Natural Gas and LNG Business Today and Tomorrow

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Mitsubishi Corporation
Energy Business Group

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Natural Gas Business Division B
LNG (Liquefied Natural Gas) is natural gas cooled to -162°C and liquefied. It is composed of a large quantity of methane and its specific weight is light. Through liquefaction, volume is reduced to 1/600th, convenient for maritime stowage and transport. The methane is not toxic or corrosive.

### Difference between natural gas and other fuels

<table>
<thead>
<tr>
<th></th>
<th>Specific weight (air = 1.00)</th>
<th>Combustible concentration range in air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas</td>
<td>0.65</td>
<td>5–15%</td>
</tr>
<tr>
<td>Propane</td>
<td>1.52</td>
<td>2.2–9.5%</td>
</tr>
<tr>
<td>Butane</td>
<td>2.00</td>
<td>1.9–8.5%</td>
</tr>
<tr>
<td>Gasoline</td>
<td>2.95</td>
<td>1.3–7.6%</td>
</tr>
</tbody>
</table>
Before Use of Natural Gas (LNG)

Gas Fields (Exploration/Development)  Liquefaction Plant  Maritime Logistics  Receiving Terminal

Thermal Power Plant

City Gas
LNG Tank Lorry  Gasification Facility  Heat Adjustment and Odorization

City Gas
Gasification Facility  Heat Adjustment and Odorization  Pipeline

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The Position of Natural Gas

External Environment

We have entered the golden era of natural gas. (IEA)

Expectations are rising regarding the role of natural gas as a primary energy source.

Abundant ⇒ Reserves are abundant compared to oil
Affordable ⇒ Prices are low compared to oil
Acceptable ⇒ Effective for reducing CO2 compared to other fossil fuels
The Position of Natural Gas

Forecast for Primary Energy Demand

(Source: IEA World Energy Outlook 2010 (New Policy Scenario) ) Published November 2010
Confirmed Reserves of Natural Gas (Source: BP Data 2010)
6,621 tcf

Shale Gas Recoverable Resources (Source: EIA)
6,587 tcf

1,3208 tcf
R/P ratio: 64
R/P ratio: 127

Based on explorations and assessments, resources will continue to expand from hereon.
## Global Unconventional Gas

<table>
<thead>
<tr>
<th>Region</th>
<th>CBM</th>
<th>Shale Gas</th>
<th>Tight Gas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>3,017</td>
<td>3,840</td>
<td>1,371</td>
<td>8,228</td>
</tr>
<tr>
<td>Latin America</td>
<td>39</td>
<td>2,116</td>
<td>1,293</td>
<td>3,448</td>
</tr>
<tr>
<td>Western Europe</td>
<td>157</td>
<td>509</td>
<td>353</td>
<td>1,019</td>
</tr>
<tr>
<td>Central and Eastern Europe</td>
<td>118</td>
<td>39</td>
<td>78</td>
<td>235</td>
</tr>
<tr>
<td>Former Soviet Union</td>
<td>3,957</td>
<td>627</td>
<td>901</td>
<td>5,485</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>0</td>
<td>2,547</td>
<td>823</td>
<td>3,370</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>39</td>
<td>274</td>
<td>784</td>
<td>1,097</td>
</tr>
<tr>
<td>Central Asia and China</td>
<td>1,215</td>
<td>3,526</td>
<td>353</td>
<td>5,094</td>
</tr>
<tr>
<td>Australia</td>
<td>470</td>
<td>2,312</td>
<td>705</td>
<td>3,487</td>
</tr>
<tr>
<td>Other Asia Pacific</td>
<td>39</td>
<td>313</td>
<td>745</td>
<td>1,097</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>9,051</td>
<td>16,103</td>
<td>7,406</td>
<td>32,560</td>
</tr>
</tbody>
</table>

Source: EIA

The Rise of Unconventional Natural Gas

**Maps showing the distribution of unconventional natural gas resources.**
What is Shale Gas?

- Shale gas / source rock can be up to 3.3 MCM / 1000 meter² (300 BCF / mile²)

- Conventional gas reservoir (sandstone)

- Seal

- Horizontal drilling with fracture stimulation

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Affordable – Prices are Low Compared to Oil

Approximately one-fifth the price of oil
Acceptable – Assessing Primary Energy

Low Carbon

Renewable Energy

Socially Accepted

Economic Viability

Supply Stability

Nuclear

Coal

Oil

Natural Gas

(Source) The Institute of Energy Economics
Part 1: Overview of and Forecast for Natural Gas and LNG

Part 2: The Impact of the Earthquake

Part 3: MC’s LNG and Natural Gas Business

Part 4: Conclusion
Japan’s LNG Demand Forecast (2011)

Unit: Million Tons

Impact of the Chuetsu Offshore Earthquake
Financial Crisis

Approximately 80 million tons

World LNG Supply & Demand Forecast (by MC)

Unit: Million Tons

- **Planned**
- **FEED:** Wheatstone, Ichthys, Browse, etc.
- **Under Construction**
- **In Operation**

### FEED:
- Wheatstone
- Ichthys
- Browse, etc.

### Unit: Million Tons
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020
- 2021
- 2022
- 2023
- 2024
- 2025
Part 1: Overview of and Forecast for Natural Gas and LNG

Part 2: The Impact of the Earthquake

Part 3: MC’s LNG and Natural Gas Business

Part 4: Conclusion
MC’s Natural Gas Business - Organizational Structure

- Corporate Staff Section
  - Corporate Communications
  - Corporate Administration, Legal, Human Resources
  - Global Strategy & Coordination
  - CFO (Finance, Corporate Accounting)

- Business Groups
  - Global Environment Business Development Group; Business Service Group
  - Corporate Planning Department
  - Internal Audit Department

- Energy Business
  - Industrial Finance, Logistics & Development

- Exploration & Production Unit
  - Natural Gas Business Division A
    - Metals
    - Machinery
    - Chemicals
    - Living Essentials
  - Natural Gas Business Division B
  - Petroleum Business Division
  - Carbon & LPG Business Division
MC’s Natural Gas Business

MC’s Influence on the Japanese Market

MC’s Share in Japan’s Imports of Energy Resources

(Million Tons)

- **LNG**
  - MC 41%
  - Others 59%
  - Total 70.6 Million Tons

- **Iron Ore**
  - MC 7%
  - Others 93%
  - Total 134 Million Tons

- **Coal (Coking Coal)**
  - MC 33%
  - Others 67%
  - Total 59 Million Tons

- **Copper**
  - MC 16%
  - Others 84%
  - Total 1.6 Million Tons

- **Coal (Thermal Coal)**
  - MC 15%
  - Others 85%
  - Total 119 Million Tons

- **Aluminum**
  - MC 15%
  - Others 85%
  - Total 1.9 Million Tons
## MC’s Natural Gas Projects – LNG Business

<table>
<thead>
<tr>
<th>Start</th>
<th>Project</th>
<th>MC’s Role</th>
<th>Shareholding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>Alaska LNG</td>
<td>Sales to Tokyo Electric and Tokyo Gas; Negotiation support; Import agent</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* First introduction of LNG to East Asia</td>
<td></td>
</tr>
<tr>
<td>1972</td>
<td>Brunei LNG</td>
<td>Investment in liquefaction and sales; Negotiation support; Import agent; Shipping</td>
<td>25%</td>
</tr>
<tr>
<td>1983</td>
<td>Malaysia LNG</td>
<td>Investment in liquefaction and sales; Negotiation support; Import agent</td>
<td>Satu/Dua/Tiga 5%/15%/4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3 Projects: Satu, Dua and Tiga)</td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td>Western Australia LNG</td>
<td>Investment in upstream, in liquefaction and in sales; Negotiation support; Import agent; Shipping</td>
<td>8.3%</td>
</tr>
<tr>
<td></td>
<td>(Includes crude oil development)</td>
<td>* First joint venture with Mitsui &amp; Co., Ltd.</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>Oman LNG</td>
<td>Investment in liquefaction and sales</td>
<td>2.8%</td>
</tr>
<tr>
<td>2004</td>
<td>Qalhat LNG</td>
<td>Investment in liquefaction and sales; Import agent; Shipping</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>(Oman)</td>
<td>* Global sales and arbitrage operations</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Sakhalin LNG</td>
<td>Investment in upstream, in liquefaction and in sales; Negotiation support; Import agent</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>(Includes crude oil development)</td>
<td>* Joint venture with Mitsui &amp; Co., Ltd.</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Tangguh LNG</td>
<td>Investment in upstream, in liquefaction and in sales; Negotiation support</td>
<td>Approx. 9.9%</td>
</tr>
<tr>
<td></td>
<td>(Indonesia)</td>
<td>* Joint Venture with INPEX Corporation</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Shale Gas (Canada)</td>
<td>Investment in upstream, in liquefaction and in sales. Joint development with Japanese utility and gas companies</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* North American natural gas business</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>Donggi Senoro LNG</td>
<td>Investment in upstream, in liquefaction and in sales - together with KOGAS</td>
<td>Approx. 45%</td>
</tr>
<tr>
<td>(Planned)</td>
<td>(Indonesia)</td>
<td>* Taking on operatorship of LNG plant</td>
<td></td>
</tr>
</tbody>
</table>
MC’s Natural Gas Business – LNG Value Chain

Project | MC’s Interest | Upstream | Liquefaction Equipment | Financing | Transport | Sales
--- | --- | --- | --- | --- | --- | ---
Alaska | 1969 | - | - | - | - | -
Brunei | 1972 | 25% | - | - | - | -
Malaysia I | 1983 | 5% | - | - | - | -
Australia | 1989 | 8.3% | - | - | - | -
Malaysia II | 1995 | 15% | - | - | - | -
Oman | 2000 | 2.8% | - | - | - | -
Malaysia III | 2003 | 4% | - | - | - | -
Qalhat | 2005 | 4% | - | - | - | -
Sakhalin | 2009 | 10% | - | - | - | -
Indonesia / Tangguh | 2009 | 9.9% | - | - | - | -
Donggi-Senoro | 2014 | - | - | - | - | -

Operation slated to begin in late 2014
Taking Operatorship in Developing Medium-scale LNG Projects

Sulawesi, Indonesia
MC is collaborating with Indonesia’s state owned oil and gas company, Pertamina; Indonesian energy company, Medco International; and Korea Gas Corporation (KOGAS).

Making use of the know-how acquired through many years’ experience in the LNG business, MC has the largest share (44.9%) and is taking the lead on the project from planning to plant operations.

From 2014 the project aims to produce approximately 2 million tons of LNG per year (with MC having an equity share of 900 thousand tons) which will be sold to Japan and Korea.
Canada – Shale Gas Project

Unconventional Gas

British Columbia, Canada
MC is developing shale gas business in the Cordova Embayment in Western Canada together with a local partner.

Reserves: Approximately 5~8 trillion cubic feet

Production: 500 million cubic feet per day (target for 2014)

Operator: Penn West Exploration (PWE)

Shareholding
- PWE: 50% (Operator)
- MC: 30%
- KOGAS: 5%
- Four consortium members: 3.75% each

The gas will be sold by CIMA Energy, a US gas marketing company in which MC has a 34% share, through the existing pipeline network.

Supplying the US gas market
The potential to be a new source of LNG in the Pacific

Transportation from Western Canada is not significantly different to that from Australia.
Through Basrah Gas Company (Ministry of Oil’s South Gas Company 51%, Shell 44%, MC 5%) the plan is for gas from 3 oil fields in southern Basrah to be collected, treated and supplied domestically as well as exported as LNG.

After refurbishment of existing gas processing plants there will be gradual expansion of processing facilities and construction of an offshore liquefied LNG plant.

By reducing flared gas, we expect to reduce the level of greenhouse gases released by approximately 20 million tons. Exploring acquisition of emissions rights in the future.

Principal contract (detailing project development agreement and agreement on shareholdings) was initialed in July 2011. A final contract is anticipated to be signed following cabinet approval.
Comprehensive Cooperation with KOGAS

Korea Gas Corp

Mitsubishi Corporation
Comprehensive Cooperation with KOGAS

Target
To secure stable supplies of resources through the development of natural gas and LNG projects involving collaboration between resource poor Japan and Korea. Historically Japan and Korea have been the principal importers of LNG but demand is now also rising in other regions such as India and Europe. By working together with Korea to secure resources we hope to be able to contribute to Japan’s energy security.

- Joint development of the Donggi Senoro Project
- Right after the March 11th earthquake, KOGAS made multiple cargoes available to MC some of which were delivered to meet emergency demand for electricity generation in Japan.
- Joint development of shale gas project in western Canada.
- Other projects under discussion.

⇒ Part of efforts to secure upstream interests by leveraging demand in Japan and Korea.
Expanding the Flow of LNG

Strengthening Trading Functions
Strengthening Trading Functions

MC’s Spot LNG Sales

130 Cargoes Since August 2007
(As of July 2011)
In 2006, MC acquired usage rights for 1.1 million tons annually in the Freeport LNG receiving terminal in Texas, U.S.A. MC is looking at the construction of a newly planned LNG exporting terminal among other opportunities.

In 2008 MC made a 34% investment in CIMA Energy Limited, a mid-size gas marketer, to ensure advantageous sales in the newly entered North American market. The natural gas volume is approximately 0.8Bcf per day. (Approximately 5-6 million tons per year in LNG equivalent.) MC is now well positioned in downstream developments that draw on the North American market pipeline and gas storage facility network.
Conclusion

LNG Production Capacity of Private Enterprises by Equity Share

- Shell
- ExxonMobil
- BG
- Total
- BP
- Chevron
- Eni
- Mitsubishi Corporation

2020 Target
10 million tonnes

Source: BG & Wood Mackenzie
Excludes NOC’s