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Report No. 14007

PROJECT COMPLETION REPORT

INDIA

COOPERATIVE FERTILIZER INDUSTRY PROJECT
(LOANS 2729-IN AND 2730-IN)

MARCH 1, 1995

Industry and Mining Division
Industry and Energy Department

CURRENCY EQUIVALENT

Currency Unit	=	Rupees (Rs.)
Rs. 1.00	=	Paise 100
US$ 1.00	=	Rs. 31.00 at time of PCR preparation
US$ 1.00	=	Rs. 13.00 at time of SAR finalization

Fiscal Year

Government of India: April 1 - March 31

IFFCO:	up to June 30, 1987:	July 1 - June 30
	transition period:	July 1,1987 - March 31,1989
	as from April 1, 1989:	April 1 - March 31

LIST OF ABBREVIATIONS

CPCB	Central Pollution Control Board
DANIDA	Danish International Development Agency
EIA	Environmental Impact Assessment
ERR	Economic Rate of Return
FAI	Fertilizer Association of India
FRR	Financial Rate of Return
GAIL	Gas Authority of India Limited
Gcal	Gigacalories (1 million kcal)
GOI	Government of India
GPCB	Gujarat Pollution Control Board
IFFCO	Indian Farmers Fertiliser Cooperative Ltd.
kcal	Kilocalories (1,000 calories)
kg	Kilogram
Mcal	Megacalories (1 million calories)
MINAS	Minimum National Discharge Standards
MMm^3pd	Million cubic meters per day
Nm^3	Normal cubic meter
OECF	Overseas Economic Corporation Fund
PDIL	Projects Development India Limited
SCF	Standard conversion factor
tpd	Metric tons per day
tph	Metric tons per hour
UP	Uttar Pradesh
UPPCB	Uttar Pradesh Pollution Control Board

THE WORLD BANK
Washington, D.C. 20433
U.S.A.

Office of Director-General
Operations Evaluation

March 1, 1995

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: **Project Completion Report on India - Cooperative Fertilizer Industry Project (Loans 2729/2730-IN)**

Attached is the Project Completion Report on India - Cooperative Fertilizer Industry Project (Loans 2729/2730-IN), prepared by the South Asia Regional Office with Part II provided by the Borrower.

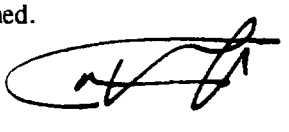
The major component of the project consisting of a large scale, state of the art, energy efficient, gas-based ammonia/urea fertilizer plant at Aonla, Uttar Pradesh, was constructed and commissioned in record time and came into production ahead of schedule. Because of the good technical design of the plant and the high quality of the operational and maintenance personnel, the plant has been consistently producing well above its nameplate capacity (125% in 1993/94). The implementation experience with the rehabilitation subcomponent (three smaller fertilizer producing units at Phulpur, Kalol and Kandla) was less impressive, though most of the objectives, in terms of higher capacity utilization, better energy efficiency and better environmental protection were met. The lengthy approval process by the Government caused a long delay in the implementation of these subcomponents.

Although the Program of Initiatives, supported by the import component of the loan (US$150 million), was supposed to address fertilizer subsector issues by setting performance targets, none of the objectives, especially those related to fertilizer pricing and subsidies, were realized. During implementation of the project, the Bank, considering that the Government of India had not made significant progress in reforms, informed the Indian authorities that the Bank would discontinue making loans in the subsector until the fundamental issues had been addressed more satisfactorily.

The last subcomponent of the project: the Performance Evaluation and Control System Study got off to a late start. Although the first phase of the Study has been finished, its second phase, including actual design and implementation of the information system, will not be completed until sometime in 1995. This Management Information System was to assist the Ministry of Fertilizer in evaluating the performance of state-owned fertilizer companies.

While the policy reform achievements of the project have been quite disappointing, the project has realized all of its physical and technical objectives. The plant at Aonla is an intrinsically economic unit, capable of meeting competition in the international market, and its management has a sound and proven track record. The project outcome is, therefore, rated as satisfactory and its sustainability as likely. The institutional impact of the project is rated as modest.

The PCR is of satisfactory quality. No audit is planned.



Attachment

PROJECT COMPLETION REPORT
INDIA
COOPERATIVE FERTILIZER INDUSTRY PROJECT
(Loans 2729-IN & 2730-IN)

TABLE OF CONTENTS

PROJECT COMPLETION REPORT

INDIA

COOPERATIVE FERTILIZER INDUSTRY PROJECT

(Loans 2729-IN & 2730-IN)

PREFACE

This is the Project Completion Report (PCR) for the Cooperative Fertilizer Industry Project in India, for which Loan 2729-IN to the Government of India (GOI), in the amount of US$150.2 million and Loan 2730-IN to the Indian Farmers Fertiliser Cooperative Ltd. (IFFCO), in the amount of US$150 million, were approved on June 26, 1986. Loan 2729-IN to GOI was closed on June 30, 1992, and was disbursed in full. Loan 2730-IN to IFFCO was closed on June 30, 1993, one year behind schedule. Due to a reduction in total financing requirements for IFFCO's project components, a total of US$45.277 million was canceled, reducing the Bank Loan to IFFCO to US$106.72 million and total Bank financing for the project to US$256.92 million.

The PCR was jointly prepared by the Country Operations, Industry & Finance Division, Country Department II (South Asia Regional Office), the Industry and Mining Division of the Industry and Energy Department (Preface, Evaluation Summary, Parts I and III), and IFFCO, the Beneficiary (Part II). For their information, a copy of the PCR has been sent to the Overseas Economic Cooperative Fund (OECF), of Japan, the Danish International Development Agency (DANIDA), of Denmark, and the OPEC Fund, the project co-financiers.

Preparation of the PCR started during a project completion mission in India in April-May 1994, and is based, inter alia, on the Staff Appraisal Report; the Loan and Project Agreements; supervision reports; the Bank project files; information prepared by IFFCO for the Aonla and the Plants Rehabilitation components; and valuable statistical information obtained from the Fertilizer Association of India.

PROJECT COMPLETION REPORT
INDIA
COOPERATIVE FERTILIZER INDUSTRY PROJECT
(Loans 2729-IN & 2730-IN)

EVALUATION SUMMARY

Objectives

1. The main objectives of the project were to expand domestic nitrogenous fertilizer production and to improve the operational efficiency of existing plants in the cooperative sector, in order to lessen India's dependence on imports and take advantage of the vast and newly developed Bombay High natural gas resources as economic feedstock. These objectives were to be achieved in part through the construction of a new ammonia/urea complex at Aonla (Uttar Pradesh) and the rehabilitation of three IFFCO existing plants. By increasing fertilizer production in some of India's major agricultural areas, the Project would reduce volumes of fertilizer transported from coastal ports and plants to northern states, and further stimulate fertilizer consumption in these areas where it was still at a low level. Through the Aonla project, GOI also seeked to promote the transfer of technology. A study was funded under the project to design and implement a management performance evaluation and control system aimed at improving existing institutional arrangements for the management of public sector fertilizer plants, to enhance their performance, and increase their levels of capacity utilization. Finally, through the provision of US$150 million to GOI for fertilizer and raw materials imports, the project aimed at supporting GOI's Program of Initiatives in the sector to reduce fertilizer costs and the level of fertilizer subsidies.

Implementation Experience

2. Plant constructions of the Aonla ammonia/urea complex was completed on January 1, 1988, thirty six months after the construction starting date, as initially planned by IFFCO, and about six months ahead of the Bank's conservative estimate. In spite of delays in supply of gas by the Gas Authority of India (GAIL), production of urea started on May 18, 1988. Commercial production was formally declared on July 7, 1988, 42 months after the zero date as estimated by IFFCO and more than two months ahead of the Bank appraisal estimate. The Aonla plant was completed well ahead of schedule, in October 1988. It was designed and implemented efficiently and within budget.

3. The plant rehabilitation program, however, encountered serious implementation delays and was adjusted several times, adding and canceling a number of sub-projects. It suffered mainly from long delays in obtaining GOI approvals and from some instability in IFFCO's top management during the critical

initiation phase of the project. Implementation only started after December 1988, when government approvals were obtained, instead of in January 1986, as planned at appraisal, three years behind schedule. While all investments were originally expected to be completed before the end of 1989, it was necessary to extend the loan closing date to June 30, 1993 to allow completion of all but one of these investments.

4. The Performance Evaluation and Control System study was also substantially delayed, as agreement on its terms of reference (TORs) and short-list of consultants was reached only in June 1988, about two years behind schedule. Late in 1989, DOF proposed changes in study implementation arrangements and break-down of the study into two phases. The first phase of the study, aimed at identifying information requirements for the Department of Fertilizer (DOF) to evaluate performance of, and control, fertilizer companies was initiated in April 1991, and the draft report was completed in April 1992 (55 months behind the original schedule). The final report was completed in October 1993. The second phase, which includes the actual design and implementation of the information system and of needed hardware, is under implementation.

5. Implementation of the import component (originally intended to finance imports of sulfur, potash and phosphate raw materials) was substantially delayed, due to unresolved disagreements over the Borrower's procurement procedures for phosphate and potash materials, which were determined to be inconsistent with Bank Guidelines. In January 1988, the Bank agreed that naphtha, fuel oil and crude oil could be financed under the loan, using procedures identical to those agreed under the Drought Assistance Program. The import component was disbursed in full in June 1990, about two years behind schedule.

6. Total financing requirements for the Aonla complex amounted to Rs.6,596 million versus Rs.8,230 million estimated at appraisal, equivalent to US$507.4 million and US$633.1 million, respectively. These significant savings (about 20%) occurred in interest during construction, working capital and commissioning costs, due to faster than expected implementation and commissioning. Large savings also occurred (US$95.8 million) in financing requirements for rehabilitation investments in IFFCO's other plants, since these amounted to US$38.7 million only, versus US$134.5 million at appraisal. Lower costs were due to the cancellation of many schemes which were no longer relevant, and to overestimated interest during construction.

7. Total Bank financing actually amounted to US$256.9 million (compared to the original loan amount of US$302.2 million), including US$89.1 million for the Aonla project, US$17.7 million for the rehabilitation component, US$150 million for the import component, and US$200,000 for the MIS study. Bank funds totalling US$45.3 million were canceled , including US$22.9 million (20.5%) for the Aonla component and by US$22.3 million (56%) for the rehabilitation component. The Loan to the Government (Loan 2729-IN), however, was fully disbursed by June 1990, before its closing date. The IFFCO loan closing date of June 30, 1992 was extended once to June 30, 1993 to allow completion of the rehabilitation component. In addition to the Bank loan, GOI also received other cofinancing funds for the Aonla project totalling US$150.8 million.

Project Results

8. Overall, for the Aonla component, project objectives were more than fully met. Capacity utilization at Aonla is high, at 118% and 125% for the ammonia and urea plants, respectively in 1993/94. It is estimated that the plants are capable of maintaining a sustained 110% capacity utilization rate during their entire economic life, which is substantially higher than the 95% maximum capacity utilization assumed at appraisal for the third year of operation. IFFCO's sales in Aonla's main market area (UP, Haryana and Punjab) have more than tripled since plant start-up. Overall increase in fertilizer demand nationwide have been in line with appraisal estimates.

9. The Aonla project economic rate of return (ERR) is now estimated at 12.2%, lower than the base case rate of 17.1% estimated at appraisal. This difference is mainly because international urea prices have been substantially lower than projected at appraisal, while the fuel oil equivalent value has not decreased to the same extent. For reasons given below, the project financial rate of return (FRR) is now estimated at 15.6%, slightly lower than the appraisal estimates of 16.6% (paras. 7.6 and 7.7).

10. The Aonla plant financial rate of return (FRR) is estimated at 9.8%, slightly lower than the appraisal estimate of 11.8%. The actual price of natural gas is slightly higher than appraisal estimates, while urea retention prices are much lower than those projected at appraisal. However, this difference in relative prices is partly compensated by higher rates of actual capacity build-up and utilization, a shorter implementation period, and lower capital costs.

11. All implemented rehabilitation sub-projects with quantifiable benefits (generally the result of efficiency improvements and energy savings), have internal rates of return ranging between 23% and 110%, compared to rates of return ranging from 20% to over 40% estimated at appraisal. Other, more difficult to quantify, benefits include reduction in negative environmental impacts through better effluent controls, increased safety, and increased plant reliability.

12. The Program of Initiatives supported by the import component was only partially implemented and had limited and at times conflicting results. Average capacity utilization rates and energy consumption did improve, mainly due to start up of a number of modern, gas-based plants and to rehabilitation and operational improvements in existing gas-based, and, to a much more limited extent, fuel oil-based plants. However, in outdated coal-based state-owned plants, capacity utilization actually decreased and energy consumption increased. Unprofitable "sick" plants have been maintained in operation, although GOI has recently officially declared two companies (owning several of these plants) "sick", triggering an audit process now underway, and a decision about their future is expected shortly. With respect to fertilizer prices, while those of phosphatic and potassic fertilizer were deregulated (which led to substantial increases), prices of urea to farmers were reduced by the Government by 10%, exacerbating existing distortions in relative consumptions of nitrogenous, phosphatic and potassic fertilizer. GOI did revise the retention price formula for gas-based plants to reduce prices and the fiscal burden of fertilizer

subsidies. However, the price of gas remains significantly above its opportunity value, affecting the financial position of efficient companies and distorting feedstock choices. Finally, fertilizer subsidies to farmers have continued to increase from about Rs.19 billion in 1986/87 (0.73% of GDP) to Rs.58 billion in 1992/93 (0.92% of GDP). During implementation of the project, the Bank, considering that GOI had not made significant progress in reforming fertilizer prices and reducing subsidies, inform GOI that it would discontinue processing of the Fertilizer Distribution Project, and would make no further loans in the sector until these fundamental issues had been addressed more satisfactorily.

Environmental Aspects

13. At Aonla, effluent treatment and discharge facilities were constructed in accordance with Indian environmental standards, which are comparable to standards applied for such installations in industrialized countries and/or other environmental standards acceptable to the Bank. The ammonia and urea plants were designed based on a zero-effluent concept. A green belt of 150,000 trees was planted to improve the ecological balance of the surrounding area and reduce noise and dust transmission. Finally, Aonla is equipped with a modern environmental management laboratory, on-line analyzers and adequate water and air pollution monitoring stations, and early- on defined and implemented an environmental management plan, including a detailed monitoring plan.

14. In 1992/93, more than four years after commissioning, IFFCO carried out a new Environmental Impact Assessment (EIA) of the plant, which concluded that Aonla pollution control measures were effective and that all effluent were within the limits specified by the UP Pollution Control Board (UPPCB). Also, in 1989, the Center for Energy, Environment and Technology carried out a case study on environmental management practices at Aonla and reached similar conclusions. The study also recommended the inclusion of periodic external auditing in the Aonla management plan. Finally, in 1992/93, IFFCO revised the Aonla Disaster Management Plan in light of new guidelines issued by the Directorate of Factories of the Department of Labor of UP.

15. The naphtha-based Phulpur ammonia-urea plant, which was commissioned in 1980, is located in the Indo-Gangetic plains. Since start-up, IFFCO has implemented an extensive program of effluent and pollution control improvement to bring the Phulpur plant in full conformity with UPPCB and MINAS standards. Part of these schemes were financed under the project. Pollution control measures for liquid effluent, air emissions, domestic sewage, and solid waste were adopted, and aim at maximum reduction and re-use of effluent and safe management and use of solid waste. A green belt of 270,000 trees was planted to improve the ecological balance of the surrounding area and reduce noise and dust transmission. Phulpur is equipped with a modern environment and pollution control laboratory, on line analyzers, stacks sampling arrangements, water and ambient air pollution monitoring stations, and has established a detailed monitoring plan.

16. In 1992/93, HBTI/KANPUR undertook an EIA of the Phulpur plant which concluded that the plant would not cause any irreversible impact on the

environment or depletion of the water table, and that impact on air, water and land bodies was negligible. It also concluded that the socio-economic environment had improved; and that the green belt moderated the plant impact on the environment. It did recommend further reductions in discharge of effluent water (currently recycled at about 60%) and improvements in the bottom of the urea storage to better control moisture seepage.

17. The gas-based Kalol ammonia-urea plant (Gujarat) was commissioned in 1975. Since start-up, IFFCO has implemented an extensive program of effluent and pollution control improvements to reduce pollutants in plant effluent within the limits of the Gujarat Pollution Control Board (GPCB) and MINAS standards. Part of the newer schemes were financed under the project. A number of pollution control measures for liquid effluent, air emissions, domestic sewage, and solid waste were taken, aiming at maximum reduction and re-use of effluent. Most of these improvements were commissioned in 1992/93 and 1993/94 and liquid and gas effluent are now in conformity with the GPCB standards.

18. The Kandla Diammonium Phosphate (DAP) and complex fertilizer (NPK) plant started commercial production in 1975. It is adjacent to the Kandla port (Gujarat). The units are based on a well-known process, with total recycle of liquid effluent, and are equipped with the necessary gas effluent treatment and pollution control systems. Under the project, a new modern ammonia tank was implemented for increased safety. The plant also received many safety awards from the Government of India and from Gujarat Safety Council.

Project Sustainability

19. It is estimated that, over its economic life, the Aonla plant is capable of maintaining a sustained capacity utilization rate between 100% and 110%. If GOI decides to deregulate the fertilizer sector (including prices of inputs and outputs), the Aonla plant would be able to withstand competition from imports, at currently projected import parity prices, even in the absence of protective tariffs, while paying natural gas at its fuel oil equivalent value. In fact, such deregulation would improve the project FRR from the currently estimated 9.8% to 12.8% (para. 2). The major risk still faced by the project is that, in order to reduce the financial burden of the fertilizer subsidy, GOI may decide to revise the urea retention price norms further downwards. This would render the project less attractive. The duplication of the Aonla plant, which is currently under implementation, should further improve project sustainability by reducing fixed cost per ton of urea.

20. In the long term, sustainable operation of the plant is also a function of adequate supplies of natural gas feedstock and efficient operation of the HBJ pipeline. GAIL is no longer supplying gas to Aonla for use in steam generation and heating. This shift was foreseen, and is not expected to have an impact on project viability. IFFCO has also reached an agreement with GAIL for the duplication of the Aonla plant. However, this duplication is being designed with a possibility of replacing up to 50% of natural gas with naphtha as feedstock. The current high price of natural gas may be resulting in wrong decisions with respect to feedstock choice for future ammonia plants, as may be the case here.

21. The main objective of the performance evaluation and control system component was to assist GOI in further improving the physical and financial performance of public sector fertilizer plants, by designing information and control systems linking greater autonomy at the enterprise level to increased accountability of its managers. Such a system is potentially very useful, but GOI should be careful not to use it to increase day-to-day control of public sector companies, further centralize decisions, and increase the number of approvals.

22. While it is correct that GOI fertilizer policy has allowed India to develop a large domestic fertilizer production which positively contributed to reaching targeted increases in foodgrain production, it has also resulted in growth in fertilizer subsidies to unsustainable levels. However, fertilizer subsidy and low-price policies have a built-in effect of increasing total amounts of fiscal subsidies by encouraging further consumption of subsidized fertilizer. As the subsidy issue will become more and more acute, GOI will have to urgently address this issue.

Findings and Lessons Learnt

23. The Aonla project was efficiently implemented, well within budget and significantly faster than the Bank's conservative implementation schedule. This points-out at the importance of sufficient and timely availability of funds and adequate project implementation and operation preparation arrangements. The constitution of a high quality on-site project team with the required autonomy and authority to manage project implementation and subsequently take over plant operations, incorporating experienced staff from other plants and supported by a modern computerized project management system, was of particular importance. Also important was the timely preparation and implementation of comprehensive manpower planning, recruitment and training programs ahead of time to prepare for later operations.

24. The many (justified) changes which were required to the plant rehabilitation program during implementation highlight a need to design and manage such programs more flexibly. Unless all subprojects have been fully designed and evaluated and are ready for immediate implementation by appraisal, the project documents should, besides a tentative listing, include a definition of the types of rehabilitation investments that would qualify, and of selection criteria that they must meet. The same flexibility, and delegation of approval authority to the company, should be obtained from government approval authorities to avoid lengthy delays.

25. The unsatisfactory implementation of the Program of Initiatives addressing major sector issues shows the difficulty for the Bank of influencing sectoral policy-making unless full government commitment to a program of reforms has been formally secured up-front. In the course of the project preparation, GOI officials have developed with assistance of Bank staff, the Program of Initiatives. However, GOI was not able to determine the appropriate speed with which adjustment can be made, given the complexity of the sector issues, particularly politically highly sensitive issues on fertilizer pricing and

subsidies. The absence of specific time-bound implementation schedule of the Program of Initiatives, agreed and specified, in appropriate legal covenants has made it difficult for the Bank to follow up on its implementation. Although the import component has partially met its objectives of supporting the Program of Initiatives, it should have been made with appropriate conditionalities securing the implementation of the required actions and probably only after the critical reform measures have already been initiated.

PROJECT COMPLETION REPORT
INDIA
COOPERATIVE FERTILIZER INDUSTRY PROJECT
(Loans 2729-IN & 2730-IN)

PART I: PROJECT REVIEW FROM BANK'S PERSPECTIVE

1. Project Identity

Name: Cooperative Fertilizer Industry Project
Loan Number: 2729-IN & 2730-IN
RVP Unit: South Asia Region
Country: India
Sector: Industry

2. Background

2.1 The agricultural policy of the Government of India (GOI) aims at ensuring increased food production, towards self-sufficiency. The objective of further expanding fertilizer use, which has grown from 66,000 tons per year of nutrients in 1952/53 to more than 12.7 million tons in 1991/92[1], is an important part of GOI strategy to increase agricultural output. Eight development plans have given priority to the development of the fertilizer industry to ensure a sustained supply of fertilizers, substitute for imports, and expedite the achievement of agricultural self-sufficiency. As a result, the bulk of nitrogenous fertilizer consumed in India is domestically produced (90.7% for 1991/92) and large amounts of phosphate fertilizers are also produced by the domestic industry, largely from imported inputs (77% of total supply in 1991/92). The entire national consumption of potassic fertilizer, however, is imported.

2.2 The policy framework of the fertilizer sector is one of the most complex in India -- with tight Government control of feedstock and most output pricing, of market allocations, and of fertilizer distribution. Government policies also limit the choice of technology, feedstock, plant location, project execution arrangements and financing, and allocation of production licenses between the public, joint, cooperative, and private sectors. Prices of phosphatic and potassic fertilizers were decontrolled on August 25, 1992, but, for all straight nitrogen fertilizer (about 59% of total nutrient consumption in 1992/93), the pricing policy remains characterized by: (i) low and uniform farmgate prices (Rs.2,760 per ton of urea since August 1992, equivalent to US$89 in April 1994); (ii) producer prices set ex-factory for each plant's output (retention prices) to cover almost all production costs on the basis of a combination of actual and normative costs and to provide a post-tax return of 12% of total equity; and (iii) a budgetary subsidy to bridge the gap between the price paid by farmers and the price paid to producers. Retention prices for urea plants currently in operation range between Rs.2,500 and Rs.6,147 per ton, and averaged about Rs.4,734 per ton in 1992/93 (Rs.4,400 per ton for the Aonla Project for the three year pricing period ending FY 1993/94) -- most Indian urea producers presently receive ex-factory prices that are in line with landed prices of imported urea or below (landed prices were estimated at about US$ 180 per ton of bagged urea in May 1994, or Rs. 5,580 at an exchange rate of Rs.31 per US$).

2.3 This policy has permitted India to develop a large domestic fertilizer production -- India is today the fourth largest fertilizer producer in the world -- and positively contributed to reaching the country's targeted large increases

[1] Average fertilizer consumption increased from 0,55 kg per ha in 1951/52 to about 70 kg per ha in 1991/92, while cropped area increased from 133 million ha to 181 million ha

in foodgrain production. However this policy has also resulted in growth of the fertilizer subsidy to an unsustainable level (Rs.58 billion in 1992/93), and in the survival of a few uneconomical fertilizer operations. GOI has recently recognized the need to address sectorial issues, but until now limited its action to the implementation in March 1992 of some timid and somewhat conflicting recommendations of a Joint Parliamentary Committee on Fertilizer Pricing: (i) full decontrol of pricing and distribution of phosphatic and potassic fertilizer; (ii) a 10% reduction in the controlled farmgate price of urea; and (iii) re-imposition of price and distribution controls on lower analysis nitrogenous fertilizer which had been decontrolled since July 1991. These measures in fact accentuated the already existing distortions in relative consumption of nitrogenous, phosphatic and potassic fertilizer. Furthermore, (probably under the pressure of the farming community and the phosphate fertilizer producers), GOI has granted a direct subsidy of Rs.1,000 per ton of phosphatic and potassic fertilizer. The only positive consequence of these measures is increased transparency of the subsidy paid for phosphatic and potassic fertilizer.

2.4 The Indians Farmers Fertiliser Cooperative Ltd. (IFFCO) Aonla plant financed under the project is an integral part of GOI's plans to utilize associated and non-associated gas from the Bombay High and South Bassein offshore oil and gas fields, for use as feedstock for petrochemical and fertilizer plants in the states of Maharashtra, Gujarat, Madhya Pradesh, Rajasthan and Uttar Pradesh. The project is one of six large, modern ammonia-urea plants planned by GOI since 1979, which were to be constructed in a phased manner during the sixth Five-Year plan, based on the lean gas portion of these gas resources, in addition to two other plants, Hazira and Thal, which were already under construction in 1984. These six plants were to be constructed along the planned Hazira-Bijaipur-Jagdishpur (HBJ) pipeline (Annex 6). Four plants out of six are already in operation (the IFFCO project plant in Aonla, the public sector NFL plant in Vijaipur, the private sector Indo Gulf plant in Jagdishpur and the Chambal Fertilizer & Chemicals in Gadepan), and the remaining two are expected to be commissioned in August 1994 by the private sector (the Bindal Agro Chemical plant in Shahjahanpur and the Tata Chemicals plant in Babrala). Furthermore, GOI has approved the duplication of the Vijaipur and Aonla plants, for which process and design contracts have already been signed, pre-project activities have started and contract for supply of gas have been signed with Gail.

2.5 The rehabilitation component of the project is also part of GOI's plans to increase domestic production of fertilizer by improving the efficiency and capacity utilization of existing plants.

2.6 IFFCO is a central cooperative society, registered in 1967, with a total membership in 1992/93 of about 30,200 cooperatives societies, covering 18 states and 3 union territories. At that date, the company's paid-in capital was Rs.3,633.5 million, of which Rs.2,896.6 million was subscribed by GOI (80% of capital, compared to 58% in 1985). IFFCO is one of the best managed fertilizer companies in India, with records of efficiency in terms of capacity utilization, project implementation, marketing, and service to farmers through extension programs. In addition to the Aonla, Kalol, and Phulpur ammonia-urea plants and to the Kandla NPK plant, IFFCO holds 21.7% of the KRIBHCO's ammonia-urea complex in Hazira, and 7% of Industrie Chimique du Senegal, a phosphate fertilizer producer.

3. Project Objectives and Description

3.1 **Project Objectives:** The main objectives of the project were to expand domestic nitrogenous fertilizer capacity and to improve the operational efficiency of existing plants in the cooperative sector, in order to lessen India's dependence on imports and to take advantage of the vast and newly developed Bombay High natural gas resources as economic feedstock. By increasing fertilizer production in India's main agricultural areas, the Project also aimed at reducing volumes of fertilizer transported from coastal ports and plants to

northern states, and at further stimulating fertilizer consumption in these areas where it was still at low level. Through implementation of the Aonla project, GOI also seeked to promote the transfer of technology. Funding of a study to establish a management performance evaluation and control system aimed at improving existing institutional arrangements for the management of public sector plants, to enhance their performance and increase their levels of capacity utilization. Finally, through the provision of US$150 million to assist GOI in meeting its fertilizer raw materials import requirements (thus freeing up equivalent resources for efficiency improvements), the project aimed at supporting GOI's program of initiatives in the fertilizer sector to reduce fertilizer costs and the level of fertilizer subsidies.

3.2 **Project Description:** The project consisted of four components:

(a) The Aonla component - An amount of US$112 million was provided from the Loan to finance the construction by IFFCO of a natural gas-based greenfield nitrogen fertilizer complex at Aonla (Bareilly district, Uttar Pradesh), including: (i) a single train- 1,350 tons per day (tpd) ammonia unit; (ii) two 1,100 tpd urea units with a common 2,200 tpd prilling tower; (iii) integrated power and steam generation facilities, including two 18 MW gas turbine generators, two exhaust heat recovery units each of 80 tons per hour (tph) of steam, and one 150 tph boiler; (iv) raw water and effluent treatment facilities, a water demineralization plant and cooling water systems; (v) storage for 20,000 tons of refrigerated ammonia in two tanks, and for 45,000 tons of bulk urea, and facilities for bagging urea; (vi) other related offsites, including maintenance workshops, warehousing, administration building, laboratory, transport facilities and effluent treatment; and (vii) infrastructure, including a township with 985 housing units and social amenities, rail links, and transmission lines for power supply from the grid;

(b) The rehabilitation component - An amount of US$40 million was provided under the Loan to finance the rehabilitation of three existing IFFCO plants, to increase their operational efficiencies. The major schemes consisted of: (i) at the Phulphur (UP) ammonia-urea production facilities (commissioned in 1980), a major revamping of the primary reformer, improvements in boilers' operation, an energy survey, an additional ammonia storage tank, and the installation of a urea hydrolizer unit; (ii) at the Kalol (Gurajat) ammonia-urea production facilities (commissioned in 1975), the revamping of the urea plant, the modification of the primary reformer, equipment replacement, an additional ammonia storage tank, various pollution control measures, and the purchase of instrumentation and inspection equipment; and (iii) at the Kandla (Gujarat) DAP/NPK production facilities (commissioned in 1974), the retrofitting of two of the process trains with pipe reactors, additional storage and bagging facilities, and an additional water system;

(c) The performance evaluation and control system component - An amount of US$200,000 was provided from the Loan to further develop the management information system (MIS) which was being implemented by the Department of Fertilizer, to incorporate: (i) periodic evaluations of company performance; (ii) a signalling system to highlight variations from established performance standards; (iii) a control mechanism to monitor progress of corrective actions being taken; and (iv) a review of the scheme of management performance incentives to foster improved plant operations; and

(d) The import component - An amount of US$150 million was provided from the Loan to finance imports of fertilizer and associated raw materials, in support of GOI's efforts to increase production efficiency, improve pricing

policies and reduce subsidies through the implementation of GOI's Program of Initiatives.

4. Project Design and Organization

(a) The Aonla Component

4.1 At the planning stage of the project, all decisions with regard to location, plant size, choice of raw materials, selection of technology and of consultants, were taken exclusively by the Ministry of Agriculture.

4.2 At the implementation stage, the project was designed, organized and implemented by the Indian Farmers Fertilizer Cooperative Fertilizer (IFFCO), with the assistance of: (i) for the construction of the ammonia plant, Harold Topsoe, of Denmark, in association with Projects Development India Limited (PDIL), a state-owned engineering firm; (ii) for the construction of the urea plants, Snam Progetti, of Italy, in association with PDIL ; and (iii) for the steam and power generation and all offsites, Development Consultants Pvt. Ltd. (DCPL), an Indian engineering firm . The scope of consultants' assistance included supply of licenses, basic design, detailed engineering, procurement services, construction supervision, and technical supervision of commissioning.

4.3 From the start, in order to implement the project efficiently, timely and under-budget (para.2), IFFCO created project organization arrangements which included: (i) a dedicated on-site, high quality project team, headed by an executive director, assisted by three managers, with the required autonomy and authority, which was in charge of project management, coordination and supervision; (ii) the setting up at plant site of a modern computerized project management system to efficiently support the planning and monitoring group and the quality control group -- it is reported that in addition to easier project planning, monitoring, control and reporting, this helped in maintaining dynamism and a goal-oriented approach among the project team; and (iii) the design and execution of a manpower planning, recruitment and training policy and of a detailed program to meet the project construction, commissioning and operational requirements -- this policy was based on the correct decision to use the project implementation team to run the plant at the operation stage, and to appoint experienced personnel from IFFCO's existing plants to the project team. IFFCO was awarded second prize for excellence in project implementation for the Aonla project by the Ministry of Program Implementation.

4.4 Another key factor in the successful implementation of the project was the timely availability of sufficient funds. Actual project costs were well below appraisal costs estimates (para. 2). Equity funds from GOI's allocations and from the company's internal cash generation were abundant and available on time. In addition to the Bank loan, the Aonla project benefitted from financing by the Overseas Economic Corporation Fund (OECF) of Japan, and by the Danish International Development Agency (DANIDA)of Denmark (para. 2 and Part III, para. 5-C).

(b) The Rehabilitation Component

4.5 The Rehabilitation project was implemented by IFFCO, using its in-house expertise and, for the most important schemes, assistance of consultants for activities such as basic engineering, detailed engineering, and supervision of construction.

4.6 Implementation of the overall rehabilitation component was under the control of IFFCO's Executive Director, at Headquarters in New Delhi. Pre-project activities (project preparation, Government approvals and clearances, obtention of import licenses), project overall coordination, communications between the different agencies involved in the project (GOI's agencies, financing institutions and consultants), and preparation of monthly progress reports were

the responsibility of the Technical Services Division at Headquarters. All site activities were carried out by the decentralized production units and included most procurement and contracting, inspection and transportation of equipment, construction and erection, and commissioning and testing. In each plant, the schemes were implemented by a task force headed by an assigned chief manager and reporting to the plant General Manager.

(c) The Performance Evaluation and Control System Component

4.7 The study for development of the MIS is being implemented by the Department of Fertilizer of the Ministry of Chemicals and Fertilizers (DOF). It is carried out by Tata Consultancy Services (TCS), of India, which was contracted in April 1991.

(d) The Import Component

4.8 Fertilizer and fertilizer imports were administered initially by the Minerals & Metals Trading Corporation of India Ltd. (MMTC). However, later on, when the Bank agreed that fertilizer feedstocks, naphtha and fuel oil, as well as crude oil, could be financed under the loan, these imports were administered by Oil India (para.23, 2).

5. Project Implementation

Implementation Schedule

(a) The Aonla Component

5.1 The zero date of the project, which was originally planned at appraisal for October 1, 1984, was revised to January 8, 1985 because of delays in obtaining the final Public Investment Board approval for the consultancy contract. However, mechanical completion of the complex occurred on January 1, 1988, thirty six months after the zero date, as initially planned by IFFCO and about six months ahead of the Bank's conservative estimate. In spite of delays in supply of gas by GAIL (Part III, para 4.1), production of urea started on May 18, 1988. Commercial production was formally declared on July 7, 1988, 42 months after the zero date as estimated by IFFCO and more than two months ahead of the Bank appraisal estimate. Completion as defined in the Loan Agreement (as operation during a period of 60 consecutive days, at an average daily production rate of 80% of full capacity), occurred well ahead of schedule in October 1988. A detailed comparative schedule is presented in Part III.

5.2 **Main Problems Resolved During Implementation**: Several problems were encountered during implementation. All were detected on time and efficiently resolved by IFFCO's project team without significant impact on the overall project schedule and within budget. These included:

(i) delays in the supply of gas for power and steam generation-- gas was due for delivery by the Gas Authority of India Ltd (GAIL) before July 31, 1987 (according to the Guarantee Agreement), however, gas supply only started on March 24, 1988, more than two months after mechanical completion. To avoid delays in pre-commissioning, the project team decided: (i) to equip the steam generation plant with dual firing (gas and liquid fuels); and (ii) to dry the primary and secondary reformers, cold collector and transfer line refractory using super kerosene. These measures allowed pre-commissioning to proceed on time and avoided a delay of about two months;

(ii) plant site soil conditions were worse than expected, preventing the piling contractors to keep on schedule. To avoid delays, IFFCO decided to use a vibro-sinker for compaction piling for the first time in India and introduced a bonus clause in the piling contracts. The average rate

increased from less than 9 piles per day to more than 60, and piling was completed six weeks ahead of schedule;

(iii) inadequate road infrastructure for excessively long transport from port to site of the 410-ton ammonia converter and other oversized equipments (ODE). The project team planned this transport efficiently -- the converter was transported from Calcutta by river over 1,800 Km on the Ganges, for the first time, and then by road to Aonla over 150 km; other ODEs were transported by river up to Varanasi over 1,250 km, and then by road to Aonla over another 690 km; and

(iv) the CO_2 compressor was supplied with a 12-month delay by BHEL, an Indian supplier. The project team, the consultants and the contractors worked around the clock to complete erection and commissioning of the CO_2 compressor on time.

(b) <u>The Rehabilitation Component</u>

5.3 The plant rehabilitation program encountered serious implementation delays. It suffered mainly from long delays in obtaining GOI approvals and from some instability in IFFCO's top management during the critical initiation phase of the project. It was anticipated at appraisal that implementation of this component would start by January 1986, and that, except for one scheme at Phulpur, all schemes would be completed before the end of 1989. However, GOI's approval was obtained only in December 1988, and it was necessary to extend the loan closing date to June 30, 1993 to allow the completion of all the schemes except for the CO_2 removal scheme-- the CO_2 removal scheme will be completed in 1995. A detailed comparative schedule is presented in Part III.

5,4 The rehabilitation investment program was adjusted several times during project implementation, adding and canceling several sub-projects to: (i) reflect changing priorities and constraints identified while implementing these programs after such long delays; and (ii) take into account the effect of increased investments costs on their respective viability -- higher investments costs resulted from the devaluation of the Rupee which occurred during the period. The status and actual cost of each sub-project compared to appraisal estimates are given in Part III, 5-B. Main events included: (i) the revamping of the primary reformers of the Phulpur and Kalol plants, leading to increased capacity and energy savings; (ii) implementation of urea hydrolizers at Phulpur and Kalol to reduce and improve plants effluent; (iii) the construction of an additional ammonia tank in each plant to improve safety; (iv) the replacement of the CO^2 compressor turbine at Phulpur for energy saving; (v) an energy survey of the Phulpur plant which resulted in an easy improvement in the operation of the boiler and consequently the cancellation of the originally planned increase in coal capacity; (vi) the revamping of the Kalol urea plant and the replacement of the high pressure carbamate condenser for capacity and energy improvements and higher reliability; and (vii) the cancellation of the storage and bagging scheme and of the granulation plant reactor scheme at Kandla -- these were no longer urgent, in light of the deregulation of phosphatic and potassic fertilizer markets.

(c) <u>The Performance Evaluation and Control System Component</u>

5.5 Agreement on the study terms of reference (TORs) and shortlist of consultants was reached by June 1988, about two years behind schedule. The first phase of the study was initiated in April 1991 and the draft report completed in April 1992, respectively 54 and 55 months behind the schedule agreed at negotiations. Late in 1989, DOF proposed changes in study implementation arrangements and proposed a study in two phases. The scope of the first phase, to be implemented by TCS, included the identification of DOF information requirements for fertilizer companies under its administrative responsibility, focusing on their performance evaluation and control. The second phase, to be

implemented jointly by TCS and the National Informatics Center (NIC), would include actual design and implementation of the information system and of needed hardware, based on TCS recommendations in phase one. Since the full scope of the original TORs were included in the two phases, the Bank accepted the revised work program in February 1990.

5.6 The final report of the first phase, which was completed in October 1993 after incorporating DOF's comments and suggestions, was handed over to the Bank in May 1994 during the PCR mission. This study: (i) includes the definition of DOF's objectives within its mandate and policy environment, and the functions and the information required for achieving them; (ii) reviews the existing MIS and its deficiencies; (iii) proposes a performance evaluation system based on a signalling system and the existing relationships between GOI and public enterprises, and suggests the types and weights of performance indicators; (iv) proposes the development of an integrated computerized system including: a fertilizer planning system, a budget system, an import management system, a fertilizer distribution system, a handling and payment system for import, a project monitoring system, and a performance monitoring and evaluation system; finally (v) makes recommendations on strategies for hardware, software and data communications and training. The second phase of the study is being implemented and will take about 15 months to complete.

(d) Import Component

5.7 This component was originally intended to finance imports of sulfur, potash and phosphate raw materials by the Minerals & Metals Trading Corporation of India Ltd. (MMTC). Implementation of this component was substantially delayed, due to important divergences between the Bank and MMTC on the wording of bidding documents, particularly with regard to the exclusion of Israel from procurement -- the import component was completed by June 1990, about two years behind schedule. Sulfur was successfully imported, but imports of potash and phosphate materials proved to be difficult since the procurement procedures were determined to be inconsistent with Bank Guidelines, resulting in very slow disbursements. In January 1988, as a corollary to the Drought Assistance Program, the Bank agreed that fertilizer feedstocks, naphtha and fuel oil as well as crude oil imported by Oil India could be financed under the loan, using procedures identical to those agreed under the Drought Assistance Program. About US$ 114 million were allocated to this use and quickly disbursed.

Procurement

5.8 Very early, IFFCO prepared model bidding documents for Bank review and subsequently adhered to Bank International Competitive Biding (ICB) procedures for procurement under the Loan. IFFCO also used ICB procedures for procurement from eligible countries under OECF's credit and equivalent procedures for local procurement. Procurement was carried out, with consultant's assistance, efficiently and without delays. Early on, IFFCO detected large potential delays in many domestic suppliers' deliveries, but quickly took corrective actions, including the formation of a special procurement task force, intense follow-up and coordination, and in some cases air transport for critical equipment. Success was also due to the formation of a special committee of IFFCO's Directors to expedite expenditure decisions during project implementation.

5.9 The pace of procurement under the rehabilitation component was very slow. The main reasons were: (a) IFFCO cleared even small packages with the Bank, until Bank staff clarified that this was not required in the legal documents; (b) GOI's approval was required for each sub-project; (c) IFFCO Management (and Board) approval was required for each sub-project, due to pervasive disagreements within IFFCO's management. Furthermore, in late 1989, the Bank received informal complaints from two bidders regarding the procurement procedures used by IFFCO for the ammonia converter retrofit and the synthesis Gas

Dryer schemes. After a detailed review, the Bank concluded that IFFCO had not violated the procurement guidelines in this instance.

Project Costs

(a) The Aonla Project

5.10 Actual financing requirements for the Aonla ammonia/urea complex amounted to Rs.6,596 million versus Rs.8,230 million at appraisal, equivalent to US$507.4 million and US$633.1 million, respectively. The major deviations from original estimates are shown in Part III, para. 5.A., and are summarized in Table 1 below.

Table 1
Costs of the Aonla Project

	Appraisal Estimates		Actual Costs		Variation
	US$ Million	Rs Million	US$ Million	Rs Million	%
- Total Base Cost	419.5	5,454	440.2	5,723	5
- Physical and Price Contingencies	45.6	593	-	-	
- Total Installed Cost	465.1	6,047	440.2	5,723	-5
- Working Capital	84.2	1,095	23.1	300	-73
- Interest During Construction	83.8	1,089	44.1	573	-47
Total Financing Required	633.1	8,230	507.4	6,596	-20

5.11 Actual total financing requirements are substantially below appraisal estimates, about 20% in both local currency and US Dollars -- the average exchange rate calculated from actual phased project expenditures being in line with the exchange rate considered at appraisal (Rs.13 per US$). The actual total installed cost of the project is in fact only 5% below appraisal estimates and the actual base cost is 5% higher than appraisal estimates. Significant savings occurred in: (a) interest during construction -- due to lower loan financing of the project and to faster than expected project implementation; (b) working capital -- much lower than estimated at appraisal; and (c) erection and commissioning costs -- due to faster than planned implementation and commissioning.

(b) The Rehabilitation Component

5.12 Actual financing requirements amounted to Rs.1,002 million, versus Rs.1,748 million at appraisal, equivalent to US$38.7 million versus US$134.5 million. Deviations from original estimates are presented in Part III, para. B, and summarized in Table 2 below.

5.13 Actual total financing requirements are substantially below appraisal estimates, about 43% in local currency and 71% in US Dollars. The differential in cost underruns between local currency and US Dollars is due to the devaluation of the Rupee during the implementation period. This high underrun is the result of: (i) the cancellation of many schemes, mainly in Kandla; and (ii) significant savings in interests during construction.

Table 2
Costs of the Rehabilitation Component

	Appraisal Estimates		Actual Costs		% Variation	
	Rs. Million	US$ Million	Rs. Million	US$ Million	Rs.	US$
Phulpur	283.3	21.8	334.7	14.0	18	-36
Kalol	532.9	41.0	440.5	16.6	-17	-60
Kandla	228.4	17.6	108.9	4.0	-52	-77
Total Base Cost	1044.6	80.4	884.0	34.5	-15	-57
Physical and Price Contingencies	260.7	20.0				
Total Installed Cost	1305.3	100.4	884.0	34.5	-32	-66
Interest During Construction	443.0	34.1	117.8	4.2	-73	-88
Total Financing Required	1,748.3	134.5	1001.8	38.7	-43	-71

Financing

5.14 Total Bank financing amounted to US$256.9 million, of which US$89.1 million for the Aonla project, US$17.7 million for the rehabilitation component, US$150 Million for the import component, and US$200,000 for the MIS study. The Aonla project was implemented with a debt/equity ratio of 56/44, in line with appraisal estimates. At appraisal, the rehabilitation component was projected to be entirely financed from long term debt, however, 45% of costs were actually financed from IFFCO's internal resources.

5.15 In addition to the Bank loan, GOI also received the following other cofinancing funds for the Aonla project: (i) US$126.8 million equivalent from OECF (Japan); (ii) US$6 million equivalent from DANIDA (Denmark); and US$18 million equivalent from the Government of Italy. These funds were transferred to IFFCO as equity. GOI also received the equivalent of US$5.35 million from the OPEC fund as cofinancing for the rehabilitation component, however, IFFCO decided to borrow only Rs.102.5 million from GOI out of these OPEC funds, or US$3.73 million equivalent.

Disbursement Schedule

5.16 Due to the large reduction in IFFCO's total financing requirements, a total of US$45.28 million (about 30% of the original loan to IFFCO) was canceled, reducing the Bank loan to IFFCO (Loan 2730-IN) to US$106.72 million equivalent and total Bank financing of the project (including the import component) to US$256.9 million -- Bank financing was reduced by US$22.9 million (20.5%) for the Aonla component and by US$22.3 million (56%) for the rehabilitation component. The Loan to the Government (Loan 2729-IN), however, was fully disbursed by June 1990, before its closing date.

5.17 The IFFCO loan closing date of June 30, 1992 was extended to June 30, 1993 to allow completion of the rehabilitation component. This extension permitted the completion of several schemes which were focussing on energy conservation, pollution control and plant efficiency improvements. Furthermore, it provided the Bank with an opportunity to continue to follow-up on developments in the fertilizer sector, at a time when policy dialogue between the Bank and the Government on sectoral issues had stopped (this project was the last Bank fertilizer project in India - see para.1 of Part III).

5.18 Compared to appraisal estimates, some disbursement delays occurred at the beginning of the project -- appraisal estimates may have been over-optimistic with respect to quick disbursement of the import component (para. 23, 2). The pace of actual overall disbursements remained slightly slower than appraisal estimates, but faster than the Bank profile (para. 3 (i) of Part III). Disbursements under the Aonla component was faster than anticipated at appraisal -- by June 1988, when urea production started, more than 82% of actual Bank funding for this component had already been disbursed, versus 56% estimated at appraisal (equivalent to 70% of actual funding). Disbursements under the rehabilitation component started about three years behind schedule and their pace remained very slow until loan closing (para. 3 (ii) of Part III).

Market Development

5.19 IFFCO sells fertilizer exclusively through a network of 30,000 cooperatives in 18 states and three union territories. At appraisal, IFFCO was already well established in UP, the main marketing area for the Aonla project, with a solid competitive position. Consequently, a market seeding program was not required. However, in order to sell incremental fertilizer volumes from the project, IFFCO increased the number of field offices from 48 at appraisal to 62, and of field officers from 372 to 511. Furthermore, IFFCO continued to implement its well established extension and farmer educational programs through its 175 Farmers Service Centers.

Operation Preparation

5.20 As indicated in para. 2, a separate team headed by an executive director was formed early-on to implement the project, organize future operations ahead of time, and assume the responsibility for plant operation at a later stage. This project team was strengthened as needed during project implementation, from 258 members at the peak of construction activities to about 963 in February 1994. Operation preparation activities took place in parallel with project implementation and included inter-alia human resource training, and preparation of management information systems and of safety, environmental and operation norms. Training was given in IFFCO's existing plants and on-site, with the help of a computerized training simulator.

The Program of Initiatives

5.21 The Program of Initiatives, which was set out in an agreed letter associated with the Project, intended to address fertilizer sector issues. This program set specific, time-bound, performance targets aiming essentially at: (i) developing the international competitiveness of the sector while reducing economic cost of production; (ii) improving efficiency of fertilizer transportation and handling; (iii) reducing the fertilizer subsidy; (iv) improving pricing by modifying and rationalizing the retention pricing system; (v) improving public companies' management; and (vi) identifying changes and strengthening measures needed in the distribution system and reviewing the appropriateness of the market allocation system. Implementation of this program was partial and had mixed results: some improvements have been made in operational efficiency (in terms of capacity utilization and energy consumption), mainly due to the addition of large, modern, capacities in the late 1980's. However, except for the few modern plants, the industry remains unable to effectively compete with imports; the old unprofitable "sick" plants have been kept in operation; Government policies continue to limit the choice of technology, feedstock, plant location, project execution arrangements and financing, and allocation of production licenses between the public, joint, cooperative, and private sectors; and, finally, very little action has been taken on the critical, but politically sensitive, matter of fertilizer subsidies and pricing policy and regulations -- the timid and conflicting measures which were taken (deregulation of phosphatic and potassic fertilizer, re-control of low grade fertilizer prices, reduction by 10% of urea prices (which remained low and

uniform at the farm gate), revision in the retention price formula, allowance of a direct subsidy of Rs.1,000 per ton of domestic phosphatic and potassic fertilizer etc...) accentuated the already existing distortions in relative consumption of nitrogenous, phosphatic and potassic fertilizer, affected the financial position of efficient companies, and, most importantly, participated in increasing fiscal subsidies for fertilizer from about Rs.19 billion in 1986/87 (0.73% of GDP) to Rs.58 billion in 1992/93 (0.92% of GDP). During implementation of the project, the Bank, considering that GOI had not made significant progress in reforming fertilizer prices and reducing subsidies, informed the Indian authorities that the Bank would discontinue processing of the Fertilizer Distribution Project, which was then under preparation, and would make no further loans in the sector until these fundamental issues had been addressed more satisfactorily. Implementation of the main performance targets set out in the Program of Initiatives is further reviewed in the paragraphs below.

(a) Capacity Utilization

5.22 The Program of Initiatives envisaged a gradual increase in average capacity utilization and production from the then existing nitrogen fertilizer plants - both in aggregate and for public sector plants. Production and capacity utilization since 1985/86 are presented in Part III para 6.3. On average, capacity utilization of Indian fertilizer plants improved but still remains low by international norms. Total nitrogen production in 1989/90 reached the targeted 4.2 million tpy and totalled 4.6 million tpy in 1992/93. Public sector production remained at 1.8 million tpy in 1989/90 (60% of capacity utilization), significantly lower than the target of 2.2 million for that year (73% of capacity utilization), which was approximated only in 1992/93 -- in 1989/90 production of "sick units" was lower than in 1984/85, and only by 1992/93 could other public sector units show a slight increase in their production. All-India nitrogen fertilizer capacity utilization increased from 74% in 1984/85 to 83% in 1989/90, in line with the target of 82%, and reached 85% in 1992/93. During this period, the cooperative and private sectors increased capacity utilization respectively from 93% and 77% in 1985/86, to 106% and 98% in 1989/90, and 111% and 107% in 1992/93.

(b) Feedstock and Energy Consumption

5.23 Nitrogen fertilizer production in India is still based on a wide range of feedstocks. Recent ammonia-urea plants are large, energy efficient gas-based plants along the HBJ pipe, however, a large part of the existing capacity is based other feedstocks, including naphtha, fuel oil and coal. The targets and achievements with regards to energy consumption are presented in Part III para. 3. Average energy consumption of gas-based plants has decreased from 10 Gcal per ton of ammonia in 1984/85, to 9.6 Gcal in 1989/90, and 9.5 in 1992/93, still higher than the targeted 9.0 Gcal, and very far from the 7 Gcal or less which currently available technologies can achieve (Aonla had an average consumption of 7.76 Gcal in 1992/93). Fuel-oil based plants have improved their energy consumption in line with the targets, but no improvement was obtained in the naphtha and coal-based units -- energy consumption of the coal-based sick plants owned by FCI and HFC increased steadily and reached 42.7 Gcal in 1992/93; for naphtha-based plants, energy consumption of even the better operated plants remain very high (energy consumption of the well operated IFFCO's Kalol plant decreased to 11 Gcal in 1992/93 but increased again to 11.5 Gcal in 1993/94).

(c) Distribution Efficiency

5.24 Progress in improving distribution efficiency has been limited, mainly because of lack of incentives associated with the equated freight and market allocation systems. However, a rationalization study is being carried out RITES and the final report is expected soon. The all-fertilizer as well as the urea average rail haulage distance (lead) has not changed significantly. it remained within a 1,010-1,080 km range for all fertilizer until 1989/90, then decreased steadily to about 900 Km by 1992/93, compared with the target of 800 km by 1990 (700-800 km for urea). The commissioning of several large plants closer to market increased the use of road transport for short movements (less than 250 km) and in fact probably contributed to the high average rail lead, as rail transport became restricted to longer distances. In 1984/85 constant terms, the equated freight paid to nitrogen and complex fertilizer producers decreased from Rs.235 per ton in 1984/85, to Rs.195 in 1990/91 and Rs.196 in 1991/92 (Rs. 302 and Rs.327 in current terms). This decrease (17%) is higher than the 10% reduction which was established as target.

(d) Ex-Factory Pricing

5.25 The retention price system was introduced in 1977. It is fixed by the Fertilizer Industry Coordination Committee (FICC) office attached to the Department of Fertilizer of the Ministry of Chemicals and Fertilizers, for individual producers, on the basis of: (i) the type of feedstock; (ii) a 12% post-tax return on share capital and reserves employed in the production of urea; (iii) plant capacity utilization; and (iv) variable and fixed costs based on standard rates, norms and actual prices of inputs. In recognition of the system's drawbacks, at negotiations, GOI to review the existing system and scope for rationalization to promote efficiency and reduce subsidies. Until now, GOI has limited its action to the implementation in March 1992 of some timid and somewhat conflicting recommendations of a Joint Parliamentary Committee on Fertilizer Pricing. These measures consisted of: (i) full decontrol of pricing and distribution of phosphatic and potassic fertilizer; and (ii) re-imposition of price and distribution controls on lower analysis nitrogenous fertilizer which had been decontrolled since July 1991. In addition, the pricing formula was adjusted -- for gas-based urea plants, the capacity utilization norm was increased to levels higher than its low initial 80% (para. 2) and the depreciation norm was raised to 15 years. Retention prices for urea plants currently in operation range from Rs.2,500 to Rs.6,147 per ton, and averaged about Rs.4,734 per ton in 1992/93 -- most Indian urea producers presently receive ex-factory prices that are in line with landed prices of imported urea or below (landed prices were estimated at about US$ 180 per ton of bagged urea in May 1994, or Rs. 5,580 at an exchange rate of Rs.31 per US$). However, the price of gas remains significantly above its opportunity value, affecting the financial position of efficient companies and distorting feedstock choices. In addition, these measures in fact accentuated the already existing distortions in relative consumption of nitrogenous, phosphatic and potassic fertilizer.

(e) Farmgate Prices

5.26 The Department of Agriculture and Cooperation fixes (uniform) prices and distribution margins for the various fertilizer types throughout the country. Farmgate prices remained virtually the same from 1981 to August 1991, when GOI decontrolled low-concentration fertilizer and increased prices of high-concentration fertilizer by 30%. Other major changes were implemented in August 1992 and consisted of the decontrol of prices of phosphatic and potassic fertilizer, re-control of low-grade fertilizer prices, and reduction by 10% of urea prices. The urea farmgate price was Rs.2,760 per ton of urea in April 1994, equivalent to US$89, still much lower than its import parity, estimated at about US$ 180 per ton of bagged urea (or Rs.5,580 at an exchange rate of Rs.31 per US$). Furthermore, these changes in price policies led to shifts in fertilizer consumption and accentuated the already existing distortions in relative

consumption of nitrogenous, phosphatic and potassic fertilizer. In spite of the direct subsidy of Rs.1000 per ton of phosphatic and potassic fertilizer granted by GOI (probably under the pressure of the farming community and phosphate fertilizer producers), farmgate prices for DAP increased from Rs.4,680/ton to Rs.7,100/ton and prices of Muriate of potash (MOP) increased from Rs.1,700/ton to Rs.4,800/ton, while at the same time prices of urea decreased from Rs.3,060/ton to Rs.2,760/ton. As a result, phosphate fertilizer consumption decreased from 3.32 million tons in 1991/92 to 2.84 million tons in 1992/93, while potash fertilizer consumption decreased from 1.36 million tons to 0.88 million tons. Consumption of nitrogenous fertilizers increased from 8.05 million tons to 8.42 million tons during the same period. Consumption, production, and Import of fertilizer in India from 1952/53 to 1992/93 are presented in Annex 1.

(f) The Fertilizer Subsidy

5.27 The total fiscal subsidy paid through FICC includes a subsidy on controlled domestic fertilizer, a freight subsidy on domestic fertilizer, and a subsidy on imported fertilizer. As a result of the above pricing policy, fiscal subsidies for fertilizer increased steadily from about Rs.19 billion in 1986/87 (0.73% of GDP) to Rs.58 billion in 1992/93 (0.92% of GDP) -- Subsidies paid on domestic fertilizer increased from Rs.17 million to Rs.48 million, and those paid on imported fertilizer increased from Rs.2 million to Rs.10 million. This increase has mainly resulted from increasing consumption and from the growing gap between low farmgate prices and high retention prices.

6. Project Results

(a) The Aonla Project

6.1 **Project Objectives and Physical Results:** Overall, project objectives were more than fully met. The Aonla plant production levels, rates of capacity utilization and specific energy consumption since start-up are presented in Part III, para. 6.1-A. The rate of capacity utilization during the first year of operation (1988/89) was over 94%, and increased steadily to 118% and 125% for the ammonia and urea plants, respectively, by 1993/94. These high rates of capacity utilization partly reflect: (a) GOI's decision to select Harold Topsoe as process licensor, who designed the ammonia plant less conservatively than usual in the industry; (b) the use of high calorific value natural gas since start-up; and (c) impressive quality of plant operation and maintenance since start-up -- between 1989/90 (the first complete fiscal year of operation) and 1993/94, the ammonia and urea plants respectively had 344 and 330 on-stream days per year, reaching 361 and 350 days in 1993/94. Since 1989/90, Aonla production has represented about 50% of IFFCO's total urea production. It is estimated that the plants are capable of maintaining a sustained 110% capacity utilization rate during their entire economic life, which is substantially higher than the 95% maximum capacity utilization assumed at appraisal for the third year of operation.

6.2 The quality of operation is also evidenced by low total specific energy consumption per ton of ammonia, which improved from 8.133 Gcal per ton at start-up, to 7.765 Gcal, substantially lower than the 8.100 Gcal guaranteed, and the 7.870 Gcal contracted consumption. In 1993/94, the Aonla plant was awarded first prize of excellence in energy conservation and management by the Ministry of Power for the period 1990/91-1992/93.

6.3 **Market:** Actual demand for nitrogenous fertilizer in India increased from 5.4 million tons of nutrients in 1984/85 to about 8.4 million tons in 1992/93, in line with appraisal estimates (Annex 1). Supply also increased in line with the most optimistic appraisal projection, from 3.9 million tons of nitrogen in 1984/85 to 7.4 million tons in 1992/93, although, from the five new ammonia plants based on Bombay-High gas originally expected to start operations in addition to this project, one started only in December 1993 and two are not expected to start before August 1994. Higher supply is mainly due to larger than

expected average capacity utilization of nitrogen plants countrywide, which reached 88% in 1992/93. In 1992/93, the 112% capacity utilization rate achieved by the project (though the lowest since the first complete fiscal year of operation) was higher than the average capacity utilization rate of nitrogen plants in both the public sector (69%) and the private sector (107%), and was in line with capacity utilization of plants in the cooperative sector (111%).

6.4 In spite of some inventory build-up during the first two years of operations, total sales of urea from Aonla increased rapidly from 270,000 tons in 1988/89 to 963,000 tons in 1991/92, much more than expected at appraisal, and remain over 825,000 tons in 1992/93 and 1993/94. At appraisal, in line with GOI's plans, it was expected that 77% of Aonla production would be consumed in UP, 15% in Punjab and 8% in Haryana. In 1992/93 and 1993/94, actual distribution of Aonla sales was very close to the above estimates -- about 69% in UP, 20% in Punjab, and 10% in Haryana.

6.5 The commissioning of the Aonla project also resulted in some rationalization of IFFCO's urea distribution from the Phulpur and Kalol plants-- the states of Punjab, Haryana and Himachal Pradesh are now supplied from Aonla, which is closer, instead of from Kalol and Phulpur. Similarly, western UP, which was supplied from Phulpur, is now supplied from Aonla. However, most IFFCO's sales from Aonla were directed to the plant's main market area (UP, Haryana, and Punjab), where the increase was impressive -- total sales of IFFCO in this states increased from 360,000 tons of urea in 1987/88 to 1.23 million tons in 1992/93 and to 1.09 million in 1992/93. IFFCO's sales, marketing program and market shares of its plants in the Aonla market area are presented in Part III, para. 6.1.

6.6 **Economic rates of return**: The project economic rate of return (ERR) is now estimated at 12.2%, lower than the base case rate of 17.1% estimated at appraisal. Currently projected economic values for natural gas and urea are both substantially lower than estimated at appraisal. However, the high value of natural gas as estimated at appraisal was more than compensated for by substantially higher economic urea prices. The project remains economically viable under any reasonable scenario and is mainly sensitive to urea and gas prices. ERRs and sensitivity analyses are presented in para. 6.1.B.1 of Part III. Calculations of urea import parity and projected economic value of gas are also presented in Annex 3-1. Economic cost and benefit streams for the base case, calculated using prices in constant 1990/91 US$, are presented in Annex 3-2.

6.7 **Financial Rate of Return**: The project financial rate of return (FRR) is estimated at 9.8%, slightly lower than the appraisal estimate of 11.8%. The actual price of natural gas is slightly higher than appraisal estimates, but the urea retention prices are much lower than those projected at appraisal. However, these differences are partly compensated by: (i) higher rates of actual capacity build-up and capacity utilization-- more than 110% compared with 95% estimated at appraisal; (ii) a shorter implementation period; and (iii) lower capital costs of the project. Assumptions used for re-estimating the FRR and sensitivity analysis results, compared to appraisal estimates, are presented in para. 6.1.C. of Part III. Financial cost and benefit streams for the base case, which were calculated using prices in constant 1990/91 Rupees, are presented in Annex 3-3.

6.8 Revenues are based on projected **retention prices**. These were estimated by IFFCO for Aonla on the basis of the plant's actual and projected performance and on the basis of the present retention price formula (para. 6.1.C. of Part III). Since April 1988, the retention price formula is based on a capacity utilization rate for natural gas-based plants of 80% in the first year of operation, 90% from the 2nd to the 10th year (85% for fuel oil-based plants) and 85% from the 11th year onwards (80% for fuel oil-based plants). Appraisal estimates were based on a plant capacity utilization rate of 80%, which was then the norm used in calculation of retention prices. Retention price calculations and projections, compared to appraisal estimates, are presented in Annex 3-4.

6.9 In January 1994, the price paid for gas, Rs.2,957 per 1,000 Nm^3 (Rs.2,276 in 1990/91 terms) was significantly above its economic value (Rs.1,422 in constant 1990/91 terms). It was assumed that the gas price would increase to the level recommended by the Kelkar Committee up to January 1995 (Rs.3,166, equivalent to Rs.2,440 in constant 1990/91 terms), and thereafter remain at its 1995 level in constant terms. Urea retention prices (established at Rs. 4,444 per ton for 1993/94, equivalent to Rs.3,424 in 1990/91 terms), are projected (in constant 1990/91 terms) at between Rs.3,559 and Rs.3,629 for the 1994/95-1996/97 pricing period, and at between Rs.3,723 and Rs.3,750 for the three years pricing period 1997/98-1999/2000). These values are slightly higher than the current and projected import parity of urea (in 1990/91 constant terms, Rs.2,949 per ton in 1993/94, Rs.3,219 in 1994/95, increasing to Rs. 3,488 by 1997/98). Based on 1993/94 current prices and Bank price projections for urea and crude oil, the Aonla project slightly benefits from the retention price scheme, but is penalized by the gas pricing system. The high price of natural gas could result in wrong decisions regarding the choice of feedstock for future ammonia plants.

6.10 The project is financially sensitive to both gas and urea prices. The FRR would increase to 12.8% if the fertilizer sector was deregulated, i.e. if, starting in 1988/89, IFFCO could buy natural gas at its fuel oil equivalent value and sell urea at its import parity. However, the FRR would decrease to 2.4% if only the urea price was set at its economic level. Urea retention prices and natural gas prices, compared with their respective economic value and appraisal estimates, are presented in Annex 3-1.

(b) <u>The Rehabilitation Component</u>

6.11 Overall, the rehabilitation objectives for the Phulpur and Kalol Plants were met. Plant production levels, rates of capacity utilization and specific energy consumption since 1985/86 are presented in Part III, para. 6.2-A. The project reduced the environmental impact of the plants by implementing schemes to reduce and better control liquid and gas effluent (paras. 6.18, 6.20 and 6.21) , and increasing safety through construction of a new, modern, ammonia tank in each plant. The rehabilitation component also resulted in the following improvements in plant operation:

(i) At Phulpur, the rate of capacity utilization of the ammonia plant increased from less than 88% before 1985/86 to 117% and 104%, respectively, in 1992/93 and 1993/94. Similarly, the rate of capacity utilization of the urea plant increased from less than 91% before 1985/86 to 123% and 109%, respectively, in 1992/93 and 1993/94. Specific energy consumption per ton of ammonia improved from 12,340 Mcal in 1985/86 to 11,040 Mcal and 11,460 Mcal, respectively, in 1992/93 and 1993/94, and overall specific energy consumption per ton of urea improved from 9,690 Mcal to 8,210 Mcal and 8,650 Mcal, respectively, in 1992/93 and 1993/95;

(ii) At Kalol, the modification of the reformer and the rehabilitation of the converter were implemented in 1993/94 and their impact is not yet reflected in the annual results. However, average monthly capacity utilization of the ammonia plant increased from 86% in the April-August 1993 five-month period before revamping, to 104% in the November 1993-March 1994 five-month period after revamping. Similarly, specific energy consumption per ton of ammonia decreased from 10,204 Mcal to 9,324 Mcal in the same periods.

6.12 The status of rehabilitation sub-projects, their benefits and actual costs, compared to appraisal estimates, and whenever possible estimated ERRs, are presented in Part III - para. 6.2.B. All implemented rehabilitation sub-projects with quantifiable benefits (generally the result of efficiency improvements and energy savings), have internal rates of return between 23% and 110%. At appraisal, rates of return ranging from 20% to over 40% were estimated for these sub-projects. Other difficult to quantify benefits include reduction in negative

environmental impacts through reduction and improvement in effluent, increased safety, and increased plant reliability.

(c) Financial Performance of IFFCO

6.13 Selected financial data and performance ratios are presented in Annex 4. Since Loan Approval in June 1986, except in FY 1986/87, IFFCO has been in compliance with Bank financial covenants (debt/equity, current and debt service coverage ratios). In 1986/87 IFFCO's debt service coverage ratio was 1.0, lower than the covenanted 1.3 times the maximum debt service. However, it increased to 1.4 in 1987/89 and has stayed above 2.8 since 1990/91. Since FY 1990/91, IFFCO has been in a good financial position -- as a result of the excellent operation of the new Aonla plant and of improved production performance attained by Phulpur and Kalol after their rehabilitation, IFFCO's operating income increased from Rs.102 million in FY 1986/87 to Rs.2,134 million in 1992/93 and the company's return on equity increased from less than 0.1% in FY 1986/87 and 1.7% in FY 1987/89, to 10.8% in FY 1992/93.

(d) Environmental Impact and Disaster Management

The Aonla Project

6.14 The Aonla project is located in a generally barren and scarcely populated area. Nevertheless, adequate pollution control measures have been adopted: adequate effluent treatment and discharge facilities were constructed in accordance with Indian environmental standards, which are comparable to standards applied for such installations in industrialized countries and/or other environmental standards acceptable to the Bank. Major effluent from the plant include: (i) liquid effluent from the ammonia and urea plants and from the water treatment plant; (ii) dust emissions from the urea plant prilling tower; (iii) blow down of the cooling tower; and (iv) sludge from the water treatment plant. The ammonia and urea plants were designed based on a zero-effluent concept, with complete recovery and re-use of process steam condensates and treated liquid effluent. A green belt of 150,000 trees was planted to improve the ecological balance of the surrounding area and reduce noise and dust transmission. Finally, Aonla is equipped with a modern environmental management laboratory, on-line analyzers and adequate water and air pollution monitoring stations, and early on defined and implemented an environmental management plan, including a detailed monitoring plan.

6.15 In addition to the compulsory initial environmental assessment, on the basis of which the Aonla project was designed, in 1992/93, after more than four years after commissioning, IFFCO carried out a new Environmental Impact Assessment (EIA) of the plant, to assess the actual impact of the project and estimate the potential environmental impact of the expansion project. The report was submitted to, and accepted by, the state and central environmental agencies. Its overall conclusion was that Aonla pollution control measures were effective and that all effluent were within the limits specified by the UP Pollution Control Board (UPPCB) -- its main conclusions were: (i) overall air quality within and around the fertilizer complex is well within the limits specified by the UPPCB; (ii) the quality of treated effluent is well within the limit of UPPCB and most effluent are used for irrigation of the green belt; and (iii) the noise level is within or close to the limit of the UPPCB Pollution Control Board. The Aonla environmental control facilities and the recent assessment carried out after four years of operation are summarized in Annex 4, para I.

6.16 In 1989, the Center for Energy, Environment and Technology carried out a case study on environmental management practices at Aonla. This study was sponsored by the Ministry of Environment and Forests. Its main conclusions were similar to those of the above-mentioned EIA. In addition, the study recommended the inclusion of periodic external auditing in the Aonla management plan. The

Bank strongly supports this recommendation which would help identify, review and improve upon the present situation and measures.

6.17 In 1992/93, IFFCO revised the Disaster Management Plan of Aonla in light of new guidelines issued by the Directorate of Factories of the Department of Labor of UP. This updated disaster management plan includes: (i) an inventory of potential disasters and precautions to be taken; (ii) an emergency plan; (iii) an evacuation plan; (iv) emergency pollution control, including mutual aid schemes in the event of disaster; and (v) a disaster management structure chart.

The Phulpur Plant

6.18 The naphtha-based Phulpur ammonia-urea plant, which was commissioned in 1980 with a nominal capacity of 1,500 tpd of urea, is located in the Indo-Gangetic plains. Since start-up, IFFCO has implemented an extensive program of effluent and pollution control improvements to maintain the Phulpur plant in conformity with UPPCB and MINAS standards. Part of these schemes were financed under the project. Except for the fly ash disposal/re-use and the overflow water of the ash pond, all other effluent are similar to those of Aonla. Pollution control measures for liquid effluent, air emissions, domestic sewage, and solid waste were adopted, aiming at maximum reduction and re-use of effluent -- many improvements in operation and effluent treatment were made in the ammonia and urea plants for maximum recovery and re-use of process steam condensates; maximum recovery of treated liquid effluent and recycle of ammonia; and safe management and use of solid waste (para 7 (b) of Annex 5). A green belt of 270,000 trees was planted to improve the ecological balance of the surrounding area and reduce noise and dust transmission. Finally, Phulpur is equipped with a modern environment and pollution control laboratory (recognized by UPPCB), on line analyzers, stacks sampling arrangements, water and ambient air pollution monitoring stations, and has established a detailed monitoring plan.

6.19 In 1992/93, HBTI/KANPUR undertook an EIA of the Phulpur plant, based on field data collected over a period of eighteen months on air, water and land pollution, solid, liquid and gaseous discharges, flora, fauna, and population and human health. Main conclusions of the study include: (i) the water table will not be depleted; (ii) no irreversible impacts on the environment are foreseen; (iii) efficient control measures are adopted and impact on air and the atmosphere is negligible; (iv) liquid effluent and solid waste are well managed and their impact on water and land bodies is negligible; (v) the socio-economic environment has improved; and (vi) the green belt moderates the plant impact on the environment and has improved its aesthetics. The study also recommends to further reduce discharge of effluent water (currently recycled at about 60%), improve the bottom of the urea storage to better control moisture seepage and continue R&D work for the use of solid waste. Phulpur environmental control facilities and the recent environmental impact assessment are summarized in Annex 4, para II.

The Kalol Plant

6.20 The gas-based Kalol ammonia-urea plant, which was commissioned in 1975 with a nominal capacity of 1,200 tpd of urea, is located in Gujarat. Since start-up, IFFCO has implemented an extensive program of effluent and pollution control improvement to reduce pollutants in plant effluent within the limits of the Gujarat Pollution Control Board (GPCB) and MINAS standards. Part of the newer schemes were financed under the project. Plant effluents are similar to those of Aonla. A number of pollution control measures for liquid effluents, atmospheric emissions, domestic sewage, and solid waste were taken, aiming at maximum reduction and re-use of effluent. Most of these improvements were commissioned in 1992/93 and 1993/94 and liquid and gas effluent are now in conformity with the GPCB standards. Main improvements implemented in 1992/93 and 1993/94 include: (i) a deep hydrolizer unit and a leakage collection and treatment system in the urea plant to improve liquid effluent; and (ii) a vent gas condensation system in the ammonia plant, an additional vent scrubber in the

urea plant and a dedusting and a wet scrubbing system in the urea storage and bagging facilities to improve gas effluent.

The Kandla Plant

6.21 The Kandla Diammonium Phosphate (DAP) and complex fertilizer (NPK) plant started commercial production in 1975 with two granulation plants using imported phosphoric acid and potassium chloride. Two additional granulation units were added in 1981 to increase production capacity to 260,000 tpy of P_2O_5. The Kandla unit is adjacent to the Kandla port (Gujarat). The units are based on well-known processes, are based on total recycle of liquid effluent, and are equipped with the necessary gas effluent treatment and pollution control systems, including cyclones, scrubbers, dedusting systems, and with total recycle of the scrubbing liquor. Under the project, a new modern ammonia tank was implemented for increased safety. The plant also received many safety awards from the Government of India and from Gujarat Safety Council.

(f) **Project Impact**:

6.22 In addition to foreseeable impacts of a large project such as Aonla in a remote agricultural area (direct and indirect employment, increased trade, company town, educational, medical and sanitary facilities, infrastructure development, etc...), the project components made significant contributions to expanding the domestic fertilizer industry, thus, to economically securing sustained supplies of fertilizer and substituting for imports. Other positive impacts of the Aonla project include: (i) transfer of technology to Indian firms -- the project was implemented with a large involvement of Indian firms, which, by working in association with international process licensors, further improved their capabilities in carrying out similar projects (as a result, for the urea plants of the Aonla and Vijaipur expansion projects, only the process license will be provided by an international firm, while the basic and detailed design as well as procurement and construction supervision services will be provided by an Indian firm under a license agreement); and (ii) development of human resources through training.

7. Project Sustainability

7.1 It is estimated that, over its economic life, the plant is capable of maintaining a sustained capacity utilization rate between 100% and 110%. If, in line with the present trend of economic policy reforms, GOI decides to deregulate the fertilizer sector (including prices of inputs and outputs), the Aonla plant would be able to withstand competition from imports, at currently projected import parity prices, even in the absence of protective tariffs, while paying natural gas at its fuel oil equivalent value. In fact, such deregulation would improve the project FRR from the currently estimated 9.8% to 12.8% (para. 2). The major risk still faced by the project is that, in order to reduce the financial burden of the fertilizer subsidy, GOI may decide to revise the urea retention price norms further downwards -- if the retention price of urea for Aonla decreased by 10% below its present level (Rs.4,444 in 1993/94), the project would become less attractive, and its FRR would decrease to about 4.2%. Finally, the duplication of the Aonla plant has been approved by GOI and is currently under implementation. If sufficient volumes of product can be sold at viable distances, the doubling of capacity will further improve project sustainability, by reducing fixed cost per ton of urea, provided adequate gas supplies are made available by GAIL for the expansion.

7.2 In the long term, sustainable operation of the plant is also a function of adequate supplies of natural gas feedstock and efficient operation of the HBJ pipeline. The project utilizes a maximum of 1.72 million cubic meters per day (MMm^3pd) of natural gas (1.38 MMm^3pd if gas for steam and power generation is excluded), out of 18 MMm^3pd of gas currently transported by the HBJ pipeline (the capacity of which can be further increased to 33 MMm^3pd). In 1990,

the Department of Petroleum and Natural Gas estimated potential supply of gas from the western region fields and potential demand from these fields as follows (in MMm^3pd):

Supply:	75.0 [2]
Demand:	
- Fertilizer	28.0
- Power	40.0
- LPG and Petrochemicals	7.0
- Sponge Iron	6.0
- Other	10.0
Total Demand	91.0

Therefore, in the western region, there is an excess demand of natural gas, the bulk of which from the fertilizer and power sectors, where demand is mainly generated by investment decisions taken by the Government. In fact, a long term supply contract (15 years starting March 24, 1988, renewable for a five- year period subject to gas availability) was signed between IFFCO and GAIL on August 20, 1991 (Part III - para. 4.1). However, in accordance with this contract, GAIL has since notified IFFCO that it will supply gas to Aonla only as feedstock, but not for steam generation and heating, and, starting April 1, 1994, the original contract supply was reduced by 15%. This shift was foreseen, and is not expected to have an impact on project viability -- the Aonla steam and power generation systems, which were already equipped with the necessary facilities, were switched to liquid fuels (para. 2) and, in addition, IFFCO is considering using liquid naphtha in the super heater within a year. IFFCO has also reached an agreement with GAIL for the duplication of the Aonla plant. However, this duplication is being designed with a possibility of replacing up to 50% of natural gas with naphtha as feedstock. This switching unit would cost about US$7 million and its additional CO_2 production would allow operation of the urea plants of both this project and the expansion at full capacity. As already commented in para. 2, the current high price of natural gas may result in wrong decisions being taken with respect to feedstock choice for future ammonia plants, as may be the case here.

7.3 The project Aonla plant has been implemented and is operated in an environmentally sound manner. The rehabilitated plants also are operated in an environmentally sound manner. IFFCO is aware of risks in these plants and has adopted the necessary safety measures. Therefore, risks of problems impacting on local communities and the environment are small.

7.4 The main objective of the performance evaluation and control system component is to assist GOI in further improving the overall economic performance of the sector and the physical and financial performance of the public sector fertilizer industry, by linking greater autonomy at the enterprise level to increased accountability of its managers. This component will be successful if the recommendations of the study are implemented in line with this objective. However, GOI should be careful not to use the system to increase day-to-day control of public sector companies, further centralize decisions, and increase the number of approvals.

7.5 GOI fertilizer policy has allowed India to develop a large domestic fertilizer production and positively contributed to reaching targeted large increases in foodgrain production through increased availability and consumption of subsidized fertilizer. This policy has resulted in growth of the fertilizer subsidy to unsustainable levels (Rs.58 billion in 1992/93). GOI has recently recognized the need to address sectorial issues (Part II). However, fertilizer

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[2]/ the Staff Appraisal Report of the Gas Flaring Project (Loan 3364-IN) indicates a total supply of 61 MMm^3pd of natural gas for the country's western region.

subsidy and low-price policies have a built-in effect of increasing the total amounts of fiscal subsidies by encouraging increased consumption of subsidized fertilizer. Hence, the subsidy issue will become more and more acute, and it is probable that GOI will have to seriously address this issue soon.

8. Bank Performance

8.1 Bank performance during project identification, preparation, and appraisal was satisfactory and procurement supervision was good. Two supervision missions per year took place in 1987 and 1988 during Aonla project implementation. Subsequently, supervision missions averaged one per year until 1994, when the PCR mission took place. Except for two missions, including the PCR mission, they consisted of two persons or more (Part III - para. 7.B.).

8.2 The Bank's major objective in this as well as prior projects in the sector was to support GOI strategy of increasing domestic fertilizer production. The main emphasis was thus on improving project implementation and efficiency; rational project selection; expanding production facilities and improving capacity utilization rates and energy efficiency; and on reducing negative environmental impacts. All project components successfully reached these objectives.

8.3 The Bank correctly demonstrated substantial flexibility during implementation of the rehabilitation component, quickly accepting on several occasions to adapt the investment program in order to reflect changing priorities and constraints identified during implementation, after such long delays.

8.4 At preparation, appraisal and negotiation stages, the Bank's main objective of the Government Loan was to support the adoption of a broader sectoral approach and address the important issues of fertilizer subsidies, pricing, and public sector enterprise management and production performance. The Bank was unable to obtain a formal Government commitment, however, at negotiations, GOI informally agreed to implement its Program of Initiatives aimed at increasing production efficiency, improving pricing policies and reducing fertilizer subsidies. Overall production efficiency agreed targets were achieved but progress in the important policy reforms was insignificant.

8.5 Besides this loan, the Bank was contemplating further assisting GOI sector restructuring efforts by supporting: (i) a production-efficiency oriented Fertilizer Industry Rehabilitation Project; and (ii) a distribution-efficiency oriented Fertilizer Distribution Project. However, this program was dependent on significant progress in reforming fertilizer prices, reducing subsidies, and improving production and distribution efficiency. The reform measures proposed by the Bank were considered too radical, and the policy dialogue on the sector between GOI and the Bank largely ceased around 1987.

9. Borrowers' Performance

9.1 The Aonla project was professionally designed, organized and implemented. The plant was completed on schedule and within cost, and is being operated efficiently at more than 110% of its nominal production capacity. IFFCO was also able to prepare commercial operations and develop adequate markets in time. Except for the debt service coverage ratio in 1986/87 (para.2) IFFCO has complied with the Loan financial covenants. As already indicated, the Aonla project was efficiently implemented and was awarded second prize for excellence in project implementation by the Ministry of Program Implementation (para.2) and first prize of excellence in energy conservation and management by the Ministry of Power (para.6.2).

9.2 Such success can be attributed to IFFCO's past experience in implementing and operating the Kalol, Kandla and Phulpur plants and to several

other strengths, from which useful lessons may be drawn for the implementation of any large public or private sector project:

(i) from the start, IFFCO entrusted project management, coordination and supervision to a dedicated, high quality project team, headed by an executive director with the necessary autonomy and authority. Furthermore, the same team organized and subsequently took over the responsibility for plant operations. This project team included a planning and monitoring group and a quality control group, both efficiently supported by an on-site modern computerized project management system;

(ii) the project was provided with sufficient and timely funds;

(iii) through its reliance on competitive bidding and a strong procurement management system, IFFCO could carry out international and domestic procurement efficiently and resolve all procurement problems in time;

(iv) experienced personnel from IFFCO's existing plants were appointed to the project team; and

(v) IFFCO timely provided on-site housing facilities and services, essential for efficient implementation in such a remote area.

9.3 In spite of long delays in implementation of the rehabilitation component, IFFCO took correct decisions on the inclusion and scope of the schemes which were eventually incorporated, and implemented them efficiently.

10. Project Relationship

10.1 The success of the large Aonla project was also due in part to the high level of professionalism of all parties and their good relationship; the Borrower's reliance on, and constructive relationship with, the consultants; and the amicable working relationships between the Bank and the Borrower.

11. Consulting Services

11.1 The Aonla project obtained process technologies and procurement, engineering and construction management services from well known international firms, in association with a state-owned engineering firm (para.2). The performance of all consultants was satisfactory, except for some delays reported by IFFCO in the supply of some specifications and design services by the Indian engineering firm. IFFCO benefitted from experience acquired by the consultants during the earlier construction of the Thal and Vijaipur plants, which included identical ammonia and urea units.

12. Project Documentation and Data

12.1 The legal documents of the IFFCO Loan were adequate for achieving the objectives of the Aonla and the plant rehabilitation project components. However, the Government Loan agreement should have included a clear and formal commitment from GOI to implement the Program of Initiatives. The Staff Appraisal Report and the documentation in the Project File provided adequate background for the review of project implementation. The Bank requested IFFCO to prepare the project-related information and data needed for the preparation of the PCR well ahead of the Bank completion mission in April 1994. All the requested information, including draft in-house PCRs for the Aonla and the Rehabilitation components, was provided and discussed during the mission. However, it was impossible to obtain the information related to the implementation of the import component from MMTC -- MMTC is no longer responsible for import of fertilizers.

12.2 The preparation of statistical data needed for Part III of the PCR is time-consuming. An effort should be made by supervision missions to obtain this information in the form requested in the PCR guidelines early-on from the start of project implementation, and maintain it up-to-date.

PART II: PROJECT REVIEW FROM BORROWER'S PERSPECTIVE

IFFCO's COMMENTS ON PROJECT IMPLEMENTATION AND PERFORMANCE

1. AONLA COMPONENT

1.1 Achievement of Project Objectives

1.1.1. With the successful completion of the project, reserves of natural gas are being used to produce fertilizer for the local market thus enhancing GOI's objective of increasing agricultural productivity toward increased self-sufficiency in food grain production.

1.1.2. Project implementation cost was about US$ 125 million below the appraisal estimate of US$ 633.1 million. The saving could be realized primarily due to early mechanical project completion (i.e. 36 months against 45 months) and commencement of commercial production (i.e. 42 months as against 48 months estimated by the Bank) that in turn led to reduced interest during construction, lower working capital etc.

1.1.3. So far, annual capacity utilization has been above 100% and IFFCO should have no problem of maintaining sustained utilization rates in excess of 100%. Generally, energy consumption has also been better than the contracted/guaranteed figures.

1.1.4. Industrial relations during the project were good, and during the entire construction period no man-hours were lost due to any industrial relations/labour problems.

1.2. Project Management and Execution

1.2.1. IFFCO's experience gained while implementing similar projects at an earlier stage at Kalol and Phulpur has significantly helped in project implementation. The performance of the consultants was generally satisfactory.

1.3. Environmental Aspects

1.3.1. The selection of "Zero Effluent Technology" for the urea and ammonia plants, aiming at recycle and re-use of waste water has significantly helped maintain a clean and healthy environment.

1.4. Benefits to Relevant Sectors

1.4.1. The project has a positive impact on the economy of the region with respect to employment, enhanced food production, higher living standards, and technology transfer.

1.5. Bank Role

1.5.1. The Bank has helped ensure cost effectiveness through use of ICB procedures and in overall project implementation arrangements.

1.5.2. As earlier Bank experience has demonstrated the need for using more conservative project implementation time estimates and proven technologies, IFFCO combined its previous project experience with Bank recommendations and thus managed to complete the project in record time and to operate it with high efficiency.

2. REHABILITATION COMPONENT

2.1. IFFCO targeted the rehabilitation component at improving energy consumption, pollution control and operational reliability at its existing plants at Kalol, Kandla and Phulpur. Although the proposal for the component was ready in July 1986, final approval by the Government of India was obtained only in December 1988.

2.2. Subsequently, some schemes had to be dropped and/or replaced by more attractive project proposals to suit the Borrower's requirements. The Bank has been accommodative and flexible in accepting new proposals during project implementation.

3. FINANCIAL ASPECTS

3.1. Of the loan allocation of US$ 152 million equivalent, IFFCO utilised US$ 106.72 equivalent and surrendered the balance. Loan disbursement by the Bank was prompt and no difficulties were experienced in loan withdrawal.

3.2. The loan has been disbursed in 43 different currencies. IFFCO has not been able to safeguard its liability which increased due to devaluation and the convertibility of the Rupee, as it was unable to hedge the risk (through a forward-booking mechanism) as the respective currency required for an installment is intimated only six weeks before the due date.

3.3. Bank disbursement is re-valued periodically under the currency pooling system with the result that it is not possible to correlate the loan outstanding with the currencies drawn and currencies repaid. It would be appropriate if a complete statement of currencies drawn by the loan closing date would be marked-up by the Bank for the Borrower's reconciliation, indicating the effect of revaluation on each currency, repayments made during the period and amounts outstanding - currency-wise and in dollars equivalent.

4. SUMMARY

4.1. Overall, the **Aonla component** has demonstrated that it is possible to efficiently execute a mega-project in India within budgeted cost and time schedule, meet guaranteed energy consumption and achieve good operating performance, provided good project management and effective project organization with relevant past experience are furnished.

4.2. Under the **rehabilitation component** and its successful completion, the Bank has been very cooperative and flexible with regard to scope adjustments required to ensure project viability. Due to this approach, the projected benefits of the schemes have been realized.

GOVERNMENT OF INDIA
COMMENTS OF THE DEPARTMENT OF FERTILIZERS ON THE "PROGRAM OF INITIATIVES" AND THE PERFORMANCE OF IFFCO UNDER THE WORLD BANK-ASSISTED COOPERATIVE FERTILIZER INDUSTRY PROJECT LOAN NO. 2729/30-IN (December 1994).

1. As per the Statement on Industrial Policy issued on July 24, 1991, industrial licensing has been abolished for the fertilizer industry. An entrepreneur is free 10 select technology, feedstock, plant location, project execution arrangements and financing. For example, GSFC is expanding its ammonia production capacity using technology from Linde. Technology from Kellogg is being used to retrofit the Hazira plant of KRIBHCO. The expansion projects of IFFCO at Aonla and NFL at Vijaipur are based on technology supplied by Haldor Topsoe and Snam Progetti. Whereas natural gas remains the preferred feedstock, ammonia/urea plants based on naphtha also are both under implementation and consideration.

2. As part of the liberalization measures, customs duty on import of capital goods for new fertilizer plants and revamping of old plants has been abolished w.e.f. September 23, 1992.

3. The per capita and total agricultural subsidies in India remained far below the levels prevalent in the developed countries, as shown in the table below:

Country	US$ per Capita	Total (US$ billion)
Norway	950	4
Switzerland	800	5
Japan	580	74
EU	420	156
OECD	410	354
USA	390	91
India	**1.2**	**1.1**

(Source: Agricultural Situation and Fertilizer Demand Paper presented at 62nd IFA Annual Conference, Istanbul, 9-12 May 5, 1994, by IFA Secretariat)

4. Regarding energy consumption, there is a trade-off between capital costs and energy required to produce 1 MT of ammonia. Beyond a particular point, the marginal decline in energy consumption may not be justified by the additional capital expenditure involved. For example, the new ammonia plant being set up in Trinidad using the Kellogg Advanced Ammonia Process (KAAP) by FARMLAND Industries of the US and Enron International CV and the National Gas Company of Trinidad and Tobago is expected to consume 33 million BTU (more than 8 Gcal) of natural gas per tonne of ammonia product. (Source: Fertilizer Week of 26-09-1994)

5. Regarding developing the international competitiveness of the sector, while reducing the economic cost of production, it may be mentioned that at present only urea is under price control. The difference between the sale price of controlled fertilizers as notified by the Government and the cost of production as assessed by the Government is paid as subsidy under the Retention Price-cum-Subsidy Scheme (RPS). Under the RPS, the retention price, which is the cost of production plus reasonable return on investment as assessed by the Government is fixed for each unit. In the case of urea, based on the latest. notified retention prices for various units, the weighted average cost of production per tonne of urea works out to Rs. 4888/-. This compares favourably

with the price of imported urea. As per the latest contract, the import of urea is being contracted at US$ 202.5 C&F per tonne. However, while on a weighted average basis, indigenous urea may be cheaper than the international price, the cost of production in some of the new urea plants is much higher than the weighted average price. This is mainly on account of high capital related charges which is roughly around 60% of the total cost.

6. In the case of prices of decontrolled phosphatic fertilizers, since the country does not have adequate reserves of phosphatic raw materials, nearly 95% of the requirement of phosphatic raw materials is met through imports. Therefore, the cost of production is directly related to the cost of imported raw material. In the case of DAP units, the variable cost is around 85% of the total cost.

7. On the issue of fertilizer subsidy, it may be mentioned that during the period 1982-91, the prices of controlled fertilizers remained unchanged, resulting in outgo of subsidy going up from Rs. 375.00 crores in 1981-82 to Rs. 4,389.06 crores in 1990-91. In order to contain the mounting subsidy bill, the prices of controlled fertilizers were increased by 30% in July-August 1991. Again, in August, 1992, all phosphatic and potassic fertilizers were removed from the price control mechanism and simultaneously the price of urea was reduced by 10%. Lastly, the price of urea was again raised by 20% with effect from June 10, 1994. The outgo on account of subsidy during 1993-94 was of the order of Rs. 4,398.97 crores. Though there may not have been any significant fall in the outgo of subsidy, this has been mainly on account of increase in production/consumption of fertilizers and this would have been much more, had the measures to raise the price of fertilizers from time to time not been taken.

8. Regarding efforts to improve pricing by modifying and rationalising the retention pricing system, it may be mentioned that the policy parameters for retention prices of controlled fertilizers are fixed once in three years. Over the successive pricing period, various norms of RPS have been tightened with a view to spurring the units to higher levels of efficiency. The major changes related to capacity utilisation, plant. life, life of catalyst etc. Individual units cannot realise the prescribed return of 12% on net worth, unless these norms are achieved. Moreover, a number of cost elements are not allowed while working out the retention prices. For example, higher inventory holding, turnover tax, purchase tax, freight incurred on longer leads compared to normative leads, cost of investment not related to requirement for production facilities, cost over-run due to delay on the part of project authorities in execution of projects etc. The Joint Parliamentary Committee on Fertilizer Pricing which went into the details of fertilizer pricing, noted that the norms have been considerably tightened over the years and, therefore, did not recommend any further tightening of these norms.

9. With respect to distribution efficiency, it may be mentioned that at present urea is the only fertilizer which is under price and movement controls and, therefore, its distribution is covered under allocation given by the Department of Agriculture & Cooperation. A "Total System Rationalisation Study'" was assigned to RITES. They have given a draft report, but there are a number of points which require moderation and reconsideration. These have been pointed out to RITES and they are reconsidering these points before submitting the final report. As far as the overall lead for all fertilizers is concerned, the same decreased considerably to 908 km in 1992-93 as compared to 1010-1080 km range till 1989-90. However, there was a marginal increase to 933 km in 1993-94. This was attributable to the tight availability of urea during the year, when some special movements had to be resorted to for taking care of the localised shortages on account of unforeseen circumstances and consequent constraints in indigenous production. The overall lead for urea has, however, maintained a decreasing trend. From a level of 679 km in 1991-92, it has decreased to 655 km in 1992--93. During these years, the average rail lead for urea decreased from

806 to 774 km. The normative lead for 1993-94 was 644 km (overall) and 741 km (by rail). However, actual leads for urea have not yet been worked out. The equated freights per tonne for urea during 1992-93 and 1993-94 were Rs. 293 and Rs. 334 per tonne (in current terms). If we take into consideration the increase in the cost of transportation, there has not been any significant increase in the equated freight.

10. The details of targets and achievements of fertilizer production and capacity utilisation during the period 1984-85 to 1992-93 as available with the Department are different from those given in the World Bank report. The information available in the Department is enclosed (Annexure-I).

11. The Aonla ammonia-urea plant has consistently performed at very high levels of capacity utilisation and energy efficiency. This is evident from Annexure-II. At the same, IFFCO Aonla has contributed about 5% of the national consumption of nitrogenous fertilizers for the past six years (see Annexure-III).

12. Regarding rehabilitation projects, capacity utilisation of the ammonia plant in the Phulpur unit increased from less than 88% before 1985-86 to 117% and 104%, respectively, in 1992-93 and 1993-94. The corresponding increase in capacity utilisation for the urea plant was from less than 91% in 1985-86 to 123% and 109%, respectively, in 1992-93 and 1993-94. The decline in specific energy consumption per tonne of ammonia and urea is given below:

S.No.	**Product**	**Specific energy consumption in Gcal/MT of product**		
		1985-86	**1992-93**	**1993-94**
1.	Ammonia	12.34	11.04	11.46
2.	Urea	9.69	8.21	8.65

The modification of the reformer and the rehabilitation of the converter in the Kalol plant was completed in 1993-94 and their impact is yet to be reflected in the annual results. Based on the figures available, the average monthly capacity utilisation of the ammonia plant increased from 36% in the five month period viz. April-August 1993 (before revamping) to 104% in the five month period of November 1993 to March 1994 (after revamping). For these periods, the specific energy consumption per tonne of ammonia decreased from 10.20 Gcal to 9.32 Gcal.

Part II/Annexure-I

DEPARTMENT OF FERTILIZERS

Fertilizer Production & Capacity Utilization - Target and Achievement

	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94
Capacity Utilization of Nitrogenous Fertilizers (%)										
Targets										
All India	73.2	67.0	75.6	79.7	78.5	85.9	86.7	89.1	90.3	91.4
Public Sector	63.3	64.9	67.0	68.5	70.2	75.1	75.1	71.0	73.7	73.5
Achieved										
All India	74.4	70.3	79.1	77.6	85.2	82.8	85.8	88.5	88.0	83.9
Public Sector	60.2	55.9	65.4	66.1	71.1	66.7	66.3	69.0	69.1	67.4
Sick Units	42.1	37.1	46.8	44.5	37.7	37.1	30.0	31.3	31.1	25.7
Viable Units	57.9	65.4	75.4	78.9	88.1	81.7	84.7	87.9	88.0	88.2
Coop. Sector	107.0	83.0	93.3	100.2	110.6	107.7	112.4	112.8	111.3	108.3
Private Sector	90.0	95.1	99.1	8.5	98.1	96.8	105.0	108.8	106.7	96.9
Fertilizer Production (N+P2O5) (Million Tonnes)										
Targets										
All India	4.90	5.73	6.91	7.00	8.60	9.40	9.07	10.00	10.45	10.00
Public Sector	2.20	2.70	3.15	3.40	3.69	3.92	3.80	3.99	3.99	3.79
Achieved										
All India	5.17	5.75	7.07	7.13	8.96	8.54	9.04	9.86	9.74	9.05
Public Sector	2.19	2.35	3.07	3.16	3.75	3.33	3.38	3.75	3.68	3.45
Sick Units	0.54	0.48	0.60	0.65	0.55	0.54	0.44	0.46	0.45	0.37
Viable Units	1.65	1.88	2.47	2.51	3.20	2.79	2.84	3.29	3.23	3.07
Coop. Sector	0.87	0.94	1.45	1.49	1.89	1.87	1.95	2.08	2.02	2.00
Private Sector	2.11	2.45	2.55	2.48	3.32	3.34	3.71	4.03	4.04	3.59

COMPARISON OF CAPACITY UTILISATION (NITROGENOUS)
& ENERGY CONSUMPTION
(For natural gas plant)

ALL INDIA vs IFFCO Aonla unit

Capacity utilisation of Nitrogenous Fertiliser plants (urea production) existing in 1984-85 (%)

	88-89	89-90	90-91	91-92	92-93	93-94
All India	80	83	86	--	85	--
Total Public Sector	64	60	58	--	58	--
Coop.Sector	--	106	110	--	111	--
Priv. Sector	--	98	106	--	107	--
IFFCO-Aonla	**98**	**114**	**120**	**117**	**112**	**125**

Feedstock and Energy Consumption (Gcal/t NH_3)

All India avg. (natural gas based)	10.0	9.6	9.6	9.6	9.5	--
IFFCO-Aonla	**8.133**	**7.888**	**7.762**	**7.808**	**7.839**	**7.765**

Part II/Annexure-III

IFFCO'S CONTRIBUTION TO THE CONSUMPTION OF NITROGENOUS FERTILISERS IN INDIA ('000 t of Nutrient)

	88-89	89-90	90-91	91-92	92-93	93-94
All India consumption	7,251	7,386	7,997	8,046	8,426	--
IFFCO-Aonla production	232.40	380.70	401.20	392.50	377.40	418.70
Total IFFCO's urea production	697.60	808.50	854.70	815.40	815.90	831.60
IFFCO-Aonla's share of all India production (%)	3.20	5.15	5.02	4.88	4.48	--
Total IFFCO's share in all India production (%)	9.62	10.95	10.68	10.13	9.68	--

It can be seen from the above that IFFCO Aonla has contributed around 5% and IFFCO as a whole about 10% of the national consumption of nitrogenous fertilisers for the past six years.

PART III: STATISTICAL INFORMATION

1. Bank Group Operations in the Fertilizer Sector

Loan Credit	Project Name	Year of Approval	Status		Loan in Millions of US$
Credit 264-IN	Fertilizer Cochin	July 1, 1971	Closed: June 30, 1977 Completion: March 12, 1980		20.1
Credit 279-IN	Fertilizer Gorakhpur	Dec. 21, 1971	Closed: March 31, 1976 Completion: Sep. 9, 1976		10.0
Credit 357-IN	Public Sector Fertilizer Nangal	Jan. 30, 1973	Closed: March 11, 1977 Completion: Aug. 31, 1979		58.0
Credit 520-IN	Fertilizer Sindri	Nov. 26, 1974	Closed: Sep. 30, 1978 Completion: Dec. 22, 1981		91.0
Credit 481-IN	Fertilizer Trombay	June 18, 1974	Closed: Dec. 12, 1977		50.0
Credit 598-IN	Fertilizer Industry	Dec. 16, 1975	Closed: Dec. 31, 1982		105.0
Credit 1125-IN	Hazira Fertilizer	Mar. 31, 1981	Closed :June 30, 1988		400.0
Loan 1079-IN	IFFCO fertilizer	Jan. 07, 1975	Closed: Dec. 31, 1980 Completed: June 29, 1982		109.0
Loan 2415-IN	Madhya Pradesh Fertilizer	May 17, 1984	Closed: June 30, 1992		203.6
Loan 2729/2730-IN	Cooperative Fertilizer	June 26, 1986	Closed: June 30, 1993		256.9
IFC	Indian Explosives Ltd	1967		Loan: Equity:	8.6 2.9
IFC	Zuary Agro-Chemicals Ltd	1969		Loan: Equity:	15.1 3.8
IFC	Deepak Fertilizer and Petrochemical Corporation	Nov. 13, 1979		Loan: Equity:	7.5 1.2
IFC	Coromandel Fertilizer Ltd	1981		Loan:	15.9
				Total	**1,358.6**

The Bank Group has been a major partner in India's effort to increase fertilizer production. Total financial contribution of the Bank Group has amounted to about US$1.4 billion. However, the Cooperative Fertilizer Industry Loan approved in June 1986, was the last operation in the fertilizer sector -- it was designed to assist GOI in (i) expanding and increasing the efficiency of fertilizer supply in India; (ii) develop and implement a system to improve management of public sector companies; and (iii) assist in defining and implementing a program of policy reform and subsidy reduction. In addition to this loan, the Bank was envisaging to further assist GOI's fertilizer sector restructuring effort by supporting: (i) a production efficiency-oriented Fertilizer Industry Rehabilitation project; and (ii) a distribution efficiency-oriented Fertilizer Distribution project. However, this program was dependent on progress in achieving significant reforms on the major issues of subsidies and production and distribution efficiency. The reform measures proposed by the Bank were considered too radical, and the sector policy dialogue between GOI and the Bank largely ceased around 1987.

2. Project Timetable

Item	Date Planned	Date Revised	Date Actual
- Project Identification			FY 84
- Preparation Mission (i)			04/85
- Appraisal Mission	07/18/85	07/18/85	07/85-08/85
- Post-appraisal Mission (ii)			10/85-11/85
- Loan Negotiations	01/86	02/86	04/86-05/86
- Board Approval	03/86	04/86	06/26/86
- Loan Signature			07/22/86
- Loan Effectiveness	10/22/86		10/20/86
- Loan Closing			
* Loan 2729 to GOI	06/30/92		06/30/92
* Loan 2730 to IFFCO (iii)	06/30/92		06/30/93
- Loan Completion (iv)	12/31/91		10/31/88 (for the Aonla Project)

Comments:

(i) This mission was organized in response to GOI's request for further lending in the fertilizer sector, particularly for the Aonla project. Its main purpose was to establish whether the Bank had a continuing role in the sector, and if so, the measures that GOI should undertake as part of, or in parallel with, additional Bank lending.

(ii) The purpose of the post-appraisal mission was to obtain updated and complete project information from IFFCO, and to discuss with Government officials the "Statement of Initiatives in the Fertilizer Sector", which was to be the basis for the Bank to proceed with lending to the sector.

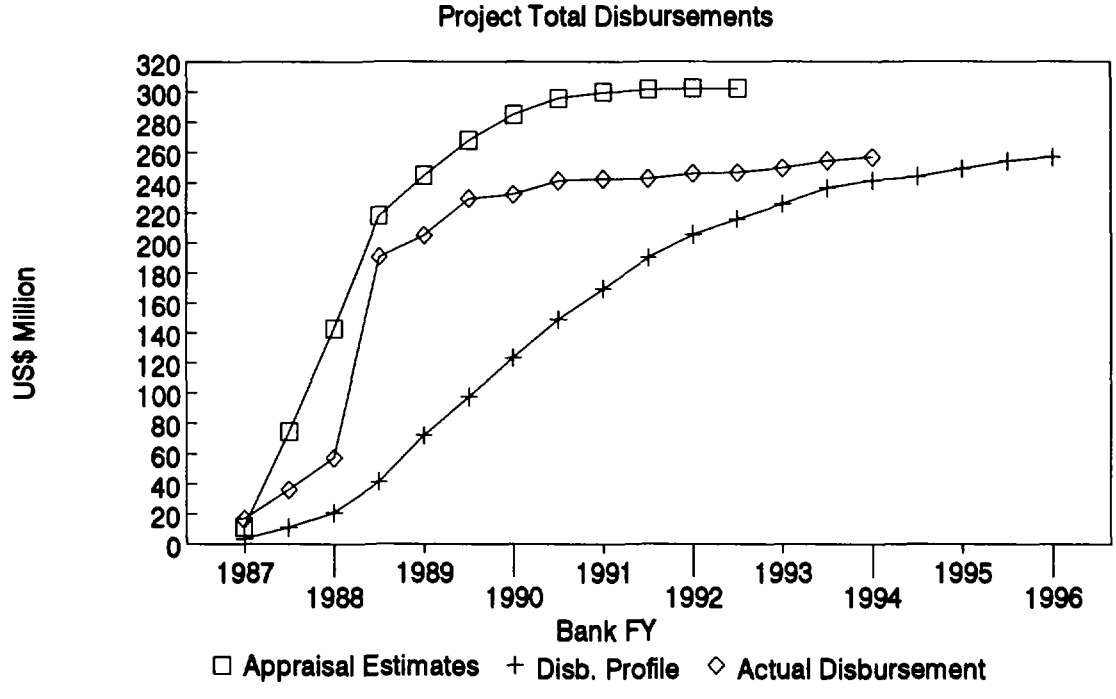
(iii) At IFFCO's request, the project original closing date was extended to allow completion of the fertilizer rehabilitation component. The outstanding schemes focused on energy conservation, pollution control and plant efficiency improvements.

(iv) Completion, as defined in the Loan Agreement (as operation of the manufacturing facilities included in the project for not less than 60 consecutive days, at an average production rate per day of at least 80% of daily capacity), was for the Aonla ammonia/urea plant at the end of October 1988.

3. Loan Disbursements (US$ million)

(i) Total Project

Bank Fiscal Year and Semester Ending		Cumulative Loan Disbursement				
		Appraisal Estimate	Revised Estimate	Profile	Actual	Actual as % Of Estimated
1987	- Dec, 86	11.2	16.3	3.2	16.3	146
	- Jun, 87	74.3	35.9	10.9	35.9	48
1988	- Dec, 87	142.9	57.1	20.6	57.1	40
	- Jun, 88	218.0	190.9	41.1	190.9	88
1989	- Dec, 88	244.9	205.0	71.9	205.0	84
	- Jun, 89	268.0	229.5	97.6	229.5	86
1990	- Dec, 89	284.8	232.3	123.3	232.3	82
	- Jun, 90	295.6	241.2	149.0	241.2	82
1991	- Dec, 90	299.6	242.6	169.6	242.6	81
	- Jun, 91	301.3	252.2	190.1	242.6	81
1992	- Dec, 91	302.2	256.7	205.5	246.1	81
	- Jun, 92	302.2	261.2	215.8	246.7	82
1993	- Dec, 92		265.2	226.1	249.8	83
	- Jun, 93		269.2	236.4	254.5	84
1994	- Dec, 93			241.5	256.9	85
	- June, 94			244.1		
1995	- Dec, 94			249.2		
	- June, 95			254.4		
1996	- Dec, 95			256.9		



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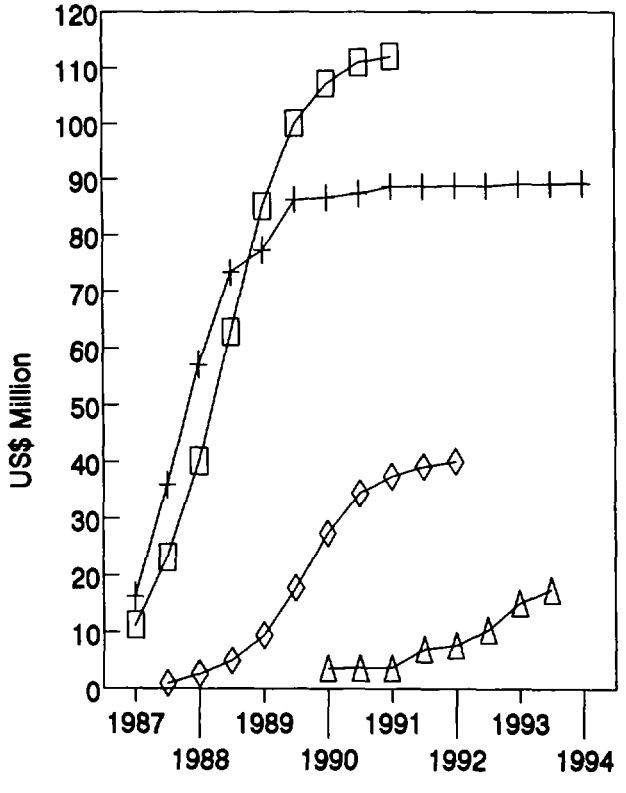
(ii) IFFCO's Loan (US$ million)

Cumulative Loan Disbursement

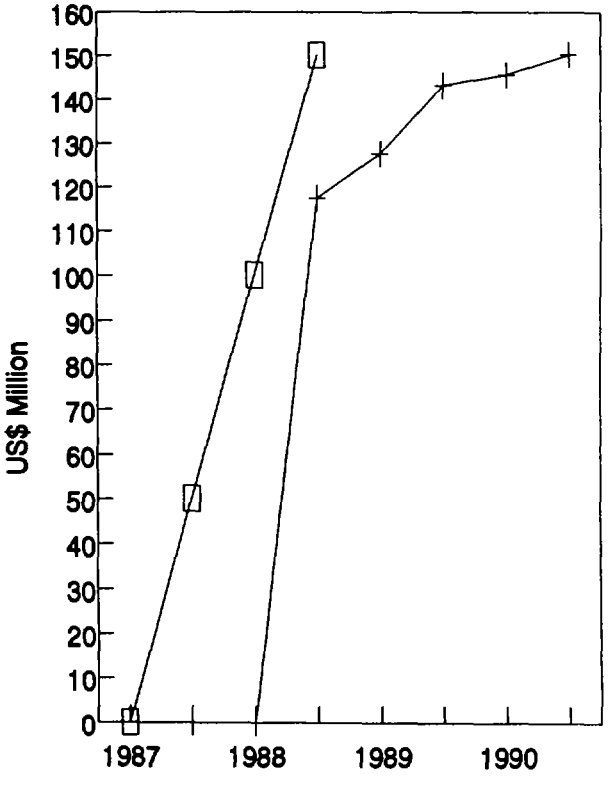
Bank Fiscal Year and Semester Ending	IFFCO Loan						Government Loan	
	Aonla Component			Rehabilitation Component				
	Appraisal Estimate	Actual	Actual as % Of Estimated	Appraisal Estimate	Actual	Actual as % Of Estimated	Appraisal Estimate	Actual
1987 - Dec, 86	11.2	16.3	145.5				0.0	
- Jun, 87	23.2	35.9	154.7	0.9			50.2	0.0
1988 - Dec, 87	40.1	57.1	142.4	2.6			100.2	0.0
- Jun, 88	62.9	73.4	116.7	4.9			150.2	117.5
1989 - Dec, 88	85.2	77.4	90.8	9.5				127.6
- Jun, 89	100.0	86.3	86.3	17.8				143.2
1990 - Dec, 89	107.2	86.7	80.9	27.4				145.6
- Jun, 90	111.0	87.4	78.7	34.4	3.6	10.5		150.2
1991 - Dec, 90	112.0	88.7	79.2	37.4	3.6	9.8		
- Jun, 91		88.7	79.2	39.1	3.6	9.3		
1992 - Dec, 91		88.8	79.3	40.0	7.0	17.6		
- Jun, 92		88.8	79.3		7.7	19.3		
1993 - Dec, 92		89.1	79.6		10.4	26.1		
- Jun, 93		89.1	79.6		15.2	37.9		
1994 - Dec, 93		89.2	79.6		17.5	43.8		

IFFCO Loan Disbursement
Aonla & Rehabilitation Components



□Aonla – SAR Est. +Aonla – Actual Disb
◊Rehab. – SAR Est. △Rehab. – Actual

Government Loan Disbursement



□Aonla – SAR Est. +Aonla – Actual Disb

4. Project Implementation

4.1 AONLA Project

Indicator	IFFCO Estimates (revised)	Appraisal Estimates	Actual
Zero Date	January 8, 1985	October 1, 1984	January 8, 1985
Detailed Engineering Completed	April 1986	February 1986	January 1987
Procurement of Equipment:			
- All Purchase Orders Placed	April 1986	November 1985	September 1986
- Supply Received	January 1987	November 1986	January 1988
Civil Works Completed	January 1987	July 1986	April 1987
Gas Contract with GAIL	June 30, 1987		August 20, 1991
Initial Gas Supply	July 31, 1987	July 31, 1987	March 24, 1988
Mechanical Completion	January 1, 1988	July 1, 1988	january 1, 1988
Commercial Production	July 15, 1988	October 1, 1988	July 15, 1988
Project Completion as per Schedule 2 of Loan Agreement		Dec. 31, 1991	October 1988

Comments:

(i) Gas supply became available about 8 months behind the original schedule but only 2.5 months after mechanical completion.

(ii) a detailed actual project implementation schedule, compared with IFFCO's revised estimates, is presented in annex 2.

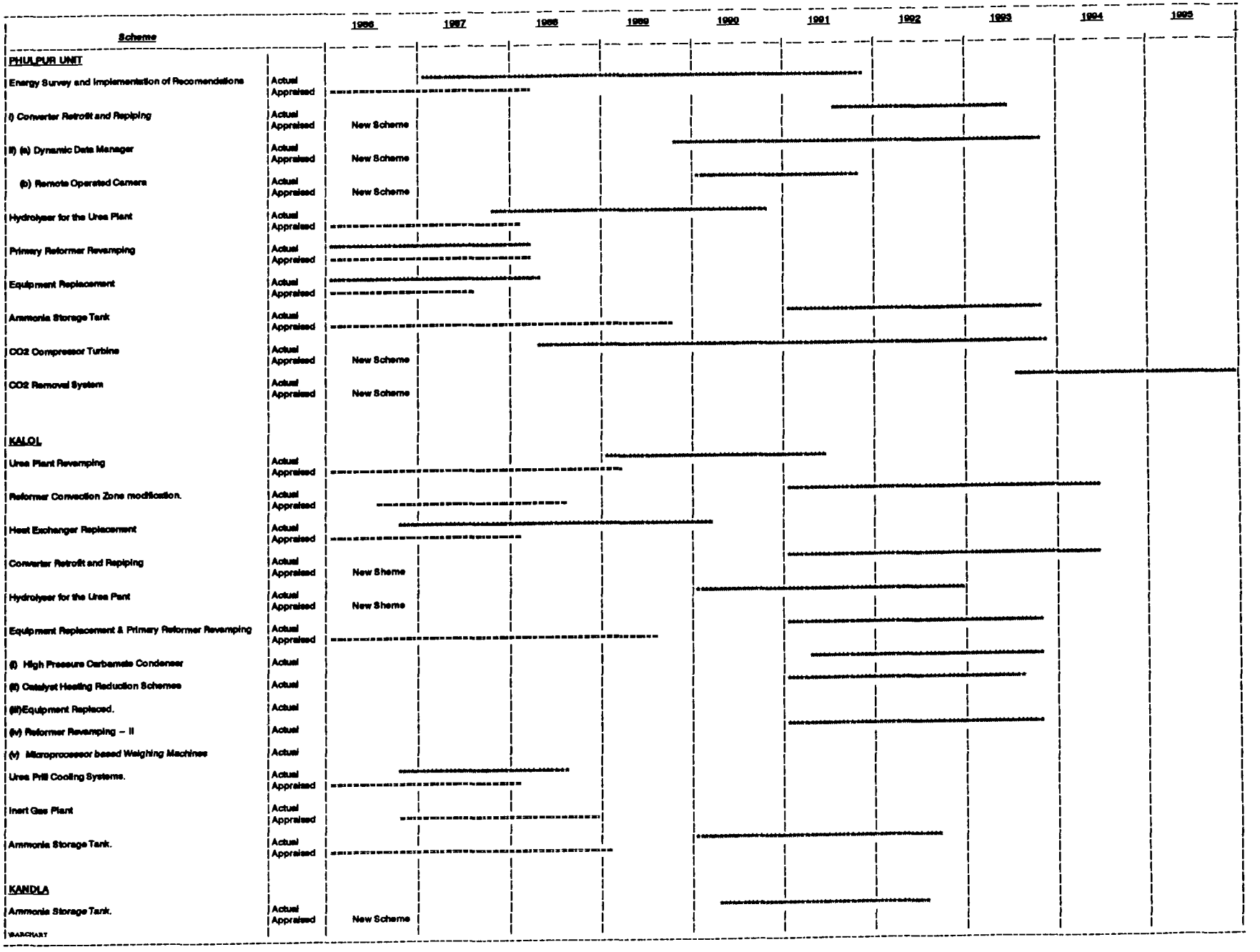
4.2 Rehabilitation Schemes

Appraisal estimates and actual implementation of the rehabilitation schemes is presented in the chart below.

4.3 Management Study and Import Component

Indicator	Appraisal Estimates	Actual
Agreement on Terms of Reference	June 1986	by mid-1988
Initiation of Study	September 1986	April 1991
Study Completed	June 30, 1987	Draft Report: Apr. 1992 Final Report: Oct. 1993
Import Component		
Full Disbursement	by FY 1988	By June 1990

Implementation Schedule of the Rehabilitation Schemes
Actual and Appraisal Estimates



5. Project Costs and Financing

A. Aonla Project Total Costs

In US$ Million 2/

	APPRAISAL ESTIMATES			IFFCO's ESTIMATES	ACTUAL COSTS			% Change from	% Change from
	Total	Local	Foreign	Total	Total	Local	Foreign	Appraisal	IFFCO
Equipment, Materials & Spares	222.9	48.0	174.9	209.4	242.7	41.1	201.6	8.9	15.9
Freight, Handling & Insurance	29.1	6.3	22.8	28.2	25.0	8.6	16.4	(14.1)	(11.3)
Excise Duties and Taxes	13.2	13.2	–	13.2	19.3	19.3	–	46.2	46.2
Sub–total	265.2	67.5	197.7	250.8	287.0	69.0	218.0	8.2	14.4
Licence and Engineering Services	32.2	15.8	16.4	25.7	30.5	2.4	28.1	(5.3)	18.7
Project, Management & Insurance	14.8	13.9	0.9	13.2	16.4	16.4	–	10.8	24.2
Land & Site Development	8.7	8.7	–	8.8	10.1	10.1	–	16.1	14.8
Civil Works and Buildings	43.8	25.1	18.7	56.4	45.7	42.9	2.8	4.3	(21.7)
Erection & Commissioning	27.4	23.0	4.4	29.4	17.1		17.1	(37.6)	(41.8)
Township	18.2	16.7	1.5	24.5	22.8	22.8	–	25.3	(6.9)
Infrastructure	9.2	8.4	0.8	11.5	10.6	10.6	–	15.2	(7.8)
Total Base Cost (BCE)	419.5	179.1	240.4	422.3	440.2	174.2	266.0	4.9	4.2
Physical Contingencies	6.8	2.7	4.1	17.8	–	–	–	–	–
Price Contingencies	38.8	14.8	24.0	28.4	–	–	–	–	–
Total Installed Cost	465.1	196.6	268.5	468.5	440.2	174.2	266.0	(5.4)	(11.4)
Working Capital	84.2	84.2	0.0	17.7	23.1	23.1	–	(72.6)	30.5
Interest during Construction and Other Financial Costs 1/	83.8	20.9	62.9	49.3	44.1	44.1	–	(47.4)	(10.5)
TOTAL FINANCING REQUIRED	633.1	301.7	331.4	535.5	507.4	241.4	266.0	(19.9)	(5.2)

In Rs Million

	APPRAISAL ESTIMATES			IFFCO's ESTIMATES	ACTUAL COSTS			% Change from	% Change from
	Total	Local	Foreign	Total	Total	Local	Foreign	Appraisal	IFFCO
Equipment, Materials & Spares	2,897.7	624.0	2,273.7	2,722.2	3,155.1	534.3	2,620.8	8.9	15.9
Freight, Handling & Insurance	378.3	81.9	296.4	366.6	325.0	111.8	213.2	(14.1)	(11.3)
Excise Duties and Taxes	171.6	171.6	–	171.6	250.9	250.9	–	46.2	46.2
Sub–total	3,447.6	877.5	2,570.1	3,260.4	3,731.0	897.0	2,834.0	8.2	14.4
Licence and Engineering Services	418.6	205.4	213.2	334.1	396.5	31.2	365.3	(5.3)	18.7
Project, Management & Insurance	192.4	180.7	11.7	171.6	213.2	213.2	–	10.8	24.2
Land & Site Development	113.1	113.1	–	114.4	131.3	131.3	–	16.1	14.8
Civil Works and Building	569.4	326.3	243.1	759.2	594.1	557.7	36.4	4.3	(21.7)
Erection & Commissioning	356.2	299.0	57.2	382.2	222.3	0.0	222.3	(37.6)	(41.8)
Township	236.6	217.1	19.5	318.5	296.4	296.4	–	25.3	(6.9)
Infrastructure	119.6	109.2	10.4	149.5	137.8	137.8	–	15.2	(7.8)
Total Base Cost (BCE)	5,453.5	2,326.3	3,125.2	5,469.9	5,722.6	2,264.6	3,458.0	4.9	4.2
Physical Contingencies	88.4	35.1	53.3	231.4	–	–	–	–	–
Price Contingencies	504.4	192.4	312.0	369.2	–	–	–	–	–
Total Installed Cost	6,046.3	2,555.8	3,490.5	6,090.5	5,722.6	2,264.6	3,458.0	(5.4)	(11.4)
Working Capital	1,094.6	1,094.6	–	230.1	300.3	300.3	–	(72.6)	30.5
Interest during Construction & Other Financial Costs 1/	1,089.4	271.7	817.7	640.9	573.3	573.3	–	(47.4)	(10.5)
TOTAL FINANCING REQUIRED	8,230.3	3,922.1	4,308.2	6,961.5	6,596.2	3,138.2	3,458.0	(19.9)	(5.2)

1/ In actual costs, Other Financial Costs include foreign exchange losses during construction of the project.
2/ actual cost in US$ is based on an exchange rate of US$1 = Rs. 13.0 , in line with the average exchange rate calculated from actual phasing of expenditures.

[illegible]

B. Rehabilitation Project (in million Rs.)

SCHEMES	TYPE OF SCHEME	APPRAISAL ESTIMATES			ACTUAL COSTS			% Change From Appraisal
		Foreign	Local	Total	Foreign	Local	Total	
A. Phulpur Pant								
Revamping of Primary Reformer	Ener. Sav./Prod. Improv	39.8	47.8	87.6	45.5	34.5	80.0	(8.7)
Installation of Urea Hydrolyser	Pollution Control	4.4	19.0	23.4	14.6	4.9	19.5	(16.7)
Liquid Effluents Quality/Quantity /1	Pollution Control	–	9.7	9.7		8.2	8.2	
Energy Survey	Energy Savings	1.0	0.3	1.3	0.3	0.0	0.3	(80.7)
Ammonia Plant Equipment Replacement	Operational Need	2.8	3.2	6.0	2.2	–	2.2	(63.3)
Existing Boiler Operational Improvements /2	Operational Need	–	30.8	30.8	–	3.0	3.0	
Synthesis Gas Drying with Molecular Seives	Ener. Sav./Prod. Improv	8.3	17.6	25.9		cancelled		
Inert Gas Generation Plant and Hyd. Storage	Production Improvement	–	13.1	13.1		cancelled		
Ammonia Storage Tank	Safety	45.2	40.3	85.5	83.6	12.4	96.0	12.3
CO2 Compressor Turbine	Energy Saving	–	–	–	34.2	0.7	34.9	
CO2 Removal System	Energy Saving	–	–	–	15.2	29.9	45.1	
Converter Retrofit								
(i) Repiping	Ener. Sav./Prod. Improv	–	–	–	25.2	16.7	41.9	
(ii) Remote Control Radiography Camera	Operational Need	–	–	–	0.7		0.7	
(iii) Dynamic Data Manager	Operational Need	–	–	–	1.1	1.8	2.9	
Sub-total Phulpur Plant		**101.5**	**181.8**	**283.3**	**222.6**	**112.1**	**334.7**	**18.1**
A. Kalol Plant								
Urea Plant Revamp for Energy Savings	Ener. Sav./Prod. Improv.	7.1	10.8	17.9	–	1.9	1.9	(89.4)
Primary Reformer Convection Zone Modif.	Energy Saving	12.0	10.6	22.6	24.0	7.0	31.0	37.2
Replacement of Heat Exchanger.	Energy Saving	–	4.0	4.0	3.4	–	3.4	(15.0)
Pressure Energy Recovery by Steam Turbine	Energy Saving	1.5	5.0	6.5		Cancelled		
Guard Bed for Low Temperature Shift	Ener. Sav./Prod. Improv	–	5.0	5.0		Cancelled		
Mass Spectrometer	Energy Saving	1.4	2.6	4.0		Cancelled		
Raw Water Desalination	Pollution Control	12.0	17.9	29.9		Cancelled		
Urea Plant Desorber Evaporative System	Pollution Control	4.5	8.5	13.0		Cancelled		
Urea Plant Desorber Modification	Pollution Control	–	9.0	9.0		Cancelled		
Urea Prill Cooling System.	Operational Need	4.0	7.9	11.9	1.8	9.6	11.4	(4.2)
Inspection & Analysis of Equipment.	Operational Need	11.1	8.9	20.0		Cancelled		
Equipment Replacement								
i) High Pressure Carbamate Condenser	Operational Need	–	–	–	39.5	5.7	45.2	
ii) Catalyst Heating/Reduction Scheme	Energy Saving	–	–	–	14.2	13.3	27.5	
iii) Equipment Replacement	Operational Need	–	–	–	33.1	20.5	53.6	
iv) Reformer Revamp-II	Operational Need	–	–	–	86.4	24.2	110.6	
v) Microprocess-based Weighing Machine	Operational Need	–	–	–	1.3	0.1	1.3	
Total Equipment Replacements		46.1	207.4	253.5	174.5	63.8	238.2	(6.0)
Ammonia Storage Tank	Safety	–	50.0	50.0	64.8	0.0	64.8	29.6
Modecular Seives and Repiping Synthesis Loop	Energy Saving	7.2	22.7	29.9		Cancelled		
PSA-based Nitrogen Generation Plant	Operational Need	–	5.0	5.0	1.3	1.5	2.8	(44.0)
Urea Supergranules Plant	Operational Need	9.8	40.9	50.7		Cancelled		
Microprocessor-based Instruments	Operational Need		New Scheme		1.4	1.8	3.2	
Converter Retrofit/Repiping	Ener. Sav./Prod. Improv.		New Scheme		23.0	21.6	44.6	
Hydrolyser for Urea Plant	Pollution Control		New Scheme		27.8	11.1	38.9	
Sub-total Kalol Plant		**116.7**	**416.2**	**532.9**	**321.9**	**118.5**	**440.5**	**(17.3)**
A. Kandla Plant								
Pipe/Pressure Reactor Modifications	Ener. Sav./Prod. Improv.	16.9	41.7	58.60		Cancelled		
Independent Water Supply Scheme	Operational Need	23.4	17.2	40.60		Cancelled		
New Product Storage, Bagging and Handling	Operational Need	13.0	116.2	129.20		Cancelled		
Ammonia Storage Tank (5000 MT)	Safety		New Scheme		91.7	17.2	108.9	
Sub-total Kandla Plant		**53.3**	**176.1**	**228.4**	**91.7**	**17.2**	**108.9**	**(52.3)**
Total Base Cost Estimates		**271.5**	**773.1**	**1,044.6**	**636.2**	**247.8**	**884.0**	**(15.4)**
Physical Contingencies		27.2	77.3	104.50				
Price Contingencies		25.7	130.5	156.20				
Total Installed Cost		**324.4**	**980.9**	**1,305.3**	**636.2**	**247.8**	**884.0**	**(32.3)**
Interest During Construction		282.0	161.0	443.00	–	117.8	117.800	(73.4)
TOTAL FINANCING REQUIRED		**606.4**	**1,141.9**	**1,748.3**	**636.2**	**365.6**	**1,001.8**	**(42.7)**

1/ Includes Rs.8.2 million of liquid effluent improvements installed with own fundings
2/ boiler improvements were made through implementation of energy schemes recommended by the energy survey
3/ Includes Rs.27 million estimated for the completion of the CO2 removal scheme.

Rehabilitation Project -- Capital Cost Summary

	(in million Rs)							(in million US$)						
	APPRAISAL ESTIMATES			ACTUAL COSTS			%Change From	APPRAISAL ESTIMATES 2/			ACTUAL COSTS 3/			%Change From
	Foreign	Local	Total	Foreign	Local	Total	Appraisal	Foreign	Local	Total	Foreign	Local	Total	Appraisal
Phulfur Plant 1/	101.5	181.8	283.3	222.6	112.1	334.7	18.1	7.8	14.0	21.8	9.4	4.6	14.0	(35.8)
Kaiol Plant	116.7	416.2	532.9	321.9	118.5	440.5	(17.3)	9.0	32.0	41.0	12.1	4.5	16.6	(59.6)
Kandla plant	53.3	175.1	228.4	91.7	17.2	108.9	(52.3)	4.1	13.5	17.6	3.3	0.6	4.0	(77.4)
Total Base Cost	271.5	773.1	1,044.6	636.2	247.8	884.0	(15.4)	20.9	59.5	80.4	24.8	9.7	34.5	(57.0)
Physical Contingencies	27.2	77.3	104.5	–	–	–	–	2.1	5.9	8.0	–	–	–	–
Price Contingencies	25.7	130.5	156.2	–	–	–	–	2.0	10.0	12.0	–	–	–	–
Total Installed Cost	324.4	980.9	1,305.3	636.2	247.8	884.0	(32.3)	25.0	75.5	100.4	24.8	9.7	34.5	(65.6)
Interest During Construction	282.0	161.0	443.0	–	117.8	117.8	(73.4)	21.7	12.4	34.1	–	4.2	4.2	(87.6)
TOTAL FINANCING REQUIRED	606.4	1,141.9	1,748.3	636.2	365.6	1,001.8	(42.7)	46.6	87.8	134.5	24.8	13.9	38.7	(71.2)

Notes:

1/ In Phulpur rehabilitation costs, the following investments are included: (i) Rs.8.2 million for liquid effluent control schemes installed by IFFCO with own funds; (ii) Rs. 3 million for optimization of Boiler operation, implemented with own funds, following the recommendations of the energy survey; and (iii) the completion cost of the CO2 removal system estimated at Rs.27 million.

2/ exchange rate at appraisal was considered at Rs. 13 per US$.

3/ average exchange rates calculated according to phased expenditures :

Phulpur: Rs. 23.7 per US$
Kaiol: Rs.26.5 per US$
Ammonia Tanks for Kaiol and Kandla: Rs.27.5 per US$
Completion Cost for CO2 Removal: Rs. 32 per US$

C. Project Financing (in million US$)

	As Planned at Appraisal		Actual	
Source	US$	%	US$	%
– The Aonla Project				
Equity				
– GOI (1)	152.4	24.1	184.9	36.4
– Cooperatives	34.6	5.5	20.9	4.1
– IFFCO Internal Resources	40.0	6.3	19.2	3.8
Total Equity	227.0	35.9	225.0	44.3
Long–term Debt				
– World Bank	112.0	17.7	89.1	17.6
– OECF 1/	126.8	20.0	–	0.0
– Denmark 1/	6.0	0.9	–	0.0
– Italy 1/	18.0	2.8	–	0.0
– GOI	85.4	13.5	–	0.0
– Indian Financing Institutions	–	–	193.3	38.1
Total Long–term Debt	348.2	55.0	282.4	55.7
Internal Cash Generation of the Project	57.9	9.1	–	–
TOTAL FINANCING FOR AONLA PROJECT	633.1	100.0	507.4	100.0
– The Rehabilitation Project				
Long–term Debt				
World Bank	40.0	29.7	17.7	45.7
GOI	12.7	9.4	–	–
Local Borrowings	81.8	60.8	–	–
OPEC Fund 3/	–	–	3.7	9.6
Total Long–term Debt	134.5	100.0	21.4	55.3
IFFCO Internal Resources 2/	–	–	17.3	44.7
TOTAL FINANCING FOR THE REHABILITATION PROJECT	134.5	100.0	38.7	100.0

Notes

1/ these loans were obtained by GOI, but transferred to IFFCO as equity.

2/ includes Rs.27 million estimated to be required for the completion of the CO2 removal sheme in Phulpur.

3/ from the initial OPEC Loan of US$7 million, total disbursements to GOI amounted to US$5.35 million. However, according to IFFCO, only US$3.73 million (equivalent to Rs.102.5 million) were relent to IFFCO.

D. Bank Financing

Category	SAR Estimates	Amount of the Loan Allocated (expressed in US$ million equivalent) Revised 09/01/1990	Revised 10/08/1992	Revised 01/08/1993	Actual
I. The IFFCO Loan (Ln. 2730 IN)					
(1) Aonla Ammonia/Urea Plant					
(a) Equipment, Materials, and Spare Parts (Including Supply and Erection Contracts)	85.000	80.600	80.600	79.400	79.270
(b) Technical Services	12.000	10.400	10.400	10.400	9.784
(c) Unallocated	15.000	-	-	-	-
Sub-Total Aonla Plant	112.000	91.000	91.000	89.800	89.054
(2) Rehabilitation					
(a) Equipment, Materials, and Spare Parts (Including Supply and Erection Contracts)	29.000	26.000	17.000	17.000	16.898
(b) Technical Services	2.000	1.260	1.260	1.260	0.771
(c) Unallocated	9.000	-	-	-	-
Sub-total Rehabilitation Component	40.000	27.260	18.260	18.260	17.669
Sub-total IFFCO Loan	152.000	118.260	109.260	108.060	106.723
Cancelled on March 31, 1989		7.000	7.000	7.000	7.000
Cancelled on September 1, 1990		26.740	26.740	26.740	26.740
Cancelled on October 8, 1992		-	9.000	9.000	9.000
Cancelled on January 8, 1993				1.200	1.200
Undisbursed Balance (i)					1.337
Total Cancelled from IFFCO Loan		**33.740**	**42.740**	**43.940**	**45.277**
II. Government Loan (Ln 2729 IN)					
(i) Fertilizer and Related Raw Materials	150.000				150.000
(ii) Consultants' Services	0.200				0.200
Sub-total Government Loan	150.200				150.200
Total Bank Financing for the Project	302.200				256.923

Comments:

(i) The undisbursed balance of US$1,336,715.03 from the IFFCO loan (Loan 2730 IN) was cancelled on November 17, 1993.

(ii) A total of US$45,276,715, or about 30% of the total IFFCO loan, was cancelled -- Bank financing was reduced by US$22.9 million (about 20.5% of the original loan allocation) for the ammonia/urea

component, and by US$22.3 million (about 56% of the original loan allocation) for the rehabilitation component. However, the Government Loan was fully disbursed before the original closing date.

6. Project Benefits

6.1 The Aonla Project

A. Direct Benefits

	88/89 1/	89/90	90/91	91/92	92/93	93/94	94/95 to 97/98	From 97/98 on
1. Production and Capacity Utilization:							(Projections)	
* Ammonia Plant:								
- Production (thousand tpy)	296.8	473.2	519.2	488.5	483.2	527.3	490.9	445.5
- Capacity Utilization (%)	94	106	117	110	108	118	110	100
- Specific Total Energy Consumption (Gcal/ton) 2/	8.133	7.888	7.762	7.808	7.839	7.765	7.765	7.765
- On-stream Days per Year	224	349	348	328	335	361	340	330
- Cumulated Production (thousand tons)	339.4	812.6	1,331.8	1,820.3	2,303.5	2,830.1		
* Urea Plant:								
- Production (thousand tons)	503.2	824.0	868.4	849.6	816.8	906.4	798.6	726.0
- Capacity Utilization (%)	98	114	120	117	112	125	110	100
- Overall Specific Energy Consumption (Gcal/ton)	6.468	5.948	5.717	5.752	5.825	5.715	5.720	5.720
- On-stream Days:								
* Urea I	217	325	327	322	323	344	330	330
* Urea II	214	335	329	322	318	356	330	330
- Cumulative Aonla Production (thousand tons)	556.1	1,380.1	2,248.5	3,098.1	3,914.9	4,821.4		
- Total IFFCO Urea Production (thousand tpy)	1,510	1,750	1,850	1,765	1,766	1.800		
- Production Share of Aonla	33	47	47	48	46	50		
2. Sales:								
Urea Sales from Aonla (thousand tons)	269.1	794.6	943.8	963.1	857.0	827.5		
Cumulative Sales from Aonla (thousand tons)	269.1	1,063.7	2007.5	2970.6	3,827.6	4,655.1		
Total Urea Sales of IFFCO	1,240	1,800	1,940	1,950	1,810	2,010		
Share of Aolna in Sales	22	44	49	49	47	41		

3. IFFCO's Marketing Program for Aonla and Marketing Shares of its Plants in Aonla's Market

(Thousand Tons)

	87/88	88/89	89/90	90/91	91/92	92/93	93/94
IFFCO's Total Sales of Urea							
Sales from Aonla	0.0	278.1	794.7	961.8	963.1	856.9	827.5
Sales from Phulpur	403.6	514.0	576.2	657.0	574.4	578.7	n.a
Sales from Kalol	357.3	461.4	430.2	372.8	396.8	366.2	n.a
Imports	58.0	41.0	5.3	11.5	1.8	3.8	n.a
Total IFFCO Urea Sales	**818.9**	**1,294.5**	**1,806.4**	**2,003.1**	**1,936.1**	**1,805.6**	**2,010.0**
Share of Aonla (%)	**0**	**21**	**44**	**48**	**50**	**47**	**41**
IFFCO's Sales of Urea in Aonla's Market							
Uttar Pradesh							
– Sales from Aonla	–	152.1	450.3	572.2	743.3	587.9	n.a
– Sales from Phulpur	188.0	204.2	202.5	227.5	133.5	148.0	n.a
– Sales from Kalol	18.6	29.7	0.3	1.9	0.5	0.5	n.a
– Sales from Imports	3.6	5.0	3.2	7.9	10.1	3.1	n.a
Total IFFCO Urea Sales in the State	**210.2**	**391.0**	**656.3**	**809.5**	**887.4**	**739.5**	n.a
Share in IFFCO's Sales in the State (%)							
– Aonla	0.0	38.9	68.6	70.7	83.8	79.5	n.a
– Phulpur	89.4	52.2	30.9	28.1	15.0	20.0	n.a
– Kalol	8.8	7.6	0.0	0.2	0.1	0.1	n.a
Punjab							
– Sales from Aonla	–	55.3	208.2	271.5	149.7	167.7	n.a
– Sales from Phulpur	2.7	15.4	0.6	1.6	4.2	–	n.a
– Sales from Kalol	90.1	24.5	1.4	14.8	97.0	55.4	n.a
– Sales from Imports	19.6	7.8	1.7	2.4	3.6	0.3	n.a
Total IFFCO Urea Sales in the State	**112.4**	**103.0**	**211.9**	**290.3**	**254.5**	**223.4**	n.a
Share in IFFCO's Sales in the State							
– Aonla	0.0	53.7	98.3	93.5	58.8	75.1	n.a
– Phulpur	1.3	15.0	0.3	0.6	1.7	0.0	n.a
– Kalol	42.9	6.3	0.2	1.8	10.9	7.5	n.a
Haryana							
– Sales from Aonla	–	31.9	79.3	89.5	57.9	89.5	n.a
– Sales from Phulpur	0.1	1.8	–	–	–	–	n.a
– Sales from Kalol	33.0	32.5	1.3	11.1	31.7	39.2	n.a
– Sales from Imports	3.7	6.4	0.1	1.2	3.0	–	n.a
Total IFFCO Urea Sales in the State	**36.7**	**72.6**	**80.7**	**101.8**	**92.6**	**128.7**	n.a
Share in IFFCO's Sales in the State (%)							
– Aonla	0.0	43.9	98.3	87.9	62.5	69.5	n.a
– Phulpur	0.0	2.5	0.0	0.0	0.0	0.0	n.a
– Kalol	15.7	8.3	0.2	1.4	3.6	5.3	n.a
Total Sales of IFFCO in Aonla Main Market	**359.3**	**568.6**	**948.9**	**1,201.6**	**1,234.5**	**1,091.6**	n.a
Sales in other States from Aonla	0.0	38.8	56.9	28.6	12.2	11.8	n.a
State Sales in % of Total Sales from Aonla (%)							
– Uttar Pradesh	–	55	57	59	77	69	n.a
– Punjab	–	20	26	28	16	20	n.a
– Haryana	–	11	10	9	6	10	n.a
– Other States	–	14	7	3	1	1	n.a

Notes:

1/ Production in 1988/89 is from the date of commercial production, on July 15, 1988. During commissioning, 42,525 tons of ammonia and 52,851 tons of urea were produced.
2/ Energy consumption includes feedstock and fuel.

Comments:

(a) At appraisal, it was assumed that the project would start commercial operation in January 1990; and capacity utilization was estimated at 65% in the first twelve-month operating period, 80% in the second period, and 95% from 1992/93 onwards.

(b) In 1993/94, the Aonla plant was awarded first prize of excellence in energy conservation and management for the period 1990/91 to 1992/93 by the Ministry of Power.

B. Economic Impact

1. **Economic Rate of Return**: Based on assumptions presented in para. 2 below, cost and benefit streams for calculating the economic rate of return are presented in Annex 3-2. The base-case economic rate of return was re-estimated at 12.2%, which is lower than the 17.1% estimated at appraisal. Results of sensitivity analyses are summarized below:

Economic Rate of Return	Current (Nov. 1992)	Appraisal Estimate
	(%)	(%)
Base Case	12.2	17.1
Project Implemented in 48 months		19.2
Variable Costs up 10%	11.1	-
Variable Costs down 10%	13.1	-
Production Costs up 10%	11.0	-
Revenues up 10%	15.2	-
Revenues up 5%	13.7	-
Revenues down 10%	8.9	13.6
Capacity Utilization up 5%	13.3	-
Capacity Utilization down 10%	9.9	-
Capacity Maintained @ 110% until year 2000/01	12.4	-

2. **Assumptions used in the ERR Analysis**

(a) Capital Cost: Total actual installed cost of the project as estimated by IFFCO is Rs.5,723 million (equivalent to US$440.2 million), excluding interest during construction and working capital. The economic cost of the project investments are based on financial costs, after deducting taxes and duties. A standard conversion factor (SCF) of 0.8 was applied to local currency costs, as at appraisal. All costs were brought to constant FY 1990/91 terms, based on actual inflation rates (Wholesale Price Index-WPI) and phasing of expenditures. In FY 90/91 terms, total actual economic capital cost of the project is US$534 million. Plant operating life is assumed to be 12 years.

(b) Revenues: Calculations and projections of economic prices of urea are presented in Annex 3-1 in 1990/91 constant terms. They are based on Bank projections of international FOB-Europe prices of bagged urea, plus ocean freight (US$35 per ton), handling, port charges, storage and losses costs (US$14 equivalent per ton), and a domestic transport differential of Rs.275 per ton, equivalent to US$15. It was assumed that all ammonia would be used for urea production. Until 1993/94, actual production levels have been used, subsequently, it was assumed that the plant would have a capacity utilization rate of 110% until 1997/98, and of 100% afterwards.

(c) **Operating costs**: the economic value of natural gas is assumed to be equal to its fuel oil equivalent value, based on calorific value. The international price of fuel oil is expected to move in line with Bank projections of international crude oil prices. Calculations and projections of the economic

value of gas are presented in Annex 3-1. Economic costs of utilities (such as power and water), labor and overhead are derived from financial costs by deducting taxes and applying a SCF of 0.8.

3. **Comments**: The ERR is now estimated at 12.2% and is lower than the base case of 17.1% estimated at appraisal. Currently projected economic values of natural gas and urea are both substantially lower than estimated at appraisal. However, the economic value of gas is not low enough to compensate for the lower economic value of urea. Appraisal estimates and revised economic and financial projections compare as follow:

Economic and Financial Prices of Gas and Urea

Year	Economic Price- Appraisal Estimates		Actual Economic Price	Actual Financial Price
	(1985 US$)	('90/91 US$)	('90/91 US$)	('90/91 US$)
Gas Prices				
- 1990/91	98	143	97	146
- 1995/96	131	191	66	135
Urea Prices				
- 1990/91	270	394	221	229
- 1995/96	286	417	187	201

About 70% of natural gas is used in the country's western part by the fertilizer and power sectors. In case of shortage, the most logical scenario would be to produce power from fuel oil. Therefore, the marginal value of gas would remain its fuel oil equivalent.

C. Financial Impact

1. **Financial Rate of Return**: The project financial rate of return (FRR) is estimated at 9.8%, slightly lower than the appraisal estimate of 11.8%. The actual price of natural gas is slightly higher than appraisal estimates, but the urea retention prices are much lower than those projected at appraisal. However, these differences are partly compensated by: (i) higher rates of actual capacity build-up and capacity utilization-- more than 110% compared with 95% estimated at appraisal; (ii) a shorter implementation period; and (iii) lower capital costs of the project. Financial cost and benefit streams for the base case, which were calculated using prices in constant 1990/91 Rupees, are presented in Annex 3-3. The results of the sensitivity analysis, compared to appraisal estimates, are summarized below:

Financial Rate of Return	Current Estimates (%)	Appraisal Estimates (%)
Base Case	9.8	11.8
Project implemented in 48 months	-	14.0
Variable Cost up 10%	7.3	10.4
Variable cost Down 10%	12.1	13.1
Production Costs up 10%	6.4	_
Revenues up 10%	14.6	-
Revenues Down 10%	4.2	-
Capacity Utilization up 5%	10.8	-
Capacity Utilization down 10%	7.8	10.2
Capacity Maintained at 110% until end of Project life	9.9	-

2. Assumptions used in the Financial Rate of Return Analysis

The financial rate of return has been calculated using prices in 1990/91 constant Rupees. Revenues are based on retention prices as projected by IFFCO on the basis of its current retention price, actual project operating costs (1990/91 and 1991/92), and the present retention price formula. The urea retention price is fixed for pricing periods of three years by the Fertilizer Industry Coordination Committee (FICC) office attached to the Department of Fertilizer of the Ministry of Chemicals and Fertilizers, for individual producers on the basis of: (i) the type of feedstock; (ii) 12% post-tax return on share capital and reserves employed in the production of urea; (iii) plant capacity utilization of 80% in the first year of operation, 90% from the 2nd to the 10th year, and 85% from the 11th year onwards; and (iv) variable and fixed costs based on standard rates, norms and actual prices of inputs. Retention price calculations and projections compared with appraisal estimates are presented in Annex 3-1. Current urea retention price projections for the project are much lower than appraisal estimates-- appraisal estimates were based on 80% plant capacity utilization, as was the norm then. In addition, the following assumptions were made: (i) the price of gas was projected according to the recommendations of the Kelkar Committee up to January 1995, and thereafter maintained constant; (ii) plant operation at 110% of capacity from 1994/95 to 1997/98 and at 100% of capacity thereafter; (iii) 10% increase in real terms for salaries; (iv) operating life of 12 years, as at appraisal; and (v) recovery at the end of project life of working capital and of a residual value estimated at 10% of depreciable assets.

6.2 The Rehabilitation Component

A. Direct Benefits

1. Plant Production and Capacity Utilization

	85/86 1/	86/87 1/	87/88 1/	88/89 2/	89/90	90/91	91/92	92/93	93/94
PHULPUR PLANT									
* Ammonia Plant:									
- Production (Thousand tpy)	261.5	278.5	264.1	254.2	319.9	330.0	295.4	346.9	308.8
- Capacity Utilization (%)	88	94	89	114	108	111	99	117	104
- Overall Specific Energy Consumption (Gcal/ton) 2/	12.34	11.72	11.86	11.04	10.95	10.87	11.29	11.04	11.46
* Urea Plant:									
- Production (Thousand tons)	450.0	482.1	446.9	444.8	546.2	590.0	506.2	607.0	540.5
- Capacity Utilization (%)	91	97	90	120	110	119	102	123	109
- Overall Specific Energy Consumption (Gcal/ton)	9.69	9.08	9.06	8.39	8.19	7.91	8.44	8.21	8.65
KALOL									
* Ammonia Plant:									
- Production (Thousand tons)		290.3	288.1	243.5	283.0	294.5	324.3	261.4	279.7
- Capacity Utilization (%)		97	96	108	94	98	108	87	93
- Overall Specific Energy Consumption (Gcal/ton)		9.77	10.14	9.54	9.88	9.94	9.57	10.316	9.86
* Urea Plant				1,240	1,800	1,940	1,950	1,810	2,010
- Production (Thousand tons)		421.9	405.2	345.9	375.8	388.5	432.1	361.0	378.6
- Capacity Utilization (%)		106	102	116	95	98	109	91	96
- Overall Specific Energy Consumption (Gcal/ton)		6.78	7.05	6.64	6.97	7.01	6.72	7.29	6.69

Notes:

1/ Production for 1985/86 to 1987/88 is from July 1 to June 30. Starting April 1, 1989, the fiscal year was changed to April 1 to March 31.
2/ Production for 1988/89 is from July 1, 1988 to March 31, 1989.
3/ Energy consumption includes feedstock and fuel.

B. Status and Economic Benefits of the Rehabilitation Sub-Projects

The status of the rehabilitation sub-projects, their benefits, actual costs compared to appraisal estimates, and when possible an estimation of the ERR are presented in Table 4 below. All the implemented rehabilitation sub-components whose benefits are quantifiable and generally the result of efficiency improvement and energy savings, have an ERR between 23% and 110%. At appraisal, a range of 20% and over 40% was estimated for these sub-projects. The ERR's were calculated from the savings as estimated by IFFCO and are based on a two-year implementation period and a ten-year operation project life. Other benefits are intangible and include the reduction of the environmental impact through the reduction and improvement of effluents, increased safety and increased reliability of the plants.

Status and Benefits of the Rehabilitation Sub-projects

	Type of Scheme	Costs (million Rs.) Appraisal Estimates	Costs (million Rs.) Actual	Actual Annual Savings (million Rs.)	IRR (%) Actual	IRR (%) Appraisal Estimates	BENEFITS	STATUS (As of May 1994)
PHULPUR PLANT								
Revamping of Primary Reformer	Energy Savings & Production Improvement.	87.6	80.0	40.0	40.0	52.0	10% increase in NH3 output, equivalent to 49,500 tpy of urea.	Completed
Installation of Urea Hydrolyser	Pollution control	23.4	19.5	8.4	35.5	43.0	Reduction in final liquid effluent by about 600 m3/day. This amount is recycled to the cooling tower.	Completed
Liquid Effluents, Reduction & Improvement	Pollution control	9.7	8.2	-	-		Improvement in liquid effluents implemented with own funds.	Completed
Energy Survey	Energy savings	1.3	0.3	Idem Boiler			The split nozzle scheme recommended by the consultant resulted in benefits of Rs.3.5 million per year. Operational benefits were also obtained.	Equipment is under procurement for the recommended improved electronic control
Ammonia Plant Equipment Replacement	Operational need	6.0	2.2	2.6	63.0	over 60	Reduction in plant shut down time.	Completed
Existing Boiler Operational Improvement	Operational need	30.8	3.0	3.5	97.4	22.0	Purchase of new coal mills was cancelled, improvement was obtained through implementation of recommendations of the energy consultant.	Completed
Synthesis Gas Drying with Molecular Seives	Energy savings & production improvement	25.9	-	-	-	29.0		Cancelled
Inert Gas Generation Plant and Hydrogen Storage	Production improvement	13.1	-	-	-		No longer viable, due to low cost of nitrogen	Cancelled
Ammonia Storage Tank	Safety	85.5	95.9	n.a			Increased safety and operational flexibility	Completed
CO2 Compressor Turbine	Energy saving	New	34.9	66.0	114.0		Reduction in steam consumption by 15 t/hr.	Completed
CO2 Removal System	Energy saving	New	45.5	13.0	23.1		After completion, will result in savings of 14 tph of low pressure and 7tph of high pressure steam.	To be completed in 1995.
Converter Retrofit (a) Repiping	Energy saving & production improvement	New	41.8	44.0	75.0		As in Kaloi, a saving of 272 Mcal is projected when the current problem in the chiller of the syn. loop is solved.	Completed
(b) Remote Operated Radiography Camera	Operational need	New	0.7	n.a			Health hazard is reduced while scanning weld joints.	Completed
(c) Dynamic Data Manager	Operational need	New	2.9	n.a			Improved diagnostic, monitoring and maintenance of rotating machines.	Completed

Status and Benefits of the Rehabilitation Sub-projects

	Type of Scheme	Costs (million Rs.) Appraisal Estimates	Costs (million Rs.) Actual	Actual Annual Savings (million Rs.)	IRR (%) Actual	IRR (%) Appraisal Estimates	BENEFITS	STATUS (As of May 1994)
KALOL PLANT								
Urea Plant Revamping for Energy Savings	Energy saving & production improvement	17.9	1.9	6.0	161.0	44.0	Saving of 6 tph of low pressure steam.	Completed
Primary Reformer Convection Zone Modification.	Energy saving	22.6	31.0	20.0	51.0	22.0	Saving of about 2000 Mcal per hour.	Completed
Replacement of Heat Exchanger.	Energy Saving	4.0	3.4	1.1	26.0	36.0	Heat recovery of about 620 Mcal per hour, in addition to lower cooling tower load	Completed
Pressure Energy Recovery by Steam Turbine	Energy Saving	6.5					No longer attractive when GOI approved this investment, due to higher costs in Rupees.	Cancelled
Guard Bed for Low Temperature Shift Reactor.	Energy saving & production improvement	5.0					Idem	Cancelled
Mass Spectrometer	Energy Saving	4.0					Idem	Cancelled
Raw Water Desalination	Pollution control	29.9					Other, more economic, solutions were implemented through the water agency.	Cancelled
Urea Plant Desorber Evaporative System.	Pollution control	9.0						better replaced by the the hydroliser
Urea Plant Desorber Modification	Pollution control	9.0						Idem
Urea Prill Cooling System	Operational need	11.9	11.4	n.a			Improved product quality and less caking.	Completed
Inspection & Analysis Equipment	Operational need	20.0					No longer attractive when GOI approved this investment, due to higher costs in Rupees.	Cancelled
Equipment Replacement		253.5	243.6					
i) High Pressure Carbamate Condenser	Operational need	n.a	48.9	n.a			Reduction in down time and improved reliability of the urea plant.	Completed
ii) Catalyst Heating/Reduction	Energy saving	n.a	26.8	11.0	30.6		Start-up time will be reduced by 6 days when catalyst is recharged, resulting in addition in 5 million Mcal saving.	Completed
iii)Equipment Replacement	Operational need	n.a	53.7	n.a			Reduction in down time and improved reliability of the urea plant.	Completed
iv) Reformer Revamping	Operational need	n.a	111.1	n.a			Increased life of reformer tubes and lower pressure drop in reformer. With more catalyst volume, the plant can be operated at higher front end load.	Completed
v) Microprocess Based Weighing Bagging Machines.	Operational need	n.a	1.3	n.a			Better control of urea bags weight resulting in less customers complaints.	Completed

Status and Benefits of the Rehabilitation Sub-projects

	Type of Scheme	Costs (million Rs.) Appraisal Estimates	Costs (million Rs.) Actual	Actual Annual Savings (million Rs.)	IRR (%) Actual	IRR (%) Appraisal Estimates	BENEFITS	STATUS (As of May 1994)
Ammonia Storage Tank	Safety	50.0	64.6	n.a			Increased safety and operation flexibility.	Completed
Modecular Selves and Repiping Synthesis Loop	Energy saving	19.9				20.0		Was replaced with the the converter retrofit scheme
PSA Based Nitrogen Generation Plant	Operational need	5.0	2.6	n.a			Increased operation reliability of Inert Gas plant.	Completed
Urea Supergranules Plant	Operational need	50.7					was no more attractive when GOI approved the investment.	Cancelled
Microprocessor-based Instruments	Operational need	New	3.2	n.a			Better control of plant operation.	Completed
Converter Retrofit & Repiping	Energy/prod.saving improvement	New	45.0	43.7	69.6		2.75% increase in NH3 conversion in the converter, resulting in an energy saving of 272 Mcal/t of Ammonia.	Completed
Hydrolyser for Urea Plant	Pollution control	New	40.7	2.6	(3.0)		Reduction in final liquid effluent. This amount is recycled to the cooling tower; results in saving of water, in addition to lower nitrogen in the discharge.	Completed.
KANDLA PLANT								
Pipe Reactor & NPK Plant Modifications	Energy saving & production improvement.	58.6						Cancelled, not yet approved by GOI
Independent Water Supply	Improved operation	40.6					the Gujarat Water Supply and Sewerage Board could increase water supply at a cost well below the cost of desalination.	Cancelled
New Product Storage, Bagging and Handling	Improved operation	129.2					A consultant study concluded that the scheme was no longer viable at current levels of production.	Cancelled
Ammonia Storage Tank (5000 MT)	Safety	New	108.6	n.a			Increased safety and operational flexibility tank.	Completed

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6.3 Targets and Achievement under the Program of Initiatives

	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
A. Capacity Utilization of Nitrogen Fertilizer Plants existing in 1984/85 (%)									
Targets									
– All India	74	75	76	78	80	82	–	–	–
– Public Sector	60	61	63	65	69	73	–	–	–
Achieved									
– All India	74	65	–	–	80	83	86	–	85
– Total Public Sector	60	–	–	–	64	60	58	–	58
* Sick Units		42				33	30		27
*Other Units		73				80	78	–	81
– Cooperative Sector		93	–			106	110		111
– Private Sector		77				98	106		107
B. Fertilizer Production (Million Tons of Nutrient)									
Targets									
– All India	3.8	3.8	3.9	4.2	4.1	4.2			
– Public Sector	1.8	1.8	1.9	2.0	2.1	2.2			
Achieved									
– All India	3.8								
– Total Public Sector	1.8	1.8				1.8	1.7		2.1
* Sick Units		0.5				0.4	0.4		0.3
*Other Units		1.3				1.4	1.3		1.8
– Cooperative Sector		0.6				1.3	1.3		1.3
– Private Sector		0.8				1.1	1.2		1.2
C. Feedstock and Energy Consumption (million Kcal per ton of Ammonia)									
Targets									
– Natural Gas	10.0			9.5		9.0			
– Fuel Oil	16.0			15.0		14.0			
– Naphta	12.0			11.0		10.0			
– Coal	18.0			18.0		15.0			
Actual									
– Natural Gas				10.2	10.0	9.6	9.6	9.6	9.5
– Fuel Oil				13.9	14.3	14.4	15.1	13.5	13.9
– Naphta				12.8	12.2	12.4	11.9	11.7	11.7
– Coal				33.5	33.8	38.9	39.1	39.7	42.7
Total				12.5	11.9	11.8	11.7	11.6	11.4
D. Average Rail Transport Haulage (Kilometers)									
Targets for all fertilizer		900					800		
Actual									
– All Fertilizer	1,089	1,094	1,073	1,089	1,011	1,024	929	935	
– Urea	682	725	804	843	746				
E. Equated freight									
Target									
– In 1984/85 Constant Rs.	235.0						211.5		
Actual									
– In current terms	235	239	197	217	299	311	302	327	
. Indian Inflation (WPI)	6.50	6.50	5.80	8.20	7.50	7.40	10.30	7.20	
. Inflation Index	100.00	93.90	88.75	82.02	76.30	71.04	64.41	60.08	
– In 1984/85 Constant Rs.	235.00	224.41	174.84	177.99	228.14	220.95	194.52	196.47	

7. Use of Bank Resources

A. Staff Inputs

Stage of Project Cycle	Staff Weeks Actual	Comments
Until Appraisal	24.7	Includes 13.3 and 11.4 staff weeks in FY 86 respectively for lending development and preparation.
Appraisal	37.3	
Appraisal through Board Approval	15.7	
Board Approval through Effectiveness	-	
Supervision	83.7	Only about 35% and 51% of total supervision time was spent respectively before mechanical completion of the Aonla plant and project completion (as defined in Schedule 2 of the Loan Agreement).
- Total	161.4	

Comments:

1. About 50% of total supervision time was spent after the AONLA Project was mechanically completed and commercial production formally declared. However, project supervision was required until the end of 1993 to follow-up implementation of the plant rehabilitation component.

2. Time spent in preparation of the PCR is not included.

B. Missions

Stage of Project Cycle	Month/Year	Number of Persons	Days in Field	Specialisation of Mission Members a/	Performance Rating Status b/	Type of Problems
Identification	FY 84	n.a.	n.a.	n.a.		
Preparation	04/85	2	18	Eco		
Appraisal	07/85	4	22	Eco, Eng, FA		
Post-Appraisal	10-11/85	1	11	Eco		To obtain updated information and discuss the statement of initiatives in the fertilizer sector with the Government..
Supervision						
1	02/87	2	11	Eco, Eng	1	Risk of delay in gas supply, delays in implementation of the rehabilitation schemes, the management study, and the Program of Initiatives.
2	10/87	4	6	Eng, Eco	2	GOI approval of the Rehabilitation schemes is already 18 months behind schedule. Delays in gas supply and in implementation of the management study and the program of initiatives. Import component is also behind schedule.
3	03/88	3	5	Eng	2	Approval of the rehabilitation component is 21 months behind schedule. No effective action has been taken on fertilizer pricing and fertilizer subsidy.
4	10/88	2	6	Eng, FA	2	Further delays in rehabilitation component and study. Progress in program of initiatives remains slow and does not address the issues of pricing and subsidies.
5	01-02/90	3	13	Eng, Eco	2	Contract for gas supply not yet signed. Rehabilitation component seriously delayed. Progress on policy reform issues and MIS study insignificant.

Stage of Project Cycle	Month/Year	Number of Persons	Days in Field	Specialisation of Mission Members a/	Performance Rating Status b/	Type of Problems
6	12/90	1	16	Eng	2	Slow implementation of the rehabilitation component and of the revised schemes.
7	11-12/91	2	16	Eng	2	Implementation of the rehabilitation component remains slow and an extension of the closing date is requested.
8	01/93	2	6	Eng	2	Implementation of the rehabilitation component remains slow.
PCR	04/94	1	12	Eng		

Comments

a/ Key to Specialization:
Eng: Engineer
Eco: Economist
FA : Financial Analyst

b/ Key to Status:
1: Problem-free or Minor Problems
2: Moderate Problems
3: Major Problems

8. Status of Covenants

Section	Description of Covenant	Status	Remarks
A - Loan Agreement with IFFCO (Loan 2730 IN)-- IFFCO shall:			
2.03	ensure that all loan funds are disbursed by June 30, 1992 (closing date)	June 30, 1993 (actual)	Closing date postponed one year to allow completion of rehabilitation investments.
3.05	take all such action as shall be necessary on its part to obtain, by Dec.31, 1986, all necessary approvals from the appropriate authorities for the implementation of Part A (ii) of the Project (Rehab. investments).	Met, with significant delays	Government approvals were obtained only in December 1988.
4.04	by June 30, 1987, enter into contractual arrangements satisfactory to the Bank for the timely and adequate supply of gas for Part A (i) of the Project (Aonla plant).	Met, with significant delays	Contract was signed only on August 20, 1991. However, gas supplies started March 24, 1988, two months after mechanical completion.
5.01 (b)	provide audit reports on financial statements, project accounts and Statements of Expenditures no later than nine months after the end of each fiscal year	Met	
5.02 (a) (i)	maintain a debt/equity ratio not greater than 60:40	Met	
5.02 (a) (ii)	after completion of the project, maintain a current ratio of at least 1.2	Met	
5.02 (a) (iii)	maintain a (projected) debt service coverage ratio of at least 1.3	Met, except in 1986/87	Ratio was 1.0 in 1986/87, but increased above 1.3 in later years
5.02 (a) (iv)	during implementation of Part A (Aonla project), not make aggregate investments in fixed assets other than the project in excess of US$80 million	Met	
5.02 (a) (v)	not prepay any debt or declare dividends if this would result in the current ratio falling below 1.4	Met	
B - Guarantee Agreement (Loan 2730 IN)-- GOI shall:			
3.01	ensure that an adequate supply of gas for operating the facilities is made available to IFFCO by July 31, 1987	Met, with delays	Gas supply started on March 24, 1988, eight months after original date and two months after mechanical completion.
3.02	make available to IFFCO an amount equivalent to US$267.8 million in the form of equity and loan, as and when needed for the project	Met, in amounts needed for the project	GOI transfered the equivalent of US$184.9 million as equity and US$3.7 million as loan.

Section	Description of Covenant	Status	Remarks
3.03	make appropriate allocation of alternative liquid fuels to IFFCO in a timely manner to operate the steam and power generation facilities constructed under Part A (i) (Aonla)	Met	
C - Loan Agreement (Loan 2729 to GOI)			
2.03	closing date: June 30, 1992	Met	
3.01	carry out Part B of the project (program of imports of fertilizer and related raw materials; and MIS study)	Met	Bank agreed also to finance oil and oil products under the import component, and first phase of MIS study was implemented, although with long delays relative to agreed schedule. Second phase of the study is under implementatation by GOI.

INDIA - COOPERATIVE FERTILIZER INDUSTRY PROJECT (LOAN NO.2729/2730-IN)

PROJECT COMPLETION REPORT

Consumption, Production and Imports of Fertilizers a/

(in thousand tons of nutrient)

	Nitrogen			Phosphate			Potash		All Nutrients		
Year	Consumption	Production	Imports	Consumption	Production	Imports	Consumption	Imports	Consumption	Production	Imports
1952/53	58	53	44	5	7	-	3	3	66	60	47
1953/54	89	53	19	8	14	-	8	7	105	67	26
1954/55	95	68	20	15	14	-	11	11	121	82	31
1955/56	107	77	53	13	12	-	10	10	131	89	63
1956/57	123	79	57	16	17	-	15	15	154	106	72
1957/58	149	81	110	22	26	-	13	13	184	107	123
1958/59	172	81	97	29	31	-	22	22	224	112	119
1959/60	229	84	142	54	51	4	21	33	305	135	179
1960/61	212	112	399	53	54	-	29	20	294	166	419
1961/62	250	154	307	60	65	-	28	75	338	219	382
1962/63	333	194	244	83	88	10	36	41	452	282	295
1963/64	377	219	228	116	108	13	50	40	544	327	281
1964/65	555	243	232	149	131	12	69	57	773	374	301
1965/66	575	238	326	132	119	14	77	73	785	357	413
1966/67	738	309	632	248	146	148	114	118	1,101	455	898
1967/68	1,034	402	867	335	207	349	170	270	1,539	609	1,486
1968/69	1,209	563	844	382	213	138	170	213	1,761	776	1,195
1969/70	1,356	730	667	416	224	94	210	120	1,982	954	881
1970/71	1,479	832	477	541	228	32	236	120	2,256	1,060	629
1971/72	1,798	949	481	558	290	248	300	268	2,657	1,239	997
1972/73	1,839	1,054	665	582	330	204	347	325	2,768	1,384	1,194
1973/74	1,829	1,050	659	650	324	213	360	370	2,839	1,374	1,242
1974/75	1,766	1,186	884	471	331	286	336	437	2,573	1,517	1,607
1975/76	2,149	1,535	996	467	320	361	278	278	2,894	1,855	1,635
1976/77	2,457	1,857	750	635	478	23	319	278	3,411	2,335	1,051
1977/78	2,913	2,000	758	867	670	164	506	599	4,286	2,670	1,521
1978/79	3,419	2,169	1,228	1,106	776	243	592	517	5,117	2,945	1,988
1979/80	3,498	2,226	1,295	1,151	763	237	606	473	5,255	2,989	2,005
1980/81	3,678	2,164	1,510	1,214	842	452	624	797	5,516	3,006	2,759
1981/82	4,069	3,143	1,055	1,322	950	343	676	644	6,067	4,093	2,042
1982/83	4,263	3,434	425	1,420	984	65	735	644	6,418	4,418	1,133
1983/84	5,236	3,487	656	1,757	1,057	143	799	556	7,792	4,544	1,355
1984/85	5,486	3,917	2,009	1,886	1,318	745	839	871	8,211	5,235	3,625
1985/86	5,660	4,323	1,616	2,005	1,430	805	808	894	8,474	5,753	3,315
1986/87	5,716	5,412	1,106	2,079	1,662	279	850	890	8,645	7,074	2,275
1987/88	5,717	5,466	175	2,187	1,666	-	881	809	8,784	7,132	984
1988/89	7,251	6,712	219	2,721	2,253	407	1,068	989	11,040	8,965	1,615
1989/90	7,386	6,747	523	3,014	1,795	1,311	1,168	1,278	11,568	8,542	3,112
1990/91	7,997	6,993	412	3,221	2,051	1,016	1,328	1,326	12,546	9,044	2,754
1991/92	8,046	7,302	566	3,321	2,562	968	1,361	1,236	12,728	9,864	2,770
1992/93	8,426	7,430	1,152	2,842	2,321	727	884	1,081	12,152	9,751	2,961

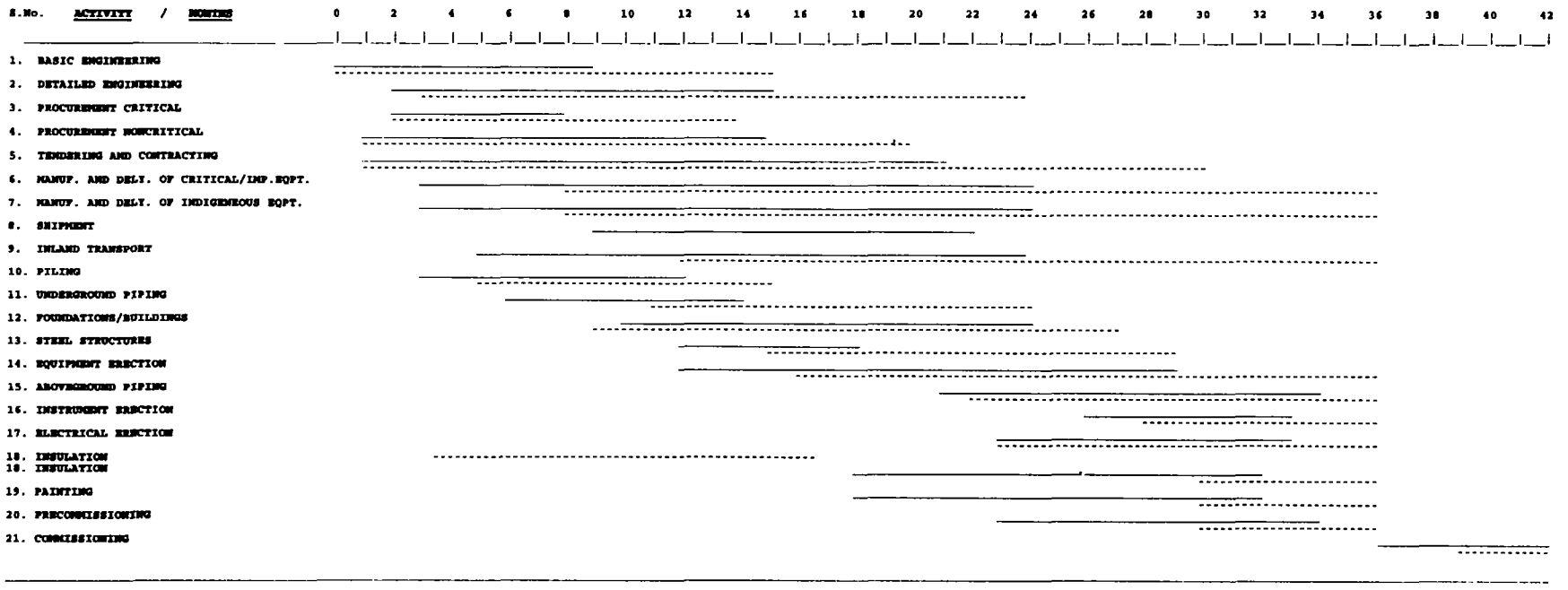
a/ Until 1985 Statistical annual consumption is from February 1 to January 31 and annual production is from April 1 to March 31.

Source : FERTILIZER STATISTICS (1992-93).
THE FERTILIZER ASSOCIATION OF INDIA.
/pcra1

INDIA - COOPERATIVE FERTILIZER INDUSTRY PROJECT (LOAN NO. 2729/2730-IN)
PROJECT COMPLETION REPORT

AONLA PROJECT

PROJECT IMPLEMENTATION SCHEDULE - Actual versus IFFCO's Estimates



Note: - At appraisal, IFFCO's implementation schedule estimates was based on (i) a 36-months period to mechanical completion; and (ii) six months for commissioning, and performance guarantee, with the start of commercial production after 42 months. The Bank's SAR considered a overall 48 months more conservative schedule, based on 45 months to mechanical completion plus a shorter commissioning period of 3 months.

- The SAR considers the zero date as of October 1, 1984, while the actual zero date is January 8, 1985 when GOI approvals were obtained and the process consultants contract for ammonia and urea became effective.

/PCRA31

IFFCO - Aonla Project

Import Parity of Urea

Fiscal Year	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01
Urea-FOB Europe, Bagged													
In Constant 1990 US$	103	140	157	166	132	100	115	123	127	130	133	136	144
Ocean Freight to Bombay	35	35	35	35	35	35	35	35	35	35	35	35	35
Handling, Port Charges, Storage and Losses	14	14	14	14	14	14	14	14	14	14	14	14	14
Urea ex-port in 90/91 US$	212	189	206	217	181	149	164	172	176	179	182	185	193
Urea ex-port in 90/91 Rs.	3,805	3,392	3,697	3,895	3,249	2,674	2,944	3,087	3,159	3,213	3,267	3,321	3,464
Domestic Transport Differential (Rs./ton)	275	275	275	275	275	275	275	275	275	275	275	275	275
Economic Price at Factory Gate in 90/91 Rs./ton	4,080	3,667	3,972	4,170	3,524	2,949	3,219	3,362	3,434	3,488	3,542	3,596	3,739
Economic Prices in 1990/91 US$	227	204	221	232	196	164	179	187	191	194	197	200	208
Retention Price for Aonla in 90/91 Rs./ton	5,263	4,697	4,115	3,784	3,668	3,424	3,559	3,615	3,629	3,623	3,705	3,749	3,730
Economic Price of Urea at Appraisal, in 1985 US$/ton			270					286					
Economic Price of Urea at Appraisal, in 1990/91 US$/ton			394					417					

Economic Value of Natural Gas

Fiscal Year	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01
Crude oil (Constant 1990 US$/BBL)	14.3	17.2	21.2	17.0	16.3	14.2	13.1	13.6	14.5	15.3	16.0	16.8	17.5
Actual Average Price of Fuel Oil HS (Current US$)	66	95	99	82	81								
Actual Average Price of Fuel Oil (1990 US$)	69	100	99	81	76								
Fuel Oil (1990/91 constant US$/ton)				81	76	66	61	63	66	71	75	78	82
Ocean Freight to Bombay	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Fuel Oil CIF Bombay (1990/91 US$)	72	103	102	84	79	69	64	66	71	74	78	81	85
Transport to Site	10	10	10	10	10	10	10	10	10	10	10	10	10
Economic Price of Fuel Oil (1990/91 US$/ton)	82	113	112	94	89	79	74	76	81	84	88	91	95
Economic Price of Fuel Oil (1990/91 Rs./ton)	1,474	2,025	2,010	1,687	1,597	1,422	1,330	1,372	1,447	1,510	1,572	1,635	1,696
Economic Price of Gas (1990/91 Rs./1000Ncm)	1,278	1,767	1,744	1,469	1,396	1,238	1,158	1,190	1,255	1,309	1,364	1,418	1,473
Economic Price of Gas (1990/91 US$/1000Ncm)	71	98	97	82	77	69	64	66	70	73	76	79	82
Actual Gas Price in Current Rs./1000Ncm	2,605	2,619	2,629	2,639	2,748	2,953	3,075	3,166					
Financial Price of Gas (1990/91 Rs./1000Ncm)	3,047	2,651	2,629	2,427	2,396	2,276	2,370	2,440	2,440	2,440	2,440	2,440	2,440
Economic Price of Gas at Appraisal, in 1985 US$			98					131					
Economic Price of Gas at Appraisal, in 1990/91 US$			143					191					

Economic Rate of Return – Aonla Project

(Constant 1990/91 US$. Million)

Fiscal Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01
Revenues																	
Quantity:																	
– Urea (thousand tons)					503.2	824.0	868.4	849.6	816.8	870.0	800.0	800.0	800.0	800.0	726.0	726.0	726.0
– Ammonia (thousand tons) \1					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Prices:																	
– Urea (Rs./ton)					3,955	3,542	3,847	4,044	3,398	2,824	3,093	3,237	3,308	3,362	3,416	3,470	3,614
– Urea US$/ton)					227	204	221	232	196	164	179	187	191	194	197	200	208
Total Revenues					114	168	192	197	160	143	143	150	159	155	143	145	151
Costs																	
Investments Costs \2	14.2	72.4	221.9	140.9	71.6	5.7	7.4	0.0	0.6	1.3	1.3	1.3	1.3	1.3	1.3	1.3	(54.4)
Working Capital \3					9.0	(0.9)	1.5	1.2	5.1								(15.6)
Variable Costs																	
– Gas																	
. Quantity (million Nom)					352	534	544	561	558	572	496	496	496	496	463	463	463
. Price (1990/91 Rs./thousand Nom)					1,279	1,757	1,744	1,463	1,366	1,233	1,153	1,190	1,255	1,309	1,364	1,418	1,473
. Price (1990/91 US$/thousand Nom)					71	98	97	82	77	69	64	66	70	73	76	79	82
. Cost of Gas (million US$)					25	52	53	46	43	39	32	33	35	36	35	37	38
– Purchased Electricity (million Rs.)					–	–	0.1	0.1	–	–	–	–	–	–	–	–	–
– Bagging (million Rs.)					5	7	8	6	5	5	4	5	5	5	5	5	5
Sub–total Variable Costs					30	59	61	52	48	44	36	37	40	41	40	42	43
Total Fixed Costs					17.2	20.0	18.1	10.3	11.9	12.6	13.4	14.3	15.2	16.2	16.7	17.8	19.0
Total Costs	14	72	222	141	127	84	88	63	65	58	51	53	58	59	58	61	59
Net Cash Flow	(14)	(72)	(222)	(141)	(13)	84	105	134	95	85	93	97	97	97	85	85	159

Financial Rate of Return (%) = 12.2

Notes

1 it is assumed that all ammonia is used for urea production.
\2 as estimated at appraisal, residual value at the end of project life is estimated at 10% of depreciable assets.
\3 recovery of working capital at the end of project life.

Sensitivity Analysis	FRR (%) Actual	FRR (%) SAR Estimates
Base Case	12.2	17.1
Project Implemented in 48 months		19.2
Variable Costs Up 10%	11.1	–
variable Costs down 10%	13.1	–
Production Costs up 10%	11.0	–
Revenues up 10%	15.2	–
Revenues up 5%	13.7	–
Revenues down 10%	8.9	13.6
Capacity Util. up 5%	13.3	–
Capacity Util. down 10%	9.9	–
Capacity Maintained @ 110% until 2001	12.4	–

Financial Rate of Return – Aonla Plant

(Constant 1990/91 Rs. Million)

Fiscal Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01
Revenues																	
Quantity:																	
– Urea (thousand tons)					503.2	824.0	808.4	849.6	816.8	870.0	800.0	800.0	800.0	800.0	726.0	726.0	726.0
– Ammonia (thousand tons) \1					–	–	–	–	–	–	–	–	–	–	–	–	–
Prices:																	
– Urea (Rs./ton)					5,283	4,697	4,115	3,784	3,688	3,424	3,559	3,615	3,629	3,623	3,705	3,749	3,730
– Ammonia (Rs./ton) \1					–	–	–	–	–	–	–	–	–	–	–	–	–
Total Revenues					2,659	3,871	3,579	3,215	3,012	2,979	2,847	2,892	2,903	2,896	2,689	2,722	2,708
Costs																	
Investment Costs \2	144	1,055	3,066	2,100	1,058	95	143	0	23	50	50	50	50	50	50	50	(803)
Working Capital \3					161	–16	27	22	92								(286)
Variable Costs																	
– Gas																	
. Quantity (million Nom)					352	534	544	561	556	572	496	496	496	496	463	463	463
. Price (Current Rs./thousand Nom)					2,605	2,619	2,629	2,639	2,748	2,953	3,075	3,166	3,166	3,166	3,166	3,166	3,166
. Price (1990/91 Rs./thousand Ncm)					3,047	2,851	2,629	2,427	2,396	2,276	2,370	2,440	2,440	2,440	2,440	2,440	2,440
. Cost of Gas (million Rs.)					1,073	1,522	1,429	1,361	1,336	1,302	1,175	1,210	1,210	1,210	1,131	1,131	1,131
– Purchased Electricity (million Rs.)					–	–	2	1	–	–	–	–	–	–	–	–	–
– Bagging (million Rs.)					81	147	171	179	158	176	170	179	188	197	188	197	207
Sub–total Variable Costs					1,155	1,669	1,602	1,541	1,494	1,479	1,345	1,388	1,397	1,407	1,319	1,328	1,338
Total Fixed Costs					278.7	382.2	398.9	404.5	465.0	491.0	524.4	567.8	593.6	632.0	602.0	696.1	741.3
Total Costs	144	1,055	3,066	2,100	2,651	2,129	2,171	1,967	2,073	2,020	1,920	1,956	2,041	2,089	2,021	924	2,079
Net Cash Flow	(144)	(1,055)	(3,066)	(2,100)	8	1,741	1,402	1,248	939	960	927	936	862	809	669	1,798	629

Financial Rate of Return (%) = 9.8

Notes

1 It is assumed that all ammonia is used for urea production.
\2 as estimated at appraisal, residual value at the end of project life was estimated at 10% of depreciable assets.
\3 recovery of working capital at the end of project life.

Sensitivity Analysis

	FRR (%)	
	Actual	SAR Estimates
Base Case	9.8	11.8
Project implem. in 48 months	–	14
Variable Costs Up 10%	7.3	10.4
variable Costs down 10%	12.1	13.1
Production Costs up 10%	6.4	–
Revenues up 10%	14.6	–
Revenues up 5%	12.3	–
Revenues down 10%	4.2	–
Capacity Util. up 5%	10.8	–
Capacity Util. down 10%	7.8	10.2
Capacity Maintained @ 110% until 2001	9.9	–
Economic Prices for Urea & Gas	12.8	–
Economic Prices only for Urea	2.4	–

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RETENTION PRICE CALCULATION FOR AONLA

(Rs. per ton)

	Jul-88 to Mar-89	Apr-89 to Mar-90	Apr-90 to Mar-91	Apr-91 to Mar-92	Apr-92 to Mar-93	Apr-93 to Mar-94	Apr-94 to Mar-95	Apr-95 to Mar-96	Apr-96 to Mar-97	Apr-97 to Mar-98	Apr-98 to Mar-99	Apr-99 to Mar-00	Apr-00 to Mar-01
	PRICING PERIOD I			PRICING PERIOD II			PRICING PERIOD III			PRICING PERIOD IV			
PRODUCTION (Tons per Year)	435,480	669,240	691,650	691,650	691,650	691,650	688,920	688,920	688,920	685,380	658,410	647,310	647,310
1.VARIABLE COST													
NATURAL GAS	1,698	1,698	1,707	1,707	1,707	1,917	2,036	2,097	2,097	2,097	2,097	2,097	2,097
PURCHASED POWER	-	-	-	-	-	-	-	-	-	-	-	-	-
BAGS	158	184	184	197	179	189	203	210	221	235	245	258	272
SUBTOTAL 1	1,856	1,881	1,891	1,905	1,887	2,106	2,239	2,307	2,318	2,331	2,342	2,355	2,368
2.FIXED COST, EXCLUDING INTEREST													
LABOR & OVERHEAD	164	166	168	195	195	195	211	211	211	278	290	295	392
MAINTENANCE	82	78	76	84	88	95	115	120	126	133	146	156	163
INSURANCE	47	50	50	54	54	54	80	80	80	93	97	99	115
CATALYSTS,CHEMICALS & WATER	88	61	59	62	62	62	72	72	72	84	88	89	103
SELLING EXPENSES	106	106	106	155	155	155	199	199	199	230	230	230	266
DEPRECIATION	517	475	460	460	460	460	528	528	528	544	566	576	590
SUBTOTAL 2	1,004	936	919	1,010	1,013	1,021	1,205	1,211	1,217	1,363	1,416	1,444	1,629
3.INTEREST-LONG TERM DEBT	581	539	522	357	357	357	307	307	307	135	141	143	-
4.FIXED COST, INCLUDING INTEREST	1,585	1,475	1,440	1,366	1,370	1,378	1,512	1,517	1,523	1,498	1,557	1,587	1,629
5.RETURN ON NET WORTH/EQUITY	1,076	989	783	960	960	960	868	868	868	872	908	923	843
6.RETENTION PRICE (1+4+5)	4,517	4,345	4,115	4,231	4,217	4,444	4,618	4,691	4,709	4,701	4,807	4,865	4,840
Retention Price in 1990/91 Rs.	5,283	4,697	4,115	3,784	3,688	3,424	3,559	3,615	3,629	3,623	3,705	3,749	3,730
Retention Price as Estimated at Appraisal													
In Current Rs/ton		5,339	6,097	6,072	6,032	6,038	6,049	6,065	6,085	6,111	6,143	6,180	6,223
In US$ /ton		411	469	467	464	464	465	467	468	470	473	475	479
Economic Price of Urea in 1990/91 Rs./ton	4,080	3,667	3,972	4,170	3,524	2,949	3,219	3,362	3,434	3,488	3,542	3,596	3,739
Economic Price of Urea in 1990/91 US$	227	204	221	232	196	164	179	187	191	194	197	200	208

Source: IFFCO - \WBRT.XLS (Range A275-O322)

FINANCIAL PERFORMANCE OF IFFCO

Balance Sheet

Fiscal Year Ending	1986/87 6/30/87	1987/89 3/31/89 (21 months)	1989/90 3/31/90	1990/91 3/31/91	1991/92 3/31/92	1992/93 3/31/93
Current Assets						
– Operating Cash and Banks	810	286	856	1,004	558	3,216
– Accounts Receivable	1,325	876	1,307	682	1,072	1,063
– Inventories	2,971	2,715	3,026	2,562	3,048	3,493
– Loans and Advances	2,316	3,809	2,940	3,608	5,177	4,166
Total Current Assets	**7,422**	**7,686**	**8,129**	**7,856**	**9,855**	**11,938**
Investments	1,127	1,127	1,127	2,549	2,656	1,127
Net Differed Revenues/Expenditures	7	7	4	1	0	0
Fixed Assets						
– Gross Fixed Assets	5,130	10,280	10,565	10,875	12,844	13,408
– Accumulated Depreciation	1,981	3,015	3,933	4,844	6,115	7,382
– Net Fixed Assets	3,149	7,265	6,632	6,031	6,729	6,026
– Work in Progress	2,980	105	53	100	280	344
Total Fixed Assets	**6,129**	**7,370**	**6,685**	**6,131**	**7,009**	**6,370**
Total Assets	**14,685**	**16,190**	**15,945**	**16,537**	**19,520**	**19,435**
Current Liabilities	**3,694**	**2,945**	**3,422**	**3,415**	**4,455**	**3,937**
Total (LT) Debt	**4,873**	**6,782**	**5,687**	**5,188**	**6,547**	**6,032**
Equity						
– Share Capital	3,250	3,529	3,562	3,580	3,606	3,623
– Retained Earnings	2,868	2,934	3,274	4,129	4,913	5,842
Total Equity	**6,118**	**6,463**	**6,836**	**7,709**	**8,519**	**9,465**

Main Financial Ratios	Covenants						
– Debt Service Coverage Ratio	1.4	1.0	1.4	1.9	2.8	2.9	3.5
– Debt Equity Ratio	0.6	0.44	0.51	0.45	0.40	0.43	0.39
– Current Ratio	1.3	2.0	2.6	2.4	2.3	2.2	3.0
– Return on Equity (%)		0.02	1.70	4.91	9.19	7.24	10.81

Income Statement

Fiscal Year Ending	1986/87 6/30/87	1987/89 3/31/89 (21 months)	1989/90 3/31/90	1990/91 3/31/91	1991/92 3/31/92	1992/93 3/31/93
Income						
– Sales	4,929	9,472	6,498	7,154	8,772	10,137
– FICC Receipts	1,019	3,847	3,470	3,873	4,307	3,908
– Other Income	621	1,240	1,109	1,115	1,528	1,139
– Change in Inventories	360	(818)	149	(555)	238	844
Total Income	**6,929**	**13,741**	**11,226**	**11,587**	**14,845**	**16,028**
Costs						
Variable Costs						
– Raw Materials	3,666	7,265	4,769	5,110	8,305	8,454
– Purchased Products	600	128	1,107	356	123	640
– Other	548	1,214	1,116	1,140	1,306	1,288
Total Variable Costs	**4,814**	**8,607**	**6,992**	**6,606**	**9,734**	**10,382**
Fixed Costs						
– Labor & Overhead	235	505	395	524	531	668
– Depreciation	301	1,010	920	917	1,398	1,264
– Other Costs	1,206	2,281	1,597	1,730	1,844	1,580
Total Fixed Costs	**1,742**	**3,796**	**2,912**	**3,171**	**3,773**	**3,512**
Total Cost of Goods	**6,556**	**12,403**	**9,904**	**9,777**	**13,507**	**13,894**
Operating Income	**373**	**1,338**	**1,322**	**1,810**	**1,338**	**2,134**
Financial Charges	448	1,106	804	712	597	488
Other Income & Adjustments	177	(25)	6	(17)	267	(93)
Income before Taxes	**102**	**207**	**524**	**1,081**	**1,008**	**1,553**
Income Taxes	–	–	–			396
Income after Taxes	102	207	524	1,081	1,008	1,157
Dividends	54	137	214	215	216	217
Retained Earnings	48	70	310	866	792	940

PROJECT COMPLETION REPORT
INDIA
COOPERATIVE FERTILIZER INDUSTRY PROJECT
(Loans 2729-IN & 2730-IN)

ENVIRONMENTAL ASPECTS

I. THE AONLA PLANT

1. The project is located in a generally barren and scarcely populated area. Nevertheless, adequate pollution control measures have been adopted: adequate effluent treatment and discharge facilities were constructed in accordance with Indian environmental standards, which are comparable to standards applied for such installations in industrialized countries and/or other environmental standards acceptable to the Bank. Major effluent streams from the plant include: (i) liquid effluent from the ammonia and urea plants and from the water treatment plant; (ii) dust emissions from the urea plant prilling tower; (iii) blow down of the cooling tower; and (iv) sludge from the water treatment plant.

A. Existing Environmental Control in the Aonla Plant

2. The environmental control facilities of Aonla are summarized below:

(a) liquid effluent treatment: the ammonia and urea plants were designed based on a zero-effluent concept, with complete recovery and re-use of process steam condensates, maximum recovery of treated liquid effluent and recycle of ammonia. The plant liquid effluent treatment facilities include: (i) a deep hydrolyzer in the urea plant to recover ammonia and CO_2 from process condensates, before they are recycled; (ii) stripping treatment of process condensates in the ammonia plant to strip ammonia and other impurities and, after polishing, recycle the condensates as boiler feed water; (iii) disk oil separators for the treatment of oily waste water from compressors; (iv) effluent neutralization pits; (v) centralized treatment of the cooling water blow-down with hexavalent chromium removal and dumping of the final de-watered cake in a low density polyethylene (LDPE) lined pit; (vi) centralized treatment of waste from ammonia and urea plants with air and steam stripping towers; (vii) two separate corrosion-resistant double-lined holding ponds for the storage of treated effluent (85,000 m^3 each), before re-use for the irrigation of the plant green belt; and (vii) sewage treatment.

(b) **Air Pollution Control**: the urea prilling tower is equipped with a dedusting system (water jet scrubbers) to remove urea dust from the exhaust air. The urea solution is recycled and the system maintains dust concentration in the exhaust effluent at about 20 mg/Nm^3, well within the limit of 50 mg/Nm^3 stipulated by the 1981 Air Act and MINAS. Also, the use of natural gas from Bombay High as fuel allows a negligible sulfur dioxide and dust content in all stacks. Flue gas stacks of ammonia, power and steam generation plants are equipped with monitoring devices (NO_x and SO_x analyzers) and CO_2 and oxygen on line analyzers were incorporated to improve combustion and reduce pollution. Use of liquid fuel (LSHS) instead of gas (Part I - para 7.2), will marginally increase SO_2 emissions, but they are estimated to be within standards -- with this in mind, the Boiler stack was constructed high, at 120 meters.

(c) **Noise Control and Land Environment**: to improve the ecological balance of the surrounding area and reduce noise and dust transmission, a green belt of

150,000 trees have been planted, in and around the plant, on a total of 350 acres. In addition, IFFCO has also established a tree nursery and distributes free seedlings to promote social forestry. The project area was initially deforested, barren and alkaline, however, the large scale tree plantation program carried out by IFFCO is improving the micro climatic conditions and the aesthetics of the area by improving the soil, reducing soil erosion and helping in the restoration of displaced fauna.

(d) Environmental Monitoring: Aonla is equipped with a modern environmental management laboratory, adequate water and air pollution monitoring stations and, with the guidance and assistance of the UP Pollution Control Board (UPPCB), the Central Pollution Control Board (CPCB), and the Department of Environment, has established an environment management plan, including a detailed monitoring plan. In addition, the local agency of UPPCB periodically checks Aonla liquid effluent and air emissions to ensure that they are within prescribed limits. Finally, a fully dedicated team of engineers from the Technical Services Department, constituting the core of the environmental monitoring group, coordinates all activities related to environmental protection. Finally, an emergency system is in place (para. ?)

B. Environment Impact Assessment of January 1993

3. In addition to the compulsory initial environmental assessment on the basis of which the project was designed, in 1992/93, more than four years after commissioning, IFFCO undertook a new Environmental Impact Assessment (EIA) of the Aonla plant to assess the actual impact of the project and estimate the potential environmental impact of the expansion project. The report was submitted to and accepted by the state and central environmental agencies. This new study was prepared on the basis of data collected for air, water, noise, biological, land and socio-economic impacts in the project area of influence. The EIA analyzed the air, water and biological, noise, land, and socio-economic environments, and included the identification, projection and evaluation of the project's environmental impacts; proposed a detailed environmental management plan, mitigating measures and a detailed environmental monitoring and disaster management plans. Its overall conclusion is that the Aonla pollution control is effective and all effluent are within limits specified by MINAS. Excerpts of the EIA are available in the PCR file, including annual average effluent analyses compared with UPPBC standards. Main conclusions on the present situation can be summarized as follows:

(a) the liquid effluent treatment plant is efficient, the quality of treated effluent conforms to the Minimum National Standards (MINAS) and can be used for irrigation purposes;

(b) cooling tower blow-down effluent are efficiently treated, treated effluent are recycled, and chromium cake safely stored in LDPE-lined pits;

(c) efficiency of the sewage plant is satisfactory;

(d) effluent discharges to the Aril river meets the UP Control Board standards and their impact is negligible and reversible by self depuration and therefore no damage to the aquatic life is expected;

(e) flue gas from the power and steam generation plant contain negligible quantities of sulfur dioxide and nitrogen oxide and suspended particulate content are well below the UP standards;

(f) exhaust air from the urea prilling tower contains less than 35 mg per Nm^3 of dust, well below the 50 mg/Nm^3 standard. All other gaseous streams from the urea plant are scrubbed and are practically free from ammonia;

(g) there is no adverse impact on ground water;

(h) air within and around the fertilizer complex is almost free from toxic pollutants -- SO_2 concentration is negligible; the maximum concentrations of NO_2 is lower than 20 micrograms/Nm^3 and well within the UP limit of 120 micrograms/Nm^3; and suspended particulates in the plant area are lower than 200 micrograms, well within the UP limit of 500 micrograms/Nm^3; and

(i) the noise level inside the factory requires the introduction of personal protective equipment, however, it is within or close to the established 90 decibel standard.

C. A Case Study of Environmental Management Practices at Aonla

4. In 1989, the Centre for Energy, Environment and Technology carried out a case study on the environmental management practices at Aonla. This study was sponsored by the Ministry of Environment and Forests. Its main conclusions were similar to those of the above later EIA. In addition, this study recommended the introduction of periodic external auditing in the Aonla management plan. The Bank strongly supports this recommendation, which will help identify, review and improve upon the existing situation and the adopted measures.

D. Disaster Management and Risk Assessment Study

5. In 1992/93, IFFCO revised its disaster plan in Aonla in light of the new guidelines issued by the Directorate of Factories of the Department of Labor of UP. This updated disaster management plan includes: (i) an inventory of potential disasters and precautions to be taken; (ii) an emergency plan; (iii) an evacuation plan; (iv) emergency pollution control, including mutual aid schemes in the event of disaster; and (v) a disaster management structure chart.

II. THE PHULPUR PLANT

6. The naphtha-based Phulpur ammonia-urea plant was commissioned in 1980 with a nominal capacity of 1,500 tpd of urea and is located in the Indo-Gangetic plains. Since start-up, IFFCO has implemented an extensive program of effluent and pollution control improvements to keep the Phulpur plant in conformity with UPPCB and MINAS standards. Part of the new schemes were financed under the project. Except for the fly ash disposal/reuse and of the ash pond ash overflow water, all other effluent are similar to those of Aonla (para. 1). Pollution control measures for liquid effluent, air emissions, domestic sewage, and solid waste were taken and aim at maximum reduction and re-use of effluent.

A. Existing Environmental Control in the Phulpur Plant

7. The environmental control facilities of the Phulpur plant are summarized below:

(a) **Liquid Effluent Treatment**: Many improvements in operation and effluent treatment were introduced in the ammonia and urea plants for maximum recovery and re-use of process steam condensates, maximum recovery of treated liquid effluent and recycle of ammonia. The plant liquid effluent treatment facilities include: (i) a deep hydrolyzer (financed under the project) in the urea plant to recover ammonia and CO_2 from process condensates, before they are recycled; (ii) a stripping treatment of process condensates in the ammonia plant to strip ammonia and other impurities and after polishing, recycle the condensates as boiler feed water; (iii) oil separators for the treatment of oily waste water from compressors; (iv) effluent neutralization pits; (v) centralized treatment of the cooling water blow-down with hexavalent chromium removal and dumping of the final settled sludge after drying and bagging in HDPE into a HPDE

lined pit; (vi) two separate holding ponds for the storage of treated effluent before its recycling for process use, irrigation of the plant green belt and in Moti Lai Nehru Farmer's Training Institute; (vii) sewage treatment; (viii) reduction in fresh water requirement by recycling the effluent from the inert gas plant; and (ix) a new ash pond constructed to reduce solid content in water overflow within the UPPBC and Minas standards.

(b) **Solid Waste Management**: Waste generated at Phulpur includes fly ash, lime sludge, and chromium sludge. The chromium sludge is dried, bagged and safely stored in a lined pit. 350 tpd of ash settle in a pond, part of which is used for land reclamation and as land filling. Phulpur is implementing a pilot plant for the production of 5,000 calcium silicate bricks with ash. Part of the 2,500 tpy lime sludge from the water softening plant is presently sold, and development work is being carried out for better use.

(b) **Air Pollution Control**: The air pollution control systems include: electrostatic separators for separating the fly ash from the flue gas; a 100 m high stack in the power plant; scrubbers for gaseous emissions and cyclones for dust collection for coal and product handling; and CO_2 and oxygen on-line analyzers were incorporated to improve combustion and reduce pollution. Finally, the urea prilling tower is 96-meter high with natural draft air flow, and the solid content of its exhaust is within UPPBC and MINAS standards.

(c) **Dust and Noise Control and Land Environment**: to improve the ecological balance of the surrounding area and reduce noise and dust transmission, a green belt of 270,000 trees was planted, in and around the plant, on more than 65% of the company area. The project area was initially deforested and barren, however, the large scale tree plantation program carried out by IFFCO improved the micro-ecological conditions and the aesthetics of the area.

(d) **Environment Monitoring**: Phulpur is equipped with a modern environment and pollution control laboratory (recognized by UPPCB), stacks sampling arrangements, water and ambient air pollution monitoring stations, and has established a detailed monitoring plan. Finally, a fully dedicated team of well trained engineers, constituting the core of the environmental monitoring group, coordinates all activities related to environmental protection.

B. The 1992/93 Environmental Impact Assessment

8. In 1992/93 HBTI/KANPUR undertook an EIA of the Phulpur plant based on field data collected over a period of eighteen months on air, water, and land pollution , solid, liquid and gaseous discharges, flora, fauna, and population and human health. Main conclusions of the study include:

(a) the water table will not deplete;

(b) no irreversible impacts are foreseen;

(c) efficient control measures are adopted and impact on air and the atmosphere is negligible;

(d) liquid effluent and solid waste are well managed and their impact on water and land bodies is negligible;

(e) the socio-economic environment has improved; and

(f) the green belt moderates plant impact on the environment and has improved its aesthetics.

The study also recommends to further reduce the discharge of effluent water (currently recycled at about 60%), improve the bottom of the urea storage to better control moisture seepage, and continue R&D work on the use of solid waste.

III. THE KALOL PLANT

9. The gas-based Kalol ammonia-urea plant was commissioned in 1975 with a nominal capacity of 1,200 tpd of urea and is located in Gujarat. Since start-up, IFFCO had implemented an extensive program of effluent and pollution control improvements to reduce pollutants in the Kalol plant effluent within the limits of the Gujarat Pollution Control Board (GPCB) and MINAS standards. Part of the new schemes were financed under the project. Plant effluent are similar to those of Aonla (para. 1). Pollution control measures for liquid effluent, air emissions, domestic sewage, and solid waste were introduced, aiming at maximum reduction and re-use of effluent. Most of these improvements were commissioned in 1992/93 and 1993/94, and liquid and gas effluent are now in conformity with GPCB standards.

A. Pollution Control Measures Implemented

10. The following pollution control measures were implemented:

(a) a deep hydrolyzer (financed under the project)in the urea plant to recover ammonia and CO_2 from process condensates, before they are recycled;

(b) collection and treatment system of urea plant leakages;

(c) use of sodium hydroxide instead of ammonia in the water treatment plant;

(d) a condensate stripper vent gas condensation system in the ammonia plant, the condensates being treated in the urea plant hydrolizer;

(e) a final ammonia scrubber to scrub vent gases from the existing HP scrubber in the urea plant; and

(f) a dedusting system with wet scrubbing of gas effluent from urea storage and bagging facilities.

IV. THE KANDLA PLANT

11. The Kandla Diammonium Phosphate (DAP) and complex fertilizer (NPK) plant started commercial production in 1975 with two granulation plants using imported phosphoric acid and potassium chloride. Two additional granulation units were added in 1981 to double production capacity. The Kandla unit is adjacent to the Kandla port (Gujarat). The units are based on well known process, are based on complete recycling of liquid effluent and are equipped with the necessary gas effluent treatment and pollution control systems, including cyclones, scrubbers, dedusting systems, and with total recycle of the scrubbing liquor. The plant received many safety awards from the Government of India and from the Gujarat Safety Council.

Annex 6

Ammonia - Urea Plants based on Natural Gas from the Bombay High and South Bassein

	Company	Site	State	No. of Plants
1	KRIBHCO	Hazira	Gujarat	2
2	RCFL	Maharashtra	Thal Vaishet	2
3	NFL	Vijaipur	Madhia Pradesh	1 + (1)
4	IFFCO	Aonla	Uttar Pradesh	1 + (1)
5	Indo Gulf	Jagdishpur	Uttar Pradesh	1
6	Bindal Agro	Shahjahhanpur	Uttar Pradesh	1 (08/94)
7	CFCL	Gadepan	Rajasthan	1 (12/93)
8	Tata Chemicals	Babrala	Uttar Pradesh	1 (08/94)

(1) Expansion already approved, process and design contracts already signed, commissioning is expected in October 1996. Design and procurement is being implemented jointly by the two enterprises.