

ASIAN DEVELOPMENT BANK

PPA: IND 26346

PROJECT PERFORMANCE AUDIT REPORT

ON THE

GAS REHABILITATION AND EXPANSION PROJECT
(Loan 1285-IND)

IN

INDIA

December 2003

CURRENCY EQUIVALENTS

Currency Unit – Rupees (Rs)

		At Project Appraisal (August 1993)	At Project Completion (February 1998)	At Operations Evaluation (October 2003)
Rs1.00	=	\$0.032	\$0.025	\$0.022
\$1.00	=	Rs31.70	Rs39.35	Rs45.15

For the purpose of cost comparison in this report, local currency costs were converted into US dollars at average annual exchange rates.

ABBREVIATIONS

ADB	–	Asian Development Bank
APM	–	Administered Pricing Mechanism
CNG	–	compressed natural gas
DESU	–	Delhi Electric Supply Undertaking
EIA	–	environmental impact assessment
EIL	–	Engineers India, Limited
EMP	–	environment management plan
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
GAIL	–	Gas Authority of India, Limited
GDP	–	gross domestic product
GFRP	–	Gas Flaring Reduction Program
GOI	–	Government of India
GREP	–	Gas Rehabilitation and Expansion Project
HBJ	–	Hazira-Bijaipur-Jagdishpur
IGL	–	Indraprastha Gas Limited
INRM	–	India Resident Mission
JEXIM	–	Export-Import Bank of Japan
LNG	–	Liquefied natural gas
LPG	–	Liquefied petroleum gas
MGL	–	Mahanagar Gas Limited
MPNG	–	Ministry of Petroleum and Natural Gas
NEERI	–	National Environmental Engineering and Research Institute
OEM	–	Operations Evaluation Mission
OIDB	–	Oil Industry Development Board
ONGC	–	Oil and Natural Gas Corporation Limited
PCR	–	project completion report
PIB	–	Public Investment Board
PIO	–	project implementation office
PLL	–	Petronet LNG Limited
PSE	–	public sector enterprise
RRP	–	report and recommendation of the President
SCADA	–	supervisory control and data acquisition
TA	–	technical assistance

WEIGHTS AND MEASURES

BCM	(billion cubic meter)	–	1,000 MMCM
hp	(horsepower)	–	746 watts
in	(inch)		
km	(kilometer)	–	1,000 meters
kcal/m ³	(kilocalorie per cubic meter)	–	unit of calorific value of gas volume
kg/cm ²	(kilogram per square centimeter)	–	unit of gas pressure
kcal/kg	(kilocalorie per kilogram)	–	unit of calorific value of gas weight
m	(meter)	–	1 meter
MMBTU	(million British thermal unit)	–	unit of energy
MMCM	(million cubic meter)	–	unit of gas volume
MMSCMD	(million standard cubic meter per day)	–	unit of gas volume per day

NOTES

- (i) The fiscal year (FY) of the Government and Gas Authority of India Limited ends on 31 March. FY before a calendar year denotes the year in which the fiscal year ends. For example, FY2001 begins on 1 April 2000 and ends on 31 March 2001.
- (ii) In this report, \$ refers to US dollars.

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BASIC DATA

Gas Rehabilitation and Expansion Project (Loan 1285-IND)

PROJECT PREPARATION/INSTITUTION BUILDING:

TA No.	TA Project Name	Type	Person-Months	Amount ¹ (\$)	Approval Date
2008	Regulatory Framework for the Gas Industry	ADTA	18.0	600,000	7 Dec 1993
1837	Natural Gas Rehabilitation and Expansion	PPTA	n.a.	100,000	31 Dec 1992

KEY PROJECT DATA (\$ million):	As per ADB	
	Loan Documents	Actual
Total Project Cost	1,008.0	560.44
Foreign Currency Cost	646.0	363.28
Bank Loan Amount/Utilization	260.0	157.47
Bank Loan Amount/Cancellation		102.53
Amount of Cofinancing	417.7	63.83

KEY DATES:	Expected	Actual
Fact-Finding		12-23 Apr 1993
Appraisal		12-27 Aug 1993
Loan Negotiations		8-12 Nov 1993
Board Approval		7 Dec 1993
Loan Agreement		17 May 1994
Loan Effectiveness	15 Aug 1994	15 Aug 1994
First Disbursement		6 Jun 1995
Project Completion	31 Aug 1997	31 Jul 1998
Loan Closing	28 Feb 1998	22 Jun 1998
Months (effectiveness to completion)	36.5	47.5

KEY PERFORMANCE INDICATORS (%):	Appraisal	PCR	PPAR
Financial Internal Rate of Return	15.0	18.8	19.8 (before tax) 18.8 (after tax)
Economic Internal Rate of Return	26.4	30.5	26.2

BORROWER/EXECUTING AGENCY: Gas Authority of India Limited

MISSION DATA:

Type of Mission	No. of Missions	Person-days
Fact-Finding	1	60
Appraisal	1	80
Project Administration		
- Inception	1	33
- Review	4	46
- Project Completion	1	9
Operations Evaluation ²	1	57

¹ Represents approved amount of technical assistance.

² The Operations Evaluation Mission comprised. Richard Simpson (Principal Evaluation Specialist/Mission Leader), Julian Bharier (international gas and energy policy expert), and Gyan Prakash (domestic gas engineer consultant).

EXECUTIVE SUMMARY

In December 1993, the Asian Development Bank (ADB) approved a loan of \$260.0 million, to finance the construction of the Gas Rehabilitation and Expansion Project (GREP) in India. The Borrower and executing agency was the Gas Authority of India Limited (GAIL) and the Government of India was the guarantor.

The main components of the GREP were the construction of a pipeline between Bijaipur and Dadri to enhance the capacity of the Hazira-Bijaipur-Jagdishpur (HBJ) pipeline, together with new or upgraded gas terminals and compressor stations as well as installation of cathodic protection and a supervisory control and data acquisition (SCADA) telecommunications monitoring system. The main objective of GREP was to raise the capacity of the HBJ pipeline from 18 MMSCMD of natural gas to 33 MMSCMD. As a result, the project was expected to annually provide feedstock for 2.45 m tons of fertilizer and meet the fuel requirements for 1,700 MW of additional power generation, as well as to produce 40,000 tons of liquefied petroleum gas (LPG) and 396,000 tons of ethane/propane. Additionally, it would increase the share of gas in India's total energy supply, resulting in savings in foreign exchange.

In addition to an overall evaluation of GREP, the main focus of the Operations Evaluation Mission (OEM) was to (i) assess in depth why project costs were 44% lower than estimated at appraisal; (ii) attempt a quantification of the environmental impacts of GREP; and (iii) evaluate the reforms carried out and proposed in the gas sector in relation to the conditions attached to the ADB loan.

The physical project was implemented successfully, with no major technical or operational difficulties encountered and with minimum delay. All project components are meeting their design outputs and the overall HBJ pipeline system is working at full capacity. Changes in the size and route of the GREP pipeline as well as in specifications of the gas compressors were discussed between ADB and GAIL during project implementation. ADB eventually approved GAIL's proposals, which proved to be both economic and effective. However, ADB could not agree to GAIL's procurement procedures for the SCADA system of continuous pipeline monitoring. This item was taken out of ADB financing and financed six years later by JEXIM, at a very much lower price than originally estimated. The system is now working well.

All project components visited were observed to be operating satisfactorily and all maintenance and safety procedures comply with international industry standards. In addition, GAIL has implemented several energy conservation measures. The GREP project has laid the groundwork for the planned massive expansion of India's gas transmission network, as well as the enhancement and diversification of GAIL's operations.

The original intention, that the Project should supply gas to electric power generation and fertilizer production has proved to be appropriate in the context of India's economic development goals. Indeed, GREP has exceeded its objectives in these two major industries. Several new gas-fired units of power plants and several new fertilizer factories are now operating.

The final project cost, was 44% lower than estimated at appraisal. The original costing, particularly in respect of the intangible non-investment items, erred substantially on the high side. For example, neither physical nor price contingencies were utilized, while interest during

construction and taxes and duties were much lower than forecast. This has happened in other ADB projects in India and is cause for broader concern. Cost savings in non-investment items represented 78% of overall project cost savings. The OEM was informed that savings in tangible costs (20–25% of project costs) were known to GAIL at the time GREP was approved by the Public Investment Board (PIB), which was 18 months later than project appraisal and 15 months after ADB's approval of the loan.

At the time of project appraisal, medium-term domestic finance was not available to GAIL and the company was therefore willing to accept ADB's, foreign currency financing. GAIL's financial situation improved dramatically after project appraisal and during implementation. Together with much lower project costs, this enabled GAIL to cancel 39.4% of the original \$260.0 million ADB loan and 62% of the JEXIM loan, while there was no need to draw on agreed loans from suppliers' credits or the Oil Industry Development Board. Rupee loans for 8-10 years are now available and, using these and its own resources, GAIL fully repaid, in 2002, both ADB and JEXIM loans.

GAIL has emerged as a well-managed, extremely competent, commercially astute and highly profitable company, proving that public sector enterprises (PSE) do not necessarily have to be unbundled and privatized to perform well, provided the right incentives are allowed and markets are opened up to real competition. GAIL has become an integral part of India's natural gas sector and been given the monopoly for construction of all new pipelines longer than 100 km. GAIL's strategic planning is highly advanced and ambitious. It aims to consolidate existing businesses, including its three joint ventures, increase its consortium activities in hydrocarbon exploration and expand its range of gas-based products, particularly CNG and LPG, as well as pursue contracts with gas-rich nations for imported supplies of gas and LNG.

Quantification of GREP's environmental benefits has proved to be extremely difficult, not least because it appears the responsibilities of the various agencies concerned with environmental issues overlap, there is little coordination between them and there is no agreement on appropriate measurable indicators, or the means of monitoring them. The OEM witnessed major environmental improvements as a result of the GREP pipeline. The introduction of compressed natural gas (CNG), manufactured by GAIL joint ventures in Delhi and Mumbai, was a major breakthrough in contributing to the Government's policy to reduce vehicle emissions. It was not foreseen at appraisal but is proving to be economically and environmentally sound and will be replicated in several other priority cities.

A massive and visible improvement in the environmental situation around the Mathura Refinery, and to historical and heritage monuments in the Agra Trapezium area, has been achieved with the conversion of the refinery's power plant from coal to gas, and there have also been major reductions in pollution formerly generated by the small-medium glass factories in Ferozabad and the iron foundries in Agra, all of which converted from coal and are now being supplied through GAIL's gas distribution networks in these cities.

GAIL has complied with all ADB's loan covenants, including those related to financial ratios. However, three loan covenants agreed by the Government have not been fully complied with, partly because they were poorly formulated and unrealistic.

The recalculated EIRR is 26.2% and the FIRR is 18.8% compared to 26.4% and 15.0%, respectively, at the time of appraisal. GAIL's financial position is very strong.

The overall conclusion of this evaluation is that the GREP was **successful** in terms of its relevance, efficacy, effectiveness and sustainability. The performance of the borrower, GAIL, was highly satisfactory. However, the performance of ADB was less than satisfactory in two major respects—inaccurate costing of GREP, leading to cancellation of 39.4% of the loan, and unrealistic formulation and implementation of loan covenants by the Government. Both of these diminished ADB's value added to GREP.

There are a number of lessons to be learned from this evaluation, particularly for ADB. The OEM recommends that:

- (i) There should be a realistic assessment of financial costs, technical risks, inflation and the competitive situation for all tangible investment components of projects. In particular, ADB should rely on expert technical advice as the basis for project cost estimation and the impact on this cost estimation of any changes in project scope or technical specifications.
- (ii) Intangible non-investment costs, especially physical and price contingencies and interest during construction, should be fully quantified on the basis of the specific conditions and risks relating to GREP. Contingencies should be fully justified and care should be taken to avoid arbitrary percentage mark-ups and double counting.
- (iii) There should have been clear justification of the financial, technical, or environmental additionality of ADB's involvement in GREP at the time of appraisal. If the loan is approved substantially ahead of PIB approval, justification should be reconfirmed at the time of PIB approval. ADB's financing was probably not required.
- (iv) ADB should make realistic efforts, at the time of appraisal, to assess its potential leverage through loan covenants, with respect to both the borrower and the guarantor, and to ensure that the covenants are adequately formulated. Consideration should be given to whether it is appropriate for ADB to impose loan covenants relating to sector policy issues in what are essentially investment projects, particularly when the borrower (in this case GAIL) has little or no influence on sector policy.
- (v) If GAIL continues to perform as well as it has done in recent years, and if it requires long-term finance in dollars or rupees, then ADB should consider to add value by financing a share of GAIL's approved investment program.

There are no specific follow-up actions.

INDIA GAS REHABILITATION AND EXPANSION PROJECT (as implemented)

-  National Capital
 -  City/Town
 - MSP Matavika Steel Plant
 - IPCL Indian Petro Chemicals Limited
 - LPG Liquefied Petroleum Gas
 - C.S. Compressor Station
 - P.P. Power Plant
 - F.P. Fertilizer Plant
 -  Existing Pipeline and Facilities
 -  GREP Pipeline and Facilities
 -  GREP Pipelines and Facilities
 -  Existing Facilities being upgraded
 -  Bridge
 -  River
 -  State Boundary
 -  International Boundary
- Boundaries are not necessarily authoritative
GREP = Gas Rehabilitation and Expansion Project



I. BACKGROUND

A. Rationale

1. The 1989 operational strategy of the Asian Development Bank (ADB) for India emphasized promoting industrialization through support of efficient physical, human and financial resource use. This overall objective was to be achieved through three initiatives: (i) strengthening the industrial policy environment in order to encourage greater private sector participation; (ii) supporting the development of physical and financial infrastructure through public and private sectors; and (iii) identifying private investment as a catalyst in areas where the policy environment was being improved or where new technology was being introduced.

2. It was in this context that ADB approved a loan for the Hydrocarbon Sector Reform Program in late 1991. This aimed to accelerate exploration for, and development of, domestic hydrocarbon resources and contain oil imports at 45% of total fuel consumption.¹ In addition to requiring major balance of payments support (from major donors) it became essential to reduce the country's dependence on hydrocarbon imports (over 27% of total imports in 1991-3), particularly since there was a steadily rising gap between energy demand and supply from domestic energy sources.

3. This enabled ADB to widen its operations across all key infrastructure sectors, and thereby assist the Government of India (GOI) in implementing its economic development policies. In particular, ADB supported national-level policy reforms in the hydrocarbon sector and financial and capital markets. At the same time, the Government in the early 1990s, faced a serious balance of payments crisis.

4. The Eighth Five-Year Plan (1992-1997) accorded priority to: (i) encouraging high levels of capacity utilization to raise productivity and cost efficiency; (ii) attracting private initiatives by reducing the Government's regulatory controls; (iii) reforming the public enterprise sector; (iv) enhancing competition by allowing a greater inflow of foreign capital and technology; and (v) reorienting public expenditures for human resource and infrastructure development. In the early 1990s, the Government's strategy for energy development was consistent with its strategy for overall economic development, which emphasized the application of greater market discipline, increased participation of the private sector, removal of institutional constraints and maximum exploitation of indigenous rather than imported resources.

B. Formulation

5. In October 1992, GOI and the Gas Authority of India Ltd. (GAIL) requested ADB assistance to construct infrastructure that would enable flared and associated gas from offshore fields to be used onshore. ADB responded, through a technical assistance (TA) grant of \$100,000, which was completed in 1993. A further \$300 million loan, for a Gas Flaring Reduction Program (GFRP), aimed at bringing flared gas onshore, was approved in 1993.²

6. The TA recommended a project to expand the existing network and found it to be technically and financially viable. Following a fact-finding mission in April 1993, and appraisal in

¹ The evaluation of this loan is available at ADB. 2001. *Program Performance Audit Report on the Hydrocarbon Sector Program Loan in India*. Manila.

² Loan 1222-IND: *Gas Flaring Reduction Project*, for \$300 million, approved on 30 March 1993.

August 1993, a loan of \$260 million was approved in December 1993 for the Gas Rehabilitation and Expansion Project (GREP).³

7. The Borrower and Executing Agency would be GAIL and the Guarantor was the Government of India.

C. Purpose and Outputs

8. The main objective of GREP was to enhance the capacity of the pipeline from Hazira, on the west coast to Bijaipur and Jagdishpur in Central India (HBJ) from 18 million standard cubic meter per day (MMSCMD) of natural gas to 33 MMSCMD, by laying a 505 kilometer (km) 28" diameter loop line between Bijaipur and Dadri, with spur lines to Bawana (75 km, 18 inch [in] diameter) and Faridabad (10 km, 12 in diameter), together with the installation of new and upgraded compressor stations and associated facilities, institutional strengthening and training.

9. GREP was expected to increase the share of natural gas in India's total energy supply from 6 to 13% by 1999/2000, saving on average, \$600 m annually in foreign exchange, providing feedstock for 2.45 m tons per annum of fertilizer, meeting the fuel requirements for 1,700 megawatt (MW) of additional power generation, and producing 40,000 tons of liquefied petroleum gas (LPG) and 396,000 tons of ethane/propane annually.

10. In addition, ADB loan covenants attached to GREP were directed at further reform in the natural gas sector. In particular, GOI was required to: (i) allow gas marketing companies to determine the price of gas, based on market conditions once the Administered Pricing Mechanism (APM) expired; (ii) reduce its equity ownership in GAIL by not less than 30% by December 1996, through dilution or divestiture of its shareholding; and (iii) limit its role to providing broad guidelines on gas use, giving gas companies freedom to determine their own marketing strategies.

D. Cost, Financing, and Executing Arrangements

11. The total project cost was estimated at \$1,008 million, of which \$646 million was foreign exchange and \$362 million local currency. The base cost (i.e., excluding physical and price contingencies, each 10% of base cost, and interest during construction, 13% of base cost, was \$753.8 million, comprising \$486.2 million foreign exchange cost and \$267.6 million local currency. The main components of the base cost were compressors and terminals (29%), pipeline and associated materials (26%) and a gas processing plant (14%). ADB's loan of \$260 million was to finance the bulk of the foreign exchange cost of compressors, pipeline and institutional strengthening, representing 40% of total foreign exchange cost and 26% of total project cost. The project scope, appraisal estimates versus actual costs, and project implementation schedule are attached as Appendixes 1, 2, and 3.

12. During project processing, the Export-Import Bank of Japan (JEXIM), indicated it would also be willing to cofinance GREP. Eventually, JEXIM agreed to finance 17% of total project cost, with a further 17% expected to be provided by export and suppliers' credit. GAIL would match ADB's contribution of 26% while the remaining 14% would be provided by the Oil Industry Development Board (OIDB). GREP was to be implemented by GAIL, which had already established a Project Implementation Office (PIO).

³ Loan 1285-IND: *Gas Rehabilitation and Expansion Project*, for \$260 million, approved on 7 December 1993.

E. Completion and Self-Evaluation

13. ADB's project completion report (PCR) was finalized in December 2001, on the basis of a review mission in August 2001, although GREP was completed in July 1998 (footnote 3). GAIL had been requested to provide a draft PCR, but one was not prepared and only basic data was provided. The major conclusion of the PCR was that the primary objective of GREP (to upgrade the capacity of the HBJ pipeline to transmit 33 MMSCMD of natural gas) had been achieved with only four months delay in commissioning, and cost savings of 44%, and, that GREP was rated as "successful". In addition, GREP had contributed to environmental improvements by reducing gas flaring, substituting gas for coal in electricity generation and industrial plants and reducing pollution from a large number of small industries, particularly in the Agra area. The PCR noted, that, while GAIL had complied with all ADB's loan covenants, GOI had failed to comply with those relating to reform of the gas sector.

14. The PCR also criticized ADB's appraisal of GREP. It was noted that in view of the fact that 44% of the ADB loan was cancelled, "a more realistic assessment of project costs should be made at appraisal" by ADB and "there is still some scope for reducing the time schedule by effective appraisal".

15. With respect to GAIL, the PCR recommended that GAIL should establish a procurement/monitoring system for cutting down delays in estimating bids; provide adequate staff training; link up with other companies to bring additional gas into India from abroad; and have more powers to operate on a commercial basis.

F. Operations Evaluation

16. The Operations Evaluation Mission (OEM) was fielded in October 2003. The main objectives of the Mission, were to undertake: (i) an in-depth assessment of why project costs were 44% lower than estimated at appraisal; (ii) an attempt at quantification of the environmental impacts of GREP, and the impact of gas supply on consumers; and (iii) an evaluation of the reforms carried out and proposed in the gas sector, as a result of covenants included in the ADB loan.

17. The OEM visited senior technical and financial management and staff of GAIL, as well as GAIL staff at installations along the GREP pipeline. In addition, the OEM consulted with the Director of Natural Gas at the Ministry of Petroleum and Natural Gas (MPNG), officials in various environmental agencies, staff of the World Bank, JEXIM and ADB's India Resident Mission (INRM), and a sample of existing and former customers of GAIL in the electric power, fertilizer, refinery and small-scale manufacturing sectors.

18. Facilities at both ends of GREP were visited, as were compressor stations at Vaghodia and Jhabua and the city gate station at Ferozabad. Site visits were also made to Delhi Electric Supply Undertaking (DESU) and Dadri power plants, Mathura Refinery, National Fertilizer Limited's plant at Bijaipur, iron foundries in Agra and glass factories in Ferozabad.

II. PLANNING AND IMPLEMENTATION PERFORMANCE

A. Formulation and Design

19. The average annual growth of India's gross domestic product (GDP), from 1992, was 6.7%.⁴ To maintain economic growth while reducing the current account deficit, the Government focused on reforms to the energy sector to reduce imports of petroleum products and increase the efficiency of energy use. GREP enhanced the infrastructure necessary to make use of offshore gas that was being flared thereby making its supply to important large consumers such as power generation and fertilizer plants possible. This was consistent with ADB's country operational strategy in India (para. 1). The relevance of GREP was reinforced by sustained high international oil prices. Without GREP, India's foreign exchange bill to meet energy demand would have increased even more rapidly than it did.

20. Project formulation and design was helped considerably by TA 1837-IND, approved in December 1992, to study the financial restructuring of GAIL and to reconfirm the proposed rehabilitation and expansion scheme represented the optimum design.

B. Achievement of Outputs

21. The prime objective of increasing the throughput of the HBJ pipeline to 33 MMSCMD was achieved by February 2000, with throughput increasing gradually from 25 MMSCMD at the time GREP became fully operational in January 1998. Even so, the share of natural gas in total energy supply is slightly less than the 10% targeted, as energy demand had grown rapidly.⁵ The objective of reducing dependence on imported petroleum and products was not achieved. As a proportion of total imports, petroleum products dropped to 15% in 1998-1999 but during the last 2 years, it had risen again to 29%.⁶ By 2000, India's energy balance showed that imports represented 69% of total petroleum consumption compared with 45% a decade earlier.⁷ Estimated foreign exchange savings due to GREP were about \$420 million annually rather than the \$600 million expected.⁸

22. The other quantitative targets were met or exceeded. Gas has provided inputs for 4.02 million tons of fertilizer production annually, 1.57 million tons more than envisaged, 2,483 MW of electricity generation, 783 MW more than forecast, and 1.1 million tons of ethane/propane/LPG, more than double the expected amount.

23. The major consumers of the HBJ pipeline are 9 electric power plants, 7 fertilizer factories, 2 petrochemical plants, 2 compressed natural gas (CNG) plants, 2 LPG plants, and one industrial complex. Total gas sales to these groups are given in Appendix 4 (Gas Sales/Percentage Sales), which shows that, in 2002, power generation consumed 44% of total gas sales, fertilizer factories 43%, petrochemical and CNG plants 3% each, and others 7%. The GREP pipeline enabled 4 new operations (2 fertilizer plants, 1 power plant, and 1 LPG plant) to be constructed to use gas and Mathura Refinery's power plant to be converted to gas, while additional gas could be provided for all other plants along the HBJ pipeline.

⁴ The World Bank. 2003. *India: Sustaining Reform, Reducing Poverty* (a World Bank Development Policy Review, p. 3).

⁵ ADB. 2003. *Country Strategy and Program – India 2003–2006*.

⁶ Data from the Central Bank of India Monthly Bulletins.

⁷ Data from *Country Energy Data Report – India*, website of U.S. Department of Energy, 13 October, 2003.

⁸ Calculated by OEM on the assumption that if the 15 m MMSCMD additional gas provided by GREP had had to be imported, the price would have been \$2.3 million British thermal unit (MMBTU) (30 SCM = 1 MMBTU).

24. In addition, and not foreseen at appraisal, by 2002/3 sufficient gas was available to Indraprastha Gas Limited (IGL) and Mahanagar Gas Limited (MGL), both joint venture companies of GAIL, to distribute sufficient supply of CNG to enable major conversion of the Delhi and Mumbai public transport systems to clean fuel. Over 82,000 vehicles in Delhi, including all buses, most motor-rickshaws and many taxis now use CNG (as well as gasoline) and the number of CNG filling stations has risen rapidly from the original nine to 115,⁹ to meet growing demand. In Mumbai, 78,000 vehicles have converted to CNG.¹⁰

25. There were some changes made to the scope of GREP, after approval but before commencement of construction, all of which clearly improved the Project and contributed substantially to reducing overall cost. The total length of the pipeline was reduced by 7 km to 498 km, due to realignment of the route and the pipe diameter was increased from 28 to 36 in to allow for future increased gas availability. The 75 km 18 in spur line from Dadri to Bawana was not laid during project implementation, because the gas-based power plant at Bawana, which was to be the sole user, had been delayed. Following a Supreme Court directive to reduce pollution and environmental degradation around the Taj Mahal and other important historical sites, spur lines were laid to Agra and Ferozabad as well as to Mathura Refinery. These spurs were not financed, but were approved by ADB.¹¹

26. There were also changes to the horsepower ratings of the compressors, partly because of the larger pipeline diameter, but mainly because compressor technology was advancing rapidly and GAIL was determined to use the most efficient, state-of-the-art equipment and take full advantage of highly competitive market conditions. ADB agreed to all changes in project scope, as well as to changes in the type of compressors, but did not reassess the impact on total project costs and consider any immediate cancellation of savings.

27. ADB's objective of further encouraging gas sector reforms, through the use of loan covenants, was not achieved, partly because the covenants were not properly formulated. The APM, which is used to set the landed cost of gas for the GREP pipeline, is still in operation 10 years after the covenant was agreed, in the absence of any other mechanism for setting the price of this untradeable product. The real issue for ADB was clearly not the APM itself, but the level at which the gas price has been set. At present, the price is 75% of the international price of a basket of internationally traded fuel oils. This, in effect, provides a "subsidy" for the delivered price of gas, and in particular helps keep prices of electricity and fertilizer lower than they would otherwise be. The latest Government deadline for abolishing the APM in December 2002, has passed and the Government has still not set a new date. However, when other market-priced sources of gas becomes available, starting in 2004, the APM will anyway have to be amended or abandoned, as gas provided by competitors will be at full market price.

28. The Government has taken measures to divest its shareholding in GAIL by 32.7%, in accordance with the ADB's covenant. However, 9.6% was to other public sector enterprises (PSEs), through a share swap, which was not the intent of the covenant. Details of GAIL's current shareholding is shown in Table 1.

⁹ This comprises 78 online/mother stations, 7 daughter stations and 30 daughter booster stations.

¹⁰ Data for Delhi from the IGL website, *CNG Consumers*, 2 October 2003; data for Mumbai from GAIL (India) Ltd., *Gas and Beyond – 19th Annual Report 2002-2003*, p. 13.

¹¹ These changes to the project scope were, however, also considered and agreed to in a separate ADB report, *Technical Assistance to the Republic of India for the Environmental Improvement and Sustainable Development of the Agra-Mathura-Ferozabad Trapezium in Uttar Pradesh*, December 1995, p. 3. This TA was approved by the President on 15 December 1995.

Table 1: Gas Authority of India Limited Current Shareholding

Item	%
GOI	67.35
PSEs	
- ONGC	4.83
- IOC	4.83
Unit Trust of India	2.03
Life Insurance Company of India	2.99
Global Depository Receipts	12.09
Other Private Investors	5.88
Total	100.00

GOI = Government of India, IOC = Indian Oil Corporation, ONGC = Oil and Natural Gas Corporation Limited, PSE = public sector enterprise.

29. Further divestment is desirable but now seems to be less relevant in a new competitive market. Nevertheless, even though GAIL pays the Government high dividends and taxes, it is likely the Government will soon divest more of its shares due to the budget deficit and short-term liquidity reasons, while still keeping a controlling interest in GAIL.

30. The original loan covenant requiring GAIL to open up its marketing arrangements to competition has also been overtaken by events. GAIL is actually doing no marketing at present to any customers, particularly to the small-scale sector, where it does have marketing freedom, because it has to restrict supply owing to a shortage of gas in the GREP, and an overall shortage of gas in the country. Moreover, GAIL's major customers are the electricity and fertilizer industries, which have entered into long-term contracts as directed by the Government. GAIL has already planned to transfer future marketing activities into a new company to compete with other major Indian and international companies that are already developing new sources of gas supply and new markets, a positive situation which did not exist at the time of project design.

C. Cost, Financing Plan, and Scheduling

31. Project cost savings of 44.4% led to only 60.6% of the ADB loan being used. A clear distinction should be made between tangible investment costs (i.e., for purchase and installation of project equipment) and physical and price contingencies which were equivalent to 25% of investment costs.¹² At the request of ADB, the contingency allowances normally used by GAIL¹³ were substantially increased. This happened in several other ADB projects at around the same time in India, even though it was not consistent with ADB's own guidelines.¹⁴ There was also an element of double counting in physical contingencies, first because the estimate for

¹² These contingencies were certainly not justified in the report and recommendation of the President, which noted (p. 27) that "it is reasonable to assume that the geological risk is minimal" and "the risks of delays in [project implementation are minimal because: (i) the Project is in an advanced stage of preparation, (ii) GAIL has gained considerable experience in implementing such projects, and (iii) GAIL is being assisted in project management and implementation by reputable consultants".

¹³ 3–5% physical contingencies for a project which extended and upgraded an existing project and negligible for price contingencies because these were essentially incorporated in the costs of delivered equipment.

¹⁴ See *Guidelines for the Financial Governance and Management of Investment Projects Financed by ADB*. pp. 12–17.

'pressure upgrading' covered costs of potential technical changes to components of the pipeline system that later proved unnecessary; second, because the estimate for 'consultancy services' was for foreign consultancy which was eventually not needed.

32. Other intangible costs proved to be inflated. For example, the actual interest during construction was lower due to the lower amount actually disbursed. Moreover, taxes, duties, insurance and handling were based on a larger foreign exchange component of investment costs than GAIL anticipated. Of the total difference between estimated and actual project costs (\$447.6 million), as much as 78% was accounted for by differences in the costs of intangibles.

33. The reasons for differences between estimated and actual costs for the investment components that had significant savings are examined in Table 2.

Table 2: Comparison of Key Appraisal Estimates with Actual Costs

Item	Estimate (\$ million)	Actual (\$ million)	Reasons
Land Acquisition and Right of Way	27.00	2.88	(i) The original estimate included a high compensatory cost for the pipeline passing through two stretches of forest, 35 km and 45 km respectively, near Guna and Muraina. The former ultimately did not require any compensation, while the latter required less than half the estimated compensation, saving over \$5 million. (ii) The land for compressor stations at Bijaipur and Dholpur was ultimately not required as these stations were dropped because of the increased pipeline size. This resulted in a saving of about \$16 million. (iii) Actual compensation paid out for right of way was at a lower rate than estimated.
Cathodic Protection	7.60	1.10	The actual cost figure is understated. It should be about \$2.5 million. The reduction was on account of selecting a different type of power source.
Compressors	188.10	110.56	Deletion of the Bijaipur and Dholpur compressors, on account of increased size of the pipeline, in early 1994 resulted in a saving of \$45 million. A further reduction of \$32 million was due to acceptance of larger compressors than those envisaged at appraisal. The original estimate had envisaged 6-9MW units as there were five competitive manufacturers in this range. However, at GAIL's insistence, manufacturers of larger compressors were later allowed to bid.
LPG (Gas Process) Plant	108.20	93.77	The actual cost was lower because of competition among suppliers.

Item	Estimate (\$ million)	Actual (\$ million)	Reasons
Telecom/ SCADA	12.20	6.62	A significant saving of \$6 million was achieved due to intensive competition in the telecommunications equipment and SCADA hardware/software market at the time of procurement. A drop of almost 50% in the prices of these items occurred during this period.
Institutional Strengthening	2.00	0.63	A Gas Training Institute was set-up by GAIL in collaboration with Dansk Olie og Natur Gas at Noida, near Delhi during 1995-1997. This institute extended all training facilities required for world class operation and maintenance of gas pipeline systems. As a result, some of the allocation for training and institutional strengthening was not required.

GAIL = Gas Authority of India, Limited, km = kilometer, LPG = liquefied petroleum gas, MW = megawatt, SCADA = supervisory control and data acquisition.

34. There are two components where costs were greater than estimated: the line pipes and pipeline construction. The increase in pipeline diameter from 28 in to 36 in should have led to an increase of about 42% in the "line pipe and coating" cost. However, due to the depressed world steel market at the time of procurement, the actual increase was only 12.5%. The increase in pipeline construction cost was 28.6%, slightly lower than expected (30%) under normal conditions.

35. It should be noted that, although ADB approved the loan in late December 1993, the Public Investment Board (PIB) did not approve GREP until the first quarter of 1995. GAIL could only begin to implement the Project after that date. In the intervening period, ADB sent two missions to India, an inception mission in March 1994 and a review mission in November 1994. Although these missions discussed project implementation issues and changes in project scope, they did not discuss PIB approval or the potentially large reduction in total project costs. Indeed, the November mission reported it was likely project costs would increase by \$1.5 m.¹⁵ This conflicts with information obtained by the OEM which suggests that, by the time of PIB approval, GAIL's management was confident that project costs (which essentially meant the tangible investment costs) would be 20-25% lower than originally estimated, partly due to a downturn in international steel prices, partly because of intensive competition among equipment and civil works suppliers, partly because of the lower cost of compressors and partly because of lower land acquisition payments.¹⁶ GAIL would have saved commitment charges if part of the ADB loan had been cancelled at that time.

36. At the time of appraisal, there were undoubtedly some advantages to GAIL to accept a larger loan from ADB, the only major multilateral development bank then operating in the hydrocarbons sector in India. The terms of the ADB loan were much better than market, with an interest rate of about 6.3%, plus 1.2% for the Government guarantee, and a maturity of 20 years, including a four-year grace period. Rupee loans were either unavailable, or only available on a short-term basis. Suppliers' credits were priced at around 8%, while funds from the OIDB would cost 16%. The offsetting factor was ADB's commitment charge of 0.8% on the

¹⁵ Back-to-Office Report of the Review Mission, dated 9 December 1994, p. 4.

¹⁶ This statement is based on OEM's interviews with GAIL management and finance personnel who were involved with GREP at the time.

undisbursed portion on the loan and, particularly, the charge on the unused portion of the original loan. This commitment charged amounted to approximately \$1.8 million.

37. As a result of savings, no suppliers' credit and the funding from OADB were not utilized. Only \$63.8 million of the original JEXIM loan of \$170 was utilized, the balance was later disbursed for other purposes. Only \$157.5 million, 60.6% of the ADB loan was disbursed. GAIL's financial situation improved dramatically during project implementation. Added to the reduction in total project costs, this enabled the company to reassess GREP's sources of finance, using astute financial management to ensure that it used the cheapest funding first. With attractively priced Rupee loans now available for 8–10 years, both the ADB and JEXIM loans have been prepaid in 2002.

38. In retrospect, the inflated project cost estimates appear to have been implicitly agreed between the Government, ADB, and GAIL, which needed cheaper and longer-term financing at a time when its liquidity situation was poor. ADB appears to have rushed the loan to the Board in December 1993, and, the Ministry of Finance appears to have supported the premature approval of ADB's loan. It would have been prudent for ADB to wait for PIB approval of GREP, and then reassess total project costs before approving its loan. Indeed, since the eventual foreign exchange cost savings in GREP (\$283 million) were actually larger than the original ADB loan, questions can now be asked about the need for ADB's loan in the first place, and, whether ADB brought any financial additionality or value added to GREP.

39. The significant savings in ADB's loan was not unique to this project. Similar ADB projects in India experienced large cost overruns. Of the 66 loans to India approved by ADB to September 2003, 22 showed a disbursed loan amount at least 20% lower than the approved loan amount. According to INRM staff, there are several reasons for this, including exchange rate fluctuations, more competitive procurement, and cancellations by ADB or the borrower over technical, financial or procurement issues.¹⁷

D. Consulting Services, Procurement, and Construction

40. As agreed at appraisal, GAIL appointed Engineers India Limited (EIL), an experienced Indian engineering firm, to: (i) carry out basic design and engineering of all project components, (EIL was supported by Det Norske Veritas, an international consulting firm); (ii) assist in procurement of materials and equipment; (iii) provide quality assurance and quality control; (iii) provide project management services reporting; (iv) assist with commissioning and start up; and (v) prepare an environmental impact assessment (EIA).

41. GAIL received considerable guidance from ADB on its procurement guidelines and both the ADB and JEXIM components of GREP followed these. No issues arose with the procurement of pipeline and associated equipment, supplied on time by two Indian companies. In the case of the compressors, ADB finally agreed to GAIL's request, in opposition to both MPNG and EIL, that bidders should determine the most cost-effective size and design. This had the impact of reducing the cost of compressors and increasing their efficiency. In the case of the supervisory control and data acquisition (SCADA) system for continuous pipeline monitoring, GAIL believed that it could procure the equipment at a substantially cheaper price than that bid by the only technically competent bid received under ADB procurement. GAIL, therefore, proposed a new tendering process, which ADB could not agree to as, under its

¹⁷ In particular the major depreciation of the rupee from Rp31 to Rp45 reduces the US\$ equivalents of project cost in local currency.

procedures, GAIL should have accepted the original bid. In the event, ADB and GAIL agreed to remove the SCADA system from ADB financing. It was financed 6 years later by JEXIM, at a very much lower price than originally estimated or bid.

42. The consultants and civil and structural contractors satisfactorily completed their work within the time schedule specified in their contracts.

E. Organization and Management

43. Throughout project implementation and operation, GAIL's performance has been highly satisfactory as the major player in the Indian long-distance gas pipeline sector. It now employs 3,385 staff, of whom 2,257 are technical (2,147 on site and 110 at Headquarters) and 1,128 are non-technical (886 on site and 242 at Headquarters).¹⁸ In 2002, GAIL, was rated second among global gas utilities by the Global Platts Survey, in terms of return on capital invested and was one of 20 Indian companies included in the Forbes 2000, where the world's biggest companies were measured by a composite of sales, profits, assets and market value. GAIL's capabilities to formulate, design, implement, operate and maintain gas pipeline projects are in line with international standards. GAIL's organization structure is shown at Appendix 5.

44. All ADB loan covenants in connection with GAIL's obligations were complied with, illustrating GAIL's commitment to GREP and the capability of its staff (Appendix 6). These included the covenant to establish take-or-pay contracts with all major gas consumers. However, as discussed in paras. 28-31 above, three covenants agreed to by the Government as guarantor of the loan, were not complied with. These related to gas reform sector issues regarding gas pricing, divestment of Government shares, and gas marketing arrangements, none of which were the responsibility of GAIL. OEM considers these covenants were imprecise and such conditions were not treated with great seriousness or commitment by the Government. It should be noted however, that, in contrast most of ADB's loan covenants included in the Hydrocarbon Sector Program Loan were complied with.¹⁹

45. The PCR noted that only 12 of the 15 training courses financed by GREP were successfully completed. This was partly because GAIL had established its own training institute and had forged linkages with leading management institutes such as the Indian School of Business and the Indian Institute of Management. GAIL's original target of training 75% of its employees has been achieved by 2001, and a new policy of "one training per employee per year" has since been adopted.

III. ACHIEVEMENT OF PROJECT PURPOSE

A. Operational Performance

46. The prime objective of GREP was met, namely, to enhance the carrying capacity of the HBJ pipeline from 18 to 33 MMSCMD, utilizing gas which otherwise would have been flared. The other project-related quantitative targets were also met or exceeded and significant environmental benefits have been achieved. All project facilities inspected were well maintained and in excellent condition at the time of OEM's visit. Assuming the constant supply of gas, which in fact will increase in early 2004 on commissioning of the Petronet LNG terminal, the project is technically, environmentally, and financially sustainable.

¹⁸ Data from GAIL's Human Resources Department.

¹⁹ ADB. 2001. *Program Performance Audit Report on the Hydrocarbon Sector Program Loan in India*. Manila.

B. Performance of the Operational Entity

47. In 1997, GAIL was conferred “navratna” status by the Government, which allows it greater financial and managerial autonomy and powers to develop, implement, and operate commercial projects. It is listed on three Indian stock exchanges and the London Stock Exchange.

48. GAIL has continued to become a stronger institution since the GREP project was commissioned. The company’s most recent financial statements are attached as Appendix 7. Performance was strong, with both turnover and operating margins in 2002-3 recording gains over the previous year. A total dividend equivalent to 70% of share capital was paid to shareholders.

49. GAIL has become a key player in the natural gas sector and has evolved into a major integrated gas company, spanning the entire upstream and downstream gas chain. Its core activity remains gas transmission and it has recently been given the monopoly to construct and operate all transmission pipelines longer than 100 km on a common carrier (open access) principle, as part of the Government’s strategy to create a 7,000 km National Gas Grid over the next five to 6 years.²⁰ GAIL has entered into upstream activities, aimed at enhancing gas supplies, through pipeline imports from nearby countries, exploring for new gas reserves—in consortium with other Indian and foreign companies—importing LNG from Qatar through a long-term contract of its joint-venture company Petronet LNG Limited and researching the potential for the development of gas hydrates and coal-bed methane. Downstream, GAIL has two joint ventures. Mahangar Gas Limited (MGL) in Mumbai and Indraprastha Gas Limited (IGL) in Delhi, to supply gas to domestic and commercial consumers and, most importantly, provide CNG to the transport sector.²¹

50. GAIL’s institutional skills have been substantially enhanced following GREP. In addition to GAIL’s upstream and downstream activities, the following activities have been commenced or are planned: (i) two new major pipeline projects, of re-gasified LNG from Petronet LNG’s terminal at Dahej to Bijaipur; and an LPG pipeline from Vizag to Secunderabad; (ii) four smaller pipeline projects for natural gas, re-gasified LNG and LPG; (iii) the Agra-Ferozabad loopline to augment existing supplies; (iv) CNG and city gas distribution networks in Lucknow, Kanpur, Agra, Faridabad and Pune; (v) upgrading of pipeline related telecommunications networks; and (vi) GAIL is also conducting research and development into methods of converting diesel generators to natural gas, producing solid fuels from plastic wastes and separating light paraffins and olefins by adsorption from natural gas.²²

C. Economic and Financial Reevaluation

51. Appendix 8 contains the recalculated financial internal rate of return (FIRR) and the economic internal rate of return (EIRR), using updated information to 2002–2003, obtained from GAIL. The assumptions are the same as used at appraisal, and are discussed in the appendix. The revised FIRR with APM is only marginally different before tax (19.8% instead of 15.0% at appraisal) and 18.8% after tax. Both total revenue and incremental operating costs in the final 12 years of operation are expected to be slightly lower (about 5.0%) than expected at the time of the PCR.

²⁰ The Statesman. 30 September 2003. *Centre to Set Up National Gas Grid*.

²¹ Further details can be found in GAIL (India) Ltd. *Gas and Beyond – 19th Annual Report 2002-2003*, pp. 9–17.

²² GAIL (India) Limited, *Gas and Beyond – 19th Annual Report 2002-2003*, pp. 14-17.

52. The EIRR has been recalculated using the same methodology at appraisal and using revised figures for the international prices of petroleum products. The EIRR is now estimated at 26.2%, compared to 26.4% at the time of appraisal and 30.5% in the PCR. It must be noted that this highly satisfactory EIRR is, in fact, the lower band, as it excludes the environmental and operational benefits produced by the use of natural gas rather than coal, fuel oil or naphtha.

53. OEM questions the original methodology for calculating the FIRR and EIRR. Use of more realistic assumptions in the calculations, such as a longer economic life of the project and increasing, rather than straight-line, benefits, and consistency in the use of residual values, would further increase the already high EIRR and FIRR.

D. Sustainability

54. The sustainability of GREP depends on continued demand for, and adequate supply of, natural gas. Demand is likely to continue to grow at a high rate, even with the substantially higher delivered prices expected for new sources of imported gas, in the order of \$3.5–\$4.0 per million British thermal unit (MMBTU), compared to \$2.175 currently, because of rapid expansion of the economy, expected high international oil prices, the popularity of gas as a fuel, particularly as the transmission grid expands to cover new areas, and improved enforcement of tough environmental emission standards. Rising gas demand is also relatively assured subject to pricing, since 78% of gas is supplied to produce electricity and fertilizer, and 5% is converted to CNG. All these gas users are currently suffering supply shortages.

55. Supply depends crucially on new discoveries of indigenous gas and the feasibility of imports from new sources of supply. India's reserves of recoverable gas are currently estimated at 692 billion cubic meters (enough for more than 20 years at currently projected demand) and major exploration is underway. Gas is produced from seven western fields²³ and recent large discoveries in the Bay of Bengal indicate the possibility of finding large reserves on the eastern coast. At the same time, India is strategically located to import gas from nearby countries in the Middle East, Central Asia and Bangladesh through pipelines, as well as LNG from the Arabian Gulf and Southeast Asia. The Government has encouraged gas imports by removing all restrictions and the private sector is now free to import natural gas, which it is doing.²⁴ LNG imports by Petronet LNG, to be transported through an expanded, HBJ pipeline, are expected to start in early 2004.

56. Project sustainability is further enhanced by the operating, maintenance and safety procedures of GAIL, which are all in accordance with internationally accepted standards. The terminal facilities have been well designed to handle additional gas and are being operated and maintained by competent and trained personnel. The expected design life is about 30 years, assuming proper corrosion inspection and remediation measures. The cathodic protection system for GREP is very effective, with only about 10–12% of protective current requirement compared to design.²⁵ This provides adequate confidence that the system will be able to run

²³ Bombay High, Heera, Neelam, Panna-Mukta, Ratna, South Bassein and Tapti.

²⁴ ADB. 2002. *Country Strategy and Program – India 2003-2006*. Manila.

²⁵ The cathodic protection system for GREP has been based on Thermo-Electric Generators (TEGs) as the power source. GAIL's experience with TEGs is satisfactory, though not as good as with Closed Cycle Vapour Turbo-Generators (CCVT), which were deployed in HBJ and are operating without any major problem even after 15 years. The coating on line pipe as a passive means of corrosion protection in GREP is the same as that in HBJ (3-layer PE).

through the design life without any problems. The HBJ pipeline is sustainable, it has been operating efficiently since 1986 and, with GREP, is setting standards for all future pipeline design, construction, and operation in India.

57. The Project is financially sustainable with a recalculated FIRR of 18.8%, after tax (para. 51).

IV. ACHIEVEMENT OF OTHER DEVELOPMENT IMPACTS

A. Socioeconomic/Environmental Impacts

58. As GREP was to upgrade and expand an existing gas pipeline, it was not originally designed to produce direct socioeconomic benefits. Indirect benefits, in terms of generation of both skilled and unskilled jobs, have been achieved through the construction and operation of new gas-fired power plants and fertilizer factories, while the relatively low price of gas has led to cheaper electricity and fertilizers, benefiting economic development in general and poorer sections of the community in particular. In addition, the spur line to Agra and Ferozabad, together with GAIL's associated gas distribution networks in these cities, has substantially increased employment of both skilled and unskilled workers, particularly in Ferozabad's glass-making industry.

59. The environmental impacts of GREP are complex. At the outset, there was concern about potential adverse environmental impacts of construction of the pipeline. An EIA was carried out by EIL in association with the Wildlife Institute of India (WII), adopting ADB and the Government guidelines. The EIA showed that none of the impacts on forests, wild life and vegetation would be significant provided that appropriate mitigating measures were taken to protect agricultural and irrigation activities, compensate local inhabitants for inconvenience, prevent adverse ecological impacts in sensitive areas and implement all approved safety measures. Its recommendations were relatively minor and concerned small additional measures to dispose of waste oil, plant more trees around compressor stations, adapt sewage treatment facilities and implement an Environmental Management Plan (EMP).²⁶ GAIL was required to provide ADB with annual reports on environmental issues. Instead, however, it chose to commission the National Environmental Engineering Research Institute (NEERI) to carry out an evaluation of the EMP. The report concluded that GAIL had "effectively implemented almost all the EMP measures outlined in the EIA report and also (those) in the WII report specifically dealing with the ecologically sensitive areas". NEERI was particularly complimentary about the efforts by GAIL to minimize disruption from disposal systems at the Bijapur control center.²⁷

60. Although it is difficult to separate the environmental impact of enhanced gas supply from that of Government environmental legislation (e.g., minimize pollution and force industrial relocation), the OEM has seen major environmental improvements as a result of the gas provided by the GREP pipeline. For example:

- (i) New gas-fired power stations visited (such as the four units at Dadri totaling 585 MW) are extremely clean and efficient, with no visible emissions and, together with the reduction in emissions from the coal-fired units in the plant have dramatically reduced the serious pollution that previously blackened the area.

²⁶ ADB. 1993. Office of the Secretary. *Summary Environmental Impact Assessment (SEIA) for the Proposed Gas Rehabilitation and Expansion Project (India)*. (Restricted). Manila.

²⁷ National Environmental Engineering Research Institute. 1999. *Evaluation of Environmental Management Plan Implemented for the Upgradation of HBJ Gas Pipeline*.

- (ii) The introduction of CNG for use in buses, taxis, auto-rickshaws, and other vehicles in the Delhi area has had a measurable impact on reducing nitrogen oxides. This success is being replicated in Mumbai and will be extended to other priority cities when gas becomes available.
- (iii) A massive, and visible, improvement in the environmental situation around the Mathura Refinery, and hence to historical and heritage monuments in the area, has been achieved with the conversion of the refinery's power plant from coal to gas. There are no visible emissions, apart from minor flaring of surplus refinery gas, and a five-acre ecological park has been established around ponds of treated refinery effluent. This is now the home to up to 90 varieties of indigenous and migratory birds.
- (iv) Major reductions have been achieved in pollution formerly generated by the small and medium glass factories in Ferozabad and the iron foundries in Agra, all of which converted from coal and are now being supplied through GAIL's gas distribution networks in these cities.
- (v) GAIL has given environmental issues, especially energy conservation, high priority in all its operations, through a variety of different measures. GAIL estimates the overall savings to its operation costs due to conservation efforts in 2002-2003 were around \$64 million (footnote 22).

61. Quantification of many of the environmental benefits has been difficult, not least because responsibilities of various agencies concerned with environmental issues overlap, there is little coordination between them and there is no agreement on appropriate measurable indicators or the means of monitoring them. However, some reliable quantitative evidence exists for the Delhi and Agra Trapezium areas.

62. A comparison of air quality at the Taj Mahal in 1997 and 2003 is given in Table 3:

Table 3: Comparison of Air Quality in 1997 and 2003 at the Taj Mahal

Year	SOx (microgm/m ³)	NOx (microgm/m ³)	SPM (microgm/m ³)
1997	13.7	12.0	380
2003	4–5	6–7	370

m³ = cubic meter, microgm = microgram, NOx = nitrogen oxide, SOx = sulfur oxide, SPM = suspended particulate matter.

63. The introduction of CNG has produced major environmental benefits. A comparison of air quality in 1998 and 2003 in Delhi is given in Table 4:

Table 4: Comparison of Air Quality in 1998 and 2003 in Delhi

Year	SOx (microgm/m ³)	NOx (microgm/m ³)	SPM (microgm/m ³)
1998	179	323	135
2003	7	19	273

m³ = cubic meter, microgm = microgram, NOx = nitrogen oxide, SOx = sulfur oxide, SPM = suspended particulate matter.

64. The improvement in air quality is, of course, not only due to CNG introduction in Delhi but also to stricter enforcement of Government anti-pollution laws in and around Delhi. A comparison of the transport sector's contribution to pollution in 1998 (which was 11 micrograms [microgm] of SO_x and 157 microgm of NO_x) gives a clearer measure of the contribution of CNG in reducing pollution. Importantly, all additions to power generation capacity in Delhi have been based only on natural gas and many polluting industries have been moved out of the national capital region. However, SPM has increased due to higher levels of sand, dust, and traffic pollution in the atmosphere.

65. In the Agra Trapezium area, the impact of the spur lines from the GREP pipeline to Agra and Ferozabad, and GAIL's associated gas distribution networks in those cities, has had a major impact on the development of small and medium scale industries. This is particularly true of the glass-making industry of Ferozabad. At present, 134 plants (mostly glass or ceramics), which formerly used coal as fuel, have entered gas supply contracts. In addition to the immediate reduction in pollution, the cleanliness and constancy of gas supply has enabled these plants to increase the quality, quantity and variety of their output. In many cases production is now mainly for export.²⁸ Moreover, new designs of furnace to replace the existing pot and tank furnaces have further increased productivity. In 1993, coal-using iron foundries in Agra were warned that they had to close down and, by 1998, only 89 were left. Of these, 46 restarted operations using gas but have had some initial difficulties in designing appropriate gas-fired furnaces. At present there are 10 firms using induction furnaces, 30 using rotary furnaces and six using cupolas. Total gas consumption in Ferozabad is 0.82 MMSCMD and in Agra 0.08 MMSCMD. The OEM was advised that the businesses which had converted to gas had increased staff on average between 20–30% and, provided additional gas is made available in 2004, these businesses can grow a further 30–50%.

66. The downside to these advancements in Ferozabad and Agra, as witnessed by the OEM in its site visits to three glass factories and two iron foundries, was that these five companies were clearly not complying with the Government's regulations on health and safety. Protective clothing and footwear was not in evidence, despite the proliferation of molten and shattered glass, molten iron and the intense heat from furnaces. Working conditions were generally primitive. This is in complete contrast to the major gas customers in the fertilizer and electricity industries, whose operational health and safety standards are maintained at a very high level.

67. Environmental benefits in the Agra Trapezium area were also significantly helped by the spur line to Mathura Refinery, which has replaced coal by gas to fuel its power plant, which also removes lead and over 96% of sulfur from its products. The refinery, which consumes 0.85 MMSCMD of gas, monitors air quality at three stations—one at the refinery, one at the Taj Mahal and the third at a point mid-way. The level of SO_x is down to 4–5 micrograms at the Taj Mahal, compared to 21 micrograms measured in 1993/1994. The refinery's emissions are down to 330–350 kg/hr from 1,000 kg/hr in 1996–1997.

68. The SPM still remains high and is not expected to reduce significantly, in the short term, as it is largely due to dust and traffic. However, GAIL has plans to introduce CNG to Agra. An outlay of \$23 million has been approved for a City Gas Distribution Project, which will include seven CNG stations, with the first expected to be operational by April 2004.

²⁸ One plant visited by the OEM is now producing large numbers of high quality vacuum flasks for export, which would have been impossible with coal-fired furnaces.

69. Additionally, CNG has no lead or benzene content, does not dilute the crankcase oil and increases the life of lubricating oils.

B. Impacts on Institutions and Policy

70. Before the early 1990s, most of India's gas production was flared, and the HBJ pipeline took some of this gas. It is only in the last decade, since the GREP project was approved, that major changes have taken place in institutions and policy in the natural gas sector with respect to supply, transmission and distribution. In particular, what was previously a state-owned sector, closed to outsiders, has been dramatically opened up in a concerted attempt by the Government to enhance gas supplies from indigenous and foreign sources, and, to encourage greater use of gas as a fuel.

71. GREP included a TA component, at the Government's request, to propose an appropriate regulatory framework for the gas industry. This component had the immediate effect of bringing gas regulation to the fore of sector discussions, and, although it had no immediate outcome, due to Government inaction, it is expected that, due to rapidly changing market conditions, the regulatory mechanism will be in place by 2004. Two independent regulators are expected. An Upstream Regulator to monitor oil and gas exploration and exploitation and a Downstream Regulator to cover gas processing and transmission, imports and exports, and, distribution and marketing. The need for the two regulators has become increasingly urgent because, following significant changes in government policy, all major players in the Indian hydrocarbon business have plans to enter the natural gas business, while several private Indian and multinational companies are expanding their activities in the Indian gas market.²⁹

72. The Government's gas sector policies have so far had no direct influence on GREP's operational performance, except the Government sets both the base price of gas through the APM (\$1.55 per MMBTU) and the gas transmission tariff (\$0.625 per MMBTU), while expected changes in policy, including establishment of a downstream gas regulator, are not expected to impinge on project performance. GAIL's fee for gas transmission is approved by the Ministry of Petroleum and Natural Gas, adopting a cost plus methodology. Similarly, noncompliance with ADB's loan covenants relating to the Government has not affected project performance.

73. GAIL itself has dramatically changed, becoming an integrated gas company. It complied with all relevant ADB loan covenants. This in itself indicates its serious intent. At present, it is preparing to face the opportunities and challenges of further policy changes, including: (i) natural gas prices to be progressively brought in line with the international price of fuel oil or a basket of petroleum products; (ii) unbundling of marketing and transmission services; (iii) introduction of a common carrier (open access) system for gas transmission; and (iv) giving the Downstream Regulator a role in the setting of gas transmission prices.

V. OVERALL ASSESSMENT

A. Relevance

74. GREP was highly relevant at appraisal as it was a logical extension of ADB's support to the hydrocarbons sector in the context of its country operational strategy, and an integral part of

²⁹ ADB, 2002. *Country Strategy and Program – India 2003-2006*. Manila; also press clippings from the Times of India and Economic Times.

the Government's strategy to substitute indigenous natural gas for imported petroleum products. Without GREP, India would have had an even higher import bill for petroleum products. GREP stimulated the rapid development and consolidation of GAIL as a major player in the hydrocarbons sector and successfully laid the groundwork for countrywide expansion of the proposed National Gas Grid. Overall, GREP has been highly relevant.

B. Efficacy

75. GREP achieved its purpose of increasing the throughput of the HBJ pipeline from 18 to 33 MMSCMD and, by doing so, utilizing gas that would otherwise have been flared. In addition, it met or exceeded other targets, such as providing inputs to the electric power and fertilizer industries, and created a whole new environmentally-friendly market in Delhi and Mumbai for CNG. It also stimulated substitution of coal in the glass-making industries of Ferozabad, the iron foundries of Agra and Mathura Refinery, all of which contributed substantially to the Government's policy to reduce pollution in the area of the Taj Mahal and other historic and heritage monuments. Through GREP and other activities, GAIL adopted modern technologies and best practices, so that today it can match international standards for the gas industry. However, the objectives of increasing the share of natural gas with resulting foreign exchange savings did not materialize as overall growth for energy was faster than forecast at appraisal. Further, the Government did not comply with the loan covenants to reform the sector as anticipated. Overall, GREP has been efficacious.

C. Efficiency

76. The investment has proved to be highly cost effective, operating at full capacity. The FIRR has been recalculated on the basis of updated information at 19.8% before tax and 18.8% after tax, while the EIRR has been recalculated at a highly satisfactory 26.2%. This demonstrates highly efficient operation. ADB worked closely with JEXIM, and GAIL implemented GREP successfully with only minor delays in completion, but, the overall project financing was inefficient as ADB's approved loan was too high and probably not required to implement the project. Both ADB and JEXIM long-term loans were fully repaid within 4 years of completion. GREP is rated efficient.

D. Sustainability

77. The HBJ pipeline, including the GREP component, is operated and maintained in line with international standards and is likely to have a life of 30 years. The demand for gas in India is rapidly increasing because it is the preferred fuel for many purposes, as well as being cleaner, and a continuous supply of gas from indigenous or imported sources appears to be assured. The future price competitiveness of gas has not been tested and may be considered to be an issue, but only because the present supply, which is dwindling rapidly, is currently priced lower than equivalent petroleum imports as it is mainly used as feedstock for the crucial electricity and fertilizer industries. GAIL is a financially strong organization. The Project is considered to be likely sustainable.

E. Institutional Development and Other Impacts

78. GREP has brought positive overall impacts on institutional strengthening, environment and society. It has helped to substantially reduce polluting emissions in the industrial, electric power and transport sectors. Although GREP did not directly address social and poverty-oriented goals, it contributed moderately to continuing rapid economic development and the

welfare of the poor by helping generate cheaper electricity and produce cheaper urea for fertilizer in the agricultural sector. The institutional impact of GREP has been substantial because it provided GAIL with the stimulus to develop into an integrated gas company of international standing.

F. Overall Assessment

79. Based on the above five performance evaluation criteria, GREP is rated as **successful**.

80. The outputs of the TA were satisfactory, although the Government has not yet fully implemented the recommendations but is likely to implement the gas regulatory environment in 2004, when the market further opens up.

81. The performance of GAIL was highly satisfactory and in some respects the performance of ADB was satisfactory. Coordination and communication between the two organizations was mostly good. However, two major aspects of ADB's activities were less than satisfactory; the estimates of, or acceptance of, total project costs, which turned out to be very much higher than actual costs, as well as ADB's loan covenants with respect to gas sector reforms, which proved to be imprecisely formulated and inappropriately attached to what is, essentially, an investment loan. These two issues raise concerns about the financial and policy additionality of ADB's contribution to GREP.

VI. ISSUES, LESSONS, AND FOLLOW-UP ACTIONS

A. Key Issues

82. There are issues and questions regarding estimation of project costs and ADB's use of sector reform covenants. First, ADB approved a project with highly inflated cost estimates and took no action to cancel a portion of the loan when the Government approved the Project, with significantly lower costs. As a result, GAIL paid higher than necessary commitment charges to ADB.

83. Second, (i) Is it appropriate to attach loan covenants relating to changes in sector policy to a loan that financed a pipeline project by GAIL, which essentially had no influence on sector policy? (ii) If such covenants were to be included, should they not have been in the context of overall energy sector policy rather than piecemeal actions as part of a general view that unbundling and privatization of PSEs are intrinsically good policies? (iii) Should the loan covenants have had broader implications and ensured that all final consumers of GREP gas abided by national health, safety, and environmental regulations (para. 66)? (iv) Should ADB, during appraisal, have realistically assessed the likelihood of covenants being complied with, and hence the potential leverage that ADB could achieve in changing sector policy? (v) Even if complied with, would they have had any major impact on the operations of the Project?

B. Lessons Identified

84. Three major lessons learned are relevant for ADB's future operations. First, in relation to project costing and the development of a financing plan:

- (i) There should be a realistic assessment of financial costs, technical risks, inflation and the competitive situation for the procurement of all project investment components. In particular, ADB should rely on technical experts at all

- times to examine the basis for project cost estimation and the impact on cost estimates of any changes in project scope or technical specifications.
- (ii) The inclusion of intangible non-investment costs in the total project cost, especially items such as physical and price contingencies and interest during construction, should be fully justified on the basis of the specific conditions relating to the country and to the project. Care should be taken to avoid arbitrary percentage mark-ups and double-counting (para. 31). If necessary, alternative, more realistic scenarios should be used.
 - (iii) There should be clear justification of the technical, environmental and financial additionality, and ADB's developmental and policy involvement in projects, at the time of appraisal.
 - (iv) If ADB approves a loan substantially in advance of Government approval for projects, a reassessment should be made of total project costs and the size of the ADB loan, once all approvals have been obtained.

85. Second, in relation to loan covenants:

- (i) Because of the lack of impact of ADB's loan covenants on the Government's policies, consideration should be given as to whether it is appropriate for ADB to impose loan covenants relating to reforms in sector policy on investment projects.
- (ii) At the same time, ADB should be prepared, in line with its country strategy, to independently assist the Government in developing and updating India's sector strategies and policies. India presently has no clearly defined overall energy policy and ADB could help to develop such a policy, including assessment of the role of GAIL and other PSEs in the sector, incentives to open up the sector to greater investment and competition, and, the appropriate functions of regulatory mechanisms.
- (iii) In general, ADB should make realistic efforts at the time of project appraisal to assess its potential leverage through loan covenants, with respect to both the borrower and improvements and reforms to the sector overall.
- (iv) In projects that lead to expanded industrial and manufacturing activities, ADB should be assured that all relevant environment, health and safety regulations of the respective governments will be complied with.³⁰

³⁰ In the case of GREP this would certainly have been acceptable to the Government, partly because major gas customers in the fertilizer and electricity industries were already operating with the highest health and safety standards and partly because it would have given the Government support in ensuring that its regulations were complied with in small-medium industries.

C. Follow-Up Actions and Recommendations

1. For GAIL

86. GAIL's performance was highly satisfactory. GAIL may wish to consider ADB's involvement and participation if the company needs innovative, long-term finance, in either foreign or local currency, to help fund its very large and ambitious, long-term investment program, particularly where there are sector policy issues, or, financing constraints from local lenders.

2. For ADB

87. ADB's current operational strategy for India is to support the gas sector, to reduce pollution and generate other socio-economic benefits. This includes:

- (i) Supporting cross-country pipelines because, by and large they "pass through rural areas and can be so developed as to provide natural gas to small-scale industries and household consumers in such areas";
- (ii) Supporting "clean fuel" projects, which have an impact on environmental, health and gender issues; and
- (iii) Expediting the establishment of a regulatory framework for the sector, encouraging private sector participation and introducing international technical and management practices.³¹

88. The OEM recommends that ADB, as the only major multilateral finance organization operating in the energy sector in India, should consider a TA grant to finance the preparation of a comprehensive national energy plan. This plan would identify the major supply and demand issues facing the sector in the coming decade, develop appropriate strategies and policies for dealing with them and specify priority investments for finance by Indian and/or foreign private and public sources.

89. There are no specific outstanding issues concerning the implementation and operation of GREP and therefore no follow-up actions are recommended.

³¹ ADB. 2002. *Country Strategy and Program – India 2003-2006*. Manila.

PROJECT SCOPE

The project scope comprised the following:

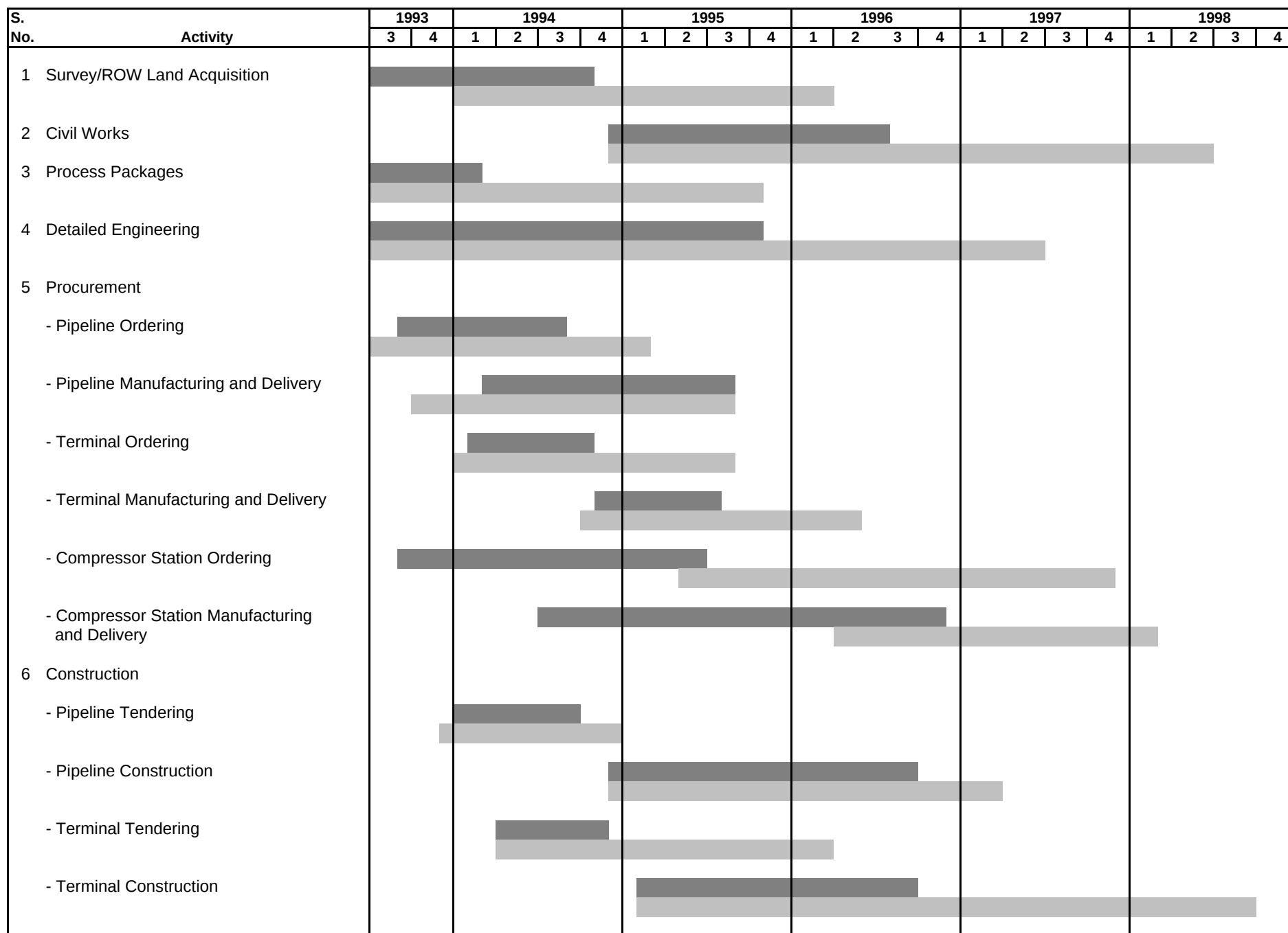
- (i) construction of a 505-kilometer long, 28-inch diameter pipeline between Bijaipur, and Dadri and spur lines to Bawana (75 kilometers long, 18 inches in diameter), and Faridabad (10 kilometers long, 12 inches in diameter);
- (ii) installation of new compressor stations at Vaghodia and Khera comprising a total of about 132,000 horsepower (hp);
- (iii) capacity enhancement and upgrading of the existing compressor stations comprising a total of about 77,400 hp at Hazira, Jhabua, and Bijaipur;
- (iv) installation of cathodic protection, telecommunications, and supervisory control and data acquisition (SCADA) facilities;
- (v) installation of new gas terminals at Faridabad, Bawana, and Jagdishpur, and upgrading of existing gas terminals at Hazira, Bijaipur, and Aonla;
- (vi) installation of a new gas processing plant of 12.7 million cubic meters per day capacity at Auraiya;
- (vii) consulting services for engineering, project implementation, and construction supervision; and
- (viii) human resources development.

Note: The portion financed by the Asian Development Bank comprises numbers (i), (ii), (iii), and (viii).

PROJECT COST (ORIGINAL VERSUS ACTUAL)

Item	Appraisal Estimate			Actual		
	Foreign	Local	Total	Foreign	Local	Total
A. Base Cost						
Land acquisition and civil works	0.00	27.00	27.00	0.00	2.88	2.88
Line pipe and coating	129.00	0.00	129.00	129.47	15.93	145.40
Line materials	5.90	0.40	6.30	0.00	6.43	6.43
Cathodic protection	7.60	0.00	7.60	0.95	0.15	1.10
Compressors	181.50	6.60	188.10	110.56	0.00	110.56
Terminals	4.60	1.40	6.00	0.00	2.80	2.80
Telecoms and SCADA	12.20	0.00	12.20	5.52	1.10	6.62
Pressure upgradation	11.00	2.80	13.80	0.00	0.26	0.26
Gas processing plant	86.30	21.90	108.20	50.68	43.09	93.77
Pipeline construction	42.00	7.40	49.40	46.27	17.49	63.76
Compressor and terminals erection	0.00	9.10	9.10	0.00	10.73	10.73
Institutional strengthening	1.70	0.30	2.00	0.63	0.00	0.63
Consultancy services	2.90	26.30	29.20	0.00	13.71	13.71
Taxes and duties	0.00	118.80	118.80	0.00	53.69	53.69
Project management	1.50	13.10	14.60	0.00	9.50	9.50
Port inland handling and insurance	0.00	32.50	32.50	0.00	0.69	0.69
Total Base Cost	486.20	267.60	753.80	344.08	178.45	522.53
B. Contingencies						
Physical contingency	48.60	26.80	75.40	0.00	0.00	0.00
Price contingency	40.90	36.90	77.80	0.00	0.00	0.00
Total Contingencies	89.50	63.70	153.20	0.00	0.00	0.00
C. Interest During Construction	70.30	30.70	101.00	19.20	18.71	37.91
Total	646.00	362.00	1,008.00	363.28	197.16	560.44

PROJECT IMPLEMENTATION SCHEDULE VERSUS ACTUAL



S. No.	Activity	1993		1994				1995				1996				1997				1998			
		3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	- Compressor Stations																						
	- Hazira, Bijaipur, & Jhabua Tendering																						
	- Hazira, Bijaipur, & Jhabua Construction																						
	- Vaghodia & Khera Tendering																						
	- Vaghodia & Khera Construction																						
7	Cathodic Protection																						
	- Tendering																						
	- Engineering and Procurement																						
	- Construction																						
8	Telecommunications/SCADA																						
	- Tendering																						
	- Manufacture and Delivery																						
9	Gas Processing Plant																						
	- Tendering and Construction																						
10	System Commissioning																						

ROW = right of way, SCADA = supervisor control and data acquisition, S. No. = serial number.

■ Appraisal Estimate
■ Actual

GAS SALES/PERCENTAGE SALES

A. Gas Sales

	Fertilizer		Power	Petrochemical	Others	CNG			GAIL IC		
			NTPC KAWAS, Jhannore, GSFC, NFL, CFCL, IGFC, OCFL, IFFCO, and TFCL	ANTA, AUR, DADFRI, FBAD, DESU, Pragati, and GIPCL		IOCL Baroda and Mathura, Samcor, Agra, Ferozabad, Maruti, Noida, Small Industries	IGL Delhi + CNG BARODA	UPPC PATA	LPG VIJ + LPGVAGH	GTC IC, GTG IC, HEATER , CCVT, and TEG	Total IC for the Year
Year	Total Gas Sale										
1998-1999	8,987.70		4,740.01	3,327.72	309.06	609.12	1.78	219.42	384.42	257.24	861.07
1999-2000	9,907.35		4,923.66	3,937.43	300.07	739.25	6.93	652.69	401.78	334.20	1,388.67
2000-2001	10,403.99		4,817.86	4,289.75	304.75	960.23	31.40	768.36	380.60	373.36	1,522.32
2001-2002	10,416.28		4,507.34	4,477.52	291.02	1,002.21	138.20	880.05	385.54	378.24	1,643.83
2002-2003	10,272.31		4,401.68	4,532.83	280.43	758.15	299.21	1,032.99	403.47	379.17	1,815.63
2003-2004	4,388.78		1,812.33	2,001.76	103.58	306.58	164.53	337.33	176.26	158.48	672.06

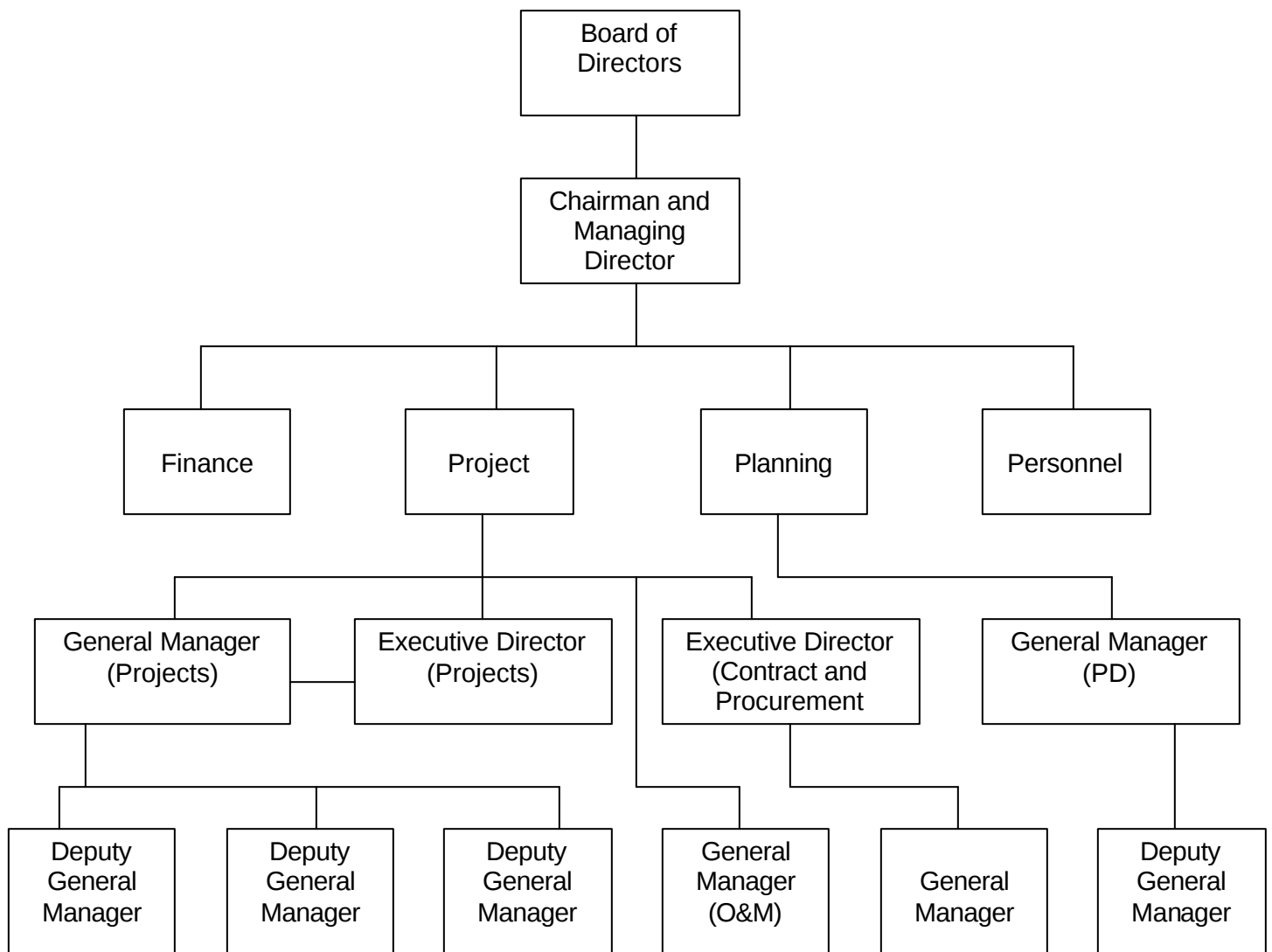
ANT = Anta; AUR = Auraiya; CCVT = Closed Cycle Vapour Turbo-Generator; CNG = compressed natural gas; DADRI = NTPC, Dadri; DESU = Delhi Electric Supply Undertaking; FBAD = Faridabad; GIPCL = Gujarat Industrial Power Corporation Limited; GSFC = Gujarat State Fertilizer Corporation; GTC IC = gas turbine compressor internal consumption; GTG IC = Gas Turbine Generator Intl. Consumption; IFFCO = Indian Farmers Fertilizer Corporation Limited; IGFC = Indo-Gulf Fertilizer Corporation; IGL = Indraprastha Gas Limited; IOCL = Indian Oil Corporation Limited; IPCL = Indian Petrochemical Corporation Limited; LPG = liquefied petroleum gas; LPG VAGH = LPG Vaghodia; NFL = National Fertilizer Limited, NTPC; KAWAS = National Thermal Power Corporation, Kawas; OCFL = Oswal Chemical and Fertilizer Limited, Shahjehanpur; PATA = GAIL's Petrochemical Plant at Pata; SAMCOR = Industrial Consumer at Kota in Rajasthan; TEG = Thermo-Chemical and Fertilizer Limited; Shahjehanpur; TFCL = Tata Fertilizer and Chemicals Limited; UPPC = GAIL's Uttar Pradesh Petrochemical Plant at PATA; VIJ = Vijaypur/Bijaypur.

B. Percentage Sales

Year	Total	Fertilizer	Power	Petrochemical	Other	CNG
1998-1999	100	53	37	3	7	0
1999-2000	100	50	40	3	7	0
2000-2001	100	46	41	3	7	0
2001-2002	100	43	43	3	7	1
2002-2003	100	43	44	3	7	3

CNG = compressed natural gas.

GAS AUTHORITY OF INDIA LIMITED: ORGANIZATION CHART



O&M = operation and maintenance, OIC = Officer-in-Charge, PD = Pipeline Development.
Source: Gas Authority of India Limited.

STATUS OF COMPLIANCE WITH MAJOR LOAN COVENANTS

Covenant	Reference in Loan Documents	Status of Compliance
1. Prior to the implementation of the overseas training, the Borrower shall submit to the Asian Development Bank (ADB) a detailed training program for its personnel to be trained. The Borrower shall make suitable arrangements for all staff sent abroad for training to return and work for the Borrower for an appropriate period after their training is completed.	Loan Agreement (LA), Sch. 5, para. 3	Complied with.
2. Except as ADB shall otherwise agree, the Borrower shall, in order to ensure its sound financial operations: (i) do everything on its part and within its power to achieve financial results from its operations which are consistent with sound business and financial standards; (ii) provide ADB with its annual investment plan and its proposed mode of financing starting from FY1992/93 for the next five years; (iii) maintain at all times a debt service ratio of not less than 1.5:1; (iv) maintain at all times a debt-equity ratio of not more than 70:30; (v) produce for each of its fiscal year funds generated from internal sources (less the amount for debt service requirements and change in working capital) as follows: equivalent to not less than 20% for each fiscal year in the period from FY1994/95 to FY1996/97, and each fiscal year thereafter less than 30%, of the aggregate of the Borrower's capital expenditures incurred or expected to be incurred for the concerned fiscal year.	LA, Sch. 5, para. 4	Complied with.
3. Except as ADB may otherwise agree, the Borrower shall, prior to the public issuing or offering of its shares under the provisions of Section 2.07 of the Guarantee Agreement, (i) make necessary amendments to its Memorandum of Association to enable the Guarantor to divest a portion of its shares as required under Section 2.07 of the Guarantee Agreement; (ii) set up a shares department for the purpose of conducting transactions for the above-mentioned transfer of shares; (iii) undertake evaluation of its shares; (iv) complete the formalities for the abovementioned share issue or transfer; (v) obtain approval of the Securities and Exchanges Board of India for the prospects of the issue or offer of the shares of the Borrower owned by the Guarantor; and (vi) obtain a credit rating for its debt instruments and equity shares.	LA, Sch. 5, para. 5	Complied with.

Covenant	Reference in Loan Documents	Status of Compliance
4. The Borrower shall establish joint ventures for the purpose of carrying out the new projects in allied downstream fields not directly in relation to its gas processing and transmission business (downstream projects) and make capital investments for the downstream projects with funds raised from the capital markets. For this purpose, the Borrower shall amend its Memorandum of Association and Articles of Association to enable it to make decisions in investing in joint ventures and to set up an appropriate organizational structure of planning and execution of these downstream projects. The Borrower shall consult with ADB on all further downstream projects to be carried out by the Borrower.	LA, Sch. 5, para. 6	Complied with.
5. The Borrower shall (i) strengthen its management and increase the number of directors on its Board of Directors by inducting specialists from the fields related to the gas industry to face future challenges; and (ii) increase the representation of the nongovernment directors on the Board of Directors of the Borrower by FY1995/96.	LA, Sch. 5, para. 9	Complied with.
6. The Borrower shall in future enter into agreements with both its suppliers of gas and its downstream consumers, which may satisfactorily reflect contractual responsibilities relating to supply of gas, and take and pay obligations. Such agreements shall cover all aspects including among others, price, gas quality, terms and conditions of payment, validity period, penalties for defaults, and procedures for settling disputes. The Borrower shall provide ADB with samples of the abovementioned agreements and take into account ADB's comments thereon.	LA, Sch. 5, para. 10	Complied with.
7. The Borrower shall establish, six months prior to the commencement of the construction work under the Project, a committee composed of prominent citizens (citizens' committees) to provide a third party monitoring program and provide funds for the operation. The Borrower shall annually provide ADB with a copy of the report of the concerned agencies and the citizens' committee on project performance related to the mitigating measures outlined in the environment impact assessment.	LA, Sch. 5, para. 11(c).	In place of citizens' committees, NEERI, Nagpur, India, conducted the review.
8. The Borrower shall furnish to ADB quarterly reports on the execution of the project and on the operation and management of the project facilities.	LA, Sec. 4.06(b)	Complied with.

Covenant	Reference in Loan Documents	Status of Compliance
9. The Borrower shall have its accounts and financial statements submitted to ADB in accordance with the agreed time schedule.	LA, Sec. 4.07	Complied with.
10. On the expiry of the current pricing policy, the Guarantor shall allow the gas marketing companies to determine the price of natural gas based on market conditions.	GA, Sec. 2.06	Not complied with.
11. Reduce its equity ownership in the Borrower by not less than 30% through dilution or divestiture of its shareholding in the Borrower and complete such dilution or divestiture by the end of December 1996.	GA, Sec. 2.07	Partially complied with, through transfer of 32.65% to other PSEs, other government institutions, and a small proportion to private shareholders.
12. The Guarantor shall ensure that, based on its gas utilization policy, its role shall be limited to providing broad guidelines on gas use, and that the gas companies shall have the freedom to determine their marketing strategies.	GA, Sec. 2.10	Not complied with. However, current government policy allows gas companies freedom to explore, develop, and market gas free from government controls. The government proposes, in 2004, to disband the APM and to establish both in Upstream and Downstream Regulator.

FINANCIAL PERFORMANCE OF GAS AUTHORITY OF INDIA LIMITED

30

A. Income Statements

(Rs million)

Appendix 7

Item	31-Mar-94	31-Mar-95	31-Mar-96	31-Mar-97	31-Mar-98	31-Mar-99	31-Mar-00	31-Mar-01	31-Mar-02	31-Mar-03
Sales Volume										
Natural Gas (MMCM)	13,079	13,680	16,495	16,798	19,512	20,129	20,521	20,946	20,676	21,129
LPG (tonne)	407,373	390,457	550,185	595,075	594,782	674,426	753,811	785,513	995,959	1,113,429
Petrochemicals (tonne)	-	-	-	-	1,760	1,483	110,169	183,311	250,951	289,375
LPG Transmission (tonne)	-	-	-	-	-	-	-	100,000	1,311,856	1,525,159
Internal Consumption (MMSCM)	315	318	522	570	538	906	1,421	1,592	1,809	2,011
Sales Price (Rs)										
Natural Gas (per MMCM)	2,219	2,300	2,342	2,360	2,597	2,746	3,129	3,396	3,418	3,399
LPG (per tonne)	5,340	5,549	5,955	6,022	6,364	9,776	10,638	15,391	11,131	14,163
Petrochemicals (per tonne)					42,163	41,727	44,252	47,025	52,480	57,261
LPG Transmission (per tonne)								1,246	1,349	1,410
Internal Consumption (per MMSCM)	3,605	3,830	4,157	3,825	5,165	4,973	4,962	5,411		
Net Revenues	33,388	36,360	46,036	49,922	63,937	68,929	85,629	101,911	107,625	120,940
Natural Gas	29,029	31,461	38,633	39,645	50,674	55,279	64,211	71,140	70,663	71,810
LPG	2,175	2,167	3,276	3,584	3,785	6,593	8,019	12,090	11,086	15,770
Petrochemicals	-	-	-	-	74	62	4,875	8,620	13,170	16,570
LPG Transmission								125	1,770	2,150
Internal Consumption	1,136	1,217	2,170	2,180	2,780	4,503	7,051	8,613	10,054	11,260
Others	1,048	1,515	1,957	4,513	6,624	2,492	1,473	1,323	882	3,380
Operating Expenses	29,254	31,898	39,946	40,890	49,391	55,660	73,657	84,417	87,338	93,900
Operation and Administration	26,963	29,585	37,864	38,546	46,906	52,265	68,766	78,411	81,604	87,480
Depreciation	2,292	2,313	2,082	2,344	2,486	3,395	4,891	6,006	5,932	6,420
Amortization										
Operating Income	4,134	4,461	6,090	9,031	14,546	13,269	11,972	17,493	20,287	27,040
Interest Expenses	928	785	691	744	646	915	1,660	1,971	2,268	1,860
Net Income Before Tax	3,206	3,677	5,400	8,288	13,900	12,354	10,313	15,522	18,019	25,180
Income Tax	1	1	244	2,092	3,697	1,755	1,700	4,260	6,161	8,790
Net Income After Tax	3,205	3,676	5,155	6,195	10,203	10,599	8,613	11,262	11,858	16,390
Dividends	300	507	719	1,268	1,860	3,285	2,816	3,728	3,805	5,920

LPG = liquefied petroleum gas, MMCM = million cubic meter, MMSCM = million standard cubic meter.

Source: Gas Authority of India Limited.

B. Ratio Analysis

(in percentage)

Item	31-Mar-94	31-Mar-95	31-Mar-96	31-Mar-97	31-Mar-98	31-Mar-99	31-Mar-00	31-Mar-01	31-Mar-02	31-Mar-03
Operating Margin Ratio	12.38	12.27	13.23	18.09	22.75	19.25	13.98	17.17	18.85	22.36
Profit Margin Ratio	12.38	12.27	12.70	13.90	16.97	16.70	12.00	12.98	13.13	15.09
Return on Net Fixed Assets	29.30	34.00	48.40	43.40	47.10	25.10	21.60	27.00	31.00	43.2
Return on Equity	23.90	22.20	24.70	24.00	29.90	25.60	18.20	20.60	22.20	25.9
Interest Coverage (Times)	4.46	5.69	8.82	12.15	22.53	14.50	7.21	8.87	8.94	14.54
Current Ratio (Times)	1.36	1.30	0.76	0.53	0.75	1.06	1.24	1.44	1.21	
Debt/Equity Ratio	39.20	32.70	27.70	24.40	30.20	32.30	33.40	33.10	31.20	
Debt-Services Ratio (Times)	3.00	3.20	3.60	4.20	4.20	3.70	3.50	3.50	3.90	
Self-Financing Ratio	42.00	69.00	179.00	162.00	80.00	56.00	58.00	68.00	23.00	
Operating Cash/Current Liabilities	67.00	56.00	43.00	36.00	58.00	60.00	50.00	80.00	52.00	

Source: Gas Authority of India Limited.

C. Balance Sheets
(Rs million)

Item	31-Mar-94	31-Mar-95	31-Mar-96	31-Mar-97	31-Mar-98	31-Mar-99	31-Mar-00	31-Mar-01	31-Mar-02
Current Assets	13,385	16,036	14,237	13,964	17,450	27,423	38,036	35,562	46,305
Cash and Bank Balances	9,938	12,510	8,507	5,952	3,345	8,517	14,341	16,548	24,506
Account Receivables	2,283	2,001	3,223	3,105	3,558	3,371	5,449	6,646	7,642
Inventories	706	967	1,121	1,249	1,853	2,234	3,526	3,266	3,824
Other Current Assets	458	557	1,387	3,658	8,694	13,301	14,720	9,102	10,333
Fixed Assets	18,449	20,942	33,442	46,376	54,848	59,736	63,702	71,013	69,605
Property, Pipeline and Equipment	25,828	27,173	28,713	39,273	51,827	77,688	85,224	100,379	107,019
(Accumulated Depreciation)	11,736	14,039	16,123	18,439	20,950	24,765	29,676	35,689	41,671
Net Fixed Assets	14,092	13,134	12,590	20,833	30,876	52,923	55,547	64,690	65,348
Capital Work in Progress	4,357	7,808	20,851	25,542	23,971	6,813	8,155	6,322	4,257
Unamortised Capital Expenditure	78	37	25	12	9	0	4	3	2
Total Assets	31,912	37,015	47,704	60,352	72,306	87,159	101,743	106,578	115,912
Current Liabilities	9,834	12,370	18,779	26,215	23,389	25,930	30,765	24,669	38,311
Account Payables	4,270	4,300	6,605	8,512	7,866	7,149	10,250	11,531	10,959
Pool Account	3,286	5,857	9,597	11,264	3,338	4,598	5,479	3,896	5,983
Others	2,278	2,212	2,577	6,439	12,185	14,182	15,036	9,241	21,369
Long-term Debt	8,661	8,059	8,021	8,345	14,779	19,775	23,725	27,109	24,248
Equity	13,417	16,586	20,904	25,792	34,138	41,454	47,252	54,800	53,355
Paid-In Capital	8,453	8,453	8,453	8,457	8,457	8,457	8,457	8,457	8,457
Retained Earnings	4,964	8,133	12,451	17,336	25,681	32,997	38,796	46,344	44,898
Total Liabilities and Equity	31,912	37,015	47,704	60,352	72,306	87,159	101,743	106,578	115,914

Source: Gas Authority of India Limited.

D. Cash Flow Statements

(Rs million)

Item	31-Mar-94	31-Mar-95	31-Mar-96	31-Mar-97	31-Mar-98	31-Mar-99	31-Mar-00	31-Mar-01	31-Mar-02
Sources									
Internal Cash Generations	6,585	6,952	8,160	9,408	13,677	15,553	15,420	19,679	20,058
Net Income After Taxes	3,205	3,676	5,155	6,195	10,203	10,599	8,613	11,262	11,858
Depreciation and Amortization	2,292	2,313	2,082	2,344	2,486	3,395	4,891	6,006	5,932
Interest Expenses	1,088	963	924	868	988	1,559	1,917	2,411	2,268
Share Capital		-	-	3	-	-	-	-	-
Borrowings		269	1,289	1,659	8,732	7,646	6,404	837	20,058
Foreign Currency Loans	-		1,128	1,308	3,102	2,961	2,357	156	(20,058)
Domestic Borrowings	-				3,900	2,500	3,010	475	-
Suppliers'/Buyers' Credit	-	269	375	558	975	832	-	-	-
Year-end Evaluations			(214)	(207)	756	1,353	1,037	207	-
Total Sources	6,585	7,221	9,449	11,070	22,409	23,199	21,824	20,517	20,058
Applications									
Capital Expenditures:	2,739	4,796	14,584	15,250	10,983	8,702	8,878	13,323	4,575
Acquisition of Capital Assets	1,092	1,344	1,540	10,560	12,554	25,861	7,536	15,156	6,640
Capital Work-in-Progress	1,647	3,451	13,043	4,691	(1,571)	(17,159)	1,342	(1,833)	(2,065)
Debt Services	2,205	2,180	2,289	2,216	3,287	4,209	4,378	5,549	5,129
Principal Repayment	1,117	1,217	1,366	1,347	2,299	2,650	2,461	3,137	2,861
Interest Expenses	1,088	963	924	868	988	1,559	1,917	2,411	2,268
Dividends	200	300	507	719	1,268	1,860	3,285	2,816	3,805
Increase/Decrease in Working Capital	(2,350)	(2,458)	(4,204)	(5,153)	8,917	2,261	(47)	1,416	(10,857)
Increase/Decrease in Other Assets	(5)	(169)	277	593	561	995	(494)	(4,794)	3,081
Total Applications	2,789	4,649	13,453	13,624	25,016	18,028	16,000	18,309	5,733
Net Cash Flow	3,796	2,573	(4,004)	(2,554)	(2,607)	5,171	5,824	2,207	14,325
Cash Balance									
- At the Beginning	6,142	9,938	12,510	8,507	5,952	3,345	8,517	14,341	16,548
- At the End	9,938	12,510	8,507	5,952	3,345	8,517	14,341	16,548	24,506

Source: Gas Authority of India Limited.

ASSUMPTIONS FOR THE FINANCIAL AND ECONOMIC REEVALUATION OF THE PROJECT

A. Financial Reevaluation

1. The financial reevaluation of the Project is carried out on an incremental basis.
2. The Project's economic life is assumed to be 16 years, with no salvage value. However, the actual life of the Project is around 30 years. The recalculated EIRR, with a 30-year life, shows a higher EIRR of 26.62%.
3. All prices and costs are expressed in constant 2001 values.
4. The capital cost includes the costs for construction of the pipeline, and modification of existing compressor stations (Bijaipur, Hazira, and Jhabua) as well as the addition of new compressor stations at Khera and Vaghodia, and installation of gas processing facilities at Pata.
5. **Incremental Gas.** The incremental gas supply amounted to 8.75 million standard cubic meter per day (MMSCMD) in FY1999, increasing to 12.67 MMSCMD in FY2000 and further to 14.49 MMSCMD in FY2001. The full design capacity of the expanded pipeline amounting to 15.2 MMSCMD was realized only from FY2002. Out of the incremental gas, ethane/propane production is estimated at 0.24 million tons in FY2000, 0.3 million tons in FY2001, and 0.41 million tons thereafter.
6. **Sale Prices.** At present, gas sale prices in India are based on a formula linking the consumer price to 75% of the international price of a basket of fuel oils. The Government had intended to dismantle the Administered Pricing Mechanism (APM) in place for gas from April 2002, but has not set a new date for this. The present reevaluation has been carried out assuming the APM remains in place. As ethane/propane is not a traded commodity in India, a price of Rs8,517 per ton has been assumed. This product is consumed by Gas Authority of India Limited (GAIL) internally for production of other petrochemicals.
7. **Financial Internal Rate of Return (FIRR).** Considering the current APM prices, the posttax FIRR works out to 18.8%. The effective corporate tax rate for GAIL has been assumed to be 30%. The posttax weighted average cost of capital for GAIL is estimated at 12.9%, based on a debt-equity ratio of 33%.

B. Economic Reevaluation

8. The economic reevaluation of the Project is on an incremental basis, considering actual revenue details till FY2002 and projected sales thereafter, based on an economic life of 16 years and a salvage value of 5%.
9. The economic capital cost of the Project is based on the financial capital costs and excludes duties, taxes, and other financial charges. The local currency costs are adjusted by using a standard conversion factor of 0.8. The capital costs are in 2001 constant prices. The capital cost includes, in addition to the costs for expansion of the pipeline, the cost of the liquefied petroleum gas (LPG) extraction facility set up at Pata.
10. **Gas Valuation.** The natural gas inputs used by GREP cannot be traded or used elsewhere, so an economic reference price is difficult to establish. For the present reevaluation,

it has been assumed that these gas inputs displace fuel oil, to the extent of 30%. The cost, insurance, and freight (SIF) prices at the point of sale are taken as \$169.5 per ton for fuel oil and \$268 per ton for naphtha. However, the actual economic value of GREP's gas output is much higher because, as preferred feedstock for the fertilizer industry, its use leads to significantly lower capital and operating costs and, as a fuel source for electric power generation and other industries, it has major environmental benefits in terms of reduced pollution and effluents.

**FINANCIAL INTERNAL RATE OF RETURN
WITH ADMINISTERED PRICING MECHANISM**
(Rs million)

Fiscal Year	Sales Revenue					Incremental Operating Cost						
	Incremental Sales MMCM	Sales Price of Gas (Rs/MMCM)	Revenue from Gas		Total Revenue	Variable Cost	Capital Cost	Incremental Tax	Change in Working Capital	Capital Investment	Net Cash Flow	
			Sales	Processing							Before Tax	After Tax
1994	-	-	-	-	-	-	-	-	-	(127)	(127)	(127)
1995	-	-	-	-	-	-	-	-	-	(363)	(363)	(363)
1996	-	-	-	-	-	-	-	-	-	(6,945)	(6,945)	(6,945)
1997	-	-	-	-	-	-	-	-	-	(6,519)	(6,519)	(6,519)
1998	-	-	-	-	-	-	-	-	-	(7,049)	(7,049)	(7,049)
1999	3,194	3,627	13,099	-	13,099	8,409	317	-	490	(1,201)	3,662	3,662
2000	4,260	4,045	18,868	2,057	20,925	14,329	837	66	1,930	(74)	7,615	7,549
2001	4,564	4,266	19,472	2,519	21,991	16,286	936	70	250	(196)	4,824	4,754
2002	4,785	4,312	20,634	3,532	24,166	17,393	817	494	670	-	6,626	6,132
2003	4,496	4,312	19,388	3,532	22,920	16,874	838	406	-	-	5,208	4,802
2004	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
2005	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
2006	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
2007	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
2008	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
2009	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
2010	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
2011	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
2012	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
2013	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
2014	4,496	4,312	19,388	3,532	22,920	16,874	838	449	-	-	5,208	4,759
FIRR								18.80%	After Tax			
FIRR								19.79%	Before Tax			

MMCM = million cubic meter.

Note: Values are in constant 2001 prices.

Source: Gas Authority of India Limited.

ECONOMIC INTERNAL RATE OF RETURN

(million Rupees)

Fiscal Year	Capital Cost	Operating Cost	Cost of Gas	Total Cost	Revenue	Net Cash Flow
1994	106.7			106.7	-	(106.7)
1995	350.9			350.9	-	(350.9)
1996	6,650.2			6,650.2	-	(6,650.2)
1997	5,927.0			5,927.0	-	(5,927.0)
1998	6,605.8			6,605.8	-	(6,605.8)
1999	2,118.6	472.5	14,890.0	17,481.1	23,823.3	6,342.2
2000	1,685.6	1,676.8	21,562.0	24,924.4	33,367.4	8,443.0
2001	416.0	2,622.3	24,657.0	27,695.3	36,153.1	8,457.8
2002	58.9	3,242.8	25,865.0	29,166.7	38,917.5	9,185.1
2003		3,266.8	39,856.0	43,122.8	49,107.0	5,313.0
2004		3,311.8	39,856.0	43,167.8	49,107.0	5,313.0
2005		3,371.8	39,856.0	43,227.8	49,107.0	5,313.0
2006		3,371.8	39,856.0	43,227.8	49,107.0	5,313.0
2007		3,371.8	39,856.0	43,227.8	49,107.0	5,313.0
2008		3,371.8	39,856.0	43,227.8	49,107.0	5,313.0
2009		3,371.8	39,856.0	43,227.8	49,107.0	5,313.0
2010		3,371.8	39,856.0	43,227.8	49,107.0	5,313.0
2011		3,371.8	39,856.0	43,227.8	49,107.0	5,313.0
2012		3,371.8	39,856.0	43,227.8	49,107.0	5,313.0
2013		3,371.8	39,856.0	43,227.8	49,107.0	5,313.0
2014	(1,196.0)	3,371.8	39,856.0	42,031.8	49,107.0	6,509.0
EIRR						26.23%

Note: Values are in constant 2001 prices.