

## **Clean Coal Day in Japan 2009 International Symposium**

# **Expected Multilayered Cooperation between Coal Exporting Countries and Importing Countries**

**7 September 2009  
Tokyo**

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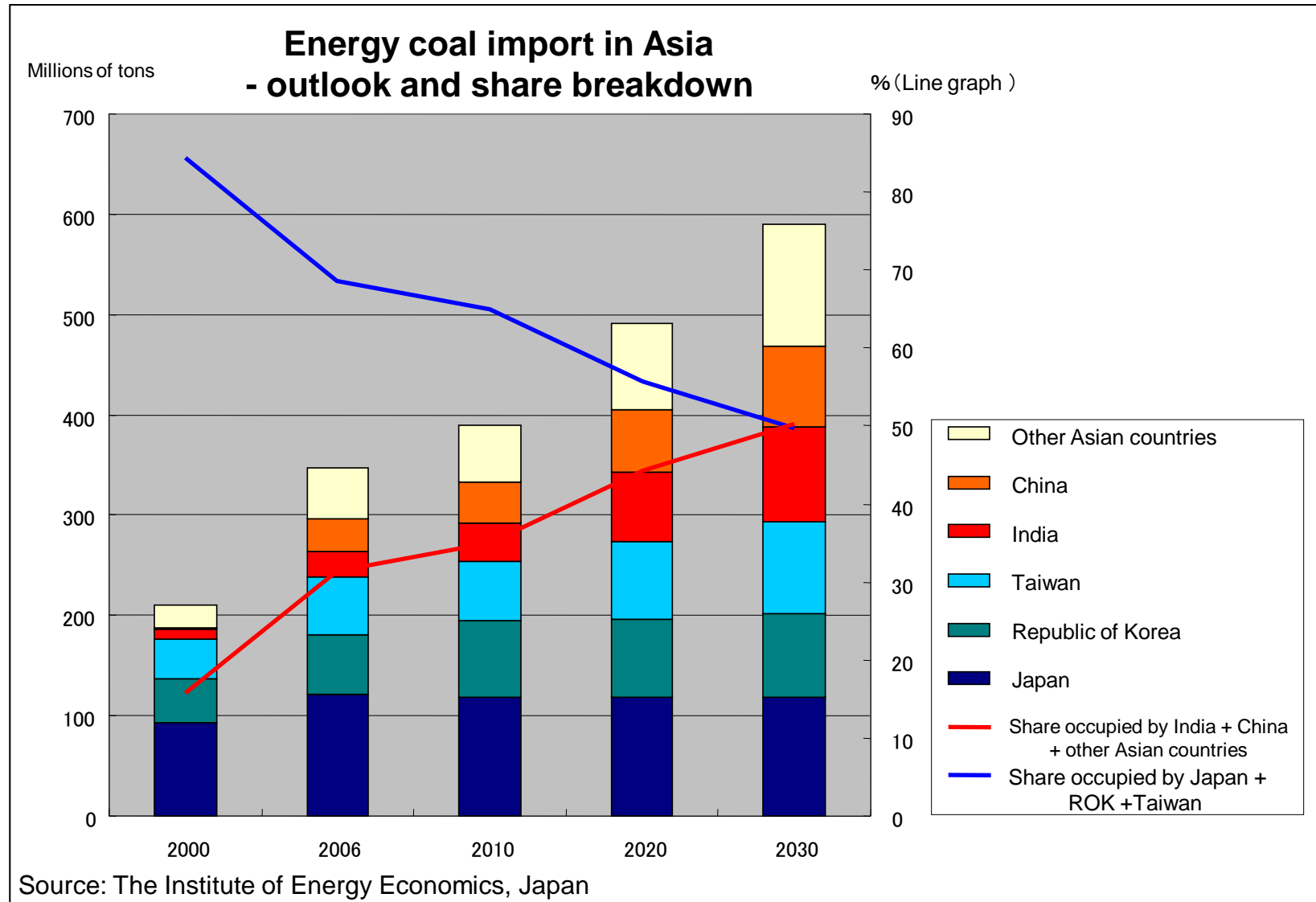
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# 1. Energy coal supply and demand outlook



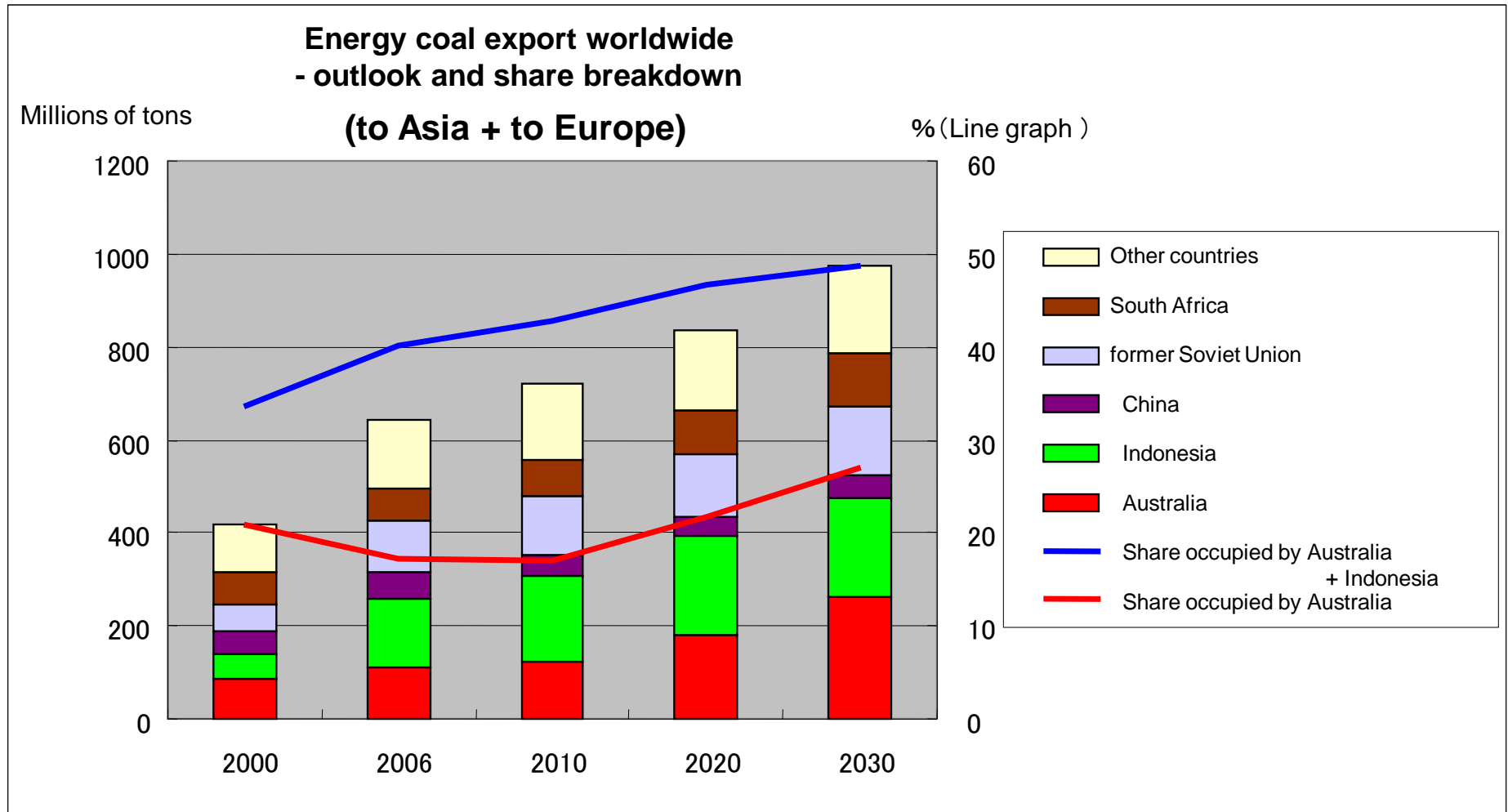
## 1.1 Further increase in demand - growth in China and India



# 1. Energy coal supply and demand outlook



## 1.2 Expectations for expanded supply capacity - focus on Australia and Indonesia



Source: The Institute of Energy Economics, Japan

## 1.3 New supply needs for a new supply-demand phase

(New supply-demand phase )

1. Volume increase in newly emerging demand countries
2. Expected expansion of supply capacity
3. Integration and interlinkage in the global market (Europe & Asia, oil & gas & coal)
4. Increase in price volatility
5. Increased uncertainty surrounding coal-fired power generation (affected by other power sources performance and CO2 issue)

Requirement for higher levels of stability, economy and flexibility in supply

Continued conventional supply schemes

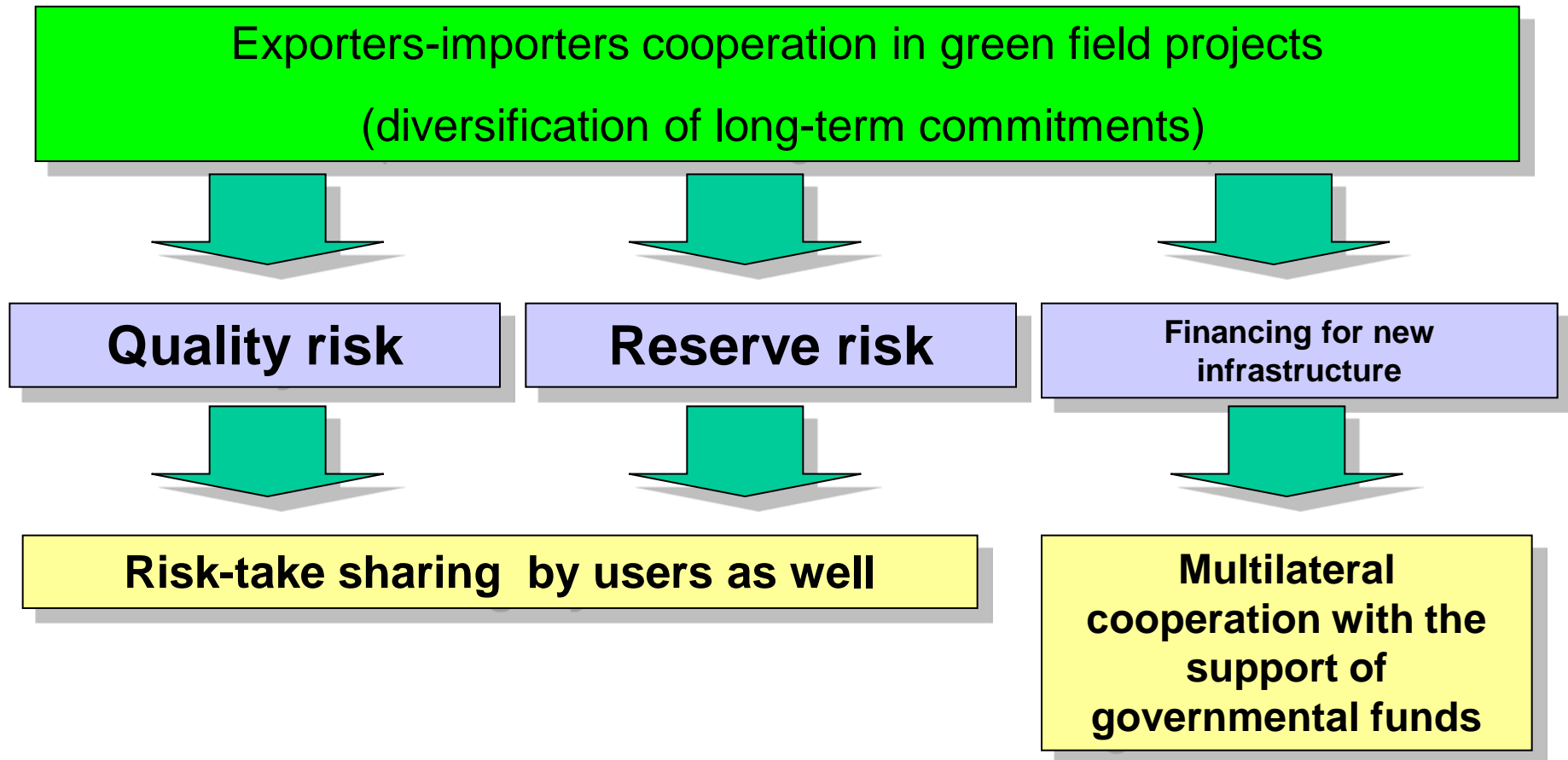
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Orientation toward new supply needs

Exporters-importers cooperation in green field projects

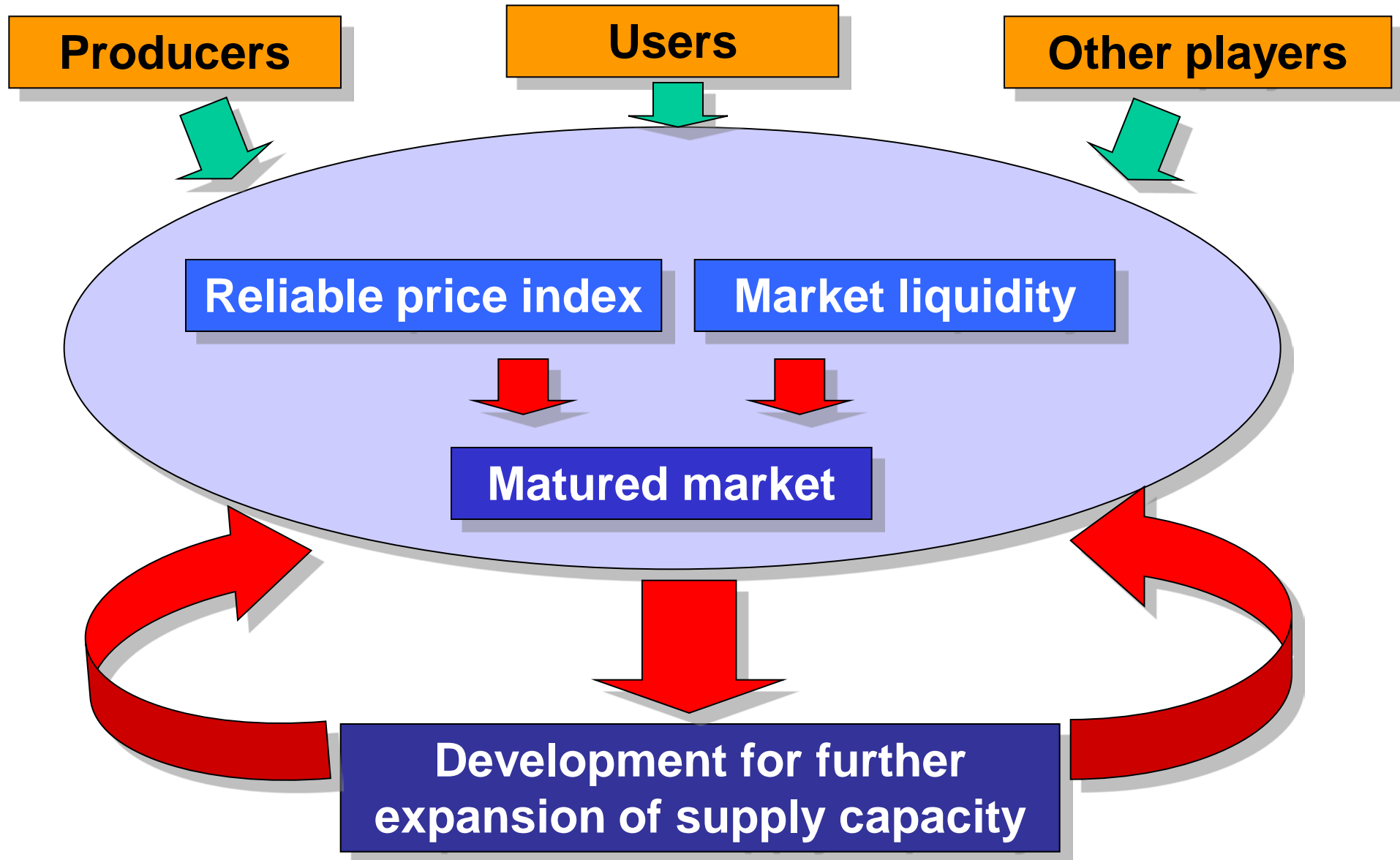
Cooperation in matured market

## 2.1 Exporters-importers cooperation in green field projects



## 2. Cooperation in coal mine development and matured market

### 2.2 Expansion of supply capacity through a matured market



### 3. Cooperation in technology development



### 3. Cooperation in technology development -Two major approaches-

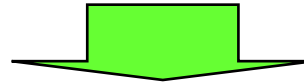
1. Assured supply capacity by promoting expanded use of low-grade coal

2. High-efficiency coal utilization and CCS to control CO<sub>2</sub> emissions

### 3. Cooperation in technology development

#### 3. 1 Assured supply capacity by promoting expanded use of low-grade coal

Concerns about coal supply capacity under the demand growth



Assured supply capacity by promoting expanded use of low-grade coal

#### Exporting countries

- Softening of domestic energy supply-demand structures
- Expansion of margin for export of energy resources
- Increase in the value-added level of energy resources

#### Importing countries

- Contribution to stable supply of energy



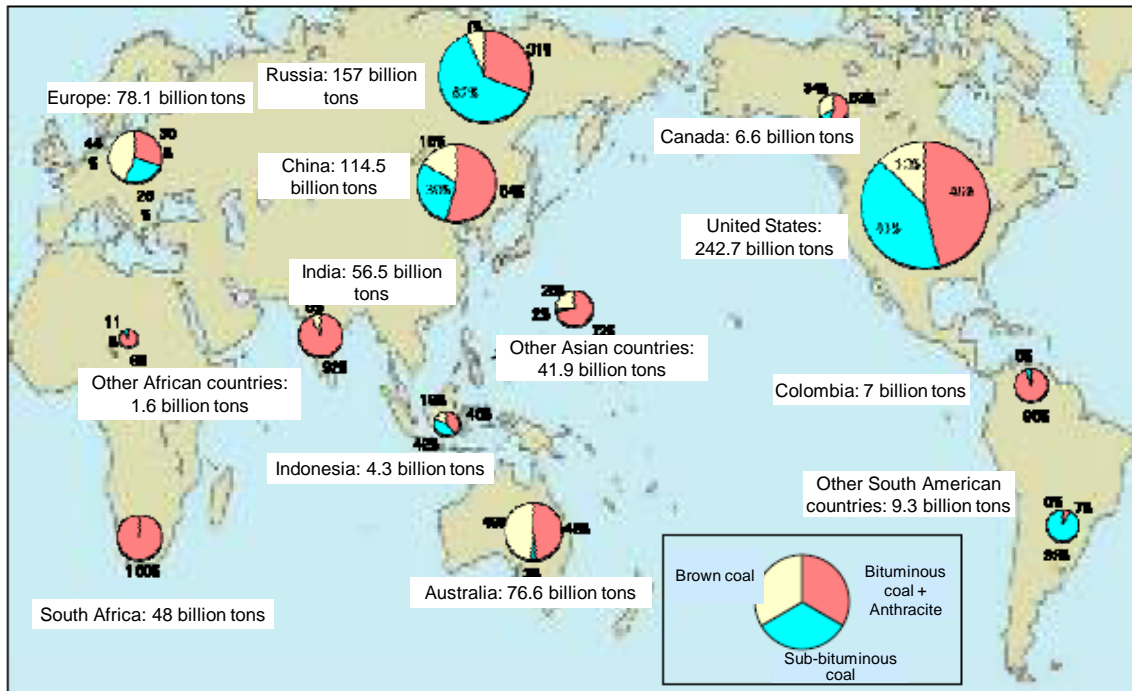
- ◆ Upgrading technology for low-grade coal
- ◆ Coal gasification technology, etc.

### 3. Cooperation in technology development

#### 3. 1. 1 Proven reserves and distribution of each grade

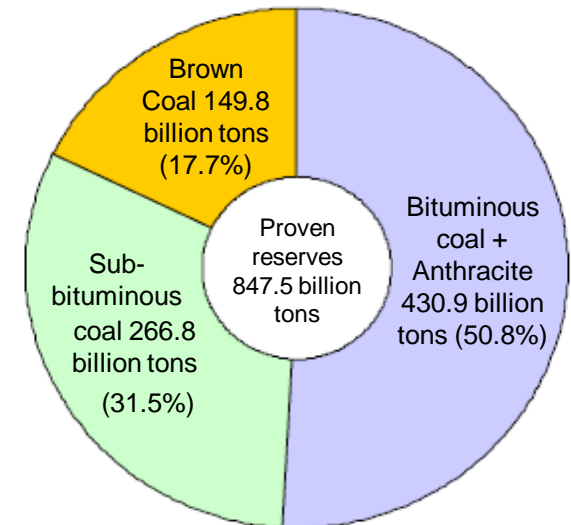
- Proven reserves of low-grade coal (sub-bituminous coal and brown coal) are on a par with those of bituminous coal and account for about half of the total.

Proven reserves of coal by country and grade



Source: WEC, "Survey of Energy Resources 2008", BP Statistics 2008

Proven reserves of coal as of the end of 2005

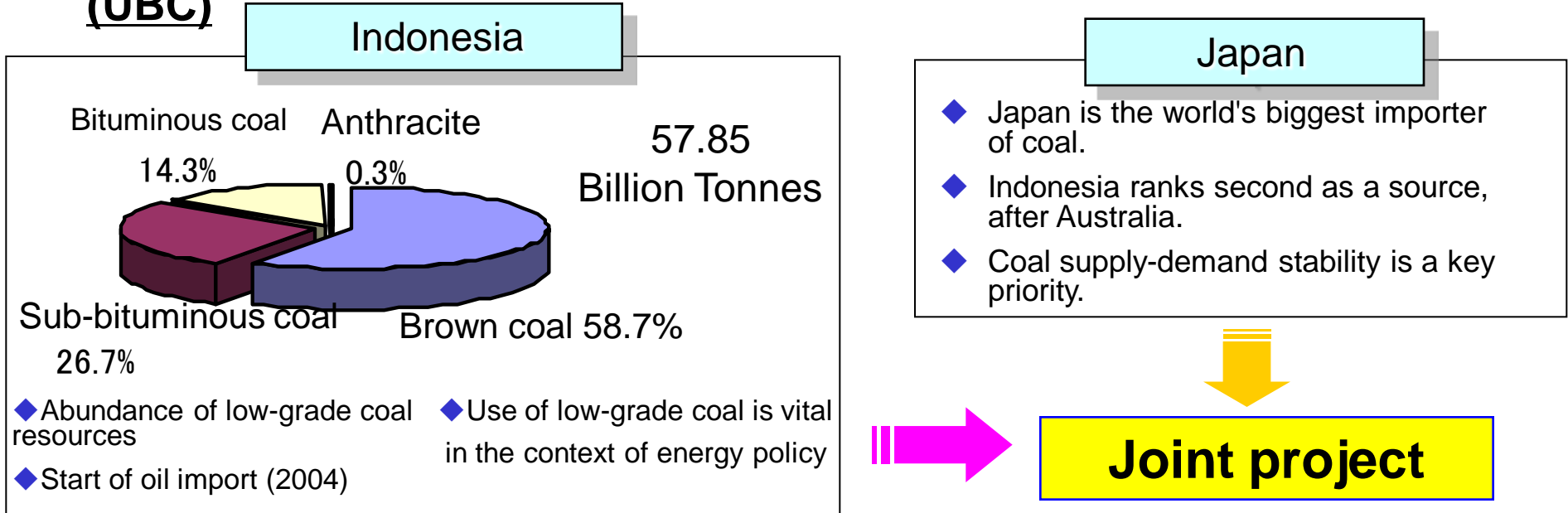


Source: WEC, "Survey of Energy Resources"

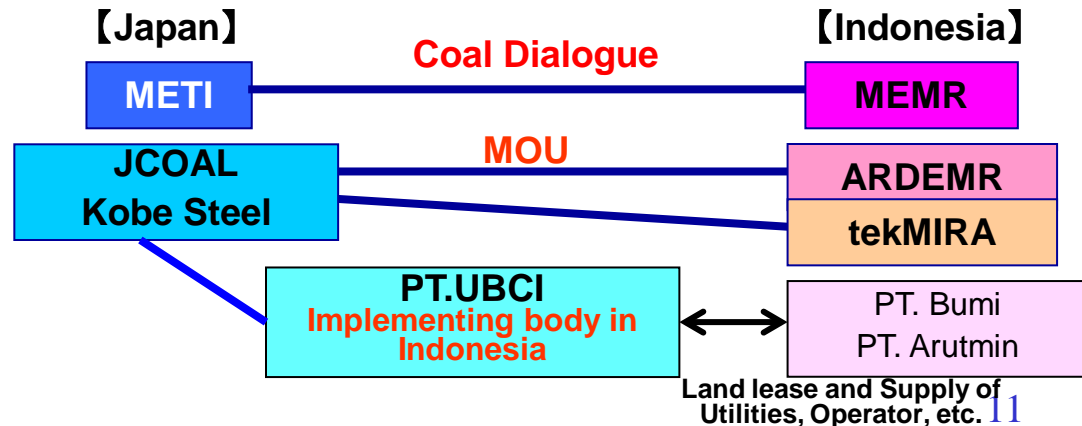
### 3. Cooperation in technology development



#### 3. 1. 2 Case of technical cooperation related to Upgraded Brown Coal (UBC)



600t/d Demonstration plant (South Kalimantan)



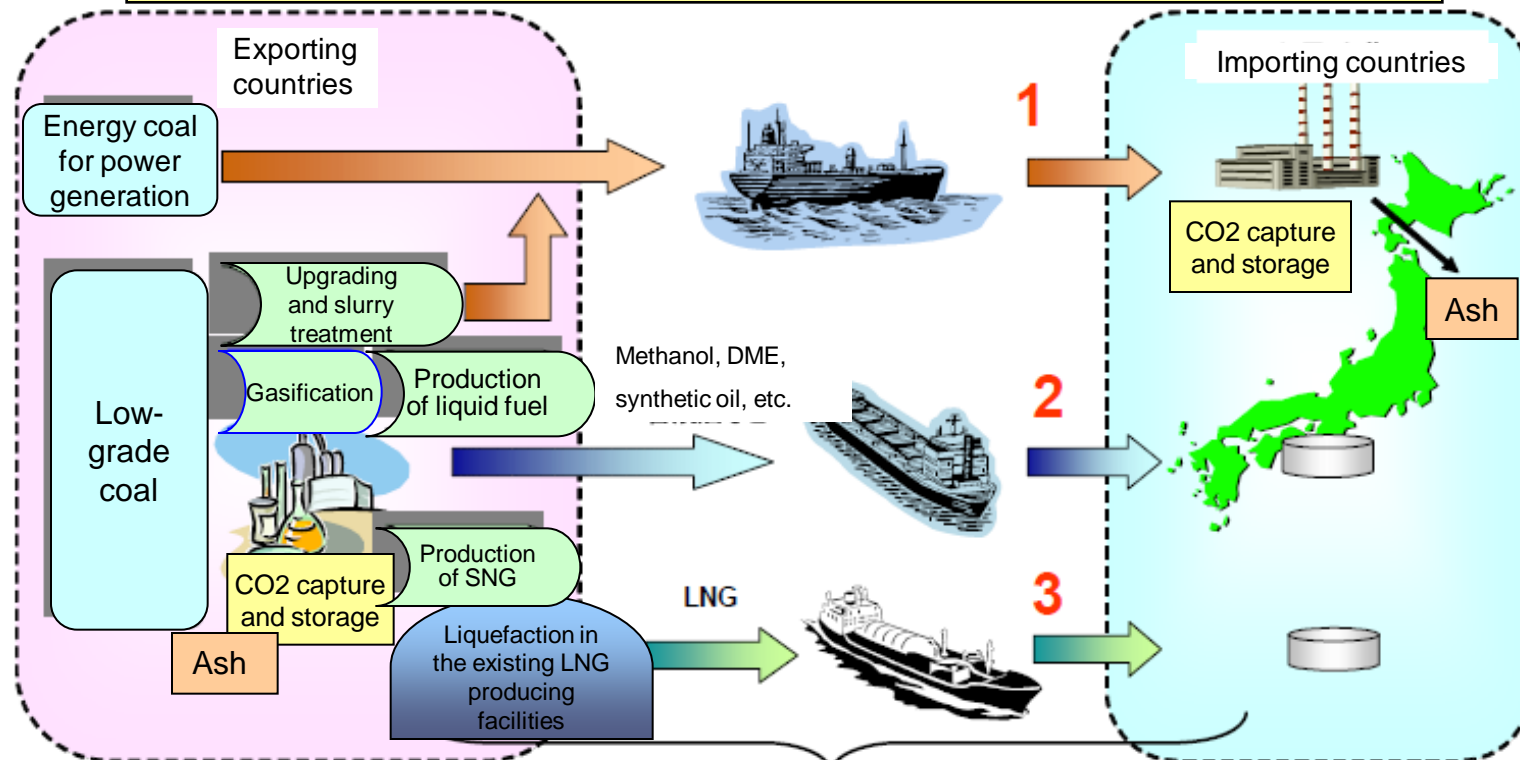
Land lease and Supply of Utilities, Operator, etc. 11

### 3. Cooperation in technology development

#### 3. 1. 3 Production of clean fuel around coal gasification technology

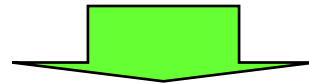
- ◆ Advantages for the coal-exporting countries from energy diversification and increase in value-added levels through effective use of low-grade coal
- ◆ Advantage of increased energy security for coal-importing countries through expansion of the export margin of exporting countries
- ◆ Technical cooperation for exporting countries and achievement of carbon control from a global perspective while taking account of the local characteristics of CCS application

#### Supply of clean fuel from exporting countries to importing countries around coal gasification technology, etc.



## 3. 2 High-efficiency coal utilization and CCS to control CO2 emissions

- Sustainable use of coal requires approaches to the CO2 issue.
- Global approaches are indispensable for CO2 emission control.



- As an initial measure, it will be effective to transfer existing high-efficiency technology in Japan
  - “Clean Coal for the Earth” Initiative -
- Ongoing promotion of further technology development by Japan
  - “CoolGen” Initiative -

## 3. 2. 1 Transfer of existing technology (JCOAL case)

- ✓ With the support of the Japanese government and NEDO, JCOAL is promoting projects of international assistance.
- ✓ J-POWER and other private companies are cooperating with these projects.

### Projects for renovation of coal-fired power generation facilities

- ✓ To contribute to higher efficiency and environmental measures at coal-fired power stations in China, the Japan Bank for International Cooperation (JBIC) and China Electricity Council (CEC) signed a memorandum in April 2007 and began a project for diagnosis and renovation proposals.
- ✓ The Clean Coal For Asia project launched in FY2009 envisions a further expansion of renovation work in China and promotion of renovation work in India and ASEAN countries.

### Implementation of a project related to coal dressing technology

- ✓ In response to needs for coal dressing technology in Japan's possession, a model project for use of high-efficiency coal dressing technology was implemented on the basis of a MOU concluded between NEDO and India (i.e., the Ministries of Finance and of Coal, and Monnet Ispat) in October, 2008.

### Model project for use of coal mine methane (CMM)

- ✓ Implementation of a model project for use of CMM in China

### 3. Cooperation in technology development



### 3. 2. 2 State of development of high-efficiency coal gasification technology in Japan

- Chugoku Electric Power and J-POWER are currently promoting a large-scale demonstration project toward commercial use of oxygen-blown coal gasification technology.
- This demonstration project will pave the way for commercial development inside and outside Japan.

**EAGLE pilot plant**  
150 t of coal per day

**CO2 capture**

#### **Large-scale demonstration project for power generation based on oxygen-blown coal gasification**

Scale: 1,100 t of coal per day (170 MWe)

Site: Osaki Power Station, Chugoku Electric Power Co., Ltd.  
(Osaki Kamijima, Hiroshima Prefecture)

Start of operation: FY2016

Demonstration: -- up-scaled EAGLE pilot plant with an IGCC power generation system  
-- CO2 capture technology

Practical utilization of the IGCC/CO2 capture plant  
(up to 600 MW)

Practical utilization for multipurpose use  
(synthetic fuels, hydrogen, etc.)

Commercial version inside and outside Japan



J-POWER Wakamatsu Research Institute  
(Kita-Kyushu City)



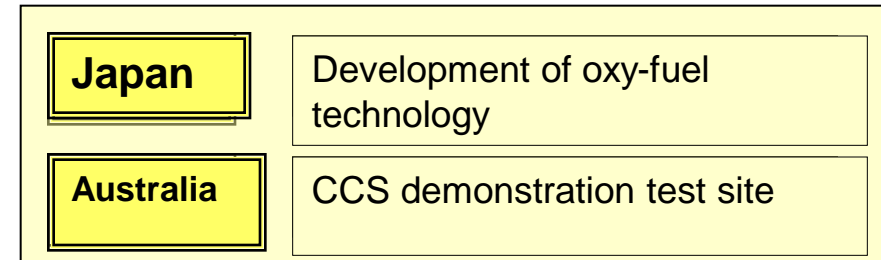
Osaki Power Station, Chugoku Electric Power  
(Hiroshima Prefecture)

### 3. Cooperation in technology development

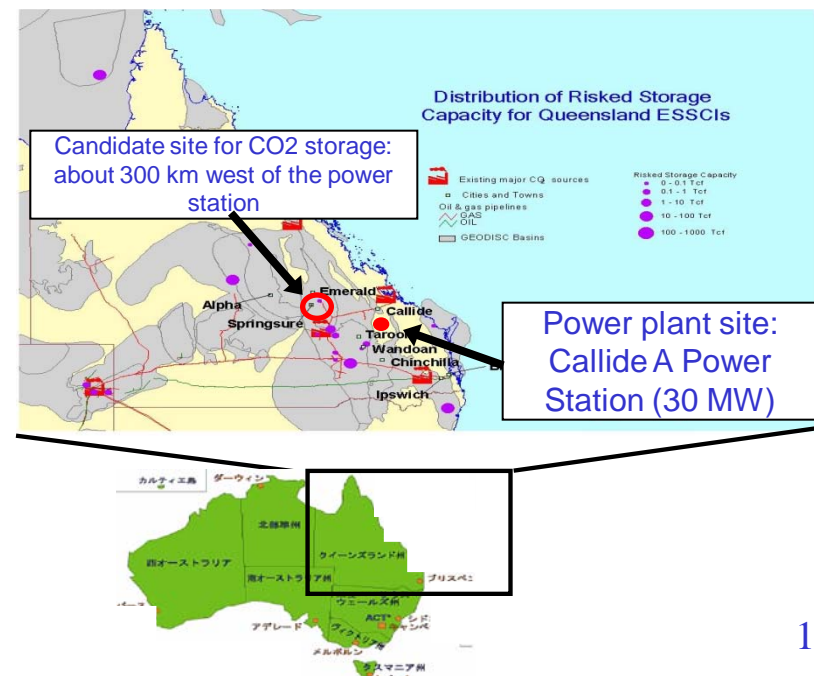
### 3. 2. 3 Case of a CCS international joint demonstration project

#### Demonstration project for oxy-fuel CO2 capture and storage

Objective	CCS demonstration test applying oxy-fuel CO2 capture technology
Demonstration plant	Callide A Power Station (30 MW), CS Energy Ltd. (Australia)
Amount of CO2 capture	Maximum of 75 t/day or 25,000 t/year (about 15% of the total amount)
CO2 storage	Candidate site: depleted gas field about 300 km to the west of the power station
Contractors	CS Energy: operation and maintenance IHI: boiler design and modification Air Liquid: air separation unit and CO2 compression equipment Schlumberger: CO2 storage
Planned schedule	- Detailed design: by the end of 2009 - Boiler modification: 2010 - first half of 2011 - Demonstration test: second half of 2011 - 2014 - Evaluation of test results: 2015 - 2016
Cost burden	- Total: AUD190.9M - Japan: national government, J-POWER, IHI, Mitsui & Co. Ltd. - Australia: commonwealth government, coal association, CS Energy, Schlumberger, Xstrata



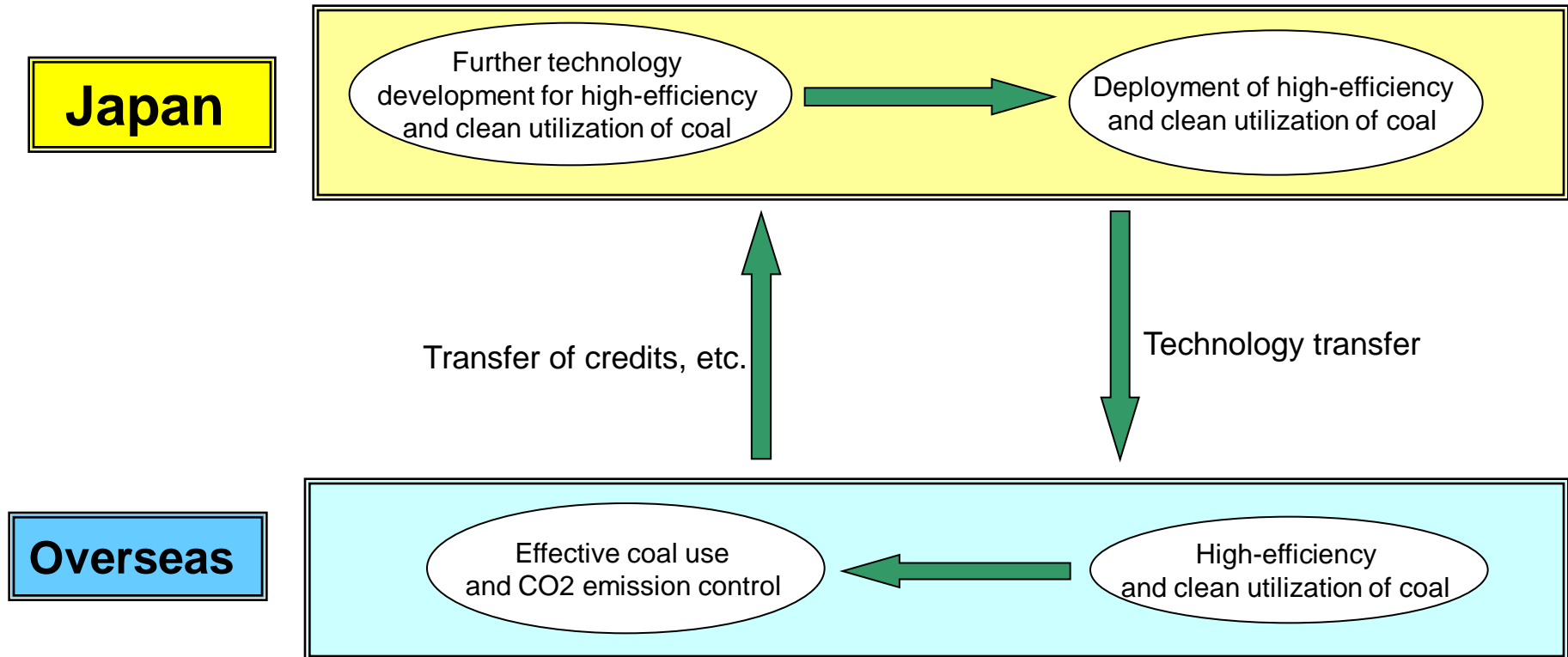
#### Japan-Australia joint CCS demonstration project



### 3. Cooperation in technology development

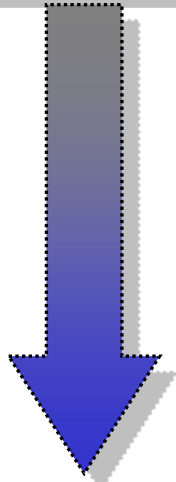


#### 3. 2. 4 Establishment of high-efficiency and clean coal utilization technology development and technology transfer



**The IMSBC\* Code sets forth the master shall ensure that coal is not stowed adjacent to hot areas.** \*International Maritime Solid Bulk Cargoes

- Now, just guideline → on 1 January 2011, become mandatory
- In case fuel storage tank is interpreted as one of “hot areas”, it will heavily impact on coal transportation.



**•DSC\* 13 of International Maritime Organization (September 2008)**

- At the DSC 13, Japan informed its intention that since inappropriate interpretation of “hot areas” might impact stable coal transportation seriously, Japan would submit proposal to clarify “hot area” at the DSC 14 in 2009.

\* Sub-committee on Dangerous Goods, Solid Cargoes, Containers (DSC)

**•Surveys conducted by Japan (from October 2008 to May 2009)**

- Investigation on incidents involving spontaneous coal combustion at holds
- Temperature measurement on the boundaries of cargo holds during coal transportation
- Numerical simulation on spontaneous heating of coal in a cargo hold

Japanese report on interpretation for “hot areas” was submitted to IMO July 2009 and is planned to be under discussion at the 14 DSC to be held 21-25 September 2009, which proposes that;

**“adjacent to hot areas” should be interpreted as “contacting to boundaries having time average of temperature higher than 55°C, such as the boundaries of fuel oil service tanks and fuel oil settling tanks.”**

This interpretation enables all holds to stow coal.

## Conclusion

**- Expected multilayered cooperation between coal exporting countries and importing countries -**

- 1. Cooperation in coal mine development and matured market**
  - **Cooperation between exporting countries and importing countries in green field projects**
  - **Expansion of supply capacity through a matured market**
  
- 2. Cooperation in technology development**
  - **Assured supply capacity by promoting expanded use of low-grade coal (upgrading and gasification)**
  - **High-efficiency coal utilization and CCS technology to control CO<sub>2</sub> emissions**