Ex-Post Project Evaluation 2012: Package IV-5

(Vanuatu, Solomons, Kiribati, Palau)

November 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

Ernst & Young Sustainability Co., Ltd.

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Preface

Ex-post evaluation of ODA projects has been in place since 1975 and since then the coverage of evaluation has expanded. Japan's ODA charter revised in 2003 shows Japan's commitment to ODA evaluation, clearly stating under the section "Enhancement of Evaluation" that in order to measure, analyze and objectively evaluate the outcome of ODA, third-party evaluations conducted by experts will be enhanced.

This volume shows the results of the ex-post evaluation of ODA Loan projects that were mainly completed in fiscal year 2009, and Technical Cooperation projects and Grant Aid projects, most of which project cost exceeds 1 billion JPY, that were mainly completed in fiscal year 2008. The ex-post evaluation was entrusted to external evaluators to ensure objective analysis of the projects' effects and to draw lessons and recommendations to be utilized in similar projects.

The lessons and recommendations drawn from these evaluations will be shared with JICA's stakeholders in order to improve the quality of ODA projects.

Lastly, deep appreciation is given to those who have cooperated and supported the creation of this volume of evaluations.

November 2012
Masato Watanabe
Vice President
Japan International Cooperation Agency (JICA)

Disclaimer

This volume of evaluations, the English translation of the original Japanese version, shows the result of objective ex-post evaluations made by external evaluators. The views and recommendations herein do not necessarily reflect the official views and opinions of JICA. JICA is not responsible for the accuracy of English translation, and the Japanese version shall prevail in the event of any inconsistency with the English version.

Minor amendments may be made when the contents of this volume is posted on JICA's website.

JICA's comments may be added at the end of each report when the views held by the operations departments do not match those of the external evaluator.

Vanuatu

Ex-Post Evaluation of Japanese ODA Grant Aid Project "The Project for Improvement of Power Generation in Sarakata River Hydroelectric Power Station"

External Evaluator: Keisuke Nishikawa
Ernst & Young Sustainability Co., Ltd.

0. Summary

This project was implemented to supply stable electricity to Luganville through hydropower generation by strengthening the supply capacity at the Sarakata River Hydroelectric Power Station. This project was highly relevant to the development policy and needs of Vanuatu, which had the goal of ensuring a stable power supply and reducing its dependence on diesel fuel, and also with the ODA policy of Japan having the focus of assistance for economic development. The effectiveness of the project was high as the actual amount of diesel fuel for power generation was reduced more than the planned amount, and the power generation capacity also continually surpassed the electricity demand. With regard to the implementation of the project, the project outputs, costs and periods were all implemented as planned, resulting in a high level of efficiency. In addition, the sustainability of the project can be seen as high since there are no issues regarding the supervising and outsourcing structure, the technical level of the concessionaire and the financial aspects.

In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description

Project Location

Generator Unit Provided in the Project

1.1 Background

Up to around 1990, electricity was mainly generated by diesel engine generators using imported diesel oil, constituting a heavy burden on the national economy. Under these circumstances, the Government of Vanuatu adopted a policy to break away from dependence on oil as a priority target, formulated an energy programme primarily featuring a shift to hydroelectric power generation and made a request to the Government of Japan for the implementation of a project to build the Sarakata River Hydroelectric Power Station to supply electricity to Luganville. In response to this request, the Government of Japan implemented the "Project to Construct the Sarakata River Hydroelectric Power Station on Santo Island" in 1994 and 1995 as a grant aid project. Following the construction of this new power station with two 300 kW turbine generators (combined generating capacity of 600 kW), this power station supplied as much as 70% of the electricity to Luganville in 1995, contributing to it breaking away from dependence on oil for some time[1].

However, the conspicuous growth in power demand in the area in the subsequent years made it impossible for the rated generating capacity of this hydroelectric power station to meet the peak power demand. This situation led to renewed dependence on diesel oil generation and the resulting increase in diesel oil procurement costs began to put pressure on the economy of Vanuatu.

In order to alleviate this situation, this project was implemented as a grant aid project to install a new 600 kW hydraulic turbine generator at the Sarakata River Hydroelectric Power Station.

1.2 Project Outline

The objective of the Project is to supply stable electric power to Luganville on Espiritu-Santo (hereinafter referred to as "Santo") through hydroelectric generation by increasing the capacity of the Sarakata River Hydroelectric Power Station.

Grant Limit / Actual Grant Amount	1,280 million yen / 1,234 million yen
Exchange of Notes Date	26 January, 2007 (Phase 1/2) 6 June, 2007 (Phase 2/2)
Executing Agency	Energy Unit, Ministry of Lands, Energy, Environment, Mines and Water Resources

[1] The area of coverage of electricity supply on Santo is only up to the area around Luganville. The means of power generation until the mid-1990s was only the Luganville Diesel Power Station, and the hydroelectric power supply was added as a result of Japan's grant aid project. At present, these are the only large-scale power stations.

Project Completion Date	29 February, 2008 (Phase 1/2) 9 January, 2009 (Phase 2/2)
Main Contractor	Construction: Dai Nippon Construction (Phase 1 & 2) Procurement: ITOCHU Corporation (Phase 2)
Main Consultant	Yachiyo Engineering Co., Ltd.
Basic Design Study	June, 2006 – January, 2007
Related Projects	[Grant Aid] Project to Construct the Sarakata River Hydroelectric Power Station on Santo Island (1994-1995)

2. Outline of the Evaluation Study

2.1 External Evaluator

Keisuke Nishikawa, Ernst & Young Sustainability Co., Ltd.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted in the following timeline.

Period of the Study: October 2011 – September 2012

Period of the Field Study: 31 March – 11 April and 24 May – 2 June 2012

2.3 Constraints during the Evaluation Study

As the financial information provided by UNELCO, a concessionaire of the power station until 2010, was not sufficient, it was difficult to analyse the revenues from electricity sales and the structure of the income and expenditure accounts.

3. Results of the Evaluation (Overall Rating: A[2])

3.1 Relevance (Rating:③[3])

3.1.1 Relevance with the Development Plan of Vanuatu

At the time of project planning, the Government of Vanuatu had placed strategic priorities on the development of infrastructure such as electricity, water and communications, as specified in the national development plan entitled Priorities and Action Agenda 2006-2015, in which power supply was seen as the most important challenge for the improvement of public services. At the time of ex-post evaluation the Priorities and Action Agenda 2006-2015 was still effective and the importance of power supply has also remained high.

In the electricity sector, a stable supply of electricity in the electrified areas of Port

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[3] ③: High, ②: Fair, ①: Low

Vila (capital) and Luganville (on Santo) and the promotion of electrification in the rural areas where 80% of the total population resided were the key challenges at the time of project planning. A framework to utilise the funds released by savings from the reduction in diesel fuel costs through the implementation of this project was established for this purpose. In Vanuatu, while there had not been any development plans for the electricity sector, an inception report of the roadmap directing the path for energy development in the country was announced in December 2011, in light of the importance of formulating an overarching plan to cover the stable supply, connection to the power supply, tariff controls and so on. A final version of the roadmap is soon to be summarised. In this sector policy, priority focuses are placed on lowering the dependence of Vanuatu on imported diesel fuel, exploring the possibilities of hydroelectric and photovoltaic generation and also increasing the electrification rate, currently standing at 27%. These priorities can be said to be in line with the aim of this project. It is also worthwhile noting that there is a concrete movement in which a plan for a 2MW-class hydroelectric power station in another river basin on Santo has emerged with assistance from another donor agency.

It can therefore be concluded that this project is consistent with the development policy and programmes of Vanuatu at the time of both project planning and the ex-post evaluation.

3.1.2 Relevance with the Development Needs of Vanuatu

With the implementation of the Project to Construct the Sarakata River Hydroelectric Power Station on Santo Island (hereinafter referred to as “the previous project”) in the mid-1990s, a reduction in diesel fuel and improvement of the electrification rate have progressed, but dependence on diesel generation was again on the increase amid the surging electricity demand. In detail, the rate of dependence on the diesel power station, which had dropped to 32% in 1996, returned to 61% in 2005, leading to higher procurement costs for diesel fuel. Under these circumstances, this project was implemented again to strengthen the hydroelectric generation facilities, and the principle of meeting as much demand as possible from hydroelectric generation has been maintained at the time of ex-post evaluation. Based on the above, the need to break away from dependence on diesel fuel has remained high and this project has consistently been in line with this need.

While the volume of power generation has recently been increasing in the Luganville area, the amount of diesel fuel used for power generation was 1.562 million litres (2008), 1.219 million litres (2009) and 0.492 million litres (2010), 0.703 million litres

(2011) [4], showing a rapid reduction after the completion of this project. The rate of dependence on diesel fuel out of the total generation has been declining, thus demonstrating the considerable importance of hydroelectric power generation as a means of power production.

3.1.3 Relevance with Japan's ODA Policy

Based on the five priority policy targets (Economic growth, Sustainable development, Good governance, Security, People to people communication and exchanges) that Japan expressed at the Fourth Pacific Islands Leaders Meeting (May 2006), Japan had a policy of providing assistance to Vanuatu, one of the Less Developed Countries (LDCs), in a strategic manner in line with the development strategy of the Vanuatu government. Among all these targets, the focuses were placed on economic growth, sustainable development and good governance, and 'economic growth' included cooperation in infrastructure development. In sum, this project, which supported the development of infrastructure leading to the growth of the Vanuatu economy, particularly the economy of Santo, demonstrates high consistency with Japan's aid policy.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness[5] (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

The effect of the project expected at the time of planning was a reduction in the amount of diesel fuel used. In this ex-post evaluation study, in addition to the amount of diesel fuel used, generated electricity, electricity sold, generator capacity, maximum demand, and the outage hours were examined as they were the basic indicators to measure the quantitative effects of the project.

3.2.1.1 Amount of Diesel Fuel Used

As stated in "3.1.2 Relevance with the Development Needs of Vanuatu", the amount of diesel used for power generation in the Luganville area decreased substantially after the implementation of this project.

[4] Data provided by the Department of Energy, Mines & Mineral Resources
[5] The evaluation result of the project impacts is incorporated into the Effectiveness rating.

Table 1: Amount of Diesel Fuel Used Before and After the Project

	2008	2009 (Completed)	2010	2011
Diesel Fuel Used for Power Generation in the Luganville Area (Unit: thousand litres)	1,562	1,219	492	703
Amount of Diesel Imported into Vanuatu (Unit: thousand litres) (Import Value (Unit: million Vatu))	70,660 (6,265)	70,140 (4,346)	68,740 (4,104)	75,890 (5,665)
Diesel Fuel Used for Power Generation / Amount of Diesel Imported into Vanuatu (%)	2.21	1.74	0.72	0.93

Source: Data Provided by the Department of Energy, Mines & Mineral Resources / Customs and Inland Revenue

At the time of project planning, a reduction of 0.85 million litres of diesel fuel for power generation in 2009 was targeted by implementing this project[6]. The amount of 1.56 million litres used in 2008 reduced to 1.22 million litres in 2009 and down further to 0.49 million litres in 2010. In 2011, the amount of diesel fuel used temporarily rose to 0.7 million litres due to the failure of the No.1 Generator Unit at the Sarakata River Hydroelectric Power Station, provided under the previous project, but the reduction from the 2008 figure was 1.07 million litres in 2010 and 0.86 million litres in 2011, with both of them achieving the target. In comparison with the amount of diesel imported into Vanuatu, hovering around 70 million litres, the amount of diesel fuel for power generation in the Luganville area which decreased in this way, also achieved a level of less than 1% both in 2010 and 2011 from 2.21 % in 2008 in terms of the proportion to the overall amount of imported diesel in Vanuatu.

3.2.1.2 Trend in the Amount of Electricity Generated and Sold, Generator Capacity and the Maximum Demand

The effects of power generation projects are generally considered to be the increase in power generation and the enhancement of generator capacity and the reduction in outage hours, in addition to the reduction in diesel fuel mentioned above. In this ex-post evaluation study, these figures were obtained to make a comparison of the planned and actual outputs as shown in Table 2.

[6] Although the project was completed in early 2009, actual operation commenced in May 2009 due to the preparatory time required for test runs. As a result, the figures for the comparison of the planned and actual outputs are obtained from 2010, when the generator operated for a full calendar year, and also from 2011, two years after the completion of the project.

Table 2: Project Effect Indicators in the Luganville Area

	2008	2009 (Completed)	2010	2011
Generated Power per year (MWh)	7,072	7,267	8,311	8,641
Diesel Fuel (MWh)	5,438	4,256	1,673	2,439
Hydroelectric (MWh)	1,634	3,011	6,638	6,202
Energy Sold (MWh)	6,482	6,529	7,555	7,558
Generator Capacity (kW)	3,450	4,050	4,050	4,050
Diesel Fuel (kW)	2,850	2,850	2,850	2,850
Hydroelectric (kW)	600	1,200	1,200	1,200
Maximum Demand (kW)	1,373	1,366	1,530	1,650
Unplanned Outage Hours (hour)	1.13	3.24	1.42	4.39
Human error (hour)	0	0.79	0.04	0.00
Mechanical trouble (hour)	1.13	2.45	1.38	4.39
Planned Outage (hour)	0.36	7.43	7.20	0.98

Source: Provided by the Department of Energy, Mines and Mineral Resources

As a result of the implementation of the project, the total amount of generation (supply) has increased to a level where the amount of sales (demand) can be met. It is particularly worth noting that the composition of diesel generation and hydroelectric generation reversed after the project implementation and 80% of the total generation was covered by hydroelectric generation in 2010 when the Sarakata River Hydroelectric Station operated for a full year. The overall generation cost has been substantially reduced as the amount of generation by diesel engines decreased through the development of the hydro-generation capacity. The supply capacity is also well above the maximum demand.

Planned and unplanned outages were not frequent or long even before the project, enabling a stable supply generally at all times. A slight increase in the time of outages (planned and unplanned) in recent years is attributed to repairs by the concessionaire when breakdowns of the generator units occurred relatively frequently due to their deterioration. These repairs had mostly been completed by the time of the ex-post evaluation and more stable operation was made possible.

3.2.2 Qualitative Effects

The following qualitative effects were expected at the time of project planning.

(1) The foundation improvement work to be implemented for the intake water canal zone would help ensure a stable supply of water needed for the hydroelectric power generation, enabling the power station to be run constantly.

(2) The excess power supply capacity to be realized would ensure a stable power supply even at the time of a generator maintenance shutdown or unexpected failure.

With respect to the qualitative effect (1) above, the foundation improvement work under this project was completed successfully in the intake water canal zone. There have been no major ground collapses, and water is constantly available in the volume required to generate electricity. The ground surface of the worked area has been covered by natural vegetation over the course of several years since project completion. The risk of soil erosion has thus been reduced.

Photo 1: Current Condition of the Intake Water Canal

With respect to the qualitative effect (2) above, the 600 kW power generation unit[7] under this project was granted at a time when one (Generator No.1) of the two generators (each with a 300 kW capacity) provided under the previous project more than 10 years before and the diesel power generation unit in Luganville had been experiencing various aging troubles. The project has made a major contribution to enhancing the excess supply capacity and ensuring stable operation of the hydroelectric power plant.

3.3 Impact

3.3.1 Intended Impacts

A major indirect impact of the project was the enhancement of the Sarakata Fund (as detailed below) to raise and pool the necessary funds for the electrification of, and stable power supply to, rural areas of Vanuatu, which in turn would improve the standard of living of the people in rural communities.

3.3.1.1 Accumulation of the Sarakata Fund

For a long time a flat-rate consumer electricity tariff system has been applied nationwide in Vanuatu. The flat-rate tariff is determined by the government on the basis of the cost of diesel power generation. Operation of the low-cost hydroelectric power station at Sarakata River generated extra income through the savings in the cost of imported diesel fuel.

At the time of the previous project, accordingly, the governments of Japan and

[7] The two 300 kW hydroelectric generators granted under the previous project are called Generators No.1 and No.2. The 600 kW generator under this project is called Generator No.3.

Vanuatu agreed with the then concessionaire UNELCO to create the Sarakata Renewal Fund and Sarakata Special Reserve Fund in which the savings in the cost of imported diesel fuel were to be pooled. The Sarakata Special Reserve Fund was to finance rural electrification projects and the Sarakata Renewal Fund was to finance the purchase of equipment and materials required for the maintenance of the facilities.

The Sarakata Special Reserve Fund was instrumental in financing many electrification projects not only in the Luganville region, but also other parts of Santo Island and other islands. The projects consisted of transmission line extensions, branching to households and streetlight installation. More specifically, between 1995 and 2006 the Fund financed 69 projects approved by the government's Technical Committee (42 on Santo Island and 27 on other islands) and some other projects. (See Table 3)

Table 3: Major Projects Funded by the Sarakata Special Reserve Fund (in Santo Island)

Year	Projects in Santo Island	Total Cost (Unit: 1,000 Vatu)
1996/97	Grid extensions to Solway Marinacce & Canal 1 / 119 Household connections / Luganville Street Lights maintenance	11,971
1997/98	Grid extensions to Fanafo, Sarakata 4, Leroy, Collet, Chabaud, Procureur, Canal 2, St Louis, Mango, Fanafo & Sarakata 3,4,5 &6 / Luganville Street Lights maintenance	31,642
1998/99	Grid extensions to Paamal, Canal 2, St Michel, Santo East 2, Ballande, Route du General de Gaulle, Quartier Sarakata & Canal du Second 1 / 276 Household connections / Luganville Street Lights maintenance	46,378
1999/2000	High Voltage grid extension to Matevulu College / Chapuis Agriculture / Luganville Street Lights maintenance	58,640
2000/01	High and Low Voltage extensions to Chapuis, Banban, Santo East 1, Sarakata Extension 5,6 & 7, Chabaud, Argrencourt, Cook & Laperouse, Fanafo 2, Natanara School , Peter Colmar & Oyster Island / Luganville Street Lights maintenance / Additional new Street Lights / 177 Household connections	48,895
2001	High and Low Voltage extensions to Lopelope, Suranda & Banban / 96 Household connections in Lopelope, Suranda & Banban / Luganville street lights maintenance / Sanma Provincial Government electricity bills	24,498
2002	Luganville Street Lights maintenance / Electricity tariff subsidy in Luganville / Tariff modification in UNELCO's system to account for the tariff subsidy in Luganville	17,001
2003	Luganville Street Lights maintenance / Sanma Provincial Government electricity bills / Santo Agriculture College / 18 Household connections / Electricity tariff subsidy in Luganville	32,091
2004	Additional new Street Lights / Luganville Street Lights maintenance / Sanma Provincial Government electricity bills / Electricity tariff subsidy in Luganville	17,569
2005	Nitchiku station transformer at Saraoutou / Sravi-Sarabo transformer / Low voltage grid extension at Ballande / Luganville Street Lights maintenance / Sanma Provincial Government electricity bills	8,784
2006	Electrify Ex-Supreme Court Judge House / Port Olry Electrification / Matevulu College electrical meters / Luganville Street Lights maintenance / Sanma Provincial Government electricity bills / Luganville Municipality electricity bills	10,154

Source: Provided by the Department of Energy, Mines and Mineral Resources

The data show that Sarakata River hydroelectric power generation project did produce surplus funds stably every year, which were used to promote rural electrification in Vanuatu.

It must be added, however, that between 2007 and 2010 no electrification projects were financed by the Fund.[8] While the Fund played a major role in financing many electrification and other projects in the period of a little over a decade since its creation, the Utilities Regulatory Authority (URA) audit revealed some problems in the fund management, and the Sarakata Fund has been frozen since the end of 2010.

3.3.1.2 Promotion of rural electrification and higher living standards

Since even before the project implementation, electric power supply in the Luganville region has been fairly stable. Our simplified beneficiary survey[9] of the residents showed that 80% of the respondents considered the supply to be "Moderately stable" and another 15% "Very stable." There was no conspicuous change between before and after the project. Rather, the project produced the significant effect of lowering the risk of scheduled power cuts and unexpected outages caused by insufficient power supply capacity.

The simplified beneficiary survey also showed that the residents of the newly-served communities around Luganville felt that their lives had been improved considerably in terms of food refrigeration and evening studies under lighting. The stable supply of electricity remains unchanged and electrification in the Luganville region has been started anew by the new concessionaire. It is fair to say that there has been an expansion of the area with a comfortable life with electricity services.

Even though the residents are generally content with the supply stability of electric power, many of them expressed in the simplified beneficiary survey that further efforts are needed to prevent the brief supply interruptions (for some minutes) that still occur occasionally.

3.3.2 Other Impacts

3.3.2.1 Impacts on the Natural Environment

The project objective was to enhance the power generation capacity of the hydroelectric power station. It was expected that its implementation would reduce the operation time of the existing diesel fuel-based power station, thus alleviating the

[8] In 2011, electrification of the communities in the Luganville region was resumed by the new concessionaire using its own funds.

[9] An interview survey was conducted during the field study by the external evaluator (May 2012). Questions related to power supply stability and changes in lifestyle were asked to 20 respondents in factories, schools, hospitals and stores in the Luganville region.

air pollution and noise problems. As discussed above, the consumption of diesel fuel for the purpose of power generation has been reduced significantly, and the air pollution, carbon dioxide emissions and noise nuisance problems in the neighborhood of the diesel fuel-based power station are believed to have been alleviated.

The assumption at the time of project planning that the increased intake of water from the Sarakata River would cause no major environmental impacts was found to be correct. The water is taken in from the top part of the surface water. Visual inspections, the simplified beneficiary survey and interviews with the authorities concerned all confirmed that there were no adverse environmental impacts.[10] Annual precipitation varied between 2,400 and 3,300 millimeters[11] in the period of 2006 – 2010. The river water level does not appear to have been affected adversely, showing only the normal water level decrease during the dry season.

3.3.2.2 Land Acquisition and Resettlement

No direct land acquisition issues exist in this project because it was implemented within the premises acquired for the previous project and no new land acquisitions were made.

No resettlement issues exist because the project site is located deep in an uninhabited mountain area. It should be mentioned that the land acquisition issue that arose after the implementation of the previous project was still pending at the time of this ex-post evaluation. When the previous project was planned, consent was duly obtained from the tribe chief of the planned project site. But the process of determining the landowners took a very long time. Recently four landowners were finally identified and land purchase negotiations began in March 2012 with the government. The negotiations concern the purchase price only and are expected to be successfully concluded soon. There are no issues concerning land use.

Vanuatu consists of many small islands, thus there are few rivers suitable for hydroelectric power generation. Yet the Sarakata River is not the only river on the biggest island of Santo with a potential for hydroelectric power generation. The executing agency feels that the experience gained through the Sarakata Hydroelectric Power Station Project, the only hydroelectric power station in Vanuatu, will provide a benchmark for future projects in the country, in particular in terms of the necessary

[10] No quantitative analysis was possible in this ex-post evaluation due to the absence of water level data for the upstream and downstream reaches of the power station, as confirmed by interviews with the government authorities.

[11] Data for Pekoa International Airport on Santo Island, the nearest data point to the Sarakata Power Station (provided by Vanuatu Meteorological Services)

processes involved in land acquisition.

3.3.2.3 Other indirect impacts

A nationwide flat-rate electricity tariff was the tradition in Vanuatu for quite some time. In 2011, however, the tariff applicable to the Luganville region was reduced by 6.8% whilst that applicable to Port Vila was reduced by 4.7%. The URA, which has the authority to determine the electricity tariff, is believed to be continuing to pass on the benefits of the Sarakata River Hydroelectric Power Station to the residents of the Luganville region, even though it is not known at this time whether the Sarakata Fund will be reactivated.

This project has largely achieved its objectives, therefore its effectiveness and impact is high.

3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

This project was a two-year project, divided into Phase 1/2 which was focused on the repair of the intake water canal and Phase 2/2 focused on capacity expansion of the hydroelectric power station. Tables 4 and 5 show a comparison between the final outputs and those planned.

Table 4: Planned and Actual Outputs (Phase 1/2: Repair of Intake Water Canal, etc.)

Plan	Actual	Quantity
[Repair of Intake Water Canal] Engineering Work of Intake Water Canal (830m) and Access Road (approx. 100m)	[Intake of the water canal]	
	Engineering work of foundation and retaining wall	30m
	Installation of gabions	130m
	Lock Bolting	452
	Surface draining sheet	130m
	[Middle section of the intake water canal]	
	Installation of deterrent piles	40
	Connection of the deterrent pile edges	81m
	Surface draining sheet	220m
	[Head tank section]	
	Surface draining sheet	50m
	[Mountain section of the canal]	
	Rainwater inlet	8
	Installation of pipes crossing the canal	8
	Installation of U-shaped drainage ditch	830m
	Surface draining sheet	690m
	[Safety works of access road]	
	Engineering work of foundation and retaining wall	103m
	Installation of gabions	103m
	Lock Bolting	376

Table 5: Planned and Actual Outputs
(Phase 2/2: Extension of Hydroelectric Power Station)

Plan	Actual
Installation of steel pipe (penstock): 40m	Installation of steel pipe (penstock): 40m
Tailrace improvement work (for water discharge): 1 set	Tailrace improvement work (for water discharge): 1 set
Powerhouse extension work	Powerhouse extension work
[Hydraulic turbine equipment] Hydraulic turbine: 660kW or higher Generator: 3.3kV 750kVA Auxiliary equipment (distribution panel, etc.) * 1,200kW capacity will be secured, in conjunction with the existing generators	[Hydraulic turbine equipment] Hydraulic turbine: 674kW Generator: 3.3kV 750kVA Auxiliary equipment (distribution panel, etc.) * 1,200kW capacity will be secured, in conjunction with the existing generators
Main step-up transformer (3.3/20 kV, 750kVA)	Main step-up transformer (3.3/20 kV, 750kVA)
Step-down transformer for Sarakata River sub-station (20/5.5kV, 1,500kVA)	Step-down transformer for Sarakata River sub-station (20/5.5kV, 1,500kVA)
Maintenance tools: 1 set	Maintenance tools: 1 set
Spare parts: 1 set	Spare parts: 1 set

In this ex-post evaluation, various documents related to the project were reviewed and representatives of the project executing agency and of the consultants were interviewed. The review and the interviews confirmed that the repair work of the intake water canal and the capacity expansion of the hydroelectric power station were both executed mostly as planned, as summarised in the above Tables 4 and 5. It was also learned that the construction work for which Vanuatu was responsible was all executed as planned, such as the repair of the interior of the intake water canal, repair of the surface of the access road to the power station (cobble stone pavement, etc.) and the installation of a mudslide prevention fence for the intake water canal.

The field study also confirmed that these outputs were duly obtained as planned (provided that no detailed inspection of the repair work on the intake water canal and access road was made).

Photo 2: Steel Pipe Installed (Left)

Photo 3: Hydroelectric Power Station Overview

3.4.2 Project Inputs

3.4.2.1 Project Cost

The project cost of the Japanese side was 1,234 million yen, below the cost of 1,280 million yen estimated during the project planning (96.4%). The total estimated project cost, including the 39 million yen to be borne by the Vanuatu side, was 1,319 million yen. In this ex-post evaluation, comparison of the actual and estimated total project costs was not possible because no data were available on the actual amount expended by the Vanuatu side. It can be reasonably assumed from the due completion of the planned construction work as described above that an amount very close to the estimate was invested.

Table 6: Planned and Actual Project Cost

(Unit: million yen)

	Plan	Actual
Phase 1 (Repair of Intake Water Canal)	573	543
Phase 2 (Extension of Hydroelectric Power Station)	707	691
Japanese portion	1,280	1,234
Vanuatu portion	39	No record
Grand total	1,319	No record

3.4.2.2 Project Period

The planned project period[12] was 22 months, including the time periods required for detailed design and public tender. Actually, Phase 1/2 took 13 months (March 2007 − February 2008) and Phase 2/2 took 17 months (August 2007 − January 2009). The total project was thus 22 months, as originally planned. The overall

[12] The project period is here defined as the total period covering the detailed design and construction work.

detailed design was made at an early stage of Phase 1/2 and the construction work on the intake water canal and the expansion of the hydroelectric power station were executed in parallel. These work schedules made it possible to complete the project in 22 months as planned.

Both the project cost and project period were within the plan, therefore efficiency of the project is high.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance

The executing agency of this project was the Energy Unit of the Ministry of Lands, Energy, Environment and Natural Resources (MOL). The actual operation and maintenance work of power generation and power transmission is performed by a private contractor under the supervision of the Energy Unit. At the time of project planning, the MOL had 134 employees, of which 9 belonged to the Energy Unit.

Subsequently, in September 2011, the Energy Unit became part of the Department of Energy, Mines and Mineral Resources of the Ministry of Lands and Natural Resources to become a unit mainly dealing with policy-related matters. In this restructuring process, the size of the Unit was reduced from the previous 9 members to 5, excluding members responsible for economics, civil engineering and administration.

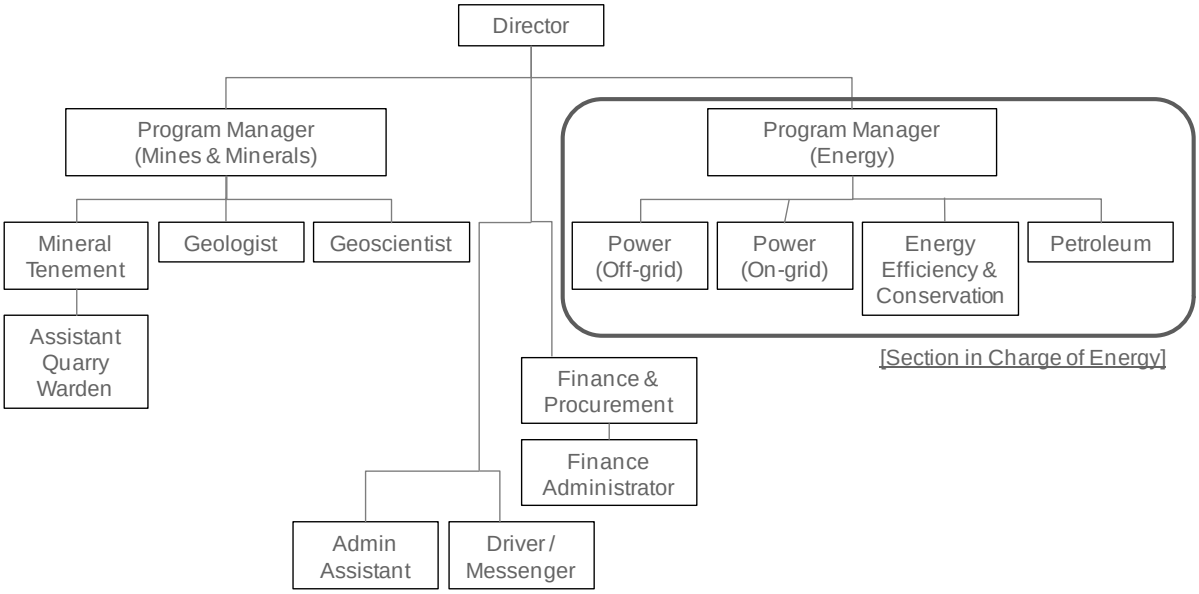


Figure 1: Organisational Structure of the Department of Energy, Mines and Mineral Resources

Since 1990, the power generation and transmission services in the Luganville region have been provided by a private firm under a concession contract. For the two decades until 2010, France-based UNELCO supplied electric power.[13] For the services starting in 2011, US-based Vanuatu Utilities and Infrastructure (VUI) won the public tender and has since then been in charge of the operation and maintenance of the power supply system in the Luganville region, including the Sarakata River Hydroelectric Power Station.

In practice, the Sarakata River Hydroelectric Power Station is run by eleven nearby villagers who had been working in shifts since the UNELCO days. The engineers are normally based at the diesel power station in the city of Luganville and they visit the site for inspections several times a week. Communications concerning the power generation operations of the hydroelectric and diesel power stations and other necessary topics are conducted on a real-time basis through radio equipment. No particular problems were found in this regard.

UNELCO, who lost the bid for the concession starting in 2011, filed a lawsuit against the government claiming that the selection process was not transparent. The suit was still pending as of the date of this ex-post evaluation. Accordingly, the government has not been able to conclude a long-term concession contract with VUI; the contracted services are performed on the basis of a Memorandum of Understanding (MOU). Even though the absence of a long-term contract has had no adverse effect on the routine work, it has deterred VUI from making decisions on what it deems to be the required investments such as improved staffing, improvement of the intake water canal, renewal of the diesel power generator and further electrification of villages around Luganville. An early resolution of the dispute is desired.

3.5.2 Technical Aspects of Operation and Maintenance

With respect to the technical aspects of power supply in the Luganville region, employees who have many years of experience are engaged in the day-to-day operation, whilst a VUI expatriate handles more sophisticated technical matters. There are no problems with regard to the management of the facilities and the machinery and equipment; most of the needed work is done by VUI alone. Since VUI took over the operation and maintenance in 2011, it has successfully conducted substantial repair work on the No.1 Generator of the hydroelectric power station and has made repairs to the diesel generator as needed.

VUI has started what it calls a “Capacity Building Initiative” to train the

[13] UNELCO continues to supply electricity in all other electrified regions of Vanuatu (Port Vila, Malekula and Tanna) even after 2011.

hydroelectric power station employees on technical and safety matters. Employees welcomed this programme, saying it provides a good opportunity to learn theoretically and systematically what they have learned on the job.

3.5.3 Financial Aspects of Operation and Maintenance

No specific data on the financial aspects of the power supply in the Luganville region were made available to the evaluator since UNELCO was in a legal dispute with the government. The evaluator learned that the business had made profits in every one of the years under this review. Here, accordingly, the evaluation will be made based on an analysis of the yearly transfer of funds into the Sarakata Fund before and after the implementation of the project.

As was mentioned already, the Sarakata Fund consists of the Sarakata Renewal Fund and the Sarakata Special Reserve Fund. The former fund finances the machinery and equipment maintenance costs, whilst the latter was regarded as revenue and was directed mainly to the financing of rural electrification projects. Every year, 10 million vatu was transferred into the Sarakata Renewal Fund and the amounts shown in Table 7 below were transferred into the Sarakata Special Reserve Fund.

Table 7: Accumulation of the Sarakata Fund (2006 – 2010)

(Unit: 1,000 Vatu (except for the power generated))

	2006	2007	2008	2009	2010
Hydroelectric power generated (MWh)	3,255.6	3,284.6	1,590.9	2,932.1	6,464.4
Total cost saved	78,523.3	73,099.9	43,873.6	50,979.3	154,091.4
Reduction of Fuel	76,929.5	71,181.1	43,097.9	49,600.8	151,052.2
Reduction of Lubricants	1,593.8	1,918.9	775,7	1,378.5	3,039.1
Concession to UNELCO	20,000.0	20,000.0	20,000.0	20,000.0	20,000.0
Transfer to the Sarakata Renewal Fund	10,000.0	10,000.0	10,000.0	10,000.0	44,296.5
Transfer to the Sarakata Special Reserve Fund	**48,523.3**	**43,099.9**	**13,873.6**	**20,979.3**	**89,794.9**

Source: Documents submitted by UNELCO to the Energy Unit

The amount transferred to the Sarakata Special Reserve Fund was considerable in 2010 when the power station came into full-scale operation. The project substantially increased the amount of hydroelectricity in that year, producing a saving of 151.05 million Vatu in fuel costs.

According to the URA audit of the Sarakata Fund (available only for the years 2003 through 2008), the balance of the Sarakata Special Reserve Fund as of the year-end

2008 was 61.53 million Vatu. Since 2007, no electrification projects have been implemented funded by the Sarakata Fund and the yearly transfers since then have brought the cumulative balance as of the time of this ex-post evaluation to 176.53 million Vatu, which is in the custody of the Ministry of Finance and Economic Management, as was confirmed in a statement by the Ministry.

During the six years from 2003 through 2008, 63% of the total disbursements from the Sarakata Fund were directed to electrification projects and the remaining 37% was paid to the government. A portion of the disbursements to the government were paid as compensation to the landowners who had been identified by then.[14]

As was mentioned earlier, a lawsuit is pending between the government and UNELCO. The government plans to decide whether to revive the Sarakata Fund soon after the final court decision is made. The original MOU with VUI remains in force and effect until a formal contract is signed, even though the initial term has expired. No problems have emerged in this respect for the operation and maintenance of the power station.

Power generation services are contracted entirely to the private sector in Vanuatu. The financial soundness of the government (Energy Unit) is not affected by the results of the private-sector services. This is not a case unique to the Luganville region; all other three regions (Port Vila, Malekula, and Tanna) have their electricity services operated on a stand-alone basis.

3.5.4 Current Status of Operation and Maintenance

The power generators of the Sarakata River Hydroelectric Power Station were being operated efficiently without any problems at the time of the visit for the ex-post evaluation. The Defect Inspection that was made one year after the project completion found that the governor for the No.1 and No.2 Generators provided under the previous project was made inoperable automatically. The visit in this ex-post evaluation confirmed that the defect had been corrected. It was learned that water was leaking from the No.1 Generator when the new concessionaire took over in 2011 and a substantial repair was made. This ex-post evaluation found no problems in the intake water canal or the access road and other civil engineering work. The power station building was in generally good condition as well.

Though not covered by the project, in contrast, most of the five diesel power generators in the Luganville Diesel Power Station had some troubles. After 2011, VUI was kept busy addressing these problems, including the replacement of large parts and components. By the time of the field study of the ex-post evaluation, repairs to the

[14] An analysis by the external evaluation, based on URA audit reports and other references

diesel power generators had been completed to the extent that they could be operated for the peak demand hours. No problems were observed in the procurement of parts; there were no inoperable generators simply left idle.

Overall, the generators never all failed simultaneously leading to a power shortage, even though minor repairs had to be made occasionally. Even since the time when UNELCO was the concessionaire, the Sarakata River Hydroelectric Power Station and the Luganville Diesel Power Station have generally been operated well. At one point, more frequent repairs were necessary than before because some of the generators tended to have trouble that was associated with aging. Currently, however, VUI applies its experience of electricity supply services in Fiji and the Northern Mariana Islands to maintain an effective level of maintenance and repair for the facilities here.

A matter of slight concern is the slow progress of efforts to narrow down the area affected by outages. The current power grid has been installed in such a way that an interruption at one location leads to a failure of the entire supply network. VUI intends to install breakers at key locations in order to isolate the outage area, but is hesitant to make a sizeable capital investment in the absence of a long-term concession contract with the government. If protracted, this contractual uncertainty can negatively affect not only the grid structure, but also the maintenance and repair of other existing facilities as well as the contemplated new investments for the expansion of the electrified area. It is hoped that accelerated efforts will be initiated for the conclusion of a long-term concession contract so that the concessionaire can reduce the business risks involved.

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project effect is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented to supply stable electricity to Luganville through hydropower generation by strengthening the supply capacity at the Sarakata River Hydroelectric Power Station. This project was highly relevant to the development policy and needs of Vanuatu, which had the goal of ensuring a stable power supply and reducing its dependence on diesel fuel, and also with the ODA policy of Japan having the focus of assistance for economic development. The effectiveness of the project was high as the actual amount of diesel fuel for power generation was reduced more than the planned amount, and the power generation capacity also continually surpassed the electricity demand. With regard to the implementation of the project, the project outputs, costs and

periods were all implemented as planned, resulting in a high level of efficiency. In addition, the sustainability of the project can be seen as high since there are no issues regarding the supervising and outsourcing structure, the technical level of the concessionaire and the financial aspects.

In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

4.2.1.1 Restructuring of power generation

The diesel power generators of the Luganville Diesel Power Station are obsolete and are suffering from trouble rather frequently. The newest generator is already more than 10 years old and the oldest has been in service for over 20 years. The successful completion of this project has made it unnecessary to run all the five diesel generators simultaneously even during peak hours. At night and on weekends and holidays it is often possible to meet the demand with the supply from the hydroelectric power station alone. This has alleviated the noise problem of the diesel power station which is located within the city.

It is believed worthwhile to consider replacing the existing diesel power station by constructing a new hydroelectric power station --- for instance, the project under consideration by another donor on a different river on Santo Island --- or by introducing more efficient diesel generator(s). Such modernization of the power generation structure would further reduce the dependence on imported diesel fuel and eliminate the increasing costs of maintenance and repair of the existing equipment.

4.2.1.2 Future of the Sarakata Fund

A nationwide flat-rate tariff for electricity has been the tradition in Vanuatu. Residents of the Luganville region, especially the local business community, often voiced the complaint that they do not benefit much from the revenues that the Sarakata River Hydroelectric Power Station generates and that most of the benefits are transferred to the capital city and other islands. In reality, the residents on Santo Island are believed to have benefitted from significant progress in the electrification of their communities. It is nonetheless felt important to pay attention to a proper balance between regional equity and the return to the local communities when deciding the future course of the Sarakata Fund.

4.2.2 Recommendations to JICA

No recommendations.

4.3 Lessons Learned

As mentioned above, the Sarakata Fund is presently frozen. Some expressed the view that the freeze does not need be lifted because the electrification of the rural areas that is financed by the Fund generates further profits from the sale of electricity. In short, profitable projects do not need such a special funding system, they say. It is however correct to state that the Sarakata Fund was indeed an effective mechanism in facilitating, at the least, the initial investment required for the low-profitability electrification projects in rural areas. It will be worth considering the advantages and disadvantages of setting up a similar funding scheme in the context of the applicable tariff system when planning a power supply project in or outside the country.

Solomon Islands

Ex-Post Evaluation of Japanese Grant Aid Project

The Project for Improvement of Honiara Power Supply in Solomon Islands

External Evaluator: Hisae Takahashi

Ernst & Young Sustainability Co., Ltd.

0. Summary

This project aimed to establish a stable power supply system in Honiara city by developing generating facilities. The relevance of this project is high, as it is consistent with the priority area of Solomon Island's development plans and Japan's ODA policy, and has development needs. By implementing the project, benefits such as increasing the power supply, stabilizing voltage drops and decreasing outage time due to damage to distribution and transmission lines, were confirmed. However, overall power outages in Honiara city have increased due to the breakdown of other generating facilities. Furthermore, the urgent reserve capacity is now at the same level as the planning stage due to the increased power demand. Conversely, it would not be possible to retain the balance of power demand and supply if the project were not implemented, and a certain level of contribution was confirmed by the project such as increasing the power supply, revitalizing economic activities and stabilizing the public facility operation. Therefore, the effectiveness of the project is fair. Its efficiency is also fair, as the project cost remained within budget while the actual project period went slightly beyond the schedule. Finally, the sustainability of the project is also fair as no major problems were observed in terms of the institutional aspect and technical capacity, despite some concerns about the financial status and supply of spare parts, etc.

In light of the above, this project is evaluated to be partially satisfactory.

1. Project Description

Project Location

Installed Diesel Engine Generator

1.1 Background

The capital of the Solomon Islands is Honiara which is located on Guadalcanal Island and which is the center for the country's political and economic activities. The city experienced a severe power

crisis originating from an insufficient available capacity from 1996-1998. This power shortage was solved in 1998 as a result of foreign assistance which included the installation of the generating unit at the Lungga Power Station under the Power Development Project in the Lungga District, a Japan's grant aid project, making a positive contribution to the securing of power supply capacity. Despite such improvement, sudden breakdowns had been frequently taking place at the time of project planning due to the aging of the existing generating facilities and insufficient maintenance during the period of ethnic conflict from the end of 1998 to 2003, illustrating the insufficiency power supply capacity in Honiara. Meanwhile, power supply to users was provided by 33 kilo Volt (kV) transmission lines and 11kV distribution lines. Almost all of the existing transmission and distribution equipment was 20 years old or more and showed signs of aging as well as wearing out. The resulting lack of capacity in distribution lines resulted in a voltage drop of some 20%, while the step-down transformers are subject to constant overloading due to insufficient capacity. This means replacing the existing distribution equipment with new distribution equipment to handle the present load is crucial.

Under these circumstances, the project aimed to ensure the power supply as well as improve the socioeconomic activities and lives of citizens by installing additional generating facilities and transmission/distribution systems.

1.2 Project Outline

The objective of this project is to establish a stable power supply system in Honiara city by installing an additional generating facilities for base load operation and improvement of the Honiara city's transmission and distribution systems.

Grant Limit / Actual Grant Amount	1,476 million yen / 1,429 million yen
Exchange of Notes Date	(Phase I) June, 2005 (Phase II) June, 2006
Implementing Agency	Solomon Islands Electricity Authority
Project Completion Date	(Phase I) February,2007 (Phase II) February, 2008
Main Contractor(s)	(Phase I) Itochu /Toshiba Plant Systems & Services, (Phase II) Itochu
Main Consultant(s)	Yachiyo Engineering
Basic Design	Basic Design Study Report on the Project for Improvement of Honiara Power Supply in Solomon Islands, Yachiyo Engineering February, 2005.
Detailed Design	June-July, 2006 for phase II
Related Projects (if any)	・Power Development Project in the Lungga District, (1998): Installation of No.9 Diesel Engine Generator (DEG) ・Grant Aid for Grassroots (2002): Procurement of spare part ・Follow up cooperation (2004): Overhaul of No.9 DEG

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisae Takahashi, Ernst & Young Sustainability Co., Ltd.

2.2 Duration of Evaluation Study

Duration of the Study: November, 2011 – September, 2012

Duration of the Field Study: March 4 – 26, 2012

3. Results of the Evaluation (Overall Rating: C[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Solomon Islands

The "National Economic Recovery, Reform and Development Plan (2003-2006)", which was the national development plan at the time of the basic design study (B/D), aimed to rehabilitate and stabilize the country[3], with the revitalization of industry and reconstruction of infrastructures as priority areas. Among them, electricity in particular was positioned as vital infrastructure to attract investment and achieve the economic recovery. The "National Development Strategy (2011-2020)", a current development plan, also highlighted infrastructure development, which would improve the access to "basic services including electricity, gas and water supply" out of nine priority areas, as well as clearly citing the vital need to ensure a reliable and affordable power supply and increase the coverage of electricity.

The "Electricity Sector Development Plan", which was formulated by the Solomon Islands Electricity Authority (SIEA) in 2004, showed a specific development plan for power sources, including the generating unit in the Honiara area based on a simulation showing a 4% increase in electricity demand. This plan, which was revised in 2011, continues to target an increase in supply in line with growing demand[4], hence confirming its consistency with the project.

3.1.2 Relevance with the Development Needs of Solomon Islands

There are two power stations in Honiara city, namely Lungga and Honiara power stations. At the time of B/D, the facilities in both power stations had deteriorated and regular operation for periodic maintenance had to be suspended due to the insufficient power supply. Accordingly, their collective output was less than 59% of the peak due to excessive operation. Furthermore, only 3–4 of 12 diesel engine generators (DEG) were operating regularly, since some had broken down and others were aging. The distribution line capacity also became insufficient in the industrial area, resulting in power outages, which affected citizens' daily lives and functions. At the time of ex-post evaluation, only 5 facilities in two power stations, including that (No. 11) procured under this project were operating out of a total of 7 facilities[5]. Their available capacity is 14.6 megawatts (MW), while peak demand hit 13.9 MW, which means a massive power outage could still occur if one large size generating unit were to break

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[2] ③ High, ② Fair, ① Low

[3] The Solomon Islands suffered considerable damage economically and socially, due to an ethnic conflict which occurred from 1998-2003.

[4] Plans to install the generation facilities were revised in 2011 to reflect the delay in the original plan and the increase in demand.

[5] 5 out of 12 generating units were removed as of B/D due to aging.

down. Furthermore, the power demand in Honiara city has increased year by year with the increased population and industrialization[6]. Thanks to the installation of DEG by the project however, day to day electric outages are avoidable, although sufficient capacity to respond to increasing demand is not ensured under the current situation, based on the scheduled maintenance plan. Since DEG must be taken offline on a regular basis for maintenance, the need to ensure the power supply remains high.

3.1.3 Relevance with Japan's ODA Policy

In ODA policy dialog held on June 2005, 1) Conflict prevention and peace building, 2) Good governance and 3) Sustainable national development were raised as priority issues. Among them, 3) especially prioritized the development of infrastructure (electricity, airport and water and sewerage systems) which are necessary for economic reconstruction. Furthermore, 5 initiatives which Japan needs to work on with the Pacific Islands Forum were agreed in the Pacific Islands Leader's Meeting held in 2003. Among them, the achievement of "more vigorous sustainable trade and economic growth" is mentioned, thus this project is consistent with Japan's policy since it targets a stable power supply, which is essential for economic reconstruction.

This project has been highly relevant with the Solomon Island's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness[7] (Rating: ②)

3.2.1 Quantitative Effects (Operation and Effect Indicators)[8]

(1) Load Shedding Accompanied by Periodic Maintenance

Daily load shedding, which is accompanied by periodic maintenance, has increased year by year. The average was 2.4 times per day in 2011, meaning it was not achieved as planned (Table 1). The major reason behind the increase in load shedding hours is due to damage to DGE and the increased number of DGE maintenance hours, which was not covered by the project. However, the situation is expected to improve as one of the DGEs (No. 6), currently down for maintenance, will resume operation in 2012.

Table 1 Number of Load Shedding Accompanied by Periodic Maintenance

(Unit: times/day)

Pre-project	Planned	Post-project		
2004		2009	2010	2011
Over 1	0	0.6	1.5	2.4

Source: Data provided by SIEA

Documents provided by JICA forecast 0 incidents per day. However, it is unlikely that the number

[6] The population of Honiara city was 49,000 in 1999 (document provided by JICA) at the time of planning. However, it increased to 64,600 in 2009 (National Statistics Office), and is currently estimated at 70,000 (SIEA).

[7] Sub-rating for Effectiveness is to be put with consideration of Impact

[8] Indicators are for Honiara city.

of load shedding incidents, which are accompanied by periodic maintenance, will remain at zero in Honiara city for an extended period, given the aging conditions of existing power supply facilities. A certain number of load shedding incidents within a certain period could have been expected, meaning stipulating such a forecast (zero times per day in Honiara city) did not completely reflect the reality. There was a need to be more realistic if the number of load shedding accompanied by any issues concerning facilities procured by the project was set as an Operation and Effect Indicator.

(2) Voltage Drops at End Users

Voltage Drops at End Users in Honiara city were kept below 10% at the time of ex-post evaluation, meaning the planned figure was achieved. Normally the electricity created at a power station is transmitted at high voltage to avoid any loss of heat in the course of transmission and then connected to substations, where the voltage is lowered and transmitted to households and companies. However, given the limited number of substations in Honiara city before the project, the electricity was transmitted without appropriate changes of voltages. After four substations were constructed under the project, electricity was transmitted to users at a more stable electric voltage, hence confirming the effectiveness of the project.

Table 2 Voltage Drops at End Users (Unit: %)

Pre-project	Planned	Post-project		
2004		2009	2010	2011
More than 20	Fewer than 10	Fewer than 10	Fewer than 10	Fewer than 10

Source: Documents provided by SIEA

(3) Power Failure caused by Insufficient Capacity of Transmission and Distribution System

The project developed aged transmission and distribution facilities. Thanks to newly extended transmission lines and the laying of underground cables, accidents and leakages of electricity were reduced. Under the project, a 33kV switching facility, which has an important function to connect and disconnect transmission lines or other components from the system in case of maintenance or failure, was established to prevent troubles and facilitate maintenance of transmission and distribution systems. Consequently, power failure caused by insufficient capacity of transmission and distribution systems can now be kept at 0 as planned.

Table 3 Power Failure caused by Insufficient Capacity of Transmission and Distribution System

(Unit: time/month)

Pre-project	Planned	Post-project		
2004		2009	2010	2011
2－4	0	0	0	0

Source: Documents provided by SIEA

3.2.2 Operation of DEG (No.11) Installed by the Project

DEG, which was installed by the project in Lungga power station, is operating well as shown in Table 4 as well as the explanation written below.

Table 4　Operation of DEG (No.11)

	2008	2009	2010	2011
Annual operation hours (hours)	7,163	6,204	7,235	6,285
Annual capacity factor Note 1 (%)	74	65	75	65
Annual availability factor Note 2 (%)	82	72	83	72
Maximum output (MW)	3.9	3.9	3.8	3.8
Annual outage hours (hours)	N.A.	N.A.	N.A.	949

Note 1: The ratio of electrical energy produced in a given period of time to the electrical energy that could have been produced based on continuous maximum power operation during the same period. (= Annual output / (electrical energy×annual hours[9])×100

Note 2: Amount of time for which electricity can be produced over a certain period, determined by the length of the period.＝(Annual operation hours[10]/ annual hours)×100

Source: Data provided by SIEA

（1） Annual Operation Hours

Given the downtime of the procured generating unit for required periodic maintenance (approximately 768 to 984 hours) and low demand at midnight, the annual operation hours of recent years are reasonable. The figure has decreased by 6200 to 6300 hours every two years, due to the overhaul conducted once every two years[11].

(2) Annual Capacity Factor and Annual Availability Factor

The annual capacity factor of the No. 11 generating unit has stabilized at around 70% for these years. Since no planned figure was set at the time of planning, the degree of attainment cannot be analyzed. However, the targeted annual capacity factor is generally between 70 and 90% and the No. 11 generating unit has generally been utilized within or slightly below this range. The annual availability factor is also stabilized between the low 70s and 80%, thus No. 11 can be said to have been operating well.

(3) Maximum Output

The maximum output of the No. 11 generating unit has ranged between 3.8 and 3.9 MW in recent years while the rated power output is 4.2 MW. According to the SIEA technical staff, the reason is mainly due to climate conditions and age-related deterioration. Normally the function of the generating unit is weakened due to high temperature and the maximum output of the No. 11 generator was confirmed as exceeding 4.0 MW on a rainy or relatively cool day. This means the maximum output of the No. 11 generating unit also functions well in terms of maximum output.

(4) Annual Downtime

About 90% of annual downtime is due to planned inspections or maintenance. Other than that, approximately 56 hours were load time due to machine trouble. In addition to this downtime, there

[9] Annual hours of the generating facility are basically 8,760 hours (=365 days ×24 hours).
[10] The figure for annual operation hours indicates the operation hours of the generating unit in 8,760 hours.
[11] Please refer to “3.5.4 Current Status of Operation and Maintenance” regarding the downtime for maintenance.

were 1,526 hours of downtime in 2011 to avoid unnecessary overnight operation, a period of low demand. This downtime is considered reasonable to ensure the safety and efficiency of the facility.

3.2.3 Qualitative Effects

At the time of B/D, a qualitative effect was anticipated, whereby the installation of 33kV switchgear within the Honiara power network would protect the transforming facilities from damage. This is because the transforming facilities would be quickly cut off from the system, preventing severe damage in the event of power failure. In interviews with the SIEA staff, the following effects were confirmed:

- The 33kV Substations (S/S) help minimize downtime elsewhere in the network since it provides more flexible switching arrangements in the distribution networks during planned maintenance or repairs.
- After the installation of the 33kV S/S, there was a notable improvement in the reliability of transmission and distribution networks and reduced equipment failure, because periodic maintenance was made easier.

Before the project, Honiara city lacked an appropriate number of S/S and switching gear facilities, meaning periodic maintenance was not adequately implemented, due to inevitable outages in the event of any trouble or maintenance. However, the construction of the S/S and switching gear facility have enabled periodic maintenance without disturbing the operations of other networks. This allowed protection against serious damage before it happened and minimized outages to other networks.

During the field survey of this evaluation, a simplified beneficiary survey was conducted to determine the qualitative effect of the project[12], the results of which are summarized below.

When comparing the condition of power supply before and after the project, 55% of the respondents answered either "Highly satisfied" or "Satisfied". Furthermore, 40% of respondents stated "There was an improvement but there remains room for further improvement" as shown in Figure 1.

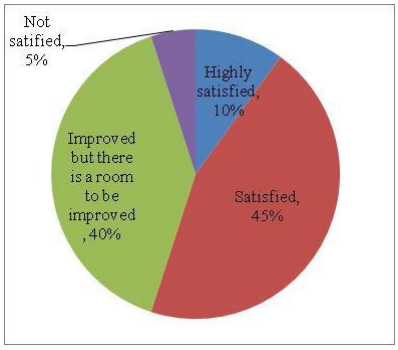


Figure 1: Situation of power supply (Comparing pre- and post-project)

Both large and individual users have recognized that the voltage stability, frequency of outages[13] and situation of the power supply in Honiara city have improved to a certain extent. In addition, all the large users interviewed owned generators in case of power outages. When comparing the pre- and post-project usage of their own generators, it was confirmed that the utilized hours and amount of fuel

[12] A simplified beneficiary survey was conducted as follows: Period: March, 2003. Number of samples: 42 (11 large users, including hotels, hospitals, ministries, city council, colleges, gas stations, and factories, etc.. The other 31 were individual users around the market or industrial area) .

[13] According to the respondents, the frequency of power outages five years ago exceeded 3.2 times daily for individual users and 1.5 times daily for large users on average. However it has currently decreased to 0.7 times for individual users and 0.5 times daily for large users on average. Here, the power is preferentially provided to areas housing many large users, such as hotels and hospitals, increasing the frequency of outages in residential areas.

had been reduced, though the figure differs from year to year, as explained in BOX below. Since the fuel price has continued to rise, the fuel cost burden on large users has also increased. Conversely, the usage hours and amount of fuel for their generators decreased, while the usable power increased, which indicates that the situation of the power supply in Honiara city has improved to a certain extent.

However, since the power demand in Honiara has increased every year, the power supply cannot keep pace, meaning temporary power outages are enforced during periodic maintenance or repairs under current circumstances. As explained above, since all large users must own and utilize their own generators in case of power outages, there remains room for improvement. This result seems to meet the qualitative effect, which shows an improvement in the power supply, albeit to a limited extent, by conducting the project.

BOX Power usage situation of large users (Based on interview surveys)
[Case of company A] Company A, one of the largest SIEA customers, has its own generator in case of outages and to avoid having to shut down the production line. According to them, their burden in terms of generator fuel has been increasing since the fuel price soared. Conversely, the annual usage hours of their own generator between the project completion and last year was approximately 50% of the pre-project figure, on average while total power usage increased more than 20% . [Case of company B] Sales of company B doubled over the past four years and power consumption also increased by 40%. However, the amount of fuel used for their standby generator was approximately 70% of the pre-project figure, as with company A. However, the burden faced by company B in terms of payment for fuel has continued to increase due to the rise in the fuel price.

3.3 Impact

3.3.1 Intended Impacts

3.3.1.1 Boosting Economic Activities and Stabilizing the Operation of Public and Welfare Facilities in Honiara

At the time of B/D, boosting economic activities and stabilizing the operation of public and welfare facilities were expected as an impact of the project. Though the evaluation team attempted to obtain data showing economic growth or the operation ratio of facilities, reliable data were not available and no quantitative analysis could be conducted. Therefore, a qualitative analysis was performed based on the result of a beneficiary survey detailed below.

① Boosting Economic Activity

The result of the beneficiary surveys cited more than 90% of respondents as stating that economic activities in Honiara had been revitalized after the project, as shown in Table 2. According to the respondents, the reason was as follows: the situation of the power supply had stabilized, with less downtime, meaning economic activities were not interrupted as frequently as before the project. In addition, they added that since power was crucial for economic activities on any scale, a stable

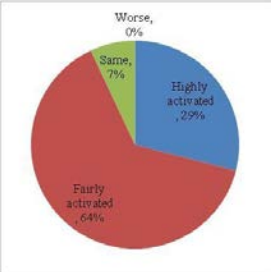


Figure 2 Revitalization of Economic Activity

power supply would always contribute to and boost economic activities.

② Stabilizing the Operation of Public and Welfare Facilities

In the beneficiary survey, most individual users answered that the operation of public and welfare facilities had stabilized as shown in Table 3. Before the project, the reduced operating hours of public services such as hospitals and schools as well as public offices were problematic. However, it emerged from beneficiaries that the operating hours of public services had become more stable and there was less damage or loss of data and equipment after the project.

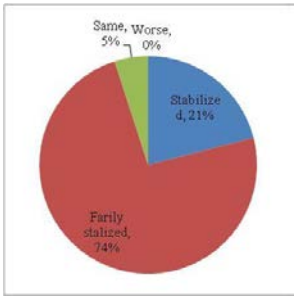


Figure 3 Stabilizing the public and welfare services

3.1.2 Electric Power Supply and Demand in Honiara City

The electric power balance of supply and demand in Honiara city showed a tight situation, as mentioned in "3.1.2 Relevance with the Development needs". The major indicators are shown in Table 5.

Table 5 Electric Power Balance of Supply and Demand in Honiara City

(Unit : MW)

Item	Pre-project	Post-project				
	2004	2008	2009	2010	2011	2012 Note 1
Peak Demand	9.9	12.6	12.8	13.8	13.9	14.0
Available Capacity (AC)	10.8	16.6	15.0	15.3	14.6	17.5
Honiara power station	0	1.9	0.6	0.6	0.6	0.6
Lungga power station	10.8	14.7	14.4	14.7	14.0	16.9
Power Balance	0.9	4.0	2.2	1.5	0.7	3.5
AC of the largest unit	3.9	4.1	3.8	3.8	3.8	3.8
Stable Capacity Note 2	6.9	12.5	11.2	11.5	10.8	13.7
Urgent Reserve Capacity Note3	-3.0	-0.1	-1.6	-2.3	-3.1	-0.3

Note 1: Data for 2012 is predicted data.
Note 2: Stable Capacity=AC－AC of largest unit
Note 3: Urgent Reserve Capacity= AC－Peak demand －AC of largest unit
Source: Documents provided by JICA or SIEA

Thanks to the project, the available capacity has increased and the urgent reserve capacity was marked as positive in 2006 when the generating unit was installed, so the situation can be said to have improved. However, some generating units stopped operating due to maintenance or damage. In addition, new generating facilities were not yet installed due to the budget shortfall after the project. Those situations, as well as the increased power demand due to the population growth and revitalization of economic activities, again resulted in the present deficit in the urgent reserve capacity. This means that despite the available capacity exceeding peak demand, the planned urgent reserve capacity, namely 0.8 MW, could not be achieved. Under these circumstances, there is the potential for a massive blackout in Honiara city if any large generating facilities were to break down.

Conversely, it is obvious that peak demand would have exceeded the available capacity if the

project had not been implemented[14]. Therefore, the project can be considered as having helped improve the lack of reserve power capacity to a certain extent.

3.3.2 Other Impacts

3.3.2.1 Impacts on the natural environment

According to the interview survey with the executing agency and the result of a beneficiary survey, no impacts on the natural environment were confirmed during and after the project implementation.

3.3.2.2 Land Acquisition and Resettlement

Land was acquired amicably to construct the White River S/S, without any complaint or dispute and in line with the appropriate process, based on the rule defined by the executing agency. Since other land used to construct the S/S belonged to the SIEA, no other land acquisition was implemented. Resettlement was also not implemented, hence no issues were raised.

As mentioned above, the available capacity was increased by installing a generating unit, and voltage to end users was also stabilized by developing the transmission and distribution facilities in Honiara. However, the effectiveness remained limited as some planned operated and effect indicators did not achieve the planned value due to damage or maintenance of other generating facilities as well as the delay in installing new generating units due to the budget shortfall. Furthermore, the current urgent reserve capacity was almost the same at when planning the project which is very tight. However, if the project did not install the No. 11 generating unit, it would not be possible to maintain the power balance of supply and demand and power cuts over a large area of Honiara on a daily basis would be inevitable. In addition, the beneficiary admitted impacts in the form of revitalized economic activities and stabilized public service operation, meaning the project could be considered as having helped the power supply in Honiara to a certain extent. Accordingly, this project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

The project consisted of phase I, the procurement and installation of equipment related to the extension of Lungga power station, and phase II, improvement of the Honiara transmission and distribution system and extension of the power house and switching gear buildings. The output of both phases I and II was conducted as planned, with planned and actual output shown in a Table.

Table 6 Project Outputs (Planned/Actual)

Phase I (Extension of Lungga Power Station)

Extension of the existing facilities and construction of the foundation	Planned	Actual

[14] If the No. 11 generating unit had not been installed by the project, the available output would be 10.8 MW against peak demand of 13.9 MW.

1) Extension of the power house 2) Extension of the switchgear house 3) Construction of the foundations for the new DEG and fuel tank, etc.	258m^2 62m^2 1set	As planned
Procurement and installation of the following equipment	Planned	Actual
1) 4.2MW DEG 2) Procurement and installation of auxiliary mechanical systems/equipment for the DEG. Fuel oil storage tank (300m^3), fuel oil supply system, fuel oil service system, lubricating oil purifier unit, air intake and exhaust gas system, cooling water system, compressed air system 3)Procurement & installation of the auxiliary electrical systems/equipment for the DEG Auxiliary equipment for the generator (Generator control panel, protection relay panel, low voltage panels, power supply system), High voltage facilities (11kV switchgears, station transformer(11kV/415-240V), cabling facilities) 4) Procurement of spare parts & maintenance tools for the DEG and auxiliary equipment 5) Preparation of O&M manuals for the DEG and auxiliary equipment and implementation of OJT.	1 unit 1set 1set 1 set 1 set	As planned

Phase II (Upgrading of Transmission and Distribution System of Honiara Power Network

Procurement and installation of the following equipment	Planned	Actual
1) Construction of the 33kV Ranadi Substation (S/S)		As planned
－33kV and 11kV outdoor type switchgears and low voltage outdoor type panels	1 set	except 5)
－ Step-down transformer, station transformer and other related facilities and foundations for the above equipment	1 set	
2) Extension of 33kV line from Lungga Power Station to the new Honiara East S/S		
－Laying of 33kV underground cable	4.2Km	
－Installation of the 33kV indoor type switchgear at the Lungga Power Station	1set	
3) Construction of the 33kV Honiara East S/S		
－33kV and 11kV outdoor type switchgears and low voltage outdoor type panels	1 set	
－Step-down transformer and station transformer,	1set	
－Other related facilities and foundations for the above equipment	1set	
4) Upgrading of the 33kV switching facilities at the Honiara Power Station		
－33kV outdoor type switchgears	1set	
－Other related facilities and foundations for the above equipment	1set	5) 33kV cable route was
5) Extension of the 33kV line from the Honiara Power Station to the new White River S/S		
－Laying of the 33kV underground cable	4.2Km	amended.
6) Construction of the 33kV White River S/S		(No
－33kV and 11kV outdoor type switchgears and low voltage outdoor type panels	1 set	additional
－Step-down transformer and station transformer	1set	cost was
－Other related facilities and foundations for the above equipment	99.6m^2	incurred and
7)Procurement of spare parts and maintenance tools for the 33kV transmission and 11kV distribution facilities	1set	no technical specification
8) Preparation of O&M manuals for the transmission and distribution facilities and implementation of OJT	1set	was made.)

In phase II, the underground cable route was partially amended since the road nearby the White River S/S was widened and a local produce market (200 meters), initially located on the coast side, was shifted to a more landward location. This change was made based on local circumstances and to avoid any potential hazard to both vendors and customers using the market. It is therefore considered reasonable.

Transformer in Ranadi S/S

Switchgear in Honiara East S/S

3.4.2 Project Inputs

3.4.2.1 Project Cost

The grant limit of the Japanese side was a total of 1,471 million yen for phases I and II, and the actual total project cost of the Japanese side was 1,429 million yen, which was 3% lower than planned.[15]

3.4.2.2 Project Period

While the planned project period at the time of B/D was 31 months in total, the actual project period was 32 months, which was slightly longer than planned. Although it did not exceed the contract period, it was delayed approximately one month based on the criterion indicated as of planning in B/D[16].

As stated above, the project cost was within the plan, the project period was slightly exceeded, therefore efficiency of the project is fair.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

SIEA is in charge of operating and maintaining the facilities installed by the project. SIEA was reorganized as part of the reform of State Owned Enterprises (SOEs) last year and the current organization chart is as shown in Figure 4. The generation and distribution units of the Engineering Department assume the roles of operating and maintaining the facilities, with 29 and 23 technical staff members in the generation and distribution units respectively. According to the chief engineer of the Engineering Department of SIEA, an adequate number of staff was allocated and no issues were noted concerning

[15] The actual cost of the Solomon Islands side was not available for either the Solomon Island or Japan sides. However, both SIEA and the consultant firm admitted that SIEA had completed all the foundation works for which the Solomon Islands side was responsible before the project. Therefore, the planned cost is considered as having been covered by the Solomon Islands side as planned.

[16] According to the consultant, the original plan as of B/D was usually tentative and the actual plan was revised during the executing phase, meaning the project was completed within the project period recorded in the official contract documents. Conversely, under the current evaluation scheme, the planned project period is defined by that described in B/D.

operation and maintenance in terms of the structural aspect.

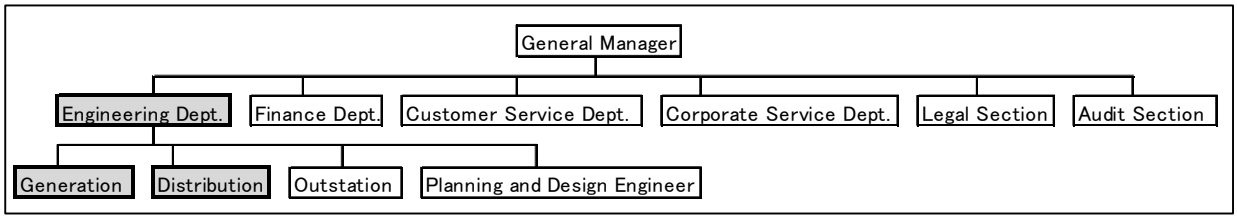


Figure 4 Organization Chart of SIEA

3.5.2 Technical Aspects of Operation and Maintenance

The technical SIEA staff members had sufficient technical capacity for the daily operation and maintenance of facilities. However, training in the operation and maintenance of newly installed facilities was provided via technicians dispatched from the manufacturing company. Currently, appropriate inspection and maintenance activities have been conducted based on the operation and maintenance manual, and SIEA is planning to establish a training program for its staff when new facilities are installed in future for necessary technical acquisition. When the SIEA technical staff were interviewed during the site survey, no issues concerning the technical capacity for daily inspection and maintenance were confirmed.

3.5.3 Financial Aspects of Operation and Maintenance

Table 7 shows the financial status of SIEA. SIEA was in deficit till 2010, but achieved a surplus for the first time in 2011. The reason is explained as follows; the burden of SIEA was reduced since its debt had been written off, while the achievement from introducing a pre-paid tariff system was shown as part of the support from the World Bank (WB) to improve management since 2008[17]. However, SIEA staff explained the need to install a new generating unit with capacity equivalent to No. 11 to maintain a stable power supply in Honiara city and improving the financial situation of SIEA was one of the challenges involved in realizing this plan. Under the current situation, it is still not easy to install new generating facilities and further effort is needed.

Table 7 Financial Status of SIEA

(Unit: Million SB$)

	2008	2009	2010	2011	2012 Note 1
1. Sales	227.8	243.5	258.9	320.2	391.0
2. Cost of sales	214.7	193.2	217.4	257.4	315.3
3. Gross profit	**13.0**	**50.3**	**41.5**	**65.8**	**75.7**
4. Operating cost	40.3	61.5	115.5	57.0	69.7
5. Operating profit/loss	**(27.3)**	**(11.2)**	**(74.0)**	**8.8**	**6.0**
6. Other revenue / expense	10.4	2.5	8.0	4.4	10.6
7. Profit / loss	**(16.9)**	**(8.7)**	**(66.0)**	**13.3**	**16.6**

Note 1: Forecast figures.
Source: Documents provided by SIEA

[17] Support from WB, Sustainable Energy Project, continues and assistance is implemented to improve the management, system liability and financial situation of SIEA. Under this support, capacity building of financial staff, promoting the pre paid system and introducing a finance and accounting manual, etc. are implemented.

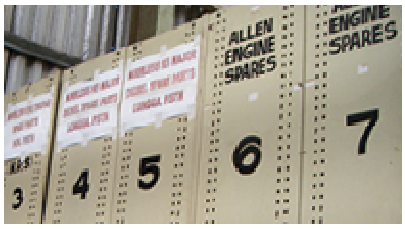
Major concerns concerning the financial status include the increased level of bad debt, which has become one of the issues delaying the installation of the new generating facilities. Total bad debt was 67 million SB$ (approximately 98 million yen) at the time of planning, rising to 93 million SB$ (approximately 1,000 million yen) as of ex-post evaluation (March, 2012). 70% of the figure is debt from the SOEs, and 70% is attributable to the Solomon Islands Water Authority (SIWA), which is equivalent to 38 million SB$ (approximately 405 million yen). Under such circumstances, the Government of Solomon Islands (GOSI), SIWA and SIEA have continued dialog and discussion whereby GOSI supports the portion repayable by SIWA to SIEA[18]. Meanwhile, measures to tackle issues such as water leakage and theft have commenced, and an increase in water tariff was also confirmed in SIWA, which is expected to improve the repayment from SIWA to SIEA,

Furthermore, the increase in fuel price has also affected the financial situation of SIEA, since part of the increase in the electricity tariff associated with the fuel price is covered by SIEA[19]. The electricity tariff, which was 1.1SB$/ kilowatt (kWh) at the time of planning, has now increased fivefold to 5.3SB$/kWh for individual users and 5.7 SB$/kWh for commercial use in 2011.

As stated above, the financial status is not fully stabilized, though the SIEA balance was positive last year. With this in mind, measures to improve the financial status are needed to install the new generating facilities. For example, many challenges remain to be measured; tariff collection is not made thoroughly, 70% of its income is paid by only 150 users, power theft must be addressed, meter reading must be done properly and there is a lack of effort among users, such as failing to turn off lights, etc. In addition to the support from WB, further efforts to solve these issues will be needed.

3.5.4 Current Status of Operation and Maintenance

The facilities installed by the project have been fully utilized and it was confirmed through the site survey and maintenance sheet that the necessary maintenance had been conducted as planned (refer to the maintenance plan in Table 8). Spare parts and equipment for maintenance are appropriately stored and the current operation and maintenance status is also appropriate.



Spare parts are stored in shelf by generating units.

Table 8 Inspection and Maintenance Plan for Generating Unit

	Type	Item
Diesel Engine	Daily maintenance	Visual check of appearance, checking of jacket cooling water level, checking of starting-up air receive pressure
	1,000 hours maintenance	Checking of proper tightening of nuts and bolts, Cleaning of fuel and filters (8 days required)
	2,500 - 3,000 hours	Checking of proper working of and oil leakage from valves, fuel pump, piston and

[18] After the site survey, an agreement of debt arbitration was concluded in May 29, 2012 among the Ministry of Finance and Treasury, SIWA and SIEA. The debt issue of SIWA to SIEA is subsequently expected to improve.

[19] The electricity tariff consists of two components, namely a base tariff and a fuel tariff. The base tariff is adjusted annually, which is 90% of the Consumer Price Index increase. The fuel price is adjusted, partially to reflect users and partially to reflect SIEA in case the fuel price exceeds the base price. This adjustment is made on a quarterly basis.

	maintenance	liner, etc. (15-18 days required)
	8,000 hours maintenance (Overhaul)	Replacement of rings, Checking and replacement of rings and valves, Overhauling of cylinder head and replacement of gasket, Inspection of fuel injection valve and replacement of nozzle, Inspection of crank pin bearings and replacement if necessary, Analysis of lubricating oil of sump tank and change of oil if necessary (20 – 25 days required)
	16,000 hours maintenance	All items under 8,000 hours maintenance, Overhauling and inspection of lubricating oil pump attached to engine and replacement if necessary, Inspection of main bearings and exhausted valves and replacement if necessary
Generator	Daily maintenance	Visual inspection of all sections and checking of abnormal sound and temperature
	Monthly maintenance	Checking of abnormal vibration, Checking of oil flow and leakage, Necessary cleaning of components
	Annual maintenance	Measurement of insulation resistance and inspection of lead sires and terminal, Visual inspection of accessories, including heater, bearing and cleaning if necessary

Source: Documents provided by SIEA

Although maintenance was conducted based on the plan, the high maintenance cost of spare parts and service engineering needed every 8,000 operation hours are currently a burden to the executing agency[20]. An exclusive contract was therefore established for these 8,000 hours of operational maintenance, based on the maintenance manual, with a Japanese agency. This was costly compared to other facilities, which affected the installation of new generation facilities. As explained in "3.5.3. Financial Aspects of Operation and Maintenance", this is a serious issue in terms of the sustainability of project effectiveness.

SIEA attempted public tendering to reduce the burden. However, this has not been sorted out for various reasons, for example the maintenance contract was established on an exclusive basis, and substituting spare parts was not easy due to the need to ensure quality. SIEA claimed that they were not informed about the exclusive contract and expensive maintenance cost at the time of planning, and later learned that an expensive fee would be needed for each overhaul, which led to SIEA distrusting agents as well as the Japanese side.

As described above, some problems have been observed in terms of the financial situation and the cost of maintenance, meaning the sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed to establish a stable power supply system in Honiara city by developing generating facilities. The relevance of this project is high, as it is consistent with the priority area of Solomon Island's development plans and Japan's ODA policy, and has development needs. By implementing the project, benefits such as increasing the power supply, stabilizing voltage drops and decreasing outage time due to damage to distribution and transmission lines, were confirmed.

[20] The cost of spare parts and dispatched service engineering fee for the No. 11 generating unit overhauling is 65 million yen and 1.56 million yen respectively. According to the technical staff of SIEA, the figures for the other generating unit in Lungga power station were about half.

However, overall power outages in Honiara city have increased due to the breakdown of other generating facilities. Furthermore, the urgent reserve capacity is now at the same level as the planning stage due to the increased power demand. Conversely, it would not be possible to retain the balance of power demand and supply if the project were not implemented, and a certain level of contribution was confirmed by the project such as increasing the power supply, revitalizing economic activities and stabilizing the public facility operation. Therefore, the effectiveness of the project is fair. Its efficiency is also fair, as the project cost remained within budget while the actual project period went slightly beyond the schedule. Finally, the sustainability of the project is also fair as no major problems were observed in terms of the institutional aspect and technical capacity, despite some concerns about the financial status and supply of spare parts, etc.

In light of the above, this project is evaluated to be partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) SIEA must continue striving to improve its financial status. For example, accumulated bad debt has affected the financial status of SIEA, and likewise the installation of the new generating unit. To install new generating facilities to cope with the increased electricity demand, solving this debt issue is crucial. For example, the following issues must be tackled: 1) measures to solve the debt issue should be drawn up and implemented as soon as possible among GSI, SIWA and SIEA; 2) examining measures similar to SIWA is required of other SOEs; at the same time, 3) the meter reading system, the number of faulty meters and the rate of tariff correction must all be improved, 4) the system to check by-passed system must be strengthened.

(2) Thanks to the project, the power balance in Honiara city has been retained. However, the situation is so severe that any damage to or stoppage of a major generating unit could result in a large scale outage in Honiara city. Therefore, the steady implementation of the plan to increase the available capacity (installation of a new generating unit, project for hydropower development) must be ensured, taking account of important assumptions which affect electricity demand, including increases in population and fuel prices.

(3) Issues to be resolved from the user side were also confirmed, to improve electricity wastage. For example, electricity not being switched off, even if unused or when users leave their workplaces. Therefore, the customer service department of SIEA, with the cooperation of the government and city council, should attempt to plan and execute awareness activities for power users to improve their awareness.

4.3 Lessons Learned

The high cost of spare parts and service engineering to date has been a burden to the executing agency and a serious issue hindering the installation of new generating facilities. Therefore, when conducting similar projects in future, there is a need to go through the procedure after a thorough

review of the appropriateness for drawing up an exclusive contract. Even if there is a need to make an exclusive contract with quality assurance in mind, it is important to consider the appropriateness of cost to ensure sustainability. Furthermore, the information must be fully shared and prior agreement reached with the executing agency concerning the content of the contract.

Kiribati

Ex-Post Evaluation of Japanese ODA Grant Aid Project

"The Project for Improvement of Fisheries-related Roads in South Tarawa"

External Evaluator: Keisuke Nishikawa

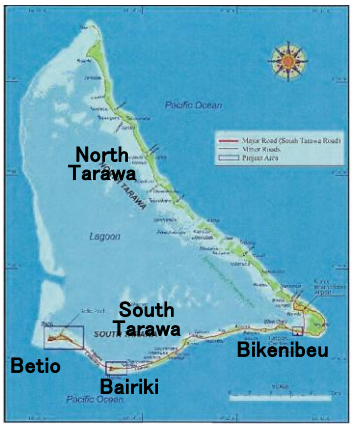
Ernst & Young Sustainability Co., Ltd.

0. Summary

This project, which facilitated smooth travel and transportation on the only arterial road in South Tarawa, was consistent with the development policy of Kiribati and also with the assistance policy of Japan. With regard to the project effects, substantial improvements were observed in terms of transportation efficiency, safety and comfort of road travel in addition to travel speed and time, achieving highly positive project effectiveness and impacts. The efficiency of the project was also high as the output, cost and the schedule were all implemented as planned. However, the output would have been more desirable, judged from the results, if some parts of the road had been completed with elaborate drainage measures and surface treatment. Also, while there were few issues in the organisational structure for operation and maintenance, budget shortages resulted in shortfalls when purchasing road materials, which meant the technical skills of the road workers were not improved accordingly. Consequently, several damaged spots were identified. Therefore, financial and technical aspects must be improved and the sustainability of the project is low.

In light of the above, this project is evaluated to be satisfactory.

1. Project Description



Project Locations

Road Section Improved in the Project

1.1 Background

South Tarawa, a political and economic centre of Kiribati, with more than half the

nation's population, had approximately 75% of households engaged in some form of fisheries-related activity in 2005, and the fisheries industry remains an important source of income. Particularly on outer islands, fisheries are managed with a view to shipping products to South Tarawa. Apart from being an important source of income, marine products constitute an important supply of animal protein and fisheries are intrinsically linked to the economy and lives of the local people.

In South Tarawa, vehicles constitute the common means of transporting both the catch and fishermen and the roads in South Tarawa play a crucial role, not only in the daily lives of the islanders and the economic activities on the island in general but also in the transportation of marine products and fishermen.

However, the roads on Tarawa are facing a number of problems, including (1) the increased traffic volume in recent years due to the population increase, (2) the growing size of vehicles, including trailers used to carry containers, due to increased imports, (3) the concentration of traffic on existing roads due to the difficulty of constructing new parallel roads, in turn, caused by the long and narrow shape of the island, (4) the severe deterioration of the roads due to aging as many roads were originally constructed in the 1960s and 1970s and (5) the lack of drainage ditches and safety facilities such as sidewalks and bus stops. These problems are now disrupting safe and smooth traffic flow.

Under these circumstances, the Government of Kiribati decided that the improvement of roads should be a key policy objective, formulated a plan to improve the roads in South Tarawa over a total length of 60 km and requested the Government of Japan to provide grant aid assistance in June 2005 to improve urban roads among those identified for improvement in South Tarawa.

1.2 Project Outline

The objective of the Project is to revitalize distribution and transportation activities in South Tarawa by improving the road conditions in Betio, Bairiki and Bikenibeu districts and providing maintenance equipment.

Grant Limit / Actual Grant Amount	1,285 million yen / 1,255 million yen
Exchange of Notes Date	24 January, 2007
Executing Agency	Ministry of Public Works and Utilities
Project Completion Date	15 February, 2008
Main Contractor	Dai Nippon Construction
Main Consultant	Construction Project Consultants, Inc.

Basic Design Study	July, 2006 – January, 2007
Related Projects	[Grant Aid] Construction of the Batio-Bairiki Causeway and Fisheries Channel (1986) [Projects by Other Organisations] <Taiwan> Project for Purchasing Heavy Equipment and Heavy Vehicles (2004) Project for Development of Feeder Roads in Betio, South Tarawa and Buota and Roads in Outer Islands (2005)

2. Outline of the Evaluation Study

2.1 External Evaluator

Keisuke Nishikawa, Ernst & Young Sustainability Co., Ltd.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted in the following timeline.

Period of the Study: October 2011 – October 2012

Period of the Field Study: 3 – 21 May, 2012

2.3 Constraints during the Evaluation Study

As it was difficult to obtain highly-reliable and consistent data to capture annual changes, a quantitative evaluation using traffic-related data such as traffic volume, vehicle registrations and the number of minibus passengers could not be conducted sufficiently.

3. Results of the Evaluation (Overall Rating: B[1])

3.1 Relevance (Rating:③[2])

3.1.1 Relevance with the Development Plan of Kiribati

The "10th National Development Strategies (2004-2007)", a development policy in place when planning this project, primarily emphasized the development, improvement and expansion of social infrastructure to 'strengthen the basis for a self-reliant economy and economic development' and included six main strategic areas such as 'economic development'. In the strategy, it was stated that the development of the

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[2] ③: High, ②: Fair, ①: Low

fisheries industry and the improvement of infrastructure for that purpose would be crucial for economic development. The theme of the subsequently formulated "Kiribati Development Plan 2008-2011" was 'Enhancing economic growth for sustainable development' with six Key Policy Areas (KPAs). One of the KPAs was 'Economic Development' and a strategy to develop and improve economic infrastructure was specified as part of the initiative. Also in the latest development policy "Kiribati Development Plan 2012-2015" approved by the Cabinet on 25 April, 2012, Infrastructure is listed as one of the KPAs under the same development theme as the previous plan. Road improvements are another strategy encompassed in this KPA, and the importance of properly maintained infrastructure facilities is also clearly stated in the plan.

While no sector strategies for road and fisheries are formulated in Kiribati, according to the Ministry of Public Works and Utilities (MPWU) and the Ministry of Fisheries & Marine Resources Development (MFMRD), infrastructure facilities such as roads have been playing a crucial role toward economic growth, poverty reduction, trade promotion and industrial development.

Based on the above, it can be concluded that this project, which supported the development of road infrastructure to achieve economic growth, has been consistent with the development policy and measures of Kiribati both during the planning and ex-post evaluation.

3.1.2 Relevance with the Development Needs of Kiribati

The fisheries sector of Kiribati is closely linked to the life of the nation's economy and its people. The proportion of the households engaged in some form of fishing activities in South Tarawa was 57% in 2006, and it was said that every I-Kiribati consumed 50 – 78 kg[3] of fish every year. Vehicles were used to transport these catches and also fishermen, but issues such as increased traffic volume, larger vehicles, the lack of alternative roads, road damage due to aging, and the lack of road safety equipment and drainage in South Tarawa have been highlighted as impediments to smooth and safe traffic flows. In particular, roads in the commercial and port area of Betio and the administrative district of Bairiki were crucial for the socioeconomic activities of the country.

At the time of ex-post evaluation, the same level (58%) of households in South Tarawa was engaged in fisheries-related activities in lagoons and reefs (2010 Census), and a general increase in the consumption level was observed in the 2011 MFMRD

[3] According to FAO's data in 2009, the amount of marine product consumption by I-Kiribati is 72.4kg per person, the third largest in the world. (Source: Ministry of Agriculture, Forestry and Fisheries of Japan, http://www.maff.go.jp/j/syouan/tikusui/gyokai/g_kenko/tokucyo/index.html)

Survey, revealing the average resident in Betio consumed 83.7kg of marine products a year, reflecting the importance of the fisheries sector. With regard to the significance of roads, as the general public normally purchases fish on their local roads, it is very important for the fisheries sector, not only for transportation but also as a trading venue. Based on interviews with medical institutions, educational institutions, Ports Authority, Central Pacific Producers and minibus operators as well as the executing agency and related government ministries, it also emerged that the importance of project roads represented by South Tarawa Road was constantly high.

3.1.3 Relevance with Japan's ODA Policy

Based on the five priority policy targets (Economic growth, Sustainable development, Good governance, Security, People to people communication and exchange) Japan expressed at the Fourth Pacific Islands Leaders' Meeting (May 2006), Japan stipulated a policy to provide assistance to Kiribati, one of the Less Developed Countries (LDCs), strategically and in line with the development strategy of the Kiribati government. Among all targets, the focuses were placed on economic growth, sustainable development and good governance, and the scope of 'economic growth' encompassed cooperation in infrastructure and fisheries sector development. Also, in light of the scattered locations of the islands and the distance from overseas markets, Japan had a clear policy to provide assistance to develop marine resources in a vast economic zone for the country's economic development.

Based on the above, this project relates both to the development of infrastructure and the fisheries sector, and contributes to the sustenance and development of Kiribati's economy and society, demonstrating high consistency with Japan's aid policy.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Effectiveness[4] (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

At the time of project planning, the expected effects of this project were the faster travel speed and consequent reduction in travel time. In this section, changes in the number of traffic accidents and offenses, as well as the traffic volume will also be briefly examined, in addition to the indicators expected as project effects.

3.2.1.1 Changes in Travel Speed

[4] The evaluation result of the project impacts is incorporated into the Effectiveness rating.

When this project was planned, the speed on open roads was 25km/h and it was expected that this speed would increase to the legal limit of 40km/h after the project implementation. In this ex-post evaluation study, the speed was measured in the section in Betio, which had been improved in this project. The result showed that travelling at 40km/h was possible without problem, apart from intersections and speed bumps. Just for reference, the speed over the entire 6.5km section of South Tarawa Road in Betio, from Dai Nippon Primary School to MTC Intersection, was recorded several times, revealing an average speed of 30.9km/h. As stated later, several areas of the road were heavily damaged, which slowed traffic down, but in all other sections of the road, 40km/h was possible. Therefore, the effect of the project can be said to have been achieved in this regard.

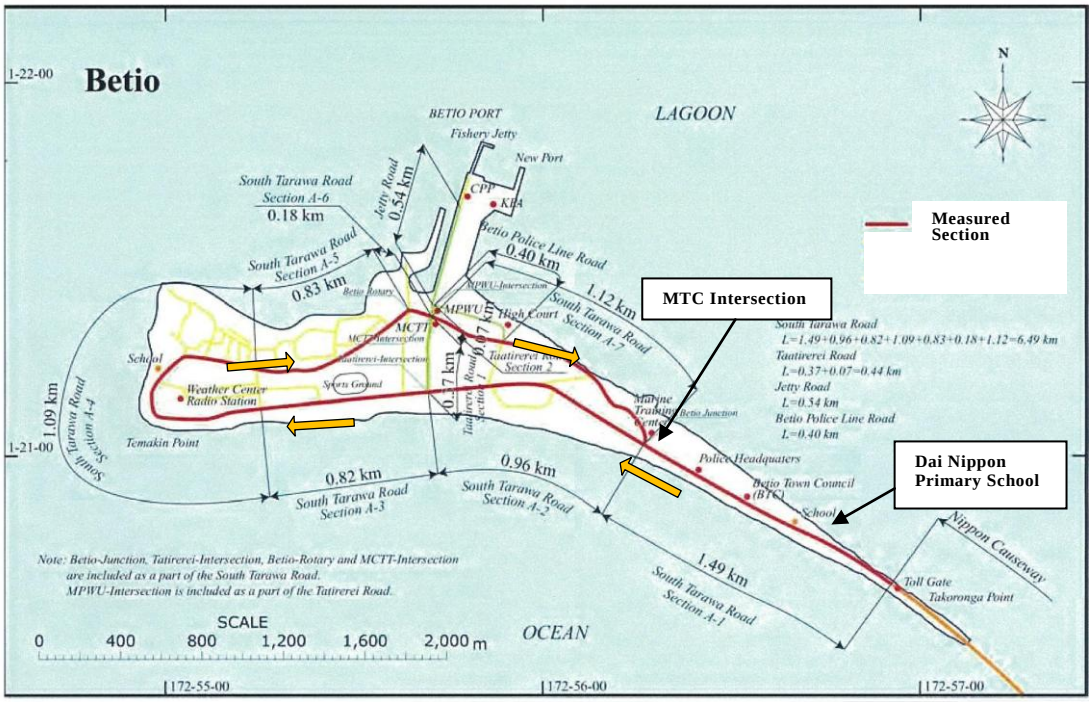


Figure 1: Improved Road in Betio and the Section where the Speed was Measured

3.2.1.2 Shorter Travel Time

Most of the road sections improved in this project were in Betio and Bairiki districts, linked by the 'Nippon Causeway', constructed with Japanese assistance.

A simplified beneficiary survey[5], conducted to capture the travel time of a 6.6km section between the centres of Betio and Bairiki revealed a reduction in the average time required from 21 minutes before the project to 13 minutes after its

[5] The simplified beneficiary survey was conducted during the field survey of the external evaluator in May 2012 by interviewing 20 people at schools, hospitals, shops and roadside stalls in Betio and Bairiki. These individuals were asked about the travel time, comfort, road safety, etc.

implementation.

A section between Betio and Bairiki includes the Nippon Causeway (3.3km), excluded from upgrading in this project and the conditions of which have remained unchanged. Therefore, the shorter travel time can be attributed to the improvement in Betio and Bairiki. The actual travel time was measured during the field visit using a sedan car, and the result was just over 10 minutes. Considering the fact that many respondents were users of minibuses requiring more time, the average travel time provided by the respondents was considered adequate.

3.2.1.3 Change in the Number of Traffic Accidents and Offenses

At the time of planning, it was expected that road safety would be enhanced and total accidents would decrease as there would be no vehicles running on hard shoulders after the implementation of this project.

After the project, few vehicles actually ran on the hard shoulders and pedestrian safety improved. It has also become safer for drivers, since hazards on the road surface, such as potholes, substantially decreased. In the simplified beneficiary survey, 70% of respondents answered that the roads had become 'much safer' and the remaining 30% said 'safer', citing the expansion of the effective road width and the installation of footpaths as the main factors.

However, no quantitative changes were observed in the number of traffic accidents and offenses in Bairiki and Betio, the districts improved in this project, with these figures fluctuating since the completion of the project in 2008, as shown in Table 1. Changes in total accidents and offenses before and after the project are also unclear as the police did not record such data prior to 2007, while the actual number of fatal accidents is 0-2 cases per year and the number of injuries is also 0-3 cases per year, reflecting the small absolute population size.

Thus, while the accident data do not clearly demonstrate changes in road safety, the results of the simplified beneficiary survey can be deemed as indicating a general improvement in safety.

Table 1: Number of Traffic Accidents and Offenses in Betio and Bairiki

	Betio				Bairiki			
	2008	2009	2010	2011	2008	2009	2010	2011
Death	1		2		1		1	2
Injury	1	2	1			2	3	1
Reckless Driving	9	8	6	2	6	5	11	3
Drink Driving	46	25	30	71	12	9	12	14
Careless Driving	94	73	64	62	47	82	56	40
Total	151	108	103	135	66	98	83	60

Source: Data provided by the Kiribati Police

3.2.1.4 Change in Traffic Volume

As the MPWU has not conducted any traffic censuses recently, the traffic volume data were obtained using the tariff collection data at the Nippon Causeway toll booth located at the eastern end of Betio (Tolls are collected only when entering Betio, which means that the actual volume is twice as large). The results are shown in Table 2.

Table 2: Traffic Volume at the Nippon Causeway Toll Booth

(Unit: Number of Vehicles)

	2008	2010
Motorbike	54,962	123,211
Saloon	357,627	200,319
Minibus	31,584	45,306
Truck	240,377	211,337
Total	684,820	580,173

Source: Data provided by MPWU
Note: The actual traffic volume exceeds these figures as some vehicles, e.g. government-owned, are exempt from toll payment. The data in the table above are the results of aggregating all the raw data available, but only 2008 and 2010 had such figures. Also, these figures are not necessarily correct due to an issue in the collection system.

According to the Nippon Causeway toll collection data of 29 July, 2006, obtained during the basic design study of this project, 1,975 vehicles went through the booth (one-way) in 24 hours, which can be simply translated into an estimated annual volume of 600,000 – 800,000 vehicles[6]. While the reliability of the data is low, approximately 600,000 vehicles (1.2 million both ways) run between Betio and Bairiki, and the project road has been underpinning traffic demand in both districts.

3.2.2 Qualitative Effects

The following qualitative effects were expected at the time of project planning:

(1) Travelling costs will fall due to reduced abrasion and tire damage and lower fuel costs.
(2) The transportation efficiency of goods such as fishing gear and marine products will be improved between the western part (Betio) and the eastern part of South Tarawa.

With regard to (1), no truck or bus owners had sufficient data on the maintenance

[6] The annual volume is estimated by the evaluator.

cost of their vehicles, but they commented that they saw the benefits of road improvement in terms of reduced tire abrasion, less frequent replacement of vehicle parts, and less burdens on the suspension and chassis of their vehicles. In other words, despite a lack of quantitative data, it can be assumed that the improvement of road surfaces has helped reduce the costs of vehicle maintenance and fuel due to the increased speed of travel.

As for the second qualitative effects, a shorter travel time between Betio and Bairiki was achieved as shown in "3.2.1.2 Shorter Travel Time" and all the respondents in the simplified beneficiary survey commented that traffic flow had become smoother. Also, there were some forwarders operating their lorries only between Betio and Bairiki due to the good road conditions, but no further east than Bairiki, due to the poor road conditions, which could damage their vehicles. Therefore, the efficiency of transportation between Betio and other districts can be seen only between Betio and Bairiki in terms of the improvement of road surfaces and the reduction in the time required. Improvements to road sections from the east of Bairiki to the eastern end of South Tarawa are planned in detail by the World Bank (WB), Asian Development Bank (ADB) and so on, and it is anticipated that construction will commence in late 2012 or early 2013. Once the road conditions of this section are improved, the transportation efficiency of goods and marine products between Betio and the eastern area is expected to be even higher.

Other qualitative effects of road improvement include improved travel comfort on the roads. In the simplified beneficiary survey, 75% of respondents replied that the comfort had 'Improved a lot' while 25% stated 'Improved', representing a high level of satisfaction among road users. In particular, the improved road sections in Betio and Bairiki were key in ensuring stable operations and facilitating the travel of minibuses, the only public transport in South Tarawa. However, as the road conditions east of Bairiki remain poor, the effects of this project have not fully reached those districts. When the project to be assisted by the WB and ADB, etc. is completed several years later, travel comfort on the roads should be felt throughout South Tarawa.

3.3 Impact

3.3.1 Intended Impacts

Indirect effects of this project expected at the time of planning were:

- Transportation of marine products will become more efficient allowing freshness to be retained
- Value will be maintained as dust and water will not be splashed on fish sold on

the roadside

- Two areas – a commercial area in the west (Betio) and a fisheries area in the east – will be connected

The following was the situation observed based on the stated indirect effects.

Betio has a port where cargoes and frozen/fresh fish are handled, and it was observed that the project road had been contributing in terms of stable transportation as a means of transporting goods and marine products from here to other districts of South Tarawa. In the simplified beneficiary survey, many positive comments were heard, stating that not only the fisheries industry but also the transportation services in general had improved. Also, the Central Pacific Producers (CPP), a government-owned seafood company, transports frozen fish to various locations in South Tarawa. Presumably, the efficiency of transporting frozen fish to their destinations has improved based on the reductions in time achieved.

The interview survey with the roadside fish sellers in Betio and Bairiki revealed that although the price of fish remained unchanged, the freshness was better retained as the fish were not heavily rocked while in transit. However, the method of preservation also remained unchanged, namely keeping the fish in cold boxes and selling them along the road, meaning the road improvement seems to have had little impact on efforts of roadside sellers to preserve freshness. Furthermore, in terms of preventing any decline in the value of fish sold on the roadside, no real impact of dust and water were seen even before the project, apart from some fresh fish sold on tables along the road. Positive effects were instead noticed in terms of the slight improvement in the selling environment, as the sellers could now avoid splashes of water during the rainy season.

With regard to the third indirect effect, the nature of the relationship between the industries in the west and east remained unclear. Under the current status where the road was developed only up to Bairiki, the ‘connection of the two areas’ was not really observed. Nevertheless, the eastern area has a fish farm near the airport as well as the largest hospital in Kiribati, and this project can be said to partially contribute to the stable transportation of marine products and other commodities.

3.3.2 Other Impacts

3.3.2.1 Impacts on the Natural Environment

As the components of this project involved rehabilitating existing roads and few environmental effects were expected, it was not deemed necessary to undergo an approval and licensing procedure as specified under environmental law. In fact, the aggregate (coral aggregates) needed to construct the roads was obtained from a

dredged waterway and the area designated by the Ministry of Environment, and no major problems were identified during and after the construction. According to the executing agency, waste materials from the construction were taken to the designated landfills and the surplus soil (aggregate) was utilised for operation and maintenance purposes, leaving no major environmental impacts either during or after the project implementation.

Conversely, coordination with the roadside residents was not necessarily sufficient in all sections of the road. Some sections of the improved road saw drainage become problematic after rain was spotted and the puddles remained there for a long time. This has caused bog moss to grow, which impairs the living environment. Improvements to these sections are expected in the project to be assisted by the WB and ADB, etc., in which repairs are scheduled for some of the problematic sections identified after the implementation of this project.

3.3.2.2 Land Acquisition and Resettlement

No resettlements and/or land acquisitions were planned as all the sections of the project roads were to be repaired within the areas of existing roads. It was confirmed that the alignments of the existing roads remained the same. There was no expansion of existing roads, nor did any resettlements or land acquisitions take place.

While not all the indirect effects of this project have obviously emerged, some improvements have been observed and it is hoped that the improvement of the rest of South Tarawa Road will generate further positive effects and impacts. No environmentally negative impacts were observed apart from some drainage issues during and after the project implementation, and there were no resettlements or land acquisitions. Therefore, this project was considered as making a certain of contribution, even in terms of an indirect effect.

This project has largely achieved its objectives, therefore its effectiveness and impact is high.

3.4 Efficiency (Rating: ③)

3.4.1 Project Outputs

This project was designed to rehabilitate the roads in Betio and Bairiki, and a section in front of the Tungaru Hospital in Bikenibeu. It was also intended to provide two concrete cutters needed for maintenance purposes.

Table 3 compares the planned and actual outputs, showing that all the road sections were improved as planned.

Table 3: Comparison of Planned and Actual Outputs (Road Repair)

District	Road Section	Length (km)	
		Plan	Actual
Betio	South Tarawa Road	6.491	6.491
	Jetty Road	0.535	0.535
	Taatirerei Road	0.436	0.436
	Police Line Road	0.398	0.398
Bairiki	South Tarawa Road	1.460	1.460
	Frontage Road	0.124	0.124
	Tabonikabaurea Road	0.270	0.270
	TAP Road	0.155	0.155
	Bairiki Wharf Road	0.482	0.482
Bikenibeu	South Tarawa Road	0.280	0.280
Total		10.631	10.631

Various documents and materials related to this project were referred to and interviews with the executing agency and the project consultant confirmed that road improvement had been implemented for the entire length of the road as planned, as shown in the table above. It was also confirmed that the two concrete cutters and the spare parts were provided as scheduled (Photo 1).

The Kiribati government was to implement the following components as part of the project:

- To secure a section of land necessary for construction materials, such as a stockyard
- To secure a disposal site for the waste and residual soil generated by the construction activities
- To relocate any buried public utilities crossing the road (telephone lines, electricity lines, etc.)
- To relocate any obstacles on the footpaths
- To install infiltration inlets

Photo 1: Two Concrete Cutters Provided in the Project

According to the information from the then-Project Director (Kiribati (MPWU) side), all the components above were implemented.

While the road was developed as planned, however, two locations where drainage was insufficient did not have any drainage facilities installed, as the existing road alignment and gradient were not scheduled for substantial change. As the land was flat, it is presumed that sloping work to secure sufficient drainage would be difficult, but the road surface was gradually damaged by rain after the completion of this project. The result shows the need to install drainage facilities at those locations. According to the executing agency, it was expected in the original plan that the rain water would flow through the land of roadside residents at those places, but the residents embanked the areas adjacent to the roads to block the rain water from flowing into their land, which eventually saw it retained at the edges of the road.

In Bairiki, all road sections apart from South Tarawa Road had their surfaces treated with SBST (Single Bitumen Surface Treatment) as planned. These surfaces were thin and heavily damaged, as the water was prone to drop from the trees above and was difficult to dry up. The traffic volume on Frontage Road was also considerable due to its central location in Bairiki. Judging from the results, it seems to have been more desirable to have these road sections finished with a more durable construction method, instead of SBST.

However, the locations where measures were considered insufficient only comprised approximately 5% of the entire sections improved under this project, which can be deemed low.

3.4.2 Project Inputs

3.4.2.1 Project Cost

The project cost to be borne by Japan was set at 1,285 million yen and the actual project cost totaled 1,255 million yen, 97.7% of the original plan. The total project cost, including contributions of 2.68 million yen from Kiribati, was planned to be 1,288 million yen, but the overall project costs could not be compared as the actual disbursement record of the Kiribati government was not available. However, it is inferred that the planned amount was disbursed as a portion to be met by the Kiribati side and implemented as described above.

3.4.2.2 Project Period

The scheduled project period[7] was 14 months, including a period of 4.5 months for detailed design and tendering processes. The actual period was 12 months (February, 2007 – February, 2008), shorter than the original plan.

[7] The project period can be defined as a “Detailed Design + Construction” period.

Both the project cost and project period were within the plan, therefore efficiency of the project is high.

3.5 Sustainability (Rating: ①)

3.5.1 Structural Aspects of Operation and Maintenance

The executing agency of this project was the MPWU (Ministry of Public Works and Utilities) and the unit in charge was CES (Civil Engineering Section), with 38 staff members responsible for the maintenance of roads, causeways and the airport runway. At the time of ex-post evaluation, the role of CES and its number of staff (number of positions) remained unchanged and the same structure was maintained. However, the executing agency felt that the number of staff was insufficient for the operation and maintenance required, hence part of the road maintenance work (relatively highly-skilled repair work) was delegated to a private sector company comprising ex-engineers of MPWU since May 2012.

While CES lacks a systematic road maintenance plan, annual work plans are usually prepared, based on which the budget is secured every year. However, in the sections of South Tarawa Road excluded from this project, maintenance activities are reactive as the road is old, has problems with drainage, and requires a series of emergency repairs.

With regard to road maintenance equipment, the site office in Betio was responsible for repairs, showing that the repair work had not been delegated to PVU (Plant and Vehicle Unit), though this was considered at the time of project planning. Some of the repairs of larger equipment have been outsourced to the private sector since 2012. It is assumed that there are no issues from the structural aspect relating to repair work as all the equipment provided in this project and the subsequent follow-up cooperation remain in working order.

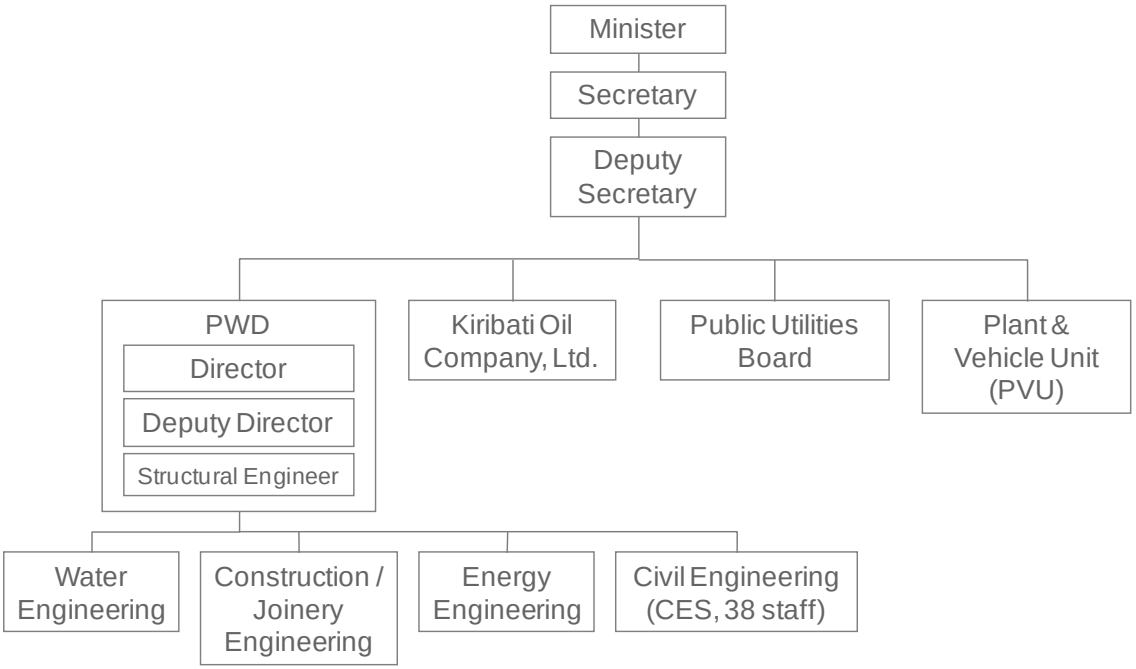


Figure 2: Organisational Chart of the Ministry of Public Works and Utilities

3.5.2 Technical Aspects of Operation and Maintenance

At the time of project planning, it was judged that the staff of CES had achieved a sufficient technical level necessary to maintain the project road as they had acquired experience and technical skills through a number of foreign aid projects. At the time of ex-post evaluation, the executing agency recognises that there are no technical issues as the staff has a certain level of fundamental knowledge on road maintenance as well as several civil engineering degree holders as new staff members after 2008.

However, the reality is that those technical skills and knowledge are neither sufficiently utilised in actual on-site maintenance work nor backed by ample practical experience. One of the main reasons for the difficulties in applying this knowledge in an actual setting is not only the lack of technical accumulation but also the lack of a budget for material procurement and the difficulties they face in obtaining such materials. No effective measures seem to have been taken to solve these problems.

According to the executing agency, there are no systematic training courses in place to raise the technical skills of their engineering staff, which means that everything relies on the technical skills improved through the limited accumulation of on-site experience.

3.5.3 Financial Aspects of Operation and Maintenance

The CES budget has remained at around 600,000 Australian dollars on average throughout the 2000s, and the budget for 2006, when the basic design study of this

project was conducted, was 666,000 Australian dollars. This budget includes the costs of improving not only roads but also seawalls and airport runways. The "Local Purchases" includes the employment cost of temporary staff for road maintenance.

Table 4: Budget of CES

(Unit: Australian Dollars)

Item	2006	2007	2008	2009	2010	2011
Salaries etc.	262,806	279,384	287,439	295,081	282,685	311,256
Transport & Travel	68,450	46,813	42,205	60,589	45,000	40,000
Local Purchases	66,190	76,208	60,000	65,000	60,000	40,500
Overseas Purchases	168,460	161,830	150,118	87,000	75,000	43,000
Local Services	35,345	18,790	30,000	49,000	30,000	15,000
Hire of Plant & Equipment	58,392	22,161	58,600	58,600	29,800	29,800
Telecommunications / Electricity and Gas	6,250	10,710	8,500	32,000	20,000	20,000
Other	-	-	-	2,000	1,000	1,000
Total	**665,893**	**615,896**	**637,862**	**649,270**	**543,485**	**500,556**
Budget of MPWU	**2,825,841**	**2,727,204**	**2,748,732**	**2,811,910**	**2,483,843**	**2,473,272**
Proportion of CES Budget (%)	23.6	22.6	23.2	23.1	21.9	20.2

Source: Budget for Each Year (Ministry of Finance and Economic Development)

Between 2006 and 2011, the overall budget has been declining in general. As the relatively large amounts of "Overseas Purchases" for 2006 – 2008 are due to purchases of heavy equipment, this figure decreased substantially in 2009.

While the salaries show signs of growth, many other budget items have recorded declines, leading to insufficient maintenance of infrastructure facilities such as roads. In particular, the insufficient allocation of Local / Overseas Purchases and Local Services has been a key factor explaining the difficulties in actual repair work, while the executing agency themselves have recognised the lack of budget as the cause of maintenance issues in a number of respects. However, given the difficulty in securing the budget, no effective solutions have been found, despite acknowledgement of the importance of maintenance. The overall budget for MPWU has also been declining recently.

The Nippon Causeway remains the only toll road in Kiribati, and the tolls collected here are all transferred to the Nippon Causeway Fund Account, used exclusively to maintain the causeway. Therefore, all the costs of maintaining the road sections covered in this project are allocated from the general CES budget. However, the maintenance cost specialised for the project road remained unclear as the budget had not been divided by road sections. Also, the maintenance cost for machinery such as concrete cutters was also unclear, as it was not separated from the overall budget.

3.5.4 Current Status of Operation and Maintenance

3.5.4.1 Conditions of Road Surfaces

Table 5 shows the main damage and problems affecting all the road sections improved in this project, as identified by actual observations of the ex-post evaluation.

Table 5: Damage to the Project Road Identified in the Ex-Post Evaluation

Road Section	Damages
[Betio]	
South Tarawa Road	Generally in good condition. Heavy damage at MCTT Intersection and in front of Moel Supermarket. Prone to puddles at the intersection with Police Line Road.
Jetty Road	Pavement at the northern end of the Road broken away due to the passage of heavy vehicles.
Taatirerei Road	Sand piled up and pavement broken away at a section of poor drainage.
Police Line Road	Some potholes and poor drainage spots.
[Bairiki]	
South Tarawa Road	Generally in good condition. Some fallen gutter lids. Sand and rubbish identified and piled on the road edges. Some potholes and drainage problems seen near bus stops.
Frontage Road	Deteriorating in general and a number of potholes identified. Drainage problem on one side of the road.
Tabonikabaurea Road	Surface conditions under the tree deteriorating, and a number of potholes observed.
TAP Road	Sections with poor drainage had potholes over a relatively large area.
Bairiki Wharf Road	Generally good, but some potholes identified near the Government building.
[Bikenibeu]	
South Tarawa Road	Heavily damaged at the entrance to the hospital and in front of the bus stop. Sand also piled up on the roadsides.

Note: The sections apart from the problematic spots shown above are generally in good condition.

The initial decline in these road surfaces was due to the heavy rain in South Tarawa from the end of 2009 till the beginning of 2010. The average annual precipitation of Kiribati is around 2,000mm and the annual rainfall in 2008 was only 927mm. It was 2,565mm in 2009 and 2,025 in 2010, hence relatively low in these years as well. However, the month of December in 2009 recorded 555mm in just one month, with another 486mm recorded in January 2010 at the Betio Observation Station. This was equivalent to half a year's rainfall in just two months, causing the rainwater to remain on the road for an extended period.

Given that only four years have passed since the project was completed, the damage can be considered heavy at some points. This damage has been exacerbated by the multiple factors such as:

- Surface damage due to stagnant water seen on poorly drained roads (Taatirerei Road and the intersection of South Tarawa and Police Line Roads)
- Insufficient cleaning of hard shoulders, gutters and infiltration inlets
- Slow passage of heavy vehicles (e.g. at MCTT Intersection)
- Further damage while damaged spots remain unrepaired

Besides these factors, there are very significant burdens on the road surface given the lack of regulations defining the weight limit of vehicles in Kiribati.

With regard to the drainage problem, insufficient road gradient and a lack of gutters are the main factors. The embankment erected by roadside residents to block the water flowing from the road into their own land has aggravated the poor drainage. It was deemed desirable to explore the potential for drainage via gutters in more detail, given the difficulty in expanding the existing road width.

As stated above, a road development project supported by the WB and ADB, etc. will be commencing soon. In this project, some repairs to the spots and sections damaged after JICA's project was completed, namely, seven spots in Betio and two spots in Bairiki, have been proposed in its planning stage.

3.5.4.2 Maintenance Work

Maintenance work on the road is undertaken by the CES workers. The method of maintenance observed during the field survey in the non-project sections (heavily damaged) simply involved throwing coral stones or sand mixed with some cement into the potholes from the truck. Consequently, those materials disappear after the rain, and the road reverts to its original condition. The road in general, including the project road, is sometimes also repaired with cement and/or bitumen, but they also tend to break off, since the height of the repaired spots only comes up to the same level as the existing road and to exactly the same size as the damaged spots. Therefore, repair work is always carried out somewhere (regardless of whether a project or non-project road) as many spots must be repaired, instead of systematically implementing routine maintenance work.

It was seen that road maintenance workers had basic knowledge on how roads should be repaired, but because most of the materials supplied to them were as described above, all they can do in reality is conduct temporary emergency repairs.

One of the main factors explaining these insufficiencies in road maintenance works was, as stated, the budget shortfall, hampering the purchase of appropriate materials from overseas. The aggregate also contains salt as it is taken from the sea, weakening and reducing the lifetime of the repaired spots.

Spare parts and consumables are procured through a domestic supplier and no

problems were seen in this respect. The concrete cutter, provided under this project, was used only when relatively large repair works were conducted.

Some equipment such as a concrete mixer was provided in 2011 under Japan's Follow-up Cooperation scheme to facilitate the maintenance work. According to the executing agency, while the mixer was of the dimensions requested by the Ministry, it turned out to be too small to conduct sufficient road maintenance work, and had never been used for a year after the provision. In reaction to this situation, JICA explained again that the concrete mixer was to be used in conjunction with other machines for the maintenance of smaller roads, and requested the executing agency to use the mixer adequately.

Photo 2: Project Road with the Surface Broken Away (Taatirerei Road)

Photo 3: Road Maintenance Work (Non-Project Section)

Major problems have been observed in terms of technical and financial aspects, therefore sustainability of the project effect is low.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project, which facilitated smooth travel and transportation on the only arterial road in South Tarawa, was consistent with the development policy of Kiribati and also with the assistance policy of Japan. With regard to the project effects, substantial improvements were observed in terms of transportation efficiency, safety and comfort of road travel in addition to travel speed and time, achieving highly positive project effectiveness and impacts. The efficiency of the project was also high as the output, cost and the schedule were all implemented as planned. However, the output would have been more desirable, judged from the results, if some parts of the road had been completed with elaborate drainage measures and surface treatment. Also, while there were few issues

in the organisational structure for operation and maintenance, budget shortages resulted in shortfalls when purchasing road materials, which meant the technical skills of the road workers were not improved accordingly. Consequently, several damaged spots were identified. Therefore, financial and technical aspects must be improved and the sustainability of the project is low.

In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

4.2.1.1 Collection of Basic Data

This ex-post evaluation study encountered considerable difficulty in collecting reliable data such as the traffic volume, vehicle registration, minibus passenger number, and so on. It is essential to keep fundamental data consistently so that the traffic conditions and the impact on the road can be determined. In addition, in the interests of preparing a road maintenance plan and implementing efficient maintenance work, regular recording and indexing of the surface conditions, at least of the arterial road of South Tarawa Road, will be important.

4.2.1.2 Development of a Preventive Maintenance Plan

While an annual action plan on road maintenance is prepared by CES, the actual maintenance work primarily concerns emergency repairs of damage to road sections excluded from this project. As the Kiribati Road Rehabilitation Project (KRRP) is to be implemented in 2013 with assistance from the WB and ADB, etc., the necessity for these emergency repairs will be substantially reduced. In parallel, therefore, the necessary budget must be secured to prepare a preventive maintenance plan for entire sections of South Tarawa Road, and maintenance activities conducted in accordance with the same. Only steady implementation can reduce the long-term maintenance cost and keep the road surface in good condition.

Another cause of damage, in addition to the problems of road structure and insufficient road maintenance, was the use of heavy vehicles. In this ex-post evaluation study, it has been revealed that Kiribati lacks any regulations or institutions to restrict overloaded vehicles. As the ground is not necessarily strong enough to support the road base, appropriate measures to limit the maximum load are thought to help prevent unexpected deterioration and extend the life of the road.

4.2.1.3 Stable Allocation of Maintenance Budget

Among the project roads, South Tarawa Road is an arterial road regarded as the

key road for the economy and society of Kiribati, meaning its intensive maintenance is significant. While the current key maintenance issue is the lack of budget, the maintenance of Nippon Causeway is financially covered by the tariff and has been effective to some extent. In light of the importance of South Tarawa Road, some form of budgeting framework will be important to prevent the deterioration of its road surface. For example, a road maintenance fund may be established, where part of the petrol tax from road users will be contributed for the purpose of maintenance.

4.2.2 Recommendations to JICA

The road section east of Bairiki will soon be improved with assistance from the WB and ADB, etc. As the damaged spots and sections in JICA's project area may also be improved under this project, it is important to monitor its progress and provide relevant information to them accordingly.

4.3 Lessons Learned

One of the characteristics of the sections in the project area heavily damaged upon completion of the project was the damage caused by water drops from trees on feeder roads, where the surface was treated with SBST. No such damage was seen on the DBST sections. On an atoll with flat land such as South Tarawa, it is difficult to include slopes when designing the road, which makes it prone to poor drainage.

Under these circumstances, in an atoll nation with weak ground and hot and humid weather, as well as the harsh impact of salt from the sea and heavy rain, it may be desirable to ensure roads are made strong enough with the DBST, to the extent possible, over their entire sections. Also, it is important for the executing agency and donors to collaborate with each other, more than in any other countries, to design drainage and determine other necessary facilities when improving the road.

Palau

Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for the Rehabilitation of Arterial Roads in the Metropolitan Area"

External Evaluator: Akemi Shimura

Ernst & Young Sustainability Co., Ltd.

0. Summary

The objective of the project was to secure smooth and safe traffic flows in the capital area of Palau through the improvement of the arterial roads in Koror and Airai state. The project is regarded as being relevant because it is consistent with Palau's development plan and Japan's ODA policy and the development need for it has been continuously high. Although the improvement of the average speed remained at a lower level than expected at the time of the ex-ante evaluation, the smoothness and safety of the traffic on the arterial roads was improved due to the rehabilitation of the road. The improvement of accessibility to social services by local residents and tourists and of the stability of transportation has been recognized. Therefore, the effectiveness of the project is fair. The outputs and the project cost were as planned, however the project period was slightly longer than the plan. Thus the efficiency of the project is regarded as fair. There are some concerns about the maintenance activities since some problems were observed with respect to the technical aspects, financial aspects, and the current condition of maintenance, although the manpower shortage can be solved.

In light of the above, this project is evaluated to be partially satisfactory.

1. Project Description

Project Location

The Arterial Road after its rehabilitation

(Section A: Downtown Koror)

1.1 Background

The arterial roads consisted of the causeways, which were improved in 2006 under a Japanese Grant Aid Program, and roads on Koror Island and other neighbouring islands, and the total length of road was about 17 km. The arterial road are the most important road in Palau because they connect

Koror Island where many social and business facilities are concentrated, Babeldaob Island with the only international airport in Palau and a new capital under construction, Malakal Island with an international port, etc. However, the condition of the roads was seriously deteriorated since no large-scale maintenance work had been carried out since 1993. Accompanying the increase in traffic at about 8% annually, partially due to the rapid increase in licensed drivers, the serious deterioration of the pavement had caused drivers to travel slowly. As a result, severe traffic congestion occurred frequently and traffic safety on the road was compromised. At the same time, the maintenance budget was not sufficient to fund large-scale road improvements or road construction since the funds had been used for routine road repair maintenance work. The deterioration of the pavement became more serious every year and traffic disturbance in downtown Koror worsened due to potholes[1] and large puddles after rainfall.

In addition, the sections of the road under this project became more important for development and government activities due to the relocation of the capital from Koror Island to Babeldaob Island.

1.2 Project Outline

The objective of this project is to secure safe and smooth transportation activity in Palau Metropolitan Area by improving parts of the arterial roads in Koror and Airai area.

Grant Limit / Actual Grant Amount	1,405 million yen / 1,405 million yen
Grant Agreement Date	May 2007
Implementing Agency	Ministry of Public Infrastructure, Industries and Commerce (MPIIC, formerly Ministry of Resources and Development)
Project Completion Date	February 2009
Main Contractor	Nishimatsu Construction
Main Consultant	CTI Engineering International
Basic Design	"Basic Design Study on the Project for the Improvement of Urban and Rural Roads in Koror and Airai States" CTI Engineering International, November 2006
Detailed Design	February - June 2007
Related Projects (if any)	[Grant Aid] The Project for Road Improvement (1987) The Project for Construction of a New Koror-Babeldaob Bridge (1998 - 2001) The Project of Improvement of Interisland Access

[1] Potholes are shallow holes in the surface of an asphalt pavement due to wear or weathering.

	Road (2004 - 2006)

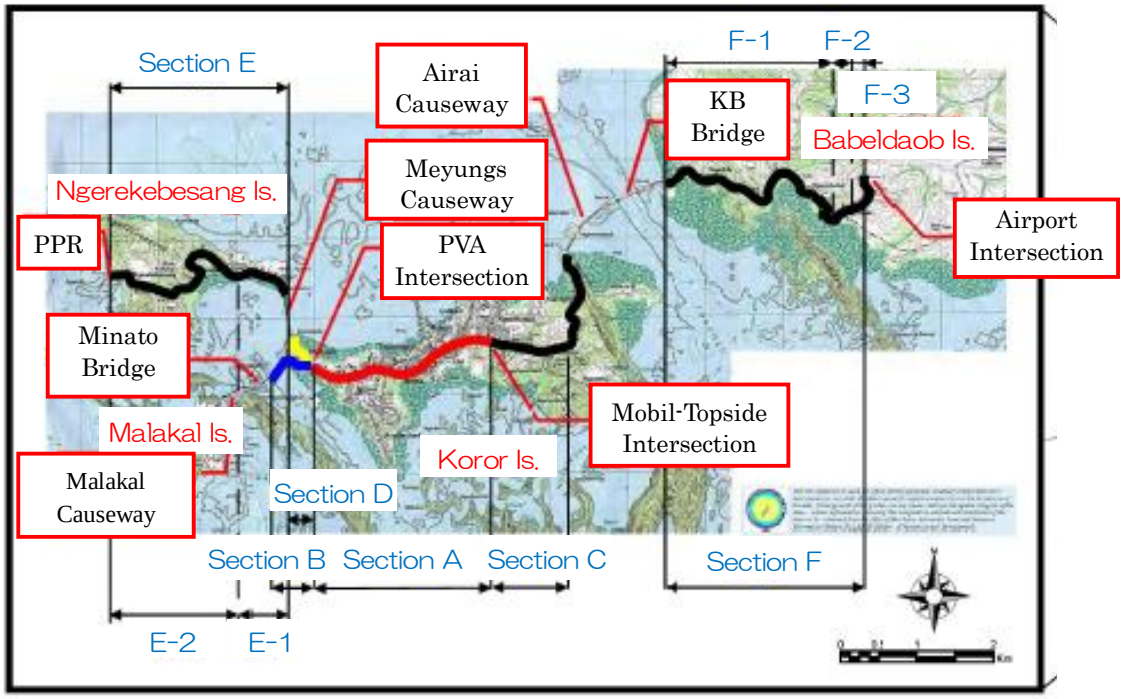


Figure 1 Project Location Map[2]

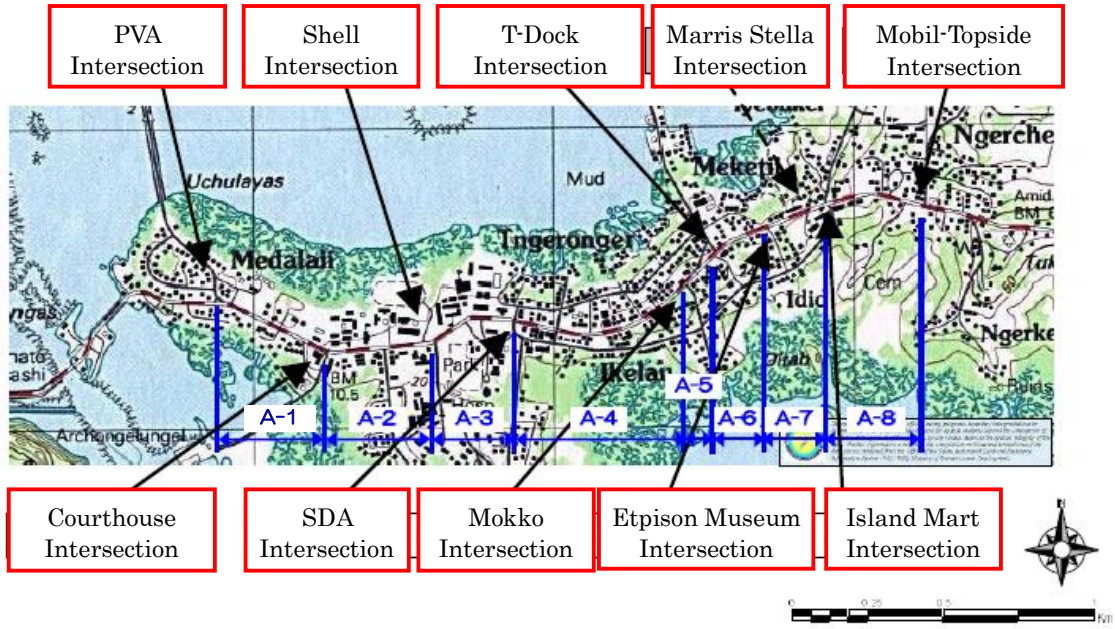


Figure 2 Location of the Major Intersections

[2] Section F-2 is excluded from the project site.

2. Outline of the Evaluation Study

2.1 External Evaluator

Akemi Shimura, Ernst & Young Sustainability Co., Ltd.

2.2 Duration of Evaluation Study

Duration of the Study: November 2011 – September 2012

Duration of the Field Study: February 26 – March 17, 2012

3. Results of the Evaluation (Overall Rating: C[3])

3.1 Relevance (Rating: ③[4])

3.1.1 Relevance with the Development Plan of Palau

In the Palau 2020 National Master Development Plan, effective before the time of the ex-ante evaluation of this project was implemented in 2006 until now, infrastructure development has been the highest priority issue to improve the Palauan quality of life. At the time of the ex-ante evaluation, the Public Sector Investment Program 2003-2007 (PSIP) defined tourism, agriculture, fishery, trade and light manufacturing industry as priority fields in economic development and the improvement of the arterial roads in the capital city was listed as one of the Tier "A" projects in the PSIP, namely the highest priority transportation project to achieve the development of industrial fields.

At the time of the ex-post evaluation, the Medium-Term Development Strategy 2009-2014 (MTDS) mentions five priorities, (i) Agriculture and Fishery, (ii) Tourism, (iii) Infrastructure, (iv) Foreign Involvement, and (v) Sustainable Government, and the MTDS puts a high priority on maintenance in (iii) the Infrastructure to prolong the lifetime of assets.

Therefore, this project has been consistent with the priority issues in Palau's development policy.

3.1.2 Relevance with the Development Needs of Palau

The relocation of the capital from Koror to Melekeok was carried out in order to remedy the overconcentration of urban functions in Koror at the time of the ex-ante evaluation. Many heavy vehicles including overloaded vehicles passed over the arterial roads for the construction of the new capital since it was the only road connecting Malakal Island with the largest landing port in the metropolitan area to Babeldaob Island and with Melekeok, the new capital. As a result, the traffic situation aggravated the deterioration and cracks in the pavement.

At the time of the ex-post evaluation after the completion of the capital relocation in 2006, the traffic volume of the arterial roads was undiminished since the basis of economic activities was still concentrated in Koror and tourism businesses, the key industry in Palau, were also based in Koror. There was no alternate road from Koror to the capital city and Palau International Airport on

[3] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[4] ③: High, ② Fair, ① Low

Babeldaob Island, Palau Port on Malakal Island, or the only national hospital on Ngerekebesang Island. The traffic in downtown Koror was also concentrated on the roads as maintenance of the side streets was only partially completed.

The need for the improvement and maintenance of the arterial roads has been recognized as stated above.

3.1.3 Relevance with Japan's ODA Policy

The Japan's basic ODA policy regarding Palau at the time of the ex-ante evaluation aimed at support for economic independence and the acceleration of sustainable development in the country through assistance in the following prioritized areas;

(a) Infrastructure
(b) Education
(c) Environment
(d) Healthcare
(e) Tourism
(f) Fishery

The project was included under "(a) Infrastructure" and is therefore consistence with Japan's ODA policy.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Effectiveness[5] (Rating: ②)

3.2.1 Quantitative Effects (Operation and Effect Indicators) [6]

(1) Average Travel Speed during Peak Hours (Section A[7])

At the time of the ex-ante evaluation, the project was expected to improve the average travel speed on section A in peak hours from 15 km/hour to 25 km/hour. However, the agencies related to road transportation did not measure the average travel speed after the completion of the project. According to measurements by the evaluator during a field study[8], the average travel speed was only improved to 16.3 km/hour.

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[5] Sub-rating for Effectiveness is to be put with consideration of Impact

[6] At the time of the ex-ante evaluation, a "decrease in traffic accidents involving pedestrians" was mentioned as one more quantitative effect of the project. However, the related agencies including the police did not have the figures for the number of pedestrian-car accidents. In addition, the source data for the calculation at the ex-ante evaluation was likely to contain other types of accidents that happened outside section A. In light of this, "Improvement of Traffic Safety of Pedestrians by a Separated Sidewalk" is discussed as one of the qualitative effects in 3.2.2 instead of as a quantitative effect.

[7] PVA Intersection - Mobil Top-side Intersection (length: 2.7 km). The section runs through downtown Koror and is lined with commercial and public facilities such as department stores, privately owned shops, hotels, restaurants, and schools.

[8] The average speed was calculated based on the travel speed in the evening peak hour on March 1 and in the morning peak hour on March 6, 2012.

At the time of measurement, there was traffic congestion in the middle of section A even though the traffic was smooth, from 30 km/hour to 40 km/hour[9], in other parts of the section. Prioritization of the travelling direction and the installation of added lanes[10] were included in the intersection improvement plan for speeding up the traffic in section A, together with the maintenance of the pavement. The intersection improvement was planned under the assumption that the traffic volume would increase by 10.4%[11] at the maximum in five years. According to the traffic count conducted during the field study in the ex-post evaluation, the traffic volume at the PVA Intersection and Mobil Top-side Intersection decreased. However, the traffic at the SDA Intersection, in the middle of section A, increased by 18.8%, as shown in Table 1. The increase in traffic in the middle of section A is considered to be the cause of the traffic congestion and the average travel speed.

Table 1 Traffic at Three Intersections (16 Hours from 6 a.m. to 10 p.m.) (Unit: No. of vehicles)

	At the ex-ante evaluation (2006)*1	At the ex-post evaluation (2012)*2
PVA Intersection (beginning of Section A)	16,868	16,436
SDA Intersection (middle of Section A)	21,114	25,089
Mobil Top-side Intersection (end of Section A)	12,911	10,394

Source: *1 "Basic Design Study on the Project for the Improvement of Urban and Rural Roads in Koror and Airai States" CTI Engineering International, November 2006
*2 Actually counted on February 29, 2012

On the other hand, 62.8% of the respondents to a simplified beneficiary survey[12] answered "Significantly improved" or "Improved" as shown in Figure 3. According to interviews with the respondents who recognized an improvement in traffic congestion, the deteriorated pavement forced the users to drive slowly at many points and traffic congestion occurred more frequently before the project.

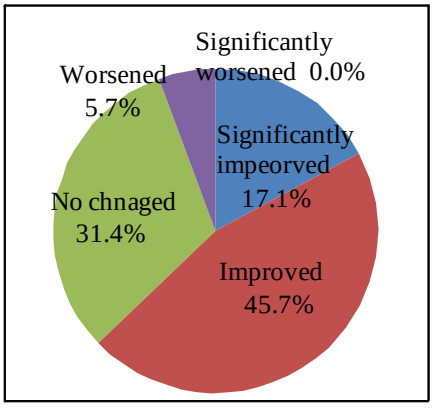

Figure 3 Traffic congestion in Section A compared with the condition before the project

Therefore, the users seem to have some recognition of the easing of congestion even though the average travel speed is slower than expected due to traffic congestion at

[9] The legal speed limit in Palau is 25 miles/hour (about 40 km/hour).
[10] An added lane in this project is a right/left-turn lane around an intersection. Added lanes were expected to avoid congestion or rear-end accidents caused by the blocking of through traffic by right/left-turning vehicles stopping at an intersection.
[11] An annual 1-2% growth in traffic over five years was expected at the time of the ex-ante evaluation. $(1.02)^5 = 1.104$ in total
[12] A simplified beneficiary survey was conducted as follows; period: March 2012, method: distribution of a questionnaire, sample size: 35 (25 local residents, 4 road-side shop managers and 6 tourist agents (including the Palau Visitors Authority).

the intersections in the middle of section A.

(2) Traffic Disturbance due to Road Submergence

At the time of the ex-ante evaluation, water accumulated on the surface of the road in the case of rainfall of 1 mm per day. The five-year average number of rainy days of 208 was regarded as the number of days the road was submerged and the target number of traffic disturbance after the project completion was set to zero. However, traffic disturbance due to road submergence and the correlation between the amount of rainfall and road submergence was not recorded even after the project. For this reason, the simplified beneficiary survey was utilized to assess the effects regarding the traffic disturbance due to submergence. 80% of the respondents were aware of a decrease in traffic disturbance, due to an overhaul of the drainage system (shown in Figure 4). Thus, the results of the beneficiary survey can be considered to indicate an effect equivalent to the original quantitative effect, even though the actual frequency of road submergence could not be obtained.

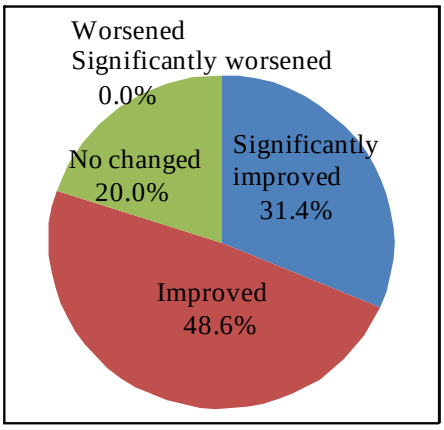

Figure 4 Traffic disturbance due to road submergence compared with the condition before the project

Therefore, the improvement of the pavement as a result of the project can be considered to have had the quantitative effects expected in the ex-ante evaluation to a certain extent.

3.2.2 Qualitative Effects

At the time of the ex-ante evaluation, "(1) To contribute to enhancement of transport reliability and efficiency by the improvement of the road," and "(2) To improve the safety of pedestrians by separating the sidewalk" were expected.

(1) Enhancement of Transport Reliability and Efficiency due to the Improvement of the Road

Interviews with the executing agency and road-side shop owners conducted to assess the qualitative effects of the project show that the project was effective in improving the punctual delivery of products and reducing the number of breakdowns of delivery vehicles. The installation of added lanes and the maintenance of the pavement are considered have been effective for the enhancement of transport reliability and efficiency by reducing the travel time and the frequency of breakdowns. According to the simplified beneficiary survey, all the respondents recognized that the condition of the asphalt pavement had improved (42.9% of them answered "significantly improved," the remaining 57.1% "improved"). Other positive answers regarding reliability or efficiency, such as the extension of the lifetime of vehicles and a reduction in vehicle maintenance

costs, were mentioned in the open question of the beneficiary survey. Thus it can be said that the expected effects were recognized.

(2) Improvement of Traffic Safety for Pedestrians due to a Separated Sidewalk

According to the simplified beneficiary survey, 94.3% of the respondents agreed to the effectiveness of the installation of the sidewalk to improve the safety of pedestrians walking along the road (Figure 5). Some respondents noticed local residents walking or jogging on the sidewalk for fitness exercise. The increase in the number of tourists strolling through downtown Koror was also pointed out in the survey.

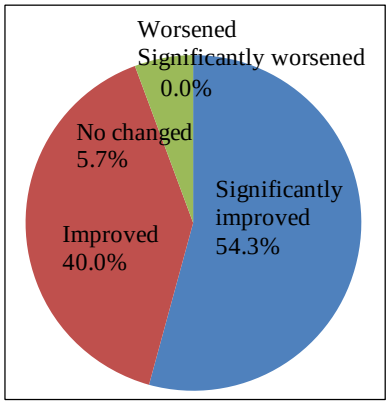

Figure 5 Improvement of traffic safety for pedestrians compared with the condition before the project

It is believed that the clear separation of the street and the sidewalk by road markings and the installation of lids covering U-shaped concrete ditches also contributed to the effects described above.

3.3 Impact

3.3.1 Intended Impacts

At the time of the ex-ante evaluation, the following indirect effects were expected after the completion of the project; "to increase the level of convenience of local residents and tourists using the arterial roads through the enhancement of transport reliability" and "to accomplish regional development, improvement of the capital functions, revitalization of the local economy, and improvement of accessibility to public service facilities for local residents and tourists through smooth road transportation."[13]

(1) Increase in the Level of Convenience for Local Residents and Tourists through the Enhancement of Transport Reliability

Research on the degree of enhancement of transport reliability was conducted by interviews with road users since it was impossible to obtain any data from the executing agency and other related agencies regarding the time required for travel between public facilities or the frequency of land transportation services before and after the project. Some school officials considered the smooth traffic after the project to be effective in reducing the number of tardy students since traffic congestion was not anticipated while most of the students in Palau come to school by car driven by

[13] "To cut air pollution by a reduction in traffic congestion and improvement of the travel speed" was also expected as one of the indirect effects of the project. However, the related agencies did not have any data regarding air pollution and the related agencies and local residents did not notice air pollution before or after the project. Thus, the effect on air pollution could not be recognized as an indirect effect of the project.

their parents. A tour operator stated that it had become easier to predict the arrival time to destinations than before the project. The project is regarded as having improved transport reliability to a certain degree.

(2) Improvement of Accessibility to Public Service Facilities

According to the simplified beneficiary survey, many road users agreed that the smoother land transportation had led to improvements in accessibility to public service facilities due to a reduction in access time (Figure 6). A hospital official remarked that the right-of-way in the center lane for emergency vehicles, which was enabled by the project, reduced the time taken to travel to the hospital.

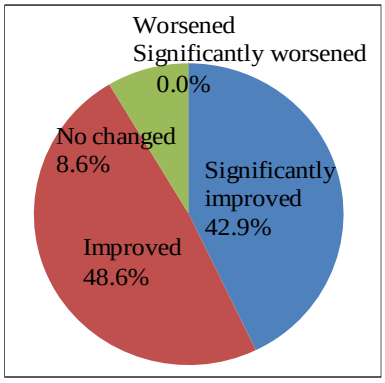

Figure 6 Improvement in accessibility to public service facilities compared with the condition before the project

(3) Improvement of the Capital Functions and Revitalization of the regional economy

An analysis of the GDP by industry was utilized to assess the change in capital functions and economic revitalization of the regional economy since the GDP by state is not provided in Palau.

Table 2 Real GDP by Industry

(Unit: Thousand US dollars)

	2006	2008	2010	2011
Real GDP	185,415	173,114	165,745	175,374
Wholesale and Retail Trade	34,500	33,344	29,035	30,049
Hotels and Restaurants	19,385	19,724	19,929	25,725
Real Estate, Renting and Business Activities	17,542	19,229	21,078	21,707
Construction	19,069	7,758	4,941	4,522

Source: Documents provided by the Office of Planning and Statistics

Shown in Table 2 above, the GDP from “construction” decreased rapidly, in contrast with urban-type industries such as “wholesale and retail trade,” which decreased slightly, or “hotels and restaurants” and “real estate, renting and business activities,” which increased in the same period. It can be said that the project indirectly promoted the mobility of people and goods in the capital area after the completion of the project since only urban-type industries are concentrated in this area.


Left: Renovated Pavement and Road Markings (Section F-1)

Right: Traffic Congestion during the Rush Hour (Section A, Shell Intersection[14])

3.3.2 Other Impacts

3.3.2.1 Impacts on the natural environment

The environmental standards for the United States Navy have been applied in Palau since the days under the trusteeship system. Implementation orders and administrative instructions regarding environmental protection and environmental assessment are well-maintained compared to other developing countries and the Environmental Quality Protection Board (EQPB) regulates construction activities to protect the environment. According to an investigation of related documents and interviews at the EQPB to check the impact of the project, the EQPB warned the contractor due to a violation of the Environmental Quality Protection Act regarding the dumping of soil and turbid water into the mangroves and the soil/asphalt cutting stockpile outside an approved area during the construction. However, the contractor immediately installed silt fence barriers after the warning from the EQPB. No impact on the mangroves was reported afterwards.

No impact on the natural environment was reported from the local residents, either.

3.3.2.2 Land Acquisition and Resettlement

At the time of the ex-ante evaluation, the project was planned without any resettlement of the local residents, but there was the possibility of land acquisition for a detour and the work areas for construction machinery beside the road in landslide areas. No land in landslide areas was actually acquired. However, land acquisition was conducted in part of section A to widen the road. The executing agency remarked that the land acquisition was completed smoothly since the land owners had appreciated the usefulness of the project, although the width of the sidewalk was decreased from 1.5 m to 1.3 m since more than one person had claimed ownership of a part of the area required for the project.

3.3.2.3 Unintended Positive/Negative Impact

According to the simplified beneficiary survey, some local residents were concerned about an increase in traffic accidents caused by speeding vehicles as a negative impact of the improvement of the asphalt

[14] The picture was taken from the Shell Intersection, looking towards the Courthouse Intersection.

pavement. The police department despatches policemen to the vicinity of schools and major intersections during the rush hour to control the traffic and give warnings to speeding drivers because of concern about speeding. Police ask for the cooperation of local residents to promptly make a report when they see speeding vehicles. The executing agency is planning to install additional traffic signs. Currently these measures seem to be effective as there are no indications that a serious increase in speeding-related accidents will become a social issue. The executing agency concerns about the possibility of collisions caused by two vehicles entering the center lane from opposite traffic simultaneously.

It can be said that the project has improved traffic flows at a certain level and convenience for the local residents and tourists due to the maintenance of the road pavement and the installation of drainage systems as mentioned above. The project can be considered effective in promoting economic activities in the capital area by improving stability in the distribution of goods and an increase in mobility for tourists. It is considered that the road markings and street lights installed under the project have contributed to traffic safety.

Accordingly, this project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.4 Efficiency (Rating: ②)

3.4.1 Project Outputs

The outputs of the project were basically implemented as planned. The general outline and changes in the outputs are shown in Table 3.

Table 3 Project Outputs and Changes

Section	Contents of the Work	Changes from the Basic Design	Length (m)
(1) Minato Bridge – Airport Intersection			9,205
A	Pavement, Auxiliary Lane, Sidewalk and Drainage, Intersection, Road Markings, Street Lighting, Guardrails	- Partial change in the width of the sidewalk (1.5 m→1.3 m) - Structure of the drainage - Height and location of the street lights	2,700
B	Pavement, Sidewalk and Drainage, Road Markings, Guardrails	As planned	530
C	Pavement, Road Markings, Traffic Safety Measures, Landslide Measures	As planned	2,377
F1	Pavement, Drainage, Road Markings, Traffic Safety Measures, Landslide Measures	- Cross-sectional structure of the landslide measures - Structure of the box culverts	3,122
F3	Pavement, Road Markings	- Pavement method - Type of center line	476
(2) PVA Intersection – PPR			3,326
D	Pavement, Road Markings	As planned	341
E1	Pavement, Drainage, Road Markings	As planned	1,150
E2	Pavement, Road Markings, Traffic Safety Measures, Landslide Measures	- Partial change in the cross-sectional structure of the landslide measures - pavement method	1,835
Total			12,531

Source: Documents provided by JICA

All the changes were regarded as reasonable for the smooth implementation of the project or as adjustments to the present state according to documents provided by JICA. No effects or impacts caused by the changes were recognized in the ex-post evaluation. Therefore, the changes are regarded as appropriate.

3.4.2 Project Inputs

3.4.2.1 Project Cost

The grant limit on the Japanese side was a total of 1,405 million yen, and the actual total project cost to the Japanese side was 1,405 million yen, as planned.[15]

3.4.2.2 Project Period

While the planned project period at the time of the ex-ante evaluation was 24 months, the actual project period was 25 months, which was slightly longer than planned. The extension of the planned period is considered to be due to the delay in the construction work for 3 months caused by a delay in the procurement and delivery from Japan of the construction machinery necessary for the project. The consultant and the constructor increased the number of Japanese engineers and completed the project within the contract period. However, the actual project period exceeded the planned period.

Although the project cost was within the plan, the project period was slightly exceeded. Therefore the efficiency of the project is fair.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

The operation and maintenance of the arterial roads after the project is under the responsibility of the MPIIC's Department of Public Works (PW)[16]. Currently, the Road and Ground Maintenance Branch, which is in charge of road maintenance, has 43 staff (one engineer and 42 laborers). The branch divides the labourers into three teams and maintains the national roads across Palau. The respective teams do not stay in particular areas, but go around the roads day by day and the branch covers all roads except state roads. The number of staff is not sufficient since the total length of the roads under maintenance increased in 2007 with the opening of the Compact Road (85 km) going

[15] The actual cost to the Palauan side was not available because the cost was not recorded nor managed separately from other routine maintenance costs. However, there was no change in the project schedule or project outputs caused by delays in undertakings of the Palauan side. Therefore, the planned costs are considered to have been expended by the Palauan side at the appropriate time.

[16] The executing agency on the Palauan side changed from the Ministry of Resources and Development to the Ministry of Public Infrastructure, Industries and Commerce due to organizational restructuring. The personnel of the Department of Public Works were not relocated at the time of the organizational restructuring.

around Palau's largest island, Babeldaob Island. The director of PW has already requested a budget for recruiting 15-20 additional staff, including supplementation due a reduction resulting from the retirement of staff.

3.5.2 Technical Aspects of Operation and Maintenance

According to the director of PW, the Road and Ground Maintenance Branch can handle all types of maintenance work within the branch's responsibility due to the branch's technical capability. During site visits, no defects in maintenance that might cause traffic disruptions were found. However, some asperity and abrasion was recognized on the maintained pavement, which seemed to be the result of shoddy workmanship. It is deemed desirable to improve the technical capability to ensure a higher quality of maintenance work. Continuous training seem to be required in terms of quality improvements in the work although almost the only training sessions currently conducted are for new recruits. The maintenance equipment is not sufficient since many of the machines are in disrepair and the branch has to organize the allocation of the equipment.

3.5.3 Financial Aspects of Operation and Maintenance

The MPIIC budget for road maintenance work is combined with that for other roads throughout Palau and there is no separately established budget for the arterial roads under this project.

Table 4 Allocated Budget and Actual Expenditures for Maintenance

(Unit: US dollars)

	FY2009[17]	FY2010	FY2011	FY2012
Allocated Budget	694,281	740,000	750,000*1	750,000*1
Actual Expenditures	641,028	842,933	292,424*2	368,338*3

Source: Questionnaire response

*1 Requested budget because the national budget was not approved.

*2 The spending of the maintenance expenditures was constrained due to the uncertainty concerning the passage of the FY2011 budget.

*3 Actual expenditures up to February 2012.

Due to the delay in the deliberations on Palau's national budget for FY2011 and FY2012, the same amount of budget as FY2010 was applied temporarily. Against this background, the execution of the maintenance budget has stagnated. According to the bill for the FY 2011 national budget (originally applied from October 2011 to September 2012) was finally passed through the Palau National Congress during the field study on March 7, the budget for maintenance costs was increased by 1.0% from the FY2010 budget.

The budget amount is growing compared with the FY2006 budget amount, which was 300,000

[17] Governmental fiscal year in Palau starts October and ends September.

US dollars. However, PW does not expect that the budget will be enough to cover all the expenditures for spare parts for the machinery and materials for the maintenance of the pavement even though the budget will be executed. Thus, the financial resources for sufficient maintenance activities are assumed to be insufficient. Currently, PW does not require the maintenance budget to be based on an analysis of the budget and the actual expenditures, or estimations from past actual expenditures since PW cannot collect the necessary data, such as the total length of roads that PW is responsible for. It seems to be necessary for PW to request a maintenance budget in accordance with a rational budget plan based on past maintenance activities.

As another financial concern regarding the project, the electricity cost borne by the executing agency has increased by the street lights installed under the project. The executing agency makes an effort to reduce the financial impact by planning the replacement of the lights to LED (light-emitting diode) lights.

3.5.4 Current Status of Operation and Maintenance

The arterial roads under the project are the main roads running from Palau International Airport to the center of Koror state where 70% of the population of Palau reside and business facilities and public service facilities such as schools and a post office are concentrated along the roads. The arterial roads are widely used by local residents and tourists. Therefore the popularity of the facility under the project is considered to be high.

Trimming of the roadside grass and the trees and cleaning of the ditches seemed to be conducted regularly and no obstacles to road traffic were found during the site visit. However, the road markings and lines have worn off at some intersections, the entrances from parking spaces and sharp turns. Maintenance activities involving the use of materials seem to be delayed. Ruts[18] that are likely caused by overloaded vehicles were occasionally found in section F-1, where the drivers meet continuous sharp turns. PW recognizes the condition of the following facilities as particular problems;

(1) Deterioration in the pavement （cracks, ruts, reveling[19]）

The pavements in some sections under the project have deteriorated compared to other sections.

(2) Disappearance of road markings

The road markings are fading in some sections.

(3) Insufficiency of the drainage facilities

At some drainage facilities, the water is not discharged from the ditch and flows back onto the pavement.

There is concern that the deterioration will worsen in future years although none of the above conditions are likely to immediately cause a serious accident. However, investigation of the current status or major improvements is not currently planned by the executing agency.

[18] Ruts in this report are wheel tracks running longitudinally on asphalt pavements.
[19] Reveling is a condition of pavements with a peeled surface that pieces of the aggregate breaks away from.

Even at the time of the ex-ante evaluation, the distress to the pavement from overloaded vehicles was a concern. The maximum load capacity had been defined as 20 tons by the Trust Territory Government. Up to now, no laws or regulations to clamp down on overloaded vehicles have been established nor has any equipment to control overloaded vehicles been installed. Heavy vehicles, which seemed to be overloaded, were noticed in the early morning and at night during the traffic count. The related parties in MPIIC are concerned about the need for countermeasures and have recommended to congress the enactment of restrictive measures. However, this enactment has not been succeeded.

Locations where maintenance is required are identified by labourers or road users. No methods for the inspection of the condition of the roads, for the prioritization of maintenance locations, or for planning or maintenance including manpower planning have been established.

As described above, some problems have been observed in terms of the technical, financial, and current situation of operation and maintenance, therefore the sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of the project was to secure smooth and safe traffic flows in the capital area of Palau through the improvement of the arterial roads in Koror and Airai state. The project is regarded as being relevant because it is consistent with Palau's development plan and Japan's ODA policy and the development need for it has been continuously high. Although the improvement of the average speed remained at a lower level than expected at the time of the ex-ante evaluation, the smoothness and safety of the traffic on the arterial roads was improved due to the rehabilitation of the road. The improvement of accessibility to social services by local residents and tourists and of the stability of transportation has been recognized. Therefore, the effectiveness of the project is fair. The outputs and the project cost were as planned, however the project period was slightly longer than the plan. Thus the efficiency of the project is regarded as fair. There are some concerns about the maintenance activities since some problems were observed with respect to the technical aspects, financial aspects, and the current condition of maintenance, although the manpower shortage can be solved.

In light of the above, this project is evaluated to be partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Maintenance activities in Palau frequently do not go according to plan due to the rainfall. In addition, the total length of the road for maintenance has increased drastically with the opening of the Compact Road. However, data regarding the actual schedule and expenditures for maintenance has not been gathered. The estimation of the budget, scheduling and manpower planning for maintenance have been drawn up without making a comparison between the plan

and the actual situation or the consideration of changes in the circumstances as above. No method for inspections concerning the condition of the roads, including how to point out locations where maintenances is required, has been established. PW is required to (i) gather the necessary data for analysis of the variance between the plan and the actual activities, and (ii) request an effective budget and increase the efficiency of the maintenance activities with the prioritization of activities based on the condition of the roads.

(2) Appropriate measures are required to prevent the deterioration or malfunctioning of some facilities that were pointed out by the executing agency after objective investigations on the causes of the facts including the adequacy of maintenance activities.

(3) After the completion of the project, the traffic situation such as the travel speed has changed due to improvements in the smoothness of traffic flows. The executing agency is required to assess the current situation of traffic accidents and overloaded vehicles and take any necessary safety measures in cooperation with the police and other related agencies, including legislation to clamp down on overloaded or speeding vehicles and the installation of speed cameras and weight scales.

4.3 Lessons Learned

It is very important to establish a process to gather actual data and analyze it in comparison with the plans to ensure continuous and self-directive maintenance activities. In similar projects, it is necessary to confirm whether each executing agency has a systematic process in place for gathering and analyzing maintenance data. If this process is not sufficient, it is deemed desirable to implement seminars and/or on-the-job training for the establishment and maintenance of the process of planning and analysis.