

# **Sectoral Approach in the Electric Power Industry**



**The Federation of Electric Power Companies of Japan**



# Sectoral Approach in the Electric Power Industry

Outline of Power Working Group of the Global Superior Energy Performance Partnership

October 2012

## The Federation of Electric Power Companies of Japan

**Executive Summary** The electricity sector has promoted peer review activities relating to the operation and maintenance of fossil power plants as one of the main action plans under the Asian Pacific Partnership on Clean Development and Climate (hereinafter referred to as APP). The US government proposed winding up the APP because it claimed that the mission of the APP had been completed, but the Japanese government and the country's private sector recognized the importance of promoting the activities of the APP and tried to carry on the achievements and experiences of the APP in the newly founded Global Superior Energy Performance (hereinafter referred to as GSEP). In collaboration with the USA, Japan set up a Power Working Group and took the chair under GSEP. The Power WG decided to expand outreach and engage the International Electricity Partnership (hereinafter referred to as IEP), a global private initiative to leverage the private resources of the electricity sector to promote public and private partnerships.

### Achievements of APP Activities

#### Introduction

It is imperative to deploy developed countries' energy saving technologies in developing countries, in order to mitigate the negative effects of global climate change. The technology of electricity, amongst others, will be more and more important. APP activity has been best practice of a public sector partnership, which provides policy assistance, and the private sector, which owns energy saving technologies. APP has been transformed into the GSEP on the basis of the experience that was acquired in APP activities. The activities that were closed to APP member countries are now expected to develop and be exploited in the wider field.

In the electricity sector, technology is not only deployed by siting and constructing power plants; the transfer of know-how focused on operations and maintenance is also important. The APP stakeholders made the O&M peer review the main activity, in addition to sharing information on energy saving technologies. The mind-set will not be changed and will develop even after transformation into the GSEP.

During this transformation, there has been close coordination between the public and private sectors to make this happen. At the private sector level, cooperation with the IEP, which includes European colleagues, was assured as a step towards international alignment. And in Japan, the iron and steel, cement and electricity sectors shared the value of APP activities, worked together, cooperated with the government to plan to set up the GSEP. While APP started as a top-down approach, GSEP started as a bottom-up approach.

This article introduces some examples of what APP achieved and examines how the GSEP has evolved, with the focus on a public private partnership.

#### The APP begins

The APP was launched by the USA in July 2005 to contribute towards energy and climate change in the Asia and Pacific region. The Bush administration tried to demonstrate how the USA was pushing forward with technology deployment for the sake of energy and climate change and worked hard to coordinate among member countries and to attract attention. The official announcement was made at the ASEAN ministerial meeting in Vientiane Laos, with participating countries consisting of Australia, China, India, South Korea, Japan and the USA (Canada joined later). It was implemented by a ministerial meeting and its' Policy Implementation Committee (PIC). It started with eight task forces; that is, Power Generation and Transmission, Cleaner Fossil Energy, Renewable Energy and Distributed Generation, Buildings and Appliances, Steel, Cement, Aluminum, Coal Mining. The vision statement designated the following;

First, by building on the foundation of existing bilateral and multilateral initiatives, we will enhance cooperation to meet both our increased energy needs and associated challenges, including those related to air pollution, energy security, and greenhouse gas intensities,

Secondly, areas for collaboration may include, but not be limited to: energy efficiency, clean coal, integrated gasification combined cycle, liquefied natural gas, carbon capture and storage, combined heat and power, methane capture and use, civilian nuclear power, geothermal, rural/village energy systems, advanced transportation, building and home construction and operation, bioenergy, agriculture and forestry, hydropower, wind power, solar power, and other renewables.

Thirdly, a non-binding compact in which the elements

of this shared vision were developed, as well as the ways and means to implement it, will be further defined and lastly, the partnership will be consistent with and contribute to our efforts under the UNFCCC and will complement, but not replace, the Kyoto Protocol.

The Japanese participants regarded the APP as one of the key components of the “Sectoral Approach”, which was strongly promoted by Japanese governments, and a peer review of the operation and maintenance of fossil power plants was given the status of a main action plan by the Generation and Transmission task force. The Sectoral Approach was developed by Japanese governments to quantify CO<sub>2</sub> emissions, with an

assumption of setting a reduction target. This plans to provide incentives to invite the main emerging economies to participate in international targets by acquiring accurate information such as the current and future potential of reduction, and of internationally comparable data, through which the challenges could be shared and the technology road map would be developed and implemented. Each sector showed various specific measures. Because the Sectoral Approach was designated to be introduced in the international context, the first thing it required was common indicators.

In the case of the electricity sector, the portion of non-fossil fuel generation in the energy mix, operation

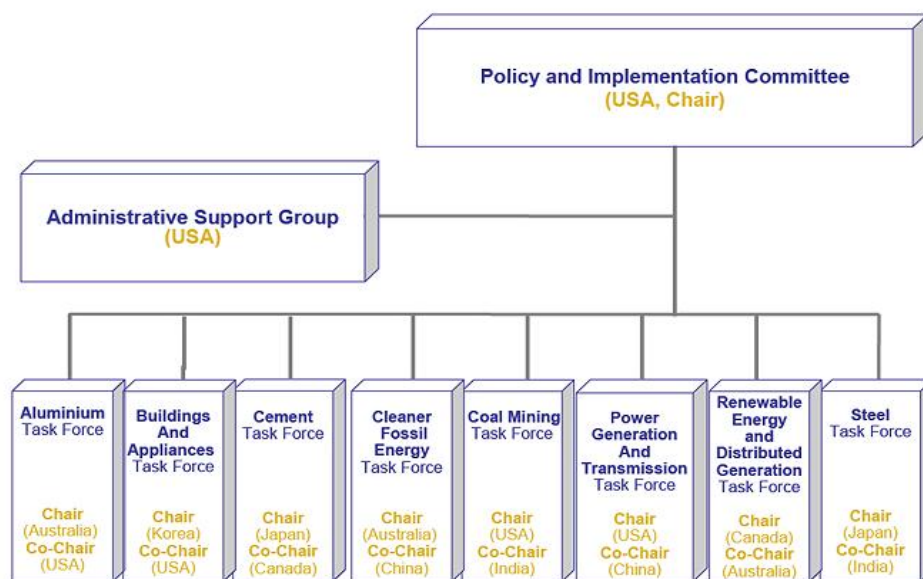


Fig. 1 Asia Pacific Partnership- Organization

<i>Measures to be considered</i>		<i>Conceptual indicator</i>	<i>Possible MRVable indicators</i>
<b>Non-fossil fuels</b>	<b>Optimization energy mix</b> -- Nuclear -- Renewables (associated with national energy policy)		<b>Proportion of non-fossil fuel generation</b>
<b>Fossil fuels</b>	<b>1. O&amp;M improvement</b> (e.g APP peer review)  <b>2. Renovation&amp; Replacement</b> (supported by financial initiatives such as tax credit etc.)  <b>3. BAT installation</b>	<b>Thermal Efficiency</b>	<b>Deviation from designed efficiency</b>  <b>Minimum efficiency standard for incoming plant</b>
<b>Others</b>	<b>Capacity building...etc.</b>	<b>Important but it is Not likely to be MRVable...</b>	

Fig. 2 Low carbon fuel mix common

and maintenance improvement, renovation and replacement potential and the best available technologies in fossil fuels generation can be common indicators. Among the above, operation and maintenance improvement can be implemented through the APP peer review<sup>4</sup> activities and it was therefore selected as a flagship project, “Power Generation Best Practices”.

Apart from the above, the following were included in the Power Generation and Transmission Task Force;

- 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

- Generator Transformer Programs (Inspection Procedures, Diagnostic Tools and Maintenance)

### Coal Fired Power Generation Peer Review Activity

With regard to the deterioration of generation efficiency through the ageing of existing coal fired power plants, this is expected to recover by improving operations and maintenance.

There is a possibility that this case is similar to refurbishment in developing countries. Peer review here means that peers mutually evaluate the power plants, identify common challenges, share best practice through discussion and propose specific improvement plans.

When implementing the Peer Review the Green Hand Book, which was compiled by Japanese electricity companies and which encompasses a wide variety of best practices, was distributed for free. The Green Hand Book was prepared for the first Peer Review activity and later acknowledged to be the office text by the task force. It can be downloaded from the following URL<sup>5</sup>.

The following peer review activities occurred after test one in the USA in October 2006.

- April 16 – 19 2007, at J Power’s Takasago Thermal Power Station in Hyogo Japan, two 250 MW, with the participation of two Australian,

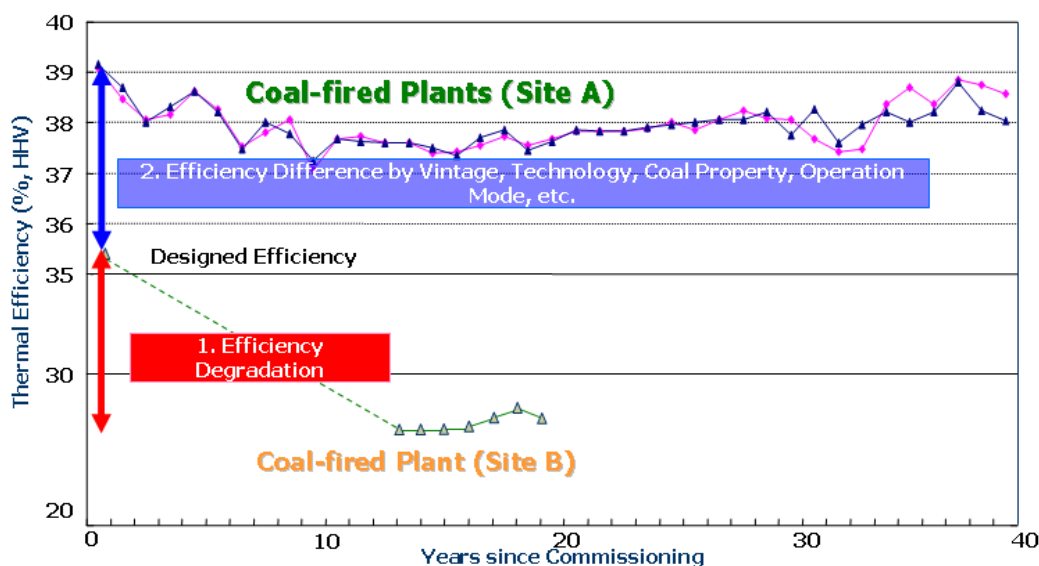


Fig. 3 Comparison on deviation from designed efficiency

<sup>4</sup>In January 2006, the Federation of Electric Power Companies of Japan (FEPC) and the Edison Electric Institute (EEI) joined the APP ministerial meeting, where Mr. Masumoto of FEPC and Mr. Morris of AEP agreed to adopt peer review because they were knew how important this is. Mr. Morris of AEP agreed to adopt peer review because they were knew how important this is.

<sup>5</sup> See <http://www.fepec.or.jp/env/app/>

eight Canadian, eight Indian, 10 Japanese, 13 Korean and six American engineers

- February 6 – 12 2008, at the Kota Power Station Rajasthan, two 110 MW, three 10MW and 1.195MW and the NTPC



**Fig.4 Green Handbook**

(National Thermal Power Corporation) Dadri Power Station in India, with the participation of four 210 MW, with the participation of two Australian, five Canadian, 37 Indian, 14 Japanese, 10 Korean and seven American engineers

- April 28-March 2 2008 at Alliant Energy's Edgewater Coal-based Station, 60 MW, 330 MW and 380 MW in Sheboygan, Wisconsin, and the Columbia coal-based Power Station, two 533MWs in Pardeeville, Wisconsin USA, with the participation of one Canadian, two Chinese, six Indian, 22 Japanese, eight Korean and 42 American engineers
- June 23 – 27 2008, the Loy Yang Power Station, two 515 MW and two 560 MW, the Yallourn Power Station, two 350 MW and two 375 MW and the Hazelwood Power Station, eight 200 MW in Australia, with the participation of 20 Australian, one Chinese, six Indian, 16 Japanese, three Korean and two American engineers
- July 6 – 10 2009 at the South-East Power Company's Yonghung coal-fired Power Plant, two 800 MW and two 870 MW in Korea, with the participation of 20 Japanese, one American, two Chinese and 80 Korean engineers

The following are examples of the result of the peer review activity. Experience in the USA shows that;

- Participants were divided into teams for boilers, auxiliary machines and turbines.
- Opinions were exchanged and experiences were shared 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 condensers, etc.
- A tentative calculation of the 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, which is equivalent to a potential of approximately 90,000 ton CO<sub>2</sub> per power plant.

Apart from the above, the National Energy Technology Laboratory of the Department of Energy under USAID's Greenhouse Gas Pollution Prevention Project established the Centre for Power Efficiency & Environment Protection (CenPEEP) and two regional CnePEEPs, and provided basic power plant diagnosis. To date, NTPC avoided a total of 30 million tons of CO<sub>2</sub> of additional reductions. Under APP, they extended the successes of the NTPC and CenPEEP to three plants operated by the State Electricity Boards of West Bengal and Punjab.

### **Quantification of CO<sub>2</sub> Potential through the improved operation and maintenance of power plants**

The APP Power Generation and Task Force quantified the CO<sub>2</sub> Potential through the improved operation and maintenance of power plants, resulting from the achievements of peer review activities, based on the mutual trust of the member countries. The study will be reported here.

After quantification, two scenarios for the introduction of new technology, BAU (Business As Usual) and BAT (Best Available Technology), were developed. Under the BAT scenario, strategic technology transfer was expected.

- The BAU scenario did not envisage the introduction of improved O&M. Current coal fired technology (Subcritical combustion) existed until 2010. From 2015 onwards Ultra- Supercritical Coal-Fired Power Plants (USC) with steam conditions up to 600 degrees will be diffused
- The BAT scenario envisages the introduction of improved O&M. Ultra-Supercritical Coal-Fired Power Plants (USC) will be diffused up to 2015. Integrated Gasification Combined Cycle (IGCC) Technology will be diffused from 2016 to 2025. Next Generation IGCC technology will be diffused after 2030.

With regard to BAT, deterioration in efficiency would begin 15 years after its start-up, but the potential for improvement was assumed, based on information gained from questionnaires sent to member countries. That of existing plants was based on the Platts database. Future prospects of power plants were based on the International Energy Agency (IEA)'s World Energy Outlook 2009. As a result of this study, the potential was 1,185 Mt-CO<sub>2</sub>/year, 2.29 Mt-CO<sub>2</sub>/year and a total



of 1,503Mt-CO<sub>2</sub>/year. The breakdown showed that the 153 Mt-CO<sub>2</sub> reduction was attributed to the improved O&M of existing plants, the 186 Mt-CO<sub>2</sub> reduction was attributed to the improved O&M of existing and incoming plants and the 1,163 Mt-CO<sub>2</sub> reduction was attributed to incoming new technologies. The study was conducted under the APP Power Generation and Transmission Task Force and presented to the IEA with the idea that the diffusion of new coal technologies was important and that improved O&M was also necessary.

### Distribution/Demand Side Management Best Practice Activities

The Distribution/Demand Side Management Best Practice Activities were led by the Lawrence Berkeley National Laboratory (LBML) in cooperation with the Edison Electric Institute (EEI). This started in 2007 in Maharashtra in India, based on California's experience focusing on structural, regulatory and administrative challenges. In 2009 they held a Distribution/Demand Side Management Event in North Carolina and California with assistance from Progress Energy and PG&E, with 35 participants from Australia, China, India, Japan, South Korea and the USA. The program was focused on technical information exchange and the identification of Best Practices, which included Smart Grid and Demand Response planning, presented by the USA. Improving the reliability of the distribution system was presented by Japan. There was an active discussion on the cost of DSM and reduced losses in the transmission and distribution system in Japan by the Indian regulators and local utilities. It was agreed to further develop the activity as one of the flagship projects.

### Renewable Energy Best Practice Activities

The 1st "Hydroelectric Generation Efficiency Improvement Project" was held from August 13-17, 2007 in support of the Asia Pacific Partnership "Power Generation and Transmission Task Force" Action Plans. The program began in Charlotte, North Carolina USA at the Duke Energy headquarters and concluded at FirstEnergy's Yards Creek Pumped Storage Hydroelectric facility in Blairstown, New Jersey, USA. More than 40 participants with hydroelectric engineering, operations, maintenance and management expertise from five APP countries participated in the event. In March 2009, 50 participants from Canada, China, India, Japan, South Korea and the USA met in San Francisco, California to exchange initial information from the different perspectives of the purchaser, operator/developer and integrated system operator. The event was hosted by PG&E and NextEra Energy Resources in cooperation with the Edison Electric Institute.

In September 2010 APP participants held a wind energy event in Montreal.

### Engagement in GSEP

#### APP completed

In the APP activities, the power generation and transmission task force was chaired by the US from the start, but because of the change in US politics it proposed giving up its status as chair of the PIC (Policy Implementation Committee) and the task force secretariat, and informed Japan in June 2010. The APP revealed new potential, from the viewpoint that this established the regional cooperation framework on energy security and environmental protection in the Asia and Pacific region, and that the collaborative public and private sector partnership progressed this. Politicians and negotiators attended the ministerial

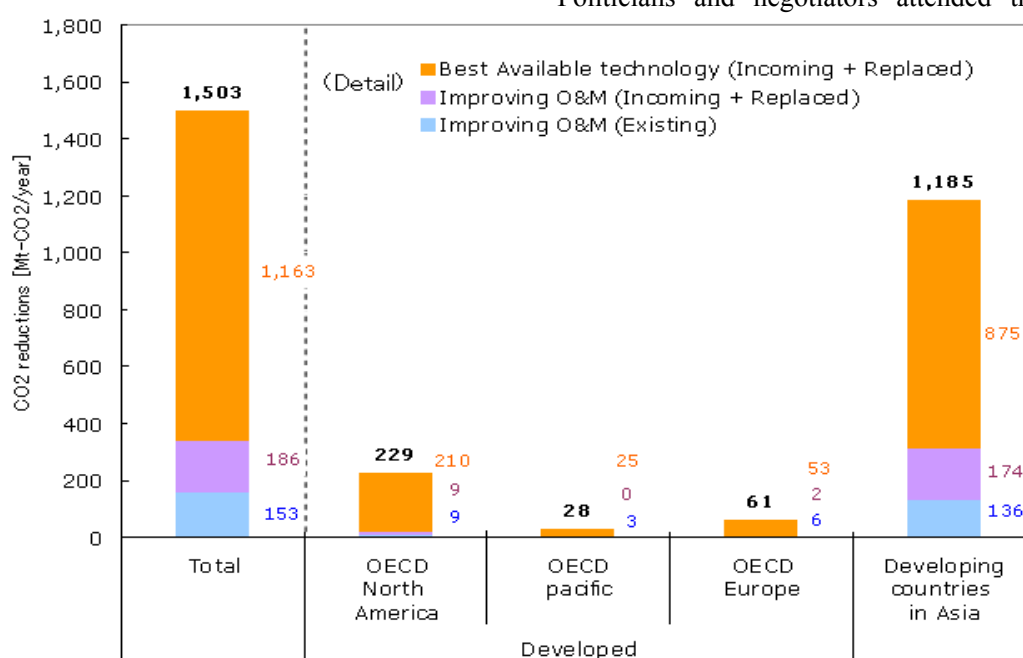


Fig. 5 Comparison of CO<sub>2</sub> reduction effect (2030 BAT Scenario)

meetings and PIC meetings, and were likely to reflect negotiations at the UNFCCC, but in the task forces, because there was less influence from the negotiations, and there was a greater private sector presence, there was a constructive discussion. Particularly in the sectors of cement, steel and electricity, a common measurement method for GHG emissions, peer reviews and plant diagnosis was developed. The Japanese private sector made APP activities the centre of international cooperation on climate change and took as many opportunities as possible to be heard, making an active international contribution. In due course there was growing attention from third parties, including the EU.

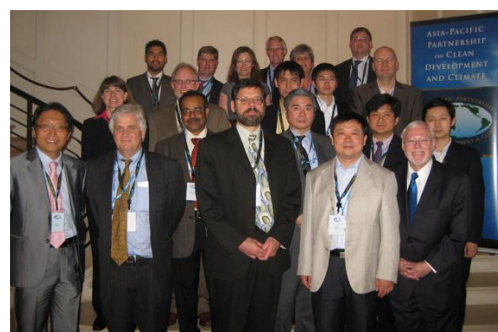
The APP showed how successfully the public and private partnership worked in terms of technology transfer and the perception was fostered that the private sector has to be given an important role in climate change policy making, while the partnership with the public sector needs to be accelerated. The Japanese public and private sectors shared the idea that it is imperative to replace the APP task forces, but on the other hand they believed that meaningful participation by the USA was not expected if it continues as the APP, and that it was task forces that should be promoted further and not the PIC meeting, because the latter was subject to political influence. They reached a judgment that the decision of the US had to be accepted and that task force activities had to be transferred to some other initiative.

In response to the above development, the power generation and transmission task force had an inner meeting in Tokyo in June 2010 with its task force chair Mr. Jarad Daniels of the US Department of Energy. The two day meeting concluded with several recommendations for future task force activity, assuming that the APP would end, which were intended to promote the expected results and to make up for deficiencies. Here are the main points of the recommendations;

- To maintain key stakeholders, government representatives must show strong support for public-private efforts and move quickly to maintain momentum in the private sector.
- To broaden engagement, additional public and private sector involvement should include service providers and technology providers, and also representatives from funding organizations for the implementation of capital-intensive projects.
- Specific near-term outreach plans for the Task Force should include, but not be limited to, organizations and countries such as the E.U.'s Eurelectric organization and the International Electricity Partnership (see below for further details), with participation from other countries which rely greatly on fossil fuel use

- The Task Force's Best Practice Peer Review project for coal-fired power plants should continue, as this has proved to be very effective and very important for significantly reducing GHG emissions.
- A technology transfer mechanism should be developed for best practices in Transmission and Distribution (T&D)
- The current Demand-Side Management activities should be expanded and
- best practices and regulations for Renewable Energy should be shared

The APP held the closing PIC meeting in Bangkok in April 2011 to conclude this activity. It was decided to transfer the cement, steel and electricity task forces to GSEP. It was expected that the valuable network that has developed through APP activities would continue on the next platform, and that new initiatives would be launched. The APP website<sup>6</sup> will be maintained to share the legacy of the information gathered, as well as best practices and other information that has been developed.



**Fig 6 APP Closing Policy Implementation Committee**

### **GSEP launched**

Before the APP's closing PIC meeting at the first Clean Energy Ministerial Meeting in Washington, D.C. in June 2010, U.S and Japanese ministers proposed a new public and private partnership initiative, GSEP. This aims to diffuse technologies to accelerate energy efficiency improvements in commercial buildings and industrial facilities, which together account for almost 60 per cent of global energy use, and to reduce greenhouse gas emissions and pollution. Participating governments include Australia, Canada, Denmark, Finland, France, India, Japan, Korea, Mexico, Russia, South Africa, Sweden and the United States, together with the European Commission.

<sup>6</sup> See <http://www.asiapacificpartnership.org/english/default.aspx>



The GSEP was initially composed of the Certification Working Group (later renamed the Energy Management Working Group) and the Sectoral Working Group.

The central focus of the Energy Management WG is to adopt an energy management system, to achieve designated minimum rates of energy performance improvements and to receive third-party validation for these improvements. (This is led by the US). It was assumed that the Sectoral Working Group would include energy intensive industries who are engaged with energy efficiency improvements, to be driven by public and private partnerships. This plans to develop a database of best available technologies and best practices with regard to successful energy saving and GHG emission reduction, and to standardize the measurement and monitoring methodology of energy consumption and GHG emissions. It is expected to implement facilities diagnosis and peer review. It was also placed under the IPEEC. (This is led by Japan)

Japan proposed that the Working Group should consist of the cement, steel and electricity sectors, which were among the most active under the APP, emphasizing that there had to be a successor to the APP task forces because these were a good demonstration of public and private partnerships. The electricity sector insisted that activities relating to improvements in operation and maintenance that were focused on coal-fired generation plants needed to continue in the new framework, knowing that the circumstances concerning coal-fired power generation differ from country to country.

With regard to the electricity industry, because APP

stakeholders met at the Tokyo Inner meeting held before the Clean Energy Ministerial Meeting to discuss the transfer to GSEP, the APP's Power Generation and Transmission Task Force was quickly transferred to the GSEP Power WG. The APP's Steel and Cement Task Forces also decided to transfer to the GSEP WGs by the end of 2010. The US added the Cool Roofs and Pavements WG and Finland launched the Combined Heat and Power WG after the Clean Energy Ministerial Meeting. Now there are six WGs.

The GSEP WGs were also adopted by the IPEEC Executive Committee.

In Japan this was followed by a period of consultation by the Ministry of Economy, Trade and Industry (METI) and relevant organizations, and resulted in a workshop in Washington, D.C in September 2011. At the meeting, the six WGs discussed how they would proceed with their activities. The Power WG was attended by METI and FEPC from Japan, the USDoE and the EEI from the US, Eurelectric from the EU, the Canadian Electricity Association and the World Resources Institute from China, with the objective of learning lessons from the APP and exchanging views on the development of the activity plans.

The main conclusions of the Power WG were as follows;

- It was confirmed that the APP Power Task Force activities and the peer review of coal-fired generation plants were particularly significant
- The WG's activity plan should be developed on the

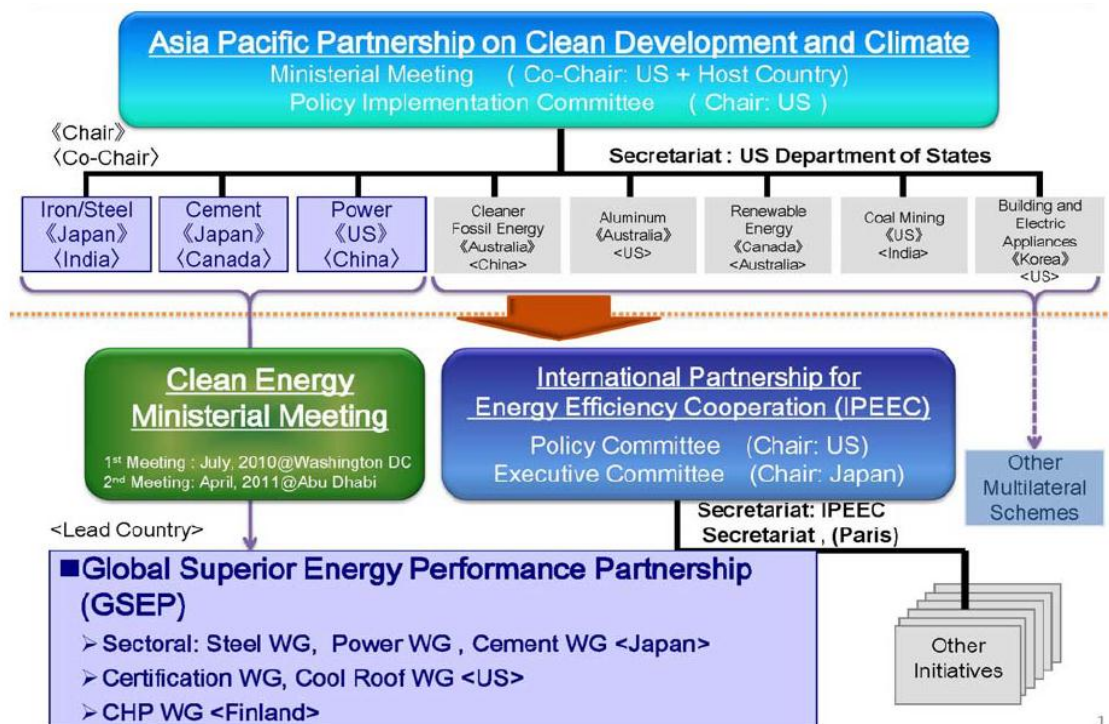


Fig. 7 Transfer of APP to GSEP

basis of recommendations (peer review, T&D, DSM etc) provided by the Tokyo Inner meeting held in June 2010

- Outreach to developing countries is important
- It was agreed that the Power WG Chair would be Mr. Asahi, Director-General of METI and that the Co-Chair would be Dr. Kyte, coordinator of the International Electricity Partnership
- The activity plan would be reported to the third Clean Energy Ministerial Meeting which would be held in London in April 2012

#### **International Electricity Partnership (IEP)**

In October 2008 the Canadian Electricity Association, essa (Australia), the Edison Electric Institute (US), Eurelectric(EU) and FEPC(Japan) agreed to establish the International Electricity Partnership at the World Electricity Summit Meeting in Atlanta, US. The Comisión de Integración Energética Regional (Latin America) joined later.

The objective of the IEP is (a) to exchange views on the agenda at international climate change negotiations, (b) to confirm common perspectives of the international electricity sector and to deliver its own views and (c) to seek what contribution the electricity sector can make to viewpoints on climate change impact.

The activities it has previously implemented are;

- April 2009, announcement of CCS roadmap at the Ad hoc UNFCCC WG in Bonn
- December 2009, announcement of “Roadmap for a Low-Carbon Power Sector by 2050 at the side event of COP 15 in Copenhagen
- April 2010, panel discussion on the above roadmap in Tokyo
- December 2010, MRV report of the electricity sector and performance of the IEP at the COP 16 side event in Cancun
- December 2011 Outreach to South Africa about common challenges facing the electricity industry, in Durban

#### **GSEP 1<sup>st</sup> Sectoral Working Group**

Following the workshop in Washington, D.C., the GSEP 1<sup>st</sup> Sectoral Working Group was held in Tokyo in March 2012, consisting of the Power WG and the Steel WG. The Power WG was attended by 30 members from Japan’s METI, FEPC, CRIEPI, Tokyo Electric Power Co., Kansai Electric Power Co., the US DoE, Indonesia’s Ministry of Mineral Resources and Energy, PLN, China’s Renmin University, CLP of China, the

IEP and the Asia Development Bank. The WG adopted the WG’s work plan and operational guidelines and approved the implementation of activities to facilitate the development, deployment and diffusion of cost-effective, cleaner and more efficient technologies based on work done by the APP Power Generation and Transmission Task Force, among others by highlighting

- Best Practices in Power Plant Efficiency and Operation
- Best Practices in Transmission and Distribution (T&D)
- Best Practices in Demand Side Management (DSM).

#### **Moving ahead**

Throughout the course of moving to the GSEP from APP, some challenges were highlighted. The most typical example was pointed out by the Centre for European Policy Studies (CEPS) report<sup>7</sup> entitled Sector-specific Activities as the Driving Force towards a Low-Carbon Economy. From the Asia-Pacific Partnership to a Global Partnership (Noriko Fujiwara 2012). This gives an assessment of the APP by describing “The APP’s two features – bottom-up approaches and a public–private partnership – were considered factors behind its success” but at the same time it pointed out “Among the major barriers, the lack of funding puts constraints on progress in the demonstration of new technologies.” and suggested “Facilitating access by the private sector to international and regional financial institutions (e.g. the World Bank, the Asian Development Bank and the European Investment Bank (EIB)) would be a possible solution to the funding problem.”

This may be correct but the focus should be on how resources can be secured to allow financing to be reimbursed. Under the APP/GSEP, it is assumed that resources are derived from increased efficiency, but electricity rates are normally low in developing countries. Therefore different ideas, including lengthening the reimbursement period and reducing the initial cost, have to be taken into account.

The above essay pointed out another barrier, “a lack of capacity for data collection and management”. This is also true of the electricity sector. However all the challenges pointed out already can be solved. These will be addressed as the GSEP moves ahead.

<sup>7</sup> See

<http://www.ceps.eu/book/sector-specific-activities-driving-force-towards-low-carbon-economy-asia-pacific-partnership-gl>