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IMPLEMENTATION COMPLETION REPORT

MEXICO

HYDROELECTRIC DEVELOPMENT PROJECT

LOAN 3083-ME

June 27, 1997

Infrastructure Sector Leadership Group
Mexico Department
Latin America and the Caribbean Regional Office

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CURRENCY EQUIVALENTS

Currency unit	=	Mexican Peso (Mex\$)
		New Mexican Peso (MXN)
US\$1.00	=	Mex\$ 2326.00 (March 15, 1989)
US\$1.00	=	MXN\$ 7.80 (January 23, 1997)

WEIGHTS AND MEASURES

kVA (kilovolt-ampere)	=	1,000 VA (volt-ampere)
kV (kilovolt)	=	1,000 V (volts)
kW (kilowatt)	=	1,000 W (watts)
MVA (megavolt-ampere)	=	1,000 kVA
MW (megawatt)	=	1,000 kW
kWh (kilowatt hour)	=	1,000 Wh (watt hour)
MWh (megawatt hour)	=	1,000 kWh
GWh (gigawatt hour)	=	1,000,000 kWh
MVA (megavolt ampere)	=	1,000 kVA
MVAR (megavar)	=	1,000,000 VAR (reactive volt-ampere)
ton (T)	=	1,000 kg
Tcal (teracalories)	=	88.02 TOE = 10 ¹² calories
TOE (ton of oil equivalent)	=	0.0102 Tcal

FISCAL YEAR OF BORROWER

January 1st - December 31st

ABBREVIATIONS AND ACRONYMS

CFE	=	Comisión Federal de Electricidad (Government owned national electric utility)
CLFC	=	Compañía de Luz y Fuerza del Centro (Government owned Electricity distribution company, serving the metropolitan area of Mexico City and environs)
CONAE	=	Comisión Nacional de Ahorro de Energía
FRA	=	Financial Rehabilitation Agreement (Between Government and CFE)
IDB	=	Inter-American Development Bank
INAH	=	Instituto Nacional de Antropología e Historia (National Institute of Anthropology and History)
NAFIN	=	Nacional Financiera, S.N.C. (Government owned national development financial institution)
PEMEX	=	Petróleos Mexicanos (Government owned national oil company)
SARH	=	Secretaría de Agricultura y Recursos Hidráulicos (Ministry of Agriculture and Hydro Resources)
SEDUE	=	Secretaría de Desarrollo Urbano y Ecología (Ministry of Urban Development and Ecology)
SEMIP	=	Secretaría de Energía, Minas e Industria Paraestatal (Ministry of Energy, Mines and State Enterprise)
SHCP	=	Secretaría de Hacienda y Crédito Público (Ministry of Finance and Public Credit)
SRA	=	Secretaría de Reforma Agraria (Ministry of Agrarian Reform)
SPP	=	Secretaría de Programación y Presupuesto (Ministry of Planning and Budget)
SAR	=	Staff Appraisal Report
SEMARNAP	=	Secretaría del Medio Ambiente, Recursos Naturales, Agricultura y Pesca (Ministry of the Environment, Natural Resources, Agriculture and Fishery)

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IMPLEMENTATION COMPLETION REPORT
MEXICO
HYDROELECTRIC DEVELOPMENT PROJECT
LOAN 3083-ME

PREFACE

This is the Implementation Completion Report (ICR) for the Hydroelectric Development Project in Mexico, for which Loan 3083-ME in the amount of US\$460 million equivalent was approved on June 8, 1989 and made effective on January 18, 1990.

The loan was closed on December 31, 1996, the original closing date. It was fully disbursed, and the last disbursement took place on October 4, 1995.

The ICR was prepared by Mr. Marcelo Osorio (LASLG) and Ms. María Clara Mejía (LATEN) and reviewed by Mr. Luis Cosenza (Task Manager) of the Infrastructure Group within the Latin America Sector Leadership Group (LASLG). Other Bank Resettlement and Environmental Specialist contributed to assess final outcomes: William Partridge, George Ledec (LATEN); Scott Guggenheim (EARS); Salomon Nahmad (LAMXC); Shelton Davis (ENVSP); Theodore Downing (Consultant). Mr. Manzoor Rehman (Consultant) contributed to the ICR by preparing some statistical tables. Preparation of this ICR began at the time of the Bank's completion mission during February, 1997. It is based on materials in the project file. The borrower contributed to the ICR by preparing its own evaluation of the project execution. **(Appendix B)**.

IMPLEMENTATION COMPLETION REPORT
MEXICO
HYDROELECTRIC DEVELOPMENT PROJECT
LOAN 3083-ME

EVALUATION SUMMARY

Introduction

1. The Hydroelectric Development Project was the twelfth operation approved by the Bank for the power sector in Mexico. Project preparation was supported mainly by an engineering loan which financed studies to improve the situation of Comisión Federal de Electricidad's (CFE) thermal power plants and distribution networks. The US\$460 million Bank loan financed four project components: the Aguamilpa and Zimapan hydroelectric plants; environmental and resettlement programs; energy conservation and efficiency studies, and other studies (system optimization, management and tariff studies) (*para. 17*). Most of the funds were allocated to the construction of the two hydroelectric plants. The Borrower was Nacional Financiera, S.N.C. (NAFIN), who acted as a financial intermediary, and the Government was the Guarantor of the operation. NAFIN lent the proceeds of the loan to the Comisión Federal de Electricidad (CFE) which was the executing agency for the project components other than the energy related studies, which were executed by Comisión Nacional de Ahorro de Energía (CONAE) (*para. 1*).

Project Objectives

2. The project objectives were to assist the sector in: (a) promoting the efficient use of electricity through realistic pricing policies, energy conservation and improvement of sector operations; (b) diversifying the sources of power generation and reducing the participation of oil-based generation; (c) strengthening CFE's financial situation by increasing electricity rates and implementing a Financial Rehabilitation Agreement; (d) making electricity available to an increasing number of consumers; and (e) improving CFE's ability to deal with the social and environmental aspects of hydroelectric power projects (*para. 2*).

3. The project objectives addressed the main problems in the energy sector. One of these was the high consumption of energy per unit of economic output, which was due partly to an inefficient use of energy, fostered by very low prices and lack of conservation programs. The project objectives were consistent with the Government's economic strategy and energy sector policy. The energy policy sought to reduce the size of the subsidies to the power sector and keep petroleum exports as a source of foreign exchange.

Implementation Experience and Results

4. The project accomplished its objectives substantially, except for that related to the improvement of the financial situation of CFE which was only partially achieved, and the likelihood of project sustainability is high:

- a) Efficiency in the use of electricity increased. Use of the standards prepared by CONAE under the project for electric appliances has produced substantial energy savings. In addition, CONAE established 15 regional centers to provide assistance to private and public companies in preparing feasibility studies for energy efficiency projects (*para. 8*).

- b) Cogeneration and the installation of private power plants are now allowed in Mexico. In March 1991, the Government enacted guidelines for cogeneration (“Reglamento de la Ley de Servicio Público de Energía Eléctrica en Materia de Autoabastecimiento”) to allow electric cogeneration and issued an inter-ministerial resolution to allow the installation of private power plants under a modified BOT system, the “Construcción, Arrendamiento y Transferencia con Cesión de Derecho de Propiedad” (*para. 9*). However, the cogeneration program has not enjoyed much success because the peso devaluation, and the insufficient tariff adjustments made thereafter, resulted in artificially low electricity tariffs which make cogeneration financially unattractive (*para. 20*).
- c) The construction of the Aguamilpa (960 MW) and Zimapan (292 MW) power plants represented an increase of about 16% in the hydroelectric installed capacity which existed at the start of the project (1988). Average annual energy expected to be produced by both power plants totals 3,422 GWh, which represents a 13.6% increase over the hydroelectric generation in 1988. CFE also built other hydroelectric projects so that in the 1989-94 period, hydroelectric capacity increased by 21 % from 7,749 MW to 9,413 MW (*para. 12*).
- d) CFE managed some substantive improvements in its productivity and operations (*paras. 21-22*), although CFE’s finances suffered in 1993 due to a Government’s decision to lower the tariffs for large industrial consumers.
- e) The number of customers increased from 15.5 million in 1989 to 20.1 million in 1995. Electricity coverage is about 95% now (*para. 14*). Quality of electric service is good: interruption time is low (251 minutes per customer in 1994); number of complaints has been reduced (18 complaints for every 1000 customers in 1994); and period of connection to new customers is acceptable (3 days).
- f) CFE’s ability to deal with the social and environmental aspects of hydroelectric project developments improved (*para. 15*). An Environmental Management Unit and a Social Management Unit were established within CFE to coordinate, plan and implement social and environmental mitigation programs.

Summary of findings, future operations and key lessons learned

5. The project was completed in December 1995, which was six months ahead of the SAR schedule. The loan was closed as scheduled on December 31, 1996 (*para. 17*). The Aguamilpa power plant has been in satisfactory commercial operation since July 1994, one year ahead of the SAR schedule, while the Zimapan power plant has been in satisfactory commercial operation since December 1995 (*para. 18*).

6. The project cost amounted to US\$1,687.9 million before interest during construction which is about 47.5% higher than the estimate of the SAR (US\$1,143.7 million). The difference, US\$544.2 million, is due to higher than estimated construction cost of the Zimapan power plant (*para. 32*). The cost of the engineering and administration, resettlement and electromechanical equipment for the Zimapan power plant was underestimated during appraisal, while its construction experienced a substantial cost overrun. The cost estimate for engineering and administration estimated as a percentage of the project cost, increased in accordance with the project construction cost; the cost estimate for resettlement was based on experiences in less

complex cases; and the estimate for electromechanical equipment was based on informal quotations provided by potential suppliers. The cost overrun in the construction of the Zimapan power plant were due to: (i) geological conditions (along the line of the power tunnel and power house) less favorable than expected at the design stage; (ii) inclusion of some elements to increase the safety of the project which were not originally contemplated; (iii) the construction of infrastructure not required by the project itself but demanded by the communities living the project area, such as the Zimapan-Boquilla road; (iv) large amounts claimed by the civil works contractor as compensation for change in conditions, items for which there were no unit prices and late payments, among others; (v) political pressure on CFE to close the reservoir and inaugurate the project before the presidential period was over, while in the process having to accept some excessive demands of the community leaders and local government; and (vi) budgetary ceiling imposed by the Government on the project which caused delays and extra costs to the contractors (*para. 34*). The Bank supervision missions detected these problems along project implementation and collaborated actively with the Borrower to solve them and complete the Project within schedule.

7. The Comisión Nacional de Ahorro de Energía (CONAE) was responsible for the following studies: (i) preparation of technical standards for electrical appliances and industrial electrical equipment; (ii) improvement of the efficiency of water pumping and air conditioning equipment and establishment of demonstration centers; (iii) establishment of regional centers to promote energy efficiency; (iv) identification of the training needs for the implementation of energy conservation programs; and (v) selection of options and incentives to foster cogeneration. Implementation of the first study, preparation of technical standards for electrical appliances and industrial electric equipment, has already produced effective results. CONAE estimates that these standards have resulted in some 25% reduction in their electricity consumption (*para. 20*).

8. CFE introduced several measures to improve its efficiency; staff was reduced from 63,909 in 1989 to 62,360 in 1995, mainly due to the elimination of CFE's own construction unit, as most of this type of work is now outsourced. The ratio of the number of customers to the number of employees increased from 182 in 1989 to 247 in 1995; thermal plant availability increased from 77.9% in 1989 to 87.3% in 1995; however, electricity losses also increased, from 11.0% in 1989 to 12.0% in 1995. CFE's financial position improved from 1989 to 1991 but declined somewhat in 1992 and deteriorated in 1993 and even more in 1994 as a consequence of the crisis that affected Mexico (*para. 13*). The covenanted operating ratio (1.0) was achieved in 1990 and 1991 but it could not be maintained and declined slightly to 0.96 in 1992 and 1993 and sharply to 0.82 in 1994. Average tariffs increased by 23.0% in real terms from 1989 to 1992 but declined after the peso crisis (*para. 7*). Subsequently, CFE has begun to progressively adjust tariffs again. At present, the average revenue per kWh is the equivalent of US cents 4.54 which is 10.8% higher in US current dollars than was the 1989 average revenue per kWh (*para. 13*).

9. Project implementation was negatively affected by a budgetary ceiling imposed by the Government on all public sector institutions as a measure to combat inflation (*para. 26*). This ceiling caused delays in the construction program and, consequently, resulted in contractors' claims and increased construction costs. In 1993, the construction budget for Aguamilpa and Zimapan was reduced by 57%. To minimize the effects of this reduction, CFE concentrated the available resources in one of the two power plants, Aguamilpa, with Zimapan suffering most of the budgetary constraints.

10. Another factor that negatively impacted project implementation was the economic crisis that affected the country in 1994 (*para. 13*). It affected the Project in several ways: first, CFE's finances deteriorated as tariffs declined in real terms as a consequence of the devaluation of the peso. Second, the resulting low tariffs hampered the development of cogenerating plants, as private generation was not able to compete with CFE's artificially low tariffs (*para. 27*).

11. The resettlement programs were affected by the lack of an overarching legal and policy framework that specifies principles, responsibilities, procedures and mechanisms to deal with involuntary resettlement. Due to the lack of a policy framework, CFE had to improvise strategies and assume responsibilities that should have corresponded to other governmental agencies (*para. 28*). The requirement for the establishment of a policy framework is an important lesson for future projects (*para. 52*).

12. It is likely that achievement of most of the project objectives will prove to be sustainable. The Aguamilpa and Zimapan power plants are operating quite satisfactorily. The highly qualified Board of Consultants contributed constantly with recommendations to improve the safety of the works. As a result, these power plants were built to very high standards, and a trouble-free long life can be expected (*para. 35*). Efforts to promote an efficient use of electricity continue. CONAE continues working very actively in the preparation of standards for the manufacturing of electrical appliances. Creation of the fifteen regional centers to promote electricity savings ensure that this program will continue in the future (*para. 39*).

13. The Bank's performance was satisfactory overall despite some weakness in the supervision of environmental aspects. The Bank properly identified the sectoral issues that had accumulated during the extended period in which the Bank was not involved in the sector. The Bank also assisted CFE and the Government to identify and address environmental and resettlement issues, but failed to demand the establishment of compensatory protected areas ecologically similar to the areas flooded, in accordance with the Bank's Wildlands Policy (*para. 41*). However, resettlement plans were not available at the time of the appraisal and, consequently, their cost estimates were not adequately supported. During project implementation, the Bank's assistance was timely and appropriate. Bank staff, aware of the negative impact that the macroeconomic crisis would have on project execution, made arrangements to modify Loan Agreement 3189-ME in order to allocate uncommitted funds to the Zimapan power plant which was suffering major cost overruns (*para. 42*). Problems related to compliance with the Financial Rehabilitation Program (FRA), particularly regarding tariffs, emerged in late 1993, and were noticed at that time by a Bank's supervision mission. However, the Bank did not strongly insist that CFE and the Government take steps to maintain tariff levels in constant terms and eventually accepted the reduction of electricity tariffs for large industrial consumers in late 1993 (*para. 43*).

14. The Borrower's performance was satisfactory despite some inconsistency on the management of the tariff policy. The Government improved CFE's financial situation and performance by monitoring the implementation of the FRA, by capitalizing CFE's debt and by authorizing tariff increases during the initial years of operations (*para. 21*). However, in late 1993, the Government made a highly inconsistent decision on tariffs that negated the advances achieved during the initial years of the project and had severe adverse impact on the sector. As a consequence of the decision to lower the industrial electricity tariff, CFE's finances deteriorated significantly (*para. 13*), and the program to promote cogeneration did not succeed because of the resulting low tariff level (*para. 20*).

15. NAFIN played a limited role as CFE had enough experience and capability to manage the loan without the support of an intermediary financial institution (*para. 47*).

16. CFE's performance was satisfactory in spite of problems resulting from budgetary constraints (*para. 48*), low tariffs (*para. 13*) and difficulties faced in the resettlement of population (*para. 28*). The construction of two large and complex hydro power plants as scheduled attests to CFE's technical and management ability. CFE improved the design of the two hydro power plants to increase their safety and was open to discuss and follow the recommendations of the Board of Consultants appointed for the project. CFE also submitted information and reports as required by the loan agreement, and implemented a satisfactory dam monitoring system. CFE was open to learn from the experiences of other countries and adopted the recommendations made by consultants in order to improve its performance by reorganizing its operations and implementing new norms and procedures (*para. 48*).

17. CFE's management of the environmental aspects of both projects and the resettlement in Aguamilpa was also satisfactory but it was less so when obstacles were encountered in the resettlement program for Zimapan. Suitable specialists were hired and institutional changes were made to incorporate resettlement and environmental management within the project's overall management. Agreements with other involved governmental institutions were made, and a highly participatory process was put in place by CFE. Approximately 155 families from three indigenous communities affected by the construction of the Aguamilpa hydroelectric power plant were satisfactorily resettled. Resettlement of three indigenous and three mestizo communities directly affected by the Zimapan hydro power plant with a total of 2,452 inhabitants had mixed results. While communal lands and traditional economic activities were restored and even improved for the indigenous families, the economic situation of the displaced mestizo families did not improve because the reservoir flooded the only irrigated lands suitable for agriculture available in the project area. The affected communities rejected land that CFE had purchased to replace those flooded by the reservoir and subsequently asked that the land be sold and that they be compensated in cash. The money was quickly spent in consumer goods and only in a few cases was used to purchase new land. As a result, both those that had rights to the communal agricultural land, as well as others who were landless and worked as wage labor in the irrigated fields, were left without jobs and therefore without a sustainable source of income (*para. 30*).

18. Project performance will be monitored through specific and comprehensive programs. The stability of the main physical project components will be monitored through the instrumentation installed in the project dams and other key structures; CFE's performance and the standard of living of the population resettled under the project will be monitored and evaluated through the indicators included in table 6 (*para. 51*).

19. There are four main project-related and four sector-related lessons learned from project execution:

Lesson 1. To minimize the cost overruns in the construction of hydro power plants, the following should be taken into account: (i) the bidding documents for the construction of civil works should include unit prices for all possible work concepts and site conditions to avoid the need for negotiated prices after the signing of the contract; (ii) suitable assistance from experienced international construction management firms should be required; (iii) budget ceilings during the construction of complex hydroelectric projects should be avoided. They are the cause of not only construction delays but also of costly contractor claims derived from the underutilization of the

construction equipment and workers; and (iv) the construction of main civil works should be carefully coordinated with the program for constructing the new settlements to avoid costly renegotiations with the resettled communities and with the civil works contractors (including those responsible for the physical works needed for the resettlement) (*para. 34*).

Lesson 2. The resettlement and social studies should start early, at the prefeasibility stage, in parallel with the technical, economic and environmental studies, and should include the design of not only the physical works needed to resettle the affected communities, but, more important, programs for restoring the economic and social well-being of the population to be resettled (*para. 41*).

Lesson 3. Progress in the construction of physical works accompanied by delays in the social and resettlement components in the compensation/restoration of affected assets, will result in negotiations under extreme pressure and a subsequent tendency to solve problems and complaints by means of monetary compensation or costly expenditures in the physical works of the new settlement (*para. 30*).

Lesson 4. Establishment of an independent monitoring system to accompany and assess the resettlement process is a key tool in managing relocation processes of indigenous communities, as proved by the success in Zimapan and Aguamilpa. Likewise, putting social teams in direct contact with the affected communities during the entire relocation process has proved to be of great help to ensure the success (*para. 49*).

Lesson 5. A sector related lesson is that the establishment of an overarching legal and policy framework that specifies principles, responsibilities, procedures and mechanisms to deal with involuntary resettlement is fundamental for the implementation of projects with complex or large resettlement programs (*para. 49*).

Lesson 6. Another sector-related lesson is that the financial rehabilitation of a power utility is sustainable only if the tariff setting process is independent of political events and influence (*para. 13*). This independent process is possible only if there are both an adequate regulatory framework and an independent commission responsible for tariff setting.

Lesson 7. Another sector-related lesson is that the key requirements for the implementation of successful energy conservation programs are: (i) electricity tariffs for public service must reflect the economic cost of service, and (ii) implementing agencies must be provided with sufficient independence so that they can train and retain their staff (*para. 20*).

Lesson 8. The participation of an intermediary institution, such as NAFIN in this project, and the corresponding costs, could be avoided when the executing agency has adequate related experience (*para. 47*).

IMPLEMENTATION COMPLETION REPORT

MEXICO HYDROELECTRIC DEVELOPMENT PROJECT LOAN 3083-ME

PART I: PROJECT IMPLEMENTATION ASSESSMENT

A. Project Objectives

1. The Hydroelectric Development Project was the twelfth operation approved by the Bank for the power sector in Mexico. Project preparation was supported mainly by an engineering loan which financed studies to improve the situation of Comisión Federal de Electricidad's (CFE) thermal power plants and distribution networks. The US\$460 million Bank loan financed four project components: the Aguamilpa and Zimapan hydroelectric power plants; environmental and resettlement programs; energy conservation and efficiency studies, and other studies (system optimization, management and tariff studies) (*para. 17*). Most of the funds were allocated to the construction of the two hydroelectric plants. The Borrower was Nacional Financiera, S.N.C. (NAFIN), whose role was to act as a financial intermediary, and the Government was the Guarantor of the operation. NAFIN lent the proceeds of the loan to the Comisión Federal de Electricidad (CFE) which was the executing agency for the main project components. The Comisión Nacional de Ahorro de Energía (CONAE) was responsible for the execution of the energy related studies.
2. The project objectives were:
 - (a) promoting an efficient use of electricity through realistic pricing policies, energy conservation and improvement of sector operations;
 - (b) diversifying sources of power generation and reducing the participation of oil-based generation;
 - (c) strengthening CFE's financial position by increasing electricity rates and implementing a Financial Rehabilitation Agreement (FRA);
 - (d) making electricity available to an increasing number of consumers; and
 - (e) improving CFE's ability to deal with the social and environmental aspects of hydroelectric power projects.
3. The project objectives were intended to deal with the main problems of the energy sector. A major problem was the high consumption of energy per unit of economic output, which was due partially to an inefficient use of energy, fostered by very low electricity prices and lack of conservation programs. To address these problems, the project included a program to promote energy conservation and efficient use of energy, and a cogeneration study (*para. 17*).
4. A second problem was the high dependency of electricity generation on non-renewable resources, due partly to a biased pricing policy which favored hydro-carbons. The Project included

the construction of two large hydro power plants, Aguamilpa with 960 MW and Zimapan with 292 MW to diversify the sources of power generation (*para. 17*).

5. A third problem was the poor financial situation of CFE. To deal with this problem, a Financial Rehabilitation Agreement (FRA) had been signed between the Government and CFE, which included commitments for substantial rate increases in real terms, improvements of productivity (efficiency targets and operating costs) and actions to institutionally strengthen CFE. The Project included commitments from the Government and CFE to: (i) extend the period of validity of the FRA until December 31, 1994; (ii) limit CFE's short-term borrowing to no more than 10% of its annual cash operating expenses; (iii) reformulate the criteria for establishing electricity rate increases to link them to their economic costs; (iv) limit Government contributions to 10% and borrowing to 50% of new investments; and (v) set performance and financial targets for CFE. Furthermore, the Project included several studies: (i) an Operation Improvement Study for a better operation of CFE's electric power system; (ii) a Management Study to streamline CFE's organization and management systems; and (iii) a Tariff Study to set up a tariff system based on marginal costs for medium voltage consumers (*para. 17*).

6. The project objectives were consistent with the Government's economic strategy and energy sector policy. The Government's economic strategy included a program of structural reforms aimed at opening up the economy to external competition, limiting the role of the State in the productive sectors and fostering the development of non-traditional exports. In addition, the stabilization program that was put in place in November 1987 was designed to sharply reduce inflation by addressing the fiscal deficit issue by, amongst other measures, raising the prices for goods and services provided by public enterprises, and by following a restrictive monetary and fiscal policy and implementing short-term price and wage controls. The energy policy was to reduce the size of the subsidies to the power sector and keep petroleum exports as a source of foreign exchange.

B. Achievement of Project Objectives

Overall Objectives.

7. The project accomplished its objectives substantially, except for those in the financial arena which were only partially achieved. CFE's finance position weakened in 1994 as a consequence of the large devaluation of the peso which occurred in that year which caused a deterioration of electricity tariffs in real terms. The following paragraphs assess the achievements of the project objectives.

8. *Promoting an Efficient Use of Electricity.* The CONAE prepared and issued several technical standards to improve efficiency of locally manufactured electrical appliances, trained its staff in the implementation of programs to save electricity and to promote energy conservation, and established regional centers to provide assistance for electricity efficiency projects. Use of the new standards has produced substantial energy savings. Standards for refrigerators alone have produced savings estimated at 186 GWh per year and a reduction of about 118,000 tons of CO₂. CONAE established 15 regional centers to provide assistance to private and public companies in preparing feasibility studies for electricity saving projects (*para. 20*).

9. To promote cogeneration and private participation in generation, the Government enacted guidelines for cogeneration ("Reglamento de la Ley de Servicio Público de Energía Eléctrica en

Materia de Autoabastecimiento”) on March 1991. Subsequently, an inter-ministerial resolution was issued to allow the installation of private power plants under a modified BOT system, the “Construcción, Arrendamiento y Transferencia con Cesión de Derecho de Propiedad”.

10. Finally, the Government traditionally controlled sector investment through the review and approval of the Ten-year Investment Plan (“Programa de Obras e Inversiones del Sector Eléctrico-POISE”) prepared yearly by CFE. In 1994, this responsibility was transferred to SEMIP, which began a publication of a report “Prospectiva del Sector Eléctrico” (Power Sector Prospective), which includes an indicative plan for the power sector in place of the POISE (Ten Year Investment Plan).

11. Following the recommendations of a tariff study financed by the loan, a new tariff schedule was implemented introducing the concept of “time-of-day” tariff; currently 35% of the energy is sold under this tariff.

12. *Diversifying Sources of Power Generation from Oil-based Generation.* The construction of the Aguamilpa (960 MW) and Zimapan (292 MW) power plant under the project represented an increase of about 16% over the hydroelectric installed capacity existing in 1988. Average annual energy produced by both power stations totals 3422 GWh, which represents a 13.6% increase over the hydroelectric generation in 1988. Considering all hydroelectric plants built by CFE in the 1989-1994 period, hydroelectric installed capacity increased by 21 % from 7,749 MW to 9,413 MW. The Aguamilpa power plant has been operating normally since July 1994; it generated 2124 GWh in 1995. Operation of the electro-mechanical equipment is normal, leakage through the dam is normal (about 50 lts/seg) and settlement and movement of the dam is smaller than expected. The Zimapan power plant is operating normally since December 1995; it generated 1070 GWh in 1996 (*para. 18*).

13. *Strengthening CFE’s Financial Condition.* This objective has not been fully achieved. Although CFE accomplished some substantive improvements in its productivity (*paras. 21-22*), operations and resource management, its financial condition deteriorated during 1993 and 1994 because average tariffs declined as a consequence of a decision to reduce tariffs to a group of consumers and to the economic crisis that affected the country in that period. From 1993 to 1995, CFE’s revenues decreased by 30%, rate of return dropped from 5.7% to 1.2%, operating income decreased by 78% and the self-financing ratio went from 69.5% to -51.6%. The target for the ratio of total operating revenues to the sum of total operating expenses (1.0) was achieved in 1990 and 1991 but it could not be maintained and declined slightly to 0.96 in 1992 and 1993 and sharply to 0.82 in 1994. Average tariff increased by 23% in real terms from 1989 to 1992 but declined subsequently. During 1993 and 1994 residential tariffs were kept constant in real terms, while high voltage tariffs were reduced about 20% in real terms as a result of an adjustment of the tariff structure (to reflect economic costs) and a general reduction of charges for large industries to supposedly improve their competitive position prior to the signature of NAFTA. Furthermore, during the severe economic crisis that Mexico faced in late 1994, the Mexican currency was devalued by about 100% in a five-month period and the producer price index increased by about 30%. This crisis caused a further deterioration of the average tariff level, which as a percentage of long-run marginal costs decreased on average from about 80% in early 1994 to 50% in March, 1995. After that, CFE started to progressively adjust tariffs again and expects to have all tariff levels in line with their corresponding long-run marginal costs by end of 1998.

14. *Making Electricity Available to an Increasing Number of Consumers.* The number of customers increased from 15.5 million in 1989 to 20.1 million in 1995. Electricity coverage is about 95% now. Quality of electric service is good: interruption time is low (251 minutes per customer in 1994); number of complaints has been reduced (18 complaints for every 1000 customers per year); and period of connection to new customers is acceptable (3 days).

15. *Improving CFE's Management of the Social and Environmental Aspects of Hydroelectric Power Projects.* Substantial improvement was achieved by CFE on its environmental and social management, although CFE has yet to develop and implement a set of policy guidelines. Both Aguamilpa and Zimapan are perhaps the first successful relocation/rehabilitation process of indigenous population in Bank projects (*paras. 29-30*). This has demonstrated that involuntary resettlement need not be an insurmountable obstacle for timely project execution but instead a development opportunity to improving the standards of living, provided it is properly planned and executed with the informed participation of those affected. Aguamilpa has also demonstrated the need of culturally sensitive strategies for the implementation of successful resettlement and rehabilitation programs. During project implementation, CFE created a Central Unit of Socioeconomic Affairs and also a Unit for Environmental Affairs. Both were staffed with interdisciplinary teams that were adequately trained. These units played a key role in the relocation of the affected population and in the mitigation of environmental impacts. In spite of these achievements, internalizing the lessons learned and adopting official guidelines for directing resettlement and rehabilitation in hydroelectric projects, is still a pending task.

Economic Analysis.

16. In order to verify that the proposed hydroelectric projects are part of the least-cost solution in the SAR, the Aguamilpa and Zimapan Hydroelectric Projects were compared with an equivalent thermal project based on oil fired steam power plants for base load and diesel-oil fired gas turbines for peak load. The resulting present value, calculated at an 11% rate of discount, was 41% higher for the thermal project, as compared to the Aguamilpa and Zimapan. A similar calculation was made with the actual cost of the Aguamilpa and Zimapan and an updated estimate of the investment and operation costs of an equivalent thermal project as prepared by CFE. The resulting present value, calculated at the same 11% rate of discount, is 5% higher for the thermal project (*Table 9*). The SAR also included the calculation of the rate of return of CFE's total investment program. Updating this calculation has been deemed unnecessary because the project cost is only marginal to CFE's total investment cost and, therefore, the result of this calculation would be meaningless. Furthermore, for reasons totally exogenous to the project, CFE's investment program suffered major changes from the appraisal date, making comparison not only meaningless, but also practically impossible

C. Implementation Record and Major Factors Affecting the Project

17. The project was completed in December 1995, six months ahead of the SAR estimate. The loan was closed as originally scheduled on December 31, 1996. As previously mentioned, the project included four basic components:

- (a) construction of the 960 MW Aguamilpa and the 292 MW Zimapan Hydroelectric Power Plants and resettlement of the population living in the reservoir areas;

- (b) preparation of a social and environmental program designed to strengthen CFE's ability to construct and operate hydroelectric projects with due consideration to the affected people and the environment;
- (c) energy related studies on energy conservation and efficient use of energy, cogeneration and optimization of the operation of CFE's power system; and
- (d) management and electricity tariff studies.

18. The Aguamilpa hydroelectric power plant has been in satisfactory commercial operation since July 1994, one year ahead of the SAR schedule. Its construction period was shortened by one year as a result of a special agreement with the civil works contractor. The Zimapan hydroelectric power plant has been in satisfactory commercial operation since December 1995.

19. CFE created a special Unit to deal with the socioeconomic and environmental affairs of project implementation and staffed it with interdisciplinary teams that were properly trained. This Unit played a key role in managing the relocation of the affected population and in the mitigation of the environmental impacts. Moving the resettlement and environmental team to the field from the beginning of construction and keeping it there all along the process, produced positive results in terms of the social assistance provided to the affected population and in fostering good relations between communities, CFE and local governmental institutions.

20. The CONAE carried out the energy related studies included in the project such as: (i) preparation of technical standards for electrical appliances and industrial equipment; (ii) identification of methodologies to improve efficiency of water pumping and air conditioning equipment and establishment of demonstration centers; (iii) establishment of regional center to promote energy savings; (iv) a study on the training needs for the implementation of energy conservation programs; and (v) a study on options and incentives for cogeneration. Implementation of the results of first study produced effective results, as the new standards for refrigerators have resulted in some 25% reduction of their electricity consumption. So far, CONAE has issued 11 technical standards, has other 5 standards ready to be issued and 7 more in preparation and has established 15 regional centers to promote energy efficiency and conservation. CONAE is also prepared to provide technical assistance to industry for the preparation of feasibility studies to support credit applications for financing energy conservation programs. It has trained its technical staff and has access to the laboratory facilities of several universities. On the other hand, CONAE lacks institutional autonomy, which renders it vulnerable to political influence. This has resulted in a high turnover in its management and technical staff. The recommendations to improve efficiency of water pumping equipment have not been implemented yet because of political opposition. As the electricity tariff for water pumping is heavily subsidized, efficiency and conservation proposals fall on deaf ears. The cogeneration programs have not progressed much either because CFE's electricity tariffs have fallen to artificially low values (*para. 13*) which make cogeneration unattractive (*para. 27*).

21. To strengthen CFE's financial condition, the Government and CFE agreed on the implementation of a Financial Rehabilitation Agreement (FRA) which included productivity, operational efficiency and resource management targets, as well as Capitalization of CFE's debt by Government, a commitment to tariff increases and steps to improve CFE's investment policies. CFE introduced several measures to improve efficiency; staff was reduced from 63,909 employees

in 1989 to 62,360 in 1995, mainly due to the elimination of CFE's own construction units, as most of this type of work is now hired with outside contractors.

22. To improve CFE's efficiency, the FRA included productivity and technical indicators to be monitored. The main indicator to measure productivity was the ratio of the number customers to the number of employees. The ratio effectively increased from 182 in 1989 to 247 in 1995. With respect to the technical indicators, the most relevant are the availability of the thermal plants and the electricity losses. Thermal plant availability has increased from 77.9% in 1989 to 87.3% in 1995 but electricity losses has also increased, from 11.0% in 1989 to 12% in 1995 for CFE's system and from 14.0% to 15.9% for the entire system.

23. In an effort to diversify its financing sources, CFE raised US\$250 million in the international capital markets backed by peso-denominated receivable. This was the first of 2 such operation by CFE, but it had limited success and was purchased entirely by the underwriting bank, Citibank.

24. Under the project, CFE took steps toward greater regionalization as recommended in the Management Study. CFE's activities were organized into strategic business units (SBU): (i) 154 generating units; (ii) 13 distribution units; and (iii) a transmission unit. Each SBU is provided with operating and financial information (cost, transfer prices and financial statements), and they compete for resources within CFE.

25. The Government initiated an institutional reform in the power sector that was expected to create a competitive environment for CFE: it enacted legislation in late 1992 to allow the development of independent power generation projects (IPPs), created an Energy Regulatory Commission (CRE) in early 1994 as an advisory body to the Ministry of Energy and Mines (SEMIP), and in 1994 and 1995, SEMIP issued regulations on wheeling charges, energy sales to the grid by self-producers and cogenerators, and back-up power charges, which are necessary for the successful operation of IPPs. Unfortunately, the impetus for reform and competition subsequently dwindled and consequently the process remains mired in its incipient stages.

26. A factor external to CFE that affected project implementation was the budgetary ceiling that the Government imposed on CFE as part of its macroeconomic management. This budgetary ceiling caused delays in the construction program of the project and, consequently, increased construction costs. In 1993, the budget for Aguamilpa and Zimapan was reduced to 43% of their requirements. To minimize the effects of this reduction, CFE concentrated the resources in one of the power plants, Aguamilpa, with Zimapan suffering most of the budgetary constraints.

27. Another factor out of the control of CFE that imperiled project implementation was the economic crisis that affected the country in 1994 (*para. 13*). It affected the Project in several ways: first, CFE's finances deteriorated as the tariffs declined in actual terms as a consequence of the devaluation of the peso. Second, the lowered tariffs hampered the possibilities of cogeneration, since private generation was not able to compete with CFE's artificially low tariffs (*para. 20*).

Resettlement Issues.

28. The resettlement programs were affected by the lack of an overarching legal and policy framework that specifies principles, responsibilities, procedures and mechanisms to deal with involuntary resettlement. Due to the lack of a policy framework, CFE had to improvise strategies

and assume responsibilities that should have corresponded to other governmental agencies. The requirement for the establishment of a policy framework is an important lesson for future projects (*para. 52*).

29. In the Aguamilpa power plant, approximately 155 families from three communities (two indigenous *Huichol* settlements, *Colorado de la Mora* and *Playa de Golondrinas*, and one mestizo community, *Los Sabinos*) living in the reservoir area were resettled. Almost 70% of the affected land was indigenous community land and 30% was private property. In the case of the *Huichol* communities, the best land near the rivers were affected. The Resettlement Plan consisted of a series of actions designed to replace the affected land, to build the new villages and to the restoration of the socioeconomic environment. Solar energy, drinking water, a community center, schools and other facilities were built in each new settlement. Resettlement of the affected population finished a year before filling of the reservoir. The successful resettlement of indigenous communities in Aguamilpa became a model for future projects.

30. In Zimapan, there were three indigenous and three mestizo communities, 2,452 persons, directly affected by the power plant. The relocation of the indigenous communities was a success but in the case of the mestizo families, the results were mixed. Some 141 *Otomi* indigenous families displaced by the Zimapan plant were relocated in new settlements. Their productive system was not dismantled and communal land and agricultural activities were not only reestablished but improved; 140 houses were built and services replaced and considerably improved. In contrast, the 412 mestizo families displaced by the Zimapan plant suffered the disruption of their agricultural activities. They were relocated in an urban setting with construction standards far above those applicable to rural areas; however, the economic situation of the population did not improve. The reservoir flooded the only land suitable for agriculture located in the project area and the nearest irrigated farm land in the area was located more than one hour by car far from the settlements. Unclear and lengthy procedures for buying and preparing the land to replace lost irrigated land, the uncertainty regarding the availability of water for irrigation and the requirement that the irrigation system be collectively managed, created community distrust. Lacking detailed agro-environmental studies, CFE offered to pump water from the reservoir to irrigate the semi-arid lands located in the plateau above the reservoir. Further studies demonstrated that this was not feasible due to high pumping costs and to the degree of contamination of the reservoir water, which made it unsuitable to cultivate vegetables and other market crops. As a result, frustration and distrust set in and negatively affected the negotiations that had to be carried out during project construction. Subsequently, new legislation was enacted to allow the sale of communal land, and based on this, the leaders of the resettled communities rejected the land purchased by CFE and requested that an equivalent amount of money be deposited in a special account in the name of those with land rights. After extremely difficult negotiations with leaders who had lost their agrarian roots, payment in cash was finally made in compensation for the lost land. The money was quickly spent in consumer goods and only in a few cases was used to buy new land. As a result, both those with rights to the communal agricultural land, as well as landless workers that used to work as wage labor in the irrigated fields, were left without jobs and a sustainable source of income. Installation of a maquila industry by private investors has somewhat alleviated the economic plight of some of the poorest families, especially those headed by women, by creating 120 new jobs. The physical facilities for the maquiladora were provided by CFE as part of the resettlement process.

Environmental Aspects.

31. The “Gerencia de Protección Ambiental” managing the environmental aspects of CFE’s projects was strengthened and gained substantial and unique experience under the Project. The Aguamilpa and Zimapan plants involved many of the environmental issues that are typical of large hydroelectric dams, including their impact on native fish, flooding of archaeological sites, floating aquatic weed proliferation, and risks of water- or vector-borne disease spread. Two of the most significant problems for both subprojects were loss of natural habitats and reservoir water quality. The Aguamilpa reservoir inundated about 13,000 hectares (ha) of land, of which about 12,575 ha were covered by tropical deciduous forest. The Zimapan reservoir flooded about 23,000 ha, about 90 percent of which was botanically rich desert vegetation. Both reservoirs also faced water quality problems, largely due to upriver pollution. In terms of specific mitigation actions, particularly noteworthy are the biological inventory and plant and animal rescue activities at Zimapan. According to CFE, 3,901 animals of 74 species were rescued and relocated under the Zimapan subproject. However, the project failed to address biodiversity concerns through the establishment of compensatory protected areas, ecologically similar than the areas flooded. At Zimapan, three new protected areas totaling 1,120 ha (much smaller than the natural area flooded) were proposed, but never implemented under the project (*para. 41*).

Project Cost.

32. The project cost amounted to US\$1,687.9 million before interest during construction which is about 47.5% higher than the estimate of the SAR of US\$1,143.7 million. The difference, US\$544.2 million is due to higher than the estimated construction cost of the Zimapan power plant. The construction cost of the Aguamilpa power plant was US\$850.3 million, which compares favorably with the US\$858.0 million estimated in the SAR. The cost includes the compensation agreed with the contractor of civil works to shorten the construction period. A more detailed comparison of costs estimated in the SAR for Aguamilpa and the actual costs are as follows, in million of US Dollars:

	SAR	ACTUAL
Engineering and Administration	128.7	121.3
Civil Works	473.0	485.2
Resettlement and Environment	12.5	17.9
Electro-mechanical Equipment	207.4	204.2
Transmission Line	36.4	21.7
	858.0	850.3

33. The construction cost of Zimapan was US\$829.2 million, which is 98% higher than the estimate included in the SAR. A comparison between the costs estimated at the SAR and the actual costs are as follows, in millions of US Dollars:

	SAR	ACTUAL
Engineering and Administration	49.5	94.4
Civil Works	269.0	416.1
Resettlement and Environment	17.6	172.2
Electro-mechanical Equipment	56.3	135.6
Transmission Line	25.6	10.9
	418.0	829.2

34. The main causes for the substantial difference between the actual cost and the estimate in the SAR were: (i) the cost of the engineering and administration, resettlement and electromechanical equipment for the Zimapan power plant was underestimated at the time of the SAR. The cost estimate for engineering and administration was estimated as a percentage of the project cost. As the actual project cost was substantially higher than the estimate, the engineering and administration cost increased accordingly. The cost estimate for resettlement was based on CFE's experiences in less complex resettlement programs that required far less socioeconomic restoration. Finally, the estimate for electromechanical equipment was based on informal quotations provided by potential suppliers, which, under the formal bid, quoted substantially higher prices; (ii) the civil works contract had a substantial cost overrun because of geological conditions that were less favorable than those expected at the design stage, addition of some elements not originally contemplated in the Project, and substantial claims submitted by the contractor. The geological conditions along the line of the power tunnel and power house were less favorable than expected at the design stage; these conditions led to the use reinforced concrete in some portions of the tunnel and to a change in the orientation of the powerhouse. New works, originally not contemplated, were included. Some were needed to increase the safety of the project, such as the construction of a second spillway discharge tunnel, the construction of additional injection galleries, and the paving of the road to the power house; others were needed to satisfy the requests of the communities living the project area such as the Zimapan-Boquilla road. The claims submitted by the civil works contractor were based on changes in contractual conditions, items for which there was no unit price and late payments. Although many of these claims were duly justified, some of them could have been avoided or reduced had CFE had the experience and the resources to anticipate and deal with contractors' claims, particularly in major underground works; (iii) excessive demands made by community leaders and local governments. The political pressure on CFE to close the reservoir and inaugurate the project before the presidential term was over, forced CFE to accept some excessive demands made by community leaders, local governments and supported by the more than 50 contractors involved who welcomed any new additional work. CFE was forced to resort to cash compensation and to accept extravagant requests as a way to reduce opposition to the project and assure compliance with its construction schedule (*para. 30*). It is therefore not surprising that the cost of resettlement reached extraordinary levels; and (iv) the budgetary ceiling imposed by the Government on the project which caused delays and extra costs to the contractors. Because of this budgetary constraint, the construction of this power plant suffered delays and the cost of storing and insuring as it waited for the completion of the civil works. Budgetary constraints also resulted in the underutilization of contractors' resources which eventually resulted in claims which CFE had to pay. The Bank supervision missions detected these problems along project implementation and collaborated actively with the Borrower to solve them and complete the Project within schedule.

D. Project Sustainability

35. It is likely that achievement of most project objectives will prove sustainable. The Aguamilpa and Zimapan power plants are operating satisfactorily. The highly qualified Board of Consultants contributed constantly with recommendations to improve the safety of the works. As a result, these power plants were constructed with very high standards, and expectations for a long a productive useful life are well founded.

36. One of the most outstanding results of the resettlement process in Aguamilpa has been the strengthening of the communal organization and the creation of new social capital, fundamental to the sustainability of new settlements. In 1990, in the midst of the relocation process, a strong

communal organization was established: “*Union de Comunidades y Ejidos Indigenas de Nayarit (UCEI)*”, encompassing 14 indigenous *Huichol* communities (several of them affected by the construction of Aguamilpa and 2 of them displaced and relocated by the Project). The reservoir has become an asset for the economic development of the local communities by diversifying family income structure, including transportation, fishing and some domestic business (*para. 29*). Fishing represents 60% of the productive activities of the indigenous communities relocated. However, its sustainability will depend on the quality of the water of the already highly polluted river and on the environmental changes that the reservoir will undergo. Fishing and public health will be monitored by the corresponding governmental agencies to ensure that water quality does not threaten either one.

37. On the other hand, the sustainability of the new settlement in Zimapan for the mestizo population is not guaranteed. The consequences of the loss of the only productive communal property can not be yet fully assessed (*para. 30*), but there is a risk of social disruption and economic impoverishment, specially for those that depended on wage labor in communal lands, those that did not benefit from the compensation in cash and those that spent the money solely in consumer goods. Women, children and the elderly are among the most severely affected.

38. CFE has begun to decentralize its operations and has granted greater autonomy and accountability of its business units. These changes, albeit modest and not yet far reaching, are conducive to sustaining the achievements generated by the Project (*para. 24*).

39. Efforts to promote the efficient use of electricity continue. CONAE actively prepares standards for the manufacturing of electrical appliances. Operation of fifteen regional centers to promote electricity savings ensure that this program will continue in the future. However, lack of CONAE’s institutional autonomy, and the high turnover in its management and technical staff are matters of concern (*para. 20*).

E. Bank Performance

40. The Bank’s performance was satisfactory overall despite some weakness in the supervision of environmental aspects. In 1984, the Bank identified properly the sector issues that had accumulated during an extended period in which the Bank had been absent from the sector (the previous loan to the power sector had been completed in 1974) and assisted CFE in defining and preparing a new project. Two years later, in October, 1986, discussions with the CFE had progressed enough to allow the identification of a new project. This was to be the partial financing of the 1987-1990 time slice of CFE’s investment program to support the following objectives: (i) improvement of CFE’s financial position; (ii) adherence to a least-cost program; (iii) implementation of an institution-building program; and (iv) opening CFE’s procurement to international competition.

41. Project preparation and appraisal took about one and a half years. Four preparation missions visited Mexico during this period, including missions to help the Government to identify and address environmental and resettlement issues. The basis for defining the project, CFE’s ten year investment program, was reviewed in detail with the assistance of consultants. However, resettlement plans were not available at the time of the appraisal and, consequently, their cost estimate did not have adequate support. Submission of the resettlement plan was a condition for Board presentation. This condition was met but the corresponding resettlement costs were not updated at that point in time (*para. 34*). The Bank however failed to demand the establishment of

compensatory protected areas ecologically similar to the areas flooded by the reservoir (*para. 31*) as a condition for project effectiveness and to include the investments required for their demarcation and management in the project cost in compliance with the Bank's Wildlands Policy (OP 4.04).

42. Project implementation was supervised by twelve Bank's missions from 1990 to 1995 (*table 12*). Although the frequency of the missions (about two per annum) might have been insufficient considering the complexity of the Project, the composition of the missions was adequate; they included a variety of specialist in key fields, particularly in the social and environmental aspects. On technical matters, the Bank relied mainly in the periodic assessment and advise provided by the highly qualified Board of Consultants (*para. 35*). The Bank responded timely and effectively to the financial crisis that affected the country in 1994. Bank staff, aware of the negative impact on project execution of the macroeconomic crisis, discussed with the borrower and made arrangements to modify the loan agreement of Loan 3189-ME in order to allocate uncommitted funds to the Zimapan power station which was by then in need of additional financing. This situation was the result of cost overruns caused, at least partly, by the crisis.

43. Problems related to meeting the targets of the Financial Rehabilitation Program, particularly regarding tariffs, emerged in late 1993, and were noticed at that time by a Bank's supervision mission. However, the Bank did not strongly insist that tariff levels be maintained in constant terms and eventually acquiesced to the reduction of electricity tariffs for large industrial consumers in late 1993 (*para. 13*).

44. Bank performance regarding social aspects both during planning and implementation was adequate. Prior to project approval, the Bank insisted on having adequate socioeconomic and environmental data-base and mitigation plans and insisted upon hiring specialists and involving pertinent governmental agencies, especially for the treatment of indigenous issues in both projects. During implementation, the Bank provided support continuously through supervision missions, assisting the borrower to solve unexpected problems encountered in the resettlement process.

45. The Bank devoted much less attention to supervising the environmental aspects. No environmental specialist visited either the Aguamilpa or Zimapan subprojects since at least 1993 and the Bank failed to demand the establishment, prior to project effectiveness, of compensatory protected areas ecologically similar to the areas flooded, in accordance with the Bank's Wildlands Policy (*para. 41*). Both Aguamilpa and Zimapan are large hydroelectric dams with significant environmental issues (*para. 31*), which should have received greater attention from the Bank during both project preparation and supervision.

F. Borrower Performance

46. The Borrower's performance was satisfactory despite some inconsistency on the management of the tariff policy. The Government made major advances in improving CFE's financial situation and performance by implementing the FRA, capitalizing CFE's debt to the Government and authorizing tariff increases during the initial years of the Project (*para. 21*). However, in late 1993, the Government made a highly inconsistent decision on tariffs that negated the progress made during the early years of the project and had severe adverse consequences for the sector and for the Government budget. The decision, probably prompted by political considerations to gain support for a free-trade policy, was to reduce electricity tariffs for large industrial customers (*para. 13*). As consequence of this decision, which lowered the average

electricity tariff, CFE's finances deteriorated significantly, and the Government had to provide a substantial subsidy to CFE from the central budget. Additionally, the program to promote cogeneration did not succeed because CFE's tariffs had been lowered to the point where cogeneration was no longer feasible (*para. 20*).

47. NAFIN played a limited role as CFE had enough experience and capability to manage the loan without the support of an intermediary financial institution (*para. 47*).

48. CFE's performance was satisfactory in spite of problems resulting from budget ceilings (*para. 26*), inadequate tariffs (*para. 13*) and significant problems in the resettlement of the population of the Zimapan area (*para. 30*). The construction of two large and complex hydro power developments as scheduled confirmed CFE's technical know-how. CFE's staff was constantly alert to introduce improvements in the design of the two hydro power plants to increase their safety and was open to discuss and follow the recommendations of the Board of Consultants appointed for the project. CFE submitted information and reports as indicated in the loan agreement, and implemented a satisfactory monitoring system. CFE was open to learn from experiences in other countries and adopted the recommendations of consultants to improve its performance by reorganizing operations and implementing new norms and procedures. Deficiencies were detected in construction management, resettlement and in the ability to sustain the reform effort so as to reap the benefits of competition.

49. In the social area, CFE's performance was also satisfactory although when obstacles were encountered in the Zimapan project, its resolve began to wane (*para. 30*). Specialists were hired and institutional changes were made to incorporate resettlement and environmental management the project's overall management. Agreements with other involved governmental institutions were made as well. CFE's performance on environmental management in both projects and resettlement in Aguamilpa should be highlighted. It is important to mention that once the project started implementation, a highly participatory process was put in place by CFE. There were hundreds of working sessions with the different committees of the communities in order to address their questions, suggestions and concerns, including the problems generated by the process. Soon after completion of the physical relocation in Zimapan, CFE quickly attempted to transfer the economic rehabilitation responsibility to the state government. The process was aggravated since some government agencies did not easily collaborate with CFE. It took the *Secretaria de Pesca de Nayarit* nearly two years to issue fishing licenses to the *Huichol* population and it has taken more than three years for the affected community to get effective support from state governmental agencies to initiate alternative production projects.

50. CONAE's performance was satisfactory, in spite of the significant turnover of key management and technical staff.

G. Future Project Operation

51. Future project operation will be monitored through three specific and comprehensive programs. The safety of the main project structures will be permanently monitored through the instrumentation installed in the project dams and other key structures, and their records evaluated on an annual basis in accordance with CFE's monitoring program entitled "Programa para atender en 1997 las Principales Centrales Generadoras en las Regiones de Generación Hidroeléctrica Grijalva, Balsas, Santiago, Ixtapantongo, Yaqui-Mayo y Papaloapan" (*Appendix B, Attachment 1*). The second program will monitor the changes in the social conditions of the populations

resettled under the project. This will be accomplished by means of the indicators included in Table 6. Finally, monitoring of CFE's financial and management performance would be accomplished through an extension of the FRA.

H. Key Lessons Learned

52. There are four main project-related and four sector-related lessons learned from project execution. Related to the Project, one of the main lessons is related to the social aspects of involuntary resettlement, since the Project required the resettlement of two distinct population groups with very different results. In the case of the Aguamilpa hydroelectric power plant, and for part of the population resettled in Zimapán, the resettlement program was successful despite the fact that it included resettlement of indigenous groups. In contrast, the resettlement of the mestizo population for the construction of the Zimapán hydroelectric power plant was very costly and far less successful.

Lesson 1. To minimize the cost overruns in the construction of hydro power plants, the following should be taken into account: (i) the bidding documents for the construction of civil works should include unit prices for all probable work concepts and site conditions to avoid the need for negotiated prices after the signing of the contract. To request unit prices only for a minimum number of items will inevitably lead to negotiating prices for items not contemplated and since these negotiations typically take place under adverse conditions for the client, the contractor will usually have a privileged negotiating position; (ii) suitable assistance from experienced international construction management firms should be required in order to minimize cost overruns and construction delays. Zimapán and Aguamilpa were the first two major hydro power plants that CFE built by hiring private construction companies. Previously, CFE designed and built power plants by force-account. In this context, it would seem clear that it would not have been reasonable to expect that CFE would be experienced in the management of large civil works, including major underground construction contracts; (iii) budget ceilings during the construction of complex hydroelectric projects should be avoided. They are the cause of not only construction delays, but also of costly contractor claims derived from the underutilization of the construction equipment and workers; and (iv) the construction of main civil works should be carefully coordinated with the program for constructing the new settlements to avoid costly renegotiations with the resettled communities and with the civil works contractors (including those responsible for the physical works needed for the resettlement) (*para. 34*).

Lesson 2. The resettlement and social studies should start early, at the prefeasibility stage, in parallel with the technical, economic and environmental studies, and should include the design of not only the physical works needed to resettle the affected communities, but, more important, programs for restoring the economic and social well-being of the population to be resettled (*para. 41*). In addition to the traditional institutions for decision-making, other participatory modalities that assure voice to women and youth are highly desirable. Adequate social analysis is needed to fully understand the social structure of the population and lack of a wide, highly inclusive and participatory approach for the decision-making process will often lead to failure (*para. 49*).

Lesson 3. Progress in the construction of physical works accompanied by delays in the social and resettlement components and in the compensation/restoration of affected assets, will result in negotiations under extreme pressure and a subsequent tendency to solve problems and complaints by means of monetary compensation or costly expenditures in the physical works of the new settlement. Cash compensation for the loss of productive land is not an adequate strategy for the

restoration of the economic well-being of the resettled population, particularly in the case of farming communities (*para. 30*). What is important is to preserve job opportunities, which is not accomplished through cash compensation

Lesson 4. Establishment of an independent monitoring system to accompany and assess the resettlement process is a key tool in managing relocation processes of indigenous communities, as proved by the success in Zimapan and Aguamilpa. Likewise, putting social teams in direct contact with the affected communities during the entire relocation process has proved to be of great help to ensure success (*para. 49*).

Lesson 5. A sector related lesson is that the establishment of an overarching legal and policy framework that specifies principles, responsibilities, procedures and mechanisms to deal with involuntary resettlement is fundamental for the implementation of projects with complex or large resettlement programs (*para. 49*).

Lesson 6. Another sector-related lesson is that the financial rehabilitation of a power utility is sustainable only if the tariff setting process is independent of political events and influence (*para. 13*). This independent process is possible only if there are both an adequate regulatory framework and an independent commission responsible for tariff setting.

Lesson 7. Another sector-related lesson is that the key requirements for the implementation of successful energy conservation programs are: (i) electricity tariffs for public service must reflect the economic cost of service, and (ii) implementing agencies must be provided with sufficient independence so that they can train and retain their staff (*para. 20*). If qualified staff leave the continuity of the programs is greatly affected.

Lesson 8. The participation of an intermediary institution, such as NAFIN in this project, and the corresponding costs, could be avoided when the executing agency has adequate related experience (*para. 47*).

IMPLEMENTATION COMPLETION REPORT
MEXICO
HYDROELECTRIC DEVELOPMENT PROJECT
(LOAN 3083-ME)

PART II: STATISTICAL ANNEXES

Table 1: Summary of Assessments

A. Achievements of objectives	Substantial	Partial	Negligible	Not Applicable
Financial objectives			x	
Institutional development		x		
Physical objectives	x			
Environmental objectives		x		
B. Project Sustainability	Likely	Unlikely	Uncertain	
	x			
C. Bank performance	Highly Satisfactory	Satisfactory	Deficient	
Identification		x		
Preparation		x		
Appraisal		x		
Supervision		x		
D. Borrower performance	Highly Satisfactory	Satisfactory	Deficient	
Preparation		x		
Implementation		x		
Covenant Compliance		x		
E. Assessment of outcome	Highly Satisfactory	Satisfactory	Unsatisfactory	Highly Unsatisfactory
		x		

IMPLEMENTATION COMPLETION REPORT
MEXICO
HYDROELECTRIC DEVELOPMENT PROJECT
(LOAN 3083-ME)

Table 2: Related Bank Loans

Loan No. and Project Name	Loan Amount (US\$million)	Purpose	Year of Approval	Status
Loan 0012-ME	24.1	First Power Project	1949	Closed 1956
Loan 0013-ME	10.0	Second Power Project	1949	Closed 1950
Loan 0024-ME	26.0	Third Power Project	1950	Closed 1953
Loan 0056-ME	29.7	Fourth Power Project	1952	Closed 1959
Loan 0186-ME	11.0	Fifth Power Project	1957	Closed 1960
Loan 0194-ME	34.0	Sixth Power Project	1958	Closed 1962
Loan 0316-ME	130.0	Seventh Power Project	1962	Closed 1965
Loan 0436-ME	16.6	Eighth Power Project	1965	Closed 1968
Loan 0544-ME	90.0	Ninth Power Project	1968	Closed 1972
Loan 0659-ME	125.0	Tenth Power Project to finance the Sector Program for the period 1970-71	1970	Closed 1972
Loan 0834-ME	125.0	Eleventh Power Project to finance the Sector Program for the period 1972-74	1972	Closed 1975
Loan 3189-ME	450.0	To fund CFE's transmission and distribution program for 1991-92	1990	Closed 1994

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Table 3: Project Timetable

Event	Date planned ^{1/}	Date actual/ latest estimate
Identification	8/86	8/86
Preparation	10/86-5/87	10/86-5/87
Appraisal	11/87	11/87
Negotiations	9/1/88	9/88-4/89
Board Approval	6/89	6/8/89
Signing	8/89	9/25/89
Effectiveness	9/89	1/18/90
Last Disbursement	6/30/96	10/4/95
Project Completion	6/30/96	12/1/95
Loan Closing	12/31/96	12/31/96

^{1/} As provided in the Staff Appraisal Report (SAR) No. 7391-ME.

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Table 4: Loan Disbursements: Cumulative Estimated and Actual
(in US\$ million)

Bank Fiscal Year	Appraisal estimate	Actual	Actual as % of estimate	Date of final disbursement
FY90	46.0	51.6	112%	
FY91	73.0	92.2	126%	
FY92	145.0	232.6	160%	
FY93	244.0	322.4	132%	
FY94	339.0	374.9	111%	
FY95	406.0	435.3	107%	
FY96	460.0	460.0	100%	10/4/95

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Table 5: Key Indicators for Project Implementation.

Key Implementation Indicator in SAR report		1989	1990	1991	1992	1993	1994	1995
Performance Indicators								
Employees 1/	Estimated (Sector)	79,700	81,700	83,700	85,800	87,900	90,000	92,200
	Actual (Sector)	77,045	78,993	81,263	82,396	82,515	82,630	85,604
	Actual (CFE)	63,909	64,427	64,902	63,614	62,545	60,560	62,360
Customers/employee	Estimated (Sector)	184	184	185	185	185	185	185
	Actual (Sector)	201	206	212	218	227	235	235
	Actual (CFE)	182	190	199	213	226	244	247
Energy losses (%)	Estimated (Sector)	13.1%	13.1%	13.0%	13.0%	12.8%	12.7%	12.6%
	Actual (Sector)	14.0%	13.8%	14.5%	14.5%	15.0%	15.2%	15.9%
	Actual (CFE)	11.0%	10.8%	11.0%	11.3%	11.4%	11.3%	12.0%
Average heat rate (kcal/kWh)	Estimated	2560	2550	2540	2525	2510	2500	2500
	Actual	2562	2556	2550	2505	2484	2460	2433
Thermal Plant Availability (%) 2/	Estimated	75.0	75.5	76.0	76.0	76.0	76.0	76.0
	Actual	77.9	78.9	78.5	83.8	85.5	86.0	87.3
Rate of return (%) 3/	Estimated	1.9%	3.3%	5.0%	7.1%	7.5%	7.9%	8.0%
	Actual	12.1%	13.4%	15.2%	5.7%	5.7%	4.1%	1.2%
Debt Service Coverage (times) 4/	Estimated	1.8	2.7	4.6	6.7	7.1	6.8	6.1
	Actual	0.6	1.8	2.5	2.6	2.2	4.2	1.1
Self-Financing Ratio 5/	Estimated	48.1%	60.9%	63.3%	69.7%	71.9%	69.5%	71.2%
	Actual	NA	NA	NA	58.7%	69.5%	77.8%	-51.6%
Government Contributions 6/	Estimated	43.7%	11.7%	3.7%	3.5%	3.4%	3.4%	3.4%
	Actual	NA	NA	NA	0.0%	0.0%	0.0%	86.8%
Borrower and other Financing 6	Estimated	26.5%	34.3%	38.4%	33.1%	31.9%	34.3%	31.9%
	Actual	NA	NA	NA	41.3%	30.5%	22.2%	64.8%
Accounts Receivable (days of billing)	Estimated	60	60	60	60	60	60	60
	Actual	56	70	75	74	66	58	62
Market Indicators								
Peak Demand (MW)	Estimated	17,340	18,250	19,500	20,830	22,200	23,700	25,250
	Actual	NA	15,340	16,430	16,853	17,693	18,728	19,213
Energy Sales (TWh)	Estimated (Sector)	89,283	95,023	101,046	109,046	116,322	123,162	131,563
	Actual (Sector) 7/	90,661	93,720	96,835	99,811	103,472	111,680	115,589
	Actual (CFE) 8/	96,430	99,669	105,419	107,875	111,850	121,582	126,349
Net Generation (TWh)	Estimated (Sector)	102,744	109,385	116,209	124,192	132,319	141,115	150,463
	Actual (Sector) 9/	105,443	108,750	113,248	116,804	121,730	131,660	137,491
	Actual (CFE) 10/	108,360	111,703	118,492	121,582	126,232	137,117	143,651
Number of Customers year ending('000)	Estimated (Sector)	14,640	15,060	15,460	15,900	16,260	16,650	17,030
	Actual (Sector)	15,470	16,285	17,239	17,975	18,690	19,434	20,143
	Actual (CFE)	11,631	12,254	12,899	13,548	14,166	14,797	15,375

1/ Permanent employees in the areas of operation, maintenance and administration (excludes construction work force)

2/ CFE's thermal plant in operation, including only oil-fired steam, coal fired steam, geothermal steam and combined cycle

3/ Net Income/Average net fixed assets in operation

4/ Gross cash generation/total requirements

6/ As compared to Investment Program

7/ Includes sales to sector's final customers and exports

8/ Includes sales to CFE's customers and bulk sales to LYFC

9/ Excludes power plants self-consumption

10/ Excludes power plants self-consumption

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Table 6A - Key Indicators for Project Operation

Indicators	Unit	1997	1998	1999
Performance				
Customers/Operations Employee	Custom/Empl			
Customers/Distribution Employee	Custom/Empl			
Sales/Operations Employee	kWh/Empl			
Installed Capacity per Generating Employee	MW/Empl			
Efficiency				
Thermal Plant Availability	%			
Hydro Power Plant Availability	%			
Average Heat Rate	kcal/kWh			
Energy losses	% of net gen.			
Technical				
Interruption time per customer	Minutes/ Customer			
Number of claims per 1000 Customers	Claims/1000 Customers			
Installation to New Customers Period	Days			
Financial				
Rate of Return	%			
Debt Service Coverage	Number			
Self-Financing Ratio	%			
Accounts Receivable	Days			
Aguamilpa Hydro Power Station				
Gross Generation	GWh			
Net Generation	GWh			
Plant Factor	Factor			
Availability	%			
Zimapan Hydro Power Station				
Gross Generation	GWh			
Net Generation	GWh			
Plant Factor	Factor			
Availability	%			

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Table 6B - Key Indicators for Project Operation

Indicators	Unit	1997	1998	1999
Quality of Water^{1/}				
Temperature				
pH				
Electric Conductivity				
Total Solids				
Solved Solids				
Depositible Solids*				
Floating Material*				
Oxygen				
Phosphates				
Nitrates				
DBO5				
Grease and oil				
Fecal material				
Mercury*				
Lead*				
Economic Indicators of Displaced Population				
Employment	%			
Migration	%			
Familiar Income	%			
Familiar Expenditures	%			
Farming, Commercial and Self-consumption production	Ton/Year			
New Productive activities	Number of New Jobs			
Buying-sale of farming land	Ha.			
Social Organization of Displaced Population				
Women Participation	%			
Sick Rate and Mortality Rate	%			
Displaced Population Adaptation to the New Village				
Building of New Homes	Number			
Sale and Rent of Homes	%			
Improvement and Maintenance of the Urban Facilities	Yes/No			

^{1/} CFE will monitor the quality of water in Taxido and Aguamilpa in 1997. The Comision Nacional del Agua will monitor quality of water in the reservoir and El Jileno Dam except (*).

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Table 7: Studies Included in Project

Study	Purpose as defined at appraisal	Status	Impact of study
1. Energy Conservation	Promotion of energy conservation and efficient use of energy in Mexico	Completed	Savings of about 186 GWh per year and reduction of about 118,000 ton of CO ₂ have been obtained by improving efficiency of electric appliances
2. Co-Generation Study	Analysis of co-generation possibilities in Mexico and incentives required	Completed	Co-generation has not significantly increased due to CDE's low tariffs. When these tariffs reach their marginal costs, co-generation is expected to substantially increase.
3. Operations Improvement Study of CFE's Electric Power System	Reducing energy losses through operating practices and/or new investments	Completed	Operating practices have improved but energy losses have not decreased due to the lack of investment in distribution.
4. CFE's Management Study	Preparation of an organizational development program to improve performance	Completed	A system to monitor performance based on an incentive program and on performance indicators have led to important performance improvements.
5. Second Phase of a Tariff Study	Definition of medium voltage tariffs and purchase of metering and data processing equipment	Completed	Medium voltage tariffs are based on marginal costs now.

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Table 8A: Project Costs

Concept	Appraisal estimate (US\$M)			Actual/latest estimate (US\$M)		
	Local Costs	Foreign Costs	Total Costs	Local Costs	Foreign Costs	Total Costs
1. Aguamilpa Hydro Power Station	399.7	266.6	666.3	689.6	160.7	850.3
2. Zimapán Hydro Power Station	187.0	124.7	311.7	576.4	253.3	829.7
3. CFE's Environmental and Resettlement Programs	2.0	1.4	3.4	1.3	0.0	1.3
4. Studies						
Energy Conservation Study	1.7	1.1	2.8	2.7	0.1	2.8
Co-Generation Study	0.4	0.2	0.6	0.0	1.2	1.2
Power System Optimization Study	0.4	0.3	0.7	0.0	1.0	1.0
Management and Tariff Studies	0.5	0.3	0.8	0.0	1.6	1.6
Total Base Cost	591.7	394.6	986.3	1270.0	417.9	1687.9
Physical Contingencies	94.2	62.8	157.0	0.0	0.0	0.0
Subtotal	685.9	457.4	1,143.3	1270.0	417.9	1687.9
Price Contingencies	85.9	57.2	143.1	0.0	0.0	0.0
Total Cost	771.8	514.6	1,286.4	1270.0	417.9	1687.9
Interest During Construction	0.0	153.2	153.2	0.0	153.2	153.2
Total Financing Requirements	771.8	667.8	1,439.6	1,270.0	571.1	1841.1

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Table 8B: Project Financing

	Appraisal estimate (US\$M)			Actual/latest estimate (US\$M)		
	Local Costs	Foreign Costs	Total Costs	Local Costs	Foreign Costs	Total Costs
Financing Requirements						
Project Costs	772.0	514.8	1286.8	1270.0	418.0	1688.0
Interest during construction	0.0	153.2	153.2	0.0	153.2	153.2
Total	772.0	668.0	1440.0	1270.0	571.2	1841.2
Sources of financing						
IBRD Loan 3083-ME	82.0	378.0	460.0	403.7	56.3	460.0
IBRD Loan 3189-ME	0.0	0.0	0.0	74.0	51.4	125.4
Government and CFE	690.0	143.0	833.0	792.3	198.4	990.7
Other Loans	0.0	147.0	147.0	0.0	265.0	265.0
Total	772.0	668.0	1440.0	1270.0	571.1	1841.1

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(LOAN 3083-ME)Table 9 - Economic Comparison of Hydro vs. Thermal Plants
(Costs in US\$ million, 1988 constant prices)

Year	Aguamilpa & Zimapan			Oil-Fired Steam & Gas Turbines				
	Capital	O&M Costs	Total	Capital	Environment	O&M Costs	Fuel	Total
1989			0.0	0.0	0.0	0.0	0.0	0.0
1990	175.3		175.3	40.0	0.0	0.0	0.0	40.0
1991	524.7		524.7	120.0	26.0	0.0	0.0	146.0
1992	447.6		447.6	220.0	30.0	0.0	0.0	250.0
1993	323.0		323.0	202.0	31.0	0.0	0.0	233.0
1994	145.5		145.5	0.0	0.0	52.8	80.0	132.8
1995	55.5		55.5	0.0	0.0	52.8	80.0	132.8
1996		6.5	6.5	0.0	0.0	52.8	80.0	132.8
1997		6.5	6.5	0.0	0.0	52.8	80.0	132.8
1998		6.5	6.5	0.0	0.0	52.8	80.0	132.8
1999		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2000		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2001		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2002		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2003		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2004		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2005		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2006		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2007		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2008		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2009		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2010		6.5	6.5	50.0	10.0	52.8	80.0	192.8
2011		6.5	6.5	150.0	20.0	52.8	80.0	302.8
2012		6.5	6.5	136.0	20.0	52.8	80.0	288.8
2013		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2014		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2015		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2016		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2017		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2018		6.5	6.5	40.0	0.0	52.8	80.0	172.8
2019		6.5	6.5	70.0	16.0	52.8	80.0	218.8
2020		6.5	6.5	70.0	10.0	52.8	80.0	212.8
2021		6.5	6.5	66.0	11.0	52.8	80.0	209.8
2022		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2023		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2024		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2025		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2026		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2027		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2028		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2029		6.5	6.5	50.0	10.0	52.8	80.0	192.8
2030		6.5	6.5	150.0	20.0	52.8	80.0	302.8
2031		6.5	6.5	136.0	20.0	52.8	80.0	288.8
2032		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2033		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2034		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2035		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2036		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2037		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2038		6.5	6.5	0.0	0.0	52.8	80.0	132.8
2039		6.5	6.5	0.0	0.0	52.8	80.0	132.8
Rate	Present Value							
	Hydro	Thermal						
i=10%	1188.8	1335.4						
i=11%	1145.2	1202.1						
i=12%	1104.1	1090.3						
i=16%	961.1	782.7						
i=18%	899.9	680.9						

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Table 10: Status of Legal Covenants

Agreement	Section	Cov. type	Present Status	Original Fulfillment Date	Description of Covenant	Comments
Loan	3.01(a)	3	C		Lend the proceeds of the Loan to CFE	
Loan	3.02	3	C		Procure goods and services in accordance with Bank Guidelines.	
Loan	4.01(a)	1	C		Maintain, or cause to be maintained, a Special Account	
Loan	4.01(b)(i)	1	C		Keep separate records and audit the Special Account.	
Loan	4.01(b)(ii)	1	C		Furnish audit reports to the Bank not later than six months after the end of each year	Audit Reports have been free of qualifications
Loan	4.01(b)(iii)	1	C		Furnish to the Bank certified statements of the Special Account	
Loan	4.01(c)(i)	1	C		Maintain, or cause to be maintained, records and accounts reflecting expenditures made on the basis of statements of expenditures	
Loan	6.01(a)	12	CD	12/25/89	Signature of a Subsidiary Loan Agreement	
Loan	6.01(b)	7	CD	12/25/89	Progress satisfactory to the Bank on the environmental and resettlement programs	
Project	2.02(a)	2	C		CFE to enter into and duly perform its obligations under the Financial Rehabilitation Agreement, FRA	CFE met the FRA's targets during the FRA's validity period, 1989-1994. After that, CFE's financial performance deteriorated as a consequence of the devaluation of the peso which occurred in 1994.

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Table 10: Status of Legal Covenants

Agreement	Section	Cov. type	Present Status	Original Fulfillment Date	Description of Covenant	Comments
Project	2.02(c)	10	C		CFE to enter into contractual arrangements with the Guarantor providing for the transfer to the Guarantor of the portion of the Loan required for Part C of the Project	
Project	2.06(a)	5	C		Maintain, until completion of the Project, a qualified and experienced board of consultants	Board's performance was excellent. Board was composed by Messrs. Giovanni Lombardi (Swiss), Don Deere (US), Jorge Haelas (Colombian) and Oscar Vega Arguelles (Mexican).
Project	2.06(b)	5	C		Proposed to the Bank, not later than one year before the completion of each dam included in the Project, appropriate arrangements for their post-construction inspection and operation	CFE provided the ICR mission a Report with the Programs to monitor all its hydroelectric power stations in 1997, including the dams at Aguamilpa and Zimapan.
Project	2.07 (a)	7	C		CFE to implement Part B of the Project in accordance with the Environmental and Resettlement Plan	Implementation of the Resettlement Plan for Aguamilpas was fully satisfactory, while the one for Zimapan was expensive, not fully effective and implemented with delay.
Project	2.07(b)	7	C		CFE to, from time to time, review the Environmental and Resettlement Plan to address environmental or resettlement matters	
Project	2.08(i)	5	C	9/30/89	CFE to present to the Bank terms of reference for the studies included in Part D	
Project	2.08(ii)	5	C	6/30/91	Carry out the studies of Part D	The studies were considered satisfactory by the Bank

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Table 10: Status of Legal Covenants

Agreement	Section	Cov. type	Present Status	Original Fulfillment Date	Description of Covenant	Comments
Project	2.08(iii)	5	C	12/31/91	CFE to exchange views with the Bank on the conclusions and recommendations of the studies and provide to the Bank a plan of action for implementation	
Project	2.08(iv)	5	C		Implement the plan of actions recommended in studies of Part D	The Studies' recommendations have been implemented with the exception of some of the recommendations of the Tariff Study, which is being revised by CFE.
Project	2.09	5	C		CFE to complete Final Engineering Design for the Zimapan power Plant	
Project	2.10	9	C	Periodically	CFE to provide, on a semiannual basis, progress reports on project implementation	Progress reports were satisfactorily submitted by CFE
Project	3.01	5	C		CFE to carry on its operations in accordance with sound administrative, financial and public utilities practice	
Project	3.02	5	C		CFE to operate and maintain its plant, machinery, equipment and other property in accordance with sound engineering, financial and public utilities practices	CFE, assisted by EDF, developed a performance monitoring system which is working satisfactorily.
Project	3.03	2	C		CFE to take out and maintain insurance with responsible insurers	
Project	4.01(a)	1	C		CFE to maintain records and accounts in accordance with sound accounting practices	

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Table 10: Status of Legal Covenants

Agreement	Section	Cov. type	Present Status	Original Fulfillment Date	Description of Covenant	Comments
Project	4.01(b)	1	C		Furnish to the Bank, no later than six months after the end of each year, audited financial statements	
Project	4.01(c)	1	C		Maintain separate records and accounts on expenditures made on the basis of statement of expenditures and ensure that the audit reports contains a separate opinion on them	
Project	4.02(a)	2	CD		CFE to update, each year, its Ten-Year Investment Plan	This covenant was complied by CFE until 1994. In 1994, responsibility for the issuance of the Power Sector Ten-Year Investment Plan was transferred to the Ministry of Energy.
Project	4.02(b)	2	C		CFE to undertake only the projects included in the Ten-Year Investment Plan	
Project	4.03	2	NC		CFE to maintain an average ratio of total operating revenues to total operating expenses of not less than 0.95 during 1990 and of not less than 1.0 during 1991 and thereafter	Actual ratios were: 1.06 in 1990, 1.02 in 1991, 0.96 in 1992, 0.96 in 1993 and 0.82 in 1994.
Guarantee	3.04(i)	10	C	9/30/89	Submit to the Bank, through SEMIP, terms of reference for the Studies included in Part C of the Project.	
Guarantee	3.04(ii)	10	C	9/30/91	Carry out the Studies included in Part C	The studies were considered satisfactory by the Bank
Guarantee	3.04(ii)	10	C	12/31/91	Exchange views with the Bank on the conclusions and recommendations of the Studies included in Part C.	

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Table 10: Status of Legal Covenants

Agreement	Section	Cov. type	Present Status	Original Fulfillment Date	Description of Covenant	Comments
Guarantee	3.05(a)	10	C		Perform all its obligations under the Financial Rehabilitation Agreement	
Guarantee	3.05(c)	10	C	9/30/89	Amend the Financial Rehabilitation Agreement to include terms and conditions satisfactory to the Bank	
Guarantee	3.06(i)	10	CD	9/30 each year	Review the progress of carrying out the Ten-Year Investment Plan with the Bank and CFE	The Government complied with this clause until 1993. In 1994, responsibility for the Power Sector Investment Plan was transferred to the Ministry of Mines who reviewed the Plan without Bank participation.
Guarantee	3.06(ii)	10	C		Take all measures necessary to ensure compliance by CFE with its investment and other obligations.	
Guarantee	4.01(a)	1	C		Maintain, or cause to be maintained, separate records and accounts to reflect the operations, resources and expenditures in respect of Part C	
Guarantee	4.01(b)	1	C	6/30 each year	Furnish to the Bank a certified copy of the audit report respect of Part C.	
Guarantee	4.01(c)	1	C		Maintain separate records and accounts reflecting expenditures made on the basis of statement of expenditures, and ensure that such separate accounts are included in the annual audit.	

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MEXICO
HYDROELECTRIC DEVELOPMENT PROJECT
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Table 10: Status of Legal Covenants

Agreement	Section	Cov. type	Present Status	Original Fulfillment Date	Description of Covenant	Comments
-----------	---------	--------------	-------------------	---------------------------------	-------------------------	----------

Covenant Types:

- | | |
|--|--|
| <p>1 = Accounts/audit
 2 = Financial performance/revenue generation from beneficiaries
 3 = Flow and utilization of project funds
 4 = Counterpart funding
 5 = Management aspects of the project or executing agency
 6 = Environmental covenants</p> | <p>7 = Involuntary resettlement
 8 = Indigenous people
 9 = Monitoring, review and reporting
 10 = Project implementation not covered by categories 1- 9
 11 = Sectoral or cross-sectoral budgetary or other resource allocation
 12 = Sectoral or cross-sectoral policy/regulatory/institutional action
 13 = Other</p> |
|--|--|

Status

- | | |
|---|---|
| <p>C = covenant complied with
 CD = complied with after delay</p> | <p>NC = not complied with
 CP = complied with partially</p> |
|---|---|

IMPLEMENTATION COMPLETION REPORT

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Table 11: Bank Resources: Staff Inputs

Stage of Project Cycle	Planned		Actual	
	Weeks	US\$ (000)	Weeks	US\$ (000)
Preparation to Appraisal	NA	NA	58.0	105.2
Appraisal - Board	NA	NA	86.3	191.4
Supervision 1/	NA	NA	134.1	348.4
Completion	6.0	21	6.0	37.5
TOTAL			284.4	682.5

n.a. not available

1/ Planned data for FY94 and FY95 only. Actual data from FY88 thru FY96.

Table 12: Bank Resources: Missions

Stage of Project Cycle	Month/year	Number of persons	Days in field	Specialized staff skills 2/ represented	Performance rating 1/		
					Implemen- -tation status	Development impact	Types of problems 3/
Identification	03/85	2	6	DC,E			
Preparation	10/86	2	11	E,F			
Preparation	03/87	2	25	E,F			
Preparation	05/87	2	8	S,A			
Pre-appraisal	05/87	4	10	E,Ec,S,A			
Pre-Appraisal	09/87	2	10	A,A			
Appraisal	11/87	5	21	E,F,F,Ec,A			
Post-Appraisal	03/88	1	7	E			
Pre-Negotiation	05/88	2	9	E,F			
Pre-Negotiation	02/89	2	12	E,F			
Pre-Negotiation	03/89	1	5	E			
Post-Ngotiation	04/89	3	3	A,S,S			
Post-Appraisal	11/89	4	5	E,F,A,S			
Supervision	08/90	4	17	E,S,F,A	1	1	1
Supervision	02/91	4	12	E,F,A,S	1	1	1
Supervision	9/91	4	18	E,S,A,S	1	1	2
Supervision	03/92	5		E,S,A,E,F,	1	1	1
Supervision	10/92	3	8	E,A,A	1	1	1
Supervision	05/93	4		E,A,S,F	1	1	1
Supervision	11/93	5	16	E,A,F,A,S,	1	1	1
Supervision	04/94	1	4	E	1	1	1
Supervision	12/94	5	11	E,F,E,S,S,C	HS	HS	HS
Supervision	05/95	3	3	E,F,S	S	S	1
Supervision	06/95	3	12	E,F,S	S	S	1
Supervision	12/95	2	3	E,S	S	S	1
Supervision							

1/ 1 - Problem free or minor problems 2 - Moderate problems; S - Satisfactory; HS-Highly Satisfactory;

2/ L.O. - Loan Officer; L - Legal; P - Procurement Specialist; W - Water Supply Specialist; S - Seismic Specialist; A - Achitecture;
ED - Education Specialist; U - Urban Planner; H - Housing Specialist; E - Engineer; F - Financial Specialist; TM - Task Manager.

APPENDIX A:
TRANSLATION OF THE
AIDE MEMOIRE OF THE IMPLEMENTATION COMPLETION MISSION

IMPLEMENTATION COMPLETION REPORT MISSION
MEXICO
HYDROELECTRIC DEVELOPMENT PROJECT
(LOAN 3083-ME)

AIDE-MEMOIRE

February 10-14, 1997

I. INTRODUCTION

1. A World Bank Mission visited Mexico from February 10 through 14, 1997, to supervise the Hydroelectric Development Project. The mission comprised María Clara Mejía, Marcelo Osorio, and Luis Cosenza.
2. The purpose of the mission was to carry out an overall assessment of the project whose physical execution was completed at the end of 1995. The project was partially financed with resources from Loans 3189-ME and 3083-ME. The first of these loans was closed in 1995 and the corresponding Implementation Completion Report (ICR) was prepared in 1996. The second loan was closed at the end of 1996 and the ICR is under preparation. This project implementation completion mission will seek information to complete the ICR. Besides gathering information as to the current project status, the mission focused on identifying the indicators to evaluate the eventual impact of the project.
3. The Mission acknowledges the cooperation and the hospitality received during its visit. The list of individuals met is attached as Annex 1 to this Aide-Memoire. The following paragraphs summarize the findings and recommendations of the Mission. According to standard procedures, the Bank will confirm the Mission's recommendations upon review of the draft Report.

II. PROJECT OBJECTIVES

4. The Project objectives were as follows: (a) to promote the efficient use of electricity through realistic price policies, conservation of energy, and improvement of sector operations; (b) to diversify generation sources; (c) to strengthen CFE's financial position through an increase in rates and the implementation of a Financial Rehabilitation Agreement; (d) to expand the coverage of the power system; and (e) to improve CFE's capability to handle environmental and social aspects of hydroelectric projects.
5. Some of the objectives, such as the diversification of generation sources, the expansion of the electric system and the improvement of CFE's capability to handle environmental and social aspects of hydroelectric projects were fully met. The other two objectives, the efficient use and conservation of energy and the financial strengthening of CFE were partially and temporarily achieved.

III. AGUAMILPA AND ZIMAPÁN HYDROELECTRIC PLANTS

6. The Mission and CFE analyzed different aspects of the Project, with special emphasis on cost overruns, resettlement works, the status of the environmental and social situation of the two plants and the resettled population, and the management indicators currently in use in CFE. The Mission also

collected information to prepare the ex-post economic evaluation of the project. As part of its work, the Mission visited parts of the Zimapán works, including the town of Bella Vista del Río.

7. The Aguamilpa hydroelectric plant construction costs totaled US\$850.3 million, a figure close to the estimated value at the time of project appraisal (SAR), estimated at US\$858.0 million. On the other hand, the cost of the Zimapán plant, US\$829.2 million, was much higher than the initial estimated value of US\$418.0 million. The cost overrun, approximately US\$410 million, was due to the following main works: (a) change of the pressure tunnel lining to reinforced concrete; (b) construction of a second tunnel for the spillway; (c) changes in the orientation and design of the powerhouse; (d) construction of unplanned access roads; (e) higher than budgeted costs for the electromechanical equipment; and (f) works and resettlement costs above those budgeted. The main causes that explain the difference between the budgeted and the actual costs of this plant are: (a) optimistic expectations used as a basis for plant design, especially with respect to the pressure tunnel; (b) some items of extraordinary works without contractual unit prices. These prices had to be agreed upon during the construction process, when CFE's ability to react was limited; (c) greater contractor resources with respect to CFE to support the claims that normally arise during construction of this type of works; (d) initial underestimation of the value of electromechanical equipment; and (e) the action plan for resettlement (at the time of preparation of the project's budget in May 1989) lacked enough details which led to underestimate the cost of the resettlement program.

8. As to the construction-related aspects, it should be remembered that CFE traditionally built hydroelectric projects through force account, thus its experience in managing contracts of a similar size than those that resulted from the project and in negotiating claims, was relatively limited. Notwithstanding the above, the Mission considers that the main lessons derived from project execution are the following: (a) during construction of large works such as hydroelectric projects, a support team should be constituted comprising experts on legal issues, contract administration and assessment of claims, as well as on financial issues, so that they provide continuous assistance in administering the contracts and in providing professional and quick solutions to the claims presented by contractors. Additionally, consideration should be given to the introduction of incentives for the staff participating in the supervision of works, including the experts that will administer the contracts and negotiate the claims; (b) the bidding of works with a high degree of geological uncertainty should, as far as possible, include price quotations for all works items considered to be potentially needed, in order to avoid negotiation of unit prices after the works have begun; (c) quotation of prices for electromechanical equipment do not constitute sufficient information on which to make budget projections. It is necessary to supplement this information with other that may be derived from recently constructed projects; (d) the construction of hydroelectric projects is most difficult in situations in which invariable budgetary ceilings are used. The very nature of the works makes it impossible to accurately budget annual expenses, and when subjected to a rigid ceiling, there are contractor claims for delayed payments or other components are sacrificed, such as those related to social works, in order to comply with payments to the contractor; and (e) the construction of large size projects becomes even more problematic if there is a limit beyond which the contract may not be increased. In these cases, the solution of cost overruns which are typically present in these works becomes difficult and slow, resulting in cost overruns due to interest on overdue payments. A way should be identified to simplify the required processes to expand the value of contracts to avoid additional cost overruns due to delayed payments.

9. With respect to the periodic inspection of hydroelectric project dams, CFE confirmed that it is preparing an annual plan for this purpose and that as a result of this, it is preparing reports with the results of the inspections and studies. The plan corresponding to 1997 is attached as Annex 2 to this Aide-Memoire.

10. As to the environmental impact, the measurements carried out show that waste waters discharged by the facilities are not a problem and that there is no apparent sign of proliferation of algae or macrophytes that may constitute a public health risk. Likewise, the monitoring of the water quality in the Taxidó creek carried out through July 1996, shows that the dam waters have not polluted the source. The Taxidó spring is especially important as it constitutes the only drinking water source with adequate volume to supply the resettled population in Bella Vista del Río as well as other borderline towns and settlements belonging to the community of Vista Hermosa. The results of the water quality monitoring of the Taxidó spring are shown in Annex 3. CFE reported that it will re-initiate the monitoring program in March 1997, and that it will continue to do so up to February 1998. If pollution levels are found to be beyond the values established by the national standards, CFE will build a water treatment plant or take another measure agreed upon to solve the problem. With regard to the fishing potential of Aguamilpa, which constitutes an important source of income for 14 Huichol communities, including the 2 communities resettled, CFE will review the reports prepared by the Fisheries Secretariat, Nayarit District, and will include the results in an annual report along with those of the water quality of the Taxidó spring. A copy of this report will be sent to the Bank.

11. The resettlement and rehabilitation program for 115 families of the Huichol community (Colorado de la Mora and Playa Golondrina) and the mestizo community (Los Sabinos) displaced by the construction of the Aguamilpa Plant, has achieved the proposed objectives. The community lands were reinstated and traditional subsistence agricultural activities were reestablished, including fishing at the dam. Resettlement was based in the participatory action of the affected communities and respect for their culture. The three resettled communities have reached a satisfactory level of socioeconomic and self-management stability. New economic activities have sprung up, such as local tourism services, motorboat passenger transportation, and some cottage industries. Aguamilpa constitutes the first successful experience in resettling indigenous communities in projects financed by the Bank.

12. The outcome of resettling 140 families affected by the construction of the Zimapán Plant in the State of Hidalgo and resettled in Paso del Arenal, El Epazote and Aljibes, is also very satisfactory. Negotiations with the community took place without major obstacles. The productive land was restituted in enhanced conditions, as well as the towns and services.

13. The situation of the 412 families displaced from Rancho Nuevo, Vista Hermosa and La Vega in the State of Querétaro and resettled in Bella Vista del Río is somewhat different. The negotiation process was quite conflictive. Cash indemnities as well as acceptance of the excessive demands made by the Resettlement Committee were the means negotiated and acceptable to the parties to reduce opposition to the project and to avoid delays in construction of the works, with the ensuing cost overruns and exacerbation of conflicts within the affected communities. Although towns and services were not only reestablished but also considerably improved, the restitution of productive irrigated land did not take place. At the end, the only irrigated lands generating profits and employment for landless community people were not replaced but compensated with cash payments. As a result, the community does not have productive agricultural lands and was left with only semi-arid lands, with agricultural restrictions that impede their productive and sustainable use. However, various efforts undertaken by CFE to promote new economic activities, such as providing camp facilities for future businesses, have allowed the installation of a private maquila company that generated 80 jobs for community women. Nevertheless, the community has lost its economic foundation based on agricultural activities for self-consumption and has become exclusively dependent on migration. This situation was already present before project construction.

14. The Mission considers that the main lessons learned with respect to social and environmental issues are the following: (a) it is advisable to strengthen and complete the regulatory framework as well as the coordination mechanisms defining the responsibilities and rights of the parties, the mechanisms for conflict resolution, and the responsibilities of the institutions involved in resettlements; (b) the social studies should be carried out in parallel with the technical, economic, and environmental studies from the initial pre-feasibility stages. Late resettlement plans once a decision has already been made on the project, generate conflicts and cost overruns; (c) information and timely consultation with the affected communities regarding productive restitution alternatives based on technical and socioeconomic feasibility studies is the best tool to avoid conflicts and generate trust and transparency; (d) the social analysis should consider gender differences and the divisions existing within the communities so as to promote consultation and decision mechanisms seeking the participation of all groups and avoid the adoption of decisions by a minority; (e) rather than the physical resettlement of populations, the social rehabilitation and economic re-establishment of the affected communities is what defines the success and sustainability of resettlement programs; (f) the tendency to invest more money and to accept unjustified claims to reduce conflicts and to ensure compliance of construction schedules, originates internal disputes within the communities and negatively affects the resettlement; (g) strict coordination and planning of main civil works and required works for the resettlement of displaced populations is needed to avoid negotiations under extreme pressure and costly solutions; and (h) the restitution of productive land in cash has not proven to be an adequate strategy for the economic rehabilitation of communities that have traditionally depended on the land for their subsistence.

15. An important project objective was the financial rehabilitation of CFE, thus a Financial Rehabilitation Agreement was executed between CFE and SHCP. The Agreement included 17 performance indicators, which are shown in Annex 4. An analysis of this Annex shows an improvement in the "price/cost ratio" indicator up to 1994, the term of the Agreement. Unfortunately, since then CFE's financial situation has once again deteriorated, this time as a result of the substantial devaluation suffered by the Mexican Peso, which has not adequately been compensated by a rate adjustment.

16. The Mission maintains that the lesson derived from CFE's financial rehabilitation process consists in proving that the sustainable financial recovery of the sector is only possible if the rate issue is resolved. This, in turn, requires the adoption of an appropriate regulatory framework and leaving rate setting as the responsibility of an independent commission, i.e. separating the ownership of sector companies from the policy setting and the regulatory functions.

17. During the process of searching management indices to follow up on project benefits, the Mission was informed that as a result of the studies financed with loan proceeds, CFE has adopted a plan of incentives to benefit, among others, the staff of generation plants. The management indicators constituting the foundation of the system are agreed upon annually and they are very adequate for the future follow up and analysis of the project and of the hydroelectric plants partially financed with loan resources. These indicators are attached as Annex 5 to this Aide Memoire. Since CFE, for its own reasons, will closely follow up these indicators, the Mission and CFE have agreed that these same indicators will be used to follow up the project. Additionally, the indicators to be used to follow up on the performance of the two hydroelectric plants, Aguamilpa and Zimapán, were selected. The above cited Annex presents the values of these indicators for 1995 and 1996, which shows the satisfactory operation and adequate maintenance to date.

18. Besides the technical indicators shown in Annex 5, it is also necessary to develop indicators applicable to social and environmental aspects. These indicators were also agreed upon and are included as Annex 6 to this Aide-Memoire. Even though CFE does not routinely follow up these indicators, it

was agreed that CFE will begin the process in order to collect and update the information annually. The CFE and the Mission agreed that the indicators mentioned in this and in the previous paragraphs, as well as in the annual plan for dam inspections, will be included in a report to be sent to the Bank during the course of the following month of March of the corresponding year.

IV. ENVIRONMENTAL AND SOCIAL PROGRAMS

19. As a result of the Project, CFE has been able to strengthen these areas. Prior to project approval CFE did not have a high level unit responsible for planning and managing environmental and social issues, including resettlement. Community relations had been performed by the engineering departments in charge of the design and operation of each project. These activities were performed on an ad hoc basis, generally by staff with no experience in social and natural sciences. To implement the environmental and social aspects of the project, CFE created the Social Development Management Office and the Environmental Management Office with technical, multidisciplinary teams with clear cut responsibilities and authority that allowed to take on this task. Today, both Management Offices are staffed by 9 and 35 professionals, respectively, and their duties include the issuance of technical and administrative standards and procedures applicable to all CFE actions and projects. Annex 7 shows a listing of the environmental standards prepared by the Environmental Management Office and officially adopted by the entity, as well as the standards and procedures on social issues that have been developed by the Social Development Management Office which will be soon approved. The strengthening of the two Management Offices as well as internalization of the of Zimapán and Aguamilpa experience through procedures, internal policies, and manuals is essential to simplify and make more efficient the processes related to environmental and social issues in future CFE projects.

20. The Bank will send to CFE (Social Development Management Office) examples of national and state resettlement policies from other countries as well as the methodology used in the Yacyretá Project in Argentina, to evaluate the resettlement carried out.

V. EFFICIENT USE OF ELECTRIC POWER

21. As part of the project, a series of studies were carried out to: (a) study and issue standards to foster energy efficiency for industry and business; (b) study and identify methods to improve the efficiency of water pumping and air conditioning equipment, establishing demonstration centers; (c) study and establish regional centers to promote energy efficiency; and (d) study and identify training needs to undertake energy conservation programs. As to cogeneration, the project included the study of appropriate alternatives and incentives for cogeneration. Finally, the project included the purchase of laboratory equipment and staff training. This project component was carried out by the National Commission on Energy Savings, CONAE, under the Secretariat of Energy.

22. Of all the studies mentioned above, the work related to the preparation and issuance of standards has been the most successful. CONAE has issued 11 standards, 5 more standards are under preparation and 7 standards are at the draft stage. Of all current standards, CONAE estimates that those applicable to household refrigeration appliances have resulted in a reduction of 25% in electricity consumption. Considering that the Mexican market demands a million refrigerators annually, the energy savings are impressive (estimated by CONAE in 186 GWh annually, with an associated reduction of 117,900 tons of CO₂). Notwithstanding the above, other standards such as those related to water pumping, with a potential savings of three times that corresponding to refrigerators, have not been implemented (in spite of having been enacted) given the related political problems and the significant subsidy included in the electricity tariff.

23. With respect to cogeneration, the programs suffered by the strong devaluation occurring at the end of 1994, which in real terms reduced the value of electricity tariffs in half. Despite the adjustments made since then, rates have yet to recover their value, making cogeneration unattractive. In addition, there are still several issues to be resolved allowing the connection of cogenerators to the CFE network as well as connection fees and wheeling charges.

24. CONAE has established 15 generation centers to promote energy efficiency and conservation. Besides, staff was trained; however many of these staff are no longer working with the institution. As to purchase of laboratory equipment, CONAE's policy currently provides that this type of service be provided by the universities and other institutions.

25. CONAE intends to focus its efforts in advising businesses so that these may prepare feasibility studies to obtain financing from commercial banks. To this end, it is preparing a web page to be placed in the Internet which will allow it to provide advice to all those concerned.

26. The Mission considers that the preliminary lessons derived from the implementation of this component are the following: (a) it is not feasible to carry out energy conservation and efficiency programs when the rates do not reflect the cost of service or when subsidies are granted that distort the price levels; (b) the high personnel turnover suffered by CONAE has affected project execution and it has particularly resulted in the loss of institutional memory as to the lessons that may be derived from its execution. The lasting solution to this problem requires changing CONAE into an institution that enjoys more autonomy and independence; (c) the transfer of resources to CONAE through CFE caused several difficulties that had an impact on contracting and payment of consultants. This has prompted CFE to consider that the use of this procedure in the future is not desirable.

VI. OTHER STUDIES

27. As part of the Project, studies related to the operation of the electric system, improvement of the administration and rate setting functions, were also included. As a consequence of these studies, the concept of business strategic units (UENs) was developed as quasi-companies responsible for their own management, which is being successfully applied in generation plants. The concept of annual negotiation of performance contracts based on management indicators and on incentives for those meeting the indicators agreed upon was also adopted. Once again, this seems to work successfully in generation and may be one of the most important and positive outcomes of the project.

28. As to rate setting aspects, rates deteriorated because of the peso devaluation that took place between 1993 and 1994. This devaluation has not yet been compensated by appropriate rate adjustments, so that the average rate has decreased in current U.S. Dollars from US\$0.061 per kWh in 1993 to US\$0.04 in 1996. Average rates in effect per type of consumption are as follows, in New Mexican Pesos:

Type of Consumption	Rate
Residential	0.376
Commercial	0.894
Services	0.636
Agricultural	0.193
Medium Size Company	0.435
Industrial	0.302
Power and Electricity	0.351

29. With respect to the study of marginal costs, the Mission was informed that the study served as the basis for the calculations that CFE currently prepares periodically. The results of the study may therefore be considered successful. The Mission requested CFE to provide the Bank, by February 28, a summary report on the marginal costs and average rates in effect by CFE by level of voltage.

VII. Preparation of ICR

30. To be able to complete the draft ICR, the information listed in Annex 8 to this Aide Memoire must be submitted. It was agreed that CFE will send this information to the Bank at the latest on February 28. For its part, the Mission estimated that if this deadline is met, the draft ICR will be sent for review by the authorities on April 1, 1997.

Mexico, D.F., February 14, 1997

(signed) For CFE - Germán Sandoval

(signed) For the Mission - Luis Cosenza J.

APPENDIX B
SUMMARY OF THE TRANSLATION OF THE
BORROWER'S CONTRIBUTION

ELECTRIC POWER FOR THE PROGRESS OF MEXICO - CFE

**SUBDIRECCIÓN DE CONSTRUCCION
COORDINACIÓN DE PROYECTOS HIDROELÉCTRICOS
GERENCIA TÉCNICA**

**HYDROELECTRIC DEVELOPMENT PROJECT
LOAN 3083-ME**

FINAL REPORT

October 1995

COMISIÓN FEDERAL DE ELECTRICIDAD

HYDROELECTRIC DEVELOPMENT PROJECT

LOAN 3083-ME

FINAL REPORT

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5. RESETTLEMENT PROGRAMS

1. EXECUTIVE SUMMARY

Project Objectives

The objectives set for the Project were:

- Promotion of the efficient use of electric power
- Diversification of electric generation sources
- Expansion of electric service coverage in the country
- Improvement of CFE capabilities in the execution of environmental and resettlement programs
- Implementation of the Financial Rehabilitation Agreement

Implementation of Project Objectives

Promotion of the Efficient Use of Electric Power. This objective is deemed to have been met. An assessment of the Electric System operational efficiency and identification of justifiable actions to enhance its efficiency were carried out by the consulting company Electricité de France (E.D.F). The study was initiated on November 27, 1990 and was concluded on February 7, 1992. The performance of the consulting firm was satisfactory and the requirements stated in the terms of reference of this study were met. Currently, the recommendations included in the study as to Generation, Load Dispatch, Fuels Handling, Design of Plants and Transmission are being implemented.

In addition, the National Commission on Energy Savings (CONAE), reporting to the Secretariat of Energy, contracted the execution of a series of studies on energy savings and cogeneration to analyze the current situation and to define new criteria for a better use of energy. The performance of the contracted consulting companies was satisfactory and currently the recommendations derived from those studies are being implemented.

Diversification of Power Generation Sources. This objective has been met. At the end of December 1988 there were 29.3 GW installed with a participation of 7,749 MW (32.3%) of hydroelectric plants. The objective for 1994 was to have 33.6 GW of which 8,839 MW (26.3%) would come from hydroelectric plants. With the additions and modifications to installed capacity during 1994, one of which corresponds to start-up operations of the Aguamilpa Hydroelectric Plant (3 x 320 MW), there is an installed capacity of 31,649 MW by the end of December of which 9,121 MW come from hydroelectric plants (equivalent to 28.82% of total capacity), surpassing the goal of the National Energy Modernization Program by 282 MW as to energy originating from hydroelectric plants.

The 1994 increase of installed capacity with respect to 1993 was 8.37%, with 39.2% of this growth corresponding to the Aguamilpa Project and 60.8% to other electric generation sources. During 1995, it was programmed to add 2,077 MW of which 732 MW (representing 35.2% of total capacity by additions) correspond to hydroelectric projects. The Zimapán Hydroelectric Project (2 x 146 MW) represents 39.9% of the hydroelectric additions programmed for 1995.

Expansion of Electric Service Coverage in the Country. This objective is deemed to have been met. With the additions and modifications to the installed capacity during 1994, one of which corresponding to the start-up operations of the Aguamilpa Hydroelectric Project, it was possible to expand electric service national coverage from 92.18% (in 1993) to 94.24% (in 1994), increasing coverage from 18.7 to 19.4 million users.

Improvement of CFE Capabilities to Execute Environmental and Resettlement Programs. This objective is deemed to have been met. Through the creation of the Social Development and the Environmental Protection Management Offices, CFE's management capabilities in these areas have increased significantly. The implementation of criteria and guidelines to study, handle, and follow up environmental and social issues, from the planning stages to project completion, was also achieved.

Implementation of the Financial Rehabilitation Agreement. It is considered that CFE satisfactorily met the objectives set in the Financial Rehabilitation Agreement, achieving 97.05% compliance during 1994, average compliance during the 1990-1994 period of 96.58%, and improving by 34.5% the behavior of the 17 indicators considered for the evaluation of the entity. The achievement of values higher than the goal on 12 of the indicators should be highlighted, and although five of them register non-compliance, only on three of these did indicators record deviations greater than 5%. The importance of the cost/price ratio should be noted, which was basically affected by factors external to CFE such as those corresponding to the impact of exchange rate variations and the fuel price policy. The fuel oil price presented important increases during 1994, and the average sale price of electric power remained practically constant.

The following table summarizes the results obtained at the end of 1994.

MANAGEMENT INDICATORS	UNIT OF MEASUREMENT	YEAR 1994		COMPLIANCE	
		ACTUAL PERIOD	DEC. GOAL	%	WEIGHTED %
PRODUCTIVITY				99.02	43.57
Operational Staff Increase	%	0.32%	0.00	100	9.97
Users/Operation Worker	--	262.09	260.09	100	10.00
Sales/Operation Worker	GWh/wkr	1.585	1.458	100	6.00
Installed Capacity/Generation Worker	MW/worker	1.82	1.95	93	5.60
Transmission Lines/ Transm. Lines Worker	km/workers	47.62	47.36	100	6.00
Users/Distribution Worker	--	440.92	437.23	100	6.00
OPERATIONAL EFFICIENCY				99.74	22.94
Average Availability in Base Thermoelectric Plants	%	85.98	81.49	100	8.00
Average Availability in Hydroelectric Plants	%	85.56	84.49	100	3.00
Thermal Efficiency in Base Thermoelectric Plants	%	34.29	34.64	99	5.94
Energy Losses	%	10.99	11.66	100	6.00
SERVICE QUALITY				100	15.00
Down Time/User	Minutes	251	292	100	5.00
Complaints/1000 Users	--	18	22	100	5.00
Connection Time of New Users	Days	3	5	100	5.00
ADMINISTRATIVE/ FINANCIAL				86.33	15.54
Administrative Service Expenses/Operational Products	%	7.17	6.91	96	5.77
Inventory Coverage in Operational Stores	Months	34.46	25.97	67	4.04
Price/cost ratio	\$/S	0.82	0.95	86	1.73
Staff growth in National offices	%	0.04	0.00	100	4.00
TOTAL	%				97.05

Technical Aspects, Design, Procurement of Goods and Services, Costs, Construction and Operation of the Financed Projects

The whole design of the main civil works was done by CFE and the electromechanical work was contracted under the turnkey modality, considering the design, supply, tests and start-up of the equipment. In the specific case of the Zimapán curtain, experts were contracted to support the design.

To contract the main civil works, an international bidding competition was carried out. The procurement of electromechanical equipment was also bided internationally, requesting full financing from suppliers. The supplementary civil works and the construction of resettlement towns were contracted with national companies, taking into account the need to have economic spillovers that would benefit the places where the projects were constructed.

Contracting for the studies charged to CONAE and to CFE was made through a process of direct invitation to companies and institutions. For the advisory services on social and environmental issues, experts accepted by the World Bank were contracted. The same method was used to hire institutions to develop a "monitoring" program for the works performed in each area.

Cost

The summary of the cost of the Hydroelectric Development Project is as follows:

ITEMS	CURRENT MILLION DOLLARS	
	COST	BANK SHARE (1)
PART A		
A.1 Construction of the Aguamilpa Generation Plant	850,3	330,3
A.2 Construction of the Zimapán Generation Plant	829,2	124,4
A.3 Expert Consultant Services for Parts A.1 and A.2	0,5	0,0
PART B Social and Environmental Program	1,3	0,0
PART C Energy Related Studies:	4,3	3,0
• Conservation		
• Cogeneration		
PART D Other Studies:	2,3	2,3
• Improvement of electric system operations		
• Improvement of administration system		
• Rates		
TOTAL	1.687,9	460,0

(1) It does not include US\$125.4 million remaining from Loan 3189-ME which were applied to the Zimapán civil works.

All construction works were performed through contractor companies, with the exception of the initial diversion works of the Río Santiago towards Aguamilpa. These works were executed by direct administration. Once the contract was awarded, the contractor continued with the works.

CFE was in charge of supervising the execution of works, relying on specialized contractors to supplement its coverage.

The Aguamilpa Plant began to supply energy to the Electric System in July 1994 and the Zimapán Plant in September 1995.

NAFIN Performance During Project Implementation

Overall, it is considered that NAFIN's performance as financial agent was of great assistance in getting CFE to fully apply the loan granted. This is because of its negotiating ability with the Bank, as well as its willingness and care to resolve the contingencies presented in a timely fashion.

During the initial stages of Project execution, some contingencies emerged when trying to handle some technical aspects with NAFIN that needed to be taken care of to have continuity in the flow of resources. However, once the degree of involvement in the matter was defined jointly with the World Bank, this situation was completely resolved.

World Bank Performance

Within the scope of its jurisdiction, the Bank's handling of the loan operation was always adequate. The Bank invariably showed great willingness to reach agreements to the satisfaction of all parties on the issues that eventually resulted in a conflict.

Following are some suggestions, which in the opinion of the different CFE areas that interacted with the Bank, may be convenient to consider for future operations.

- Expand the authority of the Bank's Representative in Mexico City, especially with respect to processes requiring granting the Bank's "No Objection". This would allow a more expeditious administration and operation of loan resources.
- Seek to maintain the continuity of financial, technical, and anthropological experts accompanying the Project Officer during evaluation and supervision missions during project execution. This would allow a clearer interpretation of the issues that may arise, as well as on the proposals and recommendations to find solution alternatives consistent both with the reality and with the practical possibility to implement them.
- Expand the coverage of Bank financing schemes so that future operations be financed under the "turnkey" concept, to ensure the comprehensive nature of the project.
- As a first order of business for future operations, it is deemed advisable that following the execution of the loan legal documents, a seminar be conducted with the participation of representatives of the Bank, the Treasury and Public Credit Secretariat, the appointed financial agent, and the executing agency. This would allow the exchange of viewpoints on the design of joint strategies that would allow better project administration, operation, and execution. This suggestion is made with a view to share, define, and determine the scope of jurisdiction and responsibility among the different stakeholders during project development.
- During loan execution, there were some complications related to Bank authorization to pay estimates for the civil works contracts. This was caused because when cost adjustments

by escalation were included, the authorized amount expressed in Pesos was rapidly reached even though the amount allotted expressed in U.S. dollars was not reached. This was due to the exchange rate situation and the inflation prevailing at that stage of the Project. It would be convenient that the figures approved by the Bank at the time of awarding a contract be expressed only in U.S. dollars and that the payment of estimates and cost adjustments be considered regardless of the corresponding exchange rate up to the depletion of the loan amount assigned to the Project.

Performance of Other Entities

With respect to CONAE, the administrative cost represented by the processing and operation of the resources assigned to that Institution was assumed. To achieve better transparency in the flow of resources, it would be convenient that in the future funds for two different executing bodies not be involved in the same project. This issue became a problem with the changes made in its management staff during the previous Administration, which caused lack of continuity in the development of studies, as well as delays in the original contract execution timetables, which finally had an impact on the timely payment of contracted consultants.

The experience generated by this type of projects, is not necessarily part of the wealth of experiences that should be institutionally maintained. Even though it is important to have other entities aside from the Commission playing a monitoring role so that they act as an alternative monitoring mechanism, it would be convenient not to lose the experiences achieved both by CFE and the Institutions that were present in the resettlement Program implemented by CFE, and to make them part of a wealth of information that may be used on future projects.

On matters of Environmental Protection and derived from the experience acquired, it is convenient that from now on agreements be made committing to a greater extent the different Government levels and agencies so that they support, intervene and be accountable for the activities falling within the scope of their responsibility. Thus, CFE may turn its attention with greater efficiency on those aspects under its direct jurisdiction.

From a technical-administrative viewpoint, valuable experiences were also obtained, some of which are being applied in new projects, such as:

- The environmental regulatory unit should be involved starting with the development specifications to contract works and environmental impact statements. Besides, it should have predominant participation in the formation of the Environmental Protection Operational Units (EPOU) which in the field will act as a support to the General Construction Residency. It should also be involved in the development of specific environmental study contracts beginning with the selection of bidders to compete.
- The EPOU, whether carrying the project's environmental responsibility by direct administration or acting as supervisor of the project's construction company, should issue periodic technical-administrative reports.
- At the end of the construction phase, the EPOU should prepare a final report on the activities.

- During the final construction phase, there should be a clear transmission of environmental duties to those responsible for the operation of any hydroelectric project, as the latter must monitor the compliance with the environmental regulations for that phase. Besides, it is quite likely that during the operational stage some studies initiated during the construction phase of the project must be continued.
- The environmental regulatory unit should prepare a series of environmental procedures mandatory to all CFE areas involved in the design, construction and operation of hydroelectric projects. Likewise, it should prepare others regulating the technical relationships between CFE and the Contractors in order to ensure that the Contractors comply with CFE policies on environmental matters.

2. THE AGUAMILPA PROJECT

Original Design and Changes Made During Construction

In accordance with the original design, it was provided that the body of the curtain would be constructed essentially with pay gravel. However, the need to build it sooner and to have available a greater volume of excavation materials, made it convenient to use basically rock-tangling instead of pay gravel thus modifying the size of the materials placed and the curtain dimensions.

The original project provided that the substation and the transformers be installed in a cave. For safety reasons, the design was modified and the installation remained in an external platform.

With a view to ensure that no landslides occur, given the poor stability found on the slope where the spillage was built, the characteristics and sizes of the latter were modified so that in case of operation, the discharge would take place at an elevation lower than that originally foreseen.

Given the requirements established by the National Water Commission and as a supplementary measure to alleviate the environmental impact caused by the suspension of the river flow, it was necessary to include a water discharge for irrigation to be used during the filling of the dam. This device was not included in the original design.

At the request of local authorities and given the convenience of transporting more easily the electromechanical equipment received, a road easement was built allowing the freight to reach the works without going through the City of Tepic. This infrastructure was not considered in the original design.

Project Execution and Problems Encountered

At the beginning of 1991, an extraordinary inflow took place with a higher expense than the maximum recorded in the hydrological studies. This inflow caused damages and landslides in the derivation tunnels and in the access roads, besides causing flooding of the chamber where the curtain was under construction. Rehabilitation of the damages caused an increase in the amount of work to be performed without the possibility of modifying the timetable for the completion of the works.

To satisfy the expected electric power demand, it was decided to speed up the project construction program, thus completion was advanced one year with respect to the schedule established in the

studies developed jointly with the World Bank. This meant that the Contractor reduced the execution term originally agreed upon by six months.

Project costs

ITEM	COSTS IN MILLION (Current Prices)			
	SAR ESTIMATE (1)		ACTUAL	
	N\$	US\$	N\$	US\$
Engineering, administration and supervision of construction	229.5	99.9	311.5	121.3
Civil works	844.0	367.4	1,678.0	485.2
Resettlement and the environment	22.3	9.7	43.3	17.9
Electromechanical equipment	370.0	161.1	670.6	204.2
Transmission lines	64.8	28.2	55.6	21.7
Physical contingencies (emergencies)	222.8	97.0		
Price contingencies (escalation)	217.5	94.7		
TOTAL (2)	1,970.9	858.0	2,759.0	850.3

(1) SAR: Staff Appraisal Report, May 1989.

(2) Direct costs are reported based on accounting expenses, including financial charges associated to partial short-term loans managed by the contractor of the main civil works.

The items where actual costs show the largest differences from that estimated in the SAR are the civil works and the electromechanical equipment.

Even though the difference between the actual cost and the estimate of civil works derives from a great array of concepts, most of these are linked to the shortening of the construction program, which at the time was subjected to a cost/benefit analysis which indicated the convenience of having the energy produced by the project in advance. The items representing the main increase are described below.

- **Infrastructure.** The difference in costs was mainly due to the increase in the amount of open air excavation derived from the construction of the additional roads required to reach different areas of the works simultaneously, based on the needs of the construction program. The bridge over Río Santiago had a higher cost than expected.
- **Derivation.** The main increase derives from the Contractor receiving the derivation tunnel with less progress than that foreseen by CFE to be done by direct administration and that it was necessary to modify the excavation procedure to speed up the construction of the two derivation tunnels. Likewise, the Contractor was requested to rehabilitate the derivation as a result of the damages caused by the extraordinary inflow that occurred in January 1991.
- **Curtain.** The items representing the difference in costs correspond essentially to additional activities not foreseen in the contract, such as the installation of the rock conveyor band to accelerate construction, instrumentation and finishing, among others. Additional injection treatments were also required, given the geological conditions of the rock in the curtain area, to form the waterproofed screen and guarantee that the dam would not spillover.
- **Power house and spillway.** The items having a main influence on the increase of the estimated amount are represented by the excavation required to construct the subterranean road allowing to reach several work fronts at the same time, by the open air excavation

derived from the convenience of constructing the transformer area outside instead of in a cave, as originally planned, and to the convenience of modifying the spillover design extending it to allow the discharge at a lower level than that considered initially.

One of the aspects having a significant impact on the cost variation of civil works is constituted by the increase in labor costs. In accordance with the Bidding Documents, unit prices where labor was to be involved were to be calculated considering as minimum reference the tables of salaries for unionized workers. In practice, as the works progressed, it was apparent that the salaries offered did not attract the required labor, as the labor market pushed towards increased costs. To give continuity to the works it was necessary to offer higher salaries, with the subsequent impact on unit prices. To adjust to these new needs, a study was contracted that finally led to the implementation of an "ADJUSTMENT FACTOR FOR REAL WAGES" (FASAR) through which higher salaries were offered based on longer working hours and increased productivity. This factor was accepted by CFE and applied to work estimates in a similar manner to the escalation factors, throwing the adjustment by reason of the increase on labor costs.

As to the electromechanical work contract, the totality of the scope foreseen was covered and a series of amending agreements were executed to cover issues not included originally, which cause the difference between the real cost of this item and its estimated cost. In summary, these issues are:

- Accelerated manufacturing of equipment associated to the reduced construction program
- Increase in supplies due to change of project in the transformers' area
- Increase in supplies due to inclusion of irrigation intake valves
- Increase in miscellaneous supplies
- Inclusion of import taxes that originally were paid at the CFE consolidated level

It should be noted that given the high financial cost, it was decided that the domestic component (essentially constituted by the setup) be paid at a variable price with own resources.

Financing

ITEM	Million of current U.S. Dollars			
	ACTUAL COST	FINANCING		
		Own Resources	IBRD	Other Loans
Engineering, administration and supervision of construction	121.3	121.3	0.0	0.0
Civil works	485.2	154.9	330.3	0.0
Resettlement and the environment	17.9	17.9	0.0	0.0
Electromechanical equipment	204.2	50.1	0.0	154.1
Transmission Lines	21.7	21.7	0.0	0.0
TOTAL	850.3	365.9	330.3	154.1

3. THE ZIMAPAN PROJECT

Original Design and Changes Made During Construction

In the original design of this project, the concrete curtain was to be supported in the Cañón del Infiernillo slopes through pulvines communicating through a system of inspection and drainage galleys. The conditions found in the field forced doing without the pulvines and to construct a cave on the right shore to mount the upper part of the curtain. The design called for a spillway with a

single tunnel, but the extraordinary inflow that occurred in 1991 made it necessary to include an auxiliary tunnel for safety reasons.

It was necessary to "turn around" the power house from its original orientation due to geological circumstances. This was done to avoid potential stability problems derived from a fault found in the excavation area.

The original project envisioned that the substation and the transformers be installed in a cave. However, for safety reasons, the design was modified and the installation was left on an external platform.

Project Execution and Problems Encountered

As in the case of Aguamilpa, the Zimapán Project was subject to a series of contingencies derived from the extraordinary inflow which occurred in January 1991. This event forced to raise over the upstream cofferdam and caused damages on part of the roads for construction, independently from its impact on the continuity of the construction program.

On the other hand, the Company contracted for the main civil works reported delays in the progress at the beginning of the works. A review of the conditions in which the works were organized, indicated the need to create additional camps to allow workers to stay close to their field of activity and avoid continuous transfers to camps located far from the site. As an additional measure, partial progress commitments were created which were met progressively until the required progress goals were achieved.

Due to public expenses controls established at the national level, there was a delay in the manufacturing of electromechanical equipment given the impossibility to pay advances to the contractor because of the need to meet the financial ceilings established.

Project costs

ITEM	COST IN MILLION (Current Prices)			
	SAR ESTIMATE (1)		ACTUAL	
	NS	US\$	NS	US\$
Engineering, administration and supervision of construction	84.8	36.9	342.5	94.4
Civil works	460.7	200.6	1,467.6	416.1
Resettlement and the environment	30.1	13.1	561.4	172.2
Electromechanical equipment	96.5	42.0	516.0	135.6
Transmission lines	43.9	19.1	32.8	10.9
Physical contingencies (emergencies)	137.8	60.0		
Price contingencies (escalation)	106.4	46.3		
TOTAL (2)	960.2	418.0	2,920.3	829.2

(1) SAR: Staff Appraisal Report, May 1989.

(2) Direct costs are reported based on accounting data.

The main differences between the real and the estimated cost in the SAR are found in the expenses of the construction residency, in civil works, in the electromechanical work, and in the human resettlements program.

With respect to the residency expenses, the initial estimate, based on previous experiences, consisted in considering these expenses as a percentage of the direct estimated cost of the project.

As the actual cost is higher than the estimated cost, the residency expenses are increased proportionally, which is justifiable by the need to open more supervision fronts during an extended period of time, in accordance with the requirements of the large extension of the works.

As to the civil works, there are many items to which cost differences may be attributed, but one of the main reasons derives from a very optimistic initial estimate of the amount of works, derived that based on previous studies, more favorable geological conditions were expected than those actually found. Following is a description of the items representing the main differences.

- **Infrastructure.** The construction of the Zimapán-Boquilla road was not planned and its construction was decided to support the infrastructure development in the State. As to the road to the engine house, the geological and surface situation found, forced making cuts in slopes higher than those estimated to provide greater stability to banks. Likewise, it was also necessary to increase the application of concrete and reinforcing steel to obtain the required stability. It became more convenient to pave the road than finishing it with only asphalt concrete given the duration of the applied materials.
- **Conduction tunnel.** As the expected rock quality was not found and because of the convenience of reducing the hydraulic load losses, it was decided to line the tunnel with hydraulic concrete instead of launched concrete with the subsequent cost increases. It was necessary to apply great quantities of massive concrete and reinforcing steel in different areas alongside the tunnel, required on geological grounds. Likewise, it was necessary to resolve the problem created by a large cave found alongside the tunnel's path.
- **Curtain.** The need to construct a greater number of encasement and injection tunnels forced to increase the excavations. On the other hand, it was necessary to stabilize a wide area on the gorge where the curtain was constructed, modifying the anchorage and drilling, with the subsequent cost increase.
- **Power house.** Due to geological reasons, it was necessary to turn around the cave to construct the power house, thus it was necessary to increase the length of the tunnels and galleries, with the subsequent increase in excavations. It was necessary to fill a large number of bores on the cave because of the geological problems encountered.
- **Spillway.** There was a strong increase in the excavations because of the convenience to construct an auxiliary tunnel for the excess works and because of the need to construct an access tunnel to the spillway which was not required in the original design. This also had an impact on the increase on the volume of reinforced concrete to be set.

One of the aspects that had a significant impact on the cost increase of civil works was constituted, as was the case in the Aguamilpa Project, by the increase in labor costs.

As to the electromechanical works contract, the initial estimate was low, even though it was based on documented supplier's quotations and on similar equipment costs to those that were to be installed. It should be noted that the amount of the successful bid in the electromechanical works competitive bidding was more than double the original estimate. Among the factors that further increased the costs are:

- Adjustment due to financial charges on amendments to equipment delivery programs
- Increases on miscellaneous supplies

- Incorporation of import taxes that were originally paid at CFE's consolidated level

As to the resettlement program, its actual cost was much higher than initially estimated, which was also lower. That is, the combination of the high actual cost with the low initial valuation exacerbate the difference. The problems encountered during negotiations with the affected people, especially with the population of the State of Querétaro, plus the local pressures to resolve the problems in the short run, gave way to the creation of unfavorable negotiation conditions. This required a systematic push to waver to the pressures (frequently excessive) of the population. More than 60% of the Resettlement Program costs corresponded to construction of towns and the new village of Bellavista del Río in the State of Querétaro, implied almost 47% of the total Program costs.

Financing

ITEM	MILLION OF CURRENT DOLLARS			
	ACTUAL COST	FINANCING		
		Own Resources	IBRD	Other Loans
Engineering, administration and supervision of construction	94.4	94.4	0.0	0.0
Civil works	416.1	166.3	124.4	125.4
Resettlement and the environment	172.2	172.2	0.0	0.0
Electromechanical equipment	135.6	23.2	0.0	112.4
Transmission Lines	10.9	10.9	0.0	0.0
TOTAL	829.2	467.0	124.4	237.8

(1) Included as "other loans" are an additional IBRD financing in the amount of US\$125.4 million resulting from an undisbursed balance of Loan 3189-ME.

4. ENVIRONMENTAL PROGRAMS

As part of the conditions for loan effectiveness, it was agreed with the World Bank that CFE should prepare a Resettlement and Environmental Impact Plan (PRIA) for each project. It was also agreed that teams should be integrated in the field to be specifically in charge of implementing such plan. These groups were formally constituted during the final phase of negotiations with the Bank, at the beginning of the works before construction.

From a practical viewpoint, it may be stated that the initiation of project construction and the issuance of the General Law of Ecological Balance and Environmental Protection (LGEEPA, January 1988) coincided. This forced CFE to renew efforts on environmental matters to meet the new regulations in all new projects and to regulate all those under construction, such as Aguamilpa and Zimapán. As a condition for the construction of the projects to be approved by the authorities responsible for environmental protection, there was an initial commitment (derived from the regulations) to develop the Environmental Impact Statement (EIS) for each project. This, in turn, originated a new commitment with the World Bank.

On the other hand, and also associated to the commitments established with the World Bank, the services of experts and institutions were contracted to execute an advisory and monitoring program in accordance with the provisions of the PRIA.

As recommended by the World Bank, in July 1990 a High Level Technical Committee (CTAN) was created for the Aguamilpa and Zimapán Projects, with the participation of the Technical

Managers (i.e., Design) and Hydroelectric Project Construction, the Manager of Civil Engineering, who at that time was in charge of an Environmental Protection Assistant Management Office, and external advisors. Especially since 1992, this Committee was decisive in the development of the environmental protection strategies to be followed.

In 1992, CFE decided to create the Environmental Protection Management Office (GPA) as a central regulatory area and to support the operational areas already in existence. The recently created Environmental Protection Management Office was incorporated to CTAN and the Civil Engineering Office was dissolved. Through an agreement with CTAN, in February 1993 GPA took charge of closely supervising the activities of the local field groups. Thus, the environmental actions were redirected towards longer range objectives, although maintaining those related to meeting legislation requirements and the agreements made with the authorities.

Besides, and following World Bank recommendations, five workshops were carried out to exchange experiences among local environmental protection groups from the Aguamilpa and Zimapán Projects.

The Environmental Protection Management Office, in coordination with the international group E7, in September 1994 organized in Mexico City the International Environmental Protection Seminar on Hydroelectric Projects. During 1994, a series of seminars took place on environmental legislation directed to operational superintendents of CFE electric generation plants.

Aguamilpa

The newly created environmental protection operational group, known as the Ecology and Environmental Unit (UEMA) provided technical support on environmental matters. At the beginning, the group was formed with technicians that were not experienced in multidisciplinary applications (which are typical of environmental problems). That is, initially there was no adequate planning or programming of environmental protection actions to be implemented in the works. But the lack of experience indicated was not privy to CFE and to the researchers contracted, but neither were there enough capabilities on the side of the technicians of the regulatory agency (at that time, SEDUE).

The UEMA focused on the development of the Environmental Impact Statement on the basis of the scarce information then available.

During the period 1991-1994, five environmental diagnosis studies were carried out in the field, five environmental forecast studies, three environmental impact studies, six fauna studies, three flora studies and the ecological organization study in the project catchment area. The latter was carried out within the cooperation agreement executed between CFE and the former SEDUE.

As mitigation and compensation measures, the rescue of wild animal life was carried out, a low intake was set up to guarantee a continuous flow downstream of the curtain during the filling of the dam, a wastewater treatment system was built for the camp sewage and 226 hectares in the office, workshops, storage and access roads were reforested with local species reproduced in a plant nursery constructed for this purpose.

As a result of the events listed above, it should be highlighted that the environmental protection activities in Aguamilpa had to be developed during the progress of works, always in a rush.

Despite this, important progress was achieved, among which the following technical achievements should be noted:

- The inventory of the regional fauna and flora was carried out, represented by 535 fauna species and 882 flora species.
- Knowledge was acquired of the national distribution of 57 flora species not previously reported in the Project area.
- The Aguamilpa plant nursery was created, where 710,000 plants of local species were produced to reforest the above mentioned 226 hectares of different project areas.
- During the filling of the dam, 6,263 fauna species were rescued, some of them with some conservation status. The rescue program was deemed a success because there was no background information or experience on the capture and handling of the different species rescued.
- Support was provided to different research centers and higher education institutions through its contracting to carry out specific studies.
- A contribution was made to enriching the main scientific collections of flora and fauna of several research institutions.
- The ecological organization study carried out will eventually allow federal, state and local authorities to agree on action plans to regulate human activities in the area where the Aguamilpa Project is located, thus achieving in an indirect manner better control of the river basins in the project area.
- The execution of the CFE-SEDUE agreement to regulate the project on environmental matters promoted better relations between both institutions.

Zimapán

The environmental protection operational group, known as Zimapán Ecology and Environmental Impact Area (AEIAZ), provided technical support on environmental matters and carried out the Resettlement and Environmental Impact Plan.

AEIAZ's lack of experience was to be alleviated with support from university research groups. The lack of practical experience of the latter was apparent, thus AEIAZ activities continued to be systemic (data gathering) and not of a planning nature, although preparation of the project's MIA was included.

The AEIAZ, in compliance with its PRIA and as previously mentioned, focused on the development of the intermediate Environmental Impact Statement on the basis of the scarce information then available and carrying out some of the general studies related to the characteristics of the project area.

In October 1989, CFE delivered the MIA for review and analysis to the environmental authority (at the time, SEDUE) and in July 1990, the agency issued a favorable decision to construct the project, subject to compliance with 46 conditions.

Ten environmental diagnosis studies, five fauna studies (animal life inventory), three environmental forecast studies, three environmental impact assessment studies and the ecological organization study were carried out in the project area. Also, the monitoring program on hydrobiontics, fish, amphibious and vegetation of riparic environment were initiated.

As mitigation and compensation measures, the rescue of flora and fauna was carried out in the dam area. Two hundred and thirty hectares were reforested at access roads, workshops, storages and the monitoring program was initiated in accordance with the conditions set up in the MIA decision.

As parallel activities, and following World Bank recommendations, five workshops were carried out to exchange experiences among local environmental protection groups of the Zimapán and Aguamilpa Projects.

As a result of the events listed above, it is clear that the environmental protection activities in Zimapán also had to be developed during the progress of works, always in a rush. Despite that, important progress was achieved, among which are the following technical achievements:

- Ample inventories of the scarcely explored regional fauna and flora were carried out (179 fauna species and 679 flora species).
- A new species of flora was collected and described.
- The flora rescue activities allowed to deepen the knowledge of cactaceous (8,250 individuals rescued belonging to 45 species).
- The study in depth of the site vegetation allowed the application of practical and successful measures to protect banks and reforest impacted areas which had never been experienced before.
- Based on the biological studies carried out, a dam monitoring program during hydroelectric plant operations has been proposed.
- Several specific studies related to environmental problems of the project were contracted, promoting scientific research and the development of several academic and/or research institutions.
- Fauna species were successfully rescued during the filling of the dam, totaling 3,901 individuals belonging to 74 species.
- The ecological organization study carried out will eventually allow federal, state and local authorities to agree on action plans to regulate human activities in the area where the Zimapán project is located, achieving in an indirect manner better control of the San Juan and Tula river basins.

5. RESETTLEMENT PROGRAMS

As already mentioned, within the conditions for loan effectiveness, it was agreed with the World Bank that CFE should prepare a Resettlement and Environmental Impact Plan (PRIA) for each project. It was also agreed that teams should be integrated in the field to be specifically in charge

of implementing such plan. These groups were formally constituted during the final phase of negotiations with the Bank, at the beginning of the works prior to construction.

On the other hand, and also associated to the commitments established with the World Bank, services with experts and institutions were contracted to execute an advisory and monitoring program in accordance with the provisions of the PRIA.

At the recommendation of the World Bank, a High Level Technical Committee was created for the Aguamilpa and Zimapán Projects, with the participation of the Social Development Manager, the Advisor contracted to support the Program and the Instituto Nacional Indigenista (the National Indigenous Institute), in its capacity as executing body of the monitoring program.

As an innovation in handling Resettlements, CFE, through the Social Development Management Office, incorporated social contents on a priority basis to the Aguamilpa and Zimapán Projects, to eliminate what social scientists call "involuntary or forced displacement" and make it a voluntary and participatory resettlement.

This meant a change in institutional attitudes to face the social issues derived from construction of infrastructure works as well as the combination of technological advances and progress with social welfare.

Within the frame of this institutional change, mechanisms to building consensus such as open and continuous dialogue with people of the affected towns, their authorities and the different levels or agencies involved, should be highlighted. This implied field trips in which the involved parties participated and allowed the search for effective solutions.

The liaison between the Local Social Development Units and the Manager's Office itself, allowed to have a greater level of knowledge on the concerns of the populations and, at the same time, to provide the appropriate mechanisms to resolve the problems that were encountered.

Also, because indigenous communities were affected both in Zimapán and in Aguamilpa, the Social Development Management Office formulated procedures to mitigate the impact caused through integration activities, promoting community participation to obtain a greater adaptation to a new social and productive environment.

1. SUMARIO EJECUTIVO.

1.1 Descripción del Proyecto de Desarrollo Hidroeléctrico. (Préstamo 3083-ME).

El Proyecto de Desarrollo Hidroeléctrico incluyó las cuatro partes siguientes :

PARTE A	Plantas de generación hidroeléctrica
A.1	Construcción de la planta de generación Aguamilpa
A.2	Construcción de la planta de generación Zimapán
A.3	Servicios de consultores especializados para las Partes A.1 y A.2
PARTE B	Programa social y ambiental
PARTE C	Estudios relativos a la energía :
	• Conservación y Co-generación
PARTE D	Otros estudios :
	• Mejoramiento de la operación del sistema eléctrico, Mejoramiento del sistema de administración y Tarifas

1.2 Objetivos del Proyecto.

1.2.1 Promover el uso eficiente de la energía eléctrica.

Se llevó a cabo un Estudio de Eficiencia Operativa del Sector Eléctrico; ejecutado por la Compañía Consultora Electricité de France (E.D.F.) y actualmente se están aplicando las recomendaciones derivadas del estudio en materia de Generación, Despacho de Carga, Manejo de Combustibles, Concepción de Centrales y Transmisión.

Asimismo, la Comisión Nacional para Ahorro de Energía (CONAE), dependiente de la actual Secretaría de Energía, contrató la ejecución de una serie de estudios sobre ahorro de energía y co-generación. En la actualidad se están aplicando las recomendaciones derivadas de dichos estudios.

1.2.2 Diversificar fuentes de generación eléctrica.

El cumplimiento de este objetivo, se expresa en la siguiente tabla :

CONCEPTO	REAL A DIC 1988	PROG. DIC 1994	REAL A DIC 1994	PROGRAMA 1995
POTENCIA INSTALADA (GW)	23.9	33.6	31.6	33.7
PARTICIPACIÓN HIDROELÉCTRICA (%)	32.3	26.3	28.8	29.2

1.2.3 Ampliar la cobertura de servicio eléctrico en el país.

Con las adiciones y modificaciones a la capacidad instalada durante 1994, una de las cuales corresponde a la entrada en operación del proyecto hidroeléctrico Aguamilpa, fue posible ampliar la cobertura de servicio eléctrico en el país de un 92.18% (en 1993) a un 94.24% (en 1994) pasando de 18.7 a 19.4 millones de usuarios.

1.2.4 Mejorar la capacidad de CFE en la ejecución de programas ambientales y de reasentamientos.

Con la creación de las Gerencias de Desarrollo Social y de Protección Ambiental, se ha incrementado de manera notable la capacidad de gestión de CFE en estas especialidades, habiéndose logrado además la implantación de criterios y guías para el estudio, manejo y seguimiento de los aspectos sociales y ambientales, desde las etapas de planeación hasta la conclusión de los proyectos.

1.2.5 Implementar el Convenio de Rehabilitación Financiera.

Se considera que CFE cumplió satisfactoriamente con los objetivos establecidos en el Convenio de Rehabilitación Financiera, lográndose en el año de 1994 un cumplimiento de 97.05% en los indicadores de desempeño considerados y un cumplimiento promedio de 96.58% en el periodo 1990-1994, mejorándose en 34.5% el comportamiento de los 17 indicadores. Destaca el logro de valores superiores a la meta en 12 de los indicadores y aunque cinco de ellos registran incumplimientos, solamente en tres de estos se tienen desviaciones mayores al 5%. Sobresale por su importancia la relación precio/costo, que resultó afectada fundamentalmente por factores externos a la CFE, como fueron los correspondientes al impacto de las fluctuaciones cambiarias y a la política de precios de los energéticos, ya que el del combustible presentó crecimientos importantes durante el año de 1994 y el precio medio de venta de la energía eléctrica permaneció prácticamente constante.

1.3 Aspectos técnicos, diseño, adquisiciones de bienes y servicios, costos, construcción, operación y mantenimiento de los proyectos financiados.

Aspectos técnicos.- Para ambos proyectos hidroeléctricos, conforme a lo previsto, se construyeron: Infraestructura temporal y permanente, Obras para desvío del río, Conducciones de agua, Cortina, Casa de máquinas, Vertedor, Equipamiento electromecánico, Subestación eléctrica y líneas de transmisión asociadas y nuevos poblados para reacomodo, realizándose además los trabajos necesarios para reasentamientos humanos e impacto ambiental.

Se consideró que la central de Aguamilpa contara con una potencia total instalada de 960 MW para una generación media anual de 2,131 GWh y que la central de Zimapán tuviera una potencia instalada de 280 MW con una generación media anual de 1,291 GWh. Zimapán quedó finalmente con una potencia instalada de 292 MW.

Diseño.- La totalidad del diseño de las obras civiles principales fue realizado por CFE y se previó contratar la obra electromecánica bajo la modalidad "Llave en mano", considerando el diseño, suministro, pruebas y puesta en servicio de los equipos. En el caso particular de la cortina de Zimapán, se contrataron especialistas como apoyo para el diseño.

Adquisiciones de bienes y servicios.- Para la contratación de las obras civiles principales, conforme a lo pactado con el Banco, se realizó una licitación internacional. La adquisición de los equipos electromecánicos se licitó también internacionalmente, solicitando su financiamiento total por parte de los proveedores.

Las obras civiles complementarias y la construcción de los poblados de reacomodo se contrataron con empresas nacionales, considerando la necesidad de tener derramas económicas que beneficiaran a las localidades donde se construyeron los proyectos.

Para la contratación de asesores especializados en construcción de obras civiles y para , también conforme a lo pactado, se realizó una selección de entre los posibles candidatos con reconocimiento del Banco Mundial.

Respecto a los estudios a cargo de la CONAE y de CFE y para la asesoría destinada a los aspectos sociales y ambientales, la contratación se realizó mediante un proceso de invitación directa a empresas e instituciones, previa aceptación del Banco.

Costo y financiamiento.- El resumen del costo y financiamiento del Proyecto de Desarrollo Hidroeléctrico es el siguiente :

CONCEPTOS		MILLONES DE DÓLARES CORRIENTES		
		ESTIMADO SAR	REAL (1)	APORTACIÓN DEL BANCO (2)
PARTE A				
A.1	Construcción de la planta de generación Aguamilpa	858.0	850.3	330.3
A.2	Construcción de la planta de generación Zimapán	418.0	829.2	124.4
A.3	Servicios de consultores especializados para las Partes A.1 y A.2	0.0	0.5	0.0
PARTE B	Programa social y ambiental	4.4	1.3	0.0
PARTE C	Estudios relativos a la energía :	4.2	4.3	3.0
	• Conservación y Co-generación			
PARTE D	Otros estudios :	2.2	2.3	2.3
	• Mejoramiento de la operación del sistema eléctrico, Mejoramiento del sistema de administración y Tarifas			
T O T A L		1,286.8	1,687.9	460.0

(1) Incluye un financiamiento por 266.5 para la obra electromecánica de los proyectos.

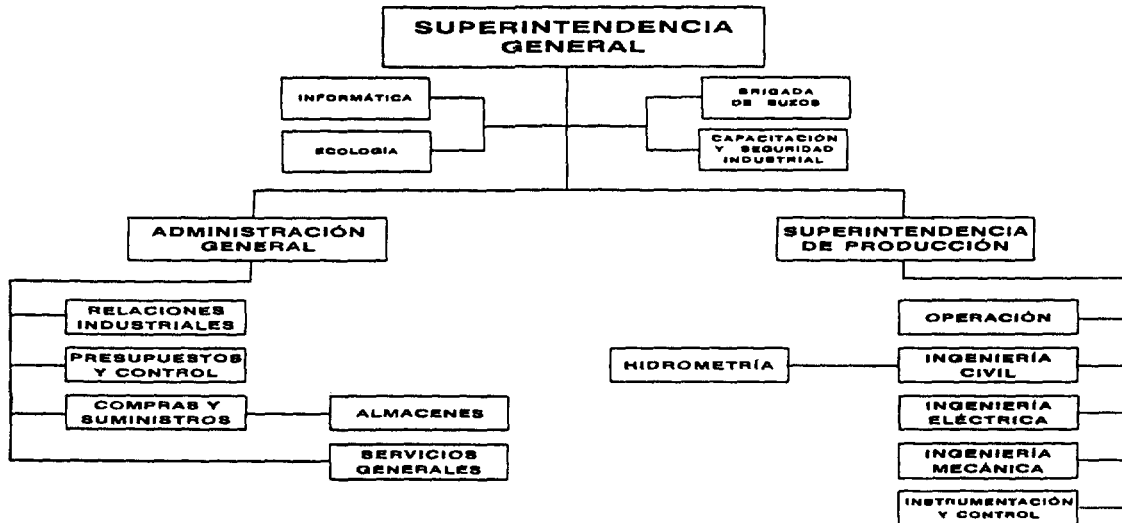
(2) No incluye 125.4 millones de dólares remanentes del Préstamo 3189-ME que se aplicaron a las obras civiles de Zimapán.

Construcción.- Todos los trabajos de construcción se realizaron a través de las empresas contratistas, salvo las obras iniciales de desvío del Río Santiago para Aguamilpa, que se ejecutaron por administración directa. Una vez que se adjudicó el contrato, la contratista continuó con los trabajos. CFE se encargó de la supervisión de la ejecución de las obras, apoyándose en contratistas especializados para complementar su cobertura.

Operación.- Desde antes de iniciar el montaje electromecánico se contó en ambos proyectos con la presencia de personal técnico de la Subdirección de Generación, que es el área encargada de recibir las obras terminadas y de operarlas. La central de Aguamilpa comenzó a aportar su energía al Sistema Eléctrico en el mes de julio de 1994 y la central de Zimapán inició en el mes de septiembre de 1995. Conforme a lo esperado, las centrales han operado de manera satisfactoria y los eventuales problemas en el funcionamiento de los equipos han sido resueltos conforme a las garantías ofrecidas por los proveedores. La producción, de acuerdo a lo previsto, se sujeta a los requerimientos de la demanda. No se dispone aún de estadísticas que reflejen el efecto benéfico de la energía suministrada por las Centrales Aguamilpa y Zimapán.

Se tiene implantada la organización necesaria para garantizar la operación ininterrumpida de las instalaciones, para procurar el mantenimiento requerido y para asegurar el suministro oportuno de los insumos que exige la operación de las centrales, incluyendo la capacitación y desarrollo de los recursos humanos.

La estructura orgánica que se ha establecido en cada una de las centrales es la siguiente :



Mantenimiento.- De acuerdo a los criterios y normas establecidos por la Subdirección de Generación, se tiene previsto aplicar un sistema de revisiones periódicas a cada una de las estructuras que constituyen la central, independientemente de lo establecido en cuanto a las revisiones posteriores a eventos sísmicos. Las revisiones sistemáticas dan la pauta para el mantenimiento preventivo de la parte civil. Los manuales de operación y servicio para el equipo electromecánico y la instrumentación proporcionan los indicativos para su mantenimiento preventivo y correctivo.

Los índices de control de gestión considerados para la operación de las centrales son los siguientes :

Disponibilidad (D).

$$D = \frac{HP - (HFSF + HFSMP + HEFSD + HFSFG + HFSCA)}{HP} \times 100$$

Donde :

- HP = Horas del periodo
- HFSF = Horas fuera de servicio por falla
- HFSMP = Horas fuera de servicio por mantenimiento programado
- HEFSD = Horas equivalentes fuera de servicio por decremento en producción
- HFSFG = Horas fuera de servicio por falta de agua
- HFSCA = Horas fuera de servicio por causas ajenas al proceso

Indisponibilidad por mantenimiento (INDMP).

$$INDMP = \frac{HFSMP}{HP} \times 100$$

1.4 Opinión sobre el desempeño de NAFIN en la implementación del Proyecto.

Se considera que la participación de NAFIN como agente financiero fue de gran ayuda para lograr que CFE pudiera ejercer en su totalidad el crédito otorgado, dada su capacidad negociadora ante el Banco y su disposición y atención para resolver oportunamente los imprevistos que se presentaron.

1.5 Opinión sobre el desempeño del Banco Mundial.

Dentro del ámbito de su competencia, el manejo que dio el Banco a la operación del crédito fue siempre el adecuado, mostrando invariablemente una gran disposición para tomar acuerdos satisfactorios para todas las partes en los aspectos que eventualmente presentaban algún conflicto.

A título de sugerencias, a continuación se presentan algunos aspectos que en opinión de las diferentes áreas de CFE que interactuaron con el Banco, sería conveniente considerar para futuras operaciones.

- Ampliar las facultades del Representante del Banco en la Ciudad de México, especialmente en lo referente a trámites que requieren del otorgamiento de la "No Objeción"; lo anterior permitiría una administración y operación más expedita de los recursos objeto del préstamo.
- Procurar que los especialistas que acompañan al oficial de proyecto en las misiones de evaluación y de supervisión tengan permanencia durante la ejecución del proyecto, para una mayor claridad en la interpretación de la problemática que se presente, así como de las propuestas y recomendaciones para encontrar alternativas de solución acordes tanto con la realidad como con la posibilidad práctica de implantarlas.
- Ampliar la cobertura de los esquemas de financiamiento del Banco para que futuras operaciones sean financiadas bajo el concepto de "llave en mano", a fin de asegurar la integralidad del proyecto.
- Durante la operación del crédito surgieron algunas complicaciones para que el Banco autorizara el pago de las estimaciones para los contratos de obras civiles, dado que al incluirse los ajustes de costos por escalaciones se alcanzó rápidamente el monto autorizado expresado en pesos, no obstante de que no se había agotado la cantidad asignada expresada en dólares. Esto se presentó debido a la situación cambiaria y a la inflación que prevalecían en esa etapa del Proyecto. Sería conveniente que las cifras que el Banco apruebe al adjudicarse un contrato, se expresen solamente en dólares y que sea considerado indistintamente el pago de estimaciones y ajustes de costos (al tipo de cambio que corresponda) hasta agotar el monto asignado del crédito.

1.6 Opinión sobre el desempeño de otras entidades directa o indirectamente involucradas.

Se considera conveniente que en el futuro no se involucren en un mismo proyecto fondos para dos ejecutores diferentes a fin de evitar la falta de continuidad en el desarrollo de los estudios, así como retrasos en los plazos de ejecución de los contratos, lo que en última instancia tiene efecto en el pago oportuno a los consultores contratados.

En materia de Protección Ambiental y derivado de la experiencia adquirida, es conveniente que en lo sucesivo se tomen acuerdos que comprometan en mayor medida a los diferentes niveles y dependencias de gobierno a fin de que apoyen, intervengan y se hagan responsables de las actividades que caen dentro de su ámbito de competencia, con lo que se podrá efectuar una transmisión clara de obligaciones ambientales hacia los diferentes responsables durante la fase final de la construcción.

2. Proyecto Aguamilpa.

2.1 Diseño original y cambios introducidos durante la construcción.

Conforme al diseño original, se preveía que el cuerpo de la cortina fuese construido esencialmente con aluvi6n. Por necesidades de programaci6n y disponibilidad de materiales se construy6 fundamentalmente de enrocamiento en vez del aluvi6n, modific6ndose con esto el volumen de materiales colocados y las dimensiones de la cortina.

El proyecto original previ6 que la subestaci6n y transformadores se instalaran en una caverna. Por razones de seguridad se modific6 el dise1o quedando la instalaci6n en una plataforma exterior.

Con la finalidad de asegurar que no se tuvieran derrumbes, dada la poca estabilidad que se encontr6 en la ladera donde se construy6 el vertedor, se modificaron las caracteristicas y dimensiones de este para que en el caso de operarlo, la descarga se hiciera a una elevaci6n m6s baja que la originalmente prevista.

Por requerimientos establecidos por la Comisi6n Nacional del Agua y como una medida complementaria para mitigar el impacto ambiental ocasionado por la suspensi6n del flujo del r6o, fue necesario incluir una descarga de agua para riego para ser utilizada durante el llenado del embalse. Este dispositivo no estaba previsto en el dise1o original.

A solicitud de las autoridades locales y por la conveniencia de transportar con mayor facilidad el equipo electromec6nico que se recib6, se construy6 un libramiento carretero que permiti6 la llegada de los transportes a la obra sin pasar por la Ciudad de Tepic. Esta obra de infraestructura no estaba considerada originalmente.

2.2 Ejecuci6n del proyecto y problemas encontrados.

Al inicio de 1991 se present6 una avenida extraordinaria con un gasto mayor que el m6ximo registrado en los estudios hidrol6gicos, la cual caus6 da1os y derrumbes en los t6neles de desv6o y en la vialidad para construcci6n, adem6s de provocar la inundaci6n del recinto en que se estaba construyendo la cortina. La rehabilitaci6n de los da1os provoc6 un incremento en la cantidad de obra a realizar sin posibilidad de modificar el plazo de terminaci6n de los trabajos.

Para satisfacer la demanda esperada de energ6a el6ctrica, se decidi6 acelerar el programa de construcci6n del proyecto, por lo que la terminaci6n se adelant6 un a1o con respecto a lo previsto en los estudios desarrollados conjuntamente con el Banco Mundial. Esto represent6 que la contratista redujera en seis meses el plazo de ejecuci6n pactado originalmente.

2.3 Origen de las principales diferencias en costo.

Aunque la diferencia entre el costo real y el estimado de las obras civiles deriva de una infinidad de conceptos, la mayor parte de ellos est6n vinculados con el acortamiento del programa de construcci6n, que en su momento se sujet6 a un an6lisis beneficio/costo resultando conveniente en cuanto a la ventaja de contar con antelaci6n con la energ6a producida por el proyecto.

Uno de los aspectos que tuvo una incidencia significativa en la variaci6n del costo de las obras civiles lo constituye el aumento en el precio de la mano de obra.

Tocante al contrato de obra electromec6nica, se cubri6 la totalidad de lo previsto y se realizaron una serie de Convenios modificadorios para considerar aspectos no incluidos originalmente, los cuales son la causa de la diferencia entre el costo real de este concepto y su costo estimado.

Cabe señalar que por el alto costo financiero, se decidió que la componente nacional (constituida esencialmente por el montaje) se pagara a precio variable con recursos propios.

3. Proyecto Zimapán.

3.1 Diseño original y cambios introducidos durante la construcción.

En el diseño original de este proyecto, se previó que la cortina de concreto quedara apoyada en las laderas del Cañón del Infiernillo mediante pulvinos y comunicada con un sistema de galerías de inspección y drenaje. Las condiciones encontradas en campo obligaron a prescindir de los pulvinos y a construir una caverna en la margen derecha para el empotramiento de la cortina en su parte superior.

Se previó en el diseño un vertedor con un solo túnel, pero la avenida extraordinaria que se presentó en 1991 hizo conveniente incluir un túnel auxiliar por razones de seguridad para el control de avenidas.

Por razones geológicas fue necesario "girar" la casa de máquinas respecto a su orientación original, a fin de evitar los posibles problemas de estabilidad derivados de una falla encontrada en la zona de excavación.

El proyecto original previó que la subestación y transformadores se instalaran en una caverna, sin embargo, por razones de seguridad se modificó el diseño quedando la instalación en una plataforma exterior.

3.2 Ejecución del proyecto y problemas encontrados.

Al igual que en el caso de Aguamilpa, el proyecto Zimapán se vio sujeto a una serie de contingencias derivadas de la avenida extraordinaria que se presentó en enero de 1991. El evento obligó a sobreelevar la ataguía de aguas arriba y ocasionó daños en parte de la vialidad para construcción, independiente de su efecto en la continuidad del programa de construcción.

Por otro lado, la empresa contratada para las obras civiles principales reportaba atrasos en su avance al inicio de los trabajos. La revisión de las condiciones en que estaba organizado el trabajo indicó que era necesario crear campamentos adicionales que permitieran la estancia de los trabajadores en la zona cercana a su frente de actividades, para evitar el traslado continuo a campamentos más alejados.

Derivado de los controles del gasto público establecidos a nivel nacional, se presentó un retraso en la fabricación del equipo electromecánico debido a la imposibilidad de pagar anticipos a la contratista por la necesidad de cumplir con los techos financieros marcados.

3.3 Origen de las principales diferencias en costo.

En lo que se refiere a los gastos de residencia, la estimación inicial, basada en experiencias previas, consistió en considerar estos gastos como un porcentaje del costo directo estimado del proyecto. Al ser el costo real superior al estimado, los gastos de residencia se incrementan proporcionalmente, lo cual es justificable por la necesidad de abrir más frentes de supervisión durante más tiempo, conforme a lo que demandaba la gran dispersión de la obra.

En cuanto a las obras civiles, existen una infinidad de conceptos a los que se puede atribuir la diferencia en costos, pero una de las razones principales resulta de una muy optimista estimación inicial del importe de las obras, derivada de que en función de los estudios previos, se esperaban condiciones geológicas más favorables de las que se encontraron en la realidad.

Uno de los aspectos que tuvo una incidencia significativa en el incremento del costo de las obras civiles lo constituye, al igual que en el caso del proyecto Aguamilpa, el aumento en el precio de la mano de obra.

En cuanto al contrato de obra electromecánica se considera también que el estimado inicial fue escaso, aunque estaba documentalmente basado en cotizaciones de proveedores y en costos de equipos similares a los que se pensaba instalar. Es notorio el hecho que el monto de la oferta ganadora en la licitación de la obra electromecánica, fue más del doble de lo que se estimaba originalmente.

Tocante al programa de reasentamientos, su costo real fue muy superior al estimado inicialmente, el cual también resultó escaso. Es decir, la combinación del elevado costo real con la baja valuación inicial, acentúan la diferencia. Los problemas que se presentaron durante las negociaciones con los afectados, principalmente con la población del Estado de Querétaro, y las presiones locales para resolver en corto plazo los problemas, dieron pie a no contar con condiciones favorables para la negociación, por lo que se requirió ceder sistemáticamente a las peticiones (frecuentemente excesivas) de la población. Más del 60% del costo del Programa de reasentamientos, correspondió a la construcción de poblados y el nuevo poblado de Bellavista del Río, en el estado de Querétaro, implicó casi el 47% del costo total del Programa.

4. Programas ambientales.

Como una parte de las condiciones para efectividad del Préstamo, se acordó con el Banco Mundial que CFE debía elaborar un Plan de Reasentamientos e Impacto Ambiental (PRIA) para cada proyecto y que debían integrarse en campo grupos específicamente encargados de ejecutar dicho plan, mismos que quedaron formalmente integrados durante la etapa final de las negociaciones con el Banco, al inicio de los trabajos previos a la construcción.

Desde el punto de vista técnico-administrativo se obtuvieron experiencias valiosas, algunas de las cuales se están aplicando en nuevos proyectos, tales como la intervención del área normativa ambiental desde la formulación de las especificaciones para contratar obras y elaboración de manifestaciones de impacto ambiental y la elaboración de informes técnico-administrativos periódicos y también la elaboración de un informe final de actividades.

Por recomendación de El Banco Mundial, en julio de 1990 se creó el Comité Técnico de Alto Nivel (CTAN) para los proyectos Aguamilpa y Zimapán. Especialmente a partir de 1992, este comité fue decisivo en el desarrollo de las estrategias de protección ambiental a seguir.

Además, y en atención a las recomendaciones de El Banco Mundial, se realizaron cinco talleres de intercambio de experiencias entre los grupos locales de protección ambiental de los proyectos Aguamilpa y Zimapán y una serie de seminarios sobre legislación ambiental dirigidos a los superintendentes de operación de las centrales de generación eléctrica de CFE.

En el periodo 1991 - 1994 se realizaron para Aguamilpa cinco estudios de diagnóstico ambiental en campo, cinco de pronóstico ambiental, tres de evaluación de impactos ambientales, seis de fauna, tres de flora y el estudio de ordenamiento ecológico del área de influencia del proyecto.

Como medidas de mitigación y compensación se realizó el rescate de fauna silvestre, se instaló una toma baja para garantizar un flujo permanente aguas abajo de la cortina durante el llenado del embalse, se construyó un sistema de tratamiento para aguas residuales del campamento y se reforestaron 226 ha de áreas de oficinas, talleres, almacenes, campamentos y caminos de acceso, con especies reproducidas en un vivero construido ex profeso en donde se produjeron 710,000 plantas de especies locales.

Se realizó el estudio de ordenamiento ecológico que eventualmente permitirá a las autoridades federales, estatales y municipales acordar planes de acción para regular las actividades humanas en la zona donde se ubica el P.H. Aguamilpa

En octubre de 1989 CFE entregó a la autoridad ambiental (SEDUE en ese entonces) la Manifestación de Impacto Ambiental del P.H. Zimapán para su revisión y análisis y en julio de 1990 dicha dependencia emitió su dictamen favorable a la construcción del proyecto, sujeto al cumplimiento de 46 condicionantes.

Se realizaron para el P.H. Zimapán diez estudios de diagnóstico ambiental, cinco estudios de fauna (inventario faunístico), tres de pronóstico ambiental, tres de evaluación de impactos ambientales y el estudio de ordenamiento ecológico de la zona del proyecto.

Como medidas de mitigación y compensación se realizó el rescate de flora y fauna silvestres en el área del embalse y se revegetaron 230 ha en zonas de caminos de acceso, talleres, almacenes y campamentos, junto con lo relativo a las condicionantes impuestas al proyecto por la autoridad ambiental.

4.1 Indicadores ambientales.

Una vez transferida la responsabilidad al área de operación de las centrales, se realizará lo siguiente :

4.1.1 Central Hidroeléctrica Zimapán.

- Monitoreo de la calidad del agua del manantial Taxidó para prevenir su contaminación.
- Seguimiento de la evolución de la calidad del agua del embalse.
- Monitoreo de la calidad de las aguas residuales descargadas por las instalaciones de la central.

4.1.2 Central Hidroeléctrica Aguamilpa.

- Seguimiento de la evolución de la calidad del agua del embalse.

4.1.3 Marco institucional.

La Gerencia de Protección Ambiental continuará realizando los siguiente :

- Un promedio anual de 25 inspecciones ambientales a las instalaciones de CFE, orientadas a verificar el cumplimiento de la normatividad aplicable.
- Un promedio anual de ocho eventos internos de capacitación para difusión del marco jurídico a que se deben sujetar las instalaciones en materia ambiental.
- Desarrollo de un promedio anual de ocho documentos de normatividad interna para la protección ambiental (procedimientos, guías y criterios técnicos).

5. Programas de reasentamientos.

Por recomendación del Banco Mundial y al igual que para el programa ambiental, se creó el Comité de Alto Nivel para los proyectos Aguamilpa y Zimapán.

Como una innovación en el tratamiento de los Reasentamientos, la CFE a través de la Gerencia de Desarrollo Social incorporó de manera prioritaria contenidos sociales a los proyectos de Aguamilpa y Zimapán, a fin de eliminar lo que los científicos sociales denominan "desplazamiento involuntario o compulsivo" y transformarlo en un reacomodo voluntario y participativo.

El enlace entre las Unidades Locales de Desarrollo Social y de la propia Gerencia, permitió contar con un mayor conocimiento acerca de las inquietudes de las poblaciones y, al mismo tiempo, proporcionar los mecanismos idóneos para la solución de los problemas que se fueron presentando.

Asimismo, dado que tanto en Zimapán como en Aguamilpa se afectó a comunidades indígenas, la Gerencia de Desarrollo Social planteó procedimientos orientados a mitigar el impacto causado a través de actividades de integración, promoviendo la participación comunitaria para obtener una mayor adaptación al nuevo entorno social y productivo.

5.1 Indicadores sociales

5.1.1 Central hidroeléctrica Zimapán.

- Nuevos poblados
- Restitución productiva
- Proyectos productivos

5.1.2 Central hidroeléctrica Aguamilpa.

- Nuevos poblados
- Restitución productiva
- Proyectos productivos

La Gerencia de Desarrollo Social implementará los procedimientos y guías necesarios para que las actividades de monitoreo específicas para los proyectos Aguamilpa y Zimapán sean realizadas por personal de las centrales.



APPENDIX C
OPERATIONAL PLAN TO MONITOR CFE'S FUTURE OPERATIONS



SUBDIRECCION TECNICA
GERENCIA DE INGENIERIA EXPERIMENTAL
Y CONTROL

841.02-2687/96

PROGRAMAS PARA ATENDER EN 1997
PRINCIPALES CENTRALES GENERADORAS EN LAS REGIONES
DE GENERACIÓN HIDROELÉCTRICA GRIJALVA, BALSAS
SANTIAGO, IXTAPANTONGO, YAQUI-MAYO Y PAPALOAPAN

Subgerencia de Comportamiento de Estructuras
Departamento de Ingeniería Electromecánica
Departamento de Procesamiento y Análisis

COMISION FEDERAL DE ELECTRICIDAD

IMAGING

Report No.:
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