

## Supplemental Information

### 1. Upgraded Brown Coal Process

1. Brown coal is pulverized.
2. The pulverized coal is mixed with light oil to make a slurry.
3. The slurry is heated and the water in the coal is evaporated.
4. The oil is recovered from the dewatered slurry.
5. The upgraded coal is formed into briquettes for easy handling.

Features: Temperature, pressure and other processing conditions are moderate. Energy efficiency is high.

### 2. History of the UBC Process: Pilot Plant Operation (FY2001-FY2004)

1993 – Began developing the UBC Process, applying dewatering technology used in coal liquefaction.

Mid-1990s – Conducted trials using a bench-scale unit (0.1 tons/day capacity) constructed at its Kakogawa Works in Japan.

FY2001-FY2004 – Over a four-year period, constructed and operated a pilot plant in Palimanan, Cirebon, Indonesia as a national project\* between Japan and Indonesia.

#### **\*Organizations promoting the UBC Project as a national project**

\* Japanese side: Japan Coal Energy Center (JCOAL), under the Ministry of Economy, Trade and Industry (METI)

\* Indonesian side: Research and Development Agency for Energy and Mineral Resources, under the Ministry of Energy and Mineral Resources (MEMR)

\* Private sector & others: Kobe Steel, Ltd. Five Indonesian coal companies were supplied with UBC samples for trial use. A trading firm, Sojitz Corporation, the Indonesian government, the Agency for the Assessment and Application of Technology (BPPT), and other organizations also provided support and cooperation to the project.

### 3. Brown Coal and World Coal Situation

1. Resource: About half of the world's coal resources consist of low-rank coal (i.e. brown coal and sub-bituminous coal).
2. Supply & demand: With a sharp rise of imports into China, supply and demand for high-rank bituminous coal have become tight.
3. Coal supply and demand situation in Japan:
  - 3.1. Japan is nearly 100% dependent on imported coal.
  - 3.2. Japan is the world's largest importer of coal.
  - 3.3. Japan is highly dependent on Australian coal (about 60% of total coal imports)
  - 3.4. Most of the coal consists of bituminous coal.
4. Indonesia's Position
  - 4.1. As a coal-exporting country and supplier to Japan, Indonesia has rapidly become the second-largest producer after Australia.
  - 4.2. Reserves of bituminous coal are limited. Indonesia has six times more low-rank coal.

### 4. Coal Supplied to Japan

Japan consumes about 90 million tons of coal for power generation. Including the amount used for steelmaking, Japan uses a total of approximately 180 million tons of coal a year. Nearly the entire amount is imported, with about 59% coming from Australia, 18% from Indonesia, and 11% from China.

High-heat-value bituminous coal is predominately used, from the standpoint of power generation efficiency, cost, and logistics, including shipping and storage. In recent years, China's imports of raw materials for steelmaking have increased sharply. This trend has tightened the market for bituminous coal for power generation. On the other hand, low-rank coal is available, but Japanese users have found it difficult to use.

The UBC Process enables low-rank coal to be upgraded to the same heat value as bituminous coal for power generation. At the same time, it solves the problem of shipping and storage limitations, making possible the utilization of upgraded coal as an alternative to high-rank coal. In addition, the UBC Process aims to produce upgraded Indonesian coal at approximately the same cost as Australian bituminous coal, used for power generation, on a CIF Japan basis.

Diversifying the sources of coal is anticipated to contribute to the stable supply of energy resources.

#### **5. Effective Utilization of Low-rank coal**

Following Australia and China, Indonesia is the third country in the Asia-Pacific region to achieve high growth. However, out of Indonesia's total coal resources, bituminous coal, much of which is exported, comprises only 15% of total coal reserves. Brown coal comprises 58% and sub-bituminous coal 27%. The commercialization of brown coal upgrading technology would contribute significantly to Indonesia's coal industry.

In addition, Indonesia became a net importer of oil in 2004, and demand for electricity is anticipated to increase considerably in the future. Under a long-term plan formulated by Indonesia's Ministry of Energy and Mineral Resources, upgraded coal production is forecast to rise to 30 million tons per year (100,000 tons per day) by 2025. Expectations are high that the utilization of low-rank coal will contribute to addressing Indonesia's energy problems.

#### **6. Reducing the environmental burden for coal users**

Indonesia's low-rank coal is noted for its low-sulfur and low-ash content. If high-heat-value upgraded coal that is low in sulfur and ash can be utilized, it is hoped that coal users would benefit from a lower environmental burden.

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