Methanol to Power Demonstration Project

Haydn I. Furlonge, Natural Gas Institute of the Americas
Vishard Chandool, Methanol Holdings (Trinidad) Ltd.

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Methanol Holdings (Trinidad) Limited

- Total production capacity of 4.1 million metric tonnes per annum
- Comprises five methanol plants
- TTMC, CMC, MIV were amalgamated into MHTL in 2004
- Second largest producer of methanol in the world
  - MHTL Production: 12% of World Capacity
  - MHTL Sales: 11.7% of World Demand
  - MHTL Sales: 20.0% of World Trade
- The largest exporter of methanol to the US

MHTL’s METHANOL COMPLEX

TTMC I (M1)
TTMC II (M2)
M IV (M4)
M5000 (M5)

MHTL Shipping Fleet

SHIPPING
CURRENT FLEET OF 10 VESSELS

One (1) 14,000 DWT - Goodrich Bay
One (1) 16,000 DWT - Cyars Vaciets
One (1) 17,000 DWT - Kemen
Four (4) 30,000 DWT - Naparima
One (1) 45,000 DWT - Las Cuevas
Two (2) 48,000 DWT - Pigeon Point
San Fernando

Natural Gas Institute of the Americas

Vision
To be in the forefront of natural gas-related research and expertise in the Atlantic Basin Region

Natural Gas Institute of the Americas

CO₂ Sequestration
Gas Hydrates
Single Cell Protein
Well Productivity
Gas Market Dynamics
Methanol to Power
ECONOMICS, ENVIRONMENT AND POLICY
Econometrics
CO₂ Sectoral Study on Mitigation
Advanced Decision Tool
Methanol to Power Initiative

- Joint UTT-MHTL Initiative
- Commenced by MHTL
  - Conversion of small liquid fueled turbine emergency/back-up generators to cleaner fuels in New York
  - To consider niche market in the Caribbean
- Demonstration Power Plant (DPP)
  - Completed construction
  - Currently being commissioned

Electricity Generation Demand Trends

Comparison of Gas Transportation Options

<table>
<thead>
<tr>
<th>Gas Supply Options</th>
<th>Economic over Long Distance by Sea</th>
<th>Economic in Small Quantities by Sea</th>
<th>Simple Legal Commerical Arrangement</th>
<th>Standard Commercial Infrastructure/Technology</th>
<th>Minimal Downstream Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline</td>
<td>Yes/No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>LNG</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>CNG</td>
<td>No</td>
<td>Yes/No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Gas to Wire</td>
<td>Yes/No</td>
<td>Yes/No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>Methanol</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</tbody>
</table>

Properties of Methanol as a Fuel

- Lower minimum air requirement
- Cleaner burning fuel
- Lower boiling point (64.5°C) and ignition temperature

Equipment Modification

- Poor Lubrication Properties
- Variable Speed Pump
- Special Coating
- Low Heating Value
- Modified fuel system
- High Flammability
- Safety Measures

Properties of Methanol as a Fuel

- Viscosity Pa s x 10^-4
- Heating value MJ/Kg

MAN Turbo THM1304 for Methanol
8.5 MW, 28.2% efficiency, 12,770 kJ/KWh

Gas Turbine Generating Package

Storage Tank System

Market Price Comparison

- Methanol more competitive than Diesel
- Methanol price can provide a level of diversity

Methanol Pricing Forecast
Source: CMAI

Methanol to Power Value Chain

Storage and Power Plant
Comparison of Power Generation Cost

<table>
<thead>
<tr>
<th>Country</th>
<th>Price, US$ per kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grenada</td>
<td>0.2559</td>
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<tr>
<td>St. Lucia</td>
<td>0.2902</td>
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<tr>
<td>Barbados</td>
<td>0.2099</td>
</tr>
<tr>
<td>Jamaica</td>
<td>0.1520</td>
</tr>
</tbody>
</table>

- 2005 Electricity prices
- Methanol to Power Value Chain cost can be competitive

Advantages of Methanol as a Fuel to Caribbean Islands

1. Favorable Economics
2. Cost is based on gas rather than oil
3. Easily transportable
4. Island by Island arrangement or "milk-run" delivery
5. Fast implementation time

MHTL-UTT R&D Programme

- Technical Feasibility of the Technology
  - Plant Reliability and Efficiency
  - Mechanical Integrity
  - Grid synchronization
  - Process control and optimization
  - Safety
  - Environmental impact
  - Fuel switching and use of fuel-grade methanol

- Economic Feasibility
  - Detailed Costing of the "methanol value chain" versus other hydrocarbon alternatives
  - Examine factors which impact viability
  - Assess niche markets (e.g. Caribbean islands)
  - Combined Heat and Power Generation Feasibility

MHTL-UTT Alliance

Thank You!