Status of 250MW Air-blown IGCC

Shozo Kaneko, Ph.D
Executive Vice President
Clean Coal Power R&D Co., LTD.
<table>
<thead>
<tr>
<th><strong>Date of Establishment</strong></th>
<th>June 15, 2001</th>
</tr>
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<tr>
<td><strong>Business Activities</strong></td>
<td>Research and Development of IGCC (Design, Construction and Operation of Demonstration Plant)</td>
</tr>
<tr>
<td><strong>Stakeholders</strong></td>
<td>Hokkaido EPCo., Tohoku EPCo., Tokyo EPCo., Chubu EPCo., Hokuriku EPCo., Kansai EPCo., Chugoku EPCo., Shikoku EPCo., Kyushu EPCo., Electric Power Development Company (EPCo.: Electric Power Company)</td>
</tr>
<tr>
<td><strong>Company Address</strong></td>
<td>102-3 Kawada, Iwama-machi, Iwaki-shi, Fukushima-ken, 974-8222 JAPAN</td>
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</tbody>
</table>
Japanese IGCC Program

--- Road to Commercial Plant

- 200ton/day Pilot Plant (25MW)
- Demonstration Plant (250MW)
- Commercial Plant (500-600MW)

Year:
- 1970
- 1980
- 1990
- 2000
- 2010
- 2020
- 2030
Location of IGCC Demonstration Plant

IWAKI City

Located within the NAKOSO Power Station of JOBAN JOINT POWER CO., LTD.

Site of Demonstration Plant

TOKYO
Nakoso Power Station
(Joban Joint Power Co., Ltd.)

Nakoso Power Station
--- Coal fired 1725 MW

IGCC Site

Clean Coal Power
Objectives of Demonstration Project

250MW

Demonstration Plant

- Design
- Construction
- Operation

Final phase to verify IGCC with regard to:

- Reliability
- Durability
- High Efficiency
- Economy

Commercial Plant
Bird's-eye View of Demonstration Plant

- HRSG
- Power Train
- Gasifier
- Gas Cleanup
**Major Plant Specification**

<table>
<thead>
<tr>
<th>Fuel Capacity</th>
<th>1700 t/d</th>
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<tbody>
<tr>
<td>G/T</td>
<td>701DA</td>
</tr>
<tr>
<td></td>
<td>TIT:1200 deg-C class</td>
</tr>
<tr>
<td>Gross Output</td>
<td>250 MW (GT:130 MW)</td>
</tr>
<tr>
<td>Net Plant Efficiency</td>
<td>42 % (LHV), 8125 Btu/kwh</td>
</tr>
<tr>
<td>Emission Level</td>
<td>SOx / NOx / PMs:</td>
</tr>
<tr>
<td></td>
<td>8ppm / 5ppm / 4mg/m³N</td>
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</table>

# Coal Feeding & Gasifier Design

Membrane waterwall, no refractory. No quench gas required.

<table>
<thead>
<tr>
<th>Dry</th>
<th>Slurry</th>
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<tbody>
<tr>
<td>Coal Powder</td>
<td>Coal Water Slurry</td>
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<tr>
<td>Entrained Flow</td>
<td></td>
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</table>

Better Plant Efficiency!
Coals for IGCC

- Low Grade Coals
  - Low Ash Melting Point &
  - Higher Moisture (upto 30%)
- PRB coal- ready
Plant Efficiency

Oxygen-blown v.s. Air-blown IGCC

- Lower in-house power consumption
- Higher net efficiency

Oxygen-blown IGCC

Air-blown IGCC
18 PC Plants started operation in Japan during 1995 - 2004. Total Capacity: 15,400 MW
Steam Conditions: Almost all units are USC.

Newly Added during 1995 – 2004
15,400MW (mostly USC)
Old Plants (mainly SC)
## List of Coal Fired Plants in Japan
### Commercially Operated during 1995 — 2004

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<tr>
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<tr>
<td>Reiho 1</td>
<td>Kyushu</td>
<td>700</td>
<td>24.1</td>
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<td>1995</td>
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<td>1997</td>
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<td>2004</td>
<td>43.0</td>
<td>Super304H, HR3C/P122</td>
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</tbody>
</table>

PC: Pulverized Coal. SH/RH: Superheater/Reheater

Source: Dr. F. Masuyama, JSME Symposium 2005
Why IGCC is necessary for Japanese Coal Fired Power Plants?

- **IGCC Commercial Plant**: (1500 deg-C G/T)
  - Net Plant Efficiency (LHV%): 48% or 7109 Btu/kwh

- **IGCC Demonstration Plant**: (1200 deg-C G/T)
  - Net Plant Efficiency (LHV%): 42% or 8125 Btu/kwh

- **USC Plant**:
  - 42% or 8125 Btu/kwh

- **Conventional Plants**:
  - 24.1MPa
  - 538/566 deg-C
  - 600/600 600/610

**Increase!** 15%
Commercial IGCC Plant Performance

- **Net efficiency (% LHV)**
  - Bituminous Coal: 35, 40, 45
  - PRB Coal: 40, 45

- **Gross Output (MW)**
  - Demonstration Plant: 250 MW
  - 501G IGCC: 500 MW, 495 MW

Clean Coal Power R&D Co., Ltd
Comparison of IGCC with USC PC

① Wide range of coals (including PRB) can be used

② Higher Efficiency --- +15% (rel.)

③ Less cooling water requirement (70% or less)

④ Less house water consumption (70% or less)

⑤ Less ash disposal volume (50% or less)

⑥ Less plant area (70% or less)
Plant Area: 25,500 m² (6.3 acre)
### History of Demo Plant Construction

<table>
<thead>
<tr>
<th>Fiscal year</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
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</tbody>
</table>

- **July. 2004**: Design of plant
- **Aug. 2005**: Construction of plant
- **Aug. 2006**: Operation tests

**Clean Coal Power R&D Co., Ltd.**
State of Construction

Gasification Plant

Clean Coal Power
State of Construction

Power Block
Present Outlook (2006.9.28)
Thank you!

The End

2006.09.28