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Page
1 Foreword

◆ JCOAL Special
2 Clean Coal Day 2015; Biggest International Event for Coal PA

◆ Regional Information
5 Situation of Coal Industry in Indonesia
8 Situation of Coal Industry in Australia
11 Information about Turkey and Serbia

◆ Technical Report
14 Evaluation of Power Generation Performance using various kinds of Lignite

◆ JCOAL Project Report
19 G20 Energy Efficiency Action Plan, Electricity Generation, Workshop on Clean Coal Technology
20 Report on CCT Workshop 2015
23 The demonstrative operation of Callide oxy-fuel combustion is completed
26 The Second Japan – Poland Energy Policy Dialogue
27 40th Clearwater Clean Coal Conference Report
30 Report on WCA workshop and general meeting
32 Summary of 47th IEA / GHG Executive Committee Meeting
34 2015 APEC Expert Workshop on Innovative Systematic Approaches to Enhancing Coal-Fired Power Generation Efficiency Conference, Participation Report
37 Report of participation in 2015 ASEAN Forum on Coal
39 The 7th Japan Mongolia Government and Business Sector Joint Committee
41 Japan mission visited Jakarta to discuss Indonesia’s 35GW electricity project
Foreword

Masayoshi Kitamura, Chairperson, JCOAL

It is my utmost pleasure to address you as the new Chairperson of Japan Coal Energy Center (JCOAL), succeeding my predecessor Mr. Yoshihiko Nakagaki. I was appointed at the Annual Board Meeting on June 9, 2015. I and the two Vice Chairpersons will make a good team with Mr. Osamu Tsukamoto, the President who is always leading our activities.

Energy industry in Japan has entered a new challenging era, while we have just come out, by establishing the new Energy Plan, of uncertainty after the Great East Japan Earthquake and Tsunami in March 2011. We had to take so much time and labor in discussions and studies to identify the Post-Earthquake and Tsunami optimal energy mix, as it was imperative to take into consideration the post-earthquake and post-Fukushima situation in formulating the new policy with the revised energy mix. “Long-term Energy Supply and Demand Outlook” was approved in July 2016.

Under this new energy policy, coal is expected to account for 25% of the overall primary energy consumption, as well as 26% of the overall generation mix. Based on the new policy, green house gas reduction target has also set to address the climate change working with the international community.

Coal, abundantly distributed all over the world and much affordable, has come to be a preferred choice as the mainstay or one of the main pillars by most of the countries. Coal demand has been continuously rising in growing economies including China and India, followed by the rest that have little fossil fuel resources of their own, even in the situation where production of new energy resources, such as shale oil or gas are growing, as observed in the U.S. and other nations.

Also Japan, as a country with very limited natural resources, considers coal as one of the main pillars of our energy mix. In the meantime, the world population is forecasted to reach 9 billion by 2040 against the current level of 7 billion. And looking at the availability of coal resources by rank, high rank coal is getting to be less available and lignite has come to be dominant, which clearly poses a challenge since the latter requires appropriate handling and/or process if we like to ensure clean and efficient utilization.

The other challenge that is now high on the global agenda is environmental impact coal utilization may cause; such as emissions of CO2, NOx, SOx and particulate matters. I have no doubt that Japan will be able to work in close cooperation with others in need, as its environmental technology makes it possible for our coal fired power plant to reduce those hazardous pollutants to the almost same level of gas fired power plant.

The remaining most challenging issue is about GHG/ CO2, emissions. While Japan already have many USC units and some IGCC units that are clean and efficient, we are continuously making endeavors toward achieving of CO2 emissions reduction at coal fired power plant to the level of gas fired power plant, through technology development of A-USC, IGFC, CCS, CCU, etc.

JCOAL is committed to enhance its one-through support of the entire coal value chain by further promoting its activities; from R&D, business promotion and implementation support, sharing and exchanges of knowledge and technology, dissemination, etc., for which we need the continuous and firm support by our partner governments, institutions and private players in the relevant sectors. Let us work together toward the shared goal.
Clean Coal Day 2015; Biggest International Event for Coal PA

Toshiko Fujita, JAPAC

The memorial day for coal PA as “Clean Coal Day” (CCD) was established in September 1992 by the request of Agency for Natural Resources and Energy, MIEI(former METI). The Clean Coal Day has been held on September 5 annually afterwards.

We will introduce 2014 activities for the Clean Coal Day as followings:
You can visit the web site below if you need some more information.

1. Name of the Event
   「Clean Coal Day 2015」

2. Theme for 2015
   「Power for Coal
   ~Clean Coal for the Future~」

3. Memorial Day
   September 5

4. Structure for the Event (scheduled)

Organized by:

- The Japan Iron and Steel Federation (JISF)
- Japan Cement Association (JCA)
- Japan Paper Association (JPA)
- Electric Power Development Co., Ltd. (J-POWER)
- Japan Coal Energy Center (JCOAL)

In cooperation with:

- Science Museum , many coal museums in Japan

Co-sponsored by :

- Engineering Advancement Association of Japan (ENAA)
- The Society of Chemical Engineers, Japan (SCEJ)
- Thermal and Nuclear Power Engineering Society (TENPES)
- City of Kushiro
- Japan Association of Energy and Environment Education (JAEEE)
- The Japan Institute of Energy (JIE)
- The Chemical Society of Japan (CSJ)
- Japan Chemical Industry Association (JCIA)
- Japan Chemical Fibers Association (JCFIA)
- Japan Soda Industry Association (JSIA)

The Iron and Steel Institute of Japan (ISIJ)
The Mining and Materials Processing Institute of Japan (MMIJ)
The Information Center for Energy and Environment Education (ICEEE)

Supported by:

- Ministry of Economy, Trade and Industry,
  City of Ube, Global CCS Institute,
  New Energy and Industrial Technology Development Organization (NEDO),
  Japan Oil, Gas and Metal National Corporation (JOGMEC)

Embassy:

USA, India, Indonesia, Australia, Canada, Korea, Thailand, Czech, China, Philippines, Viet Nam, Malaysia, South Africa, Mozambique, Mongolia, Colombia, Botswana, Poland, Russia, Nigeria, Madagascar, Bosnia and Herzegovina, Taiwan, Ukraine, Egypt, Turkey, Serbia, Kenya

State Government:

- Australia – Queensland, Victoria,
  New South Wales, West Australia
- Canada – Alberta, British Colombia

5. Executive Committee

Organize the executive committee and preparatory committee for the event “Clean Coal Day”.
Chair person: Osamu Tsukamoto (President, JCOAL)

Committee Member

| The Japan Iron & Steel Federation |
| Electric Power Development Co., Ltd. |
| Japan Cement Association |
| Japan Paper Association |
| JCOAL |

Head of Secretariat Toshiro Matsuda, Assistant Secretary General, JCOAL
6. Memorial Events

① The 24th Clean Coal Day International Symposium
8th – 10th September
[Symposium]
  Date: 8th – 9th September
  Venue: ANA Intercontinental Hotel Tokyo
[Site Tour]
  Date: 10th September
  Place: Isogo Thermal Power Station

©Main Presentations (scheduled)
  METI Senior Officials, Universities Professors,
  MHPS, Mitsui, J-POWER, RITE, WCA, IEA, GCCSI,
  CS Energy, ASEAN Center for Energy(ACE), Peabody Energy,
  Government Officials (US, Indonesia, Vietnam, Australia,
  Russia, Mozambique, Colombia, China, India, Canada)

② Other events
  Site Visites
  Free Admission in the coal musiums
  Workshop for Children in Science Museum

Other Images
Clean Coal Day in Japan 2015 International Symposium
Accelerating Powering CCT/CCS/HELE Technology with Sustainable & Advanced Coal Supply
Japan Coal Energy Center (JCOAL)

PROGRAM

DAY 1: Tuesday, September 8

8:30-9:00 Registration
9:00-9:10 Opening Remarks

9:10-9:30 Welcome Address - Dr. Tatsushi Kanoh...
Commissioner, Agency for Natural Resources and Energy

9:30-9:50 Keynote Address - I: Mr. Yoshitaka Fujii...
Director-General, Natural Resources and Fuel Department,
Agency for Natural Resources and Energy (ANRE),

9:50-10:20 Restored Speech - I: Dr. Keith Barrand...
Head, Energy Supply Technology Unit, Energy Policy and Technology Division,
International Energy Agency (IEA)

10:20-10:50 Restored Speech - II: Mr. Benjamin Sporton...
Chief Executive, World Coal Association

10:50-11:20 Restored Speech - III: Mr. Chris Spore...
Project Director, Callide Oxyfuel Services, Pty Ltd.

11:20-11:50 Keynote Address - II: Dr. David Mather...
Director-Assistant Secretary, Secretary for Coal and Carbon Management,
Office of Fossil Energy, US Department of Energy (DOE)

11:50-12:00 BREAK

12:00-13:00 Lunch

13:00-13:30 Keynote Address - III: Mr. Paul Trotman...
General Manager, Coal and Minerals Productivity Branch, Resources Division,
Department of Industry and Science, Australia

13:30-13:50 The Role of Coal in "All of the Above" Energy Strategy

13:50-14:10 Session I-1: Policy in the Coal Sector

14:10-14:20 Session I-2: Policy in the Coal Sector

14:20-14:30 Session I-3: Policy in the Coal Sector

14:30-14:50 Session I-4: Policy in the Coal Sector

14:50-15:10 Q&A

15:10-15:30 BREAK

15:30-16:10 Session II: Policy in the Coal Sector

16:10-16:30 Session III: Policy in the Coal Sector

16:30-17:00 Session I: Policy in the Coal Sector

17:00-17:30 Session II: Policy in the Coal Sector

17:30-17:40 Session III: Policy in the Coal Sector

17:40 Adjourn

18:15 Welcome Reception

DAY 2: Wednesday, September 9

9:00-9:30 Restored Speech - IV: Mr. Sanjay Valakham...
Executive Director, Asia-Pacific Centre for Energy (APCE)

9:30-10:00 Session II: CCT R&D and Deployment in the World

10:00-10:30 Session III: CCT R&D and Deployment in the World

10:30-10:50 Session IV: CCT R&D and Deployment in the World

10:50-11:10 Global Status of CCS 2014 and Update

11:10-11:30 Global Status of CCS 2014 and Update

11:30-11:50 Global Status of CCS 2014 and Update

11:50-12:00 Q&A

12:00-13:00 BREAK

13:00-13:30 Session V: CCT in Australia and India

13:30-13:50 Session VI: CCT in Australia and India

13:50-14:10 Session VII: CCT in Australia and India

14:10-14:30 Session VIII: CCT in Australia and India

14:30-14:50 Global Status of CCS 2014 and Update

14:50-15:10 Global Status of CCS 2014 and Update

15:10-15:30 Global Status of CCS 2014 and Update

15:30-16:00 Global Status of CCS 2014 and Update

16:00-16:20 Global Status of CCS 2014 and Update

16:20-16:30 Session IV: Panel Discussion

16:30-16:40 Session IV: Panel Discussion

16:40-16:50 Session IV: Panel Discussion

16:50-17:00 Session IV: Panel Discussion

17:00-17:10 Session IV: Panel Discussion

17:10-17:20 Session IV: Panel Discussion

17:20-17:30 Session IV: Panel Discussion

17:30-17:40 Session IV: Panel Discussion

17:40 Adjourn

18:15 Welcome Reception

DAY 3: Thursday, September 10 / Site Tour

9:00 Depart at ANA InterContinental Hotel Tokyo

10:00-10:30 Site Tour: Thermal Power Station (owned by J-POWER)

10:30-11:00 Lunch

11:00 Arrive at ANA InterContinental Hotel Tokyo
Situation of Coal Industry in Indonesia

Masafumi Uehara, Resources Department

1. Introduction
As Indonesia is Japan’s second largest supplier of coal following Australia, it is a very important country for Japan. Further, with remarkable economic development in Indonesia in recent years, the future demand for energy, mainly the electric power, is expected to increase rapidly. Jokowi's government has presented a construction plan for 35GW power plant. In future, for the coal produced in Indonesia, priority will be given to the domestic supply. Under such circumstances, the present situation and prospects of coal demand, power plant construction plan, government policies etc. relating to the coal industry in Indonesia are described below.

2. Coal Resources, Reserves and Coal Quality
Table-1 shows the variation in coal resources and reserves in Indonesia by year. In 2014, the coal resources and reserves in Indonesia have reached approximately 124.8 billion tons and 32.4 billion tons respectively. The coal reserves in Indonesia continue to increase as the new coal beds are discovered with the progress of exploration. The coal resources and reserves have been increased by 19.6 billion tons and 11.2 billion tons respectively as compared to 2010.

<table>
<thead>
<tr>
<th>Year</th>
<th>Resources (Unit:Billion tones)</th>
<th>Measured</th>
<th>Inferred</th>
<th>Indicated</th>
<th>Hypothec</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>22.29</td>
<td>15.81</td>
<td>32.20</td>
<td>34.89</td>
<td>105.19</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>24.10</td>
<td>27.06</td>
<td>35.63</td>
<td>33.55</td>
<td>120.34</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>24.69</td>
<td>26.40</td>
<td>35.41</td>
<td>32.95</td>
<td>119.45</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>39.45</td>
<td>29.44</td>
<td>32.08</td>
<td>19.56</td>
<td>120.53</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>39.52</td>
<td>29.31</td>
<td>36.51</td>
<td>19.45</td>
<td>124.79</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reserves (Unit:Billion tones)</th>
<th>Year</th>
<th>Proven</th>
<th>Probable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>5.53</td>
<td>15.60</td>
<td>21.13</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>10.26</td>
<td>17.76</td>
<td>28.02</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>8.90</td>
<td>22.46</td>
<td>31.36</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>9.04</td>
<td>23.34</td>
<td>32.38</td>
<td></td>
</tr>
</tbody>
</table>

Table-2 shows the percentage of resources and reserves by calorific value. The coal resources account for 86% in total, which include 20% of low-grade coal ad 66% of medium-grade coal. The coal reserves account for 88% in total, which include 41% of low-grade coal ad 47% of medium-grade coal. In terms of region, the large amounts of coal is available in Kalimantan and Sumatra, and lot of low-grade coal is available in Sumatra, whereas lot of high-grade coal is available in Kalimantan, Papua and small amounts of coal is available in other regions.

<table>
<thead>
<tr>
<th>Coal rank</th>
<th>Coal Resources</th>
<th>Coal Reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Rank  (&lt;6,100 kcal/gr ADB)</td>
<td>20%</td>
<td>41%</td>
</tr>
<tr>
<td>Medium Rank (&lt;8,100-100 kcal/gr ADB)</td>
<td>60%</td>
<td>43%</td>
</tr>
<tr>
<td>High Rank (&lt;8,100 kcal/gr ADB)</td>
<td>15%</td>
<td>11%</td>
</tr>
<tr>
<td>Very High Rank (&gt;7,100 kcal/gr ADB)</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Ministry of Energy and Mineral Resources, Directorate General of Mineral and Coal

3. Coal Production, Export and Consumption Data

Figure-1 shows the coal production, export volume and domestic consumption from 2010 to April 2015.

Source: Ministry of Energy and Mineral Resources, Directorate General of Mineral and Coal (Unit: million tons)

Figure-1: Coal Production, export and domestic consumption

In 2014, the amount of coal produced was 458 million tons, amount of coal exported was 382 million tons and the domestic consumption was 76 million tons. The level has remained high until last year, but the production volume from January to April 2015 was 130 million tons, which is lesser by 13% on an average as compared to last year. The management of the coal mining companies is facing difficulties due to stagnation of coal prices because of...
excessive coal production volume in the world and the coal production is having significantly decreasing trend. The form of coal production in Indonesia is categorized into (1) State-owned coal company (PTBA), (2) Coal contract company (CCoW: Coal Contract of Work: Classified into first to third generation), (3) Mining industry permitted coal mines (Izin Usaha Pertambangan: IUP), but CCoW is the production group originated from the coal development policy of Government of Indonesia that receives capital from foreign countries, and the current increase in coal production volume depends largely on these contractors. PTBA owns large open-cast coal mine in Tanjung Enim located in South Sumatra Province and underground coal mine in Ombilin located in West Sumatra Province. There are 7,598 IUP coal mines across Indonesia as of April 2015 of which 4,909 (65%) mines have received CNC (Clean and Clean).

4. Present Status of Electricity Supply & Demand and 35GW Power Plant Construction Plan
In 2014, the power generation capacity of Indonesia was 53,310MW and power consumption was 199TWh. The composition of power sources includes topmost share of 52.8% of coal-fired power, followed by 24.2% of power from gas, 11.7% from crude oil, 6.5% of hydro power and 4.4% of geothermal power. The power from other sources account for 0.4%. The estimated coal consumption in the year 2025 plan is 464TWh which is 2.3 times increase as compared to 2014. Under such circumstances, Jokowi’s government was formed and President Jokowi launched a plan for construction of new 35GW power plants having bold institutional and structural reforms to recover from the delay in construction of power plants. This plan aims to construct 35GW power plants until 2019 and power plants with 42.9GW capacity will be operational in 2019 in addition to the 7,900 MW power plant presently under construction. Figure-2 shows the power generation composition wherein the coal accounts for highest percentage of 60.2%, followed by 21% for natural gas and 10% for gas turbine/gas engine.

![Composition of power sources in 35GW power generation plan](image)

Source: Ministry of Energy and Mineral Resources, Directorate General of Mineral and Electricity

Figure-2: Composition of power sources in 35GW power generation plan

5. Coal Policy and Latest Activities
Various protection policies have been announced for mineral resources in the country through promulgation of “New Mining Law”. Specifically, through the authority given by the Government to control production volume, export volume and coal price, DMO (Domestic Market Obligation) and ICPR (Indonesian Coal Price Reference) were implemented, and obligation for added value and export duty etc. were implemented for mineral resources. The latest major activities are summarized below in (1) to (4).

(1) Added value to mineral resources has been prescribed in Article 103 of “New Mining Law” and its implementation period is defined in Article 170 as within 5 years from enactment. Hence, the corresponding deadline was set as January 2014. The Government of Indonesia overcame the opposition from industrial world and decided to ban the export of unprocessed minerals. However, coal is excluded even today.

(2) In order to prevent illegal coal export, the Government of Indonesia mandated the export registration to coal exporters from October 1, 2014. Further, the government plans to redevelop 14 ports which have a coal export record and strengthen the coal export control at the developed ports.

(3) Regarding coal export related L/C settlement advocated by Ministry of Trade, Directorate General of Mineral and Coal is asking to set up an exception for the coal and exclude it from the obligation.

(4) To promote the construction of mine-mouth power plants, price of coal supplied to mine-mouth power plants was defined in the past as mine cost + margin (25%) for calorific values less than 3,000kcal/kg (price is defined by HBA(coal price reference) for calorific values more than 3,000kcal/kg). However, it was decided in the new regulation to specialize in mine-mouth power plant application regardless of coal grade using average cost of CCoW, IUP as a reference, and allocate the cost by accumulating numerical values based on the variable parameters such as travel distance from coal mine, stripping ratio etc.

6. Estimation of Coal Production, Export and Domestic Consumption in Future
Figure-3 shows the estimation of coal production, export, and domestic consumption from 2015 to 2019 and Table-3 shows breakdown of domestic consumption by industry. The coal production volume until 2019 is estimated to be lot more than 400 million tons, but the increase in production volume as in the past cannot be expected. This is because of not only the stagnation of coal prices in recent years, but also the production regulations enforced by the Government of Indonesia for protection of coal resources in future. In the last year of 35GW power plant construction plan, the domestic consumption shows rapid increase. In Indonesia, 240 million tons of coal will be used in 2019.
Figure-3: Estimation of coal production, export and consumption (2015 to 2019)

Table-3: Estimation of coal consumption by industry (2015 to 2019)

7. Conclusion

The trend of coal production and export volume in Indonesia largely affects Asian region including Japan and we will continue to track such information with full attention.
Situation of Coal Industry in Australia

1. Coal Characterization and Energy Policy
In Australia, coal is the second largest exported product as a source of foreign exchange following the iron ore. Queensland (QLD) and New South Wales (NSW) states are the large coal producing areas which produce more than 97% of coal. Most of the lignite in Australia is produced in Victoria (VIC) state.

The domestic consumption of coal is 1/4th of total amount of coal produced and rest of coal is exported.

There was slight increase in the annual percentage of primary energy consumption in last 3 years. The primary energy consumption composition in Australia in 2013 includes 36% of coal (including lignite), 35% of crude oil (including LPG), 23% of natural gas and 6% of renewable energy. The coal consumption shows decreasing trend whereas natural gas percentage has increased in last 3 years.

The coal is the largest carbon dioxide generation source in Australia. Australia has signed the Kyoto Protocol and the Federal Government tried to implement measures against global warming and achieve sustainable growth of coal industry by establishing "National Low Emissions Coal Strategy" in 2009, introducing coal pricing system to impose tax of 23AS/CO₂-ton on top 500 companies producing CO₂ emissions from July 2012, and making transition to variable coal pricing in 2015. However, with the strong reaction from companies and citizens that the amount is high as compared to emissions trading system in other countries, and following the change of government in September 2013, carbon tax was discontinued from July 2014, and transition to emissions trading system was also cancelled. Further, Mineral Resource Rent Tax (MRRT) imposed on the mineral resource profit of companies owning interest in coal and iron ore project, which was also introduced in July 2012, was discontinued from September 2014.

2. Coal Production and Consumption
The trend of demand and supply of coal in Australia from 2010 to 2013 is given in Table-1. In 2013, coal production volume excluding lignite was 397 million tons, which ranked fifth in the world following China, America, India and Indonesia.

In terms of production volume by states in 2013, QLD had largest production volume of 220 million tons, followed by NSW with 196 million tons, VIC with 60 million tons and WA with 6 million tons. In terms of mining technique, ratio of underground to open-cast mining is 2:8.

In 2012, the Australian domestic coal consumption including lignite was 130 million tons, out of which 120 million tons (including 70 million tons of lignite) i.e. 93% of coal was used for electricity, 40 million tons for iron and steel industry, and 40 million tons for general industry such as cement etc.

<table>
<thead>
<tr>
<th>Production</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coking coal</td>
<td>424.4</td>
<td>402.2</td>
<td>430.8</td>
<td>459.3</td>
</tr>
<tr>
<td>Steam coal</td>
<td>189.4</td>
<td>165.5</td>
<td>212.5</td>
<td>238.6</td>
</tr>
<tr>
<td>Lignite</td>
<td>72.1</td>
<td>71.0</td>
<td>71.4</td>
<td>62.6</td>
</tr>
<tr>
<td>Consumption</td>
<td>138.1</td>
<td>133.6</td>
<td>132.5</td>
<td>121.4</td>
</tr>
<tr>
<td>Coking coal</td>
<td>4.1</td>
<td>4.4</td>
<td>3.9</td>
<td>4.1</td>
</tr>
<tr>
<td>Steam coal</td>
<td>61.9</td>
<td>58.2</td>
<td>57.2</td>
<td>54.7</td>
</tr>
<tr>
<td>Lignite</td>
<td>72.1</td>
<td>71.0</td>
<td>71.4</td>
<td>62.6</td>
</tr>
<tr>
<td>Export</td>
<td>292.7</td>
<td>284.6</td>
<td>301.5</td>
<td>336.3</td>
</tr>
<tr>
<td>Coking coal</td>
<td>157.3</td>
<td>140.5</td>
<td>142.3</td>
<td>154.2</td>
</tr>
<tr>
<td>Steam coal</td>
<td>135.4</td>
<td>144.1</td>
<td>159.2</td>
<td>182.1</td>
</tr>
</tbody>
</table>

Table-1: Trend of demand and supply of coal in Australia (million tons)

Source: IEA Coal Information 2014

3. Coal Export
Table-2 shows the amount of coal exported in 2013 by export destination and coal type. The amount of coal exported in 2013 is 336 million tons, which is equivalent to 73% of total production volume and accounts for 28% of amount of coal trading in the world. In terms of coal type, export volume of coking coal is 154 million tons and holds dominant share of 58% in the coal trade volume where Japan, India, China and Korea are the major export destinations. On the other hand, Australia is the second largest steam coal exporting country after Indonesia with export volume of 182 million tons which holds 19% share, and Japan, India, China, Korea and Taiwan are the major export destinations. As the source of Japan's
coal import, Australia’s ratio is 73.8% in steam coal, 51.7% in coking coal, and 63.7% in total. In any of these cases, Australia has become the largest supplier.

The amounts of coking coal and steam coal exported to China in 2011 were 15 million and 17 million tons respectively. Both the amounts have increased to more than 2 times in 2013 which has made China the largest export counterpart following Japan. However, in National People’s Congress in March this year, as a measure against air pollution China has announced its goal to reduce the annual coal consumption by 160 million tons by 2020. Hence, the coal export to China is expected to reduce in future. The amounts of coking coal and steam coal exported to China in first quarter of 2014 were 7 million tons and 11 million tons respectively, but those amounts have reduced to 6 million tons and 10 million tons respectively in the first quarter of 2015.

Figure-1 shows the transition of coal export price in Australia from 2010 to 2014. The coal prices tend to decrease as compared to prices in 2010 and the recent price of steam coal has been decreased to approximately 60US$/t.

![FOB Newcastle 6,000kcal/kg](image)

Source: Argus report
Figure-1 FOB New Castle Port 6,000kcal/kg (US$/t)

4. Coal trends by state

(1) NSW

The New Castle port, the largest coal port in Australia, is located in NSW, and the Sydney-Gunnedah Basin having major coal mines is located within 150 to 300km from this port. Therefore the environment is favorable for coal export with relatively shorter transportation distance. At the New Castle port, “Terminal 4 Project” by PWCS (Port Waratah Coal Services) to build new coal export terminal is under way. It has been planned to build coal stock yard on west side of existing Kooragang Island coal terminal and develop infrastructure such as ports and railroads etc.

Recently, large-scale expansion projects for Moolarben coal mine (Yan Coal Australia) or Bengalla (Rio Tinto) have been approved. After the expansion, those coal mines are expected to produce coal from 12 million tons per year to 28 million tons per year and from 10 million tons per year to 15 million tons per year respectively. Further, in July this year, development of Watermark coal mine in Gunnedah Basin planned by China’s Shenhua Group to produce 10 million tons of coal per year has also been approved.

(2) QLD

In addition to Bowen Basin located 100 to 250km from the port, new coal mine development is in progress at interior Galilee Basin and Surat Basin also. The Eagle Downs located in Bowen Basin is an underground coal mine planned to produce 7 million tons of coal per year and will be operational in first half of 2017. In terms of infrastructure development, Wiggins Island Coal Export Terminal (WICT) constructed 3 years back has started the operation in April this year and delivered 73,000 tons of coal. The target is to increase the coal delivery from the same port in future up to 27 million tons per year.

On the other hand, unprofitable coal mines have been closed or abandoned due to stagnation of coal prices in recent years. German Creek Aquila and Isaac Plains in which the Japanese companies own interest have been abandoned, and Gregory and Norwich Park have been closed. It has been also reported that Brazil’s Vale corporation, which owns interest in Isaac Plains and Integra located in NSW, is planning to sell the stake in Australian mines due to reduced profitability.

Further, at Callide Power Station A located near Biloela in QLD, demonstration of oxygen combustion was successfully conducted in end of February this year as a part of oxy-fuel combustion and CO₂ capture process under Oxy-fuel Combustion Project conducted jointly by Australia’s CS Energy, Australian Coal Association Low Emissions Technologies, Glencore, Schlumberger and Japan’s J-Power, IHI Corporation and Mitsui & Co.

(3) VIC

The lignite is produced in abundance in VIC and most of the coal produced is used for power generation. As the lignite from VIC has high moisture content and low ash melting point, its use is limited to sub-critical pressure low-efficiency power generation using drum pre-drying type lignite only boiler with European technology. In August 2012, VIC state government launched the Advanced Lignite Demonstration Program (ALDP) in cooperation with the Federal Government. The objective of ALDP is “Commercialization of lignite” focusing on reformulation of lignite and it will continue to provide assistance for development of demonstration phase. It will also provide assistance for gasification, thermal decomposition and combustion in connection with reformulation of lignite including the construction of demonstration plant for lignite briquette manufacturing at the Loy Yang A power plant run by SEAPED (Shanghai Electric Australia Power and Energy Development Pty Ltd).

Carbon Net Project that aims to store CO₂ deep underground beneath the sea bed, which has been selected as CCS Flagship Project by the Federal Government, is under way and Feasibility Study is currently under progress. The plan is to capture and store 1 to 5 million tons of CO₂ emitted per year from the industries (including coal-fired power plants) in
Latrobe Valley region.

(4) West Australia (WA)
As the quality of coal produced in WA is low as compared to the coal from eastern states, mainly the coal used in coal-fired power plants within the state is produced here. The development plan for Bunbury port funded by India’s Lanco Infratech has been approved in 2014 and it has been planned to complete the construction of that port by 2015, which is expected to export 15 million tons of coal per year and start coal export in 2017.

South West Hub CCS Project that immobilizes CO₂ above and below the ground has been selected as CCS Flagship project and is currently under way at WA state with a financial assistance from the Federal Government. In 2015-2017, based on the geological data obtained so far, it has been planned to study behavior of CO₂ below the ground including CO₂ test injection.
Information about Turkey and Serbia

Toshiko Fujita, Mikio Ando, JAPAC, Tokusaburo Fukui, Strategic Information, Planning & Communication Dept

1. Purpose of Survey
This survey was conducted in Turkey and Serbia as a part of subsidy program offered by Ministry of Economy, Trade and Industry to study that in which countries the deployment of Japan’s environment-friendly high-efficiency coal-fired thermal power generation technology should be done in near future so that it can contribute to the global environment.

2. Republic of Turkey

2.1. Energy Policy
The Ministry of Energy and Natural Resources announced the energy policy until 2023, which is 100th anniversary of foundation of Turkish Republic, during “World Clean Coal Conference” held in February. In anticipation of participation from private companies including foreign investment in large-scale energy development, the energy demand in Turkey is expected to increase to 500 billion kWh by 2023. Following goals were set to meet that demand.

- Increase the total capacity of power generation facilities from the current capacity of 57GW to 125GW which is more than the double.
- Increase the percentage of energy from renewable sources that contributes to total electric energy to 30%.
- Increase the total length of transmission network to 60,717km.
- Reduce transmission loss and electricity stealing percentage to 5% and expand the use of smart grid.
- Increase the current capacity of natural gas storage from 2.6 billion cubic meters to 5 billion cubic meters.
- Build the power plant having total facility capacity of 18,500MW in coal mine land.
- Increase the capacity of hydro-electric power generation facilities focusing on the private sector.
- Increase the capacity of wind power generation facilities to 20GW.
- Increase the capacity of geothermal power generation facilities up to 600MW.
- Increase the capacity of solar power generation facilities up to 3,000MW.
- Reduce the current dependency of power generation on gas-fired thermal power from little less than 50% to less than 30%.
- Invest 40 billion dollar and build 2 nuclear power plant units (5,000 MW). Start the operation by 2023.

2.2. Present Status and Prospects of Energy
According to the information from interview with the Ministry of Energy and Natural Resources and Turkish electricity authority at the time of first site survey conducted in December 2014, primary energy demand of Turkey in 2013 was 120.1Mtoe (oil equivalent), and composition of energy sources was 30% of coal, 31% of natural gas, 26% of crude oil, 13% of renewable energy (including hydro-electric power) and 0% of nuclear power.

As of 2013, the percentage of coal contributing to electric power was 29%. In terms of application of coal consumption, 86% of lignite (55.2 million ton in 2013) and 42% of hard coal (28.2 million ton in 2013) was used for power generation, and the capacity of power generation facilities in 2014 has increased to 69,516MW, which is 8.6% increase as compared to last year. The composition of energy sources contributing to the power generation at that time includes 29% of coal, 48% of natural gas (Majority is imported from Russia), 16% of hydro-electric power, 4% of wind power, 1% of geothermal power, 2% power from other sources and 0% of nuclear power.

The projected primary energy demand in 2023 is 218Mtoe and the composition of energy sources will include 37% of coal, 23% of natural gas, 26% of crude oil, 12% if renewable energy (including hydro-electric power) and 4% of nuclear power, wherein the composition of coal is expected to increase.
3. Republic of Serbia

3.1. Energy Policy
Serbia is currently developing “Energy sector development strategy of the Republic of Serbia for the period by 2025 with projections by 2030”, taking into consideration the issues requested by EU in the accession negotiations to EU. Following 3 points are considered as strategically important points in the energy sector development strategy until 2030.
(1) Energy security
(2) Incorporating market system in energy sector
(3) Shift toward sustainable energy sector achieving energy efficiency improvement and environmental protection

3.2. Electric Power Situation
The Electric Power Industry of Serbia (EPS) manages the power generation business and 5 affiliated companies manage the power distribution business by area. The electricity transmission company (EMS) manages the power transmission business.

The power generation capacity and amount of power generated in 2013 is given below.

<table>
<thead>
<tr>
<th></th>
<th>Capacity (MW)</th>
<th>Power Generation (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro</td>
<td>2.835 (39.5%)</td>
<td>10,729 (28.6%)</td>
</tr>
<tr>
<td>Coal-fired</td>
<td>3.905 (54.4%)</td>
<td>26,537 (70.7%)</td>
</tr>
<tr>
<td>Cogeneration</td>
<td>356 (5.0%)</td>
<td>167 (0.4%)</td>
</tr>
<tr>
<td>Other</td>
<td>81 (1.1%)</td>
<td>104 (0.3%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7,177 (100%)</strong></td>
<td><strong>37,537 (100%)</strong></td>
</tr>
</tbody>
</table>

The electricity charges are lowest among European and neighboring countries. In 2013, electricity rate was 6.24¢/kWh for domestic use and 6.35¢/kWh for industrial use (11.64 is the average of EU and Eastern European countries).

The environmental standards based on Industrial Emission Directive of EU (PM: 10mg/m³, SO2: 150mg/m³, NOx: 150mg/m³) have been requested in the EU accession negotiations. While the negotiations are still going on, the power plants have been already trying to take measures based on this standard.

3.3. Lignite Coal Mine
Most of the lignite out of approximately 4 billion tons of lignite reserves in Serbia is available in Kolubara and Kostolac coal fields. At both the coal fields, EPS is mining lignite for power generation through its subsidiaries, and the lignite is mined by open-cast mining using Wheel Excavator and Conveyor.

The coal production at both the coal mines in 2013 is given below.

<table>
<thead>
<tr>
<th></th>
<th>Waste (M3)</th>
<th>Lignite (tons)</th>
<th>Strip ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kolubara</td>
<td>69,345,181</td>
<td>30,709,715</td>
<td>2.26</td>
</tr>
<tr>
<td>Kostolac</td>
<td>41,139,991</td>
<td>8,803,759</td>
<td>4.67</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>110,485,172</strong></td>
<td><strong>39,513,474</strong></td>
<td><strong>2.80</strong></td>
</tr>
</tbody>
</table>

The lignite has 12-35% of ash content, 45-54% of moisture content and net calorific value between 2,866 to 4,299cal/kg. Kolubara coal field was damaged by massive flooding in May 2014 and two coal pits were submerged in water. However, based on the forecast as of February 2015, it was said that the water would have been removed from all the coal pits in March-April.

3.4. Coal-fired Thermal Power Generation
The major coal-fired thermal power plants operated under EPS are Nikola Tesla Power Plants and Kostolac Power Plants. In addition, there are Kolubara Power Plant (245MW) and Morava Power Plant (125MW). Nikola Tesla and Kostolac will be operated as the main coal-fired thermal power plants in the future.

At the time of visit in February 2015, FGD installation work was in progress at Kostolac Power Plant through cooperation of China. Discussion how to implement FGC installation project under yen loan was under way for Nikola Tesla Power Plant.

In order to increase and modernize the power generation capacity capital investment is required not only for the power plants but also for the increase of lignite production including the development of new mines, improvement of railroad
capacity for lignite transportation etc. Struggling for securing the financing for economic recovery, Serbia needs financial support from foreign countries for such capital investments.

4. Summary
Upon visiting these two countries and having discussion with relevant energy ministries in respective countries, we felt that they have information about Japan’s high-efficiency coal-fired thermal power generation technology to certain extent. However, further more research needs to be done as to how that technology should be introduced to contribute toward environmental issues in respective countries. Further, we found out the situation in former Yugoslavia or middle eastern region through international consulting company’s survey along with the simultaneous progress of the site survey. We hope that Japan’s environment-friendly high-efficiency power generation technology contributes to environmental issues in various countries taking advantage of these results.
Evaluation of Power Generation Performance using various kinds of Lignite

Keiji Makino, Strategic Information, Planning & Communication Department

1. Foreword
Lignite and sub-bituminous coals, which are called as low rank coal, have been produced and used in the world. Total production of these coals is even higher than high rank coal which are bituminous coals and anthracites. However, low rank coal is not economically feasible to transport to remote places because of their higher moisture content. Low rank coal is not used mainly in Japanese power generation because of higher moisture content. But the reserves and production of high rank coal is reducing at present, so utilization of low rank coal must be considered to cope with energy security of Japan. It is extremely important to evaluate the power generation efficiency or environmental performance when lignite is planned to apply for power generation. Because Japan has little experience for lignite clean application.

JCOAL conducted global survey about lignite utilization characteristics such as efficiency, environmental figures, carbon emission, ash deposit on the boiler furnace, and so on. These results were compared with those for conventional bituminous coals which Japan had already many experiences. Lignite is also used as a raw material to produce chemical products such as liquid fuel, synthetic natural gas, fertilizer and others through lignite gasification process.

In this study, evaluation of synthetic natural gas production from lignite was also done. But this report covers only the results about pulverized coal power generation case.

2. Lignite Boiler Design
Design of lignite boiler is different from bituminous coal fired boiler case in many aspects. Particularly, boiler furnace and auxiliary equipment have distinctively different concept. This is because of higher moisture content of lignite as much as 40-50%, which is significantly different from 10% of conventional bituminous coals. Very high temperature combustion gas is taken from the furnace for pulverizing in the mill, Beater mill, as explained later. In addition, completion of lignite combustion takes more time than bituminous coals. Lignite contains more sodium or potassium in the ash, and these substances may result in heat transfer failure as the melted ash deposits on surface of the boiler wall. This phenomenon is called as “slagging” or “fouling”.

Longer residence time is required to burn lignite in the furnace. Considering these characteristics of lignite burning, bigger furnace is required for lignite. This is summarized in Table 1.

Table 1: Consideration of design points for lignite and other conventional boiler

<table>
<thead>
<tr>
<th>Boiler</th>
<th>Coal characteristics</th>
<th>Consideration for boiler design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lignite boiler</td>
<td>High moisture content (40-60%)</td>
<td>Take out 800°C gas from furnace and supply to Beater mill (Lignite drying is desirable before combustion to improve generation efficiency)</td>
</tr>
<tr>
<td>Combustion</td>
<td></td>
<td>Furnace height should be big to cope with low combustibility of lignite</td>
</tr>
<tr>
<td>Slagging potential by high Na &amp; K content</td>
<td>Increase the number of de-slagger and soot blower to avoid slagging of the furnace wall</td>
<td></td>
</tr>
<tr>
<td>Sub-Bituminous boiler</td>
<td>Higher moisture content than bituminous coals (15-20%)</td>
<td>Apply the same system as bituminous coal boiler, but heat input to pulverizer should be bigger</td>
</tr>
<tr>
<td>Higher volatile matter content</td>
<td></td>
<td>Difficult to burn sub-bituminous coal in domestic boiler, so normally sub-bituminous coal is blended by conventional bituminous coals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To avoid spontaneous combustion in the pulverizer, pulverizer outlet temperature should be low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To avoid unexpected combustion at various position of the boiler, pile up of PF should not be made at any places of the boiler and pulverizer</td>
</tr>
<tr>
<td>Slagging potential by higher Na &amp; K content</td>
<td>Increase the number of de-slagger and soot blower to avoid slagging of the furnace wall</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1 shows the concept of boiler furnace dimension for lignite and bituminous coal boiler. Furnace height and horizontal sectional area is much bigger for lignite boiler. If we see lignite boiler actually in Europe, bigger size will give us strong impression.

Figure 1: Concept of furnace dimensions for lignite and bituminous boiler

Concept of lignite pulverization system is shown in Figure 2. Combustion gas of around 800°C in the furnace is introduced into Beater mill to supply enough heat for lignite drying. Beater mill is different from pulverizer of normal bituminous coal. Beater mill is in the shape of large centrifugal fan and lignite is hit by the crushing blades to make pulverized coal. For large boilers, 8 mills are provided around the boiler.

Figure 2: Concept of Beater mill design

3. Analysis of difference between lignites and other coals

Table 2 summarizes property of lignites studied in this survey. 10 types of lignites were studied from Indonesia and 1 from US. At the same time, bituminous and sub-bituminous coals which have been used in Japan in the past, were also studied in the same way for comparison. Property of these coals are given in Table 3.

Total moisture content versus ash content are plotted in Figure 3 for all the coals. It can be understood from the figure that the lignite is low ash and high moisture. In this study, total moisture content from 25 to more than 60% were covered for lignite. Further, initial deformation temperature of ash in the reducing atmosphere, which is an important parameter in terms of boiler furnace design, is shown in Figure 4. However, lignite have lower initial ash deformation temperature as compared to other coal types. Figure 5 shows higher heating value of as-received basis. Heating value of lignite is lower than the bituminous and sub-bituminous coal because of difference of moisture. (Note: Heating value of Sub-bituminous D and J are lacking.)

Table 2: Characteristics of lignites used for this study

<table>
<thead>
<tr>
<th>Lignite</th>
<th>Country</th>
<th>Higher heating value (received basis)</th>
<th>Ultimate analysis (Air dry base %)</th>
<th>Fuel Ratio</th>
<th>Ash melting temperature (Reducing atmosphere °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>H</td>
<td>O</td>
</tr>
<tr>
<td>A</td>
<td>US</td>
<td>4.170</td>
<td>58.00</td>
<td>26.00</td>
<td>28.00</td>
</tr>
<tr>
<td>B</td>
<td>Indonesia</td>
<td>4.000</td>
<td>40.00</td>
<td>20.00</td>
<td>36.00</td>
</tr>
<tr>
<td>C</td>
<td>Indonesia</td>
<td>4.700</td>
<td>30.00</td>
<td>18.00</td>
<td>38.00</td>
</tr>
<tr>
<td>D</td>
<td>Indonesia</td>
<td>5.000</td>
<td>26.00</td>
<td>14.00</td>
<td>38.00</td>
</tr>
<tr>
<td>E</td>
<td>Indonesia</td>
<td>2.813</td>
<td>56.30</td>
<td>24.30</td>
<td>23.30</td>
</tr>
<tr>
<td>F</td>
<td>Indonesia</td>
<td>3.300</td>
<td>48.56</td>
<td>14.95</td>
<td>39.50</td>
</tr>
<tr>
<td>G</td>
<td>Indonesia</td>
<td>3.203</td>
<td>49.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Indonesia</td>
<td>3.660</td>
<td>63.30</td>
<td>40.70</td>
<td>25.80</td>
</tr>
<tr>
<td>I</td>
<td>Indonesia</td>
<td>3.300</td>
<td>46.00</td>
<td>11.00</td>
<td>40.00</td>
</tr>
<tr>
<td>J</td>
<td>Indonesia</td>
<td>3.800</td>
<td>40.00</td>
<td>11.00</td>
<td>42.00</td>
</tr>
<tr>
<td>K</td>
<td>Indonesia</td>
<td>3.600</td>
<td>45.00</td>
<td>18.00</td>
<td>38.00</td>
</tr>
</tbody>
</table>
Table 3: Characteristics of bituminous and sub-bituminous coals used for comparison

<table>
<thead>
<tr>
<th>Coal</th>
<th>Country</th>
<th>Name</th>
<th>Higher heating value (as received basis, kcal/kg)</th>
<th>Ultimate analysis (Air dried %)</th>
<th>Ash melting temperature (Reducing Atmosphere °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fuel ratio (as received basis)</td>
<td>C</td>
<td>H</td>
</tr>
<tr>
<td>Bituminous coal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia A</td>
<td>6,393</td>
<td>9.00</td>
<td>2.50</td>
<td>50.00</td>
<td>33.00</td>
</tr>
<tr>
<td>Australia B</td>
<td>6,100</td>
<td>14.00</td>
<td>3.00</td>
<td>57.00</td>
<td>28.00</td>
</tr>
<tr>
<td>Australia C</td>
<td>6,450</td>
<td>8.00</td>
<td>2.50</td>
<td>52.00</td>
<td>31.00</td>
</tr>
<tr>
<td>Australia D</td>
<td>6,331</td>
<td>11.50</td>
<td>3.00</td>
<td>53.30</td>
<td>31.00</td>
</tr>
<tr>
<td>South Africa E</td>
<td>3,895</td>
<td>16.50</td>
<td>2.30</td>
<td>60.80</td>
<td>20.20</td>
</tr>
<tr>
<td>South Africa F</td>
<td>5,356</td>
<td>12.50</td>
<td>6.48</td>
<td>51.10</td>
<td>24.80</td>
</tr>
<tr>
<td>Australia A</td>
<td>4,870</td>
<td>15.50</td>
<td>9.60</td>
<td>49.10</td>
<td>24.20</td>
</tr>
<tr>
<td>Australia B</td>
<td>4,832</td>
<td>21.00</td>
<td>21.00</td>
<td>48.00</td>
<td>26.00</td>
</tr>
<tr>
<td>Australia C</td>
<td>5,040</td>
<td>24.00</td>
<td>18.00</td>
<td>48.00</td>
<td>29.50</td>
</tr>
<tr>
<td>Indonesia  D</td>
<td>3,000</td>
<td>26.00</td>
<td>18.30</td>
<td>38.00</td>
<td>26.50</td>
</tr>
<tr>
<td>US        E</td>
<td>4,889</td>
<td>25.00</td>
<td>50.34</td>
<td>43.67</td>
<td>17.00</td>
</tr>
<tr>
<td>Indonesia  F</td>
<td>4,669</td>
<td>25.00</td>
<td>—</td>
<td>48.59</td>
<td>43.80</td>
</tr>
<tr>
<td>Myanmar   J</td>
<td>4,500</td>
<td>26.00</td>
<td>18.50</td>
<td>40.00</td>
<td>43.00</td>
</tr>
<tr>
<td>Colombia  K</td>
<td>4,500</td>
<td>26.00</td>
<td>14.00</td>
<td>41.70</td>
<td>39.20</td>
</tr>
<tr>
<td>Canada    L</td>
<td>6,000</td>
<td>10.00</td>
<td>100.00</td>
<td>41.50</td>
<td>24.70</td>
</tr>
</tbody>
</table>

Figure 3: Total moisture content versus ash content of lignite

Figure 4: Melting point of ash of studied coal (softening temp. °C)

Figure 5: Higher heating value of coal used in the study (as-received basis, kcal/kg)

Figure 6: Flow sheet of lignite power plant

4. Power generation efficiency and items to be considered for lignite power plant

JCOAL studied efficiency of lignite power generation and other various items for designing the lignite plant. In this study, amount of required air, flue gas, fuel and so on.

Also environmental items are also expected. Here, items for bituminous coals and sub-bituminous coals are also shown for the comparison.

Power generation concept is shown in Figure 6. This concept is standard for lignite power plant. For NOx and SOx reduction, Denitification Facility (Selective Catalytic Reduction, SCR) and Flue Gas Desulfurization Facility (Flue Gas De-sulfurization, FGD) as environmental protection and Electrostatic Precipitator (EP) is installed for dust removal.

Recent research in Europe is development moisture removal equipment, but it is not yet commercialized. So lignite drying system is not considered in this study. However, only for 3 lignites, we studied the drying of moisture, which is described at the end.

Capacity of power generation and steam conditions used in the study are latest ones in Japan. Conditions are summarized below.

- Facility: Ultra Super-Critical power generation (USC)
- Power generation capacity: 1,000 MW (Net)
- Main steam/reheat steam temperature: 600/605°C
- Main steam pressure: 27MPa

The study results for lignite is shown below together with reference coals.
(1) Items related to power generation performance

Figure 7 shows lignite power generation efficiency (Net, higher heating value basis). Power generation efficiency of lignite varies significantly depending on the coal type. Lignite “H” has lowest efficiency. Lignite “H” has total moisture content of 63.30% and inherent moisture is 40.70%, which are higher than any other lignites. Efficiency of lignite “A” and “E” are also lower efficiency because of higher moisture content.

Sub-bituminous coals have around 41% efficiencies and little higher efficiency of around 42% can be achieved in case of bituminous coal.

Figure 7: Power generation efficiency (% Net, higher heating value basis)

As shown in the same figure, although lignite “D” has very high concentration of SOx, it is because of 1.8% sulfur content in the lignite. Ash content in lignite is low and hence the dust concentration is also low.

Figure 9: Numerical values related to environment

(2) Items related to the facility size

Figure 8 shows coal feed, air flow and flue gas numerical numbers related to the facility size. As shown in the figure, these numbers are bigger for lignite as compared to bituminous or sub-bituminous coals. Further, the difference in numerical values of lignites are much different each other.

The difference of coal consumption between lignite “D” with and lignite “H” is 2.6 times. Such factors in selection of lignite significantly affect the construction cost and that is the huge difference from the bituminous coal which has been used in the past.

Figure 8: Numerical numbers related to facility dimension determination

(3) Items related to environmental characteristics

Figure 9 shows values for dust and SOx at air pre-heater outlet.

(4) Items related to operation

Slagging is caused by molten ash deposits on inner wall of boiler furnace, and fouling is caused by accumulation of dust at convective heat transfer region.

These problems are very important related to smooth and reliable operation. Here, we have calculated the index representing slagging and fouling from ash characteristics data. Results are given in Table-4. Lignite “E”, “H”, “I” and “K” have severe slagging potential and “D” has severe fouling potential. It will be required to check slagging and fouling characteristics in the actual boiler operation.

Table 4: Boiler operation related slagging or fouling potential for each coal type
(5) Items related to greenhouse gas

Items related to global warming which include CO₂ emission and CO₂ intensity (CO₂ emission per unit power generation) are shown in Figure 10. For annual CO₂ emission calculation, availability of the plant is set to 90%.

As shown in the figure, lignite CO₂ emission and intensity are higher than that of bituminous and sub-bituminous coals. CO₂ intensity of bituminous coals is 750 to 850g/kWh and that of sub-bituminous coal is almost same as bituminous coals. In case of lignite, CO₂ intensity is different from 850 to 1000g/kWh widely than other coals.

Figure 10 CO₂ emission and CO₂ intensity

5. Impact of lignite drying

As already described, most of the lignite has high moisture content and it is necessary for lignites to apply drying before putting it into the Beater mill to make efficiency higher. Although developed drying methods are steam drying or air drying, steam fluidized bed method is considered. This system was developed by RWE which is one of the major power companies in Europe. RWE demonstrated this system at their own large-capacity lignite power plant, and studied how the power generation efficiency is improved using that method.

Lignite “A”, “E” and “H” have high moisture content, so lignite drying case were considered.

Figure 11 shows the relationship between lignite moisture and net efficiency. It can be understood from the figure that 4% improvement of efficiency will be attained by making moisture from 58% to 40%, and also 5 to 6% improvement of efficiency from 58% to 20% drying.

6. Summary

It has long been said that the reserves of high rank coal is decreasing in the world. The continuous stable supply of coal with low prices is essential for developing countries to generate electricity with low price, in order to make their economic development. On the other hand, CO₂ reduction in connection with global warming cannot be overlooked.

Under such situation, Japan is also looking forward for important role of coal as the base load fuel to take environmental protection into consideration. Japan expect to use high rank coals cleanly but low rank coal utilization will be much more important from now. In this situation, lignites will be important fuel for power generation gradually.

JCOAL believes this study would be a good information for further expand utilization of low-grade coal such as lignite in power generation.
G20 Energy Efficiency Action Plan, Electricity Generation, Workshop on Clean Coal Technology

Toshiko Fujita, JAPAC

Under co-chairmanship of Government of Japan (Toshiko Fujii, Deputy Commissioner for International Affairs, Agency for Natural Resources and Energy) and Government of Australia (Kathy Harman, General Manager, Coal and Minerals Productivity, Department of Industry and Science), G20 Energy Efficiency Action Plan, Electricity Generation, Workshop on Clean Coal Technology were held on May 25th (Monday) evening at The Grand Tarabya Hotel, Istanbul, Turkey. JCOAL co-hosted this workshop and participated as the Secretariat. In addition, from May 25th (Monday) to May 26th (Tuesday), Energy Sustainability Working Group (ESWG) meeting, which is a higher level meeting than the workshop, was also held at the same venue.

More than 70 members attended this workshop and discussed positively about the importance of coal and importance of research and development of high-efficiency coal-fired thermal power generation technology, and the report was given in Energy Sustainability Working Group meeting on following day on May 26.

The outline is given below.

Keynote Presentation/Director for Coal Gas Power Division of IEA; “It is essential to introduce high-efficiency coal-fired thermal power generation as coal will remain an important source of electricity in future also. In non-OECD Asian countries, electrification is still developing and demand for electricity is expected to increase rapidly.”

Session 1 (Policy and Technology)
Speakers (IEA-GHG, Ministry of Energy and Mineral Resources of Indonesia, Tokyo University of Science, PEABODY Energy)
“It is essential to introduce high-efficiency coal-fired thermal power generation to meet the rapidly increasing demand for electricity. It is important to work on technological development, policy support in order to support both energy access, measures against economic development climate change.”

Session 2 (Finance)
Speakers (ADB, NITI Aayong of India)
“Public financial assistance for the deployment of high-efficiency coal-fired thermal power is essential for developing countries.”

Chair of the Workshop, Toshiko Fujii, Representative of Government of Japan
Opening Remarks 1

Co-Chair of the Workshop, Kathy Harman, Representative from Government of Australia
Opening Remarks 2

Chairperson of G20 ESWG, Sefa Sadik AYTEKIN, Representative of Government of Turkey
Opening Remarks 3

Speakers from Japan: Prof. Takeo Kikkawa, Tokyo University of Science, Participatory session
1. Introduction
CCT Workshop 2015 (supported by Ministry of Economy, Trade and Industry) was held at the Science Hall of Science Museum for 2 days on July 1st and 2nd as part of the promotional activities for Clean Coal Technology (CCT). The workshop which is celebrating its 13th anniversary this year was held with a theme “Technological development for increasing efficiency, low carbonization and increasing international competitiveness of coal utilization technology”. The aim of the workshop was to have discussion by bringing together the experts in coal technology to globally expand Japan’s CCT in future while maintaining and improving technological advantages as well as identifying development issues to establish low-carbon society by contributing to environmental measures and specify measures to resolve those issues.

2. Agenda
In plenary session on Day 1, after opening remarks from JCOAL chairperson Kitamura, keynote speeches were delivered by Kakudo - Director of Coal Division at METI, Yasui - Director General at NEDO and Tanaka - Deputy Director General at JICA on “Characterization of Coal in Energy Policy and Future Coal Policy”, “Future Expansion of Japan’s Clean Coal Technology Development” and “Activities for Promoting CCT in Developing Countries” respectively. Further, speeches were delivered by Kiga - Chief Engineer at IHI Corporation, and Iijima - Executive Officer at Mitsubishi Heavy Industries Limited on “Callide Oxy-fuel Combustion Project” and “Project for CO2 Capture and CO2 EOR from Coal-fired Thermal Power” respectively. Terame from Research and Development Department at JCOAL gave a report on the deployment of high-efficiency power generation technology and effect of CO2 reduction in case of biomass co-combustion.

On day 2, breakout sessions were held same as the last year. 3 breakout sessions entitled “Development of high-efficiency and low-carbonization technology of coal utilization”, “Development for CCT overseas expansion (Indian and Chinese Market)” and “Development for expansion of low-grade coal utilization” were conducted and discussion was held at respective venues based on 6 to 10 topics given by manufacturers and trading companies.

The points in connection with the contents of breakout session were summarized by Research and Development Department of JCOAL, and on that day, meetings were held with the moderator who was the facilitator. Taking into consideration the lack of time for Q&A and discussion because of speeches delivered by many speakers last year. This year it was planned such that 4 hours were allotted for the breakout sessions and sufficient time was given for the discussion. Each breakout session was productive where participants expressed many valuable opinions and had active discussion.

After breakout sessions, Oda - Chief Scientist at RITE delivered special lecture on topic “Evaluation of CO2 emission reduction target of each country” in the main hall. Subsequently, moderator of each breakout session presented the conclusion, and summary and challenges of this workshop were identified by panel discussion.

3. Agenda of CCT Workshop 2015
The agenda of CCT Workshop 2015 is given below.
Plenary Session (July 1st)
• Opening Remarks: Masayoshi Kitamura, Chairperson, JCOAL
• Keynote Speech 1: Current Status and Issues of Coal Development
  Takafumi Kakudo, Director, Coal Division, METI
• Keynote Speech 2: Future Development of Clean Coal Technology in Japan
  Akira Yasui, Director General, Environment Department, NEDO
• Keynote Speech 3: Activities for Promoting CCT in Developing Countries
  Deputy Director General, Department of Industrial Development and Public Policy, JICA
  Hiroo Tanaka
• Speech 1: Activities for CCS Demonstration at Overseas Coal-Fired Thermal Power Plants
~ Callide Oxyfuel Combustion Project ~
Energy and Plant Sector, IHI Corporation
Takashi Kiga, Chief Engineer

• Speech 2: Activities for the project of CO₂ Capture and CO₂ EOR from Coal-fired Thermal Power Plants
  Executive Officer Fellow, Mitsubishi Heavy Industries Limited
  Masaki Iiji

• Report: Inclusion of CO₂ Reduction Effect in CCT Roadmap
  Tsuyoshi Teramae, Research and Development Department, JCOAL

• Explanation: Explanation of CCT Workshop 2015 Breakout Sessions
  Keiichiro Hashimoto, Research and Development Department, JCOAL

Breakout Sessions (July 2nd)

<Breakout Session 1: Development of high-efficiency and low-carbonization technology of coal utilization>
Prof. Ken Okazaki, Moderator, Tokyo Institute of Technology
(1-1) “Development of advanced ultra-supercritical (A-USC) coal-fired thermal power generation technology”
  Toshiaki Yoshida, High Efficiency Power Generation System Research Center

(1-2) “Increasing size and efficiency of IGCC”
  Hiromi Ishii, Mitsubishi Hitachi Power Systems

(1-3) “Overview and progress of Osaka CoolGen Project”
  Kenji Aiso, Osaka CoolGen Corporation

(1-4) “Survey on development of chemical looping coal utilization technology”
  Hayashi Sekiei, JCOAL

(1-5) “Status of CO₂ capture type high-efficiency IGCC technology development”
  Hara Saburo, Central Research Institute of Electric Power Industry

(1-6) “Activities for increasing biomass co-combustion in coal fired boiler”
  Ken Yoshida, IHI Corporation

(1-7) “Environment-conscious iron making process technology development”
  Shigeaki Tonomura, Nippon Steel & Sumitomo Metal Corporation

<Breakout Session 2: Development for CCT overseas expansion (Indian and Chinese Market)>
Associate Professor Nobuhiro Horii, Moderator, Kyushu University

(2-1) “India’s coal preparation model project”
  Yasuo Kubo, Nagata Engineering Co., Ltd.

(2-2) “Society for research on CCT business promotion in India”
  Satoshi Matsuyama, JCOAL

(2-3) “Activities of MHPS for denitrification catalyst project and AQCS project in China”

Toshio Usui, Mitsubishi Hitachi Power Systems

(2-4) “Overseas expansion of NSENGI/CCT”
  Masataka Mizuno, Nippon Steel and Sumikin Engineering Co., Ltd.

(2-5) “Activities of Chinese environment business”
  Satoshi Matsuyama, JCOAL

(2-6) “Activities of Yokogawa Electric in Indian market”
  Norinao Sato, Yokogawa Electric Corporation

<Breakout Session 3: Development for expansion of low-grade coal utilization>
Prof. Takaraeda Takayuki, Moderator, Gunma University

(3-1) “Status of low-grade coal resources in the world and development in Indonesia”
  Masafumi Uehara, JCOAL

(3-2) “Application of CFB in Indonesia”
  Kazuyoshi Ito, Sumitomo Heavy Industries, Ltd

(3-3) “Development of exclusive burner for dried lignite”
  Masato Tamura, IHI Corporation

(3-4) “Activities for ICF power generation project in Indonesia”
  Chikai Suyama, JGC Corporation

(3-5) “Improvement in quality of low-grade coal”
  Onaka Akira, Ube Industries

(3-6) “Issues in practical application of A-SCC and its measures”
  Hanawa Masazaku, The Institute of Applied Energy

(3-7) “Development of CO₂ free hydrogen chain using low-grade coal in Australia”
  Seiichi Sugawa, Kawasaki Heavy Industries

(3-8) “Project of SNG generation and CO₂ EOR using unused low-grade coal in South Sumatra region of Indonesia”
  Hiromi Nakatani, Mitsubishi Heavy Industries, Ltd.

(3-9) “Manufacturing of improved coal for electricity produced from lignite in Australia”
  Hiroshi Fujii, The Kyushu Electric Power Company

(3-10) “Study for project in UBC (Upgraded Brown Coal)”
  Naoki Kikuchi, Kobe Steel Limited

4. Main Discussion Contents
The main discussion contents in each breakout session and opinions at the venue are given below. (→” indicates the answer for the question.)

Breakout Session 1

• What is the segregation between A-USC and IGCC? → It is appropriate to differentiate it in terms of melting point of coal ash.

• Where will IGFC be introduced? → I think it will be introduced for increasing size or dispersed power source depending on the social demand. I feel that it is the time to consolidate the image of fuel cell.

• CCS must be applied to EOR to meet the current market needs. It is necessary to focus on the result of COP21. It will be better if some kind of incentive is
offered in CCS.

Breakout Session 2

• When starting the operation at overseas, will the price evaluation consider only CAPEX or whether CAPEX including OPEX will be considered as a whole? → Eventually, CAPEX tends to purchase cheaper facilities. It is necessary to lower CAPEX to certain extent to start the operations at overseas. In India, emphasis is given on CAPEX and bidding of public enterprises is done only through CAPEX.

• What is the possibility of O&M business? → It is certain that the competition is fierce but the market is profitable and the situation must be faced positively. On the other hand, O&M business system in Japan is centered on the response in case of failure and there are very few examples where day-to-day operation service is implemented comprehensively by 1 company (operations are outsourced). It is necessary to consider seriously about the service system and development of framework in Japan to knock out the O&M business.

Breakout Session 3

• What are the problems in development of low-grade coal technology? → It is important to develop the low-grade coal utilization technology that is either being practically used or is under development, in such a way that it can be expanded to the countries other than the coal producing countries where it has been practically used.

• There are situations that are difficult to be handled privately such as development of infrastructure or high taxation policy (preservation of resources in the country etc.) etc. → Initiative by entire Japan is important to solve low-grade coal specific problems.

General discussion after breakout sessions

• The reason why long-term technological development project in the past could not be put into practical use is that the development could not be progressed smoothly as the needs of society or users, application destination or objectives changed during the course of long development period.

• It can be considered that the immediate goal has been achieved, if Japan’s coal industry could sell the technology to foreign countries in pursuit of high-efficiency.

5. Conclusion

The opinions from workshop participants include “Overseas information of JCOAL should be released to member companies”, “Real needs of overseas users, which is the technology expansion destination, should be explored because it will help in commercialization”, “Seminars on changes in the industry due to electricity deregulation and measures by government against global warming will be useful for the business” etc., and JCOAL will try its best to hold productive workshops based on these requests.
The demonstrative operation of Callide oxy-fuel combustion is completed.

Keiichiro Hashimoto, Research and Development Department

1. Overview of Demonstration Operation
Callide Oxyfuel Combustion Project started formally in March 2008 as the joint international demonstration project by public and private sectors in Japan and Australia. For the first time in the world, demonstrative operations have been conducted from March 2012 for series of demonstrations which include CO₂ capture from real coal-fired thermal power plant facilities and injection of CO₂ under the ground using oxy-fuel combustion technology, and specific tests and the operations have been completed by March 6, 2015 without any severe accident. During this period, all the demonstration targets which include 10,000 hours of oxy-fuel combustion operation using real coal-fired thermal power plant facilities, 5,500 hours of operation of CO₂ compression and liquefaction facility and demonstration of injection of captured CO₂ into ground etc. were achieved for the first time in the world.

Photo-1 shows the full view of demonstration facilities at Callide Power Station A. The unit 4 of power plant A located 420km north-west of Brisbane in Queensland (QLD), which was built in 1969 and has been stopped since 2001, was remodeled and used for demonstrative operation.

![Photo-1 Callide Power Station A of CS Energy (QLD)](image1)

Figure-1 shows the project participants. The participants from Japan include IHI Corporation, J-Power and Mitsui & Co., Ltd., and financial assistance was provided by Ministry of Economy, Trade and Industry. JCOAL provided the technical assistance as a project collaborator.

![Oxyfuel Project Partners](image2)

![Figure-1: Participants of the Callide Project](image3)

Photo-2 shows the work of injecting CO₂ into the ground. The CO₂ injection site is Otway in Victoria (VIC) located at a distance of 2,400km from Callide. The liquefied CO₂ was transported by tanker and injected into approximately 1,400m deep aquifer.

![Photo-2 CO₂ CRC Otway injection site (VIC)](image4)

2. Completion Celebration
The demonstration operation completion celebration was held on April 16, 2015 in Brisbane, Australia. The distinguished guests who attended the celebration include Honorable Mark Bailey - Queensland Energy and Water Supply Minister, Martin Ferguson - Former Federal Labor Minister, Yanagisawa - Consul General of the Consulate General of Japan in Brisbane, and Enomoto - Assistant Director of Coal Division at Agency for Natural Resources and Energy, METI, in addition to approximately 80 project-related members.

The celebration was held at the special area in the Brisbane Art Museum and arrangements were made by Australian counterpart to visit exhibits even at night.
In the ceremony, speeches to congratulate project executors continued. Further, guests were also looking forward to the practical application of project in future. Many speakers from JCOAL were praised as a project collaborator.

Assistant Director Enomoto offered congratulatory speech saying that “Japan and Australia has a long friendly relationship and special complementary relationship in terms of coal. Under such circumstances, I am very delighted for successful completion of such a joint demonstration project aimed to reduce CO2. We will share the results obtained by this project conducted jointly by Japan and Australia to globally promote the low-carbon coal-fired thermal power generation that contributes to measures against global warming.”

Honorable Minister Mark Bailey said that “We are feeling extremely confident with the successful completion of this project. The utilization of renewable energy is definitely important, but we will face the climate changes through collaboration of environment and economy while continuing to utilize the results of this project.”

Stewart Butel, Director of Australian Coal Association Low Emission Technology (ACALET), said that “Coal is being supplied in various industries, but CO2 emission is a major problem. Under such circumstances, it is extremely good that geochemical test could be conducted by injecting CO2 captured in oxy-fuel combustion from Callide Power Station into aquifer with the help of this project that contributes to zero CO2 emission. This project could be implemented and quasi-commercialization could be demonstrated with support provided by the government for low carbonization for past 12 years. Policies may have changed and I don’t know the situation after 12 years. However, we would like to continue our efforts towards increased coal demand in future.”

The chief engineer Kiga (IHI) said that “I appreciate the cooperation from people concerned because of whom the demonstration operation was completed successfully in this project. I remember, when the oxy-fuel combustion research started in 1989, the powdered coal combustion amount was 1 gram/minute which is equal to the weight of coin of 1 Japanese yen, but in subsequent pilot test, it was 2kg/minute (increased by 2,000 times) which is equivalent to 2 to 3 wine bottles, and then in Callide project, it was 300kg/minute (increased by 150 times) which is equivalent to weight of 4 Japanese members present here. In the commercial equipment, coal combustion amount is 3 tons/minute (increased by 10 times) which is almost same as the weight of all members present here. Callide demonstration operation has been completed, but this is not the end. This is just the beginning of our dream and we would like to continue our efforts in future also.”

Project Director Dr. Chris Spero (CS Energy) gave the following speech, which was a distinctive speech from overseas: “Demonstration operation was successfully completed, 10,000 hours of Oxygen combustion operation was achieved and the initial target was almost achieved with the implementation of CO2 injection test. This project was started in the year 2008 by obtaining the support of the federal government, state government of Queensland and Japanese government after discussing with Professor Terry Wall of The University of Newcastle, Mr. Barry Waining of IHI Engineering Australia, Mr. Makino of IHI Corporation and Mr. Kiga in the CCSD conference of 2003. It was successful solely because of the efforts of all the stakeholders and I am thankful to them. I would also like to thank the efforts of the four ladies present here who have supported their husbands. They are Mrs. Doug, Mrs. Franco, Mrs. Lyle and my wife.”

Photo frames containing the panoramic view of the demonstration project was presented by the project executors to the main officials towards the end of the celebration.

3. Summary
This project has entered the final Phase 3 stage from March 2015 and compilation of results is in progress. At the same time, study for the realization of commercial scale project is
also under progress. JCOAL would also continue to provide its strong support.

Additionally, the intention is to further improve the accuracy of the storage site evaluation technology based on geochemical reaction that was developed in this project by JCOAL along with the agencies concerned, and continue to develop technologies that can be put to practical use.

4. Acknowledgements
Activities of JCOAL in this project have been carried out with the support and guidance of Coal Division, ANRE, and METI. I would like to express my deepest gratitude by mentioning it here. Further, I express my gratitude to all the officials concerned from Australia and the companies, namely IHI Corporation, J-POWER and Mitsui & Co., Ltd., who gave their consent for the publication of this report.

5. Reference information
(1) Callide Project website (Japanese)
http://www.callideoxyfuel.jp/
(2) Video of Callide Project (English)
https://www.youtube.com/watch?v=tIP4dI20BwQ
https://www.youtube.com/watch?v=omQDWY8LQ
https://www.youtube.com/watch?v=p1LpcK-qtc
The Second Japan-Poland Energy Policy Dialogue

Shuichi Miyaoka, Strategic Information, Planning & Communication Department

The existing power generation facilities in Poland which contribute to approximately 10.4GW of power would be renovated by the year 2025. New large-scale coal-fired power plants or new renewable energy and nuclear power plants are being considered as the potential alternatives. Under such circumstances, interactions between Japan and Poland are being actively carried out in the recent years, and not only limiting to interactions, Japan’s power generation technologies and environmental technologies are already being deployed in Poland.

In this context, the Second Japan-Poland Energy Policy Dialogue was conducted by the Ministry of Economy of the Republic of Poland (Warsaw, Poland) on 5th May, with Mr. Takagi, State Minister of Economy, Trade and Industry from Japan and Mr. Tomczykiewicz, Secretary of State, Ministry of Economy from Poland, as the representatives of two countries. JCOAL has a longstanding cooperative relationship with Poland in the coal sector, and considering the fact that coal is the most important energy fuel in Poland, President Tsukamoto also attended this meeting.

This policy dialogue was held based on the joint declaration "Building Framework for Strategic Partnership for Freedom, Growth and Solidarity" that was announced on February 27th during President Komorowski’s visit to Japan in February. Following information is reported with a focus on the coal sector.

In the speeches from Poland’s side, the hitherto cooperative relationship with Japan in the overall energy sector was highly appreciated, and continued and further cooperation was requested. In particular, MOU was signed with IChPW (Institute for Chemical Processing of Coal) and GIG (Central Mining Institute) in 2010 regarding the CCT transfer project, details of interaction thereafter were presented in detail, and with a total of four MOUs that were signed including NCBR (National Centre for Research and Development) and AGH University of Science and Technology, gratitude and high appreciation was expressed regarding the extremely active projects of JCOAL in Poland.

Poland is presently reviewing the energy policy till year 2050 (revised edition of policy till year 2030 that was adopted in year 2009), but coal and lignite are the most important energy fuel for the objective of stable supply of energy and low consumer price even though their proportion would reduce, and high-efficiency and reduction of CO2 are the major issues. Due to these reasons, it was confirmed that the CCT transfer which is in progress between the two countries and the cooperative relation to make the coal-fired thermal power more efficient would be continued in the future as well.

Apart from the coal sector, policies with respect to the International nuclear cooperation and cooperation in Poland till now in the nuclear sector, and proposals for new cooperation in the human resources sector were mentioned by the Japanese side. It was reported by the Polish side that there are plans to construct two nuclear power plants (total 6000MW) by the year 2035, initiatives were taken till now for creation of laws and a systematic foundation has been built. Further, regarding the renewable energy sector, since it is expected to be increased up to 17% in the year 2030 according to the EU energy mix, the importance of FS of smart grid that is being carried out by NEDO was mentioned and it was mutually agreed to further deepen the cooperative relation in both the sectors in the future as well.

Finally, the closure was done by conducting the signing ceremony of joint declaration by the two countries. Since we received strong appreciation regarding JCOAL projects in CCT sector from Poland during the recent energy policy dialogue, we were able to demonstrate the presence of JCOAL in both Japan and Poland. We want to take it as an inspiration for promoting future projects.

(From left, JCOAL President - Mr. Tsukamoto, METI, Policy Planning Coordination Officer - Mr. Shimakura, METI International Affairs Division - Mr. Kihara, State Minister - Mr. Takagi and Director, METI Office for International Nuclear Energy Cooperation - Mr. Kayama)

(Signing of joint declaration: Japanese representative State Minister Mr. Takagi and Polish representative Secretary of State Mr. Tomczykiewicz)
40th Clearwater Clean Coal Conference Report

Takao Tanosaki, Research Development Department

1. Introduction
I attended the 40th Technical Conference on Clean Coal & Fuel System that was held in Clearwater, Florida from 31st May (Sunday) to 5th June 2015 (Friday) and participated as a panelist in the panel discussion related to “Present state and future of low-grade coal usage” along with gathering information regarding latest CCT technologies. There were 201 pre-registered participants (US - 126 persons, Germany - 24 persons, Australia and Canada - 10 persons each, China - 7 persons, Japan - 3 persons and others), maximum 81 persons related to universities, plant related 37 persons and examination consulting related 34 persons.

2. Conference summary
Short course related to CCT or the basics of chemical looping was conducted in the prior study meeting on the first day, 31st May. Seven panel discussions were conducted from 1st to 4th June (speeches by 2 to 8 panelists and discussion including the attendees in the venue) and separate presentations were given with respect to 103 cases. From Japan, Mr. Saito of IHI Corporation gave a speech on slagging due to mineral content, and Mr. Yasushi from Central Research Institute of Electric Power Industry gave a speech on chemical kinetics at the time of combustion.

Mr. Tanosaki of JCOAL gave a speech as a panelist in the panel discussion on low-grade coal that was conducted on 1st June. World-class Japanese technologies such as JCF®, Tigar®, UBC®, Hydrogen supply chain etc., which are being deployed in the coal producing countries, were introduced.

On the final day of conference (i.e. 5th June), a study tour was conducted to Polk Power Station, which is an IGCC facility located southeast of Tampa, and 12 persons (including 3 Japanese persons) participated in this tour.

3. Conference details
(1) In this conference, a workshop on “Present state and future of low-grade coal usage” was conducted in the afternoon session of the first day by the Deputy Chairman of this organization Prof. Hein from the University of Stuttgart along with 5 panelists. After each panelist gave speeches on the following topics for 10 minutes, discussion was carried out including the attendees in the venue.

A. Prof. Hein (Introduction to low-grade coal): Characteristics such as high moisture content, easy to carry out spontaneous combustion and its usage in the fundamental coal producing bases, were elucidated. Character of lignite is not being well understood; however, it is necessary to understand the characteristic features such as slacking of mineral content, alkali content at the time of gasification etc.

B. Prof. Yuan (Tsinghua University, China; Utilization of lignite resources in China): There are 130 billion tons of lignite in Inner Mongolia. Problem of slacking occurs during its combustion and FBC boiler technology is being mainly developed. Further, we are aiming at conducting research on the chemical usage of gasification and liquefaction throughout China, and reformed briquettes are being launched.

C. Prof. Bhattacharya (Monash University, Australia; Development of ALDP (Advanced Lignite Demonstration) Program): Gasification similar to China is being planned in Australia as well, but there is a demand to expedite the development by paying attention to LCA or environmental characteristics. Ability to develop value added coal based on characteristics of lignite that appear when it is finely crushed, behavior of ultra-fine particle (0.045mm), especially flammability, ash adherence, comparative grindability etc., are the requirements of lignite market.

D. Mr. Zygarlicke (EERC, USA; Potential of IGCC outside power sector): Low-grade coal in US is an effective and low cost energy resource, and it is in a position to compensate for renewable energy on a short- to mid-term basis. Futuregen TM program and EOR, for which over 300 million USD have been spent, are different from the original development of low-grade coal and these are political measures aimed at developing lignite of Victoria in Australia as the next generation energy. Since issues specific to the region such as amount of moisture content etc., affect large-scale demonstrations, it is required to consider the limitations as well.

E. Prof. Scheffknecht (University of Stuttgart, Application of high-tech technology in accordance with the energy policy of EU): Going forward, it is unlikely that IGCC would be commercially adopted in Europe from the cost perspective. However, its premise is that the cost of natural gas is 150Euro/t, but it cannot be directly applied as done in case of Australia and China, and there is a need to re-examine its cost analysis. In general, OECD countries other than Germany and Australia are not keen on developing technologies for using low-grade coal, and its application would be in developing countries such as China. Although co-combustion with biomass is possible, we would continue to develop this technology since it also has the advantage of using coal.

F. Mr. Tanosaki (JCOAL, Status of utilization of low-grade coal
in Japan: Although Japan does not have lignite reserves worth mining, it is aiming at international cooperation with coal producing countries by integrating industry, academia and government from upstream to downstream. Japanese technologies such as JCF®, Tigar®, UBC®, Hydrogen supply chain etc., which are being deployed in coal producing countries, were introduced and it was stated that the Pacific Rim countries are important target countries for Japan.

(2) While the CCT was being treated as the topic of this conference, 3 sessions of speeches related to CCS were also arranged, and CO₂ fixation technology using high-performance carbonic anhydrase 1T1 etc. were also introduced. The speech by Prof. Drucke (The University of Newcastle, Australia, Development of Callide System) was noteworthy. In the “Callide Oxyfuel Project”, which is a joint public-private project of Japan and Australia, the demonstration operation of oxygen combustion was successfully completed in the oxygen combustion and integrated CO₂ capture process towards the end of February 2015. It was stated that, going forward, based on the expertise related to engineering and commercialization that was gained in the trial demonstration, review of practical application towards the realization of power generation with near-zero emission of CO₂ and other air pollutants such as SOx, NOx and Mercury in the coal-fired power plant is being considered.

Further, it was stated in the speech by Prof. White (US NETL, New combustion program of DOE) that NETL along with Linde LLC has started pilot test of technology to capture coal-derived CO₂ at low cost in the National Carbon Capture Center (NCCC) at Wilsonville, Alabama. It was said that, with the success of this test, the goal of US DOE to capture more than 90% of CO₂ of above 95% purity and make the cost for treating around 1 ton of the captured CO₂ to 40 USD was coming closer.

The chemical looping, which referred to a series of gas processing that was originally used for CO₂ fixation, has now been expanded to concepts such as flue gas treatment of general combustion, especially desulfurization by lime-gypsum method, and similar to the fluidized bed medium, it emphasized on the need to re-capture the reactions in terms of Ca and Mg.

(3) Many other CCT related speeches were delivered and lively discussions were carried out. However, proposals from Dr. Osborne’s Beneficiation Department were very interesting. In the proposals for analysis of "cost" related details, it was suggested that the comparison should be done based on the actual direct cost of the technology alone, as the indirect costs such as storage, transportation, labor costs etc. are being included in the normal cost, and re-evaluation of the coal usage technology should be done according to LCI method. Japan’s liquefaction project is being introduced as a good example of "necessity is the mother of invention", and it is considered to be a useful method for the presentation of future cost estimates.

4. Study tour of power station
On 5th June, a study tour was conducted to Polk Power Station, which is an IGCC facility. The schedule was to depart from the hotel at the venue before 7am, reach the plant by 9:30am, stay for one and half hour and disperse after arriving at Tampa airport after 1pm. The site had remains of phosphate rock quarry and there was a small wharf and service line of freight car from the olden days. Based on those transportation facilities and geological survey results, the current facility operations and environmental conservation is being carried out. The entire power that is generated is collected by Tampa Electric and distributed in the region.

Furnace no. 1, whose commercial operation started in the year 1998, is of 260MW which uses bituminous coal and coke, whereas the total output of furnace number 2 to 5 that use natural gas is 824MW, and slurry feed of oxide atmosphere and sulfur part are being captured as sulfuric acid. Slag is collected from the submerged hearth and is being effectively used locally as a sandblast material. Since there is no waste emitted from the system, it is named as zero-emission. Continuous commercial operation was carried out for 77 days (1,680 hours) and the rate of operation for the past few years is more than 60%. Out of the total operating expense of 303.28 million USD, 49% support is being received from DOE. Further, it was explained that starting with the MDEA method for CO₂ capture, the zero emission data of gas composition or overall water processing was being stored by obtaining CCT subsidy of 1.4 million USD from DOE.

5. Conclusion
It was a conference which gathered coal experts from
countries all over the world, and it provided an opportunity to hear about the latest trends in coal research. Under the circumstances in which coal usage is being opposed, signs of making steady preparations for countermeasures such as CO₂ fixation and biomass utilization could be perceived. There is no versatility in the development of technology for locally produced and consumed low-grade coal, and we felt that it is Japan’s duty to understand the characteristics of low-grade coal of various locations and it would become increasingly important in the future.
Report on WCA (World Coal Association) workshop and general meeting

Michiaki Harada, Research Development Department

Workshop organized by WCA and the general meeting, which was held on 1st and 2nd June 2015, is reported here.

1. Workshop organized by WCA (1st June 2015, Institute of Directors)

(1) 1st June, morning session: Topic - “Technology Demonstration for Cleaner Coal”
Keynote speech and four general speeches were delivered on the topic of “Technology Demonstration for Cleaner Coal”, and CCS technology of manufacturer and CCS demonstration project were introduced along with the presentation of an example of commercialization of CCS of Boundary Dam 3. Further, since it is considered that around 20 to 30% of CO₂ can be reduced by promoting higher efficiency and low carbonization in the coal-fired thermal power plants in Asia including China and India by WCA, efforts are being made to propagate the PACE (Platform for Accelerating Coal Efficiency) concept proposed by WCA.

(2) 1st June, afternoon session: Panel discussion - “Creation of New Policies to Promote the Deployment of CCT”
Considering the fact that energy demand in Asia including China and India is expected to increase in the future and coal is necessary in the process of growth of the developing countries, and in order to realize the future low-carbon societies, a focused discussion was carried out about the measures to be taken for the deployment of CCS. As a result, it is necessary to first implement the demonstration projects with public funds based on the policies. In the second stage, it is necessary to achieve the cost reduction through technology development and carry out the technology transfer. In particular, deployment in China and India etc., is the key. It was concluded that projects such as White Rose of UK are required to be implemented all over the world, and it is necessary to achieve cost reduction and carry out transfer of technology to developing countries to encourage further adoption of technology. Further, the moderator concluded by stating that the stable supply of energy at low cost is the first priority and therefore coal is essential, and it is necessary to make it a competitive resource even with the implementation of CCS.

2. WCA conference (2nd June, Institute of Directors)

(1) CEO candidate Mr. Benjamin Sporton was formally appointed as CEO in the general meeting.

(2) Presidential candidate Mr. Mick Buffier was formally appointed as the president. Their term of office is for a period of 2 years. Presently, Coal India is being invited to become a member.

(3) Regarding PACE Concept
• Coal is essential to ensure energy security
• For CCS, the most cost-efficient option is required
• Economic Story related to power station is required by PACE
• Implementation of CCS in developing countries is difficult
• It is essential to publish the cost information required for the realization of CCS
• Discussion for placing CCS in COP21 (in collaboration with GCCSI)

(4) Media relations
• Implementation of campaign for COP21
• Publicity of Boundary Dam 3
• Renovation of WCA website (it would include the following contents)
i) Discontinuing the publication of photographs of machines which seem to be dirty
ii) Presenting the information that many people are getting benefited by usage of coal
iii) Presenting the information that we are aiming at realization of zero-emission and countermeasures for climate change
iv) Including the phrase of “Future well (realization of a prosperous future) with coal”

(5) Next general meetings
• 17th and 18th November 2015, Belgium
• 30th November 2015, Paris, COP21 Climate Negotiations
• Subsequent meeting either in May or June 2016, China
(6) Other

- Introduction of companies which have become new members

The following two companies have become new members.
- Banpu Public Company Limited (Thailand)
- Aurizon (Australia)

In the lead-up to COP21, WCA is assuming that CO₂ can be reduced up to 20 to 30% if promotion of HELE (High Efficiency Low Emissions) is accelerated by presenting the PACE (Platform for Accelerating Coal Efficiency) concept to the outside world. However, as pointed out even by the members in the general assembly, since the way it would be actually done (capital investment) was not indicated, its concrete measures, for example, provision of capital funds by developed countries for improving the efficiency etc., are required.

Panel discussion
JCOAL has signed MOU with IEA/GHG and as I have attended the Executive Committee Meeting (convened twice a year) of IEA/GHG held in May, I would report its summary along with the details of the ADEME sponsored International CCUS Symposium which was held at the same time.

1. **47th IEA GHG Executive Committee Meeting**
   ExCo meeting was held for a duration of 2 days on 6th and 7th May 2015 and its outcome was as given below.

   **(1) International conference sponsored by IEA GHG**
   - It is planned to hold Post Combustion Conference in Regina, Canada from 8th to 10th September 2015. US DOE and JCOAL would support as sponsors and would also support the contents and management of the conference.
   - GHGT-13 would be held from 14th to 18th November 2016 in Lausanne, Switzerland.

2. **Regarding the rapid progress of CO₂ capture technology**
   It was stated in the review related to CO₂ capture and storage technology that, although the next-generation technologies and road map have been presented, commercial operations have started in Boundary Dam, and it is important to clearly indicate the requirements in order to make progress with cost reduction or improvement of efficiency etc. and to clearly explain about the next generation technologies. It is the same for the oxygen combustion technology.

3. **COP21**
   IEA and IEA/GHG have planned to present the CCS Initiative at COP21.

4. **In the future research plans, survey/research will be conducted on the following topics:**
   - Leakage into Over burden
   - CCS and the Carbon Bubble (Effect of CCS on the production of oil and natural gas)
   - CO₂ Storage Efficiency-Stage 2
   - Comparison of Accounting Protocols for CCS

5. **Membership related**
   - Withdrawal of membership of Schlumberger Carbon Services, CEZ, Repsol and Vattenfall
   - Masder (UAE) has become a member

2. **Observation of International CCUS Symposium and pilot project**
   (1) **International CCUS Symposium (5th May 2015)**
   The symposium was sponsored by ADEME, France (ADEME is the abbreviation of The French Environment and Energy Management Agency, and it is an organization affiliated to the Ministry for Ecology, Sustainable Development and Energy and Ministry for Education, Higher Education and Research). After the welcome address from mayor of Le Havre city and Director General of ADEME, the keynote speeches on CCS roadmap of IEA, production of chemicals using CO₂, CCS activities in Europe, actions of CCUS by ADEME etc. were presented by IEA GHG, Club CO₂, and ADEME. Subsequently, the research presentations in the field of CO₂ sequestering were carried out by the universities and research institutes. The focus of research presentations was on the research and development carried out by the universities related to the methods of monitoring sequestered CO₂, CO₂ sequestering capacity of France, and CO₂ utilization. Including the pilot project given below, ADEME has allocated budget for the research and development related to CCS in France.

   (2) **Observation of pilot project (4th May 2015)**
   (1) **CO₂ capture and storage technology pilot plant**
   In the production of Hydrogen from steam reforming of natural gas, the Hydrogen produced was being separated by the PSA method until now. However, by substantiating that it is possible to capture more Hydrogen with the precise separation of off-gas using a new method called as CRYOCAP H2, and CO₂ of high purity can be captured, Air Liquide company is demonstrating the usage of membrane separation method in a large-scale plant with CRYOCAP H2 method which is the combination of membrane separation and Cryogenics. The cost would be reduced by 30 to 40% when compared to the conventional amine method.

   (2) **CO₂ capture and storage pilot plant**
   EDF is France’s largest power company and by diverting the exhaust gases from the 600MW unit of its only coal-fired thermal power plant, the pilot plant trial (25t/d) of capture and storage of CO₂ based on amine absorption method was carried out from the year 2013 to 2014. Equipment used was the Advanced Amines Process (AAP) made by Alstom, and it was reported that the rate of collection was 90%, energy
consumption was 2.3-2.4 GJ/t CO₂ and the leakage of amine was lower than 2 ppm.

CO₂ capture and storage pilot plant based on amine absorption
2015 APEC Expert Workshop on Innovative Systematic Approaches to Enhancing Coal-Fired Power Generation Efficiency Conference, Participation Report

Keiji Makino, Strategic Information, Planning & Communication Department

As part of the projects of Expert Group on Clean Fossil Energy (EGCFE) under the APEC ENERGY Working Group, an Expert Workshop to improve the efficiency of coal-fired power plant commissioned by China was held in Shanghai. Based on the confirmation from METI, our organization delivered a speech and presented the information on the Present and Future of the Clean Coal Technology (CCT) in Japan. Information about the CCT in China was also collected at the same time. It is reported below.

1. Date and venue
26th and 27th March 2015, Shanghai International Convention Center

2. Topic of the workshop “Enhancing the efficiency of coal-fired power generation”
The participants presented the current status of coal-fired power generation, future methods and status of initiatives for improving the efficiency from their respective standpoints. However, majority of the presentations were done by China, which is the largest producer and user of coal.

3. Main participants
The main participants as given below are the persons who play a major role in the coal-fired power generation industry of APEC and China. There were 300 participants in total from announcement of the organizers.

- APEC Mr. Scott M. Smouse (EGCF Chairman)
- IEA Dr. Andrew Minchener (General Manager)
- WCA Mr. Benjamin Sporton (Chief Executive)
- EPRI Dr. Jeffrey N. Phillips (Senior Program Manager)
- Siemens Dr. Rainer Quinkertz (Product Manager)
- Keiji Makino, JCOAL
- China Energy Research Society Mr. Chai Songyue (President)
- State Intellectual Property Office Mr. Zhang Maoyu (Deputy Commissioner)
- China Coal-fired Power in China Electricity Council
- Mr. Wang Zhi Xuan (Secretary General)
- China Resources Power Holdings Co. Ltd. Ms. Zhou Jun Qing (Chairperson)
- Tsinghua University Prof. Ni Weidou (Academician)
- Shanghai Waigaoqiao Power Generation Co. Mr. Feng Weizhong (General Manager)
- Opening address by Chairman Scott Smouse

4. Speech by JCOAL
The speech was titled as “Present Status of Clean Coal Technology of Japan”. In the first half, status of Japan’s energy after the Great East Japan Earthquake and trend of coal was explained and the new energy master plan that was developed by the Japanese government after the earthquake was explained. In the second half, technological development for the clean utilization of coal in Japan, usage of the high-efficiency power generation equipment that is being deployed in power stations etc., were mentioned and the speech was concluded by stating that Japan’s coal-fired thermal power generation is continuing to operate with the highest efficiency in the world and we are committed to contribute to the widespread use of clean coal-fired power generation in the world with this advanced technology.

Q&A session was not set in particular in order to proceed with the conference.

5. Interesting presentations
5.1 Speech by Mr. Wang Zhi Xuan, Secretary General of China Electricity Council
The Thinking of Clean and Highly-efficient Development of
Coal-fired Power in China

Efficiency of China’s newly developed 600MW, 1,000MW sea-water cooled coal-fired thermal power should be more than 43.6% (low calorific value standard, power transmission terminal). Further, the environmental standard values of China’s latest coal-fired power generation have undergone review three times and it has become the world’s most stringent standard with the settings as given below - Particulate matter concentration near gas-fired power less than 10mg/m³, SO₂ less than 35mg/m³, and NOₓ less than 35mg/m³. Further, carbon emission trading is being considered.

Although the total power generated in China in the year 2014 was 1,360GW in which coal-fired thermal power was 916GW and accounted for 67% on the whole, the newly developed coal-fired thermal power is continuing to grow. In this way, the speech provided a comprehensive status of coal-fired thermal power in China.

5.2 Summary of other noted presentations

- Supercritical pressure circulating fluidized bed boiler (CFB) of China

Although many CFBs are being operated in China, development of supercritical pressure CFB has also been completed, and it has already achieved 600MW units which is the largest in the world and is presently operating smoothly. The design concept was developed by Tsinghua University and the actual unit was constructed by Dongfeng boiler. This unit is for Sichuan Baima Power Plant unit no.2.

- Development of A-USC in China

Discussions on enhancement of efficiency have become more popular in China, but the development of A-USC is also being perceived as a major topic in those discussions. According to the speech given by Huang Yicheng, Department Head, National Energy Administration, the target of gross thermal efficiency is set as 56% (low heating value basis) by selecting double reheat system and 700°C as main steam temperature. It was stated that development of material for high temperature is the challenge and it is at the same pace with other countries that are developing A-USC. For the main steam pipe, 25% Nickel steel is being considered as the prospective material, and with the objective of reducing the amount of this expensive material used, as shown in the photograph, a unique idea of installing the high pressure steam turbine in the upper part of the boiler room is being considered.

The design is that the high pressure steam turbine is installed near the main steam outlet header of the boiler in order to make the length of expensive main steam tube shorter. Medium and low pressure steam turbines are installed in the normal position.

H. P. Turbine
(Installed closely to outlet header of final superheater)

M.P. & L.P. Turbines
(Installed in the normal position)

- Up-grading of steam temperature of the existing subcritical pressure units

There is an announcement about up-grading of 300MW subcritical pressure unit whose operation was started in the year 2008. Steam temperature is increased from 540°C/540°C to 570°C/570°C. The steam pressure would be retained as it is, hence it would be subcritical pressure even after up-grading. With this modification, the power generation efficiency would increase by 1.2%. The cost of modification is around 80 to 120 million yuan (equivalent to 1.5 to 2.3 billion yen) and the recovery period of the cost would be in between 5 to 8 years. Additionally, it was explained that there are plans to carry out similar up-grading for 600MW, but in this case the modification cost would be around 200 to 250 million yuan (equivalent to 3.8 to 4.8 billion yen) and the recovery period of the costs would be same as that of the 300MW unit.

- New lignite drying method in the lignite-fired unit

Usually the re-generating type or steam drying methods are used, but as shown in the following diagram, a unique idea of using beater mill for lignite and installing steam separator on the powdered coal line, in which pulverized coal is sent to the burner and the separated steam is returned to water line and used as water for the plant, is being preferred.

Pilot test is being implemented in order to implement this idea in the new 600MW lignite-fired unit, and it was announced that the development has already reached the stage where it can be adopted. It is said that lignite with 40% moisture content was used for this trial, operation for 72hrs has already been carried out and it was possible to carry out drying and combustion operations with 763 tons of lignite. Incidentally, the volume of water obtained in this test was 242.78 tons.
New lignite drying and combustion system under development

6. Visit to the most efficient Unit 7 of Waigaoqiao Phase 3 Power Plant of China
As a technical tour, visit to the most efficient Unit 7 of Waigaoqiao Phase 3 Power Plant, which China is proud of, was arranged and we participated in it.
Output: 1,000MW
Steam temperature: 600°C/600°C
Steam pressure: 25.86MPa (USC)
Planned gross thermal efficiency: 42% (low calorific value base)
This is the unit that has realized the highest efficiency in China by implementing all possible measures, and China takes pride in the fact that it has achieved the highest efficiency in the world as well. Although it has not been mentioned specifically as measures taken for enhancing efficiency, small quantities of loss in the boiler is being reduced in many items by minimizing leakage of air pre-heaters, reducing the power of desulfurization equipment, energy conservation during start/stop, minimizing pressure loss of pipes etc., and on the whole, it has been successful in leading to the significant efficiency improvements. Further, the rate of operation is also high, and the presenter took pride in stating that the various things that were taken care of have proved beneficial.

7. Comments
Apart from the details mentioned here, presentations from China included details about the low NOx coal-fired combustion technology, low NOx burner, in-furnace denitrification technology of boiler, advanced control system of coal-fired thermal power etc.
JCOAL has been working with ASEAN Center for Energy (ACE), which is the central institution of ASEAN that strengthens collaboration within energy sector and promotes energy collaboration on multilateral & bilateral basis, under ASEAN Senior Officials Meeting on Energy (SOME). ASEAN Forum on Coal (AFOC) is a forum established by the ASEAN member states in order to promote inter-regional collaboration in the coal sector. AFOC holds its council meeting annually, to which Japan is invited as observer. JCOAL has been participating in the council meeting every year.

Mr. Shimakura, Director for Coal Policy, Ministry of Economy, Trade and Industry of Japan (METI) participated in the 13th AFOC Council Meeting after his first participation in the 12th meeting in 2014. In his address, he updated the participating ASEAN representatives about the situation of international discussions especially that of OECD, and expressed Japan’s will to continuously work together in close cooperation with ASEAN member states to cope with the situation. He also appreciated the actions that have been initiated by ACE to issue a letter to OECD about the issue of possible restrictions by international/bilateral institutions against coal fired power generation projects.

Excerpts of the presentation by Mr. Christophor Zamora, Manager of APAEC (Acting Executive Director at the meeting):

According to ASEAN, consumption of coal is expected to have a growth of 7.7% by 2030, and particularly, the consumption by coal-fired thermal power plants will account for the major proportion of it. On the other hand, there are challenges such as improving the trend of large-scale energy consumption (reducing energy intensity), reducing emissions, market integration etc., and these challenges need to be addressed. Since the course of action would be clearly explained in the ASEAN Ministers of Energy Meeting (AMEM) in October, we will continue to proceed with the review of various items in that direction. APAEC, the long-term inter-regional energy cooperation plan will be upgraded to be a 10-year plan (2016 to 2025) from the existing 5-year with the theme “Accessibility and Connectivity for All toward Sustainable Development”.

Summary of presentation of Mr. Shimakura, Director for Coal Policy, METI:

Since the past 2 years, a trend of limiting public finance for development of new coal-fired power plants has emerged globally. On its part, the Japanese government has been working together with ASEAN governments to ensure that ASEAN may develop efficient and clean coal-fired power plants that are deemed to be essential for the economic development of ASEAN countries. It is obvious that coal is a valuable resource for supporting the growth of ASEAN countries. The response to climate change, which has been a matter of global concern, is possible through promotion and introduction of high-efficiency coal-fired power generation and relevant technologies. Also, as indicated in the graphs shown, the economic value is adequately ensured when the high-efficiency coal-fired power generation is used on a mid-to long-term basis.

In this connection, all the growing economies including ASEAN are invited to express their views.

His address was welcomed by the participating delegates who expressed their support and willingness to further work together with Japan.

Summary of JCOAL presentation on ASEAN CCT Handbook for Power Plant: The Handbook was completed while obtaining the cooperation of all related companies of Japan and AFOC until last year and was unveiled in the ASEAN Ministers of Energy Meeting (AMEM) in September 2014 and is currently
available for download on the webpages of both ACE and JCOAL. Further, the plan of cooperation with ACE that would be continually strengthened in the future was reported. In response to this, delegates expressed their support in making the 2nd version of the Handbook.

Address by Mr. Shimakura, METI (Next to Mr. Christopher Zamora, ACE who is in the front)

Delegates also acknowledged that ACE is expected to be a hub (knowledge hub/focal point/keeper/center of all data and information) of information and data related to energy and not only related to coal, and that the initiatives related to coal sector would also be enhanced.
The 7th Japan Mongolia Government and Business Sector Joint Committee

Masafumi Uehara, Resources Department

1. Introduction
Details of the 7th Japan Mongolia Government and Business Sector Joint Committee which was convened on 29th June 2015 by METI are reported below.

2. Summary of the conference
Since this conference is conducted alternately in Japan and Mongolia, it was held after a gap of 2 years from the last one (6th conference). Until now, it was being conducted separately under the Public-Private Joint Council as "Mineral Resources Development Public-Private Conference" and "Trade and Investment Public-Private Conference". However, this time, in order to combine the two conferences, it was conducted as a "Joint Session on Trade & Investment and Mineral Resources". It is anticipated that the coal development in Mongolia would progress in the future towards the development of coal mines in the Tavan Tolgoi coalfield in South Gobi region based on consolidation of policies in Mongolia. Exchange of opinions for the future cooperation between Japan and Mongolia including the development of coal resources was carried out in this conference by bringing the public and private sectors of both countries together.

3. Participants
The following persons participated in this conference: Mr. Yosuke Takagi - State Minister of Economy, Trade and Industry, Mr. Kazuyuki Nakane - Parliamentary Vice-Minister for Foreign Affairs, Mr. Yoichi Kobayashi - Chairman of Japan-Mongolia Economic Committee, from the Japanese side, and the Mongolian side led by Mr. Erdenebat - Minister of Industry, Mr. Nyamkhhuu - State Secretary at the Ministry of Industry, Mr. D. Artag - State Secretary at the Ministry of Mining, Mr. Ariunbold - State Secretary at the Ministry of Food and Agriculture, Mr. Delgertsogt - State Secretary of the Ministry of Energy, Mr. S. Khurelbaatar - Ambassador of Mongolia in Japan, and Ms. M. Oyunchimeg - CEO, Mongolian National Chamber of Commerce and Industry. It was an open conference including public and private sector participants. Around 80 persons participated from the Mongolian side representing more than 50 government and private industries, and around 90 persons participated from Japan including METI, Ministry of Foreign Affairs, Japan-Mongolia Economic Committee, JCOAL and other private companies, and a total of 170 persons participated from public and private sectors of both the countries.

4. Details of presentations in the conference
In the sectors related to coal and mineral resources, a speech was given from the Japanese side by Mr. Takaaki Kakudo - Director, Coal Division, Natural Resources and Fuel Department, ANRE on the topic "Coal Policy of Japan", and from the Mongolian side, speeches were given by Mr. D. Artag - State Secretary at the Ministry of Mining, on "Possibilities of Joint Ventures in Coal and Mineral Resources Sector", and Mr. Delgertsogt - State Secretary of the Ministry of Energy on "Energy Policies and Challenges". Mr. Takaaki Kakudo - Director, Coal Division explained about the (1) Energy mix plan of Japan till 2030, (2) Direction of coal policy that was consolidated last year, and (3) Situational changes in the recent coal policies. Mr. D. Artag - State Secretary at the Ministry of Mining, specifically demonstrated the details of, (1) Present state of mineral resources, (2) Policies and laws, and (3) Investment opportunities, along with explaining that, (1) there would not be any differentiation of domestic and foreign enterprises, (2) environment deterioration would be reduce, (3) regional development based on mining industry is the objective etc. with respect to the mining policy of Mongolia after adoption of the policy in 2014.

Photo-1: A snapshot of the conference
Further, after completion of presentations from both the countries in the joint session, Mr. Saito - Secretary General of Japan-Mongolia Economic Committee delivered a presentation entitled "Expectations from Mongolia" on behalf of the private sector, put forth the questions and expectations about the matters related to trade & investment environment and development of coal mines as Japanese companies are keenly interested in these areas, and got the answers to some of the questions from Mongolian side. Further, a separate meeting was held between Mr. Yoichi Miyazawa, Minister of Economy, Trade and Industry and Mr. Erdenebat, Minister of Industry, and the “Memorandum of Cooperation (MOC) for the promotion of industry, trade, and investment between the Ministry of Economy, Trade and Industry, Japan and Ministry of Industry, Mongolia” was signed after the meeting.

5. Conclusion

It was a significant conference to ensure that both countries will continue to work towards building mutually beneficial relationship, and we could also get a lot of valuable information. We hope that this conference would be continued to be held in the future as well.
Japan mission visited Jakarta to discuss Indonesia’s 35GW electricity project

Yasushi Maeda, Business Promotion Department

1. Introduction
The Public-Private Partnership Mission visited the Indonesian capital Jakarta for 2 days from 3rd to 4th June 2015 in an attempt to discuss the possible contribution that Japan could make to the government of Indonesia’s plan of constructing 35GW power generation capacity in 5 years, and the brief of the mission visit is summarized below.

2. Background and purpose of visit
The Government of Indonesia has launched a large-scale power generation plan known as FTP (Crash Program) I and II in order to meet the ever-increasing domestic power demand. Considering the maximum utilization of the coal that is abundantly available in Indonesia, all the power plants planned in FTP are comprised of coal-fired power plants. Although renewable energy such as geothermal energy etc., was added to the FTP II, the share of coal-fired power plants is still as high as 33%. If FTP I and FTP II are put together, the coal-fired power plants account for the major portion of power generation plan. However, it is difficult to say that all the projects in these power plant construction plans are progressing smoothly. The operation of power plant that was planned in FTP I has already been delayed significantly. Therefore, there is a growing sense of concern in the Indonesian government that the serious power shortage would run into the coming future. President Joko Widodo, who assumed the office under such circumstances, has launched a new 35GW electricity project that includes bold institutional and structural reforms to expedite the construction of power plants.

Using its own superior coal-fired power generation technology, Japan could contribute to the clean and stable power supply and to the mitigation of pressing demand in Indonesia. At the same time, if work orders from these projects increase for the Japanese companies, it is expected to contribute significantly to the infrastructure exports program that Japan has been promoting as major economic growth policy. On this background, the purpose of the visit of this public-private partnership mission was to enhance the potential of Japan’s contribution and participation in the 35 GW electricity project through a direct dialogue with the Indonesian government agencies.

3. Members of the mission
The head of this mission was Mr. Toshihiko Fuji , Ministry of Economy, Trade and Industry serving as overall coordinator for International resources and energy strategy, and the mission included participants from 8 private companies. Apart from that, government organizations such as Nippon Export and Investment Insurance (NEXI), Japan Bank for International Cooperation (JIBC), Japan International Cooperation Agency (JICA) and New Energy and Industrial Technology Development Organization (NEDO) also participated in the mission. JCOAL is the secretariat for this mission and 2 persons participated on the day of conference.

4. Places visited
The public-private partnership mission arrived in Jakarta and visited the Directorate General of Electricity, offices of Ministry of Energy and Mineral Resources, State Electricity Company (PLN) and Coordinating Ministry for Economic Affairs. At the Directorate General of Electricity, Director General - Jarman, Director of Electricity Program Supervision - Alihuddin, Deputy Director General - Sujatmiko and Deputy Director of Electricity Program Preparation - Wanhur participated in the meeting and opinions were exchanged regarding the 35GW power plant construction plan. At State Electricity Company (PLN), Mr. Murtazi - Director of Planning & Development Affiliates, and Mr. Made - Head of System Planning Division participated in the meeting and explained the details of 35GW Electricity project construction plan and its current status. Ms. Emy, Deputy Assistant for Electricity at Coordinating Ministry for Economic Affairs, Mr. Bobby, Director General of Asia Economic Cooperation Bureau and Mr. Budi, Deputy Commissioner of Electric Power Policy Planning Division participated in the meeting at the office of Coordinating Ministry for Economic Affairs.

Vigorous exchange of opinions was carried out in this conference covering the pending issues such as land expropriation, maintenance of power network, local contents regulation when constructing power plants etc. Further, separate meetings were conducted between each participant private companies and the Indonesian government, and mutual understanding was deepened about the areas of cooperation specialized by each company and technologies required by Indonesia. A snapshot of the conference with PLN is shown below.
5. Future outlook
Regarding the 35GW electricity project, apart from Japan, not only China and Korea but also many other countries in America and Europe are showing keen interest to participate in the project, and it is expected that the aggressive approach from these countries would become more imminent in the future. In case of Japan, the export business of power generation equipment is often handled by the private companies alone on purely commercial basis. However, China and Korea are aiming to secure project orders by the joint efforts of public and private sectors by using overall low cost advantage including cheap financial package as their key competitive advantage. Under these circumstances, the visit of joint public-private mission in which METI officials accompanied with the Japanese industries, direct dialogue held by them, and the serious attitude of Japanese companies toward the contribution to 35GW electricity project seemed to have impressed the high-level officials of Indonesian government agencies, and the introduction of advanced technologies owned by the respective Japanese companies was made successfully. In the conferences at various places, it has been agreed to continue the ongoing discussions in the future as well, and through the initiatives of public-private partnership scheme, many Japanese companies are expected to secure more orders from 35GW electricity project in Indonesia.
Disclaimer

This is the English translation of the original Japanese version of the quarterly “JCOAL Journal”. While every care has been taken by the experienced team engaged in the translation work, some of the words, sentences or paragraphs contained in any of the articles may not exactly reflect the original meaning due to inherent differences in the two languages.

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