

**TERMINAL REPORT FOR THE IMPLEMENTATION OF ADB REGIONAL
TECHNICAL ASSISTANCE FOR TRANSBOUNDARY ENVIRONMENTAL
COOPERATION IN NORTH-EAST ASIA**

Background

Following the Earth Summit and with the adoption of Agenda 21 in 1992, by the international community as a global action plan for sustainable development UNESCAP in cooperation with UNDP, UNEP, ADB and the World Bank initiated efforts to tackle environmental problems and promote sub-regional environmental cooperation. This was attempted in North-East Asia at the official level by convening the First Meeting of Senior Officials on Environmental Cooperation (SOM-1) at Seoul, Korea in 1993 where the genesis of the North-East Asian Sub-regional Programme on Environmental Cooperation (NEASPEC) took place. At the second Meeting of Senior Officials on Environmental Cooperation (SOM-2), held at Beijing, China in 1994, the geographical scope of the programme was defined. This included the six main countries in the region, namely: China, Japan, Mongolia, the Republic of Korea, the Russian Federation and the Democratic People's Republic of Korea, which together account for 44 per cent of the population of the Asia Pacific region. Out of five priority projects identified at SOM-2, three projects were implemented with funding support from the Asian Development Bank (ADB) and UNESCAP. These were:

- a) Subproject-I: Training for sulphur dioxide reduction in coal-fired power plants
- b) Subproject-II: Demonstration of low-air pollution coal-fired power plant technology
- c) Subproject-III: Environmental pollution data collection, comparability and analysis.

In 1999, the Asian Development Bank (ADB) generously offered funding on some of the second phase projects. The financial package, named *Regional Technical Assistance for Transboundary Environmental Cooperation in North-East Asia*, included a \$350,000 grant by the Bank, consisting of three components. In response to the request made by the Sixth Meeting of Senior Officials (SOM-6) in Seoul, Republic of Korea in 2000, the three components were titled as follows:

- a) Regional training for reducing pollution from coal-fired power plants;

- b) Environmental Monitoring, Data Collection, Comparability and Analysis;
- c) Action plans for improving the efficiency of particulate abatement systems in existing power plants.

These three components correspond to the NEASPEC Project I to III, as endorsed by the Fourth Meeting of Senior Officials at Moscow (SOM-4).

- a) Project I - Pollution Reduction in Coal Fired Power Plants
- b) Project II - Environmental Monitoring, Data Collection Comparability and Analysis.
- c) Project III - Efficiency Improvement of Electrostatic Precipitators in Existing Power plants.

Following the conclusion of the letter of agreement between the Asian Development Bank and UNESCAP as executing agency for the implementation of the Regional Technical Assistance (RETA) project, the ADB funds became disbursable by early 2001.

For the duration of the current project, UNESCAP with the assistance from ADB and in close collaboration with the NEASPEC member states and national partners has developed a comprehensive training programme on air pollution monitoring and emission control from coal-fired power plants, including methodologies and guidebooks, has organized 13 training courses, expert group meetings, national and subregional workshops, has collected ambient air pollution data sets, has developed two action plans for selected power plants in Mongolia and China, and has initiated the development of a subregional action plan for pollution reduction from coal-fired power plants in the North-east Asia subregion.

It is acknowledged that along side with the Asian Development Bank, also the Government of Republic of Korea and the Government of Japan continue to provide financial and technical support for the implementation of the Project I: *Pollution Reduction in Coal-fired Power Plants*, and Project II: *Environmental Monitoring, Data Collection, Comparability and Analysis*. The host institutions of the relevant project activities, such as the National Institute of Environmental Research (NIER) and Korean Electric Power Research Institute (KEPRI) also provide continuous in-kind technical support. This is underlining the importance and the sustainability of the undertaken project activities.

Implementation of the Regional Technical Assistance Project Components

(a) Project I: Pollution Reduction in Coal-fired Power Plants

Project component I of the Regional Technical Assistance (RETA) consists of training courses and on-site demonstrations for increasing the efficiency of coal fired power plants and decreasing emissions of air pollutants cost effectively. The objectives of the training were to the enhance capacity of participants capabilities in operations and maintenance of coal-fired power plants as well as equipment upgrades and retrofits.

Under this project component, UNESCAP has undertaken a number of activities to strengthen the human and organizational capacities of the recipient NEASPEC countries (China, Mongolia and the Republic of Korea) in the following areas:

1. Establishment of a Regional Training Centre to facilitate onsite training of managers and technical personnel of various power plants in North-East Asia

The Government of the Republic of Korea has generously offered its support by hosting the “*North-East Asian Training Centre for Pollution Reduction in Coal-fired Power Plants*” at the Korean Electric Power Research Institute (KEPRI) in Daejeon, Republic of Korea in 2001. A two year Workplan for the Training Centre’s activities under the project component was developed, including a timetable towards the launching of the training programmes. The workplan was prepared in close consultations with UNESCAP and with the assistance of an international consultant. The Workplan was finalized in October 2001 and the revisions and comments of the participating countries and relevant organizations were incorporated.

2. The *North-East Asian Training Centre for Pollution Reduction in Coal-fired Power Plants* developed of comprehensive training programme for reducing pollution from coal-fired power plants, including training curricula, manuals and materials for on-site training demonstration and hands-on-equipment was developed and two training workshops were organized.

The first training course was held at KEPRI in Daejeon, Republic of Korea, from 10 to 21 December 2001. Five (5) participants from China and Mongolia attended this comprehensive two-week training course. The development of a training manual “*The North-East Asian Training Centre Manual for Pollution Reduction in Coal-fired Power Plants*” and conduct of

the training course were both done according to the recommendations made at the Expert Group Meeting (Ulaanbataar, 1998), which were subsequently endorsed by the Fifth Meeting of Senior Officials (SOM-5) in Kobe, Japan in 1999.

The Second Training Course, on Pollution Reduction in Coal-fired Power Plants in North-East Asia was held at KEPRI in Daejeon, Republic of Korea from 3 – 16 December, 2002 as per the Workplan and was organized jointly by UNESCAP and KEPRI. Six (6) participants from China and Mongolia attended the course the lectures and on site observations of which were conducted according to the improved training curriculum endorsed by the Eighth Meeting of Senior Officials on Environmental Cooperation in North-east Asia (SOM-8 Ulaanbaatar, Mongolia 2002). The lectures and on-site observations were conducted according to the Training Course Programme recommended by the Expert Group Meeting at Ulaanbaatar, Mongolia in 1998 and subsequently endorsed by the 5th Meeting of Senior Officials on Environmental Cooperation in North-East Asia on 24-26 February 1999 at Kobe, Japan. The programme covered among others boiler and turbine technology, new technology and practices, water chemistry, maintenance and conservation technology, materials and failure analysis technology, performance management technology, coal policy, analysis and combustion theory, air pollution regulation, fundamentals of air pollution and SO₂ control, fundamentals of denitrification, and also included a plant visit. At the end of the training course the participants evaluated/reviewed the programme favourably. As with the first Training Course an evaluation/review session was conducted at the end of the training course, which provided in general a positive feed back to the trainers.

3. Policy guidance from the Senior Officials Meetings on the training and capacity building activities.

A comprehensive report and a proposal for strengthening the training programme was developed by KEPRI in March 2003 - "*Final Report of the North-East Asian Training Centre for Pollution Reduction in Coal-Fired Plants*". The report was submitted to the Ninth Senior Official Meeting, which was held from 2-4 March 2004 in Moscow, the Russian Federation. to the Ninth Meeting of Senior Officials on Environmental Cooperation in North-East Asia. The document covers the objectives and organization of the centre, overview of the first and second training programmes carried out for two weeks in 2001 and 2002 respectively

including time table of the training courses and remarks and recommendations that followed from the two training courses, including the training material used for the on-site training visits.

The SOM 9 acknowledged with appreciation the success of the training programme, highly recommended their continuation and underlined the importance to broaden the scope of the programme to include all NEASPEC member countries.

(b) Project II: Environmental Monitoring, Data Collection, Comparability and Analysis

Project component II of the RETA was developed to include the following activities: (a) collecting and managing background information of participating countries (b) developing compatible analytical and data processing methods (c) analyzing present and predicting future regional environmental conditions (d) facilitating the exchange of available information. Under this project component UNESCAP has undertaken the following activities to support the recipient countries:

1. Establishment of the North-East Asian Centre for Environmental Data and Training

To facilitate active involvement of participating countries in the development of a regional network for environmental monitoring and in accordance with decisions of SOM-5 (Kobe, Japan, 1999) and SOM-6 (Seoul, Korea, 2000), “North-East Asian Centre for Environmental Data and Training (NEACEDT)” was established in the National Institute for Environmental Research (NIER) of the Republic of Korea in 2001.

At the First Meeting of the National Focal Points for the North-East Asian Centre for Environmental Data and Training (NEACEDT) held at NIER in Incheon, Republic of Korea, in February 2001 the progress of the preparatory activities for the establishment of NEACEDT was reviewed and views were exchanged on future development of NEACEDT activities between the national focal points nominated by participating countries. The meeting also agreed upon further steps to finalize the NEACEDT Workplan.

Following the recommendations of the First Meeting of the National Focal Points, UNESCAP recruited an international consultant to assist NIER in formulating the Workplan of NEACEDT. The consultant was assigned to develop draft Workplan for the Centre for the

period 2002-2003. The draft was circulated among the participating countries and relevant organizations for review and comments, based on which the Workplan was finalized in January 2002.

2. Establishment of a regional network on environmental monitoring, data collection, comparability and analysis.

The Task Force on Air Pollutant Emission established with the financial and technical support from the Ministry of the Environment, Government of Japan and the Japan Environmental Technology Association (JETA) had its first meeting in Kyoto in December 1999 and continued providing guidance on the data and emission monitoring activities in the NEASPEC.

As part of the network development activities, an Expert Group Meeting on Capacity Building of Air Pollutant Emission Monitoring in North-East Asia, was held in 13-15 March 2002 in Yokohama, Japan. The meeting was attended by 17 participants from China (2), Japan (8), Mongolia (2), Republic of Korea (2), and the Russian Federation (2), ESCAP (1). The Meeting (i) Endorsed the finalization of the document “Recommendations on Methodologies of Air Pollutant Emissions Monitoring”, (ii) Identified capacity building needs for air pollutant monitoring in North-East Asia, (iii) Acknowledged and recommended the use of on-site demonstration of air pollutant emission monitoring in future training programmes (iv) Called for further development of capacity building in air pollutant monitoring in North-East Asia in coordination with other project activities of NEACEDT.

A second Expert Group Meeting on Capacity Building and Data Intercomparability for Ambient Air Quality Monitoring in North-East Asia was held in 24-26 April 2002 Incheon, Republic of Korea in 2002. The meeting was attended by 23 participants from China (2), Japan (2), Mongolia (2), the Republic of Korea (16) and ESCAP (1). The Meeting recommended that the network should focus on (i) implementation of the NEACEDT Workplan and mainly the the short term activities; (ii) delivering value added outputs from data collection (e.g. comparative analysis of air quality data from different countries) thus feeding back tangible benefits to participating countries, (iii) publishing a report on more comprehensive assessment of the intercomparability of air quality data identifying both common and differentiated components of standards in the participating countries, (iv)

organization of an on-site assessment workshop in 2002-2003 as a capacity building exercise on ambient air quality monitoring in North-East Asia (v) enhanced communication with the National Focal Points and request information exchange on existing training opportunities in the respective countries (vi) applications of Web/GIS based technology and on-the-job training for experts in its future long term activities.

The Eighth Meeting of Senior Officials (SOM8) held in Ulaanbataar, Mongolia on June 20, 2002 recommended that NEACEDT should put further emphasis on early delivery of substantive outputs, as identified in the Workplan in particular, including the analytical report on monitoring activities and methodologies in North-East Asian countries. The meeting also reminded all participating countries to communicate their latest air quality data to NEACEDT. The meeting further noted with appreciation Japan's contribution to capacity building on pollutant emission monitoring and the contribution of the Japan Environment Technology Association (JETA), to this activity.

3. Comprehensive training programme to harmonize the data standards and methodologies in the subregion.

As a direct outcome of the recommendations made at the Expert Group Meeting on "*Capacity Building of Air Pollutant Emission Monitoring in North-East Asia*" held in Yokohama, Japan in March 2002, UNESCAP organized a training workshop in Beijing, China on 26-28 February 2003. The China State Environmental Protection Administration (SEPA), the Ministries of Foreign Affairs and Environment of Japan and the North-East Asian Centre for Environmental Data and Training (NEACEDT), hosted the workshop entitled "*Training on Emission Monitoring and Estimation in North East Asia*". More than 40 participants from China, the Democratic People's Republic of Korea, Japan, Mongolia, Republic of Korea and the Russian Federation attended. At the conclusion of the workshop the participants made recommendations and evaluated the programme. The participants found both the training and the publication very useful and relevant to their work.

The Meeting recommended continuation of the training programme in future, increasing the length of the training period and expanding the programme content to include widely used manual measurement techniques, monitoring dusts and particulate matter as well as discussions on economic estimation of air pollution. It further recommended that the

participants should include local government officials and policy makers involved in air pollution control. The opportunities for exchange of ideas/information and know-how through joint monitoring exercises among engineers in the sub-region should be explored, on-site demonstrations should be used as practical examples

An On-site Assessment Workshop on *Capacity Building and Data Intercomparability for Ambient Air Quality Monitoring in North-East Asia* was organized from 22 to 24 September 2003 in Ulaanbaatar, Mongolia. This workshop was co-organized by UNESCAP and the North East Asian Centre for Environmental Data Training (NEACEDT), which is hosted by the National Institute of Environmental Research (NIER) in Incheon, Republic of Korea. The workshop was attended by 21 participants from China(2), Japan (1), Republic of Korea (7), Mongolia (11). The workshop included several important aspects of air quality monitoring presented by NEACEDT as well as country presentations.

During the workshop an overview of the “*Data Reporting Format*” was presented, as well as discussions on data reporting issues were held. The Workshop participants made a field visit to the Central Laboratory of Environmental Monitoring of Mongolia and were shown the facilities and equipment available for air, water and soil analysis. The participants were also shown one of the four monitoring stations in Ulaanbaatar located on the grounds of the Central Laboratory and were briefed on the current monitoring situation of Mongolia. They also made a visit to Thermal Power Plant No. 4 as one of the potential sources of air pollution in Ulaanbaatar. The participants were informed that Mongolia does not have emission standards for stationary sources at present.

In addition, under this project component “Recommendations on Methodologies of Monitoring Air Pollutant Emissions” developed by the Task Force on Air Pollutant Emission which first met in Kyoto, Japan in December 1999 and finalized at the Yokohama Expert Group Meeting in March 2002 has been published and widely distributed through the NEASPEC network and a NEACEDT web site is currently being finalized.

(c) Project III: Action Plans for improving the efficiency of particulate abatement systems in existing power plants

According to the Regional Technical Assistance the project component III entails the development of action plans for improving the efficiency of particulate abatement systems in existing power plants. UNESCAP has undertaken activities in the following areas:

1. Organization of On-site Assessment Workshops on Efficiency Improvement of Particulate Abatement Systems in Existing Power Plants

A Workplan was developed in May 2002 for this component for the organisation of On-site Assessment Workshops on Pollution Reduction in Electric Power Plants, which stresses the need for Capacity Building activities in the form of technical assistance and future investments for large-scale particulate abatement systems in some countries of North-East Asia. These were highlighted in Workshops held in China (1997) and Mongolia (1997). While implementation of NEASPEC projects continued under the direction of Senior Officials guidance was provided by the Project Review Meetings under technical assistance funded by the ADB. The ESCAP Secretariat was implementing the organisation of the on-site assessment workshops with guidance provided by ADB. Under the Workplan two on-site assessment workshops were to be organised.

The First On-site Assessment Workshop on Pollution Reduction in Electric Power Plants in North East Asia was held on 7-9 August 2002, Guiyang, Guizhou Province, China. Attending the meeting were 12 participants from China (4), the Democratic People's Republic of Korea (2), Japan (1), Mongolia (2) and the Republic of Korea (3). The following observations and recommendations were made (i) Efficiency Improvement of particulate abatement system in the Guiyang power plant which was further upgrading its pollution control facilities for the sake of the protection of environmental quality and human health in the city and nearby communities despite the fact that its particulate emissions complied with the current national standards. The workshop suggested optimising entire plant operation in view of maximising electrostatic precipitator (ESP) performance and also exploring the potential of coal blending to improve particulate emission control, combustibility and SO_x emissions as well.

The Second On-site Assessment Workshop on Efficiency Improvement of Particulate

Abatement Systems in Existing Power Plants was organised in Ulaanbaatar, Mongolia 25 to 27 September 2003 by UNESCAP and the Mongolian Ministry of Nature and Environment. The programme was formulated taking into account feedbacks from the first on-site assessment workshop held in August 2002, in China. The participants visited and examined Ulaabbaatar's Power Plant No. 3 and No. 4 where the power plant officials made presentations. Participants noted that Power Plant No. 3 was old and almost at the end of its useful life and therefore operational conditions were very hard. In spite of this the management and workers tried their best to maintain and operate the plant under these difficult conditions. As a result of rehabilitation carried out in 2000 the thermal efficiency of Plant No. 3 was dramatically increased resulting in a 20% reduction of air pollutant emissions and a significant savings of coal per annum. The participants were informed that the plant is trying to use low temperature fluidized bed combustion technology to reduce NO_x emissions on the medium pressure side. However the plant lacked automatic emission monitoring equipment to optimize the operation of pollutant emission abatement system.

During the process of developing the workplan for the North-East Asian Training Centre for Pollution Reduction in Coal-fired Power Plants in Project I (*Pollution Reduction in Coal-fired Power Plants*), UNESCAP also consulted with the host institution, KEPRI, on how the Training Centre's activities could be linked with Project III (*Efficiency Improvement of Electrostatic Precipitators in Existing Power Plants*) considering that both projects have a number of common elements in addressing the air pollution problems of electric power plants. However, due to the limited technical and administrative capacity of the Training Centre, it was proposed that Project III should be implemented, independently of the Training Centre, which could nevertheless be able to provide technical support to some part of the Project III activities.

2. Guidelines for the development of the Subregional Action Plan for Efficiency Improvement of Particulate Abatement Systems in Existing Power Plants were developed and approved by the countries in Northeast Asia

During the First and Second On-site Workshops (Guiyang, China, 2002 and Ulaanbaatar, Mongolia, 2003) the development of a Subregional Action Plan for Efficiency Improvement of Particulate Abatement Systems in Electric Power Plants in North-East Asia was discussed.

Guidelines were developed, discussed and reviewed with the participants. The workshops stressed the importance of developing a long-term plan utilising an integrated approach to overall pollution control for the plant's future upgrading as well as the development of a constructive partnership between the plant and the environmental protection authorities. Priority was to be given in to capacity building while developing the NEASPEC sub-regional action plan for efficiency improvement of particulate abatement systems in electric power plants in North East Asia. These are to include future workshops, strengthening of the NEASPEC/KEPRI training courses based on lessons learned in the current workshop, information on existing training opportunities in the field to be collected and disseminated to the participating countries. Other strategies should include awareness raising, information collection and dissemination via workshops and databases on available technologies, recommendations on policy measures and financial mechanisms such as market based approach to attract international investments, for efficiency improvement of particulate abatement systems in electric power plants. Control of other pollutants and management of overall energy efficiency and CO₂ emissions need also to be considered as part of an integrated approach with a comprehensive clean coal programme which may need to be developed with national and international inputs. Standards for power plants should also be established, as well as an appropriate technical and management training for decision makers, managers and operators. Where necessary, on-the-job training of the trainers for engineers and technicians responsible for power plant operation with the provision of training equipment needs to be developed and replicated throughout the subregion.

3. Development of action plans for selected power plants in Mongolia and China

During the final stage of the implementation of the RETA project, UNESCAP has assisted Mongolia and China in the development of action plans for a selected coal-fired power plant in each of the countries. For that purpose international and national consultants were selected and appointed. The action plans were developed based on a technical audit study of each of the selected coal-fired power plants with the objective to review, analyze and evaluate the state of the particulate abatements systems. The action plans included emissions survey and proposed prioritized measures for rehabilitation/retrofitting for both power plants with timetable and financial provisions required.

Once developed, the Action Plans were presented, discussed and approved during national workshops, which were attended by the stakeholders involved during the process of the development, i.e. the management and experts from the coal-fired power plants, officials from the relevant government authorities related to the energy sector and were then finalized according to their comments.

A subregional workshop on Action Plan for Improvement of the Particulate Abatement Systems of Coal-Fired Power Plants was organized on 7 to 8 June 2004 Beijing, China to discuss and review the action plans for the selected coal-fired power plants in Mongolia and China and on to agree on the structure and process of preparation of the subregional action plan. The workshop was attended by 20 participants from China (12), Republic of Korea (3), Mongolia (2), two resources persons – one from the Russian Federation and the other one from Kazakhstan, and a representative from the ADB.

The subregional workshop concluded that coal will continue to be a major energy resource in the North-East Asian subregion to support economic development in the short and medium term. However, emissions from the continued utilization of coal at the coal-fired power plants in the subregion will greatly affect the lives of people and the society with economic implications.

Experts attending the meeting agreed that setting up national standards on emissions from coal-fired power plants is critical in developing any projects to reduce emissions. Some countries such as China, Russian Federation and the Republic of Korea have set up such standards. The meeting agreed to promote establishing similar standards based on the best practices in the subregion.

It was recommended that further analysis on the implications of emissions from coal-fired power plants at the subregional level was needed in order for the governments to develop policy recommendations and to be formulated as a subregional action plan.

After final review according to the recommendation from the Subregional workshop, the draft action plans developed for selected coal-fired power plants in China and Mongolia will be submitted to ADB as part of the Terminal Report of the TA Assistance Project on 6 July 2004 with recommendation to consider funding for their implementation. The APs will also be submitted as part of the report and recommendations from the Subregional workshop to the

NEASPEC Focal Points of the two countries and to the SOM 10 to be held in Japan at the end of 2004.

It was also agreed that participation of all countries from the subregion is essential in learning from the experiences from other countries to promote subregional cooperation. In this connection, the secretariat was requested to explore the opportunity to further the endeavour and support the participation of all NEASPEC member countries including identifying supplementary funds and the use of the core fund to ensure participation.

The Way Forward

Following the recommendations UNESCAP has drawn up a set of future activities in the area of pollution control of coal-fired power plants for the North-East Asia subregion:

- (a) Development of investment proposals based on the action plans for the two selected power plants in Mongolia and China to serve as demonstration projects, including elements and provisions for technology transfer pilot projects;
- (b) Development of a Decision Support System (DSS) with the following elements:
 - Develop a comparative model for the emissions from coal-fired power plants and ambient air pollution;
 - Apply the model for the selected coal-fired power plant in Mongolia, including develop a proposal for standard for the emission control;
 - Conduct a study on the standards for control of emissions from coal-fired power plants and best practices in the North-East Asia subregion;
 - Comparative study on available emission reduction technologies for coal-fired power plants
- (c) Conduct a needs assessment study for the establishment of national data collection centres in the NEASPEC Member States
- (d) On-the job-training
 - Develop a training of the trainers curriculum, including manuals and guidebooks in national languages;

- Conduct training of the trainers workshops with provisions of equipment;
 - Follow up national training conducted by the trainers
- (e) Develop the subregional action plan for improvement of the particulate abatements systems and emissions from the coal-fired power plants in North-East Asia with targets and timeframe;
- (f) Public awareness activities – further development of the NEASPEC web site, production of publications and leaflets, stakeholder involvement strategies; etc.