Gasoline Blendstock/Ethylene from Methane - The Synfuels Process Today

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Over 75% of the world’s known gas reserves are remote and/or stranded

Could yield 1.5 billion barrels of fuel per year

Over 4 million barrels per day
Incentives to employ the Synfuels GTL process

- Rising energy prices
- New source of liquid fuel
- Government restrictions on flaring and emissions
- Environmental concerns
- Laws for cleaner fuels
- Monetize all of an energy resource
Conversion

Absorption

Hydrogenation

Oligomerization

Natural Gas → Oxygen

Solvent

H2, C2H2, CO, CO2

Conversion

Absorption

Hydrogenation

Oligomerization

Syngas

H2, CO, CO2

Gasoline

H2, CO, CO2

C2H4

C2H2
Synfuels Process using Liquid-Phase Hydrogenation of Acetylene

- Selectively absorbs acetylene
- Rejects unwanted gases
- Greatly reduces reaction volume
- Operates at moderate conditions
- No thermal “run-away” gas phase reaction
- Much higher acetylene concentrations can be used
Typical Hydrogenation Conversion and Selectivity
Extended Duration Conversion and Selectivity

![Graph showing conversion and selectivity over time. The x-axis represents time on stream (HR), and the y-axis represents conversion and selectivity percentages. The graph includes data points for various components such as methane, ethane, ethylene, acetylene, butene, and heavy. The conversion and selectivity values are given as percentages and concentrations in mol%.](image-url)
• Synfuels Product Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td>0.7599 (Water=1)</td>
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<tr>
<td>API Gravity</td>
<td>54.71 @ 60 F</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>100.422</td>
</tr>
<tr>
<td>Weight</td>
<td>6.33 Lbs/Gal</td>
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<tr>
<td>Gross Heating Value</td>
<td>124190 BTU/CF</td>
</tr>
</tbody>
</table>

• Synfuels Product Composition

<table>
<thead>
<tr>
<th>Component</th>
<th>vol%</th>
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<tbody>
<tr>
<td>Paraffins</td>
<td>12</td>
</tr>
<tr>
<td>Iso-paraffins</td>
<td>35.9</td>
</tr>
<tr>
<td>Olefins</td>
<td>1</td>
</tr>
<tr>
<td>Naphthenes</td>
<td>9.8</td>
</tr>
<tr>
<td>Aromatics</td>
<td>38.5</td>
</tr>
</tbody>
</table>
Intellectual Property

Synfuels Technology is covered by 8 US Patents and dozens of patents pending:

- 6,130,260 Method for converting natural gas to liquid hydrocarbons
- 6,323,247 Method for converting natural gas to liquid hydrocarbons
- 6,602,920 Method for converting natural gas to liquid hydrocarbons
- 7,045,670 Process For Liquid Phase Hydrogenation
- 7,119,240 Method for converting natural gas to olefins
- 7,183,451 Process For The Conversion Of Natural Gas To Hydrocarbon Liquids
- 7,208,647 Process For The Conversion Of Natural Gas To Reactive Gaseous Products Comprising Ethylene
- 7,250,449 High temperature hydrocarbon cracking
Demonstration Unit
Summary

• New Synfuels GTL Process dramatically reduces capital cost
• Now majority of stranded gas fields can be utilized
• Unique new technology that blends established industrial practices with patent protected innovation
• Key to the Synfuels process are the innovative steps that isolate and convert intermediates, reducing recycle, compression, and system volumes
• Synfuels liquid-phase hydrogenation is the technology’s cornerstone
• Liquid-phase hydrogenation may be applicable to other hydrogenation processes outside GTL
The Synfuels Team

• Synfuels International, Inc.
  – Ben Weber, CEO
  – Tom Rolfe, President
  – Charles Matar, Managing Director
  – Ed Peterson, Chief Engineer

• Bryan Research and Engineering
  – Jerry Bullin, President
  – Joel Cantrell, Operations Manager

• Texas A&M University
  – Kenneth Hall