

Country Name	The Project for Total Emission Control of Nitrogen Oxide in Atmosphere
People's Republic of China	

I. Project Outline

Background	While the economy was growing rapidly, environmental deterioration was at a serious level in China. Nitrogen oxide (NOx) was one of the causes but its emission was increasing because many of the NOx emission reduction techniques were still at the introductory stage in China and there were many issues for full-scale introduction. In addition, laws and policies on the NOx emission control were underdeveloped. In view of the above, the Government of China included the restrictive index of 10% reduction in NOx emissions compared to 2010 and identified the total emission control of NOx as a priority pollution countermeasure in its "12th Five-Year Plan for the National Economic and Social Development (12th FYP)" (2011-2015).												
Objectives of the Project	The project aimed at improvement of NOx emission reduction <u>methods</u> in China through 1) preparation and utilization of technical guidelines for NOx emission control and 2) refinement of measurement of NOx emission reduction by way of simulating atmospheric dispersion of pollutants, thereby contributing to broad application of advanced NOx emission reduction techniques and methods.												
	<ol style="list-style-type: none"> Overall Goal: Advanced NOx emission reduction techniques and methods are broadly applied. Project Purpose: NOx emission reduction methods are improved. 												
Activities of the Project	<ol style="list-style-type: none"> Project Site: Urban areas in China (Xiangtan City in Hunan Province, where atmospheric simulation is conducted to measure NOx emission reduction) Main Activities: 1) Study the current NOx emission reduction techniques and challenges, organize seminars on Japanese emission reduction techniques and technical exchanges, provide technical advices and instructions to the candidate companies (or model companies) to introduce emission reduction techniques, prepare technical guidelines for NOx emission control, organize a workshop; 2) Study air pollution condition in Xiangtan City, develop simulation models and implement simulation, study statistics and monitoring methods on NOx, prepare a handbook on measurement of NOx emission reduction (draft version), organize a workshop. Inputs (to carry out above activities) <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Japanese Side</td> <td style="width: 50%;">Chinese Side</td> </tr> <tr> <td>(1) Experts: 12 persons</td> <td>(1) Staff Allocated: 33 persons</td> </tr> <tr> <td>(2) Trainees Received: 47 persons</td> <td>(2) Land and Facilities: Project Office, etc.</td> </tr> <tr> <td>(3) Equipment: Equipment for simulation and exhaust gas measurement, office equipment</td> <td>(3) Local Cost</td> </tr> <tr> <td>(4) Local Cost</td> <td></td> </tr> </table> 			Japanese Side	Chinese Side	(1) Experts: 12 persons	(1) Staff Allocated: 33 persons	(2) Trainees Received: 47 persons	(2) Land and Facilities: Project Office, etc.	(3) Equipment: Equipment for simulation and exhaust gas measurement, office equipment	(3) Local Cost	(4) Local Cost	
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Project Period	March 2013 – March 2016	Project Cost	(ex-ante) 270 million yen, (actual) 309 million yen										
Implementing Agency	Department of Total Emission Control/Division of Air Pollutants/Ministry of Environmental Protection (MEP) (Major organizations involved: Chinese Academy for Environmental Planning (CAEP), Chinese Research Academy of Environmental Sciences (CRAES), Xiangtan Environmental Protection Bureau (XEPB) *MEP and EXPB were reorganized to Ministry of Ecology and Environment (MEE) and Xiangtan Ecology and Environment Bureau (XEEB), respectively, after the project completion.												
Cooperation Agency in Japan	SUURI-KEIKAKU Co., Ltd; International Center for Environmental Technology Transfer												

II. Result of the Evaluation

<Special Perspectives Considered in the Ex-Post Evaluation>

- The target year for the Overall Goal was set in March 2019 because the terminal evaluation report of this project states that the Overall Goal is the goal to be achieved within 3 years after the project completion.
- The Overall Goal Indicator 1 ("A manual, catalog of recommended reduction techniques, an official publication, or teaching material is prepared and utilized by the MEP") was interpreted as "... is prepared with reference to the "Technical Guidelines" (draft) and "Handbook" (draft) developed by the project by the MEP and utilized by the central and local agencies in charge of ecology and environment and the relevant companies" based on the existing documents, including ex-ante evaluation sheet, and in light of the reorganization after the project completion. In addition, examples of other utilization of "Technical Guidelines" (draft) and "Handbook" (draft) which contributes to the Overall Goal ("Advanced NOx emission reduction techniques and methods are broadly applied") was also collected as supplementary information.
- As for the Indicators of the Overall Goal, judgement criteria of achievement level was not described in the existing documents; therefore, whether the confirmed results were sufficient in light of the description of the Overall Goal was checked with the grounds for judgement.

1 Relevance

<Consistency with the Development Policy of China at the Time of Ex-Ante Evaluation and Project Completion>

The project was consistent with the "12th FYP", which set forth total emission control of NOx as a priority area for air pollution control at the time of ex-ante evaluation and the "13th Five-Year Plan for the National Economic and Social Development (13th FYP)" (2016-2020), which includes the restrictive target for the total emission control of NOx.

<Consistency with the Development Needs of China at the Time of Ex-Ante Evaluation and Project Completion>

At the time of ex-ante evaluation, the project was consistent with development needs of China for total emission control of NOx as described in "Background". At the time of project completion, change in the needs was not observed.

<Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation>

The project was consistent with the Japan's ODA policy on "cooperation towards resolving environmental and other global issues", one

of the priority areas and issues in the “Economic Cooperation Program for China” (2001).

<Evaluation Result>

In light of the above, the relevance of the project is high.

2 Effectiveness/Impact

<Status of Achievement of the Project Purpose at the time of Project Completion>

The Project Purpose was achieved by the project completion. Experiences of improving the NOx reduction techniques and measurement of emission reduction were accumulated in the MEP (then) through preparation of the “Technical Guidelines for NOx Emission Control” (draft) and the “Handbook on Measurement of NOx Emission Reduction” (draft). These experiences were reflected in its activities for NOx emission control because they were referred during the drafting process of the “13th FYP”, which sets forth total emission control in discharge of NOx¹(Indicator 1). Chinese counterpart staff served as lecturers to introduce the contents of the above “Technical Guidelines” (draft) and “Handbook” (draft) at the final workshop of the project (Indicator 2).

<Continuation Status of Project Effects at the time of Ex-post Evaluation>

The project effects have continued to the time of ex-post evaluation. Experiences and deliverables related to the NOx reduction techniques and measurement of emission reduction have been continuously utilized in the MEE’s activities for NOx emission control and the former C/P have served as lectures at the training courses regarding the NOx emission techniques. (Please see <Status of Achievement for Overall Goal at the time of Ex-post Evaluation> for details of the MEE’s NOx emission control activities and the training courses.) Recognizing the importance of atmospheric simulation through the project, the Xiangtan EEB has continued the simulation and monitoring to measure the NOx emission reduction by introducing the simulation software, which is more sophisticated than the one used in the project. The model companies have continued to implement the technical advices by the project proven to be effective or suitable for their business circumstances or to apply the experiences of the project to implement the NOx emission reduction measures.

<Status of Achievement for Overall Goal at the time of Ex-post Evaluation>

The Overall Goal was achieved by the target year (March 2019), and the status of achievement was maintained at the time of ex-post evaluation. The MEE has prepared sector-specific manuals related to NOx emission control with reference to the “Technical Guidelines” (draft). Although manuals, official publications, or teaching materials that refer to the "Handbook" (draft) have not been prepared, the “Handbook” (draft) have been referred in the dissemination of the NOx emission reduction techniques and measurement of emission reduction in the provinces and the cities together with the “Technical Guidelines” (draft). In addition, the “Technical Guidelines” (draft) and the “Handbook” (draft) have been utilized to prepare air pollution prevention and control measures in the autumn and winter seasons in the priority areas in China, and the “Technical Guidelines” (draft) have been utilized to prepare plans for the related policy guidance. The “Technical Guidelines” (draft), the “Handbook” (draft), and the manuals and the policy documents prepared based on them, have been widely utilized/implemented by the central and local agencies in charge of ecology and environment as well as the relevant companies²; therefore, utilization status is considered sufficient in light of the Overall Goal (“Advanced NOx emission reduction techniques and methods are broadly applied”) (Indicator 1). The results of the project have been referenced in the regular training organized by the MEE: the basic training in the field of air pollution, targeting the staff of the local agencies in charge of ecology and environment and the environmental research institutions under the MEE (500 people participated annually), and the training for the priority industries³. The results disseminated through the training have been continuously utilized in planning and implementing the NOx emission control measures and the related research. Utilization status is considered sufficient in light of the Overall Goal because the effects of the NOx emission control measures have been widely produced (For details, please see <Other Impacts at the time of Ex-post Evaluation>) (Indicator 2).

<Other Impacts at the time of Ex-post Evaluation>

Other positive impacts have been observed. The MEE have set the total emission control standards using the national-scale atmospheric dispersion simulation. Xiangtan City has set an annual target of NOx emission of 20,000 tons/year using the dispersion simulation. It is noted that the total emission control is referred to the Japanese way of thinking, but it is adjusted according to the situation in China. The model companies have always met the NOx emission standards as a result of continuous utilization of the technical advice and/or experience of the project. Average concentration of NOx in the priority areas in China decreased by about 20% in 2017 as compared to 2013, and it decreased from 41 mg/m3 in 2015 to 32 mg/m3 in 2018 in Xiangtan City. According to the implementing agencies, the emission reduction techniques and measurement of the emission reduction transferred through the project have contributed to the decrease. In addition, during the implementation of the “Memorandum on Cooperation for Research and Model Projects for Air Quality Improvement” signed between the MEE and the Ministry of the Environment of Japan in 2018, the experiences and the results of the project have been shared by the MEE, which has led to the efficient implementation of research and model projects. On the other hand, no negative impacts have been observed.

<Evaluation Result>

Therefore, the effectiveness/impact of the project is high.

Achievement of Project Purpose and Overall Goal

Aim	Indicators	Results
(Project Purpose)	1. Experiences regarding	Status of the Achievement: achieved (continued)

¹According to the MEE, advanced technologies transferred through the project was not available in China at the time so that the experiences of the project were considered to be referenced in examining the targets of the 13th FYP such as for upgrade of 500,000 steam ton steal boilers, desulfurization and denitrification of coil boilers, steel industry desulfurization of sintering machines in the steel industry, and denitrification in the cement industry within the respective deadlines.

² According to the MEE, NOx emission reduction techniques are widely introduced in the major emission sources i.e. the power, steel, and cement industries at the time of the ex-post evaluation, referring to the techniques and experiences of the project. (In the power and cement industries, all target companies completed introduction by 2018 and in the steel industry, the introduction is planned to be completed by 2020). Simulation applying the measurement of the emission reduction improved by the project has been introduced at the provincial level and the simulated data is shared to the city level.

³ In addition, the CAEP has modified the contents of the “Technical Guidelines” (draft) and “Handbook” (draft) based on the conditions of China and utilized them in its sector-specific training on NOx emission reduction techniques and methods.

NOx emission reduction methods are improved.	improvement of NOx emission reduction techniques and measurement on NOx emission are accumulated in MEP and are reflected in its activities for NOx emission control.	(Project Completion) -The experiences of improving the NOx reduction techniques and measurement of emission reduction, accumulated in the MEP (then) through preparation of the “Technical Guidelines” (draft) and “Handbook” (draft) , were reflected in its activities for NOx emission control because they were referred during the drafting process of the “13th FYP”, which sets forth total emission control in discharge of NOx. (Ex-post Evaluation) -The experiences of improving the NOx reduction techniques and measurement of emission reduction are continuously utilized in the MEE’s activities for NOx emission control.				
	2. Counterpart staff of the project serve as lecturers at a workshop on NOx emission reduction methods.	Status of the Achievement: achieved (continued) (Project Completion) - Counterpart staff served as lecturers to introduce the contents of the above “Technical Guidelines” (draft) and “Handbook” (draft) at the final workshop of the project. (Ex-post Evaluation) -Former counterpart staff of the project have served as lecturers for the training courses on NOx reduction methods.				
(Overall Goal) Advanced NOx emission reduction techniques and methods are broadly applied.	1. Manual, catalog of recommended reduction techniques, an official publication, or teaching material (any one of them) is prepared and utilized by the MEP.	Status of the Achievement: achieved <Examples of utilization of major deliverables by the MEE> (*=Document mentioned in the Indicator)				
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	2.Results of the project are continuously utilized through workshops, etc.	Status of the Achievement: achieved -The results of the project have been referenced in the basic training for the central and local government staff and the training for the priority industries organized by the MEE: they have been continuously utilized for the NOx emission control measures.				

Source: Project Completion Report; questionnaire and interview survey to the implementing agencies

3 Efficiency

Although the project period was within the plan (ratio against the plan: 100%), the project cost slightly exceeded the plan (ratio against the plan: 114%). The Outputs of the project were produced as planned. Therefore, the efficiency of the project is fair.

4 Sustainability

<Policy Aspect>

The “13th FYP” mentioned in “Relevance” is still effective.

<Institutional Aspect>

At central and local levels, the organizational structure and duties related to air pollution control continues to be clear. The MEP was reorganized into the MEE in March 2018, but the duties of the Department of Total Emission Control have been taken over by the Department of Atmosphere Affairs (DAA) and the Department of General Affairs (DGA). DAA develops policy documents related to pollution prevention and control of fixed emission sources and provides guidance on their technical applications etc. while DGA prepares an annual total emission control plan, confirms the data on total emission reduction, conducts training for engineers and managers, etc. The name of the Xiangtan EPB has been changed to the Xiangtan EEB, but its organizational structure has not been changed. At the relevant departments of the implementing agencies, the necessary staff is considered to be allocated to promote the NOx emission reduction techniques and methods because the number of staff is either according to or more than the quota and the effects of the NOx emission control measures have been produced as described in “Effectiveness/Impact”.

The number of staff of the departments related to air pollution prevention and control at the implementing agencies (as of October 2019)

Organization	Quota	Staff allocated
MEE (only DGA)	2	4
CAEP	1	3
CRAES	1	1
Xiangtan EEB	4	4

Source: MEE, Xiangtan EEB

<Technical Aspect>

The implementing agencies, which have many years of experience in air pollution control and prevention, have maintained the knowledge and techniques necessary to disseminate the techniques and methods improved through the project. The staff members trained in the project have continued to work at their respective organizations and have carry out their duties applying the knowledge and techniques accumulated in the project and their work in the past and utilizing the deliverables of the project as needed. The sector-specific manuals prepared based on the “Technical Guidelines” (draft) and “Handbook” (draft) of the project have been updated as needed. As for the provided equipment, persons in charge are assigned to the equipment for simulation (except for the software) and measurement of exhaust gas: it is properly maintained and utilized.

<Financial Aspect>

At both the central and local levels, the budget for air pollution prevention and control, including the promotion of the NOx emission reduction methods, is provided through the Central Special Fund for Air Pollution Prevention and Control. The budget allocated to the MEE (including the CAEP and the CRAES) and the Xiangtan EEB have been increasing year by year. It is considered that the necessary budget has been secured since the effects of the NOx emission control measures have been produced as described in “Effectiveness/Impact”.

Budget and expenditure for air pollution prevention and control at the implementing agencies (Unit: 10 thousand Yuan)

	2016	2017	2018
MEE	1,120,000	1,200,000	2,000,000
Xiangtan EEB	3	5	243 ⁴

Source: MEE, Xiangtan EEB

<Evaluation Result>

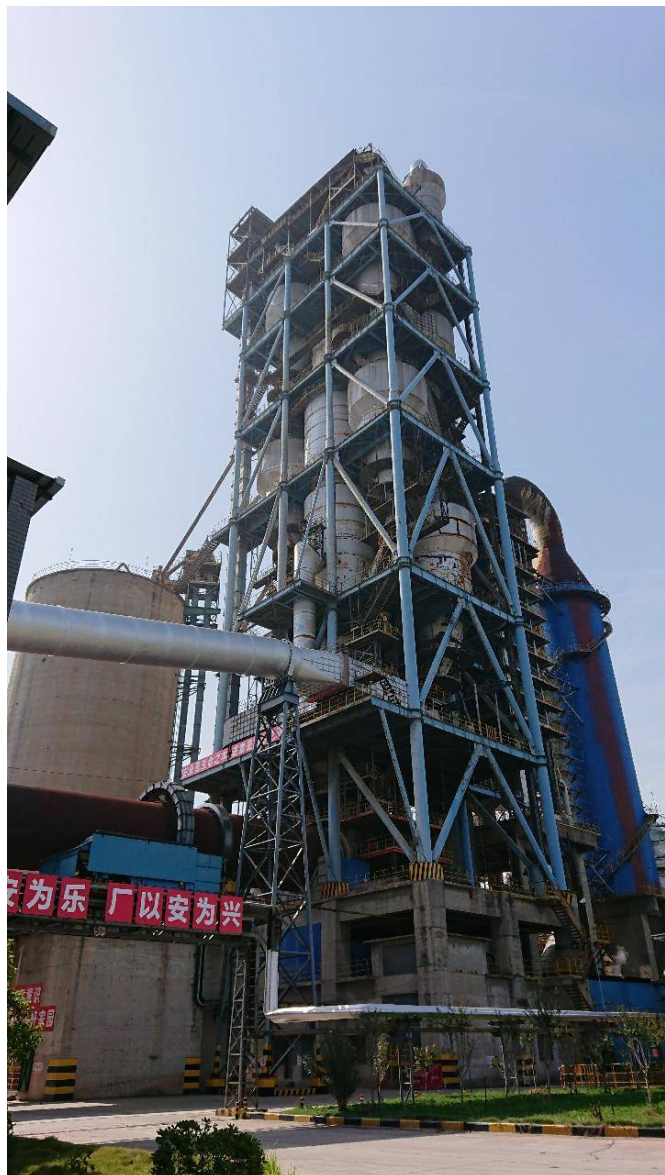
In light of the above, no problem has been observed in terms of the policy, institutional, technical, and financial aspects. Therefore, the sustainability of the effectiveness through the project is high.

5 Summary of the Evaluation

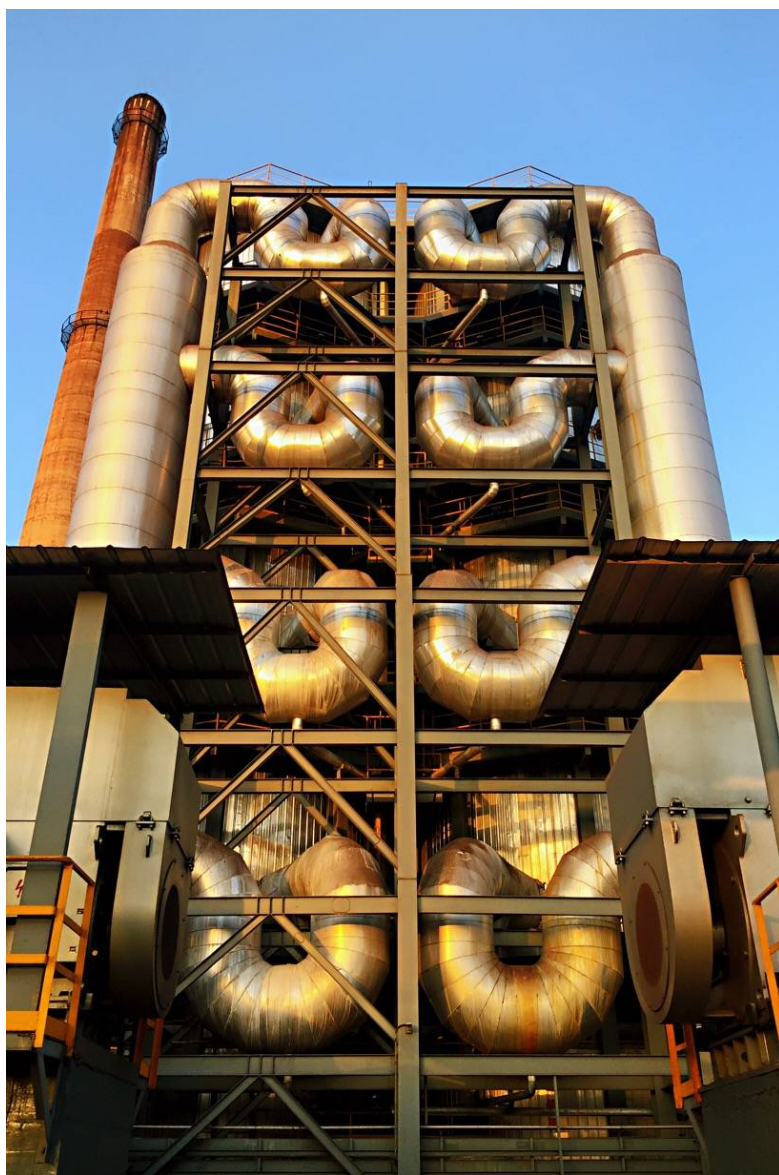
The project achieved the Project Purpose of improving NOx emission reduction methods. The effects of the project have continued, and the Overall Goal of broad application of advanced NOx emission reduction techniques and methods has been also achieved. Regarding the sustainability, no problems have been observed in terms of the policy, institutional, technical and financial aspects. As for the efficiency, the project cost slightly exceeded the plan. Considering all of the above points, this project is evaluated to be highly satisfactory.

III. Recommendations & Lessons Learned

Lessons Learned for JICA: In the case of this project, provision of assistance in line with local issues and Chinese environmental policies related to the issues contributed to high Effectiveness/Impact and ensuring of the Sustainability. Thus, at the planning stage of the technical cooperation project, it is important to plan a project that meets the policies of the concerned sector.



Sinoma Cement Factory (NOx emission reduction techniques introduced)



Desulfurization/denitration facilities of Xiangtan Steel Fence introduced based on the experiences of the project, etc.

4 The budget was increased largely because of procurement of analytical equipment and automatic measuring equipment in response to the regulations related to automobiles that became stricter.