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Report No: ICR00005068

IMPLEMENTATION COMPLETION AND RESULTS REPORT

ON AN

IDA CREDIT (P101578)

IN THE AMOUNT OF SDR 4.8 MILLION
(US$7.3 MILLION EQUIVALENT)

AND A

GLOBAL ENVIRONMENT FACILITY (GEF) GRANT (TF014583)

IN THE AMOUNT OF US$900,000

TO THE

INDEPENDENT STATE OF PAPUA NEW GUINEA

FOR THE

PNG ENERGY SECTOR DEVELOPMENT PROJECT
June 30, 2020

Energy and Extractives Global Practice
East Asia and Pacific Region

CURRENCY EQUIVALENTS
(Exchange Rate Effective November 25, 2019)

Currency Unit =	Papua New Guinea Kina
K 3.33 =	US$1
US$1 =	SDR 0.72

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AGO	Auditor General's Office
CPF	Country Partnership Framework
CPS	Country Partnership Strategy
DPE	Department of Petroleum and Energy
DSP	Development Strategic Plan
ECA	Economic Consulting Associates
EIP	Electricity Industry Policy
EMC	Electricity Management Committee
ESDP	Energy Sector Development Project
ESIA	Environment and Social Impact Assessment
FM	Financial Management
GEF	Global Environment Facility
GHG	Greenhouse Gas
GoPNG	Government of Papua New Guinea
GRM	Grievance Redress Mechanism
HPP	Hydropower Project
ICR	Implementation Completion and Results Report
IFC	International Finance Corporation
IFR	Interim Financial Report
IPBC	Independent Public Business Corporation
IPP	Independent Power Producer
ISR	Implementation Status and Results Report
LCPDP	Least-Cost Power Development Plan
M&E	Monitoring and Evaluation
NB	Naoro Brown
NEP	National Energy Policy
NEROP	National Electrification Roll out Plan
NPV	Net Present Value
ORAF	Operational Risk Assessment Framework
PAD	Project Appraisal Document

PDO	Project Development Objective
PIE	Project Implementing Entity
PMU	Project Management Unit
PNG	Papua New Guinea
PNGSDP	Papua New Guinea Sustainable Development Program Limited
PPA	Power Purchase Agreement
PPL	PNG Power Limited
PPP	Public-Private Partnership
SCD	Systematic Country Diagnostic
SESA	Strategic Environmental and Social Assessment
STEP	Systematic Tracking of Exchanges in Procurement
TA	Technical Assistance

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DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P101578	PNG Energy Sector Development Project
Country	**Financing Instrument**
Papua New Guinea	Investment Project Financing
Original EA Category	**Revised EA Category**
Partial Assessment (B)	Partial Assessment (B)

Organizations

Borrower	Implementing Agency
Department of National Planning and Monitoring	Department of Petroleum and Energy (DPE), PNG Power Limited (PPL)

Project Development Objective (PDO)

Original PDO

Project Development objective:

The project development objectives (PDO) are to (i) strengthen policy development andstrategic framework for renewable energy and rural electrification; and (ii) to attract investors for sustainable development ofnew hydropower generation to supply to the Port Moresby electricity grid.

PDO as stated in the legal agreement

The project development objectives (PDO) are to (i) strengthen policy development and strategic framework for renewable energy and rural electrification; and (ii) to attract investors for sustainable development of new hydropower generation to supply to the Port Moresby electricity grid.

FINANCING

	Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Financing			
IDA-52010	7,300,000	7,300,000	6,381,153
Total	**7,300,000**	**7,300,000**	**6,381,153**
Non-World Bank Financing			
Borrower/Recipient	1,050,000	1,050,000	0
Total	**1,050,000**	**1,050,000**	**0**
Total Project Cost	**8,350,000**	**8,350,000**	**6,381,153**

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
21-Feb-2013	27-Nov-2013	30-Nov-2015	31-Jan-2018	31-Jul-2019

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US$M)	Key Revisions
29-Jun-2016	2.05	Change in Components and Cost Change in Loan Closing Date(s) Change in Legal Covenants Change in Implementation Schedule
12-Jul-2017	2.93	Change in Results Framework Change in Components and Cost Reallocation between Disbursement Categories

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Moderately Unsatisfactory	Moderately Satisfactory	Modest

RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	10-Nov-2013	Satisfactory	Moderately Satisfactory	0
02	05-Jul-2014	Moderately Satisfactory	Moderately Satisfactory	0
03	30-Dec-2014	Moderately Satisfactory	Moderately Satisfactory	.48
04	26-Jun-2015	Moderately Satisfactory	Moderately Unsatisfactory	.59
05	31-Dec-2015	Moderately Unsatisfactory	Moderately Unsatisfactory	1.07
06	27-Jul-2016	Moderately Unsatisfactory	Moderately Unsatisfactory	2.21
07	23-Feb-2017	Moderately Unsatisfactory	Moderately Unsatisfactory	2.88
08	16-Oct-2017	Moderately Unsatisfactory	Moderately Unsatisfactory	3.04
09	31-May-2018	Moderately Unsatisfactory	Moderately Unsatisfactory	3.95
10	13-Dec-2018	Moderately Unsatisfactory	Moderately Unsatisfactory	4.81
11	21-Dec-2018	Moderately Unsatisfactory	Moderately Unsatisfactory	4.85
12	28-Jun-2019	Moderately Unsatisfactory	Moderately Unsatisfactory	5.03

SECTORS AND THEMES

Sectors

Major Sector/Sector	(%)
Energy and Extractives	**100**
Renewable Energy Hydro	86
Public Administration - Energy and Extractives	14

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3)	(%)

Private Sector Development	**26**
Jobs	16
Job Creation	16
Public Private Partnerships	10
Urban and Rural Development	**84**
Urban Development	64
Urban Infrastructure and Service Delivery	64
Rural Development	20
Rural Infrastructure and service delivery	20

ADM STAFF

Role	At Approval	At ICR
Regional Vice President:	Pamela Cox	Victoria Kwakwa
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I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

1. **At the time of appraisal in 2012, most of the population of Papua New Guinea (PNG) did not have access to infrastructure services.** The population of PNG was about 7.3 million with a land area of 463,000 km^2, hence a low population density (16 people per km^2 compared, for example, to 148 people per km^2 in Indonesia); about 15 percent of the population lived in urban areas, and rural areas were sparsely populated and had low access to infrastructure. The PNG population was organized into small, fragmented social groups, speaking over 800 distinct languages. Allegiance to local, clan-based groups was frequently strong and more immediate than a national identity, a situation which posed a challenge to the pursuit of a national vision.

2. **The economy was highly dualistic, and much of the economic fortunes enjoyed by the extractives and other modern sectors had not trickled down to the rural population.** The 'enclave-based' formal sector focused mainly on the large-scale export of natural resources. The informal sector was based mainly on the subsistence and semi-subsistence activities of the majority rural population. At the time, PNG had enjoyed markedly improved economic fortunes since the mid-2000s. One of the development challenges facing PNG was bridging this broad social and economic span: sophisticated private sector operations in mining and other sectors on the one hand and traditional, subsistence livelihoods for much of the population, on the other. Resource sector investments were propelling the emergence of a non-resource, modern private sector concentrated in urban areas.

3. **Energy as a cross-cutting sector would affect all households, businesses, and industries and thereby contribute to inclusive economic and social development.** Effective development of a sustainable energy sector targeting both increased access to electricity and more reliable power supply on the existing grids would have broad social development benefits for households, including in the rural areas, as well as a positive impact on the formal economy. The project was conceived to help identify and set the stage to achieve sustainable and inclusive development of the energy sector, leading to significant social benefits.

4. **There was no national power grid in PNG, due in part to the country's very rugged, mountainous terrain, high population dispersion, low income level, capital constraints, and the development priorities of the Government of PNG (GoPNG)**. Instead, PNG has three separate main power grids owned and operated by PNG Power Limited (PPL): Port Moresby; Ramu serving Lae, Madang, and the Highlands; and Gazelle (Rabaul) serving East New Britain Province. These three islanded networks were mixed hydrothermal power systems. PPL also operated 14 other small systems, all of which were thermal based, except for two that had mini-hydro schemes supplemented by diesel power.

5. **There were several key challenges in the energy sector**:

- **Access to electricity was low.** It was estimated that only about 10 percent of PNG's population had access to electricity. The GoPNG had set a target in its Development Strategic

Plan (DSP) 2010–2030 of achieving 70 percent access by 2030, but efforts made had been largely ad hoc.

- **There were growing demand-supply imbalances.** The electricity grid had little reserve margin due to high load growth, particularly in the Port Moresby area—where it was forecasted to grow at about 10 percent per year during the initial years of project implementation—which resulted in postponed maintenance and subsequent derating of generating units (in 2013 the installed capacity in the Port Moresby area was 175 MW but the rated capacity was 19 percent lower - 142 MW). Additionally, with high load growth, transmission and distribution networks were overloaded, resulting in poor reliability and high losses of the power systems.

- **The power system increasingly depended on diesel generation.** In the absence of access to hydropower and natural gas, which was still at a nascent stage of development, the power system largely depended on expensive diesel fuel for power generation, despite having large hydropower potential and significant gas deposits, which were being used by private sector developers. This led to high cost of power generation.

- **Despite the availability of natural resources, such as gas and hydro, the GoPNG lacked a comprehensive policy to address the issues.** This factor was a major reason for designing the project with a policy-oriented component to provide a framework for subsequent planning and development.

6. **At the time of appraisal, institutional development of the Department of Petroleum and Energy (DPE) and PPL was considered a key priority. Key sector institutions at the time were the following**:

- The DPE had responsibility for policy, strategic direction, and planning in the energy sector. Under the Electricity Industry Policy (EIP) approved in December 2011, the DPE's responsibilities had expanded to include the position of Chair of and Secretariat to the Electricity Management Committee (EMC); the latter's mandate included guiding the Government in aspects such as moving away from uniform tariffs toward cost-reflective pricing and transferring the technical regulation of the sector from PPL to the DPE.

- Independent Public Business Corporation (IPBC), which later became Kumul Consolidated Holdings (KCH) in 2015, held the Government's ownership interest in state-owned enterprises including PPL, and handled commercial aspects, monitoring, and oversight.

- Independent Consumer and Competition Commission (ICCC) was responsible for the economic regulation of electricity retail tariffs.

- PPL was the state-owned, vertically integrated electricity utility with licenses for generation, transmission, distribution, and retail covering most of the main urban centers. PPL was created in July 2002 when the electricity assets, liabilities, and undertakings of the Government-owned statutory corporation Elcom (formerly the Electricity Commission of PNG) were transferred to PPL. PPL was incorporated under the Companies Act and 100 percent owned by the General Business Trust of which the IPBC is the trustee.

- Western Province Power Limited, a wholly owned subsidiary of PNG Sustainable Development Program Limited (PNGSDP), had a license for electricity generation, distribution, and supply activities in the Western Province. Western Power's mandate is development oriented, with a focus on small-scale (less than 10 MW) power supply that would be unlikely to be commercially viable without targeted financial support. Western Power was no longer in operation since the expropriation of the Ok Tedi Mine by the Government and funding removed from the PNGSDP

7. **The project was fully aligned to the GoPNG's national development priorities.** The Government's Vision 2050 approved in 2011 incorporates the overall strategic statements that would drive development initiatives over the next 40 years. The DSP 2010–2030 provided guidance on national priorities, and the Medium-Term Development Plan 2011–2015 articulated specific actions and deliverables and the strategies through which they were to be implemented. Development of a strategic approach in the energy sector, a target of increasing access to electricity from less than 10 percent at the time to 70 percent by 2030, and specific five-year goals of increased use of hydro and improved energy sector management capacity, were particularly relevant for the project.

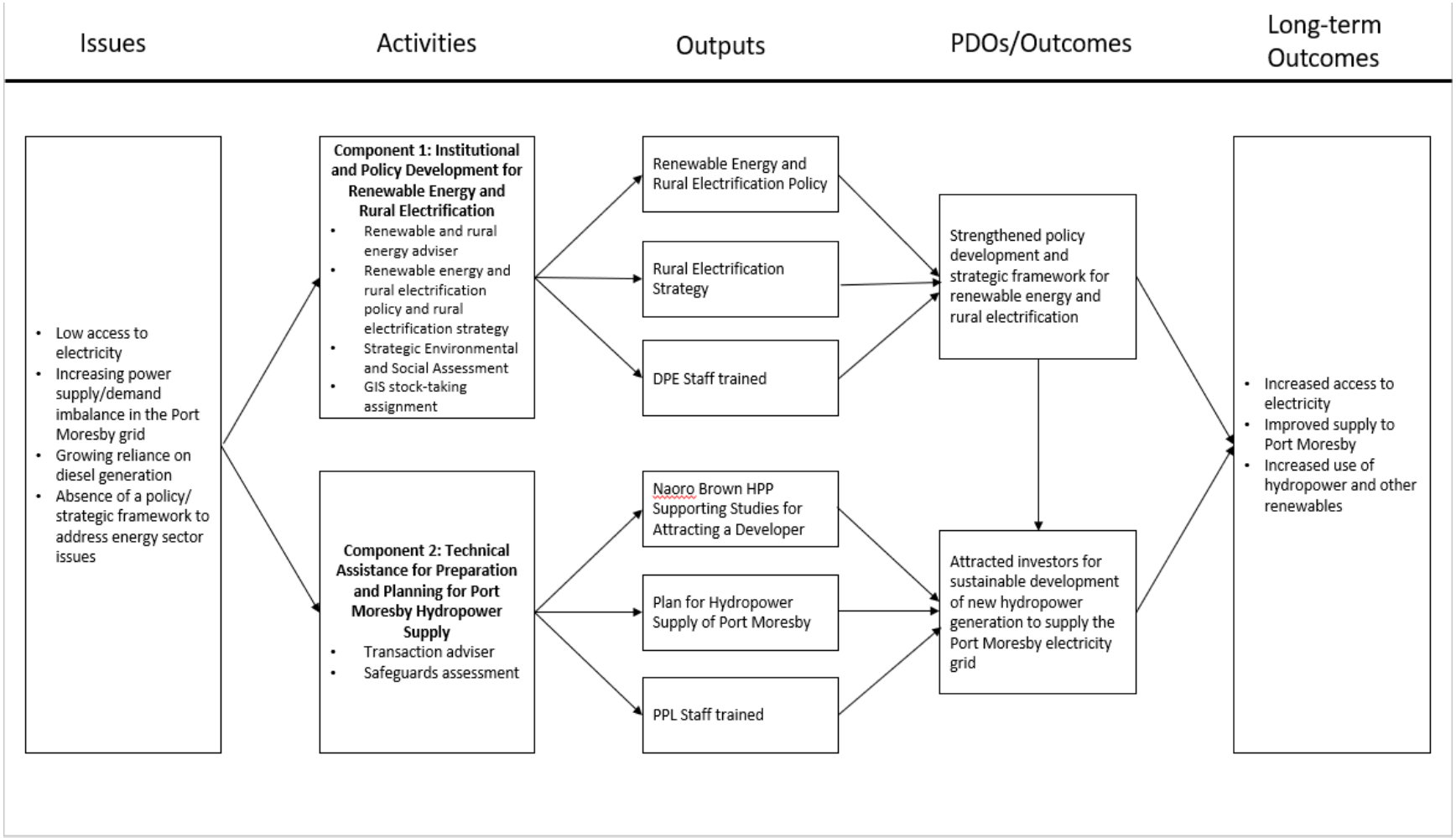
8. **The project was fully aligned with the World Bank's strategy for PNG as stated in the Country Partnership Strategy (CPS Report No. 71440-PG) for FY13–FY16**. The Government had signaled its request for a continued high priority on strategic renewable energy sector work in the World Bank Group program. The CPS identified increased and more gender-equitable access to inclusive physical and financial infrastructure as a key pillar of World Bank engagement and this project was fully aligned to support the achievement of this pillar. The development of the project was closely coordinated with the International Finance Corporation (IFC).

Theory of Change (Results Chain)

9. The Energy Sector Development Project (ESDP) was designed to lay the policy, strategy, and institutional capacity foundations for future development of the energy sector to address the key longer-term challenges such as low access to electricity, insufficient power generation capacity, and the diversification of the energy mix away from dependency on diesel generation. Two components each supported the development objectives through support for policy formulation and a strategic framework, institutional development, and investment project preparatory activities.

10. Figure 1 shows the Theory of Change inferred from the Project Appraisal Document (PAD), including a link to longer-term outcomes that the ESDP would contribute to beyond its closing date. Project activities were designed with the assumption that there would be political commitment and ownership to address energy sector issues and thereby: (a) support the ESDP project throughout the execution, (b) support and implement its recommendations regarding energy policy and rural electrification strategy, to increase electricity access, and (c) increase affordable and reliable power supply to the Port Moresby's growing energy demand through the development of new hydropower on the Port Moresby Grid and reduce its reliance on diesel generation.

Figure 1. ESDP Inferred Theory of Change



Note: GIS = Geographic Information System;
HPP = hydropower project

Project Development Objectives (PDOs)

11. The PDOs, as stated in the PAD and the Financing Agreement of the ESDP, were to: (i) strengthen policy development and strategic framework for renewable energy and rural electrification; and (ii) attract investors for sustainable development of new hydropower generation to supply the Port Moresby electricity grid.[1]

12. **Global Environment Facility (GEF)[2] Grant Objective.** The objective of the GEF Grant as stated in the Grant Agreement and the PAD was to support the development of a framework, information exchange, and consensus building to launch a national effort on development of renewable energy-based minigrids and rural electrification.

13. The GEF grant is blended with IDA financing and finances part of Component 1, in particular the electrification strategy to be developed as the National Electrification Roll out Plan (NEROP). There was no grievance redress mechanism (GRM) prepared under this project and reporting of concerns and complaints was carried out under the overall project implementation monitoring.

Key Expected Outcomes and Outcome Indicators

14. **The project was intended to provide strategic technical assistance (TA) to lay the ground works for the GoPNG to achieve its ambitious electrification targets and foster renewable energy development, especially hydropower that was abundantly available**. Despite the World Bank's long engagement in building most large-scale hydropower facilities in PNG during the 1970s and 1980s, such as Ramu 1 and Rouna hydropower plants that supply the Ramu and Port Moresby grids respectively, the World Bank had limited engagement in the energy sector at the time of appraisal. Moreover, despite abundant energy resources, there was no coordinated approach to promote rural electrification in the country where more than 90 percent of the population lacked access to electricity. Consequently, the project's emphasis was to provide the foundations for addressing the issues identified in the background and results chain through three distinct elements—energy policy, a strategic framework for its implementation, and recommendations for addressing rural electrification and renewable energy generation including hydropower—which together would provide an integrated outcome as indicated in the results chain. The second outcome is associated with executing the studies and preparations for the Naoro Brown (NB) Hydropower Project (HPP), and associated transaction advices to attract private investment for its development.

15. **Assessment of the outcomes is organized in terms of the two main outcomes of the PDO**. They were:

(a) Outcome 1: Strengthen policy development and strategic framework for renewable energy and rural electrification, which also directly reflected the GEF outcome, and

[1] The PDO formulation in the PAD and Financing Agreement is identical.
[2] The PAD and the Financing Agreement are not specific as to the split between the activities to be financed by IDA and the GEF under this component (that is, the financing is blended). In practice, GEF financing has been used mostly for the NEROP consultancy.

(b) Outcome 2: To attract investors for sustainable development of new hydropower generation to supply Port Moresby.

16. **The PDO indicators in the Results Framework, as subsequently updated during implementation, are used to evaluate the ESDP's outcomes:**

(a) **Outcome 1 indicator.** National Energy Policy and rural electrification strategy finalized by the Department of Petroleum and Energy following participatory process[3], and

(b) **Outcome 2 indicator.** Financing structure for the NB HPP is approved by the Recipient's government[4].

17. The chosen indicators reflect the achievement of the outcomes: (a) insofar as the National Energy Policy (NEP) and the rural electrification strategy are prepared with full consultation of different stakeholders in the different energy subsectors (for example, potential hydropower developers, natural gas producers, renewable energy developers, among others) and the findings are reflected in the final report, and (b) the financing structure for developing the NB HPP is complemented by intermediate indicators that provide reassurance with respect to the consultation process with the communities, and the improved institutional capacity of PPL.

Components

18. **The project had two components**, as described in the PAD.

19. **Component 1. IDA/GEF/Government: Institutional and Policy Development for Renewable Energy and Rural Electrification,** to be implemented by the DPE, included a total financing of US$2,150,000 from the IDA and GEF funding allocations at appraisal, while the actual disbursement at the project closing was about US$1,182,890. There were no allocations from the government at actual disbursements. The total contributions of financing at appraisal were US$1,100,000 IDA, US$900,000 GEF and US$250,000 government. From the IDA funding, US$550,000 were transferred to Component 2 at the second restructuring. The remaining GEF funding of US$67,107 were not disbursed and cancelled.

(a) **Energy policy development.** IDA financing covered this assignment:

(i) Development of a renewable energy policy, and

(ii) Development of a rural electrification policy.

(b) **Institutional and strategy development.** The GEF grant covered the major part of this assignment:

[3] The GEF Chief Executive Officer Endorsement Request included a Global Environment Indicator of greenhouse gas emissions reduced. However, this indicator was inadvertently not included in the Results Framework of the PAD as it may have been an oversight.

[4] The decision on the approval was the setting up of the intergovernmental taskforce to supervise and manage the project during implementation.

(i) Strategic Environmental and Social Assessment (SESA) of the policies to be developed, and

(ii) Development of a rural electrification strategy for the recipient, including, among others, initial data to define resources and demand for rural electrification; an analysis of alternative models of community and rural electrification initiatives, including cost structure, as input to the process for developing tariffs for electricity supply; and a methodology for screening social and environmental aspects of rural electrification initiatives.

(c) **Capacity building.** IDA financing covered this assignment:

(i) Strengthening the capacity of the GoPNG's institutions, for their role in oversight of the preparation and the development of electricity projects in the medium term including the NB HPP, with, among others, the environmental and social safeguard aspects, and

(ii) Strengthening project management through effective and efficient operational management, procurement management, and financial management (FM), including through initial operation of DPE regional offices and training.

20. **Component 2. Technical Assistance for Preparation and Planning for Port Moresby Hydropower Supply,** to be implemented by PPL, included IDA funds of US$6,300,000 and government funds of US$800,000 making the total cost of US$7,100,000 at appraisal. The actual disbursement cost at project closing was about US$6,032,394, including US$550,000 which was transferred from Component 1 of the IDA later through the project restructuring. There was no contribution from the government at the actual disbursements. It includes:

(a) **Preparation of the 80 MW NB HPP for Port Moresby.** Strengthening the institutional capacity of the Project Implementing Entity (PIE) in the areas of technical; financial; legal; economic; social; environmental (including the Social and Environmental Expert Panel, the Dam Safety Expert Panel, and the Environmental and Social Management Framework, further feasibility study work including drilling and grouting trials and preparation of a geological baseline assessment); communications; procurement; and project management as required to: (i) prepare the NB HPP, (ii) select a NB Project Developer, and (iii) provide support through financial close and TA required for additional assessments and feasibility studies and economic analysis.

(b) Improved planning related to hydropower supply for Port Moresby. It includes:

(i) A three-basin inventory study of the Brown, Vanapa, and Angabanga Basins, and

(ii) Institutional strengthening and capacity building for the Project Management Unit (PMU), the EMC, and supporting staff, in areas critical for implementation of improved performance and implementation of HPPs, such as planning capacity, project evaluation, preparation and negotiation of Power Purchase Agreements (PPAs), procurement, FM, social and environmental aspects, and communications.

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION (IF APPLICABLE)

21. **The project was formally restructured twice: on June 29, 2016 (Level 2 restructuring), and on August 15, 2017 (Level 2 restructuring).** The first restructuring was to: (a) extend the closing date for both the IDA Credit and the GEF Grant by 18 months, (b) amend Component 1 managed by the DPE to finance a gas master plan, and (c) amend the covenant related to establishment of two expert panels by PPL for the NB HPP as the required time frame originally outlined by the covenant proved too early**.**

22. The second restructuring, was to: (a) cancel and amend activities under Components 1 and 2, (b) reallocate funds between disbursement categories specified in the IDA Financing Agreement and GEF Financing Agreement to reflect the revised project activities and enable activities under Component 2 to be fully completed, (c) include one new disbursement category under the IDA Financing Agreement to allow for financing of operating costs under Component 2, (d) delete some indicators and change the targets for others to consider the activities that have been cancelled, and (e) change the disbursement projections to reflect the reality on the ground and more realistic projections.

Revised PDOs and Outcome Targets

23. The PDOs were not revised during project implementation.

24. The outcome targets were revised as shown in the following paragraphs.

Revised PDO Indicators

25. **The PDO indicators were revised as part of the second project restructuring in August 2017.** The restructuring was done with a view to delete some indicators and change targets of others in response to higher-than-expected cost for contracts supported under Component 2, for which the cost estimate was revised from US$6.5 million to US$7.1 million. The key changes to the PDO indicators are summarized in table 1.

Table 1. Changes in PDO Indicators during the Second Project Restructuring in August 2017

PDO Indicators		
Original Indicators[a]	**Final (Revised 2017)**	**Comments**
Rural and Renewable Energy policies are submitted to the cabinet and rural electrification strategy completed following a participatory process	National Energy Policy and rural electrification strategy finalized by the Department of Petroleum and Energy following participatory process	Changes made were reasonable given that the NEP envisaged by the ESDP included both rural electrification and renewable energy. Finalized means submitted for cabinet approval.
Financing for the NB HPP is at an advanced stage with the due diligence for financiers completed	Financing structure for the NB HPP is approved by government	Changes reflected: (a) cancelled supporting activities for reaching financial closure. (b) insufficient funds to undertake transaction advisory and other tasks such as hydrology gauging, and (c) the GoPNG's intention to seek alternative sources of funds.
Planning study is completed as a key input to preparing future	Dropped	Changes made were reasonable given that river basin planning study was not urgently needed for hydropower investments given

hydropower projects for investments		the slowdown of hydropower development in PNG while gas-to-power became more urgent. Moreover, the World Bank in 2018 supported the GoPNG/PPL in preparing a Least-Cost Power Development Plan (LCPDP), which indicated rehabilitation of existing hydropower and gas-to-power as a priority before new hydropower development given the long preparation and development duration of hydropower.

Note: a. According to the IDA Financing Agreement.

26. The remaining indicators after the 2017 restructuring synthesize the basic objectives of the project. For Component 1, producing an NEP which includes the rural electrification and renewable energy aspects and developing a rural electrification strategy to meet the Government's 70 percent access target will provide the basic institutional orientation for further sector development. Under Component 2, approval of the financing structure requires the foundations provided by the basic studies financed under the project. Two intermediate indicators supplemented the PDO indicators: (a) elements of rural electrification strategy prepared (Component 1), and (b) NB consultation process progresses in a way that results in decisions that respond to the interests and concerns of women and men in the NB project area and advances the objectives of the project (Component 2).

Revised Components

27. **The project components were streamlined during the two project restructurings**. The changes in the project's components according to the two project restructurings are summarized in table 2.

Table 2. Changes in Project Components during Project Implementation

Original Components	2016 Restructuring	2017 Restructuring	Final Components	Explanatory Note
Component 1: Institutional and Policy Development for Renewable Energy and Rural Electrification				
(a) Energy Policy Development (i) Renewable energy policy (ii) Rural electrification policy	No change	(i) and (ii) replaced with the development of an NEP	(a) NEP development	The NEP was deemed to include elements of the renewable energy and rural electrification policies initially envisaged. Reducing the number of activities and contracts for the DPE would simplify project management and implementation.

Original Components	2016 Restructuring	2017 Restructuring	Final Components	Explanatory Note
(b) Institutional and Strategy Development (i) SESA of policies under part (a) above (ii) Development of a rural electrification strategy	(i) and (ii): No change; Added (iii) Development of a natural gas master plan	Revised (i) SESA of the strategy to be developed for the rural electrification strategy instead of for the renewable energy and rural electrification policies Cancelled (iii) Development of a natural gas master plan	(b) Institutional and Strategy Development (i) SESA under (ii) below; (ii) Development of a rural electrification strategy	A natural gas master plan was added during the first restructuring, but subsequently removed during the second restructuring because there was no progress and the Government was considering developing this plan through the Mineral Resource Authority under separate funding. SESA was done for the rural electrification strategy and not the NEP.
(c) Capacity Building (i) Strengthening the capacity of the recipient's institutions (ii) Strengthening project management through effective and efficient operational management, procurement, and FM, including through initial operation of DPE regional offices and training	No change	Removed 'initial operation of DPE regional offices and training' from (ii)	(c) Capacity Building (i) Strengthening the capacity of the recipient's institutions (DPE) (ii) Strengthening project management through effective and efficient operational management, procurement, and FM	The support to DPE regional offices was removed because they were never set up, due to funding limitations.
Component 2. Technical Assistance for Preparation and Planning for Port Moresby Hydropower Supply				
(a) Preparation of the NB HPP for Port Moresby Strengthening the institutional capacity of the PMU	No change	Cancelled the support for the Dam Safety Expert Panel; Cancelled the support for the	(a) Preparation of the NB HPP for Port Moresby Strengthening the institutional capacity of the PMU in the	The support for the selection of a project developer and the support through financial close were

Original Components	2016 Restructuring	2017 Restructuring	Final Components	Explanatory Note
in the areas of technical, financial, legal, economic, social, environmental communications, procurement, and project management as required to (i) Prepare the NB HPP, (ii) Select a NB Project Developer, and (iii) Provide support through financial close and TA required for additional assessments and feasibility studies and economic analysis.		selection of a NB Project Developer and the support through financial close	areas of technical, financial, legal, economic, social, environmental, communications, procurement, and project management as required to (i) prepare the NB HPP (ii) provide TA required for additional assessments and feasibility studies and economic analysis.	cancelled as the development of NB was deferred and Government was applying for other trust funds to carry out this work. The Dam Safety Expert Panel was cancelled because experts would be financed by the project developer once selected.
(b) Improved planning related to hydropower supply for Port Moresby (i) Three basin inventory of the Brown, Vanapa, and Angabanga Basins (ii) Institutional strengthening and capacity building for the PIE and EMC and supporting staff, in areas critical for implementation of improved performance and implementation of HPPs, such as planning	No change	Cancelled the support for (i) three-basin inventory study of the Brown, Vanapa, and Angabanga Basins	(b) Improved planning related to hydropower supply for Port Moresby Institutional strengthening and capacity building for the PMU and EMC and supporting staff, in areas critical for implementation of improved performance and implementation of HPPs, such as planning capacity, project evaluation, preparation and negotiation of PPAs, procurement, FM, social and environmental aspects, and communications	The three-basin inventory study was cancelled due to insufficient funds and the basin planning became not urgent due to delays in new hydropower development as suggested by the LCPDP. Several contracts required more financing than initially expected, especially the safeguards work under Component 2. Due to exchange rate fluctuations, the project amount in U.S. dollars was reduced by US$0.7 million equivalent.

Original Components	2016 Restructuring	2017 Restructuring	Final Components	Explanatory Note
capacity, project evaluation, preparation and negotiation of PPAs, procurement, FM, social and environmental aspects and communications				

Other Changes

28. **Other than the changes already mentioned,** the project closing date was extended once, a covenant was amended, funds were reallocated between disbursement categories, and an additional disbursement category was included, as part of the project restructurings in June 2016 and August 2017.

29. As part of the first project restructuring in June 2016, the following changes were made:

(a) The closing date was extended by 18 months for both the IDA Credit (5201-PG) and the GEF Grant (TF014583), bringing the proposed closing dates to July 31, 2019, and June 30, 2018, respectively; and

(b) A covenant related to the establishment of two expert panels by PPL for the NB HPP under Component 2 was amended as the specified required time frame originally outlined by the covenant proved to be too early in the process.

30. As part of the second project restructuring in August 2017, the following changes were in effect:

(a) Funds were reallocated between disbursement categories. This was mainly attributable to (i) several contracts requiring more financing than initially expected, especially the safeguards-related activities under Component 2, and (ii) depreciation of the U.S. dollar against SDR. As a result, the project costs were changed as in table 3;

(b) There was no government contributions to the cost of the project;

Table 3. Project Costs at Approval, after the Second Restructuring and the Actuals Disbursed

Project Component	At Approval (2013) US$, millions				Second Restructuring (2017) US$, millions				Actuals US$, millions			
	Total Cost	IDA	GEF	PNG	Total Cost	IDA	GEF	PNG	Total Cost	IDA	GEF	PNG
1. Institutional and Policy Development for Renewable	2.15	1.00	0.90	0.25	1.50	0.35	0.90	0.25	1.18	0.35	0.83	—

Energy and Rural Electrification												
2. Technical Analysis for Preparation and Planning for Port Moresby Hydropower	7.10	6.30	—	0.80	7.75	6.95	—	0.80	6.03	6.03	—	—
Total	**9.25**	**7.30**	**0.90**	**1.05**	**9.25**	**7.3**	**0.90**	**1.05**	**7.21**	**6.38**	**0.83**	**—**

(c) A new disbursement category under the IDA Financing Agreement was included to allow for financing of operating costs under Component 2.

Rationale for Changes and Their Implication on the Original Theory of Change

31. **The changes summarized earlier were mainly motivated by a combination of the reduced availability of project funds, higher than anticipated costs for some contracts, limited project and fiduciary management capabilities on the part of the implementing agencies, the availability of alternative sources of funds for supporting the NB HPP, and delays in the needs of new hydropower development, as indicated in the LCPDP.** For these reasons, the number of activities and contracts was reduced to a minimum set that would still make it possible to achieve the PDOs, and some activities that could be financed under other funds were removed from the project scope, such as the selection of project developers and supporting the NB HPP through to financial close. As guided by the LCPDP, rehabilitation of existing hydro, instead of development of NB, became a priority and TA for preparation of the rehabilitation and updating the LCPDP were included in the follow on proposed Bank-supported project, which was scheduled for approval by the Board of the Bank in late 2020.

32. **As a result, the original Theory of Change was affected, as follows:**

(a) Activities for Component 2: The Three Basin Inventory Study was eliminated;

(b) Outputs: (i) the Renewable Energy and Rural Electrification Policy became an NEP, (ii) the NB HPP supporting studies for attracting a developer became NB HPP studies, and (iii) the Plan for Hydropower Supply of Port Moresby was dropped;

(c) The PDOs did not change, but Component 2 outcomes initially conceived as 'attracting investors for sustainable development of new hydropower generation to supply the Port Moresby electricity grid' became simply 'Financing Structure for NB approved by Government', given the needs of new hydropower development was deferred as indicated by the LCPDP; and

(d) Long-term outcomes were unaffected.

33. Although the scope of some activities and, consequently, the corresponding outputs changed, the overall Theory of Change did not undergo major modifications.

II. OUTCOME

A. RELEVANCE OF PDOs

Assessment of Relevance of PDOs and Rating

34. **The ESDP's PDOs remain highly relevant to the development needs of PNG**. The country had, and still has, a shortage of supply to meet its growing demand for electricity. According to the LCPDP supported by the World Bank in 2018, hydropower remains one of the lowest cost options to meet the growing demand for electricity, rehabilitation of existing hydropower plants became a priority, followed by development of new gas-to-power capacity for the short- and medium-terms before new hydropower plants could be developed and commissioned. With the low rate of access to electricity, which was less than 10 percent at appraisal and less than 20 percent at the time of project completion, electrification remains a high priority for economic and social development of PNG. The Government's development strategies at the time of approval, such as the Medium-Term Development Plan 2011–2015, articulated specific actions and deliverables and the strategies for implementing them. At the time of project completion, the GoPNG retains the ambitious goals of reaching 70 percent electricity access by 2030, a carbon-free electricity sector by 2030 under its Nationally Determined Contribution and becoming fully carbon neutral by 2050 under the National Strategy for Responsible Sustainable Development.

35. **The Systematic Country Diagnostic (SCD) carried out for PNG in 2018 identified the lack of access to affordable and reliable power supply as limiting economic growth in urban areas and contributing to poverty in rural areas**. The SCD (Report No. 127800-PG) establishes that the country will need to significantly increase generation capacity and reinforces the importance of prudently implementing an LCPDP to support the country in developing its power systems in an optimal manner and selecting projects through competitive processes.

36. **The project is aligned with the 2019–2023 Country Partnership Framework (CPF Report No. 128471-PG) as well as the CPS at the time of project approval (for the period FY13–FY16).** The 2019–2023 CPF explicitly includes as key focus areas, helping boost people's access to electricity and development of renewable energy. The project, by concentrating on developing an energy policy, supports the fundamentals for achieving these two areas of the CPF. Furthermore, by supporting the development of the NB HPP, the ESDP contributes toward making more renewable energy available, hence increasing the opportunities for better access. The NB HPP is among the least-cost power generation options at the time of project closing in 2019 and is considered for commissioning in 2026.

37. The relevance of the PDOs is rated High.

B. ACHIEVEMENT OF PDOs (EFFICACY)

Assessment of Achievement of Each Objective/Outcome

38. **The ESDP, though to a different extent, met all relevant and attributable indicators for the two outcomes associated with the PDOs**. Achievement of the PDOs to: (a) strengthen policy development and strategic framework for renewable energy and rural electrification, and (b) attract investors for

sustainable development of new hydropower generation to supply the Port Moresby electricity grid, is evaluated by assessing the two PDO indicators that were retained at the time of the second restructuring.

39. Even though restructurings made some adjustments to the Results Framework, a split rating is not done for the following reasons: (a) there were no changes to the PDOs; (b) there was minimum reduction in the project scope, for example, two policies were combined, the river basin study was substituted for a gas master plan, and resources were later transferred to assist complete other urgent studies; and (c) the restructurings strengthened the correspondences between the two outcomes and the two PDO indicators to monitor and evaluate the progress. These changes did not affect the goals and overall scope of the project.

40. **Efficacy of Outcome 1: Strengthen policy development and strategic framework for renewable energy and rural electrification.** The PDO indicator—National Energy Policy (the NEP) and rural electrification strategy developed as the National Electrification Roll out Plan (the NEROP) were finalized by the Department of Petroleum and Energy following participatory process–was achieved with the approval by the cabinet in 2018 of 'NEP 2018–2028' and in 2019 'the Next Steps for NEROP Implementation' respectively. Achievement of its actual policy orientation purpose should be judged by the quality of its analysis, conclusions, and recommendations. Annex 6 includes the table of contents of the policy document; the areas covered include all major sectors (power production, petroleum and natural gas, oil products, electricity distribution, and renewables); the quality of the quantitative analysis is uneven as there is an enormous lack of information regarding actual potential production of energy sources, in particular the renewables dimension. In fact, an important contribution of the document is providing an overall panorama of the energy sector and those aspects that urgently require investment to quantify the potential and costs of different energy sources. Filling these information gaps could not have been done through the project given the human resources and costs that such an effort would require. Despite these limitations, the NEP does provide an important first step in a systematic approach to developing the energy sector in PNG. Bridging the gap between the policy dimension and the ultimate outcome of increasing the access rate will require developing a detailed implementation plan and executing actual electrification programs using either grid extension or off-grid solutions. In this regard, NEROP was developed under the ESDP; it has a high-level geospatial planning needed for prioritizing investment decisions concerning electrification and its implementation plan is under preparation. It can be concluded that the development of the NEP is serving its purpose as a foundation for achieving the long-term outcome of significantly improving the access to electricity in PNG and reaching the 70 percent goal set by the GoPNG for 2030. Given that there is a huge information gap regarding potential production of energy source, the efficacy associated with Objective 1 is rated modest.

41. **Efficacy of Outcome 2: Attract investors for sustainable development of new hydropower generation to supply the Port Moresby electricity grid.** The PDO indicator—Financing structure for the NB HPP is approved by government—was formally achieved with the approval by the cabinet in 2018. The financing structure of the project makes up the shareholders, including onshore and offshore investors, Government, and landowners holding equity. Component 2 supported the GoPNG in the process of attracting investors by undertaking the required studies and providing the necessary documents to initiate a search for potential developers. The documents in question included the following:

(a) Draft bidding documents (PPA, Request for Expressions of Interest, invitations to prequalify, and Request for Proposal);

(b) Transaction Options Report;

(c) Environment and Social Impact Assessment (ESIA) (Inception Report, Benefit Sharing Framework, Resettlement Policy Framework, Environment and Social Management and Monitoring Plan); and

(d) Panel of Experts report (Geotechnical, Sedimentary, and Seismic experts).

42. The efficacy of Outcome 2 is rated according to a scenario in which GoPNG develops NB using the independent power producer (IPP) concept as initially conceived, or through the public-private partnership (PPP) concept.

43. Under the initial concept, the procedure for promoting NB will consist of engaging an investment bank in charge of organizing the process. The draft bidding documents and the transactions options report are likely to be used, with possible variations depending on the investment bank's strategy (the support for contracting the investment bank will be provided by other donors). The ESIA will be an important factor for attracting developers as it provides insight into some of the riskier factors faced by investors in hydropower plants, such as the attitude of the local population and the environmental consequences of the project. The same can be said of the Panel of Experts report, which provides insight into technical aspects, thereby reducing uncertainty surrounding the development. In addition, there are yet, studies to be undertaken which include hydrology gauging inclusive of sediments and rainfall, access road confirmation (89 km, of which 25 km is complete), transmission line corridor survey, geotechnical investigations on the tunnel/power house/project area, and review and update of the generation facility cost. Consequently, if this scenario materializes, the efficacy associated with Outcome 2 can be rated Substantial.

44. However, at the time of project closing, there were outstanding activities to be completed before going for market sounding, which included: (a) hydrology gauging; (b) sediment flow/rainfall equipment supply and installation; (c) update of project costs for the generation facility and components; (d) accessing of road and cost estimates; (e) conducting of sediment tests; (f) conducting of transmission line corridor surveys and cost estimation; and (g) geotechnical investigations based on Panel of Experts' advice, for the tunnel, project area including the power house area, therefore the output to attract investors is relevant. The GoPNG and PPL's intent was to continue with project preparation on a PPP scheme with the target date of plant commissioning in 2026. The ESIA and the Panel of Experts outputs would continue to be important in attracting a private partner for the same reasons as in the initial scenario. Under these conditions, the efficacy of Outcome 2 would be rated Modest.

45. Given the uncertainty surrounding the current development of the project, the efficacy associated with Objective 2 is Modest.

46. **Gas emission reduction benefits for the overall PNG ESDP.** In Component 1, the renewable energy policy will be a critical factor leading to carbon emissions reductions with the rural electrification policy and strategy and to some extent will work in tandem with the planned development of the 80 MW NB HPP under Component 2. The emission reductions expected from Component 1 is 1,165,462 tons of CO_2, and the emissions reductions expected from Component 2: 22,400,000 tons of CO_2, making the total expected emission reductions for the ESDP 23,565,462 tons of CO_2. Refer to annex 6, section 6.2.

Justification of Overall Efficacy Rating

47. Choosing the overall efficacy rating was done by examining the relative robustness of the individual ratings where both are rated modest. For the reasons given above, the overall efficacy is rated Modest.

C. EFFICIENCY

Assessment of Efficiency and Rating

48. As noted in the PAD, the ESDP TA project would not by itself have quantifiable economic and financial benefits as it supports TA, not investment. Therefore, the PAD did not include an efficiency assessment. Two approaches were explored to rate the project's efficiency:

(a) A 'reasonable-cost' approach in which project costs were compared to those of similar projects elsewhere, combined with a 'value-for-money' approach assessing the quality of the project outputs in relation to the costs incurred.

(b) A justification based upon the GEF objectives and expectations relative to the project and the benefits associated with greenhouse gas (GHG) emissions.

49. Approach (a) is documented in annex 4 and compares the ESDP with two similar TA projects in the Dominican Republic and Vietnam. Although strict replication of the activities and scope of the projects is impossible, the costs involved indicate that the resources invested in the ESDP were reasonable considering the project's components. However, these resources did not include any government contributions to the project cost. This conclusion combined with the considerations included in the efficacy analysis would indicate that the project is justified.

50. Approach (b) is based upon the justification of the project as documented in the GEF 'Request for CEO Endorsement' of July 23, 2012. The GEF contribution to the project was justified on the basis of the implementation of a low-carbon growth rural electrification strategy, supported by appropriate policies and the NB HPP.[5] The GEF expected indirect GHG emission reductions of 1,000,000 tons of CO_2 equivalent because of the policy and strategy development. It expected NB to displace diesel generation to avoid emissions estimated at 22,000,000 tons of CO_2 equivalent over the lifetime of the HPP.

51. Using these elements as guidelines, annex 4 presents an estimation of avoided GHG emissions associated with the implementation of a renewable energy strategy supported by the project, which would yield a reduction of GHG emissions of 1.05 million tons of CO_2 equivalent between 2016 and 2030. At US$15 per ton, the benefits of GHG reduction would amount to around US$16 million and a net present value (NPV) of US$5.4 million at 12 percent discount rate. This confirms the GEF expectations.

52. Regarding the 80 MW NB HPP, the expected output of 560 GWh per year over 50 years yields a GHG estimate of 22.4 million tons of CO_2 equivalent, which confirms the GEF assumption. It would also

[5] The ESDP can take credit for the preparation of the NB Project as the studies that were executed through the ESDP are essential to the implementation of the HPP.

yield an annual benefit of around US$6.7 million per year and an NPV of US$55.6 million at 12 percent discount rate.

53. Considering the combined factors mentioned, the ESDP's efficiency is rated Substantial.

D. JUSTIFICATION OF OVERALL OUTCOME RATING

54. The rating is based on the PDO relevance (High), the overall efficacy (Modest), and the efficiency rating (Substantial), which translates into a Moderately Unsatisfactory overall outcome rating.[6]

E. OTHER OUTCOMES AND IMPACTS (IF ANY)

Gender

55. The project considered gender issues during the consultation process for the NB HPP for implementing the ESIA. The latter project could have a positive gender-related impact with the construction of the access road to the dam site, thereby opening up the market for the communities' produce and products involving both men and women, however with a significant female value added.

Institutional Strengthening

56. The project had an institutional strengthening impact by requiring the DPE and PPL teams to adopt the World Bank's procurement, FM, and economic and social evaluation procedures. However, internalizing the knowledge acquired through these activities—at a high cost to World Bank staff who made a considerable effort to transfer their knowledge—was partially lost in large measure due to the rotation of staff, in the DPE and PPL PMUs and therefore provided little improvement of the very weak capacity in the PMUs. Other sections or departments in the DPE and PPL benefitted from these training through these staff movements. However, PPL is now in the process of setting up an overall or umbrella type structure that will supervise and manage projects financed by partners. This arrangement was created by the former acting managing director. There are also continuous changes in the Government with frequent changes of ministers and board members which cascades down to frequent changes of the management and staff.

Mobilizing Private Sector Financing

57. This is an expected outcome of the project related to the development of the NB HPP: if the GoPNG had gone ahead with the planned IPP solicitation, the NB HPP would have successfully mobilized private sector financing.

Poverty Reduction and Shared Prosperity

58. The NEP provides a guideline for improving the livelihoods of a large proportion of the PNG population through the provision of energy services, including electricity and natural gas, which is expected to take place throughout NEROP.

[6] A Moderately Satisfactory rating requires at least a Substantial rating for efficacy.

Other Unintended Outcomes and Impacts

59. The energy policy and the strategy supported under the project provided guidance and support to the Government's electrification program and meeting its access target and attracted development partners and donors to participate in building consensus for the implementation of NEROP with the support provided by the GEF. In addition, a resource mapping exercise was undertaken to measure commercial grade wind data and determine alternative renewable energy sources to support the Government's access target. Similar work is also being undertaken to obtain commercial grade solar data with Energy Sector Management Assistance Program (ESMAP) support.

60. There is no road access and public utilities in the project area, communities walk 3 days to access public utilities and services and having the road access created by the project development will enable communities to market their produce with greater ease. It will also have an indirect impact by providing power supply to the Port Moresby grid and avoiding the investment in diesel-based generation.

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

61. Factors that affected implementation outcomes included the following:

- **Project design.** The World Bank was reengaging with the energy sector in PNG and chose to start with a simple TA project scheme which would provide a contribution for needed institutional support and would present few implementation challenges; as stated in the PAD "the strategy of providing WB support under a technical assistance project rather than waiting for an investment opportunity is essentially in recognition of the value-added up-front capacity strengthening in order to develop the environment and undertake preparation activities needed for new investment, including in social and environmental aspects"[7]; therefore, the project outputs consisted of studies where procurement and monitoring are relatively simple and straightforward.

- **Objectives** responded to the GoPNG's EIP of December 2011 and DSP (2010–2030) and its specific goal of achieving 70 percent access by 2030, and were well-defined and realistic in terms of the resources associated with a TA operation: developing an NEP which would consider rural electrification and the development of renewables, and producing the documents required for engaging a private developer for the NB HPP.

- **The results and monitoring framework** was straightforward and associated mainly with the delivery of the policy and HPP documents.

- **Development partners** were consulted, and their energy sector activities were coordinated during preparation (Asian Development Bank, Japan International Cooperation Agency, IFC, European Union, and New Zealand Aid)

[7] PAD, page 19.

- **Risk and mitigation measures** were evaluated during project preparation. The Operational Risk Assessment Framework (ORAF) recognized that the implementing agency risk was high and assumed that it could be mitigated through training in procurement and FM; eventually this proved to be insufficient, and the delays in implementation materialized. At the project preparation, no measures were contemplated if the proposed training failed to produce the desired results. The ORAF rated the governance risk as low, which also proved wrong as the Government failed to provide sufficient support to execute the project as expected.

B. KEY FACTORS DURING IMPLEMENTATION

62. **Factors subject to government control and implementing agency control (DPE and PPL): implementation challenges in these agencies.**

- In the case of the DPE, while the project and its objectives were of high importance to the government at large, the ministry had five political head changes during the project, which negatively affected the DPE management; therefore, the delays experienced by the project were not corrected and the agency lacked the human resources required to implement it efficiently. There were long delays in obtaining financial reports and audits and delays in procurement of firms and consultants. This situation became evident since the initial period of implementation and was never fully corrected. For example, World Bank missions had great difficulty in obtaining access to higher-level officials (the head of the DPE)[8] who would have the authority to address the lack of action at the implementation levels of the department. In the case of PPL, although a similar situation occurred in the early stages of implementation, it was corrected, by a change in the Government and in the board and management structure; however, not so much change happened in the DPE.

- **Poor human resources and organizational capacity.** DPE staff in charge of procurement experienced great difficulties in implementing the very limited number of contracts required by the project; as a consequence the Implementation Status and Results Reports (ISRs) between 2015 and 2019 invariably state that "Overall Implementation Progress is rated 'Moderately Unsatisfactory' due to implementation delays that have resulted in low levels of disbursement." A similar situation occurred at PPL; an international procurement adviser was engaged to support the DPE and PPL and the latter's rate of implementation improved, whereas the DPE continued to present delays. This same factor affected FM functions.

63. **Factors subject to the control of the World Bank are the following:**

- **Adequate supervision.** The World Bank followed the project closely and made efforts to find solutions to the weaknesses in the implementation teams of the GoPNG and PPL, for example, by supporting the search for and subsequent hiring of a procurement adviser, technical adviser, and safeguards adviser, and for DPE, the hiring of an energy adviser and a financial officer. The local staff of the energy team provided hands-on supports to both implementing agencies and pursued frequent follow up on work to be done and decisions

[8] Ministerial rank.

to be made to catch up the delays, such as for the submission of audit reports, but limited results were achieved due to the reasons stated above.

- **Adequate reporting.** The ISRs provided management with thorough information regarding project progress (or, more often, lack of it) and issues surrounding project implementation. The Aide Memoires prepared by the supervision missions provided detailed and candid evaluations of challenges to be overcome. The midterm review undertaken in 2015 downgraded the project to Moderately Unsatisfactory given the delays in implementation and low disbursements; recruitments were made to strengthen PPL and DPE implementation units.

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

64. The project had been in problem status since 2015. Due to the delays experienced in the project's implementation, an 18-month extension was approved at the first project restructuring to achieve the project's outcomes. There were delays experienced during the procurement process using the World Bank's procurement system, Systematic Tracking of Exchanges in Procurement (STEP), particularly in hiring firms and consultants to help commence the TA activities; and procuring and delays in contract execution in managing the hired firms and consultants contracts during project implementation. Poor internet connectivity experienced by the two implementing agencies contributed to delays in the procurement process as the STEP system requires good internet connectivity. There were delays in FM, due to the lack of experienced staff in preparing timely interim financial reports (IFRs), proper maintenance and checks of financial records, and continuous back and forth discussion and modifications on the IFRs due to complex financial recording methods. There were delays in the provision of timely audits, which were managed by the Auditor General's Office (AGO) and although the financial statements were delivered by the agencies on time to the AGO, these were not addressed in time.

A. QUALITY OF MONITORING AND EVALUATION (M&E)

M&E Design

65. The indicators chosen at preparation and subsequently when the project was restructured were summarized in table 1. Table 4 provides comments regarding their pertinence and efficacy in tracking project performance.

Table 4. Project Indicators and Comments

	Indicator	Comment
PDO Indicators at preparation	Rural and Renewable Energy policies are submitted to Cabinet and rural electrification strategy completed following a participatory process.	This is a verifiable indicator, but it says nothing regarding the quality of the product.
	Financing for the NB HPP is at an advanced stage with the due diligence for financiers completed.	Complying with the indicator requires reaching the due diligence stage, which supposes that the project would have progressed to the point where an investment bank was hired and the project was promoted,

Indicator		Comment
		an exceedingly optimistic assessment. The exact meaning of the 'advanced stage' would have clarified the indicator considerably.
	Planning study is completed as a key input to preparing future HPPs for investments.	Clear deliverable identified, although the activity was dropped at restructuring.
Final PDO Indicators	National Energy Policy and rural electrification strategy finalized by the Department of Petroleum and Energy following participatory process	This is a verifiable indicator in the sense that finalized means the production and submission (presumably to at least a ministry-level authority) of a document on the subject. As in the PAD, the indicator says nothing regarding product quality.
	Financing structure for the NB HPP is approved by government	The new indicator is verifiable but there is not a direct relation between approval of a financing structure and the underlying effort accomplished through project preparation studies.
Component 1 Intermediate Results Indicators (after restructuring)	Elements of Rural electrification strategy prepared:	
	• Analysis of alternative models of community and rural electrification projects including cost structure undertaken. • Geographic information system Stocktaking and Development of a Stage 1 'Potential Rural Electrification Projects' Database	Verifiable and clear indicator Verifiable and well-defined indicator
	Strategic Environmental and Social Assessment (SESA) completed	Verifiable, but quality dimension is missing
	Improved GoPNG institutional capacity in the energy sector to support future investment in rural and renewable energy.	Conceived as ongoing training, did not include any specific indicators
Component 2 Intermediate Results Indicators (post restructuring)	NB consultation process progresses in a way that results in decisions that respond to the interests and concerns of women and men in the NB project area and advances the objectives of the NB project.	The ESIA work undertaken by the firm and PPL included putting in place a GRM to address concerns by women and girls at the project site. On-site consultations were held as well at a central location in Port Moresby for people who were residing in the city to take advantage of the schools, health system, and employment.
	Improved institutional capacity at PPL related to preparation and planning for hydropower development	Conceived as ongoing training, did not include any specific indicators

66. As noted in table 4, M&E design was not entirely conducive to fully following project progress as the indicators that were adopted did not allow a complete verification of PDO achievement, both for Component 1 (quality was absent from the indicators) and Component 2 (there is no assurance that having approval of the financing structure is enough to guarantee private sector interest), and the capacity

improvement intermediate indicator (no quantitative or verifiable metric). Although to a different extent, it met all relevant and attributable indicators for the two outcomes associated with the PDOs, which included strengthening policy development, enabling strategic development, and attracting investors for sustainable development.

67. TA projects, of which outputs often consist of studies and nonquantifiable products, represent a challenge regarding M&E and the choice of adequate indicators. Given this difficulty, at preparation, the project would have benefited from either more indicators (a more visible indicator of acceptance and subsequent usefulness) and/or a quality control activity with periodic reports and an explicit indicator for capacity improvement. It would have also benefited from clarifying aspects of Component 1 such as the distinction between policy (an overall guideline for energy sector orientation) and strategy (a more detailed identification of overall actions to be undertaken).

68. Regarding the actual monitoring procedures, as noted in the PAD, M&E was expected to be straightforward, based on supervision of the progress of the development of the documents and the final submission of the policies to the cabinet. For the PDO-level results related to Component 2, the M&E of the PDO level and intermediate results indicators for the project would be the responsibility of the PPL PMU, with quarterly reports according to the Procurement Plan and the contract management milestones. Intermediate results indicators were expected to be monitored through the selection of consultants to assist in preparing documents and deliverables.

M&E Implementation

69. M&E implementation followed the procedures indicated in the PAD, based on supervision of progress in developing the documents required for complying with the indicators in the PAD and the Restructuring Paper. Intermediate results were monitored according to the selection of consultants contracted for preparing the indicative documents. The capacity improvement activity, which lacked an indicator, and was expected to be achieved through on-the-job activity, was not tracked explicitly.

70. The latter approach was feasible for those aspects that were monitored by specific outputs—for example, the National Energy Policy [the NEP] and the electrification strategy [the NEROP] for Component 1 and the supporting studies of Component 2—which could be tracked during implementation. Regarding the institutional strengthening for both the GoPNG and PPL, the design did not include any specific intermediate indicator that could be monitored. In this sense the M&E design would have benefited from more defined indicators during implementation, such as number of staff trained, number of training workshops, and the organization of specialized energy groups within the beneficiary, which would have shed more light on the specific capacity-building monitoring activity.

M&E Utilization

71. The M&E information gathered through the procedures envisaged in the design, followed the selection of consultants and provided the World Bank management with the information required, to keep abreast of the project. Reporting on M&E results through different channels such as Aide Memoires provided World Bank management and GoPNG authorities with information regarding project progress, as well as detailed instructions for accelerating its execution. The M&E process supported the following:

(a) Providing World Bank management as well as GoPNG higher-level staff with information regarding project implementation;

(b) Making the decisions to restructure the project in 2016 and 2017, to reflect the status of project implementation and adapting its scope to the resource requirements resulting from different procurement processes, which exceeded the allocated budgets; however, the information was not used to revise the PDO and the associated indicators. Additionally, the drawbacks encountered in FM reporting were not used to reconsider the overall FM approach;

(c) Following up on GoPNG requests for support in particular areas, such as the development of a specific natural gas policy as part of Component 1; this request was reflected in the 2016 restructuring and was subsequently dropped in the 2017 restructuring; and

(d) Supporting the project by complementing the supervision missions with information on particular subjects; for example, the June 2014 and March 2015 missions were used to brief the DPE on wind resource mapping through presentations by specialists on the subject.

Justification of Overall Rating of Quality of M&E

72. The M&E process was overall successful in informing management despite the weakness of the chosen indicators. However, a better framework would have probably helped in obtaining better quality products on time. Because of these shortcomings in preparation and utilization, the overall M&E quality is rated Modest.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

73. **Procurement.** The procurement process faced important challenges, particularly due to the lack of experience of personnel within PPL and the DPE. Although staff in these institutions would acquire some experience in contract management, the continuous changes in the procurement team made it impossible to retain any institutional knowledge during project execution. As a consequence, there was no active project management on the part of PPL (which affected a large number of contracts) or the DPE (with fewer contracts to manage but comparatively less capacity) and there was poor support from these entities throughout the project cycle. This provides a partial explanation to the delays experienced by the project and the need to extend the closing date. The project engaged the services of an external procurement adviser who provided some improvement in implementation but nonetheless was unable to overcome the structural obstacles associated with an uncertain institutional setup.

74. **Financial management (FM).** FM presented an important challenge throughout implementation, as both the DPE (where capacity was practically nil) and PPL (where capacity was slightly better but weaker than the anticipated at preparation) failed to grasp the procedures and discipline required to account for project resources. During implementation, the World Bank struggled to keep abreast of the project and was forced to dedicate significant resources to interacting with the agencies to achieve the desired level of precision in the presentation of the project's accounts. The World Bank's intervention and support has been successful so far as bringing the IFRs up to date, however the audits outstanding at closure were up to 2017 and 2018. As of the date of the ICR, the final IFRs and the 2017 audit have been completed,

however the 2018 audit remains outstanding. In any case it is important to flag that, similar to the case of procurement, (a) FM implementation was not satisfactory on the part of the client, and (b) the expected improvement from training the DPE and PPL staff never materialized.

75. **Environment and social.** The main environmental and social impacts associated with the project concerned the NB HPP component. PPL contracted the required studies, which were executed through competent firms. The reports reflected the challenges of the project, and the consultations conducted with the communities evidenced the latter's interest in supporting the project due to the benefits associated with employment opportunities and the construction of an access road that would provide an outlet for agricultural produce. An increase in the scope of the studies was justified despite the consequent cost increase. The principal obstacle to a full utilization of the ESIA is related to the lack of capacity of the PMU for following up on its findings, particularly if the GoPNG decides to develop the project. However, if an IPP developer is selected, the ESIA can be expected to serve its purpose in guiding the decisions for plant construction regarding environmental and social matters.

C. BANK PERFORMANCE

Quality at Entry

76. The following factors are considered for evaluating quality at entry:

(a) **Strategic relevance and approach.** The project responded to the priorities of the GoPNG at the time as well as those registered in the CPS to address issues with: (i) low access, (ii) precarious supply, and (iii) an unwanted dependence on liquid fuels.

(b) **Technical, financial, and economic aspects**:

- Component 1 was prepared with a full complement of supporting studies, such as an EIP December 2011, which addressed three strategic objectives: improving access, improving the reliability of power supply, and ensuring the affordability of electricity service. The policy also envisaged attracting private sector investment.

- Component 2 was prepared based upon an updated demand forecast (September 2012) indicating 10 percent annual demand growth in the next five years and 3.8 percent henceforth; the forecast indicated that the proposed NB HPP would be fully committed once it started operating. NB implementation would address the other generation concerns such as low reserve capacity, a growing dependence on diesel generation, significant derating of existing hydro units and a solid evidence that the project would provide significant improvements to supplying the Port Moresby load.

(c) **Environmental and Social aspects:**

- Component 1 included the Preparation of a SESA for the Renewable Energy Policy and the Rural Electrification Policy, to provide the GoPNG guidance on institutional and regulatory issues to ensure environmentally and socially sustainable management of the implementation of these policies. The project was prepared considering an interim

protection zone, which includes much of the Naoro and Brown Rivers catchment area. Global environmental benefits would result from implementation of HPPs and the NB HPP in particular. The project design reflected lessons learned by the World Bank in designing sustainable HPPs. The project design envisaged a workshop on sharing the benefits of new hydropower, including environmental and social aspects. The project design was supported by several other initiatives such as a study visit to Lao People's Democratic Republic in 2011 to examine their experience in hydro development, and a Public-Private Infrastructure Advisory Facility grant that resulted in a paper 'Options Assessment for Structuring and Financing New Hydropower in PNG.'

(d) **Fiduciary aspects:**

- Implementation arrangements identified a lack of familiarity with World Bank procurement, FM, and safeguards procedures in the implementing agencies. There was a need to address these weaknesses, through training of PPL and DPE staff in World Bank procurement and FM policies, processes, and procedures.

(e) **Risk Assessment.** Preparation addressed agency risk and project risk:

- Agency risk referred to capacity constraints and governance risk (as indicated in the key factors at preparation). Capacity constraints were identified and associated with the noted weaknesses for addressing fiduciary (procurement and FM) aspects, and they were assessed as High; they occupy a prominent position in the risk analysis at entry.

- Project risk was also addressed in depth, particularly because of the hydropower aspect of the development to be supported by the ESDP; the preparation team also addressed the reputational risk faced by the World Bank, which is one of the reasons for centering its support on the social and environmental aspects of NB.

Quality of Supervision

77. The following aspects were considered:

(a) **Supervision of fiduciary aspects.** The World Bank was extremely proactive in this aspect. When it became apparent that the DPE and PPL had difficulties in coping with the procurement of firms and consultants, there was a concerted effort to find a solution; the World Bank helped the project find a procurement adviser who, despite not residing in PNG, was able to provide assistance, particularly after the second restructuring in 2017. The procurement adviser helped, among others, to recruit the Panel of Experts, the hydrology experts, and local safeguards consultants to work closely with the PPL team. The World Bank also assisted PPL in identifying and engaging an international technical adviser and an international safeguards adviser; these advisers accompanied the PPL team until the project was completed, including the point where the cabinet approved the NB financing structure, and the ESIA final reports were issued. Regarding FM, the World Bank specialist was tasked with providing support under challenging circumstances during most of the project's

implementation; ultimately a person with an accounting background was hired and provided effective local support to the DPE during the last two years.

(b) **Adequacy of supervision inputs and processes.** As noted in the M&E implementation, the World Bank programmed 18 missions to supervise different aspects of the project and provided short-term assistance from a local energy specialist. The feedback provided by the World Bank missions by way of Aide Memoires was detailed to support and help guide the implementation weaknesses of the DPE and PPL. In addition, the World Bank recognizing the lack of connectivity facilities faced by DPE and PPL provided the resources necessary to help support the project implementation.

(c) **Candor and quality of performance reporting.** The main instruments used to communicate project progress consisted of the Aide Memoires and ISRs. As noted, the Aide Memoires provided detailed diagnostics to the DPE and PPL, which was also reflected in the ISRs.

Justification of Overall Rating of Bank Performance

78. Rated individually, the quality at entry and the quality of supervision would be Satisfactory, with no significant failings. However, taken together, it appears that, the assumption regarding the fiduciary process failings could be overcome through training was incorrect; furthermore, this assumption was never questioned. If it had been questioned from the outset, an alternative course of action could have been discussed in advance when it appeared that the fundamental weakness in project management could not be overcome. Considering this, the overall rating for World Bank performance should be Moderately Satisfactory.

D. RISK TO DEVELOPMENT OUTCOME

79. **NEP outcome**. The outcome associated with Component 1 concerns the ability of the GoPNG to evaluate approaches to increasing electricity access and to articulate plans with a view to reaching the 70 percent access goal by 2030. Although the actual goal may change in the future according to implementation progress, for which the first step consists of projects aligned to implement the NEROP objectives to be financed by the World Bank or other donors, as well as political circumstances, the electrification objective is very likely to remain a prominent development goal of the current and successor governments. Consequently, the outcome regarding the capacity for evaluating plans and approaches which has been acquired by having NEP is unlikely to deteriorate or disappear; the risk associated with this component is therefore low.

80. **Stimulation of downstream investment and the NB HPP**. This is a very specific outcome which is dependent on the decision to proceed with the implementation of the NB HPP. Given the current discussions regarding the mode of implementation of the project, there is a significant risk that an unfeasible implementation alternative is chosen, such as development by PPL or a PPP which could be difficult to put together. Finally, even if an IPP development is chosen, there is a risk that no developer may be interested in the NB HPP; it is also possible that an eventual developer will be unable to reach financial closure. Consequently, there is a high risk that this development outcome may not materialize.

81. The implementation progress and development outcome performance of the ESDP changed to Moderately Unsatisfactory status in June 2015 and remained unchanged as a problem project until its closing. The initial stage of disbursement was a concern, as the two agencies were trying to figure out how to manage the tasks undertaken by the firms and make payments on deliverables when invoices were received.

82. In the DPE's case, staff who were previously engaged were moved to another agency which created a vacuum in the ministry. Numerous attempts were made to resolve this issue. Everything seemed to have stopped until the team consulted with the DPE and recruited a finance officer and an energy adviser. Progress was noted in procurements and FM, that is, procuring of the firm to commence work on the energy policy. In PPL, there was constant movement of project staff due to management and board changes. Activities undertaken included retraining of new staff in procurement and FM and managing the major contracts of the transaction advisory services, the ESIA contracts, and work done on the site.

83. The main outstanding FM-related issue was completing and signing of the audits by the AGO. Payment for the audit services was also a main issue as both entities did not have funds to meet the costs. This part was outstanding for a very long time until 2018 when the project was nearing closure. The fees were eventually paid from the project funds to take the project out of its problem status in the banks reporting system.

84. M&E implementation followed the procedures indicated in the PAD, based on supervision of progress in developing the documents required for complying with the indicators in the PAD and the Restructuring Paper. Intermediate results were monitored according to the selection of consultants contracted for preparing the indicative documents. The capacity improvement activity, which lacked an indicator, and was expected to be achieved through on-the-job activity, was not tracked explicitly.

V. LESSONS AND RECOMMENDATIONS

85. **Addressing the lack of skills at preparation.** During the preparation of the ESDP, the procurement and FM functions were evaluated and, although the associated risk was acknowledged, it was accepted under an implicit assumption that on-the-job training, complemented with specific courses, would eventually address the issue. This expectation did not materialize; the lesson to be learned is the need to question the viability of resolving the problem through the noted assumptions and to prepare a backup plan if there is no visible progress in this respect after a given period of time. The backup plan should be spelled out and resources to implement it should be estimated at preparation.

86. **Supplementing the institutional weakness.** If the conventional approach of on-the-job training and courses is not effective and sustainable, an alternative consists of providing support through specialized consultants and firms could continue and support the agencies' work as well as training staff occupying positions in the PMU. Recruiting short-term consultants and firms may not fully address the issue of continuous changes in the Government and therefore, (a) continuous capacity development of middle-level managers, (b) dedicated staffing for project implementation, and (c) regular update to senior decision makers would be recommended measures to address this challenge. The ESDP hired a short-term consultant to provide support for the procurement process; identifying and engaging the consultant was not straightforward, as several candidates refused to accept the appointment. The chosen consultant

provided support from overseas and acknowledged that it was extremely difficult to achieve results with few and far-between trans-Pacific visits. With challenges such as those encountered with the DPE, it would make more sense to rely on a long-term consultant albeit at greater expense. Another alternative could consist of transferring procurement responsibilities to an external procurement agent and hiring an accounting firm with a local presence to take on FM responsibilities.

87. **Acknowledging the need for the World Bank to dedicate greater resources to project supervision.** The previous alternatives would not relieve the World Bank of its supervision responsibilities; in fact, the World Bank would probably be called upon to resolve issues that could easily arise between consultants or agents and the PMUs. These eventualities should be acknowledged at preparation and the World Bank should be prepared to assume greater supervision costs than it would otherwise if client skills were up to the task.

88. **Implementation challenges as a portfolio-wide issue.** The lack of skills affects, in one way or another, all of the projects in PNG and seeking a project-focused solution may not necessarily constitute the best approach to the problem. This raises the possibility of examining the issue from a multisector viewpoint and contemplating the implementation of solutions such as long-term locally established consultants or procurement agents and accounting firms with a more encompassing role for multiple projects. This could possibly lead to some economies of scale and would not exclude on-the-job training or supplementary courses.

89. These alternatives should be given consideration as possible solutions to a frequent and frustrating problem. Burdening World Bank staff with the responsibility of training the client's personnel is neither efficient nor effective. Considering the outsourcing of critical administrative activities for projects facing similar weak capacity could be a mandatory recommendation for future projects.

90. **Choosing the right bank for FM.** The GoPNG chose to use the Central Bank for housing the project's accounts and resources. The procedures associated with the Central Bank proved to be cumbersome and slow and had effects throughout project execution. Choosing a commercial bank would have yielded better results.

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: Strengthen policy development and strategic framework for renewable energy and rural electrification

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
National Energy Policy and rural electrification strategy finalised by the Department of Petroleum and Energy following participatory process	Yes/No	N 05-Dec-2013	N 30-Jun-2016	Y 31-Jul-2019	Y 30-Mar-2018

Comments (achievements against targets):
The GoPNG decided to prepare a national energy policy, integrating the renewable energy and rural electrification policies which were initially assumed to be two documents.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion

GEF indicator: Identification of at least renewable energy based mini-grid concessions in accordance with the Rural electrification Strategy	Yes/No	N 05-Dec-2013	N 29-Dec-2017	N 28-Dec-2018	Y 07-Aug-2019

Comments (achievements against targets):
The least cost renewable energy based mini-grid concessions for the population living in rural and urban areas were determined in the geospatial mapping and investment prospectus undertaken under the National Electrification Roll - Out Plan.

Objective/Outcome: To attract investors for sustainable development of new hydropower generation to supply Port Moresby

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Financing structure for the Naoro brown Hydropower project is approved by government	Yes/No	N 05-Aug-2013	Y 31-Dec-2018	Y 31-Jul-2019	Y 31-Jul-2019

Comments (achievements against targets):
The PNG cabinet approved the establishment of a state task force and steering committee to direct and supervise the implementation of the project in April 2018. The financing structure of the Naoro Brown project is approved in this submission.

A.2 Intermediate Results Indicators

Component: Component one: Institutional and Policy Development for Renewable Energy and Rural Electrification

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Elements of Rural electrification strategy prepared	Yes/No	N 05-Dec-2013	N 30-Jun-2016	Y 31-Jul-2019	Y 30-Mar-2018

Comments (achievements against targets):
The national energy policy was deemed to include elements of the renewable energy and rural electrification policies initially envisaged. Reducing the number of activities and contracts would simplify project management and implementation under Department of Petroleum and Energy (DPE)

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Strategic Environmental and Social Assessment (SESA) completed	Yes/No	N 05-Dec-2013	N 30-Jun-2016	Y 31-Jul-2019	Y 30-Mar-2018

Comments (achievements against targets):
The strategic environmental and social assessment was done for the rural electrification strategy

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved GoPNG institutional capacity in the energy sector to support future investment in rural and renewable energy	Yes/No	N 05-Dec-2013	N 30-Jun-2016	N 31-Aug-2017	N 31-Jul-2019

Comments (achievements against targets):
The support to DPE for strengthening the capacity of institutions and strengthening project management through effective operational management, procurement and financial management were removed because the regional offices were never setup.

Component: Component Two: Technical Assistance for Preparation and Planning for Port Moresby Hydropower Supply

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
NB consultation process progresses in a way that results in decisions that respond to the interests and concerns of both women and men in the NB project area, and advances the objectives of the NB pro	Yes/No	N 05-Dec-2013	N 31-Dec-2018	Y 31-Jul-2019	Y 31-Jul-2019

Comments (achievements against targets):
Consultations were carried out at locations accessible to both the men and women in the project area at the project site as well as in a central location in Port Moresby city where people from the project site had to move in into the city for better access to schools for their children and health services.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved institutional capacity at PPL related to preparation and planning for hydropower development.	Yes/No	N 05-Dec-2013	Y 31-Dec-2018	Y 31-Jul-2019	Y 02-May-2019

Comments (achievements against targets):
Although many staff were trained and gained experience in the preparation of hydropower projects in PPL under this project, there needed to be continuous training for new staff due to the high turnover and movement of staff within the organization caused by restructuring and other factors.

B. KEY OUTPUTS BY COMPONENT

Objective/Outcome 1	
Outcome Indicators	1. National energy policy is submitted to the Recipient's cabinet and rural electrification strategy completed following a participatory process.
Intermediate Results Indicators	1. Elements of Rural electrification strategy prepared 2. Strategic Environmental and Social Assessment (SESA) completed 3. Improved GoPNG institutional capacity in the energy sector to support future investment in rural and renewable energy.
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	1. National Energy Policy approved 2. Electrification plan fundamentals (demand location and magnitudes). The National Electrification Roll Out Plan approved 3. GHG Emissions
Objective/Outcome 2	
Outcome Indicators	1. Financing structure for the Naoro Brown Hydropower Project **is** approved by the Recipient's government
Intermediate Results Indicators	1. Naoro Brown Hydropower Project consultation process progresses in a way that results in decisions that responds to the interests and concerns of both women and men in the Naoro Brown Hydropower Project area, and advances the objectives of the Naoro Brown Hydropower 2. Developer for Naoro Brown Hydropower Project selected following transparent process. 3. Improved institutional capacity at PPL related to preparation and planning for hydropower development.

Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	1. Environmental, Geological, Hydro data studies, Dam Safety Panel reports 2. Recommendations from transaction advisor 3. Developer search process implemented 4. Developer selected through transparent procedure

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Roberto Gabriel Aiello	Task Team Leader(s)
Cristiano Costa e Silva Nunes	Procurement Specialist(s)
David Bruce Whitehead	Financial Management Specialist
Mark C. Woodward	Social Specialist
James Orehmie Monday	Social Specialist
Margaret Ali	Team Member
Daniel Jason Toga	Team Member
Supervision/ICR	
Gerard Fae	Task Team Leader(s)
Eric Leonard Blackburn	Procurement Specialist(s)
Robert J. Gilfoyle	Financial Management Specialist
Maria Isabel A. S. Neto	Team Member
Wolfhart Pohl	Environmental Specialist
Cristiano Costa e Silva Nunes	Procurement Team
Duangrat Laohapakakul	Counsel
Ross James Butler	Social Specialist
Nathalie Suzanna Noella Staelens	Environmental Specialist

B. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US$ (including travel and consultant costs)
Preparation		
FY07	2.182	21,677.46
FY08	5.315	45,892.08
FY09	.445	8,317.73
FY10	3.857	62,760.68
FY11	19.458	374,583.89
FY12	12.653	211,988.74
FY13	29.387	211,100.43
FY14	15.289	118,474.50
FY15	4.125	44,179.35
FY17	0	0.00
Total	**92.71**	**1,098,974.86**
Supervision/ICR		
FY13	5.766	41,952.27
FY14	10.397	86,500.27
FY15	26.542	192,884.06
FY16	46.215	283,064.47
FY17	36.997	199,081.90
FY18	89.698	840,507.17
FY19	47.891	-200,929.47
FY20	40.476	137,927.68
Total	**303.98**	**1,580,988.35**

ANNEX 3. PROJECT COST BY COMPONENT

1. The annex highlights the total project costs by component at approval, at project restructuring, and the actuals at closing for funding allocations from the IDA and the GEF contributions.

2. Table 3.1 provides the details of the total IDA and GEF allocations for each component highlighting the reduction and increase of funds at Component 1 and Component 2 respectively and the actual disbursement at project closing whilst also highlighting the percentage of approval.

Table 3.1. Project Cost by Component

Components	Amount at Approval (US$, millions)	Actual at Project Closing (US$, millions)	Percentage of Approval (Percent)
Institutional and Policy Development for Renewable Energy and Rural Electrification	2.00	1.18	59
Technical Assistance for Preparation and Planning for Port Moresby Hydropower Supply	6.50	6.03	92.8
Total	**8.50**	**7.21**	**84.8**

Note: The PNG Energy Sector Development Project is financed by IDA Credit No. 5201-PG and GEF Grant TF014583. The Implementation Completion and Results Report (ICR) covers both the IDA credit and the GEF Grant. However, because the operations portal does not allow links between the GEF and IDA projects, the GEF Grant does not show up on the data sheet. The GEF is therefore only described in the narrative part of this ICR.
Reallocation between disbursement categories. A reallocation of funds between categories for both the IDA Credit and the GEF Grant is proposed as a consequence of the changes described earlier. The changes to the IDA Credit categories are detailed in the table under section IV.

ANNEX 4. EFFICIENCY ANALYSIS

1. As noted in the main text, the efficiency analysis was based (a) on a verification of 'reasonable cost' combined with 'value for money' and (b) expectations regarding GHG reductions.

A. Reasonable Cost and Value for Money

2. **Reasonable cost.** Although identifying similar projects involves a subjective judgment, the following results were obtained:

- **Dominican Republic.** Power Sector Technical Assistance Project (P082715), IEG report ICRR 13716. The project had a policy formulation component, with an appraisal estimate of US$1.9 million and an actual cost of US$2.18 million. The nature of this component was oriented to market reforms, which required more specialized services compared to the ESDP, which would explain the higher resource requirements, but the overall order of magnitude is not dissimilar.

- **Vietnam Project Preparation TA Facility (P118610), IEG report ICRR 21249.** The project included a 'Project Preparation Facility Support and Capacity Building' subcomponent for providing the relevant ministry with capacity to evaluate different project proposals. The appraisal cost estimate for the facility was US$4.7 million with an actual disbursement of US$3.98 million. A comparison with the PPL NB preparation setup would indicate similar cost orders of magnitude.

3. At least on the basis of limited comparisons, ESDP costs appear to be reasonable.

4. **Value for money.** The outputs of the project included the following:

- **Component 1:**
  - National Energy Policy Report.
  - National Electrification Rollout Plan Report.
  - Four workshops to plan activities, gather stakeholders' comments, and present findings.
- **Component 2:**
  - Draft Bidding documents (Power Purchase Agreement, Request for Expressions of Interest, Invitation to prequalify, and Request for Proposal)
  - Transaction Options Report

- Environment and Social Impact Assessment (ESIA) (Inception Report, Benefit Sharing Framework, Resettlement Policy Framework, and Environment and Social Management and Monitoring Plan)
- Panel of Experts report (geotechnical, sedimentary, and seismic experts)
- Five workshops (IPP Procurement, Financing Structure, Risk Assessment, Land Acquisition and Access Road Construction, and Project Closing)

5. The National Energy Policy was reviewed in section B of the main text (Assessment of Achievement of each Objective/Outcome), indicating that within the information limitations of PNG, it provided a good basis for guiding the development of the energy sector.

B. GHG Reduction Approach

6. **Value associated with the Implementation of a renewable energy strategy.** The evaluation was based on the potential households to be electrified, based on the following assumptions:

- Baseline alternative is diesel, with a substitution benefit of 0.8 kg CO_2 per kWh
- Total PNG population: 6.6 million
- Access rate: 10 percent
- Access rate in 2030: 50 percent
- Population in rural areas: 87 percent
- Average persons per household: 5
- Average rural consumption per household: 60 kWh per month
- Number of rural households: 1,148,400
- Current rural households with access: 114,840
- Rural households with access in 2030: 574,200
- New households gaining access per year: 30,624
- Percent of new households with renewable energy: 50 percent
- Price per ton of avoided GHG emission: US$15

7. Table 4.1 summarizes the GHG-associated benefits under the above assumptions.

Table 4.1. GHG Gas Reductions

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Added Households ('000)	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6
Cumulative Households ('000)	30.6	61.2	91.9	122	153	184	214	245	276	306	337	367	398	429	459
Households on RE ('000)	15.3	30.6	45.9	61.2	76.6	91.9	107	122	138	153	168	184	199	214	230
Cumulative GWh	11.0	22.0	33.1	44.1	55.1	66.1	77.2	88.2	99.2	110	121	132	143	154	165
tCO2 ('000)	8.8	17.6	26.5	35.3	44.1	52.9	61.7	70.6	79.4	88.2	97.0	106	115	123	132
Gross GHG Benefits (M$)	0.13	0.26	0.40	0.53	0.66	0.79	0.93	1.06	1.19	1.32	1.46	1.59	1.72	1.85	1.98

8. The GHG gas reductions expected under the previous assumptions amount to 1,058,365 tons, which is in line with the GEF expectations, a gross benefit of US$15.9 million, and a discounted NPV at 12 percent of US$5.4 million.

9. GHG reduction associated with the NB HPP.

- Installed capacity: 80 MW
- Annual production: 560 GWh
- Avoided GHG: 448,000 tons of CO_2 per year
- Lifetime: 50 years
- Energy generated over lifetime: 28 TWh
- GHG emission reduction over lifetime: 22.4 million tCO_2
- Annual value of GHG reduction: US$6.72 million
- Present value of GHG reduction: US$55.8 million

10. This verifies the GEF assumptions and provides a justification for preparing the project.

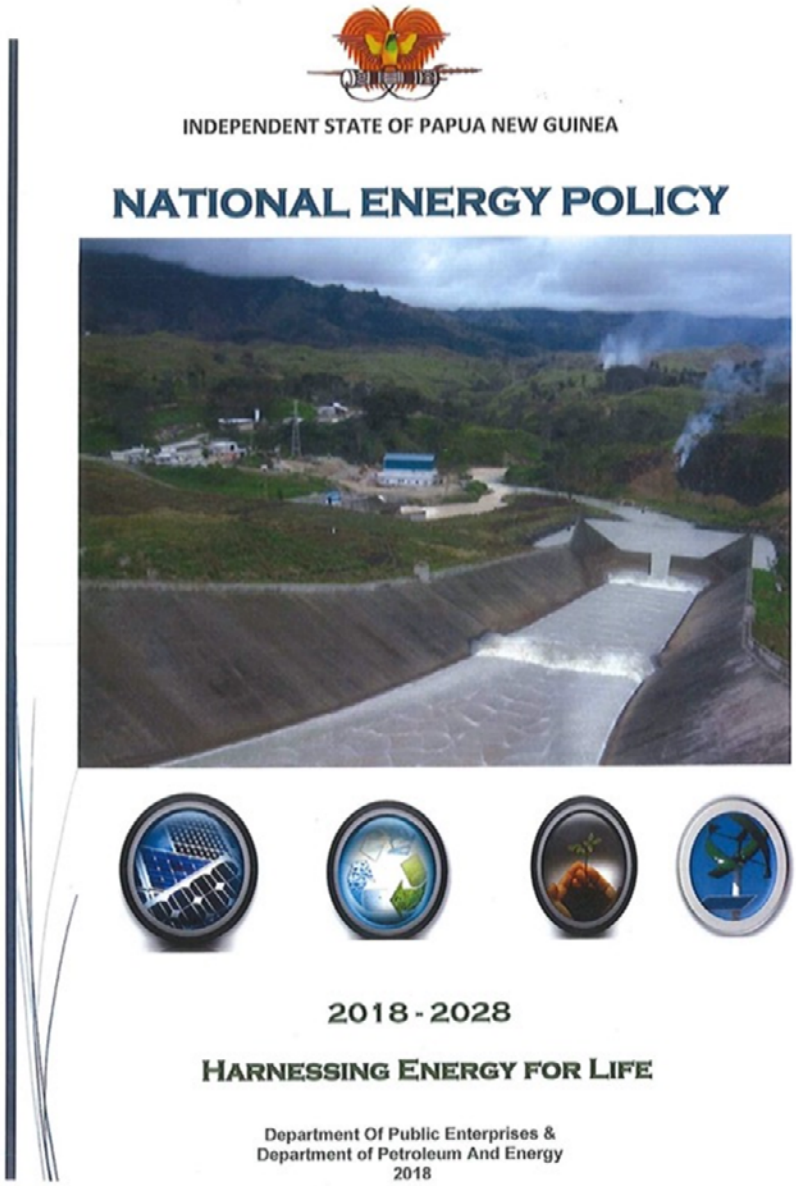
ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS

1. Although the ICR was shared with both implementing agencies, no comments were received. The agencies DPE and PPL provided their signed completion reports attached in Annex 6 as 6.4 and 6.5

ANNEX 6. SUPPORTING DOCUMENTS (IF ANY)

6.1 National Energy Policy
6.2 GHG Emissions Reduction
6.3 Client ICR report – Component 1
6.4 Client ICR report – Component 2
6.5 Map of Papua New Guinea

6.1 NATIONAL ENERGY POLICY



PNG NATIONAL ENERGY POLICY 2018-2028
Harnessing Energy For Life

CONTENTS

6.2 GHG Emissions Reduction

GHG EMISSION REDUCTION BENEFITS: PNG Energy Sector Development Project

emissions reductions from Component 1:	1,165,462	t CO2
emissions reductions from Component 2:	22,400,000	t CO2
total emission reductions:	23,565,462	

COMPONENT 1

RENEWABLE ENERGY POLICY

current demand on main grids	895	GWh/yr
avg grid demand growth through 2030	3%	p.a.
Default Emission factor diesel grids	0.8	kg CO2/kWh
	0.8	t CO2/MWh

assumptions:

baseline alternative is diesel

population increase taken into account in demand growth rate

policy lifetime of 15 year, after which may be superseded by a new policy. However, infrastructure put in place during policy would generate benefits for full investment lifetime (on average additional 20 years)

	grid demand (GWh/yr)	Cumulative GWh/yr new grid demand
2015	1,038	1,038
2016	1,069	2,106
2017	1,101	3,207
2018	1,134	4,341
2019	1,168	5,508
2020	1,203	6,711
2021	1,239	7,950
2022	1,276	9,226
2023	1,314	10,541
2024	1,354	11,894
2025	1,394	13,289
2026	1,436	14,725
2027	1,479	16,204
2028	1,524	17,728
2029	1,569	19,297
2030	1,616	20,914

scenarios:

1. percent of new demand met from renewable energy	50%	26,622	GWh renewable displacing diesel
2. percent of new demand met from renewable energy	75%	39,932	GWh renewable displacing diesel

avoided emissions from Renewable Energy Policy	50%	21,297,268	t CO2
	75%	31,945,902	t CO2

NOTE: while the renewable energy policy will be a critical factor leading to carbon emission reductions, to some extent it will work in tandem with the rural electrification policy and strategy and the planned development of the 80MW hydro power project supported under component 2. Hence to avoid potential double counting, the emission reductions indirectly attributable to the renewable energy policy are not counted IN ADDITION to the emission reductions attributable to the rural electrification policy and strategy and the emissions reductions that will result from component 2.

RURAL ELECTRIFICATION POLICY AND STRATEGY

total PNG population	6,600,000		
current electricity access rate	10%		
target access rate in 20 years	50%		
percent of the population in rural areas	87%		
avg. people per household	5		
avg. rural hh electricity consumption (for hh with access)	50	kWh/mo	based on experience in similar countries
avg. capital duration	20	years	

number of rural households	1,148,400	hh	
current number hh with access	114,840	hh	
hh with access in 2030	574,200	hh	
new hh gaining access per year	32,811	hh	
new rural electricity demand per year	19,686,857	kWh/yr	accounting for both hh load and income-generating activity demand
Default Emission factor diesel mini-grids	0.8	kg CO2/kWh	Source: IPCC/UNFCCC
	0.8	t CO2/MWh	

assumptions:

linear access scale up starting after rural elec. strategy in place
baseline alternative is diesel
demand for income-generating use of electricity included in hh demand
population increase in rural areas off-set by rural - urban migration
policy lifetime of 15 year, after which may be superseded by a new policy. However, infrastructure put in place during policy would generate benefits for full investment lifetime (on average additional 10 years)

scenarios:

1. percent of new access based on renewable energy	25%	1,456,827	MWh renewable displacing diesel
2. percent of new access based on renewable energy	50%	2,913,655	MWh renewable displacing diesel
avoided emissions from rural elec. Policy and strategy	**25%**	**1,165,462**	**t CO2**
	50%	**2,330,924**	**t CO2**

	MWh/yr new rural demand	cumulative MWh			
2015	19,687	19,687	new hh each year	32,811	
2016	39,374	59,061	peak hh demand	400	W
2017	59,061	118,121	peak demand	13.124571	
2018	78,747	196,869			
2019	98,434	295,303			
2020	118,121	413,424			
2021	137,808	551,232			
2022	157,495	708,727			
2023	177,182	885,909			
2024	196,869	1,082,777			
2025	216,555	1,299,333			
2026	236,242	1,535,575			
2027	255,929	1,791,504			
2028	275,616	2,067,120			
2029	295,303	2,362,423			
2030	314,990	2,677,413			

COMPONENT 2

PREPARATION OF THE NAORO BROWN 80 MW HYDROPOWER PROJECT

Naoro Brown installed capacity	80	MW
avg. energy output	560	GWh/yr
capital lifetime	50	years
energy generated over lifetime	28,000	GWh
GHG emission reduction over lifetime	**22,400,000**	**t CO2**

6.3 Client ICR Report: Component 1

Document Information				
Revision No:				
Revision Description:				
Prepared by:	Vore Veve	VV	Date:	26 March 2020
	Mauri Arua	MA		
Reviewed by:	Vore Veve	VV	Date:	27 April 2020
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1 INTRODUCTION

1.1 Description of the Project

This Client Implementation Completion Report (ICR) is prepared by the Department of Petroleum & Energy (DPE) as the Government's implementing agency for Component 1 of the PNG Energy Sector Development Project (PNG ESDP) – P101578 ("The Project"). The proposed Project Development Objectives (PDO) for Component 1 was *to: strengthen policy development and strategic framework for renewable energy and rural electrification*[1].

The Government of Papua New Guinea (GoPNG) approved the Electricity Industry Policy (EIP) in December 2011 and among other things, approved the Electricity Industry Policy as the White Paper for the electricity industry in Papua New Guinea. The Government also approved the establishment of an Electricity Trust Fund (ETF) within the Department of Treasury as well as the establishment of the Electricity Management Committee (EMC), reporting to the Department of Petroleum & Energy. The EMC is the overarching coordinating body for the Electricity Industry Policy (EIP) and to manage the

[1] World Bank PNG ESDP PAD PDO - 22 January 2013.

electricity sector activities and to manage the Electricity Trust Fund. The Government also approved the establishment of an EMC Secretariat within Energy Wing Structure of DPE to support the work of the EMC.

In February 2012, the World Bank (WB) Board of Executive Directors approved the Energy Sector Development Project – P101578 ("The Project"), a total project budget of US$ 8.0 million, of which US$900,000.00 technical assistance (TA) was financed by an external grant from the Global Environment Facility (GEF), and the rest was financed by an International Development Agency (IDA) credit of US$7.3 million. The Project became effective on November 27, 2013 and comprised two components, as follows: Component 1 to be implemented by the Energy Wing within the Department of Petroleum and Energy (DPE), and Component 2 to be implemented by PNG Power Ltd (PPL).

1.2 Scope of the Project

The Scope of Component 1 of the PNG ESDP[2] are as follows:

Component 1: Institutional and Policy Development for Renewable Energy and Rural Electrification, to be implemented by the Department of Petroleum and Energy, the Energy Wing as follows:

(a) Energy Policy Development
(i) Development of a renewable energy policy for the GoPNG.
(ii) Development of a rural electrification policy for the GoPNG.

(b) Institutional and Strategy Development
(i) Strategic environmental and social assessment of the policies to be developed;
(ii) Development of a rural electrification strategy for the Recipient;

(c) Capacity Building
(i) Strengthening the capacity of GoPNG's institutions;
(ii) Strengthening Project management through effective and efficient operational management, procurement and financial management, including through initial operation of DPE regional offices and training.

2 BACKGROUND

In December 2008, the then Government tasked the National Planning Committee with the responsibility of setting a visionary development strategy to guide PNG's socioeconomic development[3]. The outcome of this task was the production of the "PNG Vision 2050" document.

However, the Government realised that the opportunities and the challenges that face PNG cannot be harnessed and appropriately addressed in future without a long term strategic action plan to guide our development pathways. Thus the Government, directed the Department of National Planning & Monitoring as the mandated central planning agency of the nation in early 2008 to undertake formulation of a 20-year long term development blueprint for the country, namely the *Papua New Guinea Development Strategic Plan, 2010-2030 (PNGDSP)*.

[2] World Bank PNG ESDP PAD Project Components – 22 January 2013
[3] PNG Vision 2050 – "The Next Generation of Nation Builders" Prime Minister Somare

This *PNGDSP* document now for the first time attempts to translate the dreams of the founding fathers as contained in the directive principles of our National Constitution into workable plans. At the same time, the PNGDSP mapped out the "*how to get PNG to where our Papua New Guinea Vision 2050 wants us to be*". It therefore sets out the broad framework, targets, and strategies to achieve the vision of the Government.

Amongst other development objectives, the Government, *in PNG Vision 2050*, recognised electricity as one of the key enablers in the socio-economic development of our country and the PNGDSP 2010-2030 set a target of providing access to electricity to 70% of PNG households by 2030. In pursuit of this target, the Government, in 2011, approved the Electricity Industry Policy (EIP) and directed the Electricity Management Committee (EMC) to seek technical assistance from the World Bank.

***Project Objective**: what was the origin of the project, why was it needed.*

As mentioned in the "*Background*", the World Bank provided funding and technical assistance to PNG in the pursuit for electrification of the country, through DPE which was the Government's implementing agency for Component 1 of PNG ESDP.

In February 2018, the government approved the National Energy Policy (NEP), which, among other things, embraced the project PAD PDO objectives of *Energy Policy Development*. The NEP also recognised the significant role of the National Electrification Roll Out Plan (NEROP) as the implementation strategy for electrification of the country and in this regard, the Government in August 2019 approved the National Electrification Roll Out Plan (NEROP) – Next Steps for Implementation thus meeting the PAD PDO for *Institutional and Strategy Development.*

***Organization:** rationale for partnering with the World Bank.*

The rational for partnering with the World Bank, was the acknowledgement by the Government of the benefit to PNG of the World Bank's vast experience globally in the roll out and scale-up of national electrification projects.

***Project Design:** initial budget and additional funding.*

The initial budget for Component 1 was US$2.0 million comprising IDA credit for US$960,000.00 and GEF grant for US$855,000.00.

3 ACHIEVEMENTS

***Project outputs:** what were the products from the project. Provide details on the different contracts executed through the project, what they achieved.*

The key outcomes for PNG ESDP are as follows:

- Successful National Stakeholders Consultation Workshop held during 3-5 December 2013 and the issuing of a Closing Communique which set out the key actions necessary for NEROP implementation.
- The adoption of the Third Party Access Code and Grid Code which set the "rules for engagement" for private sector participation in power generation.
- High level report on the preparation of geospatial least-cost grid and off-grid electrification plan and financing prospectus.

- February 2018, Government approval of the National Energy Policy (NEP).
- Updating of NEROP financing plan.
- August 2019 Government approval of the National Electrification Roll Out Plan (NEROP) of Papua New Guinea – Next Steps for Implementation.

Listed below are the specific contracts procured under Component 1 of PNG ESDP by the DPE Energy Wing:

- Procurement Advisor.
- Project Implementation Officer.
- Energy Advisor.
- University of Technology Sydney,
- Columbia University in City of New York (CU) and Economic Consulting Associates (ECA).
- Energy Advisor.
- Preparation of NEROP and Financial Prospectus – Financing Plan Update by ECA.
- ECA attendance at NEROP Workshop in 2019.

Expectations: *did the projects reflect initial expectations? Provide details.*

The following explain the realisation of initial project expectations:

- The Procurement Advisor and Energy Advisor lead the bid evaluation and contractual negotiations and through Central Supply and Tenders Board, CSTB [4] (now National Procurement Commission) awarded the contract to Columbia University/ECA who then undertook investigations and study on NEROP implementation and in April 2017, prepared the high level report on geospatial least-cost grid and off-grid electrification plan and financing prospectus for PNG.
- The Energy Advisor lead the engagement of ECA who in August 2018 prepared the NEROP implementation - Financing Plan Update.
- The Energy Advisor assisted DPE, in the preparation of the Cabinet submission to seek government approval of NEROP – next steps for implementation.

Provide Contract Details as shown below:

Contract and contractor	Contract #	Initial date	Final Date	Contract Amount	Actual contract amount
Project Implementation Officer	ESDP/DPE/C/2	26th July 2014	30th June 2016	US$90,318.00 US$63,770.00	
Energy Advisor	ESDP/DPE/C/1	8th April 2015	20th May 2016	PGK427,913.00	PGK318,226.40
Columbia University, NY	CSTB 3291	11th January 2016	28th May 2017	US$760,950.00	US$751,842.00
Economic Consultant Associates		11th June 2018		US$7,529.00	US$7,529.00
University of	ESDP/DPE/C/8	24th October	12 Months	AUS$63,077.50	AU$39,428.30

[4] For Approval and Award of Contract

Technology Sydney		2016	Period		
Energy Advisor	ESDP/DPE/C/9	26th February 2018		PGK274,286.00	PGK227,987.41
Economic Consultant Associates		19th July 2019	25th July 2019	US$25,364.00	US$25,364.00

4 PROJECT EXECUTION

Provide comments regarding:

***Procurement**: the process for engaging consultants and the ease/difficulty of contract agreement, particularly in relation with delays originating in either Government procedures and/or World Bank procedures.*

Delays were experienced with CSTB in regard to the use of World Bank procurement and bid process for consultancy services for preparation of NEROP. This was eventually resolved with CSTB acknowledging that the World Bank procurement documentation and bid process were consistent with CSTB Manual for Procurement. The CSTB Board approved the award of contract to Columbia University/ECA. However, significant delays were experienced in contractual negotiations with Columbia University/ECA,

***Supervision**: how were the contracts supervised, who was in charge of supervision, were the arrangements acceptable viewed in retrospect?*

The Energy Advisor, as part of his services, administered the UC and ECA contracts. In retrospect, the ideal arrangement would have been for dedicated in-house staff to be involved in contract administration with the Advisor to oversee and mentor the in-house candidate. Nevertheless, the Energy Wing team was kept informed.

***Financial Management**: how was this aspect of the project implemented? Did the World Bank requirements present any particular challenges?*

The performance of DPE in meeting the requirements of the financial management of the project represented a major challenge. The absence of permanent staffing in DPE for management of project accounts, was a significant contributing factor and DPE was prevented from recruiting by the Government. Apart from the delays in submitting financial reports, the audits of project accounts suffered significant delays. Lack of timely responses from the AGO's office added to these delays.

***Environment and social aspects**: did these aspects apply to the project? In what way? If so, how were they managed? Did the World Bank provide support for addressing these issues?*

Columbia University/ECA (CU/ECA) scope of services included high level examination of the environmental and social aspects of NEROP at the strategic, planning, regulatory and institutional levels regarding the environmental and social impacts in the roll out of NEROP.

Their Report[5] noted that "Overall, the electrification systems proposed under NEROP will have few adverse environmental impacts. This is largely because the electrification systems being proposed under NEROP are basic and the sub-projects will be of a small size. This will reduce the magnitude of environmental and social impacts.". The environmental and social considerations were assessed recognising the provisions of PNG Environmental Act 2000 and the World Bank's Operational Procedures (OP) for environmental and social safeguards.

5 PROJECT EVALUATION

Objectives: *were the project objectives achieved, indicating the grounds for the evaluation. Rate the achievement as High/Substantial/Modest/Poor*

It can be stated that, apart from the objective of *Capacity Building*, the objectives for *Energy Policy Development* were achieved with Government approval of the National Energy Policy (NEP) and also *Institutional and Strategy Development* objectives[6] were achieved with Government approval of NEROP-Next Steps for Implementation

Agency performance: *was the Government implementing agency (DPE) performance acceptable? Could it have been better? Rate as Satisfactory/Moderately Satisfactory/Moderately Unsatisfactory/Unsatisfactory*

DPE's performance experienced numerous short comings and delays in meeting project outputs and timelines particularly financial management. These short comings were attributed to numerous factors, including but not limited to, inadequate in-house capacity, inability to recruit skilled staff which impacted on performance of the PMU, numerous changes in Government Ministerial changes and consequential Departmental Head changes as well as challenges to Ministerial and Departmental responsibilities. Despite these short comings and the consequential delays, DPE did secure Government approvals of the National Energy Policy as well as the NEROP – Next Steps for Implementation.

Bank performance: *was the World Bank performance helpful? Could it have been better? Rate as Satisfactory/Moderately Satisfactory/Moderately Unsatisfactory/Unsatisfactory.*

The World Bank demonstrated great patience and continued to provide advice and guidance in progressing the project, despite delays to deadlines by the Implementing Agency in delivering project related activities. The World Bank's performance was Satisfactory.

6 LESSONS LEARNED

Based on the achievements and the project evaluation, provide comments on:

a) What could have been done better

Difficulties experienced in accessing Borrower Counterpart funding, to some degree, impacted on project performance generally. Perhaps 100% World Bank funding would alleviate this problem.

[5] Columbia University/Economic Consulting Associated _ 11 April 2017 - Final Report
[6] World Bank PAD – Project Components – 22 January 2013

Capacity building and skills development are important project implementing agency staff. Up front training in World Bank processes at the initial stage as well as training in procurement, contract administration, financial management and project management, would have help the implementing agency's performance. The implementing agency should assess its project staff requirements in regard to its functions and responsibilities and seek approval for recruitment.

Appropriate modern office equipment and management information systems are important tools for normal institutional functions and operations as well as project management. Future World Bank project to assist with these requirements and observations.

b) How it could have been improved

Having appropriately trained and skilled staff as well as access to modern office resources and systems, in the areas mentioned in (a) above, would have assisted DPE's performance in the management of PNG ESDP implementation and in future projects.

David Manau,
SECRETARY, DEPARTMENT OF PETROLEUM AND ENERGY

6.4 Client ICR Report: Component 2.

Client Implementation Completion Report (ICR) - PNG Power Ltd

PNG Energy Sector Development Project (PNGESDP)
Component 2: Technical Assistance for Preparation & Planning for Port Moresby Hydropower Supply

Document Information

Revision no:	1.1		
Revision description:	Final ICR after World Bank Review		
Prepared by:	Damien Sonny Manager – Sustainable Development (Acting)	**Date:**	14.05-2020
	Mairawesi Pulayasi Senior Director – Strategic & Innovation	**Date:**	14/05/2020
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1. INTRODUCTION

1.1 Description of the Project

This Client Implementation Completion Report (ICR) is prepared by PNG Power Ltd (PPL) as the government's implementing agency for Component 2 of the PNG Energy Sector Development Project (PNG ESDP) – P101578 ("The Project"). Component 2 is for Technical Assistance from the World Bank for the preparation and planning for a hydropower project to supply Port Moresby electricity grid.

The Government of Papua New Guinea (GoPNG) approved the Electricity Industry Policy (EIP) in December 2011 and agreed that consistent with the objectives of the EIP, the proposed Naoro-Brown Hydropower Project shall be directed and supervised by the Electricity Management Committee (EMC), and the EMC to seek technical assistance from the World Bank to facilitate the development of the proposed Naoro-Brown hydropower project. The Government, in April 2018, confirmed the appointment of PNG Power Limited (PPL) as the Government's implementing agency (for the development of Naoro-Brown hydropower project) in accordance with the Agreement between the State and the World Bank. PPL and the World Bank facilitated the project preparation for development of Naoro-Brown hydropower project under the World Bank's PNG Energy Sector Development Program (PNG ESDP).

In February 2012, the World Bank Board of Executive Directors approved the Energy Sector Development Project – P101578 ("The Project"), an approximately US$8 million technical assistance (TA) financed by the IDA credit and a grant from the Global Environment Facility. The Project became effective on November 27, 2013 and comprises two components, as follows: Component 1 to be implemented by the Energy Division at the Department of Petroleum and Energy (DPE), and Component 2 to be implemented by PNG Power Ltd.

1.2 Scope of the Project

The Naoro-Brown hydropower project scope were as follows:

- Review of Phase 1 Detailed Feasibility Study;
- Phase 2 Feasibility Study and update of project cost estimate;
- Engage Consultants to develop project preparation documents, procurement documentation-bidding-evaluation & negotiation with the winning bidder-financial close, financing and investment arrangements for the main project parameters, Environment and Social Impact Assessment (ESIA) Study, Land Acquisition, Benefit Sharing Study and hydrological data collection;
- Equity structure; and
- Government endorsement.

2. BACKGROUND

(a). ***Project Objective***: *What was the origin of the project? Why was it needed?*

The GoPNG, in December 2011, approved the development of the Naoro Brown hydropower project. The World Bank Project Appraisal Document[1] statement on the Project Development Objective (PDO) for Component 2 of the PNG ESDP was aligned to the GoPNG Decision to: *attract investors for sustainable development of new hydropower generation to supply the Port Moresby electricity grid.* Furthermore, the objective for Component 2 was consistent with the GoPNG's overarching socio-economic plan for the country, as espoused in PNG Vision 2050, PNG DSP2010-2030 and the MTDP.

(b). ***Organisation***: *: Rationale for partnering with the World Bank*

The 2011 December GoPNG Decision directed the relevant government agency to seek technical assistance from the World Bank to facilitate preparation for the development of the Naoro-Brown hydropower project. The GoPNG Decision recognised the benefit of the World Bank's experience and expertise in assisting many member countries in the development of infrastructure projects including hydropower projects.

(c). ***Project Design***: *Initial budget and additional funding.*

The Naoro-Brown hydropower project initial budget was;

Project Components	IDA Credit (US$)	GEF Financing (US$)	IDA Credit (Expressed in SDR)
2nd Component: Goods, Services and Training for Preparation & Planning for Port Moresby Hydropower Supply	6,323,830	0	4,130,000
Total	**6,323,830***	**0**	**4,130,000**

**The US$ equivalent based on exchange rate as of 11 August 2014*

PPL also acknowledges and records receiving an additional **US$550,000.00**, which was transferred from the Department of Petroleum & Energy (Component 1) to PPL. With the additional funding, the Naoro-Brown hydropower project budget was:

Project Components	IDA Credit (US$)	GEF Financing (US$)	IDA Credit (Expressed in SDR)
2nd Component: Goods, Services and Training for Preparation & Planning for Port Moresby Hydropower Supply	6,323,830	0	4,130,000
Funds transferred from Component 1 to Component 2	550,000		
Total	**6,873,830***	**0**	

[1] World Bank PAD of 22 January 2013

3. ACHIEVEMENTS

***(a). Project outputs**: What were the products from the project? Provide details on the different contracts executed through the project and what they achieved.*

The key outcomes of the Naoro-Brown hydropower project as follows:

- Positive and successful outcome of the site trials for a grout curtain to provide sealing of permeability risk at the Right Bank of proposed the dam site and issuing of an updated Feasibility Study report and project cost estimate,
- April 2018 GoPNG approval of the project and the establishment of the Naoro-Brown hydropower Project Steering Committee,
- Appointment of Transaction Advisors who provided technical, legal, procurement and financing advice,
- ESIA Consultants who provided environmental and social impact assessment of the project consistent with PNG CEPA requirements and IFC Safeguard Standards,
- Benefit sharing study,
- Technical training and skills transfer to PPL project team.

Listed below are the specific contracts procured under Component 2 of PNG ESDP and supported PPL PMU:

- ECA - Electricity Industry Regulatory Codes for Third Party Access and Grid Code
- Entura - N-B hydropower project detailed FS and Updated FS
- Multiconsult, King & Spalding, Allens-Linklaters - Transaction Advisors
- Cardno - ESIA Consultants
- Dominik Godde - Technical Advisor
- Jorge Cavero - Procurement Advisor
- Project Implementation Officer
- Environment Safeguards Advisor
- Social Safeguards Advisor
- Dam Safety Panel of Experts which included a Geotechnical Expert, Seismic Expert, Sediments Experts.
- Hydrologist and Field Hydrographer
- Communications & Consultations Expert

***(b). Expectations**: Did the projects reflect initial expectations? Provide details. Provide contract details as shown below:*

The main contractual activities did reflect initial expectations especially the performance of the Transaction Advisors, the roles of the Regulatory Codes, the ESIA studies, and the Services provided by supporting Consultants. There were, however, some shortcomings – with regard to delays due to lack of proper internal project administration and weakness in project management. Continual changes to key project staff as well as changes in PPL Management contributed to the shortcomings in project administration and project management thereby causing delays to project implementation, generally.

Furthermore, a lack of understanding of World Bank process as well as delays in contract negotiations and administration for the ESIA consultancy are examples of the shortcomings impacting on project timeline. Land acquisition as well as the installation of hydrological data collection stations were important project activities, which did not progress as expected.

(c). *Contract details*:

Contract and contractor	Contract Number	Initial date	Final Date	Initial Contract Amount	Actual contract amount
Procurement Advisor	ESDP/PPL/C/1	13/08/2014	Jun 2019	USD364,867.67	USD364,738.10
Project Implementation Officer	ESDP/PPL/C/2	05/05/2014	31/12/2015	USD172,628.00 (US$105,657)	USD172,585.26
Transaction Advisor	ESD/PPL/C/3			USD2,306,738.89	GBP374,466.16 USD1,823,654.47
Social Safeguards Advisor/Gaius Maliaki	ESDP/PPL/C/4	16/06/2015	26/09/2016	PGK171,000.00 (US$50,891)	PGK149,487.00 (US$
Environmental Safeguards Advisor (local)	ESDP/PPL/C/5	05/10/2015	12/04/2017	PGK191,700.00	PGK88,250.00
Environmental Safeguards Advisor (Local)	ESDP/PPLC/31	13/08/2018	13/08/2019	PGK80,000.00	PGK14,000.00
Additional Feasibility Study				AUD 485,227.26	AUD469,700.00
Environmental Impact and Social Assessment (ESIA)	ESDP/PPL/C/1	15th Aug 17		AUD2,512,038.95	AUD2,512,038.95
PPL Technical Advisor	ESDP/PPL/C19	14th Aug 15	Jun 2019	USD408,723.04	USD331,739.99
Deputy Procurement Advisor				USD46,780.00	USD34,126.73
Drafting of Terms of Reference for Preparing Feasibility of Transmission and Distribution Lines	ESDP/PPL/C#23	23/11/2015	21/12/2015	USD5,700.00	USD 5,682.00

Safeguard Advisor	ESDP/PPL/C/25	19th Feb 18	Feb 19	USD186,520.00	USD126,645.30
Dam Safety Panel of Experts (Sediments specialist)	ESDP/PPL/C36	3rd Jan 19	3rd March 19	USD35,286.47	USD30,887.00
Dam Safety Panel of Experts (Geotech Specialist)	ESDP/PPL/C34	31st Jan 19	3rd March 19	USD26,517.76	USD26,420.58
Dam Safety Panel of Experts (Seismic Specialist)	ESDP/PPL/C35	31st Jan 19	3rd March 19	USD35,521.77	USD35,521.77
Management Information System	ESDP/PPL/C/38	14th April 19	30th Jun 2019	USD33,710.50	USD33,467.28
Implementation of Revenue Protection Program	PG-PPL-112795-CS-INDV	27th June 19	31st Jul 19	USD22,058.75	USD22,058.25
Deputy Procurement Advisor	ESDP/DPE/C22				
Capacity Building Workshop and Training for the Third Party Access Code/ Economic Consulting Associates (ECA)	ESDP/PPL/T2			US$64,300	US$64,300

The procurement and contracts were made according to the "Procurement Plan". However, one may find in the details absence of administrative and contractual activities as well as non-delivery of other key project activities. These may have resulted from the continual changes to "project staffing and PPL management". The records of the receiving and application of the additional US$550,000.00 received from DPE is one of such instances.

The initial objectives and expectations of the Component 2 of the PNG ESDP was to (a) prepare the Naoro Brown Project so it is investment ready, and (b) build capacity at PNG Power in hydropower preparation and planning. However, it can be seen and acknowledged that by implementing sub-component 2(a) may have achieved more than just preparing Naoro-Brown Hydropower Project but also built the capacity in hydropower preparation and planning. At the end of the Technical Assistance provided by World Bank, PPL is able to have now understood the process and requirements in preparing and planning for hydropower project in accordance with Best Practices and Protocols in hydropower project development.

Though the project may have achieved the expectations; issues and concerns, which have affected the expectations from the project implementation, were also identified. One of the issues and concern is relating to Contracts Management. PNG Power spent lot of effort dealing with two issues relating to project variation. Both dragged for over 3 years. One issue related to the ESIA Contract with Cardno and another on Transaction Advisor with Multiconsult. The claim by Multiconsult persists after ESDP Project closure date of 31 July 2019. Both claims relate to Contractors carrying out work without clearance/NO from the Bank.

There were circumstances involved but it is interesting to note that PPL's external advisors were unable to help resolve those matters when they arose. It begs the question on the performance of those project advisors. Why did not the project advisors advise against starting work until Bank processes were completed especially given that those costs were substantial? Hence, it may be concluded that one possible contributing factor is the non-siting of the Project Advisors on the ground. In future engagements it may be to PPL's advantage to negotiate for these advisors to be based in country may be 50% or more of their time engaged.

On signing the loan agreement, the Government has pledged counter-funding. However, due to the financial difficulties the country has and is facing, the PMU and PNG Power as a whole, had difficulty in accessing the Government contributions. For future projects and/or similar future projects, the Bank should evaluate the economic climate and consider 100 % financing of the projects. The difficulty in counter-part funding have led to not fully completing certain tasks and/or activities prior to Phases 3 and 4. The tasks and/or activities include:

(i). Disclosure of the ESIA including draft Benefit Sharing Frameworks and Information and Communication Strategy.
(ii). Land acquisition and titling
(iii). Cadastral/topographic surveys for generation facility, transmission facility and access roads
(iv). Hydrological installations, monitoring and data acquisition
(v). Transmission line/substations study and design
(vi). Access roads study, design and BOQ update.
(vii). Additional drilling and geotech works at dam site, tunnel route and power station site.

4. PROJECT EXECUTION

Provide comments regarding:

***(a). Procurement**: The process for engaging consultants and the ease/difficulty of contract agreement, particularly in relation with delays originating in either Government procedures and/or World Bank procedures.*

Procurement for the preparation for the development of the Naoro-Brown hydropower project under the Component 2 of the PNGESDP was not management well. The PPL PMU lacked the in-depth understanding of the "mechanics" of procurement. This would have been done through relevant training of procurement including introduction to preparation of bid documentations, conditions of contracts such as FIDIC and other standards of condition of contracts as well as World Bank Guidelines for Procurement of Services, Goods and Works.

There is also gaps in the PPL procurement manual which not well understood, hence, needs to be reviewed and updated.

This need for training in procurement generally would alleviate and improve on the shortcomings experienced in procurement activities between government/PPL and the World Bank and improve project management.

***(b). Supervision**: How were the contracts supervised? Who was in charge of supervision? Were the arrangements acceptable viewed in retrospect?*

This matter of contracts supervision cannot be adequately addressed and the reason for this is partly mention above in "Procurement". In fact, the PPL PMU did not function as required due to changes to project staffing. This impacted a lot on project management.

***(c). Financial Management**: How was this aspect of the project implemented? Did the World Bank requirements present any particular challenges?*

Similarly, to procurement management shortcomings, financial management did have its shortcomings such as project auditing, procurement according to the Procurement Plan, etc. These shortcomings, particularly in World Bank processes and requirements for compliance and project management, needed dialogue between PPL and the Bank to resolve and find solutions and not let it become a problem. This may due to changes in project staffing, as one reason.

However, the Naoro-Brown Hydropower Project would have generally made aware to the PPL team the various processes and requirements for the Bank which PPL is able to handle and manage should there be continuity of this project or any project of similar nature.

***(d). Environment and social aspects:** Did these aspects apply to the project? In what way? If so, how were they managed? Did the World Bank provide support for addressing these issues?*

The environment and Social aspects and/or safeguards were considered, not only as a key strength of WB funded projects, but also key aspects in developing sustainable electricity infrastructure. PPL initiated stakeholder engagements, particularly the resources owners and relevant government authorities, since project inception to ensure these aspects were identified and appropriately management. Stakeholder identification and engagement is *modus operandi* for any of PPL's new greenfield and brownfield projects.

Hence, the requirement for ESIA did apply to Naoro-Brown hydropower project where Conservation and Environment Protection Authority of Papua New Guinea (CEPA) regulation applied as well as IFC Environmental and Social Safeguards Standards. The World Bank assisted PPL by facilitating international experts to resolve issues and ensure compliance with CEPA regulations and IFC Environmental and Social Safeguards Standards. With the support, the initial ESIA was successfully executed and vetted by CEPA. The WB, specifically the IFC Performance Standards on Environmental and Social Sustainability and the CEPA guidelines were strictly to for the successful implementation and execution of the ESIA.

Though approved by the regulatory authority, PNG Power is yet to fully disclose the findings of the study to the relevant stakeholders as well as relevant frameworks and strategies, particularly the Land Acquisition and Resettlement Framework, Benefit Sharing Framework, Information and Communication Strategy, and Grievance Resolution Mechanism. Most of these or not, all of them are in the final draft version and needs to disclosed for deliberations prior to finalising.

5. PROJECT EVALUATION

(a). ***Objectives****: were the project objectives achieved, indicating the grounds for the evaluation. Rate the achievement as High/Substantial/Modest/Poor:*

- Preparation of Naoro-Brown hydropower project is rated as **"Substantial"**. This is based on the positive outcome of grout trials to right bank permeability issue; Transaction Advisors procurement activity sufficiently advance to go to market and GoPNG approval of the project.

- The capacity building aspect is rated as **"Modest"**. This is based on the shortcomings on procurement and project management faced by the PMU.

(b). ***Agency performance:*** *was the Government performance/PPL performance acceptable? Could it have been better? Rate as Satisfactory/Moderately Satisfactory/Moderately Unsatisfactory/Unsatisfactory:*

The Agency as **"Moderately Unsatisfactory"** based on the lack of appropriate project administration capacity and weakness in project management as well as the changes in key project staff and changes in PPL Management. The shortcomings in procurement, contract administration and project management contributed to the Agency's below par performance.

(c). ***Bank performance:*** *was the World Bank performance helpful? Could it have been better? Rate as Satisfactory/Moderately Satisfactory/Moderately Unsatisfactory/Unsatisfactory.*

PPL acknowledges an "Agreement" including supporting documents signed by the State and the World Bank. PPL acknowledges the provisions of the "Agreement" which the World Bank complied including governance and accountability requirements in the management of the project. Based on the forgoing, rates the World Bank's performance as **"Satisfactory"**.

6. LESSONS LEARNED

Based on the achievements and the project evaluation, provide comments on:

a) What could have been done better:

Given the shortcomings noted and experienced by the PMU in procurement, contract administration and project management, a well-targeted training in these areas as well as the World Bank's process should have been arranged in the initial part of the project. This would have better equipped the PMU in procurement including conditions of contract and preparation of tender notices, contract administration and general requirements of project management, including the requirements for good governance, accountability and discipline.

b) How it could have been improved:

There is need for PPL to grow experience in procurement, contract administration and project management, including the requirements for good governance, accountability and discipline, which are fundamentally necessary, for the successful delivery of infrastructure projects. There are modes of payment which PPL should assess benefits e.g. Direct payment by World Bank, based on "statement of expenditure" by PPL as opposed to payment fully managed by PPL.

6.5 Map of Papua New Guinea