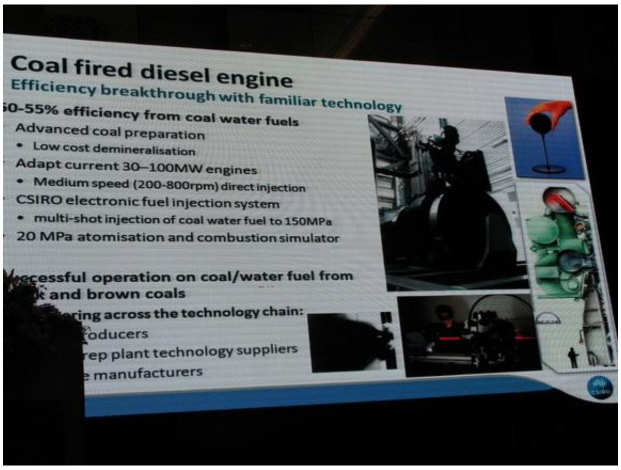

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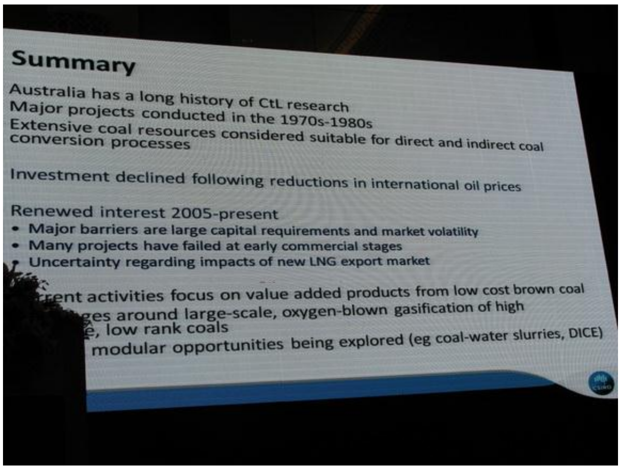


圖 III.1.2-58

圖 III.1.2-59

圖 III.1.2-60

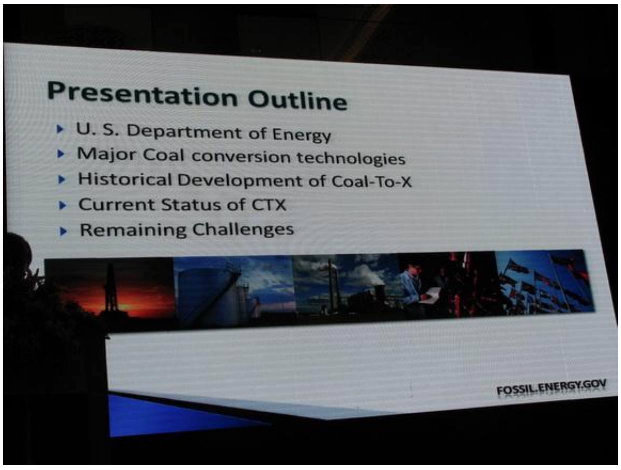
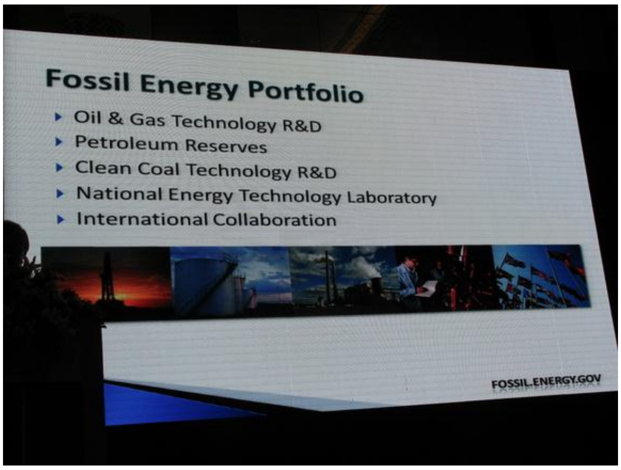


圖 III.1.2-61

圖 III.1.2-62



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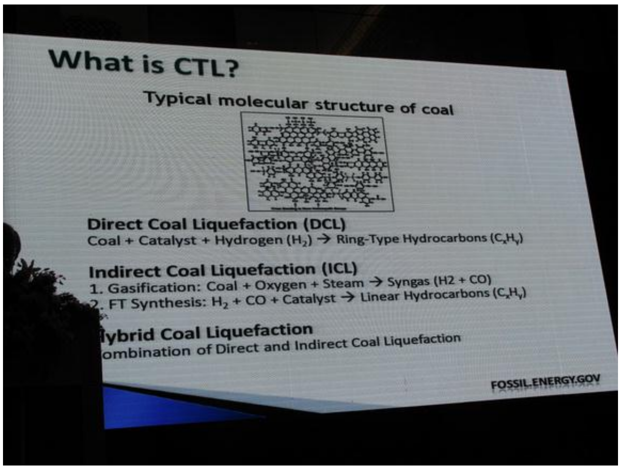

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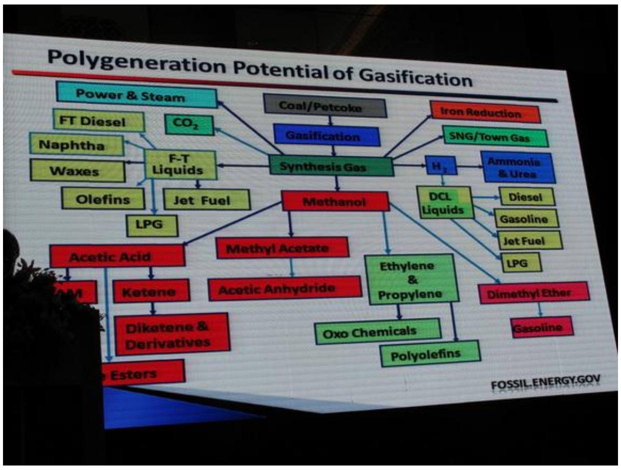
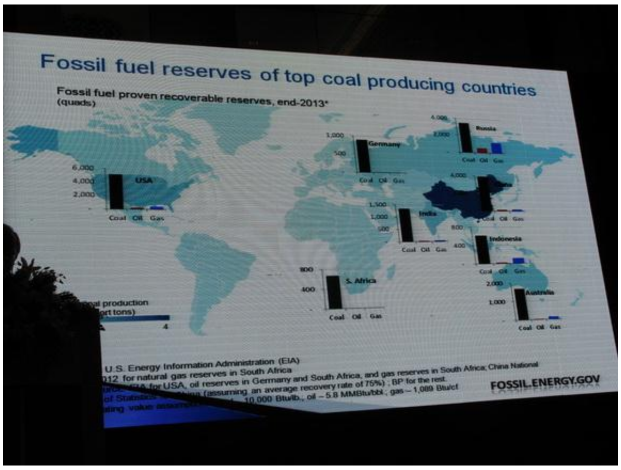


圖 III.1.2-65



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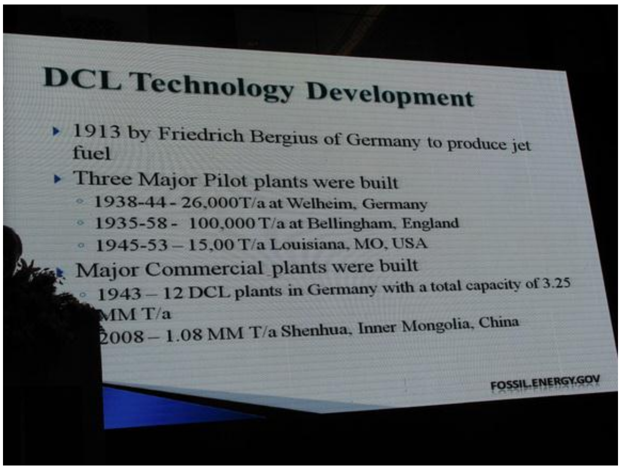

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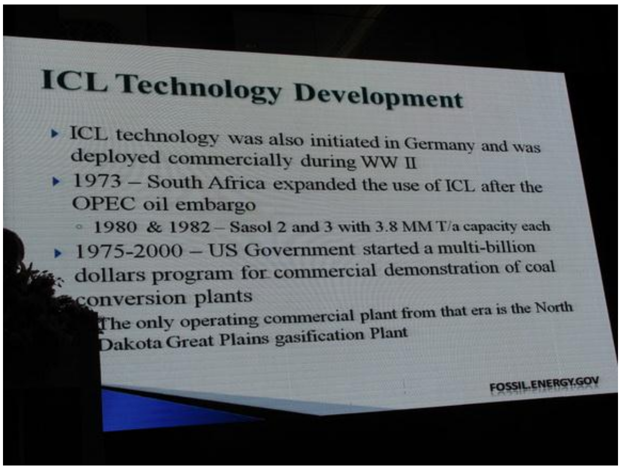

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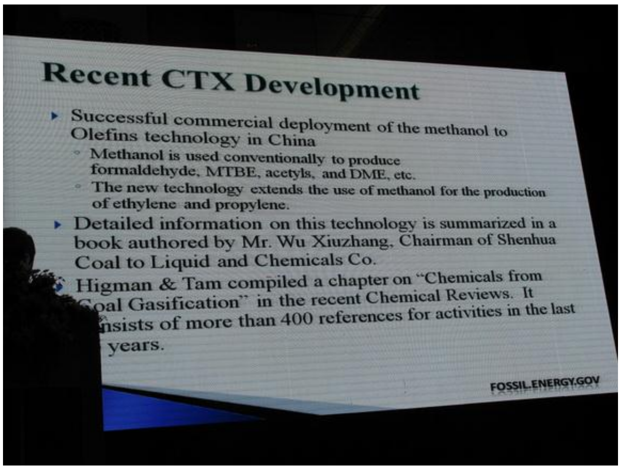
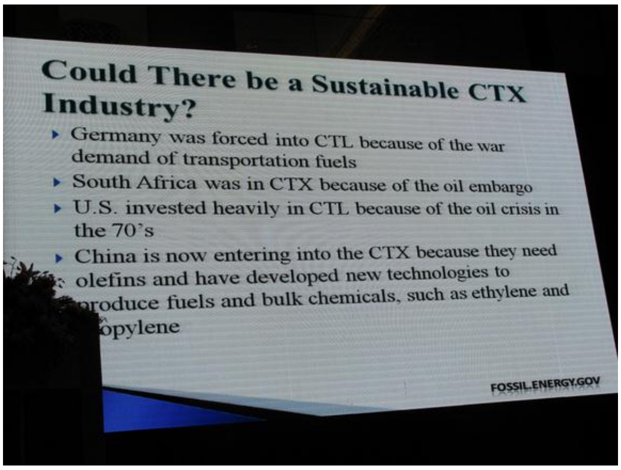


圖 III.1.2-69



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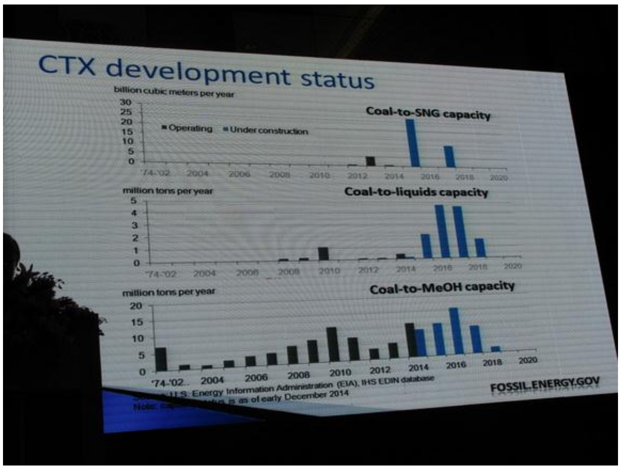

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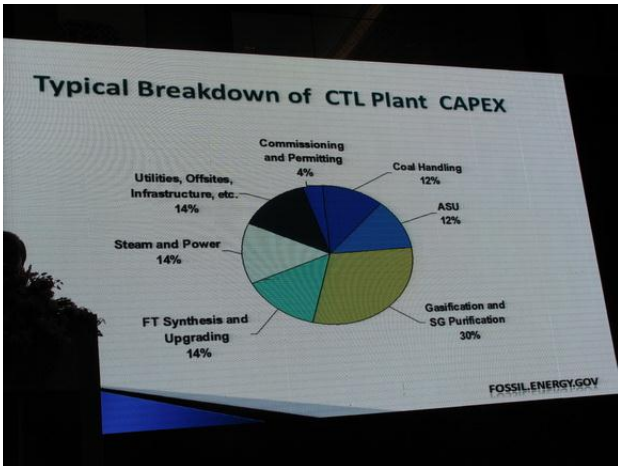

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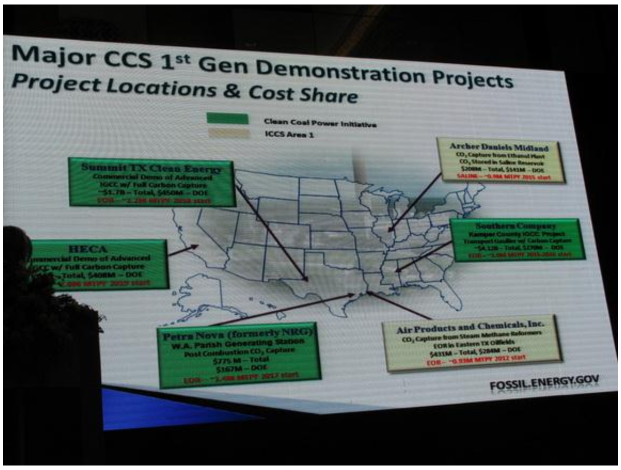

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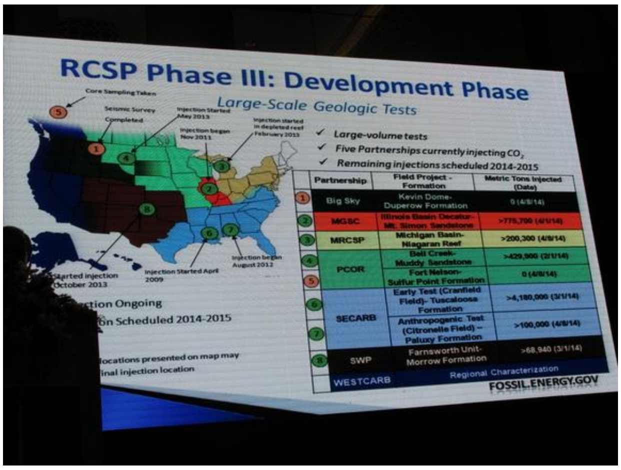


圖 III.1.2-74

圖 III.1.2-75

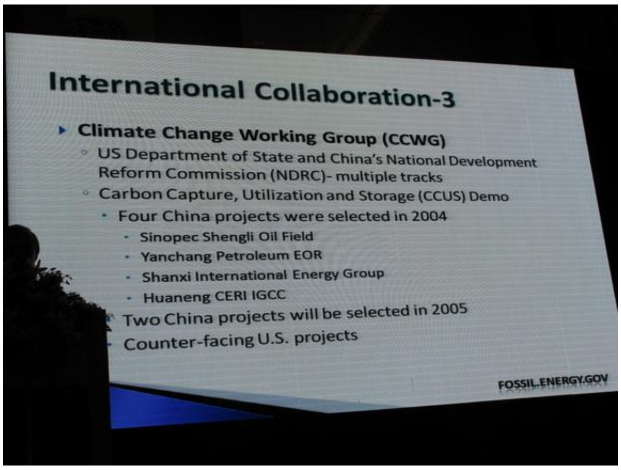


圖 III.1.2-76

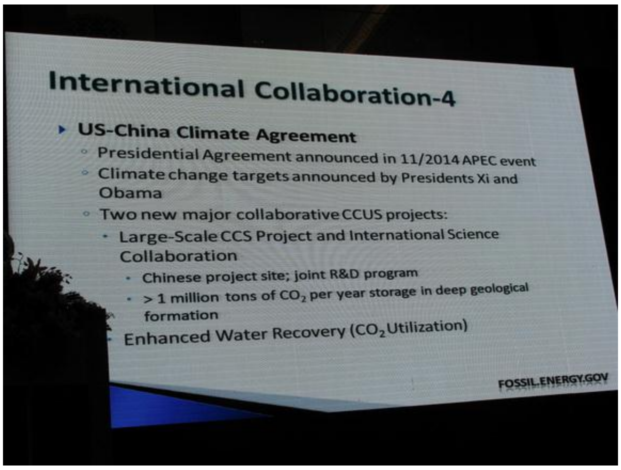


圖 III.1.2-77

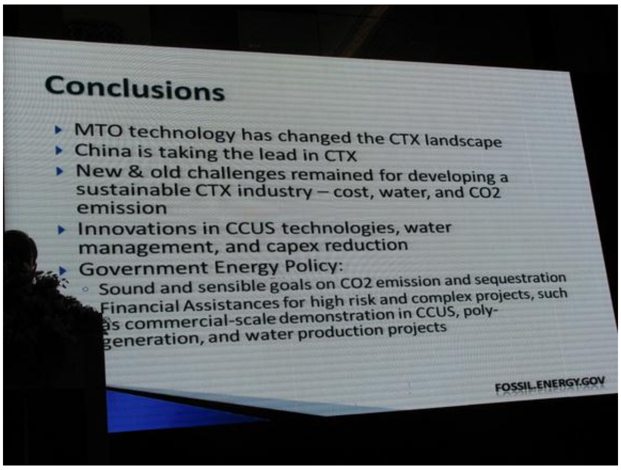


圖 III.1.2-78

3. Poster Session

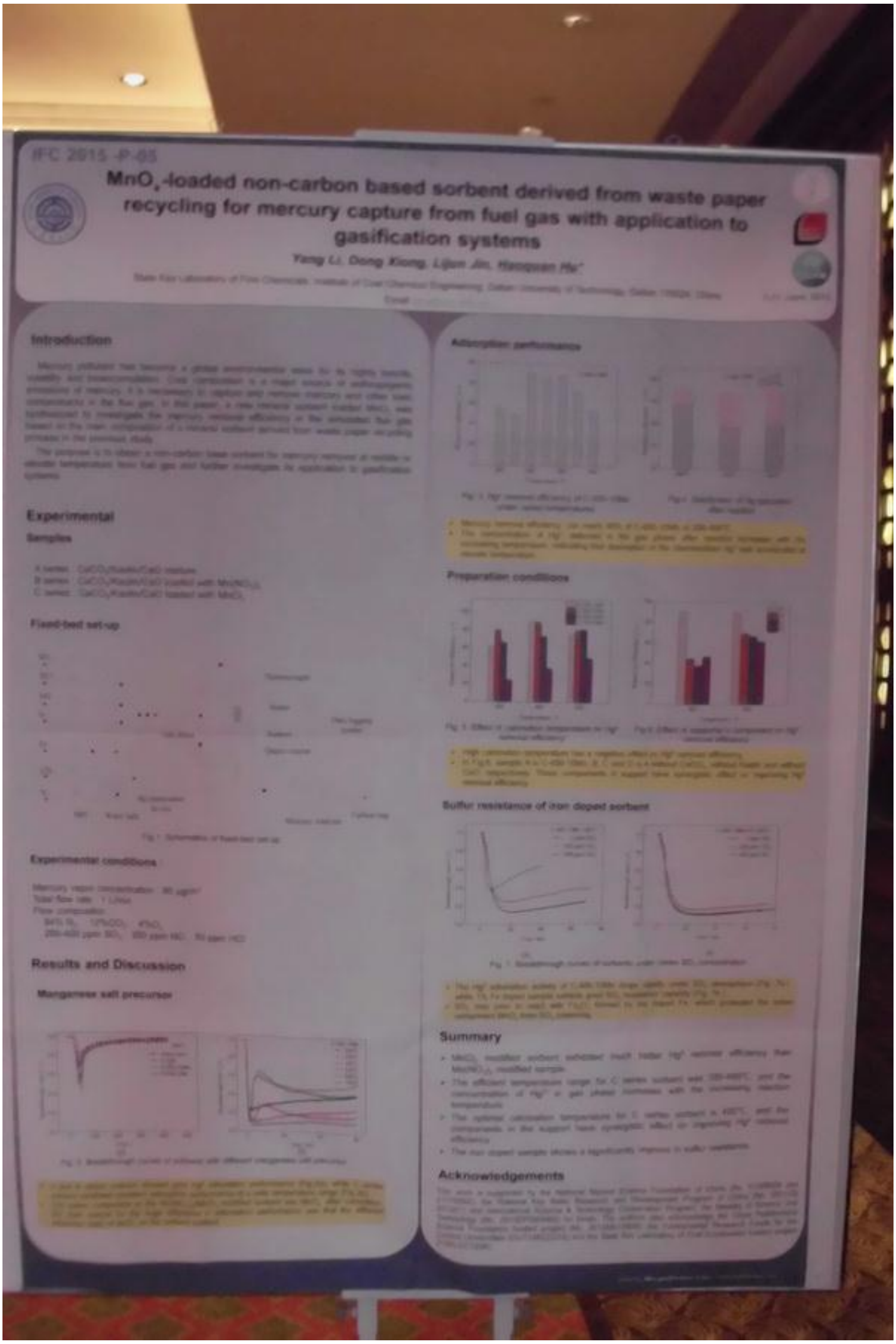


圖 III.1.3-1：

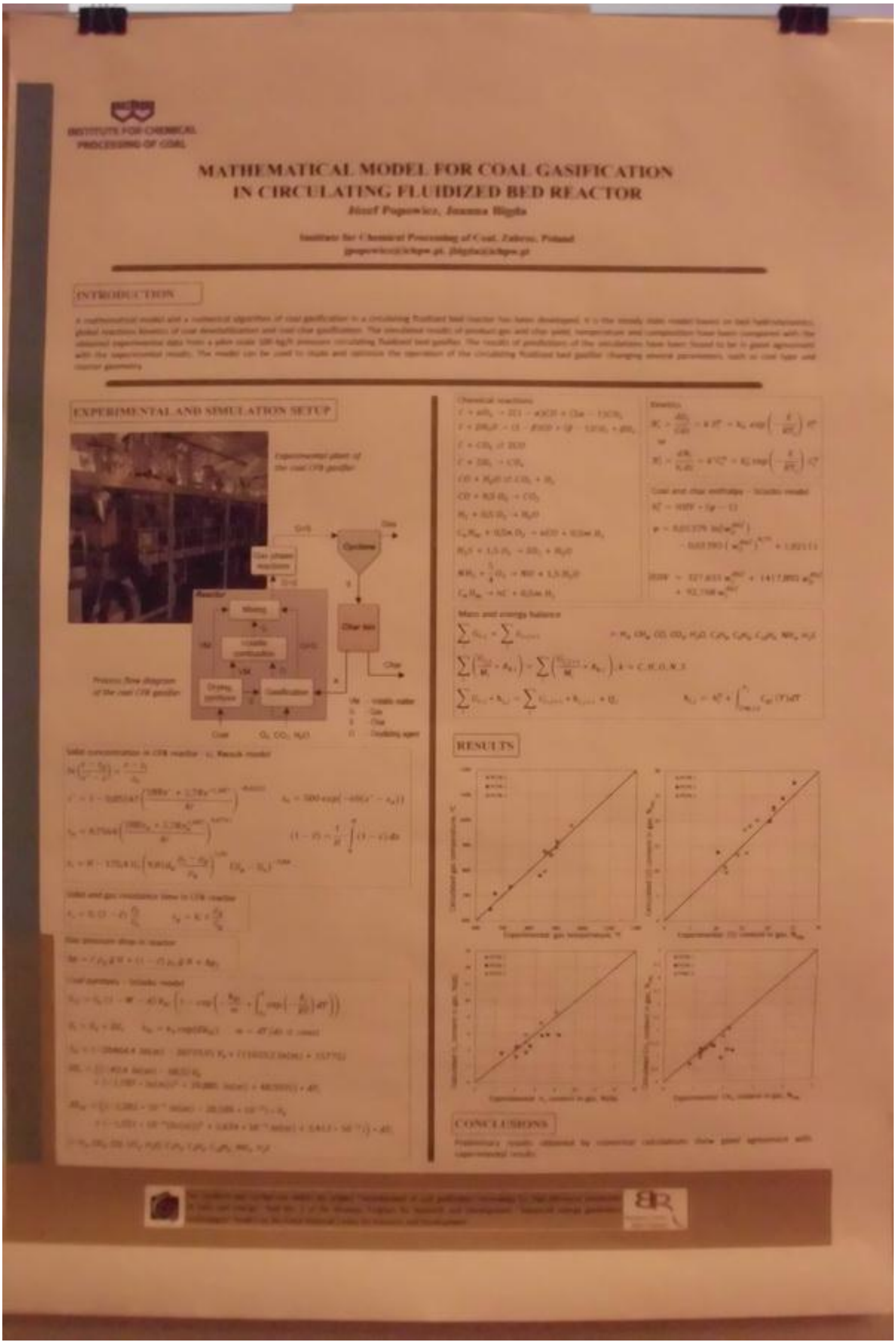
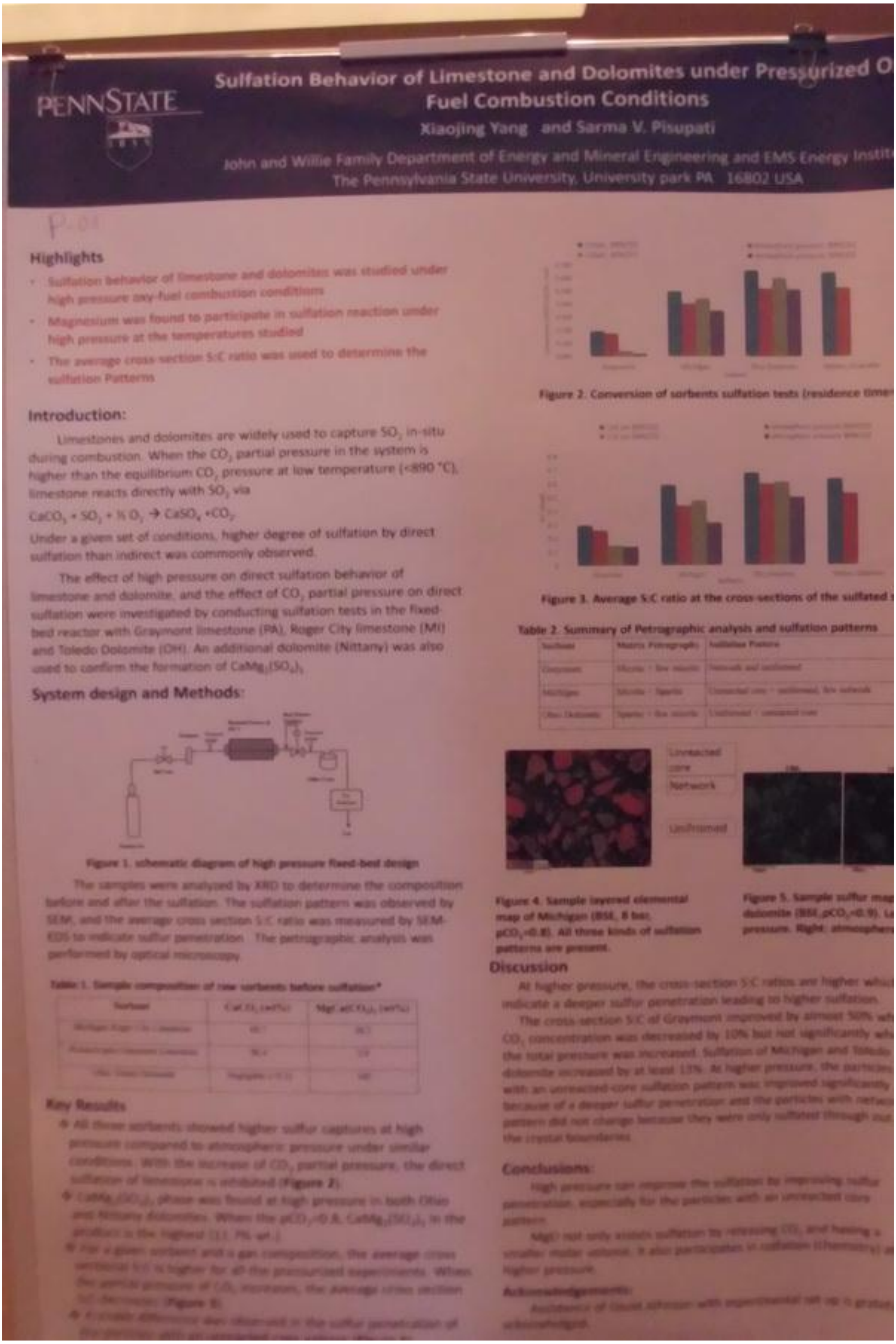

INSTITUTE FOR CHEMICAL PROCESSING OF COAL
MATHEMATICAL MODEL FOR COAL GASIFICATION
IN CIRCULATING FLUIDIZED BED REACTOR
INTRODUCTION
EXPERIMENTAL AND SIMULATION SETUP
RESULTS
CONCLUSIONS

圖 III.1.3-2：



Sulfation Behavior of Limestone and Dolomites under Pressurized O
Fuel Combustion Conditions
Xiaojing Yang and Sarma V. Pisupati
John and Willie Family Department of Energy and Mineral Engineering and EMS Energy Instit
The Pennsylvania State University, University park PA 16802 USA
PENNSTATE
Highlights
Introduction:
System design and Methods:
Figure 1. schematic diagram of high pressure fixed-bed design
Key Results
Figure 2. Conversion of sorbents sulfation tests (residence time
Figure 3. Average S:C ratio at the cross-sections of the sulfated
Table 2. Summary of Petrographic analysis and sulfation patterns
Discussion
Conclusions

圖 III.1.3-3：

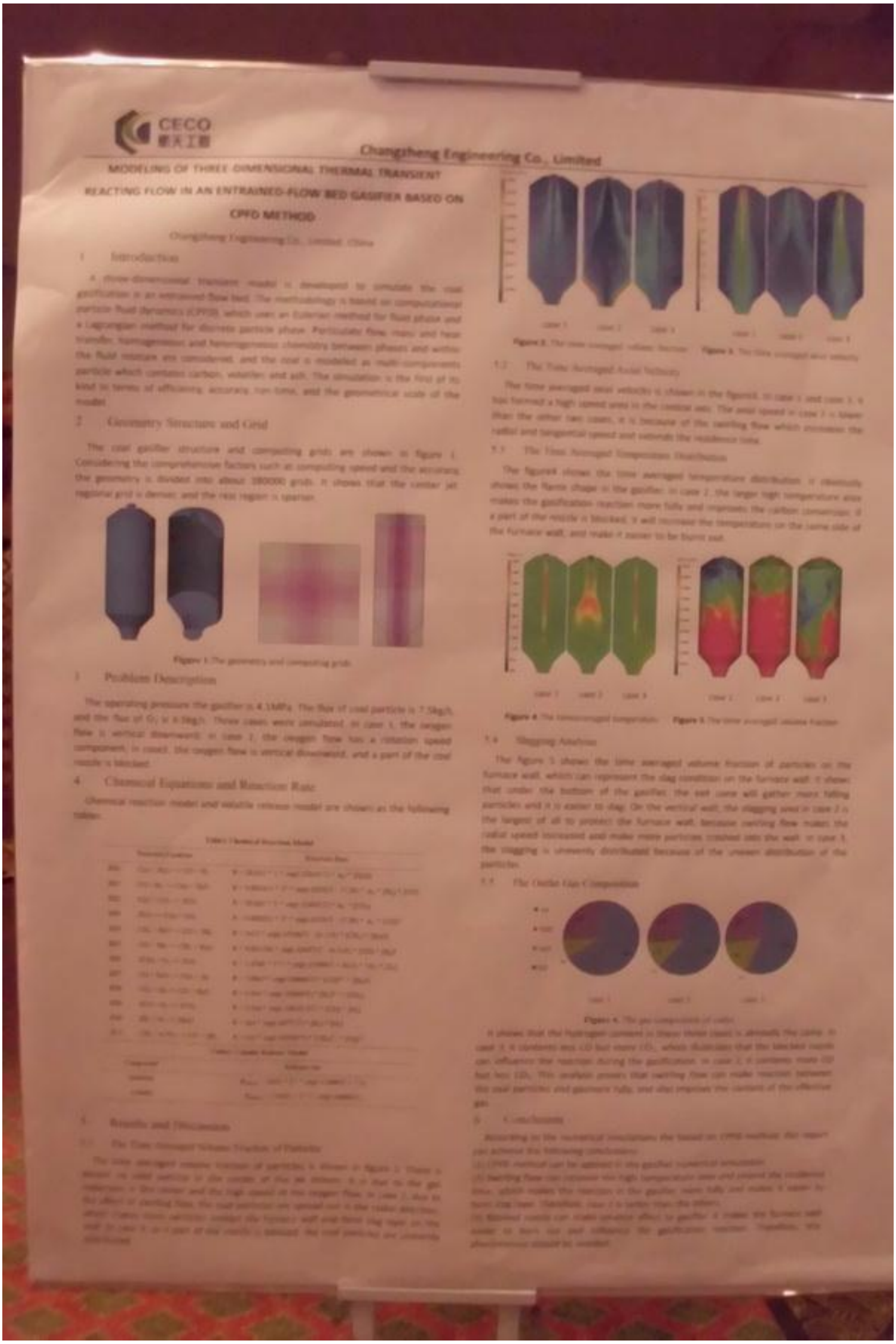

CECO
Changzheng Engineering Co., Limited
MODELING OF THREE DIMENSIONAL THERMAL TRANSIENT
REACTING FLOW IN AN ENTRAINED-FLOW BED GASIFIER BASED ON
CPFD METHOD
1 Introduction
2 Geometry Structure and Grid
3 Problem Description
4 Chemical Equations and Reaction Rate

圖 III.1.3-4：

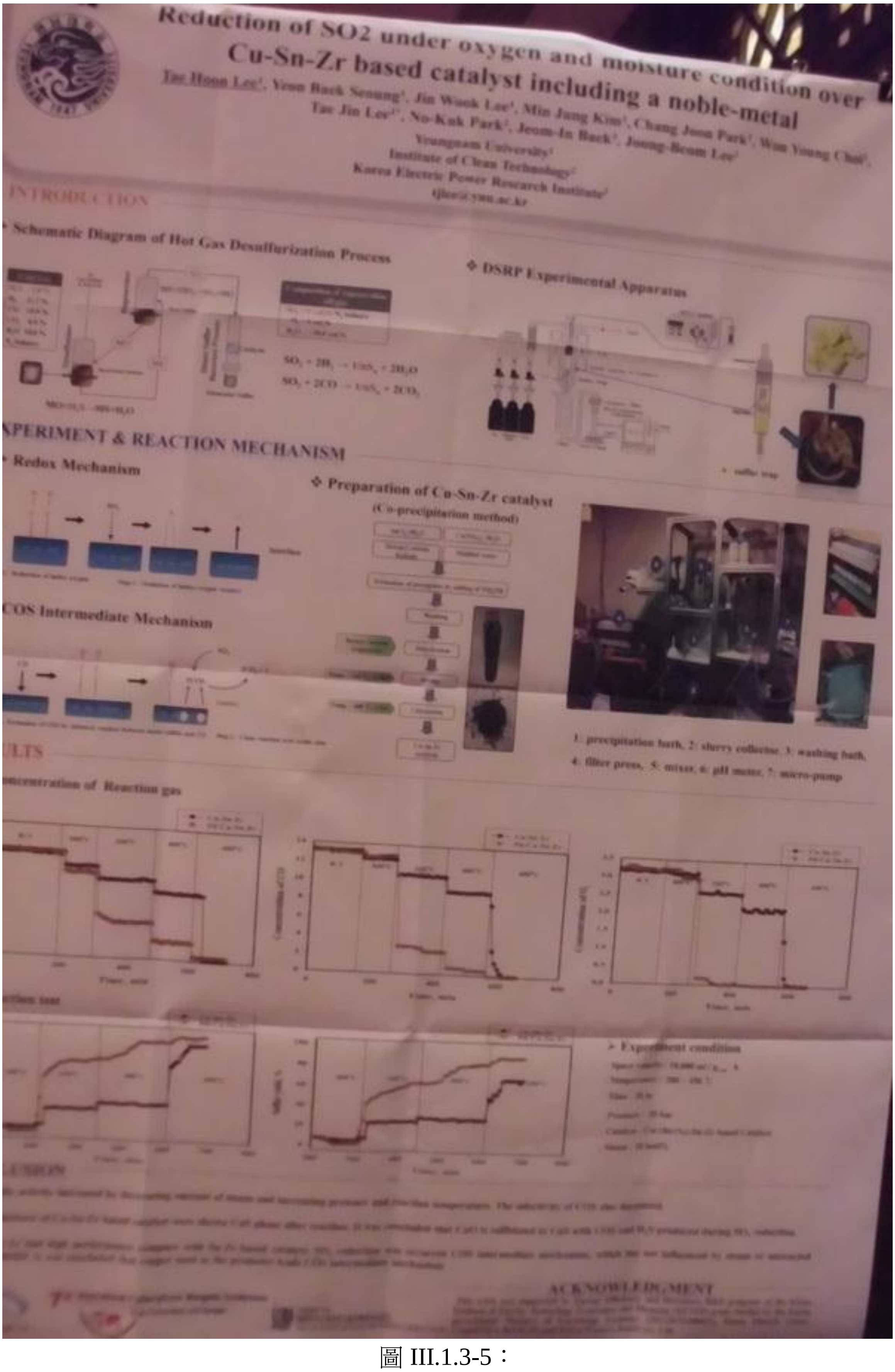

Reduction of SO2 under oxygen and moisture condition over
Cu-Sn-Zr based catalyst including a noble-metal
Yeungnam University
Institute of Clean Technology
Korea Electric Power Research Institute
tjlee@ynu.ac.kr
INTRODUCTION
Schematic Diagram of Hot Gas Desulfurization Process
DSRP Experimental Apparatus
XPERIMENT & REACTION MECHANISM
Redox Mechanism
Preparation of Cu-Sn-Zr catalyst
(Co-precipitation method)
COS Intermediate Mechanism
1: precipitation bath, 2: slurry collector, 3: washing bath,
4: filter press, 5: mixer, 6: pH meter, 7: micro-pump
Concentration of Reaction gas
Experiment condition
ACKNOWLEDGMENT

圖 III.1.3-5：

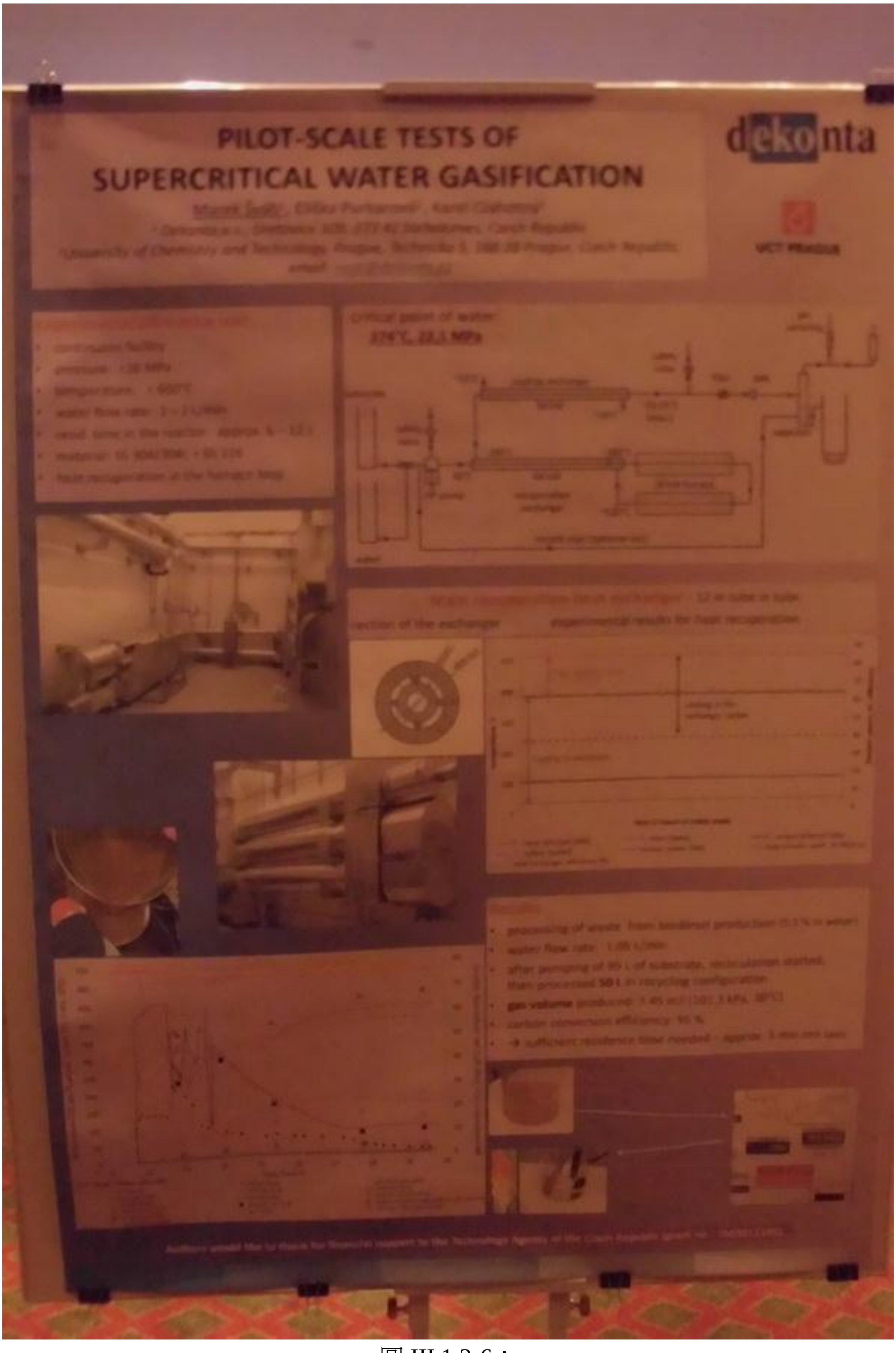

PILOT-SCALE TESTS OF
SUPERCRITICAL WATER GASIFICATION
dekonta

圖 III.1.3-6：

4. Technical Tour

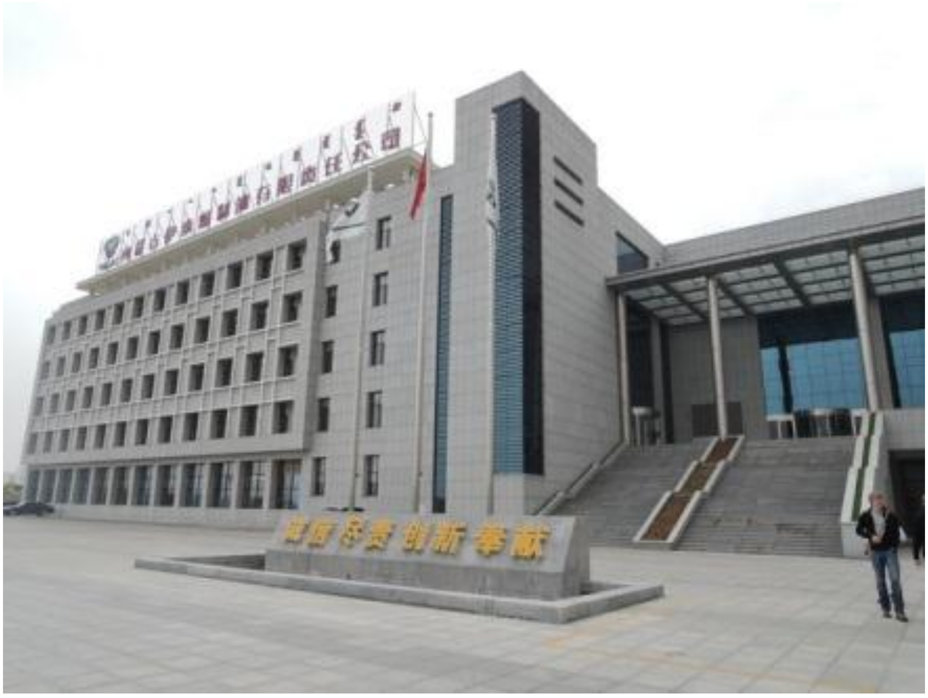


圖 III.1.4-1：

圖 III.1.4-2：

圖 III.1.4-3：

圖 III.1.4-4：

圖 III.1.4-5：

圖 III.1.4-6：

四、建　議　事　項

聯合國跨政府氣候變遷委員會 (Intergovernmental Panel on Climate Change, IPCC) 之第五份評估報告 (AR5) 已自 2013 年底起開始逐步發佈，其中 WG1 報告考慮了氣候變化的新證據，其係建立在對氣候系統觀測、古氣候檔案、氣候過程理論研究和氣候模式類比等的獨立科學分析基礎之上。該報告以 AR4 為基礎，並吸收了後續研究中的新發現，持續警示氣候變遷之相關影響。為減緩全球氣候變化，政府必須儘速明確揭櫫策略方向，投資於科技知識來支持人類活動全方位的必要改變，以確保邁向一個永續之未來。為推動國家減碳政策，政府自 2008 年發佈「永續能源政策綱領」以來積極建構低碳能源發展藍圖；因此，核能研究所積極進行**能源國家型科技計畫**領域之**「淨碳技術發展」**研究計畫，近年來並參與執行能源局能專計畫項下之「二氧化碳捕獲及封存技術研發與示範」計畫，冀望能為我國減碳情景略盡綿薄之力。此外，該計畫亦從永續發展觀點推動**自主性潔淨能源技術之建立**，研發淨煤、多元氣化與應用、碳捕捉與分離等技術，藉以**提升能源自主性、降低國內的碳排放**。

此次公差行程針對技術研發領域之建議事項可分為數個面向分述如下：

(一) IFC 大會議題涵蓋煤轉換技術、氣化技術、合成氣處置、二氧化碳捕獲等低碳能源技術重要領域，**亦相當契合核研所科專計畫的主要內容**，具備未來性與競爭力，值得推動。

(二) **煤製油**與**煤化工技術有望成為未來永續能源轉換的重要技術平台**，顯示**本所淨碳技術開發計畫**推動之多聯產與合成天然氣議題的重點項目**符合國際主流趨勢**，值得持續推動**。**

(三) **氣化技術**與**相關**議題可謂是 IFC 大會的重點項目，包含反應動力、微觀現象、工廠實務等，未來於石化、環保、能源等各領域皆或有其日趨廣泛之應用角色，頗具參考價值。

(四) 本所淨碳團隊在大會中發表之論文被安排在「新技術」領域，簡報內容為化學迴路技術研發之階段性成果，未來可在**國際合作及跨領域之整合扮演關鍵性支持角色。**

(五) IFC 大會由德國主導、澳洲與大陸等產煤大國輔助，其主題為淨煤技術之重點研究範疇；尤其強調國際合作，對實現永續發展將發揮著重要作用，本所**應積極**

參與後續活動。

五、附　錄

（一）第 7 屆弗萊貝格/內蒙古淨煤技術國際研討會議 **(The 7th International Freiberg/Inner Mongolia Conference on IGCC & XtL Technologies, IFC 2015)** 之 Scientific program

IFC 2015 Conference programme/agenda: all

7th International Freiberg/Inner Mongolia Conference on IGCC & XtL Technologies

Coal Conversion and Syngas

7-11 June 2015

Huhhot, Inner Mongolia, China

TU Bergakademie Freiberg · IEC · SYNFUELS CHINA

Programme

Sunday 7 June 2015

18:00 – 20:00	Registration
18:00 – 20:00	**Welcome Evening, Shangri-La Hotel, Huhhot**

Monday 8 June 2015

09:00 – 10:10

Ballroom A & B – **Opening Ceremony**

Bernd Meyer, Institute of Energy Process Engineering and Chemical Engineering, TU Bergakademie Freiberg – Germany

Prof. Dr.-Ing. Bernd Meyer is Director of the Institute of Energy Process Engineering and Chemical Engineering (IEC) and Professor for Energy Process Engineering and Thermal Waste Treatment (EVT) at the TU Bergakademie Freiberg in Freiberg, Germany. Since 2008, he is also the elected Rector of the TU Bergakademie Freiberg. After receiving his Dr.-Ing. degree, Prof. Meyer gained extensive research as well as industry experience through his work in the Brennstoffinstitut Freiberg (also known as Deutsches Brennstoffinstitut – DBI) and in Rheinbraun AG. He was also personally involved in the technology improvement of fixed-bed gasification technologies implemented at Schwarze Pumpe. Research activities at his department EVT focus on diverse issues related to fuel conversion with emphasis on syngas generation technologies. These range from activities related to thermo-chemical conversion, CFD modelling of high temperature processes, syngas technologies, low carbon technologies, mineral matter, process chain development to technologies for solid fuels gasification. In addition to theoretical modelling-based research and experimental work, EVT also carries out process demonstration activities and operations up to pilot scale. Prof. Meyer received an honorary doctorate from the National Mining University Dnipropetrovsk/Ukraine in 2012 and was also awarded an honorary professorship from the Lomonossov Moscow State University/Russia in 2015. Since 2012, he is also the president of the World Forum of Universities of Resources on Sustainability (WFURS). Prof. Meyer is actively involved in diverse national and international research programs in the fields of gasification technologies, gas cleaning and ash/slag behaviour as advisory board member or speaker. Over the course of his career, he has published over 200 scientific papers and obtained more than 100 patents in the field of gasification, of which many relate to fixed-bed gasification technologies.

Ballroom A & B – **Plenary Speakers**

Yong Wang Li, Synfuels China Technology Co., Ltd. – China

Prof. Dr. Yong Wang Li holds the position of Founding Manager in Synfuels China Technology Company Limited. He also holds the positions of Director in the National Engineering Laboratory of Indirect Coal Liquefaction, Director in National Research Centre for Clean Fuels and Deputy Director in the State Key Laboratory of Coal Conversion. Prof. Li is engaged in fundamental research in the fields of quantum chemistry, molecular simulation, catalysis, kinetics and process simulation related to the coal conversion processes, process development of coal/gas to liquids and related unit operation and application of new technologies in process engineering. Around 100 researchers and scientists plus 60 degree students, and more than 400 engineers have been successfully integrated within Synfuels China's platform. All his personal efforts are on scientific and technology development through integrating the financial power of the market and guided by limited government support. Prof. Li has published more than 200 scientific papers, obtained more than 60 authorised patents and one software copyright for Fischer-Tropsch synthesis process analysis. He has been honoured with many awards including the Science and Technology Innovation Award, National Award in Technology Advances and Innovation, Outstanding Science and Technology Achievement Award etc.

Jian Guo Wang, Institute of Coal Chemistry, Chinese Academy of Sciences – China

Prof. Dr. Jian Guo Wang holds the positions of the Director of Institute of Coal Chemistry, Chinese Academy of Sciences and the Director of the State Key Laboratory of Coal Conversion. He is engaged in fundamental research in the fields of zeolite catalysis by combining theoretical computation, molecular simulation with experimental investigations, catalytic process development related to coal conversion, particularly in methanol selective conversion to olefins and aromatics. He received his Ph.D. degree from the Institute of Coal Chemistry, Chinese Academy of Sciences in 1995, studying the adsorption, diffusion and reaction in zeolites. In 1996, he was awarded with an Alexander von Humboldt fellowship and worked in the Institute of Technical Chemistry, University of Erlangen-Nuremberg, Germany, studying the shape selective reactions on zeolites by both continuum and Monte Carlo simulations. He joined the Institute of Coal Chemistry in 1998, and has published some 200 papers and obtained 20 authorised patents. He is the leader of 3 national key fundamental research and technical development projects.

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Exhibitors BRUKER · CECO 航天工程 · EVT · eluwa · RUBOTHERM · SYNFUELS CHINA · Virtuhcon

Monday 8 June 2015						
09:00 – 17:10	*Foyer* – Registration, Posters and Exhibition					
09:00 – 09:10	*Ballroom A & B* – **Opening Ceremony: Bernd Meyer**					
09:10 – 10:10	*Ballroom A & B* – **Plenary Session, Chair:** Hubert Hoewener					
09:10 – 09:30	Bernd Meyer, TU Bergakademie Freiberg – Germany					
09:30 – 09:50	Yong Wang Li, Synfuels China Technology Co., Ltd. – China					
09:50 – 10:10	Jian Guo Wang, Institute of Coal Chemistry, Chinese Academy of Sciences – China					
10:10 – 11:00	**Coffee Break + Poster Session**					
11:00 – 12:20	*Ballroom A* – **Session 1: Global status CtX,** Chair: Chris Higman		*Ballroom B* – **Session 2: Mineral matter I,** Chair: Johan van Dyk		*Ballroom C* – **Session 3: Fuel preparation & upgrading,** Chair: Raymond Everson	
11:00 – 11:20	01-1	Coal for fuels and chemicals: Worldwide challenges and opportunities (Andrew Minchener, IEA Clean Coal Centre – UK)	02-1	The internal and external factors on coal ash slag viscosity at high temperatures (Jin Bai, Institute of Coal Chemistry, Chinese Academy of Sciences – China)	03-1	Pre-gasification coal beneficiation by DryFining™ (Charles Bullinger, Great River Energy – USA)
11:20 – 11:40	01-2	Overview of drivers and status of coal-to-liquids developments in Australia (David Harris, CSIRO – Australia)	02-2	Effect of initial particle size on the transformation of mineral matter rich fractions of coal and various minerals during entrained flow gasification (Sarma Pisupati, Pennsylvania State University – USA)	03-2	Investigation of high-strength lump coke from lignite and sub-bituminous coals (Franz Fehse, TU Bergakademie Freiberg – Germany)
11:40 – 12:00	01-3	Forces in and future of coal utilisation in the US (Qingyun Sun, US China Energy Centre, West Virginia University – USA)	02-3	Viscosity of partially crystalline slags (Daniel Schwitalla, TU Bergakademie Freiberg – Germany)	03-3	Effect of hydrothermal treatment on pyrolysis products of lignite (Peng Liu, ECUST – China)
12:00 – 12:20	01-4	TBD (Samuel Tam, Department of Energy – USA)	02-4	Experimental and modelling studies on viscosity of typical Australian brown coal ashes (Alexander Ilyushechkin, CSIRO – Australia)	03-4	Effects of CO_2 on sulphur removal and its release behaviour of sulphur-containing compounds during coal pyrolysis (Fenrong Liu, Inner Mongolia University – China)
12:20 – 13:20	**Lunch**					
13:20 – 15:00	*Ballroom A* – **Session 4: Syngas treatment,** Chair: Jian Guo Wang		*Ballroom B* – **Session 5: Reactor simulation,** Chair: Andreas Richter		*Ballroom C* – **Session 6 Tar upgrading,** Chair: Steffen Krzack	
13:20 – 13:40	04-1	An overview of U.S. DOE's advanced gasification technologies programme (Nelson Rekos, U.S. DOE-National Energy Technology Laboratory – USA)	05-1	Dynamic simulation of coal-water slurry gasification with opposed multi-burner (Zhenghua Dai, ECUST – China)	06-1	Microwave-induced pyrolysis of coal and biomass (Jiefeng Yan, University of Nottingham Ningbo – China)
13:40 – 14:00	04-2	Gasification treatment solutions – UOP SeparAll™ process and Polybed™ PSA (Fangzhou Hu, UOP Honeywell – USA)	05-2	CPFD modelling of CO_2 enhanced coal gasification in circulating fluidised bed reactor (Joanna Bigda, Institute for Chemical Processing of Coal – Poland)	06-2	Effect of addition zeolite catalyst on the tar quality from Shenmu coal pyrolysis (Dexiang Zhang, ECUST – China)
14:00 – 14:20	04-3	Gasification, warm-gas cleanup, and liquid fuel production with coal and biomass blends (Jason Laumb, University of North Dakota Energy & Environmental Research Center – USA)	05-3	Integration of coal drying in a mathematical model for Lurgi FBDB™ gasification (Martin Gräbner, Air Liquide F&E GmbH – Germany)	06-3	Integrated process of coal pyrolysis with tri-reforming of methane for improving tar yield (Haoquan Hu, Dalian University of Technology – China)
14:20 – 14:40	04-4	RTI warm syngas cleanup technology demonstration (David Denton, RTI International – USA)	05-4	Numerical modelling of the large-scale Virtuhcon Benchmark for non-catalytic natural gas reforming (Yury Voloshchuk, TU Bergakademie Freiberg – Germany)	06-4	Preparation and evaluation of $Ni\text{-}Mo/Al_2O_3$ catalysts for catalytic hydrogenation of low temperature coal tar (Jing Zhao, ECUST – China)
14:40 – 15:00	04-5	RD&D activities of SNG production from syngas methanation at DICP (Shudong Wang, Dalian Institute of Chemical Physics, Chinese Academy of Sciences – China)	05-5	CFD-simulation of a membrane module for carbon capture from coal derived syngas (Philipp Meysel, TU Munich – Germany)	06-5	
15:00 – 15:30	**Coffee Break + Poster Session**					
15:30 – 17:10	*Ballroom A* – **Session 7: Gasification technologies I,** Chair: Rob van den Berg		*Ballroom B* – **Session 8: Gasification kinetics & experiments,** Chair: Rajender Gupta		*Ballroom C* – **Session 9: Synthesis technologies,** Chair: Yong Wang Li	
15:30 – 15:50	07-1	Siemens fuel gasification technology: status and new developments (Frank Hannemann/Dehui Wang, Siemens Fuel Gasification Technology GmbH & Co. KG/Siemens Limited China – Germany/China)	08-1	Gasification of Athabascan asphaltenes in a drop tube furnace (André Bader, TU Bergakademie Freiberg/University of Alberta – Germany/Canada)	09-1	Present and future opportunities downstream gasifiers (Klas Andersson, Haldor Topsøe – Denmark)
15:50 – 16:10	07-2	Wison-Shell bottom quench coal gasification technology: Innovation and advantages (Fen He, Shell (China) Projects and Technology Limited – China)	08-2	Low temperature entrained flow gasification behaviour of Victorian brown coal (Sankar Bhattacharya, Monash University – Australia)	09-2	Advanced process intensification approaches for liquid production from coal (Andrew Lucero, Southern Research Institute – USA)
16:10 – 16:30	07-3	Integration of KBR's TRIG & ammonia technologies – low rank coal to ammonia (Manoj Nagvekar, KBR Technology – USA)	08-3	Influence of enhanced pressure on the initial structure of char and its CO_2 gasification reactivity (Kevin Günther, TU Bergakademie Freiberg – Germany)	09-3	Synthetic gasoline production in combination with carbon dioxide utilisation (Stephan Schmidt, Chemieanlagenbau Chemnitz GmbH – Germany)
16:30 – 16:50	07-4	Considerations on the gasification technology selection (Jiansheng Zhang, Tsinghua University – China)	08-4	Pilot scale studies on coal gasification in a circulating fluidised bed reactor with CO_2 addition as a gasifying agent (Aleksander Sobolewski, Institute for Chemical Processing of Coal – Poland)	09-4	A stochastic simulation: understanding the CO activation mechanisms in Fischer-Tropsch synthesis on Fe(110) model surfaces (Xin Xu, Fudan University – China)
16:50 – 17:10	07-5	Two-dimensional CFD simulation for industrial coal-water slurry entrained flow gasifier (Yu Zhang, Synfuels China Technology Co., Ltd. – China)	08-5	Determination of Langmuir-Hinshelwood gasification kinetics from integral drop tube experiments (Florian Keller, TU Bergakademie Freiberg – Germany)	09-5	
19:00 – 22:00	*Ballroom A & B* – **Conference Dinner**					

Tuesday 9 June 2015						
08:30 – 16:00	*Foyer* – Registration, Posters and Exhibition					
08:30 – 09:50	*Ballroom A* – **Session 10: Gasification technologies II**, Chair: Andrew Minchener		*Ballroom B* – **Session 11: New technologies I**, Chair: Peter Seifert		*Ballroom C* – **Session 12: Mineral matter II**, Chair: Stefan Guhl	
08:30 – 08:50	10-1	Gasification characteristics of typical coal used in HT-L gasifier (Yan Zhang, Changzheng Engineering Co., Ltd. – China)	11-1	Stepwise liquefaction technology for fossil fuels (Qiang Guo, Synfuels China Technology Co., Ltd. – China)	12-1	Refractory developments for gasification (Patrick Stephan, Saint-Gobain Ceramics & Plastics, Inc. – USA)
08:50 – 09:10	10-2	Development and application of ECUST OMB gasification process (Zhijie Zhou, ECUST – China)	11-2	Comparison of iron-, nickel- and copper-based oxygen carriers for chemical-looping combustion (Yau Pin Chyou, Institute of Nuclear Energy Research – Taiwan)	12-2	Coal ash sintering characterisation by means of impedance spectroscopy (Ronny Schimpke, TU Bergakademie Freiberg – Germany)
09:10 – 09:30	10-3	Shell coal gasification technology: An integrated solution for efficient coal-to-products value chains (Rob van den Berg, Shell (China) Projects and Technology Limited – China)	11-3	Recent progress on methanol to olefins reaction and technology (Zhongmin Liu, Dalian Institute of Chemical Physics, Chinese Academy of Sciences – China)	12-3	Effect of Na on mineral transformation of coal ash at high temperatures and ash flow properties under reducing atmosphere (Jin Bai, Institute of Coal Chemistry, Chinese Academy of Sciences – China)
09:30 – 09:50	10-4	Air Liquide gasification development update (Daniel van der Merwe, Air Liquide Global E&C Solutions Shanghai Co., Ltd. – China)	11-4		12-4	Slag-induced corrosion of refractory materials under simulated gasification conditions (Markus Reinmöller, TU Bergakademie Freiberg – Germany)
09:50 – 10:20	**Coffee Break + Poster Session**					
10:20 – 11:40	*Ballroom A* – **Session 13: Gasification technologies & plants**, Chair: Martin Gräbner		*Ballroom B* – **Session 14: Entire concepts I**, Chair: Martin Gall		*Ballroom C* – **Session 15: Gasification kinetics**, Chair: Sankar Bhattacharya	
10:20 – 10:40	13-1	TKIS's proprietary gasification technology HTW™, an optimal solution for brown coal and low rank coal in China (Vincent Liu, TKIS AG – Germany)	14-1	Increasing the flexibility of IGCC power plant (Chris Higman, Higman Consulting GmbH – Germany)	15-1	High pressure entrained flow studies of gasification of Rhenish lignite (David Harris, CSIRO Energy – Australia)
10:40 – 11:00	13-2	BGL-Technology (André Schmidt, ZEMAG Clean Energy Technology GmbH – Germany)	14-2	Syngas-based annex concepts for chemical energy storage and improving flexibility of pulverised coal combustion power plants (Christian Wolfersdorf, TU Bergakademie Freiberg – Germany)	15-2	Brown coal char CO_2-gasification kinetics with respect to the char structure (Evgeniia Komarova, TU Bergakademie Freiberg – Germany)
11:00 – 11:20	13-3	The present and future development plan for coal to chemicals of Yitai Group (Juncheng Li, Inner Mongolia Yitai Group Co., Ltd. – China)	14-3	The potential of water-gas shift membrane reactors for CtX and flexible polygeneration processes (Alexander Buttler, TU Munich, Germany)	15-3	Effects of processing conditions on gasification of brown coal and kinetics (Lingmei Zhou, China University of Mining and Technology – China)
11:20 – 11:40	13-4	The feature extraction of gasification parameters during the coal gasification process (Wenbin Zhang, Changzheng Engineering Co., Ltd. – China)	14-4	Flexible operation and control of methanol production from fluctuating syngas feed (Matthias Gootz, TU Bergakademie Freiberg – Germany)	15-4	Investigations on char gasification kinetics under CO_2 atmosphere at med pressures (Victor Gonzalez, TU Bergakademie Freiberg – Germany)
11:40 – 12:40	**Lunch**					
12:40 – 14:00	*Ballroom A* – **Session 16: Microscopic phenomena in gasification**, Chair: David Harris		*Ballroom B* – **Session 17: Entire concepts II**, Chair: Manfred Wirsum		*Ballroom C* – **Session 18: CFD modelling**, Chair: Jason Laumb	
12:40 – 13:00	16-1	Fragmentation behaviour of several coals and its chars in a drop-tube reactor (Jan Friedemann, TU Bergakademie Freiberg – Germany)	17-1	Development status of dynamic modelling of Taean IGCC gasifier (Youseok Kim, Doosan Heavy Industries & Construction – Korea)	18-1	Multi-scale simulation of multiphase systems with petaflops supercomputing (Wei Ge, Institute of Process Engineering, Chinese Academy of Sciences – China)
13:00 – 13:20	16-2	Fragmentation initiation prediction of coal particles in a drop tube furnace according to tensile strength and porosity (Shan Zhong, TU Bergakademie Freiberg – Germany)	17-2	Tech-economic assessment of a coproduction system integrated with lignite pyrolysis and Fischer-Tropsch synthesis (Wenying Li, Taiyuan University of Technology – China)	18-2	Numerical simulation of a new reactor for the in-situ measurement of char particle conversion (Fengbo An, TU Bergakademie Freiberg – Germany)
13:20 – 13:40	16-3	Effect of temperature and residence time on soot formation during pyrolysis and gasification of asphaltene (Rajender Gupta, University of Alberta – Canada)	17-3	Concept of demonstration plant for methanol synthesis by CO_2 enhanced gasification of coal in fluidised bed reactor (Tomasz Chmielniak, Institute for Chemical Processing of Coal – Poland)	18-3	Comparison of numerical simulation method of coal gasification (Yan Zhang, Changzheng Engineering Co., Ltd. – China)
13:40 – 14:00	16-4	The DFT molecular modelling and particle kinetics studies of the mechanism for CO_2-char gasification (Raymond Everson, North West University – South Africa)	17-4		18-4	Interface and porosity tracking of a reacting char particle in CO_2 atmosphere (Frank Dierich, TU Bergakademie Freiberg – Germany)
14:00 – 14:30	**Coffee Break + Poster Session**					
14:30 – 15:30	*Ballroom A* – **Session 19: New technologies II**, Chair: Patrick Stephan		*Ballroom B* – **Session 20: Components**, Chair: Dehui Wang		*Ballroom C* – **Session 21: Underground coal gasification**, Chair: Aleksander Sobolewski	
14:30 – 14:50	19-1	A novel method to upgrade heavy oil using non-thermal plasma technology (Haigang Hao, Synfuels China Technology Co., Ltd. – China)	20-1	Dry ash handling solution for all non-slagging coal gasification processes (Günter Baur, Magaldi Power GmbH – Germany)	21-1	Coal seam surrounding strata in terms of UCG process contaminants migration (Krzysztof Lis, KGHM Cuprum Ltd. – Poland)
14:50 – 15:10	19-2	Supercritical water gasification: carbon gasification efficiency (Eliška Purkarová, University of Chemistry and Technology Prague – Czech Republic)	20-2	Custom tailored gasifier feed pumps (Daniel Nägel, FELUWA Pumpen GmbH – Germany)	21-2	Spontaneous combustion assessment of a coal reserve planned for underground coal gasification (Johan van Dyk, African Carbon Energy – South Africa)
15:10 – 15:30	19-3		20-3		21-3	Evolution of tar compounds in raw gas from a pilot-scale underground coal gasification (UCG) trial (Krzysztof Kapusta, Central Mining Institute – Poland)
15:30 – 16:00	*Ballroom A & B* – **Closing Ceremony**					
17:00 – 19:00	**Visit to Dazhao Temple**					

Technical Tours

Wednesday 10 June 2015

08:30 – 17:00	**Technical Tour 1 – Yitai Dalu Coal-to-Liquids Plant**

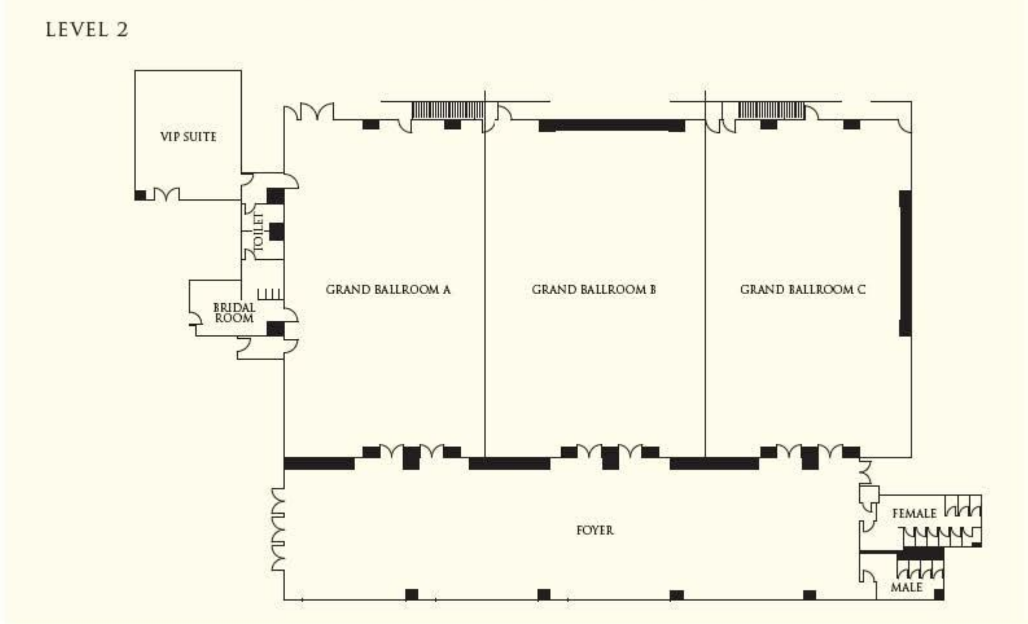
Thursday 11 June 2015

08:30 – 17:00	**Technical Tour 2 – OMB Plant in Inner Mongolia Rongxin Chemical Industry Co., Ltd.**

Poster Session Programme

P01	Reduction of sulphur amount by electrochemical method in lignite coal of Shivee Ovoo mining in Mongolia (Battsengel Baatar, German-Mongolian Institute for Resources and Technology – Mongolia)
P02	Mathematical model for coal gasification in circulating fluidised bed reactor (Joanna Bigda, Institute for Chemical Processing of Coal – Poland)
P03	MnOx-loaded non-carbon based sorbent derived from waste paper recycling for mercury capture from fuel gas with application to gasification systems (Haoquan Hu, Dalian University of Technology – China)
P04	Condition dependency of direct coal liquefaction process (Xingjia Jiang, Institute of Coal Chemistry, Chinese Academy of Sciences – China)
P05	Effect of temperature and pressure on direct coal liquefaction using Ni-Mo/macro, mesoSBA-15 catalysis (Tae Hoon Lee, Yeungnam University – Republic of Korea)
P06	Reduction of SO_2 under oxygen and moisture condition over Cu-Sn-Zr based catalyst including a noble-metal (Tae Hoon Lee, Yuengnam University – Republic of Korea)
P07	Study of hydrogen donation ability of solvents in DCL from a free radical viewpoint (Muxin Liu, Institute of Coal Chemistry, Chinese Academy of Sciences – China)
P08	Sulfation mechanism in limestone and dolomite under high pressure oxy-fuel combustion atmosphere (Sarma Pisupati, Pennsylvania State University – USA)
P09	Detailed analysis of the mass balance of a pressurised pyrolysis (Gerrit Surup, Air Liquide Research and Development GmbH – Germany)
P10	Pilot-scale tests of supercritical water gasification (Marek Svab, Dekonta, a.s. – Czech Republic)
P11	Mineral matter behaviour of brown coal ash in oxidising and reducing atmosphere (Guanjun Zhang – China)
P12	The 3D visualisation and quantitative analysis of pore microstructure of coals (Jun Zhang, Institute of Coal Chemistry, Chinese Academy of Sciences – China)
P13	Modelling of three-dimensional thermal transient reacting flow in an entrained-flow bed gasifier based on computational particle fluid dynamics method (Yan Zhang, Changzheng Engineering Co., Ltd. – China)

Floor Plan (Shangri-La Hotel, Huhhot)



Please note that the programme is prepared in British English. Presentation titles in American English are therefore edited to ensure consistency in the language used in the conference abstract book. All tours (Dazhao Temple and technical tours) will depart from and return to the Shangri-La Hotel. For conference participants who have registered to take part in these events, please meet at the front entrance of the hotel 10min before the official time whereby the tour is starting. Please note that the duration of the tour and the time we will return to the hotel may change slightly depending on traffic conditions.