California Alternative Diesel Symposium

Jim Rockwell - Manager, Gas-to-Liquids
August 19, 2003
Agenda

- ConocoPhillips GTL Background
- ConocoPhillips Commercialization Plan
- Semiworks Plant
- Well-to-Wheel Life Cycle Assessment
- Fleet Testing Plan
- West Coast Supply
ConocoPhillips GTL Background

- Began research in 1997 with DuPont
- Brought in house in 2000
- Currently 150 people
- Dozens of reactors
- Proprietary syngas, FT and hydroprocessing
- Committed to semiworks plant in Feb 2001
- Startup semiworks in last half 2003
- First commercial plant startup 2010
Basic Fischer-Tropsch Process

Carbonaceous Fuels → Syngas Generation → CO & H₂ Syngas → Fischer Tropsch → HC 
H₂O → Product Finishing → LPG, Naphtha, Kero/Diesel, Lube Stocks, Waxes

Steam → Oxygen

ConocoPhillips
Basic GTL Process

1. **Air Separation**
   - Air

2. **Gas Processing**
   - Natural Gas
   - Ethane
   - LPGs

3. **Synthesis Gas Production**
   - CO
   - H2

4. **Fischer Tropsch**
   - Diesel
   - Naphtha
   - LPGs

5. **Product Refining/Export**

6. **Utilities**
   - Power/Heat Recovery
Commercial Plant

• Large scale
  – 600 MMcfd per plant
  – 80,000 bpd per plant
• Diesel
  – 55,000 bpd per plant
• Naphtha
  – 25,000 bpd per plant
  – All paraffin, zero sulfur
<table>
<thead>
<tr>
<th></th>
<th>GTL</th>
<th>Refinery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas (@ $.50/MMBtu)</td>
<td>$ 4.00</td>
<td>$17.00</td>
</tr>
<tr>
<td>Crude Oil (@ $17/Bbl)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Costs</td>
<td>3.00</td>
<td>2.50</td>
</tr>
<tr>
<td>Cash Costs</td>
<td>7.00</td>
<td>19.50</td>
</tr>
<tr>
<td>Capital Recovery, Taxes</td>
<td>12.00</td>
<td>6.50</td>
</tr>
<tr>
<td>Total Cost to Produce</td>
<td>$19.00</td>
<td>$26.00</td>
</tr>
</tbody>
</table>
Demonstration Plant

Trucked Liquid Oxygen

Pipelined Natural Gas

COPox™ Process

Fischer Tropsch Process

Product Refining and Hydrocracking

Ponca City GTL Plant

Naphtha

Diesel

400 bbl/day total capacity ~ 250 bbl/day GTL diesel
## GTL Diesel Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>EPA 2006 Diesel</th>
<th>CARB Diesel</th>
<th>ConocoPhillips GTL Diesel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Transparent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aromatics (vol. %)</td>
<td>10</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>Sulfur (ppm)</td>
<td>15 max</td>
<td>15 max</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Dist. Temp (°C) 90% recovered</td>
<td>338</td>
<td>321</td>
<td>325</td>
</tr>
<tr>
<td>Cetane Number</td>
<td>40</td>
<td>48</td>
<td>&gt;75</td>
</tr>
<tr>
<td>Density @ 15 °C, (kg/m³)</td>
<td>820-870</td>
<td>770</td>
<td></td>
</tr>
<tr>
<td>Viscosity @ 40 °C (cst)</td>
<td>2.0-4.1</td>
<td>2.2</td>
<td></td>
</tr>
</tbody>
</table>
GTL Diesel Product Evaluation

- On Going Blend Studies
- Southwest Research Engine Emissions Testing
- Small and Large Scale Fleet Tests
- DOE Ultraclean Fuels Initiative
  - Emissions Tests-Penn State
  - GTL Life Cycle Analysis
  - DOE Funded Fleet Test ?
GTL Life Cycle Analysis

- Conducted in partnership with DOE under the Ultra-Clean Fuels Initiative
- Determine whether GTL is a viable source of transportation fuels
- Determine the energy utilization and life cycle emissions of GTL in accordance with sustainable development principles
GTL Life Cycle Analysis

• Well-to-wheel analysis of GTL fuels versus:
  – Conventional diesel
  – Ultra low sulfur diesel
  – Federal reformulated gasoline

• Energy use, greenhouse gas and criteria pollutant emissions

• Vehicle configurations:
  – Spark ignition engines
  – Compression ignition engines
  – Hybrid electric
  – Fuel cell vehicles
FT Diesel LCA Conclusions

• More energy intensive to produce than ULSD, but on par with FRFG
• Produces equivalent greenhouse gas emissions as ULSD, but less than FRFG
• Emits less criteria pollutants (NOx, SOx, VOC, PM10) than ULSD or FRFG
• Reduced environmental impacts of acidification, eutrophication, human health and ecotoxicity
Possible West Coast Supply Points
GTL Diesel Potential

• High quality supplement to conventional supply
• Logistics
  – Transport costs will increase prices
  – Product blending adds complexity and costs
Conclusions

- GTL technology is advancing
- GTL diesel properties are desirable
- GTL engine emissions are reduced
- Markets will facilitate GTL fuel use
For Additional Information Contact:

Doug Smith
GTL, Marketing Coordinator
281-293-5695

Or

Michael Callahan
Account Representative, Sacramento, CA
916-944-3633