Let's make Sectoral Approaches "MRV"able

- Lessons being learnt under the APP-

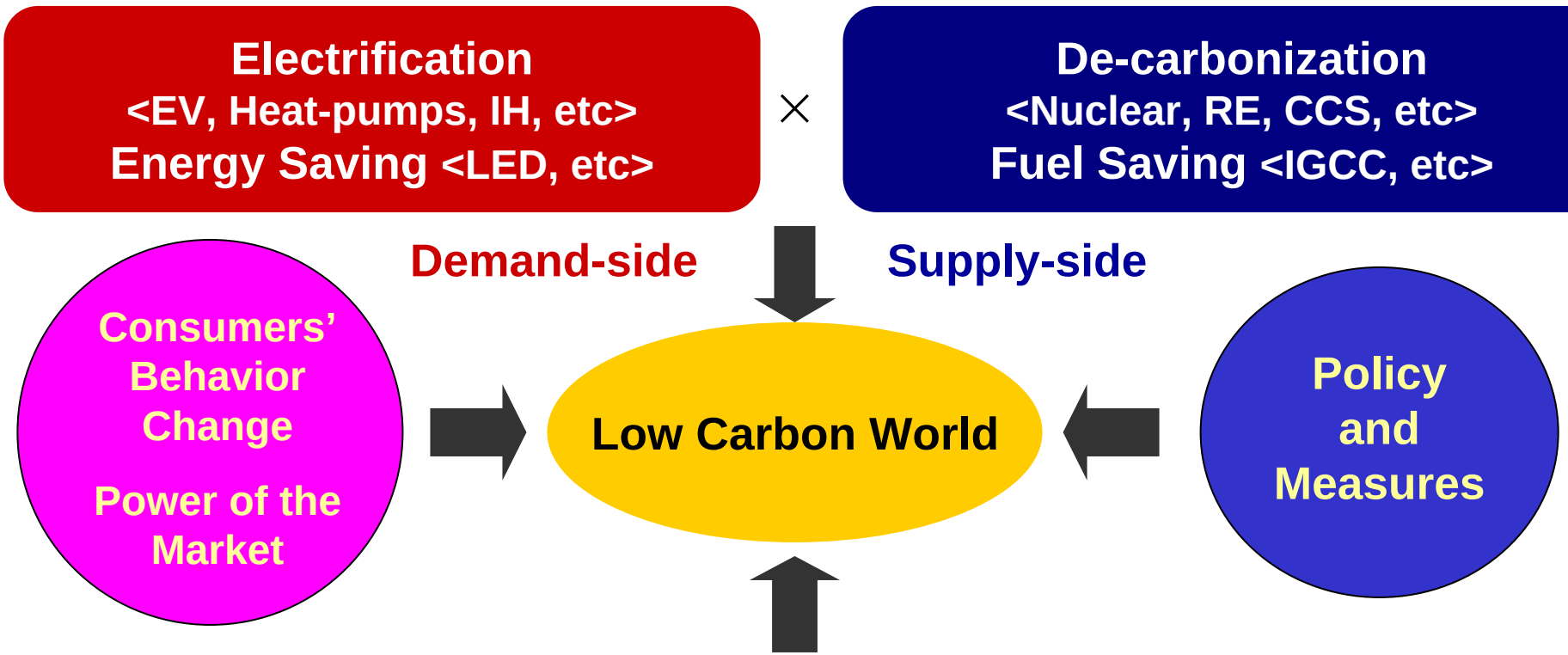
ICC SBSTA-28 Side Session

Friday, 6 June 2008

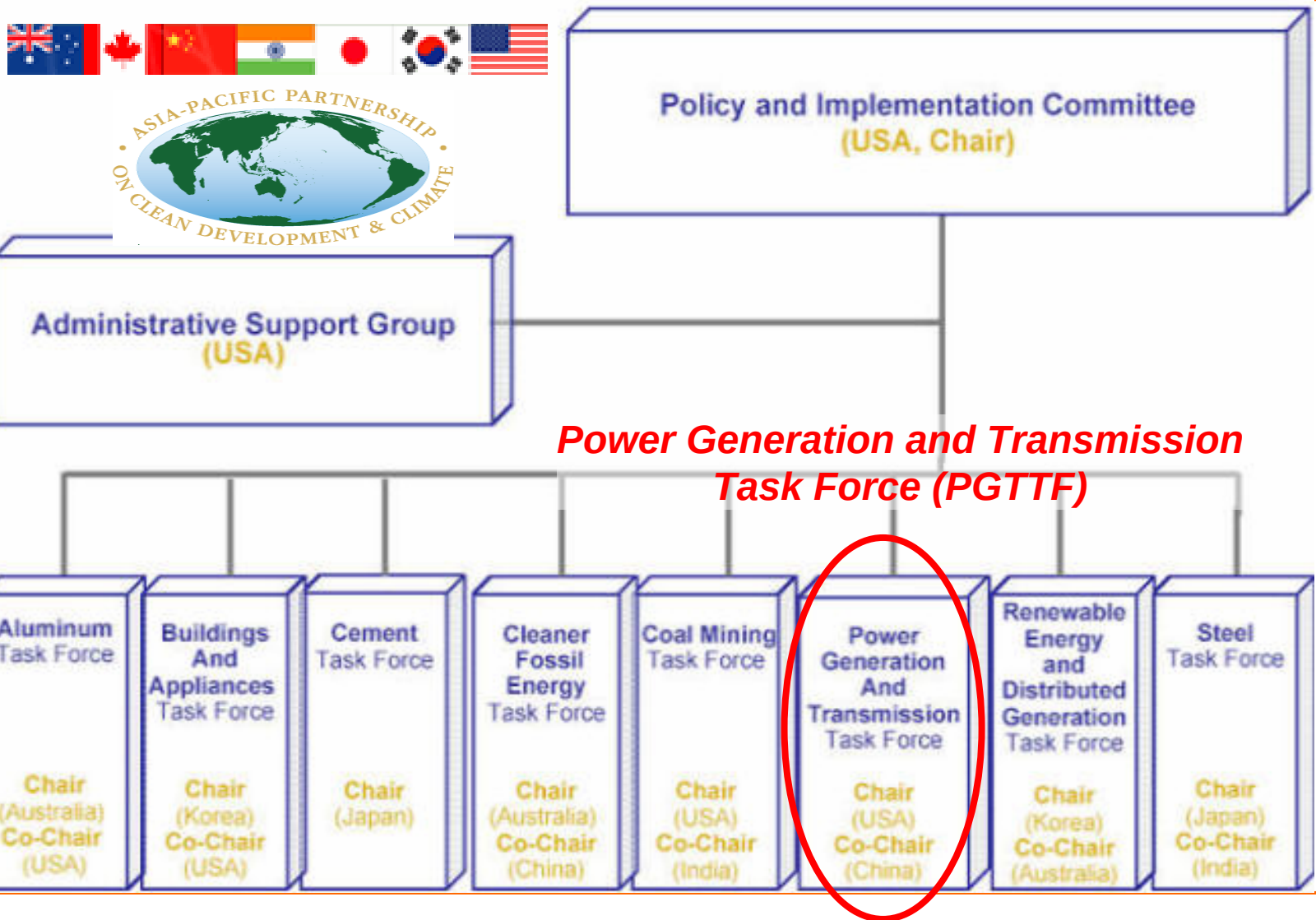
Bonn, Germany

Yoshiharu Tachibana
The Tokyo Electric Power Co. Inc.

What Power Sector can do



Structure of the Asia-Pacific Partnership on Clean Development and Climate (APP)



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 consists of Site Visits and Workshops

Peer Review consists of Site Visits and Workshops(cont'd)

Peer Review in India (Feb. 2008)

Peer Review consists of Site Visits and Workshops(cont'd)

Most recent Peer Review in United States (May. 2008)

Progress of the Peer Review & Tool Kit

Trial @US(2006, Nov.)
<50 participants>

Japan（2007, April）
<50 participants>

India（2008, Feb.）
<80 participants>

US（2008, May）
< 80 participants>

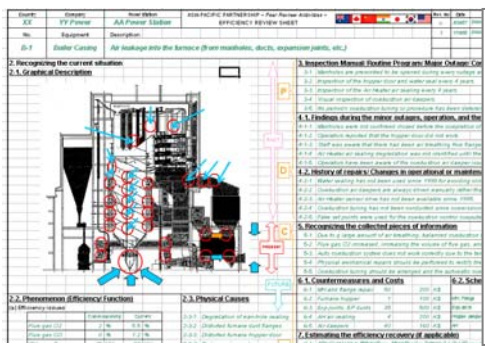
Australia
（2008, June 23-27）

China（2008?, ?? ）
ytd

'Green Handbook'

First used in performance diagnosis in China

Free of charge



'Check List' and 'Review Sheets'

First used in efficiency improvement proposal in India

'Green Handbook'

- *Instructions of day-to-day operation and maintenance technologies and practices of coal-fired power plants.*
  - *Prepared for the 1st peer review activities by the Federation of Japanese Electric Power Companies (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.fepc.or.jp/english/env/app/

‘Efficiency Checklist’

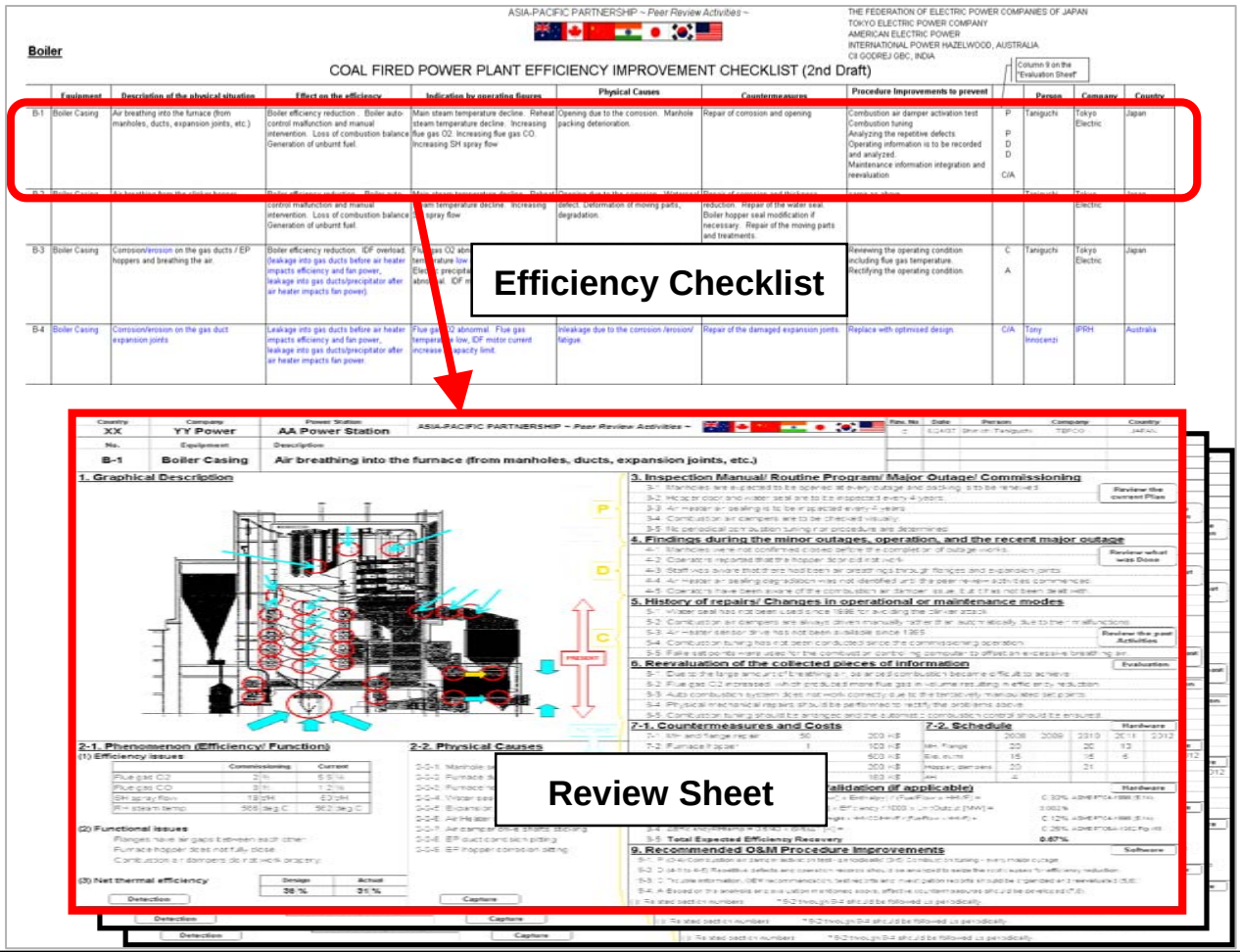
Boiler

ASIA-PACIFIC PARTNERSHIP ~ *Peer Review Activities* ~

COAL FIRED POWER PLANT EFFICIENCY IMPROVEMENT CHECKLIST (2nd Draf

	Equipment	Description of the physical situation	Effect on the efficiency	Indication by operating figures	Physical Causes (): Related Incident No.	Countermeasures	
B-4	Boiler Casing	Corrosion/erosion on the gas duct expansion joints	Leakage into gas ducts before air heater impacts efficiency and fan power, leakage into gas ducts/precipitator after air heater impacts fan power.	Flue gas O2 abnormal. Flue gas temperature low, IDF motor current increase / capacity limit.	Inleakage due to the corrosion /erosion/ fatigue.	Repair of the damaged expansion joints.	Repl
B-5	Boiler Tubes	Furnace water wall tube degradation, internal scale production.	Boiler efficiency reduction . Boiler feedwarter pump performance decline.	SH metal temperature increase. SH spray water flow increase. Economizer inlet feedwater pressure increase. Waterwall metal temperature increase. Recirculation gas flow decline. RH spray water flow increase.	Boiler feedwater quality decline. Heat transfer rate decline. Accelerated scale formation due to the increasing metal temperature.	Scale formation measurement. Chemical cleaning based on the measurement. Introduction of CWT (OT) if affordable.	Con (ND Anal prog Che anal Con
B-6	Boiler Tubes	SUS CrMo scale magnetite production inside the SH or RH tubes.	Boiler efficiency reduction.	SH/RH metal temperature high.	Boiler feedwater quality decline. Operation with the high temperature above the prescribed limitation. Pressure loss increase due to the scale formation.	Non destructive measurement (RT, etc.) Scale reduction based on the measurement. Operation following the prescribed limitation. Introduction of shot-blast tubes if affordable.	Ope Insp of th rem Rev base
B-7	Boiler Exit Gas Temperature	Exit gas temperature setting higher than necessary to maintain adequate exit gas temperature above SO3 dewpoint to prevent ductwork corrosion	Boiler efficiency reduction.	Measure SO3 Dewpoint at typical coals being consumed	Exit gas temperature higher than necessary	Reduce exit gas temperature air heater manufacture guidelines at given SO3 concentration of coal	Mea coal deve SO3
B-8	Boiler Excess Air	O2 Measurement inaccuracy or unbalance	Boiler efficiency reduction	Unbalance of O2 Profile Control O2 Measurement different than test O2. High CO and flyash LOI	Calibration drift. Unbalanced burner air flow resulting in high or low O2	Calibrate O2 probes. Adjust burner shrouds or dampers to balance burner air flow	Calil inter instr cont
B-9	Boiler Excess Air	Not operating at the optimal value.	Lower boiler efficiency than achievable.	O2 reading. Use CO measurement to trim O2 level.	Manufacturer's set point may not be optimal.	Test program to determine optimal O2 level.	N/A
B-10	Sootblowers	Slagging on the furnace water wall tubes and the ceiling tubes.	Boiler efficiency reduction.	SH metal temperature increase. SH spray water flow increase. Waterwall metal temperature decline.	Increased fuel input for maintaining the rated operation. Increased heat input into the furnace. Heat transfer rate decline. Inappropriate sootblowing frequency.	Fine tuning of the sootblowing frequency. Introduction of water cannon if affordable.	Moni and Con quali Refl
B-11	Sootblowers	Fouling on the pendant and horizontal convection tubes.	Boiler efficiency reduction.	SH steam temperature decline.	heat transfer rate decline due to fouling. Inappropriate sootblowing frequency.	Fine tuning of the sootblowing frequency.	Moni and Con quali

‘Checklist’ & ‘Review Sheets’



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

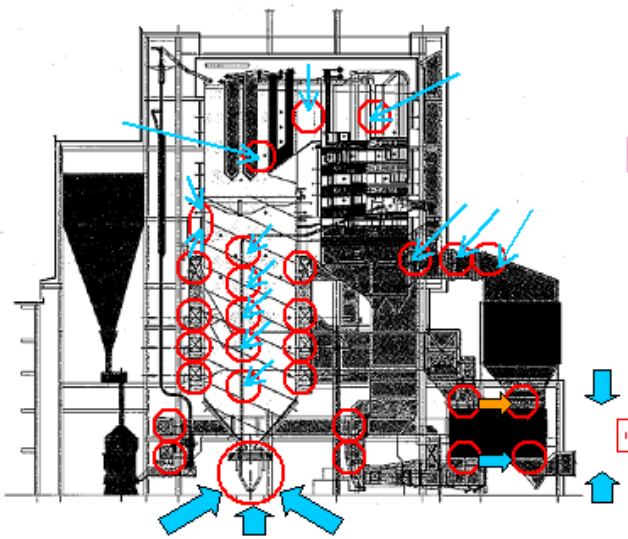
‘Efficiency Review Sheet’

Country:	Company:	Power Station	ASIA-PACIFIC PARTNERSHIP ~ Peer Review Activities ~ EFFICIENCY REVIEW SHEET	Rev. No	Date	Person	Company:
XX	YY Power	AA Power Station		0	6/24/07	Shoichi Taniguchi	TEPCO
				1	9/10/08	Shoichi Taniguchi	TEPCO

No.	Equipment	Description
B-1	Boiler Casing	Air leakage into the furnace (from manholes, ducts, expansion joints, etc.)

2. Recognizing the current situation

2-1. Graphical Description



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

2-3. Physical Causes

2-3-1. Degradation of man-hole sealing
2-3-2. Distorted furnace duct flanges
2-3-3. Distorted furnace hopper door
2-3-4. Broken water seal
2-3-5. Expansion joint pitting
2-3-6. Air sealing of the AH distorted
2-3-7. Sticking of air damper drive shafts

3. Inspection Manual/ Routine Program/ Major Outage/ Commissioning

3-1. Manholes are prescribed to be opened during every outage and packing is to be renewed
3-2. Inspection of the hopper door and water seal every 4 years.
3-3. Inspection of the Air Heater air sealing every 4 years.
3-4. Visual inspection of combustion air dampers.
3-5. No periodic combustion tuning or procedure has been determined.

4-1. Findings during the minor outages, operation, and the recent major outa

4-1-1. Manholes were not confirmed closed before the completion of outage works.
4-1-2. Operators reported that the hopper door did not work.
4-1-3. Staff was aware that there had been air breathing from flanges and expansion joints.
4-1-4. Air Heater air sealing degradation was not identified until the peer review activities commenced
4-1-5. Operators have been aware of the combustion air damper issue, but it has not been dealt with

4-2. History of repairs/ Changes in operational or maintenance modes

4-2-1. Water sealing has not been used since 1998 for avoiding clinker explosions.
4-2-2. Combustion air dampers are always driven manually rather than automatically as a result of mal
4-2-3. Air Heater sensor drive has not been available since 1995.
4-2-4. Combustion tuning has not been conducted since commissioning.
4-2-5. Fake set points were used for the combustion control computer to offset an effect of air breath

5. Recognizing the collected pieces of information

5-1. Due to a large amount of air breathing, balanced combustion became difficult to achieve.
5-2. Flue gas O2 increased, increasing the volume of flue gas, and resulting in efficiency reduction
5-3. Auto combustion system does not work correctly due to the tentatively manipulated set points.
5-4. Physical mechanical repairs should be performed to rectify the problems above.
5-5. Combustion tuning should be arranged and the automatic combustion control should be ensure

6-1. Countermeasures and Costs

6-1. MH and flange repair	50	200	K$
6-2. Furnace hopper	1	100	K$
6-3. Exp joints, EP ducts	35	500	K$
6-4. AH air sealing	4	200	K$
6-5. Air dampers	40	160	K$

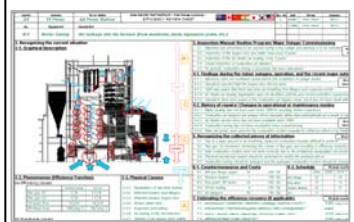
6-2. Schedule

	2008	2009	2010
MH, Flange	20		20
Exp. ducts	15		15
Hopper, dampers	20		21
AH	4		

7. Estimating the efficiency recovery (if applicable)

7-1. ΔDryGasLoss = {(MassFlow - MassFlow') x Enthalpy} / (FuelFlow x HHVF) = 0.30%
7-2. ΔFanAuxPower = FanPowerSaving [kW] x Efficiency / 1000 x UnitOutput [MW] = 0.002%
7-3. 0.12%
7-4. 0.25%

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

Participants of the 1st and 2nd Peer Review Activities

Australia	*Department of the Environment and Water Resources* *International Power, Roy Yang Power*
China	*China Electricity Council (CEC)* *Beijing Guodian Kehuan Clean Combustion Technology & Engineering Ltd.* *China Datang Corporation* *China Power Investment Corporation* *Guodian Technology & Environment Group Co., Ltd.* *Huaneng Power International Inc.* *Yantai Longyuan Electric Technology Co., Ltd.*
India	*Ministry of Power, Central Energy Agency,* *National Thermal Power Corpration Ltd. (NTPC).* *CESC Ltd. State-owned thermal power companies* *Confederation of Indian Industry (CII)*
United States	*Edison Electric Institute (EEI)* *Alliant Energy, Ameren, American Electric Power (AEP)* *Southern Company, Progress Energy*

Participants of the 1st and 2nd Peer Review Activities (cont.)

Korea	*Ministry of Commerce, Industry & Energy* *Korea Electric Power Corporation* *Korea East-West Power Co., Ltd.* *Korea Midland Power Co., Ltd.* *Korea South-East Power Co., Ltd.* *Korea Southern Power Co., Ltd.* *Korea Western Power Co., Ltd.* *Korea Electric Power Research Institute (KEPRI), Doosan*
Japan	*Ministry of Economy, Trade and Industry* *Hokkaido Electric Power Co., Inc.* *Tokyo Electric Power Company* *Chubu Electric Power Co., Inc.* *The Kansai Electric Power Co., Inc.* *The Chugoku Electric Power Co., Inc* *Kyusyu Electric Power Co., Inc.* *Electric Power Development Co., Ltd.* *The Federation of Electric Power Companies* *Thermal and Nuclear Power Engineering Society* *International Center for Environmental Technology Transfer*

Furthering Peer Review Activities

- Further Peer Review Activities are planned in:
  - Australia
    (2008, June at Hazelwood and Loy Yang)
  - China (2008? ytd)
  - In Other Parties of APP
- Further Development and Dissemination of the Tool Kit
- Quantification of Efficiency Improvement Activities
- Technology Transfer between Manufactures

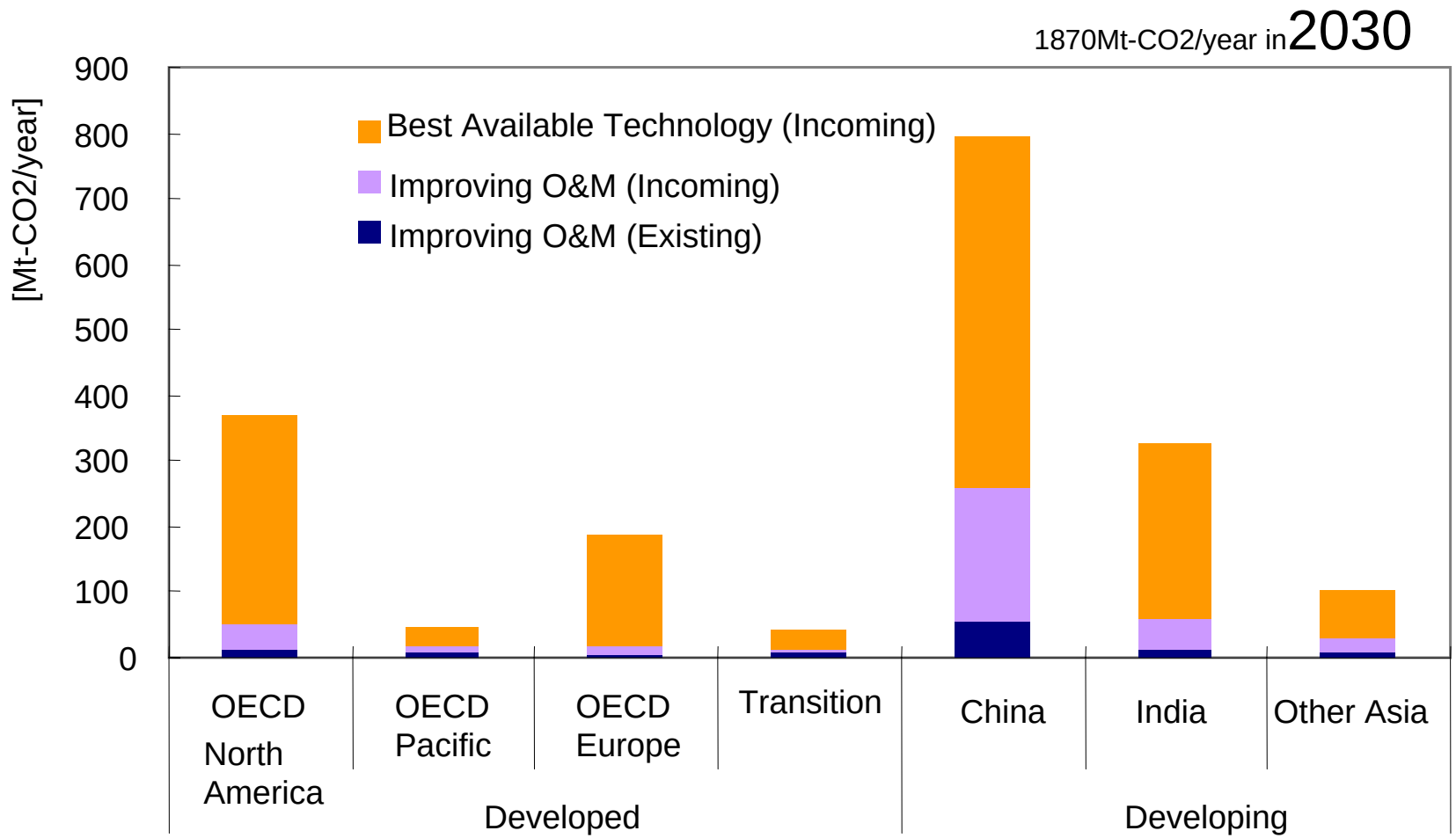
Goals of next Peer Review Activities in Australia

1. ***To build on the experiences and lessons from previous power plant site visits by actively utilising and improving the "Coal Fired Power Plant Efficiency Improvement Checklist", generated during the power plant site visit hosted by the Japanese, and enhanced by the site visit hosted by the U.S. This activity will focus on adding brown coal (lignite) efficiency improvements to the checklist.***
2. ***To provide a forum for information exchange on technology and/or process enhancements focused on increasing the operational efficiency of brown coal (lignite) among Partner nations.***
3. ***To provide a forum for representatives of Partner nations to openly discuss the challenges to brown coal (lignite) efficiency improvements, and the opportunity to learn from each other to identify ways to reduce overall emissions into the environment.***

23 - 27June 2008 in Melbourne, Australia hosted by Australia's Department of Resources, Energy, and Tourism and the National Generators Forum (NGF)

Emissions Reduction Potential

(provisional analysis)



For further information

Asia-Pacific Partnership web-site

http://www.asiapacificpartnership.org/

Federation of Electric Power Companies of Japan (FEPC Japan)

http://www.fepc.or.jp/english/env/app/

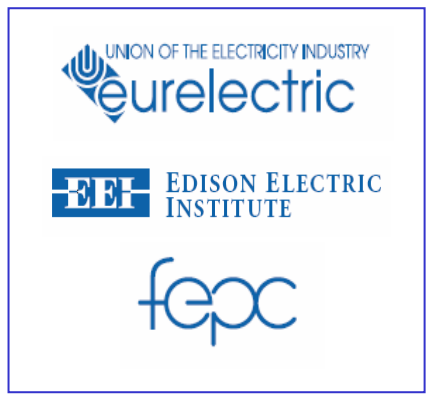
---'Checklist' & 'Review Sheets are available.
---Your inputs are welcome for further development.

Beyond APP

International Platform
to help Developing Countries reduce
GHG Emissions

e8

WBCSD
Electricity WG



3 ways

APP

Challenges for the Power Sector

Challenges for Power Sector in Sectoral Approaches

- ***Huge number of players and no international sector organization***
- ***Diversified market structure (regulated/liberalized, vertically integrated/de-bundling, private/state-owned)***
- ***Close linkage to a national policies such as energy security and development (tariff sometimes remains lower level to ensure competitiveness of industry and accessibility)***

Challenges for Power Sector in Sectoral Approaches (cont'd)

- ***Diversified resource availability (natural/fossil) and a national policy for certain technology (nuclear)***
- ***Diversified ages of assets (incentives for early replacement of inefficient assets)***
- ***Involvement of plant manufactures (e.g. raising competitiveness issues)***
- ***Source of investment and finance (public/private)***

Challenges for Power Sector in Sectoral Approaches (cont'd)

- ***Incentives and drivers of engagement in the international cooperative sectoral approach or sector-specific actions***
  - ***Less international competitions and much local competitions with other energy in some countries***
  - ***Incremental costs for emission reductions and R&D are sometime transferable to their consumer (less attention to the int'l cooperation)***