Islamic Republic of Pakistan

FY2017 Ex-Post Evaluation of Japanese ODA Loan Project
"Dadu-Khuzdar Transmission System Project"

External Evaluator: Hiroaki NAGAYAMA[1], IC Net Limited

0. Summary

This project aims to respond to the growing electricity demand in Balochistan Province by conducting a new construction of a 220 kV transmission line (total length of about 300 km) from Dadu, Sindh Province to Khuzdar, Balochistan Province and 220/132 kV substation, thereby contributing to the revitalization of the regional economy of the province and improvement of the livelihood. The purpose of the project is consistent with Pakistan's development policy and development needs at the time of appraisal and ex-post evaluation, as well as Japan's aid policy at the time of appraisal, and its relevance is therefore high. The project period was significantly longer than planned due to a number of reasons such as the impact of sanctions against Iran (suspension of Iran-related transactions by banks), delay in opening letters of credit, delay in transportation of materials and equipment. Due to these delays, the project cost was significantly higher and, consequently, efficiency of the project is low. Since the operational status of the facilities provided by the project is steady, operation and effect indicators such as reduction of load shedding risk and improvements of voltage drop rate at the demand point are largely achieved, the effectiveness is high. It is estimated that this project has a high impact in contributing directly and indirectly to the industrial revitalization of Balochistan province, expansion of employment, and improvement of the livelihood of the local residents. Operation and maintenance status and technical aspects of the current facility equipment are generally good. However, due to security problems[2], there are some difficulties in mobilizing the staff for the maintenance of transmission lines and the substation located in Khuzdar, causing some issues on the feasibility of the inspection. The sustainability of the project effect is therefore rated as fair.

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

[1] Support to IC Net Limited. The actual affiliation of the evaluator is to the Kyoto University (Professor).

[2] According to the executing agency, the security situation has now improved a lot and mobilization of staff for maintenance of transmission lines and substation, which was then difficult is now possible with requisite coordination with concerned authorities of the area. On the other hand, since the evaluation analysis is based on the data attained during the field study and the evaluator could not obtain enough evidence to confirm the comments, the contents of main report are maintained.

1. Project Description

Project location

New facility at Khuzdar substation : 220kV powered circuit[3]

1.1 Background

Electricity demand in the Balochistan Province located in the southwestern part of Pakistan was 6% of the total demand in 2005. The electrification rate was also the lowest at 26% against the national average of 72% as of the end of 2005, and the demand growth rate during 2000 to 2005 was the largest at 94% (average around 14% a year) compared to the national average of 35%. In Balochistan Province, the electricity consumption in the agricultural sector is large, mainly being utilized as a power source for pumping up groundwater, and the consumption per customer is about 4.6 times the national average. In addition to cold storage facilities of crops and cotton industry and mineral industry etc., their electricity demand has been increasing[4].

At the time of this project appraisal, the main electricity supply to the Balochistan Province was a transmission line extending from neighboring Guddu in Punjab Province to the northern part of Balochistan Province. This transmission line was partially constructed with the ODA Loan approved in 1989 "Second 220kV Guddu-Sibbi-Quetta Transmission Project ".

In the terminal distribution network in the central region of Balochistan, where load shedding was carried out for 8 hours a day, factors such as the shortage of transmission infrastructure hindered the development of the agriculture sector in the central region of Balochistan and the restoration of other industries.

1.2 Project Outline

This project aimed to cope with the demand of electricity in Balochistan Province by establishing a new 220kV transmission line from Dadu of Sindh province to Khuzdar in

[3] Receiving power from Dadu.
[4] Source: Materials provided by JICA

Balochistan province, newly establishing a substation in Khuzdar and adding new facility to the existing substation equipment in Dadu. This will contribute to revitalizing the regional economy and improving the livelihood of the state.

Loan Approved Amount/ Disbursed Amount	3,702 million yen / 3,147 million yen	
Exchange of Notes Date/ Loan Agreement Signing Date	December 2006 / December 2006	
Terms and Conditions	Interest rate Repayment period （Grace period） Conditions for procurement	1.3％ 30 years 10 years） General untied
Borrower / Executing Agencies	THE PRESIDENT OF THE ISLAMIC REPUBLIC OF PAKISTAN/ National Transmission and Dispatch Company Limited :NTDC	
Project Completion	April 2016	
Main Contractors	・ ICC(Pvt.) Limited (Pakistan) ・ Iran Power & Water Equipment & Services Export Co. (Sunir)(Iran)/UCC(Pakistan) ・ Iran Power & Water Equipment & Services Export Co. (Sunir)(Iran)/MECONS(Pakistan)	
Main Consultants	-	
Related Studies (Feasibility Studies, etc.)	F/S（April 2004）	
Related Projects	【Yen loan】 ・National Transmission Lines and Grid Stations Strengthening Project （March 2010） 【Other international organizations, aid agencies, etc.】 ＜World Bank＞ ・Electricity Distribution and Transmission Improvement Project（June 2008） ＜ADB＞ ・Power Distribution Enhancement Investment Program-Tranche 2（December 2010）	

2. Outline of the Evaluation Study

2.1 External Evaluator

Hiroaki NAGAYAMA[5]（IC Net Limited）

2.2 Duration of Evaluation Study

This ex-post evaluation was conducted with the following schedule.

Duration of the Study：July 2017-March 2019

Duration of the Field Study：November 15-30, 2017 and April 25-July 3, 2018（Field survey by local surveyors）

2.3 Constraints during the Evaluation Study

(1) For security reasons in Pakistan, field surveys including business sites were conducted by field survey assistants under the supervision of external evaluators who carried out desk evaluations. For this reason, a missing part is recognized in obtaining detailed data.

(2) The security situation in the target area was extremely bad, and an on-site survey by the field investigation assistant placed safety management as a top priority. In particular, tribal conflicts between Larkana and Khuzdar occurred frequently, which is regarded as extremely dangerous, and on-site investigation was avoided in this area. The qualitative survey chose a region[6] with representative characteristics similar to Balochistan as much as possible, but the results from qualitative surveys have the possibility of being slightly biased because the tribe, culture and customs of the Balochistan province are greatly different depending on the region.

3. Results of the Evaluation (Overall Rating:C[7])

3.1 Relevance（Rating：③[8]）

3.1.1 Consistency with the Development Plan of Pakistan

At the time of appraisal, the Government of Pakistan stated in the *10 Year Development Plan* (FY 2001 - FY 2010) the development and enhancement of transmission and distribution networks, promotion of rural electrification, reduction of transmission and distribution loss, etc.[9]. Specifically, in a new capital investment plan in the power sector, it was decided to continually develop transmission and distribution facilities in order to cope with the increasing demand for electricity. According to *Poverty Reduction Strategy Paper* (2003) and the Medium Term

[5] Participate for reinforcement

[6] Regional representation means the area that can be inferred that the data obtained in that area captures the characteristics of the entire Balochistan state.

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

[8] ③："High", ②：" Fair ", ①："Low"

[9] Materials provided by JICA

Development Framework (MTDF) (2005-2010), the supply of electricity was recognized as a catalyst to generate economic activity, employment and growth.

The Pakistan Ministry of Water and Power (MOWP) announced the *National Electricity Policy 2013* in July 2013, stating that "Pakistan responds to the needs of the people in a sustainable and inexpensive way and develops the most efficient and consumer-oriented generation, transmission and distribution system necessary for economic development". Among them, the following are listed as the 2017 target, and emphasis is placed on eliminating the gap of the supply-demand balance in particular.

1) Improvement of supply-demand balance gap: To reduce the power shortage of 4,000 to 5,000 MW to 0 by 2017.
2) Reduction of power generation unit price: 12 US cents / kWh to 10 US cents/ kWh by 2017.
3) Reduction of transmission/distribution loss rate: 23 - 25% to 16% or less by 2017.

Even in the latest power sector plan after MTDF[10](Annual Plan 2018 - 2019) (April 2018), emphasis is placed on reinforcement of transmission and distribution networks and loss reduction.

From the above, the implementation of this project is relevant to Pakistan's national development plan and power sector development plan at the time of appraisal and ex-post evaluation.

3.1.2 Consistency with the Development Needs of Pakistan

Within the terminal distribution network in the central Balochistan province, load shedding was sometimes implemented for 8 hours a day. Therefore, it was highly necessary to supply electric power sufficiently and stably to the central region of Balochistan province through the establishment of this transmission line.

At the time of appraisal, many of the thermal power generation was located in central and southern Pakistan, and most of the hydroelectric power was located in the northern part. Because they were away from the center of electricity demand, the Pakistan government needed to implement efficient and stable operations of 500 kV and 220 kV of super high voltage transmission lines.

It is expected that the population will grow significantly within the Quetta Electric Supply Company (QESCO[11]) jurisdiction including Khuzdar, which is projected to increase to around 2 times, from 6.7 million (2005) to 11.9 million (2040)[12]. According to *Pakistan 2025*, published

[10] It is updated every year after MTDF.
[11] There are ten power distribution companies in Pakistan, and the power distribution company supplies power from the 132 kV power reception to the customer. QESCO is in charge of the Balochistan Province except the Lasbela area.
[12] National Institute of Population Studies

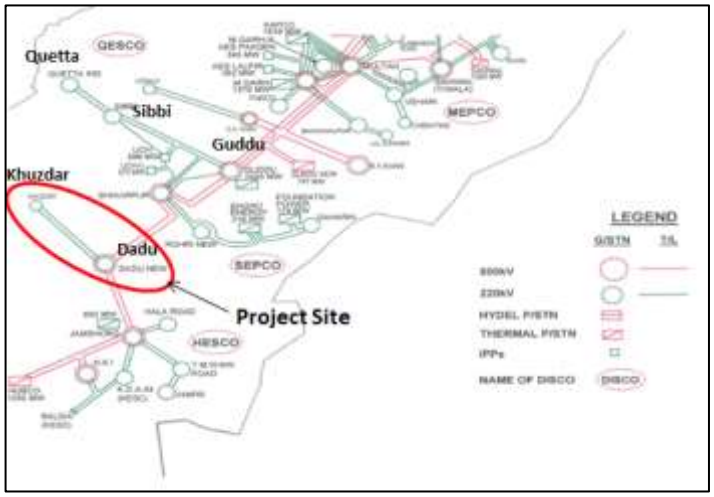
by the Ministry of Planning and Development Reform in 2014, it is expected that GDP will grow by nearly 8%. According to the *White paper 2017-2018*: Finance Department of Balochistan, the real GDP growth rate for FY 2007 - FY 2015 is 3.03%, slightly lower than the national average of 3.26% (World Development Indicator). However, the maximum demand growth in the QESCO department from 2006 to 2015 is higher than the national average (PEPCO[13]). (Table 1)

Table 1 Maximum (peak) demand in QESCO and PEPCO

(MW)

	QESCO	Growth	PEPCO	Growth
2006-2007	951	100	14,604	100
2007-2008	1,180	124	17,084	117
2008-2009	1,157	122	18,881	129
2009-2010	1,316	138	19,288	132
2010-2011	1,430	150	20,559	141
2011-2012	1,480	156	21,997	151
2012-2013	1,530	161	22,883	157
2013-2014	1,650	174	23,425	160
2014-2015	1,762	185	23,419	160
2015-2016	1,765	186	23,267	159
2016-2017	1,770	186	24,290	166

Source：NEPRA State of Industry report 2011,2012,2017
Note 1: Growth is an index with setting 2006-2007 as 100.
Note 2: KESC that supplies electricity to Karachi is not included in PEPCO.



Source: The evaluator added to what was received from the NTDC Planning Bureau on April 25, 2018 (Data is January 15, 2018)

Figure 1: Location of this project in the NTDC transmission network (220 kV, 500 kV)

[13] In October 2007, the Water and Power Development Authority (WAPDA) was divided into two companies: WAPDA and Pakistan Electric Power Company (PEPCO). WAPDA is in charge of hydraulic development, while PEPCO is in charge of construction, operations, maintenance and charging of thermal power generation, transmission and distribution facilities. PEPCO has jurisdiction over Pakistan excluding the Karachi district (controlled by Karachi Electric Supply Company n (KESC)).

Since the load factor of transmission and transformation equipment is high at this time, development needs continue to be high even at the time of ex-post evaluation. This project also meets the demand in the Balochistan province and is the only transmission line constructed to supply electricity to the Balochistan province instead of the Guddu - Sibbi - Quetta transmission line.

From the above information, the necessity of this project is recognized at the time of appraisal and ex-post evaluation.

3.1.3 Consistency with Japan's ODA Policy

In Japan, the *Country Assistance Program for Pakistan* (February 2005) aimed for the "development of a healthy market economy", which has been shown as one of the priority areas. "The importance of the expansion and improvement of economic infrastructure supporting for "Activate market economy and poverty reduction" was demonstrated. In JICA's *Medium-Term Strategy for Overseas Economic Cooperation Operations* (April 2005), development of infrastructure for sustainable development was a priority area for supporting Pakistan. JICA's Country Assistance Strategy for Pakistan (March 2006) proactively supported the idea that securing a highly reliable electricity supply system in terms of both quantity and quality will contribute to economic development.

From the above, this project aims to construct power transmission facilities to meet the demand of electricity in Balochistan Province, and was relevant to Japan's ODA policy.

3.1.4 Appropriateness of the Project Plan and Approach

This project is planned by taking into account lessons from other projects in order to improve the efficiency of the project. In the "Second 220kV Guddu-Sibbi-Quetta Transmission Project", additional costs and a delay in the construction schedule occurred because some construction materials and equipment were stolen during the construction stage. This unstable security was mainly due to NTDC prioritizing the reduction of the project cost, and some of the transmission line routes being far from the main road, making regular repair work and patrol activities difficult. In this project, based on such a precedent, measures were taken to prevent the above problems by setting most of the power transmission route along the main road.

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：①）

3.2.1 Project Outputs

The plan and actual output of this project are as shown in Table 2.

Table 2 Comparison of the Planned and Actual Outputs

	Plan	Actual
1. 220 kV Dadu-Khuzdar Transmission Line	Extension of high voltage 220 kV double circuit single conductor transmission lines from Dadu to Khuzdar with a total length of 300 km, , 833 Steel Towers (Double circuit), Conductors (Rail,1800 km), OPGW 300 km.	220 kV double circuit Transmission Lines with a length of 275 km. Steel Towers 761, Conductor 1650 km and OPGW 275 km.
2. Grid Station at Khuzdar	2 Auto Transformers (160 MVA, 220kV), Bus Isolators (14 sets for 220 kV and 6 sets for 132 kV), Line Isolators (2 sets for 220kV), Circuit Breakers (6 sets for 220 kV and 3 sets for 132 kV) and 2 Shunt Reactors (18 MVAR, 220kV).	2 Auto Transformers (160 MVA, 220kV), Bus Isolators (16 sets for 220 kV and 9 sets for 132 kV), Line Isolators (2 sets for 220kV), Circuit Breakers (8 sets for 220 kV and 3 sets for 132 kV) and 2 Shunt Reactors (18 MVAR.220kV)
3. Grid Station at Dadu	Expansion of 220kV Grid station at Dadu. Bus Isolators（6 sets）, Line Isolators（2 sets）, Circuit Breakers（3 sets）	220kV Switch yard 500/220/132kV extension Dadu GS（2 Bays）
4. Consulting Services	To assist NTDC in Engineering Services and detailed Project design, preparation of Tender Documents, Evaluation of Tenders, Award of Contract, Supervision of Construction Work, verification of Bills of Quantities and Contractor's Bills, and Testing and Commissioning of the Project.	Detailed Project design, preparation or Tender Documents, Evaluation of Tenders, Award of Contract, Supervision of Construction Work. Verification of Bills of Quantities and Contractor's Bills, and Testing and Commissioning of the Project.

Source: Created based on the materials provided by JICA

Note 1: In order to shield the electric wire from the lightning, the OPGW(Optical ground wire) uses wiring at the top of the tower. OPGW is applied to the full length of the power transmission line and has the role of transferring data of the control system.

Note 2: Changes related to the Khuzdar substation: Two pairs of 220 kV circuit breakers and two pairs of 220 kV disconnectors (insulation devices) were installed for 220 kV shunt reactors (to accommodate system voltage rise). Also, the 132 kV isolators were installed for the 132 kV bus coupler, the device used to connect one bus to another without interrupting power supply and without generating a dangerous arc, and the 132 kV instrument transformer (to measure high voltage by lowering 132 kV to 110 V).

After the appraisal, the optimum route was selected and the Dadu-Khuzdar transmission line was shortened by 25 km from the planned time. Additionally, the number of steel towers and the length of conductors also decreased. Transmission lines are constructed along the main road, but

geographical constraints and route adjustments occurred. Several iron towers in Balochistan province were located off the main road. As confirmed by NTDC, in Sindh province, the transmission line from Dadu to Mehar is along the main road, but some points are separated from the main road from Méhar to Shahdadkot. In mountainous areas where there are few suitable places to build steel towers, they are built at intervals of 500 to 600 meters. According to the interview with the NTDC, these changes could be made at no additional cost by the discretion of the construction site (team/managers,etc.).

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned project cost at the time of appraisal was 6,280 million yen (including foreign currency of 3,702 million yen, and internal currency of 2,578 million yen). The yen loan covered was 3,702 million yen for the foreign currency portion. At the time of the ex-post evaluation, we were unable to confirm the actual amount of self-funds (general administrative expenses, land compensation, royalties, interest during construction, etc.) of the Pakistan side. Therefore, the planned project cost excluding these cost (5,852 million yen) is compared with actual cost. The actual amount was 8,159 million yen, which was higher than planned (139% of the planned amount). Costs increased due to rising steel prices[14] and fluctuations in exchange rates during the project period[15].

3.2.2.2 Project Period

The project period planned at the time of appraisal was November 2006 - March 2011 (53 months). At the time of appraisal, completion of the project was set for March 2011 when the one year period of the warranty expired, after completion of equipment and materials provision and installation (March 2010); actual results are from November 2006 to December 2015[16]. It took 110 months, significantly longer than planned (208% of the planned time).

In addition to procedural delays such as delays in construction work and related procedures, the project led to a delay due to multiple factors including sanctions against Iran (suspension of Iran-related transactions by banks), flood disasters and public security. Main reasons for this project's delay are as follows.

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[14] In the World Bank Commodity Price Data, the spot price of iron ore ($ / dmtu) rose from 69.33 ($ / dmtu) in 2006 at the start of the project to 145.86 ($ / dmtu) in 2010 when it was planned for installation. DMTU is an abbreviation of Dry Metric Ton Unit, a unit of display of iron ore price per 1% iron content.

[15] Price preliminary expenses reflecting price increases are recorded in the contracts of each package, and expenses have increased in response to price increases of cement, petroleum and wages.

[16] Warranty period is stated in the construction contract of this project that it is 18 months from the completion date of the facility, or 12 months from the facility operation start date. This project is divided into Package 1 (220 kV Dadu-Khuzdar transmission line), 2 (Khuzdar substation station), and 3 (Dadu substation station). In the ex-post evaluation, we considered the day when all packages were completed (the end date of the collateral period of package 3) as the completion date of this project.

【Construction work / related procedures】

· Delayed opening of letters of credit (all packages)

· Delay in delivery of alkyd galvanized metal towers (transmission line package)

· Inspection of OPGW before loading and delay in customs clearance (transmission line package)

· Delay due to change of foundation (transmission line package)

· Delay in installing steel towers due to ROW (Right Of Way)[17] correspondence, delay in OPGW laying work (transmission line package)

· Delay in approval of shutdown (transmission line package)

Since the 220 kV transmission line of this project crosses both lines of the 500 kV transmission line, that is, "Dadu-Guddu" and "Guddu-Dadu", shutting down both lines becomes necessary; because "the north and south of the National Grid System" were to be temporarily divided, delayed approval of shutdown occurred.

· Delay of issuance of NOC (No Objection Certificate) of the Ministry of Defense because the transmission line passes through the military premises (transmission line package)

· Delay in arrival of drawings, etc. (transmission line package)

【Problems concerning sanction against Iran】

· Sanctions against Iran have made it difficult to transfer funds for construction projects to Iranian banks and Iranian builders (Sunir). Sunir could not receive payment until at least April 2013. Therefore, project progress was delayed as Sunir responded by reducing the number of workers according to its cash flow and equipment procurement.

【Public security】

·Balochistan Province has been in an unstable security situation from issues such as terrorism and the abduction of foreigners since around 2007. In August 2010, the Pakistan Ministry of Foreign Affairs stated that foreigners should refrain from visiting Balochistan as much as possible. As a result, the persons concerned (NTDC, consultants, construction companies) with the project were restricted from accessing the site of transmission lines and substations. The work was therefore restricted and there was a delay in project progress (Effective period from August 2010 to the completion of the project).

【Flood in 2010, flooding of construction site due to heavy rain in 2011】

· Floods caused by heavy rain occurred in early August 2010, and access to the transmission line and Khuzdar substation was restricted. The project was thereby suspended for approximately six months until the water was drained. Similarly, in early August 2011, heavy

[17] This is not a resettlement, but a matter of compensation for agricultural harvests.

rain caused about 6 months of business disruption. When combined with 2010, the project was suspended for about 12 months, which led to project delay.

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

Since the economic internal rate of return (EIRR) was not calculated at appraisal, recalculation has not been carried out. Financial Internal Rate of Return (FIRR) at the time of appraisal was calculated to be 8.29% with construction and maintenance expenses, benefits as a unit of system charge, and a project life of 29 years after the start of service. In the recalculation at the time of ex-post evaluation, the same conditions as at the time of appraisal were used. However, for benefits, electricity sale income (wheeling charge) was estimated from the actual electricity supply amount of the substation[18]. Regarding expenses, we cannot confirm the amount of investment for each year, so we allocated the actual amount of the project cost by using the expenditure ratio of the yen loan disbursement amount each year. The recalculated FIRR was negative[19] due to increase in costs, such as rising steel prices during the project period and fluctuations in the exchange rate.

The project cost exceeded the plan and project period significantly exceeded the plan. Therefore, efficiency of the project is low.

3.3 Effectiveness and Impacts[20] （Rating：③）

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Hereafter, the degree of realization of "Responding to Electricity Demand in the Balochistan province ", which is the outcome of this project (direct effect), is verified by three indicators as " Capacity operation rate (%)", "load shedding risk reduction (MW)" and "the voltage drop rate at the demand point (%)". (Table 3)

[18] Calculation of fee income of the substation is based on MVA and MDI (Maximum Demand Indicator), and MDI used by NTDC was utilized. Specifically, the MDI of the substation is multiplied by the electricity usage fee unit price of the substation (136 Pakistan Rupee (PKR) / kW / month).

[19] FIRR at the time of appraisal is 7.8%, and FIRR at recalculation is negative when the date of the loan agreement (L/A) signing date is taken as the starting point of project life.

[20] Sub-rating for Effectiveness is to be put with consideration of Impacts.

Table 3 Operation / Effect Indicator

	Baseline	Target	Actual
	(Yr2005)	(Yr2013)	(Yr2017)
		2 years after completion	3 years after completion
Capacity Operation Rate of Transmission Lines（%）	--	63%	85%
Load Shedding（MW）	7(MW)	0MW	0MW
Voltage Drop at End User（%）	24%	0%	10%

Source: Data provided by JICA, materials provided by executing agencies
Note 1: Operating rate of the facility means the percentage of the maximum electric power (MW) to be energized relative to the capacity of the facility, and the reserve capacity as to whether there is a need to construct a new facility.
Note 2: The load shedding is the maximum value of the load shedding of the Khuzdar substation.
Note 3: Voltage drop is the maximum voltage drop rate with respect to the reference voltage of the 132 kV bus at Khuzdar substation. That is, (reference voltage-maximum voltage drop) / (reference voltage).

(1) Capacity operation rate

The MDI of the two transformers at Khuzdar substation from June 2014 to June 2018 is shown in Figure 2. The capacity operation rate has remained at 85% or more, exceeding the target value at the time of appraisal of 63%. At the time of appraisal, the target value was set to 63% for the sake of convenience. However, since it should be seen that the aim was not to cause an overload of substation equipment, in addition to the fact that the capacity operation rate is 100% or less, it is considered that the facilities are being used moderately at a level exceeding the target value of 63%. Therefore, it was judged that it is appropriate to consider that this indicator has achieved the target.

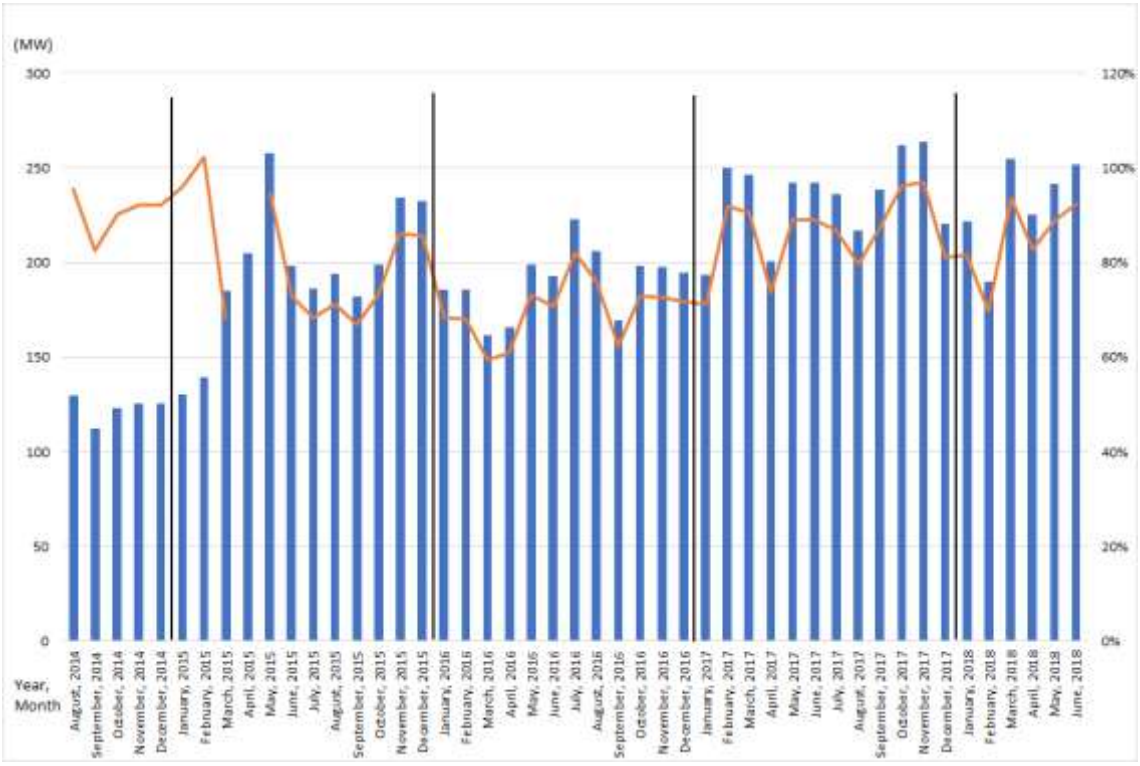

Figure 2 Numerical values of MDI at Khuzdar substation

Source: Data provided by NTDC Lahore

Note: Since the transformer (T-2) was energized since March 2015, Maximum Demand Indicator (MDI), which is the Demand Factor, is calculated based on maximum 160 MVA until February 2015.

(2) Load shedding

The implementation of this project reduced the risk of the load shedding. The load shedding did not occur and it achieved the target value.

(3) Voltage drop at demand point（%）

Voltage drop did not reach 0% of the target value, but it decreased from 24% of the baseline value (2005) to the actual value of 10% (2017). This is because it became possible to avoid extending the line from a long distance because a substation was established near the demand site. In NTDC's grid code, acceptable range of voltage fluctuation is + 8% to -5% in the normal state, but in an N-1 emergency, that is, in a situation where one out of two lines line is blocked, fluctuation of ± 10% is acceptable. Therefore the actual value of 10% in 2017 is within the allowable range of the grid code. The reason for this descent is due to the equipment of the local public distribution company QESCO rather than this project[21].

[21]According to the local interview, it is as follows: 1) While the distance of the distribution line is usually 11 - 15 km, this project has reached 70 km (it seems to be a common phenomenon in the sparsely populated area of Balochistan), 2) the quality of the lead of QESCO is bad and maintenance is not enough. The resistance value increases because of impurities in the aluminum wire used for conductors and the joints. 3) The load of agricultural well pumps and fan motors is large and the power factor is low.

（reference）Increase in sales volume at QESCO

As QESCO's power sales volume is increasing, it can be said that the demand for electricity across Balochistan is increasing substantially. Thanks to this project, the transmission and substation transformers are being developed and operating since 2015, so we can see that QESCO are increasing supply in response to Balochistan's electricity demand (Table 4).

Table 4 Power supply and transmission / distribution loss in the QESCO region

		30-6-2015		30-6-2016	
Average Monthly Demand Index (MDI)	［MW］	935		1,166	
Units Purchased (A)	［GWh］	5,186		5,547	
Transmission Losses (132kV) (B)	［GWh］	311	(6.0%) Transmission Losses = (B)÷(A)	305	(5.5%)
Distribution Losses (C)	［GWh］	882	(17.0%) Distribution Losses = (C)÷(A)	1,022	(18.5%)
Units Sold to Customers	［GWh］	3,993		4,220	

Source: QESCO materials provided

3.3.2 Impacts

3.3.2.1 Intended Impacts

At the time of appraisal, it was assumed that the stability of the power system and the revitalization of the regional economy in Balochistan province were the impacts of this project.

（1） Stabilization of the power distribution system by new expansion of transmission and substations

Electricity was supplied to the Balochistan province by only the Guddu - Sibbi - Quetta transmission line, but due to the secured alternative route by this project, reliability of power supply of the entire QESCO jurisdiction, including the Khuzdar and NTDC system network, increased. Load shedding become avoidable.

The number of System Average Interruption Frequency Index (SAIFI)[22] and System Average Interruption Duration Index (SAIDI)[23] in the QESCO jurisdiction decreased significantly in 2015 and 2016, indicating that the reliability of the power distribution system also improved. (Table 5)

[22] System average interruption frequency index (SAIFI) is the number of power outages per customer (number of times per year).

[23] System average interruption duration index (SAIDI) is the power outage time per customer (minutes / year).

Table 5 System Average Interruption Frequency Index (SAIFI), System Average Interruption Duration Index (SAIDI) in the QESCO jurisdiction

	2012	2013	2014	2015	2016
System Average Interruption Frequency Index (SAIFI) (No/year)	156.08	153.80	144.95	112.58	107.00
System Average Interruption Duration Index (SAIDI)(Minutes/year)	12,810.70	12,635.00	11,868.10	7,506.81	7,290.00

Source：State of Industry report 2016, NEPRA

The number of voltage changes[24] in Khuzdar greatly declined since the substation maintenance. (Table 6)

Table 6 Number of voltage changes

The number of changes in voltage fluctuation	GS	2014-15	2015-16
220 kV	Khuzdar	1,140	796

Source：NEPRA-State of Industry Report 2016

（2） Development of industry, revitalization of the regional economy and improvement of living infrastructure

We interviewed customers during this ex-post evaluation period[25]. The following is the result of the local beneficiary interview.

Overall, this project reduced the local power outages (planned power transmission stop to avoid power failure). This lengthened the nighttime opening hours by having lighting, and economic activity became active (local residents near Khuzdar). Land owners began to invest in local business, regional purchasing power improved and economic activity became active. Also, the number of wells pumped up by electric tubes increased, and agricultural activities became active. As a result, demand for fertilizer has also increased (farmer). Small-scale businesses also became able to receive revenue more than before as demand for consumer products, especially agricultural fertilizer, has increased (seedling production and sales company). In particular, Balochistan is a

[24] The number of voltage changes exceeds the allowable variation range. It is not preferable as it increases.

[25] An on-site research assistant interviewed local residents in the Khuzdar region of the Balochistan province. The local coordinator selected subjects from each occupation while receiving assistance from stakeholders in the target area and interviewed people who got consent among the subjects. The breakdown consists of one student, eight owners of stores, one mayor, one executive director, three farmers(including a day-hired farmer), two land owners, two seedling production and sales company employees, one electrician and one businessman. Because of religious and cultural background, women were not included in this interview. Students at the engineering technology university were interviewed at the dormitory, but because there was only a male dormitory at the university, female student interviewees could not be obtained.

poor state and the development of value-added industries was a challenge. Therefore, the development of industries with high added value as seen in the increase in marble factories is a big positive impact (common answers from several people).

On the other hand, no negative impact was mentioned.

From Table 7, it can be said that the per capita GDP of the Balochistan province is increasing after the start of this project.

Table 7 Real GDP Per Capita Per province (1999-2000 to 2014-2015)

(Fixed value based on 1999-2000)

	1999-2000	2007-08	2012-13	2014-15
Balochistan				
Provincial GDP (billion Rs)	214.5	272.6	297.0	313.7
Population (million)	6.9	8.4	9.8	10.0
Per Capita GDP (1,000 Rs)	**31.086**	**32.452**	**30.306**	**31.370**
Deviation from National Average (%)	**-26.2**	**-38.6**	**-44.0**	**-44.9**
Annual Growth Rate (%)		**0.53**	**-1.36**	**1.74**
Pakistan				
GDP (billion Rs)	5,693.1	8,549.5	9,816.3	1,0644.1
Population (million)	135.13	161.841	181.255	187.033
Per Capita GDP (1,000 Rs)	**42.130**	**52.826**	**54.157**	**56.910**
Annual Growth Rate (%)		**2.86**	**0.50**	**2.51**

Source：Dr. Hafiz A. Pasha (December 2015) "Institute For Policy Reforms, IPR Brief, Growth Of The Provincial Economies"

From the above, it is unknown how much this project contributed to the Balochistan Province per capita GDP as the start of service of this project is 2014. Nevertheless, based on the results of the qualitative survey, contribution to the revitalization of the regional economy is presumed.

3.3.2.2 Other Positive and Negative impacts

（1） Impacts on the Natural Environment

This project falls under category B on the "JBIC Guidelines for Confirmation of Environmental and Social Considerations (April 2002)". The Environmental Impact Assessment (EIA) report of this project was not obligated to be prepared under the domestic legal system of Pakistan. At the time of appraisal, air pollution accompanying construction, noise, etc. were considered not to have a particularly negative effect due to factors such as proper use of construction machinery. When we confirmed with NTDC at the time of ex-post evaluation, it was confirmed that environmental

monitoring was implemented, appropriately dealt with in accordance with NTDC policy, and no negative impact on the natural environment occurred.

（2）Resettlement and Land Acquisition

At the time of appraisal, it was necessary to acquire land for construction of the tower of the transmission line. However, the land was already acquired, and resettlement of residents was assumed not to occur[26]. According to NTDC, resettlement of residents was not undergone; only payment was made for residents whose harvests were damaged. Regarding compensation, there is a provision of Right of Entry (a real estate recovery and land restoration right) in Article 14 (2) of the Manual of WAPDA Laws (Revised Edition) that was effective in 1958. This provision ensured compensation for damages incurred. In the transmission line construction contract of this project, a total of 35 million Pakistan Rupees was accounted for due to the repair of agricultural products, trees and homes that were unavoidably damaged.

This project has achieved its objectives. Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability（Rating：②）

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

Construction of the transmission line is the responsibility of the power transmission network construction department (Project Delivery / GSC) [27] of NTDC's Ultra High Voltage Division (EHV). The responsibility for operation and maintenance (O&M) of the transmission and substation after completion of construction is transferred to the Asset Management Operations Department (GSO / AM). GSO / AM South is based in Hyderabad and is responsible for O&M of the transmission of 220 kV and 500 kV in southern Pakistan. Fig. 3 is an organization chart relating to O&M of NTDC. The Khuzdar office of NTDC is in charge of daily inspection and maintenance work for the Khuzdar substation and transmission line. The Dadu office is involved in daily inspection and maintenance work for the Dadu substation and transmission line.

[26] Materials provided by JICA

[27] EHV has a first and second division. EHV - I controls the northern part of Pakistan and is based in Lahore. EHV - II manages the southern part of Pakistan and is based in Hyderabad. EHV-I / Project Delivery North is responsible for the construction of existing facilities and transmission facilities in the Islamabad and Lahore areas. EHV-II / Project Delivery South is responsible for the construction of existing facilities and new facilities in the Multan, Hyderabad and Quetta areas.

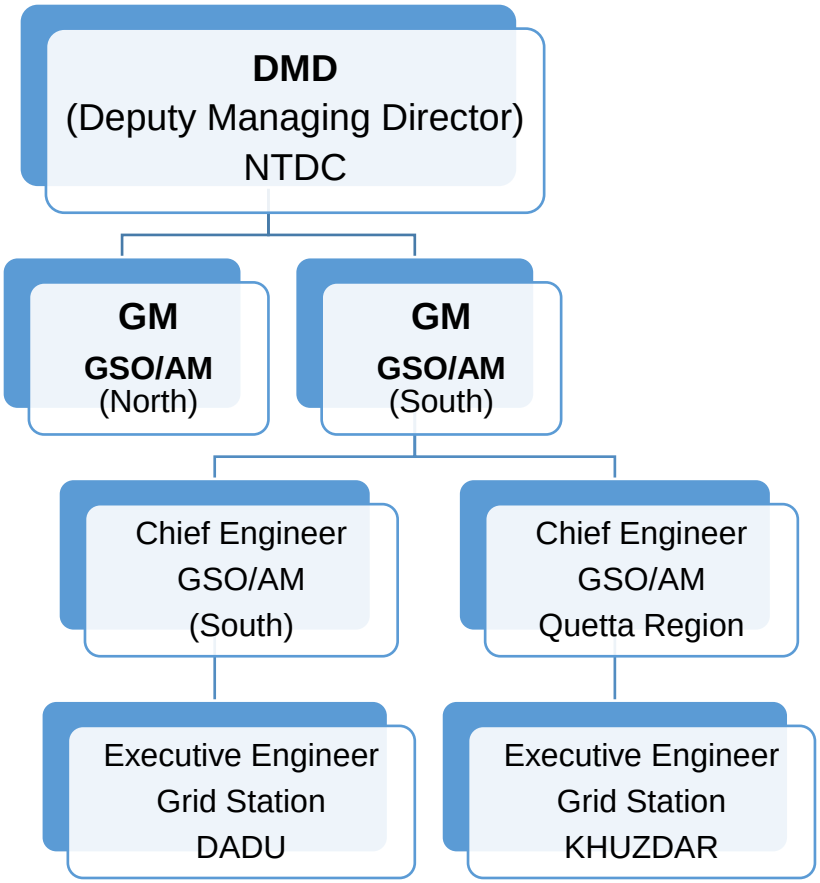

Figure 3 NTDC maintenance system

Source: obtained from NTDC

Note: GSO / AM: Grid Station Operations & Asset Management

Regarding the Khuzdar substation, 152 staff positions are available including the executive engineer related to the 220 kV system, and 64 positions are occupied and there are 88 vacancies. The maintenance staff in charge of maintenance and management of this project has an availability of 15 people, of which 6 people are working and 9 positions are available. Of the 42 possible staff positions in charge of transmission lines, there are 11 people working. The security staff position has 31 people working out of an available 33 positions. Other staff positions in charge of administration include 4 people working out of 25 total available positions.

In an interview with the Khuzdar substation and the Dadu substation, we received a response stating that the lack of staff in the area has an impact on O & M performance. The post that was approved at the Khuzdar substation remains vacant for the following reasons. In Pakistan, legislation stipulates that federal government-controlled organizations (NTDC, NEPRA, WAPDA, etc.) hire employees from all areas according to fixed constants defined by the government in the approved post. In addition to the fact that there are not many human resources in the Balochistan Province, people are reluctant to work in the Balochistan and Sindh outback due to security

concerns and long travel distances. The shortage of the staff here is dealt with not by new recruitment, but by transferring NTDC's other facility staff to the Khuzdar and Dadu substation. In the event of an emergency, NTDC 's Khuzdar and Dadu substation may ask for support from Quetta branch. In this way, securing human resources locally and from other areas is not easy, and the chronic shortage of maintenance personnel is a challenge in the operation and maintenance system.

3.4.2 Technical Aspect of Operation and Maintenance

NTDC's Technical Services Group (TSG[28]) will train NTDC staff[29] in charge of O & M in this project at three training centers (Faisalabad[30], Lahore[31], Tarbella[32]). Training manuals are in place here. According to the interview with the NTDC Hyderabad office, there is no training at the substation or regional office level, and there is no training manual.

The staff who actually do O & M have a bachelor's degree in engineering and a qualification as an associate engineer. Employees respond to everyday imperfections[33] and TSG provides support when serious flaws[34] occur.

3.4.3 Financial Aspect of Operation and Maintenance

3.4.3.1 Procedure for executing budget for operation and maintenance

The budget related to O & M is allocated by GSO to each substation. Resident engineers[35] at substations send budget proposals to GSO chief engineers, where the budget plan for that year is prepared. Subsequently, the GSO of each region presents a budget proposal to the finance department (asset management department) of the NTDC head office. Following the approval of the Board of Directors, a budget proposal is presented in accordance with the SOP (Standard Operating Procedure). The Head of Finance at NTDC Headquarters distributes the budget after getting confirmation of the relevant GSO chief.

3.4.3.2 Financial health of NTDC

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[28] TSG is a part of NTDC established in 1985 by Canada's Canadian International Development Agency (CIDA) that provides technical and financial support.

[29] The person to be trained is recommended by GSO (department in charge of O & M of NTDC).

[30] Faisalabad's training center conducts training on the maintenance and operation of the electricity grid.

[31] After the theoretical training at Tarbella, Lahore's training center conducts maintenance and maintenance management training of the transmission grid. (Source: CHIEF ENGINEER TSG NTDCL LAHORE, JUNE 2013, TSG-BRCH-001 / R0, http://www.ntdc.com.pk/publications.php)

[32] Tarbella's training center conducts theoretical training necessary for the maintenance of the power transmission system and practical training of exercise forms. (Source: CHIEF ENGINEER TSG NTDCL LAHORE, JUNE 2013, TSG-BRCH-001 / R0, http://www.ntdc.com.pk/publications.php)

[33] Tripping caused by overvoltage, failure of control relay, including breaker replacement. (Source: Executive Engineer Khuzdar)

[34] Shunt reactors, including transformer maintenance and testing. (Source: Executive Engineer Khuzdar)

[35] The resident engineer is under the control of a chief engineer. Resident engineers are responsible for O & M only for the distribution system of substations in their area. The chief engineer is responsible for all the transmission and distribution systems in the area to which it belongs.

NTDC[36] is a state-owned enterprise. Income from the operation of the transmission network is wheeling charge, which is imposed on fixed costs and variable costs.

Upon appraisal, the delinquency in payment of the distribution company (DISCO) affected the low level of the NTDC's sales and operating profits. According to the policy of the government, NTDC should be on the safe side financially, and the wheeling charge are set higher than the revenue standard that the distribution company can obtain so that NTDC can reliably supply electricity to DISCO. Therefore, it is considered that the non-payment issue at DISCO will limitedly affect NTDC's financial situation.

Due to the separation of CPPA[37] from NTDC in 2015, current assets were separated from NTDC. The net profit margin after tax is extremely high at around 30% (Table 8). This ratio is high for a power transmission project and can be said to be stable in terms of management[38]. Regarding financial sustainability, the capital adequacy ratio increased from 12% to 34% in 2014-2016, and the current ratio also increased from 100% to 161%.

Table 8 NTDC Financial Analysis

(Million Rupees)	Use of System wheeling charges	Profit before tax for the year	Profit for the year from continuing operation(Ater Tax)	Total Assets	Total equity	ROA(%)	ROE(%)	Net income to sales ratio(%)	Capital-to-asset ratio	Curent Ratio
2014	19,836	7,068	7,011	684,665	83,568	1%	8%	35%	12%	100%
2015	22,235	10,213	10,072	290,275	94,511	4%	11%	45%	33%	137%
2016	27,545	13,574	9,227	281,138	96,628	5%	10%	33%	34%	161%

Source：NTDC Financial Statement

3.4.3.3 NTDC income from the wheeling charge and operation and maintenance expenses

CPPA collects electricity charges from large customers and DISCO and pays electric power producers. After CPPA separated from NTDC in 2015, NTDC's income is revenue from wheeling charges under the electricity delivery contract with WAPDA (hydropower), IPP and KESC (Karachi electricity supply company).

NTDC must conduct transmission and distribution under the regulation[39] of transmission and distribution business under the approval of NEPRA[40]. It also includes restrictions on the wheeling

[36] NTDC was incorporated in November 1998 and started providing power in Pakistan on December 24, 1998. To allow NTDC to engage in the power transmission business exclusively for 30 years, according to Section 17 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997, Transmission License No. TL 01/2002 was approved by the Electricity Regulatory Authority (NEPRA) on 31 December 2002. According to "Market Operator (Climb Record, Standards and Procedures) Rule 2015" NTDC functions as a system operator. (Source: Provided by JICA)

[37] The Central Power Purchasing Agency (CPPA), established in 1984 under the Corporate Law, is a company fully owned by the Pakistan government and has taken over the business of NTDC in June 2015. CPPA procures electricity from GENCO (thermal power generation company), WAPDA (hydroelectric power generation) and IPP (independent power generation company) on behalf of DISCO.

[38] For reference, the UK national grid has a post-tax profit margin of 10% to 30% in 2007 to 2010, and a Netherlands Tennet has margin of 6% to 14% at the same time.

[39] Source：Annual Report 2011-2012

[40] NEPRA (Electricity Business Regulatory Authority) approves electricity price regulation and investment plan and was established to introduce transparent and wise economic regulations based on sound commercial principles in the power sector of Pakistan. The Pakistan government announced the enactment of the Regulation Act on Generation,

charge. Pakistan's wheeling charges is determined by NEPRAas a fixed cost (Rs / kW per month). After that, NTDC is notified after being submitted to the government.

O & M expenses/revenue income of 2016 (July 2015 - June 2016) occupies only 0.03% of revenue from the wheeling charge (11 million rupees ÷ 27, 545 million rupees). There should be no major problem in securing O & M resources. (Tables 9 and 10).

Table 9 NTDC Overall Operation and Maintenance Expenses

(Unit: Pakistan Rupee)

Sr#	Description	Amount in Rs.
FOR FINANCIAL YEAR 2014-15		
1	Pay & Allowances.	2,836,260
2	Honoraria	71,460
3	Overtime Claim	152,280
4	R&M of Grid Station & T/Line	25,000
5	TA／DA	263,978
		3,348,978
FOR FINANCIAL YEAR 2015-16		
1	Pay & Allowances.	9,709,118
2	Honoraria	1,007,680
3	Overtime Claim	215,163
4	R&M of Grid Station & T/Line	55,500
5	TA／DA	318,970
		11,306,431
FOR FINANCIAL YEAR 2016-17		
1	Pay & Allowances.	17,766,450
2	Honoraria	1,517,150
3	Overtime Claim	433,132
4	R&M of Grid Station & T/Line	193,776
5	TA／DA	571,280
		20,481,788

Source: NTDC

Note 1: The fiscal year of the Government of Pakistan starts on July 1 and ends on June 30 of the following year. 2016 (July 2015 - June 2016), 2015 (July 2014 - June 2015), 2014 (July 2013 - June 2014)

Note 2: TA / DA is TA = Traveling Allowance, DA = Daily Allowance

Transmission and Distribution (1997) which was enforced on December 13, 1997 in the Official Gazette of 16th December 1997. The responsibilities of NEPRA are as follows: 1. Approve power generation, transmission and distribution, 2) Establish criteria for ensuring high quality operations and safety, conduct implementation, 3) Approve power utility investment plan for utility companies, 4) Set fees for power generation, power transmission and distribution. (Source: http://www.nepra.org.pk/nepra.htm (September 16, 2013))

Table 10 Trends in NTDC's wheeling charge income

(Unit: Million Pakistan Rupees)

	Wheeling Charge	Profits from Continuing Operation
2014	19,836	7,011
2015	22,236	10,073
2016	27,545	9,226

Source: NTDC Financial Statement 2014, 2015, 2016

*NTDC handed over the market operation business to the newly established CPPA through a company split. NTDC is continuing the construction and management of traditional transmission lines.

3.4.4 Status of Operation and Maintenance

Inspection of the transmission lines are conducted every five to six months by the supervisor of the transmission line of the second department of the ultra-high voltage division (EHV-Ⅱ). Additionally, inspection through surveillance system, monitoring through visual inspection and patrol by walking is carried out. GSO / AM is conducting O & M of the power transmission system. Large-scale maintenance of the transmission line is sometimes carried out by the second department ultra-high voltage. The maintenance is done as a way to prevent any damage, such as defects, in the system or to prevent damage caused by large natural disasters such as storms in advance.

In the region, the area is wide and the population density is sparse, so security problems may be considered. However, monitoring of such places is handled without problems.

Spare parts of transmission lines are kept in Swan, Karachi and Hyderabad storage areas under the management of EHV-Ⅱ. At Khuzdar and Dadu substations, NTDC stores spare parts concerning 220 kV substation equipment.

Maintenance store of Khuzdar substation (Provided by NTDC)

Dadu substation on site 198kV surge arrester(Provided by NTDC)

At the time of ex-post evaluation, there was no breakdown of the transmission line, and large-scale repair was not conducted. Regarding the confirmation of equipment status, both the transmission line and the substation have problems in terms of feasibility because there are security and geographical problems in the Khuzdar substation and around the Khuzdar substation. There is support from TSG, which is the internal technology group of NTDC, and there is no problem with the technical level at the present time. As O & M costs are appropriately allocated, there is no particular problem in regular inspections, management of spare parts, etc. in the future. However, due to lack of staff and security concerns, there is concern about the future of O & M and the feasibility of inspection.

From the above, some minor problems have been observed in terms of the institutional aspect. Therefore, sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aims to respond to the growing electricity demand in Balochistan Province by conducting a new construction of a 220 kV transmission line (total length of about 300 km) from Dadu, Sindh Province to Khuzdar, Balochistan Province and 220/132 kV substation, thereby contributing to the revitalization of the regional economy of the province and improvement of the livelihood. The purpose of the project is consistent with Pakistan's development policy and development needs at the time of appraisal and ex-post evaluation, as well as Japan's aid policy at the time of appraisal, and its relevance is therefore high. The project period was significantly longer than planned due to a number of reasons such as the impact of sanctions against Iran (suspension of Iran-related transactions by banks), delay in opening letters of credit, delay in transportation of materials and equipment. Due to these delays, the project cost was significantly higher and, consequently, efficiency of the project is low. Since the operational status of the facilities provided by the project is steady, operation and effect indicators such as reduction of load shedding risk and improvements of voltage drop rate at the demand point are largely achieved, the effectiveness is high. It is estimated that this project has a high impact in contributing directly and indirectly to the industrial revitalization of Balochistan province, expansion of employment, and improvement of the livelihood of the local residents. Operation and maintenance status and technical aspects of the current facility equipment are generally good. However, due to security problems, there are some difficulties in mobilizing the staff for the maintenance of transmission lines and the substation located in Khuzdar, causing some issues on the feasibility of the inspection. The sustainability of the project effect is therefore rated as fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executiong Agency

Due to the security situation in Balochistan, there is concern that talented people are difficult to gather in remote areas such as Khuzdar and in areas with poor security. NTDC needs to focus on such areas in terms of sustainability in the future. For example, when arranging staff in the same area, measures such as further consideration of salaries are required. Profits are secured with regard to financial aspects, and training is also being conducted, so NTDC seems to have sufficient ability to take measures.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

It is necessary to prepare enough for foreseeable delay risks.

This project was delayed drastically, and as a result, the cost also increased from the original plan. The political issues such as sanctions against Iran and the flood condition are pointed out. Besides this, there are delays in opening letters of credit, approval of drawings, transportation of materials and equipment, and the payment procedure and problems of right of way in the construction area, which could be avoided by the efforts of the implementing organization. Prior to the project, JICA and implementing agencies should consider risk of delays and their countermeasures carefully so as to avoid such situations. It will also be necessary to prepare a projectplan that anticipates a preliminary period. Furthermore, it is desirable for the executing agency to summarize details of delay factors in progress reports and the like.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1.Project Outputs		
1)220 kV Dadu - Khuzdar transmission line	Extension of high voltage 220 kV double circuit single conductor transmission lines from Dadu to Khuzdar with a total length of 300 km. 833 Steel Towers (Double circuit), Conductors (Rail,1800 km, and OPGW 300 km.	220 kV Double Circuit Transmission Lines with a length of 275 km. Steel Towers 761, Conductor 1650 km and OPGW 275 km.
2)Khuzdar substation	2 Auto Transformers (160 MVA, 220kV), Bus Isolators (14 sets for 220 kV and 6 sets for 132 kV), Line Isolators (2 sets for 220kV), Circuit Breakers (6 sets for 220 kV and 3 sets for 132 kV) and 2 Shunt Reactors (18 Mvar, 220kV).	2 Auto Transformers (160 MVA, 220kV), Bus Isolators (16 sets for 220 kV and 9 sets for 132 kV), Line Isolators (2 sets for 220kV), Circuit Breakers (8 sets for 220 kV and 3 sets for 132 kV) and 2 Shunt Reactors (18 Mvar, 220kV)
3)Dadu substation	Expansion of 220kV Grid station at Dadu. Bus Isolators（6 sets）, Line Isolators（2 sets）, Circuit Breakers（3 sets）	220kV Switch yard 500/220/132kV extension Dadu GS（2 Bays）
4)Consulting Services	To assist NTDC in engineering services and detailed project design, preparation of tender documents, valuation of tenders, award of contract, supervision of construction work, verification of Bills of Quantities and/Contractor's Bills, and Testing and Commissioning of the Project.	Detailed project design, preparation of tender documents, evaluation of tenders, Award of contract, supervision of construction work, verification of Bills of Quantities and Contractor's Bills, and Testing and Commissioning of the Project.
2.Project Period	November 2006 - March 2011 (53 months)	November 2006 - December 2015 (110 months)
3. Project Cost Amount paid in foreign currency Amount paid in local currency Total ODA loan portion Exchange rate	 3,702 million yen 2,578 million yen 6,280 million yen 3,702 million yen 1 dollar = 112 yen = 60 Pakistan Rupees 1 Pakistan Rupee 1.87 yen (as of May 2006)	 4,583 million yen 3,576 million yen 8,159 million yen 3,147 million yen 1 dollar = 86.2 Pakistan Rupees 1 yen = 0.874 Pakistan Rupees 1 euro = 111.56 Pakistan rupees (Average between 2006 and 2016)
4.Final Disbursement	June 2015	