Republic of Iraq

FY2022 Ex-post-Evaluation Report of Japanese ODA Loan Project

"Electricity Sector Reconstruction Project"

External Evaluator: Hajime Sonoda, Global Group 21 Japan, Inc.

0. Summary

The "Electricity Sector Reconstruction Project" (hereinafter referred to as "the Project") was implemented to stabilize the electricity supply in the Republic of Iraq (hereinafter referred to as "Iraq") through procurement and rehabilitation of substation facilities throughout Iraq, thereby contributing to the country's economic and social reconstruction. The Project is consistent with Iraq's development plans and needs at the time of planning and ex-post evaluation, and with Japan's development cooperation policy at the time of planning. Its relevance and coherence are high as there are linkages with JICA's several emergency grant projects, ODA loan projects, and training programs in electricity sector. The output exceeded the plan with the addition of the 400 kV substation near Baghdad, and the project cost considering this increase was within the plan. However, as the project period was much longer than planned, the efficiency of the Project is moderately low. Since the Project functions as a crucial part of the Iraqi power system's substation facilities, contributing to the upkeep and improvement of electricity services, it is considered that the objectives of the Project have been largely achieved. Prolonged power outages due to severe electricity shortages that had persisted in Iraq have shown improvement in recent years, and the Project is considered to have made a certain contribution to the stabilization of the lives of citizens and the revitalization of the economy and industry. Therefore, the effectiveness and impact of the Project is high. Although financial constraints have affected the maintenance of some of the substation facilities and equipment, the overall operation and maintenance of the substation facilities and equipment of the Project are good. There are no policy, institutional, organizational, or technical issues regarding the sustainability of the Project. Therefore, the sustainability of the effects of the Project is high. In light of the above, the Project is evaluated to be highly satisfactory.

1. Project Description

Project location (all of Iraq)
(Source: The World Fact Book, CIA)

Newly constructed substation
(suburb of Baghdad)[1]

1.1 Background

Iraq, whose economy and society had been severely damaged by years of economic sanctions and conflict, had been advancing national reconstruction with the support of the international community since the end of the Iraq War in 2003. At the Donor Conference in October 2003, the Government of Japan announced its support for emergency reconstruction, as well as for medium-term reconstruction through ODA loans.

In the electric power sector, the lack of new investment and maintenance over the years and the destruction caused by fighting and looting had significantly degraded the functions of power generation, transmission, transformation, and distribution, therefore, restoration of these functions was one of the most important issues for reconstruction of the country. At that time, the power supply to civilian life and to the basic infrastructure such as water supply, hospitals, etc. remained unstable, with power outages lasting more than 10 hours a day in most areas of Iraq. It was necessary to provide support not only for power generation facilities but also for the restoration of power transmission, substation, and distribution facilities. Japan has provided support for power generation through several emergency grant aid projects since 2004, and started human resource development for the Ministry of Electricity (hereinafter referred to as "MOE") in Iraq through training by JICA, and a loan agreement for the Project to support substations was signed in January 2008.

[1] All photographs in this report were taken by the external evaluator (either himself or a local assistant) during the field survey, unless otherwise noted.

1.2 Project Outline

The Project aims to stabilize the electricity supply in Iraq by procuring and rehabilitating substation facilities throughout Iraq, thereby contributing to the country's economic and social reconstruction.

Loan Approved Amount / Disbursed Amount	32,590 million / 31,839 million
Exchange of Notes Date / Loan Agreement Signing Date	April 2007 / January 2008
Terms and Conditions	Interest Rates: 0.75% (0.75% for consultants) Repayment: 40 years (Grace period: 10 years) Conditions for Procurement: General untied
Borrower / Executing Agency	Government of the Republic of Iraq / Ministry of Electricity (MOE)
Project Completion	September 2019
Target Area	All of Iraq
Main Contractor (Over 1 billion yen)	Toyota Tsusho (Japan), Alstom Grids SAS (France), Toyota Tsusho (Japan) / Meidensha (Japan), Siemens Sanayi ve Ticaret AS (Turkey), Siemens S.P.A (Italy) / Sumitomo Corporation (Japan)
Main Consultant (Over 100 million yen)	TEPCO Design (Japan)
Related Studies (Feasibility Studies, etc.)	None
Related Projects	<Emergency Grant Aid> "Mobile Substation Improvement Plan" (2004), "Taj Gas Turbine Power Station Emergency Rehabilitation Plan" (2004), "Mosul Gas Turbine Power Station Emergency Rehabilitation Plan" (2004), "Mosul Hydroelectric Power Station Emergency Rehabilitation Plan" (2004), "Samawah Large Power Plant Construction Plan" (2005) <ODA Loan Projects> "Al-Musayeb Thermal Power Plant Rehabilitation Project" (2008-), "Deralok Hydroelectric Power Plant Construction Project" (2009-), "Al-Akkaz Thermal Power Plant Construction Project" (2009-), "Haltha Power Plant Rehabilitation Project" (2015-), "Power Sector Reconstruction Project (Phase 2)" (2015-), "Power Sector Reconstruction Project (Phase 3)" (2017-), "Fiscal Reform Development Policy Loan (II)" (2017-)

2. Outline of the Evaluation Study

2.1 External Evaluator

Hajime Sonoda (Global Group 21 Japan, Inc.)

2.2 Duration of Evaluation Study

The following survey was conducted for this ex-post evaluation.

Study period: December 2022 - March 2024

Field survey: March 16 - 23, 2023

2.3 Constraints During the Evaluation Study

Due to the security situation in Iraq, the external evaluator made only one trip to Baghdad, and his visit was limited to MOE headquarters, the Baghdad Chamber of Commerce, and three substations in the Baghdad area. The local consultant visited five substations in and around Baghdad and Basrah to gather additional information. The substations visited accounted for less than 10% of the total number of substations and mobile substations covered by the Project. In addition, up-to-date operational data could be obtained for only one-third of the total number of transformers installed by the Project. Furthermore, it took a long time before the information available in the MOE was provided in response to the post-evaluation questionnaire, and the latest performance data for the operation and effectiveness indicators established for the Project was provided near the end of the study period. In this ex-post evaluation, the possible analysis was carried out under the above information constraints.

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

3.1 Relevance / Coherence (Rating: ③[3])

3.1.1 Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Iraq

At the time of planning of the Project (2006), Iraq's National Development Plan (2005-2007) set development goals for the electricity sector, such as reducing power outage and meeting electricity demand, and positioned improving power generation capacity and increasing transmission and transformation capacity as important development issues. MOE's "Electricity Sector Development Master Plan" (2006-2015) also showed the same recognition as above.

The Integrated National Energy Strategy, prepared by the Government of Iraq in 2012 with support from the World Bank, aims to (1) increase reliability, efficiency, and

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

[3] ④: Very High, ③: High, ②: Moderately Low, ①: Low

accountability of electricity service delivery; (2) reduce the financial burden on the energy sector; (3) promote private sector participation in power generation and distribution to bridge the gap between investment capital and implementation capacity (4) to improve the sector's management and performance and restructure the tariff system for a gradual transition toward full cost recovery. The following year, 2013, the Electricity Law (Decree No. 53) was enacted accordingly.

The National Development Plan (2018-2022) sets goals for the electricity sector to increase generation capacity, increase per capita electricity consumption, and improve the efficiency of the electricity system. At the time of the ex-post evaluation, the Iraqi government has been working to strengthen its electricity system, including the introduction of solar power, and importing electricity by connecting its power grid with Saudi Arabia, Kuwait, Jordan, Egypt, and other countries to compensate for electricity shortages.[4] In addition, Iraq relies on natural gas imports from Iran for much of its electricity, but imports are unstable due in part to U.S. economic sanctions, and to compensate for this, Iraq is trying to utilize associated gas obtained from oil fields.[5]

Based on the above, the Project is consistent with Iraq's development policy at the time of planning and post-evaluation.

3.1.1.2 Consistency with the Development Needs of Iraq

Much of Iraq's electricity infrastructure was destroyed during the 1991 Gulf War and the 2003 Iraq War. Iraq's power generation capacity fell from 9,300 MW before the Gulf War to 1,280 MW immediately after the Iraq War, and by June 2004, the capacity had been restored to 4,500 MW, the level before the Iraq War, through the subsequent rehabilitation works . However, the electricity infrastructure had deteriorated due to inadequate maintenance since the Gulf War, and the power transmission and distribution facilities were also failing one after another due to aging and overloading, requiring urgent repair and maintenance of the facilities. While peak demand for electricity reached 9,600 MW in 2006, power generation capacity was only 5,000 MW[6], resulting in power outages of more than 10 hours a day in most areas of the country, affecting the lives of citizens and basic infrastructure such as water supply and hospitals.

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[4] According to the following websites:
https://www.mees.com/2023/2/10/news-in-brief/kuwait-iraq-power-link-deal/d3ab4960-a953-11ed-9a37-bda361e062de
https://www.arabnews.com/node/2327481/business-economy
https://www.jordannews.jo/Section-109/News/Jordan-Iraq-electricity-connection-project-to-be-completed-by-end-of-2024-27395
https://energy-utilities.com/egypt-agrees-to-supply-700mw-of-electricity-to-news113054.html

[5] In June 2023, the government concluded a contract with the French oil company Total Energies for an oil, gas, and solar project, where the associated gas will be utilized.

[6] The total installed capacity was 11,120 MW, but more than half of it was inoperable due to aging and other factors.

Iraq's electricity shortage has not been resolved until the time of the ex-post evaluation, due to the rapid growth of electricity demand in Iraq and delays in power generation projects.[7] Peak demand reached 29,260 MW in 2020, but maximum electricity production that year remained at 19,365 MW, resulting in a supply shortfall of about 10,000 MW, equivalent to 34% of the peak demand. To compensate for this, citizens rely on expensive private diesel generation.[8] On the other hand, the Iraqi government is working to strengthen the electricity infrastructure through subsequent ODA loans and other donor projects, and power outage hours have been decreasing in recent years. While, as discussed in the effectiveness section, the substation facilities of the Project are fully utilized.

Based on the above, the Project is consistent with Iraq's development needs at the time of planning and ex-post evaluation.

3.1.1.3 Appropriateness of the Project Plan and Approach

As discussed under "Effectiveness and Impacts" and "Sustainability," the Project's substation facilities are generally in good operating condition and are utilized as an important part of the power system. While there has been improvement in the long power outages due to electricity shortages power services, no visible impact on economic and social recovery was confirmed, as there still persist an average of 4-5 hours of power outages per day nationwide as of 2023.

This is mainly due to external conditions, including an increase in electricity demand that exceeded expectations at the time[9], and delays in the power generation projects due to changes in the security situation and other factors caused by the invasion of "The Islamic State of Iraq and the Levant" (hereinafter referred to as "ISIL").[10] Such changes in external conditions were not necessarily foreseeable at the time of planning the Project.

The fact that the target sites of the Project were scattered across the country (see Figure 1) was another reason why it was difficult to see the specific effects and impact of the Project. Considering the security situation in Iraq, the targets of the Project were limited to

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[7] See Table 7 and the main text in "3.3.1 Effectiveness".

[8] Country Climate and Development Report (World Bank, November 2022)

[9] For example, Iraq's National Development Plan (2013-2017) projected a peak electricity demand of 19.8 GW in 2017, when in fact it reached 25.1 GW. The Electricity Sector Development Master Plan (2006-2015), which may have been referenced during the project planning, was not available for this ex-post evaluation.

[10] ISIL, a Sunni extremist organization based in Iraq and Syria, declared its allegiance to the supreme leader of al-Qaeda in October 2004 and began its activities as "al-Qaeda in Iraq". After the death of its leader, Zarqawi, in a cleanup operation conducted by U.S. forces and Iraqi security forces, its activities temporarily stalled, but it has revitalized its activities as the "Islamic State of Iraq" by integrating several Islamic extremist organizations, and in April 2013, it announced its expansion into Syria, where the conflict is intensifying, and renamed its organization as the "Islamic State of Iraq and the Levant (ISIL)." In June 2014, ISIL invaded northern Iraq and seized control of Mosul, Iraq's second largest city, and other northern cities, and on June 29, the establishment of the Islamic State (IS) was proclaimed with Abu Bakr al-Baghdadi, the self-proclaimed "caliph (leader of all Muslims)," as its leader. Iraq's Abadi government made progress in the ISIL sweep in late 2015 by opening up major cities in provinces overrun by ISIL, and in December 2017, it declared the entire country of Iraq open.

substations where safety measures could be easily taken during construction, and selected from substations scattered across the country with high urgency, which is why the targets were scattered throughout Iraq. This was unavoidable due to the background of the formation of the Project.

As described above, there are no serious problems with the project's planning, and it cannot be said that the absence of confirmed and visibly manifested impact undermines the Project's relevance.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

At the Donor Conference in October 2003, Japan announced a grant of $1.5 billion for Iraq's emergency reconstruction needs and up to $3.5 billion in ODA loans for medium-term reconstruction needs after 2005. "Support for peacebuilding" was a priority area in JICA's (then JBIC) Overseas Economic Cooperation Operations Implementation Policy (April 2005). The policy for assistance to the Middle East region targeted medium- to long-term assistance for social stability and the consolidation of peace in Iraq. Therefore, support for the reconstruction of Iraq's economic infrastructure was consistent with JICA's aid policy. Thus, the Project is consistent with Japan's development cooperation policy at the time of planning.

3.1.2.2 Internal Coherence

In the Iraqi electricity sector, five emergency grant aid projects were implemented for the electricity system operated by MOE from 2004 until the start of the Project. After the Project, six ODA loan projects were implemented. Eight of these projects provided assistance for power generation, while the other three, including the Project, focused on substations.[11] Since the power system is electrically operated as an integrated unit, the Project was planned as part of MOE's overall plan, assuming that the preceding emergency grant aid projects would be implemented. Similarly, the projects after the Project were also planned on the assumption that the Project would be implemented as part of the overall plan of MOE. Therefore, the 12 projects, including the Project, are considered to be electrically operated in unison, and synergistic effects are considered to have emerged.

Since 2004, JICA has provided training for Iraq in a variety of fields; JICA records show that in the electricity sector, 270 trainees received training for an average of about one month over the 15-year period from 2004-2018. The number of trainees by theme is shown

[11] For concrete related projects, see the table (Related Projects) in "1.2 Project Outline." In the Kurdish Autonomous Region of Iraq, an electricity system other than MOE system is in operation, and JICA implemented the "Kurdish Regional Electricity Sector Reconstruction Project" (2008), an ODA loan to support this system.

in Table 1. In the transmission sub-sector, which operates substation facilities, 47 MOE officials also participated in training. According to MOE, these trainings have contributed to the planning and implementation of MOE's investment projects, including the Project, as well as their operation and maintenance.

Table 1: JICA Training in the Iraqi Electricity Sector
(2004-2018)

Training Topics	Number of Trainees
Thermal power generation	57
Hydroelectric power generation	23
Solar power generation	23
Electric supply (of which mobile substation equipment)	47 (18)
Distribution of electricity	20
Other (training management, etc.)	100
Total	270

Source: Materials provided by JICA

In addition, JICA is helping to promote energy efficiency improvements through the Fiscal Reform Development Policy Loan (II) (from 2017), a development policy loan co-financed with the World Bank, through the use of associated gas and enhanced tariff collection.

3.1.2.3 External Coherence

After the Iraq War, the United States, the United Nations Development Programme (UNDP), the United Kingdom's Department for International Development (DFID) and others provided assistance to the Iraqi electricity sector for reconstruction. JICA (then JBIC) conducted a three-year study of the Iraqi electricity sector, and in the course of that study, and in coordination with other donors, the Project was prepared. Since the electricity system is operated in an integrated manner, synergistic effects between the Project and other donor projects are considered to have emerged, but specific cases could not be confirmed.

Thus, the Project is consistent with Iraq's development plans and needs at both the planning and ex-post evaluation stages, as well as with Japan's development cooperation policy at the time of planning. Coordination and collaboration with other Japanese projects and other donor projects were also observed. Based on the above, the appropriateness and consistency of the Project are high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The procurement of materials and equipment for substation and distribution of electricity and the construction of facilities under the Project were carried out in a total of six contract lots at project sites throughout Iraq. The planned and implemented outputs are shown in Table 2.

Table 2: Planned and Actual Outputs

Planned Outputs	Actual Outputs	Contract Lot
Rehabilitation of 132 kV mobile substation (approx. 8 transformers, 16 circuit breakers, 8 grounding transformers, etc.)	Rehabilitation of 132 kV mobile substation (8 transformers, 25 circuit breakers, 13 grounding transformers, others)	Lot 1
Procurement of new 132 kV mobile substation equipment (approx. 24 units)	Procurement of new 132 kV mobile substation equipment (28 units)	
Procurement of transformer (approx. 15 units)	Procurement of transformer (15 units)	Lot 2
New 132 kV substation (approx. 2 substations)	New 132 kV substation (2 substations)	Lot 3
Rehabilitation of 33 / 11 kV substation for distribution (approx. 18 locations)	Rehabilitation of 33 / 11 kV substation for distribution (Lot 4 total 25 locations)	Lot 4
Expansion of 33 / 11 kV substation for distribution (approx. 6 locations)	Expansion of 33 / 11 kV substation for distribution (Lot 4 total 25 locations)	
Procurement of new 33 / 11 kV mobile substation equipment (approx. 4 units)	Procurement of new 33 / 11 kV mobile substation equipment (8 units)	Lot 5
(No plan)	Construction of 400 kV substation (1 substation)	Lot 6
Consulting Services Business plan preparation support, procurement support, construction management, training, etc.	Consulting Services (As planned)	

Source: Prepared by materials provided by JICA and MOE

Considering the unstable situation in Iraq, the Project was implemented as a sector loan consisting of multiple sub-projects to allow for flexible changes in the scope after the start of the Project. The specific scope of the Project was determined after MOE prepared an

Implementation Plan for each project site and obtained JICA's consent. The major changes from the plan at the time of the appraisal are as follows.

- After the contracts for Lot 1 through Lot 5 were concluded, Lot 6, a 400 kV substation to be built near Baghdad, was added at the proposal of MOE to use surplus funds generated by the reduction of project costs resulting from price competition. However, subsequent fluctuations in the exchange rate resulted in a shortage of ODA loan funds, and the shortage was paid for with Iraqi funds.
- In 2014, ISIL invaded northern and western Iraq and was unable to continue construction at five of the 33 / 11 kV distribution substation rehabilitation (Lot 4) sites in northern Iraq, so the target substations were changed to another five sites near Baghdad. Subsequently, mobile substation facilities procured in Lot 5 were installed in three of the five northern locations as security improved.

The Project included training of MOE staff by consultants and contractors. According to MOE, this training was highly advanced, dealing with the latest technology of the time, and was an important output that contributed to raising MOE's technical standards. The consultants conducted training mainly in Jordan (Amman) on finance and auditing (74 participants) and project management (85 participants). Contractors provided training in assembly, operation and maintenance, and repair of facilities and equipment at their home factories in Korea, Sweden, and Turkey. In total 60 participants took part in the contractor training.

Newly constructed 400 kV substation (near Baghdad)

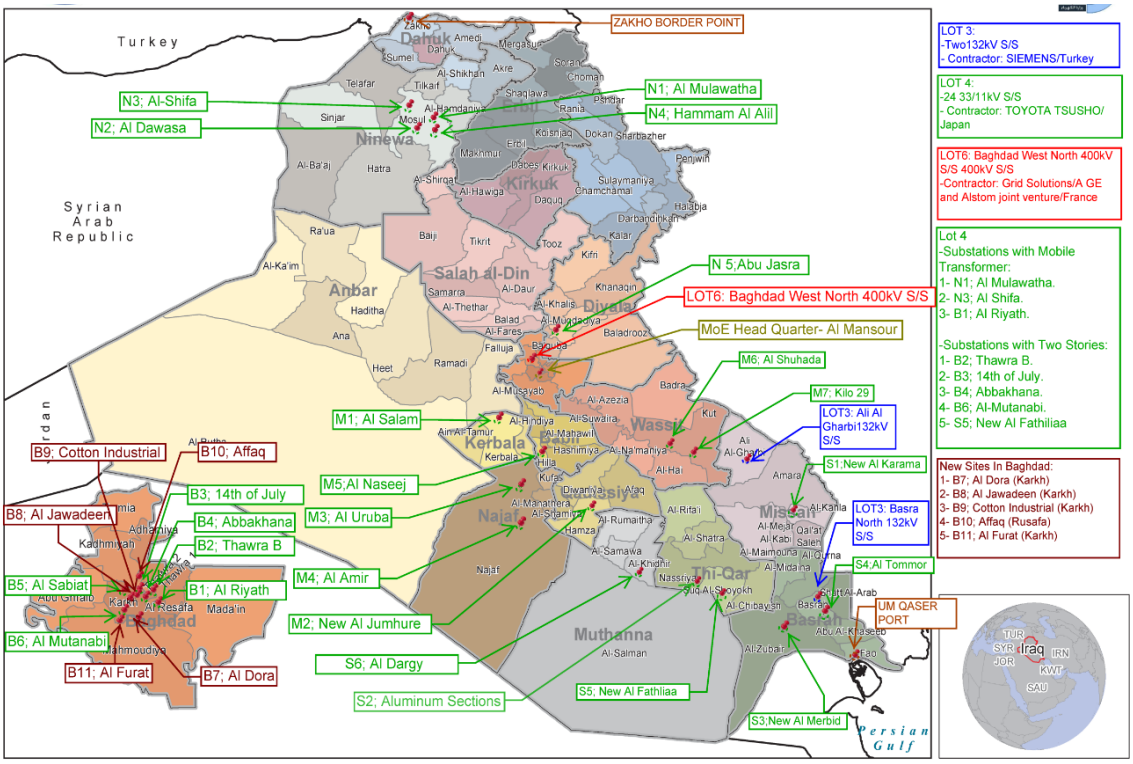

Newly constructed 400 kV substation

(near Baghdad; left: control unit under inspection; right: control room display)


Newly constructed 33 kV substation (in Baghdad, left: transformer, right: control unit)

Mobile substation

Spare parts provided by the Project



Source: Materials provided by MOE

Note: Blue letters indicate locations of new substations by Lot 3, green letters indicate rehabilitated and expanded substations by Lot 4, and red letters indicate locations of new 400 kV substations by Lot 6. However, four new substations in the north (N1-4) and one substation north of Baghdad (N5) were cancelled due to the ISIL invasion, and five new substations near Baghdad (brown letters: B 7-11) were added.

Figure 1: Locations of substations targeted for rehabilitation, expansion, and new construction

<Implementation system according to the security situation in Iraq[12]>

The consultant for the Project (a Japanese firm) set up an office in Amman, Jordan, and Japanese engineers did not enter Iraq, but used Jordanian and Iraqi consultants who had received training beforehand. MOE executives and engineers were invited to Amman on a regular basis for project supervision and problem-solving. At the time of the ISIL invasion, the route for bringing in equipment from Europe was no longer available, so the alternative route was used to bring it in from Basra in the south. Partial replacement of the target substation was also necessary. As the contractors had to shorten the period they were on site, they conducted quality control by carefully preparing before entering the site.

JICA's Japanese staff of Iraq Office had been working for project administration in

[12] Based on interviews with JICA Iraq Office Director (at the time), consultants (Japanese engineers), MOE, etc.

Iraq for a certain period of time and then leaving the country for a while, with the Iraqi staff, and the United Nations Development Programme (UNDP) with whom JICA had concluded a contract of services. However, in June 2014, when the ISIL invasion began, the Japanese staff evacuated Baghdad for about a year until April 2015, and continued project administration using a decentralized system from safe locations. They supported the implementation of the project, together with consultants, by discussing with MOE and contractors in Amman and Istanbul regarding alternative routes for materials and equipment transportation, alternative substations, and other issues.

In MOE, the deputy minister was the project manager for the Project, and the various decisions required due to changes in the security situation were made quickly at the ministerial and deputy ministerial levels, which led to quick problem solving through flexible responses.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total planned cost for the Project was 43,948 million yen (including 32,590 million yen in the ODA loan), and all costs for procurement of materials and equipment, excluding taxes on consulting services, were to be covered by the ODA loan. Although the actual cost of some items on the Iraqi side are not known, the total project cost excluding the unknown portion was 39,653 million yen (Table 3). This was 122% of the total planned project cost of 32,590 million yen for the relevant portions (procurement of materials and equipment, price escalation, contingency, consulting services, and others), or approximately 7.1 billion yen more than the planned amount. Since the excess project cost of approximately 7.1 billion yen is less than the actual project cost of approximately 8.3 billion yen for the added substation construction (Lot 6), it is judged that the actual project cost was within the planned amount, considering that the output of the Project increased from the original plan.

The addition of the substation construction (Lot 6) using surplus funds from the ODA loan expected at the exchange rate at the time, and the subsequent increase in the contract amount in foreign currency due to exchange rate fluctuations, led to the increase in project cost. When MOE proposed the addition of the substation construction (Lot 6) in September 2011, the estimated contract amount of Lot 6 was approximately 7.6 billion yen, of which approximately 6.3 billion yen was to be funded by the ODA loan and approximately 1.3 billion yen was to be funded by the Iraqi side. This plan was based on an estimate assuming a ±10% change in the exchange rate from the rate at the time, but in reality the exchange rate fluctuated much more than expected, resulting in an increase in the foreign currency

portion of the project cost.[13] As a result of the above, approximately 90% of the total amount of Lot 6, equivalent to approximately 7.9 billion yen, was ultimately borne by Iraqi funds. In addition, approximately 30% of the contract amount for procurement of materials and equipment for the Project was denominated in yen, and the rest in euros or dollars, which was similarly affected by the exchange rate fluctuation.

Table 3: Planned and Actual Project Costs

(Millions of yen)

	Plan			Actual		
	Total	ODA Loan	Iraqi Fund	Total	ODA Loan	Iraqi Fund
Procurement of materials and equipment	22,549	22,549	0	34,202	26,346	7,856
Price escalation	2,159	2,159	0	-	-	-
Contingency	4,942	4,942	0	-	-	-
Consulting Services	2,394	2,394	0	4,655	4,665	0
Administration	5,091	0	5,091	unknown	0	unknown
Land acquisition	4,434	0	4,434	unknown	0	unknown
Tax	1,833	0	1,833	unknown	0	unknown
Others*	546	546	0	796	796	0
Total	43,948	32,590	11,358	39,653**	31,807**	7,856**

Source: Prepared by materials provided by JICA and MOE
Notes: * Interest during construction, service charge
** Total amount excluding unknown portions
Exchange rate
Plan: $1 = 112 yen
Actual: $1 = 107.8 yen, 1 euro = 117.8 yen (average of JICA official rates from 2010 to 2019)

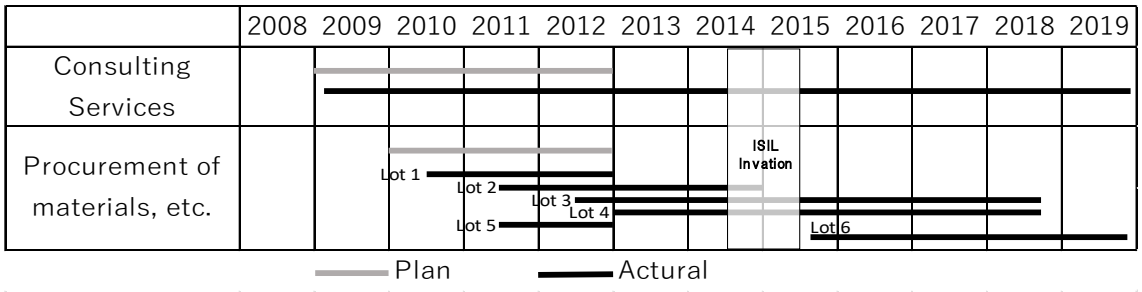
3.2.2.2 Project Period

The project was planned to be implemented over 58 months (4 years and 10 months) from the signing of the loan agreement in January 2008 to the completion of materials and equipment procurement in February 2012. In fact, the loan agreement was signed in January 2008 as planned, and the last contracted substation construction (Lot 6) was completed in September 2019, with the project duration of 141 months (243% of the plan) (see Figure 2). Even after subtracting the impact of the ISIL invasion (about 11 months) and the delay due to the addition of Lot 6 (about 5 months)[14], the actual project period was 125 months (216%

[13] Estimates were made assuming a 10% increase in the 2011 JICA cumulated rate of 85.75 yen to the dollar and 114.36 yen to the euro, but in April 2019 the rates were 110.42 yen to the dollar and 124.41 yen to the euro.
[14] Excluding the approximately 11 months in which contract execution was postponed due to the ISIL invasion from the approximately 16 months from the end of Lot 3 and 4 to the end of Lot 6, the net delay due to Lot 6 is considered to be approximately 5 months.

of the plan), which significantly exceeded the plan.[15]

Figure 2: Planned and Actual Project Period



Lot 1 and Lot 5, which procured mobile substations, were generally completed as planned, but other contract lots experienced delays due to the following reasons.

- In Lot 2, some equipment was resent from a factory outside of Japan due to damages during transportation and discrepancies with the contract specifications for the equipment.
- Lot 3 required time for MOE approval of the contractor's design drawings. In addition, implementation was interrupted by force majeure due to the ISIL invasion (June 2014 - April 2015) and it was necessary to change the route of equipment delivery from Europe to the southbound route.
- Lot 4 required time for field work (survey) and design work by the contractor. In addition, implementation was suspended due to force majeure caused by the ISIL invasion, and some of the sub-project sites and equipment transportation routes were changed.
- Lot 6 was contracted waiting the ISIL invasion to subside. Government finances deteriorated in 2016 on the back of falling oil prices and increasing security costs, and construction was temporarily suspended due to MOE's lack of funds. An armed assault on the site occurred in February 2016. In 2017, foundation construction according to geology required time for technical studies.

The implementation system for the Project took into account the security situation in Iraq, but in the event of the ISIL invasion, MOE and other related parties communicated closely with each other under various constraints, and quickly decided to change the sub-project sites and the equipment transportation route to ensure smooth implementation (for

[15] Since the period to final disbursement for the Project was set at 10 years, taking into account the unstable national situation in Iraq, no extension of the final disbursement date was necessary.

details, see "5.1 Objective Perspective").

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

At the time of planning, the internal rate of return of the project was supposed to be calculated as much as possible after the signing of the loan agreement, but it was not actually calculated. At the time of the ex-post evaluation, it was determined that the calculation could not be executed due to the unavailability of essential information required for the process.

Thus, the output exceeded the plan, and the project cost, taking into account the increased output, was within the plan, while the project period was much longer than planned. Based on the above, the efficiency of the Project is moderately low.

3.3 Effectiveness and Impacts[16] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The indicators set for the Project were "availability factor[17]" and "annual outage hours per customer".[18] As shown below, the achievement of these indicators is high.

(1) Availability Factor

The availability factor is an indicator used to evaluate whether the facility is being operated properly, and the goal is to stay within certain operational limits. In order to ensure a stable power supply, MOE normally sets a target of the availability factor at 80% or less[19].

In 2019, the year of the Project's completion, targets were achieved for the Project as a whole (Table 4). Availability factor exceeded the target for Lots 1 and 2. According to MOE, this is because the increase in substation capacity did not keep pace with the rapid increase in electricity demand in those areas, which may had overloaded the facilities of the Project. Subsequently, the overloading of Lots 1 and 2 was eliminated in 2023, and the load is now balanced throughout. It is presumed that the situation has improved due to MOE's systematic and continuous efforts in constructing and expanding substations to prevent overloading.

[16] Sub-rating for Effectiveness is to be put with consideration of Impacts.
[17] Availability Factor = Maximum load (MW) / {Rated capacity of the facility (MVA) x power factor}
[18] The indicators are for transformers newly procured and installed by the Project, and no standard values were set.
[19] Although the project completion report presents 2019 targets by contract lot (34%-88%), considering that the basis for these targets is unclear, this ex-post evaluation judged the achievement status based on the MOE's general target (80%).

Table 4: Targets and Results of Availability Factor

Output	Availability Factor (%)		
	Target (upper limit)	Results (Year of completion) 2019	Results (3 years after completion) 2023
Lot 1 132 kV mobile substations	80	88	70
Lot 2 400 / 132 kV transformer procurement	80	89	69
Lot 3 Construction of 132 kV substations	80	25	72
Lot 4 Rehabilitation/expansion of 33 kV substation	80	42	71
Lot 5 33 kV mobile substations	80	80	65
Lot 6 Construction of a 400 kV substation	80	20	66
Entire Project	80	61	68

Source: 2019 results are based on Project Completion Report (MOE) and 2023 results are based on materials provided by MOE.
Note: Shaded figures are actual results where targets were not achieved.

Table 5: Targets and Results of Annual Outage Hours

Output	Annual Power Outage Hours per Consumer (hr)		
	Target (upper limit)	Results (Year of completion) 2019	Results (3 years after completion) 2023
Lot 1 132 kV mobile substations	1,357	423	561
Lot 2 400 / 132 kV transformer procurement	804	955	1,544
Lot 3 Construction of 132 kV substations	1,316	734	784
Lot 4 Rehabilitation/expansion of 33 kV substation	5,788	6,732	1,544
Lot 5 33 kV mobile substations	5,364	6,984	1,604
Lot 6 Construction of a 400 kV substation	3,000	2,000	1,596
Entire Project	3,763	4,101	1,264

Source: 2019 results are based on Project Completion Report (MOE) and 2023 results are based on materials provided by MOE.
Note: Shaded figures are actual results where targets were not achieved.

(2) Annual outage hours per consumer

While some contract lots met their targets for 2019, the year of Project's completion, the Project as a whole did not, slightly exceeding the target (Table 5). Overall, each customer experienced 4,101 hours of outages per year (an average of 11.2 hours per day). However, in 2023, with the exception of Lot 2, outage hours decreased to 1,264 hours (average 3.5 hours per day) for the entire project, well below the target of 3,763 hours

(average 10.3 hours per day)[20]. Nevertheless, power outages due to electricity shortages still continues at the time of the post-evaluation. The 33 kV substations visited during the field survey are conducting rolling blackouts by disconnecting and restoring connections to the distribution grid in accordance with power supply orders.

3.3.1.2 Qualitative Effects (Other Effects)

The qualitative effect of the Project was to improve the stability of the Iraqi power system (the power system operated by MOE).

Table 5 shows the number of substations and substation capacity of the Iraqi power system, which in 2020 totaled 1,160 substations with a total installed capacity of 103,901 MVA. The substation capacity added by the Project accounts for about 6% of the total capacity and is an important part of Iraq's substation facilities. Based on the current operational status of the substation facilities from the Project (see Sustainability), it is considered that about 80% of the additional substation capacity is operating within the Iraqi electricity system and contributing to the upkeep and improvement of electricity service.

Table 6: Number of Substations and Substation Capacity of the Iraqi Power System

Voltage Levels at Substations	2019		2020		Substation Capacity of the Project (% of total in 2020) (MVA)
	Number of Substations	Transformer Capacity (MVA)	Number of Substations	Transformer Capacity (MVA)	
400 kV	20	20,250	26	22,250	2,000 (9.0%)
132 kV	237	37,691	223	40,396	2,713 (6.7%)
33 kV	863	39,169	911	41,255	1,987 (4.8%)
Total	1,120	97,110	1,160	103,901	6,700 (6.4%)

Source: Prepared by the material provided by MOE.

The Project's facilities are considered to have contributed to the stabilization of electricity supply by preventing overloading of substations in the MOE's power grid and by securing spare transformers. The field inspections of the substations confirmed that the Project has resulted in the construction of new substations and expansion of existing substations to meet the increasing demand for electricity in residential, commercial, industrial facilities, and agricultural irrigation. In addition, the high-voltage (400 kV and 132 kV) substations constructed and strengthened under the Project have contributed to ensuring redundancy in the power grid based on the N-1 standard, thereby contributing to

[20] The data for 2023 was provided by MOE just before the end of the study period for the ex-post evaluation, and it was not possible to determine the reason for the increase in outage hours of Lot 2.

the stabilization of the power supply.[21] For example, the 400 kV substation on the outskirts of Baghdad, newly constructed under the Project, will serve as the starting point for a new 400 kV transmission line to southern Iraq, and is considered to contribute to ensuring redundancy in the high-voltage transmission capacity.

On the other hand, Iraq has been experiencing severe power shortages. Table 7 shows the maximum power and electricity production of the Iraqi electricity system. Total electricity production increased by 76% during the eight-year period from 2013 (70,624 GWh) to 2020 (124,190 GWh). During this period, the share of imported electricity increased significantly from 13% in 2013 (9,243 GWh / 70,624 GWh) to 31% in 2020 (38,814 GWh / 124,190 GWh), indicating a growing reliance on imported electricity. Peak electricity demand increased by 68% during the eight-year period from 2013 (17,454 MW) to 2020 (29,260 MW), but only about two-thirds of peak electricity demand was met at any time during this period. It has been noted that about one-third of the design capacity of power plants has been lost due to aging, use of low-quality fuels, and overheating of generators.[22] According to MOE, the waste of electricity due to politically suppressed low electricity prices is behind the rapid increase in electricity demand.[23] It should be noted that, according to MOE, there has been improvement in power shortages in recent years, with the annual maximum power in 2023 being 77% of peak demand.

Table 7: Maximum Power and Electricity Consumption of the Iraqi Electricity System

	2013	2014	2015	2016	2017	2018	2019	2020
Peak Demand (MW)(a)	17,454	18,653	21,221	24,020	25,100	25,650	27,346*	29,260*
Annual Maximum Power (MW)(b)	10,659	11,505	12,685	13,699	15,140	16,210	19,170*	19,365*
Ratio (b)/(a)	61%	62%	60%	57%	60%	63%	70%*	66%*
Electricity Generated (GWh)	61,381	67,768	68,688	80,030	85,508	82,130	87,900	85,376
Imported Electricity (GWh)	9,243	12,251	13,104	11,965	13,644	21,793	34,396	38,814
Total Electric Energy (GWh)	70,624	80,019	81,792	91,995	99,152	103,923	122,296	124,190

Source: MOE data, * is based on IMF data

[21] The failure of one unit out of a number (N) of facilities is called an N-1 failure, and the concept of providing redundancy in facilities so that the power supply will not be disrupted even if an N-1 failure occurs is called the "N-1 standard." This concept is widely used internationally to ensure a stable supply of electric power, and MOE is also planning its transmission system based on the N-1 standard. For example, by constructing new substations, multiple transmission routes can be secured to provide alternative routes in the event of a breakdown.

[22] Iraq Selected Issues (February 2023, IMF).

[23] See "3.4.4 Financial Aspect."

According to a hearing with the Baghdad Chamber of Commerce[24], electricity supply has not improved since 2003. No opinion was expressed that electricity service had improved. Planned power outages are mainly more frequent in the summer when demand for electricity for cooling increases. In Baghdad, power is supplied for 12-16 hours in winter and only 6-8 hours in summer. Many citizens buy expensive electricity from private local generators.[25]

On the other hand, there has been an improvement in the power supply hours in recent years. According to MOE, annual outage hours per customer in the Project have decreased significantly since 2019 (Table 5). In addition, the average hours of electricity supply in Baghdad increased from 16 hours in 2021 to 20 hours in 2023, and increases in average hours of electricity supply were realized nationwide.[26]

Thus, there is a discrepancy between the electricity users' perceptions obtained in this ex-post evaluation and the MOE data regarding the extent of improvement in electricity service.at the time of the ex-post evaluation. However, in any case, the situation could have been even worse without the Project, and the Project's contribution to the upkeep and improvement of electricity service remains unchanged.

3.3.2 Impacts

3.3.2.1 Intended Impacts

The construction of substation facilities through the Project was expected to contribute to the country's economic and social reconstruction through the stabilization of Iraq's electricity supply.

However, as mentioned above, Iraq has been facing a constant shortage of electricity, and citizens are still dependent on expensive private diesel power generation. According to the interview at the Baghdad Chamber of Commerce, work is often interrupted when computers suddenly go down because they do not know when the power will go out. In summers, when power outages increase and there is a frequent reliance on expensive electricity from private providers, it is not uncommon for the entire family to gather in one room to endure the situation. The market in the Old City of Baghdad can also be dangerous, with fires caused by the complicated power distribution network of private power generators. Thus, electricity shortages are having a major impact on the lives of citizens. In Iraq, there are frequent demonstrations demanding, among other things, an improved electricity supply,

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[24] Founded in 1926, it is a non-governmental organization with a membership of more than 30,000 companies in Baghdad. During the field survey, a group interview was conducted in March 2023 with the chamber's executive entrepreneurs (three men and two women).

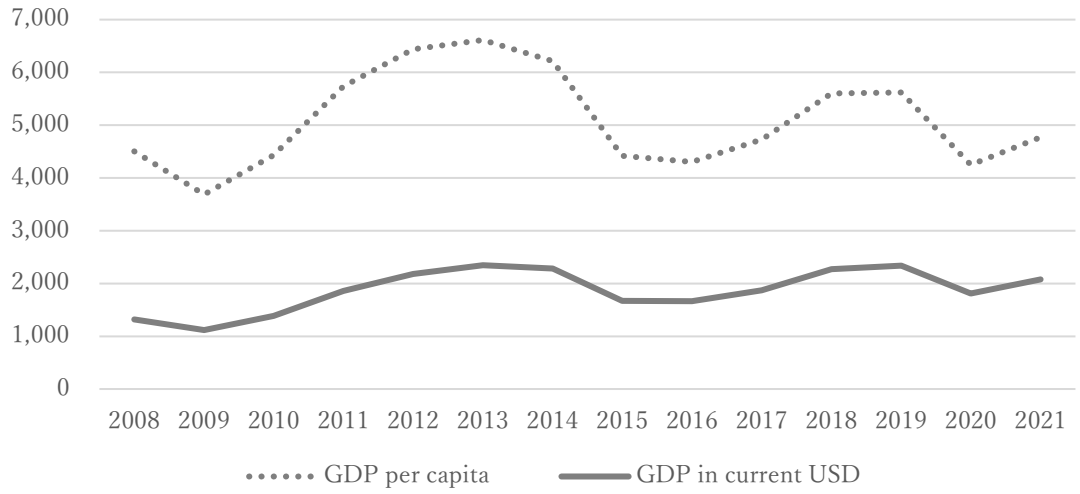
[25] According to the Baghdad Chamber of Commerce, there are about 49,000 private power generators in Iraq, each with their own diesel generators and independent distribution networks, supplying power to around 100 households.

26 This information was provided by MOE just prior to the end of the study period of this ex-post evaluation. Therefore, it was not possible to obtain the electricity users' views on this through interviews with the Baghdad Chamber of Commerce and Industry.

which had become politicized.[27]

As described above, from the interview with electricity users, no tangible impact of the Project, such as increased convenience in daily life due to reduced power outage times, improved public services, more efficient and increased production activities, and reduced use of private diesel power, has been confirmed with regard to stabilization of the lives of citizens and revitalization of the economy and industry. However, it is possible that the situation of electricity service would have been even worse without the Project, and the Project is considered to have made a certain contribution in relation to the expected impact. In addition, in northern Iraq, which was damaged by the ISIL invasion, the installation of three mobile substations is considered to have contributed to the acceleration of reconstruction through electricity supply. In the future, when electricity shortages are further alleviated, the substation facilities of the Project will be able to make a greater contribution to stabilizing the lives of citizens and revitalizing the economy and industry through the improvement of electricity services.

It should be noted that Iraq's GDP has remained at around US$200 billion for the decade since 2011, with no growth (Figure 3). Although the Project is considered to have made a certain contribution to the upkeep and improvement of electricity service, it is difficult to analyze the specific contribution to the country's economic growth.



Source: Compiled by World Bank Data

Figure 3: Iraq's GDP and GDP per capita

[27] In 2015, demonstrations calling for improved public services occurred in Baghdad and the Southern Iraq as dissatisfaction with electricity shortages built up. In 2018, demonstrations calling for improvements in electricity, water, etc., occurred mainly in Basra, the Southern Iraq. In October 2019, demonstrations calling for jobs and improved public services in government institutions and state-owned enterprises occurred in Baghdad and spread across the country. The demonstrations continued as protests demanding changes in the political system, and were suppressed after the October 2021 parliamentary elections resulting in rioting and casualties.

3.3.2.2 Other Positive and Negative Impacts

(1) Environmental impact

The Project was determined to fall under Category B because the Project did not fall into any of the sensitive sectors / characteristics and sensitive areas listed in the "JBIC Guidelines for Confirmation of Environmental and Social Considerations" (April 2002), and the undesirable environmental impacts were not considered significant. The Environmental Impact Assessment (EIA) for the project was not required to be prepared under Iraqi domestic law. Appropriate pollution prevention measures were implemented during construction in accordance with Iraqi construction guidelines and JICA Guidelines for Environmental and Social Considerations. No significant impact of the Project on the natural environment nor complaints from residents living near the facility was identified.

(2) Resettlement and land acquisition

Resettlement was not planned for the Project and was not implemented. No specific land acquisition issues were identified.

(3) Other positive and negative impacts

According to MOE, the training of MOE staff under the Project has greatly improved MOE's project management capacity. One example of this is that, in the subsequent project of the Project, MOE was able to revise the specifications and procurement of the mobile substation without the assistance of the consultant. In addition, the specifications prepared for the Project with the assistance of the consultant became MOE's standard and are now used in other substation projects. In particular, detailed specifications were obtained for the civil works and building facilities, which eliminated the frequent occurrence of civil engineering problems that had occurred in the past.

No notable impacts on gender, social systems and norms, or human rights were identified.

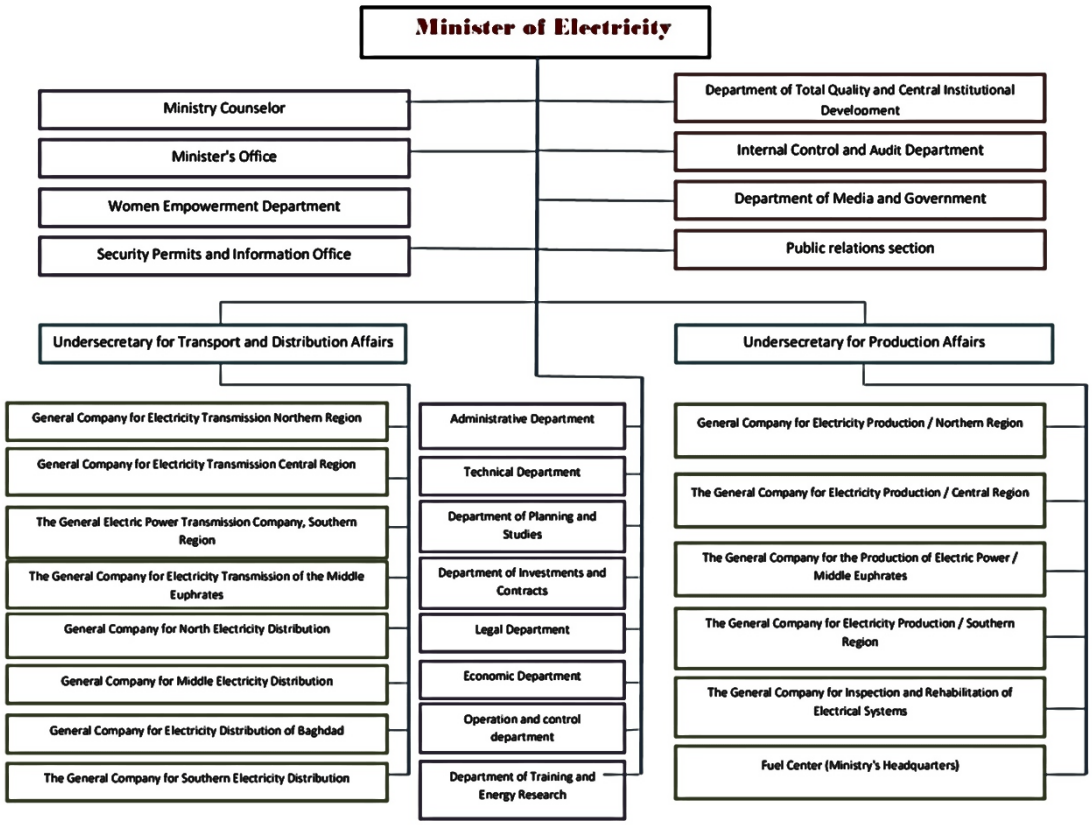
To summarize the effectiveness and impact, the Project functions as an important part of the substation facilities of the Iraqi electricity system and contributes to the upkeep and improvement of electricity service. While the problems such as long hours of power outage and dependence on private power producers persists, considering that many of the Project's facilities are being utilized and that the electricity service situation could have been even worse without the Project, it is considered that the objectives of the Project have been largely achieved. On the other hand, the Project is considered to have made a certain contribution to the stabilization of the lives of citizens and the revitalization of the economy and industry. From the above, the Project has mostly achieved its objectives. Therefore, effectiveness and

impacts of the Project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Policy and System

As discussed under "Relevance," the stabilization of electricity supply is an urgent issue in Iraq, and therefore, the utilization of existing electricity infrastructure, including the Project, is considered important, and various efforts are ongoing to compensate for electricity shortages. Therefore, there are no policy / system issues regarding the sustainability of the Project.



Source: Materials provided by MOE

Figure 4: Organization of MOE

3.4.2 Institutional / Organizational Aspect

MOE is a huge organization with approximately 100,000 employees (as of 2017), including participating affiliates. In 2018, its generation, transmission, and distribution divisions were unbundled. The organizational structure at the time of the ex-post evaluation is shown in Figure 4. The transmission and distribution divisions of the MOE were separated into four regions nationwide, each under a deputy minister in charge of transmission and

distribution.

Substations are operated according to instructions communicated by telephone from the Central Load Dispatch Control Center in Baghdad and the local load dispatch control center of each transmission and distribution company. When it is necessary to shut down operations due to overload, high temperature, etc., the substations report the situation to the load dispatch center and follow the instructions. Each substation is staffed by two to six operators in three shifts, depending on the size of the substation. Larger substations are staffed by senior operators.

Each transmission company is responsible for the operation and maintenance of high-voltage (400 kV and 132 kV) substations, while each distribution company is responsible for the operation and maintenance of low-voltage (33 kV) substations that are connected to the distribution network. Maintenance engineers belonging to the maintenance section of each company visit each substation on a regular basis or as needed to perform maintenance work. Each company's maintenance section has several teams for periodic inspection and repair of facilities by type of facility, etc.

Based on the above, the organizational structure for the operation and maintenance of the substation is clear, and there are no problems with the personnel structure. There are no institutional / organizational issues regarding the sustainability of the Project.

3.4.3 Technical Aspect

At the time of the planning of the Project, MOE was considered to have a high level of technical expertise, with approximately 15% of the staff in the transmission and distribution departments being engineers. Training was provided by consultants and contractors to MOE staff on the operation and maintenance of the Project, and MOE highly values these trainings (see "3.2.1 Project Outputs"). In addition, as mentioned in "3.1.2.2 Internal Coherence," continuous training by JICA since 2004 is considered to have contributed to the improvement of technical capacity.

MOE has a training department that provides training on a regular basis. Participation in training is considered a condition for promotion. New employees receive one year of intensive training and on-the-job training by senior employees. Substation operators receive mainly on-the-job training. According to interviews conducted during the field survey, half of the operators were high school graduates, and the others had bachelor's degrees in science fields. Manuals and other information on the Project's facilities are kept at the office of the maintenance and management section and are referred to as necessary, but there was no opportunity to visit the office during the field survey and it was unable to confirm this.

According to the opinions of the consultant for the Project and the consultant for the subsequent project, MOE's engineers are sufficiently competent. During the field survey, it

was apparent that MOE's engineers have sufficient knowledge and experience, as evidenced by the way they have overcome equipment failures through various innovations.

Based on the above, there are no particular technical issues regarding the sustainability of the Project.

3.4.4 Financial Aspect

At the time of planning, the Ministry of Finance's national budget plan called for MOE to receive a budget allocation of just over 200 billion yen annually from 2007 to 2010, with no particular financial concerns regarding operation and maintenance. According to MOE, the amount of budget disbursements to MOE by the Ministry of Finance for the three-year period 2020-2022 is shown in Table 8; the allocation for 2022 amounted to 13 trillion Iraqi dinars, or 3.4% of the country's GDP (approximately 380 trillion Iraqi dinars in 2022). The MOE's electricity tariffs have been kept low due to political decisions, and the tariff structure is not profitable. In addition, power losses in the distribution network are high, theft of electricity is widespread, and the lack of an efficient collection system means that a large amount of electricity is not subject to tariff collection.[28] The above forces MOE to rely on government subsidies for much of its revenue.

Table 8: Budget Allocations (Disbursements) from the Ministry of Finance to MOE

(Million Dinars)

	2020	2021	2022
Expenditures of the budget allocated to MOE Headquarters	24,571	27,121	26,599
Budget expenditures allocated to generation and transmission/distribution companies	603,489	945,088	1,465,026
Fuel import expenses	585,500	2,774,346	6,724,346
Electricity import expenses	806,642	979,867	1,029,867
Expenditures financed by revenues from electricity charges from government agencies	546,722	1,266,508	1,263,781
Cost of electricity purchased from private power companies	1,009,183	2,721,112	2,721,112
Total	3,576,107	8,714,042	13,230,731

Source: Response to MOE questionnaire

[28] "White Paper, Final Report, Emergency Cells for Financial Reforms, October 2020," shows that the power loss rate in 2018 reached 58%, with nearly one-third of the losses coming from power distribution network The power loss rate reached 58% in 2018, and nearly one-third of the losses were due to power theft in the power distribution network. Electricity tariff revenues only accounted for about 15% of costs, and the shortfall was covered by budget allocations from the Ministry of Finance and borrowing from the Ministry of Petroleum and other sources.

The operation and maintenance budgets for the transmission and distribution sectors of MOE (2014-2018) are shown in Table 9. There is a significant variation from year to year, but there is an increasing trend for transmission, which is used for the maintenance of the Project's facilities. While there are no serious financial constraints on the operation and maintenance of the Project's substation facilities, there are reported situations where appropriate spare parts are not readily available in the event of breakdowns.

As mentioned above, although MOE's finances are sustained by a large subsidy from the government, it partially affects the operation and maintenance of the Project.

Table 9: Operation and Maintenance Budget for the Transmission and Distribution Sector of the MOE

(Billion Dinars)

	2015	2016	2017	2018
Transmission	129.7	60.3	150.3	319.3
Distribution	281.0	151.3	16.5	120.0

Source: Material provided by MOE (PCR)

3.4.5 Environmental and Social Aspect, Preventative Measures to Risks

MOE has a procedure for operators to contact the transmission and distribution companies when environmental and social concerns or safety issues arise at each substation, and to respond to them. During the field survey, it was confirmed that the operators were engaged in their work, paying attention to safety and wearing helmets. In the event that equipment is affected by fire or natural disaster, the equipment is electrically disconnected from the system and rehabilitation work is performed. However, some newly constructed substations were observed where fire alarms were not in operation. In addition, a case was reported in which a transformer was damaged by stray bullets from a tribal war, but no human casualties were reported.

3.4.6 Status of Operation and Maintenance

At each substation, operators perform daily cleaning and visual inspection of equipment, checking for abnormal heat generation or sparks, and report any abnormalities to the maintenance engineer for action. Once a year, or as needed, maintenance engineers visit the facility to inspect and test transformers, protective devices, batteries, and other equipment, and perform preventive maintenance. Monthly checks of the energization status and any abnormalities using a thermal imaging camera are conducted. However, it was reported that sometimes maintenance work cannot be carried out in a timely manner due to a lack of

measuring equipment necessary for inspections, etc. or due to the deteriorating security situation.

For the ex-post evaluation, information was obtained on the operational status of 45 transformers, representing about one-third of the transformers installed by the project; 37 (82%) of the 45 transformers were operational, while the remaining 8 (18%) were not. Five of the eight inoperable transformers were mobile substations, all of which had major components stolen or destroyed during the ISIL invasion. Of the other three, one was destroyed during the ISIL invasion, one had parts stolen during peacetime, and one was inoperable due to damage to the transformer coils. From the above, only two of the 45 transformers for which information was collected were out of service during peacetime operation and maintenance by MOE. Both of these transformers have been replaced by other transformers owned by MOE.

Most of the transformers installed by the Project were in good working order at the substations where field inspections were conducted (four around Baghdad and four around Basrah); one transformer was replaced with another repaired old transformer due to a transformer coil failure, but the cause of the failure could not be identified. Operators and maintenance technicians on site reported switchgear failures due to frequent on/off at the direction of the feeder command center, deterioration of capacitors and other components due to high summer temperatures, and frequent malfunctions in protective relays. Many of the failures were caused by the harsh local operating environment, but some pointed to manufacturing problems with the protective relays. Although MOE sometimes procures (imports) necessary spare parts, it is widely practiced to purchase them in the domestic market or to take parts for repair from old transformers stored in MOE's warehouse. All defects were repaired at the substations subject to field inspections, and the basic functions of the substations were maintained.

Based on the above, the status of operation and maintenance of the Project is judged to be good overall, although there are minor issues.

In summary, the operation and maintenance of the Project's substation facilities and equipment are generally in good condition, although financial constraints have affected some of the maintenance. No issues have been observed in the policy / system, institutional / organizational, or technical aspects regarding the sustainability of the Project. Therefore, the sustainability of the project effect is high.

4. Conclusions, Lessons Learned and Recommendations

4.1 Conclusion

The Project was implemented to stabilize the electricity supply in Iraq through procurement and rehabilitation of substation facilities throughout Iraq, thereby contributing to the country's economic and social reconstruction. The Project is consistent with Iraq's development plans and needs at the time of planning and ex-post evaluation, and with Japan's development cooperation policy at the time of planning. Its relevance and coherence are high as there are linkages with JICA's several emergency grant projects, ODA loan projects, and training programs in electricity sector. The output exceeded the plan with the addition of the 400 kV substation near Baghdad, and the project cost considering this increase was within the plan. However, as the project period was much longer than planned, the efficiency of the Project is moderately low. Since the Project functions as a crucial part of the Iraqi power system's substation facilities, contributing to the upkeep and improvement of electricity services, it is considered that the objectives of the Project have been largely achieved. Prolonged power outages due to severe electricity shortages that have persisted in Iraq have shown improvement in recent years, and the Project is considered to have made a certain contribution to the stabilization of the lives of citizens and the revitalization of the economy and industry. Therefore, the effectiveness and impact of the Project is high. Although financial constraints have affected the maintenance of some of the substation facilities and equipment, the overall operation and maintenance of the substation facilities and equipment of the Project are good. There are no policy, institutional, organizational, or technical issues regarding the sustainability of the Project. Therefore, the sustainability of the effects of the Project is high. In light of the above, the Project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

MOE's financial situation, which relies heavily on the national budget allocated by the Ministry of Finance, has affected the maintenance of the Project's substation facilities. In addition, severe electricity shortages are preventing the Project from having an tangible impact. Therefore, the Government of Iraq and MOE need to revise the electricity tariff system to improve the financial sustainability of electricity, and to urgently resolve the electricity shortage by making capital investments in power generation, utilizing associated gas, and developing the international power grid.

4.2.2 Recommendations to JICA

JICA should monitor and encourage the implementation of the above recommendation by the Iraqi government and MOE.

4.3 Lessons Learned

Support for balanced investment and demand control

Although the substation facilities of the Project are fully utilized, no tangible impact has been manifested against a backdrop of power shortages that have not improved sufficiently. The reasons for this may include delays in power generation projects due to changes in the security situation and an unexpected increase in electricity demand due to low tariff levels and other factors. These were not necessarily foreseeable at the time of planning the Project. In addition, JICA has cooperated in the power generation sector through emergency grants and ODA loans, and has also provided support for important issues such as associated gas and tariff collection. Therefore, it should be noted that the power sector requires balanced investment in power generation, transmission, and distribution while keeping demand under control, and the executing agencies and JICA need to make continuous efforts to realize this goal.

Project management in response to the security situation

Due to the security situation in Iraq, the consultants and contractors for the Project were based out of the country, and trained local consultants were used to implement the work. JICA supervised the projects through its field offices under strict security control and always looked for opportunities to meet with the executing agency officials to build sufficient trust with them. At the time of the ISIL invasion, JICA, together with the consultants and contractors, held repeated discussions with the executing agency outside of the country, and were able to quickly examine and decide on response measures. Therefore, when supervising projects in areas where the security situation is unstable, it is important to devise an appropriate project management system and to make efforts to build a relationship of trust with the executing agency officials on a regular basis.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

Considering the security situation in Iraq, the implementation system of the Project was designed to avoid the entry of Japanese engineers of consultants and contractors into Iraq as much as possible (see box "3.2.1 Project Outputs"). On the other hand, JICA office staff made the most of the limited opportunities to build a relationship of trust with MOE and maintained a good cooperative relationship, even though their activities were restricted under strict security controls. When ISIL invaded Iraq, Japanese staff of the JICA office had to leave the country for about a year and supervise the Project from abroad, and various

measures were required, such as changing the sub-project sites in the combat area in northern and western Iraq, and changing the transporting route of materials and equipment through these areas. Through close communication, including a series of face-to-face discussions outside of Iraq (in Amman, Jordan, Istanbul, Turkey, etc.) and telephone conferences, the MOE, JICA, consultants, and contractors quickly decided on a course of action as described above and worked to ensure smooth implementation.

5.1.2 Subjective Perspective (retrospective)

The JICA office director at the time was pleased with the fact that JICA did not give up in the difficult environment, but continued to communicate with relevant parties, used wisdom and flexibility, and that everyone, including the implementing agency, consultants, and contractors, continued to look forward to the task ahead. The fact that they did not interrupt their work even during the ISIL invasion can be considered to have strengthened Japan's presence in Iraq and the relationship of trust with the Iraqi side. On the other hand, the Japanese staff involved in the Project felt frustrated by the situation in which they had no choice but to act according to the thinking of the Tokyo side, which emphasized security measures, and could not control activities in the field alone.

5.2 Additionality (none in particular)

(End)

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
0. Output Procurement of materials and equipment, etc. (1) Rehabilitation of 132 kV mobile substation (2) Procurement of 132 kV mobile substation equipment (3) Transformer Procurement (4) New 132 kV substation (5) Substation rehabilitation for 33 / 11 kV distribution (6) Expansion of substation for 33 / 11 kV distribution (7) Procurement of 33 / 11 kV mobile substation equipment (8) Construction of 400 kV substation Consulting Services	(1) Approx. 8 transformers, 16 circuit breakers, 8 grounding transformers, etc. (2) Approx. 24 units (3) Approx. 15 units (4) Approx. 2 locations (5) Approx. 18 locations (6) Approx. 6 locations (7) Approx. 4 units (8) (No plan) Support for implementation plan, procurement support, construction supervision, etc.	(1) 8 transformers, 25 circuit breakers, 13 grounding transformers, others (2) 28 units (3) 15 units (4) 2 locations (5) and (6) 25 locations in total (7) 8 units (8) 1 location As planned
1. Project Period	January 2008 - February 2012 (58 months)	January 2008 - September 2019 (141 months)
2. Project Cost Total ODA loan Exchange rate	43,948 million yen 32,590 million yen 1 USD = 112 yen (July 2009)	39,653 million yen (Note) 31,807 million yen 1 USD = 107.8 yen 1 Euro = 117.8 yen (2010-2019 average) (Note) Total amount excluding general administrative expenses, land acquisition costs, and taxes
3. Final Disbursement	July 2018	