Methanol Institute

- MI Established in 1989
- Serves as the trade association for the Global Methanol Industry
- Directs Product Stewardship Activities
- Initiates Market Development Efforts
- The Voice of the Global Methanol Industry
2008 Members

Methanol Institute

SÜD-CHEMIE
Creating Performance Technology

IMTT
Mitsuishi International Corporation

PETRONAS

MHTL

MITSUBISHI GAS CHEMICAL AMERICA, INC.

Kolmar Petrochemicals

SOUTHERN CHEMICAL CORPORATION

VITUSA PRODUCTS INCORPORATED

Shanghai Coking
World Methanol Demand

40 Million Metric Tons = 13.3 Billion Gallons

World Methanol Demand

40 Million Metric Tons = 13.3 Billion Gallons

World Methanol Demand

0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
55000

(000) Tonnes per Year

2003 2004 2005 2006 2007 2008 2009 2010

World Methanol Demand

CAPACITY 100%
Op Rate 83%
Methanol: Essential Chemical Building Block

Source: Methanex
Global Market

Methanol Use - World vs Asia

- 2007E: 37.87 million metric tons
- 2012E: 53.80 million metric tons

Asia
World
China Developing New Methanol Markets

Methanol Use in Asia
By Country

2007E
18.61 million metric tons

2012E
32.66 million metric tons

- China
- Japan
- Taiwan
- South Korea
- Malaysia
- Singapore
- Indonesia
- Australia
- New Zealand
- Other SEA
- India
- Other South Asia
Shifting Global Methanol Production

REGIONAL SUPPLY 2000 - 2007

Source: MHTL
China Has More Methanol Production Capacity Than The Middle East

Supply Capacity for Methanol by Region
2002 - 2012E

Asia
North America
South America
Europe
Rest of World
Middle East
Methanol Production: Natural Gas

THE METHANOL PROCESS
Mega-Methanol Plants and Natural Gas Prices

<table>
<thead>
<tr>
<th>Region/Country</th>
<th>$/MM BTU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle East</td>
<td>0.25-1.00</td>
</tr>
<tr>
<td>Trinidad/Venezuela</td>
<td>1.50-2.00</td>
</tr>
<tr>
<td>Chile</td>
<td>2.00-3.00</td>
</tr>
<tr>
<td>Europe</td>
<td>6.00-8.00</td>
</tr>
<tr>
<td>USA</td>
<td>8.00-10.00</td>
</tr>
</tbody>
</table>

2004-2007: Seven-mega plants started up with combined capacity of 10 million metric tons or 25% of current global demand.
Methanol Production: Coal
Methanol from Wood

- Methanol can be produced from the gasification of wood and other biomass resources.
- Mature Gasifier technologies: bubbling fluid-bed; indirectly-heated fluid bed; entrained-bed.
- Highly efficient, with energy efficiencies in the 60-70% range.
- One ton of wood produces 165-185 gallons of methanol (625-700 liters).
- Large Resource: U.S. generates 240 million tons waste wood per year.
Methanol from Black Liquor

- In Sweden, a pilot-scale reactor is producing methanol from black liquor, a sludge byproduct of paper pulping.
- If every paper mill in the U.S. used this process, could produce 28 million tons of methanol per year (9.3 billion gallons).
• Between 1985 and 1999, over 15,000 methanol FFVs and hundreds of transit buses and school buses sold in U.S.

• CA established network of 60 public retail stations and 45 private fleet stations, dozens fueling stations in other states.

• By 1993, California consumed 12 million gallons of methanol per year.
Methanol FFV Components

- Alcohol sensor monitors fuel mixture and signals on-board computer to adjust fuel flow and timing.
- Larger fuel injectors.
- Stainless steel fuel system.
- Larger fuel tank.
- Block heater.
- Optimized cylinder head combustion chamber.
- Wear-resistant piston rings.
- Exhaust valve seat inserts.
- Incremental costs: $50-$150
Methanol Fuel Costs

- 10¢ Regional Distribution
- 4¢ Local Distribution
- 5 ¢ Retail Mark-up
- 9.15 ¢ Federal Tax
- 9 ¢ State Tax (CA)
- $1.00 Wholesale Methanol Cost
- Pump Price of $1.37 per gallon
- Consumer Cost = $2.03 per gasoline equivalent gallon
Methanol Greenhouse Gas Emissions Relative to Gasoline

Source: Prepared for Methanex by Richard Bechtold, Alliance Technical Services
EPA Developing Highly Efficient Alcohol Engines

Efficiency: Methanol

33% higher efficiency with methanol
Broad region of high efficiency

Efficiency: Ethanol

25% higher efficiency with ethanol
Further optimization ongoing
# Methanol Fuel Blending

<table>
<thead>
<tr>
<th></th>
<th>Gasoline</th>
<th>Methanol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fuel Costs</strong></td>
<td>—</td>
<td>+++</td>
</tr>
<tr>
<td><strong>Multiple Feedstocks</strong></td>
<td>X</td>
<td>+++</td>
</tr>
<tr>
<td><strong>Emissions</strong></td>
<td>—</td>
<td>+</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>—</td>
<td>+++</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>—</td>
<td>++</td>
</tr>
<tr>
<td><strong>Use Current Engines</strong></td>
<td>—</td>
<td>+ (M-15)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- (m-100)</td>
</tr>
<tr>
<td><strong>Use Existing Stations</strong></td>
<td>—</td>
<td>+ (M-15)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- (m-100)</td>
</tr>
</tbody>
</table>

**Key**
- Baseline
- X Not Applicable
- + Positive
- - Negative
U.S. Methanol Challenges

- Automobile Industry
- Fueling Industry
- Automakers
- Vehicle Operators
- Methanol Industry
China Contrasts
MI Delegation to China

• In December 2007, the Methanol Institute took delegation to China at invitation of Chinese Association of Alcohol and Clean Ether Fuels and Automobiles.

• Delegates: Methanol Holdings Trinidad; Methanex; SABIC; Johnson Matthey; Mitsubishi Gas Chemical; MAN Ferrostaal; Helm

• Visited Shanghai, Shanxi Province (Changzhi, Jinzhong, and Taiyuan), and Beijing
China Polygeneration

Methanol Institute

Natural Gas

Coal

Biomass

Synthesis Gas

Methanol

Fuels

Chemicals

Methanol

Gasoline

DME

MTBE

Formaldehyde

Acetic Acid

Olefins

Players:
General Electric  Shell  ConocoPhillips  BP  Siemens  Sasol  Lurgi  Dow  Celanese  DuPont

Chemicals

Fuels
China now world’s largest methanol producer and consumer.

China has over 130 methanol plants, mostly small and inefficient.

Curtailing natural gas-based production.

Huge growth coal-based production.

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons</th>
<th>Gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>6,000,000</td>
<td>2 Billion</td>
</tr>
<tr>
<td>2007</td>
<td>11,000,000</td>
<td>3.7 Billion</td>
</tr>
<tr>
<td>2010</td>
<td>20,000,000</td>
<td>6.7 Billion</td>
</tr>
<tr>
<td>2015</td>
<td>30,000,000</td>
<td>10 Billion</td>
</tr>
</tbody>
</table>
China Methanol Fuel Blending

- According to MMSA: 2.71 million metric tons (900 million gallons) of methanol blended in gasoline in 2007
- An additional 800,000 tons of demand growth expected in 2008.
- Provincial “official” trials and “unofficial” blending.
- Methanol sells for RMB$2,500 (US$350) per ton, wholesale gasoline sells for RMB$7,000 (US$965) per ton.
11 cities with a total population of 33 million.
260 billion tonnes known coal deposits, 1/3 China’s total.
200 buses and 1,000 taxis operating on M-100.
M-15 first used in 2003 in four cities, now used in all 11 cities across the province in stations operated by PetroChina and Sinopec.
Shanxi adopted four provincial methanol specifications in 2008.
China Automakers Lead the Way

• Chery Automobile completed demonstration of 20 methanol FFVs, now ready for full-scale production.
• Shanghai Maple Automotive building 50,000 methanol cars in 2008.
• Chang’an introduced methanol Ben-Ben car.
• Greely Automotive put Haifeng methanol car into production.
• Huapa Automotive built methanol cars.
• Shanghai Automotive Industry Corporation developing methanol cars.
Clock is Ticking

• In 2007, China imported 47% of its oil, and this year may pass Japan as world’s second largest oil importer.
• China banned use of grain for ethanol production to ensure food supplies.
• China is world’s largest coal producer and consumer.

Prof. Ni Weidou, Tsinghua University-BP Clean Energy Center: “The clock is ticking, and China needs to start adopting alternative fuels now in order to lessen its dependency.”
• In September 2006, eight leaders provided report to Chinese President Hu Jintao titled “Suggestion on Promoting Methanol Fuels to Replace Gasoline and Diesel Fuel.”

• President Hu approved this “Suggestion” and directed China’s powerful National Development and Reform Commission considers coal-based methanol to be a strategic transportation fuel.
National Methanol Standards

• In March 2007, China’s Committee on Standardization requested three methanol standards.
  • High Proportion – M-70-M-85, now in final approval.
  • Low Proportion – M-15, to be completed by June.
  • Convertible Methanol Fuel – M-100 used in fuel blending, to be completed by June.

Sinopec: “The standards will surely facilitate supervision over the current methanol market, and will define the way of methanol development in the future.”
DME: An Emerging Global Fuel

- Dimethyl ether (CH$_3$OCH$_3$) is the simplest ether
- Burns like natural gas
- Handles like LPG (Liquefied Petroleum Gas)
- Made from methanol
- Very large market potential as synthetic LPG, diesel alternative and fuel for power generation
DME: Clean and Green

• HEALTH:
  – Used as propellant in personal care products for decades
  – Low acute and chronic toxicity
  – No human hazard relative to carcinogenicity, mutagenicity or teratogenicity within exposure limits

• SAFETY
  – Thermally stable
  – No tendency to peroxide formation found
  – Flammable gas
  – Compatible with all common metals
  – Consider elastomer and plastic parts carefully
  – Grounding and bonding procedures and equipment for dissipating static charge needs to be maintained

• ENVIRONMENT
  – Does not deplete ozone
  – Minimal impact on land/water due to volatility
  – Low emission fuel (Diesel, LPG, Power)

Visit www.aboutdme.org
Extensive section on Health, Safety and Environment
DME Transportation Fuels

- China plans to build 20 million tons of DME production capacity by 2020.
- Demonstrating DME-fueled buses, with fueling station in Shanghai.
- In Europe, Volvo has grant from Swedish government to build and demonstrate 19 DME-fueled trucks.
For More Information

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