US-China Advanced Coal Technology Consortia: Technical Highlights

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A lot of progress in a short time

中美清洁能源中心清洁煤技术联盟大会
Sino-US Clean Energy Research Center-ACTC Joint Meeting
2012.2.29

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A lot of progress in a short time

- Agreements, R&D plans, joint meetings
- 270 papers; 17 Patents; 80 Conference; 5 MOU
- Exchanges, peer-to-peer collaboration
- Joint R&D on flagship projects

A strong platform for closer joint research

Activities

No	Date	Place	Activities/Outputs	Attendees
1	2012.2.28	Wuhan	All hands meeting/Progress discussed	All from China-ACTC
2	2012.2.29-3.1	Wuhan	Joint-meeting/Progress and next plan	All from two sides
3	2012.3.5-3.6	Hainan	CERC IP Workshop/Discuss IP issue	Some from two sides
4	2012.6.3	Xi'an	Theme 6 Meeting/Progress, 10-pt plan	Some from two sides

Communication/Exchange

- Mutual visits
  - HNCERI/NETL
  - HNCERI/UKY
  - UWY/SPIERCE+YANCHANG
- New agreements
  - Huaneng/Duke
  - LP Amina/Gemeng
  - HNCERI/LLNL
- Field Program
- EOR Conference (Xi'An)

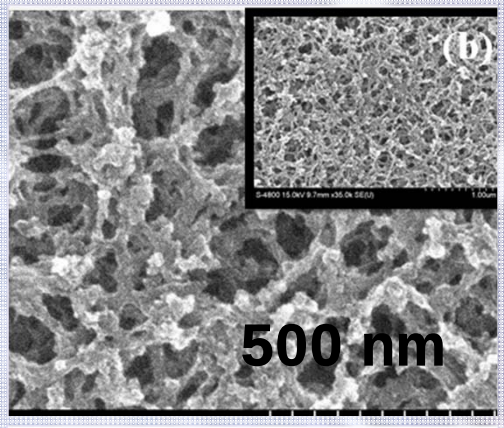
Huaneng/Duke CO2 Capture Agreement, Washington D.C., Feb

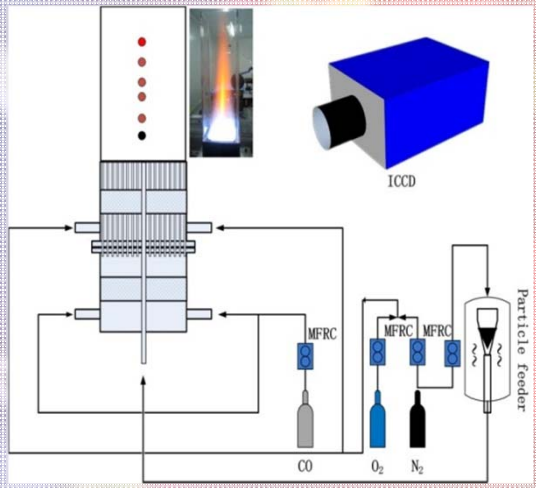
U. Wyoming/NorthWest U., Joint geological survey, Ordos Basin

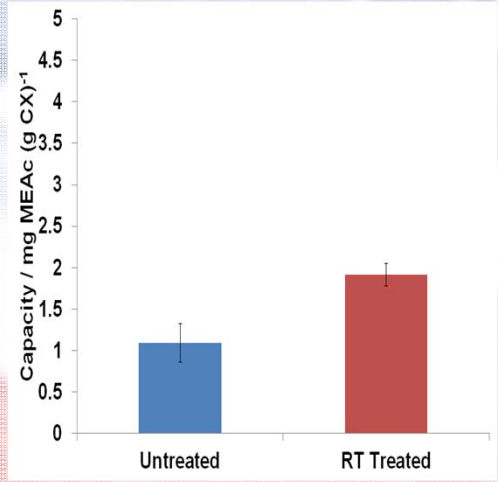
Important progress: CO2 capture

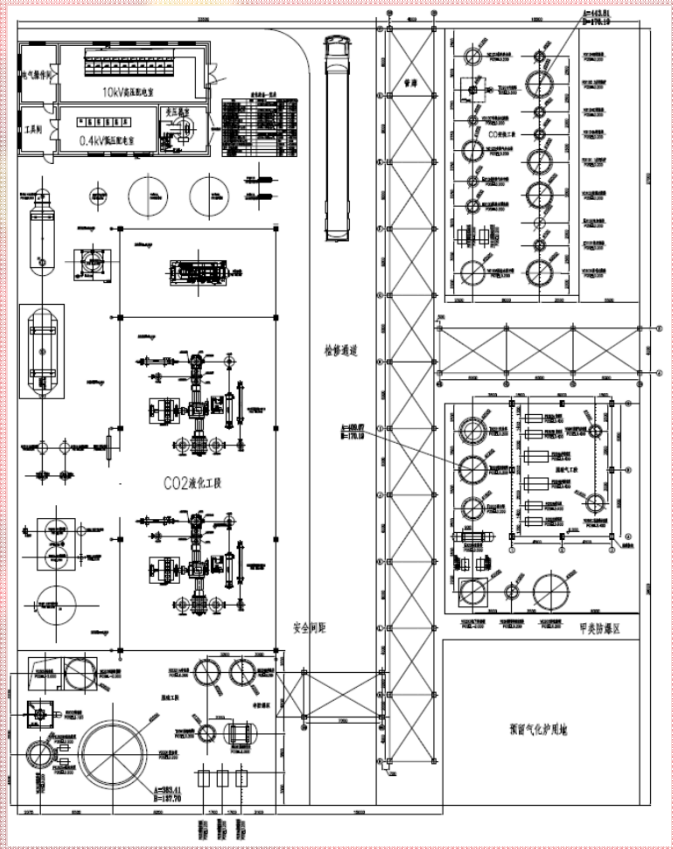
- R&D Roadmap: Advanced USC boiler (700 °C)
- Design of IGCC 30MW capture facility
- New solvent and sorbent development
- Dynamic modeling of Solvents
- Oxyfiring feasibility: 350 MW new build

Important progress: CO2 capture









Design for 30 MW pilot; Tianjin

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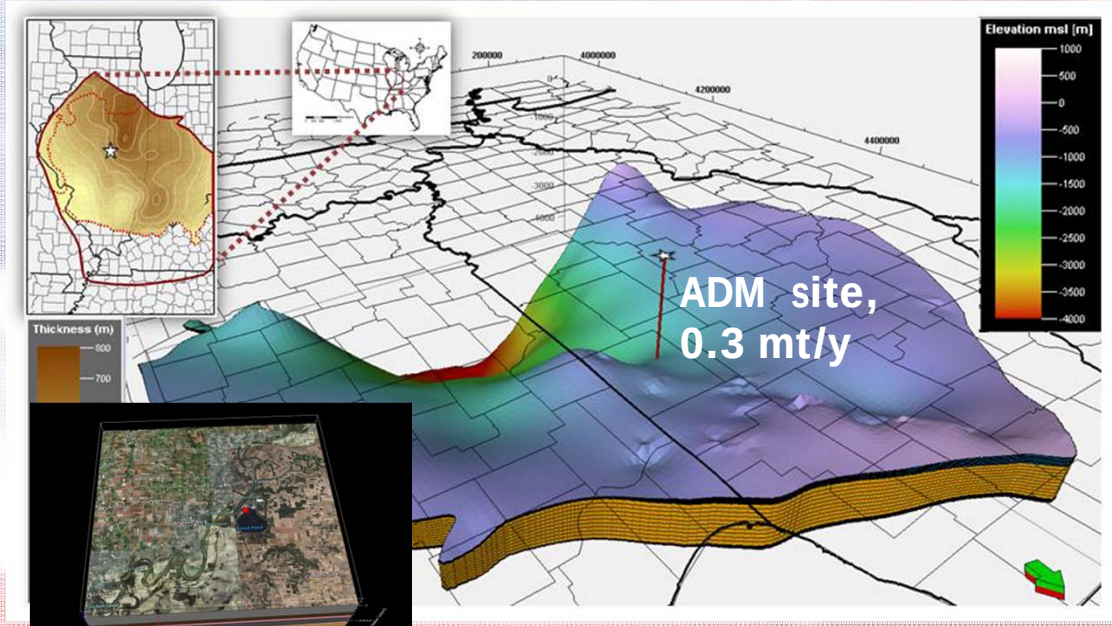
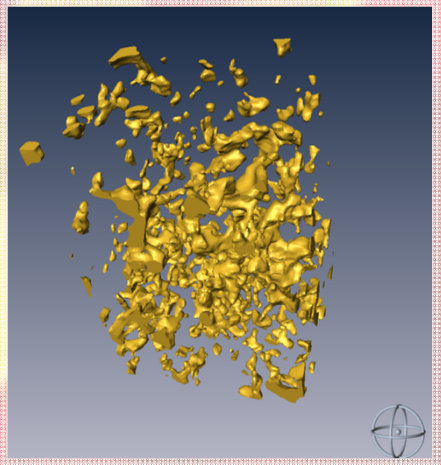
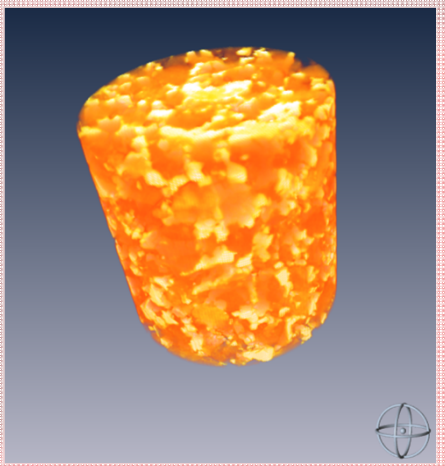
Important progress:Sequestration

- Two major studies: Indiana and Wyoming
- New China GIS data set
- Yanchang EOR: IRSM and UWY
- New opportunities: Residual Oil Zones (ROZ)
- Rapid screening tools for low-data regions

Important progress:Sequestration







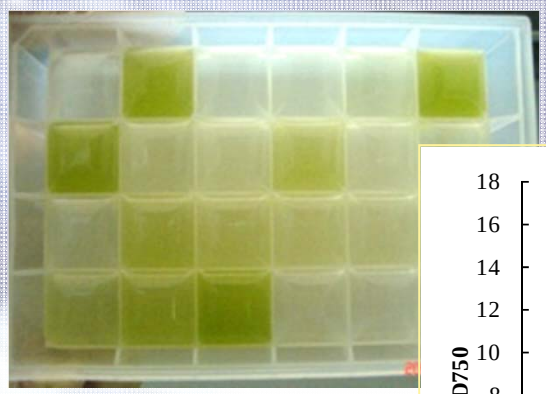
Important progress:Sequestration

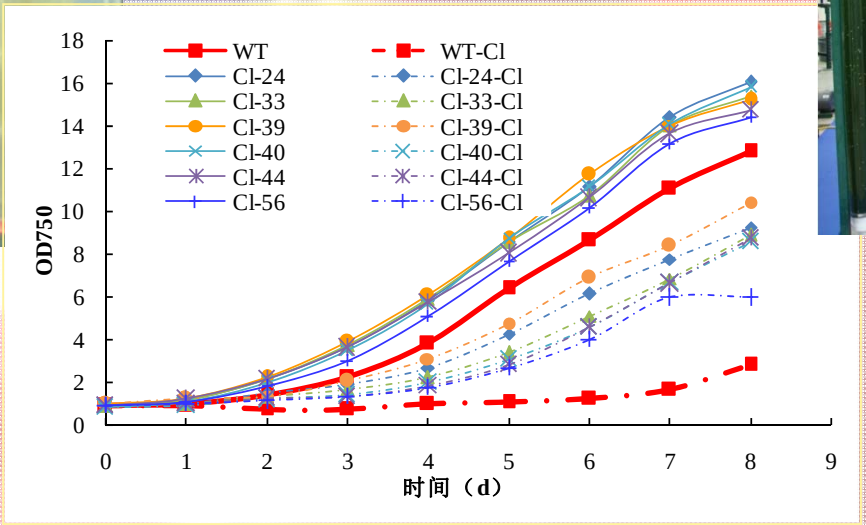
Yanchang Oil Field, Ordos Basin

Important progress: Utilization

- Microalgae retrofit and conversion

试剂A处理培养 Treatment A





Joint R&D Highlight

Huaneng/Duke Gibson-3 Retrofit Assessment

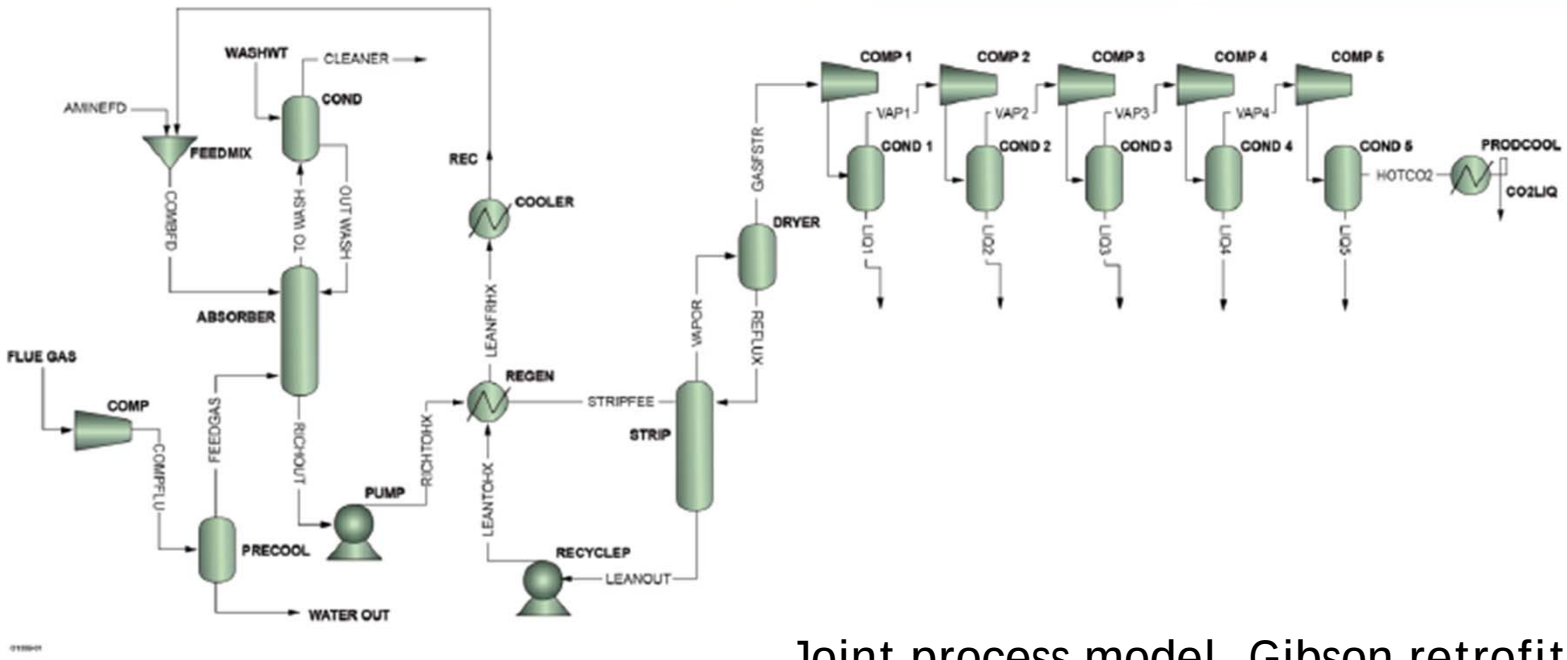
- Sharing proprietary data
- Access to plants, sites
- Model comparison
- Technoeconomic evaluation

Huaneng/Duke Retrofit Assessment

- Team: HNCERI, Duke, LLNL
- Gibson plant, Unit-3
- Shidongkou Pilot

Multiple plant visits and exchanges

Huaneng/Duke Retrofit Assessment



Joint process model, Gibson retrofit

Results of Study

- Technical:
  - 28% capture penalty, all in
  - $30/ton in China confirmed
  - $61-68/ton Gibson retrofit
  - Additional operational info
- Commercial:
  - Huaneng/Duke agreement
  - Huaneng FEED study for 400 MW
  - Challenges remain

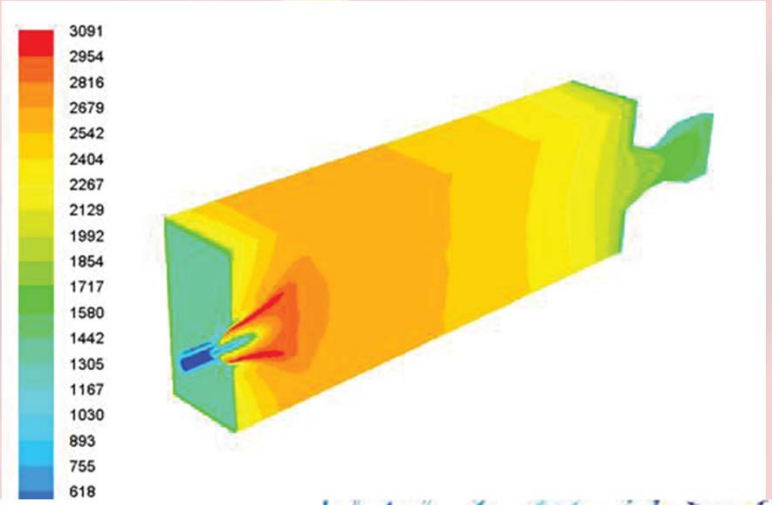
Joint R&D Highlight

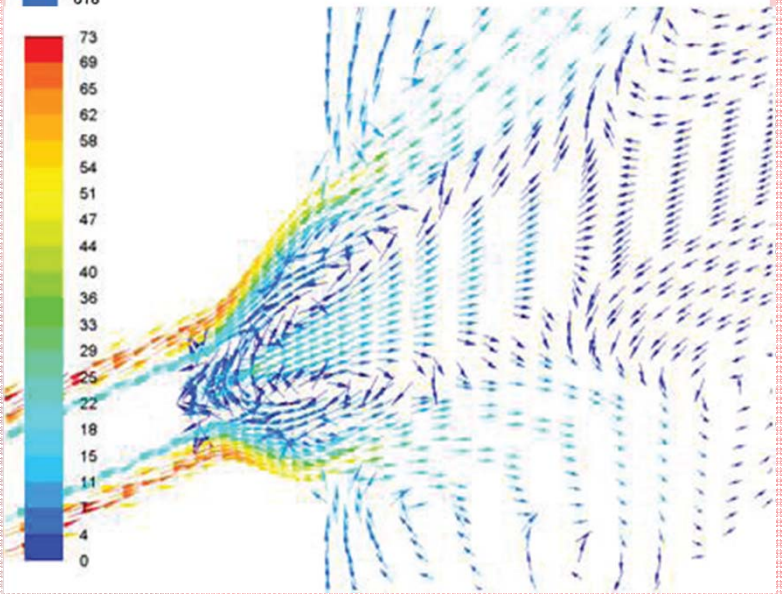
Polygeneration project: LP Amina CaC_2 process

- Novel technology with major efficiency gain
- Advanced modeling
- Prepare pilot project

LP Amina CaC_2 process

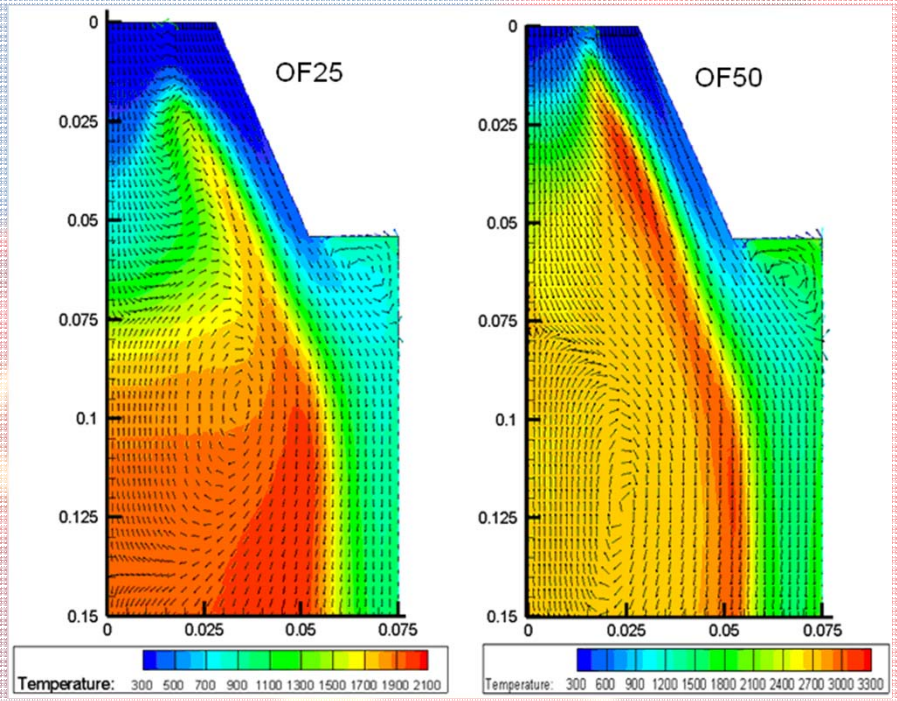
- Combines coal-to-chemical production with power generation
- Oxyfiring approach
- Team: LP Amina; WVU; GMIE; ZheJiang U.

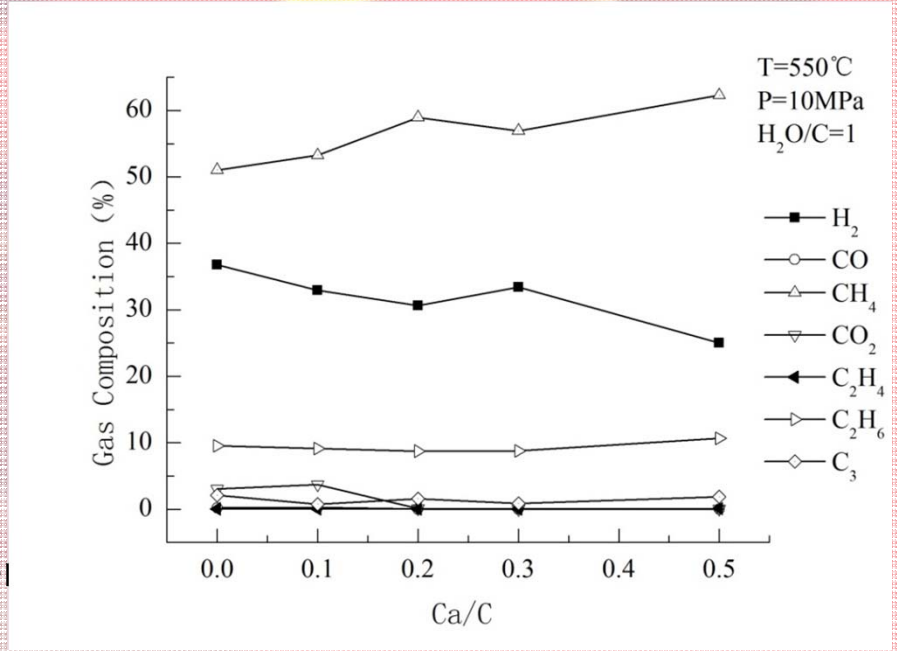




Results

- Simulations completed; validation pending
- 100 MW unit completed
- Expectations:
  - 25-50% emissions reduction
  - 50-100% efficiency gain





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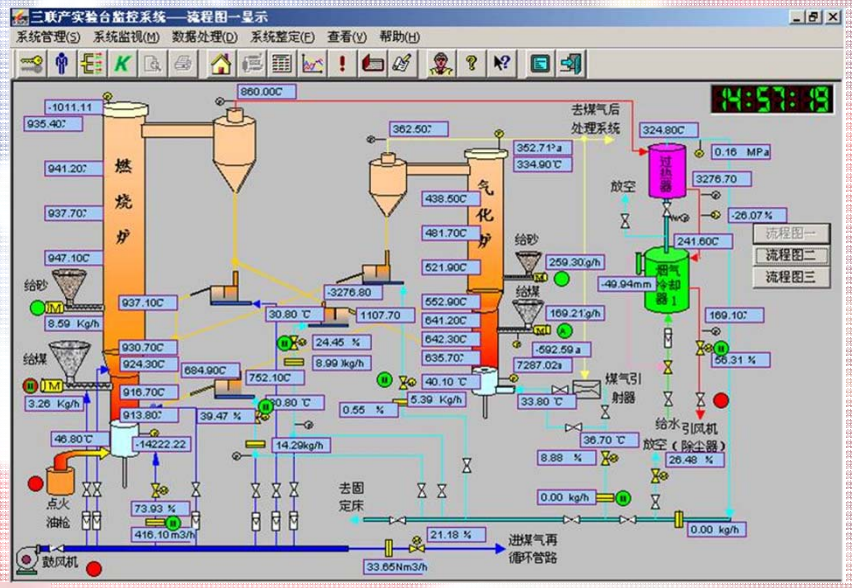
New Process: Combined Pyrolysis, Gasification, and Combustion

- **Coal co-generation technology combined pyrolysis, gasification and combustion is valided on 1MWt pilot plant and may be demonstrated in industry.**



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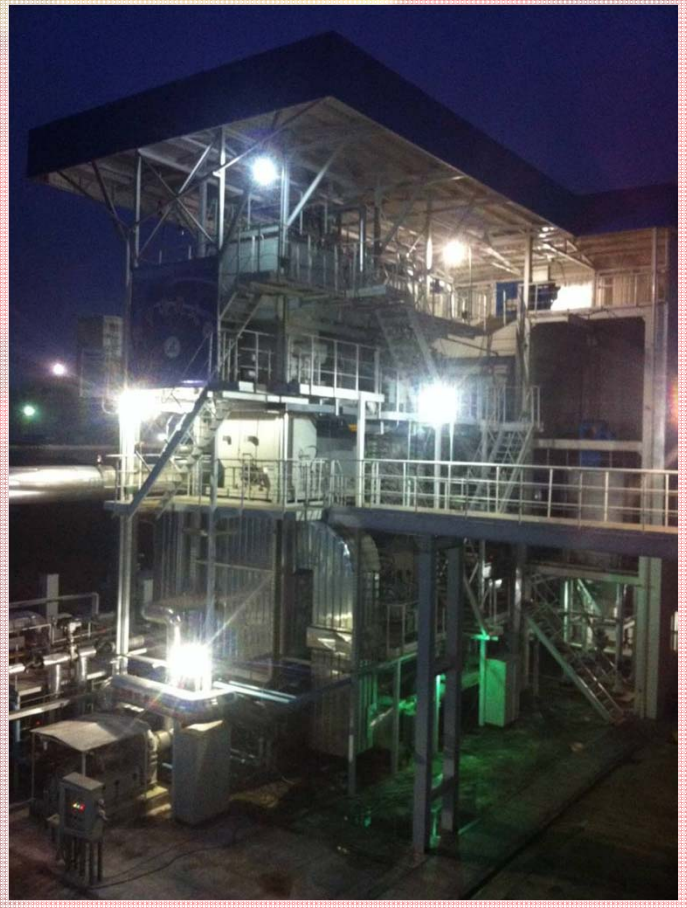
Joint R&D Highlight

Oxyfiring pilot: B&W and HUST

- Basic science R&D
- 3 MW pilot plant
- Prepare commercial scale-up



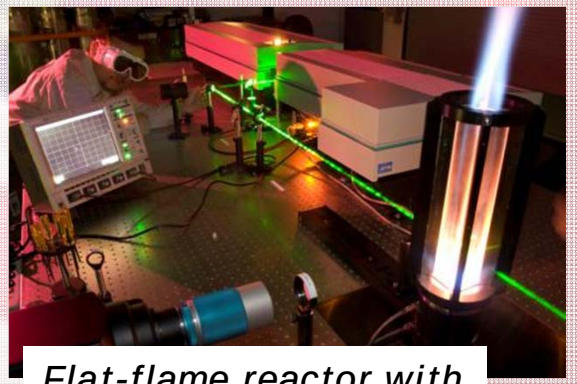
Oxyfiring pilot: B&W and HUST

FF-EFR(HUST, HIT)

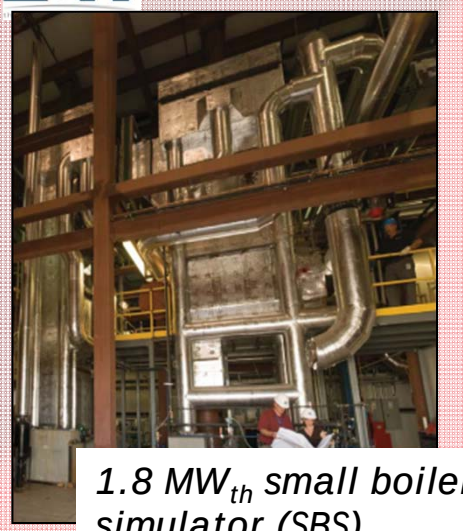
10kW EFR (THU)

3MW$_{th}$ full chain system (FCS)

Entrained flow reactor



Flat-flame reactor with optical diagnostics



1.8 MW$_{th}$ small boiler simulator (SBS)

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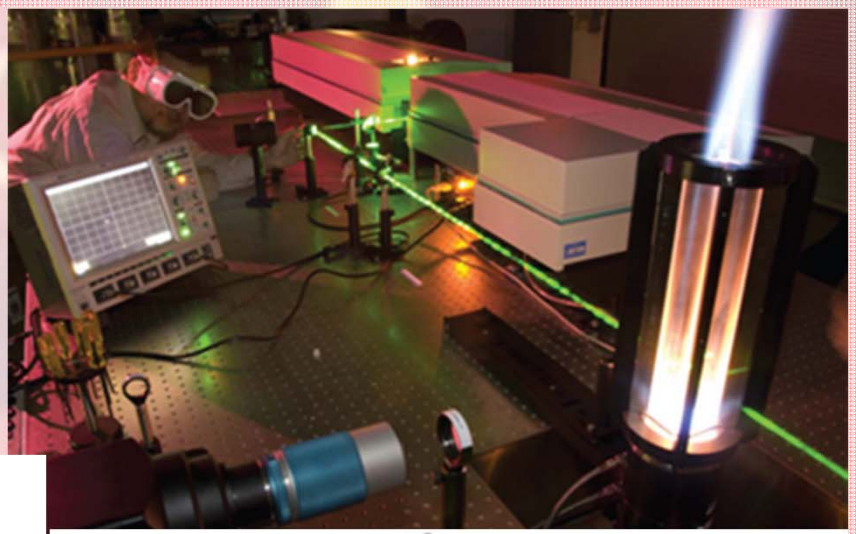
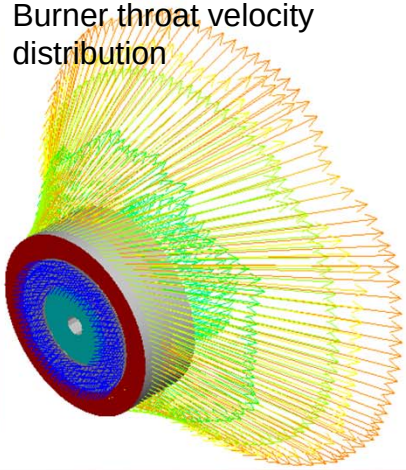
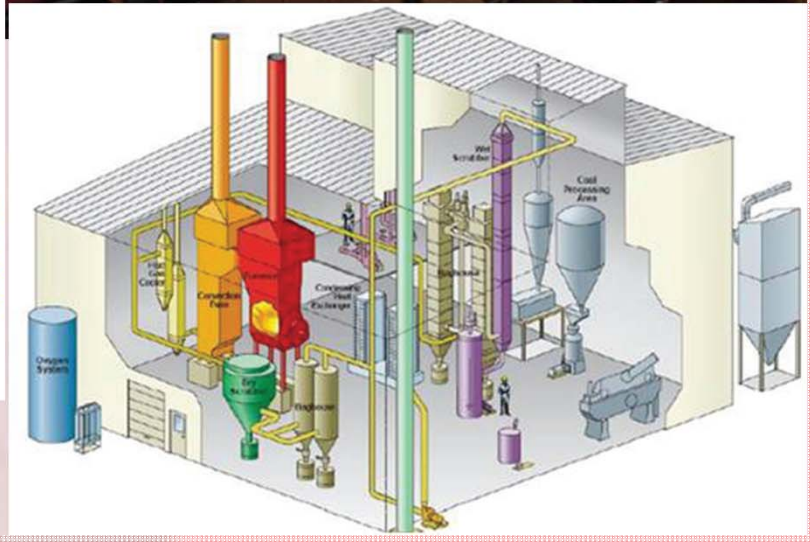
Oxyfiring pilot: B&W and HUST

- Coal combustion kinetics
- CFD modeling
- Process model information



Burner throat velocity distribution





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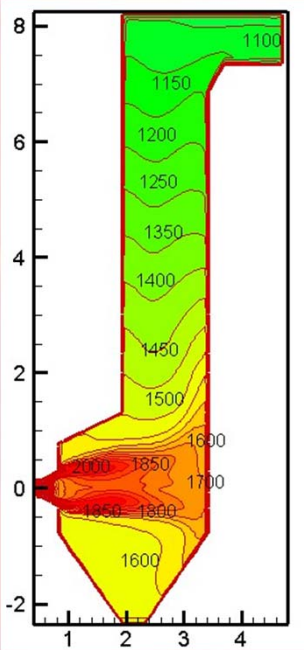
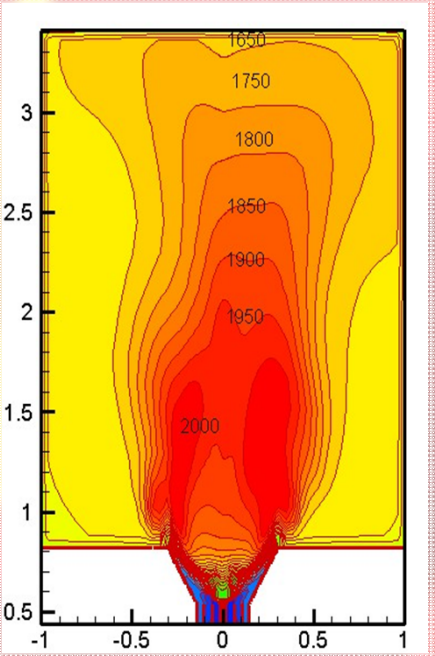
Results

- US and China coal calibrated
- Validation at 3 MW unit and 1.8 MW unit
- Next steps
  - 35 MW retrofit begun
  - 100 MW retrofit assessment
  - 350 MW new-build feasibility





Plan for Upcoming Years

- Identified new key projects
- Identified more joint efforts
- Expand student/staff exchange
- Seminar and Press conference to public access
- Considering new members

谢谢！

MANY THANKS!

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