

**ASIAN DEVELOPMENT BANK
Operations Evaluation Department**

PROJECT PERFORMANCE AUDIT REPORT

FOR

THE PEOPLE'S REPUBLIC OF CHINA

In this electronic file, the report is followed by the Management response.



Project Performance Audit Report

PPA: PRC 25252
(Final)

Second Industrial Energy Efficiency and Environment Improvement Project (Loan 1436-PRC) in the People's Republic of China

June 2005

Operations Evaluation Department
Asian Development Bank

CURRENCY EQUIVALENTS

Currency Unit – yuan (CNY)

	At Appraisal (April 1996)	At Completion (April 2003)	At Operations Evaluation (March 2005)
CNY1.00 =	\$0.12	\$0.12	\$0.12
\$1.00 =	CNY8.35	CNY8.28	CNY8.28

ABBREVIATIONS

ADB	–	Asian Development Bank
EA	–	executing agency
ECP	–	Exi Chemical Plant
EIRR	–	economic internal rate of return
EPB	–	environment protection bureau
FIRR	–	financial internal rate of return
GCF	–	Guanghua Cement Factory
GSS	–	Guiyang Special Steel Company Limited
HCC	–	Huaxin Cement Company Limited
JCC	–	Jinhua Chemical (Group) Corporation
OEM	–	Operations Evaluation Mission
PCR	–	project completion report
PRC	–	People's Republic of China
PPAR	–	project performance audit report
SETC	–	State Economic and Trade Commission
SOE	–	state-owned enterprise
TA	–	technical assistance
TSP	–	Tianjin Soda Plant

WEIGHTS AND MEASURES

kcal	–	kilocalorie (1 thousand calorie)
kg	–	kilogram (1 thousand gram)
kWh	–	kilowatt-hour
tce	–	tons of standard coal equivalent
tpd	–	tons per day

NOTES

- (i) The fiscal year (FY) of the Government ends on 31 December.
- (ii) In this report, "\$" refers to US dollars.

Director, Operations Evaluation Division 2	:	David Edwards
Evaluation Team Leader	:	Hong Wang

Operations Evaluation Department, PE-663

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Hong Wang, evaluation specialist (Team Leader) was responsible for the preparation of this report, and conducted document reviews, key informant interviews, and guided the fieldwork undertaken by the international and domestic consultants. Krishna Mohan Rao, international consultant, managed a team of domestic consultants comprising Song Junhua, Lejian Xiao, and Ping Zhuang. V. Buhat-Ramos, evaluation officer, supported the team with research assistance and A. Silverio, operations evaluation assistant, provided secretarial assistance from Manila.

In accordance with the guidelines formally adopted by the Operations Evaluation Department (OED) on avoiding conflict of interest in its independent evaluations, the Director General of OED did not review this report and delegated approval of this evaluation to the Director of Operations Evaluation Division 2. To the knowledge of the management of OED, there were no conflicts of interest of the persons preparing, reviewing, or approving this report.

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<p>Attachment: Management Response on the Project Performance Audit Report on the Second Industrial Energy Efficiency and Environment Improvement Project.</p>
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BASIC DATA
Second Industrial Energy Efficiency and Environment Improvement Project
(Loan 1436-PRC)

PROJECT PREPARATION/INSTITUTION BUILDING

TA No.	TA Name	Type	Person-Months	Amount ¹ (\$)	Approval Date
2087	Second Industrial Energy Conservation and Environmental Improvement	PPTA	24.0	393,000	26 April 1994

KEY PROJECT DATA (\$ million)	As per ADB	
	Loan Documents	Actual
Total Project Cost	417.0	277.15
Foreign Exchange Cost	178.0	149.29
ADB Loan Amount/Utilization	178.0	149.29
ADB Loan Amount/Cancellation		28.70

KEY DATES	Expected	Actual
Fact-Finding		17 May–2 Jun 1995
Appraisal		3–17 Oct 1995
Loan Negotiations		27 Mar–1 Apr 1996
Board Approval		9 May 1996
Loan Agreement		11 Nov 1996
Loan Effectivity	9 Feb 1997	13 Jan 1997
First Disbursement		6 Mar 1997
Reappraisal ²		13–17 Sep 1999
Project Completion	31 Dec 2000	Part B: Feb 1999 Part C: Sep 1998 Part D: Dec 1999 Part E: Sep 2001
Loan Closing	30 Jun 2001	25 Feb 2002
Months (effectivity to completion)	46.7	Part B: 25.0 Part C: 20.0 Part D: 35.0 Part E: 56.0

ECONOMIC AND FINANCIAL INTERNAL RATES OF RETURN (%)	Appraisal	PCR	PPAR
Financial Internal Rate of Return	Part B: 11.6 Part C: 12.8 Part D: 10.5 Part E: 12.4	Part B: 10.0 Part C: 11.5 Part D: 8.8 Part E: 9.5	Part B: — Part C: 10.4 Part D: 8.3 Part E: —
Economic Internal Rate of Return	Part B: 13.2 Part C: 20.2 Part D: 14.1 Part E: 16.0	Part B: 12.7 Part C: 18.5 Part D: 12.3 Part E: 12.2	Part B: — Part C: 14.3 Part D: 10.6 Part E: —

BORROWER People's Republic of China

— = no data available.

ADB = Asian Development Bank, co. = company, Ltd. = limited, no. = number, PCR = project completion report, PPAR = project performance audit report, PPTA = project preparatory technical assistance, TA = technical assistance.

¹ Represents approved amount of TA.

² The Project originally consisted of five components. A reappraisal mission was fielded to appraise the proposed replacement of the subproject under part A, which was later cancelled at the request of the Government.

EXECUTING AGENCIES

Part B: Huaxin Cement Co. Ltd.
 Part C: Jinhua Chemical (Group) Corporation
 Part D: Tianjin Bohai Chemical Industry Co. Ltd.
 Part E: Guiyang Special Steel Co. Ltd.

MISSION DATA

Type of Mission	No. of Missions	No. of Person-Days
Fact-Finding/Preappraisal	1	96
Appraisal/Loan Negotiations	1	70
Project Administration		
Inception	1	12
Disbursement	1	2
Reformation	1	8
Review	4	56
Reappraisal	1	12
Project Completion	1	60
Operations Evaluation	1	95

EXECUTIVE SUMMARY

The industry sector is the largest energy user and the largest source of air and water pollution in the People's Republic of China (PRC). In the early 1990s, energy intensity in terms of tons of standard coal equivalent (tce) per CNY10,000 of gross domestic product for the PRC was the highest among developing member countries. The most energy intensive industries included the chemical, cement, and metallurgical industries, which accounted for nearly one third of the energy consumption in the manufacturing sector. Furthermore, over 75% of total primary energy consumption was accounted for by coal, which resulted in serious impacts on the environment. In accordance with the Government's development policies and the operational strategy of the Asian Development Bank (ADB), the Second Industrial Energy Efficiency and Environment Improvement Project was a continuation of ADB's efforts in the PRC to promote sustainable improvements in energy efficiency in the most energy-intensive industrial subsectors with substantial environmental benefits.

The Project focused on three major groups of energy-intensive industries—chemical, cement, and iron and steel industries—and five subprojects to achieve demonstration effects while supporting compliance with prevailing environmental standards. The scope of the Project at appraisal consisted of (i) replacing the mercury and diaphragm cells for caustic soda production with ion exchange membrane cells at Jinhua Chemical (Group) Corporation (JCC); (ii) improving the preparation of dense soda ash by introducing technological modifications in the ammonia shift, absorption, and distillation sections at the Tianjin Soda Plant (TSP); (iii) replacing the wet process and shaft kilns with a suspension preheater dry process kiln at Huaxin Cement Co. Ltd. (HCC) and Guanghai Cement Factory (GCF); and (iv) replacing several obsolete melting furnaces with a large electric arc furnace with downstream continuous casting facilities at Guiyang Special Steel Co. Ltd. (GSS). Before loan effectiveness, the Government requested the replacement of the GCF subproject with another subproject at Exi Chemical Plant (ECP) because GCF was unable to mobilize the required local funds. During implementation, the Government requested the cancellation of the ECP subproject because ECP could not secure the necessary loan repayment guarantee from the local government.

The Operations Evaluation Mission (OEM) reviewed the feasibility studies prepared by the subproject entities and the consultants' report of the project preparatory technical assistance (TA). The OEM particularly looked into the appropriateness of the focus on state-owned enterprises (SOEs) to be included under the Project and found that the SOEs were the major players in the most energy-intensive industrial subsectors in the PRC and by far the main contributors to energy inefficiency and environment pollution. The catalytic role of ADB's financing in promoting energy efficiency in the PRC would be best achieved by focusing on SOEs at the time. The OEM considers the findings of the project preparatory TA as largely adequate and the formulation and design of the Project appropriate. However, during project preparatory TA, ADB's appraisal and reappraisal missions, the weak financial conditions of GCF and ECP were not detected, which led to the eventual cancellation of the component.

The Project, excluding the GCF and ECP component, was implemented largely as envisaged at appraisal and ahead of schedule. The actual total project cost at completion was \$277.15 million, compared with an appraisal estimate of \$417.00 million. The actual cost included a foreign exchange cost of \$149.30 million and \$127.80 million equivalent in local currency. All foreign exchange costs were financed by ADB's loan, and the local currency costs were fully met by domestic borrowing and executing agencies' (EAs') resources. An undisbursed ADB loan amount of \$28.70 million was cancelled. The main factors contributing to

the lower investment cost were (i) cancellation of the GCF and ECP component, which had a planned investment of \$75.99 million; (ii) price and physical contingencies that were higher-than-actual, which amounted to \$51.05 million; (iii) drop in prices for raw materials after the Asian financial crisis; and (iv) waiver of import duties on equipment for all subprojects.

For the subproject at HCC, a production of 5,500 tons per day of clinker, 37% higher than the designed capacity, was attained. In comparison with old wet process kilns, the heat consumption was reduced by 49%, from 1,400 kilocalories (kcal) to 710 kcal per kilogram of clinker, and the electricity consumption per ton of clinker was reduced from 90 kilowatt-hours (kWh) to 70 kWh. These achievements are considered highly commendable by international standards. With regard to the environmental benefits, the most significant was the reduction in dust emission of over 3,453 tons per year, as a result of closing the two shaft kilns. Modification of the three old wet kilns with a dust removal system contributed to an additional reduction of 3,537 tons per year in dust emission. Recent stack emission monitoring data of the ADB-financed kiln showed that the emission pollutant levels met stricter national standards newly adopted on 1 January 2005. However, in violation of the loan covenant, the three wet process kilns continue to operate for commercial reasons and high demand for the specific quality of cement produced by these three wet process kilns. These wet process kilns will be closed when the old plant is relocated to the new site in 2008.

For the subproject at JCC, the actual production for the new membrane cell was consistently higher than the design capacity of 80,000 tons per year of caustic soda and reached 122,100 tons in 2004. The old mercury and diaphragm plants were demolished in 1998. Demolition of the old mercury cells and the diaphragm cells was properly conducted with regard to the safe disposal of mercury and mercury containing wastes. Prior to implementation of the subproject, the average energy consumption of the old diaphragm and mercury process was 1.681 tce per ton of caustic soda. The new membrane cell consumed, on average, energy equal to 1.077 tce per ton per year during 1998–2004. The total energy saved at an annual production of 120,000 tons of caustic soda amounted to 72,480 tce per year. Current solid wastes management and wastewater discharge comply with the national requirements. Air and noise pollution levels are maintained well within the national standards, and the overall environment surrounding the JCC has been improved greatly. All environmental objectives of subproject have been fully met.

For the subproject at TSP, actual production of all three facilities has exceeded design capacities. On the energy side, the specific energy consumption of dense ash improved by about 26%; light ash by 11%; and synthetic ammonia by 10% between 1995 and 2004. Furthermore, the specific energy consumption of dense soda ash of 550,000 kcal per ton is far superior to the national average of 650,000 kcal per ton. The energy consumption of light ash is 40,000 kcal per ton lower than the national average, and for synthetic ammonia the energy efficiency figures attained are at par with the national average. On the environmental front, after the completion of the subproject, there has been a noticeable reduction in emissions and improved compliance with national standards. The site inspection by the OEM confirmed the improvements with respect to a dry and clean working environment, ammonia smell, and dust and noise levels inside ADB-financed plant premises.

For the subproject at GSS, OEM confirmed the capability of the new facility to produce quality products at the designed capacity and the overall improvement with respect to air and wastewater treatment and solid waste management at the site. Electricity consumption was reduced from the previous 680 kWh per ton to 420 kWh per ton, and water consumption was

reduced by 530,000 tons per year. The electric arc furnace imported under the subproject used the most up-to-date technology. Since completion of the subproject, such electric arc furnaces have been installed in five iron and steel plants in the PRC. However, immediately after the completion of the subproject in 2000, GSS encountered major financial difficulties. By 2002, GSS incurred a total loss of over CNY140 million. In an attempt to minimize losses, the subproject facilities were leased to a private company on a 3-year contract, starting from May 2002. In July 2004, the lease contract was terminated, partly due to the poor operation management of the private lessee. Since then, GSS has resumed its normal operation and reduced its losses by CNY30 million through expansions of its businesses to other areas, such as lease of its surplus land for commercial activities. GSS has not been able to make any loan repayments up to now.

On the basis of (i) the failure to detect the financial difficulties of GCF and its substitute ECP during appraisal and reappraisal, (ii) the neglect in providing information on and reporting the lease of project facilities of GSS after completion, and (iii) the lack of formal coordination and structured review of policy initiatives with the concerned government agencies, the overall performance of ADB is considered partly satisfactory. The EAs performed satisfactorily in terms of preparation and implementation of the subprojects but less so in timely submission of financial statements and audited project accounts. The overall performances of HCC and JCC are considered satisfactory, while the performances of TSP and GSS were partly satisfactory, in view of their poor financial health. Overall, the Project is rated successful.

The Project yielded four main lessons.

- (i) GSS and TSP did not make any repayment of the loan or interest to ADB, even during profitable years. While ADB's loans were paid by the Government, by virtue of the loan guarantee, ADB should know in a timely manner whether a subproject enterprise is making adequate surpluses and whether the enterprise is capable of sustaining a project financially. In this regard, more staff time and expertise are needed during review missions, for thorough financial analysis and recommendations.
- (ii) Periodic submission to ADB of audit and progress reports of the subprojects and financial statements of the enterprises has not been done in a satisfactory manner. A standard reporting format applicable to all projects is not very helpful in the case of the PRC, where English is not widely used. It would be useful for ADB to prepare and provide a project-specific benefit monitoring format in English prior to implementation.
- (iii) HCC did not shut down the three wet process kilns on successful completion of the subproject. Although this was brought to ADB's attention, no actions were taken to either revise the loan covenants or reach a mutually agreeable time frame. To make loan covenants more legally credible, any waiver or modification should be agreed upon between the EA and ADB and formally documented.
- (iv) The Project confirmation process was insufficient to the extent that the appraisal and reappraisal missions failed respectively to detect (a) the pending investments by GCF that eroded its financial performance and (b) the inability of the replaced ECP subproject to secure a counter guarantee from the provincial government. This resulted in the cancellation of \$28.7 million of the loan proceeds. To determine the

financial health of subproject candidates in the PRC, especially the health of SOEs, all supporting documents relating to counterpart funding commitments from local banks and counter guarantee letters from local governments should be carefully reviewed in parallel with the usual financial ratios analysis.

David Edwards
Director
Operations Evaluation Department
Evaluation Division 2

**SECOND INDUSTRIAL ENERGY EFFICIENCY
AND ENVIRONMENT IMPROVEMENT PROJECT**
SUBPROJECT LOCATION
 (as implemented)
 in the
PEOPLE'S REPUBLIC OF CHINA



- ★ National Capital
 - ⊙ Provincial Capital
 - City/Town
 - Subproject
 - SAR Special Administrative Region
 - Provincial Boundary
 - - - International Boundary
- Boundaries are not necessarily authoritative.

I. BACKGROUND

A. Rationale

1. The industry sector is the largest energy user and the largest source of air and water pollution in the People's Republic of China (PRC). In the early 1990s, energy intensity in terms of tons of standard coal equivalent (tce) per CNY10,000 of gross domestic product for the PRC was the highest among developing member countries. The most energy intensive industries included the chemical, cement, and metallurgical industries, which accounted for nearly one third of the energy consumption in the manufacturing sector. Furthermore, over 75% of total primary energy consumption was accounted for by coal, which resulted in serious impacts on the environment. Since the early 1990s, the Government had been implementing programs to promote energy efficiency and environmental improvement in the industry sector, so that the energy intensity for the country would be reduced by 20% between 1995 and 2001. The operational strategy of the Asian Development Bank (ADB) in the industry sector for the PRC at the time focused on (i) reducing high-unit energy consumption, particularly in heavy industries; (ii) reducing the high level of industrial and urban pollution; and (iii) reforming the operations of state-owned enterprises (SOEs) to increase their prospects for success in a market economy.

2. In 1992, ADB provided a loan¹ to finance investments in energy conservation and environment improvement in the cement, fertilizer, and iron and steel subsectors. Because of the good experience with this loan, the Government requested that ADB consider a second project for energy conservation and environment improvement in the industry sector. In accordance with the Government's development policies and ADB's operational strategy, the Second Industrial Energy Efficiency and Environment Improvement Project² was approved to promote sustainable improvements in energy efficiency in the most energy-intensive industrial subsectors with substantial environmental benefits. To achieve this objective, the Government was to adopt and implement the energy conservation law, establish standards governing the conduct of energy audits and energy consumption, and ensure continued progress in market-determined energy pricing.

B. Formulation

3. ADB approved project preparatory technical assistance (TA)³ in April 1994, to examine energy efficiency investments in the industry sector and prepare a project suitable for ADB financing. The project preparatory TA was completed in June 1995; a loan fact-finding mission was fielded in May–June 1995, followed by an ADB appraisal mission in October 1995.

4. Based on feasibility studies done by the concerned industrial entities, five subprojects were selected by the Government for ADB's consideration. The project preparatory TA examined in detail the technical merit, environmental impact, and financial viability of the five subprojects and concluded that all were suitable candidates for ADB financing. An appraisal mission concurred fully with the project preparatory TA findings and held a policy dialogue with the Government on energy pricing and enterprise reforms.

5. The criteria for the selection of subprojects were as follows.

¹ ADB. *Industrial Energy Conservation and Environment Improvement Project*. Manila.

² ADB. *Second Industrial Energy Efficiency and Environment Improvement Project*. Manila.

³ ADB. *Second Industrial Energy Conservation and Environment Improvement Project*. Manila.

- (i) The subproject should be in industrial subsectors with high energy intensity and aggregate energy use, and where improved energy management could generate immediate benefits.
- (ii) The subproject is in an industrial subsector in which enterprise reforms have been adopted as well as market-based pricing of the inputs and outputs.
- (iii) The main focus of the subproject proposal should be on restructuring the operating facilities, improving energy utilization, and reducing adverse environmental impacts, rather than on increasing production capacity.
- (iv) Substantial energy efficiency gains would be realized through the proposed investments, and energy efficiency would increase by at least 20% in the subproject, as measured by the energy consumption with and without the subproject, for specific equipment or manufacturing process replaced or modified.
- (v) The investment proposals should be economically and financially viable, and the subproject enterprises should be financially independent of government budgetary support and demonstrate the ability to mobilize the required domestic resources for the investment program and to cover the debt service and amortization payments.
- (vi) The subprojects should be designed to ensure that the modified plants met all local and national environmental standards and internationally accepted safety standards.
- (vii) The subprojects representative of similar plants would facilitate replication in the concerned subsector. The concerned enterprises should be willing to disseminate information on subproject performance, to increase the demonstration effects.

C. Purpose and Outputs

6. The objective of the Project was to promote sustainable improvements in energy efficiency in the industry sector with substantial environmental benefits in the PRC. The Project focused on three major groups of energy-intensive industries—chemical, cement, and iron and steel industries—and five subprojects to achieve demonstration effects while supporting compliance with prevailing environmental standards.

7. The scope of the Project at appraisal consisted of (i) replacing the mercury and diaphragm cells for caustic soda production with ion exchange membrane cells at Jinhua Chemical (Group) Corporation (JCC) in Liaoning Province; (ii) improving the preparation of dense soda ash by introducing technological modifications in the ammonia shift, absorption, and distillation sections at the Tianjin Soda Plant (TSP) in Tianjin Municipality; (iii) replacing the wet process and shaft kilns with a suspension preheater dry process kiln at Huaxin Cement Co. Ltd.

(HCC) and Guanghai Cement Factory (GCF)⁴ in Hubei Province; and (iv) replacing several obsolete melting furnaces with a large electric arc furnace with downstream continuous casting facilities at Guiyang Special Steel Co. Ltd. (GSS) in Guizhou Province. The subprojects were scattered across the country, from the Northeast to the Southwest (Map). Information dissemination through workshops and seminars was to be undertaken to ensure sectorwide demonstration effects. The energy efficiency programs to be introduced in the subprojects would result in significant annual energy savings and reductions in particulate emissions, wastewater flow, and suspended solids.

D. Cost, Financing, and Executing Arrangements

8. At appraisal, the total project cost was estimated to be \$417.0 million equivalent, including a foreign exchange cost of \$178.0 million and a local currency cost of \$239.0 million equivalent. ADB provided a loan of \$178.0 million from its ordinary capital resources to finance the foreign exchange cost of the five subprojects. A portion of the local currency financing, up to \$52.7 million equivalent, was to be provided by the subborrowers, out of cash generation from their existing operations. The remaining local currency financing, amounting to \$186.3 million equivalent, was to be obtained through domestic borrowing, new issues of shares, and other equity infusions.

9. The Borrower was the PRC. ADB loan proceeds were re-lent to subproject enterprises under subsidiary loan agreements with the same terms and conditions as ADB's loan. The former State Economic and Trade Commission (SETC)⁵ was to coordinate implementation of policy and institutional measures to support the Project. Subproject enterprises were the executing agencies (EAs) of their respective subprojects.

E. Completion and Self-Evaluation

10. ADB's project completion report (PCR) was circulated in October 2003, more than 2.5 years after the substantial completion of the Project in early 2001, and rated the Project successful,⁶ in view of the substantial achievements of project objectives. The PCR reported annual energy savings of 80.6 million tce and 21.9 million kilowatt-hours (kWh) of electricity for HCC, 0.1 million tce and 73.1 million kWh for JCC, 0.18 million tce for TSP, and 31,389 tce for GSS. Air and water emissions data provided in the PCR indicated significant environmental improvements for all subprojects. The PCR made no assessment of the demonstration effects of the Project in the concerned industrial subsectors. The recalculated financial internal rate of return (FIRR) for each subproject was lower than the corresponding appraisal estimate, mainly due to unfavorable market conditions for their products. The recalculated economic internal rate of return (EIRR) for each subproject was lower than the corresponding appraisal estimate but above 12%. The PCR did not identify any major issues during project preparation and implementation. It did not report the lease of subproject facilities at GSS for 3 years, starting from May 2002 (para. 41), but discussed the financial position of GSS in the absence of supporting financial statements. In light of significant cost underruns of about 20%, the lessons learned pointed to the need for a more accurate project cost estimate. The PCR recommended

⁴ Before loan effectivity, the Government requested the replacement of the GCF subproject with another subproject at Exi Chemical Plant (ECP), because GCF was unable to mobilize the required local funds. During implementation, the Government requested cancellation of the ECP subproject because ECP could not secure the necessary loan repayment guarantee from the local government.

⁵ As a result of central Government reorganization, SETC was dissolved in early 2003.

⁶ The PCR was one of the sample PCRs independently reviewed by the Operations Evaluation Department.

that government agencies monitor closely the compliance with environmental standards by HCC with respect to its old production facilities, which were originally required to be shut down by 2001, on successful implementation of the new facilities, but HCC later decided to decommission only in 2008.

F. Operations Evaluation

11. This project performance audit report (PPAR) reviews findings of the PCR and assesses the Project in terms of relevance, efficacy, efficiency, sustainability, and institutional and other developmental impacts. The assessment is based on a review of ADB documents, discussion with ADB staff, and findings of the Operations Evaluation Mission (OEM). A questionnaire indicating information requirements was forwarded to the EAs prior to the OEM. The OEM to the PRC was fielded during 28 February–18 March 2005 and met with representatives from the concerned government agencies, including Chemical Industry Association, China Cement Association, China Energy Conservation Association, China Energy Conservation Investment Corporation, China Petroleum, and Ministry of Finance. The OEM visited all subproject entities and carried out energy auditing, environmental assessment, and reconnaissance-level physical inspection of the facilities constructed under the Project. The OEM reviewed available data on costs, schedules, project management, subproject financing arrangements, and loan agreements. However, the OEM encountered certain difficulties in obtaining all required information, because two of the four subprojects were completed in 1999, and senior staff members actively involved with project implementation had retired. The views of concerned ADB departments and offices and those of the Government and the EAs were considered when finalizing the PPAR.

II. PLANNING AND IMPLEMENTATION PERFORMANCE

A. Formulation and Design

12. The improvement of energy efficiency in all sectors of the economy had been a government policy for a long time, and energy intensity had been reduced by 50% from the early 1980s to mid-1990s. The achievement of energy savings required major capital investment to replace outdated processes and equipment. Gains in energy efficiency achieved had come partly from investment in new plants and facilities and partly from better management and operation and maintenance of existing plants. While gains from low-cost measures were becoming more difficult to achieve, they could not be ignored for countries with the highest energy intensities in the developing world, including the PRC. The Project was conceived on the basis of being self-sustaining through energy savings and environmental benefits, rather than on an additional revenue and/or increased output basis. The most energy-intensive industrial subsectors were selected because high potential for energy savings would likely result in substantial environmental benefits as well. The cement, chemical, and iron and steel subsectors were chosen mainly because necessary market-based price incentives to encourage energy efficiency had been put in place in these subsectors. The formulation of the Project conformed to the long-term government policy of promoting energy efficient and environment friendly economic development and was in line with ADB's operational strategy in the industry sector for the PRC at the time (para. 1).

13. During implementation of the project preparatory technical assistance (TA), five energy efficiency subprojects were identified and proposed by the Government for detailed examination. The technical design and feasibility studies of these subprojects were completed by the concerned subproject entities and approved by SETC. The project preparatory TA

confirmed that all five subprojects were suitable candidates for ADB funding, on the basis of technical merit, energy efficiency improvement, environment impacts, and financial viability. The subprojects are widely dispersed from the Northeast of the country to the Southwest, with three subprojects located in poor inland provinces, so as to provide a basis for sectorwide demonstration effects. Stakeholders were consulted through the normal government process, and project scope was determined through consultations with local and central governments and project enterprises.

14. Using their own funds, the subproject entities engaged local design institutes to carry out the preliminary design and detailed engineering. These institutes are major design and research organizations in their respective fields. They were selected on the basis of their previous experience and satisfactory performance in their recent involvement in the modification of chemical, cement, and iron and steel plants in the country.

15. The OEM reviewed the feasibility studies prepared by the subproject entities, and the consultants' report of the project preparatory TA. The feasibility studies for the subprojects were comprehensive and detailed in terms of project objectives, technical design, financing arrangement, and financial analysis. The project preparatory TA study examined in detail the topics of energy efficiency promotion, environment pollution reduction, energy price reform, SOEs reforms, subproject social impacts, and options of ADB's financial support in the national context as well as at the subproject level. The OEM particularly looked into the appropriateness of the focus on SOEs to be included under the Project and found that all subproject entities had obtained autonomy of operation in financial management, production, marketing, pricing, investment and technical development, employment, and salary levels. At appraisal, two of the subproject entities were publicly listed companies, and the other three were selected by the national and provincial governments for pilot reform schemes related to new enterprise management and structure. Furthermore, the SOEs were the major if not the sole players in the most energy-intensive industrial subsectors in the PRC and by far the main contributors to energy inefficiency and environment pollution. The catalytic role of ADB's financing in promoting energy efficiency in the PRC would be best achieved by focusing on SOEs at the time. The OEM considers the findings of the project preparatory TA as largely adequate and the formulation and design of the Project appropriate. However, the project preparatory TA and ADB's appraisal mission failed to detect the impending failure of GCF to mobilize necessary domestic financial resources, because of its deteriorating financial condition, which led to the eventual cancellation of the component.⁷

B. Achievement of Outputs

16. The Project, as approved, consisted of five subprojects (para. 7), of which four were successfully implemented as envisaged and one cancelled at the request of the Government (footnote 4). The main outputs from each subproject implemented under the Project are summarized in Table 1. The overseas training⁸ provided under the Project was considered useful, particularly for the adoption of new technology and improvement of project management skills.

⁷ A similar case happened in the Industrial Energy Conservation and Environment Project (footnote 1), under which \$22 million of loan proceeds had to be cancelled because of the inability of one of the subproject entities to mobilize the required domestic resources either from its own earnings or by borrowing.

⁸ The duration of training was on average 5 days in each country. Thus, it mainly provided exposure to similar plants in other countries.

Table 1: Main Outputs of Subprojects Implemented Under the Project

Subproject	Output Envisaged	Output Achieved
Guanghua Cement Factory	Replacing wet process and shaft kilns with a suspension dry process kiln.	Cancelled at the Government's request, due to Guanghua Cement Factory's poor financial health.
Huaxin Cement Co. Ltd.	Replacing wet process and shaft kilns with a suspension dry process kiln with a design capacity of 4,000 tons per day of clinker.	Implemented as envisaged. With further minor technical modifications, the new facility now produces 5,500 tons per day of clinker.
Jinhua Chemical (Group) Corporation	Replacing mercury and diaphragm cells for caustic soda production with ion exchange membrane cells with a design capacity of 80,000 tons per year.	Implemented as envisaged. With further minor technical modifications, the new facility now produces 120,000 tons per year of caustic soda. Facilities for processing prilled caustic soda were added utilizing the loan savings.
Tianjin Soda Plant	Improving production of dense soda ash by introducing technological modification in the ammonia shift, absorption, and distillation sections with a design capacity of 400,000 tons per year of dense soda ash.	Implemented as envisaged. The new facility now produces 482,000 tons per year of dense soda ash.
Guiyang Special Steel Co. Ltd.	Replacing five obsolete 10-ton melting furnaces with a 60-ton electric arc furnace and installing downstream facilities with a capacity of continuously casting 300,000 tons of special steel per year.	Implemented as envisaged. Vacuum degassing equipment was added to the subproject scope, to eliminate gaseous contaminants in the molten steel, which affected the quality of the final products. Due to market conditions, Guiyang Special Steel Co. Ltd. did not produce to full capacity.

Co. = company, Ltd. = limited.

Source: The Asian Development Bank's Operations Evaluation Mission.

C. Cost and Scheduling

17. The EAs confirmed the costs and scheduling reported in the PCR for each respective subproject. The actual total project cost at completion was \$277.15 million, compared with an appraisal estimate of \$417.0 million. The actual cost included a foreign exchange cost of \$149.3 million and a local currency cost of \$127.8 million equivalent. The foreign exchange cost was financed by ADB's loan and the local cost was fully met by domestic borrowing and EAs' resources. An undisbursed ADB loan amount of \$28.7 million was cancelled. Table 2 compares project cost estimates at appraisal with actual project cost at completion for each subproject.

Table 2: Summary of Appraisal and Actual Project Costs

Subproject	Appraisal Estimate (\$ million)			Actual (\$ million)		
	Foreign	Local	Total	Foreign	Local	Total
Part A: GCF	30.00	45.89	75.89	0.00	0.00	0.00
Part B: HCC	50.00	93.89	143.89	49.01	47.24	96.25
Part C: JCC	25.00	32.34	57.34	25.82	26.23	52.05
Part D: TSP	33.00	36.80	69.80	33.46	23.10	56.56
Part E: GSS	40.00	30.08	70.08	41.00	31.29	72.29
Total	178.00	239.00	417.00	149.29	127.86	277.15

GCF = Guanghua Cement Factory, GSS = Guiyang Special Steel Company Limited, HCC = Huaxin Cement Company Limited, JCC = Jinhua Chemical (Group) Corporation, TSP = Tianjin Soda Plant.

Source: Asian Development Bank's Project Completion Report.

18. Overall, the Project had a cost underrun of \$139.85 million, which was 34% lower than the appraisal estimate.⁹ The main factors contributing to the lower investment cost were (i) cancellation of part A, which had a planned investment of \$75.89 million; (ii) price and physical contingencies that were higher-than-actual, which amounted to \$51.05 million;¹⁰ (iii) prices for raw materials dropping significantly, as a result of the Asian financial crisis, and (iv) waiver of import duties on equipment for all the subprojects. Strong competition among the bidders was cited in the PCR as the other major reason for the cost underrun. The OEM was unable to verify this claim from the project documents and through interviews with the EAs.

19. ADB approved the loan on 9 May 1996. The loan agreement was signed on 11 November 1996 and became effective on 13 January 1997. The delay in loan signing was mainly due to the late decision by the Government with regard to the replacement of the subproject entity for Part A. The Project, excluding Part A, was completed largely ahead of schedule, while the loan closing date was extended from the original date of 30 June 2001 to the actual date of 25 February 2002, merely to allow utilization of loan savings for additional works.¹¹

D. Procurement and Construction

20. The components financed by ADB were procured in accordance with ADB's *Guidelines for Procurement*. Accordingly, equipment and materials procurement was through international competitive bidding or international shopping. Equipment with a contract value of more than \$500,000 was procured following international competitive bidding procedures. Equipment with a contract value of less than \$500,000 was procured using international shopping procedures. However, the value of some international shopping contracts awarded was higher than the set limit, either because the bid prices exceeded estimates or subsequent addition of unique items or additional spares were required. The inaccurate estimates of contract value and spare parts were understandable, given the pilot nature of the subprojects. Domestic procurement agencies familiar with ADB procurement procedures were engaged for bid documents drafting, bid evaluation, and contract management. The design institutes (para. 14) engaged by the subproject entities for preliminary design and detailed engineering provided assistance in the preparation of specifications of equipment and materials and technical evaluation of the bids. All subproject entities were satisfied with the services rendered by the procurement agencies and design institutes.

21. Advance procurement action was allowed for the preparation of bid documents. As a result, the delay in loan signing and effectiveness did not deter the EAs from going ahead with procurement-related activities, so that physical implementation of the Project was kept on schedule. The PCR did not report any issues regarding procurement and construction. Furthermore, the representatives of the subproject entities who met with the OEM did not highlight any procurement- or construction-related problems. The standard of construction observed by the OEM at all subprojects was good and met or exceeded generally accepted engineering practices in the PRC. In recognition of the low investment cost, early completion

⁹ Among the subprojects, only GSS had a cost overrun of 3%.

¹⁰ At appraisal, physical contingency was provided at 10% of the base cost estimate and price escalation factors used were 2.2% for foreign exchange cost and 7% for local currency costs. However, this high rate of inflation did not realize partly as a result of the 1997 financial crisis in the region.

¹¹ Utilization of \$4.5 million loan savings was approved by ADB for procurement of processing equipment for prilled caustic soda production at JCC and vacuum degassing equipment for gaseous contaminant removal at GSS.

and, excellent quality of construction, the subproject at JCC won a national award recognizing the best technology upgrading project during the ninth 5-year plan period.

E. Organization and Management

22. Management of the Project at three distinct levels (EAs, government, and ADB) was envisaged to have structured interaction during the entire tenure of project implementation.

23. Each EA responsible for implementation of its respective subproject established its own project implementation office. These offices, headed by top management executives, were supported by technical, energy-environmental engineering, and finance executives. While the subproject entities were envisaged to engage international engineering firms as engineering contractors, to provide the process liaison; prepare the basic design; supply the equipment; and supervise the construction, installation and commissioning of the Project, it should be noted that all these aspects had been managed with local expertise and resources. The EAs were able to complete the subprojects within or ahead of the appraisal schedule and below cost estimates, with assistance from local project management and procurement agencies.

24. At the initial stages of project implementation, formal participation occurred at the government level, with SETC responsible for coordinating implementation of policy and institutional measures to support the Project, and a project coordination office, with representatives from various ministries, was established. However, following the 1998 government reorganization, the project coordination office became inactive, and the Project lost the advantage of requisite formal supervision and interventions and corrective actions thereafter. During implementation, the Government provided support through the waiver of duties on imported equipment for all four subprojects. When TSP and GSS failed to repay loans on time, the local governments, as the guarantors, made loan payments to ADB.

25. As per the Project Agreement, the EAs are required to maintain separate project accounts and submit the financial statements and audited project accounts no later than 6 months after the close of fiscal year. According to the project files, these reports were submitted irregularly for all subprojects and missing for most years during project implementation. The OEM found that all EAs submit extensive and focused information on the company's overall energy management aspects to the local government periodically. However, the EAs have not been keeping ADB informed in this regard and only a sporadic report or two was submitted by the EAs. In fact, energy conservation is closely monitored and considered a routine exercise in all EAs. At JCC, for instance, 20 full-time employees focus on energy efficiency. At TSP, energy consumption is used as a key factor in determining the salary bonuses for every production or administrative unit.

26. Given the lack of formal coordination and structured review of policy initiatives among project agencies, the OEM believes that the adoption of the Energy Conservation Law, market-based policy reforms, and other institutional changes during the project implementation period can at best be taken as coincidental.

27. Throughout the Project, ADB sent on a roughly annual basis review missions consisting of one project engineer. While the physical implementation of all subprojects was on or ahead of schedule, GSS, JCC, and TSP experienced financial difficulties subsequent to the implementation of the Project. Considering the depth of financial analysis required and quantum at stake, more staff time and expertise is needed during the review missions for thorough financial analysis and recommendations. Further, as per the Project Agreement, any leasing

arrangement should have ADB's prior approval. The OEM was informed by GSS representatives that project facilities were leased to a private company under a 3-year contract, starting from May 2002, at a small annual lease amount (para. 41). However, this was not reported in the project files and PCR.

III. ACHIEVEMENT OF PROJECT PURPOSE

A. Operational Performance

28. The OEM visited all four subprojects implemented, and all of them have achieved anticipated energy efficiency and environmental improvements. Their operational performance in terms of outputs, energy efficiency improvements, and environment benefits are presented in detail in Appendix 1 and summarized in the following paragraphs.

1. Subproject at Huaxin Cement Company Limited

29. The subproject was successfully completed ahead of schedule by 14 months at a total investment cost 33.0% lower than the original estimate. While the single new suspension kiln installed under the Project had a design capacity of 4,000 tons per day (tpd) of clinker, it has attained a production of 5,500 tpd, 37.0% higher than the designed capacity. In comparison with old wet process kilns, the heat consumption was reduced by 49.0%, from 1,400 kilocalories (kcal) to 710 kcal per kilogram of clinker, and the electricity consumption per ton of clinker was reduced from 90 kWh to 70 kWh. These achievements are considered highly commendable by international standards. Since the completion of the subproject, the dry process suspension kiln systems have been widely used throughout the country. The share of cement produced from the new dry process increased from 9.5% of the total production in 1999 to 27.5% in 2004. In 2004 alone, over 100 new dry processes production lines started operating in the PRC. HCC now ranks third in the country in terms of cement production capacity. In the last few years, HCC has provided technical support related to technology consultation and training for many enterprises adopting the new suspension kiln system in the PRC.

30. While the two old shaft kilns were shut down after the commercial operation of the new production line in 2000, as originally planned, the three wet process kilns continue to operate in violation of a loan covenant. However, the OEM was reassured by HCC representatives that the wet process kilns have been renovated to ensure compliance with all national air emissions standards and reduction of aggregate energy consumption. These wet process kilns are still in operation merely for commercial reasons and because high demand exists for the specific quality of cement produced by these three wet process kilns. The OEM was informed that the wet process kilns would be closed when the old plant is relocated to the new site in 2008. HCC prepaid the entire ADB loan to Ministry of Finance (MOF) in 2003. HCC considers the subproject highly successful and acknowledges the catalytic role played by ADB at a crucial time during a stringent financial market.

31. With regard to environmental benefits, the most significant was the reduction in dust emission of over 3,453 tons per year, as a result of closing the two shaft kilns. Modification of the three old wet kilns with a dust removal system contributed to an additional reduction of 3,537 tons per year in dust emission. Recent stack emission monitoring data of the ADB-financed kiln showed that the emission pollutant levels met stricter national standards adopted on 1 January 2005. The overall environment around HCC has improved greatly since the subproject's completion. Except for toilet and office water, all process water (mainly cooling water) is now continuously treated and reused without any discharge to nearby Cihu Lake. Dust

is collected continuously and recycled in the cement production process. After the subproject and further process improvement, the noise level is also maintained within national standards. For the last 3 years, HCC was awarded consecutively the best performing enterprise for environmental protection in Huangshi City and received a CNY10,000 award from the local environment protection bureau (EPB). In 2002, HCC became the first enterprise to be ISO14001 certified in the construction materials subsector of the industry sector in the PRC.

2. Subproject at Jinhua Chemical (Group) Corporation

32. The subproject was successfully completed and the facilities installed under the original subproject scope, and commercial operation started ahead 11 months ahead of schedule. Using loan savings, the subproject scope was expanded to include a prilled caustic soda plant. Against the design capacity of 80,000 tons per year for the new membrane cell, the actual production was consistently higher and reached 122,100 tons in 2004. The old mercury and diaphragm plants were demolished in 1998. Prior to implementation of the subproject, the average energy consumption of the old diaphragm and mercury process was 1.681 tce per ton of caustic soda. The new membrane cell consumed, on average, energy equal to 1.077 tce per ton of caustic soda per year during 1998–2004. The total energy saved at an annual production of 120,000 tons of caustic soda amounted to 72,480 tce per year.

33. After the completion of the subproject, demolition of the old mercury cells and diaphragm cells was properly conducted with regard to the safe disposal of mercury and mercury containing wastes. Current solid wastes management and wastewater discharge comply with national requirements. Air and noise pollution levels are maintained well within national standards, and the overall environment surrounding JCC has been improved greatly. All environmental objectives of the subproject have been fully met. The facility received no complaints, warnings, or fines from the local EPB. During the site visit, OEM found a clean working environment devoid of dust, noise, and air pollution in the entire production and auxiliary areas of JCC's manufacturing complex.

34. JCC considers the subproject highly successful and overseas training under the Project valuable. During the plant visit, the chair of the board of JCC expressed to OEM how much the corporation appreciated ADB's financial assistance to the subproject and urged ADB to consider further support to energy efficiency and environment improvement projects in future.

35. Based on the successful experience of the ion membrane cells installed under the Project, JCC successfully implemented an additional similar caustic soda plant of 120,000 tons per year using a supplier's credit loan from the Japan Bank for International Cooperation. The Project, together with the subsequent additional plant, helped JCC climb to second place, from fifth, in terms of caustic soda production in the PRC. Between 2001 and 2004, the caustic soda produced from the ion membrane cells in the PRC increased by 79%, from 14.1 million tons per year to 25.2 million tons per year.

3. Subproject at Tianjin Soda Plant

36. The subproject was successfully completed 12 months ahead of schedule. Comparisons between production and energy consumption prior to the subproject in 1995 and after in 2004 are given in Table 3.

Table 3: Production and Energy Consumption (1995 and 2004)

Product	1995			2004		
	Production (tons/year)		Specific Energy Consumption (kcal/ton)	Production (tons/year)		Specific Energy Consumption (kcal/ton)
	Design	Actual		Design	Actual	
Dense Soda Ash	200,000	126,000	740,000	400,000	482,000	550,000
Light Ash	471,000	471,000	3,600,000	600,000	607,000	3,190,000
Synthetic Ammonia	58,000	58,000	13,920,000	75,000	79,000	12,510,000

/ = per.

Kcal = kilocalorie.

Source: Asian Development Bank's Operation Evaluation Mission.

37. On the production side, the actual production of all three facilities exceeded design capacities. On the energy side, the specific energy consumption of dense ash improved by about 26%; light ash by 11%; and synthetic ammonia by 10% between 1995 and 2004. Furthermore, the specific energy consumption of dense soda ash of 550,000 kcal per ton is far superior to the national average of 650,000 kcal per ton. The specific energy consumption of light ash is 40,000 kcal per ton lower than the national average, and for synthetic ammonia the energy efficiency figures attained are at par with the national average.

38. On the environmental front, after the completion of the subproject, there has been a noticeable reduction in emissions and improved compliance with national standards. Table 4 compares ambient air quality, wastewater discharge, and solids generation in 1995 and 2004. The site inspection also confirmed the improvements with respect to dry and clean working environment, ammonia smell, and dust and noise levels inside the ADB-financed plant premises.

Table 4: Environmental Improvements Achieved

Parameter	1995	2004	Reduction (%)
Particulate Matter (mg/m ³)	0.28	0.099	64
SO ₂ (mg/m ³)	0.046	0.03	33
NO ₂ (mg/m ³)	0.06	0.03	50
Wastewater Flow (million m ³ /year)	55.7	4.0	92.8
SS (ton/year)	2,146	560	74
COD (ton/year)	1,027	394	62
NH ₃ -N (ton/year)	1,753	100	94
Oil (ton/year)	89	4.8	95
Rejected Salts (kg/ton of aggregate output/year)	279	120	57
Sand and Gravel (kg/ton of aggregate output per year)	209	120	43

/ = per.

COD = chemical oxygen demand, kg = kilogram, NH₃-N = ammonia nitrogen, NO₂ = nitrogen dioxide, SO₂ = sulfur dioxide, and SS = suspended solids.

Source: Consultant's report for TA 2987-PRC and findings of the Operations Evaluation Mission.

39. The technology used to upgrade dense soda ash production was developed by TSP, which is not only the most up-to-date in the country but also ranks among the best in the world.

The EAs' executives advised the OEM that even though TSP has been asked by foreign entities to sell the technology, due to commercial concerns, TSP does not plan to transfer or sell it in the immediate future. For ammonia absorption and distillation, the imported technology was upgraded by TSP, and three other similar plants in the country have adopted this improved technology.

4. Subproject at Guiyang Special Steel Company Limited

40. The subproject was implemented as per schedule at a cost of \$72.3 million, which was 3% higher than the appraisal estimate, due to the inclusion of vacuum degassing equipment. The OEM noted the capability of the new facility for producing quality products and attaining designed capacity. Electricity consumption was reduced from the previous 680 kWh per ton to 420 kWh per ton, and water consumption was reduced by 530,000 tons per year. The electric arc furnace imported under the subproject used the most up-to-date technology. Since the completion of the subproject, such electric arc furnaces have been installed in five iron and steel plants in the PRC.

41. However, immediately after the completion of the subproject in 2000, concerned provincial government agencies proposed the relocation of the plant farther away from Guiyang City, considering environmental improvements and capture of increased land value near the city. In anticipation of the relocation, many GSS customers stopped placing purchase orders with GSS. As a result, the plant's normal operation was disrupted, and GSS encountered major financial difficulties. By 2002, GSS incurred a total loss of over CNY140 million. In an attempt to minimize losses, the subproject facilities were leased to a private company from Guangdong Province, under a 3-year contract, starting from May 2002, with an annual fee of CNY6 million.¹² In July 2004, the local government abandoned the proposed relocation plan, and the lease contract was terminated, partly due to strong opposition from GSS employees and partly due to poor operation management of the private lessee. Since then, GSS has resumed its normal operation and reduced its losses by CNY30 million, through expansion of its businesses to other areas, such as leasing its surplus land for commercial activities. GSS has not been able to make any loan repayments up to now.

42. Since subproject implementation, stack air emissions have met national standards, and the OEM inspection confirmed the overall improvement at the site with respect to air and wastewater treatment and solid waste management. The surrounding environment at GSS has improved significantly, as evidenced by the increased value of nearby real estate property in recent years. The facility received no more complaints from nearby residents or warnings and fines from the local EPB. Thus, all the environmental objectives have been successfully met and even exceeded since the completion of the subproject.

43. Overseas training under the subproject was considered useful for establishing the most up-to-date technology and operational improvements. However, due to the deteriorating overall

¹² Taking into account of the investment cost of CNY600.00 million at completion of the new 300,000-ton steel production facility, an average steel price in the PRC at the time of around CNY2,500.00 per ton, and the lease of GSS's surplus land currently at CNY120.00 per square meter per year (the total land area of the subproject amounted to roughly 50,000 square meters), an annual leasing fee of CNY6.00 million for the subproject facilities seems to be low. In any event, in the period of the lease, only CNY9.66 million was paid. While corrective measures, including changing GSS's top management team and terminating the lease contract, were taken by GSS and the local government in 2004 to rectify the situation, legitimate concerns could be raised with respect to transparency and possible corruptive practices associated with the leasing of the subproject. The issue was referred to ADB's Integrity Division under the Office of the Auditor General.

performance of the subproject enterprise, significant trained staff losses were suffered by GSS.

44. In view of these losses, and due to many other factors, including the failure of lease management of the core activity, the operations of GSS suffered heavily in the years following subproject implementation. However, the subproject objectives have been largely achieved from the perspective of production quality and energy consumption and environmental improvements.

B. Performance of the Operating Entity

45. Analyses of financial performance have been carried out for all subproject entities for which updated annual data for the period under review is available. Financial highlights of the subproject entities are presented in Appendix 2. Some key financial indicators¹³ for these entities are given in Table 5.

Table 5: Financial Performance of the Subproject Entities

	1999	2000	2001	2002	2003	2004
HCC						
Profit after Tax (CNY million)	4.24	18.00	30.97	29.32	68.60	148.55
Debt Service Coverage Ratio	—	—	—	—	—	—
Debt-Equity Ratio	1.80	6.44	11.18	1.53	2.00	0.80
Current Ratio	1.08	0.95	0.78	0.74	0.88	0.62
JCC						
Profit after Tax (CNY million)	(4.61)	3.98	(39.83)	(149.92)	(254.38)	(160.61)
Debt Service Coverage Ratio	—	—	—	—	—	—
Debt-Equity Ratio	0.90	1.77	1.96	2.67	3.10	2.95
Current Ratio	1.17	1.02	1.04	1.00	0.78	0.59
TSP						
Profit after Tax (CNY million)	(115.98)	(31.31)	0.22	4.77	4.93	7.46
Debt Service Coverage Ratio	(0.53)	1.27	2.99	2.39	2.51	1.35
Debt-Equity Ratio	1.74	1.08	0.84	0.83	0.84	0.83
Current Ratio	0.90	0.87	0.82	0.79	0.76	0.67
GSS						
Profit after Tax (CNY million)	1.34	2.17	(59.38)	(145.54)	(227.85)	(73.03)
Debt Service Coverage Ratio	—	—	—	—	—	—
Debt-Equity Ratio	3.38	2.15	2.09	2.68	4.00	4.54
Current Ratio	0.95	0.98	0.71	0.63	0.58	0.53

— = Not Available, GSS = Guiyang Special Steel Company Limited, HCC = Huaxin Cement Company Limited, JCC = Jinhua Chemical (Group) Corporation, and TSP = Tianjin Soda Plant.

Source: Yearly data provided by subproject entities.

46. Results show that only HCC has been making a profit consistently over the period under review. Profit after tax has increased by more than 30.0 times from 1999 to 2004, while annual production increased by about 2.5 times, from 0.71 million tons to 1.74 million tons, during the same period. TSP incurred losses in 1999 and 2000 but has started earning profits from 2001. The trend of profit increases between 2001 and 2004 seems encouraging. JCC and GSS have been recording losses from 2001 onward.

47. The covenanted debt service coverage ratio, debt-equity ratio,¹⁴ and current ratio have not been complied with on a consistent basis by all subproject entities during 1999–2004.¹⁵

¹³ The loan covenant requires a debt service coverage ratio of at least 1.25:1.00, a debt-equity ratio of not higher than 1.85:1.00, and a current ratio higher than 1.00:1.00.

¹⁴ As per the Project Agreement, the debt-equity ratio was defined as debt/equity. In the PCR, it was calculated as debt/(debt+equity). In this report, the Project Agreement definition is used.

HCC prepaid ADB's loan amounts fully to the MOF in 2003. JCC's repayments of ADB loans are as scheduled. TSP and GSS have not made loan repayments to ADB, and the local government, as the guarantor, has been repaying ADB's loans. The OEM was informed by TSP and GSS that the relatively higher financial cost of ADB's loan, as compared to current domestic borrowing, is further aggravating their already weak financial position.

48. The reasons for the poor financial performances of most subproject entities are complex and deserve more thorough analysis than this study permits. Apart from the unfavorable changes of market conditions in terms of sluggish demand, lower selling prices of products, and higher costs of raw materials and inputs, certain systemic problems associated with SOEs should be considered. For example, the OEM was told by GSS that the total number of employees, including retirees on its payroll, exceeded 7,000. The number required for operations, however, was not more than 2,500.¹⁶

C. Economic Reevaluation

49. Economic and financial reevaluations for the subprojects, undertaken using the latest available information, are discussed in detail in Appendix 3. The EIRRs and FIRRs were recalculated only for two subprojects at JCC and TSP because (i) HCC did not update the relevant data submitted at the PCR stage and (ii) the subproject facilities at GSS were leased for a small lease amount of CNY9.66 million, and GSS's management had no information on the actual production and sales for the May 2002–July 2004 period.

50. The recalculated EIRRs, FIRRs for the subprojects at JCC and TSP were consistently lower than appraisal and PCR estimates, mainly due to higher-than-projected input costs. The respective FIRRs are above the weighted average cost of capital for both JCC and TSP. Table 6 summarizes the results of the economic and financial analyses at project appraisal, completion, and postevaluation.

¹⁵ ADB's *Updated Guidelines for the Financial Governance and Management of investment Projects Financed by ADB*, approved in 2001, suggests that the debt-equity ratio indicator is normally used for new enterprises for which application of the debt service coverage ratio is not practical due to a lack of earnings records. Given that all subproject entities are not new enterprises, the most relevant indicator in this case is the debt service coverage ratio.

¹⁶ Because of an inadequate social security system, retired employees and employees laid off because of structural changes are all on the payrolls of many SOEs in the PRC.

Table 6: Summary of Economic and Financial Revaluations

Item	FIRR (%)			EIRR (%)		
	Appraisal	PCR	PPAR	Appraisal	PCR	PPAR
Subproject at HCC	11.60	9.99		13.20	12.72	
Subproject at JCC	12.80	11.47	10.35	20.20	18.47	14.34
Subproject at TSP	10.50	8.79	8.25	14.10	12.30	10.56
Subproject at GSS	12.40	8.46		16.00	12.17	

EIRR = economic internal rate of return, FIRR = financial internal rate of return, GSS = Guiyang Special Steel Company Limited, HCC = Huaxin Cement Company Limited, JCC = Jinhua Chemical (Group) Corporation, n.e = not estimated, PCR = project completion report, PPAR = project performance audit report, TSP = Tianjin Soda Plant.

Source: Asian Development Bank estimates.

D. Sustainability

51. Sustainability of the implemented subprojects depends largely on proper maintenance of the facilities installed and sound financial performance of the subproject entities. All four subprojects visited by the OEM have been well maintained and have demonstrated the desired results of production, energy efficiency, and benefits to the environment. The technologies, whether developed indigenously or imported, are all now proven and stood the test of time at the operational level. However, a key concern for the Project's long-term sustainability is the poor financial health of subproject entities (paras. 45–47).

52. The poor financial performance of GSS, JCC, and TSP which were evident at the PCR stage, continue to be a matter of concern. The financial sustainability of the respective subprojects is relatively at risk for GSS, JCC, and TSP. JCC repayments to the ADB are as scheduled, even though the overall financial performance of the company needs revival. TSP and GSS have not repaid ADB and other loans, and the Government, as the guarantor, has been repaying ADB. The OEM was informed that compared to the time of project loan taking, currently the financial cost of ADB's loan is further aggravating the already negative financial position of the subprojects of TSP and GSS. By and large, the subprojects are financially viable on their own merits and devoid of any unusual technical risks. Only the financial performance of the subproject entities in the case of GSS, JCC, and TSP, remains a matter of concern and may put the overall sustainability of the Project at risk.

53. The Government, for its part, has been providing additional tacit support to energy efficiency and environmental improvement endeavors in the PRC through rules and regulations in the form of mandatory energy audits, energy awards, and incentives and penalties, so as to make the positive impacts of energy efficiency and environment improvements achieved across the concerned industrial sectors sustainable.

IV. ACHIEVEMENT OF OTHER DEVELOPMENT IMPACTS

A. Socioeconomic Impact

54. All subprojects were implemented within the premises of existing facilities and involved mainly upgrading technology and equipment. Therefore, no land acquisition or resettlement occurred under the Project.

55. The subprojects provided temporary and permanent jobs during and after implementation. The PCR reported that the construction of project facilities provided about

4,450 person-years of temporary employment, including the hiring of local residents, amounting to 650 person-years during project implementation. About 15% of those employed were women. In addition, the project facilities created permanent employment for 2,810 people, through additional employment and redeployment, and 24% of those employed were female.¹⁷

56. The OEM noted that each of the subproject facilities has a large contingent of dedicated full-time employees covering all levels, from top management to shop floor levels, for the purpose of energy and environmental management, exclusively for their respective subproject. According to all four subproject enterprises interviewed by the OEM, this is a permanent feature. The OEM also confirmed that all four subproject schemes have been widely replicated in the respective industrial subsectors in the PRC, which in turn creates additional employment during construction and operation.

B. Environmental Impact

57. As one of the key objectives of the Project, environmental improvements and/or impacts under the Project are discussed in paras. 31, 33, 38, and 42, and details are provided in Appendix 1.

C. Impact on Institutions and Policy

58. Since the policy and institutional framework was considered appropriate at appraisal for achieving the Project’s objectives, no institutional and policy components were included in the project scope, and no related advisory TA was provided. However, the OEM carried out a review of policy initiatives, laws, rules, and regulations with respect to energy efficiency undertaken by the Government since 1986. ADB’s involvement in industrial energy efficiency and environment improvement projects did support some of these government initiatives through policy dialogue. Furthermore, ADB used the window of opportunity brought about by these policy measures to support energy efficiency applications that could be replicated. Table 7 highlights some of these important policy actions.

Table 7: Policy Measures for Improving Energy Efficiency During 1986–2004

Year	Policy Measures
1986	<ul style="list-style-type: none"> • State council promulgated the <i>Management Regulations on Energy Conservation</i>.
1991	<ul style="list-style-type: none"> • Price adjustment for petroleum products. • Launch of National Energy Saving Month every year, to promote energy efficiency.
1993	<ul style="list-style-type: none"> • Partial deregulation of electricity prices and coal prices. • Elimination of energy quotas. • Specific energy consumption levels determined for key energy-intensive industries.
1994	<ul style="list-style-type: none"> • Removal of state control over coal price and reduced planned allocations of coal.
1997	<ul style="list-style-type: none"> • Passage of the Energy Conservation Law.
1998	<ul style="list-style-type: none"> • Domestic crude oil price fell in line with the international price. • Establishment of China Management Committee for Energy Conservation Product Certification.

¹⁷ While the OEM was unable to update these figures, the continued job creation by virtue of the Project could be appreciated by the fact that GCF, as one of the five subproject entities originally approved for ADB financing, was later closed down, resulting in a loss of employment for all GCF employees.

Year	Policy Measures
1999	<ul style="list-style-type: none"> • Formulation of 53 energy saving design specifications and regulations, and amendments of 26 basic energy standards, 57 energy control standards, 48 method standards, and 33 product standards. • Catalogue of outdated technology processes and products issued to phase out noncompetitive production processes and products that consumed too much energy or were highly polluting.
2001	<ul style="list-style-type: none"> • Tenth five-year plan adopted with a target of reducing the energy intensity by 20% on a yearly basis and achieving total energy savings estimated at 340 million tons of standard coal equivalent for the 10th five-year plan period.
2004	<ul style="list-style-type: none"> • Issuance of the Medium- and Long-Term Energy Development and Conservation Plan.

Source: The Asian Development Bank's Operations Evaluation Mission.

V. OVERALL ASSESSMENT

59. Since the current ADB *Guidelines for the Preparation of Project Performance Audit Reports*, approved in September 2000, is largely tailored to the context of single-investment projects, the five building blocks of evaluation (relevance, efficacy, efficiency, sustainability, and institutional development and other impacts) may become difficult to apply to projects with several stand-alone subprojects, such as this one. In an attempt to address this conceptual and practical issue, the OEM adopted an approach of providing a rating for individual subprojects as well as an overall rating for the Project.

A. Relevance

60. The Project's goals and purposes at the time of approval were consistent with the high priority accorded to industrial energy efficiency and environmental improvement in the Government's development strategy. The Project was also consistent with ADB's operational strategy in the PRC at the time. At the national peoples' congress assembly held in March 2005, the Government committed to building an energy efficient economy and society in the years to come. The Project's objectives thus remain highly relevant to the Government's short- and long-term development strategies but less so in terms of ADB's current operational strategy and strategic objective of poverty reduction. All subprojects implemented were assessed as highly relevant. Overall, the Project was assessed as highly relevant.

B. Efficacy

61. All envisaged physical outputs of the Project were achieved with actual production exceeding the designed capacity. All subprojects have achieved anticipated energy efficiency and environmental improvements. Given the wide replication throughout the country of the new production technologies and facilities adopted under the HCC, JCC, and TSP subprojects and the willingness of domestic commercial banks to lend to similar energy efficiency projects after the Project, the expected sectorwide demonstration effect is considered to have been largely achieved, despite the fact that no formal information dissemination workshops were conducted. However, the project impacts on the financial performance of the subproject entities were not achieved to the extent envisaged for GSS, JCC, and TSP. Subprojects at GSS, JCC, and TSP were assessed as efficacious, and the subproject at HCC was assessed as highly efficacious. Overall, the Project was assessed as efficacious.

C. Efficiency

62. While the Project was implemented smoothly and without cost overruns and delays, the recalculated EIRRs and FIRRS for all subprojects were lower than appraisal estimates. With FIRRs higher than the weighted average costs of capital and EIRRs close to or above 12%, the subprojects at HCC¹⁸, JCC, and TSP were assessed as efficient. In view of the abnormal operating conditions and the leasing of the subproject facilities at a meager lease amount, the subproject at GSS was assessed as inefficient. Overall, the Project was assessed as less efficient.

D. Sustainability

63. The operation and maintenance of all subprojects were satisfactory. In view of the financial performance of subproject entities, the subproject at HCC was assessed as most likely to be sustainable. The subprojects at JCC and TSP were assessed as likely to be sustainable, on the basis of FIRRs being higher than the weighted average cost of capital. The subproject at GSS was assessed as less likely to be sustainable. Overall, the sustainability of the Project is assessed as likely.

E. Institutional Development and Other Impacts

64. Although the overseas training provided under the Project was considered useful by all the subproject entities, the Project made little noticeable impact on the institutional development of the subproject entities. As discussed in para. 58, the policy changes during and after the Project took place largely independent of the Project. However, the demonstration effect of the Project has been achieved to a certain extent, as evidenced by the fact that new production technologies adopted under the Project had been replicated in other plants throughout the country. The institutional development and other impacts of the Project are assessed as moderate.

F. Overall Project Rating

65. On the basis of the preceding assessments, the Project is rated successful.

G. Assessment of Asian Development Bank and Executing Agencies Performance

66. ADB cooperated well with Government and the EAs in formulating the Project and processing the loan. During implementation, a total of eight missions were fielded by ADB in relation to project start, implementation, and completion. ADB approved the replacement of the GCF subproject and use of loan savings in a timely manner. Unfortunately, the replaced subproject was later cancelled, due to the inability of the concerned entity to obtain the necessary loan repayment guarantee from the local government. At the time of the PCR Mission, in March 2003, the subproject facilities at GSS had been leased out for almost 1 year. The PCR failed to report the leasing arrangement. It, however, discussed the financial position of GSS, in the absence of supporting financial statements. On the basis of (i) the failure to detect the financial difficulties of GCF and its substitute entity during processing, (ii) the negligence of the lease of project facilities of GSS after completion, and (iii) the lack of formal

¹⁸ Since HCC did not update the relevant data submitted at the PCR stage, the PCR reestimates of EIRR and FIRR for the subproject (Table 6) were used in the assessment of efficiency.

coordination and structured review of policy initiatives with the concerned government agencies, the overall performance of ADB is considered partly satisfactory.

67. The EAs performed satisfactorily in terms of preparation and implementation of the subprojects but less so in timely submission of financial statements and audited project accounts. In light of the status of loan repayments, the overall performances of HCC and JCC are considered satisfactory. The overall performances of GSS and TSP are considered partly satisfactory.

VI. ISSUES, LESSONS, AND FOLLOW-UP ACTIONS

A. Key Issues for the Future

68. In the last two decades, the PRC has made remarkable gains in reducing the energy intensity in terms of tce per CNY10,000 of gross domestic product from 5.32 in 1990 to 2.68 in 2002. This achievement corresponds to an annual savings rate of 5.6% and is rarely accomplished in countries at this level of development.¹⁹ However, the energy intensity in the PRC is still 3–10 times higher than in developed countries. At the current growth rate of energy consumption, primary energy consumption in the PRC is forecast to surpass that of the United States by 2020 and amount to 4 billion tce per year. This level of coal-based primary energy consumption will have considerable impact on the global economy and environment. In the context of promoting sustainable economic growth, the Government has committed to further reduce the energy intensity to 2.25 tce per CNY10,000 of gross domestic product by 2010 and 1.54 by 2020. ADB's current operational strategy in the PRC consciously stays away from direct support to SOEs in industrial projects, even though the projects have positive impacts on environmental and energy efficiency improvement. Therefore, industrial energy efficiency and conservation, an important development issue for the PRC in the short and long terms, is not touched upon in the latest PRC country strategy and program (2004–2006) and the PRC country strategy and program update (2005–2007). The greatest challenge for ADB's future operations in the PRC becomes how to remain relevant at the center stage of the country's development and to address the key developmental issues in a significant way.

69. As a development financing institution, ADB should contribute to the country's pursuit of building an energy efficient economy and society in the years ahead. Since the private sector now accounts for more than one third of the PRC's economy, appropriate lending modalities and mechanisms need to be explored with the Government with regard to ADB's involvement in the area of industrial energy efficiency and environment improvement through private sector windows. At the moment, certain procedural and operational barriers exist on the part of the Government as well as ADB for private companies to receive loans from ADB for industrial energy efficiency projects.

70. The experience of the Project shows that promotion of industrial energy efficiency in the PRC usually involves adoption and/or adaptation of new technologies on a pilot basis. The achievement and impact of pilot projects depend largely on the extent to which large-scale sectorwide replications take place. Due to legitimate commercial concerns, the subproject entities, as in the case of TSP, are often reluctant to disseminate crucial information on the newly adapted technologies. Therefore, proper mechanisms for the transfer of technology and

¹⁹ Zhongxiang Zhang. 2003. *Why did the Energy Intensity fall in China's Industrial Sector in the 1990's? The Relative Importance of Structural Change and Intensity Change*. East-West Center Working Papers. Honolulu, Hawaii.

information dissemination, other than workshops, should be taken into consideration at the project design stage.

B. Lessons Identified

71. GSS and TSP did not make any repayment of the loan or interest to ADB, even during profitable years. While ADB's loans were paid by the Government by virtue of loan guarantee, ADB should know in a timely manner whether the subproject enterprise is making adequate surpluses and whether it is capable of sustaining a project financially. Considering the depth of financial analysis required and quantum at stake, fielding ADB review missions consisting of one project engineer roughly on an annual basis seems inadequate. In this kind of situation, more staff time and expertise are needed during the review missions for thorough financial analysis and recommendations.

72. The periodic submission of audit and progress reports of the subprojects and financial statements of the enterprises to ADB has not been done in a satisfactory manner. Furthermore, since available subproject information in terms of energy efficiency improvements and environmental benefits was all in Chinese, proper and timely translation into English became difficult for most EAs. A standard reporting format applicable to all projects is not very helpful in the case of the PRC, where English is not widely used. It would be useful for ADB to prepare and provide a project-specific benefit monitoring format in English prior to implementation.

73. As per the Project Agreement, HCC should have shut down in 2001 the three wet process kilns on successful completion of the subproject. However, the old kilns will continue to be in operation until 2008. Although this was brought to ADB's attention at the PCR stage, no actions were taken to either revise the loan covenants or develop a mutually agreeable time frame.²⁰ To make loan covenants more legally credible, any waiver or modification should be agreed upon between the EA and ADB and formally documented.

74. The project confirmation process was insufficient to the extent that the Appraisal Mission and the Reappraisal Mission failed, respectively, to detect (i) the pending investments by GCF that eroded its financial performance and (ii) the inability of the replaced Exi Chemical Plant subproject to secure a counter guarantee from the provincial government. This resulted in the cancellation of Exi Chemical Plant subproject and \$28.7 million of the loan proceeds. Under the Loan 1178-PRC (footnote 1), \$22 million of loan proceeds were cancelled because of similar financial issues. Thus, lessons from the earlier project had not been learned to the extent possible in the Project. To determine the financial health of subproject candidates in the PRC, especially the health of SOEs, all supporting documents relating to counterpart funding commitments from local banks and counter guarantee letters from local governments should be carefully reviewed in parallel with the usual financial ratios analysis.

C. Follow-Up Actions

75. No follow-up actions are deemed necessary.

²⁰ The three wet process kilns were modified to meet all the national environmental requirements and will be closed when the plant is relocated in 2008. HCC prepaid ADB's loan in 2003.

PERFORMANCE OF THE SUBPROJECTS

A. Subproject at Huaxin Cement Company Limited

1. Project Scope and Implementation

1. The subproject as approved was to modernize and expand operations by replacing three kilns of obsolete wet process technology and two shaft kilns. The combined capacity of the existing wet process kilns of 1,800 tons per day (tpd) of clinker plus two shaft kilns of 400 tpd were to be replaced by a single dry process suspension preheater kiln line with a capacity of 4,000 tpd of clinker. The subproject scope included the related quarry equipment, limestone crushing and blending plant, raw material homogenizing and feeding plant, kiln preheater and calciner system, coal mill, instrumentation, process and control system, conveying equipment, weighing system, and air emission control system. The three wet process kilns were still in operation at the time of the Operations Evaluation Mission (OEM), and the two shaft kilns were removed from the facility on successful completion of the new line.

2. The subproject was completed at a total cost of \$96.25 million, against \$143.89 million originally appraised. Against the originally estimated time span of 30 months for completion, the subproject was completed in less than 16 months, with the support of specialized design institutes and a bidding agent engaged by Huaxin Cement Company Limited (HCC) at its own expense.

3. The OEM found the installed subproject facilities to be well maintained and working satisfactorily. The new line, which commenced commercial production in 1999, has been consistently giving higher quality and throughput of 5,500 tpd of clinker, exceeding the designed capacity by 37.0%.

4. HCC acknowledges that ADB's loan and subproject-related training had laid the foundation for further development. HCC has been among the first in the cement industry in the People's Republic of China (PRC) to indigenously develop and introduce the new dry process technology. Prior to HCC's new line, such technologically efficient plants were almost entirely imported. HCC has provided informal support in terms of technology consultation and training to many enterprises in the PRC cement industry. Since the completion of the subproject, the suspension preheater dry process kiln systems have been widely used throughout the country and, in 2004 alone, over 100 new production lines started operating in the PRC.

2. Energy Efficiency

5. After the new line was put into production in 1999, the obsolete shaft kiln production line was shut down in August 2000. By virtue of this, a cumulative 124,000 tons of standard coal equivalent (tce) was conserved by the end of 2004, at a reduction rate of 28,600 tce per year.

6. Subsequent to subproject implementation, the heat consumption per kilogram of clinker production was reduced substantially from 1,400 kilocalories (kcal) to nearly half, at 710 kcal, and electricity consumption per ton of clinker was reduced by 22%, from 90 kilowatt-hours (kWh) to 70 kWh. These achievements are considered highly energy efficient by international standards.

3. Environmental Improvement

7. Implementation of the subproject created the following positive and sizeable environmental impacts in terms of dust and air emissions:

- (i) Dust emission of 9,608 tons per annum was reduced to 2,618 tons per annum. Further reduction of 2,141 tons per annum is expected when the three wet process kilns are removed from production in 2008.
- (ii) The stack air emissions meet the new national air pollutant emission standard, and the overall facility's ambient air quality has been greatly improved, meeting the PRC's ambient air quality standard.

8. HCC is able to continue, with self funding, modifying, upgrading, and/or repairing the existing dedusting system and electrostatic precipitators, achieving a further reduction of air pollutant emissions to meet the new PRC's air emission standard for cement plants. HCC also contributed to the water quality improvement of the receiving Cihu Lake through the achievement of zero wastewater discharge and realized additional water savings after the completion of a water treatment and utilization project.

9. The only issue that is pending with respect to environmental management relates to the three wet process kilns that are still in operation. The OEM was informed that these are operated due to commercial reasons and would be shut down by 2008. However, the wet process kilns have been renovated at a cost of CNY15 million by HCC, which reduced aggregate energy consumption, and are in compliance with the national air emissions standards.

10. The facility received no additional complaints from its surrounding residents or warnings and fines from the local environment protection bureau (EPB). In conclusion, all environmental objectives of the subproject have been successfully met, except for the required shutdown of the three wet process kilns.

4. Issues of Concern

11. The nonclosure of the wet process kilns, while helping the short-term commercial interests of HCC, is not in the best interest of the country's environmental management and undermines the usefulness of the agreed loan covenants.

5. Overall Assessment

12. ADB's financing has been catalytically useful. Taking into account the substantial and perpetual nature of energy savings and environmental benefits, the subproject is assessed as highly relevant, highly efficacious, efficient,¹ and most likely to be sustainable with significant institutional and other development impact. Overall, the subproject is rated as highly successful.

¹Since HCC did not update the relevant data submitted at the PCR stage, the PCR reestimates of EIRR and FIRR for the subproject (Table 6) were used in the assessment of efficiency.

B. Subproject at Jinhua Chemical (Group) Corporation

1. Project Scope and Implementation

13. The subproject as approved for Jinhua Chemical (Group) Corporation (JCC) was to replace obsolete and highly polluting mercury and diaphragm cells for caustic soda production with ion exchange membrane cells with a production capacity of 80,000 tons per annum. The scope included ion membrane electrolysis section (cells), brine purification and filtration, chlorine gas compression, instrumentation and associated accessories. The existing mercury cells and the diaphragm cells were to be shut down and demolished properly after the new ion exchange membrane cells were installed. Apart from significant energy benefits, the main objectives of the subproject from the environmental aspect included (i) eliminating mercury, lead, and asbestos pollution; (ii) improving the working environment for the workers, particularly with regard to the work exposure to mercury, lead, asbestos, and chlorine gas; and (iii) reducing pollutant air emissions, primarily chlorine, and reducing global warming gases through an improved energy efficiency production process.

14. The subproject was completed at a total cost of \$52.05 million, 9% lower than the appraisal estimate of \$57.34 million, even though the subproject scope was expanded through using loan savings to include prilled caustic soda processing equipment.

15. Against the originally estimated time span of 30 months for project completion, the new caustic soda plant was completed 11 months ahead of schedule, and commercial operations began in August 1998, with actual output consistently higher than the designed capacity by over 50%. However, the additional prilled caustic soda processing equipment was completed by the end of 2002, with corresponding production commencing in early 2003.

16. In recognition of the low investment cost, early completion and excellent quality of construction, the subproject won the National Award for best technology upgrading project" during the ninth five-year period. JCC was named the best technology innovation company in Liaoning Province by the Liaoning Economy and Trade Commission in March 2001.

17. Encouraged by the phenomenal positive energy and environmental benefits of the subproject supported by ADB, JCC negotiated with the same overseas technology supplier and built another 120,000 tons per annum caustic soda plant using supplier's credit through the Japan Bank for International Cooperation.

18. During the site visit, the OEM found the subproject facilities well maintained and working satisfactorily with a clean working environment.

2. Energy Efficiency

19. After implementation of the subproject, the average specific electrical energy consumption for caustic soda was reduced by 25%, from 3,148 kWh per ton (1995–1997 average for diaphragm and mercury cell) to 2,373 kWh per ton (1998–2004 average for new membrane cell). The average specific fuel consumption was reduced by 66%, from 0.2590 tce per ton to 0.0939 tce per ton.

20. Prior to the implementation of the subproject, the average specific energy consumption per ton of caustic soda was 1.681 tce for the old cells. This improved substantially after the new membrane cell, which had average specific energy consumption per ton of caustic soda of

1.077 tce during 1998–2004. The total energy consumption saved amounted to 72,480 tce per year. These achievements are considered highly energy efficient by international standards.

3. Environmental Improvement

21. The positive environmental impacts of the subproject are as follows:

- (i) JCC completely eliminated the environmental pollution and occupational health hazard with regard to the exposure to mercury, lead, and asbestos in the production process.
- (ii) Chlorine gas in air emissions is now negligible and meets the national air pollutant emission standard.

22. JCC also contributed at its own expense to water quality improvement of the receiving Wulihe River by constructing and operating a new wastewater treatment plant and discharging the treated effluent through a common effluent pipe to the ocean. The subproject facility received no complaints or warnings or fines from the local EPB. In conclusion, all environmental objectives of subproject have been successfully met.

4. Issues of Concern

23. Although most of the mercury containing soils were removed from the facility and treated properly by a specialized firm, the groundwater and soils in and around the facility have not been sampled and analyzed for mercury, lead, etc., since July 1999. To avoid future liability and potential expansion of groundwater pollutant plume, if there is contamination, it is recommended that JCC undertake an analysis of groundwater and soil samples taken from places susceptible to mercury contamination or spills from the past.

24. JCC has been incurring financial losses since 2001, which consistently increased from CNY4.71 million in 2001 to CNY 160.61 million in 2004 and put long-term sustainability of the subproject at risk.

5. Overall Assessment

25. JCC acknowledges the crucial role played by ADB and the successful implementation of the subproject in turning JCC into the second largest caustic soda producer in the PRC. JCC considered the subproject highly successful.

26. The subproject demonstrated amply the production as well as expansion capabilities and generated energy and environmental benefits as originally envisaged. However, the financial performance of the enterprise has had a set back, and since 2001 there have been continual losses. Taking into account the achievement of energy and environmental benefits, the subproject is assessed as highly relevant, efficacious, efficient, and likely to be sustainable with little institutional and other development impact. Overall, it is rated successful.

C. Subproject at Tianjin Soda Plant

1. Project Scope and Implementation

27. The subproject aimed to improve the production of dense soda ash by modifying the technology of the ammonia shift, absorption, and distillation sections. The subproject scope covered a soda ash plant, ammonia absorption and distillation plant, and ammonia synthesis plant. The subproject was to produce low-salt, high-quality dense soda ash and increase the production capacity from 200,000 tons per annum to 400,000 tons per annum.

28. The subproject was successfully completed 12 months ahead of schedule and at a final cost of \$ 56.56 million, against the appraisal estimate of \$ 69.8 million. During the site visit, the OEM found the subproject facilities well maintained and working satisfactorily, with a clean working environment. The production output, energy efficiency, and environmental improvements achieved under the subproject are given in Table A1.

Table A1: Outputs and Outcomes Achieved

Product	1995			1999			2004		
	Production ('000 tons)		Specific Energy Consumption (kcal/ton)	Production ('000 tons)		Specific Energy Consumption (kcal/ton)	Production ('000 tons)		Specific Energy Consumption (kcal/ton)
	Design	Actual		Design	Actual		Design	Actual	
Dense Soda Ash	200	126	740,000	400	263	640,000	400	482	550,000
Light ash	471	471	3,600,000	495	497	3,270,000	600	607	3,190,000
Synthetic Ammonia	58	58	13,920,000	65	67	13,170,000	75	79	12,510,000

/ = per.

Kcal = kilocalorie.

Source: Consultant's Report for TA 2987-PRC and findings of the Operations Evaluation Mission.

29. On the production side, the actual production for all the three products of (i) dense soda ash, (ii) light soda ash, and (iii) synthetic ammonia has exceeded design capacities. The technology used to upgrade dense soda ash production was developed by Tianjin Soda Plant (TSP), which is not only the most up-to-date in the country but also ranks among the best in the world. The EAs' executives advised the OEM that even though international entities have requested that TSP sell the technology, due to commercial concerns, TSP does not plan to transfer it in the immediate future. For ammonia absorption and distillation, the technology introduced from abroad was successfully adapted by TSP to the needs of locally developed equipment, and a notable outcome of the subproject is that three other similar plants in the country have adopted this improved technology.

2. Energy Efficiency

30. The specific energy consumption of dense ash improved by about 26%, light ash by 11%, and synthetic ammonia by 10% from 1995 to 2004. Also, the specific energy consumption of dense soda ash of 550,000 kcal per ton is far superior to the national average of 650,000 kcal per ton. The specific energy consumption of light soda ash is 40,000 kcal per ton lower than the national average, and for synthetic ammonia, the energy efficiency figures attained are at par with the national average.

3. Environmental Improvements

31. The positive environmental impacts of the subproject are as follows:

- (i) The most apparent and significant achievement of the subproject is the elimination of the occupational health hazard of workers' exposure to ammonia and soda ash dust.
- (ii) Air emissions of carbon dioxide, sulfur dioxide, nitrogen dioxide, and ammonia concentration have been substantially reduced, and air quality near TSP, monitored by the local EPB, met the national air pollutant emission standard.

32. Since the completion of the subproject, TSP achieved close-loop recycling of the large quantity of cooling water, greatly minimizing the wastewater discharge to the receiving ocean (Bohai). The facility received no complaints or warnings or fines from the local EPB. In conclusion, all the environmental objectives of subproject have been successfully met, and the ADB-financed subproject has provided momentum for TSP to continuously improve the environment with its own financial resources and self-developed technologies.

4. Issues of Concern

33. While TSP has been making marginal profits from 2001 onward, TSP has to date not generated adequate surpluses to repay ADB.

5. Overall Assessment

34. Taking into account the substantial and perpetual nature of energy-environmental benefits and replication potential, the subproject is assessed as highly relevant, efficacious, efficient, and likely to be sustainable with little institutional and other development impact. Overall, it is rated as successful.

D. Subproject at Guiyang Special Steel Company Limited

1. Project Scope and Implementation

35. The subproject at Guiyang Special Steel Company Limited (GSS) was to replace five obsolete 10-ton melting furnaces with a 60-ton electric arc furnace and install downstream facilities with the capacity to continuously cast 300,000 tons of special steel per year. The subproject scope included one 60-ton electric arc furnace, one 60-ton ladle furnace, three strand continuous casting machines, one water circulation and treatment system, one additive charging system, dedusting equipment, one power distribution system, laboratory equipment, one crane, scrap yard equipment and tapping car, and steel construction materials. The subproject was implemented as planned, except using loan savings. Vacuum degassing equipment was added to eliminate some gaseous contaminants that made the quality of the steel product inconsistent. The subproject was completed at a final cost of \$72.30 million, which was 3% higher than the appraisal estimate of \$70.07 million. The level of operations has been contingent on extraneous factors, and the plant's full capacity has not been exploited since installation. However, the subproject's management confirmed that an independent panel determined the facilities to be of satisfactory quality and capable of meeting the designed throughput.

36. The subproject's operation has confirmed the attainment of the key objectives of energy efficiency and environment improvement, as originally envisaged. However, immediately after subproject completion in 2000, concerned provincial government agencies proposed relocating the plant away from the Guiyang City, in consideration of environment improvements and deriving advantage from increasing the land value of the present site. In anticipation of the relocation, many GSS customers stopped placing purchase orders with GSS. As a result, the normal operation of the plant was disrupted, and GSS encountered major financial difficulties. By 2002, GSS incurred a total loss of over CNY145 million. In an attempt to minimize losses, the subproject's facilities were leased to a private company from Guangdong under a 3-year contract, starting from May 2002, with an annual fee of CNY6 million. In July 2004, the local government abandoned the proposed relocation plan, and the lease contract was defunct, partly due to strong opposition from the GSS employees and partly due to poor operation management of the private lessee. The OEM was informed that the lessee did not formally terminate the lease contract but abandoned the operations. Since then, GSS has resumed its normal operation and reduced its loss by CNY30 million through expansion of its businesses to other areas, such as lease of its surplus land for commercial activities. GSS has not been able to make any loan repayments up to now.

2. Energy Efficiency

37. Specific electricity consumption reduced from the earlier level of 680 kWh per ton to 420 kWh per ton, and water consumption was reduced by 530,000 tons per year. The electric arc furnace imported under the subproject used the most up-to-date technology. Since the completion of the subproject, such electric arc furnaces have been installed in five iron and steel plants in the PRC.

3. Environmental Improvement

38. Since the project facilities were leased to a private company after completion, the relevant data on environment improvement attributable to the subproject were not available. The subproject facility received no additional complaints from surrounding residents or warnings and fines from the local EPB. GSS's surrounding environment has been significantly improved through the implementation of the subproject. As a result, the real estate values around the GSS facility have appreciated greatly in recent years.

4. Issues of Concern

39. The subproject brought about no apparent economic benefits to GSS. GSS has been incurring losses since 2001 and was unable to make any repayment toward ADB's loan to date.

5. Overall Assessment

40. Taking into account the issues discussed, the subproject is assessed as highly relevant, efficacious, inefficient, and less likely to be sustainable with little institutional and other development impact. Overall, it is rated as partly successful.

FINANCIAL HIGHLIGHTS OF SUBPROJECT ENTITIES

1. Huaxin Cement Company Limited (HCC) is a joint-stock company with shares listed on the Shanghai Stock Exchange. HCC did not fully provide the updated financial data requested from 1995 to 2004. Analysis was done based on the available data from 1999 onward. The profit after tax improved from CNY4.24 million in 1999 to CNY148.55 million in 2004, an increase of 35 times. This indicates that the financial performance has improved, but the covenanted debt service coverage ratio of 1.25:1.00 has not been met from 2001 onward. ADB's debt-equity ratio requirement is not higher than 65.00:35.00 (1.85:1.00 times), against which, out of 6 years, 1999–2004, this ratio has been met only during 1999, 2002, and 2004. Also during 1999–2004, the current ratio, which is indicative of liquidity position, has not met ADB's requirement of 1.00:1.00, except for 1999. This ratio has been going down in the recent years, from 0.95 in 2000 to 0.62 in 2004, except for 2003, which is marginally higher at 0.88. Table A2.1 summarizes the financial performance of HCC.

Table A2.1: Huaxin Cement Company Limited

Financial Performance						
(CNY million)						
Item	1999	2000	2001	2002	2003	2004
Current Liabilities	421.99	461.74	583.80	455.11	610.46	1,569.60
Long-Term Loan	877.90	1,276.45	1,316.90	692.51	1,002.94	1,614.03
Equity	722.48	269.82	169.96	751.71	807.63	1,772.17
Current Assets	456.06	440.18	454.44	334.65	539.89	978.12
Total Fixed Assets	1,428.91	1,567.83	1,616.23	1,226.48	1,473.07	3,950.78
Total Intangible Assets	80.58	—	—	72.87	99.39	362.89
Long-Term Investment	—	—	—	265.33	308.68	—
Retained Earnings	—	—	—	—	—	—
Depreciation (Accumulation)	—	—	—	—	—	—
Depreciation for the Year	—	—	—	—	—	—
Profit after Tax	4.24	18.10	30.97	29.32	68.60	148.55
Interest Payment (On all loans)	72.07	43.97	37.42	107.32	0.00	N.A
Principal Payment (On all loans)	27.33	62.27	62.26	170.20	928.69	N.A
Financial Ratios						
Debt Service Coverage Ratio	—	—	—	—	—	—
Debt-Equity Ratio	1.80	6.44	11.18	1.53	2.00	1.80
Current Ratio	1.08	0.95	0.78	0.74	0.88	0.62

—= Not Available.

Source: Data for 1999, 2000, 2001, and 2004 was given by Huaxin Cement Company Limited (HCC) during the OEM visit. For 2002 and 2003, the data was taken from HCC's 2003 audited annual report.

2. Jinhua Chemical (Group) Corporation (JCC) has been consistently inflicted with negative after-tax profit. The loss increased from CNY4.61 million in 1999 to CNY254.38 million in 2003. This needs closer study, as the company's loss has increased by 55 times. While the amount of loss was reduced to CNY160.61 million in 2004, the retained earnings as of 2004 are negative, at CNY740.32 million. The loan covenanted debt-equity ratio, which needs to be maintained at not higher than 1.85:1.00, has not been complied with from 2001 and has also been increasing until 2004. Compared to 2003, when the debt-equity ratio was 3.10, this came down to 2.95 in 2004 but is still higher than the compliance need. The current ratio, which should at least be

1.00:1.00, was also not meeting the loan covenant for 2003 and 2004. The project completion report indicated that the debt service coverage ratio was not complied with for any of the years during 1996–2002. Requisite data after the project completion report is not provided by JCC, citing its status as a commercial secret. Therefore, the compliance or otherwise of this for the last 2 years cannot be verified. Table A2.2 summarizes the financial performance of JCC.

Table A2.2: Jinhua Chemical (Group) Corporation

Financial Performance						
(CNY million)						
Item	1999	2000	2001	2002	2003	2004
Current Liabilities	710.86	838.43	1,077.69	1,632.63	1,593.75	1,865.90
Long-Term Loan	661.97	1,659.97	1,881.06	1,941.97	1,734.86	1,334.60
Equity	1,441.07	1,319.98	1,420.90	1,247.16	984.73	994.88
Minority Shareholding	90.00	90.00	90.00	90.00	90.00	90.00
Current Assets	833.54	858.51	1,123.77	1,630.36	1,249.65	1,107.33
Total Fixed Assets	1,855.38	2,812.24	3,030.09	2,994.12	2,847.47	2,613.06
Intangible Assets	—	187.68	94.23	83.55	79.25	66.58
Long-Term Investment	—	220.80	221.56	203.73	226.96	498.41
Depreciation (Accumulation)	691.51	783.54	886.32	1,025.28	1,167.14	1,461.11
Depreciation for the Year	29.51	92.03	102.78	138.95	141.87	293.97
Profit After Tax	(4.61)	3.98	(39.83)	(149.92)	(254.38)	(160.61)
Interest Payment (On all Loans)	25.97	77.31	52.14	(98.74)	134.51	155.25
Principal Payment (On all Loans)	—	—	—	—	—	—
Short-Term Loan	428.01	529.69	668.39	828.57	845.18	1,145.80
Retained Earnings	(23.94)	(56.90)	(136.80)	(287.84)	(554.45)	(740.32)
Financial Ratios						
Debt Service Coverage Ratio	—	—	—	—	—	—
Debt-Equity Ratio	0.90	1.77	1.96	2.67	3.10	2.95
Current Ratio	1.17	1.02	1.04	1.00	0.78	0.59

—= Not available.

Source: Jinhua Chemical (Group) Corporation.

3. Tianjin Soda Plant (TSP) has been making marginal profits from 2001 onward. In 2004, TSP made a profit of CNY7.46 million, showing an increase of 28 times when compared to its 2001 profit of CNY0.22 million. TSP is confident that the present upswing in the performance is likely to continue in the coming years. The covenanted debt service coverage ratio of 1.25:1.00 has been met consistently from 2001 onward. The debt-equity ratio requirement of 1.85:1.00 has been complied with throughout the period under review. It is worth noting that the local government, as the guarantor, has been repaying ADB's loan on behalf of TSP, in view of inadequate cash surpluses by the subproject since the first installment. This needs to be further investigated, as the debt service coverage ratio and debt-equity ratio are being met as per ADB requirements but the guarantor is making the loan repayment. The current ratio covenant of 1.00:1.00 has not been met and is continually deteriorating, from 0.87 in 2000 to 0.67 in 2004. Table A2.3 summarizes the financial performance of TSP.

Table A2.3: Tianjin Soda Plant

Financial Performance						
(CNY million)						
Item	1999	2000	2001	2002	2003	2004
Long-Term Loan	712.65	606.35	531.96	527.36	563.42	578.82
Current Liabilities	785.76	849.10	906.25	983.38	1,076.06	1,027.51
Equity (Owners Fund)	409.41	560.46	629.55	635.43	668.74	694.37
Current Assets	710.98	739.11	743.73	774.35	819.41	686.02
Total Fixed Assets	1,130.43	1,211.34	1,239.37	1,240.59	1,323.91	1,442.46
Investment	57.60	60.37	74.61	121.60	160.15	170.34
Intangible Assets	8.81	5.10	10.05	9.63	4.75	1.88
Short-Term Loan	266.70	269.10	261.70	293.15	386.10	416.15
Retained Earnings	(115.98)	(31.31)	0.33	4.91	5.08	9.30
Depreciation (Accumulation)	526.49	566.54	623.06	688.31	745.47	796.56
Depreciation for the Year	75.40	40.05	56.53	65.24	57.16	51.09
Profit After Tax	(115.98)	(31.31)	0.22	4.77	4.93	7.46
Interest Payment (On all loans)	26.55	22.72	21.69	24.99	24.99	34.89
Principal Payment (On all loans)	0.05	2.00	4.62	14.82	9.78	35.46
Financial Ratios						
Debt Service Coverage Ratio	(0.53)	1.27	2.99	2.39	2.51	1.35
Debt-Equity Ratio	1.74	1.08	0.84	0.83	0.84	0.83
Current Ratio	0.90	0.87	0.82	0.79	0.76	0.67

Source: Tianjin Soda Plant.

4. Guiyang Special Steel Company Limited (GSS) leased out its steel making business to a private party during May 2002–July 2004. Other than a lease fee of CNY9.66 million, no operational and financial information were available for that period. However, limited available data has been used for a sketchy analysis. From 2001 onward, GSS has been recording losses. From a loss of CNY59.38 in 2001, it reached a loss of CNY227.85 million in 2003. Even though GSS is still operating at a loss, the quantum of loss has come down to CNY73.03 million in 2004, from CNY227.85 million in 2003. During the later part of 2004, GSS terminated the lease arrangement and resumed its steel making operations. GSS has not been able to make any repayments for ADB loans. The debt-equity ratio covenant, which needs to be maintained at not higher than 1.85:1.00, has not been complied with. The current ratio has not been meeting the loan covenant and continually deteriorating, from 0.71 in 2001 to 0.53 in 2004. Table A2.4 summarizes the financial performance of GSS.

Table A2.4: Guiyang Special Steel Company Limited

Financial Performance						
(CNY million)						
Item	1999	2000	2001	2002	2003	2004
Current Liabilities	1061.34	949.06	1068.16	1064.58	980.29	941.57
Long-Term Loan	377.34	360.71	459.20	517.26	543.31	565.91
Equity	425.58	610.57	731.46	591.28	381.37	332.04
Current Assets	1012.57	925.40	761.99	668.48	570.08	498.02
	663.46	616.27	892.14	1489.99	1189.68	1175.11
Retained Earnings	—	—	(69.91)	(215.45)	(442.69)	(518.81)
Depreciation	26.06	5.67	126.82	41.77	(136.45)	44.04
Short-Term Loan	304.22	277.50	250.60	244.90	237.10	234.60
Profit After Tax	1.34	2.17	(59.38)	(145.54)	(227.85)	(73.03)
Interest Payment (On all loans)	—	—	—	—	—	—
Principal Payment (On all loans)	—	—	—	—	—	—
Financial Ratios						
Debt Service Coverage Ratio	—	—	—	—	—	—
Debt-Equity Ratio	3.38	2.15	2.09	2.68	4.00	4.54
Current Ratio	0.95	0.98	0.71	0.63	0.58	0.53

— = Not Available.

Source: Guiyang Special Steel Company Limited.

ECONOMIC AND FINANCIAL REEVALUATION

A. General

1. Due to the unavailability of updated data for the subprojects at Huaxin Cement Company Limited and Guiyang Special Steel Company Limited, the financial and economic reevaluation was only done for subprojects at Jinhua Chemical (Group) Corporation (JCC) and Tianjin Soda Plant (TSP).

2. The economic internal rate of return (EIRR) and financial internal rate of return (FIRR) were reevaluated on the basis of financial data and assumptions provided by the subproject entities. Data on weighted average cost of capital were provided by subproject entities.

B. Assumptions for Financial Internal Rate of Return Calculation

3. Capital costs were based on investment figures for the subprojects, as indicated in the project completion report. Incremental revenues and incremental costs by major products were not readily provided by the subproject entities. Therefore, FIRR was reevaluated on the basis of benefit method.

4. For JCC, the reduction in costs was computed in relation to total production before and after the subproject, by taking energy savings and applying it on total production to arrive at incremental revenue. The cash flow after tax is arrived at as the net cash inflow after tax and by adding back the depreciation amount. The corporate income tax rate is taken as 33%.

5. For TSP, which provided incremental cost and incremental revenue figures, depreciation and tax calculation were included to arrive at net cash flow.

6. In both subprojects, the project cost has been fully amortized by 2015 and, therefore, written down value is taken as 0 after 2015.

C. Assumptions for Economic Internal Rate of Return Calculation

7. For JCC, EIRR was calculated on the basis of incremental revenue less capital investment, which gives the cash flow. Computing this way was required since the relevant cost data was not provided. For TSP, the net cash flow figures were taken from FIRR calculation without considering depreciation and tax.

8. Table A3.1 provides the results of the recalculated EIRR and FIRR for JCC and TSP.

Table A3: Recalculated Economic Internal Rate Return and Financial Internal Rate of Return

Subproject	EIRR (%)	FIRR (%)	WACC (%)
JCC	14.34	10.35	5.78
TSP	10.56	8.25	5.66

FIRR = financial internal rate of return, EIRR = economic internal rate of return, WACC = weighted average cost of capital, JCC = Jinhua Chemical (Group) Corporation, TSP = Tianjin Soda Plant.

Source: The Asian Development Bank's Operations Evaluation Mission.

**MANAGEMENT RESPONSE TO THE PROJECT PERFORMANCE AUDIT REPORT
ON THE SECOND INDUSTRIAL ENERGY EFFICIENCY AND ENVIRONMENT
IMPROVEMENT PROJECT IN PEOPLE'S REPUBLIC OF CHINA
(Loan 1436-PRC)**

On 9 August 2005, the Director General, Operations Evaluation Department, received the following response from the Managing Director General on behalf of Management:

1. Management finds the report well prepared. The overall project rating is "successful," which is the same as the assessment presented in the Project Completion Report circulated on 17 October 2003. It is also noted that no follow-up action is recommended by OED. However, we would like to offer the following specific comments.

2. The key issues for the future, as described in the report, are (i) PRC's high energy intensity and (ii) the need for ADB to contribute to the country's pursuit of building an energy efficient economy. The report also suggests that ADB needs to increase its involvement in the improvement of energy efficiency in industries. Management recognizes the importance of reducing the energy intensity of PRC's economy. ADB's Regional and Sustainable Development Department has launched an energy efficiency initiative, wherein an interdepartmental steering committee and a task force have been established to do a study and prepare a medium-term action plan to increase ADB's interventions related to energy efficiency in the DMCs. Further, East and Central Asia Department is also preparing an advisory TA that will examine ways to overcome the barriers and provide the opportunity to prepare an investment project for energy conservation and resource management in PRC. To increase ADB's involvement in the improvement of energy efficiency in industries poses a challenge because the private sector accounts for over a third of the economy.

3. The PPAR has pointed out the importance of timely and effective monitoring of project progress reports and financial statements. Monitoring and evaluation of industrial subprojects present a special challenge because they function in a competitive environment, which require their management to follow a shorter planning horizon and face considerable volatility in prices of resources, raw materials, and products. To a certain extent, these factors have guided the current ADB operational strategy of requiring industrial units to seek commercial financing. However, considering the importance of energy conservation, discussions are proceeding with the Government of PRC to find ways to extend support to all energy consumers. When such projects are prepared, suitable monitoring and evaluation framework will also be prepared.