

**PROJECT COMPLETION REPORT**

**ON THE**

**PING HU OIL AND GAS DEVELOPMENT PROJECT**  
**(Loan 1419-PRC)**

**IN**

**THE PEOPLE'S REPUBLIC OF CHINA**

**May 2004**

## CURRENCY EQUIVALENTS

Currency Unit      –      yuan (CNY)

		<b>At Appraisal</b> (1 November 1995)	<b>At Project Completion</b> (1 December 2003)
CNY1.00	=	\$0.120	\$0.121
\$1.00	=	CNY8.315	CNY8.30

## ABBREVIATIONS

ADB	–	Asian Development Bank
CNG	–	compressed natural gas
CNOOC	–	China National Offshore Oil Corporation
CNPC	–	China National Petroleum Corporation
CNSPC	–	China New Star Petroleum Corporation
CO	–	carbon monoxide
EA	–	executing agency
EIB	–	European Investment Bank
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
IA	–	implementing agency
ICB	–	international competitive bidding
IDC	–	interest during construction
IOC	–	international oil company
IS	–	international shopping
JBIC	–	Japan Bank for International Cooperation
LNG	–	liquefied natural gas
LPG	–	liquefied petroleum gas
MGMR	–	Ministry of Geology and Mineral Resources
MOF	–	Ministry of Finance
NGDC	–	Natural Gas Distribution Company
NO <sub>x</sub>	–	nitrogen oxide
NOC	–	national oil company
PCR	–	project completion report
PRC	–	People's Republic of China
SCADA	–	system control and data acquisition
Sinopec	–	China Petrochemical Corporation
Shenergy	–	Shenergy Company Limited
SHPC	–	Shanghai Petroleum Corporation
SMG	–	Shanghai Municipal Government
SNGC	–	Shanghai Natural Gas Pipeline Networks Company, Limited
SSTA	–	small-scale technical assistance
SO <sub>2</sub>	–	sulfur dioxide
TA	–	technical assistance
TSP	–	total suspended particulates
WACC	–	weighted average cost of capital

## **WEIGHTS AND MEASURES**

bbl	—	barrel
Btu	—	British thermal unit
kcal	—	kilocalorie
km	—	kilometer
km <sup>2</sup>	—	square kilometer
m <sup>2</sup>	—	square meter
m <sup>3</sup>	—	cubic meter
ppm	—	parts per million

## **NOTE**

In this report, "\$" refers to US dollars.

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## BASIC DATA

### A. Loan Identification

1.	Country	People's Republic of China
2.	Loan Number	1419-PRC
3.	Project Title	Ping Hu Oil and Gas Development Project
4.	Borrower	People's Republic of China
5.	Executing Agency	Part A: Shanghai Petroleum Corporation Part B: Shanghai Natural Gas Pipeline Networks Company, Ltd.
6.	Amount of Loan	US\$130.0 million
7.	PCR Number	PCR: PRC 796

### B. Loan Data

1.	Appraisal	
	– Date Started	20 Feb 1995
	– Date Completed	10 Mar 1995
2.	Loan Negotiations	
	– Date Started	21 Nov 1995
	– Date Completed	24 Nov 1995
3.	Date of Board Approval	21 Dec 1995
4.	Date of Loan Agreement	27 Mar 1996
5.	Date of Loan Effectiveness	
	– In Loan Agreement	25 Jun 1996
	– Actual	20 Dec 1996
	– Number of Extensions	3
6.	Closing Date	
	– In Loan Agreement	30 Jun 2001
	– Actual	5 Mar 2002
	– Number of Extensions	1
7.	Terms of Loan	
	– Interest Rate	Pool-based variable lending rate for US\$
	– Maturity	25 years
	– Grace Period	5 years
8.	Terms of Relending	
	– Interest Rate	Pool-based variable lending rate for US\$
	– Maturity	25 years
	– Grace Period	5 years
	– Second-Step Borrower	Part A: Shanghai Petroleum Corporation

## 9. Disbursement

## a. Dates

Initial Disbursement	Final Disbursement	Time-Interval
4 Feb 1997	19 Nov 2001	57 months

Effective Date	Original Closing Date	Time Interval
20 Dec 1996	30 Jun 2001	54 months

## b. Amount (\$ million)

Category	Original Allocation	Last Revised Allocation	Amount Cancelled	Amount Disbursed
Offshore Pipelines: Engineering and Construction	63.60	53.60	11.44	42.16
Offshore Pipelines: Linepipe	24.40	18.60	2.37	16.23
Offshore Pipelines: Coating Materials and Services	18.60	18.60	2.96	15.64
Offshore Pipelines: Anodes	2.60	2.60	1.89	0.71
Consulting Services	4.20	4.00	0.83	3.17
Recovery of the project preparatory technical assistance cost	0.35	0.35	0.11	0.24
Interest and Commitment Charge		25.80	3.46	22.34
Unallocated	16.25	0.00	0.00	0.00
Offshore Wells: Casing and Drilling Services	0.00	6.25	2.58	3.67
Staff Training		0.20	0.00	0.20
<b>Total</b>	<b>130.00</b>	<b>130.00</b>	<b>25.64</b>	<b>104.36</b>

Source: Asian Development Bank records.

## 10. Local Costs (ADB-Financed)

- Amount (\$)	0
- Percentage of Local Costs	0
- Percentage of Total Cost	0

## C. Project Data

## 1. Project Cost (\$ million)

Cost	Appraisal Estimate	Actual
Part A		
Foreign Exchange Cost	603.60	400.76
Local Currency Cost	63.00	127.04
<b>Subtotal</b>	<b>666.00</b>	<b>527.80</b>
Part B		
Foreign Exchange Cost	90.80	
Local Currency Cost	108.70	
<b>Subtotal</b>	<b>199.50</b>	<b>169.00</b>
<b>Total</b>	<b>866.10</b>	<b>696.80</b>

Source: Part A: Shanghai Petroleum Corporation; Part B: Shanghai Natural Gas Pipeline Networks Company, Ltd.

## 2. Financing Plan (\$ million)

Item	Appraisal Estimate			Actual		
	Foreign	Local	Total	Foreign	Local	Total
<b>Part A</b>						
Implementation Costs						
Borrower-Financed	281.60	63.00	344.60	147.00	127.04	274.04
ADB-Financed	130.00	0.00	130.00	82.02	0.00	82.02
JBIC	120.00	0.00	120.00	74.74	0.00	74.74
EIB	72.00	0.00	72.00	40.14	0.00	40.14
Other External Financing	0.00	0.00	0.00	0.00	0.00	0.00
<b>Subtotal</b>	<b>603.60</b>	<b>63.00</b>	<b>666.60</b>	<b>343.90</b>	<b>127.04</b>	<b>470.94</b>
IDC Costs						
Borrower-Financed	0.00	0.00	0.00	0.00	0.00	0.00
ADB-Financed	0.00	0.00	0.00	22.34	0.00	22.34
JBIC		0.00		14.84	0.00	14.84
EIB		0.00		19.68	0.00	19.68
Other External Financing	0.00	0.00	0.00	0.00	0.00	0.00
<b>Subtotal</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>56.86</b>	<b>127.04</b>	<b>56.86</b>
<b>Total</b>	<b>603.60</b>	<b>63.00</b>	<b>666.60</b>	<b>400.76</b>	<b>127.04</b>	<b>527.80</b>
<b>Part B</b>						
SMG and NGDC Equity	30.80	108.70	139.50			
Mixed Credit from the Government of France	60.00	0.00	60.00			
<b>Subtotal</b>	<b>90.80</b>	<b>108.70</b>	<b>199.50</b>			<b>169.00</b>
<b>Total</b>	<b>694.40</b>	<b>171.70</b>	<b>866.10</b>			<b>696.80</b>

ADB = Asian Development Bank, EIB = European Investment Bank, IDC = interest during construction, JBIC = Japan Bank for International Cooperation, NGDC = Natural Gas Distribution Company, SMG = Shanghai Municipal Government.

Source: Part A: Shanghai Petroleum Corporation; Part B: Shanghai Natural Gas Pipeline Networks Company, Ltd.

## 3. Cost Breakdown by Project Component (\$ million)

Component	Appraisal Estimate			Actual		
	Foreign	Local	Total	Foreign	Local	Total
<b>Part A: Upstream Part</b>						
Land Acquisition	0.00	3.30	3.30	0.00	3.33	3.33
Pre-engineering Services (including recovery of part of the project preparatory technical assistance cost)	2.80	2.60	5.40	0.24	6.19	6.43
Offshore Platform	124.10	0.00	124.10	118.43	13.91	132.34
Well Drilling and Completion	71.70	0.00	71.70	55.23	37.82	93.05
Offshore Pipelines	233.10	8.20	241.30	147.40	14.99	162.39
Consulting Services, Operator Services, Site Inspection Services, and insurance	14.10	10.30	24.40	5.48	10.79	16.27
Oil Terminal	0.00	9.10	9.10	0.00	13.54	13.54
Gas Processing Plant	15.00	15.90	30.90	16.81	15.39	32.20
Office and Other Facilities	0.00	5.80	5.80	0.11	11.02	11.13
Training	0.90	0.50	1.40	0.20	0.06	0.26
<b>Base Cost</b>	<b>461.70</b>	<b>55.70</b>	<b>517.40</b>	<b>343.90</b>	<b>127.04</b>	<b>470.94</b>
Physical Contingency	45.90	5.00	50.90	0.00	0.00	0.00
<b>Subtotal</b>	<b>507.60</b>	<b>60.70</b>	<b>568.30</b>	<b>343.90</b>	<b>127.04</b>	<b>470.94</b>
Price Contingency	21.70	2.30	24.00	0.00	0.00	0.00
IDC	74.30	0.00	74.30	56.86	0.00	56.86
<b>Total Cost (A)</b>	<b>603.60</b>	<b>63.00</b>	<b>666.60</b>	<b>400.76</b>	<b>127.04</b>	<b>527.80</b>

IDC = interest during construction.

Source: Shanghai Petroleum Corporation.

### 3. Project Schedule

Milestone	Appraisal Estimate	Actual
<b>Part A</b>		
Completion of Detailed Engineering Design		
Platform	June 1997	May 1997
Pipelines (offshore)	Dec 1996	Dec 1996
Oil Terminal	Feb 1996	Feb 1996
Gas Processing Plant	Feb 1996	Mar 1996
Equipment and Supplies		
Dates		
First Procurement	Mar 1996	Jun 1996
Last Procurement	Sep 1998	Apr 1999
Completion of Construction and Installation		
Platform	Mar 1998	May 1998
Pipelines (offshore)	Jun 1998	Jul 1998
Oil Terminal	Jun 1998	Jul 1998
Gas Processing Plant	Jul 1998	Aug 1998
Commissioning		
Platform	Jul 1998	Oct 1998
Pipelines (offshore)	Oct 1998	Oct 1998
Oil Terminal	Sep 1998	Oct 1998
Gas Processing Plant	Sep 1998	Apr 1999

Source: Shanghai Petroleum Corporation.

### 4. Project Performance Report Ratings

Period	Rating	
	Development Objectives	Implementation Progress
From Nov 1998 to Feb 2001	Satisfactory	Highly Satisfactory
From Mar 2001 to Sep 2001	Satisfactory	Satisfactory
From Oct 2001 to Mar 2002	Satisfactory	Highly Satisfactory

### D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members <sup>a</sup>
Fact-Finding	21 Mar–9 Apr 1994	5	90	a, b, c, d, e
Consultation	17–22 Jul 1994	2	10	c, f
Consultation	7–11 Nov 1994	1	4	a
Appraisal	20 Feb–10 Mar 1995	5	95	a, b, c, g, h
Follow-Up	14–27 Sep 1995	4	52	a, b, e, g
Review 1	14–19 Oct 1996	2	10	a, e
Inception	25 Feb–4 Mar 1997	2	16	a, i
Loan Disbursement	26–28 May 1997	1	2	j
Review 2	17–19 Dec 1997	2	4	a, l
Review 3	10–13 Aug 1998	1	3	i
Review 4	12–14 Oct 1998	1	2	a
Review 6	25–26 Jan 1999	1	1	i
Review 7	16–18 Aug 1999	1	2	i
Review 8	24–26 May 2000	1	2	a
Review 9	26 Feb–2 Mar 2002	2	10	a, l
Project Completion Review <sup>b</sup>	26 Nov–4 Dec 2003	3	27	e, k, m

<sup>a</sup> a = engineer, b = sr. cofinancing officer, c = sr. programs officer, d = pipeline transmission expert, e = staff consultant, f = director (eid), g = sr. financial analyst or sr. evaluation specialist, h = counsel, i = project engineer, j = sr. control officer, k = energy specialist (financial), l = assistant project analyst, m = associate project analyst.

<sup>b</sup> The Mission comprised Merlita Pajarillo, energy specialist (financial) and mission leader; Mido D. Kawashima, associate project analyst; and Albert Boykiw, staff consultant.



## I. PROJECT DESCRIPTION

1. Coal is the main source for the energy requirements of the People's Republic of China (PRC). In 1994, when an assessment of the possible use of offshore gas near Shanghai began, coal was providing 75% of the PRC's primary commercial energy needs. In Shanghai, coal supplied 72%. With Shanghai's economy growing rapidly, the Government made Shanghai the growth pole for the Yangtze River Valley. The development of the Pudong area as an international commercial and financial center was an important component of the city's development plan. Meeting the increasing demand for energy in an environment-friendly manner was a key development strategy. Industrial, commercial, and residential consumers widely used coal gas,<sup>1</sup> which contributed significantly to pollution. Alleviating pollution problems by fostering the development of clean industries was a high priority.

2. The Ministry of Geology and Mineral Resources (MGMR), as it was known then, discovered the Ping Hu oil and gas field during exploration in 1983. It is in the middle block of the Xihu Trough in the East China Sea, which was judged to have a good potential for oil and gas production. The Government decided to develop the field. However, the private sector showed little interest due to the absence of a history of oil and gas production in the area. The considerable development costs required and the relatively modest returns expected also created apprehensions. Further, the risks associated with developing a relatively small concession area with adequate, but not extensive, oil and gas reserves concerned the private sector. Shanghai Petroleum Corporation (SHPC) was created to undertake the Ping Hu Oil and Gas Development Project (the Project), which involved the development of oil and gas reserves in the 240-square-kilometer (km<sup>2</sup>) Ping Hu area. SHPC's shareholders were the Shanghai municipal government (SMG) with 40%, through its investment company, Shenergy Company Ltd. (Shenergy); the China National Offshore Oil Corporation (CNOOC) with 30%; and the China New Star Petroleum Corporation (CNSPC), an MGMR subsidiary, with 30%. The Project was expected to (i) demonstrate the viability of offshore oil and gas production in an undeveloped area, (ii) allow utilization of spare oil and gas processing and transportation capacity of the Project, and (iii) open up the area around Ping Hu for further oil and gas development. The development of alternative sources of energy was strategically important for the PRC to support its rapidly growing economy. The PRC's dependence on imported energy has increased continuously as the demand for petroleum products has grown and the production capacity of oil fields has declined.

3. The Project involved integrated resource development—from the offshore oil and gas production and transportation, to the onshore gas processing and distribution. The main objective of the Project was to promote the sustainable economic growth of Shanghai in an efficient and environmentally desirable manner by producing natural gas, and making it available for use mainly in the Pudong area.<sup>2</sup> The natural gas to be produced, a clean source of energy, was to replace the coal gas that was contributing to air pollution. The distribution network for coal gas was to be expanded, rehabilitated, and upgraded to make it suitable for natural gas. The Project also intended to promote the development of other petroleum resources in the middle block of the East China Sea. The project scope also included promoting

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<sup>1</sup> Coal gas is a fuel produced by heating coal in the absence of air. It consists mainly of methane, carbon monoxide, hydrogen, and nitrogen, and its use is more environmentally friendly than directly burning coal. However, large quantities of pollutants are emitted during the production of coal gas.

<sup>2</sup> This was the third project of the Asian Development Bank (ADB) to support the development of Pudong, which was designated as one of the world's global super projects. The other two projects involved support for the Nanpu (ADB. 1991. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan and Technical Assistance Grants to the People's Republic of China for the Shanghai Nanpu Bridge Project*. Manila [Loan 1082: PRC]) and Yangpu bridges (ADB. 1992. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan and Technical Assistance Grants to the People's Republic of China for the Shanghai Yangpu Bridge Project*. Manila [Loan 1188: PRC]).

more desirable environmental and safety practices, strengthening institutions and policies, and technical training.

4. The Project had two parts:

- (i) Part A: Offshore oil and gas production and transportation and onshore gas processing.

This part of the project involved:

- (a) construction of an offshore drilling and production platform;
- (b) drilling and completion of oil and gas wells, and connecting them to the platform;
- (c) construction of two offshore pipelines (a 10-inch [in], 306-kilometer [km] oil pipeline to Dai Shan Island, and a 14 in, 386 km gas pipeline to the town of Port Luchao);
- (d) construction of an oil terminal on Dai Shan Island;
- (e) construction of an onshore gas processing plant, including a 14 in, 22 km gas pipeline from Port Luchao to the plant;
- (f) operation services by the China National Offshore Oil Corporation (CNOOC), and international consulting services;
- (g) establishment of SHPC headquarters in Shanghai; and
- (h) domestic and overseas training.

- (ii) Part B: Onshore gas transmission and distribution.

This part of the project involved:

- (a) construction of two 8 in gas pipelines (one 45 km, the other 60 km) from the gas processing plant to the Pudong area of Shanghai;
- (b) conversion, expansion, and upgrading of the gas distribution network in Pudong;
- (c) construction of liquefied natural gas (LNG) storage facilities, including natural gas liquefaction and LNG vaporizing facilities;
- (d) construction of a system control and data acquisition (SCADA) communication and control system; and
- (e) domestic and overseas training.

5. ADB approved a loan of \$130 million (the loan) for the Project on 21 December 1995 to finance part of the foreign exchange cost for Part A. The loan carried a term of 25 years, including a grace period of 5 years. Interest was determined in accordance with ADB's variable lending rate system for US dollar loans, plus an annual commitment fee. The Loan Agreement was signed on 27 March 1996 and became effective on 20 December 1996. The original loan closing date was 30 June 2001, though the loan was extended once by 6 months to accommodate the final payments to the contractors. The loan was closed on 5 March 2002 with \$104.4 million disbursed. Loan savings of \$25.6 million were canceled. As of 15 November 2003, \$11.4 million in principal had been repaid. ADB approved the request by SHPC and the Ministry of Finance (MOF) to prepay the outstanding balance of the loan on 15 December 2003, including a prepayment premium of \$2.7 million. SHPC's high level of cash and the lower cost of alternative domestic financing—based on London interbank offer rate—enabled them to prepay the loan. The Eximbank of Japan, now the Japan Bank for International Cooperation (JBIC), and the European Investment Bank (EIB) also provided cofinancing loans for Part A. The Government of France provided a mixed credit facility for Part B.

6. In 1992, a project preparatory technical assistance (PPTA) grant<sup>3</sup> was approved to review and upgrade the feasibility study for Part A and Part B of the Project. A study to confirm the adequacy of the reserves was undertaken under another technical assistance (TA) grant.<sup>4</sup> Two advisory TAs were also approved concurrently with the loan to (i) help the Executing Agency (EA) become an efficient and financially sound corporation for privatization,<sup>5</sup> and (ii) ensure sound safety and environmental practices and procedures for the offshore platform.<sup>6</sup>

7. A summary of major events during implementation is in Appendix 1.

## II. EVALUATION OF DESIGN AND IMPLEMENTATION

### A. Relevance of Design and Formulation

8. At appraisal, a central theme of ADB's country operational strategy for the PRC was providing assistance to achieve economic growth, while promoting environmental improvement. The strategy supported the PRC's energy development programs to expand energy supplies and promote energy efficiency. ADB's assistance in the development of the oil and gas field in the Ping Hu area, as a means of supporting environmentally friendly economic growth in Shanghai, was relevant to the Government's program and consistent with the ADB's strategy at the time of appraisal. The Project was designed to replace the use of coal gas with environment-friendly natural gas in Shanghai, particularly in the developing area of Pudong. The Ping Hu oil and gas field was identified as the only source of natural gas in the vicinity of Shanghai that offered an environment-friendly alternative to increasing the use of coal gas to meet the rising demand for fuel in the city.

9. Since the start of its development in 1990, Pudong's economy has grown phenomenally. Pudong's GDP in 2002 was 7.6 times higher than in 1990, representing an annual increase of 19.6% in terms of comparable prices.<sup>7</sup> The pace of economic development in Pudong required a clean environment to attract the types of firms that were envisaged in the Pudong development master plan. Thus, a supply of clean energy, such as the natural gas from the Project, was needed.

10. For Part A, all available technical information and data, particularly the results of ADB TAs (footnotes 3 and 4), were utilized to design the platform and the transportation capacities of the pipelines from the oil and gas reservoirs to the gas processing plant. During the development of the field, oil reserves were found to be about 20% smaller than estimated at appraisal, while gas reserves were slightly larger. The project facilities were adequately designed to produce, process, and transport oil and gas from the platform to the onshore facilities.

11. Part B was designed to accommodate Ping Hu gas efficiently. At the time of appraisal, gas from the West-East gas pipeline was not envisaged (para. 42). The availability of other gas sources has changed the master plan for gas pipelines in Shanghai. Nevertheless, the

<sup>3</sup> ADB. 1992. *Technical Assistance to the People's Republic of China for the Ping Hu Gas Development Project*. Manila (TA 1758-PRC, for \$600,000, approved on 29 September 1992).

<sup>4</sup> ADB. 1994. *Technical Assistance to the People's Republic of China for Hydrocarbon Sector Study*. Manila (TA 2062-PRC, for \$100,000, approved on 17 February 1994).

<sup>5</sup> ADB. 1995. *Technical Assistance to the People's Republic of China for the Strengthening Accounting and Financial Management in Shanghai Petroleum Corporation*. Manila (TA 2493-PRC, for \$330,000, approved on 21 December 1995).

<sup>6</sup> ADB. 1995. *Technical Assistance to the People's Republic of China for Sound Safety and Environmental Practices for Offshore Oil and Gas Production*. Manila (TA 2494-PRC, for \$600,000, approved on 21 December 1995).

<sup>7</sup> Shanghai municipality official web site.

availability of gas in Shanghai enhanced the need for the expansion, rehabilitation, and upgrading of the gas distribution network in Pudong, which was undertaken in Part B. The investment in the distribution network was useful, irrespective of the change in the sources of gas. The inclusion of the LNG storage facilities<sup>8</sup> was appropriate to ensure the supply of gas when interruptions occurred in Ping Hu gas supply.

## **B. Project Outputs**

### **1. Part A: Offshore Oil and Gas Production, and Transportation and Onshore Gas Processing**

12. All components under Part A were completed and are operating satisfactorily. The platform was designed to accommodate up to 20 wells. Fifteen production wells—8 gas wells and 7 oil wells—were operating in 2003. During field development, only one dry hole was drilled. As of November 2003, 3.27 million cubic meters ( $\text{m}^3$ ) of oil (about 20.6 million barrels [bbl]) and 1.6 billion  $\text{m}^3$  of gas had been produced. Average daily production of oil is about 1,600  $\text{m}^3$  (about 10,000 bbl), while gas production is 1.4–1.5 million  $\text{m}^3$ . The oil and gas condensate reserves are estimated at 5.0 million  $\text{m}^3$ , compared to 6.4 million  $\text{m}^3$  at the time of appraisal and 6.1 million  $\text{m}^3$  in the Oil Development Program (ODP) of SHPC. Gas reserves are estimated at 10,131 million  $\text{m}^3$ , similar to the 10,119 million  $\text{m}^3$  estimated at the time of appraisal and substantially higher than the 6,140 million  $\text{m}^3$  in the ODP.

13. The oil and gas pipelines were constructed as designed. The oil pipeline has a capacity of 2,958  $\text{m}^3$  per day, which includes surplus capacity for potential additional production. The gas pipeline has a capacity of 1.6 million  $\text{m}^3$  per day with an inlet pressure of 90 bars and an outlet pressure of 45 bars. It was successfully tested at a pressure of 120 bars.

14. The onshore gas processing plant at Xing Gong and the oil terminal on Dai Shan Island were constructed as envisaged, and they are operating as designed. CNOOC continues to provide operating services for the offshore facilities. The consulting services under the two complementary TAs were rendered satisfactorily. SHPC established its headquarters in Shanghai. The overseas training program for SHPC's and CNOOC's staff was completed in November 2001, and the domestic training programs were conducted as planned.

### **2. Part B: Onshore Gas Transmission and Distribution**

15. Part B also was completed as anticipated. The onshore gas pipelines from the gas processing plant to the Pudong area were constructed, and the gas distribution network was converted, expanded, and upgraded. The LNG storage facilities, which were commissioned in April 2000, can hold about 20,000  $\text{m}^3$  of LNG. At the time of the Project Completion Review (PCR) Mission, the LNG facilities had been utilized for 77 days. The SCADA communication and control system was installed, and is functioning well. Overseas and domestic training were carried out as planned. The gas transmission pipelines were constructed, forming a 97 km loop line in Pudong. An estimated 650,000 households and 4,500 commercial and industrial consumers in the Pudong area now use natural gas, higher than the appraisal targets of 575,000 and 1,000, respectively. Because more natural gas is available than originally projected, about 100,000 additional households on the opposite side of the river (Puxi area) also have been connected to natural gas supply.

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<sup>8</sup> LNG allows storage of a larger quantity of fuel than gas.

## **C. Project Cost**

16. At appraisal, the estimated cost, including contingencies, interest, and other loan charges during construction, was \$866.1 million equivalent. That consisted of \$694.4 million in foreign exchange cost (80%) and \$171.7 million equivalent in local currency cost (20%). The estimated cost for Part A was \$666.6 million, and for Part B was \$199.5 million. The actual project cost was \$696.8 million, 20% lower than the appraisal estimates. For Part A, the actual cost was \$527.8 million, 21% lower than appraisal estimates. The savings came mostly from advantageous international competitive bidding (ICB), which resulted in the lower-than-expected cost for offshore pipelines. Contingency provisions also were not utilized. The savings in foreign exchange cost more than offset the increase in local costs, which doubled from the appraisal estimate. For Part B, the actual cost of \$169.0 million was in line with appraisal estimates (\$171.8 million, including interest during construction, but excluding contingency provisions). Contingency provisions again were not utilized. Appendix 2 shows the projected and actual project costs.

17. At appraisal, the financing plan for Part A consisted of loans totaling \$322 million from ADB (\$130 million), JBIC (\$120 million), and EIB (\$72 million), and equity investments of \$281.6 million from SHPC to finance the foreign exchange costs. Equity from SHPC was to also finance the local currency requirement. For Part B, the Government of France was to provide \$60 million through a mixed credit facility to fund part of the foreign exchange cost. Equity from NGDC was to cover the balance, including the required local costs. The actual funding for Part A came from the ADB loan of \$104.4 million (20%), JBIC loan of \$89.6 million (17%), EIB loan of \$59.8 million (11%), and \$274.0 million (52%) from SHPC's equity. The financing plan represented several cofinancing firsts. Through the Project, ADB introduced EIB to the PRC. Since undertaking its first operation in the PRC, EIB has built up its portfolio in the country. The Project was also the first time that cofinancing from JBIC and the Government of France was mobilized for an ADB project in the PRC. Appendix 3 shows the projected and actual financing plans. No details were obtained on the actual funding mix for Part B.

## **D. Disbursements**

18. Disbursements under the ADB loan began in February 1997 with an initial payment of \$1.6 million to the supplier of the 10 in and 14 in pipes and bends. Disbursements were highest from the second half of 1997 to the first half of 1999, when the construction activities were in full swing. Contract awards and disbursements were basically in line with projections. The last disbursement was made in November 2001 for the payment of training expenses. The loan was closed on 5 March 2002, with a total disbursement of \$104.4 million. By the loan closing date, disbursements totaled \$82.1 million, while interest during construction (IDC) and commitment fees amounted to \$22.3 million. The unutilized balance of \$25.6 million was canceled. Overall, 80% of the ADB loan was utilized. Disbursements were made mainly through letters of credit and direct payments. Appendix 4 compares the projected and actual disbursements.

## **E. Project Schedule**

19. At appraisal, project implementation was expected to take 5 years. For Part A, land acquisition for the oil terminal and processing plant, including procurement of consulting services, was expected to begin in late 1995. The first delivery of oil and gas was scheduled for October 1998. Preparatory work for detailed engineering and procurement started immediately after the approval of the loan, as planned. Construction and installation also were carried out as planned, and were substantially on schedule with only slight delays on the completion of drilling services and production wells. The first barrel of oil flowed from the pipelines in October 1998. The oil terminal was also completed in the same month, as scheduled. All required facilities in

the platform and the offshore oil and gas pipelines were completed in 1999. The gas processing plant was completed in April 1999, and natural gas became available in Shanghai at the same time. Appendix 5 shows the projected and actual implementation schedule for Part A.

20. For Part B, construction of the gas transmission pipelines was to start by October 1996 and be completed by October 1998. Construction of the backup LNG facilities was to begin by January 1997 and be completed by November 1999. Construction of the onshore gas transmission pipelines, including the rehabilitation and expansion of the gas distribution network, commenced and was completed as envisaged. The LNG storage facilities were commissioned in April 2000 after a minor construction delay.

21. Details of implementation schedule for Part B are not available due to difficulties in obtaining data after the restructuring of NGDC in 2001 (para. 24).

## **F. Implementation Arrangements**

22. As envisaged at appraisal, SHPC (the owner of the facilities) was designated as EA for Part A. SHPC contracted CNOOC as the operator. CNOOC took the lead role in developing the Ping Hu oil and gas field in line with international practices in the oil industry. CNOOC also was responsible for the supervision and implementation of all offshore activities, including procurement, scheduling, well drilling, construction of the platform, and laying pipes. Further, CNOOC set up a well-staffed project management team for the engineering and construction, and provided the appropriate organization and procedures for the implementation and initial operation of the offshore facilities. International consultants financed under the loan provided technical consulting services and assisted CNOOC in the supervision of drilling contractors. A CNOOC subsidiary undertook the basic design for the offshore facilities. China National Petroleum Corporation (CNPC), the agency responsible for all onshore oil and gas exploration and development, handled the design for the onshore oil terminal and gas processing plant, with the assistance of foreign and local engineering firms. As planned, CNOOC operated the offshore facilities for the first 2 years of operation. With the extension of the contract for CNOOC services from 2002 until April 2004, the company remains responsible for the operation of the platform and the offshore pipelines. At the time of the PCR mission, SHPC and CNOOC expected that the latter's services would continue beyond April 2004. SHPC remains responsible for the operation of the oil terminal and gas processing plant, and it has taken on the responsibility for regularly monitoring the integrity of the offshore oil pipeline along its entire route. Appendix 6 shows SHPC's organizational setup.

23. In March 2000, the ownership of SHPC changed. The national petrochemical company, the China Petrochemical Corporation (Sinopec), purchased the 30% of SHPC's shares owned by a subsidiary of MGMR, CNSPC. Sinopec Star Petroleum Corporation, a Sinopec subsidiary, now holds those shares.<sup>9</sup> The move was in line with the PRC's oil and gas sector restructuring, which reorganized most state-owned assets into two vertically integrated firms: (i) the CNPC, which focuses on northern and western geographic areas; and (ii) Sinopec, which covers the southern and eastern region. Prior to the restructuring, CNPC was engaged mainly in oil and gas exploration and production, while Sinopec was in refining and distribution. The asset swap transferred some exploration and production assets to Sinopec and some refining and distribution assets to CNPC. CNOOC was the third-largest entity, and retained offshore exploration rights.

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<sup>9</sup> The purchase also included all other interests of the China New Star Petroleum Corporation in the Xihu Trough in the East China Sea.

24. NGDC, the designated EA for Part B, undertook the implementation and operation of the Project. In December 2001, NGDC was restructured and renamed Shanghai Natural Gas Pipeline Networks Company Ltd. (SNGC). SNGC is owned by Shenergy (60%) and SMG (40%). SNGC retained ownership and operation of the higher pressure pipelines, including the LNG storage facilities, while the downstream operations and facilities were transferred to three gas distribution companies, which are also wholly owned by Shenergy. These distribution companies are Pudong Gas Sales Company for the Pudong area, Shibe Gas Sales Company for the area around Suzhou Creek, and Shinan Gas Sales Company for the southern part of Shanghai. SNGC is responsible for the purchase, transmission (covering all the higher pressure gas transmission lines), and sale of natural gas to the three gas distribution companies. In preparation for the increased supply of gas from the West-East gas pipeline project, the downstream facilities are being expanded and restructured further.

25. Weaknesses in project implementation noted by ADB during project review missions were addressed with adequate measures. SHPC undertook all ADB-financed procurement in Part A of the Project. Local contractors carried out construction of civil works and installation of equipment, while the equipment suppliers carried out the supply, supervision of installation, and supervision of commissioning of equipment procured under ICB.

## **G. Conditions and Covenants**

26. Loan covenants were complied with, except for the covenant on phasing out consumer subsidies for coal gas and LPG, which was partially complied with. While the subsidy on LPG was removed and its price liberalized, the subsidy on coal gas has remained. The municipal government plans to replace coal gas with natural gas within 10 years. SNGC informed the PCR Mission that a precise definition of the physical gas pipeline configuration, and the related pricing structure, would be settled within 3 years. Full compliance with the covenant would likely occur then.

27. The financial covenants from SHPC have been complied with, and its financial position is sound. The audited financial statements and audited project accounts were submitted regularly and on time. The covenants on debt service coverage and debt-equity ratios were met adequately. The required return on equity was surpassed, mainly because of the favorable price of oil in the world market in recent years.<sup>10</sup> Appendix 7 shows the status of compliance with covenants in the Loan Agreement.

## **H. Related Technical Assistance**

28. ADB provided a TA grant (footnote 5) to assist SHPC in strengthening its accounting and financial management system. The international consulting firm engaged to provide the consulting services evaluated the issues and recommended (i) a revised accounting chart of accounts, (ii) improvement in financial and management systems and procedures, and (iii) implementation of an integrated enterprise resource planning (ERP) computer software for SHPC. Most of the recommendations were implemented, except for the recommended ERP computer software. SHPC instead uses the Yongyou financial management system, which is common in businesses in the PRC. The consultant also analyzed the possibility of bringing other equity investors into SHPC, but concluded that private participation in SHPC was premature, mainly because SHPC did not have any performance record. Given the regulatory framework for the oil and gas sector in the PRC, where state-owned enterprises have maintained a monopoly, the consultant found that the options for private participation are limited

<sup>10</sup> Average yearly prices per bbl of SHPC's oil were: \$18.8 in 1999, \$26.3 in 2000, \$23.4 in 2001, \$22.8 in 2002 and \$24.5 in 2003 compared to appraisal estimates of \$18.1. Oil prices in the 1st quarter of 2004 are even higher than the 2003 level.

and SHPC supported this view. The performance of the consultant was considered satisfactory. The impact of the TA would have been greater if follow-through sessions were done after the software was acquired. This would have ensured optimum implementation of the recommended systems. Nevertheless, the TA is rated successful. The TA completion report (TCR) is in Appendix 8.

29. ADB provided another advisory TA (footnote 6) to strengthen safety and environmental practices for offshore oil and gas production. This training was necessary since SHPC was a new company with newly recruited staff. CNOOC, the operator of the offshore facilities, needed to observe safety and environmental practices that conformed with international standards in operating the drilling and production platform and offshore pipelines. At the time of project development, CNOOC had not simultaneously drilled gas wells and produced oil and gas. Steps were needed to avoid hazardous conditions. The operation of the oil terminal on Dai Shan Island and the onshore gas processing plant in Xi Gong also posed hazards because of the presence of flammable fluids and gases. The TA aimed to (i) review the design and construction of the Ping Hu offshore platform, oil and gas pipelines, oil terminal, and gas processing plant; (ii) assess safety and environmental standards and practices applicable to the normal operation of such facilities; (iii) develop procedures for dealing with emergency conditions on these facilities; (iv) develop a preventive maintenance program for these facilities; (v) train staff on the application of safety procedures; and (vi) draft an overall safety and environmental plan. The TA was implemented between January 1999 and April 2000. All indications are that the TA achieved its objectives, and it is rated successful. Appendix 9 contains the TCR.

## **I. Consultant Recruitment and Procurement**

30. SHPC hired an international consulting firm to assist CNOOC in project implementation, supervision of the contractor for the drilling services during simultaneous oil and gas production, and initial production operations. The international consultant also assisted CNOOC in the preparation of bid documents and in the bid evaluation for the pre-drilling and drilling services, and in selecting suitable equipment and materials for the well completion. The international consultant was engaged in accordance with ADB's *Guidelines on the Use of Consultants*. SHPC and NGDC used domestic design institutes for the engineering design of the Project, and a research institute for the environmental impact assessment.

31. At appraisal, 17 contract packages for equipment supply and installation, with a combined value of \$81.8 million, were identified for international procurement. The ADB loan and the cofinancing loan from JBIC were to jointly fund the construction of the offshore oil and gas pipelines. The ADB loan also was to fund the consulting services. ADB approved a major change in project scope in May 1997, agreeing to finance IDC charges applicable to the ADB loan. In February 1998, ADB approved a minor change in project scope by agreeing to finance the procurement of casing and directional drilling services. The reallocation of the amount for the training requirements of SHPC and CNOOC personnel, another minor change in scope, was approved in October 1998. Procurement followed ADB's *Guidelines for Procurement*. Equipment with a contract value of \$500,000 or more was procured following ICB procedures, while equipment with a value below \$500,000, but not less than \$50,000, was procured using international shopping procedures. The ICB procedures produced advantageous bids, which allowed SHPC to realize tangible cost savings while maintaining quality. Appendix 10 shows the ADB-financed contract packages.



## **J. Performance of Consultants, Contractors, and Suppliers**

32. The performance of the international and domestic consultants was satisfactory. The consulting services were performed in accordance with their terms of reference, and contributed positively to the successful implementation of the Project.

33. CNOOC was the prime contractor for the offshore facilities—up to the oil terminal and gas processing plant. Available information confirms that CNOOC carried out the contract satisfactorily. CNOOC contracted a drilling operator, financed by SHPC, for the drilling of the wells from the platform. This contractor was in charge when a major drilling accident took place on 20 October 1999. The traveling block, which is part of the drill pipe lifting mechanism, rose beyond the rig design limits, breaking the drilling line that was pulling up the block. Subsequently, the drill pipe turning assembly crashed to the drilling platform, causing extensive damage. No one was injured. During the 3 months that it took to complete repairs, reduced standby rates were negotiated with the various contracted parties for the drilling operation. Insurance covered most of the costs. Since human error, and possibly a failure in the safety mechanism caused the accident, the performance of the drilling contractor was considered unsatisfactory.

34. Two leaks in the gas pipeline occurred during installation and testing. The contractor repaired the affected segments of the line. Material defects from the pipe mill caused the leaks, which did not reflect on the performance of the contractor. Two ruptures occurred in the oil pipeline on 15 October 2001. They were repaired temporarily by 23 February 2002, and permanently repaired by July 2003. Strong currents on the seabed and inadequate support for the pipeline caused the ruptures. The problem was addressed by rerouting the pipeline one km to the north. Insurance covered the cost of the replacement. The experience indicates that the sea currents have shifted since the detailed design of the pipeline, or that their impact on the oil pipeline was underestimated. The location of the sea currents is now closely monitored.

35. The design and installation of the gas processing plant and oil terminal were executed as planned and are operating satisfactorily.

## **K. Performance of the Borrower and the Executing Agency**

36. The performance of the Borrower, the Government through MOF, was generally satisfactory. However, the effectivity of the loan and the subsidiary loan agreement for the relending of loan proceeds to SHPC were made a year after loan approval. More time was needed to satisfy the cross-effectivity conditions, and finalize the parallel loan agreements with the co-lenders. MOF's supervision and monitoring of the Project did not require significant staff time as SHPC, CNOOC, and NGDC assumed the major responsibilities for project implementation. ADB review missions gave MOF regular briefings on the progress and the implementation issues of the Project.

37. The performance of SHPC and NGDC was generally satisfactory, as project implementation was carried out in a systematic and timely manner, and without cost overruns. However, obtaining relevant data for Part B was difficult, especially after the organizational restructuring of NGDC, which divided the operational responsibility for Part B between the newly created SNGC and the three gas distribution companies. Since loan proceeds were not utilized for Part B, the EA did not prepare a project completion report according to ADB outline.

## **L. Performance of ADB**

38. ADB's performance in monitoring the Project was satisfactory. ADB ensured that consulting services minimized the risks of simultaneous drilling and oil and gas production in the platform. Regular project review missions, and frequent consultations and briefings with the MOF, demonstrated ADB's efforts in monitoring the progress of project implementation. Seven review missions were fielded, and ADB staff spent adequate time reviewing physical progress and resolving issues with SPHC and CNOOC staff during the 5-year implementation period. ADB provided prompt approvals for contracts it financed as well as required fund disbursements. ADB also approved in a timely manner the requested changes in project scope and the reallocation of the loan proceeds. SHPC expressed appreciation for the timely action of ADB in resolving project implementation issues.

## **III. EVALUATION OF PERFORMANCE**

### **A. Relevance**

39. The Project was consistent with the priorities of ADB and the Government at the time of appraisal, and contributed to the provision of clean energy in Shanghai. Since project approval, the PRC's rapid growth has increased the demand for oil and gas. The Project was assessed to be highly relevant.

40. Normally, national oil companies (NOCs) carry out oil exploration and production in association with international oil companies (IOCs), which then share the revenue with the host government. In the PRC, the shares of the NOCs, including CNOOC, are listed on the major exchanges of Hong Kong and New York. IOCs own minority shares. The Project helped establish commercial production of offshore oil and gas in the Ping Hu area. Combined with the supply of energy to Shanghai, the Project has provided the impetus for further offshore oil and gas exploration and development. Additional reserves in the Ping Hu concession area are being developed, and the facilities are being enlarged. Three more gas wells and one more oil well, additional compressors on the platform, and an increase in the gas plant capacity to 1.8 million m<sup>3</sup> per day are in the works. Seven km north of Ping Hu, plans for the development of Ping Hu Phase 2—the Bajiaoting oil and gas reserves—are being firmed up. It will become operational in 2006, at a cost of \$190 million. The enlargement and Phase 2 projects will enhance the profitability of the Ping Hu Project.

41. The Project helped establish a market for natural gas in Shanghai. It also demonstrated that natural gas can be produced successfully in the East China Sea, which has opened up the area around Ping Hu (e.g., the Xihu Trough) for oil and gas exploration by interested oil companies. In two blocks to the north and south of Ping Hu, IOCs have signed oil and gas production sharing contracts with CNOOC. Oil and gas production will start by 2006, following the completion of a new offshore gas pipeline to the city of Ningbo. The Project played a key role leading to the development of these reserves. Because of the potential risks involved, the private sector would not finance the necessary initial investments then—in stark contrast to the current situation, where private participants are taking the lead. Considering the growth that has taken place, ADB's participation will be less relevant now.

42. Natural gas options and plans have changed significantly since the appraisal of the Ping Hu project. The discovery of large gas reserves in Xinjiang Uygur Autonomous Region in northwest PRC has resulted in the construction of a \$5.2 billion pipeline. The 4,000 km West-East pipeline, running from this autonomous region to Shanghai, will be completed by 2005. By providing an alternative supply of gas, this pipeline will increase the energy security for

Shanghai. The supply of additional gas from the West-East pipeline led to a revision of the plan for gas supply and distribution in Shanghai, and a restructuring of NGDC (para. 24). SNGC will have two loops in the Shanghai area, and an additional LNG storage tank to enhance the security of the gas supply. A third source of gas, the Xihu Trough (north of Ping Hu concession), will enhance supply security further.

43. SNGC, which has purchased natural gas only from SHPC, will also buy gas from the West-East pipeline. The price of this gas (\$4.72 per million British thermal units [Btu]) is almost identical to the price from SHPC. The prospect of more gas at a similar or lower purchase price from the East China Sea has put a ceiling on the price that Shanghai, and other customers, would be willing to pay for gas supplied through the West-East pipeline. The competition among sources of supply, and the resulting market-determined cap on the price of gas, has benefited consumers.

## **B. Efficacy in Achievement of Purpose**

44. The Project achieved its objectives of promoting economic growth in Shanghai by helping the city meet its energy demand through desirable and safe environmental practices. The financial success of the Project exceeded the expectations at appraisal. The Project helped to establish an attractive environment for private investment in oil and gas exploration in the middle block of the East China Sea, which previously was considered risky and unattractive. The Project triggered a flurry of private interest in the East China Sea, and facilitated the transfer of international technology. Under the Project, other developers will gain access to the offshore facilities through the utilization of its spare oil transportation capacities. In view of the field's declining oil production, this excess capacity is expected to increase. The Project was rated as highly efficacious.

## **C. Efficiency in Achievement of Outputs and Purpose**

45. Project implementation for Parts A and B proceeded efficiently. The project facilities were constructed, successfully installed, and commissioned with minimum delays, and with substantial cost savings. For Part A, the changes made during implementation allowed more efficient execution of the components. Part B also was carried out efficiently, although with a minor delay. The organizational setup, management, and approval processes of the EAs and CNOOC were responsive to the requirements of the Project. The ICB resulted in substantial cost savings. Cofinancing and counterpart funds were adequate, and were provided in a timely manner. ADB catalyzed the mobilization of the required cofinancing.

### **1. Economic Evaluation**

46. The economic evaluation of the Project followed the methodology used at appraisal. The economic capital cost of each project component was calculated based on the financial costs after deducting the duties and taxes on equipment and other items, and then adjusted to 2003 values. The investment costs and related benefits of the new development project were not included. Foreign costs were valued at international prices. For local costs, the applicable specific and standard conversion factors<sup>11</sup> were applied to tradable and non-tradable goods and services. The economic benefits from the Project were derived from (i) the actual and forecast production of crude oil and condensate, LPG, and naphtha, based on SHPC's latest estimate of reserves; and (ii) actual and projected volume of natural gas to be sold to the residential, commercial, and industrial consumers through SNGC and the three gas distribution companies. The crude oil, condensate, LPG, and naphtha were valued on the basis of international prices

<sup>11</sup> The conversion factors used in this evaluation are 1.10 for civil works, 1.10 for local machinery, and 0.93 for others.

realized by SHPC in 1999–2003, and World Bank's forecast of future prices. Natural gas was valued at the present LPG price to domestic consumers. A 2% system loss in distribution was assumed for natural gas. Operating costs were based on actual data for Part A, and an assumed level for Part B, adjusted to their economic values.

47. The recalculated economic internal rate of return (EIRR) for the Project was 22.9%, higher than the 16.2% estimated at appraisal. It also exceeded ADB's 12% hurdle rate for economic opportunity cost of capital. Assuming depletion premium as was done at appraisal, the EIRR would be 21.7%. The higher EIRR resulted from higher crude oil prices, which pushed up the price of LPG and other products, and lower capital costs. Because the economic benefits from environmental improvement as a result of the Project were not valued, the computed EIRR is considered conservative.

## **2. Financial Evaluation**

48. Appendix 11 summarizes the financial performance of SHPC. SHPC's financial performance has been very robust, and all the required financial ratios were met or exceeded.

49. The financial internal rate of return (FIRR) for the Project was determined using actual investment costs, and the same economic assumptions on benefits and operating cost without the application of the conversion factors. All revenues and expenditures are in constant 2003 prices, and exclude depreciation and interest. The 18.8% recalculated FIRR is higher than the 15.4% estimated at appraisal and the weighted average cost of capital of 4.6%. Substituting the LPG price with the current domestic gas selling price of \$6.34 per million Btu (excluding value added tax) as the domestic retail gas sales price over the entire project life—assuming prices are not raised to alternate fuel parity value—produces a 17.3% FIRR. The higher FIRR for the Project resulted from higher oil and gas prices compared to those assumed at appraisal, and lower than expected capital costs.

50. Summaries of the EIRR and FIRR calculations are shown in Appendix 12.

## **D. Preliminary Assessment of Sustainability**

51. The estimate of oil and gas reserves and the financial and operating parameters of Part A are sound and robust. SHPC has posted significant profits. The Project generated substantial cash, which helped SHPC to prepay the loan. SHPC has the institutional capability to effectively and efficiently manage and operate the onshore facilities. CNOOC has the technical expertise and experience to operate the offshore facilities. Thus, the operating parameters during the initial years of commercial operations assure Part A's sustainability. Proven reserves will allow operations at declining levels of production until 2022. The development of other oil and gas reserves, which is currently being undertaken (para. 40), and continued production from the Ping Hu field will further improve sustainability.

52. For Part B, the financial performance of SNGC and the three gas distribution companies are not available. However, SMG's plan to replace the use of coal gas with natural gas will place these distribution companies in an advantageous market position to supply the increasing demand in Shanghai. SMG's plan is to complete the conversion of all residential users in 10 years, with 300,000 users converted each year. This will enhance the demand for natural gas. The arrival of natural gas from the West-East pipeline in 2005 requires a rapid network expansion. SMG also is promoting the use of compressed natural gas (CNG) for buses, targeting the conversion of half the buses in Shanghai by 2010. Currently, approximately 500 tons of CNG per month is consumed. Based on the growth prospects and sound management

practices, SNGC and the three distribution companies are in a favorable position in a fast-growing market.

## **E. Environmental, Sociocultural, and Other Impacts**

53. **Environmental Impact.** The use of natural gas from the Project has had a positive impact on Shanghai's air quality. Air pollution monitoring indexes in Appendix 13 show the improvement in the air quality of Shanghai, particularly in the Pudong area, since the Project came on stream. In 2002 alone, gas consumption replaced the use of 2 million tons of coal to produce coal gas. Since the start of production, the Project has replaced 3.9 million tons of coal consumption in Shanghai. One coal gas production plant has been closed. Lower coal consumption in Shanghai also has reduced congestion in railway and port facilities, and associated energy consumption for coal transportation.

54. The oil pipeline near Dai Shan Island ruptured on 15 October 2001, causing an oil spill of about 2,500 bbl. Oil being lighter, the spill evaporated without any serious environmental damage. Oil production was halted for about 100 days until a temporary replacement of the damaged pipe section was put in place. The permanent replacement was completed in July 2003. Rerouting the pipeline 1 km to the north, and bypassing an area of extreme turbulence, will avoid similar damage and oil spills in future.

55. Water from the oil reservoir is dumped into the sea. Daily on-platform laboratory tests check the water quality for hydrocarbon quantities. Sample laboratory reports were examined, which showed 27, 42, and 44 parts per million (ppm) of hydrocarbons in the treated water. The limit set by the Central Government Marine Department is 50 ppm, which has not been exceeded since operations started. Government inspectors carry out random checks about once a year. The protection of the marine environment from on-platform activities is considered satisfactory.

56. **Social Impact.** Pipeline routing and site selection for the oil terminal and gas processing plant were carried out as planned. The offshore pipeline routing had minimal impact on fishing in the East China Sea. The oil terminal at Daishan Island did not affect any communities or residents as the site was an abandoned military camp. The gas processing plant required resettlement of 10 families, who were properly compensated and given new plots in a nearby village. The onshore pipes for gas transmission, which were constructed along existing roads, did not affect any houses. Temporary employment for more than 2,000 local residents, 10% of whom were female, was provided during project construction. The operation of the project facilities created permanent employment in SHPC and CNOOC for 220 people, 23% of whom were female. Additional employment was created for contracted services. Fifty local residents are working in the gas processing plant. Employment data on the downstream operations was not available, though it would be higher than the upstream employment.

57. **Capacity Building.** The two advisory TAs (paras. 28 and 29) imparted knowledge and skills to improve the institutional capability of SHPC. Foreign and local training were provided to SHPC and CNOOC staff on technical, as well as management, aspects. During project implementation, SHPC and CNOOC sent 26 staff abroad for training in technical, production, and marketing operations. In addition, 132 staff members received local training on technical matters, finance and accounting, English, computer, and personnel administration. The training programs enhanced the technical, production, and operational safety consciousness of the company. This will improve their institutional capability and competence to develop and expand their operations, and meet the challenges of future competition. Appendix 14 gives the details of the training programs.

58. **Enterprise Reforms.** Industry reforms are taking place in the oil and gas sector, along with the policy initiatives set out for the Project. The Project's demonstration of technical and financial success in the Xihu Trough geologic basin has contributed to the involvement of the private sector in future developments in the Xihu Trough (paras. 41 and 42). Agreements have been reached with NOCs and IOCs for developing two areas and undertaking the exploration of a 22,000 km<sup>2</sup> area. Reforms to promote greater use of natural gas in Shanghai also are being undertaken (para. 52).

## **IV. OVERALL ASSESSMENT AND RECOMMENDATIONS**

### **A. Overall Assessment**

59. The Project was implemented as envisaged at appraisal, with some changes in financing scope, and is operating satisfactorily. With natural gas in widespread use in Shanghai, the objective of using a more environment-friendly alternative to coal gas was achieved. The objective of opening up the East China Sea to private sector investment and reforming energy prices in Shanghai also has been achieved. The Project has had a positive environmental and demonstration impact, and is financially and economically viable.

60. Based on the criteria of relevance, efficacy, efficiency, sustainability, and institutional development and other impacts, the Project is rated highly successful.

### **B. Lessons Learned**

61. The successful implementation of projects with huge investment costs and associated risks requires a strong commitment and preparedness by the project proponents, as well as the involvement of experienced and well-trained project implementation staff. The expertise of competent international consultants ensured accurate evaluation of the risks involved, adoption of appropriate technical design and reasonable cost estimates, and observance of the applicable safety and operating standards.

62. Adequate planning and preparation are key elements to the smooth and timely execution of a project. Timely availability of the required funds is also important. Availability of funds was not an issue in this Project.

63. A properly administered bidding process, supported by detailed technical design and bid specifications, can obtain advantageous bid offers.

64. The issue of detailed information regarding Part B, for which loan proceeds were not utilized, could have been avoided with a more binding provision in the Loan Agreement and closer monitoring during Project implementation.

### **C. Recommendations**

#### **1. Project-Related**

##### **a. Further Action**

65. The Project does not require any specific future action from ADB. All the performance targets have been met. On the operating side, SHPC should continuously monitor the reliability of the existing communication system, so that appropriate actions can be taken immediately, especially during emergency situations, such as typhoons. Ensuring that adequate safety

precautions and emergency procedures are in place to prevent accidental, uncontrolled oil and gas flows into the sea has to be a foremost concern.

**b. Future Monitoring**

66. No future project monitoring by ADB is necessary. All the project components have been implemented and are operating as planned. The Project is a financial and economic success. The full amount of the loan was repaid in December 2003, leaving no financial risk to ADB.

**c. Timing of the Project Performance Audit Report Preparation**

67. A project performance audit review may be fielded in 2007 to assess the impact of new developments in the PRC's oil and gas sector on the Project, particularly Part B. By that time, natural gas from the West-East pipeline will be commercially available, and the envisaged reforms and pricing structure in the gas distribution sector will have taken shape.

**2. General**

68. The favorable experience with the Project demonstrates that a developmental undertaking—when carefully considered, suitably designed, and properly implemented—can be successful even though the private sector perceives a high commercial risk. Prudent decisions were made to minimize the negative impact from the risks associated with developing a very large investment in assets—with little salvage value after the investments were made—and operating in an uncertain environment to create a new market for offshore gas. The right approaches made during project preparation and implementation (i.e., assessing the quantity of reserves, obtaining international expertise, ensuring observance of international and safety practices, and spreading the risks), and the unwavering commitment of the implementing agencies ensured the success of the Project and justified ADB's support.

**CHRONOLOGY OF MAJOR EVENTS**

21 March 1994	Fact-Finding Mission fielded
17 July 1994	Consultation Mission fielded
7 November 1994	Consultation Mission fielded
21 December 1994	Management Review Meeting
8 February 1995	Summary environmental impact assessment report circulated to Asian Development Bank (ADB) Board
20 February 1995	Appraisal Mission fielded
14 September 1995	Follow-up Mission fielded
16 November 1995	Staff Review Committee meeting
21 November 1995	Loan negotiations
21 December 1995	ADB approves a loan of \$130.0 million from ADB's ordinary capital resources to the People's Republic of China (PRC) for the Ping Hu Oil and Gas Development Project (Loan 1419-PRC).
27 March 1996	Loan signing
14 October 1996	Inception Mission fielded
20 December 1996	Loan becomes effective
2 January 1997	Report submitted by consultants on hazard identification
3 February 1997	First disbursement
20 February 1997	Minor change in project scope and implementation arrangements, utilizing the unallocated portion of the loan (\$6.25 million) to finance the procurement of casing and directional drilling services, with 100% ADB financing
25 February 1997	Review Mission fielded
22 April 1997	Environmental impact assessment for liquefied natural gas submitted.
28 April 1997	Request received to utilize expected loan savings to finance interest during construction (IDC)
15 May 1997	ADB approves a major change in project scope for financing the IDC cost of \$25.8 million from anticipated loan savings



26 May 1997	Loan Disbursement Mission fielded
27 October 1997	Letter of Amendment to include IDC as an item to be financed from the loan proceeds signed
17 December 1997	Loan Review Mission fielded
21 January 1998	Borrower requests to utilize the unallocated amount of \$2.6 million to finance two platform drilling contracts
23 February 1998	ADB approves a minor change in project scope to finance the procurement of casing and directional drilling services
May 1998	Laying of the 14-inch diameter offshore gas pipeline completed
10 August 1998	Review Mission fielded
2 September 1998	Borrower requests a reallocation of loan proceeds for financing the training of Shanghai Petroleum Corporation (SHPC) and China National Offshore Oil Corporation (CNOOC) staff, at an estimated cost of \$500,000
12 October 1998	Review Mission fielded
21 October 1998	ADB approves minor change in project scope and reallocation of loan proceeds to finance under the loan overseas training of SHPC and CNOOC staff
18 November 1998	Oil wells begin production
26 December 1998	First oil tanker leaves the oil terminal
25 January 1999	Review Mission fielded
25 January 1999	The consultant for one of the attached technical assistance (TA) grants begins its services
9 March 1999	Drilling operation restarts
10 March 1999	Gas wells begin production
25 March 1999	Supply of natural gas to Shanghai begins
8 April 1999	First natural gas reaches the onshore gas processing plant
28 April 1999	Gas processing plant inaugurated
16 August 1999	Review Mission fielded
20 October 1999	Accident in the platform drilling rig, causing considerable damage

23 November 1999	Final Report, under TA 2493-PRC, submitted by consultant
9 March 2000	Drilling operation resumes
April 2000	Construction of LNG storage facilities completed
24 May 2000	Review Mission fielded.
15 October 2000	Rupture in the oil pipeline, causing oil spill
31 December 2000	SHPC renamed Shanghai Petroleum Corporation, Limited.
1 January 2001	Oil pipeline temporarily repaired and oil production resumes
March 2001	Attached TA for Sound Safety and Environmental Practice for Offshore Oil and Gas Production (TA 2494-PRC) completed
April 2001	Permanent repair work of oil pipeline starts
18 May 2001	Overseas training program in Houston, Texas, for pipeline, reservoir, and production engineers approved
13 June 2001	Borrower requests an extension of loan closing date by 6 months from 30 June 2001 to 31 December 2001
27 June 2001	Extension of loan closing date by 6 months, from 30 June 2001 to 31 December 2001, approved
30 June 2001	Original loan closing date
July 2001	Part A physically completed
19 November 2001	Final disbursement
31 December 2001	Revised loan closing date
26 February 2002	Review Mission fielded
5 March 2002	Undisbursed balance of \$25,640,978.84 canceled, and loan account officially closed
23 July 2002	Pipeline repair work successfully completed
26 November 2003	Project Completion Review Mission fielded

## PROJECTED AND ACTUAL PROJECT COSTS

(\$ million)

Project Component	Appraisal Estimate			Actual		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
<b>Part A: Upstream Part (Shanghai Petroleum Corporation)</b>						
Land Acquisition	0.00	3.30	3.30	0.00	3.33	3.33
Pre-Engineering Services (including recovery of part of the PPTA cost)	2.80	2.60	5.40	0.24	6.19	6.43
Offshore Platform	124.10	0.00	124.10	118.43	13.91	132.34
Well Drilling and Completion	71.70	0.00	71.70	55.23	37.82	93.05
Offshore Pipelines	233.10	8.20	241.30	147.40	14.99	162.39
Consulting Services, Operator Services, Site Inspection Services, and Insurance	14.10	10.30	24.40	5.47	10.79	16.26
Oil Terminal	0.00	9.10	9.10	0.00	13.54	13.54
Gas Processing Plant	15.00	15.90	30.90	16.82	15.39	32.21
Office and Other Facilities	0.00	5.80	5.80	0.11	11.02	11.13
Training	0.90	0.50	1.40	0.20	0.06	0.26
<b>Base Cost</b>	<b>461.70</b>	<b>55.70</b>	<b>517.40</b>	<b>343.90</b>	<b>127.04</b>	<b>470.94</b>
Physical Contingency	45.90	5.00	50.90	0.00	0.00	0.00
<b>Subtotal</b>	<b>507.60</b>	<b>60.70</b>	<b>568.30</b>	<b>343.90</b>	<b>127.04</b>	<b>470.94</b>
Price Contingency	21.70	2.30	24.00	0.00	0.00	0.00
Interest during Construction	74.30	0.00	74.30	56.86	0.00	56.86
<b>Total Cost (A)</b>	<b>603.60</b>	<b>63.00</b>	<b>666.60</b>	<b>400.76</b>	<b>127.04</b>	<b>527.80</b>
<b>Part B: Downstream Part (Natural Gas Distribution Company)</b>						
Land Acquisition	0.00	3.50	3.50			
Materials, Construction, Rehabilitation and Engineering Services	15.90	51.70	67.60			
LNG Storage Facility (first and second phases)	50.90	12.30	63.20			
SCADA	4.50	2.60	7.10			
Training	0.20	0.00	0.20			
Taxes and Duties	0.00	14.30	14.30			
<b>Base Cost</b>	<b>71.50</b>	<b>84.40</b>	<b>155.90</b>			
Physical Contingency	7.10	8.50	15.60			
<b>Subtotal</b>	<b>78.60</b>	<b>92.90</b>	<b>171.50</b>			
Price Contingency	5.80	6.30	12.10			
Interest during Construction	6.40	9.50	15.90			
<b>Total Cost (B)</b>	<b>90.80</b>	<b>108.70</b>	<b>199.50</b>			<b>169.00<sup>a</sup></b>
<b>Total Cost (A+B)</b>	<b>694.40</b>	<b>171.70</b>	<b>866.10</b>			<b>696.8</b>

LNG =liquefied natural gas, SCADA = system control and data acquisition.

<sup>a</sup> Details for Part B could not be obtained due to the breakup of the former Natural Gas Distribution Company as a result of restructuring.

Sources: Part A - Shanghai Petroleum Corporation; Part B - Shanghai Natural Gas Pipeline Networks Company, Ltd.

**PROJECTED AND ACTUAL FINANCING PLANS**  
(\$ million)

Source of Financing	Appraisal			Actual		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
<b>Part A</b>						
Asian Development Bank	130.00	0.00	130.00	104.36	0.00	104.36
Exim Bank of Japan	120.00	0.00	120.00	89.58	0.00	89.58
European Investment Bank	72.00	0.00	72.00	59.82	0.00	59.82
Shanghai Municipal Government,						0.00
Shanghai Petroleum Corporation's Equity	281.60	63.00	344.60	147.00	127.04	274.04
and Internal Cash Generation						
<b>Subtotal Part A</b>	<b>603.60</b>	<b>63.00</b>	<b>666.60</b>	<b>400.76</b>	<b>127.04</b>	<b>527.80</b>
<b>Part B</b>						
Mixed Credit from the Government of France	60.00	0.00	60.00			
Shanghai Municipal Government	30.80	108.70	139.50			
Natural Gas Distribution Company's Equity						
and Internal Cash Generation						
<b>Subtotal Part B</b>	<b>90.80</b>	<b>108.70</b>	<b>199.50</b>			169.00 <sup>a</sup>
<b>Total (A + B)</b>	<b>694.40</b>	<b>171.70</b>	<b>866.10</b>			<b>696.80</b>

<sup>a</sup> Details for Part B could not be obtained due to the breakup of the former Natural Gas Distribution Company as a result of restructuring.

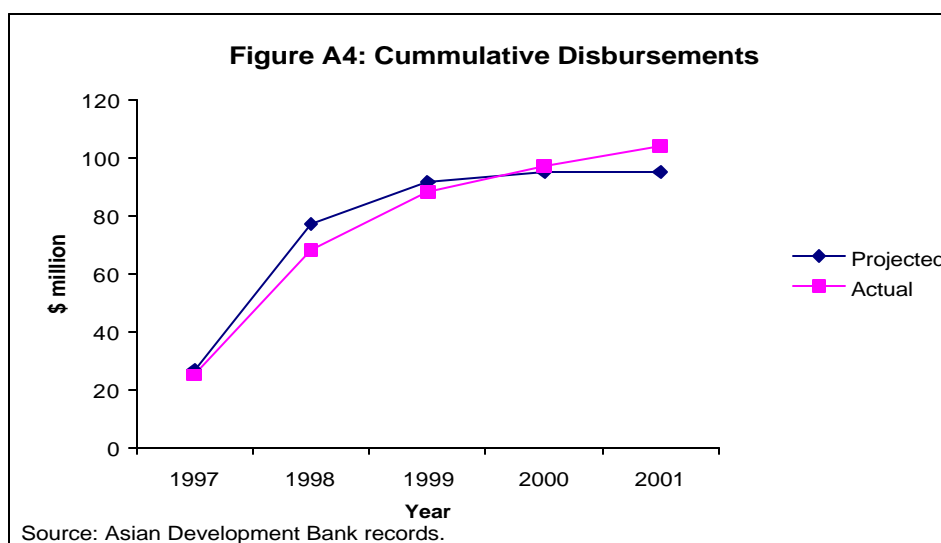
Sources: Part A - Shanghai Petroleum Corporation; Part B - Shanghai Natural Gas Pipeline Networks Company, Ltd.

## LOAN DISBURSEMENTS

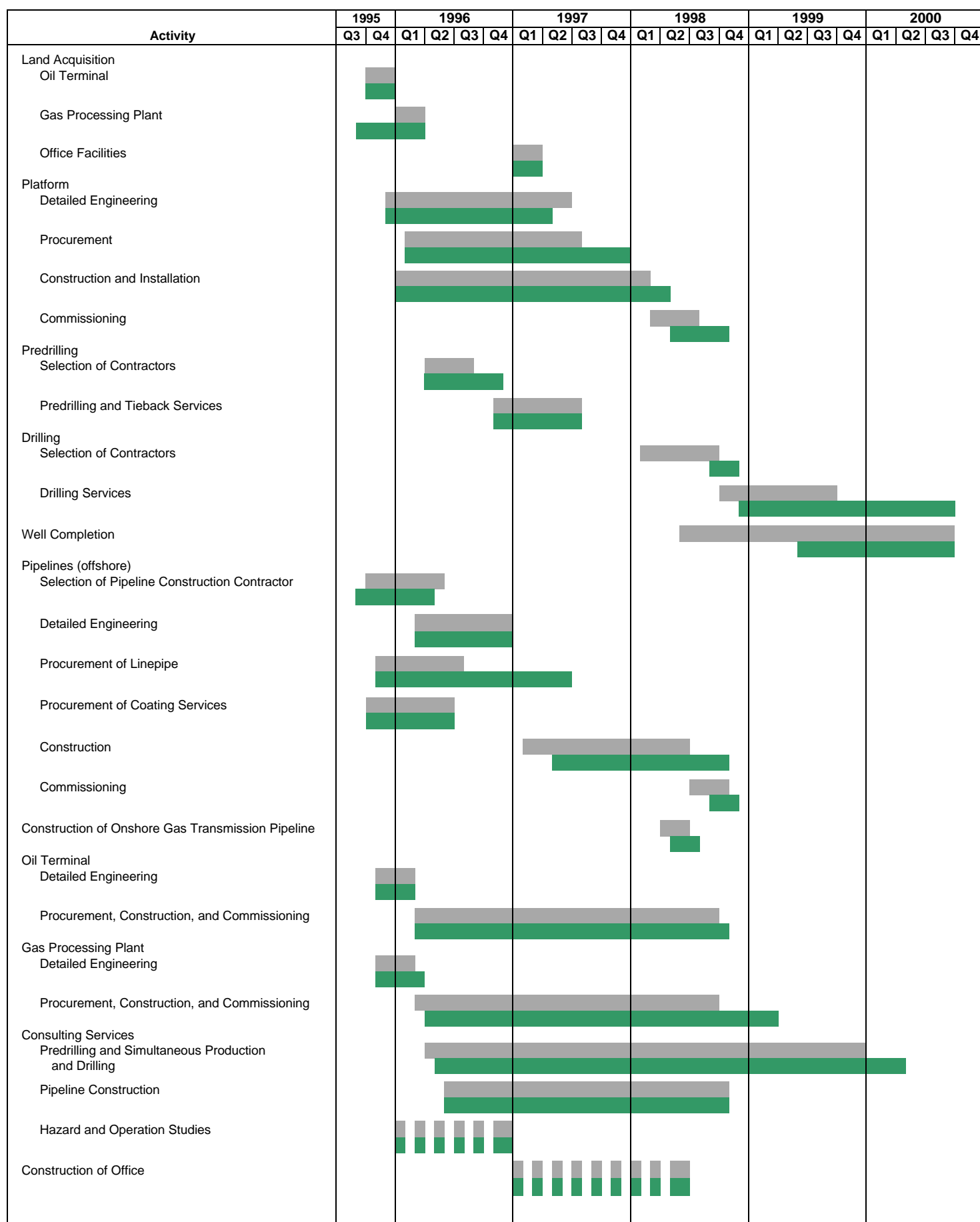
Table A4: Projected and Actual Loan Disbursements

Year	Quarter	Projected (\$ million)	Actual		% of Loan
			Quarterly Disbursement (\$ million)	Cumulative Disbursement (\$ million)	
1997	I	2.00	1.56	1.56	1.50
	II	5.00	1.68	3.24	3.11
	III	8.00	9.12	12.36	11.84
	IV	12.00	13.02	25.38	24.32
	<b>Subtotal</b>	<b>27.00</b>	<b>25.38</b>		
1998	I	24.50	8.30	33.68	32.28
	II	14.50	25.65	59.34	56.86
	III	6.00	4.00	63.33	60.69
	IV	5.50	4.88	68.21	65.36
	<b>Subtotal</b>	<b>50.50</b>	<b>42.83</b>		
1999	I	12.70	10.75	78.96	75.66
	II	2.80	5.33	84.30	80.77
	III	0.90	0.18	84.48	80.95
	IV	3.70	3.91	88.39	84.69
	<b>Subtotal</b>	<b>20.10</b>	<b>20.17</b>		
2000	I	2.40	1.96	90.34	86.57
	II	0.70	3.33	93.68	89.76
	III	0.40	0.53	94.21	90.28
	IV	0.00	3.25	97.46	93.39
	<b>Subtotal</b>	<b>3.50</b>	<b>9.07</b>		
2001	I	0.17	0.00	97.46	93.39
	II	0.10	3.36	100.82	96.60
	III	0.00	0.09	100.90	96.69
	IV	0.00	3.46	104.36	100.00
	<b>Subtotal</b>	<b>0.27</b>	<b>6.90</b>		
<b>Total</b>			<b>104.36</b>		

Source: Asian Development Bank records.



## PROJECT IMPLEMENTATION SCHEDULE (Part A)

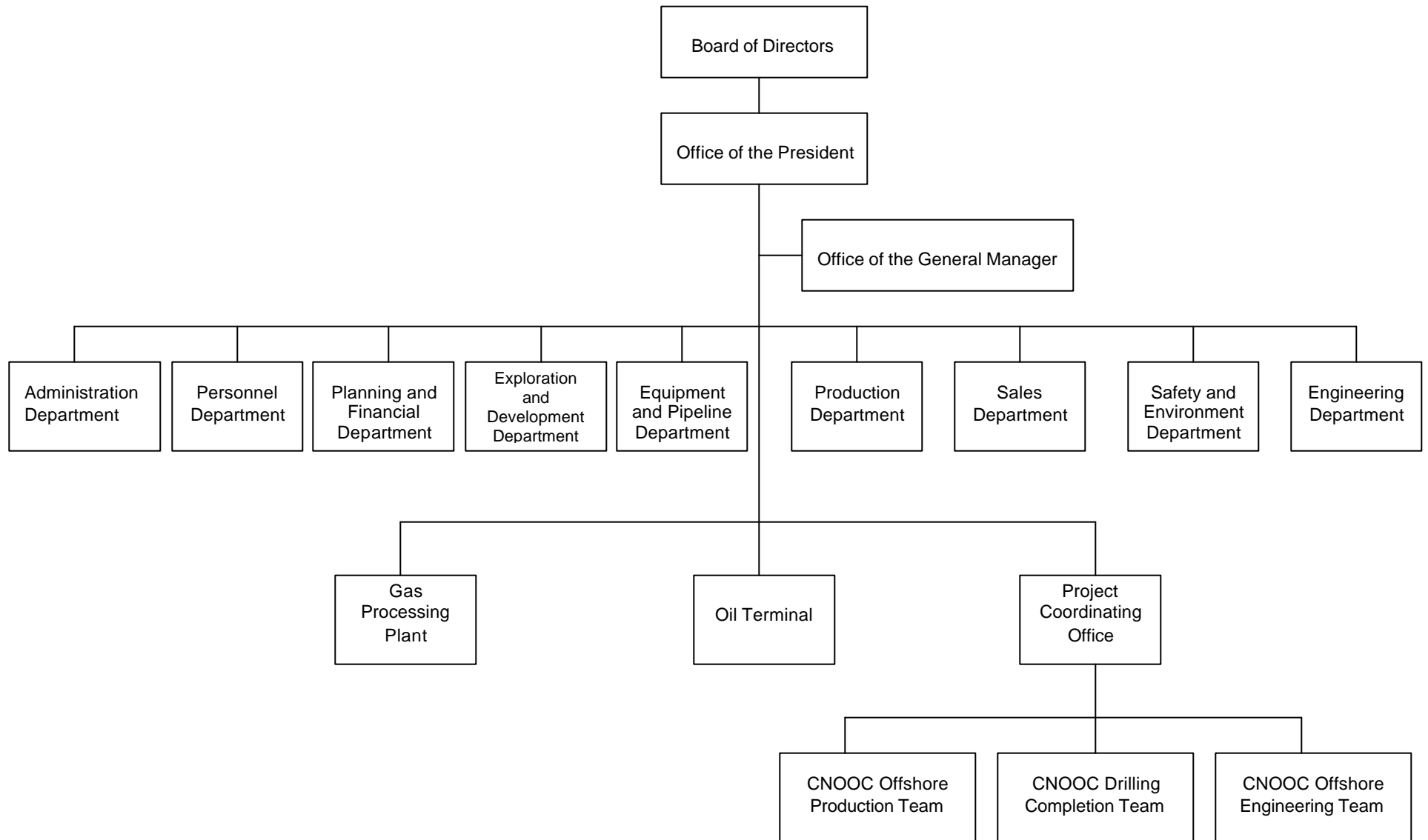


Planned  
Actual

Q = Quarter of the year.

Source: Shanghai Petroleum Corporation.

## ORGANIZATIONAL CHART OF SHANGHAI PETROLEUM CORPORATION



CNOOC = China National Offshore Oil Corporation.

## COMPLIANCE WITH LOAN COVENANTS

Covenant	Reference	Remarks
<b>Loan Effectiveness</b>		
1. The following are specified as additional conditions to the effectiveness of the Loan Agreement (LA) for the purposes of Section 9.01(f) of the Loan Regulations:	LA, Section 6.01	
(i) the subsidiary loan agreement and the Guarantee Agreement shall have been duly executed and delivered on behalf of the Borrower and Shanghai Petroleum Corp. (SHPC), and People's Bank of China and Shanghai municipal government (SMG), respectively, and shall have become fully effective and binding upon the parties in accordance with its terms, subject only to the effectiveness of this Loan Agreement;		Complied with.
(ii) the European Investment Bank (EIB) loan agreement shall have been duly executed and delivered, and all conditions precedent to its effectiveness (other than a condition requiring effectiveness of this LA) shall have been fulfilled or arrangements satisfactory to ADB shall have been made for the fulfillment thereof within a period of time satisfactory to ADB;		Complied with.
(iii) the Export-Import Bank of Japan (JEXIM) loan agreement, or, in the event the JEXIM financing is not approved, other loan agreement covering financing from an alternative source in amount and on terms and conditions satisfactory to ADB, shall have been duly executed and delivered, and all conditions precedent to its effectiveness (other than a condition requiring effectiveness of this LA) shall have been fulfilled or arrangements satisfactory to ADB shall have been		Complied with.



Covenant	Reference	Remarks
<p>made for the fulfillment thereof within a period of time satisfactory to ADB;</p> <p>(iv) a legal agreement between SHPC and Natural Gas Distribution Company (NGDC), on terms and conditions satisfactory to ADB, shall have been executed, stipulating the initial annual quantities, pricing and effective delivery dates of the natural gas; and</p> <p>(v) DNV, or an independent third party certification agency acceptable to EIB and ADB, shall have provided evidence satisfactory to EIB and ADB that the standards used in the basic design and construction methodology of the platform and offshore pipelines meet all applicable standards recognized in the offshore oil industry for the circumstances prevailing in the Project area.</p>		Complied with.
<b>Procurement</b>		
2. Procurement of goods and services will be in accordance with ADB's <i>Guidelines for Procurement</i> .	LA, Schedule 4, para. 2	Complied with.
<b>Execution of the Project</b>		
3. The Borrower shall cause SHPC, as Executing Agency (EA) for Part A of the Project, to conform with international standards and practices in the oil and gas industry in the procurement, scheduling, construction, operation and maintenance of the onshore facilities, and operation and maintenance of the offshore facilities following the second year of operations, under Part A of the Project. The Borrower shall also cause SHPC to conform with international safety and environmental standards in the design and construction of the onshore facilities and the oil and gas production under the Project. In particular, the Borrower shall ensure that it and SHPC, promptly as required, take all actions within their respective powers	LA, Schedule 6, para. 1	Complied with.

Covenant	Reference	Remarks
(i) to maintain SHPC's corporate existence and its rights to carry out Part A of the Project and to conduct its business; and (ii) to perform the obligations set forth in this schedule. Throughout the implementation period of Part A of the Project, SHPC shall maintain a special onshore project team, adequately staffed and with the appropriate qualifications to implement Part A of the Project.		
4. The Borrower and SHPC shall cause China National Offshore Oil Corporation (CNOOC), as the operator for the offshore facilities under Part A of the Project, to conform with international standards and practice in the oil and gas industry in the procurement, scheduling, and construction of the offshore facilities under Part A of the Project, as well as the operation and maintenance of such facilities during the first 2 years of operations. The Borrower and SHPC shall also cause CNOOC to conform with international safety and environmental standards in the design and construction of the offshore facilities and the oil and gas production under the Project. In particular, the Borrower and SHPC shall ensure that the Borrower and CNOOC, promptly as required, take all actions within their respective powers (i) to maintain CNOOC's corporate existence and its rights to act as operator of Part A of the project and to conduct its business; (ii) to perform the obligations set forth in the operating agreement between SHPC and CNOOC; and (iii) throughout the period of its obligations as operator, to maintain a project management team and drilling and completion project team, both of which shall be adequately staffed with appropriately qualified personnel.	LA, Schedule 6, para. 2	Complied with.
5. The Borrower shall cause NGDC, as the EA under Part B of the Project, to conform with international standards and practice in the procurement, construction, operation, and maintenance of the onshore gas transmission and distribution	LA Schedule 6, para. 3	Complied with.

Covenant	Reference	Remarks
<p>facilities. The Borrower shall also cause NGDC to conform with international safety and environmental standards in performing its obligations under Part B. In particular, the Borrower shall take all necessary actions (i) to establish NGDC as a limited liability company by 30 June 1996, and maintain NGDC's corporate existence and its rights to act as operator of Part B; and (ii) to perform the obligations set forth in this schedule. The Borrower shall cause SMG to promptly provide to ADB a copy of the certificate of registration for NGDC following NGDC's establishment as a limited liability company. The Borrower shall also cause SMG to (i) ensure that NGDC cooperates fully so that the purposes of the loan will be accomplished; and (ii) promptly inform ADB of any condition which interferes with, or threatens to interfere with, the progress of Part B of the Project. Throughout the period of its obligations as EA under Part B, NGDC shall be adequately staffed with appropriately qualified personnel.</p>		
<p>6. The Borrower shall ensure that the Project Steering Committee has been established under the chairmanship of a vice mayor of Shanghai, with representatives of SMG, SHPC, and Shanghai Municipal Gas Company (the parent company of NGDC) to ensure that implementation of Part A and Part B will be properly coordinated. The Borrower shall also ensure that the Project Steering Committee is provided with sufficient, appropriate, and accurate information regarding the implementation of Parts A and B of the Project, so that such information can be incorporated by SHPC in the quarterly reports on the Project.</p>	<p>LA, Schedule 6, para. 4</p>	<p>Complied with.</p>
<p>7. The Borrower shall ensure the acceleration of further development of oil and gas exploration and production activities in the vicinity of the Ping Hu field</p>	<p>LA, Schedule 6, para. 6</p>	<p>Complied with.</p>

Covenant	Reference	Remarks
by promoting the participation of interested interested parties, including foreign and domestic investors and international oil companies, through the offering of acreage, joint ventures or other similar arrangements, so that oil and gas exploration activities will be in progress when the project facilities become operational.		
8. The Borrower shall permit utilization of project facilities for the processing and transportation of any oil and gas produced by participating parties, including foreign and domestic investors and international oil companies, in the area around the Ping Hu field, to the extent that the project facilities have capacity in excess of the daily delivery requirements under SHPC's gas sales contract with NGDC and any oil sales contract.	LA, Schedule 6, para. 7	Partly complied with. SHPC is holding exploratory talks with interested parties, but an agreement has not been finalized.
<b>Environment</b>		
9. The Borrower shall ensure that (i) an environmental impact assessment report satisfactory to ADB is prepared for the liquefied natural gas (LNG) storage facility under Part B of the Project; (ii) NGDC staff receive appropriate training in the operation of the LNG storage facility; and (iii) during the distribution of natural gas, NGDC shall maintain its system losses at 2% or less.	LA, Schedule 6, para. 9	Complied with.
10. The Borrower shall ensure that (i) SHPC and CNOOC include in the design of the project facilities environmental protection controls and safety devices, in accordance with international standards recognized in the oil industry and taking into consideration the recommendations of the hazards and operations (Hazop) consultants; and (ii) such controls are thereafter maintained in good condition and effectively utilized.	LA, Schedule 6, para. 16	Complied with.

Covenant	Reference	Remarks
<p>11. The Borrower shall ensure that SHPC and CNOOC train their concerned personnel in the operation of a combined drilling and production platform, as well as in safety and environmental matters, including: (i) safety risk assessment; (ii) combating oil spills; (iii) personnel rescue operations; (iv) implementation of safety audit and environmental monitoring systems; (v) inspection, maintenance, and repair of the submarine pipelines; and (vi) operation and maintenance of the gas processing plant and the oil terminal. All of the above should be in accordance with the safety and environmental practices and programs recommended by the consultants under the technical assistance for Sound Safety and Environmental Practices for Offshore Oil and Gas Production.</p>	<p>LA, Schedule 6, para. 17</p>	<p>Complied with.</p>
<b>Policy</b>		
<p>12. The Borrower shall take all necessary measures to ensure that:</p> <p>(i) by the commencement of gas deliveries from the Project to consumers in October 1998, the weighted average consumer price of the natural gas (excluding any taxes thereon) shall be set at parity or above the unsubsidized consumer price of the alternative fuel that such natural gas replaces (on a heating value parity basis) and shall be adjusted from time to time to maintain such basis of pricing;</p> <p>(ii) by the commencement of gas deliveries from the Project to consumers in October 1998, the transfer price of natural gas between SHPC and NGDC shall be set to allow (a) SHPC to satisfy the financial covenants stipulated in Section VII below, and (b) NGDC to recover fully</p>	<p>LA, Schedule 6, para. 8</p>	<p>Partly complied with. Natural gas price still regulated but is gradually influenced by market forces.</p> <p>Complied with for SHPC. Compliance for NGDC cannot be determined in the absence of adequate information after the restructuring.</p>

Covenant	Reference	Remarks
its capital and operating costs (including depreciation), together with an adequate return on investments;		
(iii) SMG shall initiate its program to phase out the consumer subsidies for coal gas and LPG by 31 March 1998, with the aim to eliminate such subsidies within 3 years; and		Partly complied with.
(iv) SHPC shall be permitted to sell the crude oil produced from the Ping Hu field at the highest price obtainable in either the domestic or the international market, while the naphtha and LPG produced by the gas processing plant shall be sold at international market prices.		Complied with.
<b>Social Dimensions</b>		
13. The Borrower shall ensure, or shall cause SHPC and NGDC to ensure, that all land, rights to land and water, and all other property rights and privileges required for the project are promptly acquired or otherwise made available so as to ensure timely project implementation.	LA, Schedule 6 para. 5	Complied with.
14. The Borrower shall cause SMG, SHPC, and NGDC to take the necessary measures to mitigate possible adverse social impacts associated with the Project. Such measures shall include ensuring that all lands required for the Project are unutilized and free from settlement, or, if utilized or settled, that a resettlement plan in accordance with the laws of the Borrower and acceptable to ADB is formulated and that compensation is made to property owners or users whose land is expropriated or whose use of the land is disrupted by the Project, such compensation to be made promptly and in accordance with the laws of the Borrower.	LA, Schedule 6 para. 11	Complied with.

Covenant	Reference	Remarks
<b>Financial</b>		
15. The Borrower shall ensure that all financing in amounts and on terms and conditions satisfactory to ADB is obtained in a timely manner consistent with the project implementation schedule.	LA, Schedule 6, para. 12	Complied with.
16. Except as ADB may otherwise agree, following completion of the Project, SHPC shall not incur any debt, unless the net revenues of SHPC for the fiscal year immediately preceding the date of such incurrence or for a later 12-month period ended prior to the date of such incurrence, whichever is the greater shall be at least 1.3 times the estimated maximum debt service requirements of SHPC for any succeeding fiscal year on all debt of SHPC, including the debt to be incurred.	LA, Schedule 6, para. 13	Complied with.
17. Except as ADB shall otherwise agree, SHPC shall not incur any debt, if after the incurrence of such debt the ratio of debt to equity shall be greater than (i) 80:20 during the first 2 years after completion of the Project, and (ii) 70:30 thereafter.	LA, Schedule 6, para. 14	Complied with.
18. Except as ADB shall otherwise agree, following completion of the Project, SHPC shall maintain a return on equity after taxes of not less than 15%.	LA, Schedule 6, para. 15.	Complied with.
<b>Reports</b>		
19. The Borrower shall ensure that during the first 5 years following completion of the Project, SHPC shall provide to ADB annual benefit monitoring and evaluation reports satisfactory to ADB, to assess the Project's economic and environmental benefits, in particular, with regard to decreased coal use for coal gas production and environmental improvements.	LA, Schedule 6, para. 18	Complied with.

Covenant	Reference	Remarks
20. SHPC shall furnish to ADB quarterly progress reports on the execution of the Project and on the operation and management of the project facilities under Part A of the Project. SHPC shall include in the quarterly reports information from the Project Steering Committee regarding implementation of Part B of the Project by NGDC.	PA, Section 2.08(b)	Complied with.
21. Promptly after physical completion of Part A of the Project, but in any event not later than 3 months thereafter or such later date as ADB may agree for this purpose, SHPC shall prepare and furnish to ADB a report on the execution and initial operation of the Project, including its costs, the performance by SHPC of its obligations under this Project Agreement and the accomplishment of the purposes of the loan.	PA, Section 2.08(c)	Complied with.
<b>Accounts</b>		
22. SHPC shall, and shall cause CNOOC to (i) maintain separate accounts for the Project and for its overall operations; (ii) have such accounts and related financial statements (balance sheet, statement of income and expenses, and related statements) audited annually in accordance with appropriate auditing standards consistently applied, by the Shanghai Municipal Audit Bureau of the State Audit Administration; and (iii) furnish to ADB promptly after their preparation but in any event not later than 9 months after the close of the fiscal year to which they relate, certified copies of such audited accounts and financial statements and the report of the auditors relating thereto (including the auditors' opinion on the use of the loan proceeds and compliance with the covenants of this Project Agreement and Loan Agreement), all in the English language.	PA, Section 2.09(a)	Complied with.



Covenant	Reference	Remarks
<b>Others</b>		
23. Each of SHPC and NGDC shall produce and provide to ADB by 31 December 1998, an action plan to restructure its ownership structure, to provide for the introduction of other equity investors in SHPC and NGDC, respectively.	LA, Schedule 6, para. 10	Complied with.
24. Prior to the date of commencement of construction of the offshore pipeline facilities, SHPC shall (i) have obtained the necessary permits for the detailed routing of all offshore and onshore pipelines under Part A of the Project, and (ii) have provided to ADB the results of one pre-drilled gas well and one predrilled oil well to enable ADB to review and discuss with SHPC their effect on the proven oil and gas reserves in order to determine whether there is a need to further optimize the field development program.	LA, Schedule 6, para. 19	Complied with.

## TECHNICAL ASSISTANCE COMPLETION REPORT

Division: ECEN

TA No. and Name <b>2493-PRC: Strengthening the Accounting and Financial Management Systems in Shanghai Petroleum Corporation</b>			Amount Approved: <b>\$330,000</b>	
			Revised Amount: <b>\$330,000</b>	
Executing Agency: <b>Shanghai Petroleum Corporation</b>	Source of Funding: <b>Japan Special Fund</b>	TA Amount Undisbursed <b>\$20,946.69</b>	TA Amount Utilized <b>\$309,053.31</b>	
<div style="text-align: center;">Date</div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;">Approval <b>21 Dec 1995</b></div> <div style="width: 30%;">Signing <b>16 Jul 1996</b></div> <div style="width: 30%;">Fielding of Consultants <b>25 Jan 1999</b></div> </div>			<div style="text-align: center;">Closing Date</div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">Original <b>March 2000</b></div> <div style="width: 45%;">Actual <b>April 2001</b></div> </div>	
<p><b>Description</b></p> <p>The Shanghai Petroleum Corporation (SHPC) was established in 1992 to develop the Ping Hu oil and gas field, a 240 square kilometer area in the East China Sea. SHPC was owned by China National Offshore Oil Corporation (CNOOC) (30%), China National Star Petroleum Corporation and later eventually transferred to China Petrochemical Corporation (Sinopec) (30%), and Shanghai Municipal Government through Shenergy Company Ltd. (40%). SHPC was the designated owner and operator of the offshore platform and oil and gas pipelines in the Ping Hu area, the oil terminal on Dai Shan Island, and the gas processing plant at Nanhui. Its operation involved offshore oil and gas production and transmission, onshore oil transportation, and gas processing for eventual distribution to the residential, commercial, and industrial consumers in the Pudong area of Shanghai through the Shanghai Natural Gas Pipeline Networks Company Ltd. (SNGC) and the 3 gas distribution companies.</p>				
<p><b>Objectives and Scope</b></p> <p>The objective of the TA was to help SHPC become an efficient and financially sound operating company in accordance with the modern enterprise classification of the PRC and to prepare for private participation in SHPC. The TA had two components: (i) strengthening the accounting and financial management systems, and (ii) preparing a broad action plan for ownership restructuring. The first component of the TA was to help establish satisfactory accounting and financial management systems and procedures in budgeting, billing and collection, inventory control and procurement, cost accounting, treasury functions including debt management, financial reporting, management information system, internal auditing, take-or-pay contract obligations, and computerization. In the second component, various options for ownership restructuring such as the introduction of private capital was to be studied, the most appropriate option identified, and actions plans to implement the recommended option prepared.</p>				
<p><b>Evaluation of Inputs</b></p> <p>The design, scope and terms of reference of the TA were considered appropriate for achieving the objectives of the TA. An international consulting firm was engaged to carry out the TA in accordance with ADB's <i>Guidelines on the Use of Consultants</i>. The contract was signed on 7 January 1999. Fieldwork started on 25 January 1999 and completed by November 1999. The firm provided a total of 16 person-months of international consulting services over a period of 11 months. The consulting team comprised 7 specialists with expertise in accounting system and procedures, management information systems and privatization of public enterprises. The consulting team had the appropriate technical skills to carry out the assignment. SHPC provided a full-time project manager to oversee the day-to-day activities and coordinate with the other government agencies. ADB provided close supervision through regular correspondence and review missions.</p>				

### Evaluation of Outputs

A report on *Assessment of Ownership Restructuring* was completed in July 1999. The Final Report on *Strengthening the Accounting and Financial Management System* was completed in December 1999. The consultant concluded that SHPC's organization, manpower allocation, and capacity were not adequate to meet the business requirements of the transition from development to the production stage. Deficiencies in internal control, accounting systems and procedures, and management information and reporting system were noted. The consultant recommended to: (i) restructure the Planning and Financial Department; (ii) improve the internal control system; (iii) automate the accounting system; and (iv) implement an integrated electronic reporting system. The consultant recommended a revised accounting chart of accounts. User manuals for the recommended systems and procedures, and internal control system were developed and appropriate training programs were conducted. The consultant assessed the computerization requirements of SHPC and noted its deficiencies. Acquisition of an integrated Enterprise Resource Planning (ERP) software was recommended to provide real-time information for decision making and cover various areas including financial management, distribution, production planning, materials management, human resource, and procurement.

The consultant carried out an analysis of bringing other equity investors into SHPC. The consultant concluded that private participation in SHPC was premature mainly because SHPC did not have any performance record and that options are very limited under the existing regulatory framework for oil and gas sector in the PRC where state owned enterprises have maintained monopoly position. They presented four possible strategies, which SHPC could adopt in the mid-term: (i) major supplier strategy, where SHPC would aim to become the major natural gas supplier in Shanghai by focusing on improving its capabilities in the area of natural gas development; (ii) vertical integration strategy, where SHPC would aim for integration with the downstream natural gas distribution company to effectively compete with other natural gas suppliers; (iii) horizontal integration strategy, where SHPC would pursue natural gas related business; and (iv) mixed strategy, which is a combination of the earlier described strategies. Because of the considerable divergence of views among SHPC's shareholders and management, a consensus on the restructuring plan could not be achieved. More importantly, the restructuring measures taken by the Government on the petroleum industry provided China National Petroleum Corporation (CNPC) and Sinopec – the two giant petroleum companies – the geographical focus on the onshore operations, and to CNOOC, the dominant position for the offshore operations. Given the SHPC's limited capabilities and the prevailing industry environment, the consultant recommended that SHPC's core business should be on oil and gas transportation and should form a holding company, comprising exploration and production, transportation, and distribution/retailing divisions to provide flexibility to consider other options in the future.

### Overall Assessment and Rating

The consultant identified the major issues and inadequacies in SHPC's accounting and management systems. The recommendations were relevant and appropriate. SHPC implemented majority of the recommendations, except the acquisition of the recommended ERP software. SHPC decided to acquire the Yongyou financial planning and management software, which is commonly used by business establishments in PRC, and fulfils most of the requirements.

SHPC's management supported the conclusion reached by the consultant on the limited options for privatization. SHPC management also does not believe that a public offering of its shares will generate strong interest since stocks of two of its major shareholders (Sinopec and CNOOC) are already available to the public. Ping Hu's operations are insignificant when compared to the trading of the shareholders' stocks on international stock exchanges.

The TA is rated successful.

**Major Lessons Learned**

The impact of the TA would have been greater if follow through sessions were done after the software was acquired. This would have ensured optimum implementation of the recommended systems.

**Recommendations and Follow-Up Actions**

No further action is recommended.

Prepared by: Merlita Pajarillo

Designation: Energy Specialist (Financial)

## TECHNICAL ASSISTANCE COMPLETION REPORT

Division: ECEN

Division: EOEI

TA No. and Name <b>2494-PRC: Sound Safety and Environmental Practices for Offshore Oil and Gas Production</b>			Amount Approved: <b>\$600,000</b>	
			Revised Amount: <b>\$600,000</b>	
Executing Agency: <b>Shanghai Petroleum Corporation</b>		Source of Funding: <b>Japan Special Fund</b>	TA Amount Undisbursed <b>\$17,590.09</b>	TA Amount Utilized <b>\$582,409.91</b>
Date			Closing Date	
Approval <b>21 Dec 1995</b>	Signing <b>16 Jul 1996</b>	Fielding of Consultants <b>26 January 1999</b>	Original <b>31 March 2000</b>	Actual <b>March 2001</b>
<b>Description</b>				
<p>The development of the Ping Hu oil and gas field in the East China Sea involved certain safety and environmental issues which needed to be addressed. Shanghai Petroleum Corporation (SHPC), the owner and beneficiary of the facilities, and China National Offshore Oil Corporation (CNOOC), the contracted operator of the offshore facilities, needed to develop appropriate safety and environmental practices in connection with the operation of the drilling and production platform and offshore pipelines. CNOOC needed to apply the most modern safety and environmental practices to ensure that the offshore operations will conform with international standards. The simultaneous drilling of gas wells and producing oil and gas was, at the time of project development, a new practice that had not been previously carried out by CNOOC such that hazardous conditions could develop. In view of the expected increase in offshore oil and gas production in the East China Sea, arrangements needed to be made for a coordinated response by all parties to emergency situations such as oil spills and platform evacuations.</p> <p>The oil terminal on Dai Shan Island and the gas processing plant at Nanhui are the two other facilities that are also owned and operated by SHPC. Operation of these facilities requires implementation of safety measures for handling highly flammable gas and fluids, which present significant risk to the assets and to the surrounding communities. The Government requested ADB to provide a technical assistance (TA) to strengthen SHPC's and CNOOC's operating capabilities and develop appropriate emergency plans for the East China Sea, and develop safe operational procedures for the offshore and onshore facilities.</p>				
<b>Objectives and Scope</b>				
<p>The objective of the TA was to ensure the development and adoption of sound safety and environmental practices and procedures on the Ping Hu offshore oil platform and pipelines, oil terminal, and gas processing plant. The scope of work under the TA included: (i) reviewing the design and construction of the Ping Hu offshore platform, oil and gas pipelines, oil terminal, and gas processing plant; (ii) assessing safety and environmental standards and practices applicable to the normal operation of such facilities and making recommendations in this regard for the Ping Hu facilities; (iii) developing procedures for dealing with emergency conditions at these facilities; (iv) developing a preventive maintenance program for these facilities; (v) training staff on the application of safety procedures; and (vi) developing an overall safety and environmental monitoring plan.</p>				
<b>Evaluation of Inputs</b>				
<p>The design, scope and terms of reference of the TA were considered appropriate for achieving the objectives of the TA. An international consulting firm was engaged to carry out the TA in accordance with ADB's <i>Guidelines on the Use of Consultants</i>. The contract was signed on 11 January 1999. Fieldwork started on 26 January 1999 and was completed by April 2000. The firm provided a total of 25 person-months of international and 3 person-months of domestic consulting services over a period of 16 months. The consulting team comprised 8 specialists with appropriate technical skills in various aspects of operational safety and sound environmental practices. SHPC, the executing agency provided a full-time project manager to coordinate day-to-day activities with the consultants, CNOOC and with other government agencies. ADB provided supervision through regular correspondence and review missions.</p>				

### Evaluation of Outputs

The Final Report on *Sound Safety and Environmental Practices* was submitted in May 2000. The expected outputs from the TA were all achieved. The consultant carried out a detailed review of all operational procedures from a safety point of view, prepared an extensive list of hazardous conditions, and made recommendations for implementation. Major hazards on the platform were identified and plans were put into place to control them. Plans for different typhoon scenarios were upgraded and the need to upgrade typhoon prediction data was noted. Manning level at the platform was assessed. Needed preparations for forced evacuation of the platform because of a typhoon were identified and undertaken and the emergency response strategy was developed. For the onshore facilities, detailed recommendations were made with respect to certain design defects at the gas processing plant. Capacity of the escape craft was exceeded and rectification was put into place. Smoke and gas hazards hindering escape were identified. Need to minimize flaring was emphasized. Emergency shutdown measures were reviewed. Relief valve sizing and re-certification was examined. Possible landslip problems at Dai Shan oil terminal were noted and proper preventive measure was recommended. Discussions were held on environmental and safety planning and appropriate recommendations were given. Recommendations on the safety and operating procedures were properly documented and training sessions were successfully conducted between January 1999 and January 2000.

### Overall Assessment and Rating

All indications are that the TA achieved its objectives and is rated successful.

### Major Lessons Learned

Proper identification of needs is a key element for a well-planned TA. Selection of experienced industry experts ensure successful implementation of a crucial operating requirement in a risky undertaking.

### Recommendations and Follow-Up Actions

No further action is recommended.

Prepared by: Merlita Pajarillo

Designation: Energy Specialist (Financial)

## SUMMARY OF CONTRACT PACKAGES

PCSS No.		Mode of Procurement	Date of Contract	Contract Number	Contract Amount (\$)	Amount Disbursed (\$)
0001	Detailed Engineering and Offshore Installation of Pipelines	ICB	06-Sep-96	CT/9608- PL	42,158,941	42,158,941
0002	10-inch and 14-inch Linepipe and Bends	ICB	03-Sep-96	PH-PO/96/PL/MT-036	16,099,912	16,099,912
0003	Corrosion/Concrete Weight Coating and Anode	ICB	29 Nov 96	CT/9610- PC7	15,330,255	15,330,255
0004	Inspection Services for Construction of Subsea Pipelines	IS	4 Oct 96	CT/9614-IP	313,621	313,621
0005	Sacrificial Anode Materials for Ping Hu	IS	06 Nov 96	PH-PO/96/PL/AN-037	709,875	709,875
0006	Consulting Services Contract—Pre-drilling	ICB	10 Oct 96	PH-PC-12/96	2,243,640	2,243,640
0007	Consulting Services Contract	ICB	18 Nov 96	CT/9613- CS	836,326	836,326
0008	Hazards and Operations Oil Terminal	ICB	01-Oct-96	96 SHPC HC01	23,199	23,199
0009	Hazards and Operations Onshore Gas Terminal	ICB	01-Oct-96	96 SHPC HC02	46,969	46,969
0010	Consulting Services—Evaluation of Semi-submersible rig	ICB	29 Jul 96	PH-PC-11/96	17,708	17,708
0011	13-3/8", 7" Casing	ICB	17-Aug-98	PH-PC-22/98	1,929,496	1,929,496
0012	Staff Training	Others	25 Aug 98		48,000	48,000
0013	Directional Drilling Services	ICB	26 Nov 98	PH-PC-120/98	1,740,175	1,740,175
0014	Pipeline Integrity Monitoring System	IS	9 Jun 99	PH/PO- PT-051	128,189	128,189
0015	Staff Training	Others	6 Jan 99		15,000	15,000
0016	Overseas Training (pipeline engineer)	DP	10 Jul 01	OPT-1	91,860	91,860
8801	Staff Training (technology and management personnel)	Others	25-Aug-98		48,000	48,000

DP = direct purchase, ICB = international competitive bidding, IS = international shopping, PCSS = procurement contract summary sheet.

Source: Asian Development Bank records.

**FINANCIAL PERFORMANCE OF PROJECT ENTERPRISE  
SHANGHAI PETROLEUM CORPORATION**

**Table A11.1 : Income Statements**  
(CNY million)

Item	Year Ending December 31			
	1999	2000	2001	2002
<b>Operating Data</b>				
Oil (ton)	535,475.8	555,841.1	586,618.2	438,908.4
Increase in Oil Sales (%)	-	3.8	5.5	(25.2)
Natural Gas (000 m <sup>3</sup> )	108,707.6	260,470.3	330,144.4	432,702.2
Increase in Natural Gas Sales (%)	-	139.6	26.7	31.1
LPG (ton)	7,154.6	30,312.4	39,274.1	49,115.8
Increase in LPG Sales (%)	-	323.7	29.6	25.1
Naphtha (ton)	2,734.9	9,535.6	12,585.0	16,750.2
Increase in Naphtha Sales (%)	-	248.7	32.0	33.1
<b>Revenues and Expenses</b>				
<b>Revenues</b>				
Oil (without VAT)	688.1	999.7	936.8	683.7
Natural Gas (without VAT)	144.6	346.4	439.1	575.5
LPG (without VAT)	16.5	69.3	98.9	112.4
Naphtha (without VAT)	4.4	17.3	25.4	31.0
VAT	42.7	71.6	75.0	70.1
Other Revenues	0.6	0.1	0.3	0.0
<b>Total Operating Revenues</b>	<b>854.3</b>	<b>1,432.9</b>	<b>1,500.6</b>	<b>1,402.6</b>
<b>Operating Costs</b>				
Oil	46.2	61.7	98.2	96.1
Natural Gas	28.2	54.4	62.6	85.9
LPG	1.9	7.3	13.8	17.8
Naphtha	0.7	2.2	3.9	4.9
Depreciation	606.1	540.1	564.9	330.9
Administrative Costs	14.2	52.9	15.5	22.2
Taxes	5.1	8.8	8.3	7.6
Selling Costs	1.8	1.8	1.3	1.8
<b>Total Operating Costs</b>	<b>704.1</b>	<b>729.1</b>	<b>768.4</b>	<b>567.1</b>
<b>Operating Income</b>	<b>150.1</b>	<b>703.8</b>	<b>732.1</b>	<b>835.5</b>
Financial Expenses	164.8	173.5	134.6	111.4
Nonoperating Income/(Expense)	(0.3)	29.8	29.8	(0.9)
Income from Investment	0.0	0.0	9.0	3.8
Adjustments for Prior Years	0.0	6.7	0.0	0.0
<b>Net Income Before Tax</b>	<b>(15.0)</b>	<b>566.7</b>	<b>636.3</b>	<b>727.0</b>
Income Tax	0.0	0.0	0.0	120.2
<b>Net Income</b>	<b>(15.0)</b>	<b>566.7</b>	<b>636.3</b>	<b>606.7</b>
<b>Ratios</b>				
Rate Base <sup>a</sup> (CNY million)	1,621.2	3,103.3	2,737.7	2,338.3
Operating Ratio <sup>b</sup> (%)	82.4	50.9	51.2	40.4
Return on Rate Base <sup>c</sup> (%)	9.3	22.7	26.7	30.6
Return on Equity <sup>d</sup> (%)	(1.7)	41.0	37.9	30.5

LPG = liquefied petroleum gas, VAT = valued added tax.

<sup>a</sup> Average of beginning and ending net fixed assets.

<sup>b</sup> Total operating expenses as a percentage of total revenues.

<sup>c</sup> Net operating income after taxes as a percentage of rate base.

<sup>d</sup> Net income as a percentage of total equity.

Source: Shanghai Petroleum Corporation.



**Table A11.2: Balance Sheets**  
(CNY million)

Item	Year Ending December 31				
	1998	1999	2000	2001	2002
<b>Assets</b>					
<b>Current Assets</b>					
Cash	81.6	280.6	759.1	883.5	1,312.3
Accounts Receivable	1.2	154.4	169.5	273.6	199.6
Other Accounts Receivable	77.8	8.4	39.9	73.5	49.6
Inventories	12.3	39.2	15.8	23.3	58.2
Other Current Assets	13.5	3.5	101.0	7.2	152.0
<b>Total Current Assets</b>	<b>186.4</b>	<b>486.1</b>	<b>1,085.3</b>	<b>1,261.0</b>	<b>1,771.6</b>
<b>Fixed Assets</b>					
Gross Fixed Assets	0.0	3,860.5	4,114.9	4,225.8	4,227.0
Accumulated Depreciation	0.0	618.1	1,150.7	1,714.5	2,061.6
<b>Net Fixed Assets in Service</b>	<b>0.0</b>	<b>3,242.4</b>	<b>2,964.2</b>	<b>2,511.3</b>	<b>2,165.4</b>
Construction Work in Progress	3,268.5	0.0	2.8	7.1	72.8
<b>Net Fixed Assets</b>	<b>3,268.5</b>	<b>3,242.4</b>	<b>2,966.9</b>	<b>2,518.3</b>	<b>2,238.2</b>
<b>Other Assets</b>					
Intangible and Deferred Assets	0.0	3.8	3.4	0.9	1.3
Long-Term Investments	0.0	0.0	0.0	2.9	2.9
<b>Total Other Assets</b>	<b>0.0</b>	<b>3.8</b>	<b>3.4</b>	<b>3.8</b>	<b>4.2</b>
<b>Total Assets</b>	<b>3,455.0</b>	<b>3,732.3</b>	<b>4,055.5</b>	<b>3,783.1</b>	<b>4,014.0</b>
<b>Liabilities and Equity</b>					
<b>Current Liabilities</b>					
Accounts Payable	3.5	25.1	32.2	3.7	14.9
Others	16.7	429.7	670.7	241.6	249.7
<b>Total Current Liabilities</b>	<b>20.2</b>	<b>454.9</b>	<b>702.9</b>	<b>245.3</b>	<b>264.6</b>
<b>Long-Term Debt</b>	<b>2,534.8</b>	<b>2,392.7</b>	<b>1,971.2</b>	<b>1,858.2</b>	<b>1,763.1</b>
<b>Total Long-term Liabilities</b>	<b>2,534.8</b>	<b>2,392.7</b>	<b>1,971.2</b>	<b>1,858.2</b>	<b>1,763.1</b>
<b>Equity</b>					
Paid-In Capital	900.0	900.0	900.0	900.0	900.0
Reserves and Retained Earnings	0.0	(15.2)	481.5	779.6	1,086.3
<b>Total Equity</b>	<b>900.0</b>	<b>884.8</b>	<b>1,381.5</b>	<b>1,679.6</b>	<b>1,986.3</b>
<b>Total Liabilities and Equity</b>	<b>3,455.0</b>	<b>3,732.3</b>	<b>4,055.5</b>	<b>3,783.1</b>	<b>4,014.0</b>
<b>Ratios</b>					
Current Ratio <sup>a</sup> (times)	9.2	1.1	1.5	5.1	6.7
LTDebt/LTDebt+Equity Ratio	0.7	0.7	0.6	0.5	0.5
Debt/(Debt +Equity) Ratio <sup>b</sup> (%)	73.8	73.0	58.8	52.5	47.0

LT = long-term.

<sup>a</sup> Ratio of current assets to current liabilities.

<sup>b</sup> Ratio of total long-term debt to long-term debt plus equity.

Source: Shanghai Petroleum Corporation.

**Table A11.3: Cash Flow Statements**  
(CNY million)

Item	Year Ending December 31			
	1999	2000	2001	2002
<b>Sources</b>				
Net Income After Tax	(15.2)	566.7	636.3	606.7
Add: Depreciation	616.8	535.4	564.2	345.3
Other Noncash Items	(246.7)	111.9	(147.6)	123.4
Interest	167.1	187.8	143.8	126.4
<b>Internal Cash Generation</b>	<b>522.0</b>	<b>1,401.9</b>	<b>1,196.7</b>	<b>1,201.9</b>
Long-Term Loans	424.2	230.6	83.3	0.0
<b>Total Sources</b>	<b>946.2</b>	<b>1,632.5</b>	<b>1,280.0</b>	<b>1,201.9</b>
<b>Applications</b>				
Capital Expenditures	469.3	295.1	164.0	56.6
Debt Service	290.1	689.0	769.8	301.7
Principal	248.5	439.1	616.0	174.6
Interest	41.6	249.9	153.8	127.2
Long-Term Investment	0.0	100.0	(108.1)	145.8
Dividend Payment	0.0	70.0	330.0	270.0
Others/Changes in Working Capital	(12.2)	0.0	(0.2)	(1.1)
<b>Total Applications</b>	<b>747.2</b>	<b>1,154.1</b>	<b>1,155.5</b>	<b>773.1</b>
<b>Net Cash Flow</b>	<b>199.0</b>	<b>478.4</b>	<b>124.4</b>	<b>428.8</b>
Cash, Beginning	81.6	280.6	759.1	883.5
<b>Cash, End</b>	<b>280.6</b>	<b>759.1</b>	<b>883.5</b>	<b>1,312.3</b>
<b>Ratios</b>				
Debt Service Coverage Ratio <sup>a</sup>	1.8	2.0	1.6	4.0
Self-Financing Ratio <sup>b</sup>	60.7	230.4	248.3	816.1

<sup>a</sup> Ratio of internal cash generation to debt service requirement.

<sup>b</sup> Internal cash generation net of changes in working capital and debt service as a percentage of the 3-year moving average of capital expenditures.

Source: Shanghai Petroleum Corporation.

## ECONOMIC AND FINANCIAL EVALUATION OF THE PROJECT

### A General

1. The economic and financial evaluations of the Ping Hu Oil and Gas Development Project (the Project) followed the methodology used at appraisal. The Project was evaluated based on its benefits, investment, and operation and maintenance (O&M) costs. All costs are expressed in constant 2003 prices. The economic life of the Project was assumed to end in 2022 on the basis of reservoir studies carried out by Shanghai Petroleum Corporation (SHPC). No residual value was considered at the end of the economic life. An exchange rate of CNY8.30 to \$1.00 was used to convert local costs into US dollars.

### B. Economic Capital Costs, Incremental Benefits, and Operating Costs

2. The economic capital cost of each project component was calculated on the basis of the financial costs after deducting the duties and taxes on equipment and other items. That cost then was adjusted to 2003 values using the MUV G-5<sup>1</sup> index for international goods and the consumer price index of the People's Republic of China (PRC) for domestic goods. For Part A, the upstream component consists of the offshore platform, wells, oil and gas pipelines, gas processing plant, and crude oil terminal. The investment costs and related benefits of the new development project were not included. The natural gas marketing system, which makes up Part B, consists of the downstream gas transmission and distribution pipelines, starting at the gas processing plant, and the liquefied natural gas (LNG) storage facilities. Because of the physical and corporate restructuring of the gas pipeline distribution system in Shanghai after the Project was started, which resulted in the breakup of the responsibilities for the operation of Part B, the cost details for Part B of the planned investment are not available. Therefore, the appraisal investment breakdown and profile were used in the economic internal rate of return (EIRR) calculation, since the actual cost closely approximates the appraisal level. Imported costs were valued at international prices. For local costs, the applicable specific and standard conversion factors<sup>2</sup> were applied to tradable and non-tradable goods and services.

3. The economic benefits of the Project were derived from (i) crude oil and condensate, LPG, and naphtha sold to a number of different buyers at international market values; and (ii) natural gas sold to Shanghai Natural Gas Pipeline Networks Company Ltd. (SNGC) for resale to residential, commercial and industrial consumers in the Pudong and Puxi areas of Shanghai through the three gas distribution companies. The economic benefits of the Project were calculated based on production forecast in SHPC's latest estimate of reserves. The crude oil, condensate, LPG, and naphtha prices were valued based on the international prices realized by SHPC in 1999–2003, and World Bank's forecast of future prices as adjusted by the difference between its price and that of SHPC's in 2003. Natural gas was valued at the current LPG price to domestic end users, which is a free market, unsubsidized price. The projected price was determined based on the relationship of the price of LPG to the World Bank crude oil price in 2003, and adjusted according to the World Bank crude oil price forecast. The sales volume of the natural gas to end users was set at 98% of the natural gas sold by SHPC to SNGC to take into account a probable 2% system loss in distribution.

4. O&M costs include the costs associated with the operating and maintaining the facilities. For Part A, expenses were forecast based on the expenses incurred in the 4 years of operating

<sup>1</sup> MUV G-5 is the unit value index in U.S. dollar terms of manufactures exported from the G-5 countries (France, Germany, Japan, the United Kingdom, and the United States) weighted proportionally to the countries' exports to developing countries. Source: WB Global Commodity Price Prospects.

<sup>2</sup> The conversion factors used in this evaluation are 1.1 for civil works, 1.1 for local machinery, and 0.93 for others.

experience, and the projected production levels. In the absence of operating cost data for Part B, the gas distribution system O&M costs were taken from the Project appraisal levels, adjusted to 2003 levels. Duties and taxes were deducted.

### **C. Economic Internal Rate of Return**

5. The recalculated EIRR for the Project was 22.9%, is higher than the 16.2% estimated at appraisal. It also exceeded Asian Development Bank's (ADB) 12% hurdle rate for economic opportunity cost of capital. The higher EIRR was due mainly to the increase in the price of crude oil, which pushed up market prices of the other oil-related products. The average price assumed at appraisal for 1999–2003 was \$18.10 per barrel (bbl), compared to SHPC's actual average price of \$22.81 per bbl. The international LPG price for end users, which was used as a benchmark for the value of natural gas at appraisal, was \$5.80 per million British thermal units (Btu) as compared to \$9.00 per million Btu in the reevaluation. Assuming depletion premium as was done at appraisal, the EIRR would be 21.7%. The computed EIRR is considered conservative, because the economic benefits from the environmental improvement as a result of the Project were not valued.

### **D. Financial Internal Rate of Return**

6. The same assumptions on benefits and costs were used in the financial evaluation as in the economic evaluation. That resulted in an 18.8% financial internal rate of return (FIRR), above the 15.4% estimated at appraisal. Substituting the LPG price with the current domestic gas selling price of \$6.34 per million Btu (excluding value added tax) as the domestic retail gas sales price over the project life—assuming prices are not raised to alternate fuel parity value—produces a 17.3% FIRR. The calculations exclude income and other taxes.

### **E. Sensitivity to Crude Oil Prices**

7. The World Bank crude oil price forecasts over the long term usually have gravitated to an \$18.00–\$20.00 per bbl price range. At appraisal, the price was near the \$18.00 level. Current prices are in excess of \$27.00 per bbl, but World Bank forecasts<sup>3</sup> that the price will decline to \$19.78 in 2005 (at 2003 constant prices). The large decrease projected in the next 2 years has a parallel effect on the recalculated EIRR and FIRR. Adopting prevailing oil and product prices in the EIRR and FIRR calculations would result in much higher returns.

### **F. Weighted Average Cost of Capital**

8. The estimated weighted average cost of capital (WACC) for the Project—in real terms, after taxes—was derived following the methodology in the ADB's *Guidelines for the Financial Governance and Management of Investment Projects Financed by the Asian Development Bank*, using actual capital mix and costs of funds. The real interest costs of loan funds were considered, while the cost of equity was assumed to be 8%. The actual income tax rate was used. The standard income tax rate in the PRC is 33%, although preferential rates are given in some inland provinces. Domestic inflation was assumed at 3% per year.

9. The recalculated WACC is 4.6%, compared to 2.0% estimated at appraisal. The WACC calculated at appraisal, using a different methodology, assumed varying levels for the costs of debt and equity and a higher inflation rate.

<sup>3</sup> Source: World Bank. 2003. *Commodity Prices and Price Projections, Global Economic Prospects*.

## ECONOMIC AND FINANCIAL EVALUATION

**Table A12.1: Sales and Prices**

Item	Total	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2015	2022
<b>Sales Volumes</b>															
Oil (000 bbl)	32,053.5	4,412.3	4,580.1	4,833.7	3,616.6	2,727.2	2,159.1	1,684.2	1,337.8	1,093.5	914.0	782.7	685.0	343.2	32.0
LPG (000 bbl)	11,374.3	94.7	323.1	474.1	474.6	553.9	676.3	685.0	685.0	685.0	685.0	685.0	685.0	520.6	76.2
Naphtha (000 bbl)	2,595.1	7.8	40.6	113.2	111.5	128.7	156.9	158.9	158.9	158.9	158.9	158.9	158.9	120.8	17.7
Natural Gas (million m <sup>3</sup> )	9,121.2	100.0	291.0	345.0	379.0	443.0	541.0	548.0	548.0	548.0	548.0	548.0	548.0	416.5	61.0
Natural Gas (million Btu)	325.8	3.6	10.4	12.3	13.5	15.8	19.3	19.6	19.6	19.6	19.6	19.6	19.6	14.9	2.2
<b>Product Prices (in \$)</b>															
Oil (\$/bbl)		18.8	26.3	23.4	22.8	24.5	20.1	17.8	17.5	17.2	17.0	16.7	16.4	17.9	17.9
LPG (\$/bbl)		21.6	25.7	25.2	28.4	26.5	22.1	19.8	19.5	19.2	19.0	18.7	18.4	19.9	19.9
Naphtha (\$/bbl)		62.0	50.4	26.6	33.5	30.5	26.1	23.8	23.5	23.2	23.0	22.7	22.4	23.9	23.9
Natural Gas (\$/million Btu)		9.3	9.5	9.4	8.5	9.0	7.5	6.7	6.6	6.5	6.4	6.4	6.3	6.8	6.8

bbl = barrel, Btu = British thermal unit, LPG = liquefied petroleum gas, m<sup>3</sup> = cubic meter.

Source: Shanghai Petroleum Corporation and staff estimates based on World Bank crude price forecasts.

Table A12.2: Economic Internal Rate of Return

Item	Total	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2015	2022
<b>Capital Costs (\$ million)</b>																	
Part A	517.5	155.3	253.4	69.3	28.6	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Part B	154.8	38.6	75.1	7.6	11.2	11.2	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>672.4</b>	<b>193.8</b>	<b>328.5</b>	<b>76.8</b>	<b>39.8</b>	<b>22.2</b>	<b>11.2</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Benefits (\$ million)</b>																	
Part A	2,508.4	0.0	0.0	102.9	172.5	180.7	168.9	160.1	153.6	139.7	133.0	128.2	124.6	121.9	119.9	89.7	12.8
Part B	717.4	0.0	0.0	15.2	55.4	61.1	43.3	64.8	50.7	36.4	34.6	32.9	31.1	29.4	27.7	28.3	4.1
<b>Total</b>	<b>3,225.9</b>	<b>0.0</b>	<b>0.0</b>	<b>118.1</b>	<b>227.9</b>	<b>241.8</b>	<b>212.3</b>	<b>225.0</b>	<b>204.4</b>	<b>176.1</b>	<b>167.6</b>	<b>161.0</b>	<b>155.7</b>	<b>151.4</b>	<b>147.6</b>	<b>118.0</b>	<b>16.9</b>
<b>Operating Expenses (\$ million)</b>																	
Part A	402.3	0.0	0.0	11.2	21.7	23.5	27.5	25.9	26.6	24.7	23.2	22.2	21.4	20.9	20.4	14.8	2.1
Part B	214.1	0.0	0.0	6.3	6.9	6.9	9.3	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
<b>Total</b>	<b>616.4</b>	<b>0.0</b>	<b>0.0</b>	<b>17.5</b>	<b>28.6</b>	<b>30.4</b>	<b>36.8</b>	<b>35.1</b>	<b>35.8</b>	<b>34.0</b>	<b>32.5</b>	<b>31.4</b>	<b>30.7</b>	<b>30.1</b>	<b>29.7</b>	<b>24.0</b>	<b>11.3</b>
<b>Net Benefits (\$ million)</b>																	
<b>Total</b>	<b>1,937.1</b>	<b>(193.8)</b>	<b>(328.5)</b>	<b>23.7</b>	<b>159.5</b>	<b>189.2</b>	<b>164.2</b>	<b>189.9</b>	<b>168.6</b>	<b>142.1</b>	<b>135.1</b>	<b>129.6</b>	<b>125.1</b>	<b>121.3</b>	<b>117.9</b>	<b>94.0</b>	<b>5.6</b>
Part A	1,588.6	(155.3)	(253.4)	22.4	122.2	146.2	141.4	134.3	127.1	115.0	109.7	106.0	103.2	101.1	99.5	74.9	10.7
Part B	348.5	(38.6)	(75.1)	1.3	37.3	43.0	22.8	55.6	41.5	27.2	25.4	23.7	21.9	20.2	18.4	19.1	(5.1)
<b>EIRR =</b>	<b>22.9%</b>																

EIRR = economic internal rate of return.

Source: Staff estimates.

**Table A12.3: Financial Internal Rate of Return**

Item	Total	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2015	2022
<b>Capital Costs</b> (\$ million)																	
Part A	517.5	155.3	253.4	69.3	28.6	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Part B	166.0	41.7	81.4	8.1	12.5	11.2	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>683.6</b>	<b>197.0</b>	<b>334.7</b>	<b>77.4</b>	<b>41.1</b>	<b>22.2</b>	<b>11.2</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Benefits</b> (in million \$)																	
Part A	2,508.4	0.0	0.0	102.9	172.5	180.7	168.9	160.1	153.6	139.7	133.0	128.2	124.6	121.9	119.9	89.7	12.8
Part B	717.4	0.0	0.0	15.2	55.4	61.1	43.3	64.8	50.7	36.4	34.6	32.9	31.1	29.4	27.7	28.3	4.1
<b>Total</b>	<b>3,225.9</b>	<b>0.0</b>	<b>0.0</b>	<b>118.1</b>	<b>227.9</b>	<b>241.8</b>	<b>212.3</b>	<b>225.0</b>	<b>204.4</b>	<b>176.1</b>	<b>167.6</b>	<b>161.0</b>	<b>155.7</b>	<b>151.4</b>	<b>147.6</b>	<b>118.0</b>	<b>16.9</b>
<b>Operating Expenses</b> (including taxes)																	
Part A	833.2	0.0	0.0	11.2	21.7	23.5	41.9	52.7	54.8	49.2	46.0	43.8	42.1	40.8	53.0	39.3	5.6
Part B	325.5	0.0	0.0	6.9	19.4	21.1	17.4	23.9	19.7	15.4	14.8	14.3	13.8	13.3	12.7	12.9	8.0
<b>Total</b>	<b>1,158.6</b>	<b>0.0</b>	<b>0.0</b>	<b>18.1</b>	<b>41.0</b>	<b>44.5</b>	<b>59.3</b>	<b>76.6</b>	<b>74.5</b>	<b>64.6</b>	<b>60.9</b>	<b>58.1</b>	<b>55.8</b>	<b>54.1</b>	<b>65.8</b>	<b>52.2</b>	<b>13.6</b>
<b>Net Benefits</b>	<b>1,383.7</b>	<b>(197.0)</b>	<b>(334.7)</b>	<b>22.7</b>	<b>145.8</b>	<b>175.0</b>	<b>141.7</b>	<b>148.3</b>	<b>129.9</b>	<b>111.5</b>	<b>106.7</b>	<b>103.0</b>	<b>99.9</b>	<b>97.3</b>	<b>81.8</b>	<b>65.7</b>	<b>3.3</b>
Part A	1,157.7	(155.3)	(253.4)	22.4	122.2	146.2	127.0	107.4	98.8	90.5	86.9	84.4	82.5	81.1	66.9	50.3	7.2
Part B	225.9	(41.7)	(81.4)	0.2	23.6	28.8	14.7	40.9	31.1	21.0	19.8	18.6	17.4	16.2	14.9	15.4	(3.9)
<b>FIRR =</b>	<b>18.8%</b>																

FIRR = financial internal rate of return.

Source: Staff estimates.

## ENVIRONMENTAL MONITORING INDEXES

Table A13.1: Pudong Area

Parameter	Unit	PRC	1998	1999	2000	2001	2002
		Standard					
SO <sub>2</sub>	mg/m <sup>3</sup>	0.06	0.02	0.02	0.02	0.02	0.02
TSP	mg/m <sup>3</sup>	0.20	0.18	0.16	0.15	0.14	0.11
NOx	mg/m <sup>3</sup>	0.08	0.06	0.06	0.06	0.05	0.05
CO	mg/m <sup>3</sup>	4.00	2.24	2.18	2.11	1.98	1.87

CO = carbon monoxide, mg = miligram, m<sup>3</sup> = cubic meter, NOx = nitrogen oxide, PRC = People's Republic of China, SO<sub>2</sub> = sulfur oxide, TSP = total suspended particulates.

Source: Shanghai Petroleum Corporation based on data obtained from Shanghai Environmental Bureau.

Table A13.2: Puxi Area

Parameter	Unit	PRC	1998	1999	2000	2001	2002
		Standard					
SO <sub>2</sub>	mg/m <sup>3</sup>	0.06	0.03	0.03	0.03	0.02	0.02
TSP	mg/m <sup>3</sup>	0.20	0.18	0.18	0.17	0.19	0.12
NOx	mg/m <sup>3</sup>	0.08	0.06	0.06	0.06	0.06	0.05
CO	mg/m <sup>3</sup>	4.00	2.37	2.23	2.12	2.03	1.94

CO = carbon monoxide, mg = miligram, m<sup>3</sup> = cubic meter, NOx = nitrogen oxide, PRC = People's Republic of China, SO<sub>2</sub> = sulfur oxide, TSP = total suspended particulates.

Source: Shanghai Petroleum Corporation based on data obtained from Shanghai Environmental Bureau.



### TRAINING PROVIDED UNDER THE PROJECT

Type	Location	No. of People	No. of Person-Days
<b>Overseas</b>			
Reservoir Simulation Software	USA	9	44
Production Analysis Software	UK	5	14
Technical Management	USA	6	56
Pipeline Engineering	USA	4	35
Marketing and Management	Japan	2	53
<b>Subtotal</b>		<b>26</b>	<b>202</b>
<b>Local Training</b>			
Automation and Instrumentation	Shanghai	27	210
Gas Production Techniques	Shanghai	50	1,350
Well completion Supervision	Chengdu	2	10
English and Computer	Shanghai	26	540
Finance and Accounting	Shanghai	15	103
Personnel Administration	Shanghai	12	4,413
<b>Subtotal</b>		<b>132</b>	<b>6,626</b>
<b>Total</b>		<b>158</b>	<b>6,828</b>

UK = United Kingdom, USA = United States of America.

Source: Shanghai Petroleum Corporation.