Summary

<table>
<tr><td colspan="3">I. Outline of the Project</td></tr>
<tr><td colspan="2">Country: People's Republic of China</td><td>Project title: Improvement of Environment Protection Technology for Metallurgical Combustion Project</td></tr>
<tr><td colspan="2">Issue/Sector: Energy and mining</td><td>Cooperation scheme: Technical cooperation</td></tr>
<tr><td colspan="2">Division in charge: Natural Resources and Energy Conservation Team, Group II (Natural Resources and Energy), Economic Development Dept.</td><td>Total cost (at the time of evaluation):
Approx. 800 million yen</td></tr>
<tr><td rowspan="3">Period of Cooperation</td><td rowspan="3">(R/D): 01/09/2002 – 31/08/2007
(Extension): –
(F/U): –
(E/N): (Grant aid)</td><td>Partner Country's Implementing Organization:
the Central Iron & Steel Research Institute</td></tr>
<tr><td>Supporting Organization in Japan: Japan International Cooperation Agency (JICA)</td></tr>
<tr><td>Other Supporting Organization: Ministry of Economy, Trade and Industry</td></tr>
<tr><td colspan="3">1-1 Background and Overview of the Project
In the People's Republic of China (hereinafter called China), recent economic growth has been putting a large burden on the environment, and especially air pollution in urban areas are widely recognized as a serious social issue. Looking at each industry sector, the iron and steel industry accounts for 15% of the total smoke emissions and about 7% of the total SO2 emissions in all industries. However, the SOx removal efficiency remains as low as 16% and the industry is slow in taking measures against SO2.
Moreover, as steel production has increased, energy consumption in the iron and steel industry has increased to 10% of the total energy consumption in all industries, and, combined with combustion of fossil fuels and insufficient antipollution measures, it has led to increased air pollutant emissions. Therefore, there is an urgent need to reduce energy consumption through the improvement of combustion efficiency in the iron and steel industry.
Against such background, in 2001, the Chinese government announced guidelines for the iron and steel industry in its 10th 5-Year Plan, and set concrete numerical targets: for environmental protection, reduction of emissions of major pollutants by 10% from the 2000 level, and, for energy conservation, reduction of standard coal equivalent to energy consumption per ton crude steel from 920 kg to 800 kg by around 2005. To achieve these targets, the Chinese government requested the implementation of the Improvement of Environment Protection Technology for Metallurgical Combustion Project in the form of a technical cooperation project aiming at transfer of environmental protection technologies and human resource development in the iron and steel industry that has especially low heat efficiency as well as dissemination of environmental protection technologies to the ironworks in the country.</td></tr>
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1-2 Contents of the Cooperation

(1) Overall Goal

Technologies of energy saving and environmental protection in metallurgical combustion are widely accepted by the iron and steel industry in China.

(2) Project Purpose

Enabling the Energy Saving and Environmental Protection Center for Metallurgical Combustion to teach technologies related to energy saving and environmental protection in metallurgical combustion to ironworks in China

(3) Outputs

1. Project becomes operational.
2. Equipment is furnished.
3. Capability to improve combustion technology is increased.
4. Exhaust gas treatment technology is mastered.
5. Factory audit technology for combustion and the environment are mastered.
6. Dissemination activities for environmental protection and energy saving technology in metallurgical combustion can be carried out.

(4) Inputs (Actual)

Japanese side

Long-term experts: 5 persons

Short-term experts: 27 persons

Trainees: 37 persons

Equipment provided: About 194 million yen

Local cost: About 23.4 million yen

Others: - yen

Chinese side

Counterparts: 28 persons

Land and facilities

Local cost: 2.207 million RMB

Others

II. Evaluation Team	
Members of Evaluation Team	Leader: Makoto Ashino (Director, Natural Resources and Energy Conservation Team, Group II, Economic Development Dept., JICA) Environmental protection technologies in metallurgy: Takumi Yamano (Sumitomo Metal Industries, Ltd.) Research planning: Daisuke Iijima (Natural Resources and Energy

	Conservation Team, Group II, Economic Development Dept., JICA) Evaluation analysis: Ren Arakane (Global Planning Corp.)	
Period of Evaluation	04/03/2007 – 17/03/2007	Type of Evaluation: Terminal evaluation

III. Results of Evaluation

3-1 Project Performance

- Although there was a delay in delivery of some equipment items due to the outbreak of SARS, other equipment items were installed as scheduled.
- Although there was a delay in some of the planned activities in an early stage, most activities are expected to be completed.
- Outputs will be achieved.
- The Project has achieved the Purpose and produced results exceeding it.
- The implementation processes were mostly good (except some negative impacts caused by resignation of counterparts, etc.).
- If the proposed improvement measures are carried out for the target furnaces, energy conservation of an average of 30% or more can be expected.

3-2 Summary of Evaluation Results

(1) Relevance

- The Project is highly relevant to China's policy to develop an resource-saving and environmentally-friendly society.
- The Project is highly relevant to Japan's policy for cooperation with China in the fields of energy conservation and environment protection.
- The Project is highly relevant to the development of next-generation recyclable steel processes led by the Central Iron & Steel Research Institute.

(2) Effectiveness

- Chinese staff members have acquired capabilities for all processes of combustion experiment and diagnosis from planning to report, except analysis of combustion experiment data.
- They have reached the level to be able to provide instructions to ironworks with the use of existing technologies for environmental protection such as desulphurization of smoke emissions.
- 15 improvement proposals have been made to ironworks.
- It is difficult for the ironworks that received improvement proposals to carry out all the proposals due to management issues, etc.

(3) Efficiency

- Although there was a delay in the installation of a multifunctional experimental combustion furnace due to such factors as the outbreak of SARS and experiments were also delayed, thanks to the efforts made in the latter half of the Project, the planned activities including experiments are expected

to be completed.

- There was a delay in some technical transfer activities due to resignation of Chinese staff members.
- Some of the dispatches of Japanese short-term experts were delayed or cancelled.
- With deeper understanding of combustion technologies, emission control technologies, and diagnostic techniques for combustion and environment of ironworks, each Chinese staff member is now able to carry out his/her duties in his/her own position.
- Major activities to be carried out include the implementation of experiments based on a road map, technical transfer of methods to analyse combustion experiment data, and a performance review meeting at the time of project completion comprised of seminars and demonstrations.

(4) Impact

- We are still waiting for a reply from the Iron and Steel Association about whether the percentage of the heating furnaces with heat storage type burners has reached 30%. However, considering that the iron and steel industry in China has been growing rapidly and there is an increasing number of new heating furnaces, the indicator for the overall goal is likely to be achieved.
- Based on the diagnosis of special steel manufacturers, it is estimated that existing heating furnaces have energy saving potential of an average of about 30%.

(5) Sustainability

- China's environmental protection and energy saving policy is very unlikely to regress and will support the sustainability of the Project.
- The Central Iron & Steel Research Institute will play the central role in the development of next-generation recyclable steel processes. The institute is expected to further develop the outputs of the Project.

3-3. Conclusion

Considering the fact that the JICA project was carried out for the five year period when steel production increased in China and the Chinese government put weight on energy saving and environmental protection technologies, the implementation of the Project was timely.

Despite some negative factors in the first half of the project period including the outbreak of SARS and delay in the multifunctional combustion experiments, the Project caught up and met the schedule especially in the latter half. The Project purpose is expected to be achieved and contribute to the achievement of the overall goal.

3-4. Recommendations

1. Recommendations for the Remaining Periods till the Completion of the Project

1) Technical transfer concerning combustion experiment methods has made progress. Technical transfer concerning methods for evaluation and analysis of experiment data should be carried out in the remaining

period.

2) The seminar at the performance review meeting to be held before the completion of the Project should be led by the Chinese side.

2. Recommendations for the Period after the Completion of the Project

1) Japanese high-efficiency combustion technologies have been transferred to the Chinese side. Further spreading the technologies across the country will be important in ensuring sustainability of the Project.

2) To ensure effective utilization of the multifunctional experimental combustion furnace, it has been decided to submit a report to JICA biannually for three years after the Project completion.

3) Measures should be taken to accumulate the outputs of the technical transfer in the organization.

3-5 Lessons Learned

1. Country-focused training was included in the training conducted in Japan with many participants invited from the counterpart organization and other organizations, and it increased the ripple effect of the Project. This method can serve as a useful reference for other projects.

2. To prevent inconsistent interpretation of PDM at the time of evaluation, subjects should be clarified in PDM descriptions and all activity results should be evaluated.

3. When introducing large-size equipment items, it is necessary to thoroughly check the use plan and ownership of the recipient as well as the purpose of use.

3-6 Follow-up Status

As described in the recommendations, effective utilization of the multifunctional experimental combustion furnace is important in ensuring the future presence of the Central Iron & Steel Research Institute in the industry. For this purpose, it has been decided that both Chinese and Japanese sides will continue monitoring the use of the experimental furnace after the completion of the Project. Specifically, the status of use will be reported to the JICA China Office biannually for three years after the completion of the Project.

3-7 Factors Promoting Impact

(1) Rapid Development of the Iron and Steel industry in China

The iron and steel industry in China has remarkably grown. The production volume has been showing tremendous increase at the annual rate of over 20% for the last few years, exceeding 400 million tons in 2006. In this situation, many new production facilities have been constructed. As new facilities for rolling etc. usually have a heating furnace with high heat efficiency, the number of furnaces with heat storage type burners has increased. The heat storage type heating furnace is especially useful for effective utilization of blast furnace gas with low heating value generated in small-scale ironworks without a coke oven.

(2) Further Reinforcement of China's Energy Saving and Environmental Protection Policy in the 11th 5-Year Plan

The 11th 5-Year Plan, published in March 2006, mentions the development of a resource-saving society, an environmentally-friendly society and recycling-oriented economy. Reduction of energy consumption per unit of GDP by 20% and reduction of emissions of major pollutants by 10% for the 5 years from 2006 to 2010 were defined as binding numerical targets for the 5-year plan.

The 11th 5-Year Plan was a major contributor to the generation of effect in the latter half of the project period, in terms of promotion of the Project aiming at the enhancement of capabilities of the Central Iron & Steel Research Institute to spread energy conservation and environmental protection technologies to the ironworks across the country.

(3) Designation and Certification of the Central Iron & Steel Research Institute as State Key Laboratory of Advanced Steel Process, Materials, etc.

In March 2005, the Central Iron & Steel Research Institute was designated as above by the Ministry of Science and Technology. This is not only for the researches of processes and materials but also high-temperature air combustion. It can be a good motivation for the preferential promotion of experiments and researches concerning combustion from the latter half of the Project to the period after the termination.

In December 2005, the high-temperature air combustion development project was certified by the National Development and Reform Commission as a state project and will receive a subsidy of a total of 30,000 RMB for 3 years. It will also be a good motivation for the future research activities for the utilization of the multifunctional experimental combustion furnace.

Moreover, in connection with the 11th 5-Year Plan, the next-generation recyclable steel process development project has been certified as a state project and the Central Iron & Steel Research Institute will receive research funding of 75 million RMB as well as play a core role in the development.

All these events are relevant to the intention of the Project, which has been promoting improvement of use efficiency of thermal energy and effective utilization of smoke emissions and slag, etc., and will further increase the effect of the Project.

3-8 Factors Inhibiting the Promotion of the Project

(1) SARS

The epidemic of SARS of spring 2003 caused a 4-month delay in the construction of the multifunctional experimental combustion furnace and forced all the experts to return to Japan temporarily. This contributed to the delay in the combustion experiment.