Commercial Developments in Japan

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DME Vehicle Promotion Committee (DMEVPC), Japan

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DME Plant completed in Niigata, and Commercial Delivery launched from 2009

1st DME Promotion Plant in Japan
Plant Site : Inside MGC Niigata Factory
Production : DME 80KT/Y sourced from imported Methanol
Production Start : August 2008
Delivery Start : January 2009
Fuel DME first User in Japan

First DME Boiler started commercial operation in 13th Jan, 2009.

New DME Steam Boiler

Onsite DME Storage tank at the user’s factory, producing fish paste

Type: once-through steam boiler

Output: 2,000kg/h

Efficiency: 96%

DME: 79.1Nm³/h (162.7kg/h)

Size: 1,790 x 2,095 x 2,520 mm (W x D x H)
DME’s Position at Japan National Strategy (Ministry of Economy, Trade & Industry)

Outline of Subsidy program for DME introduction

- Subsidy for modification and/or new construction of DME boilers

  → 2008: 150 Million Japanese Yen (≒ US$1.5 Mil)
  2009: 186 Million Japanese Yen (≒ US$1.9 Mil)
  2010: 37 Million Japanese Yen (≒ US$0.4 Mil)

- Merits for introducing DME Fuel

  ➢ DME does not contain Sulfur, and is expected to contribute to diversification of energy like oil or LPG substitute.

  ➢ In order to promote DME utilization, the subsidy should be used for development of DME application.
Current usage of Fuel DME

- **Diesel engine generator**
- **Diesel Vehicle**
- **Agriculture use**
  - (Exhaust gas, CO₂ promotes plant’s growth)
- **Household use**
  - (LPG/ DME blend)
- **Co-generation System**
- **Industrial use**
Sophisticated New DME Truck in Japan

Running with commercial Number Plate at Chiba, Saitama District by Idemitsu/ Trinet Logistics

Running with commercial Number Plate at Niigata District by Niigata Unyu

DME Filling Station at Saitama

DME Filling Station at Niigata

Supported by the subsidy of Ministry of Land, Infrastructure, Transport & Tourism (MLIT) operated by National Traffic Safety and Environment Laboratory (NTSEL)
# DME Vehicle Promotion Roadmap

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<th>Year</th>
<th>2003</th>
<th>2005</th>
<th>2007</th>
<th>2009</th>
<th>2010</th>
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<td>NA to TC, Improvement of Fuel Consumption</td>
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<td><strong>Cost</strong></td>
<td>Classified 2 ton to 4 ton class</td>
<td>J¥20mil./car</td>
<td>J¥10mil./car</td>
<td>J¥5mil./car</td>
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<td><strong>Emission</strong></td>
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<td><strong>Fuel DME</strong></td>
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<td>F-DME 80 kt</td>
<td>Papua New Guinea, etc. 1 mil. ton</td>
<td>Middle-East, China 10 mil. ton</td>
<td>Bio DME</td>
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- **Promotion Prospects**: 5,000-car, 50,000-car
- **Bio Fuel, Low Carbon**
Developing DME High Speed Filling System

DME Storage Tank

Filling Equipment used for LPG Vehicle

DME middle/heavy-duty truck with 250 to 600 Liter storage tank

Present System
20 to 30 Liter/Min.

Necessity to improve filling speed up to the level of Diesel oil

Pressure balanced filling system

Flow meter for liquid DME

Developed System
Secured 80 Liter/Min.

Newly developed High Speed Filling Equipment

Developing DME High Speed Filling System

Integrated nozzle for filling and vapor return lines
Among the versatile rubber materials, EPDM (ethylene propylene diene Monomer) with high Ethylene contents has smaller swelling-rate against DME than others.

By blending above EPDM, as base-rubber and low molecular weight Polyethylene which has well compatibility with EPDM, finally Japanese firms succeeded to develop the versatile rubber which was superior to DME tolerance.

Based on this technology, they established two kinds of practical blend-rate by each hardness, obtained basic property and carried out tests with actual equipment. Finally, they confirmed that these rubber materials were all able to use without any problems as DME sealing rubber.

This result was applied to patent on January 20, 2010 in Japan.

Application No. : 2010-10037 “DME tolerant rubber composition”
Bio DME Fuel for DME Vehicle

Prior research

Iwatani Corporation and Hiroshima Biomass Technology Research Center of AIST, Japan studied DME synthesis from woody biomass during January to June, 2008.

Recent research

DMEVPC and Hiroshima Biomass Technology Research Center of AI ST studied again DME synthesis from woody biomass until the end of March, 2010 and finally obtained 1.113 kilograms of biomass DME for demonstration of DME vehicle.
Running ceremony of Bio DME truck was held on May 18, 2010 at Yokohama Liquefied Gas Terminal adding a few percents of bio DME with Niigata fuel DME.
Bio DME Seminar was held on May 24, 2010 at Sanjo Conference Hall of The University of Tokyo organized by DMEVPC, DME Promotion Center (DPC) and NTSEL, attended around 130 audiences including mass medias.
Utilization of Bio DME in Japan

DME Producing Equipment at Hiroshima Biomass Center, AIST

Fuel DME from Niigata

Yokohama Liquefied Gas Terminal

Hiroshima Biomass Center produced 1.113 kg of Bio DME on February,

Bio DME fuel was filled into Isuzu advanced DME tuck.

Running ceremony of Bio DME Truck was held on May 18, 2010.

Expanding to

Others

Utilizing to the fuel of Boiler, Heating furnace

By mixing Bio DME into LP Gas, it could be contributed to produce Bio LP Gas, just as Gasoline with ETBE.

To utilize Bio DME as vehicle fuel could reduce Diesel oil dependence and promote to utilize Bio fuel for the transportation sector.
Administrative Guidance for utilizing Nonfossil Resources

**Hatoyama Initiatives**
- Midterm target of 2020 for reducing 25% of GHG compared with 1990.
- Global Warming Solutions Act, Total Buy-Out System for Nonfossil Energy, CDM, Environmental Tax

**Revised Energy Master Plan (each three year)**
- Focused on renewable and nonfossil energy.
- Stipulated “LP Gas industry should address the utilization of nonfossil resources, such as mixture of Bio Gas, etc.”
  Approved by the Cabinet on June 18, 2010

**Requirement of Revision**
  Aimed to:
  - reduce oil dependence
  - mainly promote the development of new energy, and LP gas was the target to reduce

**Administrative Guidance**
- Act on the Promotion of the Use of Nonfossil Energy Sources and Effective Use of Fossil Energy Source Materials by Energy Suppliers: enforced on August 28, 2009
- Act on the Promotion of Development and Introduction of Nonfossil Energy Resources Promotion Act: Based on old Act

**Administrative Guidance**
- Energy Suppliers must endeavor to use nonfossil energy sources and promote effective use of fossil energy source materials.
- Minister of METI provides targets for specific energy suppliers and the suppliers provide and enforce their own plans.
- LP Gas was outside of the framework due to the difficulty from its technology and economics.
  Power, Town Gas and Oil were obliged to this Act
  Council was held from the beginning of August, 2010

**Proposal from METI (Reaction of LP Gas Suppliers)**
LP Gas Suppliers “will address the utilizing nonfossil energy resources by mixture of the fuel which will be produced from biomass etc.”
Local Production for Local Consumption (LPLC) by utilizing Bio DME

- Utilizing rich domestic biomass resources.
- Collaboration with companies who hold technologies and equipments.
- Employing domestic human resources.

How to supply DME with reasonable price?

Reducing Production Cost for Bio DME Fuel

Supply

- Blending with existent DME or LP Gas

Utilization

- Securing Supply Stability of Bio Fuel
- Diversification for Utilization of Bio Fuel

DME’s original characteristic of “Multi-purpose”

Or import Bio DME from other countries?
To utilize Bio DME as vehicle fuel could reduce Diesel oil dependence and promote to utilize Bio fuel for the transportation sector.

By mixing Bio DME into LP Gas, it could be contributed to produce Bio LP Gas, just as Gasoline with ETBE.

Others Utilizing to the fuel of Boiler, Heating furnace.

Procuring DME from conventional resources (fossil resources) from Niigata, etc.

Realization of Local Production

- Selecting Biomass Resources existing in wide area
- Collection of Biomass Resources
- Recovering Biomass Resources collected at each area
- Storing at Biomass DME Production Plants (Including drying Process)
- Production of Bio DME

Securing of Local Consumption

- Utilizing Partially

Started Negotiation with Some Local Governments

- Image of LPLC
- Realization of Local Production
- Securing of Local Consumption
In spite of the richness of wood resources in Japan, it is very difficult to select the means of collection and needs enormous money to recover them. By placing many Hub Units consisting small sized Bio DME production plants, it could be easy to produce Bio DME and to transport Bio DME to storage hubs. Finally, it could build up LPLC model more widely. Moreover, if the hub areas are properly enlarged, this model could be spread nationwide as the promotion model of Bio DME.
Expectations from Paper Mill Industries

By Utilizing diversified Biomass Materials, to be a Factory to produce Paper, Biomass Fuel, Energy and Chemical Products

New Biomass Resources
- Woody Biomass: Thinned Wood, Scrap Wood, Forest Surplus
- Agricultural Biomass
- Other Biomasses

Pulp & Paper Factory
- Pre Processing
- Glycation, Fermentation Process
- Thermochemical Conversion Process
- Synthetic - FT - Separation Gasification Synthesis
- Gasification of Black Liquor
- Biomass Boiler
- Black Liquor
- Pulp Factory
- Pulp
- Paper Factory
- Paper

Fuel, Chemical Materials
- Biomass Ethanol
- Biomass Fuel (DME、BTL) Chemical Materials
- Heat, Electricity
- Energy
- Paper Product

Framework of Paper Mill to Bio Refinery

DME VEHICLE PROMOTION COMMITTEE, JAPAN
**Critical Issues of Bio DME in Japan**

**Constraint of Bio Resources in Japan:**
- Japan is too small to produce mass and concentrated Bio resources.
- It is difficult to collect Bio resources due to their wide and shallow existence.
- Higher collection fees will raise the production cost.
- Japanese Government has not taken measures to secure wood resources until now, it is hard to get thinned wood, etc.
- Bio projects are depending on Governmental subsidies, too much subsidy will be the burden afterward.
- It is very difficult to consume massive bio products (including electricity and Gas) which comes from the bio plant.

**Direction hereafter:**
- Building up business model at the place where can utilize abandoned bio production plants like small sized gasification furnace or methanol plant.
- Developing the small sized DME production plant which can reduce the production cost.
- Securing the LPLC model to sell the Bio LP Gas which is mixed a few percents of Bio DME into LP Gas.
- Running DME vehicles with the fuel which is mixed Bio DME into conventional (fossil) DME.
- Expanding from LPLC level to the nationwide.

**Bio Study Until Now:**
- Mainly targeted to the Bio Ethanol derived from fermentation.
- In the studies of producing synthetic gas from Gasification furnace, there are few verification study of DME production from synthetic gas.
- Considering cost problem, the projects of producing synthetic gas were designed large scale production, therefore the plant cost and the collection cost for massive Bio materials were too high to accept.
Thank you very much for your kind attention!!

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