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**The World Bank**  
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**Report No. 7350**

**PROJECT COMPLETION REPORT**

**ROMANIA**

**VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT  
(LOAN 2148-RO)**

**June 30, 1988**

**Energy Department**

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**COUNTRY EXCHANGE RATES**

<b>Name of currency</b>	<b>Lei</b>
<b>Appraisal year average</b>	<b>US\$1 = 15 Lei</b>
<b>Intervening year's average</b>	<b>US\$1 = 17.3 Lei</b>
<b>Completion year's average</b>	<b>US\$1 = 17.5 Lei</b>

June 30, 1988

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Project Completion Report on Romania Videle/Balaria  
Enhanced Oil Recovery Project (Loan 2148-RO)

Attached, for information, is a copy of a report entitled "Project Completion Report on Romania Videle/Balaria Enhanced Oil Recovery Project (Loan 2148-RO)" prepared by the former Energy Department. As a result of the reorganization the PCR was reviewed by the Europe, Middle East and North Africa Regional Office. Further evaluation of this project by the Operations Evaluation Department has not been made.

Yves Rovani

by Graham Donaldson

Attachment

ROMANIAVIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT(LOAN 2148-RO)PROJECT COMPLETION REPORTTABLE OF CONTENTS

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IBRD 16066 - Videle/Balaria Enhanced Oil Recovery Project

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VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT

(LOAN 2148-RO)

PROJECT COMPLETION REPORT

PREFACE

This report reviews the results of an enhanced oil recovery (EOR) project, partly financed by Loan 2148-RO. The loan, made to the Banca de Investitii (IB) with the guarantee of the Socialist Republic of Romania, for the equivalent of US\$101.5 million (including the capitalized front end fee of US\$1.5 million) was approved on May 20, 1982. It was fully disbursed in December 1984, about 18 months ahead of the appraisal forecast. The proceeds of the loan financed tubulars (casing, tubing, linepipe), drilling and production materials and equipment for drilling over 900 wells, installation of surface production and in situ combustion facilities. The project was physically completed with a two-year delay, mainly in the installation of compressor stations in Videle, caused by three successive severe winter seasons, together with an excessively long compressor delivery schedule. The reservoir performance in Balaria indicates higher oil recovery than originally expected. The initial results in the other reservoirs are also encouraging. The target incremental production of 731,000 tons/year is expected to be achieved by 1989, approximately 3 years behind the appraisal estimate. This project completion report was prepared by the former Energy Department and subsequently reviewed by EM4IE, and was based on the information obtained during completion mission and from the Appraisal, President's and Supervision reports, as well as other documents from the project files. The borrower submitted a final completion report containing its views on the project implementation and supplied additional data for this report. The PCR has been submitted to the Borrower, whose response (Annex 16) did not contain any objections or critical remarks to the PCR.

In accordance with the revised procedures for project performance audit reporting, this Project Completion Report was read by the Operations Evaluation Department (OED), but the project was not audited by OED staff.

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VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT

(LOAN NO. 2148-RO)

PROJECT COMPLETION REPORT

BASIC DATA SHEET

KEY PROJECT DATA  
(AS OF JUNE 1987)

	<u>Appraisal Expectation</u>	<u>Actual or Current Estimate</u>
Total Project Cost (Lei Million)	6,620	5,802
Underrun (X)	--	12
Loan Amount (US\$ Million)	101.5	101.5
Disbursed	101.5	101.5
Cancelled	--	--
Repaid (to 6/31/87)	--	16.9
Outstanding	--	84.6
Date Physical Components Completed a/	12/31/86	12/31/87
Proportion Completed by Above Date (Z) b/	100	95
Proportion of Time Overrun (X)	--	25
Economic Rate of Return (X)	29	13
Financial Performance	Satisfactory	Satisfactory
Institutional Performance	Satisfactory	Satisfactory

a/ Work still to be completed after June 1987 represents less than 1% of project cost.

b/ In terms of project expenditures.

CUMULATIVE LOAN DISBURSEMENT

	<u>FY 81/82</u>	<u>FY82/83</u>	<u>FY83/84</u>	<u>FY84/85</u>	<u>FY85/86</u>
(i) Planned	7.9	67.0	91.5	98.7	101.5
(ii) Actual	35.1	89.3	101.5	---	---
(iii) (ii) as % of (i)	444.3	133.2	110.9	---	---

OTHER PROJECT DATA

	<u>Original Plan</u>	<u>Actual or Reestimated</u>
First Mentioned in Project File	--	Sept. 1980
Government Application	--	Nov. 1980
Negotiations	4/04/82	4/04/82
Board Approval	5/20/82	5/20/82
Loan Agreement Date	--	7/23/82
Effectiveness Date	9/15/82	10/06/82
Closing Date	6/30/87	12/31/84
Borrower:	Banca de Investitii (IB)	
Executing Agency:	Bolintin Petroleum Trust (TPB)	
Fiscal Year of Borrower:	January 1 - December 31	
Follow-On Project:	None	

MISSION DATA

	<u>Month/ Year</u>	<u>No. of Days</u>	<u>No. of Persons</u>	<u>Man Weeks</u>	<u>Date of Report</u>
Appraisal	Oct. 1981	18	4	14.4	4/30/82
Supervision I	May 1982	8	2	3.2	5/20/82
Supervision II	Sept. 1982	9	3	5.4	10/22/82
Supervision III	March 1983	7	3	4.2	4/25/83
Supervision IV	Sept. 1983	6	1	1.2	10/4/83
Supervision V	April 1984	7	2	2.8	5/22/84
Supervision VI	May 1985	6	2	2.4	5/17/85
Supervision VII	Oct. 1986	8	2	3.2	10/22/86
Completion	June 1987	<u>6</u>	3	<u>3.6</u>	
		75		40.4	

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HIGHLIGHTS

1. The loan under review, in the amount of US\$101.5 million, was to help finance the 1982-86 slice of the Videle/Balaria in situ combustion enhanced oil recovery (EOR) program. The Investment Bank (IB), was the borrower, and Bolintin Petroleum Trust (TPB), a state enterprise, was the beneficiary and the implementing agency.

2. The main objective of the project was to stop and reverse the sharply declining production from the Videle and Balaria oil fields by applying the in situ combustion process. It was predicted (para 2.04 of this report) that this measure would increase the ultimate oil recovery from these two fields from 15% to 39% of the oil initially in place and that the annual incremental production due to the ECR process would reach 731,000 tons (4.9 million barrels) by 1986 and continue at this level over the 20-year life of the project. The incremental production goal is now expected to be reached in 1989 (three years later than planned during project appraisal) because of the long delivery schedule of the 110 compressors required for supplying air to support the combustion front, and also construction delays caused by the unprecedented severe winters during the project implementation period. Nevertheless, production and reservoir data observed so far give positive indications that, except for the three-year delay, the production objective will be met and that the 39% ultimate recovery goal will not only be met but may even be exceeded (para 4.03).

3. The project facilities were completed more than two years later than planned during project appraisal at a cost of Lei 5.8 billion, approximately 12% less than the appraisal estimate (Lei 6.62 billion). The difference is mainly attributed to the lower than estimated cost of the air compressors and other equipment and materials (para 3.06).

4. The economic reevaluation (para 7.01) projects that the economic rate of return (ERR) from the project will be 13% which is satisfactory but substantially short of the 29% expected at appraisal. The lower ERR is largely due to the sharp drop in actual and projected future international oil prices along with the three-year delay in benefits and increased production costs (mostly offset by the lower project cost). TPB met the financial objectives under the project and is expected to maintain a satisfactory financial performance given the Government's commitment to increase crude oil prices from time to time to reflect the rising oil production costs which will accompany the increased use of expensive EOR production techniques (paras. 5.02-5.03).

5. TPB is a mature and competent institution, and the various specialized support organizations it has access to provide it with a self-reliance which is not paralleled in many developing countries. However, the project has shown that TPB, as well as the petroleum sector as a whole, could benefit from relaxing the almost total reliance on Romanian equipment and technology (para 6.03). The practice is understandable in light of the country's severe foreign exchange constraints, but this self-reliance must be weighed against the increasing lag in technology and efficiency which will follow if it is continued.

6. Experience in carrying out the project has highlighted the following lessons (para 9.06):

- (a) The EOR process, based on in situ combustion, is a highly effective and efficient method for recovering large oil reserves which would otherwise have to be abandoned in the reservoir; however, the reservoir must possess the appropriate geological qualifications, and careful study and analysis of the EOR surface and sub-surface parameters along with costs and benefits are required for a successful EOR operation.
- (b) In preparing an in situ combustion project, the design and optimization of the surface facilities, especially the air supply system, should receive the same detailed attention as is given to the reservoir aspects.
- (c) In selecting items to be financed from its loans, the Bank should focus on critical items which can promote procurement efficiency and lead to improved project design and operations.

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VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT

(LOAN 2148-RO)

PROJECT COMPLETION REPORT

I. INTRODUCTION

1.01 Oil production in Romania dates back to the nineteenth century when it was one of the important oil producing centers in the world. However, the major oil fields have long since passed their peak primary production years. Despite the widespread application of secondary recovery techniques of water and gas injection, production began to fall sharply from 1976 on, from 14.7 million tons in 1976 to 11.5 million tons in 1980. The year 1976 was also when Romania became a net oil importer for the first time; by 1980, the cost of these imports had increased to almost US\$ 2 billion per year. The 1981-1985 Five-Year Plan focused on arresting the oil production decline by finding and developing new oil reserves and by increasing the production from existing oil fields so as to stabilize future oil production at about 13 million tons per year.

1.02 The Plan allocated about a billion dollars to develop increased production from existing reservoirs, about half that amount to finance conventional secondary recovery and the other half to finance tertiary enhanced oil recovery (EOR<sup>1/</sup>) projects. Extensive laboratory and field tests had identified some 41 possible EOR projects, 18 of which were sufficiently prepared to be included in the plan. These projects incorporated the generally applied tertiary recovery techniques: thermal including steam injection and in situ combustion, carbon dioxide injection and polymer micellar solution injection. The Videle/Balaria EOR project, the most important and largest of the 18, was based on the in situ combustion process.

1.03 Essentially, the project covered the 1982-1986 portion of the long term EOR program for the Videle and Balaria reservoirs and was expected to increase ultimate recovery from 15% to 39% of the oil initially in-place. This increase would be equivalent to roughly 10% of the country's net oil imports or about a US\$ 0.2 billion foreign exchange saving per year based on crude oil prices prevailing in 1981. Major components of the project included: (i) well drilling and the facilities necessary to recover, process, store and transport the oil produced at the two fields; (ii) air injection facilities; (iii) utilities; and (iv) civil works, engineering and technical services.

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<sup>1/</sup> Annex 4 gives a short description of modern EOR processes.

1.04 The borrower was the Investment Bank (IB), the specialized agency under the Ministry of Finance for dealing with investment projects in all sectors of the economy except agriculture and food processing. The Bolintin Petroleum Trust (TPB) was the beneficiary of the Bank loan and the implementing agency of the project. TPB, a juridical entity under Romanian law, is responsible for oil development and extraction in the southwestern part of Romania. Its responsibilities and activities are executed through a headquarters staff, which takes care of technical, financial and coordination matters, and seven semi-autonomous operating divisions known as enterprises: (i) four engaged in crude oil production in geographically divided areas; (ii) one in drilling; (iii) one in maintenance and manufacture of oilfield equipment; and (iv) one in construction and erection services.

1.05 The project was estimated to cost US\$ 454.1 million, 28% of which was to be covered by the Bank loan of US\$ 101.5 million. The balance of the project was to be financed by TPB from internally generated funds and from budgetary allocations by the Government. This report is based on the completion report prepared by the Investment Bank and the Bolintin Petroleum Trust and the findings of a mission which visited Romania in June 1987.

## II. PROJECT PREPARATION AND APPRAISAL

2.01 In 1980, a Bank petroleum mission visited Romania to review the Government's investment program for increasing the country's crude oil production. The mission found that new oil discoveries could not be counted on to be a major contributor to production in the near or medium term. However, enhanced oil recovery (EOR) from existing fields held the promise of stabilizing production from these fields at a substantial level over the next 20 years or more. From the EOR projects<sup>1/</sup> under preparation at the time, the Bank mission selected the Vidale/Balaria project as the best suited for Bank participation as it was both the largest in terms of potential incremental oil production and the most advanced in terms of project preparation. The in situ combustion process was selected in lieu of steam injection (the other EOR process which was deemed to be suitable for the Vidale and Balaria reservoirs) because of the greater ultimate oil recovery potential, better fuel economy and the fact that the existing production and injection wells could be used with the in situ combustion process but not with the steam injection system.

2.02 Project preparation proceeded expeditiously. The Institute of Research and Industrial Design for Oil and Gas Production (ICPPG)<sup>2/</sup> designed the EOR process on the basis of extensive laboratory tests, studies and pilot operations which had already been carried out. Bank consultants and a Bank engineering panel reviewed the EOR design and offered several beneficial

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<sup>1/</sup> The Romanian oil industry was among the first in the world to apply, or experiment with, the technically feasible EOR processes.

<sup>2/</sup> The state-owned research, engineering and design institute comprising a geological research center in Bucharest, a design and engineering center in Ploiesti and a center for drilling, production and reservoir development in Cimpina.

recommendations which were subsequently incorporated into the project. The project was appraised during September/October 1981.

2.03 Looking at the project preparation process retrospectively, some flaws can be seen in the Bank's and TPB's performance in this activity. The project preparation effort concentrated almost entirely on the technical aspects of the EOR program, while three other important elements of the project preparation process were not given the close attention they should have received.

- (a) Mechanical design of the surface facilities: At appraisal, ICPPG had already prepared preliminary engineering for these facilities based on past practices and experience at TPB's ongoing EOR operations. The large number of small compressors suggests that a better air supply system could have been developed. However, there is no way to confirm this conclusion since no thorough project optimization study was undertaken (para. 8.04).
- (b) Project planning and implementation: Considering the history of project implementation delays in other sectors, a special effort was made to ensure expeditious project implementation. Nevertheless, the project completion goals could not be achieved; in fact, the incremental crude oil production target was missed by three years. Any improvement in this area will require a greater effort, especially in identifying and correcting the institutional constraints responsible (para. 6.03).
- (c) Use of the Bank loan: It now appears that the Bank loan should have financed the air compressors instead of the standard drilling equipment and materials. This requirements would have provided an opportunity to compare the merits of the compressors available on the international market with those manufactured in Romania and may possibly have resulted in a superior air supply system (para. 8.05).

Considering the financial and institutional constraints at the time, it is unlikely that any Bank initiative toward improving the shortcomings noted above would have been very successful. However, any future lending operation in the sector should address the issue of correcting the project preparation and implementation deficiencies brought to light by the project.

2.04 The project was expected to increase the ultimate recovery of oil from the two oil field from about 15% (without the project) to 39% of the oil initially in place in the reservoirs. This was expected to result in an annual incremental production at full development (then expected in 1986) of 731,000 tons per year, equivalent to roughly 10% of the country's net oil imports and saving some \$0.2 billion per year in foreign exchange. The project covered the 1982-86 portion of a long term EOR program for the Videle and Balaria oil fields and comprised the following:

- (a) Drilling of 909 wells for oil production and air injection;
- (b) Construction of 24 oil and gas separation centers (7 of these 9 separation centers would be equipped with water injection facilities);
- (c) Construction of one central oil treatment storage and pumping facility;
- (d) Construction of one water treatment facility for water reinjection into the reservoirs;
- (e) Construction of 5 compressor stations and air injection facilities;
- (f) Laying of approximately 1,300 km. of pipelines for air and water injection, gas supply, fluid collection and disposal;
- (g) Construction of power substation and distribution lines, treated water and steam supply facilities;
- (h) Setting up of laboratory and field monitoring instruments; and
- (i) Engineering and technical services for surveys, hydrological, and geotechnical investigations, coring, logging, cementing, perforations and design engineering.

### III. IMPLEMENTATION

#### Start-Up

3.01 Project implementation got underway on schedule without undue problems except that initial delays in procuring Bank-financed materials, establishing a site organization and drilling rig mobilization slowed drilling during the first year (295 wells scheduled vs. 34 actually drilled). There was no permanent adverse impact from this delay as drilling progressed at an accelerated rate in the following years. In fact, by end-1986, 1,220 wells had been completed compared to the 909 originally anticipated. The larger number of wells was a result of operating experience gained as the project progressed; it was found that a closer spaced well configuration was necessary for optimum recovery efficiency along with more in-fill drilling to realize earlier production gains. There were no revisions to the original project scope other than the increased number of wells.

#### Implementation Schedule

3.02 Annex 3 shows graphically the original scheduling of the major project activities and the actual accomplishments. It can be seen that the compressor plants, the heart of the in situ combustion process, missed the mid-1984 completion target by a wide margin, in fact almost 3.5 years based on the current October 1987 completion target for the last of the five compressor plants. The project schedule allowed only about two years to procure, deliver and construct the five compressor plants. To complete in the time allocated an air compressor system of the size required for the project would have

required an all-out construction effort and about a one-year delivery period for a system based on high capacity compressor trains (not of Romanian manufacture). Actually, no such effort was made. The compressors (110 or 22 per compressor plant) were purchased from a Romanian manufacturer with a staggered delivery time ranging from early 1983 to September 1986. In addition to the prolonged compressor delivery schedule, further delays were encountered during the construction phase. The unusually severe winters during the construction period accounted for most of these delays, but labor shortages was also a factor, although to a lesser degree. Ancillary facilities experienced similar delays as the compressor plants, but they were completed by the time they were actually required.

3.03 The EOR program had an air injection target of 8.7 million cubic meters per day by end-1986 but, because of the compressor delays, only a 5.0 million cubic meters capacity (57%) was installed by that date. The reduced air injection capacity caused a substantial decrease in the incremental oil recovery, from a rate of 731,000 tons per year expected to 101,000 tons per year actually produced. It is now expected that the full 731,000 ton rate will be achieved in 1989, three years later than the original target.

#### Reporting

3.04 TPB and IB met all the reporting requirements; both submitted, on a regular basis, the progress reports agreed with the Bank.

#### Procurement

3.05 The borrower procured oil field tubulars (valued at US\$60.3 million) and production equipment (valued at US\$39.7 million) totalling US\$100 million out of the Bank's funds following the Bank's international competitive bidding guidelines. Nine bid lots, approved by the Bank, were internationally advertised in June 1982. Fifty-one firms procured bid documents and 24 foreign participants competed in the bidding. However, all nine bid lots were won by Romanian companies which were the lowest evaluated bidders, probably because there was an overall shortage of these types of goods in the world at that time, and international suppliers quoted high and not firm prices and long deliveries. TPB did not find it necessary to avail itself of the domestic preference option available to it under the Loan Agreement. The Bank and the borrower had no disagreement over any procurement matters.

#### Project Costs

3.06 The following table based on Annex 1 compares the project costs by major components as estimated in the Staff Appraisal Report (SAR) and the actual costs incurred.

Comparison of SAR and Actual Costs  
(Lei Billion) a/

	<u>SAR b/</u>			<u>Actual</u>		
	<u>Local</u> <u>Currency</u>	<u>Indirect</u> <u>Foreign</u> <u>Exchange</u>	<u>Total</u>	<u>Local</u> <u>Currency</u>	<u>Indirect</u> <u>Foreign</u> <u>Exchange</u>	<u>Total</u>
Design, Engg & Supervision	0.25	-	0.25	0.73	-	0.73
Land Development & Roads	0.37	0.01	0.38	0.07	-	0.07
Well Drilling	0.91	0.98	1.89	0.99	1.10	2.09
Well Completion & hook up	0.65	0.38	1.03	0.33	0.37	0.70
Compressed air supply	1.47	0.74	2.21	1.00	0.22	1.22
Other facilities	<u>0.63</u>	<u>0.23</u>	<u>0.86</u>	<u>0.71</u>	<u>0.28</u>	<u>0.99</u>
<b>Total</b>	<b>4.28</b>	<b>2.34</b>	<b>6.62</b>	<b>3.83</b>	<b>1.97</b>	<b>5.80</b>

a/ Costs are given in Lei since foreign exchange expenditures were recorded in Lei in cost accounts.

b/ Physical and price contingencies have been prorated to each item.

The SAR cost represents the project cost to the Government which adjusted the cost of the indirect import contents (e.g., petroleum products, iron ore, coking coal, special steels, sub-assemblies, etc.) of locally purchased equipment and materials to import prices or international levels as opposed to the Government-set domestic catalog prices which were reflected in the financial cost to TPB. From 1981-86, the government raised catalog prices three times with the view to eliminate any hidden subsidies to State enterprises; catalog prices are currently the same as the Government costs. As indicated in the comparison table, the actual project cost of 5.8 billion Lei underran the 6.62 billion Lei estimated SAR cost by 0.82 billion Lei, or 12% of the estimated cost. The estimated financial cost to TPB at the time of appraisal was 5.89 billion Lei based on 1981 catalog prices.

3.07 The cost variance analysis in Annex 1 shows that there were substantial underruns in the cost of three project components (land development and roads, well completions and hook-ups, and compressed air supply) which more than made up for both the over-expenditures in the other three project components. As a general conclusion, the cost underrun can probably be attributed to the sizeable physical and price contingencies included in the estimate. Three of the more significant variances can be explained by the fact that:

- (a) Well costs were higher because of the increased number of wells;
- (b) Engineering and supervision costs were underestimated; based on Romanian standards, they were estimated at only 4% of the project cost whereas one would expect them to be at least 10% on

the basis of international experience (and actually turned out to be 12.6% in this case); and

- (c) Compressor costs in the estimate were based on more expensive foreign supply.

Disbursements and Financial Sources

3.08 Except for the US\$101.5 million Bank loan, all other funds were raised by TPB through internal cash generation and budget allocations from the State. The Government and IB confirmed during negotiations their intention to seek co-financing for the project as soon as foreign capital market conditions and Romania's external borrowing program allowed. However, because capital market conditions did not improve and Romania's creditworthiness continued to be a concern along with the Government's policy of not incurring new foreign debt, no action was taken on co-financing arrangements.

3.09 The comparison of appraisal versus actual disbursement is given in Annex 7. Actual disbursement was one and half years ahead of the appraisal estimate due to expeditious procurement by the borrower and faster than expected deliveries of the Bank financed items. After the conclusion of these contracts, the borrower requested, and the Bank agreed in November 1983 to the reallocation of the loan amounts under various categories shown in the following table:

Reallocation of the Loan  
(US\$ Million)

	<u>Amount Allocated</u> <u>Under the Loan Agreement</u>	<u>Revised</u> <u>Allocation</u>
Oil field tubular materials	65.0	60.3
Drilling and production equipment	35.0	39.7
Front end fee	<u>1.5</u>	<u>1.5</u>
	<u>\$101.5</u>	<u>\$101.5</u>

Performance of Consultants, Contractors and Suppliers

3.10 The borrower appointed ICPPG, the designated organization in Romania for all research, design and engineering activities for oil and gas, as the consultants for the basic design, reservoir engineering and project monitoring. With extensive experience of EOR techniques, the consultant's team of experts performed their assignments satisfactorily. They closely monitored reservoir behaviour and made modifications in the drilling and production plans (e.g., drilling 1,220 wells instead of 909 wells as planned) to assist in arresting the production decline during the early phase of the EOR program and to improve the overall EOR efficiency in Balaria and Videle fields. ICPPG satisfactorily monitored reservoir performance as influenced by

the EOR process at Balaria and Videle. The Institute is well qualified for this type of assignment, particularly when in situ combustion is involved.

3.11 Drilling and construction of surface facilities were provided by the state enterprises responsible for these services in accordance with the system prevailing in Romania. These entities were well qualified to carry out the tasks assigned to them, and they performed them satisfactorily. As already noted, the construction delays encountered during project implementation were largely due to the exceptionally severe winters during this period, and labor shortages were also reported to have been a problem. However, the major cause of the extended implementation period was the long compressor deliveries. The supplier of the compressors (a Romanian manufacturer) cannot be held completely accountable for the delivery schedule since the company apparently had other priority commitments to fulfill and, in fact, did essentially meet the contract delivery dates except for one compressor station.<sup>1/</sup> There were no problems or difficulties of any substance with the supply of the other equipment and materials required for the project.

#### Environmental Impact

3.12 The Videle/Balaria fields are located in the densely populated agricultural area of the country, and, thus, the environmental impact of the in situ combustion project with carbon monoxide and carbon dioxide as effluents is particularly significant. As agreed with the Bank during appraisal, the borrower took the required measures for the protection of the environment against pollution by crude oil, chemically treated water, and combustion products in oil/gas separation centers. A monitoring system, including setting up of special laboratories, was installed to determine average concentration of carbon monoxide and carbon dioxide on a regular basis. Particular attention was paid to installing facilities to protect against fire and toxic combustion products, and to coordinate with the Institute of Hygiene and Safety to solve any problems that might be encountered. These arrangements appear to be satisfactory.

### IV. OPERATING PERFORMANCE

#### Overall Assessment

4.01 The appraisal anticipations were that the field-wide in situ combustion program in the Balaria "a+b," Videle (East) "a+b," Videle (West) "a+b" and Videle "c" reservoirs would lead to a peak incremental production of 731,000 tons in 1986 which would then be maintained over the next 20 years. The current estimate, however, is that full incremental production now stands to be achieved and maintained only in 1989. The comparison between past and expected performance against the appraisal forecasts is as follows:

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<sup>1/</sup> Two stations were delivered early by two months; two stations were delivered late by one month; and one station was late by six months.

<u>Reservoir</u>	<u>Appraisal Forecasts</u>	<u>Actual/Expected Forecasts</u>
Balaria "a+b"	Air injection to commence in October 1983,  To achieve peak incremental 100,000 tons in 1986,	Air injection commenced in June 1984,  Achieved 84,000 tons in 1986, To achieve 100,000 tons in 1987.
Videle (East) "a+b"	Air injection to commence in October 1983,  To achieve peak incremental 182,000 tons in 1986,	Air injection commenced in July 1986,  To achieve 91,000 tons in 1987, To achieve 182,000 tons in 1988,
Videle (West) "a+b"	Air injection to commence in April 1984,  To achieve peak incremental production of 288,000 tons in 1986,	Air injection commenced at one compressor station in February 1987. At a second compressor station, air injection is scheduled to start in October 1987.  To achieve 20,000 tons in 1988, and 288,000 tons in 1989
Videle (West) "c"	Air injection to commence in April 1983,  To achieve peak incremental production of 160,000 tons in 1985.	Air injection commenced in October 1986.  To achieve incremental production of 120,000 tons in 1988, and 160,000 tons in 1989.
Total (Balaria/Videle Reservoirs)	To achieve 731,000 tons incremental production in 1986	Achieved 101,000 tons incremental production and 1,272 tons/day peak and 288,000 tons total production in 1986  Expect to achieve incremental production of 731,000 tons in 1989

4.02 The difference between the SAR forecast and the actual and projected production rates noted above is directly related to the air supply which, along with the critical reservoir parameters, governs the performance of an in situ combustion operation. The prolonged air compressor deliveries and installation delays (paras. 3.02 and 3.02) resulted in a corresponding delay in achieving the incremental production targets.

4.03 The question arises as to how reliable are the projected reservoir performances and whether the projected incremental production of 731,000 tons per year can indeed be achieved by 1989. At Balaria, nearly peak production has already been realized. At Videle East "a+b," a daily production of 210 tons of which 190 tons are incremental (90% of total production) has been attained. At this location, 83 wells on production have so far been influenced by the combustion front. At Videle West "c," all of the 80 tons per day of production at present are incremental, the combustion front having influenced 33 production wells so far. Given these data and various other performance details and parameters of the reservoirs, as well as the future program for air and water injection, it is reasonable to expect that the production targets will be achieved by 1989. In situ combustion on a field wide scale has proved to be a success in Balaria. It has been demonstrated that the ultimate oil recovery from Balaria will exceed the 39% of the oil initially in place conservatively assessed at appraisal; an average recovery of 42% is now expected. Therefore, with the similar or better reservoir characteristics existing at Videle, it should be possible to at least meet or even exceed the 39% recovery target.

#### V. FINANCIAL PERFORMANCE

5.01 At the time of appraisal in late 1981, TPB's financial performance had deteriorated from an operating profit (or benefit<sup>1/</sup>) breakeven situation in 1978 to progressively larger operating losses in 1979 and 1980. The Government had recognized this problem and had adopted a policy, as part of the 1981-1985 Five-Year Plan, that the petroleum industry would earn during the Plan period a five-year average benefit (i.e., profits before interest expense) equivalent to at least 7.5% of the costs of oil extraction. On the other hand, the service or non-petroleum activities of the petroleum trusts, which mainly comprise sundry services for employees, were expected to cover just about 95% of their corresponding costs reflecting additional employee benefits. Thus, the overall benefit or operating profit rate during 1981-1985 of the individual petroleum trusts, such as TPB, was expected during appraisal to be somewhat lower -- roughly ranging from 4% to 6% of total revenues. While this policy on petroleum production profits was a major step in the right direction, it remained to be demonstrated at the time of appraisal whether the Government would in fact increase prices sufficiently and in a timely manner given the experience during the 1978-1980 period when prices were not adjusted sufficiently to reflect increases in costs. The Bank's financial appraisal of the project and of TPB further indicated that because most of its oil fields have been in production for over 20 years and have passed their peak productive years, TPB's oil production costs would continuously increase as it resorts to more capital and energy intensive secondary and tertiary oil recovery techniques. The investments required for these more capital intensive drilling, as well as enhanced recovery techniques, would also be very substantial. Thus, in the context of the project, it

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<sup>1/</sup> The Romanian financial system uses the concept of "benefits," which corresponds to operating profit before interest expenses, as a measure of profitability. Since 1979, a value-added tax replaced the profit tax but the petroleum industry was exempted from this charge.

was agreed to set minimum financial performance objectives for TPB. These were: (a) that TPB would earn reasonable annual benefits (i.e., profits before interest) equivalent to at least 7.5% of oil production costs; and (b) that TPB would finance a substantial portion (i.e., at least 30%) of its annual investment program from internally generated cash after provisions for debt service and benefit distributions. For TPB to comply with these undertakings, it was forecasted that the Government would have to progressively raise the price TPB received for its oil by a total of about 60% (in current terms) between 1981 (Lei 483/ton) and 1986 (Lei 776/ton) and another 9% in 1987 (Lei 847/ton).

5.02 TPB has complied with all the financial covenants, including the submission of audited accounts and other reports. In particular, TPB exceeded the minimum financial objectives during the period 1982-1986. During this period, the actual benefits averaged 10.3% of the cost of petroleum operations, compared with the minimum of 7.5% assumed in the SAR. Likewise, the actual self-financing rates averaged 41% of the investments, compared to the 38% estimated in the SAR and a minimum ratio of 30% agreed during negotiations. This satisfactory financial performance is mainly due to three factors: (a) the Government increased the price received by TPB for crude oil by a total of about 68% between 1981 and 1986; on average the price increases were about 5% higher than the SAR forecasts; (b) the service or non-petroleum activities of TPB earned benefits (i.e., profits) averaging 6% of the corresponding costs compared to the SAR assumption that revenues from such activities would, as mentioned earlier, incur a 5% loss (i.e., only cover about 95% of the costs) reflecting additional employee benefits; and (c) TPB produced about 6% more crude oil than estimated during appraisal because higher production from other oil fields made up for the lower production from the Videle and Balaria oil fields caused by the delay in project implementation. The financial annexes contain details for the income statement (Annex 8), cash flow statement (Annex 9), balance sheet (Annex 10) and the production cost structure (Annexes 11 and 12) of TPB and the Videle enterprise respectively. The revised incremental production cost structure of the project is given in Annex 13. It is shown that the average financial production cost of the Videle enterprise when full output is achieved in 1989 would be about Lei 768 per ton in current terms compared to Lei 732 per ton estimated in the SAR for 1986 when the corresponding full output was expected. A summary of the actual annual financial results for 1982-1986, together with a comparison between the SAR estimates for the entire five-year period is shown below.

**TPB FINANCIAL PERFORMANCE**  
(IN MILLION CURRENT LEI)

	Actual					Cumulative (Total) 1982-1986		
	1982	1983	1984	1985	1986	SAR Est.	Actual	% Diff.
	Crude Oil Sales (1,000 Tons)	2,908	2,936	2,886	2,670	2,448	13,056	13,848
Crude Oil Price (Lei/Ton)	582	562	709	691	814	642 <u>a/</u>	+672 <u>a/</u>	+5%
Petroleum Revenues <u>b/</u>	1,780	1,753	2,202	2,079	2,188	8,710	10,002	+15%
Non-Petroleum Revenues	<u>1,302</u>	<u>1,674</u>	<u>1,865</u>	<u>1,843</u>	<u>1,658</u>	<u>4,718</u>	<u>8,342</u>	+77%
Total Revenues	3,082	3,427	4,067	3,922	3,846	13,428	18,344	+37%
Cost of Petroleum Operations	1,580	1,776	1,952	2,004	2,217	7,869	9,529	+21%
Cost of Non-Oil Activities	<u>1,334</u>	<u>1,601</u>	<u>1,874</u>	<u>1,660</u>	<u>1,358</u>	<u>4,968</u>	<u>7,827</u>	+28%
Total Operating Costs	2,914	3,377	3,826	3,664	3,575	12,837	17,356	+35%
Benefits <u>c/</u>	168	50	241	258	271	591	988	+67%
Internal Cash Generation <u>d/</u>	865	986	1,424	1,640	1,570	5,121	6,485	+27%
Debt Service	NA	211	261	395	574	756 <u>f/</u>	1,441 <u>f/</u>	+90%
Investments	NA	2,343	2,192	2,630	1,963	8,700 <u>f/</u>	9,328 <u>f/</u>	+7%
Benefits as % of Cost of Petroleum Operations	10.6	2.8	12.3	12.9	12.2	7.5	10.3	+37%
% Self-Financing <u>e/</u>	NA	31	44	40	51	38 <u>f/</u>	41 <u>f/</u>	+8%

a/ Annual average for 1982-1986.

b/ Sales of crude oil, natural gasoline and natural gas.

c/ Benefits (i.e., profits) before interest expense.

d/ Benefits plus depreciation and reserve discovery charges (before debt service payments).

e/ Internal cash generation less debt service and benefit distribution as a percentage of fixed investments and increases in net working capital.

f/ Cumulative for 1983-1986 only.

5.03 As noted in the SAR, TPB does not pay oil production royalties nor income taxes. Thus, the price it receives for crude oil (equivalent to about US\$6.50/Bbl in 1986) is not comparable to the international price of crude oil of which typically anywhere from 40% to 70% is accounted for by royalties, taxes and government share. In addition, TPB does not undertake petroleum exploration, the most risky activity in the sector, but develops fields discovered by other specialized exploration enterprises funded by the Government. Thus, TPB's profitability or return on investments, given the relatively lower risk of its production operations, need not contain a "risk" premium and can be lower than the rates for typical international oil exploration and production companies. In this context, and in light of the operating losses incurred by TPB during the years preceding the project appraisal (i.e., 1979 and 1980) as well as its other projected large

investments for enhanced oil recovery in the future (i.e., 1982-1987), the minimum financial performance objectives established under the project, as well as the actual results, were reasonable and satisfactory.

## VI. INSTITUTIONAL PERFORMANCE AND DEVELOPMENT

### Background

6.01 The petroleum industry in Romania is among the oldest in the world and has a long-standing reputation for being well-organized and self-reliant. The Ministry of Petroleum is responsible for the overall direction and coordination of the sundry activities in the petroleum sector under its purview. Actual operations are carried out by a network of trusts and enterprises organized along regional and functional lines. The main elements in the network are the six oil drilling and extraction trusts of which TPB is the one responsible for oil development and production (along with various ancillary operations and services) in the southwest region of Romania.

### Organization and Performance

6.02 TPB is organized into seven semi-autonomous operating divisions, also known as enterprises, and a headquarters group which performs the necessary support and coordination functions. Its annual investment and operating budget is subject to ministerial approval in the context of the Government's Five-Year and Annual Plans. The top decision making power within TPB rests with the Working People's Council which has 25 members representing management and labor unions and which includes the director of the Trust who reports to a deputy minister in the Ministry of Petroleum. A People's Executive Board chaired by the director and made up of 7 to 9 members picked from the Council manages the Trust's operations.

6.03 TPB and its operating divisions and the other organizations which assisted in carrying out the project are staffed with experienced and capable individuals. Project management and coordination was assigned to a team of senior level staff from these organizations, the Ministry and ICPPG, and the project activities came under periodic review by a high-level interministerial committee and the Minister of Petroleum who took an active interest in the project. Despite this strong, well-organized back-up, TPB fell three years short of meeting the end-1986 incremental oil production goal. The cause of this shortfall is not due to any lack of experience or technical short-coming; it is mainly due to two essentially interrelated institutional weaknesses. The first is to the propensity to use exclusively Romanian equipment and technology to avoid imports and reliance on foreign technology. This predilection led to a project design based on air compressors of Romanian manufacture with a protracted delivery schedule and which by virtue of their numbers required a lengthy installation period. Then secondly, having no options on compressors, it was natural not to devote time to the kind of comprehensive studies and planning for the overall project design that went into the in situ combustion design. For example, there was no investment study to analyze the costs and benefits associated with the various possible project design scenarios. Any future Bank lending operation in the petroleum sector should focus on rectifying the institutional constraints responsible for the project preparation and implementation experienced with this project.

### Training

6.04 The project did not include provisions for training because it was felt to be redundant considering the Romanian oil industry's experience and expertise which was on a par with any in the world in this field. However, Romania has not kept pace with the international oil industry in offshore exploration and production and in deep drilling technology. Any future Bank lending operation in the petroleum sector should address this technology transfer issue along with the project preparation and implementation weaknesses demonstrated in this project, and include appropriate training and technology transfer provisions.

### Loan Covenants

6.05 TPB complied fully with the conditions of the Loan Agreement. Although not a loan condition, the Government and IB did confirm during negotiations that cofinancing of the project would be sought; however, no cofinancing arrangements were entered into because of adverse capital market conditions and other unfavorable conditions (para. 3.08).

## VII. ECONOMIC REEVALUATION

7.01 The economic reevaluation of the project follows the same methodology as was used in the SAR. The economic costs and benefits, expressed in constant 1981 US dollar terms, are on an incremental basis using actual costs and benefits realized during 1982-1986 and revised estimates from 1987 onwards. The details are discussed in Annex 15. The economic rate of return (ERR) of the project is now revised at 13% compared to the 29% estimated in the SAR. This revised ERR is still satisfactory. The lower return is mostly due to the sharp decline, in real terms, in international oil prices and to a lesser extent to the higher production cost, as well as to the three-year delay in achieving the full incremental production. These adverse developments were slightly offset by a 11% lower actual economic capital cost (US\$332 million) compared to the SAR estimates (US\$371 million). Whereas the SAR assumed (base case) that the economic value of the crude oil produced by the project would be about US\$221 per ton (in 1981 terms based on an international crude oil price of US\$34/Bbl)<sup>1/</sup> throughout the project life, the actual (1982-1986) and revised forecast or assumed values (1987-2009) show a trend declining from US\$196 per ton in 1982 to a low of US\$79 per ton in 1986, temporarily rising to US\$99 per ton in 1987 and again falling to US\$92 per ton by 1989 before gradually rising again to about US\$163 per ton by the year 2000 and remaining at that level through the end of the project economic life (2009). The incremental economic production cost (before provisions for capital charges or recovery) has been revised upwards and now reestimated at about US\$9.87 per ton (US\$1.47/Bbl) compared to the SAR estimate of US\$5.06 per ton (US\$0.76/Bbl). This increase is due primarily to higher labor, chemicals and other input requirements, as well as the real increases in the economic costs of these inputs.

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<sup>1/</sup> See Annex 15, page 2, footnote "a" for the basis for projecting crude oil prices for the economic reevaluation.

## VIII. PERFORMANCE AND ROLE OF THE BANK

8.01 A cooperative working relationship was maintained throughout the project cycle by Bank staff and IB, TPB and Government officials. These officials confirmed that complying with Bank procedures and requirements created no problems of any consequence in carrying out the project. Bank staff undertook seven supervision missions between May 1982 and October 1986. These missions along with the timely progress reports submitted by the borrower were adequate for the effective supervision of the project.

8.02 In addition to providing funds needed for accelerating the EOR program, an important contribution considering the rapid production decline taking place in Romania's oil fields, the Bank participated in the technical preparation of the project. The Romanian petroleum industry was among the first in the world to experiment with and commercialize the in situ combustion type EOR process. Nevertheless, the Bank correctly insisted that it was prudent to have an outside party study the project especially in view of the fact that the project represented the largest application of the in situ combustion process in the world and entailed a significant technical risk. Accordingly, the Bank engaged a consortium of EOR experts<sup>1/</sup> to review the project design and expected production gains, as well as the monitoring system for the combustion front and its effluents for operational and environmental protection purposes. The experts agreed with the project concept and the design parameters, and they made a number of useful recommendations regarding the phasing of the fireflooding of the Videle reservoirs, the number and configuration of injection and production wells and the combustion monitoring scheme. These recommendations were subsequently incorporated in the EOR program.

8.03 A Bank engineering panel reviewed the final project design:

- (a) the choice of technology (in situ combustion) and basic design parameters;
- (b) the reservoir data requirements;
- (c) the combustion monitoring arrangements; and
- (d) the investment phasing.

Except for recommending additional and better data acquisition through well coring and logging during implementation, the panel found the project acceptable with regard to these points. This recommendation was subsequently included as a covenant in the loan agreement.

8.04 On the choice of equipment, the Bank engineering panel noted that basing the air injection facilities on an exceptionally large number (22 per compressor station and a total of 5 stations) of relatively small compressors was contrary to Western practices of taking advantage of the economy of scale principle. On the other hand, the panel accepted the fact that the Romanian

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<sup>1/</sup> A Canadian research institution in cooperation with ROMPETROL, the Romanian enterprise for international cooperation in the oil and gas industry.

injection design had the merit of being a tested working design familiar to Romanian technical, operating and maintenance personnel and had the advantage of ready access to spare parts and established maintenance services since the compressors were of Romanian manufacture. These considerations along with the fact that the Bank loan could not cover the total cost of the compression equipment which was consequently entirely excluded from Bank financing, caused the panel to conclude that the Romanian choice of compressors was acceptable. Also, reinforcing this conclusion was the fact that it was of utmost importance to initiate the EOR program as soon as possible because of the rapidly declining production in the Videle and Balaria fields. It was felt that any delays in developing a different air injection system could not be justified because of the consequent production loss that would be incurred. However, it appears in retrospect that an optimization study of the air injection system would probably not have added significantly to the implementation delays actually experienced and might have developed a more efficient and cost effective air compressor installation not necessarily of Romanian manufacture.

8.05 The Bank's rationale for participating in the project was to help improve the quality and efficiency of project preparation and implementation activities. Although generally successful in this area, events have shown that the Bank should have opted for financing the air compression equipment instead of the standard oil field items actually selected, even if it required increasing the loan amount. It can be seen now that such an allocation of the Bank loan was particularly important in the absence of an optimization study of the air injection system because the Bank's international competitive bidding requirements would have provided cost, operating, delivery and other essential data on air compressor systems internationally available. It is possible that the Romanian air compressors would still have turned out to be the best selection because of price, spare parts and other considerations. However, not having investigated the international market, it is impossible to know whether an opportunity was missed to install a better air injection system at less cost.

## IX. CONCLUSIONS

9.01 Results of the Balaria and Videle EOR operations indicate that the ultimate oil recovery target of 39% of the oil initially in place will be achieved, and in fact, the recovery could be as high as 42%. These results strongly support the conclusion that the project objective of recovering 731,000 tons per year of incremental oil over a 20-year period can be realized. However, the long implementation period coupled with the fall in international crude oil prices and higher than forecasted production costs have reduced the economic rate of return to 13% which is still satisfactory but falls short of the 29% return projected at appraisal.

9.02 The minimum financial performance objectives established for TPB under the project were justified and have proved to be successful. As a result of the increased crude oil price it now receives from the Government, TPB has exceeded these objectives and is now in a much better financial position to carry out future EOR operations.

9.03 The project demonstrated that the EOR technique based on in situ combustion is highly effective and efficient in recovering oil which might

otherwise be abandoned in the reservoir. However, intensive study, tests and pilot operations are required to assure that the EOR process to be applied is the correct one for the specific reservoir under consideration. In this regard, preparation of the Videle/Balaria EOR program was excellent and could be used as a model for similar applications elsewhere, possibly with the assistance of the Romanian oil industry which is an internationally recognized leader in EOR technology, especially where in situ combustion is involved.

9.04 The project also demonstrated that economic considerations are as important as the technological factors in preparing an EOR investment. This fact was amply emphasized by the sharp drop in crude oil prices, especially in the first part of 1986, which essentially wiped out new EOR investments everywhere. Since then, crude oil prices have recovered considerably and reestablished the economic viability of the project. However, considering the magnitude of the investments required for EOR projects, the need to pay particular attention to the economics of these projects is still valid.

9.05 As a corollary to the conclusions discussed above, it can be observed that in contrast to the thorough and detailed preparation devoted to the reservoir aspects of the EOR program, relatively less of an effort went into preparing the rest of the project, as for instance, the surface facilities which include the heart of the in situ process, the air supply system, and an analysis of the economic costs and benefits associated with the possible alternative arrangements. Although the EOR facilities actually installed undoubtedly meet the design parameters established for the project, there is no basis for concluding that they satisfy the least cost criteria for the project from the standpoint of overall costs and benefits.

9.06 To complement its high degree of technical expertise in EOR processes, TPB, and the Romanian oil industry in general, need to correct three institutional weaknesses brought to light by the project:

- (a) to stop relying exclusively on Romanian equipment and technology; this is particularly important in the areas of offshore petroleum activities and deep drilling where the Romanian oil industry has not kept up with developments in the international oil industry;
- (b) to strengthen its project preparation performance, particularly with regard to the analytical studies required to develop an optimum project design aimed at achieving the maximum benefits from the project at least cost in economic terms; and
- (c) to strengthen its project implementation performance by developing the project management arrangements necessary for planning and executing a project expeditiously and in accordance with an implementation schedule to be strictly adhered to.

9.07 The Bank should select items to be financed from its future loans with the view to promote the introduction of more efficient technology and provide an opportunity to assist in achieving optimum design and operational objectives.

**9.08** Any future Bank lending operation in the Romanian petroleum sector should address the weaknesses discussed above. A rationale for such lending would be the beneficial changes and improvements in these areas which the Bank could effect by its participation.

ROMANIA  
 VIDELE BALARIA BOR PROJECT  
 PROJECT COMPLETION REPORT

PROJECT COSTS

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 (In Billion Lei) [1]

	[2]			----- VARIANCE (ACTUAL vs. APPRAISAL) -----			----- In Billion Lei -----			----- (%) -----		
	----- APPRAISAL ESTIMATE -----			----- ACTUAL -----			-----			-----		
	Local Currency	Foreign Exchange	Total	Local Currency	Foreign Exchange	Total	Local Currency	Foreign Exchange	Total	Local Currency	Foreign Exchange	Total
Design, Eng'g & Supervision	0.25	0.00	0.25	0.73		0.73	0.48		0.48	192%		192%
Land Development & Roads	0.37	0.01	0.38	0.07		0.07	-0.30	-0.01	-0.31	-81%	-100%	-82%
Well Drilling	0.91	0.98	1.89	0.99	1.10	2.09	0.08	0.12	0.20	9%	12%	11%
Well Completion & Hook-Up	0.65	0.38	1.03	0.33	0.37	0.70	-0.32	-0.01	-0.33	-49%	-3%	-32%
Compressed Air Supply	1.47	0.74	2.21	1.00	0.22	1.22	-0.47	-0.52	-0.99	-32%	-71%	-45%
Other Facilities	0.63	0.23	0.86	0.71	0.28	0.99	0.08	0.05	0.13	12%	24%	15%
<b>Total Project Costs</b>	<b>4.28</b>	<b>2.34</b>	<b>6.62</b>	<b>3.83</b>	<b>1.97</b>	<b>5.80</b>	<b>-0.45</b>	<b>-0.37</b>	<b>-0.82</b>	<b>-11%</b>	<b>-16%</b>	<b>-12%</b>

[1] Costs are given in lei since foreign expenditure is recorded in lei.

[2] Physical and price contingencies have been prorated to each item.

## ROMANIA

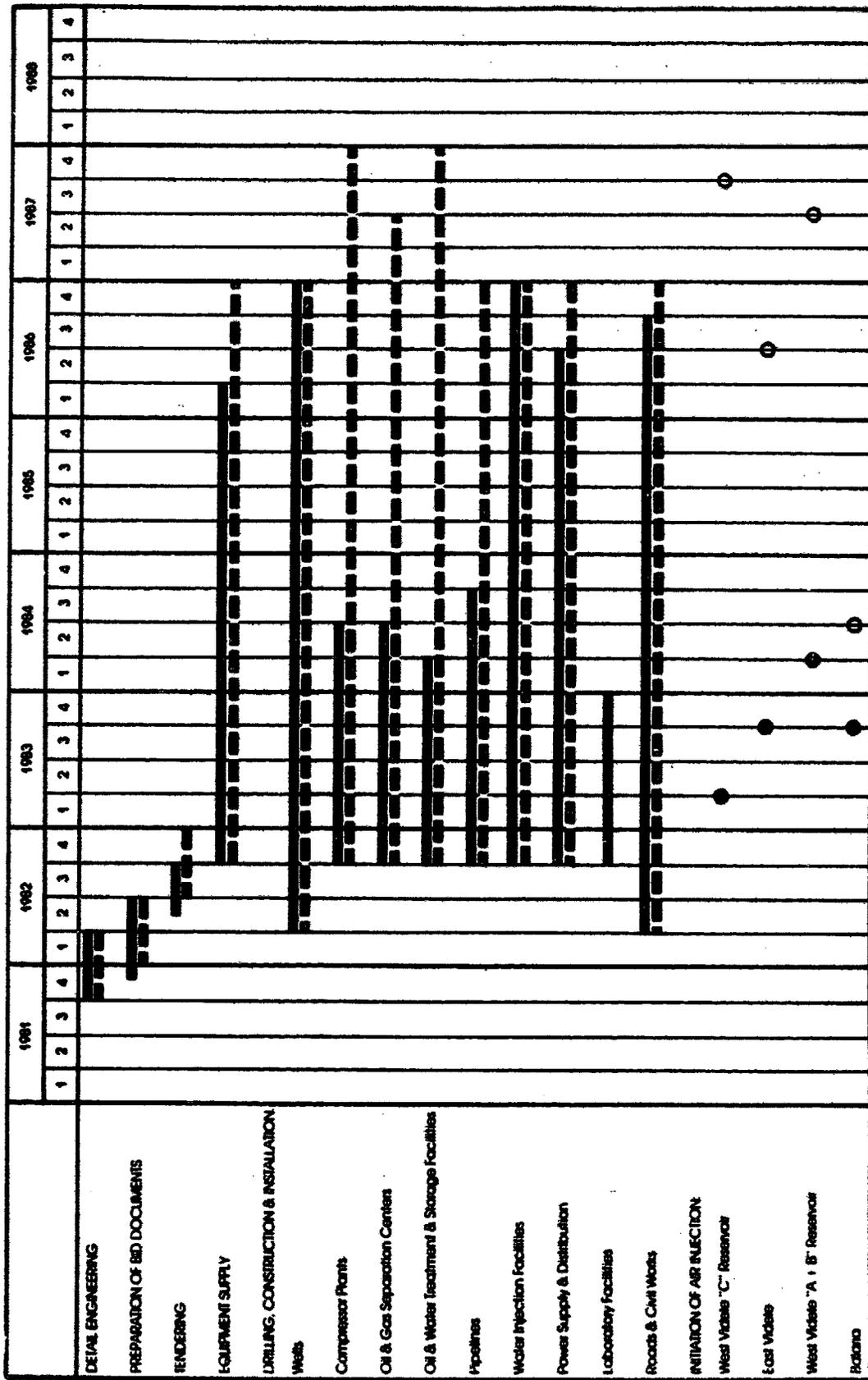
## VIDELE BALARIA EOR PROJECT

## PROJECT COSTS - YEARWISE EXPENDITURE

(In Million Lei)

	1982		1983		1984		1985		1986		1987		TOTAL		
	L.C.	F.E.	L.C.	F.E.	L.C.	F.E.	L.C.	F.E.	L.C.	F.E.	L.C.	F.E.	L.C.	F.E.	Total
WELL DRILLING & COMPLETION	24.0	130.0	57.0	719.0	73.0	826.0	750.0		599.0				1503.0	1675.0	3178.0
COMPRESSOR STATIONS & AIR PIPING	20.0		353.0		110.0	121.0	233.0	132.0	282.9		183.1		1182.0	253.0	1435.0
GAS FEEDING			20.0		17.0	1.0	16.0		14.0				67.0	1.0	68.0
OIL SEPERATION CENTRES	20.0		135.0		120.0	12.0	116.0	14.0	108.0		17.0		516.0	26.0	542.0
OIL STORAGE & TREATMENT CENTER	8.0		20.0		17.0	1.0	17.0	2.0	17.0				79.0	3.0	82.0
WASTE OIL & SALT WATER DISPOSAL	10.0		51.0		51.0	1.0	47.0	3.0	32.0		13.0		204.0	4.0	208.0
ELECTRICAL SUPPLY			19.0		19.0	3.0	13.0	5.0	9.0		10.0		70.0	8.0	78.0
WATER INJECTION FACILITIES	4.0		22.0		20.0		19.0	2.0	18.0		3.0		86.0	2.0	88.0
LAND & ROADS			19.0		21.0		20.0		1.0		15.0		76.0	0.0	76.0
OTHER WORKS	1.0		15.0		10.0		11.0		8.1		2.0		47.1	0.0	47.1
<b>TOTAL COSTS</b>	<b>87.0</b>	<b>130.0</b>	<b>711.0</b>	<b>719.0</b>	<b>458.0</b>	<b>965.0</b>	<b>1242.0</b>	<b>158.0</b>	<b>1089.0</b>	<b>0.0</b>	<b>243.1</b>	<b>0.0</b>	<b>3830.1</b>	<b>1972.0</b>	<b>5802.1</b>
<b>INTEREST DURING CONSTRUCTION</b>		<b>23.2</b>		<b>102.3</b>		<b>214.5</b>		<b>195.9</b>		<b>227.5</b>		<b>191.5</b>	<b>0.0</b>	<b>954.9</b>	<b>954.9</b>
<b>TOTAL</b>	<b>87.0</b>	<b>153.2</b>	<b>711.0</b>	<b>821.3</b>	<b>458.0</b>	<b>1179.5</b>	<b>1242.0</b>	<b>353.9</b>	<b>1089.0</b>	<b>227.5</b>	<b>243.1</b>	<b>191.5</b>	<b>3830.1</b>	<b>2926.9</b>	<b>6757.0</b>

ROMANIA  
 VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT  
 Implementation Schedule  
 (Appraisal vs Actual)



Planned at Appraisal  
 Actual Achievement  
 Planned at Appraisal  
 Actual

ROMANIA

VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT

PROJECT COMPLETION REPORT

ENHANCED OIL RECOVERY (EOR)

1. Oil reservoirs are initially produced using their latent energy in the form of oil, gas and water expansion and reservoir rock compaction. Depending on reservoir properties, the final oil recovery obtainable by this technique (primary recovery) may be as high as 45% of the oil initially in place (OIIP). However, in most cases, it is rather low, being on the order of 15%-30%.

2. In most reservoirs, the ultimate oil recovery can be increased by the use of the so-called enhanced oil recovery techniques (EOR). EOR techniques essentially consist of introducing extraneous energy into oil reservoirs in order to extract more of the oil in place. The simplest and oldest EOR techniques are waterflooding and gas injection (secondary recovery) in which additional energy is introduced into the reservoir in the form of injected water and gas, respectively. Being the least expensive EOR techniques, water and gas injection are usually the first to be considered towards the end of the primary producing life of an oil reservoir. The additional oil production from these simple and inexpensive secondary oil recovery techniques would range from 5% to 20% of the OIIP.

3. The ultimate recovery of oil can be further increased by the application of more advanced EOR techniques designed either to improve the performance of water and gas injection where they are applicable or to supplant them where they are not applicable, such as heavy oil reservoirs. As such, they can be classified as both secondary (coming immediately after primary) and tertiary (coming after secondary) recovery mechanisms. Advanced EOR methods which are generally accepted as proven by the petroleum industry can be divided into three groups: (i) improved waterflooding, (ii) miscible displacement and (iii) thermal oil recovery. In improved waterflooding, the efficiency of oil displacement by the injected water is enhanced by the injection of chemicals (surfactants), viscous solutions (polymers) or microemulsions of oil and water (micellar solutions) to achieve higher oil recovery. Miscible displacement achieves the same goal by injecting into the reservoir substances that are miscible in both the displaced oil and the displacing fluid, normally a gas. Carbon dioxide, high-pressure natural gas, enriched natural gas, LPG and solvents are the most widely used miscibility agents. In thermal EOR techniques, extraneous energy is introduced into the reservoir as heat in the form of either surface-generated steam (cyclic or

continuous steam injection) or high-pressure air which burns part of the reservoir oil (in situ combustion).

4. Although they are rather simple in concept, advanced EOR techniques involve many physical and chemical phenomena which are not yet well understood; have widely differing conditions of applicability; are expensive and difficult to implement and monitor; and require extensive pilot-scale testing before full-scale field application.

ROMANIA

VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT

PROJECT COMPLETION REPORT

PRODUCTION PERFORMANCE

	<u>Videle</u>		<u>Balaria</u>		<u>Total Field</u>	
	<u>Mid-1981</u>	<u>End-1986</u>	<u>Mid-1981</u>	<u>End-1986</u>	<u>Mid-1981</u>	<u>End-1986</u>
Number of Wells on Production	660	486	60	387	720	873
Daily Oil Production	959	729	162	543	1,121	1,272
Average Well Productivity (ton/day/well)	1.45	3.55	2.70	1.4	1.56	1.45
Average Water Cut, %	96.9	98.0	84.6	92.1	96.5	96.7
No. of Air Injection Wells in Operation	--	30	--	29	--	59
No. of Water Injection Wells	--	172	--	9	--	81
Avg. Air/Oil Ratio Nm <sup>3</sup> /Ton		3,026		2,950		

ROMANIA

VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT

PROJECT COMPLETION REPORT

OIL PRODUCTION TO BE ACHIEVED WITH AND WITHOUT THE PROJECT  
( '000 TONS/YEAR)

	<u>Appraisal Estimates</u>			<u>Actual</u>			<u>Forecast</u>		
	<u>Incre- mental</u>	<u>Without Project</u>	<u>Total</u>	<u>Incre- mental</u>	<u>Without Project</u>	<u>Total</u>	<u>Incre- mental</u>	<u>Without Project</u>	<u>Total</u>
1982	9	400	409	18	373	391	--	--	--
1983	16	351	367	24	321	345	--	--	--
1984	50	304	354	33	281	314	--	--	--
1985	395	264	659	67	235	302	--	--	--
1986	731	229	960	101	187	288	--	--	--
1987	731	201	932	--	--	--	206	157	363
1988	731	177	908	--	--	--	422	132	554
1989	731	156	887	--	--	--	731	116	847
1990	731	138	869	--	--	--	731	102	833

ROMANIA

VIDELE/PALARIA ENHANCED OIL RECOVERY PROJECT

PROJECT COMPLETION REPORT

SCHEDULE OF DISBURSEMENTS

<u>Fiscal Year and Quarter</u>		<u>Appraisal Estimate</u>	<u>Actual</u>	<u>Actual/Appraisal (%)</u>
1982	III	3.4	--	0
	IV	7.9	35.1	444
1983	I	34.3	50.6	147.5
	II	46.0	64.2	139.6
	III	57.0	64.2	112.6
	IV	67.0	89.3	133.2
1984	I	76.0	91.9	120.9
	II	83.4	95.2	114.1
	III	88.7	98.7	111.1
	IV	91.5	101.5	110.9
1985	I	95.1	--	--
	II	96.9	--	--
	III	97.9	--	--
	IV	98.7	--	--
1986	I	99.7	--	--
	II	<u>101.5</u>	<u>--</u>	<u>--</u>
<b>TOTAL</b>		<u>101.5</u>	<u>101.5</u>	

## ROMANIA

## VIDELE-BALARIA ENHANCED OIL RECOVERY PROJECT

## INCOME STATEMENTS

(In Million Lei)

	1982		1983		1984		1985		1986	
	Actual	Appraisal								
<b>Sales Quantity</b>										
Crude Oil (000 tons)	2908.0	2970.0	2936.0	2695.0	2886.0	2515.0	2670.0	2145.0	2483.0	2531.0
Natural Gasoline (000 tons)	0.6	1.8	0.7	1.7	0.8	1.6	0.5	1.4	0.2	1.4
Natural Gas (mmcm)	329.0	355.0	365.0	345.0	358.0	345.0	406.0	345.0	360.0	345.0
<b>Sales Revenue</b>										
Crude Oil	1,693	1,486	1,649	1,551	2,045	1,562	1,845	1,664	2,020	1,965
Natural Gasoline	1	3	1	3	1	3	1	3	1	3
Natural Gas	44	30	65	32	82	34	83	35	59	37
Others (oil-related)	42	45	38	52	74	61	150	69	108	76
Subtotal (oil activity)	1,780	1,563	1,753	1,637	2,202	1,659	2,079	1,770	2,188	2,080
Non-Oil Activity Revenue	1,302	856	1,674	897	1,865	909	1,843	989	1,658	1,067
Total Revenue	3,082	2,419	3,427	2,534	4,067	2,568	3,922	2,759	3,846	3,148
<b>Production Costs</b>										
<b>Oil Activity</b>										
Variable Costs	969	628	909	645	1,028	659	939	585	1,171	592
Fixed Costs	611	83	103	91	20	96	47	102	122	109
Depreciation		400	482	471	615	491	756	679	739	935
Reserve Discovery Charge		297	282	270	289	252	262	235	185	253
Subtotal	1,580	1,407	1,776	1,476	1,952	1,497	2,004	1,600	2,217	1,889
<b>Non-Oil Activity</b>										
Depreciation		50	71	50	89	50	109	50	134	50
Others	1,334	856	1,530	897	1,785	909	1,551	989	1,224	1,067
Subtotal	1,334	906	1,601	947	1,874	959	1,660	1,039	1,358	1,117
Total Costs	2,914	2,313	3,377	2,423	3,826	2,456	3,664	2,639	3,575	3,006
Benefits	168	106	50	111	241	112	258	120	271	142
Operating Ratio	0.95	0.96	0.99	0.96	0.94	0.96	0.93	0.96	0.93	0.95

ROMANIA

VIDELE-SALARIA ENHANCED OIL RECOVERY PROJECT

SOURCES AND USES OF FUNDS

(In Million Lei)

SOURCES	1983		1984		1985		1986	
	Actual	Appraisal	Actual	Appraisal	Actual	Appraisal	Actual	Appraisal
Benefits Before Interest	130.7	110.7	431.4	112.3	513.2	120.0	511.5	141.7
Add: Depreciation on Productive Assets	482.0	471.0	615.0	491.0	756.0	678.5	739.0	933.2
Other Depreciation	71.0	50.0	89.0	50.0	109.0	50.0	134.0	50.0
Reserve Discovery Charge	282.0	269.5	289.0	231.5	262.0	234.5	185.0	253.1
Internal Cash Generation	985.7	901.2	1424.4	904.8	1640.2	1083.0	1369.5	1380.0
Loan Drawings - IBRD	1043.7	886.3	251.0	367.5	0.0	108.0	0.0	42.0
- IB	277.0	3.0	139.0	4.0	256.5	5.0	99.0	5.0
State Budget Funds	319.0	513.3	728.0	1101.2	1605.0	1496.9	942.0	841.2
Sale of Scrap and Obsolete Assets	14.0	3.0	14.0	3.0	5.0	4.0	5.0	4.0
Increase in Working Capital	112.2	0.0	121.4	0.0	0.0	0.0	0.0	0.0
<b>Total Sources</b>	<b>2753.6</b>	<b>2307.0</b>	<b>2697.8</b>	<b>2380.5</b>	<b>3506.7</b>	<b>2696.9</b>	<b>2615.5</b>	<b>2272.2</b>
<b>USES</b>								
Investments								
Investments for Project	1248.0	1751.9	632.0	1357.3	884.0	752.6	454.0	732.2
Other Investments	1295.0	448.1	1560.0	842.7	1946.0	1647.4	1509.0	1167.8
Debt Service								
Interest on IBRD Loan	99.0	73.3	175.0	145.3	241.5	169.5	227.5	169.6
Interest on Other Loans	1.7	1.7	15.4	1.9	13.7	2.0	13.0	2.3
Repayment of IBRD Loan	0.0		46.8		74.3	63.0	281.2	126.0
Repayment of Other Loans	109.9		43.6		65.7		51.8	1.2
<b>Total Debt Service</b>	<b>210.6</b>	<b>75.2</b>	<b>280.8</b>	<b>147.4</b>	<b>395.2</b>	<b>234.5</b>	<b>573.5</b>	<b>299.1</b>
Remittance to State Budget	-	11.1	225.0	11.2	-	12.0	-	14.2
Decrease in Working Capital	0.0	20.7	0.0	21.9	281.5	50.4	79.0	58.9
<b>Total Uses</b>	<b>2753.6</b>	<b>2307.0</b>	<b>2697.8</b>	<b>2380.5</b>	<b>3506.7</b>	<b>2696.9</b>	<b>2615.5</b>	<b>2272.2</b>
Debt Service Coverage	4.68	11.98	5.07	6.14	4.15	4.62	2.74	4.61

## ROMANIA

## VIDELE-BALARIA ENHANCED OIL RECOVERY PROJECT

## BALANCE SHEET

(In Million Lei)

ASSETS	1982		1983		1984		1985		1986	
	Actual	Appraisal	Actual	Appraisal	Actual	Appraisal	Actual	Appraisal	Actual	Appraisal
<b>Current Assets</b>										
Cash and Accounts Receivable	161.5	70.0	154.2	70.0	141.4	70.0	190.2	70.0	256.7	70.0
Inventories and Prepaid Items	134.1	156.2	280.2	167.4	221.0	180.2	271.7	193.7	278.7	263.1
Other Current Assets	2.0	10.0	81.0	10.0	38.5	10.0	53.9	10.0	49.8	10.0
<b>Total Current Assets</b>	<b>297.6</b>	<b>236.2</b>	<b>515.4</b>	<b>247.4</b>	<b>400.9</b>	<b>260.2</b>	<b>515.8</b>	<b>273.7</b>	<b>585.2</b>	<b>343.1</b>
<b>Fixed Assets in Operation</b>										
Gross Fixed Assets	9584.7	8910.0	10981.0	10102.0	12737.2	10695.0	14884.8	13741.2	17236.8	17451.0
Less: Accumulated Depreciation	4680.1	4053.0	5292.0	4517.0	5962.4	4970.0	6735.4	5583.5	7537.9	6266.1
<b>Net Fixed Assets</b>	<b>4904.6</b>	<b>4857.0</b>	<b>5689.0</b>	<b>5585.0</b>	<b>6774.8</b>	<b>5725.0</b>	<b>8149.4</b>	<b>8157.7</b>	<b>9698.9</b>	<b>11184.9</b>
Investment Under Construction	1484.3	1907.9	3011.9	2879.8	3776.4	4452.1	7619.5	3757.5	8307.8	1899.9
Other Assets	177.3	23.1	113.1	26.4	258.6	29.7	306.7	33.3	294.5	37.5
<b>Total Assets</b>	<b>6863.8</b>	<b>7024.2</b>	<b>9329.4</b>	<b>8738.6</b>	<b>11210.7</b>	<b>10467.0</b>	<b>16591.4</b>	<b>12222.2</b>	<b>18886.4</b>	<b>13465.4</b>
<b>LIABILITIES</b>										
<b>Current Liabilities</b>										
Current Portion of L/T Liabilities						63.0		127.2		127.2
Short-term Loans	132.6	80.9	231.8	84.3	117.9	88.1	266.8	92.1	265.2	112.9
Supplier Credits and Payables	154.8	73.1	324.7	74.2	275.3	75.5	267.2	76.9	312.3	83.8
<b>Total Current Liabilities</b>	<b>287.4</b>	<b>154.0</b>	<b>556.5</b>	<b>158.5</b>	<b>393.2</b>	<b>226.6</b>	<b>534.0</b>	<b>296.2</b>	<b>577.5</b>	<b>323.9</b>
<b>Long-Term Liabilities</b>										
IBRD Subsidiary Loan	526.6	118.5	1572.3	1005.0	1776.5	1309.5	1702.2	1291.5	1421.0	1207.5
Others	110.8	2.0	277.9	5.0	393.3	9.0	584.1	12.8	631.3	16.6
<b>Total Long-Term Liabilities</b>	<b>637.4</b>	<b>120.5</b>	<b>1850.2</b>	<b>1010.0</b>	<b>2169.8</b>	<b>1318.5</b>	<b>2286.3</b>	<b>1304.3</b>	<b>2052.3</b>	<b>1224.1</b>
Long-Term Funds (i.e. Equity)	5939.0	6749.7	6922.7	7570.1	8647.7	8921.9	13771.1	10621.7	16256.6	11917.4
<b>Total Liabilities</b>	<b>6863.8</b>	<b>7024.2</b>	<b>9329.4</b>	<b>8738.6</b>	<b>11210.7</b>	<b>10467.0</b>	<b>16591.4</b>	<b>12222.2</b>	<b>18886.4</b>	<b>13465.4</b>
Current Ratio	1.0	1.5	0.9	1.6	1.0	1.6	1.0	1.6	1.0	1.7
Debt-Equity Ratio	10/90	2/98	21/79	12/88	20/80	13/87	14/86	12/88	11/89	10/90

VIDELE-BALARIA ENHANCED OIL RECOVERY PROJECT

FINANCIAL UNIT PRODUCTION COST STRUCTURE OF OIL EXTRACTION ACTIVITY

(in Current Lei)

	1986 ACTUAL			1986 APPRAISAL		
	UNITS OF INPUT/TON OF CRUDE	LEI/ UNIT OF INPUT	LEI/ TON OF CRUDE	UNITS OF INPUT/TON OF CRUDE	LEI/ UNIT OF INPUT	LEI/ TON OF CRUDE
<b>A. Variable Costs</b>						
1. Power (kwh)	157.69	0.91	80.42	110.00	0.91	95.29
2. Diesel Oil (kg)	4.00	2.85	11.40	4.70	3.07	18.31
3. Natural Gas (cm)	30.00	0.16	8.62	25.80	0.11	2.76
4. Chemicals & Consumables (AF) [a]			18.48	1.07	37.40	40.02
5. Labor Costs (man-months) [b]			151.20	0.0132	4380.00	57.92
6. Other Cash Costs (AF)			94.01	1.01	60.20	60.95
7. Reserves Discovery Charge (AF)			100.00	1.00	100.00	100.00
Subtotal			444.13			373.59
<b>B. Fixed Costs [c]</b>						
1. Admin & General Expenses			27.10			29.30
2. Maintenance Materials & Spares			25.36			27.60
3. Depreciation [d]			272.07			309.50
Subtotal			324.53			412.40
<b>Total Cost of Production</b>			<b>768.66</b>			<b>785.99</b>
<b>C. Total Crude Oil Production (000 tons)</b>			<b>2.483</b>			<b>2.571</b>

[a] AF stands for arbitrary factor taking the 1981 consumption/cost of the Vidale Enterprise for the group of inputs as the base with a factor value of 1.0.

[b] Includes 15% wage tax and 16.5% social security tax applied to both wage and wage tax.

[c] Annual fixed costs allocated per ton of crude oil output (costs, except for depreciation, have been escalated using the industrial wholesale price escalation rates).

[d] At historical cost of fixed assets (productive assets only, non-productive assets contribute about Lei 50 million more per year to total amortization).

**ROMANIA**  
**VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT**  
**FINANCIAL UNIT PRODUCTION COST STRUCTURE OF THE VIDELE ENTERPRISE**  
**(IN CURRENT LEI)**

	Actual - 1982			Actual - 1983			Actual - 1984			Actual - 1985		
	Units of Input/Ton of Crude	Lei/Unit of Input	Lei/Ton of Crude	Units of Input/Ton of Crude	Lei/Unit of Input	Lei/Ton of Crude	Units of Input/Ton of Crude	Lei/Unit of Input	Lei/Ton of Crude	Units of Input/Ton of Crude	Lei/Unit of Input	Lei/Ton of Crude
<b>A. VARIABLE COSTS</b>												
1. Power (kWh)	131.50	0.41	53.92	152.20	0.41	62.41	145.30	0.41	59.56	150.44	0.41	61.68
2. Diesel Oil (kg)	2.90	2.85	8.26	3.25	2.85	9.26	3.03	2.85	8.66	3.37	2.85	9.60
3. Natural Gas (m <sup>3</sup> )	50.00	0.16	8.00	50.00	0.16	8.00	50.00	0.16	8.00	50.00	0.16	8.00
4. Chemicals and Consumables			8.42			14.10			15.80			18.02
5. Labor Costs			72.11			98.90			124.52			132.05
6. Other Costs			73.97			97.86			119.46			111.60
7. Reserve Discovery Charge			<u>100.00</u>			<u>100.00</u>			<u>100.00</u>			<u>100.00</u>
Subtotal			324.68			390.53			436.00			439.95
<b>B. FIXED COSTS</b>												
1. Admin. and General Expense			22.85			25.07			27.45			28.60
2. Maintenance Materials and Spares			13.80			15.84			21.27			26.20
3. Depreciation			<u>135.94</u>			<u>150.73</u>			<u>202.18</u>			<u>274.00</u>
Subtotal			172.59			191.64			250.90			328.80
TOTAL COST OF PRODUCTION			497.27			582.17			686.90			768.75
<b>C. TOTAL CRUDE OIL PRODUCTION</b>												
(in Thousand Lei)			1,113.8			1,238.5			1,158.6			1,088.7

	<u>Actual - 1986</u>			<u>Forecast - 1987</u>			<u>Forecast - 1988</u>			<u>Forecast - 1989</u>		
	Units of Input/Ton of Crude	Lei/Unit of Input	Lei/Ton of Crude	Units of Input/Ton of Crude	Lei/Unit of Input	Lei/Ton of Crude	Units of Input/Ton of Crude	Lei/Unit of Input	Lei/Ton of Crude	Units of Input/Ton of Crude	Lei/Unit of Input	Lei/Ton of Crude
<b>A. <u>VARIABLE COSTS</u></b>												
1. Power (kWh)	153.92	0.51	78.50	150.20	0.51	76.60	143.70	0.51	73.29	137.20	0.51	69.97
2. Diesel Oil (kg)	4.12	2.85	11.73	4.15	2.85	11.83	3.65	2.85	10.40	3.11	2.85	8.86
3. Natural Gas (m <sup>3</sup> )	51.00	0.16	8.20	45.00	0.16	7.20	37.00	0.16	8.16	30.00	0.16	4.80
4. Chemicals and Consumables			18.90			20.34			21.10			22.30
5. Labor Costs			138.20			138.70			139.20			139.20
6. Other Costs			102.82			91.15			75.92			57.38
7. Reserve Discovery Charge			<u>100.00</u>			<u>100.00</u>			<u>100.00</u>			<u>100.00</u>
Subtotal			458.35			445.82			425.83			402.51
<b>B. <u>FIXED COSTS</u></b>												
1. Admin. and General Expense			28.64			28.30			28.30			28.30
2. Maintenance Materials and Spares			26.80			26.40			26.40			26.40
3. Depreciation			<u>337.36</u>			<u>341.50</u>			<u>327.42</u>			<u>311.25</u>
Subtotal			392.80			396.20			382.12			365.95
TOTAL COST OF PRODUCTION			851.15			842.02			807.95			768.46
<b>C. <u>TOTAL CRUDE OIL PRODUCTION</u></b>												
(In Thousand Lei)			986.9			1,061.9			1,252.9			1,545.9

**ROMANIA**  
**VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT**  
**(LOAN 2148-RD)**

**REVISED INCREMENTAL PRODUCTION COST ESTIMATE**

**Videle Enterprise Revised Production Cost (Financial) Estimate (1989)**

Variable Costs	(In Current Lei)							
	Lei/Unit of Input	With the Project		Without the Project		Incremental Due to Project		
		Units of Input/Ton of Oil	Total Input cost (Million Lei)	Units of Input/Ton of Oil a/	Total Input Cost (Million Lei)	Total Input Cost (Million Lei)	Lei/Ton of Oil	Units of Input/ Ton of Oil
Power	0.51 Lei/kWh	137.20 kWh	108.2	153.92 kWh	64.0	44.2	60.46	118.56 kWh
Diesel Fuel	2.85 Lei/kg	3.11 kg	13.7	4.12 kg	9.6	4.1	5.61	1.98 kg
Natural Gas	0.16 Lei/m <sup>3</sup>	30.00 m <sup>3</sup>	7.4	51.00 m <sup>3</sup>	6.6	0.8	1.09	6.84 m <sup>3</sup>
Chem. & Consumables		22.30 Lei	34.5	18.90 Lei	15.4	19.1	26.13	26.13 Lei
Labor		139.20 Lei	215.2	225.30 Lei	183.6	31.6	43.21	43.21 Lei
Others		57.38 Lei	88.7	102.82 Lei	83.8	4.9	6.70	6.70 Lei
Reserve Discovery Charge		100.00 Lei	<u>154.6</u>	100.00 Lei	<u>81.5</u>	<u>73.1</u>	<u>100.00</u>	100.00 Lei
Subtotal			622.3		444.5	177.8	243.20	
Admin. & Gen. Expenses			43.7		35.6	8.1	11.08	
Maintenance Materials			40.8		32.1	8.7	11.90	
Depreciation			<u>481.2</u>		<u>298.0 b/</u>	<u>183.2</u>	<u>250.62</u>	
Subtotal			565.7		365.7	200.0	273.60	
Total Cost			1,188.0		810.2	377.8	516.80	
Total Oil Production (1,000 Tons)			1,545.9		814.9	731.0		

a/ Identical to the technical input coefficients for 1986 (except labor and fixed cost items) just before substantial incremental production (i.e., over 200,000 tons/year) from the project is realized.

b/ Identical to 1985 actual (based on assumption that the initial project facilities installed in 1982 through 1984 are depreciated starting 1986).

**ROMANIA**  
**VIDELE-BALARIA SOR PROJECT**  
**ECONOMIC REEVALUATION**

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
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<b>Definitions &amp; Data</b>											
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Incremental Crude Oil Production (1,000 tons)	18	24	33	67	101	206	422	731	731	731	731
International Crude Oil Price (FOB Persian Gulf Current US\$/bbl)	31.0	28.1	27.5	26.7	13.6	17.5	18.0	18.0	18.0	19.2	20.5
<b>Price Inflation Index (1981=1.000)</b>											
a. Foreign Exchange (US\$) Index	0.986	0.961	0.944	0.933	1.133	1.145	1.224	1.266	1.234	1.262	1.290
b. Local Currency (Lei) Index	1.107	1.169	1.168	1.155	1.155	1.155	1.167	1.190	-	-	-
Foreign Exchange Rate (Lei/USA)	15.0	17.0	20.9	17.5	16.8	17.5					
<b>Project Capital Costs (Million Current Lei)</b>											
a. Foreign Exchange Costs	130.0	719.0	965.0	158.0	0.0	0.0					
b. Local Currency Costs	87.0	711.0	458.0	1,242.0	1,089.0	243.1	-	-	-	-	-
Recurrent Capital Costs (Millions as constant 1987 Lei)	-	-	-	-	-	-	-	-	210.0	420.0	420.0
<b>Incremental Variable Technical Production Coefficient per ton of Crude Oil</b>											
a. Power (kWh)	131.50	152.20	145.30	150.44	153.92	142.14	130.36	118.36	118.36	118.36	118.36
b. Diesel Fuel (kg.)	2.90	3.25	3.03	3.37	4.12	3.41	2.70	1.98	1.98	1.98	1.98
c. Natural Gas (Cubic meters)	50.00	50.00	50.00	50.00	51.00	36.28	21.56	6.84	6.84	6.84	6.84
d. Chemicals & Consumables (Lei /a)	8.42	14.10	15.80	18.02	18.90	21.31	23.72	26.13	26.13	26.13	26.13
e. Labor (Lei /a)	0.00	0.00	0.00	0.00	0.00	0.00	3.18	43.21	43.21	43.21	43.21
f. Others (Lei /a)	73.97	97.88	119.46	111.60	102.82	70.78	38.74	6.70	6.70	6.70	6.70
<b>Incremental Fixed Production Costs (Million Lei /a)</b>											
a. Admin. & General Expenses						5.1	10.2	15.4	15.4	15.4	15.4
b. Maintenance Materials & Supplies						4.8	9.6	14.4	14.4	14.4	14.4
<b>Unit Economic Price of Variable Inputs</b>											
a. Power (1981 US\$/kWh)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
b. Diesel Fuel (1981 US\$/kg)	0.30	0.28	0.28	0.27	0.12	0.15	0.14	0.14	0.14	0.15	0.15
c. Natural Gas (1981 US\$/cubic meter)	0.15	0.14	0.14	0.13	0.06	0.07	0.07	0.07	0.07	0.07	0.08
d. Chemicals & Consumables (1981 US\$)	0.51	0.80	0.90	1.04	1.09	1.23	1.36	1.46	1.46	1.46	1.46
e. Labor (1981 US\$)	0.32	7.92	7.97	8.10	2.49	2.49	2.47	2.42	2.42	2.42	2.42
f. Others (1981 US\$)	4.45	5.58	6.82	6.44	5.93	4.09	2.21	0.38	0.38	0.38	0.38
<b>Unit Economic Value of Oil Production (in constant 1981 US\$/ton)</b>											
	196.28	183.02	182.36	175.64	79.08	98.86	95.36	92.43	94.66	98.44	102.33
<b>Economic Cost/Benefit Streams (in Millions of Constant 1981 US\$)</b>											
Project Capital Costs	14.0	84.6	75.1	81.2	62.9	14.0					
Recurrent Capital Costs									12.1	24.2	24.2
Variable Production Costs	0.5	0.6	0.9	1.0	1.0	3.1	5.0	6.3	6.3	6.3	6.3
Fixed Costs	0.0	0.0	0.0	0.0	0.0	0.33	0.6	0.94	0.94	0.94	0.94
Total Production Costs	0.5	0.6	0.9	1.0	1.0	3.7	6.1	7.9	7.9	8.0	8.0
Total Costs	14.5	85.2	76.0	83.0	64.8	17.8	6.1	7.9	20.1	32.8	32.8
Economic Value of Oil Production	3.5	4.4	6.0	11.8	8.0	28.4	40.2	67.6	69.2	72.0	74.9
Net Economic Benefits	(11.0)	(80.8)	(69.9)	(71.2)	(56.7)	2.6	34.1	59.6	49.1	39.7	42.7
Economic Rate of Return	13.2%										

a/ Current Lei for 1982-1989 and assumed to remain in constant 1989 terms thereafter.  
19-Aug-87

**ROMANIA  
WIDEL-SALARIA FOR PROJECT  
ECONOMIC REEVALUATION**

Year	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989
Definitions & Data															
Incremental Crude Oil Production (1,000 tons)	731	731	731	731	731	731	731	731	731	731	731	731	731	731	731
International Crude Oil Price (FOB Persian Gulf Current US\$/bbl)	21.9	23.4	25.0	27.5	30.2	33.1	36.4	40.0							
Price Index (1981=1,000)	1,319	1,349	1,377	1,409	1,441	1,474	1,508	1,543							
a. Foreign Exchange Index (US\$/LEU)	-	-	-	-	-	-	-	-							
b. Local Currency Index (LEU/US\$)	-	-	-	-	-	-	-	-							
Foreign Exchange Rate (LEU/US\$)	-	-	-	-	-	-	-	-							
Project Capital Costs (Million Current Lei)	-	-	-	-	-	-	-	-							
a. Foreign Exchange Costs	-	-	-	-	-	-	-	-							
b. Local Currency Costs	-	-	-	-	-	-	-	-							
Recurent Capital Costs (Millions as constant 1987 Lei)	420.0	420.0	420.0	420.0	420.0	420.0	420.0	420.0	420.0	420.0	420.0	420.0	420.0	420.0	420.0
Incremental Variable Technical Production Coefficient per ton of Crude Oil	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56
a. Power (kWh)	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98
b. Diesel Fuel (kg.)	6.84	6.84	6.84	6.84	6.84	6.84	6.84	6.84	6.84	6.84	6.84	6.84	6.84	6.84	6.84
c. Natural Gas (Cubic meters)	26.13	26.13	26.13	26.13	26.13	26.13	26.13	26.13	26.13	26.13	26.13	26.13	26.13	26.13	26.13
d. Chemicals & Consumables (Lei/a)	43.21	43.21	43.21	43.21	43.21	43.21	43.21	43.21	43.21	43.21	43.21	43.21	43.21	43.21	43.21
e. Labor (Lei/a)	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70
f. Others (Lei/a)	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4
Unit Economic Price of Variable Inputs	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
a. Power (1981 US\$/kWh)	0.16	0.17	0.18	0.19	0.20	0.22	0.23	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
b. Diesel Fuel (1981 US\$/kg)	0.08	0.08	0.08	0.09	0.10	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
c. Natural Gas (1981 US\$/cubic meter)	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46
d. Chemicals & Consumables (1981 US\$/a)	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42
e. Labor (1981 US\$/a)	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
f. Others (1981 US\$/a)	106.82	111.30	116.18	124.39	133.07	142.11	152.25	163.02	163.02	163.02	163.02	163.02	163.02	163.02	163.02
Unit Economic Value of Oil Production (in constant 1981 US\$/ton)	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Project Capital Costs (in Millions of constant 1981 US\$)	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Recurent Capital Costs	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Variable Production Costs	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fixed Costs	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Total Production Costs	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Economic Value of Oil Production	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Economic Benefits	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Total Costs	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Economic Value of Oil Production	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Net Economic Benefits	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Economic Rate of Return	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

\* Current Lei for 1982-1989 and assumed to remain in constant 1987 leu thereafter  
19-Aug-87

**ROMANIA  
VIDELE-BALARIA FOR PROJECT  
ECONOMIC REEVALUATION**

	2004	2005	2006	2007	2008	2009
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<b>Definitions &amp; Data</b>						
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Incremental Crude Oil Production (1,000 tons)	731	731	731	731	731	731
International Crude Oil Price (FOB Persian Gulf Current US\$/bbl)						
Price Inflation Index (1981=1.000)						
a. Foreign Exchange (US\$) Index	-	-	-	-	-	-
b. Local Currency (LEI) Index	-	-	-	-	-	-
Foreign Exchange Rate (Lei/US\$)						
Project Capital Costs (Million Current Lei)						
a. Foreign Exchange Costs	-	-	-	-	-	-
b. Local Currency Costs	-	-	-	-	-	-
Recurrent Capital Costs (Millions as constant 1987 Lei)	420.0	420.0	-	-	-	-
Incremental Variable Technical Production Coefficient per ton of Crude Oil						
a. Power (kWh)	118.56	118.56	118.56	118.56	118.56	118.56
b. Diesel Fuel (kg.)	1.98	1.98	1.98	1.98	1.98	1.98
c. Natural Gas (Cubic meters)	6.84	6.84	6.84	6.84	6.84	6.84
d. Chemicals & Consumables (Lei /a)	26.13	26.13	26.13	26.13	26.13	26.13
e. Labor (Lei /a)	43.21	43.21	43.21	43.21	43.21	43.21
f. Others (Lei /a)	6.70	6.70	6.70	6.70	6.70	6.70
Incremental Fixed Production Costs (Million Lei /a)						
a. Admin. & General Expenses	15.4	15.4	15.4	15.4	15.4	15.4
b. Maintenance Materials & Supplies	14.4	14.4	14.4	14.4	14.4	14.4
Unit Economic Price of Variable Inputs						
a. Power (1981 US\$/kWh)	0.03	0.03	0.03	0.03	0.03	0.03
b. Diesel Fuel (1981 US\$/kg)	0.25	0.25	0.25	0.25	0.25	0.25
c. Natural Gas (1981 US\$/cubic meter)	0.12	0.12	0.12	0.12	0.12	0.12
d. Chemicals & Consumables (1981 US\$)	1.46	1.46	1.46	1.46	1.46	1.46
e. Labor (1981 US\$)	2.42	2.42	2.42	2.42	2.42	2.42
f. Others (1981 US\$)	0.38	0.38	0.38	0.38	0.38	0.38
Unit Economic Value of Oil Production (in constant 1981 US\$/ton)	163.02	163.02	163.02	163.02	163.02	163.02
Economic Cost/Benefit Streams (in Millions of Constant 1981 US\$)						
Project Capital Costs						
Recurrent Capital Costs	34.2	34.2				
Variable Production Costs	6.7	6.7	6.7	6.7	6.7	6.7
Fixed Costs	0.94	0.94	0.94	0.94	0.94	0.94
Total Production Costs	8.4	8.4	8.4	8.4	8.4	8.4
Total Costs	32.6	32.6	8.4	8.4	8.4	8.4
Economic Value of Oil Production	119.2	119.2	119.2	119.2	119.2	119.2
Net Economic Benefits	86.6	86.6	110.8	110.8	110.8	110.8
Economic Rate of Return						
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a/ Current Lei for 1982-1989 and assumed to remain in constant 1989 terms thereafter.  
19-Aug-87

ROMANIA

VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT

(LOAN 2148-RO)

ASSUMPTIONS FOR ECONOMIC REEVALUATION

1. The economic reevaluation of the project is done on an incremental costs and benefits basis, expressed in constant 1981 US dollar terms, as was done in the economic analysis in the SAR. Likewise, a 20-year period of full incremental production at 731,000 tons of oil per year is used, but starting in 1989, three years later than expected in the SAR. Some small actual incremental production during 1982 through 1986 is also used, which quickly rises to the full level by 1989. This revised production profile, as mentioned earlier, represents a two-year production response lag between the completion of full-scale commencement of in situ combustion in 1987 and the attainment of the full EOR-induced incremental production, which is normal for this type of EOR technique.

2. The economic value of the incremental crude oil production of the project is derived on the basis of international crude oil prices (FOB) adjusted by a 10% discount for the lower quality (e.g., heavier oil at 18°API) of the project output compared to the typical or reference internationally traded crude oil and for the transport cost to Romania. Actual average prices for OPEC oil exports during 1982-86, as well as World Bank estimates for 1987 through 2000 expressed in constant 1981 US dollars, are used. The economic reevaluation assumes prices will remain constant in real terms from 2000 onwards. These are summarized below:

CRUDE OIL ASSUMPTIONS

		<u>Revised FOB Price (OPEC)</u>		<u>Economic Value of Project Oil Production 1981 US\$/Ton a/</u>	
		<u>Current</u>	<u>1981</u>	<u>Revised</u>	<u>SAR Est.</u>
		<u>US\$/Bbl</u>	<u>US\$/Bbl b/</u>		
<u>Actual</u>	1982	31.0	31.4	196.3	221.0
	1983	28.1	29.2	183.0	221.0
	1984	27.5	29.1	182.4	221.0
	1985	26.7	28.0	175.6	221.0
	1986	13.6	12.0	79.1	221.0
<u>Estimate</u>	1987	17.5	15.3	98.8	221.0
<u>Forecast</u>	1988	18.0	14.7	95.4	221.0
	1989	18.0	14.2	92.4	221.0
	1990	18.0	14.6	94.6	221.0
	1995	25.0	18.2	116.2	221.0
	2000	40.0	25.9	163.0	221.0

a/ Based on the heavy oil produced by the project (6.7 barrels per ton) being priced at 10% below the typical OPEC crude (7.4 barrels per ton) and a transport provision of US\$1.00 per barrel (1981 terms).

b/ Deflated using the MUV index (as of February 1987, see Table 1).

3. The SAR made a distinction concerning the capital costs between the financial cost to TPB (excluding interest during construction) and the financial cost of the project to the Government. The financial cost to TPB estimated in the SAR was based on the then prevailing 1981 Romanian catalog prices (i.e., Government-set prices) for locally purchased items. At that time, these catalog prices did not generally fully reflect the cost of the indirect import contents of locally produced or distributed items. In the specific case of the locally procured items for the project, the SAR estimated that on average, the financial cost to the Government would be about 12% higher than the financial cost to TPB, on the basis of the international prices of their indirect import contents. This financial cost to the Government was used in the SAR as the economic capital cost for the equipment, materials and supplies used by the project. The SAR did use the financial cost to TPB of labor and services as the economic costs. However, between 1981 and 1986, the Government revised the catalog prices three times and adjusted the foreign exchange rate five times in order to eliminate these indirect or hidden subsidies. In the judgment of the PCR mission, the difference between the financial capital cost to TPB and the financial capital cost to the Government did not actually materialize. Thus, for the economic reevaluation of the project, the economic capital cost is based on the actual financial costs incurred by TPB for the purchase of equipment, materials,

supplies, as well as for labor and services (there is no tax element in these financial prices since the project was exempt from sales and import taxes).

4. The foreign exchange resource cost of the project is taken as the foreign exchange financing in the economic reevaluation. Since this foreign exchange financing has been recorded in current Lei by TPB, it was first converted to current US dollars using the average exchange rate prevailing during the year of disbursement, and then converted to constant 1981 US dollar terms using the Bank's manufacturing unit value (MUJ) index issued in February 1987. The domestic resource cost is taken as the local currency financing in current Lei (or difference between the total economic capital cost and the foreign exchange financing), first converted to constant 1981 Lei using the Romanian producer price inflation rate during 1982-1986 as deflator, and then finally converted to constant 1981 US dollars using the exchange rate (Lei 15/US\$1.00) prevailing in 1981 (Table 1). On this basis, the actual economic capital cost of the project in constant 1981 terms is about US\$331.8 million compared to about US\$371 million estimated in the SAR. Finally, recurrent annual capital investments to sustain the full level of incremental production will be required from mid-1990 onwards at a revised cost of about US\$24.5 million in 1981 terms (equivalent to Lei 420 million in 1987 terms) which is almost the same as the SAR estimate of about US\$24.6 million per year but starting from 1986 onwards.

5. The economic variable operating cost for the project is based on technical input coefficients for energy, chemicals, labor, etc. experienced during 1982-1986 and estimated by TPB for 1987 through 1989. These technical input coefficients are expected to remain constant from 1989 onwards when the project reaches full incremental production. The unit economic cost of the variable operating inputs have been reestimated as follows:

- (a) For power, the economic cost is now revised at US\$0.030 per kWh in 1981 terms (Lei 52/kWh in 1987 terms) compared to US\$0.035 per kWh estimated in the SAR reflecting the real decline in energy prices worldwide. This revised economic price is only marginally higher than the financial price prevailing in 1987 (Lei 51/kWh in 1987 terms).
- (b) For diesel fuel, the economic cost is derived from the actual (1982-1986) and projected crude oil international prices (FOB) and the expectation that diesel fuel international prices would on average be about 30% higher (on a per barrel basis) than the typical or reference crude oil international prices.
- (c) For natural gas, the economic cost is derived from the economic cost of fuel oil on a gross heating value equivalent basis (i.e., 1,192 cubic meters of gas is equivalent to one ton of fuel oil). The economic cost of fuel oil in turn is derived from the international crude oil prices on the basis that fuel oil international prices would on average be about 20% lower (on a per barrel basis) than the typical crude oil price.
- (d) The economic cost of all the other variable operating costs (chemicals, consumables, labor, etc.), as well as the incremental fixed costs, are taken as their actual financial

values for 1982-1986 and TPB's estimates for 1987 through 1989 deflated to constant 1981 terms as in the case of the local currency capital costs. The economic costs from 1989 onwards are projected to remain constant in real terms for these non-energy operating cost items.

On these bases, the operating cost (before capital charges) when full production is attained is now estimated at about US\$9.87 per ton or US\$1.47 per barrel compared to the SAR estimate of US\$5.06 per ton or US\$0.76 per barrel (all in 1981 terms). The higher revised incremental production cost is primarily due to more labor, chemicals and other input requirements and, to a lesser extent, the higher real costs of these items. The comparison is shown below.

	Incremental Economic Production Cost (1981 US\$) a/					
	Revised Estimate (1989)			SAR Estimate (1986)		
	Units of Input/Ton of Oil	US\$/Unit of Input	US\$/Ton of Oil	Units of Input/Ton of Oil	US\$/Unit of Input	US\$/Ton of Oil
<b>Variable Costs</b>						
Power	118.56 kWh	0.03	3.56	80.0	0.035	2.80
Diesel	1.98 kg	0.14	0.28	3.79	0.29	1.11
Natural Gas	6.84 m <sup>3</sup>	0.07	0.48	20.46	0.15	3.02
Chemicals			1.46			0.19
Labor			2.42			0.21
Others			<u>0.38</u>			<u>(3.12)</u>
Subtotal (Variable)			8.58			4.21
<b>Fixed Costs</b>						
Admin. & Gen. Expense			0.62			0.02
Maintenance Materials			<u>0.67</u>			<u>0.41</u>
Subtotal (Fixed)			1.29			0.43
Total Production Cost			9.87			4.64

a/ When full incremental production of 731,000 tons per year of oil is initially achieved. The production cost does not include provisions for capital charges or recovery.

6. The reestimated economic rate of return (ERR) of the project is about 13.2% (Annex 15), compared to the SAR estimate of 29%. The lower revised rate is due primarily to the lower revised price of crude oil compared to the SAR estimate and, to a lesser extent, to the two-year delay in the project

benefits and the higher production costs. Nonetheless, the reestimated ERR is still satisfactory. The lower capital cost, as a result of good cost control and engineering efforts on the part of TPB, mitigated slightly the adverse effect of higher production costs and the delay in project benefits.

Table 1  
Price Inflation Rates Used  
For Deflators in Economic Analysis

	<u>Actual/Revised Estimates</u>		<u>SAR Estimates</u>	
	<u>Foreign Exchange</u> <u>Resource Cost a/</u>	<u>Domestic</u> <u>Resource Cost b/</u>	<u>Foreign Exchange</u> <u>Resource Cost a/</u>	<u>Domestic</u> <u>Resource Cost b/</u>
<u>Actual</u>				
1982	-1.4%	10.7%	8.0%	5.5%
1983	-2.6%	5.6%	8.0%	9.5%
1984	-1.7%	-0.1%	7.5%	5.5%
1985	0.9%	-1.1%	7.0%	5.0%
1986 (prov)	18.9%	0.0%	6.0%	4.5%
<u>Forecasts</u>				
1987	1.1%	0.0%		
1988	6.9%	1.0%		
1989	3.4%	2.0%		

a/ World Bank Manufacturing Unit Value (MUV) Index, February 1987.

b/ Romanian Producer Price Index. IMF data for 1982-1986. PCR mission estimates for 1987-1989.

ROMANIA

VIDELE/BALARIA ENHANCED OIL RECOVERY PROJECT  
(LOAN 2148-RO)  
COMMENTS RECEIVED FROM THE BORROWER

WORLD BANK MSS

ZCZC OERP0069 JWS0852

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REF : TCP PJ

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JWS0852 ZJ0221 IN 08/02:09 OUT 08/02:12

TELEX NR. 85/08.04.1988

TO MR. ALEXANDER NOWICKI  
CHIEF DEPARTMENT  
OPERATIONS EVALUTION DEPT.

RE.ROMANIA

VIDELE-BALARIA ENHANCED OIL RECOVERY PROJECT

WE WOULD LIKE TO THANK YOU FOR YOUR LETTER OF MARCH THE  
1 ST. 1988 BY WHICH YOU HAVE SUBMITTED US THE PROJECT  
COMPLETION REPORT FOR THE VIDELE-BALARIA ENHANCED OIL RECOVERY  
PROJECT, AND WHICH REFLECTS THE SUCCESSFUL IMPLEMENTATION OF  
THE PROJECTS, AND THE GOOD COOPERATION BETWEEN THE BORROWER  
AND THE BANK DURING THE IMPLEMENTATION .

WITH THANKS FOR YOUR COOPERATION

YOURS SINCERELY,

GHOERGHE POPESCU

PRESIDENT OF THE INVESTMENT BANK OF ROMANIA

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# ROMANIA ALBANIA OIL RECOVERY PROJECT OIL AND GAS SUBSECTOR

- Oil Fields
- Gas Fields
- Oil Pipelines
- Gas Pipelines
- Gas Pipelines Under Construction
- Petroleum Products Pipelines
- Refineries
- Tanker Terminals
- Railways
- Rivers
- International Boundaries

