Current Status and Future Development of Coal Thermal Power Plant in Indonesia.

Presented in Clean Coal Day 2013 International Symposium
Tokyo, September 4th, 2013

I Made Ro Sakya
Head of System Planning Division
imadero@pln.co.id
Indonesia

Area: Land 1,9 M km², territorial: 5,2 M km²
Population: 247 million; Growth: 1%
GDP: 900 Billion USD; growth: 6.2%
PLN is Major Integrated Electric Utility Company in Indonesia

Sole owner of transmission and distribution assets with control over majority of generation assets in Indonesia

**Generation**
- Owner of 38 GW Power Plant
- Controls over 85% of national generation capacity
- Main purchaser of electricity from Independent Power Producers (IPPs)

**Transmission**
- Sole responsibility for power transmission in Indonesia
- Transmission lines with 38 thousands kmc and 72 GVA of power transformer capacity

**Distribution**
- Sole distributor of electricity to end customers in Indonesia
- Distribution lines of 740 thousands kmc and 39 GVA of transformer capacity, serving around 50 Millions customers, 10 million PrePaid Meters.
More than 60 million Indonesian people had no access to electricity.
PLN has an extensive generation portfolio with total installed capacity of approximately 36,612 MW across Indonesia.

### As of December 31, 2012.

* Total power generation capacity in Indonesia, of which PLN produces 36GW.
Indonesia Coal Resources and Reserves

Coal classification (air-dry basis):
- Very high rank coal: $\geq 7,100$ kCal/kg
- High rank (bituminous) coal: $6,100 - 7,100$ kCal/kg
- Medium rank (sub-bituminous) coal: $5,100 - 6,100$ kCal/kg
- Low rank (lignite) coal: $\leq 5,100$ kCal/kg

Source: Geological Agency, MEMR, 2010
Average of national electricity demand growth 2012-2021 is 8.65% annually.

Source: RUPTL PLN 2012-2021
New Power Plant Capacity Addition by Owner [Incl. IPP]

- Total capacity addition to 2021: approx 55 GW or 5.5 GW per year
- Allocation for IPP and PLN are not firmly defined except those projects already committed.

Source: RUPTL PLN 2012-2021
• Power plants capacity increase from 32.1 GW in 2008 to 40.3 GW in 2012 or additional 1,700 MW per year.

• The biggest capacity is for CFPP (48%), then CCPP (23%), HEPP (10%), GTPP (9%), dieselPP (7%) and geoPP (3%).

• From about 18,000 MW existing CFPP:
  - 64% using subbituminous and 36% lignite. The lignite share will increase when FTP1 projects completed.
  - 99% pulverized boiler and 1% CFB.
Energy production in 2012: coal (50%), gas (23%), oil (15%), hydro (6%) and geothermal (5%)

Source: RUPTL PLN 2012-2021
Roadmap of Clean Coal Technology [CCT] in Indonesia

SC, $\eta = 30\text{-}40\%$

USC, 43%

Jawa-4 (USC 2x1000 MW)
Jawa-5 (USC 2x1000 MW)

Jawa-6 (USC 2x1000 MW)

IGCC 45\text{-}48\%

2000\text{-}3000 MW per year

Indramayu #1 (USC 1000 MW)
Indramayu #2 (USC 1000 MW)

Central Java (USC 2x1000 MW)
Jawa-1 (USC 1x1000 MW)

Source: JICA CCT Study, October 2012, with updated projects and schedule by PLN
Super Critical Generation Coal Fired Power Plants (CFPP) in Java-Bali System

- **CFPP Jawa-6**
  - #1: 1,000 MW (2021)
  - #2: 1,000 MW (2021)

- **CFPP Jawa-5**
  - #1: 1,000 MW (2018)
  - #2: 1,000 MW (2019)

- **CFPP Indramayu**
  - #4: 1,000 MW (2018)
  - #5: 1,000 MW (2020)

- **CFPP Jawa-1**
  - #2: 1,000 MW (2017)

- **CFPP Jawa-3**
  - #1: 660 MW (2017)
  - #2: 660 MW (2018)

- **CFPP Jawa-4**
  - #5: 1,000 MW (2019)
  - #6: 1,000 MW (2020)

- **CFPP Banten**
  - #1: 625 MW (2016)

- **CFPP Cirebon (SC)**
  - #1: 660 MW (2012)

- **CFPP Adipala (SC)**
  - #1: 660 MW (2014)

- **CFPP Jawa Tengah**
  - #1: 1,000 MW (2017)
  - #2: 1,000 MW (2018)

- **CFPP Paiton (SC)**
  - #3: 815 MW (2012)
CO₂ Reduction Effect By Introduction of CCT

Source: JICA CCT Study, October 2012
## Economical Evaluation of CCT

<table>
<thead>
<tr>
<th></th>
<th>Sub Critical</th>
<th>SC</th>
<th>USC</th>
<th>IGCC</th>
<th>Coal Price 4,200 kCal/kg ($/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Gross Power</td>
<td>1,000 MW</td>
<td>1,000 MW</td>
<td>1,000 MW</td>
<td>1,000 MW</td>
<td>Y2011</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y2020</td>
</tr>
<tr>
<td>Plant Efficiency</td>
<td>36%</td>
<td>39%</td>
<td>42%</td>
<td>49%</td>
<td>53.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>107.6</td>
</tr>
<tr>
<td>Construction Cost</td>
<td>100%</td>
<td>106.5%</td>
<td>108.5%</td>
<td>130%</td>
<td></td>
</tr>
<tr>
<td>(Base)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal Consumption</td>
<td>100%</td>
<td>90%</td>
<td>84%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>(Base)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O&amp;M Cost</td>
<td>2.5%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td></td>
</tr>
</tbody>
</table>

### 2010 Generation Cost (US cent/kWh)

- **Sub-C**: 5.88
- **SC**: 5.82
- **USC**: 5.65

\[ \Delta 11.3 \text{ MUSD/Y} \]

### 2020 Generation Cost (US cent/kWh)

- **Sub-C**: 9.21
- **SC**: 8.82
- **USC**: 8.44
- **IGCC**: 8.43

\[ \Delta 25.3 \text{ MUSD/Y} \]

Source: JICA CCT Study, October 2012, with updated projects and schedule by PLN
1. Fuel Supply
   - The type of coal that would be used more in electricity generation Indonesia is low rank coal, due to plentiful availability in Kalimantan and Sumatera and more economical, thus securing more stable supply, whilst most high rank coal would be exported to global market.

2. Boiler Type:
   - CFB: for small to medium scale CFPP outside Java-Bali system.
   - USC: should be introduced for next new CFPP project in Java-Bali system (2017).

3. Further Development
   - Coal gasification – Syngas:
   - IGCC: will be introduced around 2025, considering the development situation in the world.
   - CCS: in the early stage of development, and will reduce a significant amount of CO2 emission. Will be introduced in Indonesia maybe after 2025.
Terimakasih