

Ex-Post Project Evaluation 2014: Package III-2 (India, Macedonia, Turkey, Ukraine)

August 2015

JAPAN INTERNATIONAL COOPERATION AGENCY

OPMAC Corporation

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India

Ex-Post Evaluation of Japanese ODA Loan
“Umiam Stage II Hydro Power Renovation & Modernization Project”

External Evaluator: Keishi Miyazaki, OPMAC Corporation

0. Summary

The objective of this project was to meet the growing demand for electricity in the State of Meghalaya by the renovation of the Umiam Stage II Hydro Power Station (18 MW) which is located in the river basin of the Umiam River. The project matched India’s national development policy and development needs at both the appraisal (2004) and the time of the ex-post evaluation as well as Japan’s ODA policy at the time of the appraisal, therefore its relevance is high. For the project outputs, there was no major changes except for the expansion of installed capacity from 18 MW to 20 MW. This augmentation corresponded with the project objective to take measures against power shortage. However, the project period significantly exceeded the plan; therefore the efficiency of the project is fair. For the operation and effect indicators, the planned outage hours and the maximum output reached the target values, however, the forced outage hours, the plant load factor and the net electric energy production did not reach the target values. The main factors for the failure to attain the target value of the plant load factor and net electric energy production were considered to be the water shortage for power generation due to changes in the amount and pattern of rainfall. However there is the possibility that the setting of the target values at the appraisal was overrated. There was a certain level of achievement in the improvement of the operation and management capacity of the executing agency by capacity building. On the other hand, the Umiam Stage II Hydro Power Station generates approximately 2-2.5% of the annual electric power generated in Meghalaya State and contributed to a stable power supply as the state's base load power generation¹. However, the state has not solved the issue of power shortage completely, and it was difficult to confirm the impacts of the project on industrial development and improvements in the living standards of the local residents in Meghalaya. No negative impact of the project on the natural environment was observed and there was no land acquisition or resettlement. Therefore, the effectiveness and impacts of this project are fair. As for the sustainability of the project effect, some minor problems have been observed in terms of the financial aspects and therefore sustainability of the project effect is fair.

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

¹ The base load power generation means that the power generation which can provide stable power with low cost regardless of season, weather or time of day.

1. Project Description



Project Location



The Generator of the Uiam Stage II Hydro Power Station

1.1 Background

Meghalaya State, located in the northeastern part of India, has had a growing demand for electric power due to the industrialization policy established by the state government in 1997; on the other hand, it experienced severe power shortages in 2002 when its shortage was 530 GWh (46.9%) against a power demand of 1,130 GWh, as well as a supply shortage of 51 MW (21.7%) during peak hours against a power demand of 235 MW. The Uiam Stage II Hydro Power Station, the target facility of this project, was built with a grant aid from the United States Agency for International Development (USAID) in 1970. However the power generation facility has notably deteriorated, and its power generation efficiency has decreased. For this reason, the power station was in need of renovation.

1.2 Project Outline

The objective of this project was to meet the growing demand for electricity in the State of Meghalaya by the renovation of the Uiam Stage II Hydro Power Station (18 MW) located in the river basin of the Uiam River, thereby contributing to the promotion of industrial development and to improvement in the living standards of local residents in the state.

Loan Approved Amount / Disbursed Amount	1,964 million yen / 1,825 million yen
Exchange of Notes Date / Loan Agreement Signing Date	March 2004 / March 2004
Terms and Conditions	Interest Rate: 1.3% Repayment Period: 30 years (Grace Period: 10 years) Conditions for Procurement: General untied

Borrower / Executing Agency	The President of India / Meghalaya State Electricity Board (current Meghalaya Energy Corporation Limited: MeECL)
Final Disbursement Date	June 2012
Main Contractor (Over 1 billion yen)	-
Main Consultant (Over 100 million yen)	Joint venture of TEPCO (Japan) and TEPCO (Japan)
Feasibility Studies, etc.	1. Feasibility Study (F/S) (November 1994) 2. The Special Assistance for Project Formation (SAPROF) for the Umiam Stage II Hydro Power Renovation & Modernization Project (September 2003)
Related Project	-

2. Outline of the Evaluation Study

2.1 External Evaluator

Keishi Miyazaki, OPMAC Corporation

2.2 Duration of Evaluation Study

Duration of the Study: August 2014 - September 2015

Duration of the Field Study: November 29 - December 27, 2014, March 8 - 21, 2015

2.3 Constraints during the Evaluation Study

It was difficult to obtain the financial statements of the executing agency for the latest three fiscal years of 2012/13, 2013/14 and 2014/15 from the executing agency as they had not been audited and officially authorized at the time of ex-post evaluation of this project. Therefore, it was necessary that the evaluation judgement on the financial sustainability of the project was made based on the available secondary information as mentioned in “3.5.3 Financial Aspects of Operation and Maintenance”.

3. Results of the Evaluation (Overall Rating: C²)

3.1 Relevance (Rating: ③³)

3.1.1 Relevance to the Development Plan of India

At the project appraisal (2004), one of the most important tasks of the Tenth Five-Year

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

³ ③: High ②: Fair, ①: Low

Plan (2002-2007) was stated as the need to make new power resource development to meet the increased demand for electricity in the future. Power resource development of 46,939 MW (of which 17,311 MW would be hydropower) nationwide by 2007 was planned.

The Meghalaya state government had been promoting alloy iron, steel and cement industries based on an industrial policy established in 1997. However, the state experienced severe power shortages caused by the growing demand of these industries which took up almost half of the electricity consumption. The Meghalaya State Electricity Board (at that time) planned to increase the installed capacity of generation to a total of 242 MW by 2012 through the renovation of the existing hydropower station as well as the construction of new power stations such as the Umngot Stage I & II Hydro Power Stations and the Myntdu Leshka Hydro Power Station, in order to cope with the power shortage.

The objective of this project was to cope with the power shortage in the state of Meghalaya by renovation of the existing hydropower station; therefore it was relevant to the mentioned Tenth Five-Year Plan and to the state's power sector plan.

At the time of the ex-post evaluation, under the national development plan of the Twelfth Five-Year Plan (2012-2017) which acknowledged the need for a stable power supply for all economic activities and inclusive growth, new power development of 88,000 MW was planned for the same period.

Furthermore, the Twelfth Five-Year Plan (2012-2017) of Meghalaya State had three priority areas: (i) Use of natural resources for development and living, (ii) Infrastructure development, and (iii) Human resource development. As for (ii) Infrastructure development, the need for new power resource development to include hydro power and thermal power was stated as being necessary to meet the state's severe power shortage. Umngot Stage I & II Hydro Power Stations are in a preparatory phase, and Stage I of the Myntdu Leshka Hydro Power Station was completed in 2013 with Stage II in a preparatory phase. In Meghalaya, another 64 MW of generation capacity will be added, with the target that this is expanded to 378 MW by 2017.

Improvement in the power supply capacity continues to be a priority in India's national and Meghalaya state's development plans, and it was relevant to the objective of this project at the time of the ex-post evaluation.

3.1.2 Relevance to the Development Needs of India

In 2002, Meghalaya State experienced severe power shortages where its supply shortage was 530 GWh (46.9%) against a power demand of 1,130 GWh as well as a supply shortage of 51 MW (21.7%) during peak hours against a power demand of 235MW. The Umiam Stage II Hydro Power Station, the target facility of this project, was built with a grant aid by the United States Agency for International Development (USAID) in 1970. However the power station facility had notably deteriorated, and its power generation efficiency had

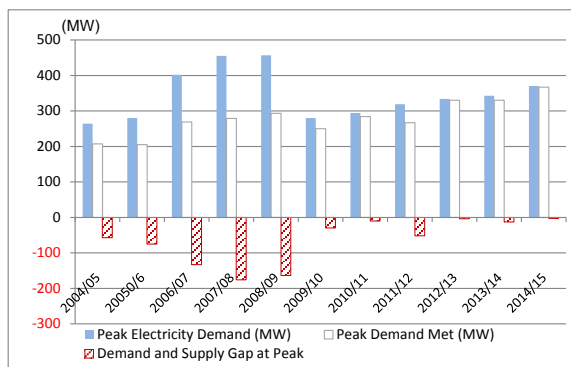
decreased due to frequent breakdowns as seen in an incident in 2002 when it was forced to experience a long-term power outage. On the other hand, the construction of a new power station to replace it would take considerable time and investment, therefore it was necessary to meet the state's severe power shortage by renovation of the existing power station.

At the time of the ex-post evaluation, the total installed capacity of power stations under the management of Meghalaya Energy Corporation Limited (MeECL) had increased to 314.7 MW (Table 1). As a result, the power shortage at peak hours was eased to 13 MW (3.8%) in 2013/14 (Figure 1). Similarly, there was a power shortage of 190 GWh (10.6%) against the required power supply volume of 1,794 GWh in 2013/14, which indicates the improvement in power supply in Meghalaya State⁴.

Table 1: The Installed Capacity of Existing Hydro Power Stations under the Management of MeECL (As of 2014)

No	Power Station	Total Capacity
1	Uiam Stage I Hydro Power Station	36 MW (9 MW x 4 units)
2	Uiam Stage II Hydro Power Station	20 MW (10 MW x 2 units)
3	Uiam Stage III Hydro Power Station	60 MW (30 MW x 2 units)
4	Uiam Stage IV Hydro Power Station	60 MW (30 MW x 2 units)
5	Umtru Hydro Power Station	11.2 MW (2.8 MW x 4 units)
6	Sonapani Hydro Power Station	1.5 MW (1.5 MW x 1 unit)
7	Leshka Hydro Power Station	126 MW (42 MW x 3 units)
	Total	314.7 MW

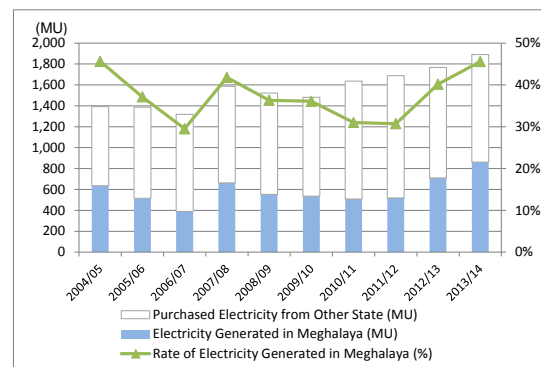
Source: Meghalaya Energy Corporation Limited (MeECL).



Source: Central Electricity Authority (CEA), Ministry of Power, Government of India.

Note: At the time of the ex-post evaluation in 2013/14, the peak power supply was 330 MW against a peak power demand of 343 MW. The above 330 MW includes generation from the power stations of private companies and central government in addition to that of MeECL.

Figure 1: The Power Demand and Supply Gap at Peak Hours in Meghalaya



Source: Meghalaya Power Generation Cooperation Limited (MePGCL).

Note: 1 MU (Mega Unit) is equivalent to 1,000,000 KWh.

Figure 2: Annual Power Supply Volume in Meghalaya

⁴ Load Generation Balance Report 2014-2015, Central Electricity Authority (CEA), Government of India.

For this reason, Meghalaya purchases electricity from the power stations⁵ of neighboring states through India's northeastern power grid. Of Meghalaya's total power generation of 1,891 GWh in 2013/14, 862 GWh, which is the equivalent of 46%, was generated within the state. The remaining 1,029 GWh, which is the equivalent of 54%, was purchased from out of state (Figure 2). The Umiam Stage II Hydro Power Station shares 6% of the total installed capacity in Meghalaya, and 5% of the annual power supply volume as its base load power source. However, this figure drops to 2-2.5% if the power purchased from out of state is included in the state's overall annual power supply volume. As seen here, although the power supply gap of Meghalaya during peak hours has somehow been improved since the time of appraisal, it had yet to be completely closed at the time of the ex-post evaluation. For this reason, there is a continuing need for improved generation capacity to meet the power shortage.

3.1.3 Relevance to Japan's ODA Policy

At the project appraisal, Japan's Country Assistance Plan for India (established in May 2006) had not yet been established. However, Japan's ODA policy for India in 2004 included the following priority sectors: (i) Economic infrastructure, (ii) Poverty alleviation, and (iii) Environment protection. For (i) Economic infrastructure, it was stated that the economic infrastructure would be promoted mainly in power and transportation. This project was implemented along the lines of (i) of the above mentioned priority sectors.

Furthermore, in JICA's Country Assistance Strategy for India (September 2003), the "development of economic infrastructure with a focus on power" was stated as a priority area, and it was planned that support would be provided for the development of power sources, the development of distribution lines for a stable and efficient power supply and for efforts to reform the central and state government sectors. From the above, it is clear that this project was relevant to Japan's ODA policy.

3.1.4 Appropriateness of Target Values of the Operation and Effect Indicator

The Umiam Stage II Hydro Power Station (18 MW at the time of planning) generates power by recycling 100% of the water used in the Umiam Stage I Hydro Power Station (36 MW) that is located upstream and therefore the operation of the Umiam Stage II depends on the operation status of the Umiam Stage I. At the project appraisal, the target value for the plant load factor (3 years after completion) that was one of the application effect indexes was set to be 45%. This was established based on the results of the Special Assistance for Project Formation (SAPROF) for the Umiam Stage II Hydro Power Renovation & Modernization

⁵ Meghalaya State has signed long-term power purchase agreements with the North Eastern Electric Power Corporation (NEEPCO), the National Hydroelectric Power Corporation (NHPC), the National Thermal Power Corporation (NTPC), and power generation companies under the Oil and Natural Gas Corporation (ONGC), and receives power supply from them.

Project (September 2003). According to the above study report, there was the precondition of an expected annual power generation volume of 70.4 GWh from the Umiam Stage II, recycling the water used for power generation in the Umiam Stage I, which was calculated based on the actual power generation volume of 129.4 GWh in 2002. The target value of 45% in the plant load factor was set based on this precondition⁶.

However, the actual plant load factor of the Umiam Stage II, which is the target facility of this project, after the project completion, was less than 30%, remaining at an approximate 60% achievement of the target value (45%). The reasons for the actual value being less than 30% in the plant load factor are considered to be the decreased amount of water available for power generation caused by changes in the amount and pattern of rainfall. The actual volume of power generation in Umiam Stage I in 2002, which was the precondition for the establishment of the target value, was, in fact, a result attained with relatively good conditions of available water for power generation. If the target value had been calculated based on the average rainfall for the past 5-10 years, or the future rainfall forecast using this trend, it is possible that the target value could have been lower than 45%. Therefore, the target value of 45% in the plant load factor may have been overestimated to some extent.

In the light of the above, this project has been highly relevant to India's development plan and development needs, as well as to Japan's ODA policy; therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The outputs of this project are shown below (Table 2).

Table 2: Project Outputs (Plan/Actual)

Item	Plan	Actual
(1) Installed Capacity	• 18 MW (9 MW x 2)	• 20 MW (10 MW x 2)
(2) Mechanical Equipment	<ul style="list-style-type: none"> • Turbine (runner, inlet valve, guide vane control system, main shaft water sealing device, etc.) • Governor and Turbine Control System • Air Compressed Supply System • Dewatering & Drainage System • Others 	• As planned
(3) Electrical Equipment	<ul style="list-style-type: none"> • Generator and its Auxiliary (Fixed Coils, Fixed Core, etc.) • Excitation System • Main Control Boards • 11KV Metal-Enclosed Cubicles • Generator Transformer and Station Transformer • Others 	• As planned

⁶ The installed capacity of the Umiam Stage II Hydro Power Station at the initial plan was 18 MW, and the target value or 45% was set based on this precondition. This project has augmented the installed capacity from 18 MW to 20 MW.

Item	Plan	Actual
(4) Consulting Services (a) Assistance for Renovation Work	<ul style="list-style-type: none"> • Assistance in Procurement, Implementation of Renovation and Modernization Work, Operation and Maintenance Instruction, Project Reporting • Input: 45 M/M 	<ul style="list-style-type: none"> • The service contents were as planned • Input: 58.39 M/M
(b) Capacity Building	<ul style="list-style-type: none"> • Capacity Building of the Meghalaya State Electricity Board <ul style="list-style-type: none"> ➢ Improvement of financial issues, improvement of the organization management, Improvement of problem solving skills by introducing QC circles • Survey on Upgrading of the Human Development Center <ul style="list-style-type: none"> ➢ Recommendations for improvements in the human resource development system, facilities and equipment, utilization of the North-Eastern Regional Centre of the National Power Training Institute • Input: 48 M/M 	<ul style="list-style-type: none"> • The service contents were as planned • One month of Total Quality Management (TQM) training for 10 staff members of Meghalaya State Electricity Board was conducted in Japan. • Input: 80.5 M/M

Source: Data from JICA and responses from questionnaires.

Note: QC is an abbreviation for Quality Control. In the QC circle activities, a small group of volunteers in the office work on quality control, the improvement of products and services, and also on reducing defective products and on safety measures.

There was no significant change in the components of the mechanical and electrical equipment except for the change in the installed capacity from 18 MW (9 MW x 2 units) to 20 MW(10 MW x 2 units). As for the change in the installed capacity, the Central Electricity Authority (CEA) of the Ministry of Power recommended to the executing agency that augmentation was possible considering turbine capability. This recommendation was studied by the executing agency who concluded that a 2 MW of augmentation was possible within the project cost. Design change was then implemented. This augmentation corresponded with the project objective to take measures against power shortage.

Furthermore, the input of consulting services increased. The work volume of consulting services regarding assistance for renovation works increased by 13.39 M/M (approximately 30%) due to some additional work for design changes and retendering of the main contract. The work volume of capacity building increased by 32.5 M/M (approximately 68%) due to some additional work caused by the extended project period.

For procurement, the generator transformer, the station transformer and the water supply facility were procured as a package through Local Competitive Bidding (LCB) and the other main electrical devices were procured as a package through International Competitive Bidding (ICB).



Generator (Unit 1, Unit 2)



Substation



Controller



11KV Switch Gear Panel



Umiam Lake (Umiam Reservoir)



Channel (Out of Project Scope)

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost amounted to 2,147 million yen (Japan's ODA loan: 1,825 million yen) against the planned cost of 2,343 million yen (Japan's ODA loan: 1,964 million yen) and this was within the plan (equivalent to 92% of the original plan) (Table 3).

In this project, the machinery cost exceeded the estimation by 257 million yen due to some additional outputs (the augmentation of installed capacity). However, other costs such as electrical equipment, transportation, installation, administration and physical contingency were below the plan, therefore the actual project cost was within the plan. In addition, although the actual work volume of the consulting services increased, the actual cost was below the plan. It is thought that the reason for this was that it was possible to contract with consulting services at a lower unit cost of man-month (M/M) than the unit cost of M/M estimated at the time of appraisal as a result of competitive bidding.

Table 3: Project Cost (Plan/Actual)

Unit: Million yen

Item	Plan			Actual		
	ODA loan	Indian government	Total	ODA loan	Indian government	Total
1. Mechanical equipment	365	0	365	622	0	622
2. Electrical equipment	589	0	589	582	0	582
3. Transportation cost	112	0	112	21	0	21
4. Installation cost	200	0	200	122	0	122
5. Price escalation	81	28	109	0	0	0

Item	Plan			Actual		
	ODA loan	Indian government	Total	ODA loan	Indian government	Total
6. Physical contingency	135	34	169	56	28	84
7. Consulting service	415	0	415	356	0	356
8. Administration cost	0	142	142		8	8
9. Tax and duties	0	175	175		285	285
10. Interest during construction (IDC)	67	0	67	67	0	67
Total	1,964	379	2,343	1,826	321	2,147

Source: Data from JICA.

3.2.2.2 Project Period

The planned project period was 55 months, or from March 2004 (signing of loan agreement) to September 2008 (start of a test run of the power station). The actual project period was 95 months, or from March 2004 to January 2012, which significantly exceeded the plan (equivalent to 172% of the original plan) (Table 4). The main reason for the delay was that the Central Electricity Authority (CEA) of the Ministry of Power did not agree on the contents of the terms of reference and the tender price for the main contract making retendering necessary. This resulted in a delay of 3 years. On the other hand, the actual project period between the announcement of the result of retendering and the start of the commissioning of the unit 2 generator was 25 months as planned.

Table 4: Project Period (Plan/Actual)

Item	Plan	Actual
Signing of loan agreement	March 2004	March 2004
Start of tender for main contract	April 2005	July 2008 (retendering)
Announcement of tender	June 2005	August 2008 (retendering)
Tender evaluation by MeECL	January 2006	September 2009 (retendering)
JICA concurrence for the award of contract	July 2006	November 2009 (retendering)
Award of contract	August 2006	December 2009 (retendering)
Commissioning of Unit 1	June 2008	January 2012
Commissioning of Unit 2	August 2008	December 2011
Project Period	March 2004-September 2008 (55 months)	March 2004-January 2012 (95 months)

Source: Data from JICA.

Note: MeECL: Meghalaya Energy Corporation Limited.

3.2.3 Results of Calculations of Internal Rates of Return

At the appraisal, the Financial Internal Rate of Return (FIRR) of the project was 18.8%, and the Economic Internal Rate of Return (EIRR) was 20.5%. The results of recalculation of the FIRR and EIRR at the time of the ex-post evaluation were FIRR=7.9% and EIRR=7.9%. The preconditions at the time of project planning were as follows:

	Financial Internal Rate of Return (FIRR)	Economic Internal Rate of Return (EIRR)
Cost	Investment cost, operation and maintenance cost	Investment cost, operation and maintenance cost (tax and duties excluded)
Benefits	Power sales revenue	Power sales revenue (tax and duties excluded)
Project life	30 years after commercial operation	30 years after commercial operation

In the light of the above, the project cost was within the plan but the project period significantly exceeded the plan; therefore the efficiency of the project is fair.

3.3 Effectiveness⁷ (Rating: ②)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

At the project appraisal, the forced outage hours, planned outage hours and plant load factor were set as the operation indicators, and the maximum output and net electric energy production as the effect indicators (Table 5).

Table 5: Operation and Effect Indicators

Index	Baseline	Target	Actual		
	2002	2011	2012/13	2013/14	2014/15
	Prior to appraisal	3 years after completion	Completion year	1 year after completion	2 years after completion
<Operation Indicator>					
Forced Outage Hours (hours/year)					
(1) By Mechanical Trouble	530	88	0	0	0
(2) By Human Error	0	0	0	0	0
(3) Other	0	0	Unit 1: 44h46 Unit 2: 937h46 Total: 982h32	Unit 1: 103h25 Unit 2: 69h45 Total: 173h10	Unit 1: 127h07 Unit 2: 19h31 Total: 146h38
Planned Outage Hours by Periodical Inspection (hours/year)	3,787	88	Unit 1: 154h24 Unit 2: 100h49 Total: 255h13	Unit 1: 22h45 Unit 2: 28h45 Total: 51h30	Unit 1: 73h00 Unit 2: 10h30 Total: 83h30
Plant load factor (%)	36	45	28.8	23.6	26.1
<Effect Indicators>					
Maximum output (MW)	18	18	20	20	20
Net electric energy production (MWh/year)	56,470	70,000	50,408	41,322	41,327

Source: Data from JICA and response to questionnaires.

Note 1: Actual values are the data based on the Indian fiscal year (April-March).

Note 2: The actual value for 2014/15 is based on data for 11 months between April 2014 and February 2015.

The forced outage hours due to mechanical trouble was 0 hour/year during 2012/13-2014/15 against the target value of 88 hours/year, therefore the target value was achieved. The forced outage hours by human error was 0 hour/year during 2012/13-2014/15, therefore the target value was achieved. On the other hand, however, the forced outage hours by other causes was 982 hours/year in 2012/13, 173 hours/year in 2013/14 and 146

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

hours/year in 2014/15, which meant that the target of 0 hour/ year was not achieved. This was because at the Umiam Stage II, there were frequent occurrences of rapid voltage increase during power supply, and the operation of generators was temporarily suspended in order to avoid any damage to the machinery. Such cases were more frequent in 2012/13. According to the executing agency, another distribution line should be developed in order to avoid rapid voltage increase. However, this would cost a lot of time and money and therefore the temporary suspension of the operation of generators to prevent damage was the only available countermeasure.

Although the planned outage hours was 255 hours/year in 2012/13, the total was 51 hours/year in 2013/14 and 83 hours/year in 2014/15 which meant that the target value of 88 hours had been achieved.

For the maximum output, the installed capacity was originally 18 MW, changed to 20 MW, therefore the target value of 18 MW was achieved. The net electric energy production and plant load factor were below the 2002 baseline before renovation in both 2012/13 and 2014/15, and the target values were not achieved. According to the executing agency, this was considered to be due to changes in the amount and pattern of rainfall which led to a decrease in the water volume available for power generation. In addition, there is the possibility that the change of installed capacity from 18 MW to 20 MW affected decrease in the plant load factor. Meanwhile, as mentioned earlier, the target value for the plant load factor of 45% was set based on good preconditions and there is the possibility that it was overestimated to some extent.

The water drawn from the Umiam lake (Umiam reservoir) is used to generate power at the Umiam Stage I, carried to the Umiam Stage II through a channel⁸, then reused to generate power at the Umiam Stage II (Figure 3). For this reason, the operation of the Umiam Stage II highly depends on the operation status of the Umiam Stage I. When looking at the past 13 years of annual rainfall and the power generation volume of the Stage I and Stage II during 2001/02-2013/14, the power generation volume of these two stations

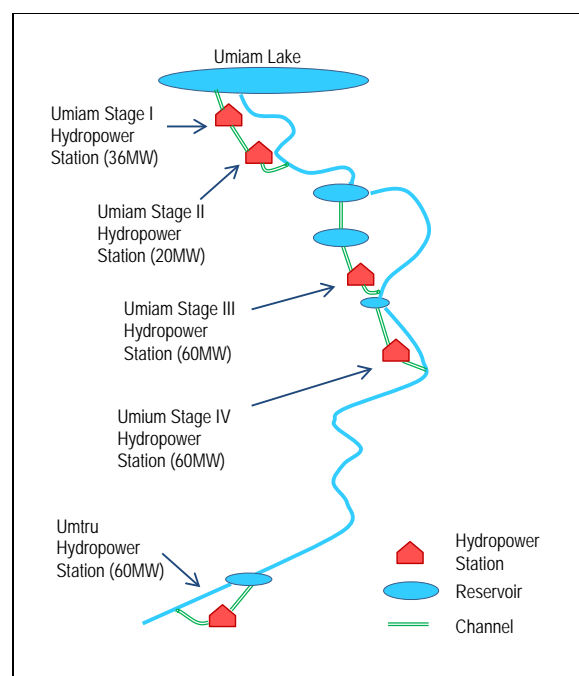
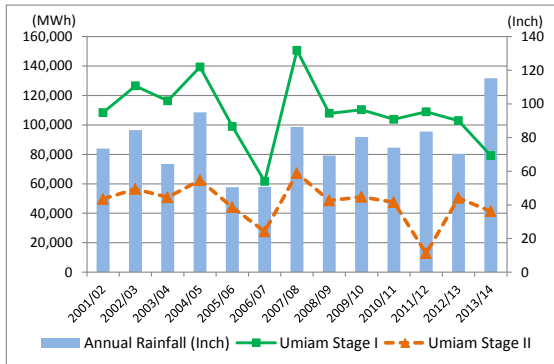


Figure 3: Map of Project Site

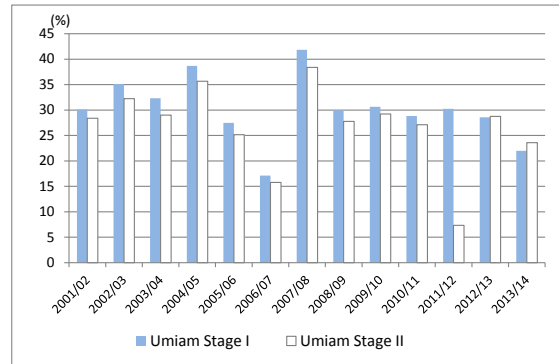
⁸ Total extension of the channel is 3,411 m (open channel: 1,188 m, tunnel: 2,226 m).

changes in almost the same pattern, except for 2011/12 when there were more planned outage hours (Figure 4). Furthermore, there were only two times (in 2004/05 and 2007/08) when the plant load factor of the two stations went above 35% during the past 13 years. For other years, it fluctuated around approximately 25%-30% (Figure 5). Considering this, a realistic target value for the plant load factor of the Umiam Stage II would have been an average of 30%-35%, and 40% at the most.



Source: Meghalaya Power Generation Corporation Limited (MePGCL).

Note: 1 inch is equivalent to 25.4 mm.



Source: Meghalaya Power Generation Corporation Limited (MePGCL).

Figure 4: Annual Rainfall and Power Generation

Figure 5: Plant Load Factor

3.3.2 Qualitative Effects

(1) Improvement in the operation and maintenance capacity of the executing agency

In this project, capacity building of the executing agency was implemented in addition to procurement assistance, the supervision of renovation works and operation and maintenance instruction as part of the consulting services. In particular, there were the improvement of financial issues, the improvement of organization management, the improvement in problem solving skills by introducing QC circles, recommendations for the improvements of human resource development systems, facilities and equipment, and a survey on the upgrading of the human resource development center to include examination of the usage of the North-Eastern Regional Center. At the ex-post evaluation interviews with current and former cadres of the human resource development department of the executing agency, accounting personnel and the head of the Umiam Stage II Hydro Power Station were conducted, and the following qualitative effects were confirmed.

Strengthening the organizational capabilities by introducing QC circles

At the executing agency, a TQM secretariat was established under the department of human resource development, and this secretariat supported the spread of TQM in the areas of human resource development, accounting, sales and corporate management. Furthermore, a circular was made on TQM promotion, and activities were conducted to disseminate QC

circles in each section and department of the power generation and transmission sectors. As the result, the power generation company started to conduct OJT on transformer repair as a part of quality management as well as holding regular meetings in order to standardize the work within each QC circle. In addition, the concept of OJT was newly introduced.

QC circles were also introduced in the Stage II Hydro Power Station, and this has shown certain effects. Prior to this, for example, when there was a breakdown, the staff of the power station opened the machine for repair, instead of following specific procedures. However, when a breakdown occurs today, they (i) refer to the manual and follow the procedures → (ii) discuss countermeasures among themselves → (iii) and conduct the repairs, as instructed in the procedures. This has led to the improvement of their maintenance and management skills.

According to the officer responsible in the department of human resource development, the importance of problem solving through QC circle activities has been widely acknowledged among employees. However, the person in charge of human resource development who played an important role in the TQM secretariat was transferred to a different department in 2013. Since then, the activities of the TQM secretariat have been discontinued and the QC circle activities have not been as active as before.

Strengthening training capacity

This project studied the upgrade of the human resource development center, which is an in-house training center of the executing agency, and based on the survey results, the executing agency improved their training programs, contents and methods at the human resource development center as well as conducting employee training using a new training program. Each training program requires a subject on TQM (See 3.4.2 Technological Aspects of Operation and Maintenance for the current training system).

Strengthening financial and accounting capacities

An accountant who received training on financial management in Japan was able to conduct accounting works based on expenditure plans, and this helped optimize financial management. In addition, there are several sections within the finance and accounting department, and now staff members hold regular meetings to share information on their duties, leading to improvement in their business.

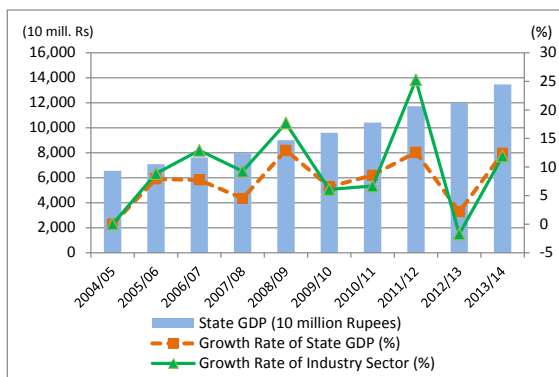
As seen above, this project had positive effects on the improvement of the operation and maintenance capabilities of the executing agency to some extent.

3.4 Impacts

3.4.1 Intended Impacts

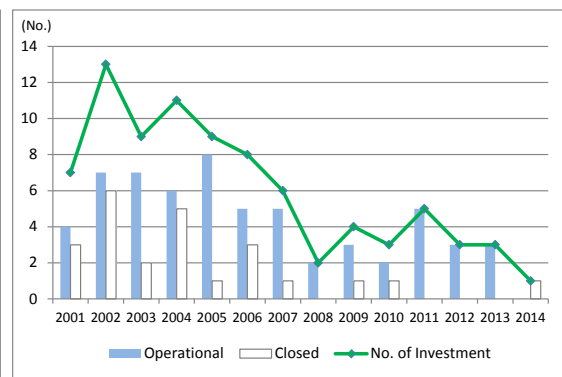
(1) Industrial development of Meghalaya State

The Umiam Stage II Hydro Power Station generates 6% of the installed capacity of Meghalaya State and 5% of the annual electricity generated as its base load power source. Its annual power generation volume accounts for approximately 2-2.5% of that of the entire Meghalaya State including electricity purchased from out of state, and this contributes to the state's power supply source to some extent. The main industries of Meghalaya are technical industries including alloy, steel and cement. For the past 10 years since 2004/05-2013/14, Meghalaya's state GDP and its growth rate have been improving steadily. The growth rate of the industrial sector, has shown positive growth except for 2012/13 (Figure 6). On the other hand, the number of investments (more than 1 billion rupees) has been decreasing to around 3 annually, with a peak in 2003-2004 (Figure 7). According to an interview with the Directorate of Commerce and Industry of the Meghalaya state government, the problem of the state's power shortages has had a negative effect on investments.



Source: Planning Commission, the Government of India.
Note: Industry sector includes mining, manufacture and energy such as electricity and gas.

Figure 6: Major Macro Economic Data of Meghalaya State



Source: Directorate of Commercial and Industrial, the Meghalaya state government.
Note: The investments were in factory plants, facilities and equipment.

Figure 7: Number of Investments in Meghalaya State (more than 1 billion rupees)

According to interviews with bulk users of electricity⁹ such as those in the alloy, steel and cement industries, the power system has been steady and electricity has been provided stably most of the time since the renovation of the Umiam Stage II power station through securing the generation capacity of 20 MW. This has contributed to the issue of power shortage.

⁹ Interviews were conducted with three companies in the fields of alloy iron manufacturing, manganese alloy manufacturing and cement manufacturing. The companies were members of the Bynihat Industries Association (BIA). BIA is an organization with 30 manufacturing companies doing business in the Export Promotion Industrial Park (EPIP) in Bynihat, Meghalaya State. Most of the BIA members are in alloy iron, cement or beer manufacturing and their sales contacts are in the domestic market.

However, most manufacturers have installed their own captive power plants in order to overcome problems such as power shortage and seasonal drops in voltage. The cost for captive power plants is a financial burden for business enterprises. These enterprises had the intention of expanding existing facilities as well as building new facilities in Meghalaya, if the state could resolve the problem of power shortage or increase the power supply volume.

Meanwhile, as the Stage III power station is located downstream of the Stage II and generates power using recycled water from the Stage II, according to the executing agency, if the renovation of the Stage II power station stops, or shuts down due to deterioration, a significant negative influence can be expected on the operation of the Stage III power station¹⁰. Furthermore, if the operation of the Stage II is stopped, it becomes necessary to purchase power from out of state to replace power generated in the Stage II. At this point some additional financial burdens are expected.

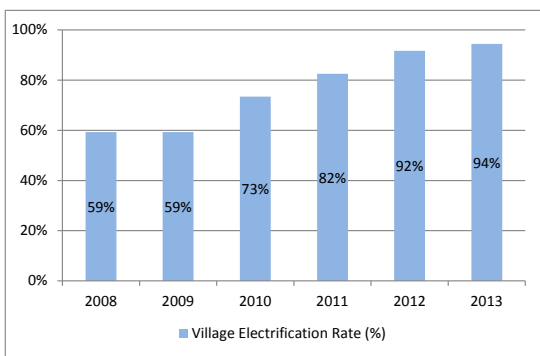
As seen above, this project contributed to the stable power supply of Meghalaya State to some extent by the renovation of the Umiyam Stage II Hydro Power Station. However the state has not solved power shortage issues completely, and the positive impacts of the project on Meghalaya's industrial development have not been sufficiently confirmed. On the other hand, the implementation of this project has made it possible to avoid future risks such as a decreased power generation capability of the Stage II and Stage III, as well as that of an additional financial burden caused by substitutional power purchase from out of state. It can therefore be said that there has been a positive impact on the state's power sector.

(2) Improvement in the living standards in Meghalaya State

The rural electrification rate¹¹ of Meghalaya has been improving over the years, rising to 94% in 2013 from 59% in 2008 (Figure 8). The number of subscribers has increased from 200,000 in 2004/05 to 350,000 in 2013/14 (Figure 9). The average growth rate of Meghalaya's GDP in the past 10 years (2004/05-2013/14) is as high as 8.4% (Figure 6).

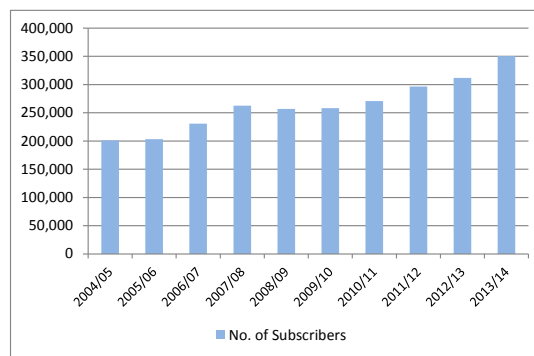
¹⁰ It is necessary to construct a detoured water channel in order to deliver water from the Stage I to the Stage III without going through the Stage II. However, this is not a realistic option due to the significant costs involved.

¹¹ According to the definition revised in February 2004, village electrification is defined as: (i) basic infrastructure such as distribution transformers and distribution lines provided in the inhabited locality as well as in the Dalit Basti/hamlet where they already exist, (ii) electricity is provided to public places such as schools, the Panchayat office, health centers, dispensaries, community centers etc. and (iii) the number of households electrified should be at least 10% of the total number of households in the village (Source: Ministry of Power, vide letter No. 42/1/2001-D (RE) dated on February 5, 2004).



Source: Meghalaya Power Generation Corporation Limited (MePGCL).

Figure 8: Village Electrification in Meghalaya State



Source: Meghalaya Power Generation Corporation Limited (MePGCL).

Figure 9: Number of Subscribers in Meghalaya State

However, the objective of this project was a renovation of the existing hydro power station, and although the contribution of the Umiam Stage II Hydro Power Station was recognized to some extent in the state's base load power source, it was still difficult to collect data that proved the causality between the project and the impact in the improvement of the living standards in Meghalaya. Therefore, in the end, it was impossible to validate the impact.

3.4.2 Other Impacts

(1) Impacts on the Natural Environment

This project was categorized as type C in the Japan Bank for International Cooperation (JBIC) Guidelines for the Confirmation of Environmental and Social Considerations (established in April 2002) since the project did not correspond to a sector or area that was likely to be influenced. The Environmental Impact Assessment (EIA) report for this project was established in May 1996, and the environmental clearance by the Ministry of Environment and Forests was obtained in August of the same year.

The environmental monitoring of this project was controlled by the Maintenance and Small Hydro Department of Meghalaya Power Generation Corporation Limited (MePGCL). The executing agency has submitted an environment compliance report in every 6 months (twice a year) on the Umiam Stage II Hydro Power Station to the Meghalaya State Department of Forest and Environment during and after completion of the project. The reports have not mentioned any particular negative impact on the environment. In addition, all water from the Umiam lake (Umiam reservoir) is supposed to be used for power generation, and the executing agency controls the water level of the lake within the required standard range of 3,220-3,155 feet (about 981-961 meter).

As seen above, there was no specific negative impact on the natural environment through implementation of this project.

(2) Land Acquisition and Resettlement

The objective of this project was to replace a power generator in the existing facility; therefore there was no land acquisition or resettlement.

In the light of the above, this project has to some extent achieved its objectives. Therefore effectiveness and impact of the project are fair.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

In March 2010, the Meghalaya State Electricity Board was reorganized into the Meghalaya Energy Corporation Limited (MeECL) which supervised all areas of power generation, transmission and distribution. MeECL was then divided into three corporations in 2013/14: Meghalaya Power Generation Corporation Limited (MePGCL), Meghalaya Power Transmission Corporation Limited (MePTCL) and Meghalaya Power Distribution Corporation Limited (MePDCL). The administration of these three corporations, such as the Department of Finance and the Department of Corporate Affairs that includes the human resource development department, remained in MeECL. Currently, MeECL is in the position of a holding company for the power generation (MePGCL), transmission (MePTCL) and distribution corporations (MePDCL). Therefore, the operation and maintenance (O&M) agency of the project is MePGCL in the narrow sense. However, MeECL is included in a wider sense. The number of staff in the above four corporations, and the organization chart of the executing agency are shown in Table 6 and Figure 10 respectively.

The Uiam Stage II Hydro Power Station which is under the Generation Department of MePGCL has taken charge of the direct O&M of the project facility. The staff of the power station consists of 28 full-time employees (10 engineers, 17 technicians, 1 administration staff) and 11 contracted employees (part-time employees), totaling 39 staff members. They are divided into 4 groups, and there are 3 shifts in 24 hours. The power station is short of entry level technicians and young full-time employees, so for the time being they hire contractors to compensate for the shortage in order to avoid any impediment in business.

From the above, it is clear that there is no issue in the institutional aspects of operation and maintenance.

Table 6: Number of Staff in the Four Meghalaya State Power Corporations
(As of November 1, 2014)

	Category I	Category II	Category III	Category IV	Total
Meghalaya Energy Corporation Limited (MeECL)	47	62	173	104	386
Meghalaya Power Generation Corporation Limited (MePGCL)	58	259	180	292	789
Meghalaya Power Transmission Corporation Limited (MePTCL)	19	110	100	99	328
Meghalaya Power Distribution Corporation Limited (MePDCL)	51	208	727	595	1,581
Total	175	639	1,180	1,090	3,084

Unit: person

Source: MePGCL.

Note: Category I includes higher level executives such as chief engineers, additional chief engineers, or accountants, Category II includes mid-level executives such as assistant engineers or assistant accountants, Category III includes intermediate or entry level engineers or technicians, and Category IV includes technicians, electricians, drivers or telephone operators.

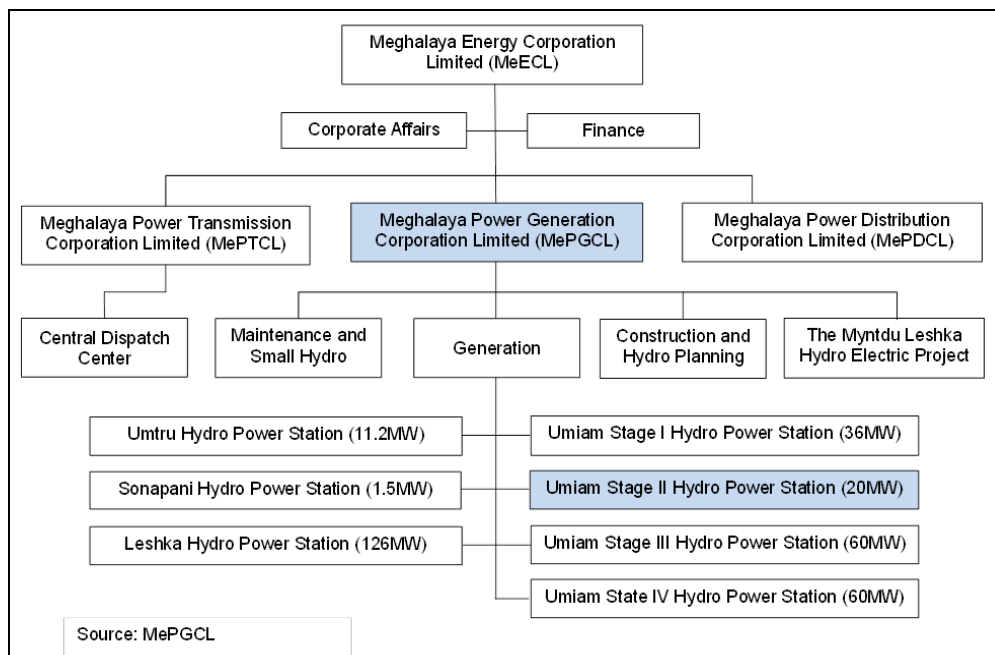


Figure 10: Organization Chart of the Executing Agency

3.5.2 Technical Aspects of Operation and Maintenance

The staff of MePGCL working at the Umiam Stage II possess degrees or certificates in electrical or mechanical engineering, and they have a certain level of technical skills in the O&M of a power generation facility. The contracted staff also hold diplomas from the Industrial Training Institute (ITI) of the state. The executing agency has an evaluation system for employees and evaluates their staff annually. Furthermore, MeECL owns its own Human Resource Development Center (located in Umiam), an in-house training center equipped

with a training room that can accommodate 35-40 people as well as training equipment such as audio equipment. Here, training is conducted for the staff members of the three power companies under MeECL. The training system is divided into three schemes: (i) in-house training organized by MeECL employees, (ii) on-site training/sponsored training at the partner training institutes, and (iii) training at MeECL with lecturers invited from the partner training institutes. There are four levels, A, B, C, D (levels according to duty positions or job title). For (i), the target is young employees at level C & D, and the training usually incorporates a combination of lectures and OJT. The content is electrical security, disaster management, power distribution management systems and also injuries associated with work. For (ii), the target is managers and veteran staff at the level A & B. They are sent to the reputable training institutes¹² in India using the Indian government's training schemes. In the Human Resource Development Center of MeECL, five training programmes¹³ were planned and conducted in 2014/15. One of these was in-house training, and the remaining four were conducted at the partner training institutes. The executing agency is currently planning to augment the facilities of the human resource development center, such as expanding its accommodation by increasing the number of training rooms or introducing new training equipment.

The Umiam Stage II Hydro Power Station is equipped with an O&M manual prepared by the manufacturer and this is referred to and used for routine O&M works. As shown in the operation and effect indicators, there was no incident of forced outage hours through mechanical trouble or human error after project completion, and this shows the high O&M ability of the power station staff.

From the above, it is clear that there were no issues in the technical aspect of operation and management.

3.5.3 Financial Aspects of Operation and Maintenance

Table 7 indicates the operation and maintenance budget of the Umiam Stage II Hydro Power Station after project completion. According to the head of the Umiam State II Hydro Power Station and the Director of the Financial Department of MeECL, the budget necessary for the operation and maintenance of the project had been secured every year.

¹² Such as the National Power Training Institute (NPTI), the Central Institute of Rural Electrification (CIRE) of Rural Electrification Corporation (REC) or the training center of the Aditya Birla Group.

¹³ They are: (i) Design and O&M of Hydro Generating Station, (ii) Root Cause Analysis of failures of electricity, (iii) Power System Operation, (iv) Life Assessment of Transformers & Generators, and (v) Personality Development & Behavioral Science. The training programs of (i)-(iv) are organized by the partner training institutes, and (v) is conducted through in-house training.

Table 7: O&M Budget of the Umiam Stage II Hydro Power Station

Unit: thousand rupee

Item	2011/2012		2012/13		2013/14	
	Plan	Actual	Plan	Actual	Plan	Actual
O&M cost	6,172	1,389	6,323	2,720	2,785	3,139
Employment cost	9,710	10,034	10,678	11,407	11,173	10,917
Administration cost	268	38	278	29	163	51
Total	16,150	11,461	17,279	14,156	14,121	14,107

Source: Responses to questionnaires.

Since the establishment of the four public corporations after 2013/14, each of the power generation, transmission and distribution corporations had individual financial statements. However, as the financial statements for the most recent three years of 2012/13, 2013/14 and 2014/15 had not been audited or officially approved at the time of the ex-post evaluation, it was difficult to obtain them from the executing agency. According to the available information¹⁴, MeECL showed a loss for three years from 2007/08-2009/10, marking a loss amount of approximately 1.04 billion rupees in 2010/11. The cost recovery rate in 2010/11 was 81% (national average: 76%) if revenue included the subsidy. However, the loss increased to 2.09 billion rupees in 2011/12 and the cost recovery rate was 71% (national average: 72.5%) if the revenue included the subsidy. It should be noted that the above figures were better than for the other states in the North East Region.

In March 2013, the Ministry of Power announced the performance ratings¹⁵ of the transmission and distribution companies nationwide, mainly their financial capacity. According to the ratings, MeECL was rated “Grade C⁺”¹⁶, and its operation as well as financial capabilities were evaluated to be low (however, this rating was carried out before MeECL was divided into three corporations to include power generation, transmission and distribution). On the other hand, according to a petition¹⁷ regarding electricity bill revision for 2014/15, submitted to the Meghalaya State Electricity Regulatory Commission by the MeECL, MePGCL’s rate of return on equity for 2014/15 was expected at 14%, which is a high profitability for a single corporation.

¹⁴ MeECL Annual Reports of 2007/08-2010/11, and the Performance of State Power Utilities for the Year 2010-11 to 2012-13, Power Finance Corporation (PFC), 2003.

¹⁵ “State Distribution Utilities First Annual Integrated Rating” Ministry of Power (March 2013). The Ministry of Power implemented the performance rating of transmission and distribution companies nationwide in order to understand their financial status and specify their needs for future financing. The actual evaluation was conducted by India’s Power Finance Corporation Ltd. and the rating was conducted by Investment Information and Credit Rating Agency of India Limited and Credit Analysis and Research Ltd.

¹⁶ The definition of each grade is as follows: Grade A: Very high operational and financial performance capability (Score distribution: 80-100), Grade B+: Moderate operational and financial performance capability (Score distribution:50-65), Grade B: Below average operational and financial performance capability (Score distribution:35-50), Grade C⁺: Low operational and financial performance capability (Score distribution: 20-35), and Grade C: Very low operational and financial performance capability (Score distribution: 0-20).

¹⁷ Petition for Annual Revenue Requirement and Generation Tariff for FY2014/15, Meghalaya Power Generation Corporation Ltd.

From the above, there are some concerns about the financial aspects of operation and maintenance.

3.5.4 Current Status of Operation and Maintenance

The project facility of the Umiam Stage II has been kept in a good condition. The operation and maintenance of the facility has been appropriately conducted according to the maintenance plan, the O&M manual and the standard operation procedures (SOP), and, during the site visit, an hourly operation record for each piece of equipment was made with each check point of the logbook. In the case of problems that could not be handled by employees at the power station, the headquarters of manufacturers were contacted and repairs conducted with instructions from the manufacturer's representative office in Delhi. As for the procurement of spare parts, Since genuine products for the power generator were procured through the manufacturer's representative office in Delhi, there were no issues noted. The Umiam Stage I and II use the same type of power generators from the same manufacturer, therefore they can share spare parts in cases of emergency.

From the above, it is clear there were no issues in the current status of operation and management of the project facility.

In the light of the above, some minor problems were observed in terms of the financial aspects of operation and maintenance of this project. Therefore the sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project was to meet the growing demand for electricity in the State of Meghalaya by the renovation of the Umiam Stage II Hydro Power Station (18 MW) which is located in the river basin of the Umiam River. The project matched India's national development policy and development needs at both the appraisal (2004) and the time of the ex-post evaluation as well as Japan's ODA policy at the time of the appraisal, therefore its relevance is high. For the project outputs, there was no major changes except for the expansion of installed capacity from 18 MW to 20 MW. This augmentation corresponded with the project objective to take measures against power shortage. However, the project period significantly exceeded the plan; therefore the efficiency of the project is fair. For the operation and effect indicators, the planned outage hours and the maximum output reached the target values, however, the forced outage hours, the plant load factor and the net electric energy production did not reach to the target values. The main factors for the failure to attain the target value of the plant load factor and net electric energy production were considered to be the water shortage for power generation due to changes in the amount and pattern of rainfall. However there is the

possibility that the setting of the target values at the appraisal was overrated. There was a certain level of achievement in the improvement of the operation and management capacity of the executing agency by capacity building. On the other hand, the Umiam Stage II Hydro Power Station generated approximately 2-2.5% of the annual electric power generated in Meghalaya State and contributed to a stable power supply as the state's base load power generation. However, the state has not solved the issue of power shortage completely, and it was difficult to confirm the impacts of the project on industrial development and improvements in the living standards of the local residents in Meghalaya. No negative impact of the project on the natural environment was observed and there was no land acquisition or resettlement. Therefore, the effectiveness and impacts of this project are fair. As for the sustainability of the project effect, some minor problems have been observed in terms of the financial aspects and therefore sustainability of the project effect is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Continuing Use of the TQM Secretariat

The improved problem solving skills and strengthened organizational capacity introduced by QC circles as part of the consulting service of this project have taken root in the companies and it is acknowledged that there has been a certain effect in some work places. It is recommended that the TQM secretariat, which is currently in a dormant state, be reactivated and used as a promoter of TQM in order to continue to disseminate this effect in the organization.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

- (1) The necessity to factor in the operation status of other facilities that work as an integral part of the entire system including the project facilities.

The Umiam Stage II Hydro Power Station generates power by recycling 100% of the water used in the Umial Stage I Hydro Power Station which is located upstream. Thus the operation of the Umiam Stage II depends on the operation status of the Umiam Stage I. This means that both Umiam Stage I & II operate as an integral part of the entire system. In a case like this, where the project target facility operates together with another non-project target facility operated by the executing agency, it is desirable that operation and effect indicators and target values are also set for the non-target facility at the time of planning in order to keep track of its operation status after project completion. It is also necessary that the water

level of the reservoir and future rainfall amount are predicted as they can significantly influence the operation of the facility. These should be examined in as much detail as possible and the results of this should be reflected in the plan.

Comparison of Original and Actual Scope

Items	Plan	Actual
(1) Project Outputs (i) Installed capacity (ii) Mechanical Equipment (iii) Electrical Equipment (iv) Consulting Services (a) Assistance for Renovation Works (b) Capacity Building	<ul style="list-style-type: none"> • 18 MW (9 MW x 2) • Turbine (runner, inlet valve, guide vane control system, main shaft water sealing device, etc.) • Governor and Turbine Control System • Air Compressed Supply System • Dewatering & Drainage System • Others • Generator and its Auxiliary (Fixed Coils, Fixed Core, etc.) • Excitation System • Main Control Boards • 11KV Metal-Enclosed Cubicles • Generator Transformer and Station Transformer • Others • Assistance in Procurement, Implementation of Renovation and Modernization Work, Operation and Maintenance Instruction, Project Reporting • Input: 45 M/M • Capacity Building of the Meghalaya State Electricity Board <ul style="list-style-type: none"> ➢ Improvement of financial issues, improvement of the organization management, Improvement of problem solving skills by introducing QC circles • Survey on Upgrading of the Human Development Center <ul style="list-style-type: none"> ➢ Recommendations for improvements in the human resource development system, facilities and equipment, utilization of the North-Eastern Regional Centre of the National Power Training Institute • Input: 48 M/M 	<ul style="list-style-type: none"> • 20 MW (10 MW x 2) • As planned • As planned • The service contents were as planned • Input: 58.39 M/M • The service contents were as planned • One month of Total Quality Management (TQM) training for 10 staff members of the Meghalaya State Electricity Board was conducted in Japan. • Input: 80.5 M/M
(2) Project Period	March 2004-September 2008 (55 months)	March 2004-January 2012 (95 months)
(3) Project Cost Amount Paid in Foreign Currency Amount Paid in Local Currency Total Japanese ODA Loan Portion Exchange Rate	<p style="text-align: center;">1,700 million yen</p> <p style="text-align: center;">643 million yen (248 million rupee)</p> <p style="text-align: center;">2,343 million yen 1,964 million yen</p> <p style="text-align: center;">1 rupee = 0.386 yen (As of August 2003)</p>	<p style="text-align: center;">unknown</p> <p style="text-align: center;">unknown</p> <p style="text-align: center;">2,147 million yen 1,825 million yen</p> <p style="text-align: center;">unknown</p>

India

Ex-Post Evaluation of Japanese ODA Loan
“Rural Electrification Project”

External Evaluator: Keishi Miyazaki, OPMAC Corporation

0. Summary

The objective of this project was to stabilize the transmission and distribution system and to expand access to electricity for un-electrified rural households, by constructing and augmenting substations and associated distribution lines in the three target states of India: Andhra Pradesh, Madhya Pradesh and Maharashtra. This project matched the Indian national development policy and development needs as well as Japan's ODA policy at the appraisal, therefore its relevance is high. The project cost was within the plan, but the project period significantly exceeded the plan, therefore the efficiency of the project is fair. The project outputs were altered in response to some situational changes during project implementation.

The operation and effect indicators such as the system average interruption duration index (SAIDI), the household electrification rate, distribution loss, the bill collection rate, and the electricity sales volume attained their respective target values. An estimate of 2.9 million rural households were newly electrified by this project. A large contribution was made to this achievement by some external factors such as the implementation of Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY), a rural electrification scheme of the government of India, improvement in distribution losses by each distribution company, improvement in bill collection methods, and the implementation of appropriate maintenance. The beneficiary survey revealed that there were some positive impacts on the economic and social aspects which improved the living standards of local residents such as increased information access, improved safety after dark, education, hygiene and sanitary conditions, public services, vitalized social activities, and decreased poverty. No negative impact on the natural environment was observed, and the land acquisition was executed according to the related Indian domestic laws. There was no resettlement for this project. Therefore, the effectiveness and impacts of this project are high.

As for sustainability of the project effects, no major problems have been observed in the institutional, technical, and financial aspects of the operation and maintenance system, and the project facilities have been maintained in good condition. Therefore, sustainability of the project effect is high.

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

1. Project Description



Project Location



A substation constructed by the project
(Andhra Pradesh State)

1.1 Background

In 2005, urban areas of India had achieved a household electrification rate of 88%. On the other hand, the household electrification rate of rural areas, which make up 72% of the overall population of the country, still remained at 44%, and approximately 78 million households were un-electrified. Each of the three target states of the project, Andhra Pradesh, Madhya Pradesh and Maharashtra, had more than 3 million households (2001) that were un-electrified. This was considered as one of the factors that caused disparity between urban and rural areas, and an improved household electrification rate in rural areas was demanded in order to achieve disparity rectification as well as balanced and continuous development.

1.2 Project Outline

The objective of this project was to stabilize the transmission and distribution system (relieving the existing overloaded system and reducing transmission and distribution losses), and to expand access to electricity for un-electrified rural households by constructing and augmenting substations and associated distribution lines in the three target states¹ of India: Andhra Pradesh, Madhya Pradesh and Maharashtra, thereby contributing to improvement in the living standards of local residents and vitalizing local economic and social activities.

¹ Andhra Pradesh State was divided into two states in June 2014, Telangana State in the north and Andhra Pradesh State in the south, so there were 4 target states at the time of the ex-post evaluation. In the ex-post evaluation report, 3 states were referred to as the project target states in the relevancy and efficiency sections, and 4 states including Telangana State were referred to as necessary in the effectiveness, impacts and sustainability sections.

Loan Approved Amount/ Disbursed Amount	20,629 million yen / 16,949 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March 2006 / March 2006
Terms and Conditions	Interest rate 0.75 % Payment period 15 years (Grace period: 5 years) Condition for Procurement General untied
Borrower / Executing Agency	Rural Electrification Corporation (REC) / REC
Final Disbursement Date	August 2012
Main Contractor (Over 1 billion yen)	Larsen & Toubro Ltd. (India)
Main Consultant (Over 100 million yen)	-
Feasibility Studies, etc.	<ul style="list-style-type: none"> • Feasibility Study (F/S): REC (May 2005) • Related study: Development study on the improvement of the power distribution system of Andhra Pradesh in India (2001-2003).
Related Projects	-

2. Outline of the Evaluation Study

2.1 External Evaluator

Keishi Miyazaki (OPMAC Corporation)

2.2 Duration of the Evaluation Study

Duration of the Study: August 2014 - September 2015

Duration of the Field Study: November 29 - December 27, 2014, March 8 - 21, 2015

3. Results of the Evaluation (Overall Rating: A²)

3.1 Relevance (Rating: ③³)

3.1.1 Relevance to the Development Plan of India

(1) National Development Plan

At the time of project appraisal (2006), the Tenth Five-Year Plan (2002-2007) stated that electrification in rural areas was one of the most important rural development issues. The New Electricity Act (2003) stated that the promotion of electrification in rural areas was an obligation for the central and local governments. Rajiv Gandhi Grameen Vidyutikaran

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

³ ③: High, ②: Fair, ①: Low.

Yojana (RGGVY) which was established in April 2005 aimed to secure electricity access for all rural households in India by 2009. RGGVY was to support the construction or augmentation of distribution lines and substations necessary for household electrification, as well as providing equipment for individual house connections of electricity for the poor at no cost. Financing of 160 billion rupees by RGGVY was planned⁴.

The objective of this project was to expand the electricity access of un-electrified rural households in the three target states of India by constructing or augmenting distribution lines and substations; therefore the project was consistent with the above mentioned Tenth Five-Year Plan, and with the New Electricity Act as well as RGGVY.

At the time of the ex-post evaluation, the Twelfth Five-Year Plan (2012-2017) stated that a stable electricity supply was essential to all economic activities as well as to inclusive growth, and that access to electricity by the nation was one of the most important issues. The Twelfth Plan aims to raise the electrification rate in urban areas from 92% to 94% and in rural areas from 55% to 67.3% during its period. For this reason, the government of India continues to promote RGGVY during the Twelfth Five-Year Plan, which includes the electrification of another 8,299 rural villages, the complete electrification of 153,811 partially electrified villages and the electrification of 8.14 million rural households below the poverty line (BPL households). As of February 2014, 110,000 un-electrified villages and 22.9 million un-electrified rural households below the poverty line had been electrified by RGGVY.

After the regime change in June 2014, Deendayal Upadhyaya Gram Jyoti Yojana⁵ (DDUGJY) which was a new rural electrification scheme replacing RGGVY was endorsed by the Cabinet on November 20, 2014. While the existing RGGVY targeted mainly electrification of villages and BPL households in rural areas, DDUGJY expanded its target to electrification of all households in rural areas including BPL households, in addition to system strengthening and feeder separation for agricultural consumers. All planned projects under RGGVY will be integrated into DDUGJY, and are expected to be implemented.

Rural electrification continues to be a priority in India's national development plan, and it was consistent with the objective of this project at the time of the ex-post evaluation.

3.1.2 Relevance to the Development Needs of India

In 2005, urban areas of India had achieved a household electrification rate of 88%. On the other hand, the household electrification rate in rural areas, which make up 72% of the overall population in the country, still remained at 44% and approximately 78 million households were un-electrified. In each of Andhra Pradesh, Madhya Pradesh and

⁴ 90% of the fund for rural electrification provided by RGGVY was determined to be a subsidy with no repayment obligation and 10% to be a loan.

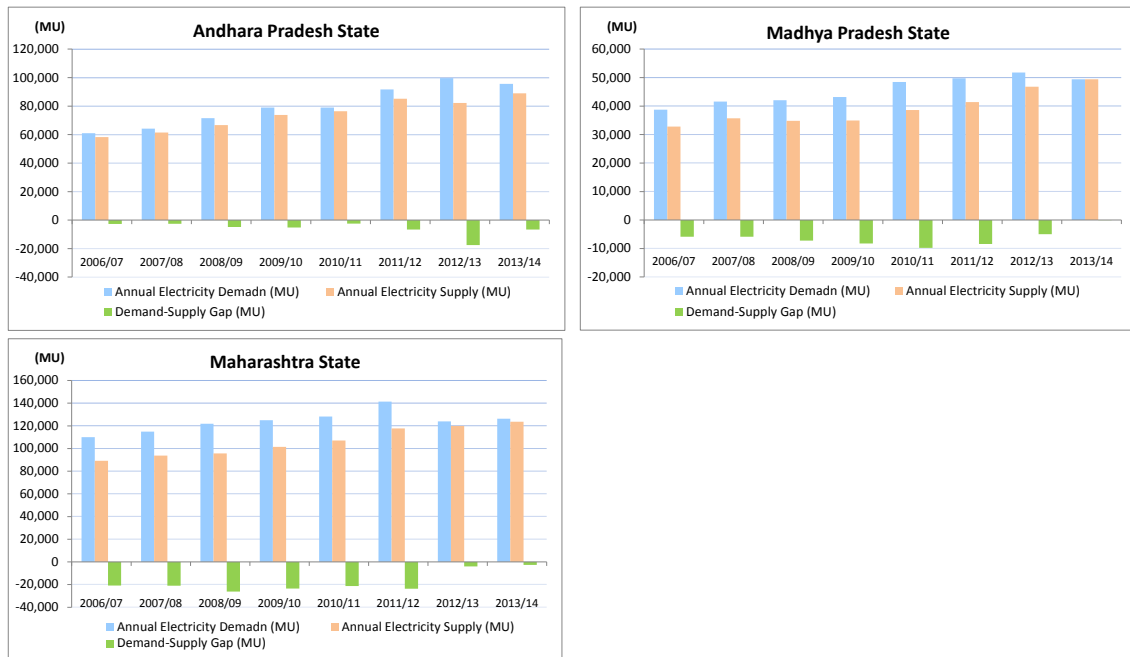
⁵ The budget for DUGYJ is 430.33 billion rupees, of which the central government provides 334.53 billion rupees.

Maharashtra, the three target states of the project, there were more than 3 million households that were un-electrified (2001). For this reason, the need for the further promotion of rural household electrification and disparity rectification of electrification rate between urban and rural areas were required in order to achieve balanced and sustainable development.

If the household electrification project were to be implemented, it was considered that the three states, Andhra Pradesh, Madhya Pradesh and Maharashtra, would see significantly improved household electrification and high sustainability. For the most part they had achieved rural electrification, their existing loan repayment status from REC was good and there were many un-electrified rural households. For the above reasons, they were chosen by REC as the target states for the project.

The objective of this project was to expand the electricity access of un-electrified rural households in the three target states of India by constructing or augmenting distribution lines and substations; therefore it is consistent with the above mentioned development needs.

At the time of the ex-post evaluation, the household electrification rate of both urban and rural areas in the three target states had improved to 92% in Andhra Pradesh, 67% in Madhya Pradesh and 84% in Maharashtra. As for the electrification of rural areas, this had improved to 90% in Andhra Pradesh, 58% in Madhya Pradesh and 74% in Maharashtra. On the other hand, the electricity supply and demand gap in Andhra Pradesh had slightly expanded, from -4.4% in 2006/07 to -6.9% in 2013/14; however it has greatly improved in Madhya Pradesh from -15.18% in 2006/07 to -0.05% in 2013/14 and in Maharashtra from -18.97% in 2006/07 to -2.07% in 2013/14. Power shortages were alleviated for the latter two states (Figure 1). However, the target set by the government of India, which aimed to bring up the household electrification rate in rural areas to 100% had not been achieved in the three target states at the time of the ex-post evaluation, and the household electrification disparity between urban and rural areas still existed; therefore it is necessary to continue the promotion of rural electrification in the three target states.



Source: Central Electricity Authority, Ministry of Power
 Note: 1 MU (Mega Unit) is equivalent to 1,000,000 KWh.

Figure 1: Demand and Supply Gap in the Three Target States

3.1.3 Relevance to Japan's ODA Policy

At the appraisal, the following three items were listed as priority targets in the Japanese Country Assistance Program for India (established in May 2006): (i) Promoting economic growth through support for power and transportation infrastructures, (ii) Improvement of poverty and environmental issues through support for health and sanitation, regional development, water and sewer services, and afforestation, and (iii) Support for the expansion of human resourced development and personal exchanges. This project was implemented along (i) of the above mentioned priority targets.

The power sector was categorized as a main sector for Japan's ODA loan in JICA's County Assistance Strategy for India 2005, and "Economic vitalization through a stable power supply and developing distribution lines and rural electrification to reduce poverty" was stated as a priority in assistance. From the above, it is clear that this project was consistent with Japan's ODA policy.

In the light of the above, this project has been highly relevant to India's development plan and development needs, as well as to Japan's ODA policy; therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

This project was to newly construct and augment substations for power distribution (33KV/11KV) as well as to construct 33KV/11KV distribution lines in the three target states of Andhra Pradesh, Madhya Pradesh and Maharashtra. The outputs for each component are shown below (Table 1-Table 4).

Initially the project was divided into two phases (Phase 1 and Phase 2) according to the timing of procurement. Meanwhile, since there was an additional outputs in this project, this ex-post evaluation report mentions Phase 3 for additional outputs in order to distinguish the outputs of Phase 1 and Phase 2.

Table 1: Newly Constructed Substations (33KV/11KV) (Plan/Actual)

Unit: number of substations

Service Area of Distribution Company		Plan			Actual				Gap
		Phase 1	Phase 2	Total	Phase 1	Phase 2	Phase 3	Total	
AP State	North	95	90	185	95	90	-	185	0
	Central	42	54	96	41	54	-	95	-1
	East	50	50	100	47	49	-	96	-4
	South	50	50	100	50	49	97	196	+96
	Total	237	244	481	233	242	97	572	+91
MP State	Central	24	12	36	36	0	-	36	0
	West	50	27	77	74	0	-	74	-3
	East	37	35	72	37	35	-	72	0
	Total	111	74	185	147	35	-	182	-3
Maharashtra State		40	57	97	18	0	-	18	-79
Total		388	375	763	398	277	97	772	+9

Source: JICA internal documents and response to questionnaires.

Note 1: AP State: Andhra Pradesh State, MP State: Madhya Pradesh State

Note 2: Phase I is the first procurement package and Phase II is the second procurement package.

Note 3: The output of this project is the 97 substations that were completed by August 2012, which was the expiry date of the loan agreement although the number of newly constructed substations in AP state as an additional output (Phase III) was 124. The remaining 27 substations were implemented with India's own finance, and 24 had been completed as of October 2014, with 3 to be completed in January 2015.

In the overall project, the actual number of newly constructed substations was 772 in comparison to the plan of 763, which was an increase of 9 sites. One noted significant change was that 79 sites were cancelled in Maharashtra. At the appraisal, there were rural electrification schemes supported by the government of India other than this project in Maharashtra. These schemes were Infrastructure Plan I⁶ which constructs and expands substations and develops power distribution networks within the state, and the AG Pump

⁶ 20% of the Infrastructure Plan I (2007-2008) project fund was a subsidy from the Indian government, and 80% was a loan from REC or Power Finance Corporations (PFC). In Maharashtra, 600 newly constructed substations, 501 augmented substations, 70,903 transformers, 43,458 km high-voltage distribution lines and 12,116 km low-voltage distribution lines were developed by Infrastructure Plan I.

Backlog Scheme⁷ which develops the power distribution network to regions that were lagging behind in the electrification of agricultural pumps. For this reason, Maharashtra state implemented a rural electrification scheme of the government of India to construct 79 new substations that were urgent out of the 97 substations that were originally planned, instead of using Japan's ODA loan project which would take a certain amount of time for procedures⁸. Therefore, the newly constructed substations of this project were reduced to 18 sites from the original plan of 97 sites in Maharashtra.

In southern Andhra Pradesh, the new construction of 97 substations was added as Phase 3 using a residual fund of the project that was caused by output changes such as the reduced number of substations and other components as well as fluctuations in the foreign currency exchange rate. For other areas, the target number has been reduced due to difficulties in land acquisition for the construction of substations and adjustment with other rural electrification projects. In addition, many substations have been constructed in different locations from the original plan.

Table 2: Augmented Substations (33KV/11KV) (Plan/Actual)

Unit: number of substations

Service Area of Distribution Company	Plan			Actual				Gap	
	Phase 1	Phase 2	Total	Phase 1	Phase 2	Phase 3	Total		
AP State	North	61	0	61	57	0	-	57	-4
	Central	43	44	87	43	44	-	87	0
	East	46	45	91	46	47	-	93	+2
	South	15	15	30	15	15	-	30	0
	Total	165	104	269	161	106	-	267	-2
MP State	Central	12	11	23	21	0	-	21	-2
	West	0	0	0	0	0	-	0	0
	East	16	14	30	16	16	-	32	+2
	Total	28	25	53	37	16	-	53	0
Maharashtra State	80	53	133	17	0	-	17	-116	
Total	273	182	455	215	122	-	337	-118	

Source: JICA internal documents and responses to questionnaires.

Note : AP State: Andhra Pradesh State, MP State: Madhya Pradesh State

For the overall project, the number of augmented substations was reduced to 337 sites from the 455 sites of the plan, which was a reduction of 118 sites in total. In Maharashtra,

⁷ The AG Pump Backlog Scheme promotes electrification in 18 districts of Maharashtra state where the electrification of agricultural pumps was delayed, and 100% of the project fund was a subsidy from the Indian government. In Maharashtra, the construction of 46 new substations, the augmentation of 57 substations, 8,866 transformers, 5,211 km of high-voltage distribution lines and 12,811 km of low-voltage distribution lines as well as the electrification of 134,216 agricultural pumps was conducted in the 8 years from 2005/06 to 2013/14 using this scheme.

⁸ Of the 79 cancelled new substations, 52 were developed by Infrastructure Plan I and 27 by the AG Pump Backlog Scheme.

the number of augmented substations of the project was reduced to 17 sites from 133 sites, due to the same reason as for the drastic cut in newly constructed substations⁹. For other areas, the number of target sites fluctuated due to adjustment with other rural electrification projects.

Table 3: 33KV Distribution Lines (Plan/Actual)

Unit: Km

Service Area of Distribution Company	Plan			Actual				Gap	
	Phase 1	Phase 2	Total	Phase 1	Phase 2	Phase 3	Total		
AP State	North	744	616	1,360	462	425	-	887	-473
	Central	325	386	710	220	263	-	483	-227
	East	400	400	800	287	257	-	544	-257
	South	275	263	538	208	224	506	938	+400
	Total	1,744	1,665	3,408	1,177	1,169	506	2,852	-556
MP State	Central	188	157	345	378	0	-	378	33
	West	315	319	634	442	42	-	484	-150
	East	340	286	626	400	0	-	400	-226
	Total	843	762	1,605	1,220	42	-	1,262	-343
Maharashtra State	400	570	970	143	0	-	143	-827	
Total	2,987	2,997	5,983	2,540	1,211	506	4,257	-1,726	

Source: JICA internal documents and responses to questionnaires.

Note : AP State: Andhra Pradesh State, MP State: Madhya Pradesh State

For the overall project, the distance of constructed 33KV distribution line was 4,257 km against the plan of 5,983 km, which was a reduction of 1,726 km. The increase of 400 km in the 33KV distribution line in southern Andhra Pradesh was due to the additional 97 newly constructed substations. The 827 km decrease in Maharashtra was due to the cancellation of the constructions of 79 substations and 116 augmented constructions of substations.

For other areas, there was no significant change in the amount of new and augmented construction of substations. However, many of the new substations were constructed in different locations from the original plan due to difficulties in land acquisition or the construction of a substation near the planned site through other rural electrification projects. Due to this, the route of the 33KV distribution line has been significantly altered. In addition, there were places where obtaining the permit for constructing distribution lines was difficult and in some sections it was necessary to alter the route¹⁰. For these reasons, there was a gap between the planned and actual construction distance of the 33KV distribution line.

⁹ Of those 116 cancelled new substations, 91 were developed by Infrastructure Plan I and 25 by the AG Pump Backlog Scheme.

¹⁰ For example, the target regions in Maharashtra had relatively large urban areas, and there were many places where it was difficult to obtain the right-of-way (ROW) when a distribution line crossed a road or railway. It was also reported that there were some land owners in rural regions who did not agree with distribution lines passing over their sites or fields.

Table 4: 11KV Distribution Lines (Plan/Actual)

Unit: Km

Service Area of Distribution Company	Plan			Actual				Gap	
	Phase 1	Phase 2	Total	Phase 1	Phase 2	Phase 3	Total		
AP State	North	279	231	510	515	449	-	964	+454
	Central	227	249	476	139	179	-	318	-158
	East	150	150	300	215	247	-	462	+162
	South	234	249	483	182	213	446	841	+358
	Total	890	879	1,769	1,051	1,088	446	2,585	816
MP State	Central	96	65	161	242	0	-	242	+81
	West	170	126	296	204	15	-	219	-77
	East	112	117	229	126	0	-	126	-103
	Total	378	308	686	572	15	-	587	-99
Maharashtra State	120	171	291	129	0	-	129	-162	
Total	1,388	1,358	2,746	1,752	1,103	446	3,301	+555	

Source: JICA internal documents and responses to questionnaires.

Note : AP State: Andhra Pradesh State, MP State: Madhya Pradesh State

For the overall project, the distance of the constructed 11KV distribution line was 3,301 km against the plan of 2,746 km, which was an increase of 555 km in length. The reason for the gap between the planned and actual construction distance of the distribution line was the same as that mentioned above for the 33KV distribution line.

According to REC, this project was established based on project plans submitted by each distribution company of the target states in 2005. However, the rural electrification schemes of the government of India were executed in parallel with this project. In addition, some changes in the project scope during project implementation were expected depending on the situation, as there was the possibility of alterations in state policies and priorities after establishment of the plan. The changes in the outputs for each component mentioned above were in response to situation changes that were different from the assumptions made at project planning, and such changes were appropriate when they were referred to the project objectives. Furthermore, the number of beneficiary households newly electrified by this project was estimated based on the plan and actual outputs; the number of beneficiary households for the planned output was 3,063,972 and the number of beneficiary households for the actual output was 2,965,969. As can be seen from the above, however, the project effects were not reduced by the changes in the outputs.

Procurement Methods

In this project, REC was responsible for financing the 8 distribution companies in three target states as well as for the overall project management, while each distribution company was in charge of the procurement of equipment and the supervision of civil works in the

service areas for which they were responsible. No consultant was employed. For the procurement method, a full turn-key contract method covering contract packages for both civil works and equipment was adopted. However, a partial turn-key contract method was applied to some contracts. In total, there were 82 full turn-key contracts and 53¹¹ partial turn-key contracts, all of which were conducted through domestic tender bidding (Table 5).

Table 5: Number of Procurement Packages

Unit: Number of contract

Distribution Company	Number of Procurement Packages	
	Full turn-key	Partial turn-key
Northern Power Distribution Company of Andhra Pradesh Limited (APNPDCL) (Currently Northern Power Distribution Company of Telangana State Limited (TSNPDCL))	10	-
Central Power Distribution Company of Andhra Pradesh Limited (APCPDCL) (Currently Southern Power Distribution Company of Telangana State Limited (TSSPDCL))	17	-
Eastern Power Distribution Company of Andhra Pradesh Limited (APEPDCL)	10	-
Southern Power Distribution Company of Andhra Pradesh Limited (APSPDCL)	12	53
Madhya Pradesh Central Area Distribution Company Limited (MPMKVVCL-Bhopal)	8	-
Madhya Pradesh West Area Distribution Company Limited (MPPKVVCL-Indore)	13	-
Madhya Pradesh East Area Distribution Company Limited (MPPKVVCL-Jabalpur)	4	-
Maharashtra State Electricity Distribution Co. Limited (MSEDCL)	8	-
Total	82	53

Source: Responses to questionnaires

Note: For a breakdown of the partial turn-key contracts of Southern Power Distribution Company of Andhra Pradesh Limited, there were 34 contracts for civil works, and 19 contracts for the procurement of equipment. Both were implemented during Phase 3.

According to the results of interviews with REC and the 8 distribution companies, the above mentioned demarcation of responsibilities between REC and the distribution companies was executed smoothly. On the other hand, for procurement, some issues were found in the implementation capability of the contractors engaged in the Phase 3 package for southern Andhra Pradesh and a package for central and western Madhya Pradesh. In the above cases, when a contractor was awarded several packages, it was difficult for them to execute the several packages at the same time due to limited capacity and this resulted in the delay of the project. As the background to this, many distribution companies usually procure equipment directly by themselves and only civil works are procured through competitive

¹¹ In south Andhra Pradesh, 97 substations were newly constructed as an additional output (Phase 3). However, if the procurement is conducted with a full turn-key contract, the project may not be completed by the expiry date of the loan agreement and therefore a partial tur-key contract was adopted.

bidding¹²; therefore they are not familiar with procurement by the full turn-key contract method as adopted by the project. It might have been possible to avoid cases where a single contractor was awarded multiple contracts beyond its implementation capability had there been, as a requirement for tender, the obligation to check the contractor's existing contracts and remaining implementation capacity for additional contracts.. However, no consultant was employed for assistance in tender for this project. REC organized a workshop on procurement for distribution companies at the beginning of the project. It mainly focused, however, on explanation of the standard procurement guidelines of the Indian government, and did not cover specific issues such as the risks and countermeasures associated with the procurement of a number of contract packages by the full turn-key contract method as was seen in this project.

Implementation Status of RGGVY Related to This Project

This project was implemented in collaboration with RGGVY with a demarcation of responsibilities. On the one hand, the project was responsible for the development of substations and distribution lines between the existing 33KV distribution lines and low voltage transformers at each village. On the other hand, RGGVY took charge of developing individual electrical connections between low voltage transformers and each household (Figure 2). In this framework, by using RGGVY, each distribution company in the three target states was able to implement the development of distribution lines reaching each household as well as low-voltage transformers in each village, individual electrical connections and electricity meters in parallel with this project.

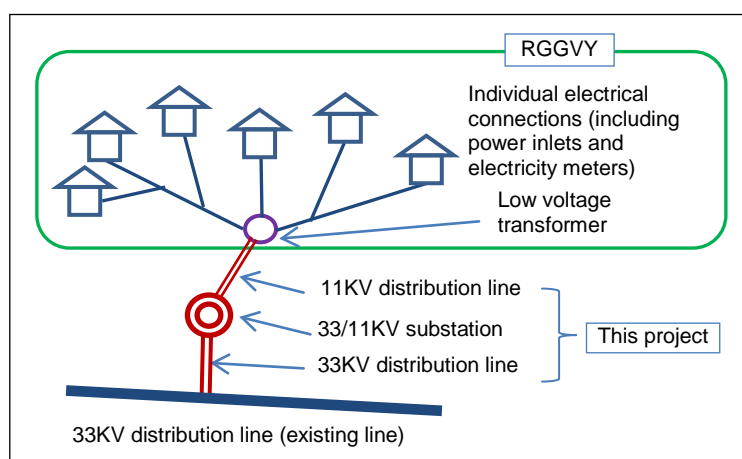


Figure 2: Demarcation between this Project and RGGVY in the target village

¹² The advantages of this method for the distribution companies are: (i) The unit price of equipment can be reduced if distribution companies procure a substantial amount of equipment collectively, (ii) A sufficient and standardized quality of equipment can be secured, (iii) There is the possibility of relatively small-scale contractors participating in the tender, and (iv) Risks of delay in the project implementation schedule caused by delays in the procurement of equipment by the contractor, often seen in full turn-key based procurement, can be reduced. On the other hand, the disadvantage is that a great burden is placed on the distribution company.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost amounted to 24,009 million yen (including the 16,949 million yen of Japan's ODA loan) against the planned cost of 24,649 million yen (including the 20,629 million yen of Japan's ODA loan). This was within the plan (equivalent to 97% of the original plan).

There were some changes in the outputs of each component in this project. Although there were some significant changes in Maharashtra, such as the cancellation of 79 new substation constructions and the construction of 116 augmented substations, the residual fund which emerged from the cancelled outputs and foreign currency exchange fluctuation was used for the construction of 97 new substations and the accompanying augmentation of distribution lines in southern Andhra Pradesh¹³. In the end, the actual project cost was lower than planned.

3.2.2.2 Project Period

The planned project period was 29 months, or from March 2006 (signing of the loan agreement) to September 2008 (project completion). The actual project period was 78 months, or from March 2006 (signing of the loan agreement) to August 2012 (project completion), which was significantly longer than planned (equivalent to 252% of the original plan) (Table 6).

Table 6: Project Period (Plan/Actual)

Item	Plan	Actual
Loan Agreement Signing Date	March 2006	March 2006
Phase 1		
• Commencement of tender	June 2006	October 2007
• Commencement of supply of major equipment and materials	November 2006	February 2008
• Commencement of installation of equipment and materials	January 2007	May 2008
• Completion of construction of substations	September 2007	September 2010
Phase 2		
• Commencement of tender	June 2007	March 2008
• Commencement of supply of major equipment and materials	November 2007	June 2008
• Commencement of installation of equipment and materials	January 2008	October 2008
• Completion of construction of substations	September 2008	September 2011

¹³ Due to cancellation of a part of the project output in Maharashtra, a 2,900 million yen residual fund was estimated as of October 2009, and 2,384 million yen was estimated as the project cost of 97 newly constructed substations (Phase 3) in southern Andhra Pradesh.

Item	Plan	Actual
Phase 3		
• Completion of construction of substations	—	August 2012
Project Period	March 2006-September 2008 (29 months)	March 2006-August 2012 (78 months)

Source: JICA internal documents and responses to questionnaires.

Note: Although some of the construction of new substations in south Andhra Pradesh implemented as an additional output (Phase 3) was incomplete, the project was deemed to be completed in August 2012, which was the expiry date of the loan agreement.

Table 7: Actual Project Period of Each Distribution Company

Distribution Company	Actual Project Period
Northern Power Distribution Company of Andhra Pradesh Limited (APNPDCL) (Currently Northern Power Distribution Company of Telangana State Limited (TSNPDCL))	March 2006 - November 2011 (68 months)
Central Power Distribution Company of Andhra Pradesh Limited (APCPDCL) (Currently Southern Power Distribution Company of Telangana State Limited (TSSPDCL))	March 2006 - March 2010 (49 months)
Eastern Power Distribution Company of Andhra Pradesh Limited (APEPDCL)	March 2006 - February 2010 (48 months)
Southern Power Distribution Company of Andhra Pradesh Limited (APSPDCL)	March 2006 - August 2012(78 months)
Madhya Pradesh Central Area Distribution Company Limited (MPMKVVCL-Bhopal)	March 2006 - January 2011 (59 months)
Madhya Pradesh West Area Distribution Company Limited (MPPKVVCL-Indore)	March 2006 - September 2011 (67 months)
Madhya Pradesh East Area Distribution Company Limited (MPPKVVCL-Jabalpur)	March 2006 - August 2011 (66 months)
Maharashtra State Electricity Distribution Co. Limited (MSEDCL)	March 2006 - January 2012 (71 months)

Source: Responses to questionnaires.

A common reason for delays among the eight distribution companies in the three target states was that it took time for land acquisition for substations and for obtaining the right-of-way for distribution lines. Thus all the distribution companies experienced delays of approximately 1.5 - 3.5 years (Table 7). Furthermore, the construction of 97 new substations in southern Andhra Pradesh as an additional output (Phase 3) was also a factor in delays. Re-tender was conducted as there were problems in the implementation capability of some contractors for the contract package in Phase 3. This was another factor leading to the prolonged implementation period for the additional output. Similarly, another delay was observed in central and western Madhya Pradesh due to the issue of the implementation capability of the contractors.

3.2.3 Results of Calculations of Internal Rates of Return

The Economic Internal Rate of Return (EIRR) was 15.4% at the appraisal. The result of the recalculation of EIRR could not be obtained. The calculation of FIRR was not conducted at the appraisal and therefore it was not calculated at the time of the ex-post evaluation.

<Assumptions for calculation of the EIRR at the time of planning>

- Cost: Project cost (tax excluded), operation and maintenance cost, connection fee for each household
- Benefits: Substitution effects of existing energy (candles, lamps, etc.)
- Project life: 25 years

In light of the above, the project cost was within the plan but the project period significantly exceeded the plan; therefore the efficiency of the project is fair.

3.3 Effectiveness¹⁴ (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

(1) System Average Interruption Duration Index (SAIDI)

The System Average Interruption Duration Index (SAIDI) was achieved in all the distribution companies (Table 8). The appropriate implementation of both daily and regular maintenance inspections at each distribution company was considered to be a contributing factor in this achievement. The factors causing interruptions of the power supply were damage to the 33KV/11KV distribution lines, malfunction of the transformers, and meteorological phenomena such as strong wind.

Table 8: System Average Interruption Duration Index (SAIDI)

Unit: Hour/Household per year

Distribution Company	Baseline	Target	Actual		
	2005	2010	2012	2013	2014
	1 year prior to appraisal	2 years after completion	Completion year	1 year after completion	2 years after completion
TSNPDCL (Former APNPDCL)	1,373	1,005	144	129	83
TSSPDCL (Former APCPDCL)	1,320	930	739	746	752
APEPDCL	1,260	870	42	50	33
APSPDCL	1,300	920	1,109	1,051	916
MPMKVVCL-Bhopal	2,328	2,100	2,045	2,045	2,044
MPPKVVCL-Indore	3,000	2,400	2,854	2630	1,970
MPPKVVCL-Jabalpur	15,082	9,600	2,300	1,464	1,305
MSEDCL	3,500	2,600	1,190	1,480	1,160

Source: JICA internal documents and responses to questionnaires.

Note 1: Above index indicates figures for all the districts where the project facilities were developed.

Note 2: **APNPDCL**: Northern Power Distribution Company of Andhra Pradesh Limited, **APCPDCL**: Central Power Distribution Company of Andhra Pradesh Limited, **APEPDCL**: Eastern Power Distribution Company of Andhra Pradesh Limited, **APSPDCL**: Southern Power Distribution Company of Andhra Pradesh Limited, **TSSPDCL**: Southern Power Distribution Company of Telangana State Limited, **TSNPDCL**: Northern Power Distribution Company of Telangana State Limited, **MPMKVVCL-Bhopal**: Madhya Pradesh Central Area Distribution Company Limited, **MPPKVVCL-Indore**: Madhya Pradesh West Area Distribution Company Limited, **MPPKVVCL-Jabalpur**: Madhya Pradesh East Area Distribution Company Limited, **MSEDCL**: Maharashtra State Electricity Distribution Co. Limited.

¹⁴ Sub-rating for Effectiveness is to be put with consideration of Impact

(2) Household Electrification Rate

Regarding the household electrification rate, the actual value in western Madhya Pradesh was 64.7% (76% achievement rate) in 2014 against the target value of 85%. However, the actual values in southern Telangana, eastern and southern Andhra Pradesh, central Madhya Pradesh and Maharashtra exceeded the target values. An achievement rate of 92% was reported against the target value of 100% (92% achievement rate) in northern Telangana, and an actual value of 69.4% (86.7% achievement rate) was reported in 2014 against the target value of 80% in eastern Madhya Pradesh; both achieved more than 80% of the target values (Table 9). From the above, it can be judged that overall, the household electrification rate mostly achieved the target in this project. The above improvement in the household electrification rate was due to the major contribution of RGGVY in addition to the expansion of substations and distribution lines through the project.

Table 9: Household Electrification Rate (Electrified Households/All Households)

Unit: %

Distribution Company	Baseline	Target	Actual		
	2005	2010	2012	2013	2014
	1 year prior to appraisal	2 years after completion	Completion year	1 year after completion	2 years after completion
TSNPDC (Former APNPDC)	58	100	72	90	92
TSSPDCL (Former APCPDCL)	70	93	89	91	93
APEPDCL	61	85	90	95	98
APSPDCL	70	91	75	86	96
MPMKVVCL-Bhopal	24	45	45	47	50
MPPKVVCL-Indore	37	85	53.16	60.73	64.65
MPPKVVCL-Jabalpur	39	80	N.A.	66.60	69.36
MSEDCL	66	87	83.97	87.32	89.64

Source: JICA internal documents and responses to questionnaires.

Note 1: Above index indicates figures for all the districts where the project facilities were developed.

Note 2: **APNPDC**: Northern Power Distribution Company of Andhra Pradesh Limited, **APCPDCL**: Central Power Distribution Company of Andhra Pradesh Limited, **APEPDCL**: Eastern Power Distribution Company of Andhra Pradesh Limited, **APSPDCL**: Southern Power Distribution Company of Andhra Pradesh Limited, **TSSPDCL**: Southern Power Distribution Company of Telangana State Limited, **TSNPDC**: Northern Power Distribution Company of Telangana State Limited, **MPMKVVCL-Bhopal**: Madhya Pradesh Central Area Distribution Company Limited, **MPPKVVCL-Indore**: Madhya Pradesh West Area Distribution Company Limited, **MPPKVVCL-Jabalpur**: Madhya Pradesh East Area Distribution Company Limited, **MSEDCL**: Maharashtra State Electricity Distribution Co. Limited.

(3) Distribution Loss

All the distribution companies achieved the targets for distribution loss in their respective areas (Table 10). The renewal of old equipment such as transformers, the development of a high-voltage distribution system and the strengthening of monitoring in areas prone to a high level of electricity stealing were conducted concurrently with, and in addition to, the project's augmentation of substations and distribution lines, which greatly contributed to the improvement in distribution loss.

Table 10: Distribution Loss

Unit: %

Distribution Company	Baseline	Target	Actual		
	2005	2010	2012	2013	2014
	1 year prior to appraisal	2 years after completion	Completion year	1 year after completion	2 years after completion
TSNPDCL (Former APNPDCCL)	19	18	14.02	13.82	14.18
TSSPDCL (Former APCPDCL)	21	16	13.42	12.03	11.76
APEPDCL	15	12	6.91	6.46	6.33
APSPDCL	22	21	12.40	11.82	10.68
MPMKVVCL-Bhopal	44	38	32.71	30.85	29.60
MPPKVVCL-Indore	38	27	30.30	26.39	24.29
MPPKVVCL-Jabalpur	31	25	25.12	24.48	23.67
MSEDCL	31	24	18.33	17.46	16.40

Source: JICA internal documents and responses to questionnaires.

Note 1: Above index indicates figures for all the districts where the project facilities were developed.

Note 2: **APNPDCCL**: Northern Power Distribution Company of Andhra Pradesh Limited, **APCPDCL**: Central Power Distribution Company of Andhra Pradesh Limited, **APEPDCL**: Eastern Power Distribution Company of Andhra Pradesh Limited, **APSPDCL**: Southern Power Distribution Company of Andhra Pradesh Limited, **TSSPDCL**: Southern Power Distribution Company of Telangana State Limited, **TSNPDCCL**: Northern Power Distribution Company of Telangana State Limited, **MPMKVVCL-Bhopal**: Madhya Pradesh Central Area Distribution Company Limited, **MPPKVVCL-Indore**: Madhya Pradesh West Area Distribution Company Limited, **MPPKVVCL-Jabalpur**: Madhya Pradesh East Area Distribution Company Limited, **MSEDCL**: Maharashtra State Electricity Distribution Co. Limited.

(4) Bill Collection Rate

The bill collection rate achieved the targets in all areas of the distribution companies (In Maharashtra, the actual value in 2014 was 90.7% against the target of 100% (90.7% achievement), which means that Maharashtra achieved its target) (Table 11). Furthermore, the reason for the decline in the bill collection rate in Maharashtra from 96.4% in 2012 to approximately 90% in 2013 and 2014 was a delinquency of electricity bill payment by farmers due to drought. The improvement in the bill collection rate was due to the countermeasures taken by each distribution company such as improvements in bill collection methods (abolition of bill collection by collection staff visiting individual households, the introduction of a payment method whereby people can pay their electricity bills on the internet or at a village kiosk), strict bill collection for those in arrears, and the prevention of electricity stealing through the development of high-voltage distribution lines. In addition, RGGVY installed electricity meters in each household and there were other schemes.

Table 11: Bill Collection Rate

Unit: %

Distribution Company	Baseline	Target	Actual		
	2005	2010	2012	2013	2014
	1 year prior to appraisal	2 years after completion	Completion year	1 year after completion	2 years after completion
TSNPDCCL (Former APNPDCCL)	93	97	100	100	100
TSSPDCL (Former APCPDCL)	80	86	97	100	95
APEPDCL	95	95	100	100	99
APSPDCL	95	98	96	97	98
MPMKVVCL-Bhopal	83	86	89.8	100	100
MPPKVVCL-Indore	93	97	97.8	100	100
MPPKVVCL-Jabalpur	91	100	95.6	100	100
MSEDCL	100	100	96.43	89.95	90.71

Source: JICA internal documents and responses to questionnaires.

Note 1: Above index indicates figures for all the districts where the project facilities were developed.

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(5) Electricity Sales Volume

As for the electricity sales volume, all distribution companies achieved their targets in their respective areas (the actual value in southern Telangana was 3,238MWh in 2014 against the target value of 3,547MWh (91.3% achievement)) (Table 12). The increase in the electricity supply volume due to household electrification was the key factor for the increased electricity sales volume.

Table 12: Electricity Sales Volume

Unit: MWh

Distribution Company	Baseline	Target	Actual		
	2005	2010	2012	2013	2014
	1 year prior to appraisal	2 years after completion	Completion year	1 year after completion	2 years after completion
TSNPDCCL (Former APNPDCCL)	1,142	1,590	10,230	9,671	10,286
TSSPDCL (Former APCPDCL)	2,852	3,547	3,160	3,063	3,238
APEPDCL	6,252	10,252	11,725	11,665	12,900
APSPDCL	1,788	2,536	16,388	16,444	18,024
MPMKVVCL-Bhopal	5,132	6,000	7,100	9,939	11,557
MPPKVVCL-Indore	1,020	1,288	6,849	8,243	9,121
MPPKVVCL-Jabalpur	8,929	10,872	12,225	13,127	13,977
MSEDCL	7,359	9,848	22,809	23,723	26,000

Source: JICA internal documents and responses to questionnaires.

Note 1: Above index indicates figures for all the districts where the project facilities were developed.

Note 2: **APNPDCL**: Northern Power Distribution Company of Andhra Pradesh Limited, **APCPDCL**: Central Power Distribution Company of Andhra Pradesh Limited, **APEPDCL**: Eastern Power Distribution Company of Andhra Pradesh Limited, **APSPDCL**: Southern Power Distribution Company of Andhra Pradesh Limited, **TSSPDCL**: Southern Power Distribution Company of Telangana State Limited, **TSNPDCL**: Northern Power Distribution Company of Telangana State Limited, **MPMKVVCL-Bhopal**: Madhya Pradesh Central Area Distribution Company Limited, **MPPKVVCL-Indore**: Madhya Pradesh West Area Distribution Company Limited, **MPPKVVCL-Jabalpur**: Madhya Pradesh East Area Distribution Company Limited, **MSEDCL**: Maharashtra State Electricity Distribution Co. Limited.

(6) Number of Beneficiary Households

The estimated number of newly electrified rural households (2014) through this project is shown in Table 13. It is estimated that approximately 2.9 million rural households in the four target states were newly electrified by the project. This is equivalent to 6.5% of the total electrified households in the four target states. On the other hand, although this is not included among the above beneficiary households, each substation provides electricity to agricultural pumps and commercial establishments in addition to ordinary households; thus the target beneficiaries expand further if these are included.

Table 13: Estimated Number of Newly Electrified Households through the Project
(Beneficiary Households) (2014)

Unit: Number of Households

State	Distribution Company	Entire Service Area of Distribution Company	Beneficiary Households of the Project	
		Households	Households	Percentage
Telangana	TSNPDCL (Former APNPDCL)	3,393,494	823,702	24.3%
	TSSPDCL (Former APCPDCL)	4,243,291	354,060	8.3%
	Subtotal	7,636,785	1,177,762	15.4%
Andhra Pradesh	APEPDCL	6,108,451	542,058	8.9%
	APSPDCL	7,610,667	636,300	8.4%
	Subtotal	13,719,118	1,178,358	8.6%
Madhya Pradesh	MPMKVVCL-Bhopal	2,268,092	96,480	4.3%
	MPPKVVCL-Indore	3,147,916	188,034	6.0%
	MPPKVVCL-Jabalpur	2,832,070	247,954	8.8%
	Subtotal	8,248,078	532,468	6.5%
Maharashtra	MSEDCL	16,246,589	77,382	0.5%
	Total	45,850,570	2,965,970	6.5%

Source: Responses to questionnaires.

Note 1: The beneficiary households of this project were estimated based on the number of newly constructed and augmented substations and an average taken of the electrified households per substation in rural areas of each distribution company. When there were 20% of newly electrified households (beneficiary households) through the project within all the electrified households of each substation, this was taken as an augmented station .

Note 2: **APNPDCL**: Northern Power Distribution Company of Andhra Pradesh Limited, **APCPDCL**: Central Power Distribution Company of Andhra Pradesh Limited, **APEPDCL**: Eastern Power Distribution Company of Andhra Pradesh Limited, **APSPDCL**: Southern Power Distribution Company of Andhra Pradesh Limited, **TSSPDCL**: Southern Power Distribution Company of Telangana State Limited, **TSNPDCL**: Northern Power Distribution Company of Telangana State Limited, **MPMKVVCL-Bhopal**: Madhya Pradesh Central Area Distribution Company Limited, **MPPKVVCL-Indore**: Madhya Pradesh West Area Distribution Company Limited, **MPPKVVCL-Jabalpur**: Madhya Pradesh East Area Distribution Company Limited, **MSEDCL**: Maharashtra State Electricity Distribution Co. Limited.

3.3.2 Qualitative Effects

The beneficiary survey with rural households newly electrified by this project revealed that 84% of the respondents had realized a stable power supply and 94% were satisfied with the power supply reliability and quality (70% highly satisfied and 24% satisfied) (See 3.4.1 Intended Impacts for the beneficiary survey). In Madhya Pradesh, electricity is supplied 24 hours in most rural households; for other states, electricity is supplied for 12-24 hours depending on the status of each distribution company. In addition, there were improvements in the system average interruption duration index (SAIDI) and distribution loss in the project target states as mentioned earlier, and it is considered that it is such improvements that have led to the high satisfaction level.

From the above, it can be seen that the operation and effect indicators such as the system average interruption duration index (SAIDI), the household electrification rate, distribution loss, the bill collection rate, and the electricity sales volume have attained their target values and it is estimated that approximately 2.9 million rural households in the four target states have been newly electrified by this project. Furthermore, it was confirmed from the results of the beneficiary survey that the electricity supply to each household is stable. Thus, the objectives of this project, which were to stabilize the transmission and distribution system (to relieve the existing overloaded system and reduce transmission and distribution losses) and to expand access to electricity for un-electrified rural households have been achieved. Some external factors also greatly contributed to this achievement. Each distribution company conducted projects concurrently with this project, such as the improvement of transmission and distribution losses, improvement of bill collection methods and the implementation of appropriate maintenance. In addition there was the provision of individual electrical connections to each household from the project facilities by the project and RGGVY.

3.4 Impacts

3.4.1 Intended Impacts

At the time of the ex-post evaluation, a beneficiary survey was conducted with 150 rural households which were newly electrified by this project in 6 villages¹⁵ from the four project target states¹⁶ in order that the socio-economic impacts of this project might be comprehended. In addition, an interview was conducted with each village head to understand the impacts from the village point of view. The results of the beneficiary survey are shown in Table 14 below.

¹⁵ See the box “The Results of the Beneficiary Survey (A Case of Improvement in Hygiene and Sanitary Conditions)”.

¹⁶ Andhra Pradesh was divided into two states in June 2014, Telangana state in the north and Andhra Pradesh state in the south, and there were 4 target states at the time of the ex-post evaluation.

Table 14: Results of the Beneficiary Survey

Impacts	Results	Main responses
Increased access to information	Significantly increased: 12% Increased: 86% Same: 2%	Increased access to various types of information such as domestic/international news and the latest market values of agricultural products as the use of TV at home or cell phones became available.
Improvement in safety after dark	Improved: 92% Same: 8%	Installation of streetlights has improved safety after dark. It has also contributed to a reduction in the crime rates.
Improvement in child education	Improved: 85% Same: 15%	Outcomes in children's education has improved since they can study at night. In addition, children can concentrate on their academic work better with the use of electric fan in a hot weather.
Improvement in hygiene and sanitary conditions	Significantly improved: 2% Improved: 97% Same: 1%	People's awareness of household cleanliness has improved. The use of electric appliances such as refrigerators made it possible to keep fresh food such as milk, and hygiene and sanitary conditions have improved.
Reduced labor	Same: 92% Reduced: 8%	There was no change in domestic labor at home after electrification.
Improvement in public services such as schools and hospitals	Improved: 85% Same: 15%	Public services have been improved by computerized works and improved information access. The stable electricity supply made it possible to provide education using labs at school.
Increase in social activities	Increased: 90% Same: 10%	The bond between families and communities has been strengthened. More community events such as movie-viewings take place.
Reduced poverty	Reduced: 72% Same: 27%	Increased agricultural production and income through the use of electric agricultural pumps. New employment opportunities found such as tailors using electric sawing machines, sales of electric appliances, or the repair of electric appliances. This has led to income generation.

Source: Results of the beneficiary survey

For changes in the living environment, the increased access to information, improved safety after dark and better education and hygiene and sanitary conditions have been highly evaluated. In addition, the improvement in public services such as schools and hospitals has also been highly evaluated. The public facilities of each village apparently received an electricity supply from village electrification prior to project implementation. However, since project implementation they received a more stable electricity supply and it is considered that this has led to the more efficient and improved services. On the other hand, no change was observed in the amount of domestic labor at home.

Social activities in each village have been activated by the electrification. Because of the increased safety after dark, there were more opportunities for night outings or events; furthermore, there were more opportunities for residents to communicate with each other using cell phones. Some said a sense of solidarity had been strengthened among villagers. There were improvements in economic aspects such as increased opportunities for income generation and a reduction in poverty. In rural areas where agriculture is the main industry, agricultural production activities became more active, and employment opportunities in the agricultural sector have increased along with incomes after farmers became able to use

agricultural pumps. In Bineca Dob village in Madhya Pradesh, double cropping became possible after electrification. In Melegaon village in Maharashtra, the expansion of agricultural production through the introduction of irrigation agriculture meant that there were more opportunities for agricultural labor in the region, and that the migration of laborers during the harvest was reduced. Furthermore, an improvement in the sales and incomes of shops and small-scale business (self-employed) were observed because of extended operation hours due to electrification.

Positive impacts such as the improved living environment of residents and the activation of local economic and social activities were observed from this project.

**Box: The Results of the Beneficiary Survey
(A case of improvement in Hygiene and Sanitary Conditions)**

1. Targets and methods of the beneficiary survey

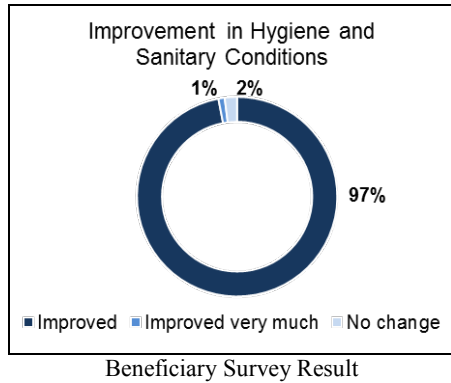
For the survey, six districts from the four target states were selected first, then a newly constructed substation from each of the 6 districts was chosen. Next, 25 households that receive their electricity supply from each of the substations were selected, totaling 150 households (25 households x 6 districts=150 households). Target households (samples) were randomly selected from each village, and interviews were conducted based on questionnaires. Occupationally, 60% of the respondents were directly involved in agriculture, while 12% ran small business, and 11% were daily laborers (mainly involved in agriculture). In terms of gender, 70% were males and 30% were females. In addition, interviews were conducted with six village heads as a supplement to the beneficiary survey.

Distribution Company	State/District	Prefecture	Substation
Northern Power Distribution Company of Telangana State Limited (TSNPDCL)	Telangana	Warangal	Nagapuri
Southern Power Distribution Company of Telangana State Limited (TSSPDCL)	Telangana	Ranga-reddy (South)	Moinabad
Eastern Power Distribution Company of Andhra Pradesh Limited (APEPDCL)	Andhra Pradesh	Vishakhapatnam	Boni
Madhya Pradesh Central Area Distribution Company Limited (MPMKVVCL-Bhopal)	Mahdya Pradesh	Bhopal	Bineca
Madhya Pradesh East Area Distribution Company Limited (MPPKVVCL-Jabalpur)	Mahdya Pradesh	Narsingpur	Khursipar
Maharashtra State Electricity Distribution Co. Limited (MSEDCL)	Maharashtra	Pune	Malegaon

2. Impacts on Improvement in Hygiene and Sanitary Conditions

The beneficiary survey revealed that there were significant positive impacts on the living environment such as increased access to information, improved safety after dark, and improvement in education. In addition to these, improvement in hygiene and sanitary conditions had the highest mark and 98% of the respondents acknowledged this improvement. After electrification, many families were able to preserve fresh or cooked foods more hygienically by using a refrigerator. In Malegaon village in Maharashtra, the awareness of people about hygiene and sanitation has been changing as fresh water from the well became available at any time by the use of an electrical pump. People have started cleaning their bathrooms and floors to keep their houses clean by using the water. In Khursipar village in Madhya Pradesh, there were many incidents of waterborne infectious diseases and malaria, but since electrification people have using electric run mosquito repellents for the prevention of malaria.

Thus it can be seen that the use of electric appliances such as refrigerators or electrical mosquito repellents and the use of sufficient water drawn by an electrical pump for cleaning have become available since electrification. These changes have led to the improvement of hygiene and sanitary conditions in each household.



Bineca Village, Bhopal District, Madhya Pradesh State

3.4.2 Other impacts

(1) Impacts on the Natural Environment

At the time of appraisal of the project, this project was categorized as type B in the Japan Bank for International Cooperation (JBIC) Guidelines for the Confirmation of Environmental and Social Considerations (established in April 2002) since the project did not correspond to a sector or area that was likely to be influenced and no major negative impacts on the natural environment were foreseen. For this reason, no Environmental Impact Assessment (EIA) was conducted for this project, and there was no obligation to do so in the related Indian domestic laws.

Although there is no department specializing in environmental monitoring in any of the distribution companies, their operation departments usually conduct the environmental monitoring of power distribution facilities as a part of their duties. In this project, permission was required from the Forest Department for the installation of distribution lines in some locations and this was carried out appropriately by following the necessary procedures in related Indian domestic laws. In the beneficiary survey, all the respondents said that there had been no negative impacts on the natural environment due to the implementation of this project.

From the above, it is clear that no negative impacts on the natural environment through the implementation of this project were observed.

(2) Land Acquisition and Resettlement

At the appraisal, approximately 13 ha of land acquisition was expected for substation building sites. However the actual land acquisition was 182.45 ha (1,824,505 m³) (Table 15). The reason for the actual value expanding 14 times against the planned value could not be verified since the grounds for the estimation at the appraisal was unclear. Land acquisition

was appropriately executed according to related Indian domestic laws. In the beneficiary survey, 96% of respondents said there had been no negative impacts from land acquisition. There was no resettlement for this project.

From the above, it can be seen that no negative social impacts occurred due to land acquisition.

In the light of the above, the project has largely achieved its objectives. Therefore effectiveness and impact of the project are high.

Table 15: Area of Land Acquisition

Unit: m³

Distribution Company	Area of Acquisition
TSNPDCL (Former APNPDCL)	129,991
TSSPDCL (Former APCPDCL)	485,622
APEPDCL	21,456
APSPDCL	660,000
MPMKVVCL-Bhopal	72,843
MPPKVVCL-Indore	266,400
MPPKVVCL-Jabalpur	58,000
MSEDCL	130,193
Total	1,824,505

Source: Responses to questionnaires.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

The eight distribution companies from each state are in charge of operation and maintenance (O&M) of the project facilities. In June 2014, Andhra Pradesh State was divided into Telangana State (northern part) and Andhra Pradesh State (southern part); the former Andhra Pradesh North Power Distribution Company Limited (APNPDCL) and the former Andhra Pradesh Central Power Distribution Company Limited (APCPDCL) have changed their names into Telangana State Northern Power Distribution Company Limited (TSNPDCL) and Telangana State Southern Power Distribution Company Limited (TSSPDCL), respectively. Other than the name changes mentioned above, there were no significant changes in the institutional setting and service areas of the four distribution companies in Telangana and Andhra Pradesh.

The number of employees in the eight distribution companies are shown in Table 16 below. No significant issue has been noted regarding the sufficiency level of staff numbers in each department of the eight distribution companies. However, there tends to be a shortage of staff who are in charge of daily O&M duties in the facilities. For this reason, each distribution company outsources the O&M of substations to private operators. For example, in APEPDCL, 40% of O&M is directly taken care of by internal staff, while the remaining 60% is outsourced. In Madhya Pradesh Central Area Distribution Company Limited (MPMKVVCL-Bhopal), 80% of the substation O&M is outsourced. Private operators conduct the operation of substations and routine maintenance while the zone engineers of distribution companies conduct the monitoring of substation and distribution lines in the zones for which they are responsible (the distribution area of each distribution company consists of several zones). The zone engineers also conduct the O&M of the distribution

facilities and equipment that is beyond the capacity of the private operators¹⁷. Each distribution company takes responsibility for the O&M of the individual electrical connections from the project facilities to each household implemented by RGGVY.

Table 16: Operation and Maintenance Agencies of the Project Facility and the Number of Employees

Unit: Number of employees

State	Service Area	Distribution Company	Number of Employees
Telangana	North	Northern Power Distribution Company of Telangana State Limited (TSNPDCL)	8,273
	South	Southern Power Distribution Company of Telangana State Limited (TSSPDCL)	9,841
Andhra Pradesh	East	Eastern Power Distribution Company of Andhra Pradesh Limited (AEPDCL)	7,915
	South	Southern Power Distribution Company of Andhra Pradesh Limited (APSPDCL)	17,086
Madhya Pradesh	Central	Madhya Pradesh Central Area Distribution Company Limited (MPMKVVCL-Bhopal)	8,212
	West	Madhya Pradesh West Area Distribution Company Limited (MPPKVVCL-Indore)	13,322
	East	Madhya Pradesh East Area Distribution Company Limited (MPPKVVCL-Jabalpur)	17,170
Maharashtra	All	Maharashtra State Electricity Distribution Co. Limited (MSEDCL)	76,534

Source: Questionnaire responses

In order to promote rural electrification, the New Electricity Act and RGGVY have encouraged distribution companies to introduce “franchise schemes” in which a part of the operation of distribution services are subcontracted to community-based organizations and NGOs. There are actual cases where franchise schemes have been introduced in some distribution companies. For example, in MSEDCL, meter reading and bill collection were subcontracted to a women’s organization called Mahila Bhachat Gut¹⁸ in all service areas from 2009. Madhya Pradesh East Area Distribution Company Limited (MPPKVVCL-Jabalpur) also introduced a franchise scheme in Gagar prefecture.

From the above, it can be seen that there were no issues in the institutional aspects of operation and maintenance.

3.5.2 Technical Aspects of Operation and Maintenance

The staff of each distribution company hold a certain level of technical ability with a

¹⁷ There are two types of O&M of substations and distribution lines in the areas with bad traffic access, conducted by the distribution company or outsourced to non-government operators.

¹⁸ A women’s self-help group helping poor and needy women earn their livelihood through the production and marketing of home products.

degree or certification in their respective technical field, such as electrical engineering. There is a performance evaluation system for employees which regularly evaluates their technical abilities. Each distribution company has an in-house training center and conducts staff trainings according to the training program. Furthermore, REC has a training center (the Central Institute for Rural Electrification) in Hyderabad, where technical training for rural electrification is conducted for domestic and international trainees. The eight distribution companies send their staff to the REC training center in Hyderabad on a regular basis to learn and update their knowledge and skills for rural electrification. On the other hand, it is required that private operators who are contracted for O&M duties in the substations have a certification from a government vocational training school such as an Industrial Training Institute (ITI).

The substations and distribution lines developed by this project were the same as the existing facilities, and the staff from each distribution company possessed sufficient experience and knowledge on their operation and maintenance; therefore no issues were found from the technical aspects.

3.5.3 Financial Aspects of Operation and Maintenance

The O&M cost for each distribution company is shown in Table 17. According to the distribution companies, the necessary budget for O&M is secured. The bill collection rates for each distribution company were as high as 95-100%, as shown in the operation and effect index.

Table 17: Operation and Maintenance Costs of Distribution Companies (All)

Unit: Ten million rupee

Distribution Company	Item	2011/12		2012/13		2013/14	
		Plan	Actual	Plan	Actual	Plan	Actual
TSNPDCL	Labor	244.04	345.24	288.93	432.89	324.08	491.46
	Maintenance	27.68	40.41	29.48	48.60	29.75	53.89
	O&M	45.51	57.86	49.61	78.59	54.08	101.00
	Total	317.23	443.51	368.02	560.08	407.91	646.35
TSSPDCL	O&M	231.37	166.23	321.29	254.80	391.80	288.41
APEPDCL	Labor	338.27	408.68	338.27	502.58	402.84	482.60
	Maintenance	47.59	52.59	47.59	53.83	58.56	56.86
	O&M	23.07	31.37	23.07	51.30	36.80	70.47
	Total	640.30	658.87	730.22	862.51	890.00	898.34
APSPDCL	O&M	727.00	727.00	1,003.80	1,003.80	1,217.53	1,217.53
MPMKVVCL-Bhopal	Labor	N.A.	508.41	590.00	497.33	610.00	644.42
	Maintenance	N.A.	84.53	78.00	75.15	114.00	66.47
	O&M	N.A.	26.68	80.00	344.66	82.00	49.00
	Total	N.A.	619.62	748.00	607.14	806.00	759.89

Distribution Company	Item	2011/12		2012/13		2013/14	
		Plan	Actual	Plan	Actual	Plan	Actual
MPPKVCL-Indore	Labor	N.A.	622.99	N.A.	671.62	N.A.	750.91
	Maintenance	N.A.	124.67	N.A.	128.37	N.A.	130.93
	O&M	N.A.	44.86	N.A.	52.85	N.A.	86.50
	Total	N.A.	792.52	N.A.	852.84	N.A.	968.34
MPPKVCL-Jabalpur	O&M	N.A.	64.30	N.A.	85.90	N.A.	110.10
MSEDCL	Labor	568.10	723.10	803.50	817.30	903.90	833.80
	Maintenance	70.60	113.60	79.50	120.00	115.50	116.60
	O&M	121.30	145.60	115.40	121.10	116.40	201.70
	Total	760.00	982.30	998.40	1,058.40	1,135.80	1,152.10

Source: Responses to questionnaires.

Note 1: For TSSPDCL, APSPDCL, MPPKVCL-Jabalpur, they only provided data on O&M cost.

Note 2: **APNDCL**: Northern Power Distribution Company of Andhra Pradesh Limited, **APCDCL**: Central Power Distribution Company of Andhra Pradesh Limited, **APEPDCL**: Eastern Power Distribution Company of Andhra Pradesh Limited, **APSPDCL**: Southern Power Distribution Company of Andhra Pradesh Limited, **TSSPDCL**: Southern Power Distribution Company of Telangana State Limited, **TSNDCL**: Northern Power Distribution Company of Telangana State Limited, **MPMKVCL-Bhopal**: Madhya Pradesh Central Area Distribution Company Limited, **MPPKVCL-Indore**: Madhya Pradesh West Area Distribution Company Limited, **MPPKVCL-Jabalpur**: Madhya Pradesh East Area Distribution Company Limited, **MSEDCL**: Maharashtra State Electricity Distribution Co. Limited.

On the other hand, there are financial losses almost every year, as shown in Table 18. This is because there is a policy in India to keep the electricity tariff low, set to approximately 70-80% of the electricity purchase cost (generation and transmission cost) from a transmission company to a distribution company. For this reason, it is difficult for distribution companies to recover the cost from electricity sales revenue. The subsidy from the state government is not sufficient to cover the above gap, and the annual financial losses are a result of this.

Table 18: Income and Expenditure of Distribution Companies

Unit: million rupee

	TSNDCL			TSSPDCL		
	2011/12	2012/13	2013/14	2011/12	2012/13	2013/14
Sales	54,331	53,113	62,915	151,322	158,981	170,614
Profit	41	-34,918	-338	-79	-78,229	-9,281
Profit after tax	32	-34,361	-310	-40	-77,183	-8,112
	APEPDCL			APSPDCL		
	2011/12	2012/13	2013/14	2011/12	2012/13	2013/14
Sales	55,083	50,914	63,507	79,143	82,273	95,605
Profit	54,898	-16,805	-1,358	75	-46,729	-4,008
Profit after tax	252	-16,805	-1,358	34	-46,753	-4,031
	MPMKVCL-Bhopal			MPPKVCL-Jabalpur		
	2011/12	2012/13	2013/14	2011/12	2012/13	2013/14
Sales	43,518	52,798	39,601	55,406	67,389	N.A.
Profit	-6,322	-14,149	-11,668	-6,241	-14,250	N.A.
Profit after tax	-6,322	-14,149	-11,668	N.A.	N.A.	N.A.

	MPPKVCL-Indore			MSEDCL		
	2011/12	2012/13	2013/14	2011/12	2012/13	2013/14
Sales	39,601	52,681	58,453	408,064	470,151	522,621
Profit	-11,668	-14,322	-18,872	-18	-5,762	-11,666
Profit after tax	-11,668	-14,322	-18,872	-8,079	-8,714	-2,804

Source: Responses to questionnaires.

Note : **APNDCL**: Northern Power Distribution Company of Andhra Pradesh Limited, **APCPDCL**: Central Power Distribution Company of Andhra Pradesh Limited, **APEPDCL**: Eastern Power Distribution Company of Andhra Pradesh Limited, **APSPDCL**: Southern Power Distribution Company of Andhra Pradesh Limited, **TSSPDCL**: Southern Power Distribution Company of Telangana State Limited, **TSNDCL**: Northern Power Distribution Company of Telangana State Limited, **MPMKVVCL-Bhopal**: Madhya Pradesh Central Area Distribution Company Limited, **MPPKVCL-Indore**: Madhya Pradesh West Area Distribution Company Limited, **MPPKVCL-Jabalpur**: Madhya Pradesh East Area Distribution Company Limited, **MSEDCL**: Maharashtra State Electricity Distribution Co. Limited.

In March 2013, the Ministry of Power announced the performance ratings¹⁹ of the transmission and distribution companies nationwide, mainly their financial capacity. According to the ratings, MSEDCL was rated “Grade A”²⁰, APEPDCL, APSPDCL, and TSSPDCL (known as Andhra Pradesh Central Power Distribution Company Limited in 2013) were rated “Grade B+”²¹, and the three distribution companies in Madhya Pradesh and TSNDCL (known as Andhra Pradesh Northern Power Distribution Company Limited in 2013) were rated “Grade B”²².

The Ministry of Power established the Financial Restructuring Scheme of State Distribution Companies²³ in 2012 in order to support the financial restoration of each distribution company. Under this scheme, the state government takes over 50% of the distribution company's short-term liabilities (the state government purchases the 50% of the securitized short-term liabilities in 2-5 years), while the remaining 50% has a moratorium on the capital for 3 years, with the state government supporting the interest payment during the moratorium period. Meanwhile, the state government and distribution companies are required to improve profitability by promoting the efficiency of distribution companies by raising the electricity tariff and reducing distribution loss during the moratorium period. The Ministry of Power has selected seven states, including Andhra Pradesh and Madhya Pradesh as targets for the scheme.

In Andhra Pradesh, the budget necessary for the financial restructuring scheme has been secured and the state government has begun support for the financial restoration of two distribution companies in the state for five-years starting in 2014. Telangana state, which

¹⁹ “State Distribution Utilities First Annual Integrated Rating” Ministry of Power (March 2013). The Ministry of Power implemented the performance rating of transmission and distribution companies nationwide in order to understand their financial status and specify their needs for future financing. The actual evaluation was conducted by India's Power Finance Corporation Ltd. and the rating was conducted by Investment Information and Credit Rating Agency of India Limited and Credit Analysis and Research Ltd.

²⁰ Grade A: Very high operational and financial performance capability (Score distribution: 80-100).

²¹ Grade B+: Moderate operational and financial performance capability (Score distribution:50-65).

²² Grade B: Below average operational and financial performance capability (Score distribution:35-50).

²³ Scheme for Financial Restructuring of State Distribution Utilities, No. 20/112012-APDRP, Government of India, Ministry of Power, October 5th, 2012.

came into existence in June 2014, has taken over the policy from Andhra Pradesh, and it supports the financial restoration of the two distribution companies within the state using the financial restructuring scheme. Madhya Pradesh did not participate in this scheme since the distribution companies did not possess any short-term liabilities. Instead, the Madhya Pradesh state government established its own financial restoration scheme for distribution companies. That is, the state government has converted the outstanding working capital loans of distribution companies borrowed from the state government into perpetual loans. Also, the state government exempts interest payments on the above loan for three years. Through this, the three distribution companies in the state have been able to maintain a cash flow for a certain period of time. On the other hand, MSEDCL, which possesses the highest financial capacity of all the eight distribution companies, has been working on improving its profitability by reducing the average power purchase unit price by a long-term Power Purchase Agreement and promoting efficiencies such as reductions of distribution loss. The Maharashtra government is executing a pilot scheme which compensates a part of the state's electricity bill for agriculture. From this, it is expected that MSEDCL's liabilities will be reduced for the agricultural sector. Maharashtra state is planning to expand the pilot scheme statewide, based on the outcome of the above mentioned pilot project.

Although the eight distribution companies operate at a financial loss, the necessary budget is more or less secured for the operation and maintenance of the project facilities; they are working on mid-long term financial restoration with the support of the central and state governments. Therefore, it is considered that there is no specific problem in the financial sustainability of this project.

3.5.4 Current Status of Operation and Maintenance

The O&M of the project facilities is properly conducted according to the O&M plan of each distribution company and the manual and standard operating procedures (SOP), and the facilities were in operation without a significant problem at the time of the ex-post evaluation. There was no specific problem reported regarding the current status of O&M of the individual electrical connections from the project facilities to each household implemented by RGGVY. Furthermore, SAIDI and distribution losses are improving as seen in the operation and effect indicators. In the beneficiary survey, 90% of the respondents said that the substations and distribution lines were operating properly, and that their O&M status was satisfactory. Spare parts can be procured domestically. Therefore, it is considered that there is no specific problem in the current O&M status of this project.

From the above, no major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system, and the project facilities have been maintained in good condition. Therefore sustainability of the project effect is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project was to stabilize the transmission and distribution system and to expand access to electricity for un-electrified rural households through the construction and augmentation of substations and associated distribution lines in the three target states of India, Andhra Pradesh, Madhya Pradesh and Maharashtra. This project matched the Indian national development policy and its development needs as well as Japan's ODA policy at the appraisal, therefore its relevance is high. The project cost was within the plan, but the project period significantly exceeded the plan, therefore the efficiency of the project is fair. The project outputs were altered in response to some situational changes during project implementation.

The operation and effect indicators such as the system average interruption duration index (SAIDI), the household electrification rate, distribution loss, the bill collection rate, and the electricity sales volume attained their respective target values. An estimate of 2.9 million rural households were newly electrified by this project. This achievement was greatly helped by some external factors such as the implementation of RGGVY, which was a rural electrification scheme of the government of India, improvements in the distribution losses of each distribution company, improvements in bill collection methods, and the implementation of appropriate maintenance. The beneficiary survey revealed that there were some positive impacts on the economic and social aspects and that the living standards of local residents had seen such improvements as increased information access, improved safety after dark, education, hygiene and sanitary conditions, and public services, vitalized social activities, and decreased poverty. No negative impact on the natural environment was observed, and the land acquisition was executed according to the related Indian domestic laws. There was no resettlement for this project. Therefore, the effectiveness and impacts of this project are high.

As for sustainability of the project effects, no major problems were observed in the institutional, technical, and financial aspects of the operation and maintenance system, and the project facilities have been maintained in good condition. Therefore, sustainability of the project effect is high.

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

4.2 Recommendations

4.2.1 Recommendations to the executing agency

None.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

(1) Project Design to Secure Realization of Project Effects

At the appraisal, the three states, Andhra Pradesh, Madhya Pradesh and Maharashtra were selected based on 4 selection criteria for the target states: (i) An almost 100% achievement of village electrification, (ii) Power sector reform has been introduced, (iii) The repayment status of the existing loan from REC is good, and (iv) There is a substantial number of un-electrified rural households. These selection criteria were based on the premise that the outcome of the household electrification would be large, and that project sustainability would be high in a state where the necessity for and usefulness of electricity are recognized by the people through the use of electrified public facilities, and where, if a household electrification project was conducted, there would be a high village electrification rate with a large potential household electrification demand. This project was implemented in collaboration with RGGVY through the mutual demarcation of responsibilities. That is, on the one hand, this project was responsible for the development of substations and distribution lines between the existing 33KV distribution lines and low voltage transformers at each village, while, RGGVY took charge of developing individual electrical connections between low voltage transformers and each household. The above mentioned selection method for the target states and the project design to supplement the rural electrification scheme by the government of India was effective in terms of securing the realization of project effects.

In similar future cases, it is expected that even higher project effects would be realised by designing a project to link and supplement the government scheme of partner countries at the planning stage if there is an existing support scheme on the part of the government of the partner country in the said sector. Furthermore, there is a high possibility of securing the realization of project effects by selecting project target areas strategically, noting conditions such as the development status of the said sector or the ability of the executing agency.

(2) Confirmation of the Implementation Capability of Contractors

Basically the procurement method of this project applied a full turn-key contract method in which the procurement of civil works and equipment was packaged into one contract. The number of contracts was extremely high with a total of 82 full turn-key contracts and 53 partial turn-key contracts. On the other hand, there was a delay in the project and poor performance of contractors in some distribution companies as a single contractor was awarded multiple contract packages, thus exceeding its implementation capacity. When bidding is carried out with conditions described above, it is typical that the contractor's existing contracts are checked as well as the contractor's remaining capacity for additional contracts in order to avoid a case where the contractor takes orders beyond its capacity and performance. However some distribution companies did not take such countermeasures. In addition, a consultant who could support the project management and procurement management of the distribution companies

was not employed for this project, and there is the possibility that the above problem could have been avoided had there been the support of a consultant. Furthermore, although REC organized a workshop on procurement for distribution companies at the beginning of the project, it mainly focused on an explanation of the standard procurement guidelines of the Indian government, and it did not cover the specific issues associated with a procurement.

Therefore, it is required that JICA and the executing agency have discussions on the number of potential contractors participating in the bidding, their capacity and past performance records, as well as the possibility of introducing the bidding conditions prior to project implementation so that a contractor cannot take an order beyond its capacity in a case like this project where there are many contract packages but no consultant to support procurement management.

Comparison of Original and Actual Scope of the Project

Item	Plan	Actual
(1) Project Outputs		
1. Target states	Andhra Pradesh Mahdya Pradesh Maharashtra	As planned
2. Construction of 33KV/11KV substation	763 locations (3 states)	772 locations (3 states)
3. Augmentation of 33KV/11KV substation	455 locations (3 states)	337 locations (3 states)
4. Construction of 33KV distribution line	5,983km (3 states)	4,257km (3 states)
5. Construction of 11KV distribution line	2,746km (3 states)	3,301km (3 states)
(2) Project Period	March 2006- September 2008 (29 months)	March 2006- August 2012 (78 months)
(3) Project Cost		
Amount paid in foreign currency	13,853 million yen	Unknown
Amount paid in local currency	10,796 million yen (26,882 million rupee)	Unknown
Total Japanese ODA loan portion	24,649 million yen 20,629 million yen	24,009 million yen 16,949 million yen
Exchange rate	1 rupee = 2.49 yen (As of July 2005)	Unknown

India

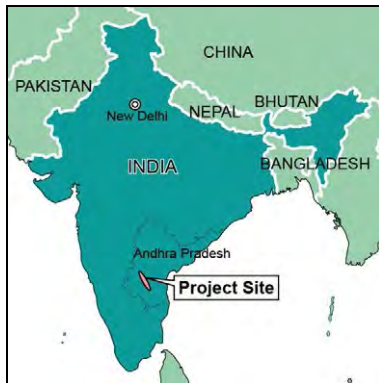
Ex-Post Evaluation of Japanese ODA Loan
“Kurnool-Cuddapah Canal Modernization Project (I) (II)”

External Evaluator: Junko FUJIWARA, OPMAC Corporation

0. Summary

This project was intended to utilize water resources efficiently, recover the original designed area of irrigation, and increase agricultural production by the rehabilitation and modernization of the irrigation system between Kurnool and Cuddapah in Andhra Pradesh State in Southern India, thereby contributing to income improvement for farmers. The project relevance is high as project implementation was well in line with India’s development policy and development needs, as well as with Japan’s ODA policy at the time of both appraisal and the ex-post evaluation. The project output achieved more or less as planned and the project cost was within the plan. The efficiency of the project is fair as the project period was significantly longer than planned. Water supply to farmland has been improved, the area benefited by Kurnool-Cuddapah Canal has been expanded, there has been stable planting of principal food, improvement of production volume and yields, and the diversification of agricultural products has been promoted since project implementation. Furthermore, household income, farm and non-farm incomes in the target area have been improved, and household savings have been secured since project implementation. The living environment of local residents has been improved to a large extent as seen in improvements in the level of children’s education and in life infrastructure, and their living standards have been steadily improving. Therefore it is concluded that the effectiveness and impacts of the project are high since the planned effectiveness has been achieved through project implementation. With regard to project sustainability, there are no problems with the institutional and technical aspects and the present operation and maintenance condition of the irrigation facilities covered under the project, but there have been some issues with the financial aspects. The sustainability of the effects realized by this project is therefore fair. In light of the above, this project is evaluated to be satisfactory.

1. Project Description



Project Location



Alaganur Balancing Reservoir constructed under the Project

1.1 Background

Agriculture in India had largely been dependent on the precipitation during the rainy season, and ensuring a sufficient amount of water had been an urgent issue to be tackled through the development of irrigation facilities for securing stable food production. In Andhra Pradesh, the target state of this project, agriculture was an important industry, with approximately 70% of the total workforce as of 1991 involved in agriculture. The agriculture sector had about a 40% share of the State GDP. However, the farming population largely depended on water sourced from major rivers in the state, and water was scarce at the end of the dry season. Under these circumstances, Andhra Pradesh State targeted the expansion of agricultural production and promoted the efficient use of irrigation facilities through the construction of new irrigation canals and the rehabilitation of existing ones.

The irrigation system between Kurnool and Cuddapah was constructed for navigation purposes in the 1860s, and converted into an irrigation facility in the 1930s. A severe deterioration of the aging facilities had made it difficult to deliver water to the peripheral and tail-end area of the system, and the amount of water available in the system was not sufficient, particularly during the dry season. To cope with the above situation, it was necessary to construct and rehabilitate the lining of the main canal, the existing structure, and to distribute water properly in order to secure irrigation water in the catchment area. Also to establish an appropriate cropping system, increase agricultural production and thus improve income for farmers.

1.2 Project Outline

The objective of this project is to utilize scarce water resources efficiently, recover the original designed area of irrigation, and increase the production of agriculture by the rehabilitation and modernization of the deteriorated irrigation system located between Kurnool

and Cuddapah districts, thereby contributing to the improvement of farmers' income in the project area.

	Phase I	Phase II
Loan Approved Amount / Disbursed Amount	16,049 million yen / 15,729 million yen	4,773 million yen / 3,394 million yen
Exchange of Notes Date / Loan Agreement Signing Date	January 1996/ January 1996	March 2004/ March 2004
Terms and Conditions	Phase I	Phase II
Interest Rate:	2.3 %	1.3 %
Repayment Period : (Grace Period)	30 years (10 years)	30 years (10 years)
Conditions for Procurement:	General untied (main portion) Partial untied (consulting portion)	General untied
Final Disbursement Date	February 2005	June 2012
Borrower / Executing Agency	President of India / Department of Irrigation & Command Area Development, State Government of Andhra Pradesh	
Main Contractor (Over 1 billion yen)	Progressive Construction Ltd, New Delhi (India) Gayatri Projects Ltd. (India)	
Main Consultant (Over 100 million yen)	Water And Power Consultancy Services (India) Limited (India) / WAPCOS (India) / Nippon Koei Co., Ltd. (Japan)	
Related Projects	None	

2. Outline of the Evaluation Study

2.1 External Evaluator

Junko FUJIWARA, OPMAC Corporation

2.2 Duration of Evaluation Study

Duration of the Study: September 2014 – September 2015

Duration of the Field Study: December 7, 2014– December 20, 2014, and March 8, 2015 –
March 14, 2015

3. Results of the Evaluation (Overall Rating: B¹)

3.1 Relevance (Rating: ③²)

3.1.1 Relevance to the Development Plan of India

(1) National development plan level

In the 8th Five-Year Plan (April 1992 to March 1997), the national development plan of India on which the first appraisal of the project was based (1995), the total investment amount in the public sector was 4,341 billion rupees. Out this amount, investment in the agriculture sector accounted for 20% of the total budget for the enhancement of rural employment and income through food production growth and the diversification of rural industries in order to sustain the increasing population, for the resolution of regional disparity, for environmental considerations, and for enforcement of the private sector. The irrigation sector was emphasized in the said five-year plan as agricultural activities in India largely depended on the rainfall during the rainy season and agricultural production was unstable. Focus was put on on-going irrigation projects for completing their construction at their earliest and the modernization of existing irrigation facilities, for the expansion of the irrigated area with the intension of increasing food production and for more efficient water management.

At the timing of the ex-post evaluation of this project (2014), the 12th Five-Year Plan (April 2012 to March 2017) was underway. The Plan targeted an 8.2% of real GDP growth rate during its period, out of which the benchmark of the growth rate of the whole agriculture sector was 4.0%. With the intension of achieving employment creation and fiscal soundness of the Government, public investment was expected to be as large as 56 trillion rupees for the acceleration of further economic growth. The total planned amount of investment in the irrigation sector was as much as 5,000 billion rupees, following the energy, road, communication and railway sectors. The Plan also targeted an increase in the total irrigated area of the nation from 90 million ha to 103 million ha during the period through recovery and increase of irrigated areas by the modernization, rehabilitation and expansion of existing irrigation facilities, the completion of irrigation facilities under construction, and the promotion of improvement of small-scale irrigation facilities by public-private partnership.

(2) State development plan level for Andhra Pradesh

Andhra Pradesh State is located in the southern part of India, and the share in GDP of the agriculture sector was approximately 40% of the whole State GDP at the time of appraisal (1995). The State played an important role in India as its rice production was approximately 10% of that of the whole country. The development budget for the irrigation sector in the State in the 1994 Plan shared as much as 25.7%, following the power and energy sector

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

² ③: High, ② Fair, ① Low

(29%).

In Andhra Pradesh State, where a high economic growth rate had been achieved, further economic growth was expected in the 12th Five-Year Plan which was underway at the time of the ex-post evaluation of this project (2014). The State GDP growth rate expected in the period of the Plan was 8.4%, out of which the target for the agriculture sector was 5.2%. As much as 750 billion rupees (21.9%) investment budget was allocated to the irrigation sector, which was second only to the social sector³ (38.9%). Modernization, improvement and expansion of the existing irrigation facilities and the completion of on-going projects were given the most priority, and food production volume was expected to expand from 2 billion to 3 billion metric tons during the implementation period 12th Five-Year Plan.

To summarize, the relevance of this project implementation to the national development plan and the state's irrigation sector development plan was recognized both at the timing of appraisal and the ex-post evaluation.

3.1.2 Relevance to Development Needs of India

Approximately 70% of the employed population in Andhra Pradesh State at the time of this project's appraisal (1995) was involved in agriculture. The State is in a semi-dry zone nearing a dry zone in the western part of India. A stable water supply was thus essential as a majority of the agricultural activities in the State depended on rain-shed agriculture and suffered from droughts mainly during the dry season. Furthermore, irrigation facilities were available in less than half of the total cultivated area. In addition to the expansion of agricultural production, there was the need for securing the efficiency of irrigation through the construction of new irrigation canals and rehabilitation of the existing ones.

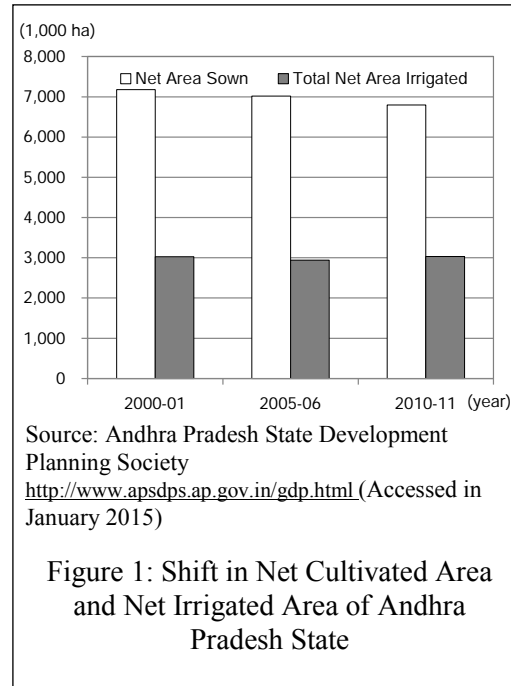
According to data collected by the Department of Planning of Andhra Pradesh State at the time of the ex-post evaluation (2014), the share of the agricultural sector in the State GDP was down from the 30% of 2004 to 23% in 2012. The agricultural sector, however, still played an important role as shown in the fact that the population involved in agriculture was still over half of the entire employed population of the State.

Looking at the shift in the net cultivated area and the net irrigated area from 2000/01 to 2010/11 in Andhra Pradesh State (Figure 1), it can be seen that the cultivated area was apt to decrease while industrialization, population increase, and housing land development accelerated in the State. The net irrigated area, on the other hand, repeatedly increased and decreased in total, while the area per household tended to be subdivided for land inheritance among siblings or for sales to people outside. The number of farmland owners was on the increase while the total area was not; immediate benefits of individuals have been pursued, which has made people less committed to the daily operation and maintenance of irrigation

³ The "Social sector" in the 12th Five-Year Plan comprised of education, health, water supply, housing, urban development and other social services.

facilities. Their duties and responsibilities have thus become unclear, and facilities management has become more complicated. It was thus necessary that the existing irrigation systems were managed more attentively in order to ensure a stable water supply to farmland.

To summarize, the agriculture sector GDP of Andhra Pradesh State has been relatively on the decrease, but the farming population has a 50% share of the whole, which means that the agriculture sector remains important in the State. The need for continued support for improvement of the existing irrigation facilities to ensure an assured water supply to farmland is still recognized in the State.



3.1.3 Relevance to Japan's ODA Policy

At the timing of the first project appraisal, the combat against poverty was among the highly prioritized sectors and this was also described in the country assistance policy by the Government of Japan toward India (1997). The promotion of agricultural and rural development (improvement of agricultural productivity and the development of agricultural infrastructure for sustaining self-sufficiency in food production along with population growth) was one of the policy instruments. Assistance for rural development to cope with the poverty issue was prioritized in Japan's 2006 country assistance plan for India, in which the development of intensive irrigation facilities and technical dissemination for the improvement of agricultural productivity were included.

In summary, this project has been highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

Through the project implementation, weir facilities were constructed and rehabilitated, a reservoir was newly constructed, main canal and distributaries, related structures, farm roads and drainage systems were constructed and rehabilitated, pilot farms were developed with related equipment, and technical training on agriculture extension was provided.

Major differences between the original plan and the actual are as follows:

- Rehabilitation of the main canal: the total canal length for rehabilitation increased from the planned length of 244.8 km to 305.6 km in order to repair damage caused by the torrential rains of 2000 and 2007 while the project was being implemented. New rehabilitation works on existing parts of the main canal were added when deterioration took place after the project commenced.
- Construction and rehabilitation of distributaries: the total canal length for rehabilitation increased from the planned length of 790.3 km to 840.0 km for similar reasons as the main canal. The extension of new distributaries, on the other hand, became shorter in total length from the planned 169.2 km to 50.0 km as there were difficulties in land acquisition.
- Construction and rehabilitation of farm roads: the amount of farm road development increased from the planned 336.1 km (235.5 km of existing road rehabilitation and 100.6 km of new road construction) to 407.0 km (71.0 km of rehabilitation and 336.0 km of new construction). The plan was revised with less rehabilitation and more new construction taking into consideration the better transportation of farm products and the traffic access of local farmers.
- On-farm development (10,000 ha of the area benefited by the project): Development of pilot farms at 10,000 ha of the area benefitted by the project was planned aiming at rational and efficient water management and the dissemination of relevant technologies. However, local farmers strongly showed reluctance for such development as they anticipated that their farming area would be reduced. The plan was reviewed at the timing of the second appraisal (2003) and the direction taken that on-farm development should go step-by-step with the promotion of farmers' understanding through demonstrating good practices. The actual pilot farms constructed under the project resulted in 70.97 ha in total at five venues after difficulties in acquiring the required land and gaining the understanding of farmers.
- Sustainability Scheme (Water Users Association consolidation activities and capacity building of farmers / WUAs): Along with the enactment of "the Andhra Pradesh Farmers management of Irrigation Systems Act 1997", this incentive scheme was created and added at the timing of the second appraisal in order to assist farmers and WUAs to develop their skills and technical capacity. Under this scheme equipment such as farming instruments required at pilot farms were procured, and local technical instructors, NGOs and volunteers provided farmers with technical training on agriculture extension works⁴.

⁴ The expenses for the employment of local instructors, NGOs and volunteers came from the budget item 'sustainability scheme'. All 200 samples of the beneficiary survey (explained in the latter part of this report) referred to improvement in farm skills through training conducted by the project, and it is concluded that no problem is found in the effectiveness of training .

Such changes in output were deemed appropriate for achieving the project objectives and worked positively in securing project effectiveness as it was anticipated that the function of the whole irrigation system would have become severely deteriorated without them. The actual project outputs against the plan are shown in the table “Comparison of the Original and Actual Scope of the Project” at the end of this report.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual cost of the project was 24,312 million yen in total against the planned cost at the first appraisal of 29,875 million yen (81% of the budget) (Table 1). Among the items, civil works increased by 141%, while the actual cost spent on interest during construction was far under the plan, while foreign exchange rates (appreciation of the Japanese yen and depreciation of the Indian rupee⁵) fluctuated during the project implementation period (except from 1996 to 1998). As a result, the project cost was lower than planned.

When the project outputs were changed, for the sake of evaluating the appropriateness of the project cost the actual project cost should be compared to the planned budget adjusted with such increases and decreases taken into consideration. However, the nature of this project, the majority of which is the rehabilitation of existing facilities, makes it technically difficult to have a retrospective cost estimate of the increases and decreases of project outputs going back to the time of project planning. It is also difficult to collect evidence of cost estimation data in detail, item by item. For such reasons, the above comparison analysis is not conducted in this ex-post evaluation.

For reference, the project cost reviewed at the time of the second appraisal (2003) was 25,666 million yen in total taking into consideration exchange rate fluctuations, project implementation progress at that time, and changes in the project outputs. The actual project cost reached 95% of the revised budget at the second appraisal, which still remains within the plan.

⁵ The inflation rates between 1995 and 2013 were rather low, around 3 % from 1999 to 2004, but they stayed as high as 9 to 10 % from 2008 to 2013. Exchange rates of the Indian rupee were depreciated against US dollar throughout the project period, and against the Japanese yen after 1999.

Table 1: Plan and Actual of Project Cost

Unit: million JPY

Budget Item	Plan (at the time of the first project appraisal)						Actual					
	Foreign Currency		Local Currency		Total		Foreign Currency		Local Currency		Total	
	Total	ODA loan	Total	ODA loan	Total	ODA loan	Total	ODA loan	Total	ODA loan	Total	ODA loan
CW ^{*1(1)}	0	0	13,861	12,336	13,861	12,336	21	19	19,578	17,434	19,599	17,453
Sustainability	0	0	0	0	0	0	0	0	16	14	16	14
MIS	20	20	0	0	20	20	0	0	0	0	0	0
Vehicle	0	0	15	15	15	15	0	0	0	0	0	0
LA ^{*1(2)}	0	0	390	0	390	0	0	0	742	0	742	0
Admin	0	0	714	0	714	0	0	0	2,300	0	2,300	0
PE ^{*1(3)}	2	2	9,378	9,966	9,380	9,966	0	0	0	0	0	0
PC ^{*1(4)}	2	2	2,436		2,438		0	0	0	0	0	0
C/S ^{*1(5)}	657	657	85	85	742	742	593	593	273	273	867	867
IDC ^{*1(6)}	2,314	2,314	0	0	2,314	2,314	789	789	0	0	789	789
Total	2,995	2,995	26,880	22,398	29,875	25,393	1,403	1,401	22,909	17,722	24,312	19,123

Source: Survey response from executing agency.

Note 1: Abbreviations in the table are as follows: (1) CW: civil works, (2) LA: land acquisition, (3) PE: price escalation, (4) PC: physical contingency, (5) C/S: consulting service and (6) IDC: interest during construction.

Note 2: The exchange rate at the time of the first project appraisal was 1 rupee = 2.89 yen as of April 1995. Physical contingency was estimated as 10% of the total project cost, price escalation was estimated 2.0% per year for foreign currency, and 10.9% per year for local currency.

Note 3: Expenditure for the on-farm development planned in the first appraisal are included in that for civil works, with which pilot farms were developed in a step-by-step manner aiming at the dissemination of water management skills. A budget item named "sustainability scheme" (Consolidation activities of Water Users' Associations (WUAs) and capacity building of farmers / WUAs) was created and added at the time of the second project appraisal. This was used for the cost for procuring equipment at pilot farms and providing skill development training on agriculture extension works by local instructors, NGOs and volunteers.

3.2.2.2 Project Period

Although the project period planned at the time of the first appraisal was for 90 months from January 1996⁶ to June 2003⁷, all construction works under both the first and second phases were completed in July 2013⁸. The main reasons, confirmed at the time of the second appraisal (2003⁹), for the extended project period were: delay in design approvals by the Indian authorities, delay and prolonging of the tender process and construction works, prolonging of the land acquisition process, and the necessary response to damage caused by the torrential rains and floods of 2000. Approximately only 20% of contract packages was complete as of the second appraisal. Moreover, some outputs were changed such the length of the main canal and the distributaries for rehabilitation. A "sustainability scheme" (WUA consolidation activities and capacity

⁶ The project start was defined as the signing of the loan agreement for the first phase.

⁷ The project completion was not defined in any relevant document at that time.

⁸ Although the last loan was disbursed in June 2012, the Indian side continued some unfinished construction works (rehabilitation of damage to the main canal and distributaries caused by the heavy rain of 2007) using their own funds up to July 2013.

⁹ The Government of Japan suspend all new loan assistance to India after the nuclear test of 1998. The second appraisal of this project was therefore conducted in 2003 after the Government of Japan restarted its loan assistance.

building of farmers / WUAs) was created and added under which equipment were procured at pilot farms and technical training on agriculture extension activities was conducted. Accordingly, the majority of the major outputs of this project was complete in the first half of 2006. Drastic rehabilitation works on the main canal and distributaries were then conducted as countermeasures for the severe damage caused by the torrential rains and large-scale floods of 2007. These additional construction works ended in July 2013. On the other hand, the operation of the whole irrigation system commenced in May 2007¹⁰.

The above circumstances taken into consideration, the timing of project completion is judged in this ex-post evaluation to have been May 2007, when the construction of the major facilities was complete and their operation commenced at full-scale. Based on this, the actual project duration was 137 months, from January 1996 to May 2007, which was significantly longer than planned (152% of the plan).

3.2.3 Results of Calculations of Internal Rates of Return

The Financial Internal rate of Return (FIRR) was not calculated while the Economic Internal Rate of Return (EIRR) was 16.9% at the time of the first project appraisal and 17.2% at the time of the second appraisal. The calculation basis for the EIRR in each phase is shown in Table 2.

Table 2: Calculation Basis of EIRR (at the time of appraisals)

	At the timing of the first project appraisal	At the timing of the second project appraisal
Cost:	Cost required for the project and maintenance cost	Construction cost and maintenance cost
Benefit:	Agricultural production increase through increase of irrigated area and improvement of farming methods	Agricultural production increase through irrigation
Project Life:	30 years	50 years

Source: Information provided by JICA.

This ex-post evaluation does not calculate the FIRR same as in both appraisals. It does not calculate the EIRR either because the cropping pattern in the area benefited by the project saw significant changes during the project implementation period, which requires alternative parameters as the base of calculation, and it was impossible to get hold of the data and information required for the recalculation of the EIRR.

¹⁰ The evaluator consulted with the executing agency and found that it was 2006 when the development of the drainage structure in this irrigation system (inlets, tunnel sluices, drainage culverts, aqueducts and such) was completed, and that it was May 2007 when the whole irrigation system started to function at full scale as the amount of water flowing into the main canal was taken under control and water was distributed properly in all reaches of the whole system by recovering and reinforcing the drainage function for directing rain water and diverting flood water.

To summarize, the project cost was lower than planned, but the project period was significantly longer than planned. Therefore, the efficiency of this project is fair.

3.3 Effectiveness¹¹ (Rating: ③)

The intended outcome of the project was to “utilize scarce water resources efficiently, recover the original designed area of irrigation, and increase the production of agriculture”. The degree of accomplishment of the quantitative and qualitative effects of the project were analyzed in this ex-post evaluation.

In order to measure the quantitative effects, the Operation Indicators (“area benefited by the project” and “planted area by crop”) and the Effect Indicators (“production volume by crop” and “yield per unit area by crop”¹²) set at the time of the project appraisal of the second phase (2002) were analyzed, comparing the base figures (2002), the target figures (three years after project completion), and the actual figures collected at ex-post evaluation (2014)¹³. For the evaluation of the extent to which the “efficient utilization of water resources” was achieved, quantitative data on the water volume secured in the irrigation system of the project was collected, in addition to the above indicators (as none of the latter included this).

For the analysis of the qualitative effects, the results of a beneficiary survey conducted in the project area were used¹⁴. The beneficiary survey targeted 200 farmers, out of whom 95 (in four villages) were from Kurnool District, and the rest 105 (in thirteen villages) were from Cuddapah District¹⁵. The average age of beneficiary survey respondents was approximately 49 years of age, and the average number of household members was 4.4.

The project objectives, indicators and data used for the analysis of the project effectiveness are shown in Table 3.

¹¹ Sub-rating for effectiveness is to be put with consideration of Impact.

¹² Base figures and target figures for paddy, groundnut, cotton, sunflower, pulses and cereals were set as measurable indicators for planted area, production volume and unit yield. In this ex-post evaluation, some more major crops (chilly, vegetable, turmeric and onion) were added and the actual figures were collected for analysis as it had been admitted visually in the first site survey (December 2014) of this ex-post evaluation that there had been crop diversification and cropping pattern change in the project area.

¹³ In addition to the “area benefited by the project” and the “planted area by crop”, the “collection rate of the irrigation water tax” was also among the Operation Indicators set at the time of the project appraisal of the second phase, while “gross annual average farm income” was added to the Effect Indicators along with “production volume by crop” and “yield per unit area by crop”. However, these two figures were used for the analysis of sustainability and impact respectively as the “collection rate of irrigation water tax” was part of the quantitative data for the analysis of financial sustainability, and the “gross annual average farm income” was one of the indicators for the degree of accomplishment of the overall goal of this project: “improvement of farmers’ income.”

¹⁴ The results of beneficiary survey were also reflected in the analysis of “project impact.”

¹⁵ This was from 10 to 14 December 2014 when the beneficiary survey was conducted in the project area. As the irrigation system between Kurnool and Cuddapah is divided into five reaches, the number of samples taken from Reach 1 to Reach 5 were 15, 44, 36, 72 and 33 respectively.

Table 3: Indicators / Data for the Measurement of Project Effectiveness and the Project Objectives

Indicators and Data		Relevant Tables and Figures	Project Objectives		
			Efficient utilization of water resources	Recovery of the original designed area of irrigation	Increase of agricultural production
Quantitative Data	Amount of water available in the irrigation system	-	✓		
	Area benefited by the Project	Table 4		✓	
	Planted area by crop	Table 4		✓	
	Production volume by crop	Table 5			✓
	Yield per unit area by crop	Table 6			✓
Qualitative Data	Water supply to farmland, water quality and quantity	Table 7, Table 8	✓		
	Irrigated land area for cultivation	Table 9		✓	
	Change in cropping pattern	Table 10			✓
	Crop diversification	Table 11			✓
	Change in planted crops	Figure 2			✓
	Change in yield by crop	Table 12			✓

Source: Developed by the Evaluator

Note 1: Quantitative data obtained from the executing agency through a questionnaire survey, and qualitative data through the results of beneficiary survey.

Note 2: There is no figure or table created for the “amount of water available in the irrigation system” as no quantitative data was obtained.

3.3.1 Quantitative Effects (Operation and Effect Indicators)

(1) Efficient utilization of water resources

According to the executing agency, the Department of Irrigation and Command Area Development of Andhra Pradesh State (hereinafter as the “I&CAD Dept.”), out of the total 900 million m³ of water volume taken from the original water source, approximately 680 million m³ of water was available in the Kurnool-Cuddapah irrigation canals at the time of the ex-post evaluation¹⁶. It was confirmed that approximately 620 million m³ were actually used for crop production in farmland (92.0 % of the water available in the project area) while the remaining amount of water remained in the irrigation system as excess.

Quantitative data for whether or not water efficiency had improved through project implementation was not accessible although the Evaluator did try to obtain this from the executing agency.

¹⁶ There was as much as 5,663 m³ of water loss between the original water source dam and the project irrigation system. Approximately 170 million m³ of water was exclusively used as drinking water as prioritized by the State Government. Andhra Pradesh State prioritizes the drinking water supply, and orders that a certain amount of irrigation water is allocated for drinking purpose in response to “drought declarations” issued by the local government based on precipitation and yields. Some surface water in the project irrigation system is also secured for drinking purposes, particularly during dry season. According to the I&CAD Dept., certain farmers also take groundwater by themselves and strategically choose specific products in each season based on the available amount of water in total. The whole picture, including these individual efforts made by farmers, however, has not been figured out nor has it been reflected in the quantitative data.

(2) Recovery of the original designed area of irrigation

The area benefited by the project and planted area by crop are shown in Table 4. The totals were over 80% of the target figures both in 2012/13 and 2013/14 ¹⁷.

Table 4: Area Benefited by the Project and Planted Area by Crop (Operation Indicators)

Unit: ha

Indicators	Baseline (2002)	Target (3 years after completion)	Actual		
			2012/13 (5 years after completion)	2013/14 (6 years after completion)	
Area benefited by the Project	47,552	106,420	100,079	92,526	
Total planted area	47,552	110,510	100,079	92,526	
Measured crops	Paddy	2,613	49,030	35,067	56,560
	Groundnut	549	26,760	12,575	1,340
	Cotton	725	13,380	3,309	2,518
	Sunflower	5,322	3,770	4,118	2,136
	Pulses	15,189	12,000	2,787	1,488
	Cereals	23,124	5,540	26,248	11,348
Other crops	Chilly	-	-	322	626
	Vegetable	-	-	4,819	2,896
	Turmeric	-	-	611	1,231
	Onion	-	-	70	123

Source: Survey response from executing agency

Note 1: "Area benefited by the project" indicates the cultivated area out of the entire area where irrigation facilities are developed, and the "planted area by crop" indicates the sum of the planted area of each crop within a year in the area benefited by the project.

Note 2: The actual figures for the area benefited by the project and the planted area are based on the facts of planting for the benefitted area which is sufficiently covered by the amount of surface water available for irrigation purposes.

Note 3: The sum of the planted area of crops appearing in the table is not compatible with the total planted area or the area within the whole irrigation system and the area benefited by the project, since crops other than those in the table were also planted.

Looking at the planted area by crop, although the planted area of paddy in 2012 was below target, that of 2013 exceeded target. The executing agency explained that paddy, which is one of main staples, was planted in a sustainable and stable manner in the project target area, though the planted area changes a little year by year. Cereals¹⁸ were found planted in far larger areas than the target. Those of measured plants, i.e., groundnut, cotton, and pulses, were far below the targets; the planted areas change greatly year by year. The I&CAD Dept. provides an annual precipitation forecast and water budget for the whole irrigation system, as

¹⁷ The actual figure of 2013/14 was lower than that of 2012/13 due to a severe water shortage in 2013/14. According to the executing agency, it is anticipated that the area benefited by the project will no longer be expanded due to housing development, mainly in the suburb of Kurnool, the construction of health and education facilities, road expansion, and development activities in Cuddapah District where the commercial value of land is high.

¹⁸ The data obtained from the executing agency for describing the actual figure of cereals was divided into two: one for sorghum and another for *jowar*. Sorghum is *jowar* in the local language of Andhra Pradesh State, and both words are used with the same meaning in most cases. Due to this, the sums of data for sorghum and *jowar* are shown as "cereals" for the planted area (Table 4) and the production volume (Table 5), while two different data are shown separately for the unit yield (Table 6).

so does the Department of Agriculture of Andhra Pradesh State (hereinafter referred as the “DOA”) for soil condition, technical advice based on natural conditions and year-to-year specific market information to farmers. Farmers then choose specific crops with intention and rotate them based on the information and advice given as above. In addition to those crops determined as the Operation and Effect Indicators at the time of project appraisal, other crops such as chilly, vegetable, and turmeric were also found planted in the project area.

(3) Increase in agricultural production

Production volume by crop is shown in Table 5. The production volume of paddy and cereals exceeded the target figures, which indicates that farmers produced a sufficient amount of staple foods. The production volume of the rest of the measured crops did not reach the target figures either in 2012/13 or 2013/14 as described above, since farmers choose crops year by year for specific reasons (also as described above). However, other crops such as chilly, vegetable and onion showed a high production volume given the small planted areas. This implies that farmers, along with staple crops, often grow those crops which have a high profit and high yield and are able to do so as they have already secured the stable planting of their principal crops as well as diversified crops.

Table 5: Production Volume by Crop (Effect Indicators)

Unit: ton/year

Indicators	Baseline (2002)	Target (3 years after completion)	Actual		
			2012/13 (5 years after completion)	2013/14 (6 years after completion)	
Measured crops	Paddy	14,894	316,845	177,523	343,955
	Groundnut	824	86,172	42,512	4,164
	Cotton	7,450	40,140	11,570	8,566
	Sunflower	4,258	7,823	8,137	3,194
	Pulses	4,365	12,111	4,069	1,665
	Cereals	34,686	23,470	109,116	39,074
Other crops	Chilly	-	-	2,103	4,128
	Vegetable	-	-	17,807	10,062
	Turmeric	-	-	417	1,741
	Onion	-	-	5,378	9,308

Source: Survey response from executing agency

The actual figures for the unit yield by crop are shown in Table 6. Looking at the yield of the rainy season, the unit yield of staple foods and others exceeded the targets. Paddy and groundnut exceeded the targets for both 2012/13 and 2013/14. Cereals, both sorghum and *jowar*, exceeded the target in 2012/13. Cotton exceeded the yield target for the year 2012/13, and reached close to the target in 2013/14. On the contrary, in the dry season, only the unit yield of cereal (sorghum) in 2012/13 reached the target, while that for paddy and groundnut

reached close to 80 % of the target in 2012/13, and nearly 90 % in 2013/14. Pulses showed stable yields reaching close to 90 % of the target figure in 2012/13, and 80 % in 2013/14.

Among the yields of other crops at the time of the ex-post evaluation, that of chilly, which is grown with a large amount of water, was remarkably high in the dry seasons of both 2012/13 and 2013/14. Turmeric had a higher yield in the dry season than in the rainy season of 2013/14. Vegetable and onion had a certain amount of yield throughout the year in 2013/14.

It is concluded that the yields of not only the main staples but also high-valued crops and productive crops were secured in a stable manner.

Table 6: Unit Yield by Crop (Effect Indicators)

Unit: ton/ha

Indicators		Baseline (2002)		Target Figure (3 years after completion)		Actual				
						2012/13 (5 years after completion)		2012/13 (6 years after completion)		
		Rainy season	Dry season	Rainy season	Dry season	Rainy season	Dry season	Rainy season	Dry season	
Measured crops	Paddy	5.7	-	6.5	6.0	6.7	4.6	6.8	5.3	
	Groundnut	1.5	-	2.3	3.5	2.5	2.6	2.5	3.1	
	Cotton	2.0	-	3.0	-	3.4	4.0	2.9	3.7	
	Sunflower	0.8	-	2.0	2.1	1.1	0	1.4	1.5	
	Pulses	1.0	-	2.0	2.5	1.9	2.2	0	2.0	
	Cereals	Sorghum	1.5	-	3.5	4.5	5.4	6.4	1.2	2.2
		Jowar	-	-	-	-	3.9	0	2.0	2.9
Other crops	Chilly	-	-	-	-	11.9	20.0	9.5	22.0	
	Vegetable	-	-	-	-	9.2	0	8.5	8.4	
	Turmeric	-	-	-	-	1.2	0	1.2	2.0	
	Onion	-	-	-	-	4.9	0	4.9	4.9	

Source: Survey response from executing agency

Note: In the base year 2002 there was a severe drought and there was no production during the dry season (“-”). No base figures were obtained for “other crops” as it was only the actual figures that were collected in the ex-post evaluation. There was no record of planting those crops for which the actual figures were “0” at the time of the ex-post evaluation.

3.3.2 Qualitative Effects

(1) Efficient utilization of water resources

As in 3.3.1 (1), it was impossible to obtain quantitative data on to what extent the water supply and distribution reached the peripheral area and the far reaches of the irrigation system. However, in the beneficiary survey (see the eighth page of this report), as shown in Table 7, 195 respondents, including 172 whose “cultivation area with a sufficient amount of water throughout a year was less than 50% of their total farmland and who had cultivated only once a year” before the project, answered that “their cultivation area with a sufficient amount of water use had risen to over 50% of their total farmland throughout a year” at the time of the ex-post evaluation (2014). The water supply to their farmland had improved

drastically compared with that before project implementation¹⁹. Asked if there was any change in the water supply to farmland, the water quality and quantity in canals and on farmland before and after project implementation, all 200 respondents answered that “water supply to farmland has been improved through the modernization of irrigation facilities”, and that “water quality and quantity at canals and farmland has been improved” (Table 8).

To summarize, it is confirmed that project implementation provided sufficient water in the farmland served by the irrigation system, and that it improved the quality and quantity of the water supply at canals and on farmland.

Table 7: Shift in the Water Availability on Farmland

Unit: person

Water Availability at Farmland		As of 2014 at the Timing of the Ex-post Evaluation		
		Wet area accounts for 50% and more of cultivated land throughout a year	Irrigated dry area accounts for more than 50% of cultivated land cultivated only once a year	Total
Before Project Implementation	Wet area accounts for 50% and more of cultivated land throughout a year	23 (11.5 %)	5 (2.5 %)	28 (14.0 %)
	Irrigated dry area accounts for more than 50% of cultivated land, cultivated only once a year	172 (86.0 %)	0 (0.0 %)	172 (86.0 %)
	Total	195 (97.5 %)	5 (2.5 %)	200 (100.0 %)

Source: Beneficiary survey results

Table 8: Changes in the Water Supply to Farmland

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Water Supply to Farmland	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Water Quality at Canals and Farmland	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Water Quantity at Canals and Farmland	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results

(2) Recovery of the original designed area of irrigation

In addition to the quantitative data obtained from the executing agency (Table 4), all 200 respondents of the beneficiary survey replied that “their irrigated cultivated area has been

¹⁹ Out of these 172 beneficiaries, all 35 except one beneficiary in Reach 3, all 72 in Reach 4, and all 33 in Reach 5 were included. Reach 4 and Reach 5 are where water availability had been drastically improved through the new construction of the Alaganur Balancing Reservoir. By farming location, all 13 at mid-stream and all 55 at lower-stream were included in the said 172, which showed improvements in water availability even at the peripheral areas of the irrigation system.

improved compared with the situation before project implementation” when asked if there had been any change before and after project implementation (Table 9). This implies that the irrigated area for cultivation had increased compared to the situation before project implementation.

Table 9: Changes in Irrigated Cultivated Area

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Irrigated Cultivated Area	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results

(1) Increase in agricultural production

- Changes in cropping pattern

Looking at changes in planting, those beneficiaries who used to plant sugarcane accounted for 28 (14.0 %) of 200, and those who planted a crop once a year during the rainy season with a sufficient amount of water were 172 (86.0 %) before project implementation. At the time of the ex-post evaluation, however, the “single crop without water shortage” figure stood at 21 samples (10.5 %) only, and 179 (89.5 %), which is close to 90 % of the total respondents, planted crops twice a year without experiencing water shortage (Table 10).

These results confirm that farmers had a better environment for planting whatever crops they wanted to plant throughout the year without specific limitations after the project implementation.

Table 10: Changes in Cropping Pattern

Unit: person

Cropping Pattern		Current Situation (As of 2014 at the Time of the Ex-post Evaluation)				
		Sugarcane	Single crop (rainy season only: without water shortage)	Double crops (without water shortage)	Single crop with less water	Total
Before Project Implementation	Sugarcane	0 (0.0 %)	0 (0.0 %)	28 (14.0 %)	0 (0.0 %)	28 (14.0 %)
	Single crop (rainy season only: without water shortage)	0 (0.0 %)	21 (10.5 %)	151 (75.5 %)	0 (0.0 %)	172 (86.0 %)
	Double crops (without water shortage)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
	Single crop with less water	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
	Total	0 (0.0 %)	21 (10.5 %)	179 (89.5 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results

- Diversification of Farm Crops

In order to confirm the project effect on changes in cropping pattern, beneficiaries were asked if improvement of the irrigation facilities had contributed to the diversification of their farming crops, and all 200 respondents answered positively (Table 11). Moreover, a question about whether or not there had been any change in planted crops before and after the project implementation revealed that there was a large difference among foods excluding principal ones such as paddy and cereals as in Figure 2.

There were large numbers of beneficiaries (191 and 190 respectively) who, before project implementation, planted groundnut, which requires a relatively small amount of water to grow and which takes only four months for cropping with high yields, and sunflower which needs more or less three months to grow with a small amount of water. However, these sharply declined after project implementation (51 and 40 respectively) (Figure 2). On the other hand, the number of beneficiaries planting cotton, pulses and chilly increased to a large extent after project implementation (from 52 to 200, 3 to 198, and 48 to 200 respectively) (Figure 2). Chilly requires a large amount of water, and cotton and chilly need a large number of laborers for harvesting although the expected cash income is high.

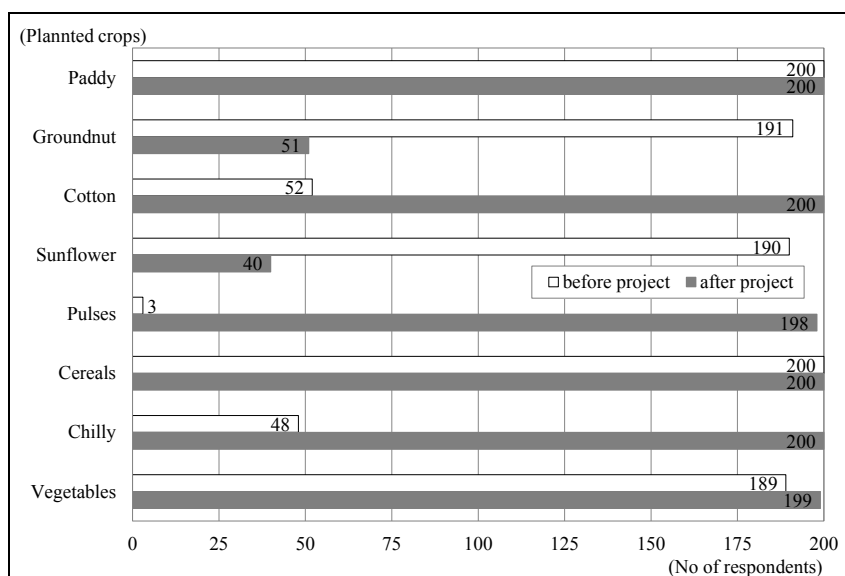
It was thus confirmed that project implementation made it possible for farmers to plant crops which need a larger amount of water, and to rotate crops, including those with a high profit.

Table 11: Diversification in Crops

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Diversification in Crops	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results



Source: Beneficiary survey results

Figure 2: Changes in Planted Crops Before / After the Project

- Stable crop production

When asked if there was any change in crop yield, all 200 respondents said that it had increased and improved for all the crops except groundnut, for which the answer “others / N.A.” had the greatest share²⁰ (Table 12). This implies that improvements in crop yield mainly came from the fact that project implementation enabled farmers to use the required amount of water when needed, to change cropping patterns, to promote crop diversification, and to sustain soil fertility by rotating crops.

Table 12: Changes in Yields by Crop

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Paddy	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0%)	200 (100.0 %)
Groundnut	35 (17.5 %)	0 (0.0 %)	0 (0.0 %)	165 (82.5%)	200 (100.0 %)
Cotton	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Sunflower	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Pulses	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Cereals	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Chilly	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Vegetable	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results

²⁰ This result was mainly due to the fact that it was only 51 households out of 200 who planted groundnut at the time of the ex-post evaluation.

To summarize, water availability to farmland has improved in each Reach as far as peripheral areas, the area benefited by the project and the planted area has expanded, staple crops have been planted in a stable manner, production volume and the unit yield by crop have improved, and changes in cropping pattern and crop diversification have been in progress. Therefore, the project objective “to enhance improvement in water efficiency, the recovery of the irrigated area, and the expansion of agricultural production” has been achieved and the project effectiveness is high.

3.4 Impacts

3.4.1 Intended Impacts

A series of analyses was made based on the results of the questionnaire survey with the executing agency, the beneficiary survey, interviews with people living in the project area, and the site survey to ascertain whether or not there was any contribution to the accomplishment of the overall goal of this project, “improvement in farmers’ income”, and the extent to which this contribution had been achieved as project impact.

(1) Household income and expenditure

The beneficiary survey results on the household income and expenditure showed that 30 (15.0 %) and 50 (25.0 %) out of 200 respondents saw an increase / improvement in their household income and expenditure respectively. Those who said that their household income and expenditure remained at the same level, on the other hand, share the majority (170 (85.0 %) and 150 (75.0 %) respectively) (Table 13).

According to the results of beneficiary survey, however, 161 out of 200 (80.5%) beneficiaries answered that “their savings had increased”, which implies that they had secured and improved their incomes to the extent that they could afford to save excess money in their households. Apart from the beneficiary survey, interviews with residents and the site survey confirmed that farming activities had become more active than before and that farmers were better off (owning home appliances, motorbikes and vehicles, having better education for their children, better clothes and houses) as well as having increased savings. This gave confidence that there had been increases in income and expenditure.

Table 13: Household Income and Expenditure

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Household Income	30 (15.0 %)	170 (85.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Household Expenditure	50 (25.0 %)	150 (75.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results

Table 14: Savings

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Savings	161 (80.5 %)	39 (19.5 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results

(2) Farm income and expenditure

Looking at farm income²¹, the actual figures for the “gross average annual farm income per household” for both 2012/13 and 2013/14 collected from the executing agency at the time of the ex-post evaluation show that they were above the base figure as well as the target (Table 15), which confirmed a quantitative improvement in farm income. The beneficiary survey showed that 170 respondents (85.0 %) out of 200 answered that “their farm income had increased from what it had been before project implementation” (Table 16). Taking into account the expansion of planted area, mainly of principle food crops, the attainment of the stable production of major crops, improvements in production volume and yields, the diversification of crops and the production of high value crops, the contribution of project implementation to increases in farm income can be seen and regarded to have been to a considerable degree.

Meanwhile, 140 beneficiaries (70.0 %) replied that “their farm expenditure had increased” (Table 16). The increase in farm expenditure is confirmed together with an increase in farm income, and the purchase of high quality seeds, fertilizers and farming equipment were given by residents as reasons for this increase. Moreover, all 200 beneficiaries said “they now required more laborers compared to before project implementation”, which implies that they spend more on laborers for cultivating larger farmland, ensuring a higher production volume, increasing yields, and securing manpower for planting high-value crops.

Table 15: Gross Annual Average Farm Income per Household

Unit: rupee/year/household/ha

Indicator	Baseline (2002)	Target (3 years after completion)	Actual	
			2012/13	2013/14
Gross Annual Average Farm Income per Household	37,329	54,353	72,949	68,352

Source: Survey response from the executing agency

Note: The gross annual average farm income is the crop production volume multiplied by crop price.

²¹ “Farm” income and expenditure includes those due to cultivating farmland. Those due to dairy farm and livestock raising are given in “non-farm” income and expenditure.

Table 16: Farm Income and Expenditure

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Farm Income	170 (85.0 %)	30 (15.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Farm Expenditure	140 (70.0 %)	60 (30.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Farm Labor	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results

(3) Non-farm income and expenditure

The number of beneficiaries who answered that both non-farm income and expenditure had “increased” reached 198 (99.0 %), which indicates that the trend is for increases in areas other than farm income and expenditure (Table 17).

For non-farm expenditure, residents said in their interviews that they had spent on high quality dairy cattle and other livestock, animal raising, high quality seeds, farm machines, electrical appliances such as mobile phones and TVs, the purchase and repair / maintenance of motorbikes and vehicles, the purchase of furniture and the construction of permanent houses. It is confirmed that they also applied for loans from banks with their farmland as collateral, which meant repayment as expenditure. It was also confirmed through interviews that farmers were interested in spending money on their children’s education (details are given later in this report), on healthcare and on investments.

Looking at non-farm income, on the other hand, there were profits from the sale of dairy cattle and livestock raised in farmers’ dairy farms, as well as income from the renting of farmland. Beneficiaries are seen to have been involved in such activities as stable agricultural production, increase in yields per unit area and improvement in farm income had enabled them to secure a certain level of livelihood. A total of 171 respondents (85.5 %) stated that “job opportunities for family members remained the same as before project implementation”, which indicates that this did not contribute much to non-farm income.

Table 17: Non-farm Income and Expenditure

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others/N/A	
Household Non-farm Income	198 (99.0 %)	1 (0.5 %)	1 (0.5 %)	0 (0.0 %)	200 (100.0 %)
Household Non-farm Expenditure	198 (99.0 %)	1 (0.5 %)	1 (0.5 %)	0 (0.0 %)	200 (100.0 %)
Job opportunities for family members	29 (14.5 %)	171 (85.5 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results

To summarize, although the beneficiary survey results show that the majority of respondents said their household income had remained at the same level as before, according to the same survey it can be seen that household savings were secured, and it was confirmed through interviews with residents and the site survey that living standards improved. Moreover, improvements in farm and non-farm income were confirmed in the beneficiary survey, and it is judged that the project effectiveness contributed to this to a major degree. Farm expenditure and non-farm expenditure were also on the increase, with the expenditure mainly used for better farm and non-farm income and improvements in living standards. As people became more affluent, more expenditure was required for production activities and life improvement, and the project implementation was a major factor in the raising of incomes to sustain expenditure.

Although this is not a counterfactual comparison of “with” or “without” project, it can be considered from a comprehensive point of view, taking into account all kinds of survey results in this ex-post evaluation, that the project has contributed to the overall goal of “improvement in farmers’ income” and that the degree of this contribution was high.

3.4.2 Other Impacts

(1) Impacts on the Natural Environment

This project was appraised in accordance with the “OECD Environmental Guidelines for ODA Loans (enacted in October 1989)” when the first phase was appraised. Also, an Environmental Impact Assessment (EIA) report was submitted in 1997 to the Ministry of Environment and Forestry (MOEF) of the Government of India, after the first project appraisal. The MOEF issued environmental clearance in November of the same year determined that the degree of environmental impact caused by this project was considered as small, most components of this project being the rehabilitation and enhancement of the existing irrigation facilities. In addition, no adverse impact was anticipated due to the inundation caused by the construction of the Alaganur Balancing Reservoir as there was no forest in the sunken area, and it was farmland or abandoned areas no longer cultivated. When the second phase was appraised in 2003, it was “JBIC Environmental Guidelines for ODA Loans (April 2002)” which was referred and this project was classified as Category A²². The executing agency promised that “environmental mitigation measures (such as canal lining and embankment installation) would be incorporated into the design to prevent water leakage from the reservoir in order that there would be no impact on the habitat of wild birds at the wild life sanctuary near the reservoir.”

In the first site survey in December 2014 of this ex-post evaluation, it was confirmed

²² Since this project included a large-scale reservoir construction, it was classified as Category A defined in the JBIC Guidelines as “likely to have a significant adverse impact on the environment”. However, no EIA was conducted at the time of the second appraisal as the Indian side had already conducted one when the first phase of this project was appraised.

through interviews with the executing agency as well as check with eyes during the site visit that an impact on the wild life sanctuary near the reservoir had been avoided. The executing agency no longer report to the MOEF, but they submit reports to the Central Water Commission twice a year in accordance with their guidelines on the safety of the Alaganur Balancing Reservoir.

(2) Land Acquisition and Resettlement

Land as large as 1,905 ha was acquired between 1997 and March 2004 for project implementation (Table 18). Seven households were resettled due to the said land acquisition. The executing agency confirmed that it was the Revenue Department which compensated them in accordance with the conditions described in the Resettlement Policy of Andhra Pradesh State.

Table 18: Land Acquisition and Compensation (Actual)

Land Acquisition and Compensation	(i) Canal Improvement	(ii) Construction of Alaganur Balancing Reservoir and Inlet Channel of ABR	(iii) Total (i+ii)
Land Acquisition	306 ha	1,599 ha	1,905 ha
Kurnool District	216 ha in total in three divisions	1,599 ha in total in five divisions	1,815 ha
Cuddapah District	90 ha in total in two divisions	-	90 ha
Compensation	None	145.3 million rupees	145.3 million rupees

Source: Survey response from executing agency

(3) Unintended Positive/Negative Impacts

- Improvement in educational environment

In the beneficiary survey, 170 respondents (85.0%) out of 200 answered that “their children’s education level had improved after project implementation” (Table 19). For schooling, a sizable amount of money was necessary for transportation and clothes in addition to that needed for education materials. Increases in farm income mainly due to project implementation and improvements in non-farm income made it easier for farmers to meet such costs than they it had been for them before project implementation, and to let their children attend school.

Table 19: Improvement in Educational Environment

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Education Level for Children	170 (85.0 %)	30 (15.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results

- Enhancement in life infrastructure

All 200 beneficiaries answered that the “water supply to their households improved after project implementation” (Table 20). The water taken from the water source of the whole irrigation system of this project was used not only for irrigation purposes but also for drinking purpose as directed by Andhra Pradesh State (See footnotes 16 and 17). Water was now available at distributaries for residents’ daily use. Water supplied by the project contributed to satisfying the need for water for general purposes in peoples’ daily lives.

Similarly, all 200 beneficiaries answered that “road access has improved”. Improvement in the income of beneficiaries was confirmed at the time of this ex-post evaluation, as they were able to use motorbikes and other vehicles as their living standards improved. It is considered that the development of the surrounding infrastructure (such as farm roads and bridges) as well as the roads around the main canal and distributaries helped people move smoothly within regions and contributed to better traffic connections with neighboring villages.

Moreover, 170 residents (85.0 %) out of 200 mentioned that their houses were improved after project implementation. According to interviews with residents, they used to live in temporary or semi-permanent houses of one story before project implementation. Income improved after project implementation as they were able to harvest agricultural products in a stable manner.

Table 20: Improvement in Life Infrastructure

Unit: person

Question Item	Answer				Total
	Increased / Improved after Project	Same as before Project	Decreased / Aggravated after Project	Others / N/A	
Water Supply to Household	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Road Access	200 (100.0 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)
Housing Situation	170 (85.0 %)	30 (15.0 %)	0 (0.0 %)	0 (0.0 %)	200 (100.0 %)

Source: Beneficiary survey results

In summary, it can be confirmed that appropriate measures were taken to mitigate impacts on the natural environment, and impacts caused by land acquisition and resettlement. Improvements in children’s education levels and the living environment of local residents in the form of water supply to households, road access and houses have also been confirmed, and the living standards of beneficiaries have been steadily improving. These are positive impacts that are considered to have been brought about indirectly by implementation of the project.

This project has largely achieved its objectives. Therefore effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

(1) Organization of the executing agency

The Chief Engineer of the I&CAD Kurnool Office is ultimately responsible for the whole of the operation, maintenance and budget arrangement of the irrigation system between Kurnool and Cuddapah, including the facilities rehabilitated and developed under this project. Under his supervision, the Superintending Engineer conducts the O&M of the project facilities, while the Executive Engineer of the Nandyal Division Office performs guidance, management and overall planning (O&M planning, budget planning and expenditure management). The Deputy Executive Engineers at the Sub-divisional Offices of Kurnool, Nandyal, Allagadda, Mydukur, and Nandikotkur are in charge of implementing the O&M related activities (Table 21).

Table 21: O&M Organizational Framework of the Project Irrigation System

Position	Main Functions	Office
Chief Engineer	Responsible for the O&M of the project and budget arrangements with the State Government	Kurnool Division Office
Superintending Engineer	O&M of the project facilities	
Executive Engineer	Guides and manages the O&M of the project facilities (such as water supply), water management, the preparation of the O&M plan and cost estimates	Nandyal Division Office
Deputy Executive Engineer	Actual execution of the O&M of the project facilities (such as water supply, gate operation etc.)	Sub-division Office
	Sunkesula Barrage, main canal and distributaries from km 0.0 to km.120.19 (Reach 1) and Lock-in-Sula	Kurnool
	Santhajatur Anicut, main canal and distributaries from km.120.19 to 150.65 (Reach 2) and km.150.65 to 174.00 (part of Reach 3)	Nandyal
	Main canal and distributaries from km.174.00 to 234.64 (part of Reach 3)	Allagadda
	Rajoli Anicut, Adinimayapalli Anicut and main canal and distributaries from km.234.64 to 290.22 (Reach 4) and from km.290.22 to 305.60 (Reach 5)	Mydukur
	Alaganur Balancing Reservoir and Inlet Channel of ABR	Nandikotkur

Source: Survey responses from executing agency

The staff allocation for O&M as at the ex-post evaluation is shown in Table 22. There were no technicians, skilled workers, nor gate operators (*lascar*), and so for each of these the executing agency requested that an additional ten staff be allocated. As for service rendered contracts, Andhra Pradesh State employs and allocates manpower together with those for other irrigation systems, but recruitment was behind schedule. Under these circumstances the existing staff conducted O&M as required, and there were no specific problems in the irrigation system.

Table 22: Staff Allocation for the Project Irrigation System

Unit: person

Position Name	Cadre	Existing	Requirements for the strength of sanctions submitted to the State Government
Executing agency staff			
Chief Engineer, Superintending Engineer	1	1	1
Executive Engineer	1	1	1
Deputy Executive Engineer	5	5	5
Assistant Executive Engineer	25	25	25
Manager (Admin) Superintendent	1	1	1
Manager (Financial)	1	1	1
Technician	0	0	10 (new)
Skilled worker	0	0	10 (new)
Gate operator (<i>lasca</i> r)	0	0	10 (new)
Total	34	34	64
Service rendered contracts for the maintenance of canals and water regulations (<i>work charged establishment</i>)			
Work Inspector Grade I	1	0	1
Work Inspector Grade II	4	0	4
Work Inspector Grade III	16	11	16
Work Inspector Grade IV	58	9	58
<i>Lasca</i> r / Watchman / Head of worker / Worker)	346	308	346
Driver	5	5	5
Total	430	333	430

Source: Survey response from executing agency

Note: Shortages in service rendered contracts (*work charged establishment*) are filled with those applicants who provide their private land according to their skills. Andhra Pradesh State manages information and appoints by proxy as other projects have also acquired land from private owners.

(2) O&M by farmers organizations

In accordance with the Andhra Pradesh Farmers Management of Irrigation Systems Act enacted in 1997, Andhra Pradesh State conducted elections for the members of Water Users' Associations (WUA), Distributary Committees (DC) covering 5 to 8 WUAs, and for Project Committees (PC) supervising DCs, and also organizing them. These farmers' organizations and the I&CAD Dept. were expected to jointly manage the irrigation systems for distributing water equally, to promote and confirm the efficient and economical way of using water, to encourage the modernization of agriculture, maximize agricultural production and maintain irrigation systems based on annual water budgets and operation plans.

However, with the planned separation of Andhra Pradesh State into two states in 2014 as the main reason, the State has not held an election of farmers' organizations nor their own organizations since February 2013²³. The State was split into two in June 2014, after which there has also been no action taken. At the time of the ex-post evaluation no farmers' organizations existed in the irrigation system of this project, and future schedule of elections remained unknown.

²³ There organized 86 numbers of WUA, 14 Distributary Committee (DC), and one Project Committee (PC) in this project irrigation system as of February 2013.

The farmers' organizations of the irrigation system of this project used to report to and consult with the I&CAD Dept. regarding the condition of the farmland they covered, meanwhile the executing agency provided technical judgements and instructions whenever necessary and took measures which required financial expenditure. In response to the suspension of elections and the organization of farmers' organizations in 2013, the officers of the executing agency in charge and staff members at division offices as shown in Table 21 took over the O&M roles of the WUAs, DCs and PC. It was confirmed at the ex-post evaluation that the executing agency systematically worked well on the operation and maintenance of the irrigation system based on the 1997 Act, which they managed well and no specific problems had occurred.

To summarize, although farmers' organizations did not exist as of the ex-post evaluation, each division office of the executing agency looked after their functions, roles and responsibilities. There are thus no specific problems found in the institutional aspect.

3.5.2 Technical Aspects of Operation and Maintenance

The executing agency conducts staff skill evaluation once a year, and systematically promotes the improvement of technical, management and administrative skills.

The Water and Land Management Training and Research Institute (hereinafter "WALAMTARI"), established in 1983 in Andhra Pradesh State, provides training opportunities on quality control, soil management, water management, basin management and irrigation project operation and maintenance to the staff members of the executing agency.

The WALAMTARI also provides technical training to farmers. The executing agency provides farmers with advice on planning of maintenance plans, on estimating budgets for operation and maintenance, water regulation and annual water budgets, as well as on technical site inspections at irrigated land. In addition, the DOA provides assistance to farmers on the development of action plans for agricultural production, guidance on agricultural records, direction on growing agricultural products in peripheral areas of the irrigation system, on comprehensive nutrition management, and integrated pest management. In order to respond to various inquiries from farmers, the DOA also regularly writes technical articles and introduces and promotes farm technology on TV programs, as well as establishing a telephone help line exclusively for technical consultation, conducting soil inspections, providing advice on which crops to choose based on the soil condition, providing high quality seeds and subsidies, and allocating agriculture extension workers at village level. The executing agency and the DOA exchange information as required at ground level, coordinate and collaborate with each other. Both of them provide useful technical inputs on the O&M of this project as well as the provision of guidance to residents.

To summarize, the executing agency promotes the improvement of staff skills with a periodic evaluation system to secure the quality of operation and maintenance. In addition to the executing agency, the WALAMTARI and the DOA fulfill their roles according to their functions. Thus no specific problems were found in the technical aspect.

3.5.3 Financial Aspects of Operation and Maintenance

(1) The Kurnool - Cuddapah Canal Operation and Maintenance Budget

Table 23 shows the operation and maintenance budget and expenditure of the past three years approved and allocated by Andhra Pradesh State. The same budget has been secured for “Operation” and “Maintenance” every year, and a certain budget allocation and expenditure for “Human Resources (staffing costs)” has also been admitted. There has been no budget allocation in recent years to “Staff Training Costs” as the organizations often conduct training by themselves. “Others” includes large-scale rehabilitation and the new construction of canals.

According to the executing agency, the budget allocated for operation and maintenance was not sufficient, and activities were prioritized based on the degree of urgency for repair and rehabilitation. De-silting in peripheral areas and in field channels as well as weed removal where there was no great harm to the function of the irrigation system were given less priority.

Table 23: O&M Budget and Expenditure for the Project Irrigation System

Unit: million rupees

Item	2011/12		2012/13		2013/14	
	Budget	Expenditure	Budget	Expenditure	Budget	Expenditure
Operation	5.0	4.6	5.0	2.5	5.0	2.5
Maintenance	5.4	2.3	5.4	3.9	5.4	2.7
Others	370.4	311.9	475.4	251.3	689.8	91.8
Human Resources	70.9	55.3	80.9	63.7	94.5	60.2
Staff Training costs	2.3	2.3	-	-	-	-
Gov. Subsidies	-	-	-	-	-	-
Total	454.0	376.4	566.7	321.4	794.7	157.2

Source: Survey responses from the executing agency

(2) Collection of irrigation water tax

Table 24 shows the shift in the planned amount of collection, the actual amount of collection, the actual expenditure of the irrigation water tax, and its collection rates. The irrigation water tax was expected to be redistributed after being collected²⁴. The collection rate at the time of the second project appraisal (2002) was as low as 6.6 %, and JICA strongly proposed that the executing agency improve the rates and review the water charge

²⁴ These were re-distributed to WUAs, DCs, PCs, and GCs at 50%, 30%, 20%, and 10% respectively for the purpose of irrigation system management.

ratio²⁵.

As for the shift in collection rates, they remained below the target (50%) except those of 2007/08 and 2009/10, and those after 2011 were found to be lower than the base figure of 2002. According to the executing agency, the tax collection rates had been low as it depended on the Revenue Department of each division as to what extent collection was completed. Residents felt no motivation to pay tax as its advantages were not recognized by them. In addition, the executing agency did not collect the irrigation water tax during the dry seasons, taking into account the droughts of recent years²⁶. Although the existence of WUAs, the entry point for irrigation water tax collection, was terminated at the beginning of 2013, the local Revenue Department continued to collect the tax even after termination, although not much was spent on maintenance as the collected amount was far below that required. The executing agency explained that no irrigation water tax was collected at the time of the ex-post evaluation (2014).

Table 24: Shift in the Planned and Actual Amount of Irrigation Water Tax Collection and the Actual Expenditure and Collection Rate of the Irrigation Water Tax in the Project Irrigation System

Irrigation Water Tax (Unit)	Baseline (2002)	Target (3 years after Completion)	Actual						
			2007/08 (completion year)	2008/09 (1 year after completion)	2009/10 (2 years after completion)	2010/11 (3 years after completion)	2011/12 (4 years after completion)	2012/13 (5 years after completion)	2013/14 (6 years after completion)
Planned Amount of Collection (mil rupees)	-	-	15.0	41.1	53.9	55.5	39.2	30.5	39.3
Actual Amount of Collection (mil rupees)	-	-	13.5	10.1	30.7	13.8	2.5	0.6	0.6
Actual Expenditure (mil rupees)	-	-	-	34.3	40.0	4.3	0.07	0.07	0.05
Collection Rate (%)	6.6	50	89.8	24.5	56.9	24.9	6.3	1.9	1.5

Source: The data on the planned amount, actual amount, and actual expenditure from 2007 to 2010 was collected from PCR, while the figures for 2011 to 2013 are from the data submitted by the executing agency in this ex-post evaluation. The collection rate is calculated as the actual amount of collection divided by planned amount of collection.

²⁵ The amount of water charges are based on the Andhra Pradesh State Government Order by the Revenue Department. This project is categorized as a “major” sector and Rs. 200 are charged per acre (Rs. 50 from WUAs, Rs. 20 from DCs, Rs. 20 from PC and Rs. 10 from villages (*Gram Pachayats*), and Rs. 100 from the I&CAD Dept.). The charge ratio has been left unchanged since July 2001.

²⁶ Described as in footnote 16, as there are drinking water shortages mainly in the dry season, the Andhra Pradesh State Government preferentially allocates some irrigation water to the drinking water supply including in the irrigation system of this project. The executing agency is supposed to provide irrigation water only to those with registered farmland, but unofficially they extend their service to the non-registered area. The executing agency therefore is not in a position to provide surface water officially as they cannot guarantee the provision of a sufficient amount of irrigation water until the end of dry season when the water supply is most required, although they do supply available water as much as possible. Instead, therefore, they do not collect the irrigation water tax during the dry season.

The planned amount of the irrigation water tax collection far exceeds the operation and maintenance budget allocated by Andhra Pradesh State (Table 23). This implies that a sufficient amount will be secured if the irrigation water tax is collected as planned. In order to supplement the fund shortage, the executing agency took countermeasures such as the provision of excess water to private companies (factories and power generation companies) in order to collect water royalty charges in return. They said that they would continue to discuss to increases in water sales to private companies, but the income remains insufficient²⁷.

In summary, the Andhra Pradesh State Government has allocated a certain budget for the operation and maintenance of the project in a stable manner. However, the amount is not sufficient and operation and maintenance works are implemented according to the degree of urgency. The irrigation water tax, part of which is supposed to be spent on facility maintenance, had not been collected as planned, particularly recent years, resulting in a chronic shortage in the operation and maintenance budget. The executing agency has made efforts to secure alternative funds by selling excess water to private companies, but it is unknown to what extent this has been effective. There are therefore some problems in the financial aspect of the operation and maintenance.

3.5.4 Current Status of Operation and Maintenance

(1) Maintenance works for the project

The executing agency develops an annual water budget, forecasts the amount of water intake within the system before the rainy season, confirms how much water remains at the reservoir, and distributes water in the system. At the end of each season they confirm the planting area and develop a detailed plan for the discharge and blockade of water. Based on the Andhra Pradesh Farmers Management of Irrigation Systems Act of 1997, the executing agency is supposed to conduct O&M activities together with the WUA as described in Table 25. As of December 2014, at the time of the ex-post evaluation, no WUA existed and it was the executing agency who conducted such works. They conducted repair works based on the urgency to do so as allocated from the State, and there was no specific problem found in their O&M works.

²⁷ Data from the executing agency shows that the actual water sales collected from private enterprises in 2013/14 was 522,798 rupees against the planned amount 743,194 rupees.

Table 25: O&M Activities of the Project Irrigation System

Maintenance Works	Contents
Daily Inspection	<ul style="list-style-type: none"> • De-silting • Weed removal • Embankment repairs • Revetment • Repairs to shutters • Repairs to masonry and lining • Cleaning and oiling of screw gearing shutters • Painting of hoists and gates etc. • Emergent breach closing works • Maintenance of inspection paths
Periodic Inspection	<ul style="list-style-type: none"> • Reconstruction of sluices • Reconstruction / repairs to drops and regulators • Reconstruction of measuring devices • Rehabilitation of the system
Large-scale Works	<ul style="list-style-type: none"> • Modernization of the system • Other construction work in the irrigation system
System Diagnosis	<ul style="list-style-type: none"> • Inspection of each and every hydraulic structure and recording of its status before each season • Identification of all critical reaches

Source: Survey response from executing agency

(2) Current operational condition of the irrigation system

At the time of the ex-post evaluation, no breakdown or deterioration of the irrigation facilities was identified, nor were there problems caused by bad construction. The irrigation system was found in good condition. Construction and lining of the existing part of the main canal and distributaries under the project had contributed to a reduction in seepage losses to a large extent, and also to a minimization of the time necessary to deliver water to peripheral and tail-end areas. It is also confirmed that there was a sufficient amount of water compared to the period before project implementation.

Thus no specific problems were found in the inspection and repair works, and the operation of the irrigation system, nor in the present condition of operation and maintenance.

To summarize, no problems have been observed in the institutional and technical aspects of the operation and maintenance system, however there is room for improvement of the financial aspects. Therefore sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was intended to utilize water resources efficiently, recover the original designed area of irrigation, and increase agricultural production by the rehabilitation and modernization of the irrigation system between Kurnool and Cuddapah in Andhra Pradesh State in Southern India, thereby contributing to income improvement for farmers. The project relevance is high as

project implementation was well in line with India's development policy and development needs, as well as with Japan's ODA policy at the time of both appraisal and the ex-post evaluation. The project output achieved more or less as planned and the project cost was within the plan. The efficiency of the project is fair as the project period was significantly longer than planned. Water supply to farmland has been improved, the area benefited by Kurnool-Cuddapah Canal has been expanded, there has been stable planting of principal food, improvement of production volume and yields, and the diversification of agricultural products has been promoted since project implementation. Furthermore, household income, farm and non-farm incomes in the target area have been improved, and household savings have been secured since project implementation. The living environment of local residents has been improved to a large extent as seen in improvements in the level of children's education and in life infrastructure, and their living standards have been steadily improving. Therefore it is concluded that the effectiveness and impacts of the project are high since the planned effectiveness has been achieved through project implementation. With regard to project sustainability, there are no problems with the institutional and technical aspects and the present operation and maintenance condition of the irrigation facilities covered under the project, but there have been some issues with the financial aspects. The sustainability of the effects realized by this project is therefore fair. In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Collection rates of the irrigation water tax were overall low since project appraisal as the extent to which the irrigation water tax collection was completed depended on the Revenue Department in each division of the project irrigation system, and the motivation and willingness of residents to pay the tax remained low. Drinking water is in short supply, particularly during the dry season, and Andhra Pradesh State has a policy to prioritize the water supply for drinking purposes. The executing agency allocates some water in the project irrigation system for drinking purposes, and provides water to non-registered farmland through the Revenue Department. As they cannot guarantee a sufficient amount of water for registered farmland, the executing agency does not collect the irrigation water tax during the dry season. The planned amount of collection far exceeds the operation and maintenance budget allocated from Andhra Pradesh State, and a sufficient amount of funds will be secured if the entire planned amount of the irrigation water tax is collected. In order to secure the stable allocation of the operation and maintenance budget, it is necessary that the irrigation water tax is continued to be collected, which should help raise the awareness of farmers and motivate them to participate in O&M activities more positively. It is strongly recommended that the executing agency secure stable water supply throughout a year, and examine concrete measures to directly collect the irrigation water tax from farmers, while on

the other hand introducing penal regulations and thorough discipline for those farmers who do not pay the tax.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

None.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
(1) Construction and Rehabilitation of Weir Facilities	Construction of the Sunkesula Weir (<i>Barrage</i>), the Rehabilitation of Four Weirs (<i>Anicuts</i>) (Lock-in Sula, Santa Jutur, Rajoli, and Adinimmayapalli)	Construction of Sunkesula Weir (<i>Barrage</i>), Rehabilitation of Four Weirs (<i>Anicuts</i>) (Lock-in Sula, Santa Jutur, Rajoli, and Adinimmayapalli)
(2) Construction of the Alaganur Balancing Reservoir	Reservoir area (water surface): 15.64 km ² Storage capacity: 84 million m ³ Designed cull water level: 265 m Dam crest elevation: 269 m Dam crest length: 5,500 m	Reservoir area (water surface): 13.59 km ² Storage capacity: 84 million m ³ Designed cull water level: 265 m Dam crest elevation: 269 m Dam crest length: 7,500 m
(3) Construction and Rehabilitation of the Main Canal and Distributaries	Main Canal: 244.8 km (rehabilitation) Distributary: 790.3 km (rehabilitation) and 169.2 km (new construction)	Main Canal: 305.6 km (rehabilitation) Distributary: 840.0 km (rehabilitation) and 50.0 km (new construction)
(4) Construction and Rehabilitation of Related Structures	Bridges: 30, Cross drains: 14, Aqueducts: 8, Offtakes: 137, Measuring devices: 900, Outlets to field channel: 2,700	Bridges: 30, Cross drains: 14 Aqueducts: 8, Offtakes: 137, Measuring devices: 900, Outlets to field channels: 2,700
(5) Construction and Rehabilitation of Farm (<i>Ayacut</i>) Roads	100.6 km (construction of new roads) and 235.5 km (rehabilitation of existing roads)	336.0 km (construction of new roads) and 71.0 km (rehabilitation of existing roads)
(6) Construction and Rehabilitation of Drainage System	71.0 km in length, and 165,000 m ³ for earthworks volume	71.0 km in length, and 165,000 m ³ for earthworks volume
(7) On-farm Development	Development of on-farm facilities: 10,000 ha in total (5 places in the area benefited by the project)	Development of pilot farms: 70.97 ha in total (5 places)
(8) Sustainability Scheme (WUA consolidation activities and capacity building of farmers / WUAs)	-	Procurement of farming equipment at pilot farms and provision of technical training on agriculture extension
(9) Improvement of VHS Communication System and MIS	Procurement of computers and VHS communication system and MIS	Procurement of computers and VHS communication system (without MIS)
(10) Procurement of Vehicles	Included	Excluded
(11) Consulting Service	482 man / month (International: 132 and Local: 350)	474.5 man / month (International: 172 and Local: 302.5)
2. Project Period	January 1996 – June 2003 (90 months)	January 1996 – May 2007 (137 months)
3. Project Cost		
Amount paid in Foreign currency	2,995 million yen	1,403 million yen
Amount paid in Local currency	26,880 million yen (9,301 million rupees)	22,909 million yen (9,235 million rupees)
Total	29,875 million yen	24,312 million yen
Japanese ODA loan portion	25,393 million yen	19,123 million yen
Exchange rate	1 Indian rupee = 2.89 Japanese yen (As of April 1995)	1 Indian rupee = 2.48 Japanese yen (Average between 1996 and 2013)

Note: Although this project was implemented until July 2013, it is concluded in this ex-post evaluation that the project completion was May 2007 when the major facilities such as weirs, reservoir and drainage structures were developed and their operation was commenced at full-scale.

Former Yugoslav Republic of Macedonia

Ex-Post Evaluation of Japanese ODA Loan

“Zletovica Basin Water Utilization Improvement Project”

External Evaluator: Nobuyuki Kobayashi, OPMAC Corporation

0. Summary

The objective of this project was to stabilize the supply of service and industrial water by the construction of a multipurpose dam and water supply related facilities in the eastern part of Macedonia, thereby contributing to the improvement of living among residents and the promotion of industry in the region. This project is in line with the Macedonian national development policy and their development needs as well as Japan's ODA policy. However, the project scope was not defined appropriately as water quality tests at the water intake points and the tributaries were not conducted. The output of this project was not sufficient for incidence of outcome and, therefore, the relevance of the project is fair. The efficiency of the project is fair. Although a price competitive Macedonian company undertook the engineering work and the project cost was less than planned, the project period exceeded the plan due to a delay in the procurement and an extended construction period. Also, although a piped water system is in use at the target area, and there have been improvements in sanitary conditions and life convenience; the coverage of this project is limited and the raw water supply volume and revenue from raw water sales are significantly below the plan. Furthermore, as there are no transmission pipelines (hereafter, “raw water pipelines”) installed in the upstream area, the water quality has tended to worsen and therefore water supply service to municipalities with large populations has not yet commenced. For the above reasons, the effectiveness and impact of this project are low. Although the revenue of PE Hydrosystem "Zletovica" can ensure the minimum level to finance O&M activities, it will be difficult to recover the investment cost and it is unlikely that revenue to cover rehabilitation can be secured and, therefore, the sustainability is fair.

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

1. Project Description



Project Location



Knezevo Dam

1.1 Background

The former Yugoslav Republic of Macedonia (Macedonia) was a country with little rain and the eastern part of the country (the target area of this project) suffered the most. The target area faced frequent water outages during the summer because the source of existing water supply system was underground water. In addition, underground water in the project area located in the eastern part of the country contained a high concentration of heavy metals due to mining operations. Heavy metal contamination from a mining accident had occurred in the past which further limited utilization of the underground water. Low quality drinking water was being used because of scarce water sources, and there was a risk of infectious diseases. Furthermore, since the independence of Macedonia, job creation had been an issue in this region, and promotion of industry and agricultural development through water source development has gained interest. It was concluded that constructing a dam which could utilize snow and rain in winter seasons was promising because the amount of precipitation has significant seasonal variations and the eastern region's mountainous geography made supplying water from other areas difficult .

Given the above situations, supplying safe and stable water to the target area was an important policy task for Macedonia, and developing water sources in the Zletovica river basin (including the construction of a multipurpose dam) was established. At that time, this water source development was divided into three phases; construction of a dam and developing water supply facilities (Phase 1), development of irrigation facilities (Phase 2) and construction of a small-scale hydropower plant (Phase 3). This project was Phase 1, which included the construction of the Knezevo dam and water intakes, the construction of raw water pipelines and the construction and rehabilitation of a water treatment plant.

1.2 Project Outline

The objective of this project was to stabilize the supply of service and industrial water by the construction of a multipurpose dam, water intakes, and raw water pipelines in the eastern part of Macedonia, thereby contributing to the improvement of living among residents and the promotion of industry in the region.

Loan Approved Amount/ Disbursed Amount	9,689 million yen / 9,685 million yen						
Exchange of Notes Date/ Loan Agreement Signing Date	October 2003 / November 2003						
Terms and Conditions	<table> <tr> <td>Interest Rate</td> <td>1.5%</td> </tr> <tr> <td>Repayment Period (Grace Period)</td> <td>25 years (7 years)</td> </tr> <tr> <td>Conditions for Procurement</td> <td>General untied (Consultants are general untied)</td> </tr> </table>	Interest Rate	1.5%	Repayment Period (Grace Period)	25 years (7 years)	Conditions for Procurement	General untied (Consultants are general untied)
Interest Rate	1.5%						
Repayment Period (Grace Period)	25 years (7 years)						
Conditions for Procurement	General untied (Consultants are general untied)						
Borrower/Executing Agency	Government of Republic of Macedonia/ Ministry of Agriculture, Forestry and Water Economy						
Final Disbursement Date	January 2013						
Main Contractor	FZC 11 Oktomvri A.D.(Macedonia) /DG Beton A.D.(Macedonia) / GD Granit A.D.(Macedonia) (JV), DG Beton A.D. (Macedonia) / GD Granit A.D. (Macedonia) (JV)						
Main Consultant	Coyne et Bellier (France) / Electric Power Development Co., Ltd. (Japan) / Oriental Consultants Co. Ltd. (Japan) (JV)						
Feasibility Studies, etc.	<ul style="list-style-type: none"> • JICA (1999), The study on integrated water resources development and management master plan in FYR Macedonia • JBIC (2001), Special Assistance for Project Formulation (Phase I) for Zletovica Basin Water Utilization Improvement Project(SAPROF I) in FYR Macedonia • JBIC (2003), Special Assistance for Project Formulation (Phase II) for Zletovica Basin Water Utilization Improvement Project(SAPROF II) in FYR Macedonia • JBIC (2004), Special Assistance for Project Implementation for Zletovica Basin Water Utilization Improvement Project in FYR Macedonia (SAPI) • JICA (2014), Special Assistance for Project Implementation for Zletovica Basin Water Utilization Improvement Project in FYR Macedonia (SAPI) 						
Related Project	Government of Slovenia “Construction of Water Treatment Plant for Drinking Water in Probistip”, Government of Slovenia “Renovation of Waste Water Treatment Plant for Drinking Water in the Municipality of Stip”						

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuyuki Kobayashi (OPMAC Corporation)

2.2 Duration of Evaluation Study

The duration of the evaluation study is as follows.

Duration of the Study: September 2014 - September 2015

Duration of the Field Study: December 18 - December 31, 2014, March 20 - March 26, 2015

3. Results of the Evaluation (Overall Rating D¹)

3.1 Relevance (Rating: ②²)

3.1.1 Relevance to the Development Plan of Macedonia

The Medium-Term Development Plan (“Macedonia 2003” established in 2000) for the four year period 2000 to 2003 emphasized the need for effective use of limited water resource in Macedonia, and it also listed water shortages during summer months, deterioration of water supply facilities, and a risk of water pollution as issues to be handled by the water sector. The project was a part of the investment in the Public Investment Plan for the period 2002 -2004 to address the above issues.

Although Macedonia does not establish a National Development Plan on a regular basis, and there was no established National Development Plan at the time of ex-post evaluation, the Fiscal Strategy of the Republic of Macedonia (2015-2017) at the time of ex-post evaluation stated that the section on infrastructure development for water was a priority area, and refers to the initiatives to implement Phase 2 and 3 of this project. The Macedonian government established the Water Strategy for the Republic of Macedonia (2012) and set out the sector's basic policy up to 2040. As for drinking water, it aimed to increase the ratio of water pipes connected to households by securing drinking water sources and improving water quality for all users. As for industrial water, policy objectives included: establishing a plan to secure sufficient cooling water and developing and protecting water sources.

At the time of appraisal, the National Development Policy had a policy giving priority to investment in the water sector and this was still a high priority in the budget strategy at the time of ex-post evaluation. At the time of ex-post evaluation, it was the Water Strategy's objective to increase the water pipe connection rate of households, and securing water resource for drinking water was considered to be important in order to achieve this objective.

The project scope was to construct a multipurpose dam, a water treatment plant, and water transmission facilities (water intakes and raw water pipelines) to the water treatment plants. Both at the time of appraisal and the ex-post evaluation, securing water sources was an

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

² ③: High, ②: Fair, ①: Low

important policy and investment in the water sector had a high priority. The scope of this project matches the country's policy.

3.1.2 Relevance to the Development Needs of Macedonia

At the time of appraisal, the amount of rainfall in the eastern part of Macedonia was 500mm/year, (2/3 of the world average³ of 880 mm/year) and there were large seasonal variations in rainfall, and water scarcity during the summer was a major issue. Of the project target area, Probistip had a heavy metal mine and a battery factory in the past. The contamination of groundwater was a restricting factor to increase the water supply, though it did not affect the water quality of the Zletovica river. Furthermore, there were occurrences of diseases (such as dysentery) due to the fact that people had to use insanitary water during water shortage season. Unemployment was an issue in the project area due to Macedonia's entry in market-based economy. Promoting employment in new industries and agriculture was intended but water shortage became an obstacle. This project (Phase 1) was an initial phase of a large-scale water source development.

The country's development needs in the eastern region of Macedonia are based on weather conditions and restrictions (such as the area with heavy metal contamination), and there was no change in such development needs at the time of the ex-post evaluation. The amount of rainfall in Stip (the average during the period 2008-2013 was 470.8mm/year) was smaller than other regions (the average in 8 regions is approximately 490~780mm/year) and the project area was one of the most dry areas in the country. As for heavy metal contamination, there was no significant change since no large-scale decontamination work had been implemented. The development needs in the water sector is high and since 2009 the Municipal Service Investment Project has been supporting infrastructure investment in the municipal water supply and sewage system. In addition, since 2010 the European Investment Bank has been providing a sector loan for the water sector throughout Macedonia.

This project was in response to the need for safe drinking water and to help secure water resources which are preconditions for long-term regional development. The objective of this project matched Macedonia's development needs at the time of appraisal and ex-post evaluation.

3.1.3 Relevance to Japan's ODA Policy

Japan has announced the policy in the "Japan Water Initiative" to continue and strengthen the support through all aid schemes to achieve the goal in water and sanitation as defined in the Millennium Development Goals (MDGs). (Target 7c states that by 2015: The ratio of those who do not have regular access to safe drinking water and sanitation facility will be reduced by 50%). The project constructed a multipurpose dam as well as facilities for water

³ FAO(2003) "AQUASTAT 2003"

intakes and raw water pipelines in the eastern region of Macedonia which faced issues including water contamination and little rain. The project objective matched Japan's ODA policy, which supports supply of safe drinking water. Furthermore, the Official Development Assistance White Paper in 2003 published by the Ministry of Foreign Affairs emphasized the importance of economic and social infrastructure development in the former Yugoslavia region, focusing on the transition to a market economy, environmental conservation, and support for infrastructure rehabilitation and development in Europe. Macedonia, the target country of this project, belongs to the former Yugoslavia region, matched the geographical importance of Japan's assistance policy.

3.1.4 Appropriateness of the Project

The target area suffers from severe water shortages during summer months, and the outcome of attaining a stable supply of municipal and industrial water would contribute to the project impact related to improving the living standards of residents. Therefore the outcome and the impact of the project are relevant. According to the beneficiary survey of residents of the region where water supply commenced, it was confirmed that the water drawing labor had decreased. The stable supply of industrial water was an essential condition to attract new factories and it could contribute to the long-term industrial development of the area.

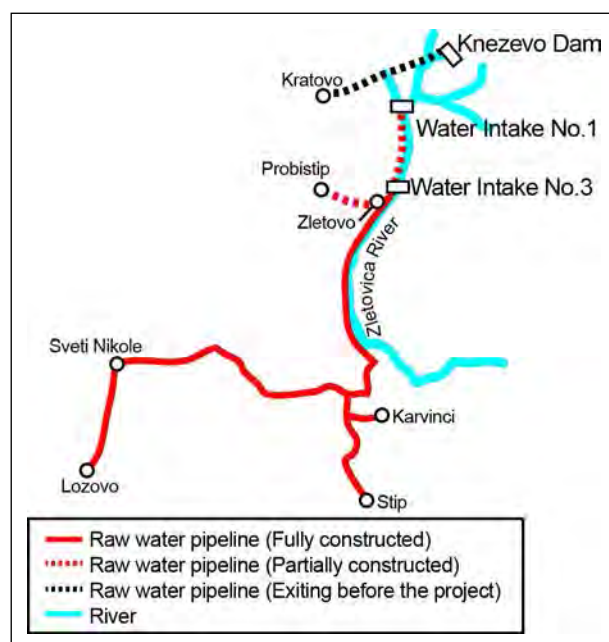


Figure 1: Location of Raw Water Pipelines

On the other hand, the output of this project is not sufficient for incidence of outcome at the time of the ex-post evaluation. Since raw water pipelines from the dam to the water intake was not installed, the water was contaminated with mud at the Zletovica riverbed and water from the tributaries⁴. This resulted in substandard raw water quality and the treatment plants of each municipality need to take a measures to deal with turbidity. Mainly due to high turbidity, there is no water supply in Stip where 50% of the served population in the target area resided at both appraisal and ex-post evaluation. The expected project effects at

⁴ Exact data to evidence the finding could not obtained in this evaluation. Given that turbidity at the Knezevo dam was not problematic, PE Hydrosystem "Zletovica", an O&M agency of this project, and the Institute of Public Health which conducts water quality tests concluded that mud at the Zletovica riverbed and water from the tributaries contaminated water quality at the water intake points.

appraisal have not been achieved. The regulation (Regulation for Classification of Water, the Official Gazette of the Republic of Macedonia No.18, 1999) had been applied since 1999. The regulation set the water quality standards which remained the same at the time of the ex-post evaluation. In 2012, PE Hydrosystem "Zletovica" pointed out that the quality of raw water would not satisfy the above standards but this claim did not affect the output of this project.

Water quality tests at the water intake points and the tributaries were not conducted in the feasibility studies and water quality issue was not fully taken into account. If the water quality issue had been understood adequately, necessity of a countermeasure would have been obvious. It is possible to consider that foreseeable risks had been overlooked at the time of appraisal. Although the succeeding project (Phase 3) planned to construct the raw water pipelines from the dam to the water intakes, the construction has not taken place due to some constraints in demand and technical aspects.

In the light of the above, this project was highly relevant to Macedonia's development plan, development needs, as well to Japan's ODA policy; however a part of the project plan was inappropriate, therefore its relevance is fair.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The project outputs are shown in Table 1. The main output changes include the cancellation of the rehabilitation of water intakes, the construction of a pumping station, the extension of raw water pipelines, and the construction and rehabilitation of water treatment plants. According to the Operation and Maintenance (O&M) agency, the rehabilitation of the water intake was abandoned because water supply to Kratovo was commissioned to a private sector entity and the operation of the intake was also transferred to the private sector entity. Since the pumping station was built for supply water directly to the pipeline connected to Kratovo, it is considered that the cancellation of the rehabilitation of water intake did not influence the project effects.

Investment from municipalities necessary for water supply was a precondition of the project, however, the municipal councils kept the water tariff low for final users and it was therefore difficult for municipal water supply utilities to invest by using their internal funds. For this reason, this project has utilized the Japanese ODA loan to develop necessary infrastructure (extension of raw water pipelines, or construction and rehabilitation of water treatment plants) to realize project effects, though it was not included in the original project scope. The existing water treatment plant in Stip needed to be rehabilitated and upgraded before supply of raw water from the dam. The existing raw water pipeline was to be used from the water intake No.1 to Probistip, however a part of the existing pipeline needed to be

newly constructed since it was deteriorated.

Table 1: The Project Outputs

Plan	Actual
<p>Engineering works:</p> <ul style="list-style-type: none"> • Knezevo dam <ul style="list-style-type: none"> - Method: Center-core type rock fill dam - Overall water storage volume: 23.5 million m³ - Dam height: 75m - Dam crest length: 270m - Access road: 9km • Water intake facility <ul style="list-style-type: none"> - Rehabilitation of water intake: 1 - Construction of water intake: 2 • Raw water pipelines <p>Section: 3 sections, total of 57km (Water intake No.3 to branch point 23km, branch point- Sveti Nikole 23km, branch point - Stip 11km)</p> 	<p>Engineering works:</p> <ul style="list-style-type: none"> • Knezevo dam <ul style="list-style-type: none"> - Method: Center-core type rock fill dam - Overall water storage volume: 23.0 million m³ - Dam height: 75m - Dam crest length: 290m - Access road: 20km • Water intake facility <ul style="list-style-type: none"> - Construction of water intake: 2 - <u>Pumping plant: 1</u> • Raw water pipelines <p>Section: 7 sections, total of 83 km (Water intake No.3- branch point 22km, branch point – Sveti Nikole 24km, branch point – Stip 11km, <u>Sveti Nikole – Lozovo 11km, Karvinci 5km, Water intake No.1- Probistip 6km, Probistip- Zletovo 3km</u>)</p> • Construction and rehabilitation of water treatment plant⁵ <ul style="list-style-type: none"> - <u>Construction of water treatment plant: treatment capacity 6,480 m³/day</u> - <u>Rehabilitation of Stip water treatment plant: treatment capacity 43,200 m³/day</u>
<p>Consulting service:</p> <p>Foreign: 216M/M Domestic: 355M/M</p>	<p>Consulting service:</p> <p>Foreign: 294M/M Domestic: 500M/M</p>

Source: Information provided by JICA, Project completion report, PE Hydrosystem “Zletovica”

Note: Underlined parts are the additional project scopes



Photo 1: Water Intake No.1



Photo 2: Water Intake No.3

⁵ The investment funds are Slovenia grant aid and local state funds in addition to the Japan’s ODA loan.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost amounted to 12,692 million yen against the planned cost of 13,174 million yen. However, if the cost related to the construction and rehabilitation of water treatment plants (154 million yen) is deducted from the actual cost (as it was not originally included in the planned cost), the adjusted actual cost was 12,538 million yen. The adjusted project cost was within the plan as compared to the planned cost (95% of the planned cost). The project cost decreased because price competitive Macedonian companies won the engineering works (access road, dam, water intakes, pipelines). While the Japanese ODA loan was eligible for civil works, procurement of equipment, consulting service, and physical contingency, the Macedonian government was responsible for financing administration cost, land acquisition cost, and tax.

3.2.2.2 Project Period

The planned project period was 80 months whereas the actual project period was 110 months which exceeded the plan (138% of the period planned)⁶. The reasons for the delay were as follows: (1) There was a delay in the procurement of construction supervision consultant and that of dam construction as the executing agency was not familiar with procurement procedures of Japanese ODA loan, and (2) The construction period was extended.

The service commencement of the construction supervision consultant was December 2004, which was a 6 months delay from the plan (May 2004). The commencement of the construction was moved forward by making the access road an independent procurement package and by using local competitive bidding (LCB) for more simple procedures. Nevertheless, the procurement of the dam construction and the construction period took longer, and resulted in the delay in project completion. The delay in progress of construction works was caused by (1) a design change (location of spillway, etc.) and (2) an insufficient construction plan of the company in charge. While the planned construction period was from July 2006 to June 2010 (48 months), the actual construction period was from September 2005 to December 2012 (87 months).

3.2.3 Results of Calculations of Internal Rates of Return (Reference Only)

The actual Financial Internal Rate of Return (FIRR) was -2.4% against the estimate of 1.3% (See Table 2 for calculation conditions). There are two main causes for the FIRR falling below the estimate: (1) Decreased sales volume of unsupplied industrial water, and (2) Lower sales prices than estimated at the time of appraisal. According to sales projections

⁶ Because the time period for the construction and rehabilitation of a water treatment plant was not included in the project scope during project planning, they have been excluded for a more accurate comparison.

made by PE Hydrosystem "Zletovica", despite an increase in sales volume after 2015, the sales volume of 2029 remained approximately 40% of the initial estimate. At the appraisal the raw water price during the project period was estimated to be 15MKD⁷/m³. At the time of ex-post evaluation, however, in 2014 it was estimated to be 3.12MKD/m³ in 2014 and it was estimated to be 14.02MKD/m³ in 2029 (all the unit price is the actual price). The actual Economic Internal Rate of Return (EIRR) was 3.0% against the estimate of 7.1%. The cause for the EIRR falling below the estimate was mainly the sales volume which also fell below the estimate. No sensitivity analysis was conducted for both FIRR and EIRR at the time of appraisal and the influence that major changes in parameters could have on investment efficiency was not analyzed.

Table 2: Conditions for Calculation of Internal Rates of Return at the Time of Ex-Post Evaluation

	FIRR	EIRR
Cost	Project cost, O&M cost	Project cost, O&M cost
Benefits	Raw water sales income (municipal water)	Water supply stabilization, resolving water shortage, cost reduction effects
Project Period	27 years	50 years
Preconditions	<ul style="list-style-type: none"> ● O&M cost was added after non-capital cost was subtracted from operating cost for 2013. No increase is expected since O&M is mostly inspections and cleaning. ● The sales volume of raw water is based on the sales projection of an O&M agency. Although the sales volume will reach 8 million m³ in 2029, the sales of industrial water will not be projected. ● The remaining value (2,172 million MKD) was added during the final year of the project life based on depreciation period (23 years remaining) as at the appraisal. ● The nominal raw water price after 2015 was expected to increase 1MKD/year (based on the hearing from the O&M agency). ● The cost was calculated with the actual price at appraisal. For accurate comparison, the nominal price was recalculated and adjusted based on CPI (Consumer Price Index) as an inflation rate and converted to the actual price. 	<ul style="list-style-type: none"> ● The items with no sufficient data (price unit of each benefit, water shortage volume) used the preconditions at the time of appraisal. ● The rate of water leakage was estimated to decrease from 41.6% in 2000 to 28.1% in 2025 based on the preconditions at the time of appraisal. There was no estimate given after 2025 at the time of appraisal, however, a downward trend of approximately 10% (referred to the water leakage rate of Moscow) is expected. ● The demand forecast used the same preconditions as FIRR until 2029, and then the prepositions at the time of appraisal after 2030. There is no benefit estimation related to industrial water. ● The conversion factor from financial price to economic price was estimated to be 0.85 times as the time of appraisal. ● The cost was calculated with the actual price at appraisal. For accurate comparison, the nominal price was recalculated and adjusted based on CPI as an inflation rate and converted to the actual price.

In the light of the above, the project cost was within the plan but the project period slightly exceeded the plan; therefore the efficiency of the project is fair.

⁷ MKD stands for Macedonian Denar.

3.3 Effectiveness⁸ (Rating: ①)

Upon analyzing the project effectiveness, there was an intervention theory with the hypothesis that the project outcomes brought about by the stable raw water supply would result in an increase in served population as well as an improvement in water supply coverage. The evaluation of project effectiveness and impacts were made based on analysis of quantitative effects (supply volume and sales income of raw water) that were directly related to the above outcomes, and at the same time, the water quality which was an intermediate outcome to influence the target of supply volume. Qualitative analysis of project effects focuses on the incidence of projects effect in the target area, analyzes the usage conditions and stability of the water supply service as outcome, and shows the improvement in sanitation and living standards caused by water supply service as impacts.

3.3.1 Quantitative Effects (Operation and Effect Indicators)

(1) Supply Volume and Revenue of Raw Water

There were seven municipalities including Stip, Probistip, Sveti Nikole, Zletovo, Lozovo, Karvinci, and Kratovo listed as the target area for water supply at the appraisal. However at the time of the ex-post evaluation, water supply was implemented only in Probistip (except for the former Zletovo area in Probistip) and Sveti Nikole. Although the water treatment plant in Stip was completed in July 2014, the municipal water supply utility has not received water supply mainly due to the high turbidity of the raw water during the test operation immediately after the completion. As of March 2015, a trial supply to the water treatment plant in Stip was expected to start soon; at least 3-4 months of trial period would be followed by full water supply as long as there were no issues but its supply commencement has not officially been

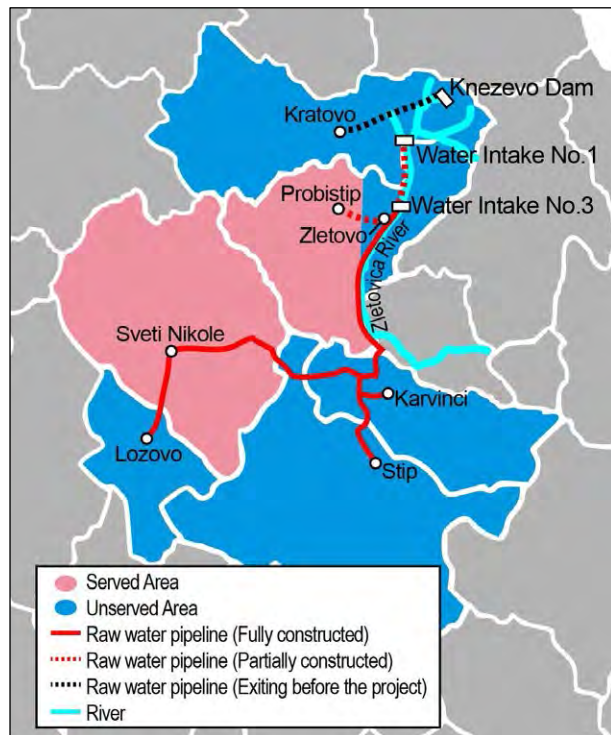


Figure 2: Served Area

⁸ Sub-rating for Effectiveness is to be put with consideration of Impact.

determined⁹. The water supply is planned to start during 2015 in the former Zletovo area, and Lozovo is considering to take supply from Sveti Nikole. Although there is a water treatment plant in Kratovo, the municipality has not experienced water shortage for the past few years, therefore they have no plan to purchase raw water. There is no ongoing construction of a water treatment plant in Karvinci, therefore the water supply commencement period is not determined. Since the water supply for Stip, which accounts for almost 50% of the population in the target area at the time of the ex-post evaluation, has not yet been commenced, the amount of raw water supply remained approximately 20% of the planned target.

Table 3: Raw Water Supply Volume and Sales Revenue

	Baseline	Target	Actual	Actual	Actual
	2003	2012	2012	2013	2014
	At appraisal	Two years after project completion	The year of project completion	One year after project completion	Two years after project completion
Raw Water Volume (for Municipal Water)	NA	11,276,000 m ³	NA	2,183,000 m ³	2,377,000 m ³
Raw Water Sales Revenue	NA	179 million MKD	2.9 million MKD	6.5 million MKD	9.5 million MKD
Municipal Water	NA	112 million MKD	2.9 million MKD	6.5 million MKD	9.5 million MKD
Industrial Water	NA	67million MKD	No Sales	No Sales	No Sales

Source: Information provided by JICA, PE Hydrosystem "Zletovica"

Note: Raw water was supplied to Sveti Nikole prior to the project completion which was December 2012. The year of project completion is at the time of the completion of the project scope in the original plan.

The sales revenue of raw water was significantly below the plan as the sales volume was lower than planned and the sales price was also low. In addition to the low volume of municipal water, there was no industrial water sales. The sales of industrial water was expected in two locations (Stip and Probistip) at the time of appraisal. The demand for industrial water, however, was not sufficient at the time of the ex-post evaluation, therefore the water utility in Stip has no specific plan for supply of industrial water. During the feasibility studies of this project, there was no regional development plan to be used for demand forecast of industrial water and the difficulty with estimating the industrial water was pointed out. At the appraisal, the sales price for both municipal and industrial water was estimated to be 15MKD/m³ but the actual raw water price for the municipal water in 2014 remained as low as 4MKD/m³.

With the assumption that the source of municipal water in Stip is switched completely

⁹ According to the letter from the executing agency dated on July 23, 2015, a test supply has begun since April 2015 and the water utility in Stip is expected to accept the supply of raw water after the completion of the test. However the evaluation judgment is based on the result of interview with the municipal water supply utility, a beneficiary of raw water supply.

from ground water to the supply of PE Hydrosystem "Zletovica" after 2016, raw water volume for Stip, Probistip, and Sveti Nikole is expected to be 6,350,000 m³ (forecasted served population for 2016 is 76,415¹⁰ and actual raw water volume was 83.1m³/person¹¹) for 2016. In addition, raw water sales revenue is estimated at 32 million MKD (forecasted raw water price is 5 MKD/m³ ¹²) for 2016. Raw water sales revenue would be approximately 20% of the target for 2012 even in the above case since the sales of industrial water is not expected in 2016 and raw water price is below the forecasted price in the original plan.

(2) Water Quality

The objective on water quality at the appraisal was to meet Macedonian standards at routine testing. The quality of water was classified into five categories (radiation, substances/chemicals, pesticides, parasites, microorganisms) and the quality level is set from Class I to Class V on each category based on the regulation (Regulation for Classification of Water, the Official Gazette of the Republic of Macedonia No.18, 1999) at the time of the ex-post evaluation. Since raw water supplied from the Knezevo dam is used as drinking water, it is required to be classified in Class I or Class II in all categories (See Table 4 for description of each class). The results of routine testing in June and December 2013 revealed that the water quality of the water intake No.1 and No.3 had parameters which did not fulfill the standards for substances/chemicals and microorganisms (See Table 5). Throughout the year, E. coli is abundant in the water intakes No.1 and No.3. As explained in the footnote No.5, the water quality tends to worsen in downstream areas because mud at the Zletovica contaminates raw water and the tributaries flows into raw water. Although turbidity is not usually a concern, for the above reason it tends to reach higher levels after rains. Water outages occur in the Probistip water treatment plant as the treatment operation automatically stops when the turbidity reaches a high level. In the water treatment plant in Sveti Nikole, in response to high turbidity a high usage of chemicals has increased water loss during the treatment process. For this reason, the municipalities strongly demand for improvement of water quality.

¹⁰ This figure is estimated from the data provided by the municipalities on actual served population in Stip, Probistip, and Sveti Nikole for 2014 and that of the growth rate of served population from 2000 to 2014.

¹¹ Based on actual raw water volume for 2014 (data source: PE Hydrosystem "Zletovica") and actual served population in Probistip and Sveti Nikole for 2014 (data source: the municipalities).

¹² Based on the forecast of PE Hydrosystem "Zletovica"

Table 4: Classification of Water Quality

Classification	Use
Class I	In its natural state, it can be used for drinking, production and processing of food product, suitable for cultivation of noble types of fish (salmonid species).
Class II	In its natural state, it can be used for bathing and recreation, water sports, production of other types of fish (cyprinid species), or after usual methods of purification for drinking, which can be used for production and processing of food products.
Class III	In its natural state, it can be used for irrigation, and after usual purification methods, for industries which do not need drinking water quality.
Class IV	In its natural state, it can be used for other purposes only after certain processing.
Class V	In its natural state, it cannot be used for any purposes.

Source: Regulation for Classification of Water, the Official Gazette of the Republic of Macedonia No.18, 1999

Table 5: Results of Water Quality Assessment

	Knezevo Dam		Water Intake No.1		Water Intake No.3	
	6/2013	12/2013	6/2013	12/2013	6/2013	12/2013
Radiation	Class I	Class I	Class I	Class I	Class I	Class I
Substances/ Chemicals	Class I	Class IV	Class I	Class IV	Class I	Class V
Pesticides	Class I	Class I	Class I	Class I	Class I	Class I
Parasites	Class I	Class I	Class I	Class I	Class I	Class I
Microorganisms	Class IV	Class I	Class IV	Class IV	Class IV	Class IV
Parameters that did not fulfill Class II	E. coli	Iron, manganese, nitrite nitrogen	E. coli	Iron, potassium permanganate consumption, E.coli	E. coli	Turbidity, potassium permanganate consumption, E. coli

Source: Institute of Public Health

In regards to the water quality of tap water, water quality standards are based on the Regulation on Water Safety, Official Gazette of the Republic of Macedonia No.46, 2008. According to the water quality inspection of tap water in Probistip and Sveti Nikole by the Institute of Public Health, standards are defined for 24 out of 33 parameters (color, turbidity, potassium permanganate consumption, ammonia, heavy metals, etc.). During the scheduled inspections in 2013 and 2014, all parameters fulfilled the standards for drinking water. Although some parameters of the raw water did not satisfy their standards, the quality of tap water in both towns were appropriate with proper treatment.

3.3.2 Qualitative Effects (Other effects)

(1) Current status of service water usage

At the time of the ex-post evaluation a beneficiary survey was conducted by PE Hydrosystem "Zletovica" in two municipalities that received raw water. Residents of 100 households from the target area (50 households from each of Probistip and Sveti Nikole) were surveyed.

Table 6: Water Source for Domestic Water at the Time of the Ex-Post Evaluation

		Water Tap	Community Water Tap	Well	Other	Total
What is the water source for domestic water?	Response	97	1	1	1	100
	%	97.0%	1.0%	1.0%	1.0%	100.0%

Source: Beneficiary survey

The results of the survey indicated that at the time of the ex-post evaluation the local residents of the region used tap water as a main water source several times a day. Most respondents in the target area (97%) considered the water pipes connected to their houses as a primary water source (See Table 6). In addition, most households (99%) used tap water several times a day (See Table 7). Those households which did not use the water pipes as their primary water source also used tap water to some purposes such as laundry, bath, and toilet.

Table 7: Frequency of Water Tap Usage

		Several times a day	Once a day	Several times a week	Once a week	Do not use it	Total
How often do you use the water tap?	Response	99	1	0	0	0	100
	%	99.0%	1.0%	0.0%	0.0%	0.0%	100.0%

Source: Beneficiary survey

(2) Frequency of Water Outage

From the beneficiary survey mentioned above, a total of 56% respondents answered that the frequency of water outage has "decreased" or "decreased significantly", whereas compared to 5 years ago (before the water supply service started), 36% answered that the frequency has "increased" or "increased significantly" (See Table 8). The statistical test showed that frequency of water suspension was reduced in Sveti Nikole but it was not reduced in Probistip. Certain number of residents felt that the frequency of water outage has increased, though the malfunction of distribution pipes should be taken into account as well. Of 36 residents who answered that the frequency has "increased" or "increased significantly", 24 of them were from Probistip. The number of water outage within the past year averaged 4.22 times in all areas whereas the average in Probistip was 4.98 times. At the water treatment plant in Probistip, filtration process stopped when the turbidity of water was high. This may have led to the relatively high frequency of water outage.

Table 8: Frequency of Water Outage

		Increased significantly	Increased	No change	Decreased	Decreased significantly	Total
Do you experience water outage more frequently than 5 years ago?	Response	28	8	8	25	31	100
	%	28.0%	8.0%	8.0%	25.0%	31.0%	100.0%

Source: Beneficiary survey

3.4 Impacts

3.4.1 Intended Impacts

(1) Water service penetration rate and served population of water supply

Although the water service penetration rate and served population are increasing, it has not reached the targets set at the appraisal (See Table 9). While an increase of served population (target minus baseline) was expected to be 17,258 people at the appraisal, the increase of served population reached 6,051 people (35% of the target). In 2014, the Knezevo dam built by this project supplied water to two municipalities (Probistip and Sveti Nikole) out of seven municipalities that were planned to be supplied water at appraisal. The increase in the served population in Probistip and Sveti Nikole between 2000 and 2014 (1,532 people) was equivalent to 30% of the overall increase in the target area of the said time, therefore it is considered that the project has contributed to the water service penetration rate and served population to some extent. Nevertheless, the served population of the two municipalities (28,599 people) still accounted for just 30% of the total served population (88,299 people) of the area which were planned to be supplied water at appraisal.

Table 9: Water Service Penetration Rate and Served Population for Project Target Area (7 Municipalities)

	Baseline	Target	Actual	Actual	Actual
	2000	2012	2012	2013	2014
	F/S Implementation	Two years after project completion	The year of project completion	One year after project completion	Two years after project completion
Water service penetration rate	81.5%	95.3%	NA	NA	89.9%
Served population	82,248	99,506	NA	NA	88,299

Source: Information provided by JICA, hearing from each municipality

(2) Behavioral changes and sanitary conditions

The above-mentioned beneficiary survey indicated that after the project completion there were some behavioral changes among the beneficiaries. As a result of being able to obtain safer water, approximately half of the respondents said the frequency of dish washing and hand washing have "increased significantly" or "increased" as compared to 5 years ago before the water supply commencement (See Table 10).

Table 10: Frequency of dish washing, hand washing and diarrhea

		Increased significantly	Increased	No change	Decreased	Decreased significantly	Total
Do you wash dishes more frequently than 5 years ago?	Response	21	30	49	0	0	100
	%	21.0%	30.0%	49.0%	0.0%	0.0%	100.0%
Do you wash hands more frequently than 5 years ago?	Response	24	29	47	0	0	100
	%	24.0%	29.0%	47.0%	0.0%	0.0%	100.0%
Do you have diarrhea more frequently than 5 years ago?	Response	0	2	52	3	43	100
	%	0.0%	2.0%	52.0%	3.0%	43.0%	100.0%

Source: Beneficiary survey

The percentage of people who answered that the frequency of diarrhea has "not changed" was 52%, and those who said that the frequency has "decreased significantly" or "decreased" was 45%. In the target area for water supply, some behavioral changes were seen among residents and very few respondents who reported to have experienced a higher frequency of diarrhea, and approximately half of them acknowledged some reductions. Since sanitary conditions could have improved for other causes, it is difficult to identify specific reasons behind the reduction of diarrhea. Thus, it cannot be determined that these results were solely caused by the project. Nevertheless, it was plausible that the project had contributed to the results to some extent because of the behavioral changes.

(3) Labor time of drawing water

From the beneficiary survey, it can be interpreted that the time for water drawing labor has been decreasing. Of all the respondents, 45% reported that time of water drawing labor has "decreased significantly" or "decreased", and no respondents said it has "increased significantly" or "increased" (See Table 11). Even those who said the frequency of water outage has increased also responded that the time of water drawing labor has decreased, and it is inferred that long-term water outages that required water drawing labor has been decreased. Interviews to individuals revealed that prior to the implementation of this project, some beneficiaries used public water taps of other areas or neighbor's well when water outage was prolonged.

Table 11: Labor Time of drawing water

		Increased significantly	Increased	No change	Decreased	Decreased Significantly	Total
Has the labor time of drawing water increased compared to 5 years ago?	Response	0	0	55	18	27	100
	%	0.0%	0.0%	55.0%	18.0%	27.0%	100.0%

Source: Beneficiary Survey

3.4.2 Other Impacts

(1) Improvement in manufacturing and service industries

PE Hydrosystem "Zletovica" does not sell industrial water. However, PE Hydrosystem "Zletovica" provides raw water to the state-owned water supply utilities and, then, each state-owned water supply utility provides municipal water to large users. From individual interviews of large users, it was appraised that the use of water facilities (shower, bath) became more stable at a hotel in the water supply area. In addition, drained water from the water treatment plant is used for drilling and ore dressing at mines in the target area. In addition to using underground water and rainwater, the mining company purchased water during summer months when water resources run short. Obtaining stable water supply contributed to the stabilization of mining operation.

(2) Impacts on the Natural Environment

Environment safeguards were implemented based on an environmental monitoring and management plan during the project implementation. In particular, setting the construction period to minimize soil erosion, management of garbage and industrial wastes, noise and vibration countermeasures, and monitoring of flora and fauna were implemented. In addition, fishways were made in the water intakes under the design with an attention to migration of fish. Regulations make it necessary to protect the natural environment of water resource, and the Ministry of Environment and Physical Planning conducts inspections of protected areas. At the time of the ex-post evaluation, the ministry gave no indication of negative impacts on the natural environments surrounding the dam. In addition, no negative impacts on the natural environment was found during the site assessment for this evaluation.

(3) Land Acquisition and Resettlement

No resettlement was required because there were no residents in the planned submergence area of the dam at the time of appraisal. Land acquisition took place in accordance with Macedonian regulations, and the area of land acquisition was 107.4 ha and that of temporary land lease was 45.5 ha.

In the light of the above, the project achieved its objectives at a limited level. Therefore effectiveness/impact of this project is low.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

During the project implementation, the Ministry of Agriculture, Forestry and Water Economy was the executing agency of this project while PE Hydrosystem "Zletovica" was in charge of practical matters of project implementation. After the project completion, PE

Hydrosystem "Zletovica" took charge of O&M of the facilities as well as sales of raw water to state-owned water supply utilities. PE Hydrosystem "Zletovica" negotiates with the state-owned water supply utilities to set the tariff for raw water, and establishes annual management plans. The management plan is then approved by the cabinet in consultation with relevant government ministries (Ministry of Finance, Ministry of Agriculture, Forestry and Water Economy, and Ministry of Environment and Physical Planning).

PE Hydrosystem "Zletovica" was established in June 2001 in order to implement the project and take charge of O&M of the facilities to supply raw water after the completion of the project. There were nine staff members as of 2002. At the time of the ex-post evaluation, PE Hydrosystem "Zletovica" consisted of the Technical Department, General and Legal Affairs Department, Economy and Finance Department, and Internal Audit Unit. Staff from the Technical Department directly engaged in the O&M of constructed facilities. As of December 2014, there were 29 staff members at PE Hydrosystem "Zletovica", of which six were managers, six were engineers or technicians, seven were administrative staff and ten were general workers.

The O&M of water treatment plants were managed by the water supply utilities in Stip and Probistip at the time of the ex-post evaluation. There is a total number of 332 staff members at the water supply utility in Stip, and 70 of them work in the water sector. At the water treatment plant in Stip, there are three work shifts and one staff member in each shift who specializes in the electric and machinery field and the chemical field. There is a total number of 91 staff members at the water supply utility in Probistip, and approximately 20 of them are allocated to the water sector. No staff is stationed at the water treatment plant in Probistip as it is fully automated but there is a work arrangement that ensures at least three staff members to be present in case of emergency.

The responsibility of O&M for the facilities developed by this project is clearly defined. The number of staff members at PE Hydrosystem "Zletovica" has increased as compared to the time of appraisal, and there is no shortage of staff to take charge of O&M. There are enough staff members allocated for daily operations at the water treatment plants in Stip and Probistip.

3.5.2 Technical Aspects of Operation and Maintenance

Recruitment of PE Hydrosystem "Zletovica" is based on Macedonia's civil servant regulation and under such regulations workers are required to have experience in the relevant fields. Technical staff have participated in a seminar on large-scale dam management as well as other seminars conducted by the Government of Macedonia related to regulations. At interviews at PE Hydrosystem "Zletovica", some officials suggested that advanced use of SCADA was not possible and therefore it would be desirable to allocate engineers who are experts on SCADA. There was a high demand for trainings for SCADA. There is an O&M

manual for major facilities such as dams, water intakes, pipelines, and SCADA. The manuals developed by contractors were written in English, and essential sections were translated into Macedonian. According to the briefing by the executing agency, they have developed a plan for equipment inspection and maintain records for repair works.

Both the water supply utilities in Stip and Probistip had operational experience of water treatment plants prior to the implementation of the project, therefore they had technical knowledge that was required for operation. In addition, manuals were developed in Macedonian. In regards to the purification filter, there was a five-year warranty period from its completion, and technical advices were available from a contractor at the time of the ex-post evaluation.

Based on recruitment standards, training content, and preparation of manuals, it is considered that staff members of the government agencies involved in O&M have acquired essential technical knowledge for daily operation.

3.5.3 Financial Aspects of Operation and Maintenance

At the time of the ex-post evaluation, there was no regulation on tariff for raw water; hence PE Hydrosystem "Zletovica" set the tariff by negotiating with each water supply utility. PE Hydrosystem "Zletovica" submits a tariff proposal to the cabinet who then makes a final decision on the tariff. The sales price of raw water was 3MKD/m³ in 2012-2013, and 4MKD/m³ in 2014-2015. PE Hydrosystem "Zletovica" plans to gradually raise the price to 5MKD/m³ in 2016, and 1MKD per year thereafter.

Table 12: Sales and Operation Costs of PE Hydrosystem "Zletovica"

Unit: MKD

	2011	2012	2013
(A) Sales	7,038,066	9,853,313	9,781,371
(B) Operation cost	32,572,740	157,611,786	86,371,978
(A)-(B) Sales revenue	-25,534,674	-147,758,473	-76,590,607
(C) Operation cost excluding non-fund cost	3,447,095	5,615,698	10,312,003
(A)-(C) Balance	3,590,971	4,237,615	-530,632

Source: PE Hydrosystem "Zletovica"

Although PE Hydrosystem "Zletovica" had been experiencing an operating loss at the time of the ex-post evaluation, it was mostly due to their non-cash costs (reassessment of asset price and depreciation), hence when these items were removed, sales and operation costs balanced out each other (See Table 12). The O&M cost (excluding staff salary) which the company defrayed was 196,000 MKD in 2012 and 229,000 MKD in 2013. After the project completion, the Ministry of Agriculture, Forestry and Water Economy has been providing financial support for a part of current expenditure (studies, etc.), new investment, and repayment (both capital and interest) of subleased Japanese ODA loan (See Table 13). It is considered that PE Hydrosystem "Zletovica's" revenue is enough to secure essential O&M

costs but it is not enough to cover the cost of rehabilitation or reinvestment. The Macedonian Government, however, has shown an interest in a subsequent project and intends to raise investment funds through multilateral development banks. It is likely that the financial support will be continued in order to secure financial stability for the subsequent project.

Table 13: Financial Support for PE Hydrosystem "Zletovica"

	Unit: MKD	
	2012	2013
Goods and service purchase	5,000,000	5,000,000
Loan interest payment	75,250,000	75,300,000
Facility investment	55,000,000	84,000,000
Loan capital payment	306,890,000	318,710,000
Total	442,140,000	483,010,000

Source: Ministry of Agriculture, Forest and Water Economy

The state owned water supply utilities prepare a water tariff proposal based on a certain formula, and obtain approval from municipal councils. However, it is difficult to obtain approval from the councils and tariff revisions are not implemented frequently. The water tariff in the water supply area as of December 2014 is shown in Table 14.

Table 14: Water Tariff of the Target Water Supply Regions

	Unit: MKD/m ³	
	Household	Legal Entity
Stip	29.5	47
Sveti Nikole	31	47
Probistip	28	55

Source: Interviews for the ex-post evaluation

The net income of the water sector for 2013 in Stip was in surplus (29,249,764 MKD) and in Probistip was in loss (-5,343,728 MKD). As price pass-through to final users under the current tariff system is not possible, it is difficult for the state-owned water supply utilities to accept a significant increase in raw water price.

With the support from the European Union, there is an ongoing reform such as establishment of an independent supervisory body which would take charge of water tariff revisions, introduction of water tariff setting procedures to cover supply of raw and municipal water and sewage service. The Ministry of Environment and Physical Planning plans to establish a supervisory body in December 2015 and to change the tariff system of a large-scale utility from 2018. The water tariff is planned to be set such that O&M costs and small-scale investments (new pipe installation, etc.) can be recovered even with the lowest tariff. If this reform is implemented, the tariff approval process from municipal councils is not required anymore and it is possible to set a water tariff that can recover investments with approval from the supervisory body.

There are minor financial issues. Since the tariff for raw water was kept low, the profitability of PE Hydrosystem "Zletovica" is barely enough for O&M and requires the Ministry of Agriculture, Forestry and Water Economy to provide financial support. Although water tariff reform is in progress, a significant increase of tariff for both raw and municipal

water cannot be expected due to difficulty in price pass-through to final users.

3.5.4 Current Status of Operation and Maintenance

No damage was found on the dam, the water intakes, and the equipment during the site visit because just a few years passed after the project completion. Inspections and cleaning of the facilities required for routine operation are undertaken appropriately. The current status of the facilities developed by this project is shown in Table 15.

Table 15: The current status of the facilities developed by this project

Facility	Current Status
Dam, water intakes	Visual inspections are implemented 3-4 times weekly. There are monthly detailed inspections by engineers as well as an annual inspection to follow up the monthly inspection items with executives. More frequent inspections and cleaning take place during autumn when fallen leaves often block the water intakes.
Access road	Countermeasures for a landslide is required, therefore maintenance with heavy machineries is implemented as necessary. There was no traffic obstacle at the time of site assessment.
Raw water pipelines	According to the O&M agency, they drain water and wash off dirt at least once a year. Technical specifications of a drainage valve shaft were changed as some defects were found at the time of project implementation. At the time of the ex-post evaluation, rehabilitation of the section (from a junction to Sveti Nikole) constructed based on former specifications was implemented with the budget of the Ministry of Agriculture, Forestry and Water Economy.
SCADA	There are no data or items (flow volume, water temperature, facility video monitor, etc.) that cannot be monitored, and no defect is reported. The staff acknowledged that although they are acceptable for daily use, they are not yet to be applied in a higher level.
Water treatment plants	A Slovenian company supplies the equipment, and it handles technical inquiries from the water supply utilities. There is no problem obtaining replacement parts or chemicals.

Source: Site assessment during evaluation study, hearing assessment



Photo 3: Access Road

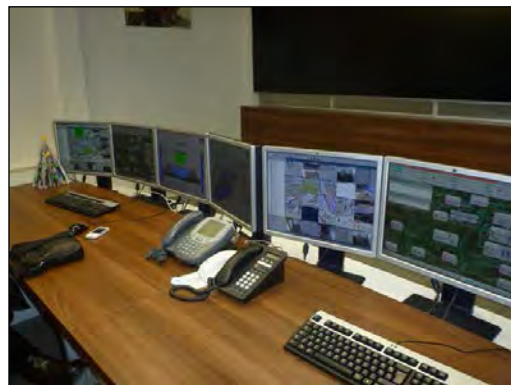


Photo 4: SCADA

In the light of the above, some minor problems have been observed in terms of the financial aspects of the O&M in this project. Therefore sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project was to stabilize the supply of service and industrial water by the construction of a multipurpose dam, water intakes, and raw water pipelines in the eastern part of Macedonia, thereby contributing to the improvement of living among residents and the promotion of industry in the region. This project is in line with the Macedonian national development policy and their development needs as well as Japan's ODA policy. However, the project scope was not defined appropriately as water quality tests at the water intake points and the tributaries were not conducted. The output of this project was not sufficient for incidence of outcome and, therefore, the relevance of the project is fair. The efficiency of the project is fair. Although a price competitive Macedonian company undertook the engineering work and the project cost was less than planned, the project period exceeded the plan due to a delay in the procurement and an extended construction period. Also, although a piped water system is in use at the target area, and there have been improvements in sanitary conditions and life convenience; the coverage of this project is limited and the raw water supply volume and revenue from raw water sales are significantly below the plan. Furthermore, as there are no raw water pipelines installed in the upstream area, the water quality has tended to worsen and therefore water supply service to municipalities with large populations has not yet commenced. For the above reasons, the effectiveness/impact of this project is low. Although the revenue of PE Hydrosystem "Zletovica" can ensure the minimum level to finance O&M activities, it will be difficult to recover the investment cost and it is unlikely that revenue to cover rehabilitation can be secured and, therefore, the sustainability is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Since water supply to Stip has not commenced due to high turbidity, the incidence of benefit is geographically limited. Water quality is likely to meet the standards in the future if Phase 3 (a subsequent project which was expected to be undertaken at the time of appraisal) is implemented. At the time of the ex-post evaluation, however, funding for Phase 3 had not been obtained. If implementation of Phase 3 remains difficult in near future, it is recommended that the executing agency assess a smaller size investment to solve the water quality issue (such as installation of sedimentation tank).

4.2.2 Recommendations to JICA

It is desirable to monitor actions to cope with water quality issue and, if appropriate, influence relevant agencies to take necessary actions. Although available resources are limited, it is desirable to consider continuing technical advice.

4.3 Lessons Learned

- Adequate testing of raw water quality and defining appropriate project scope

As the scope of this project did not include a raw water pipeline in the upstream area, substandard quality of raw water resulted in unrealized expected outcomes. As water quality tests at the water intake points and the tributaries were not conducted adequately, no assessment was made on water quality to be achieved under the project scope. For a project to provide raw water to water treatment plants, it is desirable to assess raw water quality to be achieved under the project scope in light of water quality standards at a project area and users' needs and, then, to define a project scope or expand a project scope in a project implementation phase in consideration of the assessment result.

- Countermeasures in the case that price pass-through to final users is difficult

If the price of raw water was set high enough to ensure the financial stability of PE Hydrosystem "Zletovica", (the state-owned enterprise in charge of O&M), the water supply utilities in the target municipalities would face difficulties in price pass-through to final users by raising tariffs and suffer from worse financial performance. Although the issue was well recognized at the appraisal, subsidies and measures to improve collection of receivables were assessed in the feasibility study, the institutional and political feasibility of these measures were not assessed. If price pass-through to final users is difficult, it is desirable to not only recommend policy measures but also assess the feasibility of such measures and encourage executing agencies to implement feasible measures.

- Discussion for risk identification and demand projections management

Industrial water (which makes up 40% of overall raw water sales) was not provided by the project and revenue sources to carry out rehabilitation or investments were not secured, hence project effects related to industrial water supply did not occur. Insufficient demand was behind unsupplied industrial water. At the appraisal, there was no regional development plan that could be grounds for demand projections of industrial water, and it was pointed out that accurate projection was difficult. On the other hand, the sensitivity analysis was not conducted in IRR analysis, and risks on the project's effects and profitability caused by unrealized demand projections were not clearly understood. At the appraisal, it is desirable to decide on project implementation after carrying out sensitivity analysis and reviewing several demand scenarios in light of accuracy of demand projections.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs	<p>Engineering works:</p> <ul style="list-style-type: none"> • Knezevo dam <ul style="list-style-type: none"> - Method: Center-core type rock fill dam - Overall water storage volume: 23.5 million m³ • Water intake facility <ul style="list-style-type: none"> - Rehabilitation: 1 - Construction: 2 • Raw water pipelines <ul style="list-style-type: none"> - Section: 3 sections Total: 57km <p>Consulting service: Foreign: 216M/M Domestic: 355M/M</p>	<p>Engineering works:</p> <ul style="list-style-type: none"> • Knezevo dam <ul style="list-style-type: none"> - Method: Center-core type rock fill dam - Overall water storage volume: 23.0 million m³ • Water intake facility <ul style="list-style-type: none"> - Construction: 2 - Pumping facility: 1 • Raw water pipelines <ul style="list-style-type: none"> - Section: 7 sections Total: 83km • Construction and rehabilitation of water treatment facility <ul style="list-style-type: none"> - Construction: Treatment capacity 6,480 m³/day - Rehabilitation: Treatment capacity 43,200 m³/day <p>Consulting service: Foreign: 294M/M Domestic: 500M/M</p>
2. Project period	November 2003 - June 2010 (80 months)	November 2003 - December 2012 ¹³ (110 months)
3. Project Cost		
Amount paid in Foreign currency	4,993 million yen	7,020 million yen
Amount paid in Local currency	8,181 million yen (Local currency 3,636 million MKD)	5,672 million yen (Local currency 2,602 million MKD)
Total	13,174 million yen	12,692 million yen
Japanese ODA loan portion	9,689 million yen	9,685 million yen
Exchange rate	1MKD = 2.25 yen (As of May 2003)	1MKD = 2.18 yen (Average between January 2003-December 2012)

¹³ The year of project completion is the completion year of the original project scope. Construction and rehabilitation of water treatment facilities which were not included in the original project scope were completed in July 2014.

Republic of Turkey

Ex-Post Evaluation of Japanese ODA Loan
“Bozuyuk - Mekece Road Improvement Project”¹

External Evaluator: Nobuyuki Kobayashi, OPMAC Corporation

0. Summary

The objective of this project was to improve State Road D650 and construct the Bozüyük bypass road to accommodate an increasing traffic volume, and thereby contribute to smoother freight logistics and vitalization of the local economy. The relevancy of this project is high as the project scope is consistent with the Turkish Government’s policy to encourage a high-standardization of roads and with the necessity of handling an increase in freight vehicles. On the other hand, the efficiency of the project is low since the project costs exceeded the plan due to difficult engineering works in mountainous areas, and the project period substantially exceeded the plan due to a delay in procurement and prolonged construction works. The traffic volume in the section targeted by the project has increased mostly as forecasted and the number of freight vehicles has also increased remarkably. As the result of the road improvements, the average travel speed is faster and the number of traffic accidents has decreased. In addition, the following improvements have been seen; improved driving comfort, and a decrease in cargo damage. As effects sufficient for an industrial road project have been seen, effectiveness and impact of the project is high. Moreover, the executing agency has dealt with an increasing proportion of contract management in operation and maintenance by a training program. Major problems which could impair the project sustainability have not been observed in the management, technical, and financial aspects of the project. Thus, sustainability of the effects induced by the project is high.

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

1. Project Description



Project Location



The road section improved by the project

¹ In this report, the names of places contain accent marks in accordance with Turkish names except the project name which does not contain accent marks in the loan agreement.

1.1 Background

Turkey's national land size (790,000km²) is twice as large as Japan's land size. Thus, the road sector plays a major role in domestic transportation. Since the 1950's, the Turkish Government has prioritized the road sector in its national development plans and promoted the development of a road network. Trunk roads (expressways, state highways, and provincial roads) have been extended from approximately 47,000km in 1950 to approximately 62,000km in 1998.

State Road D650 (the road targeted by the project) runs north-south through the west part of the country. It is an industrial road connecting the Marmara Region, an advanced industrial area, and the Mediterranean Region, a major agricultural area. In particular, one section targeted by the project (the Bozüyük - Mekece target-section) includes industrial cities such as Bursa, Izmit, and Eskişehir. As a result of developing the road network since the 1990's, motorization has developed remarkably in Turkey. Vehicle passage, especially freight vehicles, has continued to increase, noticeably reducing travel speed and traffic jams because of insufficient road capacity. Moreover, as freight transportation increased there were concerns that the State Road would be an obstacle for road traffic, and improving road standards to meet the demand for an increase of freight traffic using the roads had become imperative.

Given the background mentioned above, the Turkish Government prioritized the improvement of the State Road D650 in the road development plan, and conducted a feasibility study in 1997. Taking the results of this study into consideration, this project set out to improve the Bozüyük - Mekece section of the State Road, which is approximately 85km. While the old road ran through urban areas in Bozüyük and Bilecik (two major cities along the State Road D650) the new road renovated by the project took a route which detours around the urban areas of the two cities.

1.2 Project Outline

The objective of this project is to meet an increase of transport demand by the widening and construction of the Bozüyük - Mekece section of State Road D650 and the Bozüyük bypass road, thereby contributing to smooth freight logistics and vitalization of the local economy.

Loan Approved Amount/ Disbursed Amount	29,367 million yen / 29,199 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	August, 1999 / September, 1999
Terms and Conditions	<p>Interest Rate 2.2% (Consulting Service: 0.75%)</p> <p>Repayment Period 25 year (Consulting Service: 40 year) (Grace Period: 7 year) (Consulting Service: 10 year)</p> <p>Conditions for Procurement: General untied (Consulting Service: Bilateral tied)</p>
Borrower / Executing Agency	The Republic of Turkey / Ministry of Transport, Maritime Affairs and Communications, General Directorate of Highways (KGM)
Final Disbursement Date	June, 2012
Main Contractor (Over 1 billion yen)	Mon Ins. Ve Tic. Ltd. Sti. (Turkey), Limak Ins. San. Ve Tic. A.S. (Turkey)
Main Consultant (Over 100 million yen)	Nippon Koei CO., LTD. (Japan) / Temelsu Ulus, Huh. Hiz. A.S. (Turkey) (JV)
Feasibility Studies, etc.	“Bozüyük-Bilecik First Division Border Feasibility Report” KGM, 1997
Related Projects	—

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuyuki Kobayashi, OPMAC Corporation

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted according to the following schedule.

Duration of the Study: September, 2014 – September, 2015

Duration of the Field Study: December 31, 2014 – January 14, 2015

March 28, 2015 – April 3, 2015

2.3 Constraints during the Evaluation Study

Since JICA's internal information was insufficient, analysis in "3.2. Efficiency" is based on the project completion report and information provided by the executing agency. As the average speed data from the executing agency covers only the period after 2004, the lack of sufficient data disabled the analysis of average speed to compare before and after construction.

3. Results of the Evaluation (Overall Rating: B²)

3.1 Relevance (Rating: ③³)

3.1.1 Relevance to the Development Plan of Turkey

The transportation sector of the Seventh Development Plan (1996-2000) planned that 80% of public investment in the sector would be allocated to road construction reflecting an importance of road traffic in passenger and freight transportation. In the period of the Seventh Development Plan, it had been planned that 75% of all the state highways and the provincial roads would be paved and that divided high-standard roads would be extended from 5,000km to 5,500km. Moreover, the Development Plan mentions gaps in local development as one of the most significant development issues in the country and the plan proposed reducing such gaps. As a sector plan of road development, the Turkish Government formulated the "State Road Investment Program" targeting the period between 1997 and 2007 which focused more on reinforcing transportation capacity through improvement of the road standards. In this program, 17 sections were selected as the most prioritized projects. This project planned to construct an 85.8km part of the selected prioritized section (Adapazarı - Bozüyük, 133km).

The development plan at the time of the ex-post evaluation (the 10th Development Plan (2014-2018) approved by the national assembly in July 2013) includes an extension of high-standard roads in the targets. It is planned that divided roads would be extended from 21,067km in 2013 to 25,722km by 2018, and roads for automobiles use are to be extended from 2,256km in 2013 to 4,000km by 2018. Moreover, asphalted roads on which heavy vehicles are able to travel are to be extended from 18,468 km in 2013 to 39,552km in 2018. This Development Plan also mentions the importance of balancing national welfare among regions by alleviating the development gap. "The Plan of Transportation and Telecommunications of Turkey", a sector plan of transportation at the time of the appraisal, sets 2023 as the target year and plans to extend the length of divided roads to 37,000km. This plan also touted a policy to promote reinforcing South - North Corridor through improvement of transportations by high-standardizing roads between the Black Sea Region and the Mediterranean / Southeastern Anatolia Region. The section improved by the project is a part of the Third South - North Corridor (Karasu - Sakarya - Kütahya - Afyon - Burdur -

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

³ ③: High, ② Fair, ① Low

Antalya Corridor).

Both the Turkish Government's Development Plans and their transportation sector plans at the time of the appraisal and the ex-post evaluation maintained the aim of promoting high-standardization of the roads, and there was no change in the priorities of the policy (high standardization of roads to improve freight logistics, etc.) before and after the project implementation. In the sector plan at the appraisal, this project was included in the prioritized sections to be developed. In the sector plan at the time of the ex-post evaluation, the project has been also regarded as a prioritized section for improvement and as one of the major corridors in the South-North transportation. This project is to high-standardize the Bozüyük - Mekece section of State Road D650 which connects the South and the North areas, thus, the project scope and the targeted section is consistent with the above policies.

3.1.2 Relevance to the Development Needs of Turkey

At the time of the appraisal, the State Road D650 targeted to be improved by the project was the main trunk road connecting Marmara Region (İstanbul, Bursa, etc.) and the Mediterranean Region/ the Southeastern Anatolia Region (See Figure 1). It was the base route to transport industrial products from the Marmara Region to the Mediterranean / Southeastern Anatolia Region while agricultural products are transported from the Mediterranean Sea/ Southeastern Anatolia Region to the Marmara Region.

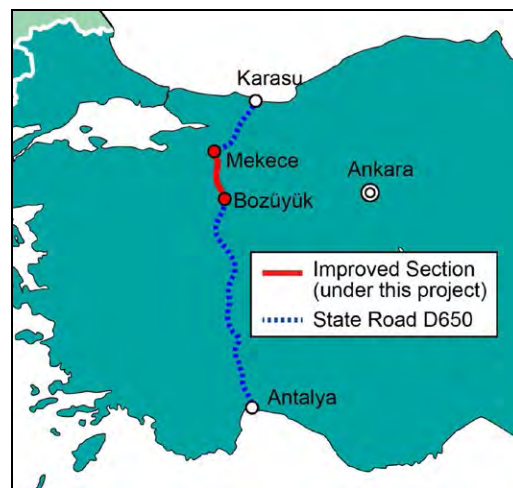


Figure 1: State Road D650

The traffic volume between Bozüyük and Mekece in 1997 recorded 7,103 cars/day, which was 2.5 times the average traffic of the trunk roads in the country. In analysing the total traffic volume, the number of the freight vehicles, such as trucks and trailers, was 3,402 cars/day accounting for 47% of the total traffic volume in terms of the number of units. The traffic of large-sized vehicles has increased by 9.6% per year since 1992. Traffic jams had been chronic because the existing roads had only two lanes (one lane each way) and the road capacity was insufficient to meet the increased traffic demand especially for the large-sized vehicles which had increased significantly. In urban areas of the major cities along the road, serious traffic jams were common because through-traffic and inner city traffic were mixed in these cities. This brought about the necessity to meet the increasing traffic demands by improving the road standards.

At the time of the ex-post evaluation, the basic structure of economic activities had not undergone considerable change: the Marmara Region is an industrially advanced area

whereas the Mediterranean / South-eastern Anatolia Region’s major significant economic activity is related to primary industry. The State Road D650 targeted by the project has been continuously ranked as a trunk route for freight logistics among the regions. In 2000 immediately after the project implementation, Turkey’s share of road transportation in domestic freight transportation was 88.9%. The ratio in 2008 during the project implementation was 88.9% and it was 88.1% in 2012 after the project completion. Road transportation has an overwhelming share in freight transportation, thus, it is a pivotal sector in freight logistics (see Table 1).

Table 1: Domestic Freight Transportation by Traffic Mode (Share based on Tons and Kilos)

Year	Roads	Sea Transport	Railways	Air Transport	Total
2000	88.9%	5.4%	5.4%	0.2%	100.0%
2008	88.9%	5.4%	5.2%	0.4%	100.0%
2012	88.1%	6.4%	4.8%	0.7%	100.0%

Source: documents provided by the executing agency

The traffic volume between Bozüyük and Mekece in 2013 was 12,824 cars/day, in which the total volume of trucks and trailers was 5,055 cars/day. Its share of all the traffic volume was 39% in terms of the number of units. Development of motorization brought about an increase in automobile traffic, which resulted in a decrease ratio of freight vehicles. However, the number of freight vehicles itself has increased by 1.5 times the 1997 number of the units, which means the improved section fills a significant role as an industrial road.

The road constructed and rehabilitated by this project is a major trunk road for the country’s freight logistics that connects the Marmara Region and the Mediterranean/Southeastern Anatolia Region. At the appraisal, the State Road D650 was an important section of domestic logistics and an increase in freight transportation was notable on the road. Alleviating the bottleneck was a development need for the project. Before and after the project implementation, the trend in the number of freight vehicles has been increasing. At the time of the ex-post evaluation, the improved section has played a role as an industrial road. Thus, the road constructed and rehabilitated by this project has strong needs in terms of the country’s freight logistics.

3.1.3 Relevance to Japan’s ODA Policy

As a reason for cooperation to transportation sector, in “Japan’s ODA White Paper 1999” issued by the Ministry of Foreign Affairs of Japan, investment in transportation sector was recognized as indispensable for economic development and improvement of living standards in the country, since unequipped transportation infrastructure impedes the transportation of living necessities, activation of industries, and correcting the gaps between cities and the

countryside. In addition, Turkey was ranked as a priority country for assistance for the Middle East Region. For such reasons, contribution to stabilize the region, potential power of economic growth, geographical significance, and a good relationship between the two countries were raised. Also, the important point for the assistance to Turkey included encouraging industrial development for addressing the disparities among regions. As the country's GNP has reached a relatively higher standard, it was planned that loan assistance would predominantly be implemented instead of grant aid. As the project is both a loan assistance and for road improvement in Turkey, it was consistent with Japan's ODA policy in terms of three points, namely, the project objective, the target country, and the aid scheme.

In light of the above, this project has been highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

The project outputs are shown in Table 2. A main alteration in the outputs was that a needed change to the road alignment caused a change in the plan: instead of widening the existing road it was necessary to build a new section of road. The reasons for the change are as follows: ①the necessity to take the possibility of a landslide into consideration, ②a part of the route was changed from the left side to the right side of a river as it was difficult to operate heavy equipment. However, the target section of the project was the Bozüyük - Mekece section both for the plan and for the actual outputs, and there was no critical change in the distance of the section. Thus, no change in the project outputs which would affect the project effectiveness occurred. The road width of the Bozüyük bypass was 33m (for each direction, carriage way 3.5m x 3 lanes, shoulder 3m, and inner clearance 1m, plus refuge 4m) and that of the State Road D650 (the Bozüyük - Mekece section) was 26m (for each direction, carriage way 3.5m x 2 lanes, shoulder 3m, and inner clearance 1m, plus refuge 4m). Southbound and northbound directions of the target section were divided, and traffic safety equipment, such as guard rails, lights, delineators, and traffic enforcement cameras were installed.

Table 2: The Project Outputs

Plan	Actual
<p>Civil Works:</p> <ul style="list-style-type: none"> ● Road Construction: total 85.8km <ul style="list-style-type: none"> - Widening of the existing roads (2 lanes for one side) 42.2km - New road establishment (2 lanes for one side) 32.8km - Bozüyük bypass road (3 lanes for one side) 10.8km ● Bridge Construction: 32 places (total 2.1km) ● Tunnel Construction: 2 places (2.4km and 0.8km) 	<p>Civil Works:</p> <ul style="list-style-type: none"> ● Road Construction: total 85.1km <ul style="list-style-type: none"> - Widening of the existing roads (2 lanes for one side) 33.6km - New road establishment (2 lanes for one side) 41.4km - Bozüyük bypass road (3 lanes for one side) 10.1km ● Bridge Construction: 40 places (total 2.1km) ● Tunnel Construction: 2 places (2.4km and 0.8km)
<p>Consulting Services:</p> <ul style="list-style-type: none"> Overseas: 240M/M Domestic: 1,781M/M 	<p>Consulting Services:</p> <ul style="list-style-type: none"> Overseas: 232M/M Domestic: 2,121M/M

Source: documents provided by JICA, Project Completion Report, documents provided by the executing agency



Photo 1: Tunnel of the State Road D650



Photo 2: the Bozüyük bypass road

3.2.2 Project Inputs

3.2.2.1 Project Cost

Actual project cost was 52,496 million yen whereas the planned project cost was 39,154 million yen. As the actual cost does not include the cost for obtaining the land, the calculation uses data that deducts the land obtaining cost from the project cost at appraisal as a benchmark value and is compared with the actual cost. Comparing the project cost at the appraisal with the land obtaining cost deducted (36,236 million yen), the actual project cost was 145% of the planned cost which is higher than planned. The reason for the increase in the project cost is that difficult engineering works in mountainous areas required additional works, such as soil improvement, protection of side slope, counter measures for landslide, and a change of road alignment. Although the civil works contract did not have a price adjustment clause, the contract amount was raised in accordance with the public procurement laws of Turkey.

3.2.2.2 Project Period

Project period was significantly longer than planned. The actual project period was 145

months (199% longer than planned) whereas the planned period at the appraisal was 73 months. Although it was initially planned that the contract of road construction would be concluded in March 2001, the actual contract conclusion was made in December 2002, (more than a year and a half delay). The cause of the delay was that the executing agency was unfamiliar with procurement procedures. The actual period of civil works was 102 months whereas the planned period was 51 months. One of the causes of the prolonged period of civil works was an increase in establishing sections of new road because of a road alignment change. Also, the road alignment change required more land, which took additional time to obtain. In case agreement about compensation with the rightful claimants cannot be obtained, it is necessary to have an executive order from the court. This required more time for the procedures. Moreover, the economic crisis necessitated the need for an austerity budget which caused a decrease in the allocation of the project budget from the Turkish government and delayed civil works.

3.2.3 Results of Calculations of Internal Rates of Return (Reference only)

With regard to calculating the Economic Internal Rate of Return (EIRR), the actual EIRR was 8.6% whereas the planned EIRR was 10.1% (see Table 3 for preconditions for the calculation). The traffic volume exceeded expected volumes at the time of the appraisal and also there was an unexpected decrease in the number of traffic accidents which has increased the project's benefit. However, an increase in the project cost exceeding the planned data lowered the EIRR.

Due to the fact that the State Road D650 targeted by the project is an ordinary road and toll revenue is not generated, calculating the Financial Internal Rate of Return (FIRR) is not possible.

Table 3: Calculating Conditions of the Internal Rate of Return

	Calculating Conditions
Costs	Construction costs, Increased amount of O&M cost
Benefits	Decreased traffic accidents, Decreased travel costs
Project Period	30 years after the completion
Preconditions	<ul style="list-style-type: none"> ● As for traffic volume, actual data for 2011~2013 and projected data by the executing agency for 2014~2029 was used. The traffic volume is not projected to increase after 2029 given the road capacity. ● Based on the projection at the appraisal on a benefit unit for decrease in travelling cost. ● As for the decrease in traffic accidents, projected the decreasing rate comparing to the number of accidents in new and old roads for 3 years before/after the project completion. (actual data for rate decrease was 54% whereas the rate at the appraisal was assumed to be 50%) ● As the project cost was 145% of the planned cost, O&M cost was increased by the same ratio. ● The conversion factor from financial price to economic price was 0.95 times with reference to EIRR at the appraisal. ● As calculated in real terms at the appraisal, nominal price was adjusted by CPI, recalculated and converted to real terms for comparison.

In light of the above, the project cost exceeded the plan and project period significantly exceeded the plan. Therefore, efficiency of the project is low.

3.3 Effectiveness⁴ (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

(1) Traffic Volume

Actual traffic volume data (2 years after the completion) in the Bozüyük - Mekece section of the State Road D650 has achieved the target of 2 years after the project completion that was set at the appraisal. Also, the traffic volume in the Bozüyük bypass road has reached approximately 90% of the target (see Table 4). Also, as to traffic of freight vehicles (total of trucks and trailers), the volume in the Bozüyük - Mekece section mostly achieved the target and that of the bypass section was 80% of the target. Since the first half of the 2000's, a policy to shift the carriers of freight vehicles from individuals to enterprises has been in place. This policy change promoted introduction of high performance tractors and as a result, the number of trailer trucks has increased whereas the number of trucks has decreased.

Table 4: Traffic Volume in the Project Targeted Section

Unit: Number of Cars/day

	Baseline	Target	Actual	Actual	Actual
	1997	2007	2011	2012	2013
	F/S Implementation	2 years after Project Completion	Project Completion Year	1 year after Project Completion	2 years after Project Completion
Traffic Volume in the Bozüyük - Mekece section of the State Road D650	7,103	12,668	10,699	11,525	12,824
Automobiles	3,466	6,818	5,411	6,305	7,372
Buses	235	348	326	366	397
Trucks	3,139	5,113	2,889	2,614	2,443
Trailers	263	389	2,073	2,240	2,612
Traffic Volume in the Bozüyük bypass road	13,677	24,351	NA	NA	21,732
Automobiles	6,653	13,087	NA	NA	12,761
Buses	691	1,023	NA	NA	591
Trucks	5,827	9,492	NA	NA	3,654
Trailers	506	749	NA	NA	4,726

Source: documents provided by JICA and the executing agency

(2) Average Speed per Hour

After opening the new road improved by the project (2011 and thereafter), the average driving speed in the Bozüyük - Mekece section has increased for all types of cars. The

⁴ Sub-rating for Effectiveness is to be put with consideration of Impact. In accordance with the project objective, the direct project effects appeared in transportation in the targeted area is analyzed in "Effectiveness", and the effects to freight logistics and local economy induced as the result are mentioned in "Impact".

increase in speed is due to resolving slower travel by fewer traffic jams as the new road took a detour around urban areas in Bozüyük and Bilecik, which separated long-distance traffic and local traffic. The improvement of road alignment such as gentler curves and slopes also contributed to faster speed. The latest average speeds of the vehicles except passenger cars levelled off or moderately increased in comparison with the data in 2004. This result was due to lower speed limit for the vehicles except passenger cars.

Table 5: Average Speed in the Bozüyük - Mekece Section

Unit: km/h

Type of Cars	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Passenger cars	79	75	75	77	76	79	82	94	100	103
Pick-up	89	71	71	68	68	74	71	87	90	90
Buses	84	72	71	72	67	75	72	86	89	91
Trucks	76	66	66	62	61	67	65	74	75	76
Trailers	74	65	66	63	61	66	60	72	73	74

Source: KGM

Notes: average speed of old road until 2010, average speed of new road since 2011. Average speed data before 2004 could not be obtained.

(3) The Number of Traffic Accidents

After the new road opened (2011 and thereafter), the number of traffic accidents, deaths, and injured has decreased remarkably. In comparison with the data in 2002, a year before the civil work, the number of traffic accidents, deaths, and injured decreased. Prior to the project implementation, many accidents occurred where road alignment was dangerous (e.g., steep curve). The following road improvements contributed to the decrease, i.e. separation of up and down lanes, widened road width, and gentler curves and slopes. Because the project targeting section is located mainly in mountainous areas, road improvement effectiveness in preventing traffic accidents was considerable. KGM has aggregated the number of traffic accidents every year and has taken safety measures for black spots where traffic accidents frequently occurred. For example, a left-turning lane was established at a place where vehicles waiting to turn left often collide with oncoming-passenger vehicles.

Table 6: Number of Traffic Accidents in the Bozüyük - Mekece Section

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Number of Traffic Accidents (cases/ year)	106	119	130	296	139	126	128	133	130	54	64	63
Number of Deaths (persons/ year)	18	21	10	46	12	13	6	8	12	4	0	3
Number of the Injured (persons/ year)	212	225	259	610	282	229	250	269	257	104	124	139

Source: KGM

Notes: the number of traffic accidents for the old road until 2010, that for the new road since 2011.

3.3.2 Qualitative Effects

(1) Change of Transportation Route

In this ex-post evaluation, a questionnaire study was implemented for truck drivers (61 persons in total) at three rest areas (the 7km, 47km, 52km spots from the starting point) in the improved section of the State Road D650. The result of the study shows that most drivers have stopped using the old road (see Table 7). As a decrease in traffic through urban areas in Bozüyük and Bilecik was assumed, it is judged, therefore, that the expected effect has been shown.

Table 7: Change of Transportation Route

		Yes	No	Total
Do you still use old road?	Number of respondents (persons)	2	59	61
	%	3.3%	96.7%	100.0%

Source: Results of the questionnaire studies

(2) Vibration and Driving Comfortableness

In the questionnaire study for truck drivers, questions about vibration and driving comfort were also asked. 90% of the respondents chose “improved” and “somewhat improved” about vibration (see Table 8). Also, as to improvement of driving comfortableness, drivers answering “yes” and “yes to some extent” accounted for 90% of all respondents (see Table 9). Individual interview research also revealed that opinions of long-distance bus drivers are consistent with the result of the questionnaire study. The opinion was, “vibration has decreased in the Bozüyük – Bilecik section and the increased road width and gentler slopes made driving more comfortable”.

Table 8: Vibration during Driving

		Improved	Somewhat improved	Somewhat worsen	Worsen	Total
Is vibration improved after the road improvement?	Number of respondents (persons)	44	13	2	2	61
	%	72.1%	21.3%	3.3%	3.3%	100.0%

Source: Results of questionnaire study

Table 9: Driving Comfortableness

		Yes	Yes to some extent	Not so much	No	Total
Do you feel more comfortable when you drive after the road improvement?	Number of respondents (persons)	52	3	5	1	61
	%	85.2%	4.9%	8.2%	1.6%	100.0%

Source: Results of questionnaire study

3.4 Impacts

3.4.1 Intended Impacts

(1) Impacts on Local Traffic

Comparing the situation before and after project implementation, road traffic has become activated not only in the section targeted by the project but also in a wider area. In four sections neighboring the improved sections, the traffic volume has substantially increased compared to 1998 before the project commencement (see Figure 2 and Table 10). In particular, the traffic volume in South-North direction (Mekece - Sakarya section and Bozüyük-Kütahya section) had almost doubled from 1998 to 2013. Nevertheless other factors affecting the traffic demand need to be considered, it is inferred that the high-standardization of the road network brought about by this project induced traffic demand.

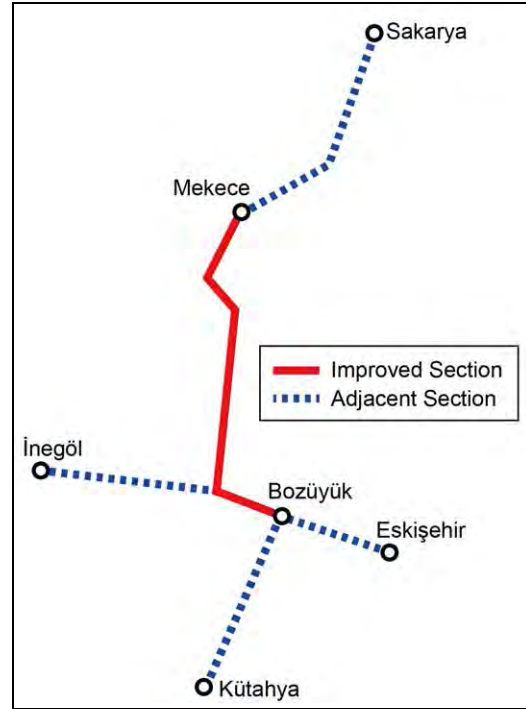


Figure 2 Neighboring sections

Table 10: Traffic Volume in Neighboring Sections

Unit: cars/day

	Baseline	Actual	Actual	Actual
	1998	2011	2012	2013
	1 year before Project Commencement	Completion Year	1 year after Completion	2 years after Completion
Eskişehir - Bozüyük section	12,472	16,621	17,681	19,737
Bozüyük - İnegöl section	6,240	10,220	10,608	11,783
Mekece - Sakarya section	11,693	16,902	17,734	21,298
Bozüyük - Kütahya section	5,257	9,308	10,076	12,348

Source: KGM

(2) Cargo Damage

The questionnaire research for truck drivers included a question about cargo damage. 90% of the respondents answered “reduced” or “somewhat reduced” (see Table 11). As mentioned before, vibration improved after the project implementation, which resulted in reduced cargo damage. In a hearing at a tableware factory in the area targeted by the project, there was an opinion that tableware broken during its transportation has been reduced. In addition, as the State Road D650 is used as a route to transport agricultural products from

Antalya in the agricultural area to consuming city, İstanbul, and also to Europe for exportation, it is considered that the project has contributed to the distribution of agricultural products.

Table 11: Cargo Damage

		Reduced	Somewhat reduced	Somewhat Increased	Increased	Total
Is damage on cargo reduced after the road improvement?	Number of Respondents (persons)	29	28	3	1	61
	%	47.5%	45.9%	4.9%	1.6%	100.0%

Source: Results of questionnaire study

(3) Activation of Local Economy

In the ex-post evaluation, the questionnaire study for local residents (41 persons in total) was implemented at six places targeted by the project. The section has both comparatively large-scaled cities having a population of approximately 100,000 and small-scaled towns with a population of less than 1,000 people. Thus, the study took samples from both types of cities in profoundly different circumstances⁵. In the larger cities, more people than those in smaller towns stated opinions that both opportunities for employment and for starting a business increased (see Table 12 and Table 13). It is conjectured that residents answered “poor opportunities for employment” due to tendency not to build factories and/or commercial facilities in the smaller towns and many residents need to commute to neighboring towns for work. In regards to opportunities for starting a business, it is considered to have more advantages in the larger cities having many latent customers.

Table 12: Opportunity for Employment

			Yes	Yes to some extent	Not so much	No	Total
Do more people find employment after the road improvement?	Large-scaled city	Number of respondents (persons)	4	4	2	5	15
		%	26.7%	26.7%	13.3%	33.3%	100.0%
	Small-scaled town	Number of respondents (persons)	1	10	4	11	26
		%	3.8%	38.5%	15.4%	42.3%	100.0%
	Total	Number of respondents (persons)	5	14	6	16	41
		%	12.2%	34.1%	14.6%	39.0%	100.0%

Source: Results of questionnaire study

⁵ Concretely, Bozüyük and Bilecik were selected from the larger cities and Karaköy, Demirköy, Başköy and Mekece were selected from the smaller towns.

Table 13: Opportunity for Starting Business

			Yes	Yes to some extent	Not so much	No	Total
Do more people start businesses after the road improvement?	Large-scaled city	Number of respondents (persons)	2	6	3	4	15
		%	13.3%	40.0%	20.0%	26.7%	100.0%
	Small-scaled town	Number of respondents (persons)	1	6	4	15	26
		%	3.8%	23.1%	15.4%	57.7%	100.0%
	Total	Number of respondents (persons)	3	12	7	19	41
		%	7.3%	29.3%	17.1%	46.3%	100.0%

Source: Results of questionnaire study

3.4.2 Other Impacts

(1) Traffic Noise

The questionnaire for residents also included a question about traffic noise. In the large-scaled cities, 70% of the respondents answered “decreased” or “somewhat decreased”, and no resident answered “increased” or “somewhat increased” (see Table 14). On the other hand, in the smaller towns, 40% of respondents answered that traffic noise has “decreased” or “somewhat decreased” and 30% of the respondents answered “increased” or “somewhat increased”. Even though traffic in urban areas has decreased in Bozüyük and Bilecik which resulted in a decrease in traffic noise in areas where the State Road D650 cuts across residential areas, a certain number of residents in the smaller towns are concerned about traffic noise.

Table 14: Traffic Noise

			Increased	Somewhat increased	No Change	Somewhat decreased	Decreased	Total
Has traffic noise increased after the road improvement?	Large-scaled city	Number of respondents (persons)	0	0	4	6	5	15
		%	0.0%	0.0%	26.7%	40.0%	33.3%	100.0%
	Small-scaled town	Number of respondents (persons)	1	6	9	5	5	26
		%	3.8%	23.1%	34.6%	19.2%	19.2%	100.0%
	Total	Number of respondents (persons)	1	6	13	11	10	41
		%	2.4%	14.6%	31.7%	26.8%	24.4%	100.0%

Source: Results of questionnaire study

(2) Traffic Safety Recognized by Residents

The questionnaire for residents also asked about traffic safety. In the larger cities, 80% of the respondents answered “improved” or “somewhat improved” and no resident answered

“worse” or “somewhat worse” (see Table 15). Meanwhile, respondents in the smaller towns recognizing that traffic safety has “improved” or “somewhat improved” remained approximately 30% and respondents who answered “worse” or “somewhat worse” accounted for 50%. A reason for the difference of opinions between cities and smaller towns is that the State Road D650 divides the urban area into two parts and thus it is conjectured that local residents often cross the State Road D650. In hearing with residents in the smaller towns, the following opinions were heard: 1) a mirror needs to be installed as there is a blind spot at the exit of the passage under the State Road D650 (Karaköy), 2) persons who cannot walk properly do not want to use a pedestrian overpass because of its steep flight of stairs (Demirköy), and 3) there is no pedestrian overpass (Başköy).

Table 15: Traffic Safety Recognized by Residents

			Improved	Somewhat improved	No Change	Somewhat worse	Worse	Total
Has traffic safety improved after the road improvement?	Large-scaled city	Number of respondents (persons)	4	8	3	0	0	15
		%	26.7%	53.3%	20.0%	0.0%	0.0%	100.0%
	Small-scaled town	Number of respondents (persons)	1	6	6	11	2	26
		%	3.8%	23.1%	23.1%	42.3%	7.7%	100.0%
	Total	Number of respondents (persons)	5	14	9	11	2	41
		%	2.4%	14.6%	31.7%	26.8%	24.4%	100.0%

Source: Results of questionnaire study



Photo 3: Passage under the State Road D650



Photo 4: Pedestrian overpass on the State Road D650

(3) Impacts on the Natural Environment

This project was formed before environmental guidelines for Yen Loan projects were applied, and an Environmental Impact Assessment was also not required according to the

laws and regulations of Turkey. Yet, it was agreed at the appraisal that an environmental assessment would be implemented in the early stage in order to properly carry out environmental countermeasures during the project implementation, and a report on environmental countermeasures was drafted in 2002 before civil works started. In this report, measures to reduce negative impacts on the natural environment, countermeasures against noise during construction works, waste-disposal plans, and the environmental monitoring plan were offered. According to those opinions suggested in the report, civil works was carried out. In the project completion report, it is mentioned that no negative impact on the natural environment has been observed. Also, no negative impacts have been found in the site survey at the ex-post evaluation.

(4) Land Acquisition and Resettlement

According to information provided by the executing agency, the area of land acquisition was 156.6ha. Affected Residents were 2,131 households and 284 houses (including non-dwelling structure such as barns). Compensations in cash were made to the households subject to land acquisition according to the laws and regulations of Turkey. If an agreement on compensation could not be reached with a rightful claimant, a third party estimated the value of the property and executed the land acquisition based on an executive order from the court. For public works that KGM implemented, although the number of the paid households with compensation was aggregated, the number of the resettled households was not aggregated based on a detailed categorization of paid households. Since TOR consultants' work for construction and supervision did not include aggregating the number of resettled households, the number of the resettled households was not determined.

In light of the above, this project has largely achieved its objectives. Therefore effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

At the time of the ex-post evaluation, KGM is an extra-ministerial bureau of the Ministry of Transport, Maritime Affairs and Communications, which is in charge of planning, designing and operation and management of expressways, state highways, and provincials roads. The Bilecik branch office of the 14th section General Directorate of Highways is in charge of the section targeted by the project.

The number of KGM staff members in 2014 was 15,084 persons (2,506 persons in the management section, 3,925 engineers, 8,653 workers for construction and for operation and maintenance). At the time of the ex-post evaluation, the outsourcing rate of operation and maintenance works of KGM reached 75% (in terms of the amount of money). In KGM,

operation and maintenance works both for daily and for regular intervals have been outsourced. As outsourcing increases, the number of KGM staff members has decreased by approximately 40% from the time of the appraisal, which brought about a remarkable decrease in the number of workmen. While operation and maintenance has been outsourced, contract management work and quality inspection after engineering work has been carried out by KGM. Since KGM had undertaken operation and maintenance by themselves before, they have staff members with knowledge and experience of quality management for engineering works. Also, KGM enhanced training programs in order to enable staff members to obtain adequate knowledge on contract management. In the section targeted by the project, 33 staff members (2 persons for management section, 4 engineers, and 27 workers for construction, and operation and maintenance) of Bilecik branch office are in charge of operation and maintenance. Also, in the project targeting section, the works of operation and maintenance have been outsourced.

In terms of institutional aspects, no problem which could impair sustainability was observed. As KGM is responsible for operation and maintenance of the section targeted by the project and a responsible branch of KGM is clearly assigned for operation and maintenance of constructed infrastructures. KGM, does have an established system for contract management and quality inspection of engineering works.

3.5.2 Technical Aspects of Operation and Maintenance

In KGM, staff members are employed based on the regulations for public officers of the Turkish Government. When employing a staff member requiring engineering ability, their technical capability is closely examined. Civil works engineers and mechanical engineers take six-month-training immediately after being employed. The training includes not only the relevant technologies but also contract management. KGM has conducted short-term trainings for all its staff members. In 2014, 11,883 persons in total joined 417 training courses. As part of highly specialized trainings (e.g. contract management based on FIDIC), it is possible to take lectures and join seminars outside of KGM. Also, when the government changes a procurement guideline, staff members sometimes take lectures in other ministries. According to hearings with staff members of the Bilecik branch office, they have sufficient capabilities to take charge of operation and maintenance.

Manuals for road operation and maintenance are distributed to KGM branch offices doing operation and maintenance. In addition, manuals for traffic signs are provided to the branch offices. Types of road operation and maintenance works are as follows:

Daily Operation and Maintenance (everyday): dealing with potholes⁶, painting road signs, changing reflective plates, cleaning drainage ways, snow removal, etc.

⁶ Holes appeared on the road because of subsidence of pavement and detachment of paved surface.

Regular Operation and Maintenance (every 5 years): overlay⁷, reconstruction, etc.
 Urgent Operation and Maintenance (necessary): correspondence to disasters

For technical aspects, no major problem which could impair sustainability was discovered. KGM confirms technical capability when employing staff members and also provides them opportunities to take relative training programs. A system to conduct ongoing trainings after employment is established for contract management since it accounts for a larger proportion of KGM services.

3.5.3 Financial Aspects of Operation and Maintenance

Both general budgets and investment budgets in the Ministry of Transport, Maritime Affairs and Communications fluctuated in a stable manner for the past three years (see Table 16). Although there was rise or fall in accordance with the progress of large-sized construction works, investment budgets for the transportation sector has been relatively stable. At the time of the ex-post evaluation, , although special tax (fuel levy, etc.) and toll road revenue were not appropriated for the budget, both general budgets and investment budgets were allocated from the governmental budget. Both general budget and investment budget are used for the operation and maintenance of roads.

Table 16: General Budget and Investment Budget for the Ministry of Transport, Maritime Affairs and Communications

Unit: Million TL

	2011	2012	2013
General Budget	2,841	3,091	2,987
Investment Budget	12,106	11,096	12,358
Transportation Sector	10,393	9,659	10,916

Source: KGM

KGM's operation and maintenance budget for the road sector has increased remarkably from 2011 to 2012 and had remained at the same level in 2013 (See Table 17). In particular, the budget for regular operation and maintenance increased sharply in 2012, and desirable budget allocation was made to prevent damage of road infrastructures. In 2013, the operation and maintenance budget was 1,710 million TL (approximately 87,500 million yen). Since the overall length of the road network was approximately 66,000km, the budget per 1km was 1.33 million yen. In 1997 before the implementation of the project, the operation and maintenance budget was 21,500,000 million Old TL (approximately 17,100 million yen) and total length of the road network was approximately 62,000km, thus, the operation and maintenance budget per 1km was 0.28 million yen. The budget per 1km of road has

⁷ Construction method of paving a new layer of asphalt on the surface of the road.

increased significantly in comparison of before and after the project implementation.

Table 17: KGM’s Budget for Operation and Maintenance of Road Sector

Unit: thousand TL

	2011	2012	2013
Daily Operation and Maintenance	154,830	241,349	177,489
Regularly Operation and Maintenance	86,884	1,584,275	1,501,297
Urgent Operation and Maintenance	19,116	32,911	26,521
Total	260,830	1,858,535	1,705,307

Source: KGM

In allocating the budget, state highways are given priority over provincial roads. Although introduction of a road operation and maintenance system⁸ had been implemented at the time of the ex-post evaluation, it has not yet been put into practical use and the system has not drawn a budget for operation and maintenance.

For financial aspects, no problem which could impair sustainability was observed. Both general budgets and investment budgets have been stably allocated and the budget for road operation and maintenance has significantly increased in comparison of before and after of the project implementation.

3.5.4 Current Status of Operation and Maintenance

In the project targeting section, KGM staff members have inspected roads, bridges and tunnels twice a week, and assigned daily operation and management work to appropriate contractors. As far as the site survey could confirm, there was no observed rutting⁹ or potholes, road markings have not disappeared, and snow was removed. In the section where the road had cracks, engineering works had been conducted to prevent pavement from peeling off. Also, at one place where the road shoulder was broken, repair work has been carried out. Regular operation and management has not been conducted in the section targeted by the project yet, since it is carried out on a 5 year basis.



Photo 5: Control Centre of Tunnel

Works for daily operation and maintenance of tunnels have also been outsourced to private enterprises and supervision has been carried out at a 24 hour a day control center.

⁸ The proposed system includes an IT system consisting of a database (for data such as road conditions, passage volume, and record of operation and maintenance works), and a program of operation and maintenance planning.

⁹ A hollow generated in the part where tires on the paved road touch it because of passive vehicles’ load.

The control center includes operating or supervising items such as: electric traffic signs, lights, power-distribution system, ventilation, temperatures (fire check), and road conditions (temperatures). Moreover, the weight of vehicles is being measured at the entrance of a tunnel (heavy vehicles are required to take a detour from the tunnel).

In the current status of operation and maintenance, no problem which could impair sustainability was found. Although some sections had damage to the facilities, adequate countermeasures had been carried out. Also, whereas there has been heavy freight vehicles traffic in the project targeting section, serious rutting has not occurred.

In light of the above, no major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project was to improve State Road D650 and construct the Bozüyük bypass road to accommodate an increasing traffic volume, and thereby contribute to smoother freight logistics and vitalization of the local economy. The relevancy of this project is high as the project scope is consistent with the Turkish Government's policy to encourage a high-standardization of roads and with the necessity of handling an increase in freight vehicles. On the other hand, the efficiency of the project is low since the project costs exceeded the plan (due to difficult engineering works in mountainous areas), and the project period substantially exceeded the plan (due to a delay in procurement and prolonged construction works). The traffic volume in the section targeted by the project has increased mostly as forecasted and the number of freight vehicles has also increased remarkably. As the result of the road improvements, the average travel speed is faster and the number of traffic accidents has decreased. In addition, the following improvements have been seen; improved driving comfort, and a decrease in cargo damage. As effects sufficient for an industrial road project have been seen, effectiveness and impact of the project is high. Moreover, the executing agency has dealt with an increasing proportion of contract management in operation and maintenance by a training program. Major problems which could impair the project sustainability have not been observed in the management, technical, and financial aspects of the project. Thus, sustainability of the effects induced by the project is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

The beneficiary survey showed that truck drivers and residents in Bozüyük and Bilecik recognized traffic safety had improved, but some residents in smaller towns felt traffic safety worsened. It is conjectured that the latter group used the improved section as a community road and felt an increase in danger due to an increase in the traffic volume. The executing agency has monitored traffic accidents on D650 and improved the sections where accidents occurred. An increase in traffic may increase risk of accidents in the smaller towns. It is desirable that the executing agency continues to monitor traffic accidents and construct speed bumps, pedestrian overpasses, underpasses, traffic signs, and mirrors when there is an increase in traffic accidents.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

Points to note for a road project in a mountainous area

Road improvement projects often result in an increase in traffic accidents due to higher traffic volumes and faster travel speeds. Nevertheless, the number of traffic accidents decreased in the improved sections after the implementation of this project. Use of dividers, an increase of road width, and gentler curves and slopes were effective in the reduction of traffic accident. On the other hand, this project required road alignment after the commencement of civil work and the design change was one of the factors behind project delay and an increase of project costs. For a road project in a mountainous area, it is desirable to assess road alignment for smooth project implementation, design a road with an adequate attention to traffic safety, and estimate appropriate project costs under the proper design during the feasibility study.

Measures to stimulate local economy in smaller towns

In general, there has been improvement in the impacts relevant to road traffic (such as active traffic in wider areas, contribution to cargo traffic and, less congestion). In smaller towns, however, it takes more time for incidence of the impacts relevant to the local economy (such as income, employment, and business opportunity). When constructing and rehabilitating roads, it is desirable to assess the undertaking of measures to stimulate the local economy in smaller towns (for example, posting a bulletin board for tourists, building roadside stations, etc.)

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1.Project Outputs	<p>Civil Works: Road Construction: total 85.8km - Widening of the existing roads (2 lanes for one side) 42.2km - New road establishment (2 lanes for one side) 32.8km - Bozüyük bypass road (3 lanes for one side) 10.8km Bridge Construction: 32 places (total 2.1km) Tunnel Construction: 2 places (2.4km and 0.8km) Consulting Services: Overseas: 240M/M Domestic: 1,781M/M</p>	<p>Civil Works: Road Construction: total 85.1km - Widening of the existing roads (2 lanes for one side) 33.6km - New road establishment (2 lanes for one side) 41.4km - Bozüyük bypass road (3 lanes for one side) 10.1km Bridge Construction: 40 places (total 2.1km) Tunnel Construction: 2 places (2.4km and 0.8km) Consulting Services: Overseas: 232M/M Domestic: 2,121M/M</p>
2.Project Period	September 1999 – September 2005 (73 months)	September 1999 – September 2011 (145 months)
3.Project Cost		
Amount paid in Foreign currency	22,465 million yen	29,101 million yen
Amount paid in Local currency	16,692 million yen (local currency 37,800,000 million Old TL)	23,395 million yen (local currency 404 million New TL)
Total	39,157 million yen	52,496 million yen
Japanese ODA loan portion	29,367 million yen	29,199 million yen
Exchange rate	1 Old TL = 0.000442 yen (As of September 1998)	1 New TL = 57.91 yen (Average between January 2001 and December 2011)

Ukraine

Ex-Post Evaluation of Japanese ODA Loan
“Boryspil State International Airport Development Project”

External Evaluator: Naomi Murayama, OPMAC Corporation

0. Summary

The project aimed to meet the increasing passenger demand in Boryspil State International Airport and then to improve services for airport users by constructing a passenger terminal building and other related facilities. The objective of this project was highly relevant to Ukraine’s development plan and development needs at the time of both the appraisal in 2004 and the ex-post evaluation, as well as to Japan’s ODA policy at the time of the appraisal; therefore its relevance is high. The project scope was expanded in response to external factors such as a drastic increase in the passenger demand and a change in the land to be used for the planned terminal building. This expansion of the scope, however, was appropriate for the emergence of the project effects. Considering the modifications in the scope, the project cost was almost within the plan, although the project period exceeded the plan. Therefore, the efficiency of the project is fair. The targeted operation and effective indicators of the project were broadly achieved and the project largely achieved its objectives; therefore, the effectiveness and impact of the project are high. While the conflicts in the eastern region, as of the time of the ex-post evaluation, seem to have had some limited negative impacts on project sustainability, no major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore the sustainability of the project effects is high.

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

1. Project Description



Project Location



Boryspil Airport Terminal D Departure Lobby

1.1 Background

Kyiv, the capital city of Ukraine, is the political and economic center of the country with a population of 2.6 million. Boryspil State International Airport, located in Kyiv Oblast¹, is the country's largest international airport serving as a gateway for passengers flying to and from Ukraine. At the time of the appraisal, the number of passengers using the airport had been increasing at the rate of, on average, 24% per year, reflecting the eastward enlargement of the European Union (EU) as well as the brisk recovery of the Ukrainian economy. A demand forecast for the airport showed that the number of passengers would rise significantly to become nearly three times as high in 2015 as in 2003. An expansion of the international passenger terminal to increase its handling capacity was thus urgently called for in order to meet the growing demand.

1.2 Project Outline

The objective of this project was to meet the increasing passenger demand at Boryspil State International Airport and then to improve services for airport users by constructing an international passenger terminal building and other related facilities, thereby contributing to the promotion of economic activities through expansion of foreign direct investment and tourism resources utilization.

Loan Approved Amount/ Disbursed Amount	19,092 million yen / 19,092 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March, 2005 / March, 2005
Terms and Conditions	Interest rate: 1.5% Repayment period: 30 years (Grace period 10 years) Conditions for procurement: General untied
Borrower / Executing Agency	Cabinet of Ministers of Ukraine / State International Airport Boryspil
Final Disbursement Date	October, 2012
Main Contractor (Over 1 billion yen)	ALSIM ALARKO SAN TES. VE TIC AS (Turkey)/ YSD INSAAT SANAYI VE TICARET A.S. (Turkey)/ DOGUS INSAAT VE TICARET (Turkey) (JV)

¹ An oblast is a type of administrative division of the former Soviet bloc including Ukraine. The term is analogous of "state" or "province".

Main Consultant (Over 100 million yen)	Japan Airport Consultants, Inc. (Japan)
Feasibility Studies, etc.	<ol style="list-style-type: none"> 1. F/S: “Boryspil State International Airport Development Project” (March 1999) 2. JICA report: “JBIC Special Assistance for Project Formation (SAPROF) for Boryspil State International Airport Development Project” (June 2004)

2. Outline of the Evaluation Study

2.1 External Evaluator

Naomi Murayama, OPMAC Corporation

2.2 Duration of the Evaluation Study

This ex-post evaluation study was conducted according to the following schedule.

Duration of the Study: September, 2014 – September, 2015

Duration of the Field Study: November 16, 2014 – November 29, 2014

2.3 Constraints during the Evaluation Study

A lawsuit was filed during project implementation over the right to use the land for the planned passenger terminal building. Detailed information on the suit, however, has not been disclosed by the executing agency; therefore analysis on the possible impacts of the land issue on project implementation has been excluded from the scope of this study.

3. Results of the Evaluation (Overall Rating: A²)

3.1 Relevance (Rating: ③³)

3.1.1 Relevance to the Development Plan of Ukraine

In 2001 the government of Ukraine produced “The State Comprehensive Program for the Development of Air Transport in Ukraine up to 2010”. The program aimed to enable the air transport industry to recover from past stagnation; to ensure sufficient competitiveness of the industry in both the domestic and international transport markets; and to satisfy the growing demand for air transport in terms of both quantity and quality. Thus a hub airport development policy was being implemented to establish the most effective airport network possible. To execute this, it was necessary to attract foreign, as well as government investment, into airport-related facilities. “The State Program for the Development of the

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

³ ③: High, ② Fair, ① Low

Transport and Railway System of Ukraine between 2000 and 2004” stressed the development of Boryspil State International Airport as a top priority project and clearly stated that a Japanese ODA Loan was expected as a funding source.

It was also confirmed at the time of the ex-post evaluation that, in “The Concept of the State Programme for Boryspil International Airport Development for the period up to 2020” (in 2007), the strong necessity for airport terminal development to be funded by government budget and Japanese ODA Loan was mentioned against the backdrop of the following sectors:

- Air transport is one of the most important sectors in the national economy. Boryspil State International Airport in particular is becoming more important as a gateway to Ukraine;
- The International Civil Aviation Organization (ICAO) provides the analysis that the number of passengers in the airport is forecasted to increase at the rate of, on average, 4.5% per year, becoming 2.7 times greater than before by 2020;
- The insufficient handling capacity of the passenger terminal prevents increases in the number of passengers.

“The Concept of the State Target Programme for Airports Development for the period up to 2023” (in 2013) further confirmed the consistent policy to modernize the airport into a hub airport satisfying international standards (modernization)⁴ and to improve efficiency in the operation of national assets.

The project aimed to meet the increasing passenger demand of the State International Airport and then to improve services for airport users by constructing an international passenger terminal building and other related facilities; thus the objective was consistently relevant to the development plan of Ukraine from the time of the appraisal to the time of the ex-post evaluation.

3.1.2 Relevance to the Development Needs of Ukraine

The actual number of passengers at Boryspil State International Airport, confirmed at the time of the appraisal, is shown in Table 1. Though rather stagnant from 1998 to 1999 due to the Russian financial crisis, the number, which includes domestic passengers, soared after 2000 reflecting the brisk recovery of the Ukrainian economy as well as rapid economic growth in neighboring countries through the eastward enlargement of the European Union (EU). Average growth rates of the number of passengers and volume of cargo from 1998 to 2004 were 15.7% and 15.0%, respectively. The total number of passengers in 2004 was 3,169 thousand (international passengers: 2,652 thousand, domestic passengers: 517 thousand, an increase of 34.2% from the previous year).

⁴ For instance, the security system was modernized by the project.

Table 1: The Number of Passengers at Boryspil State International Airport (at the appraisal)

Unit: thousand

Year	1998	1999	2000	2001	2002	2003	2004	Average growth rate
International passengers	1,313	1,268	1,346	1,478	1,703	2,105	2,652	12.9%
Domestic passengers	61	62	50	59	104	257	517	54.1%
Total	1,373	1,330	1,396	1,537	1,807	2,362	3,169	15.7%

Source: Documents provided by JICA

Table 2 shows the demand forecast of passengers at the time of the appraisal. The demand was forecasted to become 4,534 thousand (including 3,978 thousand international passengers) in 2010 and 6,483 thousand (including 5,667 thousand international passengers) in 2015. Therefore, an increase in the handling capacity by an expansion of the international passenger terminal was considered an urgent issue to be addressed.

Table 2: Demand Forecast of Passengers at Boryspil Airport (at the appraisal)

Unit: thousand

Year	2004 (actual)	2010	2015	2020
International	2,652	3,978	5,667	7,603
Domestic	517	557	816	1,080
Total	3,169	4,534	6,483	8,683

Source: Documents provided by JICA

The demand forecast had been revised several times since the appraisal work, which is summarized in Table 3. Special Assistance for Project Formation (SAPROF) in 2004 assumed an average passenger growth rate up to 2020 at 12% per year. However, State International Airport Boryspil (hereinafter referred to as “SIAB”) conducted a new demand forecast survey in 2007 because SIAB had found it impossible to use the land originally allocated for the planned terminal building and needed to draw up a revised project plan on a new site. The survey revealed the actual number of international passengers as 3,220 thousand in 2005 and 3,810 thousand in 2006 with a growth rate of 16% per year. A new demand forecast was made based on the information above, concluding that 3,500 passengers per hour were to be handled as peak hour passengers. Out of the 3,500, 2,000 of the peak hour passengers were to be accommodated by the existing terminal while the remaining 1,500 were to be accommodated by the new terminal building D to be constructed by this project.

Although Ukraine was confronted with a serious economic crisis at the end of 2008, the actual number of passengers in 2008 reached 5,490 thousand, exceeding the number

forecasted by the 2007 survey⁵. The forecast was further modified to 8,800 thousand per year in 2012 when the UEFA European Football Championship was held in Ukraine and to maintain more than 10,000 thousand per year between 2015 and 2020.

Table 3: Change in Demand Forecast of International Passengers at Boryspil Airport

Unit: thousand

Demand forecast year ⁶	PHP (Terminal D)	2010	2015	2020
Appraisal (2004)	1,000	3,978	5,667	7,603
March 2007	1,500	4,631	6,442	n.a.
February 2009	3,000	6,200	10,400	15,600
Ex-post evaluation (2014)	—	—	6,481	9,460

Source: Documents provided by JICA (for 2004, 2007 and 2009) and answers to the questionnaire (for 2014)

Note: PHP = Peak Hour Passengers

The number of passengers, however, has been decreasing due to the difficult social and security environment in Ukraine since the end of 2013. The number of tourists has declined mainly because the Crimean Peninsula, one of the major tourist destinations, was virtually annexed by the Russian Federation in March 2014. Further intensified conflicts in the eastern region of the country which includes the major industrial city of Donetsk, have caused a decrease in business visitors. Taking this situation into consideration, at the time of the ex-post evaluation, SIAB further modified the demand forecast for year 2015 downwards to the same level as that of 2007. Meanwhile, as stated later in “3.3.1 Quantitative Effects (Operation and Effect Indicators)”, the figure of international passengers for 2014 still exceeded the original target at the appraisal in spite of the recent drop. The executing agency expects the potential demand will return and that there will be a robust recovery in the number of passengers realized once the social situation in the eastern region is stabilized.

Viewed in this light, the project was relevant to development needs of Ukraine both at the time of the appraisal and the ex-post evaluation.

3.1.3 Relevance to Japan’s ODA Policy

The Medium-Term Strategy of Overseas Economic Cooperation Operations at the time of the appraisal gave priority to economic infrastructure and environment projects in its support for Middle and Eastern European countries. The project is considered to have contributed to economic infrastructure development in Ukraine; therefore, it was relevant to Japan’s ODA policy.

⁵ The number of passengers in 2008 was estimated with a high-case of 5,465 thousand in the 2007 survey conducted by SIAB. The figures shown in Table 3 were utilized by JICA in considering the relevance of the scope modification. The figures are more realistic than the SIAB ones.

⁶ Figures at the time of appraisal shown in this table are ones which were conclusively calculated by JICA based on the SAPROF study. The figures for 2007 and 2009 were those which were conclusively adopted by JICA based on the SIAB surveys. The 2014 data was from SIAB.

In light of the above, this project has been highly relevant to the country's development plan and development needs, as well as to Japan's ODA policy. Therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The project aimed to construct an international passenger terminal and other related facilities to meet the growing passenger demand. Major construction works, equipment and consulting services (output) are shown in Table 4.

Table 4: Comparison of Outputs (planned and actual)

Item	Original scope	Actual	Remarks
Major Constructions Works and Equipment			
International passenger terminal building	1,000PHP*note, 3-story, total floor area of approx. 37,000m ²	3,000PHP, 3-story, total floor area of approx. 107,000m ²	Enlarged (about 3 times)
Equipment installation	1) baggage handling system 2) passenger boarding bridge 3) 100% baggage screening system etc.	1) baggage handling system 2) passenger boarding bridge 3) 100% baggage screening system etc.	Same as planned. But the quality of equipment and capacity increased to meet the enlarged terminal capacity.
Apron pavement	Approx. 117,000m ²	Approx. 183,000m ²	Increased (about 1.6 times)
Ground supply equipment (GSE) road & parking	Approx. 24,000m ²	Approx. 24,000m ²	Same as planned.
Gallery	Approx. 1,000m ²	Cancelled	Due to change of terminal location (original gallery not required).
Adjustment of Airport Surface Detection Equipment (ASDE)		Cancelled	Due to change of terminal location (adjustment not required).
Infrastructure for newly relocated Official Delegation Hall (ODH)	1) Apron: approx. 42,000m ² 2) Taxiway: approx. 12,000m ²	Cancelled	ODH was not relocated.
Fuel hydrant system	Pipe and pits	Pipe and pits	Same as planned
Utilities	1) Hot water line etc. 2) Sewerage treatment plant	1) Hot water line etc. 2) Cancelled	Sewage was discharged to an existing sewage treatment works near Boryspil city.
Road & car park (outside of the airport)	1) Road: two lanes in the general section and five lanes along the terminal curb side 2) Carpark: total area of approx. 100,000m ²	1) Road: two lanes in the general section and five lanes along the terminal curb side 2) Cancelled	A multi-story carpark is now being constructed under a separate contract using the funds of SIAB (it will be completed in June 2015).

Item	Original scope	Actual	Remarks
Consulting Services			
Engineering design	1) Professional A: 118MM 2) Professional B: 114MM Total: 232MM	1) Professional A: 103.7MM 2) Professional B: 333.0MM Total: 436.7MM	Design was changed in accordance with the revised demand forecasts. Construction supervision was extended due to expansion of the project scope.
Assistance in tendering	1) Professional A: 28MM 2) Professional B: 28MM Total: 56MM	1) Professional A: 15.88MM 2) Professional B: 0.81MM Total: 16.69MM	
Construction supervision	1) Professional A: 269MM 2) Professional B: 321MM Total: 590MM	1) Professional A: 328.54MM 2) Professional B: 377.93MM Total: 706.47MM	

Source: Documents provided by JICA (for original scope) and answers to questionnaires (for actual)

Note: PHP = Peak Hour Passengers

A major modification from the original project scope is the further expansion of the international passenger terminal. The background and appropriateness of this are explained as follows: (i) the revision of the international passenger demand forecast in 2007 arising from hosting the 2012 UEFA European Championship and from cancelling the construction of a planned private terminal building (handling capacity: 1,000 PHP⁷) to be owned by a civil aviation organization of Ukraine, Aerosvit; and (ii) the further revision of the demand forecast in 2009 because of the drastic increase in the number of passengers in 2008 despite the worldwide economic turmoil. In line with these revisions, the size of the international passenger terminal under this project expanded to three times as large as that of the original scope. In reality the number of airport passengers had rapidly risen as expected until the conflicts in the eastern region broke out at the end of 2013 (please refer to “3.3.1 Quantitative Effects (Operation and Effect Indicators)”). Furthermore, an analysis of the passenger handling capacity of 2014 shows that the number of passenger per hour at peak times, from 7 am to 8 am and from 8 pm to 9 pm, exceeded 3,000. These results lead to the conclusion that the further expansion of the terminal building floor and handling capacity is reasonably justified.

Besides the above, a lawsuit was filed against Aerosvit over the right to use the land for the planned terminal building. A decision in 2007 to construct the terminal building in another lot within the airport boundary resolved this issue.

Other modifications in the project scope were broadly made according to the further expansion of the terminal and the change in the construction site mentioned above. These modifications, which were mainly related to changes in equipment including the cancellation of unnecessary equipment and the additional procurement of some equipment, are thus

⁷ PHP = Peak Hour Passengers

considered to have been appropriate in securing the effectiveness of the project.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost was 45,206 million yen (including 19,092 million yen funded by the ODA Loan), which substantially exceeded the planned cost of 25,457 million yen (including 19,092 million yen from the ODA Loan), at 178% against planned. The cost overrun resulted from the aforementioned scope change. In modifying the project scope in 2007 and in 2009, JICA confirmed the expansion of the terminal building and apron, as well as the increase in equipment such as check-in counters and the improvement in the quality of facilities. Considering the effects of these modifications, JICA concurred the increases in project costs of 15,963 million yen in 2007 and about 4,100 million yen in 2009. The costs, which were conclusively estimated at the time of scope revision in 2009, were used as base costs for comparison with the actual costs (as shown in Table 5). The table shows that the actual costs were 99–103% against the newly estimated costs though there are some differences in the estimations depending on the payment currency, foreign or domestic, for the civil works. Assuming the payment was made in foreign currency, the actual total cost would be mostly as planned.

Table 5: Comparison of Planned (as of scope revision) and Actual Total Project Cost

	Unit: million yen	
	Plan	Actual (against plan)
Total project cost (civil works payment in foreign currencies)	45,503	45,206 (99%)
Total project cost (civil works payment in local currency)	43,920	45,206 (103%)

Source: Documents provided by JICA (for plan) and answers to the questionnaire (for actual)

3.2.2.2 Project Period

The project period planned at the time of the appraisal was 70 months, from March 2005 to December 2010. The actual project period was 105 months, or from March 2005 to November 2013, which was longer than the planned project period: equivalent to 150% of the original plan. In the same way as for the project cost (Table 6), when the impact of scope modification on the project period was being considered, a revised planned completion date was set for May 2012 which, at the time of the scope modification in 2007 had been decided on as a new target, coinciding with Ukraine's hosting of the UEFA European Championship in May 2012. The official project completion date is defined in the Loan Agreement as the date of issuance of the taking-over certificates. Though the new terminal building physically started operating in May 2012, SIAB finally received all of the taking-over certificates in November 2013 and therefore the project was delayed by 18 months (121% against the planned period).

Table 6: Comparison of Planned (as of the scope revision) and Actual Project Period

	Plan	Actual (against plan)
Loan Agreement Signing Date	March 2005	March 2005
Completion Date	May 2012	November 2013
Project Period	87 months	105 months (121%)

Source: Answers to the questionnaire for the ex-post evaluation

The following factors may have impacted on the delay in the project implementation.

- 1) Time taken for the legal conflict with Aerosvit over the right to use the land for the terminal building to be resolved (resolution in March 2007).
- 2) Unexpected issues including the required government approval of the Basic Design of the terminal building. SAPROF had not fully recognized that more time than estimated would be needed to deal with this.
- 3) Two demand forecast revisions were conducted during implementation. In addition, the forecast revisions were made not by the project-recruited consultant team but by a different team which had initially prepared the master plan for the airport development. This split caused difficulty in communications between the two teams and finally led to the delay in implementation through an inefficient process of modifying the terminal design as required.
- 4) It was difficult for the contractor to execute the required works on schedule due to the design changes for the terminal building.

3.2.3 Results of Calculations of Internal Rates of Return (Reference only)

(1) Financial Internal Rate of Return (FIRR)

The result of the recalculation of FIRR for this project at the time of the ex-post evaluation was 26%, which was higher than the original FIRR of 5.4% at the time of the appraisal. The main reason for this was that the assumption for the calculation had changed. Although at the appraisal the new terminal building was originally planned to be used exclusively for international flights, the terminal was reasonably assumed to serve both international and domestic passengers since the domestic services provided at the other terminal moved to the terminal constructed under the project from November 24, 2014 in order that the airport might be more efficiently operated. The FIRR calculation at the appraisal was based upon the preconditions below:

<Preconditions of FIRR calculation at the appraisal>

- Cost: Project cost, operation and maintenance cost
- Revenue: Airport related revenues (landing fees, passenger service charges, parking charges etc.); non-airport related revenues (tenant fees etc.)
- Project life: 40 years

(2) Economic Internal Rate of Return (EIRR)

The EIRR for this project at the time of appraisal was 12.9%. Due to the fact that data needed for a quantitative analysis was not available, an analysis for EIRR was not possible. The EIRR calculation at the appraisal was based upon the preconditions below:

<Preconditions of EIRR calculation at the appraisal>

- Cost: Project cost, operation and maintenance cost
- Benefit: Additional tourism income through increases in foreign visitors, airport related revenues (landing fees, passenger service charges, parking charges etc.); non-airport related revenues (tenant fees etc.)
- Project life: 40 years

In light of the above, although the project cost was within the plan, the project period exceeded the plan. Therefore, the efficiency of the project is fair.

3.3 Effectiveness⁸ (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

Operation and effect indicators were set as follows at the time of the appraisal for the project: (i) annual international passengers; (ii) peak-month international passengers; (iii) peak-day international passengers; (iv) annual international aircraft movement; (v) peak-month international aircraft movement; (vi) peak-day international aircraft movement; (vii) annual tourist arrivals; (viii) annual business visitors. Though the target year to achieve the indicators was five (5) years after project completion, the ex-post evaluation was carried out only one (1) year after completion; thus the evaluation also included comparisons of the estimated demand forecasts of SAPROF with actual figures. Moreover, indicators regarding tourists and business visitors should be handled as impact indicators because (i) the expansion of the terminal does not cause a rise in the number of these visitors and so should be evaluated by how efficiently it has accommodated the increasing number of passengers; and (ii) these indicators should be utilized to evaluate whether or not the economic activities of Ukraine are promoted through the expansion of foreign direct investment and tourism development. The indicators (i) through (vi) with their baseline values, targets, the SAPROF estimation, and actual figures are laid out in Table 7.

⁸ Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 7: Comparison of Operation and Effect Indicators (planned and actual)

	Baseline	Target		SAPROF Estimation	Actual			
	2003	2015		2010	2013		2014	
	Baseline year	5-years after completion		Completion year	Completion year		1-year after completion	
Indicators	Total	Total	Terminal D	Total	Total	Terminal D	Total	Terminal D
International passengers								
Annual	2,105,000	5,366,000	1,850,000	3,978,000	7,174,203	5,646,778	6,340,547	5,511,269
Peak-month	253,800	649,300	233,900	464,400	853,921	796,065	725,570	622,045
Peak-day	9,070	23,120	7,970	17,150	31,117	23,354	26,477	21,702
International aircraft movement								
Annual	33,182	48,229	15,842	39,292	35,099	27,596	32,084	29,782
Peak-month	3,207	4,659	1,530	2,148	3,604	3,437	3,130	2,850
Peak-day	133	194	64	158	139	110	117	85

Source: Documents provided by JICA and answers to the ex-post evaluation questionnaire.

Note: "Peak-month" means the busiest month. "Peak-day" is the second busiest day in the average week in the busiest month.

The figures for international passengers both in the year of project completion and one year after exceeded those estimated by SAPROF as well as those targeted by the operation and effect indicators. The number of annual international passengers for all terminals had increased for 10 years to 3.4 times higher than that of 2003. The 2012 UEFA European Championship from June 8 to July 1 2012 co-hosted by Poland and Ukraine and articles on Ukraine's tourist destinations in international magazines attracted more foreign visitors to Ukraine. Besides this, the number of Ukrainians going abroad also increased as Ukraine's economy grew. Consequently, more international passengers than expected used the airport.

Actual international aircraft movements for the terminal building D met estimated and targeted figures but those for all terminals did not. Aircraft currently using Boryspil State International Airport are much larger than those expected in SAPROF because the terminal design changed during implementation to accommodate the double-decker Airbus A-380 and then to provide access to other such larger airplanes through the boarding bridge before the 2012 UEFA European Championship. Thus aircraft movements did not satisfy the target even though the number of passengers exceeded its target.

3.3.2 Qualitative Effects (Other Effects)

The ex-post evaluation conducted beneficiary satisfaction surveys with users of the airport facilities (airlines and passengers) in order to comprehend to what extent the project facilities had satisfied users and improved services and security.

(1) Improvement of services for users of airport facilities

The survey with the airlines (Table 8) showed that about half of the respondents evaluated current services in the new terminal positively to be “very good” or “good”. Only one airline company out of 13 judged the facility services as “bad”. Satisfactory points were: cleanliness, easy access to information (easy access to flight information screens, information desks etc.) and the short time required for check-in. Unsatisfactory aspects were: no availability of drug stores and limited numbers of available cafes.

Table 8: Evaluation of airport services by airlines

Answer	Respondents
Very good	2
Good	5
Neutral	5
Bad	1
Very bad	0
Don't know / no answer	0

Source: Beneficiary survey to airlines

The other beneficiary survey with passengers (Table 9) indicated that passengers rated the terminal facilities themselves as broadly satisfactory, but gave some negative assessments on the availability of shops and services (the aforementioned drug stores and cafes) and on passenger flow in departure and arrival (time-consuming procedures required for security checks and immigration)⁹.

Table 9: Passengers' satisfaction with airport facilities

	Very satisfied/ Very good	Satisfied/ good	fair	Unsatisfied/ Not good	Very unsatisfied/ Very bad	Don't know/ No comment
General impression of terminal D	4	22	8	6	5	0
Terminal's cleanliness	17	17	5	3	2	0
Reasonability of departure passenger flow	3	10	21	9	2	0
Ease of access to information	13	15	14	2	1	0
Availability of shops and services	2	15	20	6	2	0
Quality of shops and services	1	14	26	4	0	0
Availability of toilets	12	15	9	6	2	0
Elevators, escalators, moving sidewalks	9	22	8	4	1	0
Comfort of the boarding lounges	12	20	12	0	1	0
Facilities for the disabled and passengers who need special care	1	22	11	2	0	9
Availability of telephones, Wi-Fi internet	10	15	15	3	0	2
Reasonability of arrival passenger flow	1	16	14	11	2	0
Convenience of the baggage claim	5	21	16	2	0	1
Convenience of transport services	9	13	19	1	2	1

Source: Beneficiary survey to passengers

⁹ As SIAB has only limited involvement in security checks and immigration (where the Ukrainian military takes strict control) it may be difficult for SIAB to improve these two operations.

74% (29 out of 39 respondents) of those passengers who had used the old passenger terminal responded to a terminal-building-comparison question that the new terminal building facilities were better than those of the old ones (Table 10).

Table 10: Comparison with the old international passenger terminal building

	Much better	Better	Unchanged	Worse	Much worse	No answer
Airport facilities	9	20	6	3	1	0

Source: Beneficiary survey to passengers

At the time of the ex-post evaluation (November 2014) several new duty-free shops were soon to be opened near gate lounges. SIAB explained that a drug store would soon also be located in the terminal as SIAB had applied to the State Property Fund for the necessary permission.

(2) Improvement of airport security

Responses from the airlines to a question about airport security and security systems are summarized in Table 11.

The responses showed that the airline companies gave positive ratings and no negative ones. The introduction of modern, good-quality equipment, in particular the luggage inspection system and the security gate system, was highly appreciated.

Table 11: Evaluation of airport security by airlines

Answers	Respondents
Very good	5
Good	6
Neutral	1
Bad	0
Very bad	0
Don't know / no answer	1

Source : Beneficiary survey to airlines

As seen before, the targeted operation and effective indicators were broadly achieved and the beneficiary satisfaction survey showed positive results; therefore, the effectiveness of the project is high.

3.4 Impacts

3.4.1 Intended Impacts

(1) Impacts on tourism

The number of Ukrainians going abroad and the number of foreigners visiting Ukraine both generally increased except for a drop in the period around year 2008 due to the financial crisis (Table 12). The number of foreign visitors rose to more than 24 million in 2013 from only 6 million in 2000. However, the impacts of the project on tourism cannot be evaluated since the rising number of tourists is due to multiple reasons and is not just as a result of the project. Even so, the international passenger terminal developed by this project sufficiently

accommodates the increasing number of tourists thanks to the expansion of the terminal; thus the project is considered to have bolstered Ukraine's economic activities through tourism development.

Table 12: Change in number of tourists

	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013
Ukrainian citizens having travelled abroad	13,422	16,454	16,875	17,335	15,499	15,334	17,180	19,773	21,433	23,761
Foreigners having visited Ukraine	6,431	17,631	18,936	23,122	25,449	20,798	21,203	21,415	23,013	24,671

Unit: thousand

Source: Statistic Annual Journal of Ukraine, 2013. State Statistic Service of Ukraine

(2) Impacts on foreign direct investments and business visitors

Ukraine has steadily attracted foreign direct investments (FDI) since project commencement. However, the impacts of the project on FDI cannot be evaluated as the steady rise in FDI affects is not only as a result of the project but is due to multiple reasons.

Table 13: Cumulative Amount of FDI to Ukraine

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
6.79	9.05	16.89	21.61	29.54	35.72	40.05	44.81	50.33	55.30

Unit: million USD

Source: Statistic Annual Journal of Ukraine, 2013. State Statistic Service of Ukraine

Due to the fact that statistics on annual business visitors are not available, an analysis for the evaluation of the impact was not possible.

3.4.2 Other Impacts

(1) Impacts on the Natural Environment

An Environment Impact Assessment (EIA) was prepared in the Basic Design and then approved by the Ministry of the Environment of Ukraine. An Environment Management and Monitoring Program was also prepared as a part of the Basic Design and then incorporated into the tender documents. The environmental monitoring system for this project is summarized as follows.

<Environment Monitoring System>

Air pollution: Monitoring once a year for the following items: particulate matter (PM), acetone, butyl acetate, xylol, toluol, ethyl acetate, and ethoxyethanol

Noise: No monitoring conducted as no housing areas are located near the airport

Waste and discharge water: Treated in the existing treatment facilities. The project did not include a water treatment facility in the scope.

The contractor had carried out an adequate Environment Management and Monitoring Program under the supervision of the consultants; thus no major issues are observed.

(2) Land Acquisition and Resettlement

The project site is located within the existing airport boundary and so no land acquisition and resettlement was required for the project. However, since a lawsuit with Aerosvit was filed over the right to use the land for the planned passenger terminal building, the terminal building could not be constructed at the planned lot but was constructed at another lot on the airport property.

This project has largely achieved its objectives. Therefore the effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

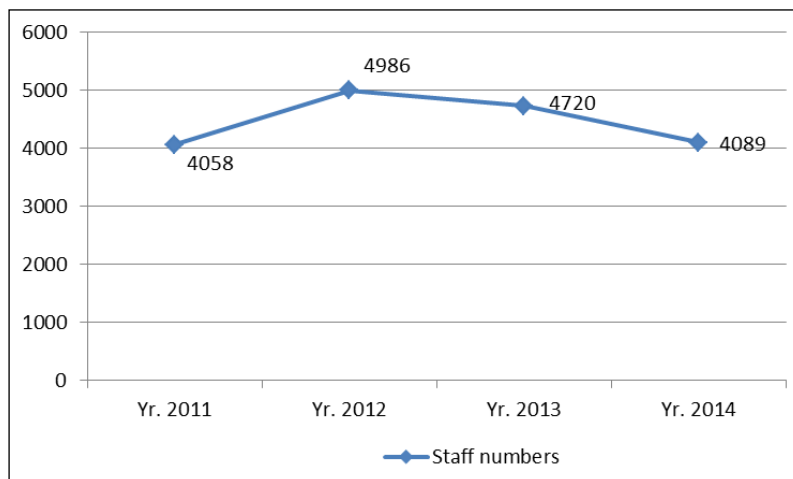
The operation and maintenance agency of the project is State International Airport Boryspil (SIAB). As of December 2014, there were 4,089 employees in total at SIAB, 2,007 of whom were in charge of the operation and maintenance of Terminal D. These belong to the Group for Building Operation and Maintenance Supervision Terminal D, comprising of a Chief Mechanic of the Airport Department, an IT Department, a Ground Handling Department, a Passenger Service Department, a VIP and Business Passenger Service Department and some others. These departments each take responsibility for assigned facilities and provide services appropriate to boarding class.

Table 14: Staff and Departments for the Operation and Maintenance of Terminal D

Unit/Department	No. of Staff	
	Total	Number of Engineers
Group for Building Operation and Maintenance Supervision	3	2
Chief Mechanic of the Airport Department	243	36
Chief Power Engineer of the Airport Department	219	27
Economic Provision Department	332	2
IT Department	144	112
Ground Handling Department	484	3
Passenger Service Department	218	10
VIP and Business Passenger Service Department	104	0
Aerodrome Department	184	7
Radio and Lighting System Support Department	76	35
Ground total	2,007	234

Source: SIAB

SIAB explained that a sufficient number of staff members are deployed in each department with the adequate knowledge and skills required for operation and maintenance (Table 14). At the time of the appraisal, it was planned that an additional 800 workers would be recruited for the operation and maintenance of Terminal D. The further expansion of the terminal then meant about 900 new staff members with an additional 100 staff members to be actually employed in time for the opening of Terminal D in 2012. The decision in December 2014 to concentrate all flight services, including domestic ones, on Terminal D, however, meant that some employees were made redundant in personnel cuts (Figure 1). SIAB has no concerns about the negative impacts of the personnel reductions on the operation and the maintenance of the facilities developed under the project due to the fact that the facilities currently working in terminals other than Terminal D are rather limited.



Source: Answers to the questionnaire for the ex-post evaluation

Figure 1: Changes in staff numbers in SIAB

3.5.2 Technical Aspects of Operation and Maintenance

SIAB provides various kinds of staff training including that on operation and maintenance in line with an annual human development plan. In addition to this existing training, it was planned that particular training on the operation and maintenance of advanced facilities, such as the security system introduced by this project, would be given during implementation. The training was provided in accordance with the modifications of the project plan, and continued even after the completion of the project. In total, 86 employees have received training on the sophisticated equipment procured under the project since 2012. SIAB confirmed that training contributes not only to strengthening the capacity for operation and maintenance but also to reducing accidents, even slight ones, through staff skill development. All necessary manuals for each facility are made available.

No major problems have been observed in technical aspects of operation and maintenance and there are necessary manuals for each facility.

3.5.3 Financial Aspects of Operation and Maintenance

Table 15 shows the profit and loss statement for SIAB and the annual cost of operation and maintenance from 2010 to 2013. As the number of passengers grew, the net income from the sales of products and services increased accordingly. In 2013 SIAB suffered from deteriorating profits due to the bankruptcy of Aerosvit which had had the largest number of flights at the airport. Except for this isolated case, the underlying revenue structures (the net income from sales of products and services) and expenditure (the cost of products sold) are relatively stable and thus the revenue from Boryspil Airport is a major financial source for SIAB. The net profit to sales has also continued to be high at the 27% to 41% level. Administrative expenses are relatively low; thus it can be considered that SIAB runs the airport efficiently. Since repayment of the Japanese ODA Loan for the project and commercial bank loans has started, the financial costs have been increasing since 2012. During this time, SIAB still enjoyed a net profit in surplus; thus it seems unlikely that the repayments have put pressure on the operation. Although the operation and maintenance costs have been increasing since the commencement of the operation of Terminal D, they account for just a small portion of expenditure as a whole and SIAB have ensured the necessary operation and maintenance costs even in 2013 when revenues declined. Therefore, no major problems have been found in the financial aspects between 2010 and 2013.

Table 15: SIAB profit and loss statement and the annual cost of operation and maintenance (2010-2013)

Unit: million UAH

	2010	2011	2012	2013
Net income from sales of products and services	1,191,691	1,416,004	1,510,549	1,384,761
Cost of products sold	570,523	651,630	841,732	908,943
Gross profit/ loss	621,168	764,374	668,817	475,818
Administrative expenses	37,939	47,583	77,102	61,321
Other operating revenues	421,132	316,861	57,777	121,298
Other operating costs	396,326	284,779	43,188	89,370
Sales costs	1,472	1,732	2,123	3,399
Operating profit / loss	606,563	747,141	604,181	443,026
Financial costs	41,921	6,066	178,131	327,726
Other financial revenues	3,063	11,875	35,243	32,395
Other revenues (costs)	1,418	39,832	72,922	25,184
Profit before tax	569,123	792,782	534,215	172,879
Profit tax	195,381	206,401	131,739	46,346
Net profit (loss)	373,742	586,381	402,476	126,533
Expenditure for O&M	38.6	59.1	88.2	99.7
Of which, Terminal D	—	—	16.1	58.9
Net profit to sales (%)	31	41	27	9

Source: SIAB

Although the conflicts of 2014 possibly had some negative impacts on the number of passengers, the actual number for that year exceeded that forecasted in SAPROF. The number of passengers is now more than that of the demand forecast and therefore the current financial status is manageable in line with expectations. In addition, a close look at the breakdown of airport passengers (Table 16) makes it clear that there has been more of a negative influence on domestic passengers than on international ones as domestic flights to the Crimean Peninsula and the eastern region are currently not in operation. On the other hand, the ratio of international passengers to domestic passengers in 2012 was 7 to 1. As less passengers have used domestic flights, the impacts of the conflict on the financial status of SIAB are considered to have been rather limited. Furthermore, SIAB have made efforts towards greater management efficiency such as the concentration of all international and domestic flights on Terminal D in order to minimize the negative impact of a decrease in domestic passengers. Thus, at the time of the ex-post evaluation, SIAB seemed to have no major problems in the financial aspects.

Table 16: Breakdown of Boryspil Airport passengers

	2010	2011	2012	2013	2014
International	5,761	6,947	7,432	7,174	6,341
Domestic	931	1,082	1,037	742	548
Transit	2	18	9	11	2
Total	6,694	8,047	8,478	7,927	6,891

Unit: thousand

Source: Answers to the questionnaire for the ex-post evaluation

3.5.4 Current Status of Operation and Maintenance

As pointed out in the previous beneficiary satisfaction surveys, the airport terminal is kept clean and without damage. Equipment procured under the project is currently well functioning without any trouble.

No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore the sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project aimed to meet the increasing passenger demand in Boryspil State International Airport and then to improve services for airport users by constructing a passenger terminal building and other related facilities. The objective of this project was highly relevant to the development plan and development needs of Ukraine at the time of both the appraisal in 2004 and the ex-post evaluation, as well as to Japan's ODA policy at the time of the appraisal; therefore its relevance is high. The project scope was expanded in response to external factors

such as the drastic increase in passenger demand and a change in the land to be used for the planned terminal building. This expansion of the scope, however, was appropriate for the emergence of the project effects. Considering the modifications in the scope, the project cost was almost within the plan, although the project period exceeded the plan. Therefore, the efficiency of the project is fair. The targeted operation and effective indicators of this project had been broadly achieved and thus the project has largely achieved its objectives; therefore, the effectiveness and impact of the project are high. Although the conflicts in the eastern region, as of the time of the ex-post evaluation, seem to have had limited negative impacts on project sustainability, no major problems were observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore the sustainability of the project effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

None.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

[Preparatory study in a country where a Japanese ODA project has been conducted for the first time]

This project was the first Japanese ODA project in Ukraine. Not only was the Executing Agency unfamiliar with JICA's ODA procedures, but JICA also was unfamiliar with Ukraine's laws and business practices. Nevertheless, the scope of the preparatory study for the Project was limited within general items such as the confirmation of development policies, development needs and technical matters. No study on procurement procedures and business practices nor a risk analysis were conducted. As a result, some issues such as the necessity for national approval of the basic design manifested themselves during project implementation and this delayed project progress, especially in the early stages of the project. In order to avoid this sort of problem, a more detailed study on laws and business practices including risk analysis than a preparation study for an ordinal project should be conducted at the preparatory stage in a country where a Japanese ODA project is being conducted for the first time.

[Scope of consulting services for construction supervision]

During project implementation, several changes in the design and the project scope were made which caused delay of the project. The changes were needed because 1) another parallel

project for terminal construction was aborted by a private company, 2) the candidate project site was changed, and 3) the number of passengers increased beyond the demand forecast of SAPROF. On the other hand, the Scope of Works for consulting services was limited to procurement support and construction supervision. The construction works actually began in 2008. As five years had already passed since the SAPROF study, the demand forecast was reviewed twice in this period. However, this review was carried out not by the consultant in charge of construction supervision under the project but by a third party consultant preparing for the development plan of the entire Boryspil Airport. Communication between these consultants was not smooth and this caused delays in the project. In order to avoid unnecessary delays, the Consultant should have reviewed the project scope in a timely way, while watching the progress of another parallel project. The design should then have been reviewed based on the proper demand forecasts and the usage of the other terminals in Boryspil Airport. For a future similar project, it is desirable that the whole development plan of Boryspil Airport and a review of the existing studies, including the demand forecast, should be included in the scope of the consulting services for construction supervision.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs	Civil Works: <ul style="list-style-type: none"> • International passenger terminal building: 3-stories, approx. 37,000 m² • Road and apron • Other related equipment Consulting Service: Total: 878 M/M	Civil Works: <ul style="list-style-type: none"> • International passenger terminal building: 3-stories, approx. 107,000 m² • Road and apron • Other related equipment Consulting Service: Total: 1,159.86 M/M
2. Project Period	March 2005 – December 2010 (70 months)	March 2005 – November 2013 (105 months)
3. Project Cost		
Amount paid in Foreign currency	11,459 million yen	28,260 million yen
Amount paid in Local currency	13,998 million yen	26,946 million yen
	(683 million UAH)	(2,209 million UAH)
Total	25,457 million yen	45,206 million yen
Japanese ODA loan portion	19,092 million yen	19,092 million yen
Exchange rate	1UAH = 20.5 yen (As of June 2004)	1UAH = 12.2 yen (As of April 2013)