Commercializing the Rentech Process

China-US Coal Gasification and Liquefaction Workshop

Beijing, China

June 15-16, 2006
Ultra-High Purity Fuel - from Coal (CTL)

- The U.S. needs clean economical fuel from secure sources
  - Persistent high oil prices
  - Unstable oil supply regions
- The U.S. has the largest proven coal reserves in the world
  - 265 billion tons of recoverable reserves
  - Well over 100 years of potential production
  - Low cost resource development and low price volatility
- CTL is economically feasible
- Rentech is the domestic US technology leader to convert coal into high-valued FT fuel products
Rentech’s Primary Product is a Premium Diesel Fuel

- **High performance**
  - Higher cetane index improves engine performance

- **Storage stability**
  - Long shelf life (≥ 8 years)

- **Ultra high purity fuel**
  - Significant emissions reduction
  - Exceeds global sulfur and aromatics limits
  - Environmentally friendly

- **Existing infrastructure**
  - Today’s pipelines
  - Today’s engines

**Cetane Index and Sulfur Content Ranking**

<table>
<thead>
<tr>
<th>Cetane Index</th>
<th>Sulfur (PPM)</th>
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<tbody>
<tr>
<td>&lt;72</td>
<td>&lt;50 &lt;50</td>
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<tr>
<td>&lt;50</td>
<td>&lt;48 &lt;40 &lt;40</td>
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<td>&lt;48</td>
<td>&lt;15</td>
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<tr>
<td>&lt;40</td>
<td>&lt;10</td>
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<tr>
<td>&lt;40</td>
<td>&lt;1</td>
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<tr>
<td>&lt;500</td>
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- **Low Sulfur D-975**
- **California CARB**
- **EPA (2006)**
- **Rentech (FT)**

**FT Fuel Emissions % Reductions (1)** Relative to EPA Low Sulfur Diesel

- **Hydrocarbons**: -45%
- **Carbon Monoxide**: -33%
- **N0x**: -9%
- **Particulates**: -28%

(1) **HC** = Hydrocarbon, **CO** = Carbon Monoxide, **CO2** = Carbon Dioxide, **N0x** = Nitrogen Oxide, **PM** = Particulate Matter.

FT fuel will command a premium value due to its preferred characteristics.
World Demand Growth for Diesel vs. CTL Production

**DIESEL:**

- 2005 ~13.5 million bbl/d \(^{(1)}\)
- 2025 @ 3% per annum growth ~ 23 million bbl/d \(^{(1)}\)

**PROJECTED CTL PRODUCTION 2025:**

- 2 to 3 million bbl/d ≈ 25% of projected increase \(^{(2-3)}\)

\(^{\text{Source: (1) Sasol Chevron  
(2) National Coal Council  
(3) EIA}}\)
Abundant U.S. Coal Reserves

- 265 billion tons of recoverable reserves

This is roughly equivalent to:

- 500 billion barrels oil

and

- Easily enough coal to support over 500 FT plants @ 50,000 bbls/d each

Utilizing Rentech’s technology to convert just 5% of these reserves would double the known domestic oil reserves.
FT Comes of Age

**FT Diesel (FTD) Supply**
- Technology advances
- Economies of scale
- Co-Production Alternatives
  - Stranded/low cost resources

**Conventional Diesel Supply**
- Finding and developing crude costs increasing
- Limited refining expansion and increasing cost
- Stricter Environmental Regulations

\[ \text{\$ per Barrel} \]

\[ \text{Time} \]

\[ \text{1980} \quad \text{2004} \]
What is Coal-to-Liquids?

FT coal-to-liquids is a three-step process.

**The Rentech Process**

**Step 1**
Gasification
Coal is converted into syngas

**Step 2**
FT Conversion
The syngas sent through an FT catalyst is converted to an ultra-clean intermediate liquid products

**Step 3**
Upgrade
These intermediate products are upgraded to ultra high purity fuels
Rentech - CTL Industry Leadership

A leading CTL technology provider

► 25 years of FT technology development
► Currently holds 21 U.S. patents, with others currently under review
► Technological evolution in catalyst design, catalyst separation and reactor design
► Process vetted by multiple large energy companies
► No patent conflicts with cobalt alternatives

Proven operating experience

► Six pilot plants including 300 BPD slurry reactor and DOE test program w/ Texaco

CTL leadership in North America

► Only domestic iron-based FT technology available for licensing w/ plant experience
► Working closely with the DoD and DoE on fuels initiatives
Rentech’s Technology Advantages

Feedstock flexibility
- Wide range of feedstock, including coal and petroleum coke

Lower costs
- Slurry reactor supports:
  - Higher on-line time and throughput
  - Lower pressure drop and excellent temperature control
  - Ease of scale-up

Stable performance
- Iron-based catalyst (advantages versus cobalt-based catalyst)
  - Converts a wider range of feedstocks
  - Higher diesel production
  - Significantly lower risk of sulfur poisoning and other contaminant exposure
  - Lower cost with simple and safe disposal (no regeneration required)

Flexible
- Capable of working with multiple technology providers on front/back-end

The Rentech Process is a significant enhancement of the FT technology.
Over Two Decades of Technology Development

- **Sterling, CO Plant**
  - (1982-1987)
  - Developed Rentech’s proprietary and patented iron catalyst

- **Zuni, CO Plant**
  - (1988-1989)
  - Used syngas gas as feedstock to produce FT diesel for engine testing

- **Boulder, CO Catalyst Plant**
  - (1990-1991)
  - Produced over 22,000 pounds of Rentech’s iron catalyst
  - Proved the technology using different operating conditions, and feedstocks, including coal
  - Still serving as Rentech’s R&D facilities

- **Pueblo / Denver, CO**
  - (1993-Present)
  - Then the largest FT slurry reactors in the world
  - Verified Rentech Process at full scale

- **Synhytech Plant, Pueblo, CO**
  - (1992-1993)
  - Tested Rentech’s FT iron catalyst technology under exclusive CTL license with Texaco (offshoot of DOE EECP program)

- **La Porte, TX**
  - Test

Rentech has spent its early years proving and patenting its proprietary FT technology successfully deployed in several pilot plants.
Rentech Strategic Plan to Move Forward

Rentech’s objective: Establish Rentech as the leading North American CTL company

<table>
<thead>
<tr>
<th></th>
<th>1. Accelerate deployment of the Rentech Process</th>
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<tbody>
<tr>
<td></td>
<td>▶ Acquisition and conversion of an existing facility to jump-start CTL production</td>
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<tr>
<th></th>
<th>2. Develop strategic projects in the U.S.</th>
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<tr>
<td></td>
<td>▶ Expand use of the Rentech Process at multiple sites</td>
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<th>3. Develop a repeatable and scalable process</th>
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<tr>
<td></td>
<td>▶ Up to 50,000 bbls/d per plant</td>
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<th>4. Maintain FT technology leadership</th>
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<tbody>
<tr>
<td></td>
<td>▶ Continued innovation through research and development</td>
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<th>5. Expand the reach of the Rentech Process</th>
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<tr>
<td></td>
<td>▶ Licensing on selected basis</td>
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Rentech seeks to further its leadership in CTL by continuing to target repeatable and scalable projects.

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
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<tbody>
<tr>
<td>2006</td>
<td>10 bpd</td>
</tr>
<tr>
<td>2007</td>
<td>1,800 - 6,800 BPD</td>
</tr>
<tr>
<td>2008</td>
<td>10,000 BPD</td>
</tr>
<tr>
<td>2009</td>
<td>25,000 - 50,000 BPD</td>
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<tr>
<td>2010</td>
<td>Open Volume</td>
</tr>
<tr>
<td>2011</td>
<td></td>
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<td>2012</td>
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The Rentech Technology Center

A 10-15 bbl/day Integrated Coal-to-Liquid fuels facility (Product Development Unit or PDU) for producing test quantities of CTL liquids
Rentech’s PDU

A clear and focused set of operating objectives for the first fully-integrated US CTL facility:

- Produce fuel samples for certification and customer testing
- Optimize operating conditions for the FT reactor and product upgrading units
- Validate catalyst consumption rates
- Develop operating and training manuals
- Use as a training facility
- Provide a solid platform for continuous improvement of the Rentech Process
The Cornerstone of Rentech’s Forward Strategy

Rentech Energy Midwest Corporation – Conversion to Coal

► Solid basic economics for agri-chemicals and co-produced power & FT fuel products
► Clear path to coal-to-liquids commercialization
► Minimizes the FT financial risk on total project economics
► Leverages a strong operating platform
Poly-Generation in East Dubuque

“Coal to Corn”

- Vast farming communities in Illinois and Iowa - all products consumed within 200 miles
- Abundant local coal supply

On the Mississippi River

- Multiple transportation options - barge, truck and rail
- Northern-most ammonia facility on the Mississippi River

Substantial existing operations and infrastructure

- Large scale fertilizer plant ready for immediate conversion
- Permits, safety systems and experienced management team and staff in place

Multiple Revenue Streams means Improved Profitability and Lower Risk

- Domestic Production with significantly reduced feedstock costs can compete with imports

The East Dubuque plant enables Rentech to accelerate deployment of its FT technology.
# REMC - A Multi-Phased Project

## 2005 - Natural Gas
- 830 t/d ammonia
- 14 MW imported power

## 2009 - Initial Conversion to Coal
- 920 t/d ammonia
- 37 MW export power
- 1,800 b/d FT fuels

## 2011 - Final expansion
- 920 t/d ammonia
- 76 MW export power
- 6,800 b/d FT fuels

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<thead>
<tr>
<th>Phase 1 – Gasification Unit with Spare</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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</thead>
<tbody>
<tr>
<td>Construction</td>
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<tr>
<td>Startup</td>
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| Phase 1A – FT Unit                   |      |      |      |      |      |
| Construction                         |      |      |      |      |      |
| Startup                              |      |      |      |      |      |

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<tr>
<th>Phase 2 – 2nd Gasification Train and 2nd FT Unit</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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REMC Project Benchmarks

- Feasibility Study  
  Completed
- Optimization Study  
  Completed
- Entered Definitive Purchase Agreement for Royster Clark East Dubuque  
  Completed
- Purchase of East Dubuque  
  Completed
- Begin Front End Engineering and Design Phase  
  Process Initiated
- Filing for Permitting  
  Process Initiated
- Finance REMC Conversion  
  2007
First Dedicated CTL Facility - Natchez, MS

- Barge Access
- Tank Farm
- Rail Road
- Power Access
- Water
- Waste Water Treatment
Synergies in FT design with the REMC conversion

► 2 gasification trains with one spare
► 5,200 tons of Illinois coal or Gulf Coast petcoke per day
► 10,000+ barrel per day with flexibility for surplus power

Future expansion by adding 10,000B/D process trains

► Reference plant design reduces engineering and construction costs

Strategic fuels production to meet national priorities

► DoD Clean Fuels Initiative testing and evaluation program
► Meet needs for local First Responders on natural disasters
Major Domestic Mine-Mouth Projects

Benefits of mine-mouth facilities:

- Improved logistics and lower fuel cost
- Improved coal cost stability
- Abundant U.S. coal reserves in areas with EOR opportunities

Critical success factors in selecting development sites:

- Product distribution to critical/attractive markets
- Expansion potential to gain economies of scale
- CO₂ sequestration
- Relationships with feedstock providers

Rentech is actively developing mine-mouth CTL facilities in conjunction with resource owners.
A mine-mouth facility is economically attractive at crude prices of $35-40/bbl

► Single train producing 10,000 bpd of diesel, jet and naphtha plus 104 MW of export power

► EPC capital costs of $870 million & total costs about $1 billion

► Feed of 2.6 million tpy of PRB coal

► Economics improve significantly as additional trains are added or at today’s crude prices

Based on findings from a study for the Wyoming Business Council using PRB Coals
Licensing to Support a Viable CTL Industry

The DKRW Medicine Bow Project
The Long Term Vision

Proven and Superior FT Technology
- Deployed successfully in numerous operating facilities
- Low cost, efficient process using patented iron-based catalyst
- High Diesel/Jet fraction

Favorable Economic Environment
- Persistent high and volatile oil and natural gas prices
- Stable and low coal price with abundant supply
- Attractive margins for ammonia and FT fuels

National Security and Environmental Benefits
- Energy independence
- Economic security
- FT liquids exceed environmental standards

Clear Path to Commercialization
- First large scale commercial U.S. CTL project with the conversion of East Dubuque facility
- Advanced project development pipeline
- Positioned to set industry standard for future CTL projects

Rentech offers a commercially viable technology today.
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