



# *APP Activity as an Illustrative Case of Sectoral Approach*

*Technical Workshop on Sectoral Approaches:  
Bench Marking, Sector Boundary  
and Monitoring, Reporting & Verification Issues*

*17&18 September 2008*

*CEPS Brussels*

*Ichiro Maeda*

*The Federation of Electric Power Companies of Japan*

# *What is APP?*

---

- ✓ *ASIA-PACIFIC PARTNERSHIP on Clean Development & Climate was initiated by USA*
- ✓ *Partners are; Australia, Canada, China, India, Japan, Korea & USA.*
- ✓ *Address increased energy needs, energy security and climate change in Asia-Pacific region*
- ✓ *Accelerate deployment, transfer & diffusion of Cleaner, more efficient technologies in order to reduce GHGs.*
- ✓ *Is consistent with and contributes to Partners' efforts under UNFCCC while complementing the Kyoto Protocol*

# *Background*

---

*July 2005 Announced at the ASEAN Ministerial Meeting in Vientiane, Laos*

*Jan. 2006 Inaugural ministerial Meeting in Sydney, Australia*  
✓ *Sectoral Approach was discussed as a methodology*

*2006-2007 Policy Implementation Committees were held in Berkeley, USA, Jeju, Korea & Tokyo, Japan.*

- ✓ *Eight task forces were established and their action plans were endorsed, containing nearly 100 individual projects & activities.*
- ✓ *Task forces then began the implementation phase of their work*

# *Background*

---

*Oct. 2007 Ministerial Meeting in New Delhi*

- ✓ *Canada joined as seventh partner*
- ✓ *18 Flagship Projects were recognized.*
  - ex) Management of PFC (perfluorocarbon) Emission,*
  - Management of Bauxite Residue,*
  - Harmonization of test procedures for CFLs (Compact Fluorescent Lamps) and so on.*

# Structure of APP



**Policy and Implementation Committee**  
(USA, Chair)

**Administrative Support Group**  
(USA)

**Power Generation and Transmission Task Force (PGTTF)**

**Aluminum Task Force**  
Chair (Australia)  
Co-Chair (USA)

**Buildings And Appliances Task Force**  
Chair (Korea)  
Co-Chair (USA)

**Cement Task Force**  
Chair (Japan)

**Cleaner Fossil Energy Task Force**  
Chair (Australia)  
Co-Chair (China)

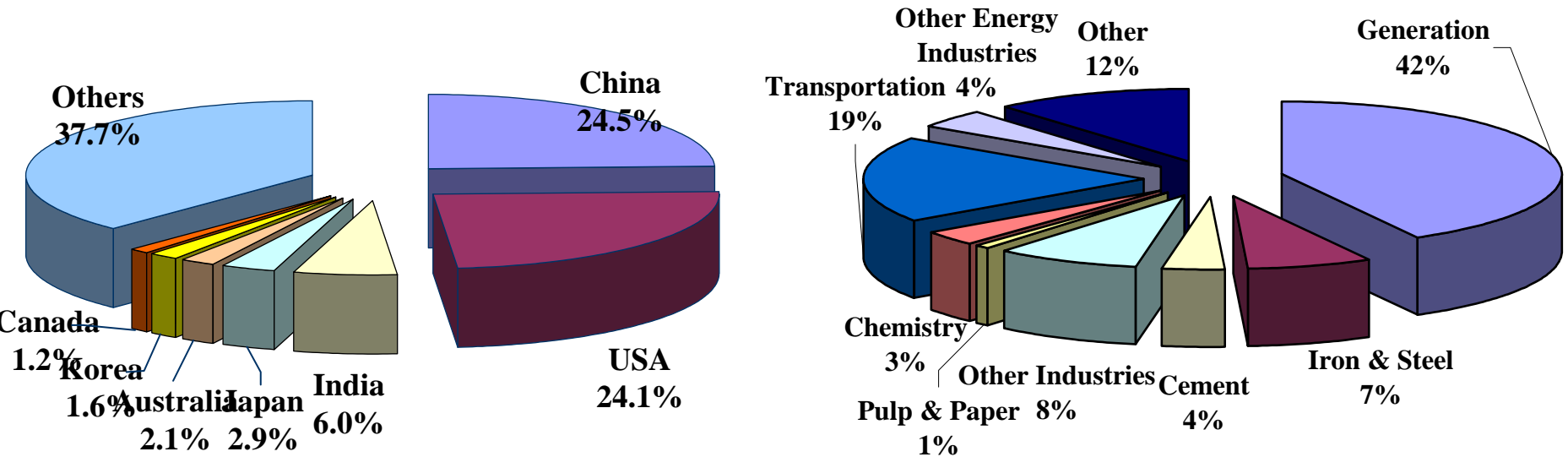
**Coal Mining Task Force**  
Chair (USA)  
Co-Chair (India)

**Power Generation And Transmission Task Force**  
Chair (USA)  
Co-Chair (China)

**Renewable Energy And Distributed Generation Task Force**  
Chair (Korea)  
Co-Chair (Australia)

**Steel Task Force**  
Chair (Japan)  
Co-Chair (India)

# CO2 Emission of APP Countries



*APP countries amount to 60% of the world total*

*Sectors APP activities cover amount to 60% of APP countries*

✓ *APP activities are expected to reduce significant amount of CO2*

# *Action Plans of Power Generation & Transmission Task Force*

## *Best Practices for Power Generation Activity Plan*

- 
- Best Practices for Transmission and Distribution Activity Plan
  - Best Practices for Demand Side Management Activity Plan
  - Energy Regulatory & Market Development Forum
  - Trade Exhibitions/Conferences and Trade Missions
  - Hydroelectric Generation Best Practices
  - Combustion Optimization in Coal Based Power Plants
  - Implementation of Artificial Intelligent Soot Blowing System for Improving the Steam Generator Efficiency by increasing the Effectiveness of Soot Blowers
  - SOx Reduction Technologies in Flue Gas
  - Risk Evaluation and Prioritization (REAP) for Maintenance and Renovation & Modernization (R&M) of Power Plants
  - Life Extension & Remaining Life Assessment of Power Plants
  - Site Visit of Energy Conservation and Environment Protection Technology – Application of Plasma Ignition Technology in Power Generation

**Peer Review**

**Site Visit**

**Workshop**

**Capacity Building**

# Peer Review Activities in Japan

✓ *April 16-19, 2007*

✓ *Takasago Thermal Power Station in Hyogo*  
*250MW × 2*

✓ *Participants;*

- *Two from Australia (Gov., International Power)*
- *Eight from China (CEC, China Datang Corp. etc.)*
- *Eight from India (NTPC, CESC, CII)*
- *10 from Japan (METI, FEPC, EPDC, TEPCO, etc.)*
- *13 from Korea (MCIE, KEPCO etc.)*
- *Six from USA (EEI, AEP, Southern Company, Alliant Energy, Ameren)*

✓ *FEPC, Japan and TEPCO proposed*

*Start of Peer Review to Show How It Works*

✓ *Result*

- *Share the Best Practice of Operation & Maintenance for Aged Coal –Fired Power Plants*
- *Demonstrate Action Plan Project “Best Practices for Power Generation”*
- *Draft Checklist for Efficiency Improvement &*

*a handbook which was named “Green Handbook”*



# *Peer Review Activities of Indian Thermal Power Stations (1)*

✓ *February 6 to 12, 2008*

✓ *Kota Power Station, Rajasthan state*

*110MW × 2, 210MW × 3, 195MW × 1*

*NTPC Dadri Power Station*

*210MW × 4*

✓ *Participanats;*

• *Two from Australia (International Power, Loy Yang Power)*

• *Five from China (Yantai LY Power, etc.)*

• *37 from India (Gov., CEA, NTPC, CESC, etc.)*

• *14 from Japan (FEPC, EPDC, TEPCO, KEPCO, etc.)*

• *10 from Korea (Various Power Companies)*

• *Seven from USA (EEI, AEP, Southern Company, Progress Energy, Ameren)*



# Peer Review Activities of Indian Thermal Power Stations (2)

## ✓ Result

- *Opinion exchange & experience-sharing with regard to data management on maintaining efficiency, Optimizing boiler combustion, reduction of auxiliary power and so on.*
- *Japan offered proposals on operational & facilities improvement for better heat efficiency.*
  - *Decrease auxiliary power for ventilation equipment by reducing economizer vent oxygen density.*
  - *Improve plant efficiency by lowering reheater spray amount & optimizing combustion.*
  - *Decrease auxiliary ventilation equipment by optimizing pulverizer vent temperature*



# *Peer Review Activities of US Coal-based Power Stations (1)*

- ✓ *April 28 to March 2, 2008*
- ✓ *Edgewater Coal-based Power Plant in Sheboygan, WI*  
*60MW ×1, 330MW ×1, 380MW ×1*
- Columbia Coal-based Power Station*  
*in Pardeeville, WI 535MW ×2*
- ✓ *Participants;*

- *One from Canada (Natural Resources Canada)*
- *Two from China (Guodian Technology & Environmental)*
- *Six from India(CEA, DVC, NTPC Ltd.)*
- *22 from Japan(FEPC, EPDC, TEPCO, KEPCO, etc.)*
- *Eight from Korea (Various Power Companies)*
- *42 from USA*  
*(EEI, AEP, Southern*  
*Company, Progress*  
*Energy, Alliant Energy,*  
*StatSoft Power Solutions,*  
*NeuCo, etc)*



Columbia Coal-based Plant



Edgewater Coal-based Plant

# *Peer Review Activities of US Coal-based Power Stations (2)*

## *✓ Result*

- Participants were divided into teams for “Boilers,” “Auxiliary Machines,” and “Turbines.”*
- Opinion exchanges & experience-sharing with regard to the optimization of boiler combustion, increased efficiency of air-preheaters, improvement of steam turbine efficiency, water quality improvement of cooling water for condenser, etc.*
- Tentative calculation of improvement effects of steam turbines was made. It was confirmed that heat efficiency could be increased by 1% to 1.5% at each power plant, Equivalent to a potential of approximately 90,000 ton CO<sub>2</sub> per power plant.*



# Peer Review Activities of Australian Coal-based Power Stations (1)

- ✓ *June, 2008*
- ✓ *Loy Yang Power Station 515MW×2, 560MW×2*
- ✓ *Yallourn Power Station 350MW×2, 375MW×2*
- ✓ *Hazelwood Power Station 200MW×8*
- ✓ *Participants;*

- *20 from Australia (NGF, Loy Yang Power, True energy Yallourn, International Power Australia, etc.)*
- *One from China (CPECC)*
- *Six from India (CESC, NTPC Ltd.)*
- *16 from Japan (FEPC, EPDC, TEPCO, KEPCO, etc.)*
- *Three from Korea (Various Power Companies)*
- *Two from USA (DOE, EEI)*

AUSTRALIA



Loy Yang Power Station  
Yallourn Power Station  
Hazelwood Power Station



Loy Yang Power Station



Yallourn Power Station



Hazelwood Power Station

# *Peer Review Activities of Australian Coal-based Power Stations (2)*

## *✓ Result*

- Participants were divided into teams for “Boilers,” “Turbines,” and “Auxiliary Machines.”*
- Opinion exchanges & experience-sharing with regard to the optimization of boiler combustion, improvement of steam turbine efficiency, increased efficiency of air-preheaters and condenser, etc.*
- Found steam leaks, air leaks into boilers, and coal leaks and confirmed that the condenser vacuum could be maintained or improved by a regular cleaning of the narrow tubes of the condenser to increase heat efficiency by 0.5% on one unit, equivalent to a potential 24,000 ton CO<sub>2</sub> per year.*

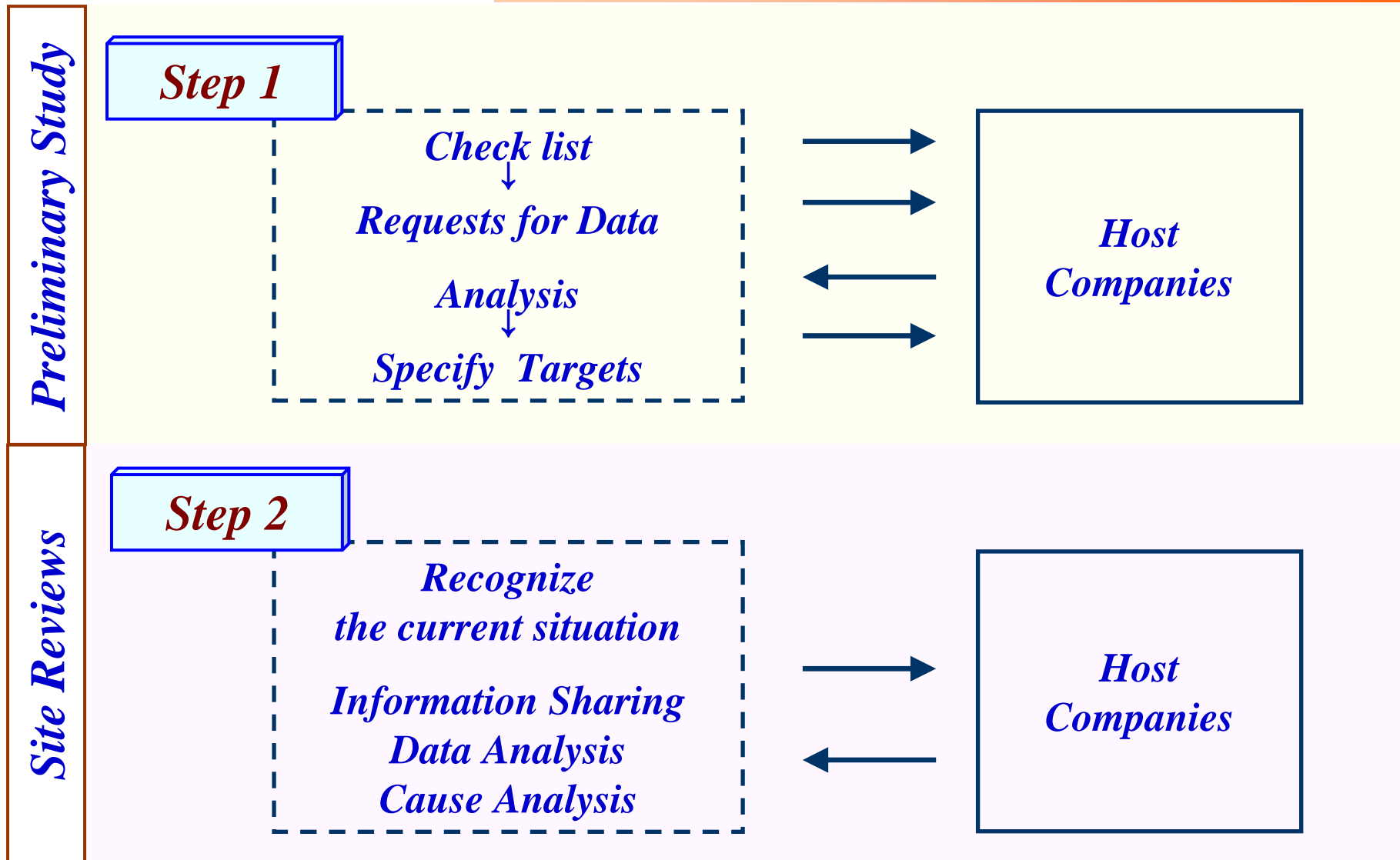


# *Potential Area of Cooperation with IEA*

---

- 1. Dissemination of the achievement of the Peer Review activities*
- 2. IEA-APP PGTTF cooperation on the work on 'Quantification of energy savings/CO2 emission reduction potential (through efficiency gains and/or avoiding efficiency degradation) by O&M improvement for coal power generation'*
- 3. Introduction of advanced high-efficiency coal power technology*

# *Established Peer Review Method*



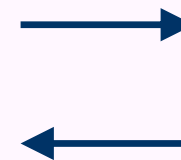
# *Established Peer Review Method*

*Site Reviews (continues)*

## *Step 3*

### *O&M Practice Review*

- *Inspection*  
*Manual / Routine Program /*  
*Major outage scope /*  
*Commissioning*

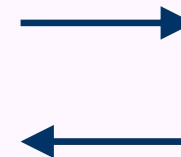


*Host*  
*Companies*

## *Step 4*

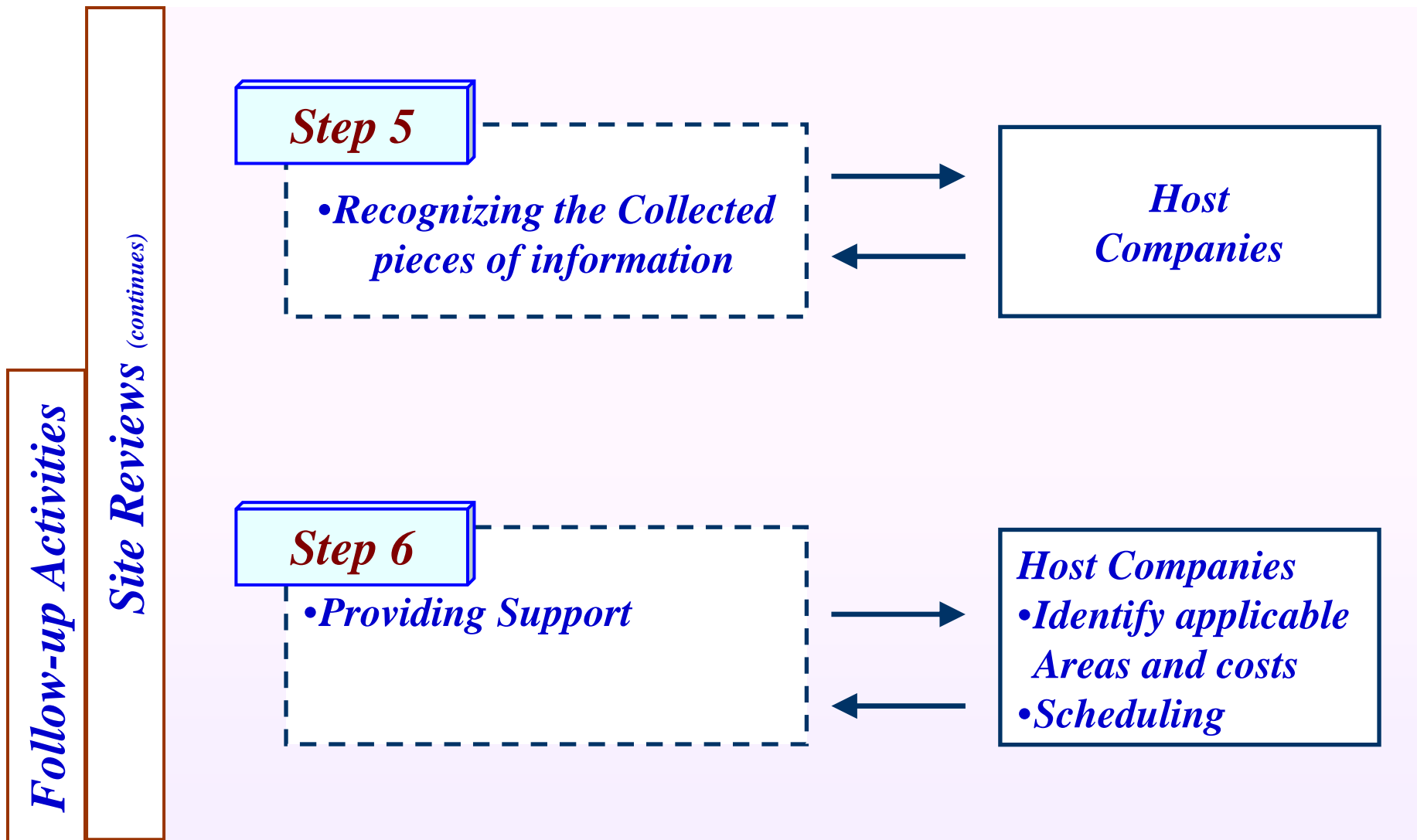
### *O&M Past Activity Review*

- *Findings during operation and*  
*outages*
- *Historical Records*



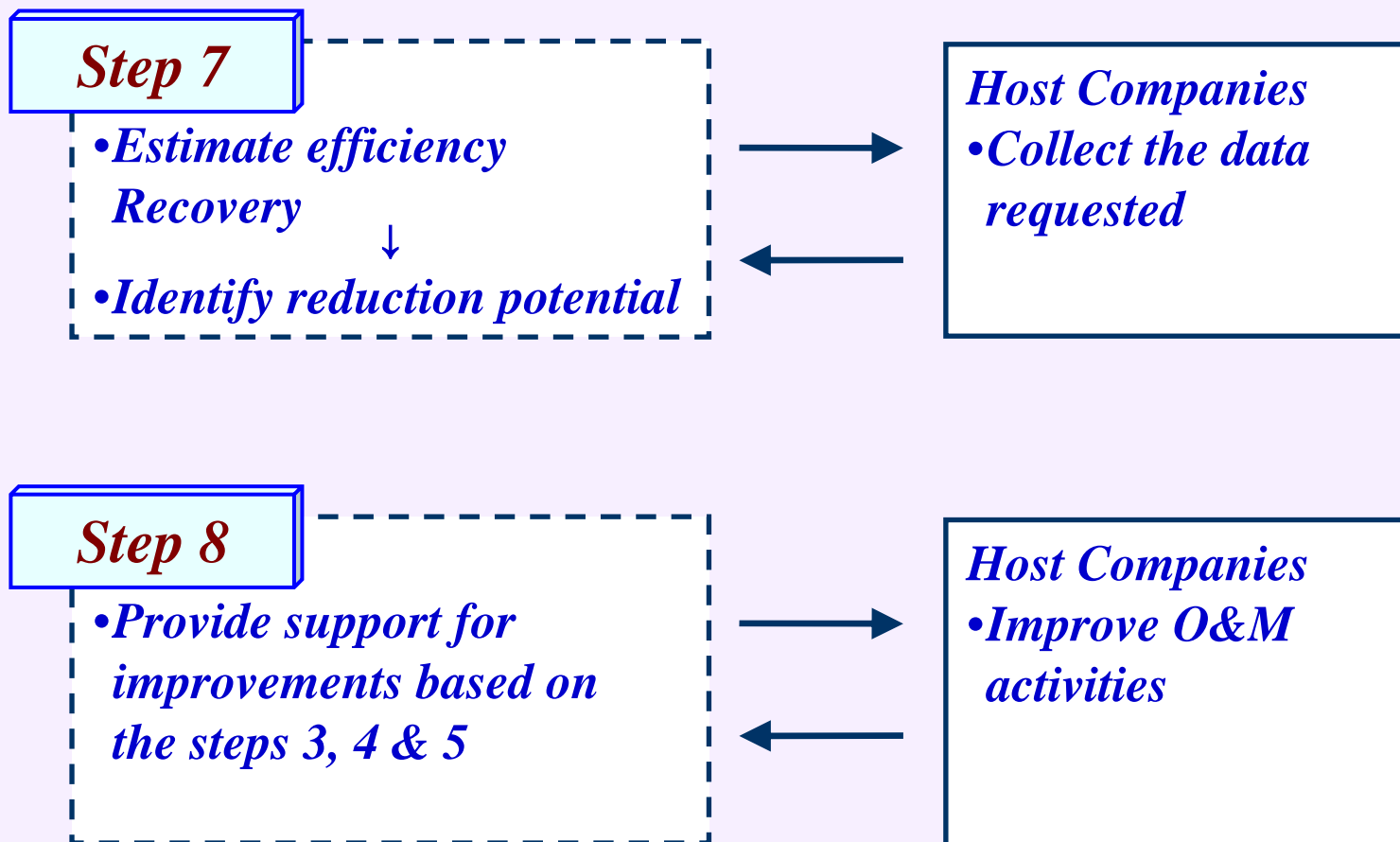
*Host*  
*Companies*

# *Established Peer Review Method*



# *Established Peer Review Method*

## *Follow-up Activities*



# How to use the Tool Kit

## Host country

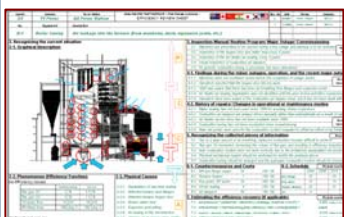
## Peer review team

### Preliminary review (preparation for successful site visit)

- *Collect & provide data*
- *Complete a Checklist*

- *Request data*
- *Analyze the submitted data*
- *Specify targets to be reviewed*

### Site review (visit a power plant in the host country)



- *Invite peer review team*
- *Ensure involvement of managers, engineers...*

- *Review current O&M practices*
- *Share good practices*
- *Develop a Review Sheet*

### Follow-up activities (including application for other sites)

- *Implement recommended measures*
- *Refer to the Green Handbook*

- *Provide recommendations*
- *Estimate efficiency recovery*
- *Support implementation*

# Peer Review Tool Kit

## “Check List & Review Sheets” (1)

- ◆ Developed at the first peer review
- ◆ Invited comments
- ◆ Used in efficiency improvement proposal in India

Boiler

COAL FIRED POWER PLANT EFFICIENCY IMPROVEMENT CHECKLIST (2nd Draft)

Equipment	Description of the physical situation	Effect on the efficiency	Indication by operating figures	Physical Causes (checked boiler No.)	Countermeasures	Procedure improvements to prevent the recurrence	Person	Company	Country
B-1	Boiler Casing	Air breathing into the furnace (from manholes, ducts, expansion joints, etc.)	Boiler efficiency reduction. Boiler auto control malfunction and manual intervention. Loss of combustion balance. Generation of unburnt fuel.	Main steam temperature decline. Increased steam temperature decline. Increasing flue gas CO <sub>2</sub> . Increasing flue gas CO. Increasing DF spray flow.	Opening due to the corrosion. Manhole packing deterioration.	Combustion air damper actuation test. Combustion tuning. Analyzing the negative defects. Operating information is to be recorded and analyzed.	P D D D CA	Taniguchi Electric	Japan

**Efficiency Checklist**

3. Graphical Description

3.1. Inspection Manual/ Routine Programs/ Major Outage/ Commissioning

3.2. Findings during the major outages, operation, and the recent major outage

3.3. History of repairs/ Changes in operational or maintenance modes

3.4. Key messages or the coexistence pieces of information

3.5. Countermeasures and Costs

3.6. Schedule

3.7. Calculation of savings

3.8. Summary of the countermeasures

**Review Sheet**

**APP Peer Review Activities**

The Procedure for Reviewing Efficiency Based on ‘The Efficiency Checklist For The Coal-fired Power Plants’

18th January 2008

The Federation of Electric Power Companies of Japan

◆ One item on the ‘Efficiency Checklist’ corresponds to one ‘Review Sheet’.

# Peer Review Tool Kit

## “Review Sheets” (2)

Country <i>XX</i>	Company <i>YY Power</i>	Power Station <i>AA Power Station</i>	ASIA-PACIFIC PARTNERSHIP ~ Peer Review Activities ~ EFFICIENCY REVIEW SHEET		Rev. No 0	Date 8/24/07	Person <i>Shinichi Taniguchi</i>	Company TEPCO	Country JAPAN
No.	Equipment	Description			1	1/18/08	<i>Shinichi Taniguchi</i>	TEPCO	JAPAN

### 2-2. Phenomenon (Efficiency/ Function)

#### (a) Efficiency issues

	Commissioning	Current
Flue gas O2	2 %	5.5 %
Flue gas CO	0 %	1.2 %
SH spray flow	18 t/H	50 t/H
RH steam temp.	566 deg.C	562 deg.C

#### (b) Functional issues

- Air gaps between flanges.
- Furnace hopper does not fully close.
- Combustion air dampers do not work properly.

#### (c) Net thermal efficiency

Detection

Design	Actual
38 %	31 %

Combustion air dampers do not work properly.

(c) Net thermal efficiency

Design	Actual
38 %	31 %

Detection

...s, etc.)

**Manual/ Routine Program/ Major Outage/ Commissioning**

are prescribed to be opened during every outage and packing is to be renewed. ... of the hopper door and water seal every 4 years. ... of the Air Heater air sealing every 4 years. ... ection of combustion air dampers. ... e combustion tuning or procedure has been determined.

**... during the minor outages, operation, and the recent major outage**

... were not confirmed closed before the completion of outage works. ... reported that the hopper door did not work. ... aware that there had been air breathing from flanges and expansion joints. ... of air sealing degradation was not identified until the peer review activities commenced. ... s have been aware of the combustion air damper issue, but it has not been dealt with.

**... of repairs/ Changes in operational or maintenance modes**

... aling has not been used since 1998 for avoiding clinker explosions. ... on air dampers are always driven manually rather than automatically as a result of malfunctioning. ... r sensor drive has not been available since 1995. ... on tuning has not been conducted since commissioning. ... oints were used for the combustion control computer to offset an effect of air breathing.

**... ng the collected pieces of information**

... large amount of air breathing, balanced combustion became difficult to achieve. ... O2 increased, increasing the volume of flue gas, and resulting in efficiency reduction. ... ustion system does not work correctly due to the tentatively manipulated set points. ... echanical repairs should be performed to rectify the problems above. ... on tuning should be arranged and the automatic combustion control should be ensured.

measures and Costs			6-2. Schedule		Physical countermeasures				
Flange repair	50	200 K\$	MH, Flange	20	2009	2010	2011	2012	
Hopper	1	100 K\$	Exp. ducts	15		15	5		
EP ducts	35	500 K\$	Hopper, dampers	20		21			
Aling	4	200 K\$	AH	4					
ers	40	160 K\$							

**... ng the efficiency recovery (if applicable)**

Physical countermeasures

Loss =  $\frac{(MassFlow - MassFlow) \times Enthalpy}{(FuelFlow \times HHVF)}$  = 0.30% ASME PTC4-1998 (5.14)

Power =  $\frac{FanPowerSaving [kW] \times Efficiency}{1000 \times UnitOutput [MW]}$  = 0.002%

VolumeCO x MolesCO x MolecularWeight x HHVCO/HHVF / (FuelFlow x HHVF) = 0.12% ASME PTC4-1998 (5.14)

1/RHtemp =  $0.5/40 \times (9/5)\Delta T [K]$  = 0.26% ASME PTC6A-1982 Fig. V/8

**ected Efficiency Recovery** = 0.67%

**... nded O&M Procedure Improvements**

Systematic approach

8-1. P (3-4) Combustion air damper activation test - periodically/ (3-5) Combustion tuning - every major outage

8-2. D (4-1, 4-2) Repetitive defects and operation records should be analyzed to seize the root causes for efficiency reduction.

8-3. C Trouble information, OEM recommendation, test reports and investigation reports should be organized and reevaluated (3).

8-4. A Based on the analysis and evaluation mentioned above, effective countermeasures should be developed (6, 7).

(1): Related section numbers \* 8-2 through 8-4 should be followed up periodically.

# *Peer Review Tool Kit*

## *“Green Handbook”*

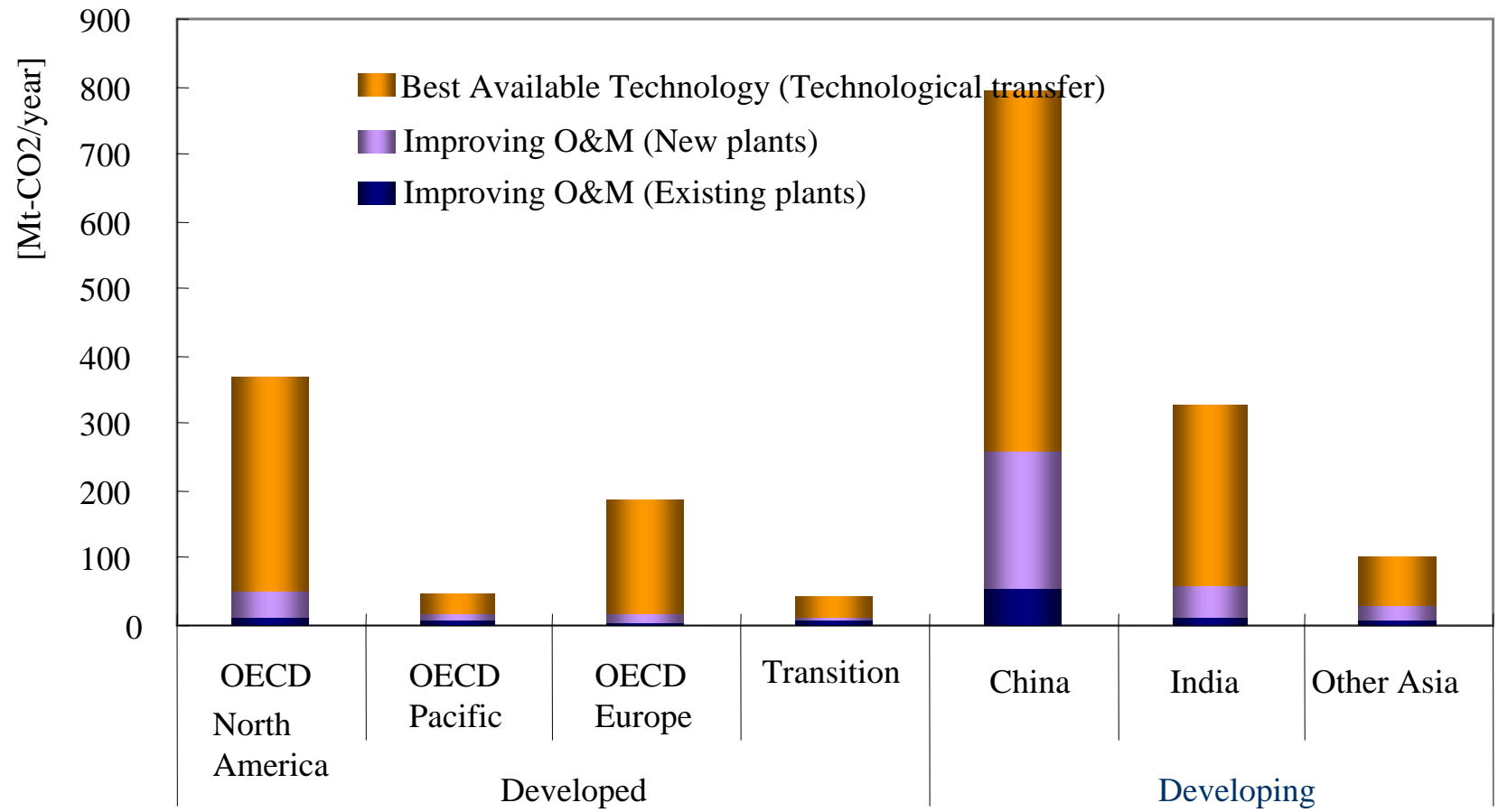
- ◆ *Instructions of day-to-day operation and maintenance technologies and practices of coal-fired power plants.*
  - *Prepared for the 1<sup>st</sup> peer review activities by the Federation of Electric Power Companies of Japan (FEPC).*
  - *Edited by engineers, by quoting extract from a Japanese bulletins for engineers.*
  - *Approved as an official text of the peer review activities.*
  - *Already used in performance diagnosis in China.*
- ◆ *Available at:*  
*<http://www.fepec.or.jp/english/env/app/>*



# Emissions Reduction Potential

*(provisional analysis)*

1870Mt-CO<sub>2</sub>/year in 2030



# *Further APP Activity*

---

- ✓ *Further Peer Review Activities are planned in Korea, China & Canada. (Further Deployment & Dissemination of the Tool Kit)*
- ✓ *Potential Collaboration with IEA on the Work of*
  - *Dissemination of the Achievement of the Peer Review Activities*
  - *Quantification of CO<sub>2</sub> emission reduction potential by O&M improvement for coal power generation*
- ✓ *Start other Action Plan of Power Generation & Transmission Task Force.*

---

## *Thank you for Listening*

*(For further information)*

*Asia-Pacific Partnership web-site*

*<http://www.asiapacificpartnership.org/>*

*Federation of Electric Power Companies of Japan*

*<http://www.fepec.or.jp/english/env/app/>*

*---Green Handbook and 'Checklist' & 'Review Sheets are available.*

*Ichiro Maeda      FEPC, Japan*