

DME: Global Developments – Opportunities and Challenges

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On behalf of
International DME Association
IDA

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Copy of presentation for conference proceedings.

Actual presentation may differ.





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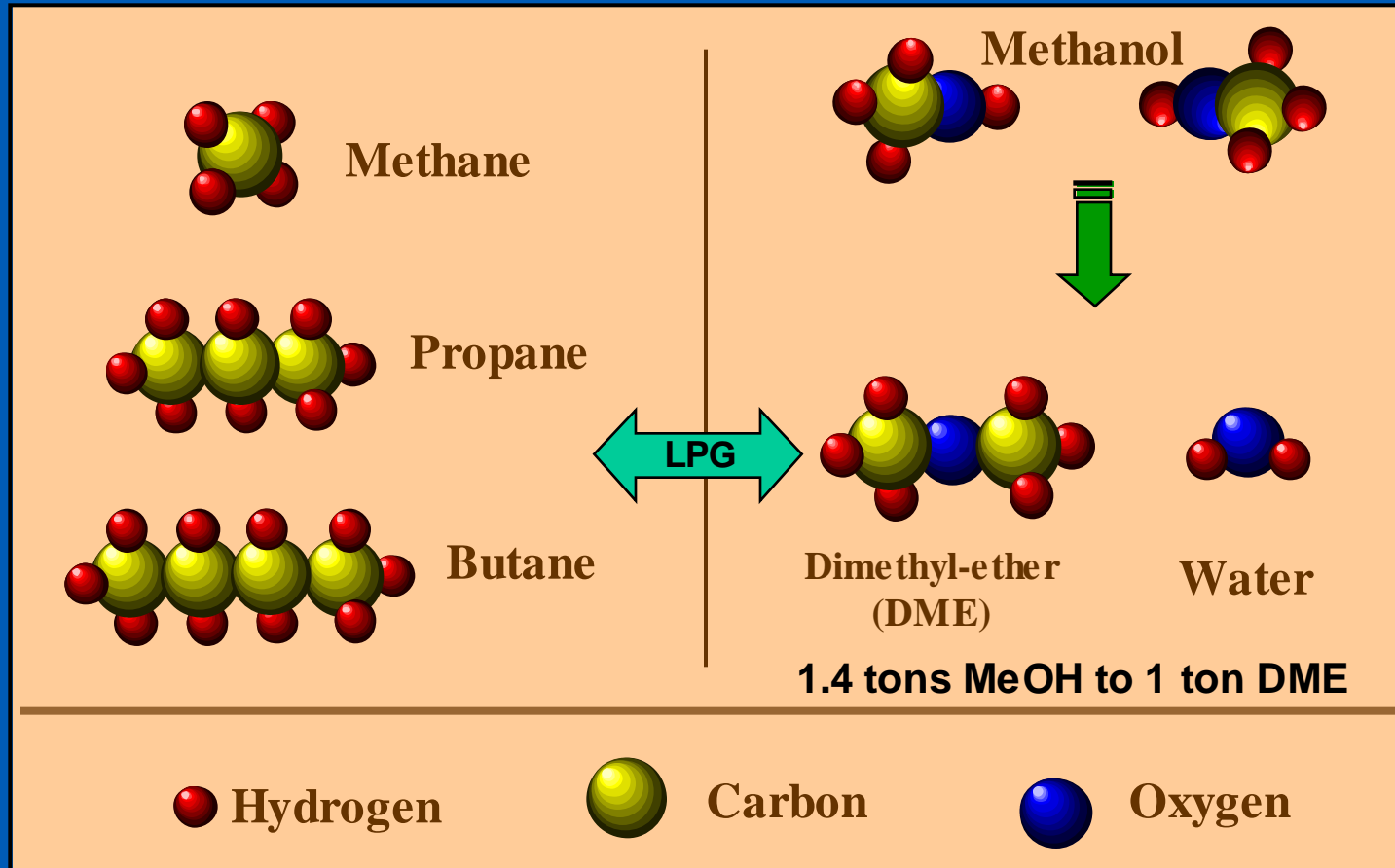
Dimethylether: A Fuel for the 21st Century

Our PATRON members

VOLVO LURGI BP

- Over 35 members
- Website: www.aboutdme.org
- Conferences, workshops, newsletter
- “DME 2”: London, May 15 to 17, 2006

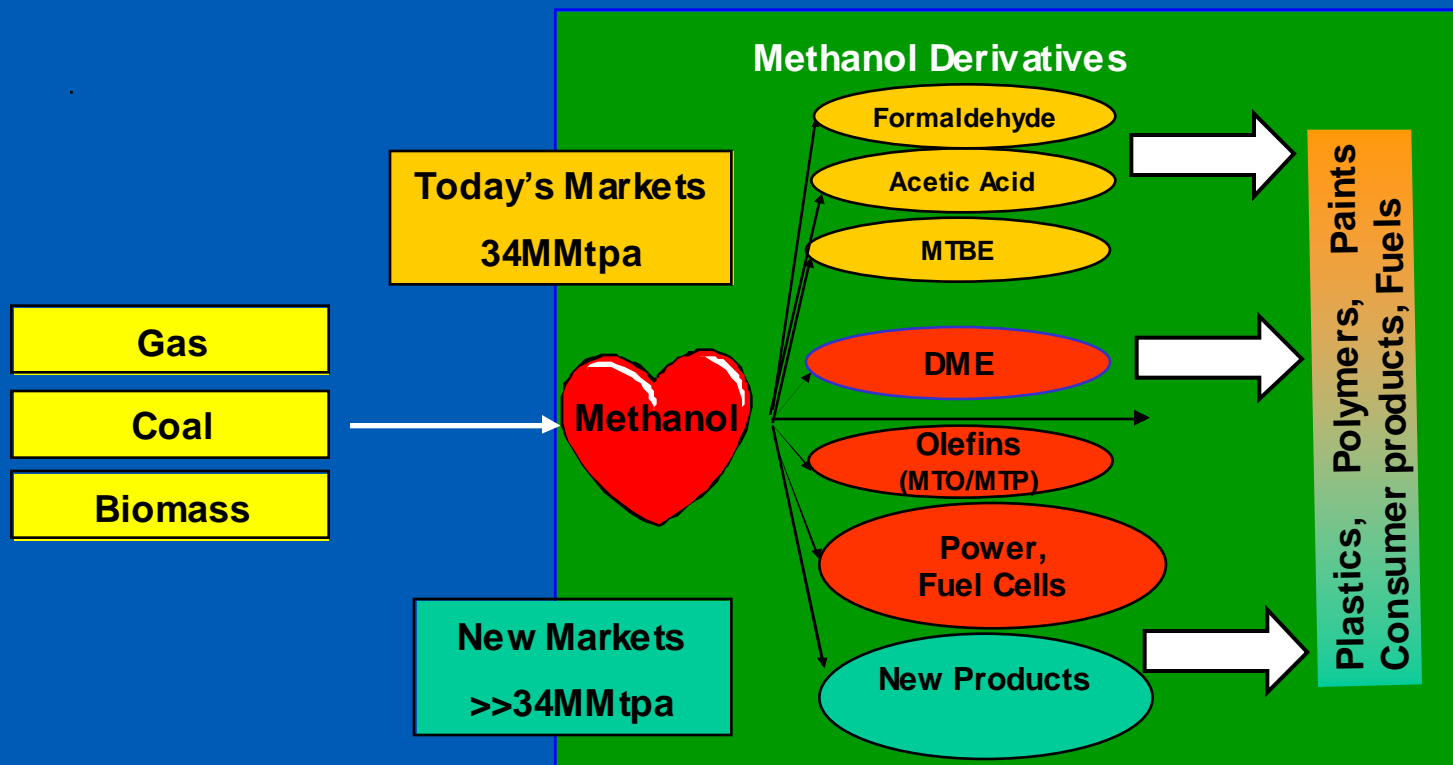
What is DME? "Synthetic LPG"



Outline

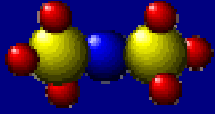
- The changing methanol business
- About DME
- Why DME Now
- DME Markets
- Latest DME Developments
- Global Challenges
- Conclusions

The changing methanol business



Methanol: in transition

- Plant sizes are increasing (>5000tpd)
- Remote gas locations for low cost feedstock
- Decreasing manufacturing costs
- New markets open up
 - DME as LPG alternative
 - DME as transportation fuel
 - Olefin production (MTP)
 - Methanol as transportation fuel (re-birth in China)



About DME

Overview

- Burns like natural gas
- Handles like LPG
- Similar to methanol with respect to:
 - Manufacturing technology
 - Costs
 - Petrochemical feedstock
- Environmentally friendly with significant global consumer history as propellant.
 - Clean burning
- Outstanding diesel alternative fuel
- Very large market potential as synthetic LPG, diesel alternative and fuel for power generation



A brief history of DME

	Major Activity/Event	Companies
1963	First use as aerosol	Akzo Nobel
1992-95	Diesel fuel demonstration	AVL, BP, DTU, HTAS, Navistar
Jan 1995	DME multi-purpose fuel strategy	BP visit with NEDO, TEPCO, EPDC and others
Feb. 1995	BP press conference and first papers in Detroit	AVL, BP, DTU, HTAS, Navistar
1996-2001	IEA DME Annex XIV and XX (workshops and studies)	TNO and 16 companies
1996-now	Multiple commercial projects pursued	Japan DME Ltd, DME International, India DME, Chinese ventures
2000/01	Formation of IDA and JDF	160+ members
2004/5	Iran DME project; DME 1 Conference; China DME projects 2 nd Asian DME Conference	

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Why DME now?

Multiple Markets

Multiple Sources

Ready technologies

Green

Economic viability

DME

The stars are aligned for success

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DME: clean and green

Green

- HEALTH:
 - non toxic, non carcinogenic
 - Approved as consumer product propellant
- SAFETY
 - Flammable liquid like LPG
 - Similar safety guidelines and codes as LPG
- ENVIRONMENT
 - Low emission fuel (LPG, Power, Diesel)
 - Short half-life in atmosphere



Visit www.aboutdme.org

Extensive HSE file

*Photos Courtesy of Akzo Nobel and
DuPont*

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Drivers for DME

Multiple Sources

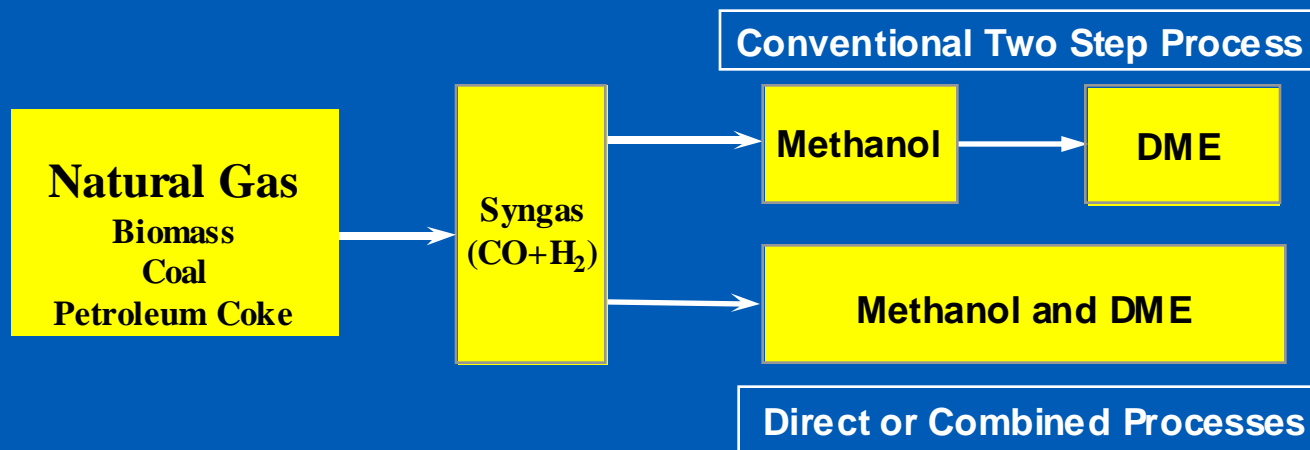
Gas monetization
Clean Coal utilization
Biomass conversion
Methanol marketing

Multiple Markets

LPG alternative
Ultimate diesel
Power generation
Hydrogen carrier
Chemical Feedstock

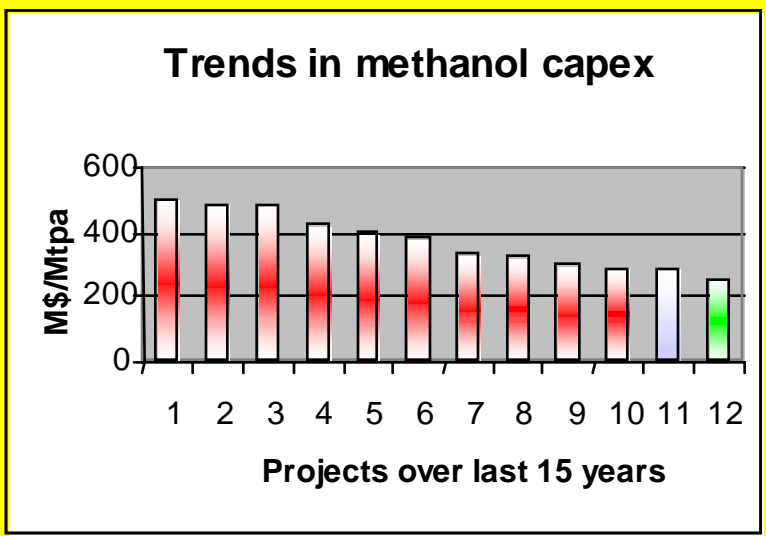
Methanol and DME production

Ready technologies



- Same chemistry, different engineering
- Methanol to DME conversion is very simple
- Similar Capex and Opex (lower than GTL-FT!)
- Co-production feasible
- Choice of technologies

Methanol Plant Costs are Decreasing



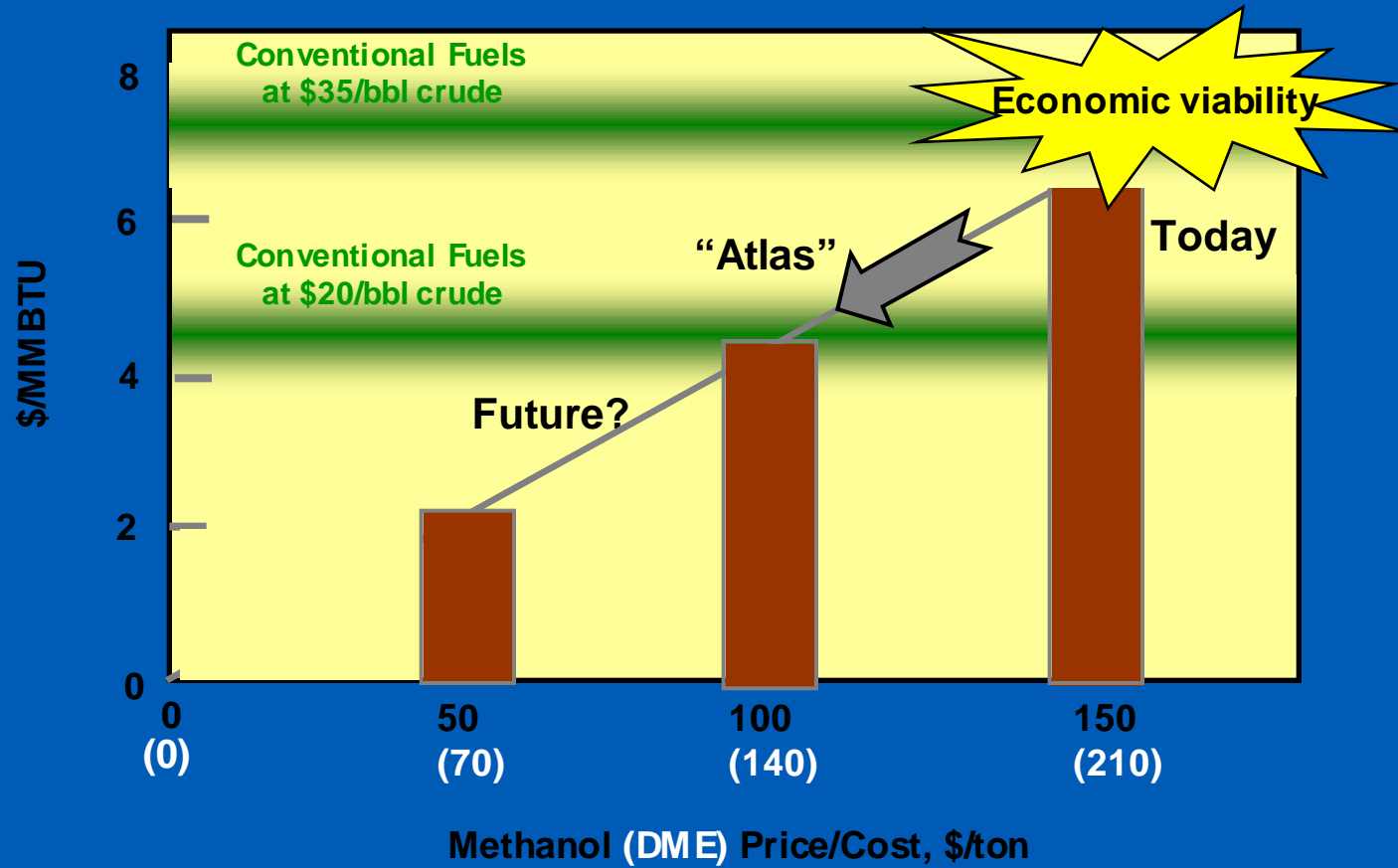
BP and Methanex announced that the industry pacesetter 5,000 TPD Atlas plant started-up on June 2, 2004.



Titan and Atlas Methanol Plants

Trinidad, Early 2004

Competitiveness in fuel markets



Outline

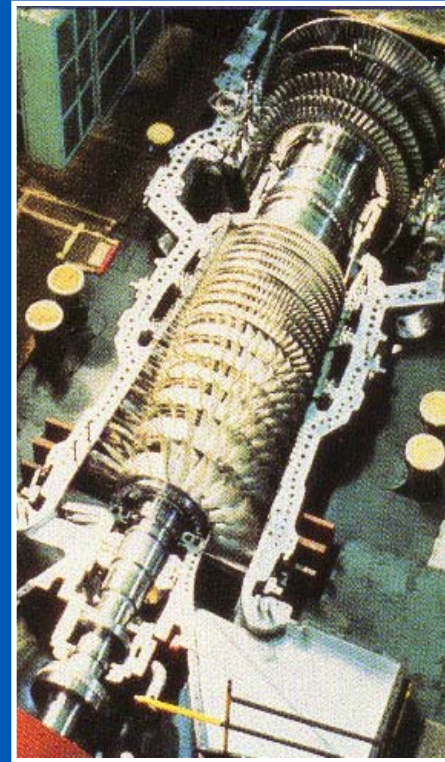
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DME as LPG blendstock

- DME/LPG blending work (BP, ENI)
- Completely miscible
- Below 20% DME, existing LPG infrastructure can be used
- THIS IS THE PRIMARY MARKET
 - Simple marketing
 - High value markets
 - Large demand (>200 million T/yr market size)

DME and Methanol for Power Generation

- 1995-2000: Partnership with GE and EPDC; Studies with SW
- Multiple, detailed combustor tests
- DME is excellent gas turbine fuel
- GE and SW provide commercial offerings of DME-fired E class and F class gas turbines
- GE and SW guarantee power output, heat rate and performance
- DME/Methanol exhibit record efficiencies and low emissions



Picture Courtesy of GE

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BP pioneering diesel demonstration

- 1992: Invention by Sorensen/Mikkelsen
- 1994: BP Demonstration in truck engine
 - Partnership with HTAS, AVL, Navistar
 - Proof of sootless, low NOx, quiet combustion
 - **“DME is diesel wonderfuel”**
- Feb. 1995: Press conference and SAE paper #950061
- Ongoing collaboration with Volvo and AVL

Powertrain

“DME is our preferred long term fuel.”

Volvo Group



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DME - Global Activities

Over the past several years, global recognition of DME's potential manifested by the formation of four associations representing about 160 companies, technical institutes, universities and individuals



Korea DME Forum

China DME Association

DME in Japan

Japan DME Forum coordinates multiple programs (\$200 million over 2002-2005)

- Utilization

- Power generation systems
- Household/industry fuel
- Diesel related technologies
- Emission tests from diesel engine
- Marketing study
- Road test of DME vehicles

- Production

- Production technologies
- Ocean transportation

- Codes & Standards

- Studies for standardization of DME fuel

Numerous Fleet Tests



Direct process (JFE) 100t/d demonstration plant

DME Commercial Projects - Studies

- Japan DME Ltd: 5,000 t/d, Western Australia
 - DME International Inc, 2,500-4,000 t/d, Qatar/Indonesia/Australia
 - Mitsui & Co, TEC: 7,000 t/d, Iran, Indonesia
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DME in China

Shandong Jiutai Chemical Industry, Linyi, Shandong

- 100,000 T/yr DME capacity. 50,000 customers using bottled DME.
- Established Jiutai Energy Mongolia Ltd. Planning 1 million T/yr.

"Now, energy is in short supply. DME can not only ensure energy security of our country, but also reduce environmental pollution." Shandong Jiutai Chem. Ind.

Luthianhua Group Inc, Luzhou, Sichuan

- 10,000 T/y – Commercial DME plant for fuel use - August 2003 start-up. Toyo Engineering methanol dehydration technology.
- 110,000 T/y – with 2005 start-up



DME in Iran

World's First Large-Scale DME Plant

- Production capacity: 800,000 T/yr
- Owner: Zagros Petrochemical Co.
- Location: Bandar Assalouyeh/ Pars Special Economic/Energy Zone
- Licensor: NPC-RT and Haldor Topsoe AS
- Feed: ASTM Grade AA Methanol
- Technology: methanol dehydration, fixed-bed reactor
- Product purity (wt%) – above 99%
- Primary market: LPG substitute in Iran and Region
- Current Project Status:
 - EPC company selected
 - First production in 2008

Other DME Activities Around the World *

Sweden

- Volvo DME fleet tests in Växjö



Russia

- Moscow program: "Alternative fuels use in city's motor transport for 2002-2004" ..
- VNIIGAZ (GAZPROM Research Institute) developing technology to manufacture DME

USA

- DME-Fueled Shuttle Bus Demonstration, Penn State University,



Italy

- Snamprogetti Program : DME as LPG substitute, and LPG/DME interchangeability in diesel engines (with SwRI)

Brazil

A network, headed by the Petrobras Research Centre, was established including one Research Institute and three University Laboratories.

Europe/USA

- AFFORHD. Alternative Fuel for Heavy Duty Engines
- Volvo, AVP/PTI, DTU, BP, TNO, Växjö
- 2002-2005, 4 million euro



Korea

- KOGAS Demo Plant, 2004-9
- Conducting engine research
- KIER/SK/Inha Univ. Project: First prototype truck



* Only a partial list of the extensive global efforts

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Global challenges

- Raising awareness of DME
- International standards
- Strategic partnerships with other industries (methanol, LPG, clean transportation fuel)
- Competition with LNG, GTL-FT and hydrogen fuel cells
- Lack of first successful, LARGE plant

Conclusions

Dramatic progress has been made in the past 10 years in understanding and advancing the DME business

- DME is a very promising new, multi-purpose fuel
- Manufacture from methanol
- Many drivers and opportunities
- A significant global DME effort has evolved - led by Asia.
- DME community has joined forces for advancement of DME