Global DME Developments: An Update

Dr. Ronald Sills,
Director , DME Institute[SM]
Honorary Member of International DME Association

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9 th Annual Methanol Forum

Houston, September 15, 2010

Outline

- Introduction and Context
- About DME
  - Overview *
  - Markets
    - LPG Blend Stock
    - Diesel Alternative
  - Regional Development Highlights
    - China
    - Egypt
  - Demand Forecast
  - Economics
  - Key Messages

* DME properties with comparisons shown in back-up slides

The DME Industry – Entering its 2nd Decade

4th IDA Meeting
2002 Copenhagen

6th IDA Meeting
2003 Phoenix

7th IDA Meeting
2005 – Stockholm

DME Seminar
2006 – London

DME 1
2004 Paris

DME 2
2006 London

DME 3
2008 Shanghai

DME 4
2010 Stockholm
September 6-9, 2010

Key Challenges

- Since the DME market in China as LPG blend stock is maturing, need to develop other markets, particularly as a transportation fuel.
- To commercialize DME as LPG blend stock in other countries such as Egypt, Korea and Indonesia.
- To establish DME as large-scale transportation fuel market, particularly in Asia and Europe.
- To raise awareness of DME as a new fuel, in other areas of the world.
- Product Stewardship
  - Standards and regulations
  - Health, Safety and Environment

About DME (Dimethyl Ether)

Overview

- Colorless gas at normal temperature and pressure, with a slight sweet ether odor
- Burns like natural gas
- Handles like LPG
- Methanol derivative

$$2\ CH_3OH \rightarrow CH_3OCH_3 + H_2O$$

1.4 MT methanol → 1 MT DME

- Environmentally friendly with significant global consumer history as propellant
- Large market potential as LPG blend stock, diesel alternative and fuel for power generation

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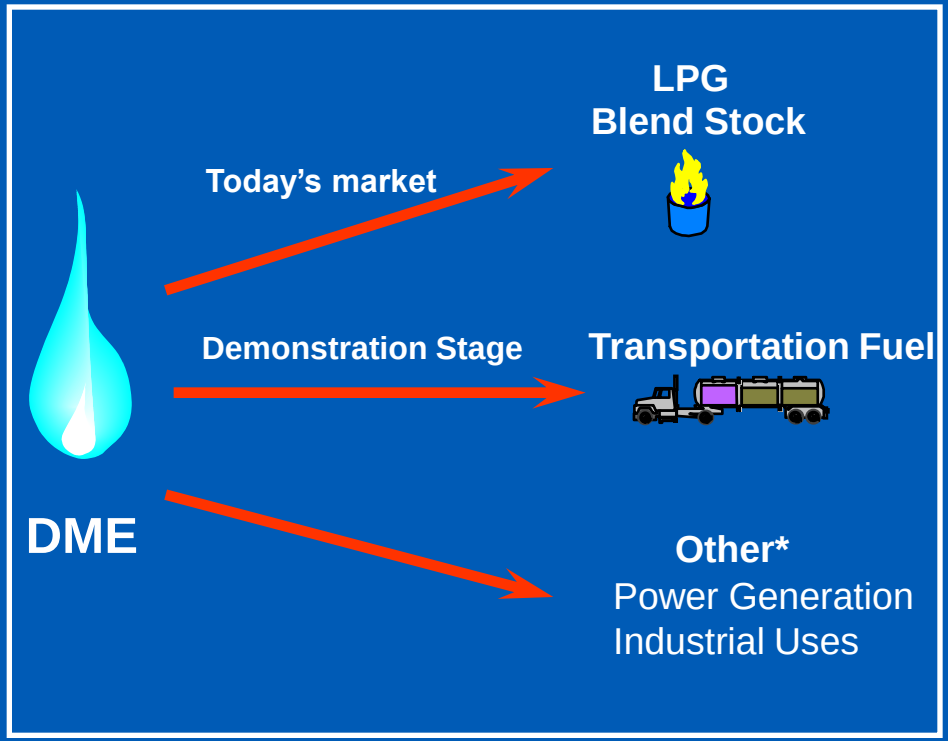
DME Markets

CFC Replacement

Emerging Energy Applications



DME Institute℠

*Other markets also include petrochemicals feedstock to produce olefins

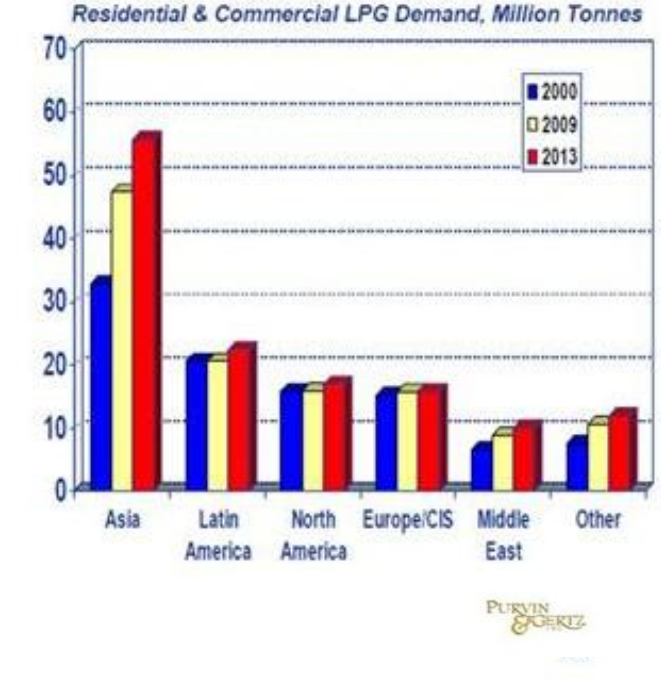
1. DME as LPG Blend Stock

More than 80% of DME currently produced is blended with LPG

- Blending~20% DME/ 80% LPG
- Market development best in countries that:
  - Import LPG
  - Have local feed stocks to produce DME
- Largest market is China (6+MMTPY installed capacity) but regulations and standards must be put in place.
- Major companies in Egypt, Indonesia, Korea, India and Vietnam preparing to enter this market.

Let's look at the global LPG market to understand the DME prospects for growth as LPG blend stock

- LPG demand as Res/Com fuel is expected to continue to expand, particularly in Asia. Asia accounts for 40% of global demand*



* Purvin & Gertz, Ken Otto, LPG Conference, March. 2010

2. DME as Diesel Alternative

Opportunities

- Can be used in conventional diesel engines with a modified fuel injection system
- Combustion and engine noise noticeably lower
- Clean burning: sootless – no smoke or particulates, 100% SOx reduction
- Market potential is very large

Challenges

- Technical and regulatory hurdles remain
- Lower lubricity requires lubricating agent
- Lower viscosity can cause leakage
- Large volume vehicle production
- LPG-like distribution infrastructure

Factors Driving DME Fuels Growth – Diesel Substitution

International DME Association

Much Work Underway

- Japan DME Vehicle Promotion Committee
- Volvo & BioDME Consortium
- Shanghai Automotive Corp.
- Alternative Engine Technology
- Isuzu Advanced Engineering Center
- Nissan

Volvo DME Diesel Engine

SAIC DME Diesel Engine

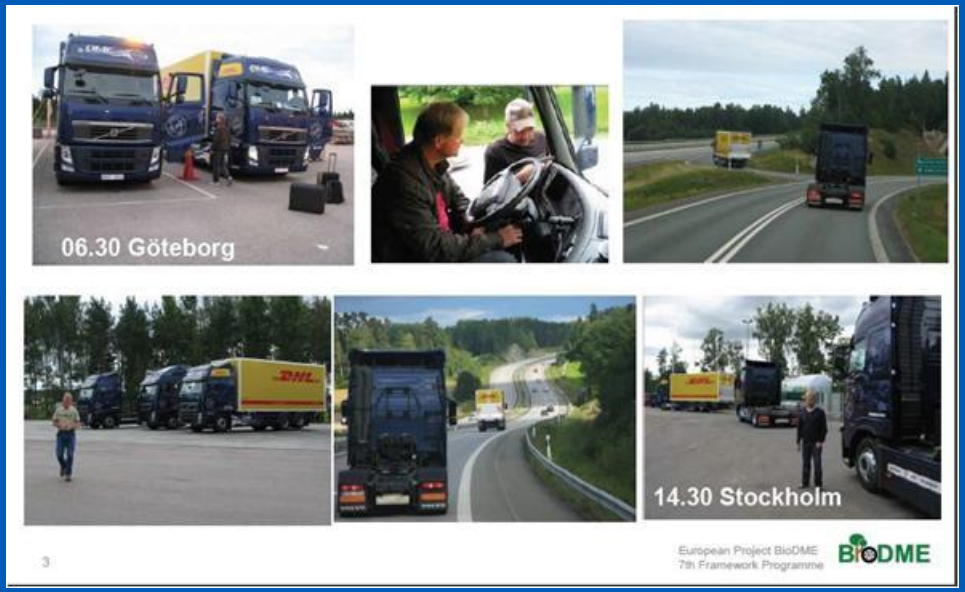
Isuzu DME Diesel Truck

Nissan NTSL DME Diesel Truck

SAIC DME Diesel Bus

Volvo trucks drive to Stockholm from Goteborg (400 km) on September 6, 2010

Start of Vehicle Field Tests



DME as a commercial vehicle fuel for the future

Ideal for the efficient diesel process

- Minimal change in basic engine
- No soot particulate emissions
- Less complicated after treatment
- Reasonable tank installation

Customer acceptance

+ Performance similar to diesel
+ Acceptable technology cost level
+/- Driving range
- Dedicated fuel with limited infrastructure
- Not established as transport fuel

Conclusions

- The complete DME field test is an important step to further verify DME in real operation
- Volvo believes that DME has good potential to be an important transport fuel
- Stable and long-term engagement is needed from all major stakeholder: Society, policy makers, authorities, fuel producers, vehicle manufacturers and customers

So: Volvo presentation at DME 4, September 2010, Stockholm

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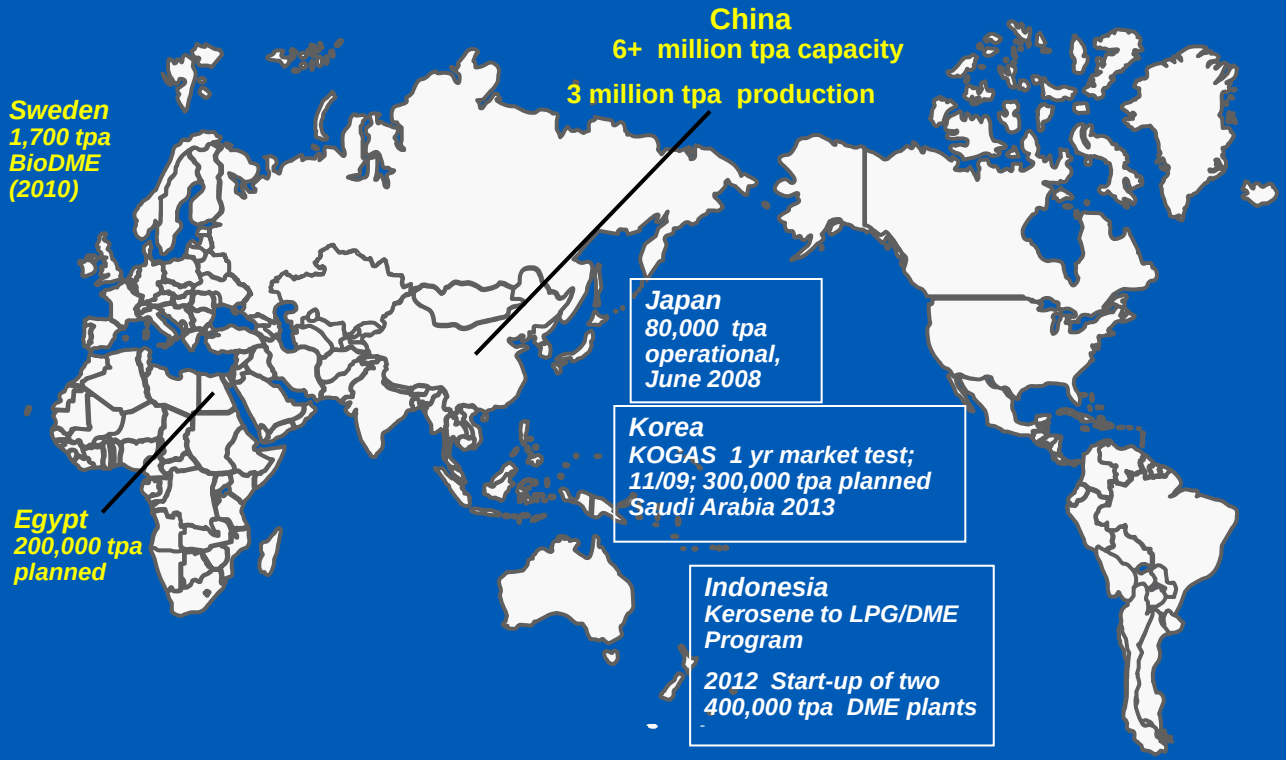
DME Project and Market Developments



What is happening in China

As told by two major DME producers/marketers at DME 4 Conference

(aka XinAo)

(aka China Energy)

DME in China

Update

- Current DME demand is about 3 million tpa
- Production capacity is about 6.5 million tpa with 40-50% utilization rate
- 17 producers with 200,000+ tpa capacity. XinAo Group, Jiutai Energy, Tianmao Group, Lutianhua and Lanhua Kechuan represent 60% of capacity or 4 million tpa
- Market Demand: 90+% used in LPG blend stock for household fuel; other markets include aerosol, refrigerant , industrial kilns, cutting gas and transportation
- 10 buses using DME operating in Shanghai
- DME consumption represents 8% of total LPG + DME demand (energy equivalent basis).*
- Methanex and Total involved in production/marketing.

Challenges

- DME market as LPG blend stock is maturing, future development should focus on other applications
- No clear direction for DME as automotive fuel by government
- More national standards and regulations needed

Source: Jiutai Energy and ENN presentations at DME4

* R.Sills calculation

DME in Egypt: Project Update

Egyptian Dimethyl Ether Company

- Project Status
  - XinAo (ENN) is technology provider
  - DME production (200,000 tpa) from domestic gas-derived methanol
  - FEED is completed
  - EPC contract award is targeted for Q1/2011
- Project Drivers
  - Egypt LPG Demand: Total 3.8 million tpa for cooking/heating; includes 2 million tpa imports,
  - Most LPG consumers can not afford to connect to pipeline gas
  - Widespread LPG distribution pipeline network enables large centralized DME production sites
  - Economies of scale can be easily realized
- Long-term goal: 1 million tpa DME

So: Methanex presentation at DME 4, September 2010, Stockholm

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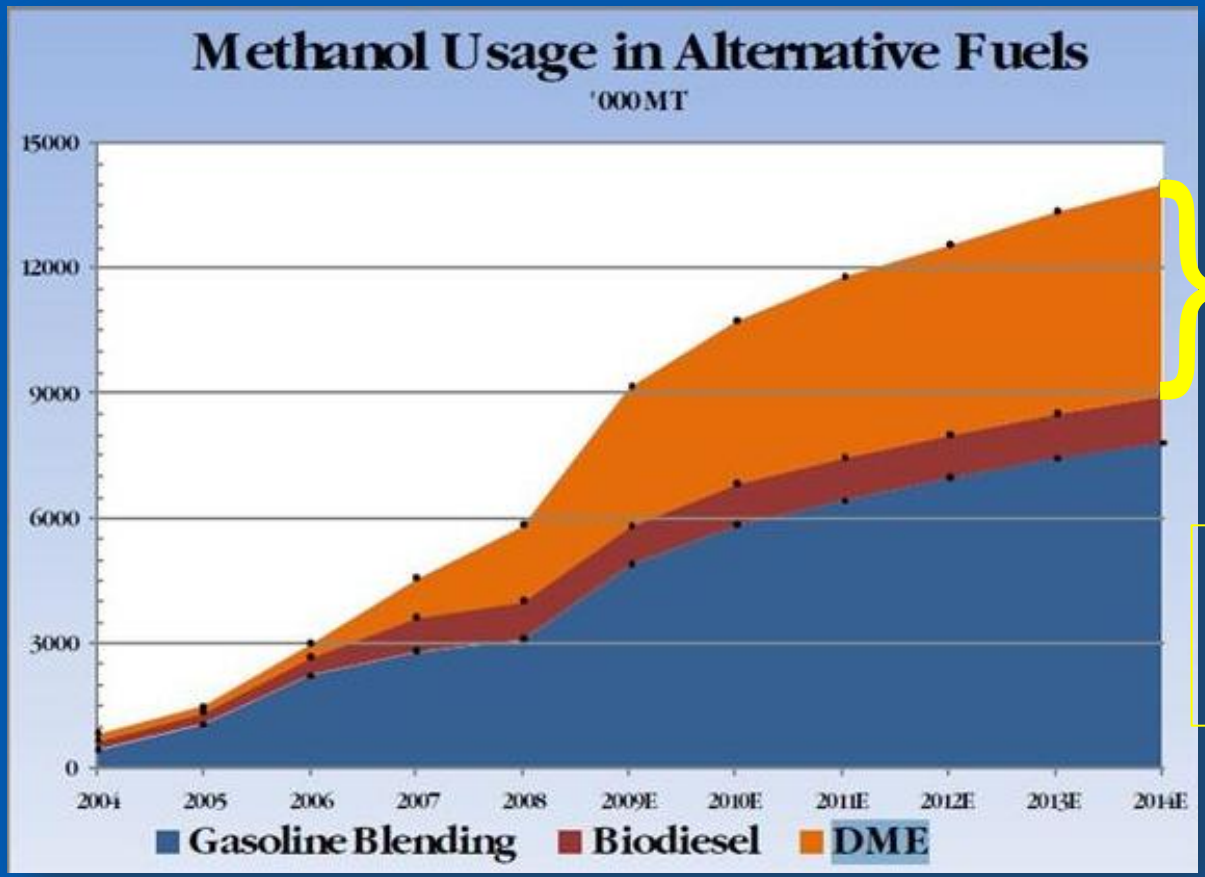
DME Demand Forecast



2014 Forecast (million MT)

5.2 MeOH
or
3.7 DME

About 8% annual growth rate from 2010 to 2014

Source: Methanol Institute Milestones 2010

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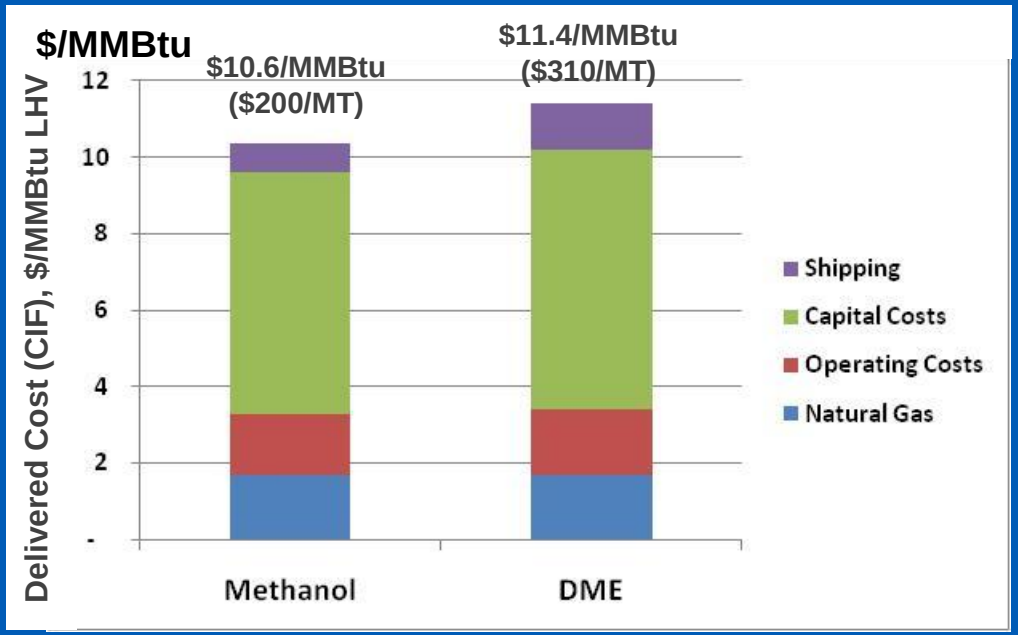
Delivered Cost of Methanol and DME

Methanol and DME produced integrated plants in Middle East from natural gas and delivered to Far East



Basis

- Natural Gas @ $1.25/MMBtu
- 5,000 mtpd Methanol Plant @ $600/tpa
- 3,500 mtpa DME Plant @ 8% more than methanol plant
- 70% LHV thermal efficiency, both plants
- Capital Costs @ 20% capital recovery factor for ~12% DCF ROR

Robust economics can be achieved with integrated projects using low-cost gas

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Key Messages

Dramatic progress has been made over the past almost 2 decades in understanding and advancing the DME business

- DME has become a COMMERCIAL REALITY
  - First commercialization of fuel DME is as a LPG blend stock in China
  - Future significant demand growth depends on LPG blend stock market development in other countries, and on the transportation fuel market

- Global DME effort is led by Asia due to need for:
  - Growing energy demand and security of supply
  - Energy diversification
  - Environment friendly clean fuel in Industry and transportation sectors.

  with Europe being involved.

- DME is the fastest growing methanol derivative but it is still an emerging market with challenges.

Acknowledgments and Disclaimer

Acknowledgments

The speaker gratefully acknowledges the significant information provided by others used in this presentation, particularly the International DME Association and its members.

Disclaimer

The speaker has prepared this presentation utilizing reasonable care and skill in applying methods of analysis consistent with normal industry practice.

Information contained in these materials or presented orally at this meeting, either in prepared remarks or in response to questions, contains forward-looking statements. The speaker believes that it has a reasonable basis for making such forward-looking statements. Such statements should not be a substitute for the exercise of one's own due diligence and judgment.

No implied warranty of merchantability or fitness for a particular purpose shall apply.

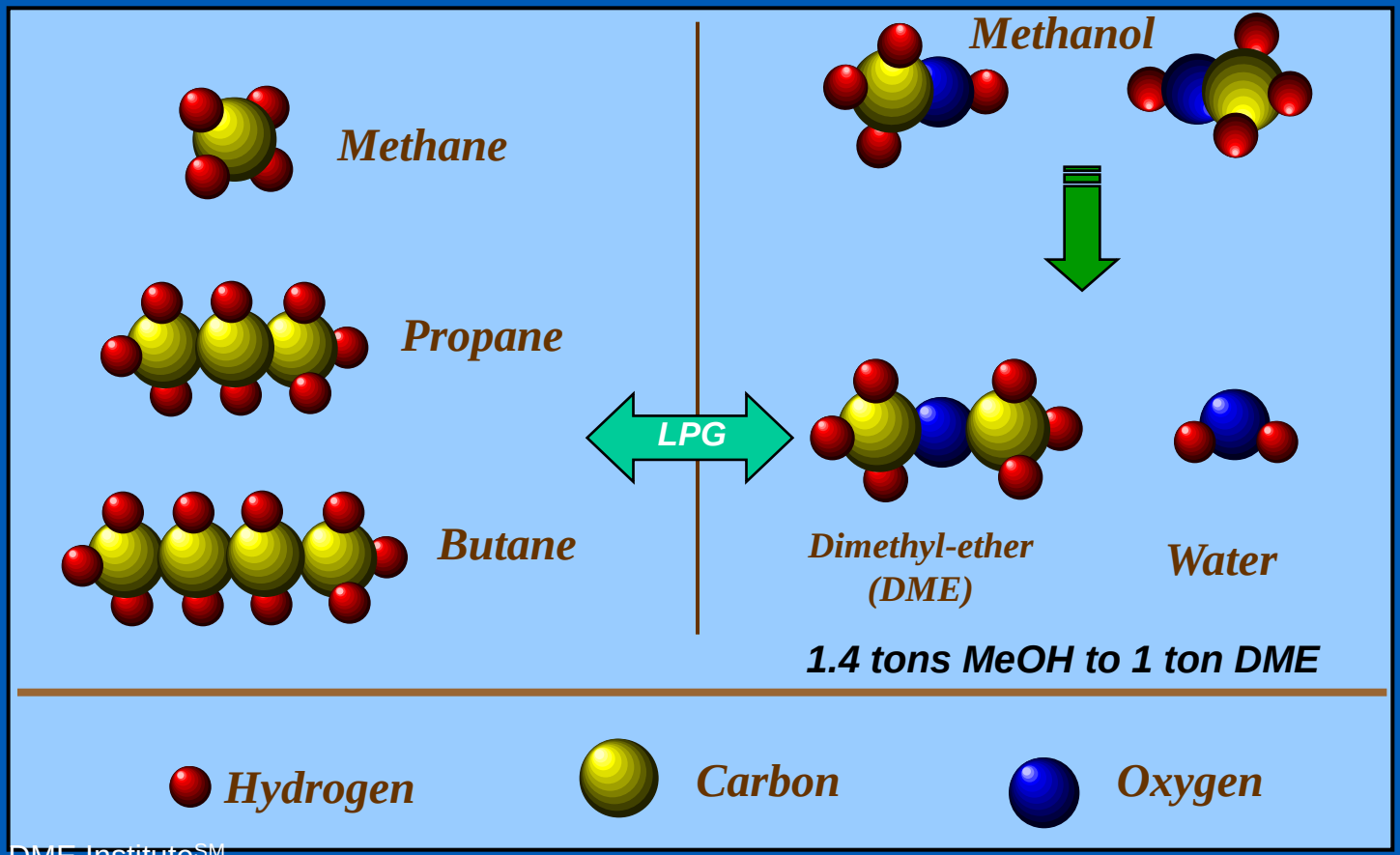
Back-up Slides

About the DME Institute℠

Newly-created educational service provided by Dr. Theo Fleisch (Fuel Conversion Solutions, LP) and Dr. Ronald Sills (Ronald A. Sills, LLC) , Co-Directors, on all aspects of DME as a fuel and chemical feedstock.

DME Fundamentals Tutorial at DME4 on September 6, 2010

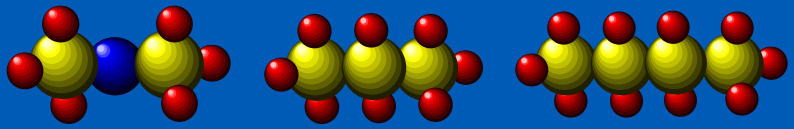
What is DME


Methanol
Methane
Propane
LPG
Butane
Dimethyl-ether
(DME)
Water
1.4 tons MeOH to 1 ton DME
Hydrogen
Carbon
Oxygen

Blue flame color from DME-fuelled lighter indicates complete combustion

Source: CO-OP Eco Vehicles (Japan), DME1

DME has similar physical properties as LPG but different thermal properties



Property	DME	Propane	N-Butane
Boiling Point (deg C)	-25	-42	-1
Vapor Pressure @ 20 deg C (bar)	5.1	8.4	2.1
Liquid Density @ 20 deg C (kg/m^3)	668	501	610
Lower Heating Value (MJ/kg)	28.4	46.4	45.7
Octane, (R+M/2)	10-15	104	94
Cetane	55-60	5	10

Hydrogen *Carbon* *Oxygen*

- 1.6 MT DME equivalent to 1 MT LPG
- 1.2 m^3 DME equivalent to 1 m^3 LPG

Properties of DME and Diesel – Relevant to Combustion and Fuel Injection

Property	DME	Diesel
Boiling Point (deg C)	-25	180-370
Liquid Density @ 40°C (kg/m^3)	634	840
Lower Heating Value (MJ/kg)	28	43
Viscosity (cst)	<0.3	~ 3
Cetane	~ 65	40-50

Presented by D. W. Gill, AVL, at DME 2 Conference, London, 2006

Environment, Health, and Safety

- HEALTH:
  - Approved as consumer product propellant
  - No human hazard relative to toxicity or carcinogenicity within exposure limits
- SAFETY
  - Flammable liquid like LPG
  - Thermally stable
  - No tendency to peroxide formation found
  - Visible flame
  - Safety same as LPG, demonstrated by various tests including those by The High Pressure Gas Safety Institute of Japan.
- ENVIRONMENT
  - Low emission fuel (LPG, Power, Diesel)
  - Does not deplete ozone
  - Minimal impact on water due to volatility

Photos Courtesy of Akzo Nobel and DuPont

Material Safety Data Sheet for DME (Source: DuPont)
http://msds.dupont.com/msds/pdfs/EN/PEN_09004a2f8000776f.pdf