DME Production Technology Overview

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DME is still progressing; however, challenges are faced

- Production overview
- Market trends
- Technology and development
- Conclusions
Methanol and DME production

- Methanol conversion to DME via well-known catalytic reaction
- Similar Capex and Opex (lower than GTL-FT)
- Co-production feasible
- First plants: all two-step processes
- Technology providers include Haldor Topsøe, Lurgi, Toyo, Mitsubishi Gas Chemicals, Tiayi, ENN and JFE Holdings

![Diagram showing the conversion of various feedstocks to syngas, methanol, and DME through conventional and direct processes.](image)
DME synthesis - basic reaction

\[ 2 \text{CH}_3\text{OH} = \text{CH}_3\text{OCH}_3 + \text{H}_2\text{O} + \text{Heat} \]
\[ \text{R}_1\text{-OH} + \text{R}_2\text{-OH} = \text{R}_1\text{-O-R}_2 + \text{H}_2\text{O} + \text{Heat} \]

Feed can be Grade AA methanol or for the Topsøe technology also fuel grade methanol
Overview of process layout

- Methanol
- Reactor
- Off-gas
- DME column
- DME product
- Waste water column
- Waste water
- Recycle
Overview including HEAT integration
Market trends
DME is a high-efficiency diesel and LPG substitute. China is already well prepared!

- DME can substitute LPG directly with 20% volume blending
- With its high efficiency, DME reduces CO$_2$ emissions ("well to wheel")
- DME can be used instead of diesel for designated users
  - No smoke
  - No sulphur
  - Almost no NOx (90% reduction)
  - High cetane
  - Distribution like LPG
Sweden is on the map

- Bio DME
- Volvo
Production and trends

- Over-capacity in China
  - Re-evaluation of the permissions for
    - New plants
    - Use of DME
- To jump, legislation is needed
- Egypt
  - Driver is needed for LPG
  - There could be many other opportunities
- Associated gas
  - CO$_2$ restriction
  - Smaller units
Ways of developing

- **Feedstock cost and perception**
  - Less clean
  - Renewable (Piteå)
  - Lower production cost of feedstock (Piteå - technology)

- **Integration**
  - Technology (JFE etc)
  - Systems
Economical evaluation – simple function of methanol price

DME price as a function of methanol cost

DME production price per MT of DME

Methanol price /MT

DME cost price

HALDOR TOPSØE
Integration into the energy systems

- Feedstock integration (Renewable)
  - Piteå
  - Electricity + H₂O + CO₂
    - Wind
    - Solar
- Mixing with existing fuels
  - LPG
  - Diesel
  - Other ethers
- No integration
  - Dedicated fleets
In conclusion: China is the world leader in applying the clean DME fuel

- One way could be a designated use of DME for busses, trains, etc. that operate in the cities
  - Designated distribution
  - Engine injection system can easily be modified
- A unique opportunity for Chinese diesel engine manufacturers
- Legislation is needed
- The future could require an integration approach