Ecuador

Transmission (Phase D) Project and Sub-Transmission (Phase B-2) Project

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Field Survey: August-September and November 2006

1. Project Profile and Japan's ODA Loan

Map of project area: Entire Area of Ecuador

Dos Cerritos Transformer Station

1.1 Background

During the 1980s, installation of electric power infrastructure in Ecuador[1] progressed, for example with the start of operation of the Paute Hydroelectric Plant (facility capacity 500 MW) which met approximately 50% of the domestic power demand at the time (1983). The electric power supply of cities was boosted, and rural areas were in the process of being electrified.

However, due to the growing demand for further improvement in electric power supply services, a number of issues began to surface, including the inadequacy of power supply in urban areas and the need for stable power supply in rural areas. Two priority issues in particular were raised. The first was the need for reinforcement of the mainline transmission system that connects Guayaquil, the largest city in Ecuador, with the Paute Hydroelectric Plant. The second was the need for installation of a sub-transmission system[2] that would link the mainline transmission system that extends nationwide with regional electricity distribution networks.

In view of the above conditions, the Ecuadorian government needed to promote the construction of the above-mentioned mainline transmission system and the

[1] Ecuador has a population of 13 million, and the land area is approximately equivalent to that of the Japanese islands of Honshu and Kyushu.

[2] This is a load-type transmission system, and it is the intermediate voltage system between the mainline transmission system and the distribution system. In the sub-transmission system, the transmission lines are referred to as sub-transmission lines, and the transformer stations are referred to as sub-transformer stations.

sub-transmission system, so as to promote stabilization of the power supply. For this reason, Ecuador's Ministry of Natural Resources, the competent authority concerning energy, asked the Ecuadorian government request this ODA loan from the Japanese government to assist fund procurement, and it issued instructions to Ecuador's national electric power agency, INCECEL, to implement the improvements in the mainline transmission system and the sub-transmission system.

Furthermore, prior to this ODA loan project, the Sub-Transmission (Phase B-1) Project (1986–1993)[3] was implemented. Following a review of the electric power supply-demand balance and alterations in areas with a demand for electric power, part of the ODA loan project under evaluation, the Sub-Transmission (Phase B-2) Project, was implemented to supplement the prior project and to further promote rural electrification in Ecuador.

1.2 Objective

The project's objective is to assist Ecuador in meeting the demand for electric power by constructing and installing power lines (for the mainline transmission system) and transformer stations, and by installing a sub-transmission system to connect the mainline transmission system and the power distribution network, thereby contributing to stabilization of the power supply and improvement of the rate of rural electrification.

1.3 Borrower/Executing Agency

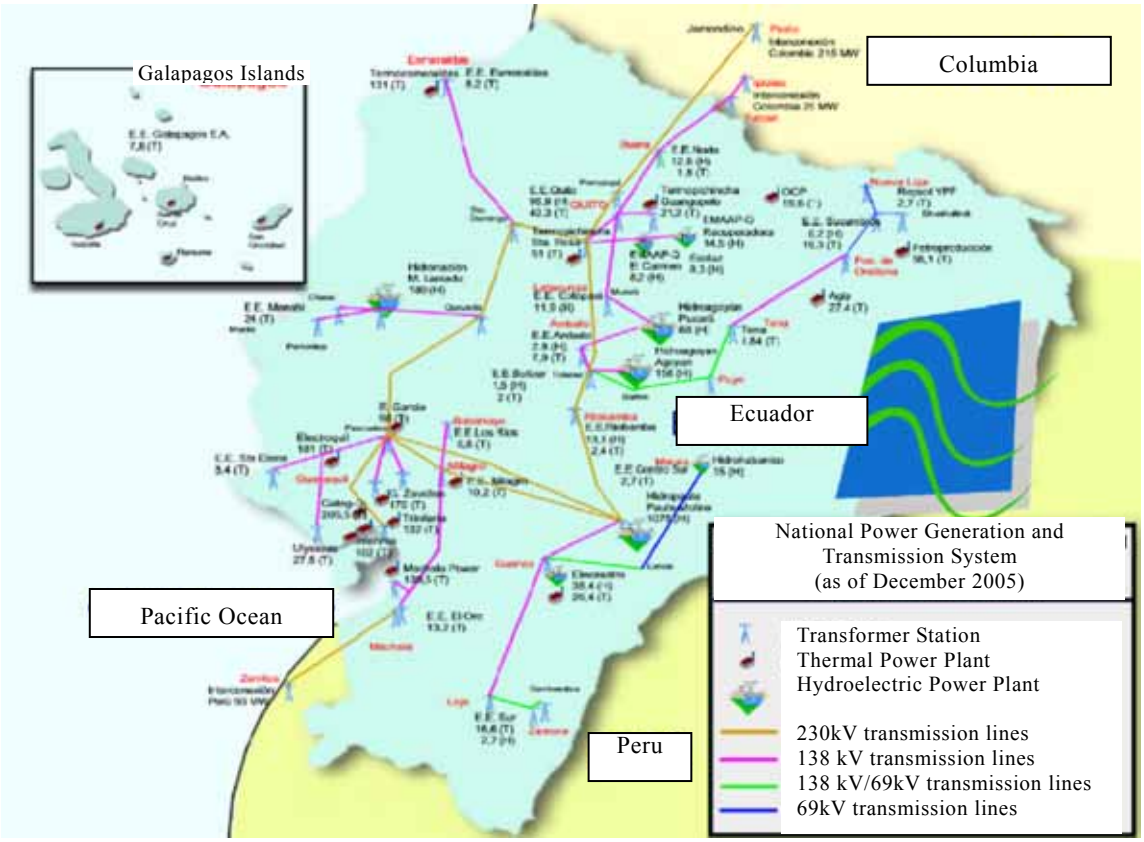
Borrower: Government of Ecuador

Executing Agency: INECEL (Ecuador's national electric power agency) (executing agency at time of appraisal)

TRANSELECTRIC S.A (power transmission company that was split from INECEL due to structural reorganization) (executing agency at time of evaluation)

[3] The ex-post evaluation of Sub-Transmission (Phase B-1) Project was conducted in FY2002.

Figure 1: National Power Transmission Network System



source: CONELEC

1.4 Outline of Loan Agreement

Loan Amount/ Loan Disbursed Amount	[Transmission Lines (Phase D) Project] 8,913 million yen/7,806 million yen [Sub-Transmission (Phase B-2) Project] 8,576 million yen/ 8,321 million yen
Exchange of Notes/Loan Agreement	[Transmission Lines (Phase D) Project] May 1990/ November 1990 [Sub-Transmission (Phase B-2) Project] May 1995/July 1996
Terms and Conditions -Interest Rate -Repayment Period (Grace Period) -Interest Rate Repayment Period (Grace Period)	[Transmission Lines (Phase D) Project] 2.9%/year 25 years (7 years) [Sub-Transmission (Phase B-2) Project] 3.0%/year 30 years (10 years)

-Procurement	General untied
Final Disbursement Date	[Transmission Lines (Phase D) Project] January 1999 [Sub-Transmission (Phase B-2) Project] January 2002
Main Contractors	[Transmission Lines (Phase D) Project] Mitsubishi Corporation, Mendes Junior Montag, and several other local companies [Sub-Transmission (Phase B-2) Project] Mitsubishi Corporation, Mitsui & Co., Ltd., and several other local companies
Consulting Services	J-Power, La Asociacion EPDC Internacional - Conprotec
Feasibility Study (F/S), etc.	[Transmission Lines (Phase D) Project] F/S: 1986/1988 revised/ J-Power [Sub-Transmission (Phase B-2) Project] F/S: 1982/1993 revised/INECEL

2. Evaluation Result

2.1 Relevance

2.1.1 Relevance at time of appraisal

In Ecuador's Electrification Master Plan (1987-2010) which aimed to meet the demand for electric power, the Ecuadorian government drew up a plan for development of the mainline transmission system and the sub-transmission system. In particular, given that domestic power demand was growing in all parts of Ecuador, especially high priority was placed on the following two points in the Master Plan.

First, in response to the issue of increasing demand for power in Guayaquil, the largest city in Ecuador, a stable power supply was to be ensured by expanding the capacity of the transmission lines that connect the Paute Hydroelectric Plant, the largest domestic power plant, and Guayaquil.

Second, in response to the increased demand for power in all regions of the country, not only from industry but also from individual consumers, a stable power supply was to be ensured by installing a sub-transmission system that would link the nationwide mainline transmission system with local distribution networks.

Consequently, this ODA loan had high priority because it was for the installation of the

mainline transmission system and the sub-transmission system.

2.1.2 Relevance at the time of evaluation

The Ecuadorian government places emphasis on securing a stable supply of electric power by improving and strengthening the nationwide mainline transmission system and sub-transmission system in its National Electrification Plan (2004-2013), which is the revised version of the Electrification Master Plan (1987-2010). The government's objective is to provide a stable power supply to regional areas where new demand for electric power is expected to increase, including around large cities, in newly developing cities and regional cities, and for personal consumption in regional areas.

Consequently, with the demand for electric power increasing nationwide, the improvement and strengthening of the mainline transmission system and the sub-transmission system for stable power supply is an urgent matter of national policy, and it continues to have high priority.

2.2 Efficiency

2.2.1 Outputs

The tables below show a comparison of the planned output and actual output of the Transmission (Phase D) Project and the Sub-Transmission (Phase B-2) Project.

Table 1: Comparison of Planned Output (at time of appraisal)
and Actual Output of Transmission Lines (Phase D) Project

Output	Planned	Actual
1) Transmission line construction		
•Paute - Pascuales - Trinitaria segment	•218 km(230 kV×2 lines)	•As planned (steel utility poles added)
•Salitral - Trinitaria segment	•8 km(138 kV×2 lines)	•Cancelled
2) Transformer station equipment/materials procurement, construction, and installation		
•PauteHydroelectric Transformer Station	•PLC electric line conveyance system	•As planned
	•230kV Bus line	•As planned (4 disconnecting switches and 1 circuit breaker)
• Pascuales Transformer Station	•230kV Transmission lines inlet and outlet	
	•Protective relay	•As planned
	•PLC System	•As planned
3) Newly constructed transformer stations		
•Dos Cerritos Transformer Station	•230/69/13.8 kV	•Additional construction work

•Trinitaria Transformer Station	•230/138/13.8 kV	•As planned

source: TRANSELECTRIC S.A

Table 2: Comparison of Planned Output (at time of appraisal) and Actual Output of Sub-Transmission (Phase B-2) Project

Output	Planned	Actual
1) Sub-transmission line construction		
•69 kV transmission lines	•24 segments(total 337.5 km)	•19 segments(total 397.33 km)
•138 kV transmission lines	•2 segments(total 43.0 km)	•2 segments(total 51.54 km)
2) Sub-Transformer Station Construction		
•69 kV/13.8 kV Transformer Station	•58 locations	•35 locations (planned to increase by 5 by end of 2008)
•138 kV/69 kV Transformer Station	•2 locations	•The 2 locations as planned and additional construction of 2 transformer stations(69kV/22kV):4 locations

Note: During the reorganization of the agencies, rust was discovered on some pieces of electrical equipment stored in an INECEL warehouse, but they were properly repaired and are being used without problem.
source: TRANSELECTRIC S.A

Furthermore, the increase or decrease in various outputs was mainly due to revisions of the project plan for the following reasons.

Transmission (Phase D) Project: Construction of transmission lines

- Addition of steel utility poles: Accompanying the change in the transmission route, there were locations where it became necessary to switch from steel towers to steel poles.
- Cancellation of the Salitral-Trinitaria segment: Following a review of the power demand plan for Guayaquil, because it was decided to connect the Salitral Transformer Station to the Guayaquil Thermal Power Station and to connect the Guayaquil Thermal Power Station to the Trinitaria Transformer Station, the transmission lines for the Salitral-Trinitaria segment became unnecessary.

Transmission (Phase D) Project: Construction/installation of transformer stations

- Pascuales Transformer Station: At the time the project was planned, it was thought that there was a stock of existing equipment at INECEL; however, the equipment was discovered to be insufficient after the start of the project, and it was necessary to purchase equipment. (JBIC's approval was received for the additional materials and equipment.)

・ Dos Cerritos Transformer Station: Because electric power demand increased rapidly due to sudden urbanization of parts of Guayaquil, the boosting of Pascuales Transformer Station was inadequate, and so it became necessary to supplement it with a demand plan to make up for the insufficiency. (JBIC's approval was received for the additional materials and equipment.)

Sub-Transmission (Phase B-2) Project

・ Following the reorganization of the agencies (in 1999), the distribution companies in each region reviewed their original plans in view of the latest power demand forecast and adjusted the length of segments and transmission lines and the number of transformer stations.

Figure 2: Duran Transformer Station

Figure 3: Montero Transformer Station

Figure 4: Milagro Sur Transformer Station

2.2.2 Project period

Whereas the planned project period of this ODA loan was November 1990 to December 2000 (94 months), the actual project period was November 1990 to December 2004 (170 months), an increase of 76 months over the plan.

Of that, the project period of the Transmission (Phase D) Project was planned for November 1990 to February 1994 (40 months), but the actual project period was November 1990 to May 1997 (79 months), 39 months over the plan. Moreover, the planned project period of the Sub-Transmission (Phase B-2) Project was July 1996 to December 2000 (54 months), but the actual project period was July 1996 to December 2004 (102 months, 48 months over the plan.

The main reasons for the delay were as follow.

Transmission (Phase D) Project

・ Together with the shrinkage of government tax receipts due to the economic crisis starting in 1995, the domestic currency allowances could not be secured as planned, and so implementation of construction was delayed.

・ Because the government was in arrears on payment of foreign debt, issuance of

L/COM for procurement of materials and equipment was halted during January 1993 to June 1994.

- Due to the Great Hanshin-Awaji Earthquake in January 1995, delivery of materials and equipment from Japan was delayed by about 2.5 months.

Sub-Transmission (Phase B-2) Project

- Following the reorganization of INECEL, time was required for each regional distribution company to review its plans in view of the latest power demand forecast and to apportion budgets.
- Delivery of some of the electric power equipment was delayed. (Time was required for procedural matters and for signing new contracts for additional equipment when switching from INECEL, and so preparations for construction were completed in 2001 and thereafter.)
- There were delays due to lack of funds at local electric power companies for installation of transformer stations and transmission lines. (Some of the transmission lines are scheduled to be installed by the end of 2008.)
- Due to the inflation caused by the switch from the Ecuadorian sucre to the US dollar in 2000, there was a delay in the domestic currency allowance, and so the project was delayed.

Table 3: Comparison of Planned Project Period (at time of appraisal) and Actual Project Period

Project	At Appraisal	Actual	Difference
Transmission (Phase D) Project	November 1990 -February 1994 (40 months)	November 1990 -May 1997 (79 months)	Increase of 39 months
Sub-Transmission (Phase B-2) Project	July 1996 - December 2000 (54 months)	July 1996 - December 2004 (102 months)	Increase of 48 months
Total	November 1990 - December 2000 (94 months)	November 1990 - December 2004 (170 months)	Increase of 76 months

source: TRANSELECTRIC S.A

2.2.3 Project cost

The planned total project cost was 21,491 million yen, and the actual cost was 18,464 million yen, or 86% of the planned amount.

Of that, the planned project cost of the Transmission (Phase D) Project was 11,503 million yen, and the actual project cost was 8,511 million yen, or 74% of the planned cost. Moreover, the planned project cost of the Sub-Transmission (Phase B-2) Project was 9,988 million yen, and the actual cost was 9,953 million yen, nearly as planned.

The main reasons for the cost reduction in the Transmission (Phase D) Project are as follow.

- Because the results of the competitive bidding were significantly below the expected bids, the project cost was reduced.
- Due to favorable movement of the exchange rate, the cost was reduced.

Furthermore in the Transmission (Phase D) Project, there was an additional cost added by the new construction of the Dos Cerritos Transformer Station, but the project cost remained as planned due to the allocation of remaining ODA loan funds and reserve funds.

Table 4: Comparison of Planned Project Cost (at time of appraisal)
and Actual Project Cost (million yen)

	Planned	Actual	Difference
Transmission (Phase D) Project	11,503	8,551	74.3%
Sub-Transmission (Phase B-2) Project	9,988	9,953	99.6%
Total Project Cost	21,491	18,464	85.9%

source: TRANSELECTRIC S.A

2.3 Efficiency

2.3.1 Transmission Loss Rate

Generally transmission loss[4] increases more the longer the transmission distance becomes, and it decreases more the higher the transmission voltage. In Ecuador, the transmission loss increased until 2002, immediately after the completion of the project. However, after the completion of this ODA loan project, from 2003 onward, the transmission loss rate decreased due to an increase in the voltage of the transmission voltage. This ODA loan project is considered to contribute support-wise to improvement in the financial status of the power transmission company, to ensuring of the volume of power transmission, and to conservation of local resources. Furthermore, the table below shows the transmission loss rate data as a whole of Transelectric S.A., the executing agency of this ODA loan project and the only power transmission company in Ecuador.

Table 5: Transmission Loss Rate

Goal at time of appraisal for Transmission (Phase D) Project	1999	2000	2001	2002	2003	2004	2005

[4] Transmission loss rate is the rate of loss in the transmission network of electric energy produced by the power plant. Furthermore, Transelectric does not posses data on transmission loss rate for this ODA loan project only.

4.5%	3.2%	3.3%	3.6%	3.9%	3.3%	3.2%	2.8%

source: TRANSELECTRIC S.A

2.3.2 Power Generation at Sending End

As a result of this ODA loan project's contribution to the increase in power generation at sending end[5] through improvement of operation and maintenance capacity in the transmission and transformer areas, it became possible to meet the increasing domestic demand for electric power, and the power generation at sending end is increasing steadily. Just as Table 5, the table below shows the total power generation at sending end of Transelectric S.A. overall.

Table 6: National **Power Generation at Sending End** (GWh)

1999	2000	2001	2002	2003	2004	2005
7,701	7,889	7,966	8,097	8,362	8,901	10,262

source: TRANSELECTRIC S.A

2.3.3 Rural electrification

While the scope of rural electrification is gradually expanding to farm villages in remote areas, there has also been an increase in cases where time is required for operation and maintenance and for repair work when accidents involving transmission lines occur (e.g., workers often spend several hours going to worksites by foot when work vehicles cannot be used due to the hilly topography around rural villages). This is one reason why an increased number of outage hours and supply problems occur. Table 7 below displays data on outages in rural areas, and it shows that the outage hours, etc., for 2003 to 2005 increased. (The detailed cause was not determined by this evaluation study.) Moreover as a result of the increased outages, there has been an increase in the operation and maintenance expenses of rural electric power companies.

Table 7: Indexes of Outages in Rural Areas

	2003	2004	2005
Forced outage hours per year	539	838	990
Electricity supply per year affected by outages (MWh)	2,444	5,848	8,586
Outages per year	410	674	534
Outage hours per outage	1.3	1.2	1.9
Electricity loss per outage (MWh)	6.0	8.7	16.1

Note: Figures are totals for 12 rural electric power companies

[5] Power generation at sending end is the amount of electric power actually sent out of the power plant, after subtracting the electric power used inside the power plant from the gross electric energy production at generating end. Furthermore, Transelectric does not posses data on Power generation at sending end for this ODA loan project only.

related to this ODA loan project.
source: 12 rural electric power companies.

2.3.4 Financial internal rate of return

The financial internal rate of return (FIRR) for the Transmission (Phase D) Project was calculated at the time of the appraisal as 8.9%, with the benefit as the anticipated increase in income from selling electricity. The FIRR for the Sub-Transmission (Phase B-2) Project was not calculated.

The FIRR of the Transmission (Phase D) Project was not recalculated at the time of evaluation because it was extremely difficult to measure the actual contribution of this ODA loan project to the overall benefits due to partial assistance from the nationwide transmission network and inadequacies in the data collection system. Moreover, the FIRR could not be recalculated for the Sub-Transmission (Phase B-2) Project because operation and maintenance expenses, etc., for this ODA loan project could not be acquired from the local electric power companies.

2.3.5 Qualitative effects

Improvement in the rate of rural electrification through installation of the transmission network contributed to alleviation of poverty as a cause of social unrest (65% of the population lives in poverty, and 33% of those live in extremely poverty (2001 census)), together with promoting installation of social infrastructure and improvement in living standards and environmental standards in rural areas. It may be said that installation of the transmission network by this ODA loan project played a part in alleviating social unrest.

To give one example, according to the leader of a remote mountain village where a beneficiary survey[6] was implemented, the pump-type water supply facilities in the mountain village began to operate stably due to installation of the transmission network by the project, contributing to a more convenient life and ensuring a stable supply of electricity for the villagers.

2.4 Impact

2.4.1 Increase in reliability of electric power

2.4.1.1 Stabilization of electric power supply

Due in part to the implementation of this ODA loan project, it is presumed that a stable electric power supply for rural areas of Ecuador was achieved. As shown on Table 8 below, the amount of electric power not only for family residences but also for

[6] The estimated number of beneficiaries in the Transmission (Phase D) Project is approximately 13.6 million persons (i.e., the national population targeted) and in the Sub-Transmission (Phase B-2) Project is approximately 10.78 million persons (i.e., the population of the 15 provinces targeted).

commercial and industrial use is steadily increasing. As a result, together with providing the benefits of electricity for more rural residents, the project appears to be contributing to improved convenience in household life and stimulation of commerce and industry because usage of electric products is growing,

Table 8: Power Generation at Sending End for Residential, Commercial, and Industrial Use (GWh)

	1999	2000	2001	2002	2003	2004	2005
Residential Use	2,943	2,794	2,897	3,098	3,270	3,533	3,701
Commercial Use	1,258	1,359	1,412	1,570	1,674	1,818	1,964
Industrial Use	2,071	2,196	2,115	2,025	1,931	1,835	2,965

source : TRANSELECTRIC S.A

2.4.1.2 Increase in Rate of Rural Electrification

Due to the progress of FERUN[7], a fund for electrification of rural villages near cities operated by the Ecuadorian government, and progress in investment of internal capital by private electric power companies together with the installation of the transmission network by this ODA loan project, electrification of remote areas was made possible. As shown on Table 9 below, the rate of rural electrification is rising.

Table 9: Changes in Rural Electrification Rate (%)

Region	1985	1992	2001
National average	44.2	63.2	89.7
North	54.7	69.7	91.1
Central north	41.0	70.8	84.3
South	34.6	52.6	81.4
Esmeraldas	29.8	41.7	75.8
Pichincha	55.5	67.9	91.0
Manabi	34.1	44.6	82.7
Guayas-Los Rios	45.6	62.1	86.6
El Oro	47.5	62.5	95.0
Central south	51.2	71.4	89.6

source: 2001 Census.

2.4.2 Improvement of electric power service

As part of this field survey, a beneficiary survey was conducted in a rural area where the electric power supply was inadequate and a stable power supply was not secured prior to the project. The beneficiary survey[8] covered 190 persons in 9 districts of three counties

[7] A fund established by the government for providing fund assistance to local electric power companies for the purpose of promoting rural electrification.
[8] Beneficiaries were selected randomly from among residents of rural villages where electric power service was gradually spreading but was in an unstable condition.

in Pichincha Province (78 men, 112 women; the main occupations were housewife, small business owner, and farmer) to whom services were provided by this ODA loan project.

As shown on Table 10 below, 73% of beneficiaries replied that they are very satisfied or satisfied, and so overall their evaluation was highly positive.

As shown on Table 11 below, a high rating was given to the increase in the quality of life due to introduction of household electric appliances in the rural areas, accompanying the expansion of electric power supply to rural areas and the assurance of a stable electric power supply. In their statements, the beneficiaries mentioned improved access to current news and administrative services information due to improved television and radio reception, an improved educational environment for children due to the higher percentage of the population served with electricity, and increased opportunities to earn cash due to the spread of labor-saving household electrical appliances. In addition, beneficiaries also mentioned improved public safety due to the new installation of street lights, improved family communication due to lighting at nighttime, and reduction in eye disorders that had been caused by kerosene lamps.

Table 10: Satisfaction of Beneficiaries with Stabilization of Electric Power due to the ODA Loan Project

Very Satisfied	Satisfied	Somewhat Satisfied	Not Satisfied
17%	56%	23%	4%

source: Beneficiary Survey (190 beneficiaries).

Table 11: Recognition of Living Improvements due to Stabilization of Electric Power

	Very improved	Improved	No change	Worse
Household lighting	11%	57%	30%	2%
TV and radio reception	11%	64%	24%	1%
Education	29%	56%	13%	2%
Housework	29%	52%	18%	1%

source: Beneficiary Survey (190 beneficiaries).

Meanwhile, the main reason why respondents were only somewhat satisfied or not satisfied was because of the increase in their regular monthly cash expenditures, and it can be observed that some are in arrears in their payment of electricity fees (Tables 12 and 13). As the main reasons why they are behind on their payments, 66% of the

beneficiaries stated that it was due to inadequate income, and 9% of the beneficiaries stated that access to the payment location was poor. Moreover, in many cases farmers receive cash income only several times per year, so they do not have regular monthly cash income; it is likely that payments become delayed because they pay using incidental income from seasonal farm work or construction work, etc.

Table 12: Beneficiaries' Opinion of Electricity Fees

Very expensive	Expensive	Appropriate	Cheap	Very cheap
29%	33%	38%	0.3%	0.3%

source: Beneficiary Survey (190 beneficiaries).

Table 13: Condition of Electric Fee Payments

On time	Sometimes delayed	Always delayed	Unpaid
65%	31%	2%	2%

Note: Local electric power companies do not possess data on fee collection rates.
source: Beneficiary Survey (190 beneficiaries).

Figure 5: Electrification of Stores

Figure 6: Beneficiary Survey

Figure7: Electrification of Stores

2.4.3 Environmental impact

There was no particular indication of negative environmental impact in the project area, and there were no problems.

Implementation of an environmental impact assessment (EIA) is required by the environmental standards of CONELEC, the national electric power commission, when constructing electric power-related facilities. Moreover, where environmental burden alleviation plans are required, measures are devised in accordance with the environmental impact standards.

2.5 Sustainability

2.5.1 Executing agency

2.5.1.1 Technical capacity

There are no particular problems in the technical system of Transelectric S.A. and the local electric power companies, which are the bodies that carry out management of this ODA loan project.

Transelectric S.A., which operates the transmission network, has a total of 262 employees. Of those, 47 employees divided into five sections are involved in operation and maintenance. Specialized technicians are assigned to each section, and adequate personnel are secured for the operations. There are no technical problems.

Moreover, the local electric power companies which control the local distribution networks and transformer stations engage in operations mainly using technicians who specialize in electricity, and they face no technical problems. A system is in place for the local electric power companies to receive technical assistance from Transelectric S.A. and from equipment suppliers. The electric power companies conduct operation and maintenance according to an operation and maintenance manual prepared by Transelectric S.A. and the equipment suppliers.

2.5.1.2 Operation and maintenance system

A change occurred in Ecuador's electric power sector when INECEL (Ecuador's national electric power agency), which had been in charge of all matters related to electric power, was reorganized in March 1999 and the power generation operations, transmission operations, and distribution operations each became independent.[9]

After INECEL, which was this ODA loan project's executing agency at the time of appraisal, was reorganized in March 1999, Transelectric S.A. (Ecuador's only electric transmission company) became the executing agency starting in May 1999. Transelectric S.A. is also in charge of operation and management of transmission operation.[10]

With regard to operation and mangement of distribution operations, the 20 local electric power companies in charge of each region nationwide carry out operation and management in their respective regions. There are 13 local electric power companies covered by this ODA loan project (Sub-Tranmission (Phase B-2) Project).

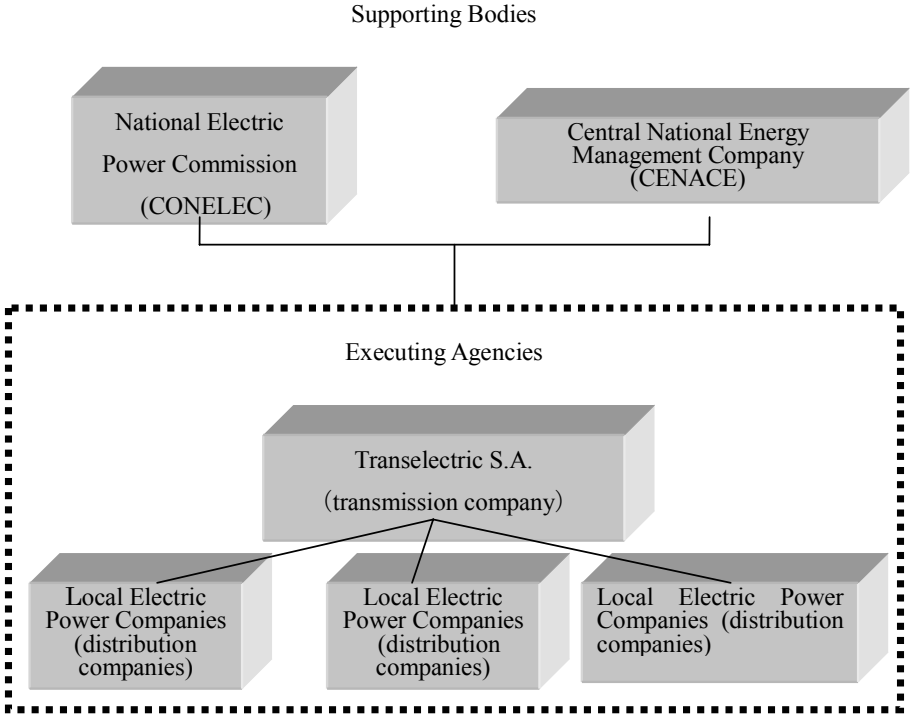
Furthermore, both Transelectric S.A. and the local electric power companies are

[9] Following reorganization, Transelectric S.A. and the local electric power companies are owned by a joint fund（Fondo de Solidaridad）organized by the Ecuadorian government.

[10] The transmission network controlled by Transelectric S.A. is as shown in Figure 1: National Power Transmission Network System.

public corporate bodies that are managed by the government, but essentially the companies are in charge of planning and other responsibilities.

Figure 2: Organizational Chart of This Project



source: Transelectric S.A.

2.5.1.3 Financial status

The electric power sales price set by the central government was maintained until 2006 at a lower level than the price at which electric power was purchased from power generation companies. This meant that the local electric power companies were not structured to produce profit, and so they had a deficit.[11]

In order to improve the financial status of the local electric power companies, the central government including the Ministry of Energy and Mines decided to set the electric power sales price so as to reflect the cost of generating power starting in 2007. Moreover, in the event that it is difficult to raise electricity fees paid by beneficiaries, it was decided that the central government would supplement the difference in the purchase price and sale price paid by the local electric power companies ((purchase price paid to power generation company)- (sales price paid by beneficiaries)).

[11] Through Transelectric, the executing agency, and other related central government bodies such as the joint fund （Fondo de Solidaridad）, attempts were made to acquire the balance sheets of the local electric power companies. However, because most of the companies are producing a deficit, they refused to provide financial data. The deficit up until 2006 is scheduled to be supplemented by the central government.

Given the above, Transelectric S.A. and local electric power companies are expected to free themselves of structural deficit in the future and basically to improve operations through stable fee income from beneficiaries.

2.5.2 Operation and maintenance status

Daily and periodic operation and maintenance work is being carried out appropriately. Moreover, sudden troubles are repaired promptly, and there are no particular problems.

With regard to the transmission-related facilities of the Transmission (Phase D) Project, Transelectric S.A. is in charge of the transmission network nationwide, and operation and maintenance work is essentially consigned to and carried out by private local firms under the supervision of Transelectric S.A. It was confirmed that there are no problems in this operation and maintenance.

With regard to the local distribution-related facilities of the Sub-Transmission (Phase B-2) Project, the local electric power companies are in charge of operation and maintenance, and operation and maintenance work is essentially carried out by specialized technicians at the local electric power companies or consigned to private firms. It was also confirmed that there are no problems in this operation and maintenance either.

Figure 8: Daily Management inside a Transformer Station

Figure 9: Inspection of Batteries

Figure 10: Fee Payment Location inside Electric Power Company

3. Feedback

3.1 Lessons Learned

N.A.

3.2 Recommendations

-Recommendations to Ecuador

The local electric power companies are endeavoring to improve operation and maintenance. However, time is required for operation and maintenance because access to

repair sites is poor due to lack of roads in remote areas and particularly in mountainous areas, such that repair vehicles cannot be driven to the repair sites. This is one factor that causes increases in outage hours and in supply problems due to outages. Consequently, it may be said that the Ecuadorian government needs to pursue development that includes installation of social infrastructure such as roads, together with supporting rural electrification in remote areas.

Comparison of Original and Actual Scope

Item	Plan	Actual
1.Output		
Transmission (Phase D) Project 1) Transmission line construction •Paute - Pascuales - Trinitaria segment •Salitral - Trinitaria segment	 •218 km(230 kV×2 lines) •8 km(138 kV×2 lines)	 •As planned •Cancelled
2)Transformer Station equipment/materials procurement, construction, and installation •Paute Hydroelectric Transformer Station • Pascuales Transformer Station	 •PLC electric line conveyance system •230kV Bus line •230kV Transmission lines inlet and outlet •Protective relay •PLC System	 •As planned •As planned (4 disconnecting switches and 1 circuit breaker) •As planned •As planned
3) Newly constructed transformer stations •Dos Cerritos Transformer Station •Trinitaria Transformer Station	 •230/69/13.8kV •230/138/13.8kV	 •As planned •As planned
Sub-Transmission (Phase B-2) Project		
4) Sub-transmission line construction •69 kV transmission lines •138 kV transmission lines	 •24 segments (total 337.5 km) •2 segments (total 43.0 km)	 •19 segments (total 397.33 km) •2 segments (total 51.54 km)
5) Sub-Transformer Station Construction 69kV/13.8kVTransformer Station 138kV/69kVTransformer Station	 58 locations 2 locations	 35 locations (planned to increase by 5 by end of 2008) The 2 locations as planned and additional construction of 2 transformer stations(69kV ／ 22kV）:4 locations
2. Project Period Overall Transmission (Phase D) Project Sub-Transmission (Phase B-2) Project	 November 1990-December 2000 (94 months) November 1990-February 1994 (40 months) July 1996-December 2000 (54 months)	 November 1990 -December 2004 (170 months) November 1990-May 1997 (79 months) July 1996-December 2004 (102 months)
3. Project Cost Transmission (Phase D) Project Foreign currency Local currency Sub-total Sub-Transmission (Phase B-2) Project	 7,698 million yen 3,805 million yen (22,121 million sucre) 11,503 million yen	 6,646 million yen 1,863 million yen (25,791 million sucre) 8,511 million yen

Foreign currency	8,576 million yen	8,331 million yen
Local currency	1,412 million yen (US$13,197 thousand)	1,672 million yen (US$13,495 thousand)
Sub-total	9,988 million yen	10,003 million yen
Total	21,491 million yen	18,514 million yen
ODA Loan Portion	17,489 million yen	16,141 million yen
Exchange Rate	1 sucre = 0.52 yen (as of 1988) 1 sucre =57.4 yen (as of 1996) US$1 =107 yen (as of 1996)	1 sucre = 30.0 yen (as of 1997) US$1 = 123.9 yen (as of 2004)