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PERFORMANCE AUDIT REPORT

INDIA

GAS FLARING REDUCTION PROJECT
(LOAN 3364-IN)

June 29, 1999

Operations Evaluation Department
Sector and Thematic Evaluations Group

Currency Equivalents (annual averages)

Currency Unit = Rupee (Rs.)

1991/92	US$1 = Rs. 23.5
1992/93	US$1 = Rs. 28.9
1993/94	US$1 = Rs. 31.4
1994/95	US$1 = Rs. 33.0
1995/96	US$1 = Rs. 34.0
1996/97	US$1 = Rs. 36.0
1997/98	US$1 = Rs. 38.7

Fiscal Year

Government: April 1 – March 31

Abbreviations

bbl/d	barrels/day
BH	Bombay High
BICP	Bureau of Industrial Costs and Prices
DGH	Directorate General of Hydrocarbons
GAIL	Gas Authority of India Ltd.
GFR	Gas Flaring Reduction Project
GOI	Government of India
GOR	Gas-oil ratio
ICR	Implementation Completion Report
IOC	International oil company
LNG	Liquefied natural gas
MMCMD	Millions of cubic meters per day
MTY	Million tons per year
NELP	New Exploration and Licensing Policy
ONGC	Oil and Natural Gas Corporation
SAR	Staff Appraisal Report
SB	South Bassein

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Office of the Director-General
Operations Evaluation

June 29, 1999

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Performance Audit Report on India
Gas Flaring Reduction Project (Loan 3364–IN)

Attached is the Performance Audit Report prepared by the Operations Evaluation Department on the above project, which was approved in FY91 and closed in December 1997. Cofinancing of US$292 million in total was provided by the Asian Development Bank and the Japanese Ex-Im Bank.

The objectives of the Gas Flaring Reduction Project were to cut the flaring of gas at the Bombay High field and supply that gas to onshore consumers by increasing the gas transportation capacity from the Bombay High and South Bassein fields, improve reservoir management of the BH field to reduce the rate of decline of oil production; reduce energy shortages in western India, and promote greater private sector involvement in the oil and gas industry. The project entailed the construction of two offshore oil and gas production and processing platforms and four major gas pipelines, modification of existing production platforms and expansion of the Hazira gas processing terminal at a total cost of about US$2 billion.

The physical components of the project were completed satisfactorily, albeit two years later than planned. The project had a major positive impact on oil production and gas supply to western and northern India and has yielded very large economic benefits. The ex-post EIRR is estimated to be 26%. The initial reduction in gas flaring in the BH field was the result of the decision by the Oil and Natural Gas Corporation (ONGC) to shut in wells with excessively high gas-oil ratios and by a water injection program, both of which were independent of this project. However, the project helped to ensure that gas flaring did not recur after 1994. The project had no impact on GOI's gas pricing policy, which remains unsatisfactory. Oil exploration policies have improved greatly in recent years, but without any significant input from the Bank. The reservoir management study carried out under the project has contributed to a better understanding of the BH field and may have assisted in a modest transfer of technology to ONGC. The project also contributed to a better integration of safety and environmental issues in ONGC's operations.

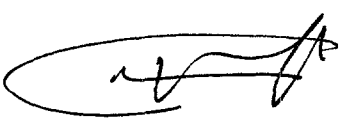
The project outcome is rated as satisfactory. The audit assesses the institutional development impact of the project to have been modest (substantial in the ICR). Both the ICR and this audit consider sustainability of the project to be likely. Bank performance is rated as unsatisfactory because the project design did not take into account the reasonable expectation that gas availability would decline rapidly when the wells with high gas and water output were shut in (as a result of decisions taken *prior* to loan

approval), and because the Bank failed to pursue the energy pricing dialog with GOI. ONGC's performance is rated as satisfactory. The ICR considers Bank and borrower performance to have been highly satisfactory.

The main lessons learned from this project are:

- The "value added" from Bank involvement in a project is small if it opts out of an active policy dialog with borrowers;
- The Bank needs to find alternative ways of maintaining a policy dialog on critical sector issues when it decides to withdraw from direct lending to a sector; and
- Setting gas producer prices administratively at levels below import parity hinders the development of new indigenous gas reserves and the viability of LNG import schemes.

Attachment



Contents

This report was prepared by Sunil Mathrani (Consultant) who audited the project in January 1999. William Hurlbut edited the report. Soon-Won Pak provided administrative support.

Principal Ratings

	ICR	Audit
Outcome	Highly satisfactory	Satisfactory
Sustainability	Likely	Likely
Institutional Development	Substantial	Modest
Borrower Performance	Highly satisfactory	Satisfactory
Bank Performance	Highly satisfactory	Unsatisfactory

Key Staff Responsible

	Task Manager	Division Chief	Country Director
Appraisal	Peter Pollak	Eugene D. McCarthy	Heinz Vergin
Midterm	Peter Pollak	Jean-Francois Bauer	Heinz Vergin
Completion	Hannachi Morsli	Alastair J. McKechnie	Edwin Lim

Preface

This is the Performance Audit Report (PAR) on the India Gas Flaring Reduction Project (Ln. 3364-IN), for which the Bank approved a loan of US$450 million in June 1991 to the Oil and Natural Gas Corporation (ONGC). The loan closed in December 1997, two years behind schedule.

This report is based on a review of the Implementation Completion Report (ICR) prepared by the South Asia Region and issued on October 6, 1998, the Staff Appraisal Report (SAR), loan documents, and project files, and on discussions with Bank staff. An OED mission visited India in January 1999 for discussions with the government and ONGC. Their cooperation and assistance is gratefully acknowledged.

Following standard OED procedures, the draft PAR was sent to the borrower and cofinanciers for comments. All comments have been taken into account and included as an attachment to the PAR.

1. Background

1.1 The Bank has been extensively involved in the Indian oil and gas sector over the past 20 years, beginning with the development of the country's largest oil and gas field, Bombay High, for which the Bank made loans in 1977 and 1980. Production from the offshore field peaked in the mid-1980s at about 20 million tons per year (MTY). The volume of associated gas produced with the oil continued to rise very sharply after oil production had leveled off, reaching 26 million cubic meters per day (MMCMD) in 1990 of which 12 MMCMD had to be flared, equivalent to wasting 10,000 tons of oil daily. This became a serious technical, environmental, and political issue in the late 1980s. In 1990, an independent inquiry into the management of the field recommended the closure of wells with the highest levels of gas and water production. Once these measures were carried out, oil production plunged to 12 MTY. It has since been stabilized at that level.

1.2 Gas consumption increased very sharply during the 1990s due to the combined effect of increased availability and low prices. Gas has become the premium fuel of choice in less than a decade, particularly for power generation. Contrary to Bank concerns at the time of project appraisal that there would be a risk of excess gas supply, today there is unserved demand for gas, the supply of which is now close to the peak production from existing fields. Total gas sales rose from about 35 MMCMD in 1990 to 62 MMCMD in 1998.

1.3 Between 1983 and 1991 the Bank also made three loans, totaling US$967 million, for offshore gas production and transportation. The most recent of these is the subject of this audit. Following a review of lending priorities by regional management in 1994, lending to the hydrocarbons sector ceased and there have been no new Bank operations in oil and gas since then.

1.4 The Gas Flaring Reduction (GFR) project was prepared and appraised in late 1990/early 1991, a time when oil prices had suddenly been pushed up by the Gulf War. Although ONGC had frequently borrowed in the international capital markets during the 1980s, by late 1990 when the project was pre-appraised it was apparent that India's weakening creditworthiness[1] meant that ONGC would require both direct financial support from the Bank toward the US$2.9 billion cost of this project as well Bank assistance in arranging the necessary foreign cofinancing of nearly US$1.4 billion.

1.5 In parallel, India's foreign exchange reserves had fallen to below two weeks cover and the country faced an acute balance of payments crisis. A macroeconomic stabilization program was negotiated with the IMF in mid-1991 and numerous measures to deregulate the economy were passed. The rupee was devalued by 24 percent and foreign investment in the economy was liberalized.

1.6 The Bank also made a parallel quick-disbursing loan[2] of US$150 million to the GOI in mid-1991 to help mitigate the consequences of higher oil import prices and reduced output from the Bombay High field. The Asian Development Bank (ADB) provided similar program assistance in late 1991.[3]

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1. India's credit rating was downgraded several times by Moody and S&P in 1990/91.

2. The Oil and Gas Sector Development Loan (Loan 3391-IN), which has been audited separately (Report No. 14787)

3. Hydrocarbon Sector Program Loan (US$250 million)

2. Objectives and Description

2.1 The Gas Flaring Reduction (GFR) project was designed to (a) cut the flaring of 12 MMCMD of gas at the Bombay High field and supply that gas to onshore consumers by increasing the gas transportation capacity from the Bombay High (BH) and South Bassein (SB) fields by 29 MMCMD to both major outlets, Bombay and the Hazira-Bijapur-Jagdishpur (HBJ) pipeline to northern India; (b) improve reservoir management of the BH field to reduce the rate of decline of oil production; and (c) reduce energy shortages in western India, and (d) promote greater private sector involvement in the oil and gas industry.

2.2 The original project components included:

- Construction of two offshore processing platforms from which oil, gas and water were to be separated and treated (US$699 million);
- Modification and capacity expansion of 18 existing platforms to recover associated gas previously flared (US$79 million);
- Four connecting gas pipelines - a short line connecting the northern platform to an existing trunk Bombay line connecting the major oilfields, two larger ones connecting to the Heera and South Bassein fields, and the largest, a 42 inch, 242 km line connecting the South Bassein field to the Hazira gas terminal, which connects to the land based HBJ pipeline to northern India (US$754 million);
- Expansion of the Hazira gas processing terminal (US$493 million);
- Engineering services, equipment and technical assistance for optimization of the Bombay High oilfield reservoir management and the development of safety and environmental safety policies (US$58 million).

2.3 The equally important increase in oil production capacity by 160,000 bbl/d to be developed from the two new processing platforms although mentioned in the SAR, was not explicitly stated as a project objective, or acknowledged as such by the ICR. Yet for ONGC the increased oil producing capability in new areas of the field was surely the key priority addressed by the project, given that total oil production from the field had dropped sharply as a result of measures taken to reduce gas flaring. These process platforms were multi-purpose installations—they included facilities for processing oil and gas and for injecting water back into the field. Since Bank staff had decided to present the project within the Bank as predominantly aimed at cutting gas flaring, for consistency reasons the economic analysis in the SAR excluded all benefits accruing from increased oil production.

2.4 GFR was a traditional "hardware" project with minimal policy content. Despite the stated objective of promoting greater participation of private oil companies in the oil and gas sector, the project did not contain any components or policy measures designed to further this objective. Given the importance of the issue, and its recurrence in the Bank's dialog with GOI under the preceding oil and gas projects, it is a surprising omission.

Project Implementation and Results

2.5 As the ICR indicates, the physical objectives of the project were met. Total gas supplied to consumers from India's offshore fields has almost doubled, largely because of this project (see

Annex B). However, the incremental gas supply did not come from BH, as envisaged at appraisal, but predominantly from SB. Gas flaring at BH virtually ceased[4] in 1994, mainly because of a fast response to closures of wells with the highest gas/oil ratio (GOR) and a water reinjection program. The audit found that the *initial* elimination of gas flaring at BH, one of the key project objectives, cannot be attributed to this project, but that the facilities built as part of the project helped ONGC to ensure that flaring did not recur after 1994.

2.6 The sharp reduction in BH's associated gas production, from 26 MMCMD at the time of appraisal to under 14 MMCMD just two years later, completely overturned the basis for the original project. It imposed a major project redesign in 1993 because very little BH gas was available for the pipelines to the northwestern market that were to be constructed under the project. The redesign[5] resulted in a two-year delay in increasing the gas availability to the HBJ gas pipeline.

2.7 The GFR project has contributed to raising awareness of the importance of safety and environmental issues and they have become much more integrated into the normal course of ONGC's operations. Safety procedures have been improved and valuable staff training was carried out in a safety management system used by the international oil and gas industry. However,the two oil spill response centers envisaged by ONGC for each coast have been very delayed due to protracted discussions with the Oil Industry Safety Directorate of the Ministry of Petroleum and IOC over cost sharing arrangements, and are yet to be built. As the largest offshore oil and gas operator, it would have been preferable for ONGC to proceed with these independently, while the financial arrangements were worked out in parallel.

2.8 Prior to this project, despite the Bank's large portfolio with ONGC it had little success in persuading ONGC to improve its procurement procedures. Procurement matters were frequently problematic and the cause of several Bank/ONGC disagreements. In the case of the GFR project, procurement issues appear to have been handled better and ONGC's own procedures have been simplified and streamlined in line with the Bank's standardized practices.

Project Redesign

2.9 Faced with the unanticipated sharp drop in associated gas output, new non-associated sources of gas had to be rapidly developed in order for ONGC to meet its supply commitments to the Gas Authority of India Limited (GAIL). Hence, expansion of gas production at South Bassein became a major new project component—production from SB tripled from 10 to 30 MMCMD between 1991 and 1998. The construction of desulfurization facilities at Hazira also was not anticipated at appraisal because BH associated gas, unlike SB gas, is free of sulfur. However, due to substantial savings in the cost of the pipelines and terminal, the total project cost was about US$2 billion instead of US$2.9 billion expected at appraisal.

2.10 ONGC undertook the originally envisaged investment in a 28-inch gas pipeline from BH capable of transporting 16 MMCMD of gas to connect with the SB-Hazira trunk line (see Map), even though there was insufficient associated gas at BH to justify it. Although it was probably too late to cancel construction of the SHG-BPB pipeline when the scale of the shortfall in associated gas became apparent to Bank staff in 1993, it is unclear if ONGC considered alternatives to proceeding with it. Today, only 1–2 MMCMD of gas flows through this pipeline in normal circumstances. Fortunately this enhances ONGC's operational flexibility by allowing associated

4. For technical reasons, some flaring is unavoidable.

5. The Bank did not formally restructure the project.

BH gas that is normally sent to Uran to be diverted to Hazira in case of a shutdown of the Uran fertilizer plant. It will also be used to transport about 2.5 MMCMD of gas from a newly developed field (B-55). Meanwhile, it remains a very underused US$37 million investment with marginal benefits.[6]

3. Key Issues

Project Timing

3.1 Given the high levels of gas flaring at the BH field from 1982 onwards,[7] it is clear that ONGC should have initiated the project several years earlier. Bank staff proposed it in 1987, but ONGC was unenthusiastic at that stage. ONGC's top management at that time sought to maximize short-term production from the BH field and did not appreciate the importance of reservoir pressure maintenance (by water reinjection) for the future of the field.[8] This is evident in the low priority assigned to the water reinjection program, which suffered major implementation delays (para. 3.3). During the 1980s both ONGC and the Bank were focusing their efforts and investments on exploration in new areas, as indicated by the resources committed to the Krishna-Godavari basin (US$0.9 billion), for which the Bank made its largest-ever petroleum exploration loan in 1983.

Project Appraisal

3.2 At project appraisal, ONGC and the Bank apparently expected increased water injection and well shut-ins to reduce the GOR to 400 m^3/m^3 of oil produced.[9] But they were unconcerned about the risk of inadequate associated gas supplies because oil production from BH was projected to *rise sharply*, as a result of the additional development of the L-II and L-III reservoirs, thereby ensuring additional associated gas as well. Hence, the Bank and ONGC did not anticipate any difficulty in ensuring adequate gas supply to users, and the SAR does not mention insufficient gas as a potential project risk. On the contrary, the main risk foreseen at that time was an oversupply of gas due to sluggish development of the gas market. In reality, the additional 3 MTY obtained from L-II and L-III has only partly compensated for the fall in oil production in other parts of the field, which arose from the early-1991 decision to shut in the wells with GORs exceeding 700 m^3/m^3. Since this occurred before Board approval of the GFR project, it is unclear why ONGC and the Bank did not anticipate the gas supply shortfall. The ICR argues that the field's geological complexity was such that the fall in associated gas production could not have been predicted during project preparation. While the complexity of the field is undeniable, the audit mission found that the main reason for the reduced availability of associated gas was not geological. It was due to the operational decision to reduce oil (and hence gas) production based on the Bombay High Review Committee's recommendations on the management of the field, which were submitted to GOI in late 1990.[10] The implications of this recommendation, the closure

6. However, the impact on the project's economic rate of return is minor because the pipeline represents under 2% of the total cost.

7. Nearly 6 MMCMD was flared in 1985 and by 1989 it had doubled to 12 MMCMD.

8. ONGC does not agree with this assessment (see Annex C, para. 4.1).

9. SAR Annex 2.1

10. Although full implementation of its recommendations started only in May 1992, in its comments (Annex C, para. 4.8), ONGC has indicated that it had already started closing down the high GOR and high water cut wells before this date.

of high GOR and high water cut wells, and the buildup of water injection and its positive effects were not taken into account at the time of project appraisal in March-April 1991. For this reason, the project's quality at entry is assessed as unsatisfactory.

Bombay High Reservoir Management, Gas Flaring, and Enhanced Oil Recovery

3.3 Oil production from the BH field peaked at around 20 MTY in 1984-85 and remained at this level until 1989-90. As a result of insufficient water injection to maintain reservoir pressure, it fell to 18 MTY in 1990-91. From the early 1980s onward the field had exhibited a rising GOR, and in 1985 ONGC's reservoir consultants (CFP-Total) had recommended water injection in the field's central zones in addition to the ongoing reinjection in the peripheral areas. But this program was slow to be implemented and was not completed until 1989. In 1991, following the GOI commission of inquiry into the operation of BH, ONGC shut in about 40 wells with GORs in excess of 700 m^3/m^3 as well as another 40 wells with excessive water production. These measures rapidly had a favorable impact. Flaring was dramatically reduced from 12 MMCMD at the time of project appraisal to under 2 MMCMD. and by mid-1993 the average field GOR had fallen to 320 m^3/m^3 from 470 m^3/m^3 in 1991. However, the well closings, combined with the natural decline of the reservoir pressure sharply pushed down oil production to a little under 12 MTY in 1992-93. Production has been maintained at this level ever since.

3.4 The production of gas from BH throughout the 1980s considerably exceeded market requirements, making large-scale flaring unavoidable. Meanwhile, the SB free gas field was also developed,[11] along with the main HBJ trunk line to bring gas to northern India. Due to the unforeseen time required to build desulfurization facilities needed to use this sour gas, part of the surplus (sweet) BH gas was piped to Hazira between 1985 and 1988, using the trunk line originally intended to transport SB gas. This helped reduce the gas flaring at BH and compensated for the supply shortfall to GAIL that would otherwise have arisen as a result of the additional time required to build desulfurization facilities at Hazira. Unfortunately, in 1989, just as SB gas came on-stream, the associated gas production at BH also dramatically increased. Flaring of BH gas rose to 12 MMCMD, which was a massive waste of energy.[12]

3.5 A full reservoir management study of the BH field was carried out by ONGC's consultants (IPEC) in 1995–96 under the GFR project, with a view to maximizing the recovery of oil and gas reserves. Although ONGC is broadly satisfied with the study, the outcome is not entirely satisfactory. First, the IPEC study provided the basis for a 1997 plan to enhance recovery from BH North by means of a US$500 million program of infill drilling, but this has yet to begin because of a difference of opinion between ONGC and the Directorate General of Hydrocarbons (DGH)[13] over the need to carry out 3-D seismic surveys before drilling. Second, a contractual disagreement that arose with the consultants remains unresolved. Outstanding payments are still due to the consultants, and ONGC has not received the IPEC's database and simulations in electronic form.

3.6 In 1998, ONGC hired new consultants (Gaffney Cline Associates) for two years to advise it on improving field operations, with a view to increasing total oil recovery from the field by 7–8 percent, or about 150 million tons. Current indications suggest that achieving this additional oil

11. With considerable Bank assistance: Loans 2241 (FY83) and 2904 (FY88)

12. Equivalent to more than 3 million tons of oil per year.

13. The DGH is a regulatory body set up in 1993 along the lines of the Norwegian Petroleum Directorate. Its functions include monitoring of ONGC's reservoir operations.

recovery would require the drilling of about 400 new infill wells.[14] If production from the field continues for another 25 years, as expected, much of the existing equipment will also need to be replaced. The oldest platforms and wells in the field already need to be revamped, so the financial implications of extracting the maximum reserves from the field are considerable. It also remains to be seen if the use of consultants to gain access to the latest enhanced oil recovery (EOR) technology will prove satisfactory. Since the consultants receive their fees whatever the outcome, the results will depend greatly on ONGC's performance in applying and managing the new technology. The risks of disappointing results would have been mitigated if an IOC with direct experience of EOR techniques, and whose returns were linked to performance, had been brought in as a joint venture partner,[15] as had been envisaged in 1994 (para. 3.19). EOR technology has progressed rapidly and there is clearly considerable potential to raise overall recovery from the field if the right incentive and management structure can be put in place.

Gas Supply Allocations

3.7 The development of the market for offshore gas was directed by GOI from the start. Gas supply was reserved for the fertilizer and petrochemicals industries until 1986. Since then, other users have been given quantitative allocations of gas to substitute for liquid fuels. Until today, however, access to gas supply and modifications to quotas are still decided by GOI. GOI issued a policy paper on gas allocations to different sectors in 1990. At that time, the Bank considered this satisfactory for ensuring that allocations were economically efficient,[16] even though price signals played no part in determining the amount of gas to be consumed by different consumers. The Guarantee Agreement for the GFR project committed GOI to ensuring that the allocation of gas to end-users was economically efficient and that the Bank was kept informed about changes in gas allocations, but compliance with this covenant was both delayed and partial. As a complementary step toward improving coordination between gas producers and consumers, GOI agreed to set up the Gas Linkage Committee, which, *inter alia*, revises gas allocations quarterly to optimize gas usage. This committee has apparently functioned well and is still operational since there is not yet a true "market" for gas supplies. In its 1996 review of the energy sector,[17] the Bank recommended that GOI scrap the allocation system and replace it with commercial contracting between producers and consumers, with GAIL acting solely as a gas transporter rather than a marketer as at present. These reforms are still some way in the future, after a gas regulatory agency has been set up. A proposal for the latter is to be presented for cabinet approval soon.

Gas Pricing Policy

3.8 The ICR does not review GOI's gas pricing policy during the project period. At appraisal it was expected that GOI would continue to use the marginal cost of replacement fuel as the basis for its gas pricing policy, just as had been agreed for the Bank's previous gas project. In 1987, when the policy was first introduced, the gas price at landfall points was fixed for three years at Rs. 1,400 per 1,000 m^3, then slightly above fuel oil equivalent. By the time these prices were reviewed by the Bureau of Industrial Costs and Prices (BICP) in early 1990, they had fallen

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14. The output from infill wells now averages 700–800 bbl/day, compared to over 3000 bbl/day for new wells when the field was young.

15. ONGC has commented (Annex C, para. 4.14) that "methodology, execution, knowledge, etc., varies from operator to operator. As such there is no guarantee that any such alliance will bring in the required benefits in a transparent manner."

16. SAR para. 2.19

17. India Energy Sector – Issues & Options, July 1996 (unpublished)

significantly below fuel oil equivalent, due to the combined effects of higher crude prices and a depreciating currency. GOI felt unable to impose the full price increase in a single step and hence opted for a three-year phased increase from mid-1991 in order to bring the gas price up to Rs. 1,850 per 1,000 m³ by the end of the third year, even though it should have been apparent that the BICP recommendation for 1990 would not be valid four years later. However, this approach was accepted by the Bank as a satisfactory basis for proceeding with the GFR project, and this phased program of increases was recorded in the agreed minutes of negotiations. The related loan covenant only requires the government to "exchange views" with the Bank on any revision to its gas pricing policy and does not contain any date for reaching fuel oil parity. Bank staff had attempted to obtain a clear link of gas prices to import parity of fuel oil with a series of regular price increases to reach parity. However, at the time of loan negotiations, obtaining GOI commitment to quarterly price increases proved impossible, and the Bank accepted the loosely worded covenant[18] proposed by GOI.

3.9 The outcome was far worse than expected at loan negotiations because GOI did not even implement the modest increases that it had indicated were approved policy. After an initial increase to Rs. 1,500 per 1,000 m³, gas producer prices were frozen from 1992 to 1997, resulting in a further sharp reduction in real terms and in its fuel oil equivalence. In 1997, producer prices were still only 55 percent of the international FOB price of a basket of fuel oils, i.e., lower than at appraisal and much below the equivalent level of a decade earlier. The Bank does not appear to have actively pursued gas pricing issues with GOI during project supervision. Bank staff responsible for the project at that time pointed out that following the decision in late 1994 to cease new lending in the oil and gas sector, it became very difficult for project staff to tackle policy issues with GOI.

3.10 The pricing of gas and the payments for it are modified by the workings of the Gas Pool Account, which is not discussed in either the SAR or ICR, although it was set up in 1990. This mechanism is used to subsidize gas consumers in northeast India, finance research and development, and absorb the extra cost of the growing volumes of gas produced by the joint venture fields (para. 3.20), which is priced at full parity with fuel oil. Until the 1997 pricing reforms, it was also used to compensate GAIL for the shortfall in earnings[19] arising from the low gas transportation margin.

3.11 In late 1997, GOI decided to abolish the administered price mechanism for oil and gas products over a four-year period to 2001. The landed gas price was to rise progressively from 55 percent of a basket of fuel oils to 75 percent by early 2000. Although initially designed to allow ONGC a satisfactory (12–15 percent) return on its gas-related investments, the current price policy fails to do so because of the drop in international oil prices and the deductions from the benchmark price needed to keep the Gas Pool Account in balance. In the final quarter of 1998, these deductions meant that ONGC received only Rs. 1,650 per 1,000 m³ (US$1.15/MMBTU), instead of Rs. 2,000 per 1,000 m³ benchmark price based on the fuel oil formula. What ONGC receives for its gas represents less than a 20 percent nominal increase on the level of a dozen years ago, during which time India has experienced substantial consumer price inflation. The low producer price for gas has deterred ONGC from accelerating development of satellite fields around the BH and SB structures, which are required to meet its future gas supply commitments to GAIL.

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18. Section 3.01 states ' The Guarantor shall establish and maintain a gas pricing policy which relates closely the domestic gas prices to the international prices of fuel oil and shall, prior to making any changes in said policy, exchange views with the Bank.'

19. GAIL was entitled to earn 12.5 percent on assets and in FY97/98 received Rs. 6,060 million (more than US$150 million) from the Gas Pool Account.

3.12 The currently depressed level of international oil prices and a relatively stable exchange rate provides GOI with an opportunity to move gas prices to fuel oil parity more quickly and easily than envisaged when the current policy was drawn up in 1997. Higher oil prices or a rupee devaluation in the future will make it politically harder to close the gap and will put strain on the finances of the Gas Pool Account. Furthermore, there is a strong likelihood of liquefied natural gas (LNG) imports in the medium term, which is generally priced substantially higher than fuel oil. This makes moving gas prices up to fuel oil equivalent in the short term all the more essential as a first step toward eventual parity with imported gas.

Petroleum Product Pricing

3.13 The ICR correctly identified the impediment to sector restructuring arising from GOI's petroleum pricing policy in the mid-1990s, which deviated from the previous practice of ensuring that products taken as a whole were not subsidized. However, the ICR does not discuss the impact on ONGC of GOI's reluctance to rectify its subsidy policy on diesel and kerosene. This put severe strain on overall sector finances in 1996/97. Even though the Oil Pool Account was supposed to be "budget-neutral," its deficit touched Rs. 190 billion (US$5 billion), with a sharply adverse impact on ONGC and Indian Oil Corporation, the sole crude oil importer, which were used to finance the consumer subsidies at the retail level.

3.14 In March 1998, GOI issued ONGC with Rs. 31.2 billion of special bonds[20] in lieu of the amounts due to it from the Oil Pool Account. The recent fall in oil import prices has enabled the account to go back into surplus and some of these bonds have already been redeemed. However, there is pressure from the Finance Ministry to use the surplus to reduce the overall budget deficit, rather than repay the oil companies the balance of their dues. Given that the GFR was not explicitly an oil project and oil pricing was not a policy issue it addressed, the Bank had limited scope for addressing this issue, despite its sectoral and macroeconomic importance.

Policy Dialog Between GOI and the Bank

3.15 During 1991–93 the Bank envisaged continuing its activities in the hydrocarbons sector and had even prepared a second oil and gas sector development (non-project) loan to address various policy issues. The 1994 decision to cease new lending to the sector was taken for internal budgetary reasons and because of a perception that the policy dialog with GOI in the sector was ineffective. Given the failure of GOI to stick to its policy on gas pricing (para. 3.9), and the disappointing outcome of the various exploration bidding rounds (para. 3.24), the decision was probably linked to both the budgetary constraint and the quality of the policy dialog. It led to a cutback in staff resources devoted to supervision of the ongoing project, and consequently, during the latter years of the GFR project there was very little interaction with GOI on policy matters. The Bank's supervision of gas pricing policy and sector finances was a casualty of the cutback: it became inadequate and ineffective. Bank staff involved in the project at that time indicate that GOI no longer considered the Bank an important actor in the sector and, hence, pursuit of a policy dialog with GOI was impossible.

3.16 The decision to cease lending also meant that the Bank opted out of playing any role in promoting regional gas trade and LNG imports by India, issues where its neutrality and vision of broader issues could have been useful. Several different sector entities interviewed by the audit mission perceive that one of the advantages from the financial presence of a multilateral lender in the sector lies in the positive impact this presence has on the pace of decision making and project

20. These bonds pay 10.5 percent interest and are redeemable in 2005.

implementation. GOI may wish to examine the possible advantages of a future facilitating role for the Bank group in the sector.

Institutional Development

3.17 ONGC faces a new and progressively more competitive operating environment, but it is still hampered by an insufficiently business-oriented culture. Transforming it from the culture of a government department, with an over-preoccupation with meeting physical targets regardless of cost, is a major challenge. It will take many years and require forceful top management with a clear mandate, which it has not always had. Despite its importance, the institutional reform of ONGC was not a GFR objective. Under its own initiative, however, ONGC has begun the process. With assistance from management consultants (McKinsey), ONGC is preparing to adopt an asset-based organization structure. This entails assigning multidisciplinary teams to each exploratory area and producing field (the assets). Services such as drilling are to be purchased by the "assets" from in-house departments or from external suppliers. So far two pilot "assets," one offshore and the other onshore, have been set up to serve as practical guides to extending the changed structure throughout ONGC. But to achieve a real transformation, these institutional changes will also need to be accompanied by reforms in ONGC's personnel policies. The latter are currently aligned to those of GOI. Promotions are virtually automatic, giving staff little incentive to perform well, and there are no financial rewards for excellence.

3.18 There is a recognition that the gap between ONGC's oil exploration and production capabilities and the best IOCs has increased. In late 1996, the Strategic Planning Group on Restructuring of Oil Industries,[21] concluded that "there is evidence that the technology gap in certain parts of India's hydrocarbon industry in relation to state-of-the-art global practice has actually widened recently. This is particularly true in the case of information technology in the hydrocarbon sector." To the extent that the GFR project assisted in exposing ONGC staff to the techniques used in the IPEC reservoir management study and the 3-D seismic surveys, the project may have made a modest contribution to the transfer of technology to ONGC. Much more remains to be done, particularly regarding EOR techniques, and it is too early to assess if the current arrangement with Gaffney Cline Associates (para. 3.6) will significantly reduce the technological gap.

ONGC's Joint Ventures with the Private Sector

3.19 In 1994, ONGC sought bids from IOCs to help it enhance overall recovery from the BH field, with their returns linked to the additional production obtained. The bidders were cautious and committed themselves to guaranteeing only 30–35 percent ultimate recovery from the field, while ONGC's expectations were in the 40 percent range. An advisory committee set up to review the proposals did not recommend proceeding with any of the offers. Given the degree of internal ONGC staff opposition as well as the anticipated political objections, the guaranteed returns would have had to be much greater for this fundamental change in business philosophy to have been accepted.

3.20 One of the main policy undertakings the GOI made to obtain the Oil and Gas Sector Development Loan was the decision to permit ONGC and Oil India Ltd. to enter into joint ventures with IOCs to develop existing oil fields. Since 1994, two consortia in which ONGC has

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21. Also known as the R Group, it was set up by GOI to "make recommendations on the policy objectives and initiatives required for restructuring the oil industry to meet the strategic objective of developing an internationally competitive hydrocarbons sector."

a 40 percent stake have operated 4 medium-sized fields. Production has increased rapidly, and these joint ventures now account for about 10 percent of total oil and gas production. Their share of gas production is likely to increase further following the confirmation of additional reserves. The output from these fields is priced at full parity with internationally traded crude oil.

3.21 Although controversial at the time of contract award, the experience with these joint ventures has been positive and should be extended to cover other discovered fields as well. ONGC feels that the experience demonstrates the advantages of a faster decision-making process and dynamic management, which it cannot match, due to the bureaucratic constraints it operates under.[22]

Exploration Policy

3.22 The project objectives included the promotion of greater private sector involvement in the industry. However, despite the Bank's considerable leverage in 1991, with two oil sector operations close to approval and India's foreign exchange crisis, the Bank does not appear to have used this leverage to persuade GOI to offer a quantum improvement in the quality of the exploration acreage on offer to potential investors. Bank influence on the terms of the fourth bidding round during preparation of the GFR project and its associated quick-disbursing loan (Oil and Gas Sector Development Loan), was ineffective.[23]

3.23 The GOI policy of reserving the most promising areas for ONGC was a key reason for the low level of IOC interest. In parallel with the processing of the GFR project, GOI prepared a fourth bidding round for oil exploration blocks, the launch of which became a condition of loan effectiveness. However, out of 24 offers received for 13 of the 72 blocks, only two contracts were signed.

3.24 A further five rounds took place until 1995, but the extent of private sector exploration activity arising from them has been modest, despite improvements in the quality of blocks offered and the contractual terms proposed. Each of the bidding rounds was supposed to make India as attractive an area for exploration by IOCs as any other comparable country, but the outcome indicates that the private sector remained reluctant to make a substantial commitment to this activity in India. At end-1998, exploration activity by private firms was taking place in 21 blocks out of a total of 35 blocks awarded under all the bidding rounds to date.

3.25 The GOI approval of the New Exploration and Licensing Policy (NELP) in 1997 was a step toward changing its approach to seeking the participation of IOCs. The key features of NELP that make it much more attractive than all previous bidding rounds are a seven-year tax holiday from the start of production, no preferential treatment of the state oil companies (who are also required to bid for these blocks), and no obligatory state participation. The terms of NELP are believed to be as attractive as those on offer anywhere else in Asia. The first offering of blocks under NELP took place in January 1999 and for the first time included 12 deep-water blocks (beyond 400 meters in depth) along the east coast.

3.26 The PAR shares the view of the ICR that the NELP represents a significant step in the right direction. Although the ICR (para. 20) states that the GFR project contributed to the

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22. ONGC commented (Annex C, para. 4.15) that its ongoing organizational transformation with the help of international management consultants, and the increased autonomy recently granted to it by GOI "is expected to impart the necessary speed in its decision-making process."

23. See the PAR (para. 6.10) for the sector loan.

improvements in the contractual terms offered, the audit mission was informed by DGH that the Bank had little input to the process that led to defining the terms of the NELP.

3.27 Since bids are due in May 1999, it is too early to assess if NELP will succeed where the previous bidding rounds have failed. Experience shows that even when bids are received, they often do not culminate in signed contracts. In the past, the contract negotiation process for exploration blocks has often been opaque, cumbersome, and slow, thereby contributing to the low number of contracts finalized. Few IOCs have the time and money or patience to stick with a process whose outcome is far from guaranteed, particularly when they are offered the chance of faster progress elsewhere in the world. Finally, the timing of the launch of the current bid process is unfavorable due to the depressed international crude price that has reduced IOC exploration budgets worldwide.

Divestiture of Government Shares in Petroleum Sector Entities

3.28 GOI's privatization efforts to date in the sector have not been successful. As part of the conditions for release of the second tranche of the ADB Hydrocarbon Sector Program Loan[24] in 1993, GOI committed itself to reducing its equity in ONGC to 80 percent. By the time the preparatory work was complete in mid-1994, financial market conditions were no longer favorable. Instead, 2 percent of the equity was placed with local financial institutions and a further 2 percent sold to employees. In late 1995, GOI offered a further 2.5 percent to local financial institutions, but very few bids were received and the offer was shelved. Subsequently the Divestment Commission advised GOI in mid-1997 to defer any further divestment until ONGC's organizational restructuring was complete and GOI's petroleum pricing policy was clarified.

3.29 In 1997, GOI had decided to divest a 25 percent stake in GAIL to international investors, but this was shelved following the Asian financial crisis. A share offering in the domestic market took place in February 1999, but only 3.5 percent of the shares were eventually placed, mostly with state-owned financial institutions.

3.30 In January 1999, GOI decided to sell 5 percent of GAIL to both ONGC and Oil India Ltd. as part of a wider effort to increase industry-wide coordination/collaboration following the trend toward greater integration in the international oil and gas industry. However, the main motivation for the build-up of cross-shareholdings within the publicly owned oil and gas industry is that it is a politically painless way for GOI to raise more than Rs. 50 billion (US$1.2 billion) in revenues to help reduce the budget deficit. GAIL is to buy 2.5 percent of ONGC from the government, which will also sell a 10 percent stake in the Indian Oil Corporation and ONGC to each other. This is not divestiture or privatization, since ownership remains entirely within the public sector. Nor will it lead to any gains in operational or management efficiency in the entities themselves.[25]

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24. ADB never disbursed the second tranche of US$125 million.

25. ONGC commented (Annex C, para. 4.16) that "it is expected that these cross-holdings will enable the companies to prepare better to face future competition and share managerial talent and resources."

4. Ratings

Overall Assessment and Ratings

4.1 The completed project had a major positive impact on oil production and gas supply to western and northern India and has yielded very large economic benefits. These benefits would have been even greater had the project been undertaken several years earlier. The ICR estimates the ex-post EIRR on the project to be 26 percent, compared to 30 percent at appraisal.[26] Given India's macroeconomic problems at that time, it would have been hard for ONGC to mobilize the foreign exchange necessary for the project without Bank participation in the financing. Despite this, the Bank's financial contribution did not translate into a satisfactory policy dialog with the government.

4.2 The project did not eliminate gas flaring in the BH field, contrary to the impression conveyed by the ICR. Flaring was eliminated by ONGC's decision to shut in high GOR wells and by the water injection program, both of which were independent of this project. However, the project facilities helped to ensure that flaring did not recur after 1994. The project had no impact on GOI's gas pricing policy, which remains unsatisfactory. Oil exploration policies have improved greatly in recent years, but without any significant input from the Bank. The reservoir management study carried out under the project has contributed to a better understanding of the BH field and may have assisted in a modest transfer of technology to ONGC. The project also contributed to a better integration of safety and environmental issues in ONGC's operations.

4.3 This audit rates the overall outcome of the project as satisfactory. The ICR assessed it as highly satisfactory, but such a positive rating is not consistent with the limited impact of the project on institutional and policy issues. The audit shares the ICR's view that the project's sustainability is likely. However, the audit assesses the institutional development impact of the project as modest, while the ICR considers the achievement of institutional objectives to have been substantial.

Bank Performance

4.4 The Bank's performance at appraisal is assessed as unsatisfactory because the project was appraised and designed on the premise that adequate associated BH gas would be available, even though it should have been apparent this was unlikely when the wells with high gas output (high GOR) were shut-in. Once this fact became apparent, the Bank worked effectively with ONGC to redesign the project to replace the suppressed gas supply from the Bombay High field. However, implementation was delayed by two years and one of the pipelines laid under the project is largely superfluous. Supervision of the physical implementation and the project's restructuring was satisfactory. However, Bank performance in the policy areas had several shortcomings. Initially the project design lacked any policy-based components to underpin the objective of enhancing private sector participation in the sector. Bank efforts to convince GOI to improve the attractiveness of the terms of the fourth exploration bidding were ineffective. Supervision efforts were concentrated on technical issues following the decision to withdraw from new lending to the sector and to cut supervision resources. This decision undermined the effectiveness of staff in charge of supervising the project and reduced the Bank to a minor player in the sector. Therefore, OED rates overall Bank Performance as unsatisfactory. The ICR rated Bank performance as highly satisfactory.

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26. Both of these estimates exclude benefits from incremental oil production. Including the oil benefits raises the ex-post EIRR to 48 percent.

Borrower Performance

4.5 ONGC's performance under the project was generally satisfactory and appears to have been better than under previous Bank projects, particularly on procurement decisions and expeditious implementation of the project's physical components. However, there were excessive delays in implementing the "software" components such as the reservoir study, safety improvements, and training activities. The main technical shortcoming was the erroneous estimation of associated gas production from BH, which underpinned the whole basis for the initial project design.

4.6 GOI's performance under the project was unsatisfactory. Gas prices fell in real terms during the 1990s, despite GOI's declared policy of progressively increasing them to fuel oil parity. The artificially low gas producer price imposed on ONGC by GOI during the mid-1990s had a negative impact on both supply and demand. It held back the development of small, higher-cost gas fields while artificially boosting gas demand and creating a supply scarcity almost as soon as the project was completed. Finally, GOI and ONGC reluctance to involve IOCs in exploration and production on a large scale has held back the discovery of new reserves and the maximization of recovery from existing fields. Nevertheless, in the light of ONGC's performance OED rates overall borrower performance as satisfactory. The ICR rated Borrower performance as highly satisfactory.

5. Lessons Learned

5.1 The main lessons from this project are:

- One of the Bank's major contributions is to help borrowers establish efficient sector policies. This project has shown that the "value added" from Bank involvement in a project is small if project design does not facilitate the pursuit of important sectoral policy goals. (paras. 3.8-3.9).

- Pool accounts are not an efficient method of addressing pricing problems and should be abolished as soon as possible. They are non-transparent, complex to administer, and create fresh distortions in economic transactions while attempting to solve others (paras. 3.10–3.11 and 3.13–3.14).

- The Bank needs to find alternative ways of maintaining a policy dialog on critical sector issues with wider macroeconomic implications when it decides to withdraw from direct lending to a sector. In India gas prices have a significant impact on power, fertilizer and fiscal policy and should be an integral part of the Bank's Country Assistance Review process.

- Setting gas producer prices administratively at levels below import parity hinders the development of new indigenous gas reserves and the viability of LNG import schemes. Gas prices in India should be moved up to fuel oil equivalent right away and to parity with imported gas in the longer term (paras. 3.11–3.12).

- The Bank should back up the institutional development components of its projects with appropriate lending conditionality to ensure that implementation is expedited (para. 3.5).

Basic Data Sheet

GAS FLARING REDUCTION PROJECT (LOAN 3364-IN)

Key Project Data *(amounts in US$ million)*

	Appraisal estimate	*Actual or Current estimate*	*Actual as % of appraisal estimate*
Total project costs[1]	3,184.3	2,098.9	65%
Loan amount	450.0	450.00	100%
Asian Development Bank	300.0	241	80%
Export-Import Bank of Japan	350.0	51.1	15%
Export/supplier credits	745.6	574.3	77%
ONGC	1,388.7	647.2	46%
Cancellation	-	0.0	--
Date physical components completed			
Economic rate of return[2]	30	26	87

Cumulative Estimated and Actual Disbursements

	FY92	*FY93*	*FY94*	*FY95*	*FY96*	*FY97*	*FY98*
Appraisal estimate (US$M)	111.1	139.4	135.0	61.0	3.5		
Actual (US$M)	90.0	125.6	189.8	15.6	0.0	6.5	22.7
Actual as % of appraisal	81	90	141	26	0.0	--	--

Date of final disbursement: March 3, 1998

Project Dates

	Original	***Actual***
Identification	n.r.	3/20/91
Appraisal	n.r.	5/31/91
Negotiations	n.r.	6/1-5/91
Board approval	n.r.	6/25/91
Signing	n.r.	7/11/91
Effectiveness	n.r.	7/12/91
Completion	n.r.	12/31/97
Closing date	n.r.	12/31/97

n.r. = Not Reported.

Staff Inputs (staff weeks)

	Planned		*Actual*	
	Weeks	US$	Weeks	US$
Through appraisal	n.r.	n.r.	103.3	259.3
Board approval through effectiveness	n.r.	n.r.	29.9	75.8
Supervision	n.r.	n.r.	214.0	775.6
Completion	n.r.	n.r.	9.0	38.7
Total	n.r.	n.r.	356.2	1,149.4

Mission Data

	Date (month/year)	*No. of persons*	*Staff days in field*	*Specializations represented*	*Implementation Status*	*Development Impact*
Through appraisal	10/90	3	10	TM, G, PE	n.a.	n.a.
	2/91	5	8	TM, G, PE, PR, EC		
	4/91	6	10	TM, PE, EC, FA, PR, EN		
Appraisal through Board approval						
Board approval through effectiveness						
Supervision	2/92	4	12	TM, PE, EC, G	S	S
	12/92	3	8	TM, PE, PR	S	S
	6/93	2	10	TM, G	S	S
	10/93	4	10	TM, PE, PC, PR	S	S
	11/94	2	7	PE, PC	S	S
	3/95	3	7	PE, PC, PR	S	S
	10/95	4	10	TM, PR, PC	S	S
	6/96	2	10	TM, EC	S	S
	2/97	2	10	TM, PC	S	S
	12/97	2	10	TM, PC	S	S
Completion						

TM=Task Manager, EC=Economist; EN=Environmental Specialist; FA=Financial Analyst; G=Geologist; PC=Process Engineer; PE=Petroleum Engineer; PR=Procurement Specialist.
S=Satisfactory.

Other Project Data

Borrower/Executing Agency:

FOLLOW-ON OPERATIONS

Operation	*Loan no.*	*Amount (US$ million)*	*Board date*
Oil and Gas Sector Development Loan	3391	150.0	July 23, 1991

Indian Offshore Gas Production, Flaring, and Supply 1990–98 (in MMCMD)

Field	1990/91	1997/98
SWEET GAS		
Bombay High	26.1	12.6
S-1	-	2.0
Heera	1.7	1.5
Neelam	0.4	2.4
B-121	-	1.2
Total Production	**28.2**	**19.7**
Less: field use	1.5	2.5
Flaring	10.7	2.2
Total piped to shore	**16.0**	**15.0**
Of which: Uran	(12.5)	14.8
Hazira	(3.5)	0.2
SOUR GAS		
South Bassein	10.1	29.9
Joint Venture Fields	-	2.9
Total production	**10.1**	**32.8**
Less field use	0.2	0.3
Total piped to Hazira	**9.9**	**32.5**
TOTAL OFFSHORE GAS SUPPLY	**25.9**	**47.5**

Comments from Borrower

ऑयल एण्ड नेचूरल गैस कारपोरेशन लिमिटेड
तेल भवन, देहरादून-२४८ ००३
Oil and Natural Gas Corporation Ltd.
Tel Bhavan, Dehra Dun - 248 003

इन्द्र नाथ चटर्जी
निदेशक (वित्त)
INDRA NATH CHATTERJEE
DIRECTOR (FINANCE)

Confirmation Copy
By Courier

No. MSGF/WB/3364/1
Dt. 18 June 1999
Fax # 001- 202-522-3123

World Bank
1818 H Street NW
Washington DC 20433 (USA)

Attn: Mr Gregor K. Ingram, Manager, Sector and Thematic Evaluations Group
Re: Gas Flaring Reduction Project (3364-IN) - draft Performance Audit Report

Dear Sirs,

Kindly refer to your letter dated 10 May 1999 on the subject.

2. We are enclosing our comments on the draft PAR about the issues relating to ONGC and its performance as a Borrower . As regards the various observations in the draft PAR about the performance of the Guarantor, it is presumed that the Bank would be obtaining the comments of the Guarantor and duly incorporate the same.

With regards.

Yours sincerely,

(I.N. Chatterjee)

Copy to

1. Joint Secretary (E), Ministry of Petroleum and Natural Gas, Shastri Bhawan, New Delhi

2. Mr Jitesh Khosla, Director, Deptt. of Economic Affairs, North Block, New Delhi

COMMENTS OF ONGC ON PERFORMANACE AUDIT REPORT RECEIVED FROM WORLD BANK ON GAS FLARING REDUCTION PROJECT (LOAN NO. 3364-IN)

1. Introduction

1.1 Gas Flaring Reduction Project was conceived with the objective of reducing gas flaring in western offshore of India and to increase the gas availability in western and northern parts of India so as to reduce energy shortages. The implementation of the Project by ONGC primarily involved procurement and installation of specified physical components and measures to improve reservoir management in the Bombay High field. The Project was successfully implemented by ONGC as acknowledged at various places in the Implementation Completion Report as well as the draft Performance Audit Report. The Project outcome and the Borrower Performance has been rated as highly satisfactory by the ICR and satisfactory by Audit.

1.2 Our comments on the various observations made in the draft Performance Audit Report (DPAR) appear in the following paragraphs.

2. Project Implementation and results

2.1 Para 2.5 of the DPAR makes a reference to the cessation of the gas flaring in Bombay High. Gas Flaring at Bombay High virtually ceased in 1994 because of the following reasons:-

1. Closure of high GOR and high water cut wells in phases from May 1992 onwards consequent upon the implementation of recommendation of BHRC report.
2. Build up of water injection and its positive effects in certain parts of the field
3. Natural decline of oil production
4. Workover jobs for gas/water shut off

Closure of high GOR and high water cut wells consequent upon the implementation of recommendations of the BHRC report, building up of water injection to the desired level and workover jobs for gas/water shut off were aimed at improved reservoir management.

2.2 The Audit has made an observation that the elimination of Gas Flaring at Bombay High, one of the key project objectives, cannot be attributed to this project.It is felt that this statement does not reflect true picture. The elimination of gas flaring in Bombay High, however, needs to be seen in the overall context of the development events and its impact since 1992.

2.3 Between May, 92 till commissioning of L-II and L-III Development Projects and the GFR Project, i.e. till April, 94, the overall production of associated gas from Bombay High and

flaring were reduced as a consequence of the implementation of BHRC recommendations including deliberate decision for closure of high GOR wells and other actions for improving health of the reservoir. Therefore, reduction in gas flaring during May 1992 to April 1994 could not be attributed to the project. The fact that various rectificatory measures initiated by ONGC resulted in significant improvement in reservoir performance cannot be ignored. This helped ONGC in maintaining oil production at a level of about 12 MMTPA during last few years.

2.4 The GFR Project among other facilities also increased gas compression capacity substantially at SHG and NQP in April 1994. Commissioning of these facilities had not only given greater flexibility in diversion of gas towards shore terminals at Uran and Hazira but also allowed ONGC to go in for an accelerated programme of converting more and more oil wells on gas lift. The number of wells on gas lift as on 31st March, year-wise from 1992 till 1999 is placed at Annexure-1. The number of wells on gas lift is presently around 370 out of total of 430 flowing oil wells in Bombay High. Thus requirement of gas lift gas, which was at level of about 5 MMSCMD during 1992-93, has now increased to the level of about 15 MMSCMD.

2.5 Though gas transportation from Bombay High area towards shore terminals at Uran/Hazira had remained at the same level, the compression and dehydration created under GFR project helped ONGC in utilising gas effectively over the years. Presently ONGC is utilising the gas compression and dehydration facilities at the platforms to almost maximum levels. The detailed disposition of gas in Bombay High from 1992-93 till 1998-99 is enclosed as chart at Annexure-II. It could be seen from the chart that without the GFR facilities, it would not have been possible to utilise the large quantities of gas that have been compressed and dehydrated. Without the additional facilities, it would have led to flaring of gas. In fact, if this project was not implemented, despite closure of high GOR wells, gas flaring would have once again shown increasing trend from 1994 onwards. As would be seen from the Annexure-II, total compression of gas which was about 18 MMSCMD during 1992-93, was around 29 MMSCMD during 1998-99. *Therefore, in absence of GFR facilities, gas flaring would have increased by about 11 MMSCMD during 1998-99 at current level of production.*

2.6 In view of above, it can be concluded that observation made by Audit in the "Performance Audit Report" (PAR) of the World Bank on GFR project is *not* truly reflective of the actual situation. In reality, the project was able to reduce flaring of gas in the past and would continue to contribute in future towards higher utilisation of gas.

3. Project redesign

3.1 The upgradation and expansion of gas production facilities for 5.0 MMSCMD (from existing 20.0 MMSCMD to 25.0 MMSCMD) at South Bassein and desulphurisation facilities at Hazira were included in the original project itself and it does not form major new project component. However, due to decline in associated gas output from Bombay High, the sour gas production had to be increased from South Bassein. The total availability of sour gas at Hazira were increased to 35.0 MMSCMD to meet ONGC's supply commitement to the Gas Authority of India Ltd. (GAIL). Since the availability of sour gas was more than the capacity either of 30" & 42" dia. trunklines individually, it had become necessary to transport the gas in a mixed mode

through both the 36" and 42" line upto Hazira. This resulted in requirement of additional desulphurisation facilities at Hazira. The Audit have already noted that the requirements were met well within the estimated costs and in fact with substantial savings.

4. Key Issues

Project timings (para 3.1 of DPAR)

4.1 It is mentioned that the 1982-87 period of the Bombay High development was in association with recommendations of ONGc's consultants, ie, CFP and scheme for development as jointly worked out in 1984-86 ~~was~~ for BH North and South was under implementation. The observation that ONGC's top management did not appreciate the importance of reservoir pressure maintenance by water injection for the future of the field is a misplaced observation as the water injection scheme in Bombay High North had already been implemented by 1987 in flank part and in south the scheme as per recommendations of CFP was approved for execution.

4.2 ONGC had conceived the importance of water injection in Bombay High field well in time to maximize the oil recovery. Peripheral water injection in Bombay High North was started in April 1984. CFP in their study of April 1985 suggested to supplement peripheral water injection with updip water injection by converting some of the existing producers into injectors and by drilling new injectors updip area. The water injection in up dip area of Bomaby High North was started from October 1988.

4.3 Water injection in Bombay High South was started in 1987. There is no doubt that its build up was slow and it reached a level of 633,000 BWPD in 93-94 and peaked to level of 761,000 BWPD during 95-96. The peaking of water injection upto 761,000 BWPD in Bombay High South was possible due to the creation of additional water injection facilities at SHW Platform which formed a part of additional development of Bombay High South under EORP Project.

4.4 The updip water injection in Bombay High North and increased water injection in Bombay High South helped in reduction of GOR from 430 V/V in 1991-92 to 300 V/V in 1993-94 and maintenance of the pressure in certain parts of the field.

Project Appraisal (para 3.2 of draft PAR)

4.5 The decision with respect to implementation of BHRC report was taken in May 1992. High GOR wells were closed in phases from May 1992 onwards. In view of this it is suggested that the last 3 lines of para 3.2 of DPAR be deleted.

4.6 It may be mentioned that Bombay High field is a very heterogeneous and geological complex field. The reservoir rock is fossil reef limestone, which contains highly permeable layers intercalated in a much less permeable matrix. Originally all the reservoir rock layers were saturated with the same fluids, but in the course of oil production pressure differentials

developed within the reservoir and the more permeable zone, acted as conduits to bring gas and water towards the producing wells by passing the oil in the less permeable sections of the reservoir. This problem was compounded by an overall reservoir pressure drop resulting from an increase of oil production rates not being compensated adequately by injection of water into the reservoir below the gas/water contact, as envisaged in the original production plan.

4.7 Thus, the reservoir heterogeneity and complexity was responsible for the incidence of excessive gas production and pre mature water break through in high permeability layers in the producers. In view of the foregoing it is clear that the operational decision to reduce oil and associated gas production, based on the Bombay High Review Committee recommendations on the management of the field, is interlinked with the reservoir heterogeneity.

4.8 Incidentally, it may also be mentioned that prior to the implementation of the recommendations of the BHRC report with respect to closure of large number of high GOR and high water cut wells and augmentation of water injection to the desired level. ONGC was taking necessary actions to close down the high GOR and high water cut wells, though on limited scale prior to the workover job for gas and water shut off in order to conserve the reservoir energy.

Bombay High Reservoir Management, Gas Flaring and Enhanced Oil Recovery (paras 3.3 to 3.6 of DPAR)

4.9 The recommendations of BHRC report were implemented from May 1992 onwards and not in 1991. It may be mentioned in this context that the observation in DPAR that soaring GOR endangered the total recoverable potential from the field is stretching the imagination to extreme. The soaring GOR under any operating system cannot endanger in the reservoir engineering parlance **the total recoverable reserves potential of any field.**

4.10 Water Injection facilities were augmented in the field from time to time as per the various technological schemes developed by ONGC. It is pertinent to note that such facilities were created prior to CFP report as well as subsequent to report. Under additional oil recovery project (AORP) in Bombay High South, a Water Injection Platform ICW was commissioned in September, 1989 having a capacity of 2,50,000 BWPD. Further, as a part of L-III Development under Enhanced Oil Recovery Project (EORP) SHW injection platform was commissioned in Dec. 1994 with a capacity of 3,20,000 BWPD.

4.11 The World Bank loan for the Gas Flaring Reduction Project was approved in June 1991. This loan stipulated a full reservoir management study of Bombay High field by an independent external consultant. The contract for the independent study by the consultant (IPEC) was signed in December 1993 after completing all the procedural formalities. In view of the foregoing it is suggested that lines 3-6 i.e. "The study ---------- external review" may please be deleted.

4.12 IPEC through their study had recommended additional development of Bombay High North and South both for L-III reservoirs with a total additional investment of US$ 1492 million,

which involved drilling of about 270 additional wells and change of the water injection pattern. The suggested additional development also included the exploitation of oil from peripheral areas of Bombay High field (speculative areas) where the data available are sparse. About 38% of the incremental oil potential as estimated by IPEC was from the speculative areas. IPEC in their report had suggested that the development of the speculative areas would call for 3-D seismic data acquisition. The observations of the IPEC in this context are reproduced below.

> *"Some of the upside potential in the L3 reservoir is predicted to exist in areas peripheral to the main developments in the North and South of the field (the so called "speculative areas"). By their very nature, the data available on these areas are relatively sparse and they will therefore require further assessment through 3-D seismic acquisition and appraisal drilling before full commitment to their development can be made"*

4.13 In view of the foregoing ONGC and Directorate General of Hydrocarbon (DGH) thought it prudent to go for the additional development of Bombay High field on a large scale, only after the availability of 3-D seismic data. In this connection it may be mentioned that ONGC in consultation with DGH went ahead for drilling of infill wells both in Bombay High North and South, in the main producing area where the level confidence was high. ONGC has drilled about 70 infill wells during the period from 1996-97 to 99-2000.

4.14 The DPAR has made an observation at para 3.6 about ONGC's decision to avail the services of Gaffney Cline Associates (GCA) and suggested that it would have been better alternative to bring in an IOC as partner. It may be mentioned that an effort was made in that direction. It was found that there was wide variation in the reservoir potential and lack of unanimity about acceptable base profile as indicated by ONGC and the perception of various bidders. As a result, efforts could not lead to conclusive understanding. Baed on information received from various such parties, it reinforced the belief that the methodology, execution , knowledge etc varies from operator to operator . As such there is no guarantee that any such alliance will bring in the required benefits in a transparent manner. GCA are one of the foremost reservoir and field development consultants having wide ranging knowledge and expertise . It is our considered view that such input from consultants like GCA will go a long way in management of BH reservoir in optimum manner.

ONGC's Joint Ventures With Private Sectors (paras 3.19 to 3.21 of DPAR)

4.15 ONGC has already initiated the process of organisation transformation with the assistance of internationally reputed management consultants , McKinsey and Co. And is in the process of implementing an Asset based organisation structure. Initiatives have been taken with the assistance of reputed consultants to upgrade and modernise the accounting, HR, material management and communication systems in ONGC. Further, ONGC's Board has been extended increased autonomy under Navratna package with the recent appintment of five part-time non-official directors. It is expected that these developments would enable ONGC to impart the necessary speed in its decision making process and the dynamism in management.

Divestiture of Government Shares in Petroleum Sector Entities (paras 3.28 to 3.30 of DPAR)

4.16 With respect to crossholding of shares by ONGC, IOC and GAIL , the DPAR has made an observation to the effect that this is not divestiture or privatisation since ownership remains entirely within the public sector. The DPAR have ignored the strategic alliance aspect involved in such cross-holdings. With the gradual freeing of market and increase in competition, it is only appropriate that the players acquire a strategic interest in each other so as to lay the requisite foundation for mutual cooperation and business partnerships . IOC and ONGC are already discussing the implementation of quite a few projects – both upstream and down stream- on joint venture basis. It is expected that these cross-holdings will enable the companies to prepare better to face future competion and share managerial talent and resources.

5. Conclusions and Performance Ratings

5.1 As may be observed, the performance of the Borrower has been quite satisfactory and , despite changes in gas profiles mid-way of the project, alternative solutions were found and implemented quickly within the estimated project costs. In fact, the Project has been implemented with significant cost savings. The position of the Borrower on the various observations has been brought out in the preceding paras which, it is hoped , will place the observations in the corect perspective.

5.2 As regards the various observations regarding the performance of the Guarantor, it is presumed that the Bank would be obtaining the comments of the Guarantor , that is, Government of India and duly incorporate the same.

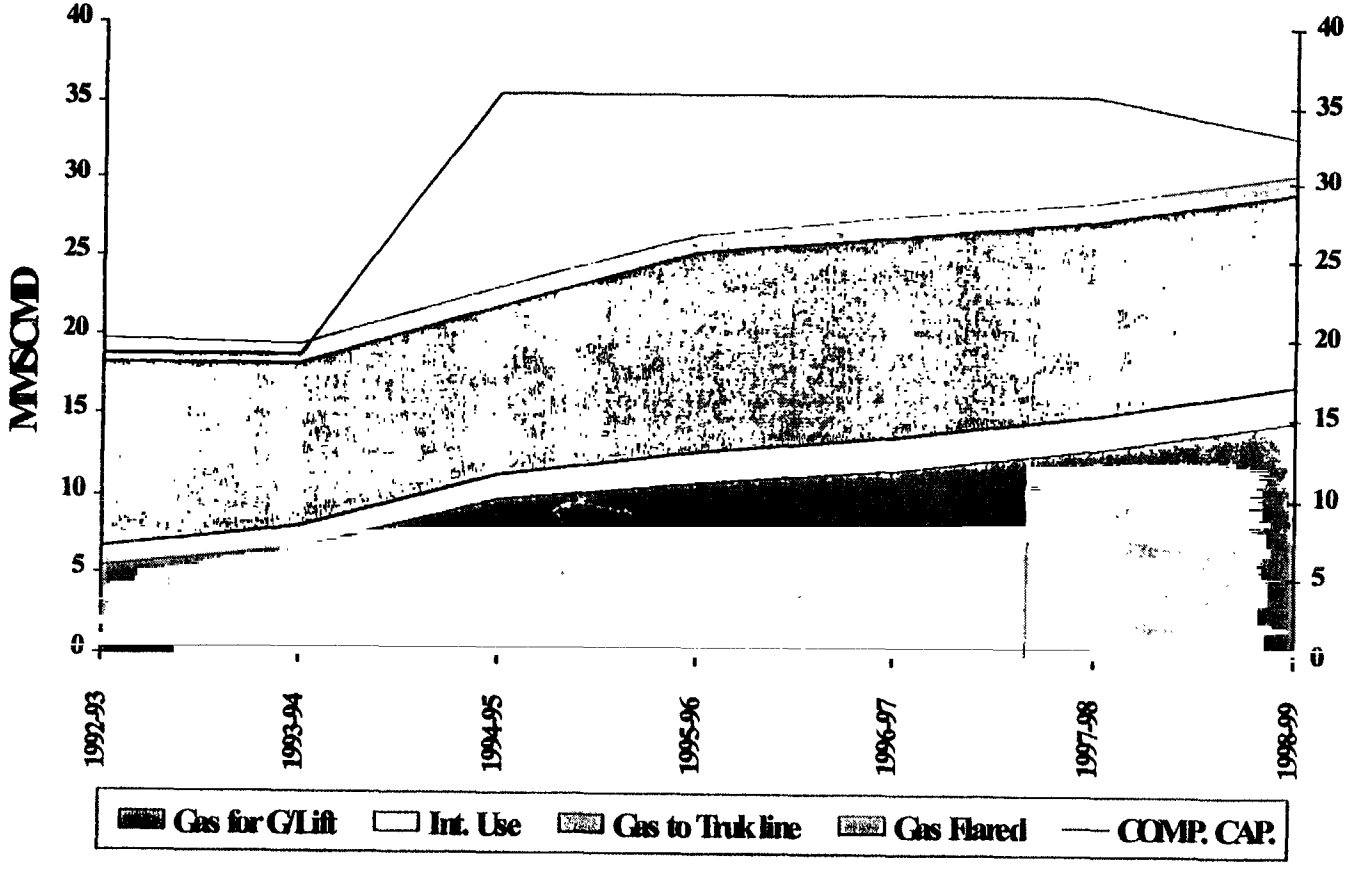
ANNEXURE - I

WELLS FLOWING ON GAS LIFT IN BOMBAY HIGH

As on 31st March of each year

As on	No. of wells flowing on gas lift
31-Mar-91	32
31-Mar-92	112
31-Mar-93	126
31-Mar-94	170
31-Mar-95	263
31-Mar-96	312
31-Mar-97	331
31-Mar-98	339
31-Mar-99	368

DISPOSITION OF GAS IN BOMBAY HIGH
1992-93 THROUGH 1998-99



Note: 1. Gas compressed = gas lift + Int. use + Trunk line
2. Gas production = Int. use + Trunk line + flaring

INDIA
GAS FLARING REDUCTION PROJECT