Review of Ex-Post Evaluation Reports
by Country and Sector

Sector Review Report

Electric Power Sector

Final Report

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This sector review report (Electric Power sector) was compiled and analyzed by Global Group 21 Japan at the request of Development Assistance Operations Evaluation Office, Project Development Department of the Japan Bank for International Cooperation (JBIC).

Forward

This analyses ex-post evaluation report (henceforth, evaluation reports) for 100 electric power sector projects supported by the Japan Bank for International Cooperation (JBIC).

In order to improve the quality of aid projects in developing countries, the JBIC has conducted ex-post evaluations of completed projects. Ex-post project evaluation is the assessment of how a project was implemented and administrated in contrast with the initial plan, and whether the expected results were realized after completion of the project. The ex-post evaluations are conducted with two goals in mind. The first is to compile the lessons learned from the project evaluations, and to use the lessons in the implementation of future projects. The second goal is to improve the transparency of aid projects, and to increase the accountability for people both in Japan and the borrowing countries through the disclosure of evaluation results.

The goal of this review is to create an overview of the performance of completed electric power sector projects using ex-post evaluation reports, to analyze the data to determine the cumulative effect of the Japanese ODA loan projects in the sector, and to derive possible lessons or recommendations for future ODA loan projects. In addition, by reviewing and studying the evaluation indices, it is hoped that reference material for future appraisals, administration and evaluations will be provided.

This report consists of four chapters. The first chapter outlines all projects in the sector as well as the 100 electric power sector projects analyzed in this report. Chapter two establishes a framework for the analysis, and chapter three analyzes the performance of the 100 projects based on the evaluation reports. Chapter four presents the comprehensive results of the analysis, and offers lessons and recommendations for future electric power sector projects.

The performance analysis is performed through the establishment and analysis of five primary criteria broken down into 23 evaluation check criteria.

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1. The Japanese ODA Loan Projects in the Electric Power Sector

1.1 Loan Conditions for the Electric Power Sector

By the end of the year fiscal 2000, a total of ¥4,166,600 million was approved for electric power sector projects (power stations, power transmission lines, other electric and gas projects) making up 24.7% of all project loans[1].

The regional distribution of the approved loan to the electric power sector is as follows: An overwhelming 84.7% of loans were approved in Asia, 5.5% in the Middle East, 5.2% in Latin and South America, and 2.9% in Africa. Broken down by sub-sector (power stations, power transmission lines, and others), 372 loan agreements for power station projects comprised 75% of approved loan value, while 114 projects involved power transmission lines and seven projects involved other sub-sectors (Table 1).

Table 1: Regional Breakdown of Approved Loan Value for Electric Power Sector Projects and of Sub-sector Distribution (September, 2001)

	Approved Loan Value		Number of Loan Agreements						
			Power Stations				Power Trans-mission Lines[2]	Other	**Total**
	(in millions of yen)	(%)	Thermal Power	Hydro-Power[3]	Geothermal Power	Wind Power			
South East Asia	1,811,617	43.5%	62	120	9	0	66	7	**264**
South Asia	1,093,950	26.3%	38	40	0	0	24	0	**102**
East Asia	619,408	14.9%	16	37	0	0	4	0	**57**
The Middle East	228,109	5.5%	6	8	0	0	0	0	**14**
Africa	120,455	2.9%	10	7	0	0	6	0	**23**
Latin and South America	216,518	5.2%	2	6	2	1	12	0	**23**
Other	76,626	1.8%	3	5	0	0	2	0	**10**
Total	**4,166,683**	**100.0%**	**137**	**223**	**11**	**1**	**114**	**7**	**493**
						372	**114**	**7**	**493**

Looking at the annual variations in the Japanese ODA loan agreements to the electric power sector (Table 2), the total number of loan agreements was especially high during the period between 1991 and 1995, the increase resulting from increased numbers of thermal power station projects. During the early 1990's, large-scale successive projects were conducted in India (four loan agreements each for the thermal power stations in Anpara and

[1] Including engineering services loans
[2] Facilities for power transmission, power transformation, and power distribution
[3] The "Hydro-Power" total includes multi-purpose dams.

Gandhar), China (nine loan agreements for thermal power stations in Hubei Ezhou, Sanhe, and Shanxi Hejin), and Vietnam (four loan agreements each for the thermal power stations in Phu My and Pha Lai). Economic development in each country was accompanied by increased demand for electricity, and it is believed that in order to quickly respond to the increase, the countries requested loans to create thermal power stations.

Table 2: Number of Loan Agreements by Year and Type of Power Generation

Fiscal Year	Number of Loan Agreements						
	Power Stations				Power Transmission Lines	Other	**Total**
	Thermal Power	Hydro-power	Geothermal Power	Wind Power			
Pre-1975	13	58	0	0	15	0	**86**
1976-1980	19	41	2	0	18	0	**80**
1981-1985	22	31	3	0	17	0	**73**
1986-1990	18	31	1	0	15	1	**66**
1991-1995	42	35	4	0	22	5	**108**
1996-2000	23	27	1	1	27	1	**80**
Total	**137**	**223**	**11**	**1**	**114**	**7**	**493**

Table 3 displays the total approved loan amount for the electric power sector broken down by country. The country with the largest total approved loan amount was India, followed by Indonesia, China, Malaysia, Thailand, the Philippines, and Vietnam. The top five countries in the chart account for 60% of the total approved loan amount for the electric power sector. However, the number of loan agreements with Indonesia is significantly higher than four other countries.

Table: 3 Total Approved Loan Amount by Country

Country	Approved Loan Amount		Number of Loan Agreements
	(millions of yen)	(%)	
India	721,205	17.3	54
Indonesia	580,421	13.9	126
China	521,185	12.5	41
Malaysia	355,800	8.5	29
Thailand	306,903	7.4	46
The Philippines	280,787	6.7	29
Vietnam	234,815	5.6	22
Pakistan	163,541	3.9	14
Syria	125,341	3.0	3
Sri Lanka	96,382	2.3	14
Bangladesh	79,751	1.9	15
R. O. Korea	76,791	1.8	10
Peru	64,843	1.6	6
Egypt	63,783	1.5	10
Iran	46,108	1.1	2
Other	449,027	10.8	72
Total	**4,166,683**	**100.0**	**493**

A common characteristic shared by the top four borrowing nations (excluding Thailand) is that multiple series of large-scale successive projects were implemented. In

Indonesia, these successive projects included 12 loan agreements for the development of hydro-power in Asahan, 11 loan agreements for the hydro-power station in Karangkates, eight loan agreements for the Kali-Konto dam project, and eight loan agreements for the Gresik thermal power station. Likewise, successive loans were made for power transmission line projects including the Java-Bali Electric Power Transmission and Distribution Network projects and the East Java Electric Power Transmission and Distribution Network Projects. In India, five loan agreements totaling ¥119,058 million were made for the Anpara B thermal power station project. Likewise, over ¥50,000 million was loaned the gas power station in Assam and to the thermal power station projects in Gandhar and Bakreswar. In China, a total of 10 loan agreements totaling ¥117,975 million were made to the Tianshengqiao hydro-power and the Tianshengqiao. First hydropower station projects in Malaysia, over ¥100 billion was loaned to projects in both Port Dixon and Port Klang. There were no successive projects in Thailand, where the projects were largely for power transmission line projects to bring electricity to rural areas and agricultural villages.

It is a characteristic of the electric power sector that successive projects are common in the development of hydro-power sources in a single water system, or the expansion of power stations and increasing the amount of power generation equipment for thermal power generation. The above-mentioned items are not included in the projects reviewed in this report. In the future, it is necessary to conduct an impact study on the electric power sector in Indonesia, the Anpara B thermal power station in India, the Tianshengqiao hydropower station in China, and the two thermal power stations in Malaysia.

1.2 Overview of Reviewed Projects

This report focuses on 100 Japanese ODA loan projects[4] for electric power sector (151 loan agreements) for which evaluation reports were completed by the fiscal year 2000. Information including project names, countries, sector (sub-sector), the month and year the loans (loan agreements) were entered into, are provided in the material appended to this review. These projects have been conducted since the 1960's, and were primarily conducted in Asia. As shown in Table 4, the total actual loan amount for electric power sector projects was ¥1,058,000 million. Broken down by region, approximately ¥845,900 million was loaned to Asia (79.9%), approximately ¥69,900 million to Africa (6.6%), approximately ¥67,700 million to Latin and South America (6.4%), approximately ¥59,500 million to the Middle East (5.6%), and approximately ¥15,100 million to Oceania (1.4%). Loans were made to 27 countries, but over 60% of the total actual loan amount was loaned to the top five borrowing countries. As displayed in Table 5, largest borrower was Indonesia, with 15 projects totaling ¥176,100 million (16.6% of the total yen value), followed by the Philippines with 8 projects totaling ¥146,700 million (13.9%), Malaysia with 11 projects totaling ¥137,500 million (13.0%), Thailand with 8 projects totaling ¥97,300 million (9.2%), and Pakistan with 8 projects totaling ¥91,000 million (8.6%).

The Japanese ODA loan projects reviewed in this analysis were conducted primarily in the 1970's and 1980's, with four of the 100 projects being relatively recent projects with loans made in the 1990's (Tables 6 and 7).

Table 4: Number of Projects and Actual Loan Amount by Country (September, 2001)

	Number of projects	Actual yen loan amount (millions of yen)	Actual yen loan amount (%)
South East Asia	44	578,177	54.6%
South Asia	22	185,904	17.6%
East Asia	8	81,874	7.7%
Central Asia / the Caucasus	0	0	0.0%
The Middle East	3	59,496	5.6%
Africa	12	69,890	6.6%
Latin and South America	8	67,746	6.4%
Oceania	3	15,084	1.4%
Europe	0	0	0.0%
Total	100	1,058,171	100.0%

[4] In cases where a single project included multiple phases, the phases were counted as a single project. Also, here are cases where multiple projects were evaluated in a single report. In cases where information was provided from separate evaluations, the projects were counted separately, while if multiple projects were evaluated in a single report, the projects were grouped and counted as a single project. There were three projects of this type.

Table 5: Number of Reviewed Projects and Actual Loan Amount

Country	Number of projects	Actual loan amount (millions of yen)	(%)
Indonesia	15	176,107	16.6%
The Philippines	8	146,709	13.9%
Malaysia	11	137,535	13.0%
Thailand	8	97,288	9.2%
Pakistan	8	91,007	8.6%
Egypt	8	56,476	5.3%
R.O. Korea	6	50,887	4.8%
India	6	50,076	4.7%
Turkey	2	32,810	3.1%
China	2	30,987	2.9%
Bangladesh	5	29,757	2.8%
Syria	1	26,686	2.5%
Myanmar	2	20,538	1.9%
Papua New Guinea	3	15,084	1.4%
Nepal	2	14,406	1.4%
Brazil	1	12,489	1.2%
Colombia	1	12,300	1.2%
Jamaica	1	9,459	0.9%
Costa Rica	1	9,457	0.9%
Peru	2	8,466	0.8%
Honduras	1	7,793	0.7%
Ecuador	1	7,782	0.7%
Tunisia	1	6,840	0.6%
Madagascar	1	3,000	0.3%
Botswana	1	1,981	0.2%
Tanzania	1	1,593	0.2%
Sri Lanka	1	658	0.1%
Total	**100**	**1,058,171**	**100.0%**

Table 6: Number of Reviewed Projects and Loan Amount by Year

Fiscal Year	Number of projects	Actual yen loan amount (millions of yen)
Pre-1975	14	171,370
1976-1980	30	240,197
1981-1985	31	357,582
1986-1990	21	249,025
1991-1995	4	39,997
Total	100	1,058,171

Table 7: Number of Reviewed Projects by Year and Region

Fiscal Year	South East Asia	South Asia	East Asia	The Middle East	Africa	Latin and South America	Oceania	Total
Pre-1975	8	1	2	1	1	1	0	14
1976-1980	17	6	2	0	0	4	1	30
1981-1985	10	7	2	1	8	2	1	31
1986-1990	8	6	2	1	3	0	1	21
1991-1995	1	2	0	0	0	1	0	4
	44	22	8	3	12	8	3	100

1.3 Types of Reviewed Projects and their Characteristics

In this report, the reviewed projects' characteristics were analyzed after being categorized using the following criteria: 1) classification by sub-sector: power generation or power distribution, (transformer facility / transmission facility / distribution facility / communication facility) and 2) classification by construction type: new construction / improvements and repairs.

(1) Sub-sector

Table 8 displays the number of reviewed projects broken down by sub-sector and region. Over 70% of projects were power generating station construction and improvement projects, while the remaining projects aimed to improve power distribution and transmission facility.

Table 8: Number of Reviewed Projects by Sub-sector and Area

	Power Generating Station								Power distribution facility[5]	Total
	Thermal Power[6]					Hydro-Power[7]		Geo-thermal[8]		
	Oil	Oil and gas	Gas turbine[9]	Coal	Diesel	General hydro -power[10]	Pumped storage power generation			
South East Asia	4	1	3	3	5	11	1	3	13	44
South Asia	1	2	6	0	0	6	1	0	6	22
East Asia	0	0	0	0	0	6	1	0	1	8
The Middle East	1	0	0	0	0	2		0	0	3
Africa	0	3	2	1	0	2		0	4	12
Latin and South America	1	0	0	0	1	2		1	3	8
Oceania	0	0	0	0	0	3		0	0	3
	7	**6**	**11**	**4**	**6**	**32**	**3**	**4**	**27**	**100**
Total					**34**		**35**	**4**	**27**	**100**

[5] Including transmission equipment, transformer equipment, distribution equipment, and communication equipment

[6] Thermal power generation facilities include steam power generation (where fuels including coal, oil, and natural gas are burnt in boilers, and the heat energy is converted into steam which turns turbines to generate electricity), gas turbine power generation (where fuel gas turns the turbine directly to generate electricity), combined cycle power generation (where steam power generation and gas turbine power generation are combined), and internal combustion power generation (where a diesel engine turns the power generator to generate electricity).

[7] Hydro-power generating station projects include general hydro-power (which uses the energy from the water flow in rivers) and pumped storage power generation (which pumps water from a downstream reservoir to an upstream reservoir during times when energy demand is low so the water can be used to generate energy during times of heavy demand.

[8] Geothermal energy is converted to steam, which turns a turbine to generate electricity.

[9] Including combined cycle power generation

[10] Including 11 multi-purpose dam projects

(2) Construction type

As displayed in Table 9, almost all reviewed power generation improvement projects (henceforth power generation projects) involved new construction and expansion, while only one project involved improvements and renovations.

Table 9: Number of Reviewed Projects by Type of Power Generation and Construction Type

	Thermal Power	Hydro-power	Geothermal Power	Total
New Construction	20	32	4	56
Expansion	13	3	0	16
Improvement/ Renovation	1	0	0	1
Total	34	35	4	73

* Project scope includes project components not conducted using Japanese ODA loans.

2. Framework for Analysis

2.1 Five Evaluation Criteria and Evaluation Check Items

This chapter consists of a performance analysis of 100 projects based on the evaluation reports. The framework for analysis consists of five primary evaluation criteria. These five evaluation criteria are based upon the “Principles for Evaluation of Development Assistance” established by the Development Assistance Committee (DAC) of OECD in 1991, which evaluates a project from the standpoint of project relevance, efficiency of implementation, effectiveness, impact and sustainability. To perform a more detailed analysis for this review, each of the five parameters was broken down into the 23 “evaluation check items” listed in Table 10. Also, the effects parameter has come to include a review of the operation and effect indicators.

In preparation for conducting the performance analyses, the information in the project evaluation reports was checked against the 23 evaluation check items.

Table 10 : The Five Evaluation Criteria and Evaluation Check Items

Project Relevance	Does the goal and the approach to the project match the priorities and policies of the target group, counterpart country and the donor?
A1. Consistency with Development Policy and Priority Issues	
	Do the project goals and overall goals of this project match the development policies (including the national policy and master plan) and priority issues of the country or region in question?
A2.Relevance of Project Scope	
	Was the project plan (scope and approach) at the time of appraisal judged appropriate to achieve the overall and project goals?
A3. Relevance of Project Scope Alterations	
	In cases where project scope was altered after the project was implemented, were the alterations relevant?
A4. Relevance of Project Goals at the Time of Evaluation	
	In cases where terms and conditions were altered after the planning stage, are the project goals still valid at the present?
Efficiency of Implementation	
	Was the impact appropriate and achieved as planned in terms of quality, quantity and timing? Was the method used the most efficient in regard to output?
B1.Completeness of Output	
	Was the output (project results) completed as planned?
B2. Implementation Schedule Efficiency	
	Were there any problems in the project that caused the implementation schedule to exceed original plans?
B3. Project Costs Efficiency	
	Were there any problems in the project that caused the project costs to exceed original plans?
B4. Project Implementation System	
	Was the system appropriate for decision-making, monitoring and troubleshooting during the project?
Effectiveness	Achievement of Project Purpose .To what extent did the project output achieve its purpose?
C1. Output Utilization	Is the output (project results) being used adequately? (Determined primarily using the operation indicators. In cases where there is no planned value, sufficiency will be determined using absolute values.)
C2. Project Goal Realization	
	Was the direct effectiveness of the project sufficiently realized, and was the project goal sufficiently achieved? (Determined primarily using the effect indicators. When there is no planned value, sufficiency will be determined using absolute values)
C3.Achievement of FIRR / EIRR	
	Is the Financial Internal Rate of Return or the Economic Internal Rate of Return sufficient when compared with initial project values?
C4.Effect of Technical Assistance	
	Were the training and technological instruction component effects sufficiently realized?
Impact	Were the intended overall goal of the project achieved? Direct, indirect and subordinate results in terms of technical, economical, socio-cultural, systematic and environmental aspects.
D1. Contribution to Overall Goal Achievement	
	To what level were the original overall goals of the plan achieved, and to what extent did the project contribute to their realization.

D2. Impact on Policy and Institutional System

What impact did the project have upon development policy of the country in question and the institutional systems of the sector in question? Was the impact positive or negative?

D3. Socio-Economic Impact

What kind of impact was there on the regional society and economy? Was the impact positive or negative?

D4. Impact on Technology

What contribution did the project make to technological innovation and improvement in the country in question?

D5. Impact on Natural Environmental

What impact was there on the regional environment? Was the impact positive or negative?

D6. Resident Relocation and Land Acquisition

What impact was there on regional society in terms of resident relocation and site acquisition?

Sustainability

After completion of aid, to what extent will the agencies and organizations of the counterpart country be able to sustain the output and effects of the project?

E1. Output Condition

Is the output (project results) being maintained and operated appropriately? Is facility in good condition?

E2. Operation and Maintenance System

Are the systems, human resources (quality and quantity), work procedures (manuals) technology, maintenance facilities and equipment, and stock and procurement of spare parts for operation and maintenance sufficient?

E3. Financial Resources for Operation and Maintenance

Are sufficient financial resources available for appropriate operation and maintenance? Are those resources expected to remain available in the future?

E4. Continuation of Needs

Is it expected that need for the project will continue in the future?

E5. External Factors

What external factors will have a major affect on project effects and sustainability (environment, politics, policy, institutional systems, market, other related projects, etc.)? Is it expected that positive factors can be maintained in the future?

2.2 Sector-Specific Evaluation Check Items.

In considering the characteristics of the electric power sector, the following three sector-specific check items were envisioned. However, there were no information in the evaluation reports that corresponded to these items, and it was impossible to perform a data analysis. As these are important evaluation points for future evaluations, they are offered here as a reference.

(1) Location within the entire power system
(2) Fee system/public financing and government aid for the maintenance organization
(3) Plans to privatize or semi-privatize the implementing organization

(1) Location within the entire power system

A power system consists of power generation and power distribution facility which must be designed systematically and operated economically. Therefore, at the time of evaluation, the location of the project power generation or power distribution facility within the total power system must be considered. Moreover, it is important to evaluate whether the total power system that includes the project facilities is appropriate and economical.

(2) Fee system/public financing and government aid for the maintenance organization (evaluating sustainability)

Glancing over project evaluation reports, it is clear that although financial statements were included, few projects analyzed their contents. In considering the income from the sale of electricity, it is important to consider whether fees were set autonomously, how fees were calculated in cases where the operating organization had discretion, what mechanism was used to set fees when the operating organization did not have discretion, and what was done when deficits were realized. This is because financial evaluations are closely related to verifying the financial resources for operation and maintenance.

(3) Plans to privatize or semi-privatize the implementing organization (Evaluating sustainability)

The majority of the projects reviewed in this report were evaluated in the first half of the 1990's, with more recent projects, including the Transmission System Augmentation and Development Project (I) and (II) in Sri Lanka and the Patau-Patau Power Station Extension Project in Malaysia, evaluated in 2000 and 1998 respectively. The Patau-Patau Power Station Extension Project touched upon the privatization of the Sabah Electricity

Board. However, as the movement towards privatization or semi-privatization is a relatively recent phenomenon occurring primarily in the last ten years, it is generally not mentioned in the evaluation reports. In future evaluations, it will be necessary to include the movement towards privatization or semi-privatization, and the related financial conditions, as an important check item.

3. Performance Analysis

3.1 Relevance

In this review, the terms “plan” and “goal” refer to the initial project plan and the initial project goals (principally at the time of appraisal), or the revised plan and revised goals in cases where plan modifications were approved during project implementation. This definition applies to all uses of the words except where they are otherwise defined.

(1) Consistency with development policy and priority issues

In the 100 reviewed reports, consistency with development policy and priority issues was specifically mentioned in 80 evaluation reports, and was not mentioned in 20. It was judged that the majority of projects were sufficiently compatible with government development policy or priority development issues. Examples of such cases include:

1) Projects which were central to government development plans (five-year plans) or to central or regional government sector development plans. For example, the Indonesian East Java Transmission and Distribution Network Project (I), (II), and (III), which was implemented in response to rapid growth in power demand in the East Java region, was a part of the country’s first through third five-year plan for socio-economic development. Likewise, the content of the project conformed to the goals of the five-year plan for electric power sector development. In the case of the Rouna 4 Hydroelectric Project in Papua New Guinea, which was implemented in response to increased power demand in the capital of Port Moresby, the development of hydroelectric power generation had been declared important in the sixth National Economic and Social Development Plan. Moreover, the project was specifically mentioned as an important component of the plan.[11]

2) Projects which respond to clearly defined problems that required resolution. These problems included chronic power shortages in regions where stable energy supply could not be provided due to insufficient maintenance of power facility (power generation facility and power distribution facility), and projects which respond to increased power demand due to industrial development. For example, the Chinese

[11] After weathering two oil crises, countries which import oil as a fuel began to consider fuel procurement risks (trends in procurement volume and fuel costs), and began to formulate energy development plans that emphasized the effective use of energy resources. Therefore there is a trend for the energy policies of project countries to indicate that the natural gas, coal thermal power and hydropower generation projects reviewed in this report effectively utilizing alternative energy sources.

Shisanling Pumped Storage Power Station Project was implemented because the country's open policy since the 1980's resulted in economic development that deepened power shortages during peak hours. Prior to the project, excess demand was managed through planned power outages or unilateral load shutdown by the supplier. A series of projects in rural Thailand to improve the power distribution network and to bring electricity to agricultural villages were indicated as important parts of the third through the sixth National Economic and Social Development Plan.

On the other hand, there were cases where projects clearly concerning specific problems, such as demand on an already hard-pressed power supply, were not given high priority by area governments. The Indian Tamil Nadu State Micro Hydro-Power Stations Construction Project was implemented to improve power supply conditions in Tamil Nadu, but it was indicated that project priority was not quite high because in comparison with other states with similar income levels, power infrastructure conditions were good and the ratio of areas supplied with power was comparatively high.

(2) Relevance of project scope

Although there were evaluation reports that did not clearly detail the relevance of the project plan, the majority of initial project plans were designed to reflect area needs and external conditions. No significant problems arose due to inadequate initial plans. Seventeen projects reported minor problems relating to project plan relevance, wherein pre-project investigation of predictable events and comparison studies of alternative proposals were insufficient. In 13 projects, these problems were indicated to have affected project implementation and effects. Examples included the following:

1) Cases where project effects were limited due to insufficient investigation of alternate proposals relating to project scope. In the Marsa Matruh Barge Mounted Steam Power Plant Project in Egypt and the Barge-Mounted Power Plant Project (II) in Bangladesh, it was indicated that the comparison study of alternative proposals was insufficient, and that the utilization of a nidation system where the barge is emplaced on the ground rather than being moored does not sufficiently utilize the advantage of mobile barge mounted power plants. In the Indian Tamil Nadu State Micro Hydropower Stations Construction Project, there was no comparison study of the alternative proposal to rehabilitate existing power generation facilities, and as a result the project was unable to decisively resolve the power supply shortages in the area. Moreover, because power projects show effects as long as the facility is in use, almost all reports considered this sufficient and did not clearly explore the full possibilities of the plan. However, it is impossible to go back in time to when the project plan was developed

and investigate what alternative proposals existed. Therefore, it is important to confirm whether comparison studies of alternative proposals were performed at the time of appraisal using the project F/S, and to record them for posterity.

2) Cases where insufficient investigation of fuel reserves affected project implementation and results. In the Indian Nagarjunasagar Hydroelectric Power Station Expansion Project, the effects to procure power to pump water was based on an insufficient understanding of the balance of supply and demand in the state's power grid. This resulted in a lack of power for pumping water, and led to deliberate delay in dam construction projects. In the Quetta Power Station Expansion Project in Pakistan, it was ascertained during project implementation that there was insufficient supply pressure in the natural gas pipeline, and it was impossible to obtain the necessary gas volume to be used for fuel. As a result, it was necessary to change the fuel from natural gas, as initially planed, to HDS oil after the commencement of plant operation, which resulted in higher power generation costs.

3) Cases where insufficient consideration of resident opinion and the environment resulted in delays due to the opposition of area residents in early stages of facility construction. In the Calaca II Coal-Fired Thermal Power Plant Project in the Philippines, area residents and NGOs opposed construction before it began because of environmental pollution problems related to the Calaca I power plant. These problems included spontaneous combustion in coal-yards and the dispersion of coal dust from coal handling facilities. As a result, the National Power Company, which was implementing the project, established drastic supplemental measures to attend to environmental and residential concerns. As construction on the second plant could not begin until these measures were fully implemented, there was a five year delay between when the loan was made and when work began. Also, increased project costs resulting from changes in generator specifications and delays in work period had to be covered with additional loan, and the new loan project "Calaca I Coal Fired Thermal Power Plant Environmental Improvement" was made to support the environmental impact project for the Calaca I Power Plant. As there was sufficient understanding of the existing environmental problems at Calaca power generation facility at the time the loan was made, it is believed that these problems could have been prevented by earlier implementation of countermeasures.

4) Cases where low quality Feasibility Study resulted in both drastic changes in project scope and increases in project implementation period and costs. In the Tongonan Geothermal Power Plant Construction Project in the Philippines, poorly defined initial plans for power transmission lines resulted in changes in line routes, cancellations in

portions of construction, construction delays due to domestic currency shortfalls, and a two-year extension of the loan agreement when the original loan agreement could not be completed within the loan period. In the Palinpinon Geothermal Project (II)(II-2) in the same country, it was reported that the NPC made no comments and included no information related to ocean floor topography or ocean currents in the F/S, and it is believed that the organization simply selected the shortest route. As a result, additional funds became necessary after the project was begun when the detailed plan created by a consulting service drastically changed the route, demonstrating the insufficient scope of NPC's plan. Similarly, changes in location and increases in project costs occurred during power station construction, resulting in delays and indicating that the initial examination of the planned construction location should have been conducted more carefully.

(3) Relevance of project scope alternation

If slight changes of figures are included, changes were made to the majority of project plans. In 26 out of 73 power station projects (35.6%), and in 12 out of 27 (44.4%) power distribution facility projects, changes were made to important portions of the project plan (Table 11).

Table 11: Breakdown of Projects with Plan Changes

	Number of projects with changes	Ratio（to the total number of projects）
Thermal power station	7 Projects	20.6%（34 Projects）
Geothermal power station	3 Projects	75.0% （4 Projects）
Hydropower station	16 Projects	50.0%（32 Projects）
Pumped storage power station	0 Projects	0.0% （3 Projects）
Transmission and transformation facilities	12 Projects	44.4%（27 Projects）

Interestingly, the ratio of changes is proportionate to project risk. In other words, in geothermal power generation there is a risk related to striking (or not striking) an efficient geothermal fluid production well, and in hydropower generation projects the large-scale civil engineering projects incur risks related geology and hydrology. Conversely, in the three pumped storage power generation projects, risk was comparatively low because the project involved supplemental construction to hydropower stations that were already in use. Transmission and transformation facility projects are different from power generation projects in that they involve increasing power service coverage, and route changes and significant quantitative changes are common, resulting in a high ratio for plan changes.

In cases where there were plan changes in power generation projects, the changes were generally appropriate[12]. The main reasons for project plan changes included changes to reflect environmental conditions at the site that were discovered at the time of detailed design, increases in scope to effectively utilize unused portions of loans, changes to respond to unforeseen natural disasters and changes in socio-economic conditions[13], and changes to reflect area residents' opinions and demand. Rarely, problems such as those in the Chinese Guanyinge Multipurpose Dam Projects 1, 2 and 3 occurred, wherein the scope of the consulting service was reduced without the prior approval of the JBIC. No technical problem resulted from this change, but it was pointed out that in the future it must be kept in mind that such drastic contractual changes might create problems.

The Yonki Hydroelectric Project and Warangoi Hydroelectric Project in Papua New Guinea are examples of cases where changes in the scope of project components by the joint-financing organization or the area implementing organization that were not funded using the Japanese ODA loans showed questionable relevance. In the former case, it is reported that a lack of coordination between the World Bank and the implementing organization resulted in the following planned items not being conducted: the expansion of training facilities under the personnel training component, components of plans to provide power to neighboring villages in agricultural village electrification plans, and the procurement of trial project facility. In the latter case, scope changes included changes in the design of driving channels funded by the Asian Development Bank, and the choice of a more circuitous route for power transmission lines using the funds of the implementing organization. In both cases, the changes were reported as being inappropriate.

(4) Relevance of project goals at the time of evaluation

It is believed that electric power sector projects are generally conducted in situations where it is impossible to sufficiently meet the annual growth in power demand. The projects are implemented to provide a stable power supply, so as long as the facility is being used properly, the power supply will increase, and both industrial development and improvement in lifestyles will result from the improved power supply ratio. Therefore, it is nearly impossible for project goal importance or necessity to decrease. In fact, in the majority of reviewed projects where project goal relevance was mentioned in the evaluation report, project effects including increases in power supply capacity and in the electrification ratio were confirmed. However, there are a few cases where the demand for power fell below projections due to changes in conditions during project implementation, and a plant is either not being used sufficiently, or is being used for a different purpose than was originally

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[12] However, even relevant changes in project plans sometimes resulted in work period extensions.

[13] Examples include landslide accidents due to heavy rain, dramatic changes in prices or exchange rates, and worsening public safety.

planned. The Egyptian Marsa Matruh Barge Mounted Steam Power Plant Project was created to meet projected power needs for the Green Revolution Project (a large scale agricultural development plan). However, the Green Revolution Project was aborted due to worsening economic conditions in Egypt, and power demand in the area stagnated. As a result, facility utilization was very low at the time of evaluation. It is expected that utilization rates will improve through the development of a power transmission network, which was not a part of initial plans, which is to be connected to the region. However, it must be acknowledged that the power station may become unnecessary, and utilization rates may decrease even further. In the Estero Salado (Guayaquil) Thermal Power Station Unit No. 3 Installation Project in Ecuador, project goals were met and the project output was used to provide a base-load. However, at the time of evaluation, the generator had come to be used as a backup power source due to the completion of the Paute hydropower station and slower than projected growth in power demand.

3.2 Efficiency of Implementation

(1) Completeness of output

In the majority of reviewed projects, output was completed as planned[14]. However, there were 10 projects where portions were not completed due to a shortfall in domestic funds[15] or where output was worse than planned[16].

The following were impediments to the completion of project output:

1) Delays to coordinate concerned parties

In the Tunisian Rades Thermal Power Station Project, time was required for the contractor and the implementing organization to come to a final agreement on the list of spare parts to be loaned interest-free by the contractor for the power plant. As a result, the delivery was significantly delayed, and was not yet completed at the time of evaluation.

2) Shortfalls in domestic funds

This includes cases where the project was not completed during the loan period due to shortfalls in the area government's domestic budget. In the Tongonan Geothermal Power Plant Construction Project in the Philippines, delays in the coordination of construction scope between the two implementing organizations were further impacted by a shortfall of domestic funds due to worsening domestic economic conditions. As a result, the construction of power transmission lines was completed in only one section, and all other sections were still under construction at the time of evaluation.

3) Problems with the implementing organization or contractor

In the Indian Nagarjunasagar Hydroelectric Power Station Expansion Project, power to operate pumps could not be secured due to strained power supply in Andhra Pradesh. As a result, the completion of a dam to create a lower reservoir was purposefully delayed, and was not completed at the time of evaluation. Also, in the Barge-Mounted Power Plant Project (II) in Bangladesh, insufficient alignment of equipment, interfusion of extraneous materials at the time of installation, and poor conformation of equipment use to area conditions resulted in problems and interruptions to operations. It is indicated that these

[14] In cases where the plan was changed, output was completed according to the revised plan.

[15] The Nagarjunasagar Hydroelectric Power Station Expansion Project in India, the Tongonan Geothermal Power Plant Construction Project in the Philippines, the Tenom Pangi Hydro-Electric Project in Malaysia, and the Equipment Supply for Scattered Diesel Power Plants and Distribution Network (2) in Indonesia.

[16] The Power Generating Barge Project II in Bangladesh

problems may have resulted from poor construction quality on the part of the contractor.

(2) Implementation schedule efficiency

Approximately 50% of projects (45 projects) were delayed up to a year beyond the planned project completion date, and approximately 30% (31 projects) were delayed between one to three years. A comparison of the five countries to which the largest amount was loaned (Indonesia, the Philippines, Malaysia, Thailand, and Pakistan) showed that delays were comparatively rare in Malaysia and Thailand, and were more pronounced in Indonesia, the Philippines, and Pakistan. The majority of cases where delays surpassed a year were the result of various factors acting synergistically. The major causes were as follows:

1) Plan changes

In 20 projects (20%), project plan changes, and increases in construction volume that accompanied changes and additions to project scope contributed to delays of over one year[17].

2) Natural disasters

In 10% of projects, damage from floods contributed to delays of over one year. This type of problem was found primarily in hydropower generation projects[18].

3) Worsening public safety

In five projects[19], worsening public safety contributed to delays of over one year. Three of these projects were ultimately delayed for over three years.

4) Negotiation of loan conditions and procedures for domestic borrowing (including ratification by the legislature)

In 15 projects, the time is required for the negotiation of loan conditions and procedures for domestic borrowing contributed to delays of over a year. Four of the eight reviewed projects in Egypt fall in this category.

5) Delays in procurement processes

In nearly 30% of projects, delays in bidding and in the selection of consultants and

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[17] Four projects in R. O. Korea, three projects in the Philippines, two projects in Indonesia, and one project each in Madagascar, Colombia, Brazil, Indonesia, Thailand, Malaysia, China, Nepal, and Pakistan.

[18] Two projects each in Malaysia and India, and one project each in Turkey, Indonesia, R. O. Korea, Nepal, and Pakistan.

[19] Two projects in Myanmar, and one project each in the Philippines and Sri Lanka.

contractors contributed to delays of over one year[20]. Delays most commonly resulted from problems with procurement, including the following causes: a) Time requirements to procure a consultant, b) Time requirements to make decisions under a complicated domestic procurement approval process, c) Overwhelmed administrative capacity due to a large number of bids. These situations are generally believed to result from a lack of ability on the part of the implementing organization. In cases where there are concerns related to the implementation system at the time of appraisal, the early and preventive introduction of Special Assistance for Project Implementation Development (SAPI) and the utilization of JICA specialists may be an effective solution.

6) Problems with the capabilities of the implementing organization or the contractor.

In just under 20% of projects, low technical or financial capacity of the contractor contributed to delays of over a year[21].

7) Problems related to land acquisition

In 6 projects, delays in land acquisition contributed to delays of over one year[22].

Table 12 displays the reasons for work delays broken down by type of power generation. Overall, problems with domestic processing by borrowing nations and lack of capability on the part of implementing organizations and contractors were more common than problems relating to plan changes, natural disaster, and worsening public safety. There is room for improvement of these problems in the future.

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[20] Four projects in Indonesia, three projects each in the Philippines and India, two projects in Pakistan, and one project each in Egypt, Tunisia, Malaysia, Myanmar, Nepal, and Bangladesh.

[21] Four projects each in Indonesia and Pakistan, two projects each in the Philippines and India, and one project each in Egypt, Turkey, Thailand, Sri Lanka, and Nepal.

[22] Two projects in India and one project each in Indonesia, the Philippines, Malaysia, and Sri Lanka.

Table 12: Number of Projects Broken Down by Type of Power Generating station and Reason for Delays in Project Implementation

	Reason for Delays							
	Plan changes	Natural disasters/ Work environ ment	Worsen ing public safety	Domestic processes	Procure ment processes	Imple menting organiza tion capabili ty	Contract or capabili ty	Land acquisi tion
Thermal power	0	1	2	5	9	1	3	1
Geothermal power	3	1	0	2	2	2	0	0
Hydropower	8	9	1	4	9	3	3	1
Pumped storage power	0	1	0	0	0	0	1	1
Total number of generation plants	**11**	**12**	**3**	**11**	**20**	**6**	**7**	**3**
Power transmission facility	9	1	2	4	7	4	5	3
Total	**20**	**13**	**5**	**15**	**27**	**10**	**12**	**6**

Totals do not match the total number of reviewed projects because cases with multiple reasons for delays were counted in each category.

(3) Project cost efficiency

In 50 projects out of 100, project costs[23] were within plan, while project cost overruns were within 10% of plan in six projects, and between 10% and 50% in 30 projects (30%). In six projects, project costs were within plan, but the project scope was reduced and project budgets were judged to have been used inefficiently. In 14 projects, a comparison of the projected and actual total project costs in yen could not be conducted, so these projects were not evaluated.

In roughly 70% of the 100 projects, domestic currency costs increased. However, in 30% of cases increases in domestic currency costs[24] were offset by contract costs lower than projected due to international competitive bidding for foreign currency portion procurement and appreciation of the yen. As a result, actual costs met or fell below projected costs.

The major reasons for increased project costs included:

1) Additional work due to plan changes or natural disasters

In nearly 30% of projects, increases in work volume contributed to increases in project cost of over 10%[25]. Three projects suffered natural disasters or the theft of construction facility

[23] Total project costs in yen

[24] In the majority of cases, increases resulted from inflation and increased personnel costs accompanying work delays, increased engineering costs, and compensation for acquired land.

[25] Two projects each in Thailand, the Philippines, R. O. Korea, and India, and one project each in Papua New Guinea, Turkey, Colombia, Brazil, Honduras, Malaysia, and Nepal.

and materials[26].

2) Cost increases accompanying work delays

In three projects, increases in consulting and labor costs accompanying work delays contributed to increases in project cost of over 10%[27].

3) Other reasons included dramatic fluctuations in exchange rates (appreciation of the yen against the dollar)[28], compensation for land acquisition significantly higher than projected costs (two projects in R.O. Korea), and inappropriate initial financial plans[29].

As shown in Table 13, additional work and extension of the work period were the most significant of the aforementioned causes.

Table 13: Causes of Project Cost Fluctuations

	Reason for Project Cost Fluctuation			
	Additional work	Rising prices	Work period extensions	Disasters and accidents
Thermal power	8	1	3	3
Geothermal power	3	1	1	2
Hydropower	14	1	6	3
Pumped storage power	0	0	0	1
Total number of power stations	25	3	10	9
Power transmission equipment	5	0	4	0
Total	30	3	14	9

On the other hand, project costs were below projected costs in a little less than 30% of projects for the following reasons:

1) Competitive bidding

In over 10% of projects, severe competitive bidding drove the price of orders below projected values[30].

2) Fluctuations in the exchange rate[31]

In less than 10% of projects, a strong yen drastically lowered foreign currency costs,

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26 One project each in Papua New Guinea, Malaysia, and Pakistan

27 Two projects in R. O. Korea and one project each in Egypt, the Philippines, Malaysia, and India.

28 One project in Thailand and one in the Philippines

29 One project each in Papua New Guinea, Costa Rica, and Brazil

30 Six projects in Indonesia, two projects in Malaysia, and one project each in Papua New Guinea, Thailand, R. O. Korea, and Bangladesh.

31 Two projects each in R. O. Korea and Pakistan, and one project each in the Philippines, Malaysia, China, and Sri Lanka.

bringing total yen project costs in under cost.

3) Reductions to project scope

In six projects, portions of project scope were conducted using area government funds[32] or project costs were decreased by decreasing project scope[33].

(4) Project implementation system

In 60% of projects, the project implementation system was judged to be appropriate or no specific problems were indicated. Minor problems with the project implementation system were indicated in 16 projects, and significant problems were reported in 14. Broken down by country, project implementation systems were appropriate in the majority of Thai and Malaysian projects, while problems were indicated in a majority of Pakistani and Indian projects.

Significant problems with project implementation systems included the following:

1) Problems with implementing organization capabilities

In 14 projects, weaknesses in the regulatory, technical and budget management capabilities of the implementing organization drastically affected project implementation[34].

2) Problems with consultant, contractor or supplier capabilities

In 12 projects, weaknesses in the experience, technical capabilities and finances of consultants and contractors worsened the performance of applications, and drastically affected project implementation[35].

(5) The relation between project plan changes and efficiency of project implementation

It is not hard to imagine plan changes resulting in work period delays. Delays due to plan changes were pronounced in hydropower generation projects and power transmission projects. Project plan changes also caused fluctuations in project costs. Overall, contingency in

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[32] One project in Botswana and one in Thailand

[33] The Miravalles Geothermal Power Project in Costa Rica, the Calaca II Coal-Fired Thermal Power Plant Project in the Philippines, the Equipment Supply for Scattered Diesel Power Plants and Distribution Network in Indonesia, and the Second Kulekhani Hydroelectric Project in Nepal.

[34] Four projects in Pakistan, three projects in India, two projects each in Indonesia and Nepal, and one project each in Egypt, the Philippines, and Bangladesh.

[35] Three projects in India and Pakistan, two projects in Indonesia, and one project each in Sri Lanka, Nepal, Turkey and Tunisia.

loan agreements for hydropower generation projects should be increased to counter unpredictable situations and construction risks (relying on the funds of the borrowing nation to cover shortfalls will result in delays which could increase construction and consultant fees, and ultimately places an unnecessary burden on the finances of the borrowing nation). In power transmission projects, project plan changes should be considered a given, and a flexible response to the situation where changes are desirable.

3.3 Effectiveness

(1) Output utilization

In approximately 80% of projects, facilities developed during the project are being utilized sufficiently, and are providing a stable power supply (59 projects out of 73). However, in approximately 10% of projects, worsening economic conditions caused sluggish growth in power demand which resulted in the facility utilization ratio falling below planed values, and sufficient effects were not realized by the time of evaluation. In the remaining 10% of projects, 1) project components were not completed, 2) facility malfunctioned or was damaged, and 3) useable water volume decreased in hydropower generation projects, factors of which resulted in insufficient utilization.

(2) Project goals realization

Almost all power generation facility improvement projects were conducted with the purpose of closing the gap between power supply and the demand, and to respond to increasing demand for power. Therefore, the following criteria were used in determining the level to which projects met their goals: 1) generation capacity of the power generation facilities, 2) capacity operating rate, 3) utilization rate, 4) ratio of facility power generation capacity to total power consumed in the supplied area, 5) ratio of power supplied by project facilities to the total project country power supply, and 6) changes in profits from the sale of electricity. Projects to improve power distribution facility (projects involving power transmission, transformation, and distribution facility) were conducted either to bring electricity to areas that were previously without power services or to create a stable, efficient power supply. Therefore, projects were judged using electrification ratio, power loss ratio during transmission, and changes in profits from the sale of electricity. Projects where the aforementioned direct effect indicators were not recorded were judged comprehensively, based on the content of the reports.

In 90% of projects, project goals were sufficiently realized. The remaining projects included projects where damage and delays in related work resulted in insufficient realization of facility capacity despite increasing demand for power, projects where target levels were constricted due to stagnant power demand[36], and projects where changes in power demand conditions resulted in generators intended for base-load power generation being used as

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[36] One project each in Egypt, Papua New Guinea, Bangladesh, the Philippines, Peru, and Malaysia

backup generators[37].

As mentioned in the "Relevance" section, the plan for the Indian Tamil Nadu State Micro Hydro Power Stations Construction Project was not sufficiently investigated. As a result, although the facility is being used effectively, it is indicated that the project was not an effective countermeasure to the gap between power supply and demand for power in the state.

(3) Achievement of FIRR / EIRR

In two-thirds of all projects, the Financial Internal Rate of Return (FIRR), and/or Economic Internal Rate of Return (EIRR)[38] was recalculated and reported. The majority of projects met or surpassed projected FIRR (or EIRR). However, there were 15 projects where recalculated values were significantly below planned values.

The major reasons that actual FIRR surpassed projections included: 1) Higher than projected fee revisions, 2) Lower than projected actual construction costs, and 3) Higher than projected facility utilization ratios. However, major reported reasons that actual FIRR was below projections included: 1) Higher than projected construction costs, 2) Lower than projected actual power generation capacity when the facility was put online, 3) Higher than projected increases in fuel costs, 4) Increased power loss ratios during transmission due to power theft, and 5) Lower than projected fee revisions.

EIRR was primarily affected by changes in thermal power generation fuel (primarily oil) prices.

There are evaluation reports that indicate that increased prices for imported alternative fuels caused higher than projected FIRR values, but it is believed that the reports did not adjust project revenue to account for returns from the Consumer Price Index (CPI), nor did it consider fluctuations in the exchange rate. Thus, the calculation of the FIRR was flawed. There was insufficient documentation to perform further analysis, and it is not the purpose of this review to do so. However, caution is necessary in the calculation of the FIRR. It is believed that evaluating whether all power projects and the reviewed power projects are being operated reasonably and economically would provide a more accurate picture of the state of projects. This could be achieved by tracking the yearly change in the volume of power

[37] The Estero Salado (Guayaquil) Thermal Power Station Unit No. 3 Installation Project in Ecuador

[38] This is calculated as the beneficial cost reductions from the use of alternative thermal power generation (primarily oil). In hydropower and geothermal power generation projects, the EIRR was calculated.

sold per employee, and the power unit production cost per KWh over the entire power grid and by individual power plant.

The FIRR was not calculated in the majority of power transmission projects, likely because of the inability of such projects to generate profits by tehmselves. Even in cases where a recalculated FIRR was reported, the accounting process was unclear, and the majority of reports indicate the values are “for reference only,” or “are not appropriate to represent project results.” In the rare cases where the accounting process could be determined, the FIRR had been recalculated excluding power generation facility costs, and including power transmission and distribution equipment costs and the benefits from the increased power capacity. The result was a high FIRR of 33.4%, but it is probably not appropriate to judge the entire project based upon this figure.

(4) Effect of Technological assistance

In 65 projects out of 100, the hiring of a consultant or the implementation of training was included as a project component. Of these 65 projects, 41 mention the effects of technical support, performance, or the training by the consultant in the evaluation report. Judging from the contents of those reports, it is believed that consultant performance was on the whole satisfactory, with only two reports indicating significant problems. Consultants were primarily responsible for the detailed planning of construction methods and processes, and for the management of applications in projects to improve power generation facility. However, consultants were also reported to have contributed to creating a beneficial maintenance and operation system through the implementation of training and the introduction of technology in 16 projects[39].

(5) Utilization of operation and effect indicators and achievement of project purpose

In the electric power sector, 1) plant load factor[40], and 2) availability factor were frequently used as operation indicators for power generating plant projects, while 1) ratio of facility power generation capacity / electric power supply to total power consumed in the supplied area, 2) ratio of project power plant capacity to total domestic capacity, 3) power generation capacity (end power capacity), and 4) volume of power sold were frequently used as direct effect indicators. Less frequently, maximum power output, Outrage Hours / Times due to machine trouble and due to periodic inspection were used as operational indicators. Twelve

39 Five projects in Indonesia, two projects each in Egypt, Malaysia, and Myanmar, and one project each in Papua New Guinea, Costa Rica, the Philippines, Pakistan, and Bangladesh.

40 However, because it is calculated as [plant load factor = (annual power generation capacity) / (rated output) (hours per year), so plant load factor is tied to annual power generation capacity.

projects (16% of all projects) provided no indicators.

In power transmission and transformation facility improvement projects, transmission loss was frequently used as an index. Power distribution facility improvement projects frequently used distribution loss as an operation index, while effect indicators included 1) Electrification rate, and 2) the number of villages electrified. Eleven out of 27 power distribution facility improvement projects (41%) established no indicators, a higher ratio than for power generation plant improvement projects.

In all cases, the operation and effect indicators were judged to be appropriate, but because evaluation reports did not include planned values or target values, in many cases it was difficult to determine whether sufficient effects were realized. This is either because clear target values were not established at the appraisal stage, or because insufficient data was collected at the post-project evaluation stage. Recently, progress has been made towards establishing clear targets at the appraisal stage, and it is expected that each operation and effect indicators will be regularly monitored. However, the demands of monitoring will place a heavy burden upon implementing organizations, so indicators must be carefully selected.

3.4 Impact

(1) Contribution to overall goal achievement

As there were few projects that clearly defined overall goals, this review defined the overall goals for the electric power sector as the alleviation of the gap between power supply and demand for power, and the indirect socioeconomic effects (development of area economy and industries, and the improvement of area residents' lifestyles) that are realized when a stable, efficient power supply is achieved. Because most projects achieved initially planned project goals, it is believed that all projects showed indirect socioeconomic results. However, only one-third of all projects (35 projects out of 100) included a specific evaluation of socioeconomic impacts in the evaluation report. Such impacts were reported in 23 power generation projects and in 12 power transmission and distribution projects.

(2) Impact on policies and institutional systems

There were only four projects that mentioned impacts on policy and organizational systems.

In the Indonesian Sagluing Hydro-electric Power Plant Project, the National Electricity Corporation of Indonesia (PLN) implemented an environmental impact study (of the relocation of residents displaced by submersion of their homes, affects of projects on residents downriver from the dam, incidences of new endemic diseases) as required as a prerequisite to receive funds from the World Bank[41]. As a result of this impact study, in 1982 the Indonesian government established laws relating to basic standards in order to maintain living conditions, which required plans for all projects that may affect the environment to conduct an impact study like the one performed in this project. As a result, other related organizations implemented their own environmental impact investigations and countermeasure projects, including landslide investigations, water quality tests, hydrologic-observations, woodland conservation, and the promotion of alternative industries (including the relocation of residents in submerged areas and reparation projects). In this way, the project is reported to have contributed to the establishment of a system to consider the environment and the residents of Indonesia.

Similarly, the Calaca II Coal-Fired Thermal Power Plant Project in the Philippines led the National Power Company (NPC) to establish a system to consider the environment and area residents. This was done by establishing a community relations section in the power

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[41] Implemented during the two years from 1979 to 1981

plant, which implemented various activities to improve area residents' understanding of the plant. The NPC also implemented environmental and social monitoring by a panel made up of residents of Calaca City, and employees of NGOs and the Department of Energy and Natural Resources (DENR).

The Korean Soyang River Dam Construction Project was the first multipurpose dam project in the country. The momentum generated by the project is reported to have convinced the Korean government to create laws related to the development of water resources, which significantly increased continued support for similar projects.

In a series of rural electrification projects in Thailand, power losses during transmission were minimized, by placing substations for distribution as close as possible to areas requiring power and the power supply was stabilized. This project became the first project including power transmission lines and substation facilities conducted by the local Provincial Electricity Authority (PEA)[42], and after completion of the project, regional PEA came to operate and maintain power transmission lines and substations.

(3) Socioeconomic impact

Socioeconomic impacts should be noticeable in all of the projects analyzed in this report, but in fact only slightly more than one-third of all reports explicitly mentioned any socioeconomic impacts. As such references were not quantitative, it is believed that not a few references were based on conjecture, and it is difficult to establish a causal relationship with the project. The following socioeconomic impacts were reported:

1) Promotion of area economy and industry, and improvement of social welfare.

In over 20% of projects (most notably power transmission and distribution facility projects), it is reported that the resulting power supply contributed to the promotion of the area economy and industry, and to the improvement of social welfare[43]. The introduction of electricity to areas that had been without electricity, improved the quality of life and welfare through the increase of consumer electronics, and the improved social services through the resulting maintenance of educational and medical facilities. In the Village Electrification Project and the Normal Rural Electrification Project in Thailand, and in the Rural Electrification Project in Pakistan, it is reported that domestic labor for women

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[42] Conventionally, the Electricity Generating Authority of Thailand (EGAT) had jurisdiction over power sources, power transmission lines, and power transformers, while the PEA had jurisdiction over the construction and maintenance of output switching equipment.

[43] Eight projects in Indonesia, four projects in Thailand, three projects in the Philippines, two projects in Pakistan, and one project each in Tanzania, Tunisia, Papua New Guinea, Brazil, Malaysia, and Sri Lanka.

decreased as it became possible to use consumer electronic goods.

In the Metro Manila Depressed Area Electrification Project in the Philippines, a social impact study was performed, and the socioeconomic impacts upon those affected by the project were described. Reported social impacts of the project included (a) strengthened regional solidarity due to activities to prepare for the reception of electricity, (b) increased desire to purchase consumer electric goods resulting in improved willingness to work, (c) decreased incidences of fires and crimes, (d) decreased incidences of alcoholism and substance abuse, (e) increased influx of residents, and (f) the creation of not-kinsman based community which is a social base of politics.

2) Foreign exchange savings due to diversification of energy sources and reduction in oil imports for use as fuel in thermal power generation.

In a little under 20% of projects[44], it is reported that diversification of energy sources and reduction in oil imports for use as fuel in thermal power generation resulted in foreign exchange savings. After the oil shock, oil-dependent countries[45] considered fuel procurement risks such as securement quantity and fuel cost trends. As a result, the countries set policy goals to diversify energy sources and to actively utilize domestic resources, and invested in the effective utilization of domestic resources including coal, natural gas, water, and geothermal sources and not oil and diesel thermal power. From the standpoint of diversification of power sources, it is believed that the projects were believed to be effective to a certain extent.

3) Creation of employment opportunities

In over 10% of projects[46], it was reported that employment opportunities were created for the construction and operation of power stations, as well as in area factories after stabilized power supply spurred industrial development.

4) Improvement of agricultural productivity and promotion of agriculture-related industries.

In electrification projects in agricultural villages, it was reported that agricultural productivity increased as a result of attainment of a stabilized water supply due to pumping[47].

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[44] Four projects each in the Philippines and Malaysia, two projects each in Papua New Guinea and Indonesia, and one project each in Costa Rica, India, Thailand, and Bangladesh.

[45] Indonesia is an oil-exporting nation, but governmental policy focuses on the export of oil and the effective utilization of non-oil domestic resources in the development of domestic power sources.

[46] Three projects in the Philippines, two projects each in Indonesia and India, and one project each in Egypt, Syria, Costa Rica, Thailand, Nepal, and Pakistan.

[47] Three projects in Pakistan and one project each in Tanzania, Brazil, and Bangladesh.

5) Development of tourism

In hydropower generation projects that included the construction of a dam or dams, it is reported that reservoirs were opened for tourism, contributing to the development of the regional tourism industry[48].

(4) Impact on technology

In 30% of projects[49], it is reported that some technology transfer occurred through project implementation. In the Baluchaung Hydroelectric Project (No.1 Power Station) in Myanmar, the implementing organization, for the first time, directly managed the construction of a hydroelectric power station under the instruction of the consultant, and has since utilized the experience gained from the project to implement subsequent hydropower station projects. Similarly, in the Korean Soyang River Dam Construction Project, the Japanese consultant transferred various technologies during the construction of the first large-scale multi-purpose dam in R.O. Korea. The technology accumulated during this project spread to other domestic construction companies and consultants, and contributed to significant improvements in the level of construction technology in R.O. Korea.

(5) Impact on natural environment

In thermal power stations, there are concerns that the sulfur content and ash in liquid and solid fuels (crude oil, heavy oil, and coal) generate air pollutants including sulfur oxide and ash dust, and concerns about the affects of water pollution due to waste water, hot waste water, noise, and vibration. In the case of hydropower stations, there are also concerns about the affect of dam construction on wild animal life in the regions where will be submerged after completion and water quality in reservoirs and downriver from the dam. Of the 41 projects which mentioned the possibility of negative impact on the environment, 11 projects reported negative environmental impacts. In the majority of thermal power generation projects, measured SOx and NOx levels were below the standards and regarding the quality of waste water and hot waste water, noise or vibration no major problem was reported. In hydropower generation projects, water quality monitoring was implemented periodically, but there were no specific water quality problems or reforestation was conducted, so no significant negative environmental impacts were reported.

[48] One project in Malaysia, one in R. O. Korea, and one in China

[49] Four projects in Indonesia, three projects each in Thailand and Egypt, two projects each in the Philippines, Malaysia, and R. O. Korea, and one project each in China, Myanmar, India, Nepal, Pakistan, Tanzania, Tunisia, Papua New Guinea, Syria, Turkey, Ecuador, Costa Rica, and Jamaica.

The following two projects reported significant negative impacts upon the environment as an effect of implementation.

In the Thai Mae Moh Power Plant Project (Units 8 & 9), serious air pollution from SO_2 resulted because lignite from the adjacent coal field with a low calorific value and high sulfur content was used. At the time of appraisal, countermeasures to prevent air pollution were being taken, but because the power plant generated roughly one-quarter of all power generated in Thailand, there was significant damage to villagers, domestic livestock, and agricultural crops. The implementing organization and the Thai government were diligent in improving the situation, providing medical services and reparations for the aggrieved, and by imposing countermeasures to forestall similar problems[50].

In the Malaysian Trengganu Hydro-Electric Project, it was reported that 42% of tropical rain forest in Trengganu state was lost, economic damage was sustained from the submersion of palm oil plantations, and that wild animals were annihilated.

(6) Resident relocation and land acquisition

It is thought that resident relocation and land acquisition was conducted in the majority of projects, but only 21 projects (20%) included those information relating to those check items in the evaluation report. In 12 of the 21 projects, resident relocation and land acquisition was completed with no particular problems, but in six projects additional time was required for land acquisition, which resulted in project delays. In one project[51], it was necessary to change the scope of the plan to reroute power transmission lines. In the remaining three projects, resident relocation and land acquisition was completed by the time of evaluation, but it was reported that there were problems with the terms for reparations to residents displaced when the area was submerged, and the lifestyles of some relocated people worsened after the relocation.

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[50] At the time of evaluation, the JBIC has agreed to provide the ODA loans for a project to establish an exhaust gas desulfurizer to counteract air pollution from the Mae Moh power station.

[51] The Power Plant Barge Project in the Philippines

3.5 Sustainability

(1) Output condition

In 30% of projects, problems of some sort were reported with the physical condition of facilities. Among these projects, there were three projects where the problems were seen to be significant enough to raise fears about sustaining project effects. In the remaining reports, the good condition of project facility was confirmed, or no operation and maintenance problems were reported.

(2) Operation and maintenance system

In just under 30% of projects, concerns or problems related to the operation and maintenance system were indicated. In the remaining projects, technical training was conducted by the consultant, contractor, or supplier, the pertinence of the operation and maintenance system was confirmed, or no problems were reported.

The majority of problems related to insufficient proactive measures to prevent accidents and damage, and insufficient technical capability to recover from such events, resulting in an inability to secure a sufficiently stable power supply. For example, in the Tongonan Geothermal Power Plant Construction Project in the Philippines, problems including spare part shortages, operational mistakes, damage to the house generator lines, and power transmission accidents occurred one after another, hindering the attainment of sufficient project effects. Other problems reported in several projects related to financial resources for operations and management, the management of stock, and non-implementation of environmental monitoring.

(3) Financial resources for operation and maintenance

Of the 51 projects that mentioned financial resources for operation and maintenance, it was judged that 40% of projects would be able to secure a sufficient budget for future operation and maintenance, while there was reason for concern in slightly over 30% of projects, and clear problems in slightly under 30% of projects. Broken down by country, financial situations were comparatively positive in Thailand, R. O. Korea and China.

In electric power sector projects, large capital investment and fuel costs make it necessary to set appropriate power fees and to collect accounts receivable reliably. However, in countries such as Syria, Turkey, and Pakistan, power fees were regulated by the government, resulting in chronic systematic deficits. In Egypt, increases in power demand were accompanied by increased net system energy capacity, and power fees were increased to increase operating profit. However, the increased power fees decreased revenues and cash flow from primary customers, and increased the number of unpaid accounts receivable. As a result, the implementing organization's cash flow worsened, so the Egyptian Finance Ministry provided aid in the form of no-interest loans. It is reported that the loans are expected to be discontinued. In Papua New Guinea, it was indicated that problems including price increases coupled with unstable power supply hindered electrical power consumption. In Myanmar, the budget for the Myanmar Electric Power Enterprise (MEPE) was included in the national budget, so losses are automatically compensated by government expenditure, and profits are paid to the government.

On the other hand, the Electricity Generating Authority of Thailand is an independent corporation of public utility that does not rely on government subsidies, and is being managed soundly. No specific problems were indicated in R.O. Korea or China.

(4) Continuity of needs

In the majority of developing nations where the reviewed projects were implemented, power demand is continuously increasing due to population growth and industrial development. It is believed that the demand for a stable power supply will be constant in all countries. However, there were several projects where changes in supply and demand raised concerns about the sustainability or future increases in power demand at the time of evaluation[52]. In the Warangoi Hydroelectric Project in Papua New Guinea, it is reported that power demand is stagnating for the following reasons: 1) stagnation of economic activity after the second oil crisis, 2) lessened public and private investment due to fears of volcanic eruptions, constant power fee increases, and delays in the plan to change to systemic power reception for household power generation facility.

(5) External factors

Judging from the 100 projects reviewed in this report, factors that significantly impacted effects and sustainability included: 1) the implementation of other related projects (especially projects that improve any type of facility connected to the power grid), 2) whether or not there is technical support for operation and maintenance, 3) changes in the structure of the implementing organization, and 4) whether or not there were unavoidable occurrences such as natural disaster or deterioration of public safety. Specific examples of each are as

[52] Two projects each in Papua New Guinea and the Philippines, and one project each in Egypt and Malaysia.

follows:

1) Implementation of related projects

Cases where the implementation of related projects had a significant impact upon the realization of effects and sustainability of effects of the project in question: In the Indian Nagarjunasagar Hydroelectric Power Station Expansion Project, delays in completion of the thermal/nuclear power station planned to act as the feed source for pumped storage hydropower generation resulted in deliberate delays to portions of the project. At the time of evaluation, portions of the project were left uncompleted, and the goal of changing over to pumped storage hydropower generation as a measure to meet peak loads was not achieved. However, power transmission lines and facility projects, which will make possible the transfer of power to other states after the operation of pump power generation equipment becomes possible, are progressing. Therefore, positive external conditions were created for the expansion of project results.

In the Costa Rican Miravalles Geothermal Power Project, project scope had to be decreased due to a sudden, sharp appreciation of the yen. At the time of evaluation, the eliminated project sections were being performed using facility and materials paid for by IDB Finance and with construction costs being paid by the implementing organization's own funds. Completion of these sections will contribute to the further realization of project goals and sustainability.

In the Indonesian Wlingi Multipurpose Dam Construction project (II), there were problems with the possibility of the dam sedimentation having a negative effect on the project, but countermeasures were implemented in the Irrigation and Flood Protection Project, a subsequent ODA loan project. This project was initially planned to respond to peak demand in East Java, but because the power distribution network was expanded to Central and West Java, the project came to respond to demand across Java, further magnifying the effects of the project.

2) Technical support for operations and maintenance

Cases where technical support for operations and maintenance conducted using funds from JBIC or other donors had a significant impact of the realization of project goals and sustainability: In a series of electrification projects conducted in Thailand, experts from JICA provided technical guidance to the PEA (the executing agency) which strengthened the realization of project effects and sustainability. Moreover, Australian support to Thailand aimed to increase operation and maintenance efficiency by formulating a material management improvement plan and introducing a computerized material management system.

3) Changes in the structure of the implementing organization

Cases where restructuring of the implementing organization (especially privatization) had a significant impact of the realization of project goals and sustainability: In the Malaysian state of Sabah, the Sabah Electricity Board (SEB, a federal office under the jurisdiction of the Ministry of Energy, Telecommunications, and Posts), which was responsible for development of power resources, power generation and power transmission / distribution, was to be privatized according to the project plan. Due to government concerns that the financial situation might worsen, a policy was established not to embark upon new projects until the privatization was completed.

For this reason, the work on the planned changeover to combined cycle power generation[53] at the power station in the area was extended indefinitely right before the Patau-Patau Power Station Extension Project began. Likewise, hydropower station and power transmission line construction projects, which were expected to play a significant role in the expansion of the power grid in the state, were similarly put off.

4) Unavoidable occurrences such as natural disaster or deterioration of public safety

Cases where unavoidable occurrences such as natural disaster or deterioration of public safety had a significant impact of the realization of project goals and sustainability: In the Peruvian Transmission Lines Improvement Project, it was reported that acts by humans (including terrorism) damaged the power transmission system and limited the realized project effects.

[53] A method where steam power generation and gas turbine power generation are combined, which is efficient, economic, and appropriate for use as middle load power supply and base power supply.

4. Conclusions

4.1 Performance Analysis Overview

(1) Summary

Amongst the 100 projects subjected to ex-post evaluation, most were considered highly relevant, as demonstrated by the fact that they directly enabled increased electric power generation, and have also served to improve electrification rates.

Further, the projects have indirectly brought about positive socioeconomic developments such as the promotion of regional economies and industries as well as improving the lives of local residents.

Despite the fact that electric power projects are considered important and their positive effects well-known, efficiency issues were reported for half of the cases in this sector, with reasons behind the difficulties including alterations made to project scope at the implementation stages; problems with domestic administrative procedures on the part of borrower countries; competence issues with regard to executing agencies and/or contractors; increased costs stemming from construction period delays; plus external factors such as natural disasters. On the issue of sustainability, physical problems related to facilities were cited for 30% of projects, and either reason for concern or outright problems regarding operations and maintenance systems were reported for slightly less than 30%. Concerns pertaining to financial resources for operations and maintenance were noted for slightly more than 30% of projects.

Reports also indicate that the implementation of related projects, as well as of technical assistance, has resulted in enhanced project effectiveness as well as sustainability for some projects.

(2) Relevance

Electric power sector ODA loan projects are generally sufficiently consistent with the development policies and/or development planning of recipient country governments, either claiming an important position within sector development planning, or assigned priority as a means to accommodate increasing demand for power. At the time they were subjected to evaluation, the majority of power projects had produced results in terms of enhanced power supplying capacity and/or improved electrification rates, an indication of their ongoing necessity and importance.

Many project plans have been formulated in accordance with circumstances related to sector development planning as well as increasing demand for electric power. A few projects, however, were substantially altered in scope, or incurred extended construction periods and/or expanded costs due to inadequate preliminary surveying —which failed to anticipate certain foreseeable factors——and/or the lack of an alternative plan for comparison purposes. As a result, these projects produced less than the desired effects.

Approximately 40% of projects incurred modifications in major areas of project planning following the ODA loan contract; the majority of these, however, were considered appropriate changes.

(3) Efficiency

Approximately half of ODA loan projects in the electric power sector were deemed to have been implemented in an efficient manner in terms of level of completion of facilities as well as implementation period duration and project cost. At the same time, however, some projects did not prove as efficient for various reasons. Ninety percent of electric power facilities, for instance, were completed according to plan; some projects, however, had not been fully completed by the time they were evaluated, or failed to meet targets in terms of quality. Consequently, project objectives were not always fully achieved. Projects that were completed within a one-year extension of the deadline and also projects exceeding budget by 10% or less, each comprise 50% of the total number of projects.

Reasons for less-than-optimal efficiency include changes in planning or expanded project scope following the conclusion of the ODA loan contract; domestic administrative procedures in borrower countries; competence issues on the part of executing agencies and/or contractors; and rising costs resulting from extended construction periods. On a positive note, slightly less than 30% of projects were completed with fewer funds than allocated in preliminary planning budgets. This is largely attributed to intense competition at the bidding stages as well as appreciation of yen during implementation.

Analyzing by country, efficiency levels of construction period and implementation systems were rated relatively high for projects conducted in Thailand and Malaysia. Projects taking place in Indonesia and the Philippines were, however, plagued by delays in construction periods and those in India by problems with implementation systems. Projects in Pakistan, meanwhile, were hindered on both points.

(4) Effectiveness

Judging by operational status of power generation/distribution facilities and the various kinds of direct impact the projects have had, 90 % of projects can be said to have sufficiently achieved project goals, and project output was appropriately utilized. Implementation of those projects has resulted in upgraded electric power supply/electrification rates and mitigation of the supply and demand gap for electric power, as well as serving to accommodate increasing demand.

For projects where FIRR and EIRR were calculated, more than half had approached or surpassed original targets. This was attributed to factors such as increased electric power revenues derived from upward revisions to electricity charges, which surpassed expectations; lower levels of initial investment; and increased facility use. On the down side, other projects did not achieve target levels due to higher levels of initial investment; decreased power generation volume; higher operations and maintenance costs (particularly fuel cost); increased instance of power distribution losses; the setting of power rates lower than anticipated, and so on.

According to evaluation reports, training and technical guidance provided by consultants on operations and maintenance served to contribute to the establishment of an effective operations and maintenance system for 16 of the projects.

(5) Impact

Nearly all projects achieved the original project objectives of mitigating the gap between demand and supply for power and of efficiently providing a stable, power. Thus it can be inferred that the projects were indirectly responsible for fostering socioeconomic benefits. Slightly more than one-third of the reports, however, described socio-economic impact of projects. They cited positive impact in the form of promotion of the economy and industry as well as a more convenient life for local residents as stemming from increased power supply. In particular, electrification of areas previously lacking electricity was linked to a better standard of living and improved social welfare by enabling increased use of home appliances as well as the provision of enhanced social facilities and services including educational and medical facilities. Further, slightly less than 20% of evaluation reports pointed out that the projects had resulted in diversification of energy sources as well as foreign currency savings stemming from reduced petroleum imports, which is one type of fuel used in thermal power stations.

Reviewing technical aspects, 30% of projects entailed some type of technical transfer to developing country counterparts as part of the project implementation process. In the

Republic of Korea, for instance, a multipurpose dam project was implemented via a series of technical transfers conducted with the assistance of Japanese consultants. The technology accumulated by recipient countries under these circumstances was shared not only within the executing agencies, but also with domestic construction and consulting companies, representing a tremendous contribution to an improved technological standard for the country.

No negative impact on the environment was reported for most projects. Those that were cited having negative impact were regularly monitored, the result of which showed that SOx and NOx levels as well as water quality indicators presented no problems. Two projects had serious negative impact on the environment. On such impact took the form of severe air pollution caused by the burning of lignite as fuel at a thermal generation plant; the other was the destruction of tropical rainforest and the annihilation of wild animals inhabiting the area, attributed to the construction of a dam.

Among the approximate 20% of reports mentioning land acquisition and/or relocation issues, more than half of the projects were completed with no difficulties on these points. The construction period for six of the projects, however, was delayed due to extra time required for land acquisition. An additional three projects entailed further points of contention, including a case where, although the relocation process was completed, agreement on compensation amounts to be paid to affected parties had not yet been reached, and another case where the affected individuals experienced a decline in their standard of living subsequent to relocation, among others.

Two projects purportedly had a positive impact on bringing about policy and organizational change through the establishment of borrower countries' systems pertaining to concern for the environment as well as the welfare of affected individuals. For instance, in Indonesia, an environmental impact study on one of the projects provided the impetus for a new environmental law, enacted by the government, requiring impact studies to be conducted for all project plans affecting the environment. For a project in the Philippines, a social welfare unit was established within the premise of power station for the purpose of environmental and social monitoring, to be carried out in cooperation with local residents and NGOs.

(6) Sustainability

Sustainability in the electric power sector was not, overall, rated very highly. Some type of physical problem with facilities was observed for 30% of projects, with three of these demonstrating problems serious enough to possibly compromise project effects. Problems or concerns were pointed out for slightly less than 30% of all projects with regard to operations and maintenance systems. Concerns over the issue of financial resources for operations and maintenance were cited for slightly more than 30%, while those with irrefutable financial problems totaled slightly less than 30%.

Most problems reported on operations and maintenance systems were related to inadequate control systems and/or technical capacity to prevent accidents or breakdowns and inability to facilitate restoration, which led to a situation where the electric power supply was considered unreliable. The biggest factor threatening the sustainability of electric power sector ODA loan projects is insufficient budget for operations and maintenance. Because power projects require huge sums for facility investment and fuel, usage fees must be set at appropriate rates and systems established for proper collection of receivables in order to secure funds for operations and maintenance. Many projects in countries such as Syria, Turkey, and Pakistan are running built-in deficits due to polices designed to ensure that electricity rates are kept low. Such a situation is conducive to power projects becoming dependent on government subsidies and interest-free capital; their operational base is therefore not considered sound.

On the other hand, projects concerned with the enhancement of related electric power facilities, as well as technical assistance for operations and maintenance systems, have been carried out effectively. This support has, in certain cases, resulted in greater efficiency and sustainability for the projects surveyed in this report.

4.2 Lessons Learned / Recommendations

(1) Thorough preliminary appraisals and/or comparison with alternate plans.

More than 10% of projects in the electric power sector had to be dramatically altered in scope, resulting in lower efficiency and less tangible impact than stipulated in the original plan. The difficulty is believed to stem from failure to consider an alternate plan pertaining to project scope and/or inadequate preliminary surveying. The problem encountered here suggests that sufficient consideration is required in order to ensure, at the project planning stages, that project scope appropriately corresponds to the conditions and needs of project area. Also, for purpose of future and current planning, it is advisable to ascertain the status of planned electric power facilities within the overall electric power structure, and whether the proposed facilities and/or the electric power network is appropriate and economically viable.

(2) Improvement of financial status of executing agencies

Just 20% of electric power projects were found to be problem-free in terms of their finances, with the remaining 80% of plagued by budgetary difficulties. Hindered by the inability to securer sufficient funds, some projects were not effectively maintained.

Since evaluation reports based on which we conducted this review did not incorporate an in-depth financial analysis or study of the causes for pressures on revenues, we can only comment in general on the subject. It can be stated, however, that developing-country electric power company profits are affected by factors such as government controls designed to keep power rates down, plus sociopolitical problems including chronic delinquent payments on the part of large-scale users (administrative agencies, state-owned enterprise, schools, hospitals, and so on), as well as power theft. No single policy exists, however, that will solve these multiple problems. Executing and/or operations and maintenance agencies must endeavor to stem artificial losses by enhancing financial competence, cutting maintenance costs, shortening collection time for receivables, improving user fee collection systems, and so on. The provision of technical cooperation, and/or the application of SAF and other programs are considered effective in this regard.

(2) Strengthening of operation and maintenance systems.

Problems related to operations and maintenance systems were pointed out for slightly less than 30% of all projects. Most of the difficulties were due to inadequate technical capacity and control systems, which failed to prevent accidents and breakdowns and/or to facilitate restoration of power. As a result, power supply projects have been saddled with a reputation for being unreliable. Where such issues are foreseeable from the project formulation and appraisal stages, it is recommended that consultancy services be incorporated into projects for enhancement of systems and staff skill, compilation of guidelines on operations and management, and so on. Ongoing follow-up is also crucial. In addition, it will be effective to plan and implement finely-tuned training programs, held party in Japan, and to make use of technical assistance programs of SAF or JICA.

Reviewed Projects (Electric Power Sector)

Project Name	Country	L/A
GUANYINGE MULTIPURPOSE DAM PROJECT	China	Aug 88~ Nov 90
SHISANLING PUMPED STORAGE POWER STATION PROJECT	China	Mar 91
SOYANG RIVER DAM CONSTRUCTION PROJECT	R. O. Korea	Aug 67~ Feb 70
DAECHEONG MULTIPURPOSE DAM PROJECT	R. O. Korea	Dec 74
THE CHUNGJU MULTIPURPOSE DAM PROJECT	R. O. Korea	Jan 78
HABCHEON MULTIPURPOSE DAM CONSTRUCTION PROJECT	R. O. Korea	Oct 83
CHUAM MULTIPURPOSE DAM CONSTRUCTION PROJECT	R. O. Korea	Aug 84
HIGH-VOLTAGE POWER TRANSMISSION LINE FACILITIES PROJECT	R. O. Korea	Nov 77
THE WONOGIRI MULTIPURPOSE DAM PROJECT	Indonesia	Jan 77 ~Mar.79
THE WLINGI MULTIPURPOSE DAM CONSTRUCTION PROJECT	Indonesia	Dec 76
SULAWESI ISOLATED DIESEL POWER PLANTS AND DISTRIBUTION NETWORK PROJECT	Indonesia	Dec 74 ~Mar.77
GRESIK STEAM POWER PLANT PROJECT	Indonesia	Jun 77 ~Mar.77
EQUIPMENT SUPPLY FOR SCATTERED DIESEL POWER PLANTS	Indonesia	Aug 79
EQUIPMENT SUPPLY FOR SCATTERED DIESEL POWER PLANTS AND DISTRIBUTION NETWORK	Indonesia	Jul 80
PALEMBANG ELECTRIC POWER SYSTEM PROJECT (PHASE II)	Indonesia	Jul 80
SAGULING HYDRO-ELECTRIC POWER PLANT PROJECT	Indonesia	Dec 80
GRESIK THERMAL POWER PLANT (UNIT 3,4) PROJECT	Indonesia	Apr 82 ~Mar.84
BAKARU HYDROELECTRIC POWER PLANT PROJECT	Indonesia	Sep 83 ~Mar.84
THE GAS FIRING MODIFICATION WORKS OF GRESIK STEAM POWER PLANT UNITS III AND IV PROJECT	Indonesia	Dec 89
EAST JAVA ELECTRIC POWER TRANSMISSION AND DISTRIBUTION NETWORK PROJECT	Indonesia	Apr 71~ Mar.78
THE EQUIPMENT SUPPLY FOR DISTRIBUTION NETWORK	Indonesia	Feb 78
NORTH SUMATRA TRANSMISSION LINE PROJECT	Indonesia	Dec 80
THE EQUIPMENT SUPPLY FOR POWER DISTRIBUTION VOLTAGE CHANGE	Indonesia	Dec 77 ~Dec.79
THE TEMENGOR HYDRO-ELECTRIC PROJECT	Malaysia	Jan 74~ Jul 75
THE PRAI POWER STATION UNIT NO.6 PROJECT	Malaysia	Mar 77
GAS TURBINES PROJECT	Malaysia	Sep 78
PASIR GUDANG POWER STATION PROJECT	Malaysia	Sep 78
TRENGGANU HYDRO-ELECTRIC PROJECT	Malaysia	Jan 79~ Sep 80
TENOM PANGI HYDRO-ELECTRIC PROJECT	Malaysia	Mar 79~ Jun 79
BATANG AI HYDROELECTRIC PROJECT	Malaysia	Jun 82~ Dec 82
PORT KLANG POWER STATION PROJECT	Malaysia	Apr 84
KUALA LUMPUR (NORTH)- KAMPONG AWAH TRANSMISSION LINE AND SUBSTATION PROJECT	Malaysia	Jun 79
ENGKILILI SIBU TRANSMISSION LINE CONSTRUCTION PROJECT	Malaysia	Nov 86
PATAU-PATAU POWER STATION EXTENSION PROJECT	Malaysia	Sep 93
BALUCHAUNG HYDROELECTRIC PROJECT(NO.1 POWER STATION)	Myanmar	Aug 82
GAS TURBINE POWER STATION PROJECT (RANGOON)	Myanmar	May 86
POWER PLANT BARGE PROJECT	Philippines	Feb 79 ~ Sep 83

Project Name	Country	L/A
TONGONAN GEOTHERMAL POWER PLANT CONSTRUCTION PROJECT	Philippines	Jun 80
SOUTHERN NEGROS GEOTHERMAL DEVELOPMENT PROJECT	Philippines	Jun 81
CALACA II COAL-FIRED THERMAL POWER PLANT PROJECT	Philippines	Sep 87 ~ Dec 94
PALINPINON II GEOTHERMAL PROJECT	Philippines	May 89~ Jan 93
CAGAYAN VALLEY ELECTRIFICATION PROJECT	Philippines	Nov 74~ Jan 78
MINDANAO TRANSMISSION LINE PROJECT (BUTUAN-BISLIG-MANAT)	Philippines	Jun 81
METR0 MANILA DEPRESSED AREA ELECTRIFICATI0N PR0JECT	Philippines	Jun 90
THE BAN CHAO NEN HYDROELECTRIC PROJECT (I)	Thailand	Apr 74 ~ Sep 74
THE LOWER QUAE YAI REGULATING DAM PROJECT	Thailand	Sep 77
MAE MOH POWER PLANT PROJECT	Thailand	Mar 86 ~ Apr 87
THE POWER DISTRIBUTION SYSTEMS REINFORCEMENT PROJECT (1,2,3-1), ELECTRIC DISTRIBUTION SYSTEM REINFORCEMENT PROJECT IN CHAING MAI LA NIPHUN AND LAMPANG	Thailand	Dec 74 ~Jul.82
VILLAGE ELECTRIFICATION PROJECT	Thailand	Apr 81 ~Oct. 85
POWER DISTRIBUTION SYSTEMS REINFORCEMENT PROJECT (4-2,4-3), NORMAL RURAL ELECTRIFICATION PROJECT (2) VILLAGE ELECTRIFICATION PROJECT (3)	Thailand	Sep 88~ Sep.91
POWER GENERATING BARGE PROJECT	Bangladesh	Apr 79
KAPTAI HYDRO-ELECTRIC POWER PLANT PROJECT	Bangladesh	Jan 83 ~ Mar 84
BARGE-MOUNTED POWER PLANT PROJECT	Bangladesh	Nov 84
GOALPARA-BARISAL TRANSMISSION LINE PROJECT	Bangladesh	Jan 77
BHERAMARA-FARIDPUR-BARISAL TRANSMISSION LINE CONSTRUCTION PROJECT	Bangladesh	Oct 80
NAGARJUNASAGAR HYDROELECTRIC POWER STATION EXPANSION PROJECT	India	Jun 78~ Oct 81
PAITHAN HYDROELECTRIC PROJECT	India	Aug 78
LOWER METTUR HYDRO ELECTRIC PROJECT	India	Oct 81
TAMIL NADU STATE MICRO HYDRO POWER STATIONS CONSTRUCTION PROJECT	India	Feb 83
RAICHUR THERMAL POWER STATION EXPANSION PROJECT	India	Dec 88
BASIN BRIDGE GAS TURBINE PROJECT	India	Mar 90
KULEKHANI HYDROELECTRIC PROJECT	Nepal	Mar 76 ~ Dec 78
SECOND KULEKHANI HYDROELECTRIC PROJECT	Nepal	Apr 82 ~ Jun 83
KARACHI GAS TURBINE POWER STATION CONSTRUCTION PROJECT	Pakistan	Jan 78
QUETTA POWER STATION EXPANSION PROJECT	Pakistan	Mar 82
JAMSHORO THERMAL POWER STATION PROJECT	Pakistan	Fe 84
BIN QASIM THERMAL POWER STATION EXPANSION PROJECT	Pakistan	Sep 87
BIN QASIM THERMAL POWER STATION EXTENSION UNIT 6 PROJECT (I)	Pakistan	Mar 92
RURAL ELECTRIFICATION PROJECT	Pakistan	Nov 88
500KV MULTAN AND GUDDO SUBSTATION EXTENSION PROJECT	Pakistan	Nov 88
SECOND 220KV GUDDU-SIBBI-QUETTA TRANSMISSION PROJECT	Pakistan	Mar 89
TRANSMISSION SYSTEM AUGMENTATION AND DEVELOPMENT PROJECT (II)	Sri Lanka	Aug 93
THE WARANGOI HYDROELECTRIC PROJECT	Papa New Guinea	Oct 79
ROUNA 4 HYDROELECTRIC PROJECT	Papa New Guinea	Jul 83
YONKI HYDROELECTRIC PROJECT	Papa New Guinea	Jan 87
BANIAS POWER STATION EXTENSION PROJECT	Syria	Feb 87
HASAN UGURLU DAM AND HYDROELECTRIC POWER PROJECT	Turkey	Oct 71 ~Feb 81

Project Name	Country	L/A
ALTINKAYA HYDRO ELECTRIC POWER PROJECT	Turkey	Feb 84
SHOUBRAH EL KHEIMA THERMAL POWER STATION PROJECT	Egypt	Jun 81
ASWAN II HYDROELECTRIC POWER STATION PROJECT	Egypt	Apr 82
DAMANHOUR GAS TURBINE PROJECT	Egypt	Nov 83
MARSA MATRUH BARGE MOUNTED STEAM POWER PLANT PROJECT	Egypt	Aug 85
ASSIUT THERMAL POWER STATION PROJECT A	Egypt	Oct 88
UPPER EGYPT REGIONAL CONTROL CENTER PROJECT	Egypt	Nov 83
ASSIOUT SUBSTATION PROJECT	Egypt	May 84
ABOU-ZAABAL SUBSTATION PROJECT	Egypt	Oct 88
SHOUBRAH EL KHEIMA THERMAL POWER STATION PROJECT (II)	Egypt	May 84
RADES THERMAL POWER STATION PROJECT	Tunisia	Sep 82
MORUPULE POWER STATION EXPANSION PROJECT	Botswana	Aug 86
NAMORONA HYDROELECTRIC DEVELOPMENT PROJECT	Madagascar	Jul 73 ~ Dec 76
KILIMANJARO REGION TRANSMISSION AND DISTRIBUTION NETWORK PROJECT	Tanzania	Nov 81
STATE OF GOIAS RURAL ELECTRIFICATION PROJECT	Brazil	Sep 91
SALVJINA DAM CONSTRUCTION PROJECT	Colombia	Mar 80
MIRAVALLES GEOTHERMAL POWER PROJECT	Costa Rica	Dec 85
ESTERO SALADO (GUAYAQUIL) THERMAL POWER STATION UNIT NO.3 INSTALLATION PROJECT	Ecuador	Jul 77
EL CAJON HYDROPOWER PROJECT	Honduras	Apr 80
BARGE-MOUNTED DIESEL POWER PLANT PROJECT	Jamaica	Dec 83
LIMA-CHIMBOTE TRANSMISSION LINE AND SUBSTATION CONSTRUCTION PROJECT	Peru	Feb 73~ Jun 78
TRANSMISSION LINES IMPROVEMENT PROJECT	Peru	Jun 80

The first Loan agreement year/month and the last Loan agreement year/month are described for multi-phased projects, etc.