RESEARCH AND DEVELOPMENT OF INDONESIA LOW RANK COAL

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INTRODUCTION

- Indonesia has been strongly affected by economic crises since 1977
- The challenge and opportunity to explore and developed its natural resources are still very open including the fossil energy
- The fossil energy plays two big roles:
  - to meet the domestic demand and to generate revenue as export commodity
- The domestic oil consumption is still very high, while its reserve is shortage
## Indonesia Main Energy Sources (January 2005)

<table>
<thead>
<tr>
<th>TYPE OF FOSSIL ENERGY</th>
<th>RESOURCES</th>
<th>RESERVES</th>
<th>PRODUCTION</th>
<th>R/P (YEARS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>86.9 billion bbl</td>
<td>8.6 billion bbl</td>
<td>387 million bbl</td>
<td>22</td>
</tr>
<tr>
<td>Gas</td>
<td>384.7 TSCF</td>
<td>185.8 TSCF</td>
<td>2.95 TSCF</td>
<td>62</td>
</tr>
<tr>
<td>Coal</td>
<td>61.3 billion tons</td>
<td>19.3 billion tons</td>
<td>132 million tons</td>
<td>146</td>
</tr>
</tbody>
</table>
Status and Targeted Energy Mix

Current Status Primary Energy Mix
- Hydro Power: 3.11%
- Geothermal: 1.32%
- Gas: 28.57%
- Oil: 51.66%
- Coal: 15.34%
- Biofuels: 5%
- Geothermal: 5%
- Biomass, Nuclear, Hydro Solar, Wind, CBM: 5%
- Coal Liquefaction: 2%

Energy Mix 2025 (BaU Scenario)
- Hydro: 1.9%
- Micro Hydro: 0.1%
- Geothermal: 1.1%
- Gas: 20.6%
- Oil: 41.7%
- Coal: 34.6%

Energy Mix 2025 (Perpres No. 5/2006)
- Oil: 20%
- Gas: 30%
- Coal: 33%
- NRE: 7%

Optimization of Energy Management
Resources : 61.3 billion tons
LRC : 70 %

DISTRIBUTION OF COAL DEPOSIT

Lignite 58.7%
Sub Bituminous 26.7%
Bituminous 14.3%
Anthracite 0.3%

Distribution of coal deposit:
- Kalimantan: 1.58%
- Papua: 7.58%
- Sulawesi: 28.37%
- Jawa: 40.13%
- LRC: 70%
CHARACTERISTICS OF LRC

- Resources: 70% of total national resources
- Calorific Value: <5,000 kcal/kg
- Total Moisture: 20 - 40%
- Ash: <10%, average 5%
- Sulphur: <1%, average 0.4%
- Low Thermal Efficiency
- Low Ash Melting Temperature
- High Tendency for Spontaneous Combustion
THE ROLE OF R & D OF LRC

- Various coal utilization technologies have become of the R & D concern
- Coal can be used directly in the form of solid or converted into gas or liquid that cleaner to the environment and much easier to be handled in transportation and utilization
LRC UTILIZATION

✓ Coal Upgrading
✓ Coal Liquefaction
✓ Coal Gasification
✓ Coal Briquetting
✓ Foundry Coke

..... Added Value Processing
Indonesia under cooperation with J COAL, Japan has successfully developed UBC process on pilot plant scale. The UBC upgrades LRC into coal of 6,000–6,800 kcal/kg heating value, mostly through moisture content reduction technique from 20–40% to <5%

Under cooperation with J COAL and Kobe Steel, a semi-commercial plant of 1,000 tons/day capacity is developing in South Kalimantan and will be operated in 2008.

The cost of the process is estimated to be US$ 5 – 7 per ton product with an investment of approximately US$ 80 – 90 million for UBC commercial plant of 5,000 tons/day.

The first commercial plant is expected to be operated in 2010.
**Technology:**

- **Indirect Coal Liquefaction (ICL)** - SASOL (modified by Fisher Tropsh)
- **Direct Coal Liquefaction (DCL)** - developed by BCL, HTI, NEDO
  - ICL: proven, already commercial using bituminous coal
  - DCL: being developed, using low rank coal

- R&D on coal liquefaction using BCL process has been conducted for 3 types of coal from 1992 to 2004 (ARDEMR, BPPT, NEDO, JCOAL)

- Japan (NEDO and METI) and Indonesia will cooperate to develop a demonstration coal liquefaction plant
POSSIBILITY OF COAL LIQUEFICATION

PLANT LOCATION

KALIMANTAN

Baru – East Kalimantan
(Coal resources ± 3.0 billion ton)

Mulia – South Kalimantan
(Coal resources ± 1.2 billion ton)

Banko – South Sumatera
(Coal resources ± 2.5 billion ton)

Musi Banyuasin – South Sumatera
(Coal resources ± 2.9 billion ton)

PAPUA

SULAWESI

JAWA
COAL GASIFICATION

conversion of coal in a gasifier into gaseous product (esp. CO and H$_2$) either without or with reactant (air, oxygen, steam, carbon dioxide or mixture of these). CO and H$_2$ can be processed into CH$_4$ (SNG)

Application of Coal Gasification

- Small-Medium Scale Industry
  - Agro Industry
  - Metal Industry
  - Mineral Industry

- Diesel Oil Substitution
  - Hybrid Diesel (PLN)
  - Gaseous Fuel
  - Chemical Industry
  - Fertilizer
  - Synthetic Oil
  - SNG

- Syngas Production
COAL BRIQUETTE

- Since 1993, coal briquette has been promoted to replace oil and firewood either in small industry or household.
- In 1995-1998, the carbonized coal briquette has been developed under cooperation between ARDEMR and KIGAM (Korea Institute of geology, Mining and Material) of South Korea.
- In 1997-2001, a bio-coal demonstration plant with the capacity of 15,000 tons/year has been developed under cooperation between MEMR and NEDO – Japan in Palimanan, Cirebon.
- ARDEMR continuously supports the utilization of coal briquette, especially in combustion technology and handling of coal ash resulted from combustion.
- ARDEMR is preparing National Standard for coal briquette, stoves, kitchen and gas emission in cooperation with BPPT and the Ministry of Environment.
Since 1993, ARDEMR has successfully developed foundry coke, by applying double process technology.

A pilot plant of 1 ton per day capacity has been constructed at Palimanan, Cirebon.

The quality of foundry coke is better than that of imported coke from China, in which heating value and ash content are 8,000 kcal/kg and 2 %, respectively.

Foundry coke has been tested and accepted in casting industries as a based coke and charge coke.
POLICY OF LRC DEVELOPMENT

- LRC is a primary strategic energy source to generate power and fuel for industry, due to its abundant reserves and good quality in terms of low ash and sulphur contents.

- Optimize the utilization of LRC, both for domestic use and export markets.

- LRC should be utilized close to mining site, due to its inferior properties such as high total moisture content, low calorific value, low thermal efficiency, low ash melting temperature and high tendency for spontaneous combustion.

- Clean Coal Technology is implemented to support environmentally sound sustainable development. Consequently, destruction and ecosystem degradation resulted from LRC utilization activities are continually being decreased by reducing negative impacts of local, regional and even global levels activities.
STRATEGIC PLANNING OF LRC UTILIZATION

- LRC should be upgraded to clean and high calorific energy sources before used or transported for long distance
- LRC should be utilized for power generation that must be developed close to the mining area
- LRC is converted into liquid through coal liquefaction
- LRC is converted to gas through coal gasification
- Providing economic incentives for technical feasibility of using LRC, starting from exploration, through exploitation to the end user
- Improving conducive and competitive investment climate and effective supervision of LRC exploitation and utilization
- Encouraging an intensive R & D on LRC utilization in cooperation with relevant institutions, both domestic and overseas
- Establishing Coal Technology Centre, to introduce innovation and socialize coal utilization technology
CONCLUDING REMARKS

- The LRC technology as apart of the clean coal technology has been available in this country, therefore LRC can play an important role to support the sustainable development in energy sector.
- The LRC technology includes coal upgrading, coal liquefaction, coal gasification, coal briquetting and foundry coke.
- To support the success of implementation of this technology, Indonesian Government initiate to collaborate with R & D of developed countries to improve the performances of the existing pilot plants by scaling up to commercial plants.
Thank You