



PNG POWER LIMITED

TERMS OF REFERENCE

Project Name: Papua New Guinea Energy Utility Performance and Reliability Improvement Project (EUPRIP)

Position/Role: Owner's Engineer (Senior Power Systems Engineer)- EUPRIP

Duration: 350 days over 3 years

Location: Remote or Local

1.0 PROJECT BACKGROUND

The Independent State of Papua New Guinea (the Borrower) has received financing from the World Bank toward the cost of the Energy Utility Performance and Reliability Improvement Project (EUPRIP). The Implementing Agency for EUPRIP is PNG Power Limited (PPL) with a Project Implementation Team (or referred to as PIT in this ToR).

The EUPRIP aims to improve operational performance of PPL. It will (a) urgently rehabilitate PPL's aging transmission and distribution network and control systems on the Port Moresby and the Ramu Grids so that the people connected to these two grids will experience less power outages and (b) implement measures to reduce power system losses and enhance revenue collection to continue transforming PPL into a commercial utility and a financially credible off-taker for independent power producers.

The Project includes the components described below consisting of both soft and hard investments that are urgently needed to improve the utility performance.

Component 1: Urgent rehabilitation and upgrade of PPL infrastructure.

This component will support execution of investments in urgent rehabilitation and upgrade of facilities for electricity supply needed to improve service quality to acceptable levels, with a focus on (i) improvements, reinforcements, and upgrades in the medium voltage (MV) distribution network, (ii) rehabilitation and upgrades of selected substations, and (iii) enhancements in electricity supply control and protection functionality.

Component 2: Implementation of key components of Performance Improvement Plan (PIP) for PPL.

This component will support implementation of key components of the PIP, which has been adopted by PPL management. The PIP focuses on improving efficiency, transparency and accountability in key operations areas (electricity supply, commercial functions, management of corporate resources) in a sustainable manner, with specific emphasis on better service quality and revenue optimization (loss reduction and maximizing collection) under other components of the plan.

- (i) Incorporation of tools to support management.
- (ii) Revenue protection and optimization.

Component 3: TA on Least Cost Power Development Plan and Implementation.

This component will provide TA to support any supplementary planning and preparatory studies as may be needed to implement the LCPDP and achieve the country's electrification targets.

Component 4: Project Management support.

This component will provide technical and operational assistance, including carrying out capacity building activities and training, to support PPL on: (i) Project management and implementation; (ii) technical areas related to the activities carried out under the Project; and (iii) measures to address and monitor gender-related matters. In particular, this component will finance: (i) TA for project management and related technical issues through the recruitment of a project manager, and technical, financial management (FM), procurement, and social and environmental safeguards experts as needed, (ii) TA for efficient implementation of previous components, (iii) the preparation of project safeguards studies and audits, (iv) office equipment and incremental operating costs, (v) technical advisory services to PPL for project design, implementation and supervision, (vi) capacity building on key areas, including safeguards and resilience to climate change and natural hazards, and (vii) consultancy services to address and monitor gender-specific targets through the project.

2.0 TECHNICAL BACKGROUND

Component 1: Urgent Rehabilitation and Upgrade of PPL infrastructure.

This project will include components that will support execution of urgent investments in rehabilitation/upgrade of facilities for electricity supply needed to improve service quality to acceptable levels and minimize outages. Priority investments are as follows:

Subcomponent 1.1. Distribution Network Upgrades

Improvements and upgrades of the medium voltage distribution network, including installation of new switchgear equipment (reclosers, load breaker switches) and fault indicators in the Medium Voltage (MV) network, and implementation of backup facilities and reinforcements of around 100km of MV network to reduce overload and avoid large voltage drop situations in the Ramu system. This will likely include 50km of urban network reinforcement focusing on Taraka and Milford areas and 50km of reinforcements in rural areas. The reinforcements consist of mostly replacing conductors in existing lines, with possible small sections of a new network. Under this subcomponent, PPL will procure goods and materials and utilize PPL's own resources for design, implementation, and completion of distribution network upgrades.

Subcomponent 1.2. Substation Upgrades

Rehabilitation and upgrades in selected substations (Milford and Taraka) through support for increasing the transformer capacity and for the installation of MV capacitor banks in substations for reactive power compensation. According to the current forecasts, both the Taraka and Milford substations are suffering from overloading, causing issues such as voltage drops, increases in transformer losses, and possible sudden losses of supply, hence the project will expand the transformer capacity in each substation. A replacement of one 132/66kV 15/20MVA power transformer (Tx) including associated Tx bay switchgear configuration enhancement and 11kV feeder cubicles repair/enhancement is recommended for the Taraka substation, and a replacement of one 66/11kV 15/20MVA Tx, including grounding transformer (subject to the PPL's grid system design), all 66kV switchyard configuration enhancement and an incoming 11kV cubicle repair is recommended for Milford substation. Currently there is only one 66kV single circuit line from Taraka to Milford.

Subcomponent 1.3. Controls and Protection Enhancements

Enhancements in control and protection functionality; Because a complete SCADA would require an investment that goes beyond the current available project budget, smaller investments will be undertaken under this project to improve the system operation. This would include: (i) upgrading the main SCADA Systems in POM and Ramu Grids, and (ii) upgrading the protection system.

Radio network works will also be done for Port Moresby and Ramu Grids, subject to the approval of a revised Procurement Plan (PP).

3.0 SCOPE OF SERVICES

PPL under EUPRIP is seeking to hire a qualified and experienced Power Engineer, an individual consultant (Senior Power System Engineer), to support the PIT as Owners Engineer (OE) to deliver the Component 1 (Urgent Rehabilitation and Upgrade of PPL's Infrastructure). OE will be responsible for working closely with PPL Project Manager (PM), other engineers, and other PIT consultants (consultants for Environmental and Social aspects, Gender aspects, procurement aspects, and financial/accounting aspects), mainly to support the **Subcomponent 1.2 (Substation Upgrades)**. The OE will support the PIT in the procurement planning, procurement of contractors, and contract implementation and monitoring. In the process of providing the above support the OE will train PIT and other PPL staff and build their capacity to carry out similar activities in the future. In addition, OE will be required to offer support where required with subcomponents 1.1 and 1.3. The general support OE will offer to PPL are;

- 1) Provide the technical support needed to implement subcomponent 1.2 (Substation upgrades) such as assessment of targeted PPL infrastructures, identification of specifications of required substations' equipment and facilities, and basic design for bid/implementation plans/schedules, with taking account of E&S requirements under the World Bank procurement procedure.
- 2) Provide bid, bid evaluation, contract process, and project management support to PIT to implement subcomponent 1.2 (Substation upgrade works);
- 3) Provide technical and project management support to PIT whenever required for the subcomponent 1.1 (Distribution Network Upgrades) work.
- 4) Provide technical and project management support to PIT whenever required for the subcomponent 1.3 (Controls & Protection Enhancements) work.
- 5) Provide training in identified areas that PPL requires.
- 6) Provide daily support for PPL's capacity building.
- 7) Provide adequate support to the further development of the working team. This support is expected to take the form of Technical Assistance and transfer of know-how to the PIT members. The assistance provided may also include provision of training, if necessary to boost the PIT's capacity in performing assigned tasks.

Specific details of works are as follows;

- 8) Support PIT in technical and project construction management.
- 9) Assist PIT in reviewing tender documents (request for tender documents and contracts), and provide comments/ recommendations if any,
- 10) Review the prequalification and tender documents including performance specifications, if any.
- 11) Provide construction support as requested by PIT.
- 12) Provide technical assistance in construction of distribution lines upgrade works
- 13) Participate in all meetings and assist with all negotiations considered necessary.

3.1 SUBSTATION UPGRADES

OE will provide mainly technical support in substation upgrade works. The works will involve procurement of power transformers, Capacitor Banks and Control panels to be installed at Substation in Lae and Port Moresby. The Owners Engineer will support the PIT in preparing documents and/or reviews, equipment

and materials specifications and designs, tendering, procurement, installations or construction, commissioning, and handover. Hence, the Owners engineer will provide support as follows;

3.1.1 Documentation Preparation & Reviews

- 3.2.1.1 Assist PIT in preparing bidding documents for the tender, and reviewing relevant documents such as designs and equipment/materials specifications for EPC contract.
- 3.2.1.2 Review designs and specifications, and provide written comments/recommendations.
- 3.2.1.3 Review the procurement strategy and EPC packaging for the physical implementation. Provide written comments/recommendations.
- 3.2.1.4 Review the bidding documents including performance guarantees and technical specifications, evaluation criteria, and other documents, if any, prepared by another consultant for each bid, and provide written communications/recommendations. Ensure that environmental and social safeguard and gender requirements are properly incorporated in the bidding documents.
- 3.2.1.5 Review the O&M proposals that should fit the institutional development and business plan, and analyze the follow-up activities related to the EPC contracts if necessary.
- 3.2.1.6 Verify that World Bank procurements requirements have been taken into consideration.
- 3.2.1.7 Propose written amendments, options, and variations that can be requested in the context of EPC contracts to achieve the most cost-efficient line and substation structure.
- 3.2.1.8 Review system studies done by PPL, and provide recommendations for improvement of the project design and outputs

3.1.2 Bid Process and Contract Award

- 3.2.2.1 Assist PIT in specifying the scope of work and estimating the cost of contract.
- 3.2.2.2 Assist the PIT in preparing the evaluation criteria, launching and conducting the bidding process for all EPC contracts, including among others pre-tender meetings, answering queries from bidders and opening of bids.
- 3.2.2.3 Assist the PIT in evaluating the bid, drafting Bid Evaluation Report (BER) including commercial and technical evaluations and recommendations for the award of the contract, and answering requests for clarification from the World Bank to obtain the no objection.
- 3.2.2.4 Assist the PIT in preparing the Notification of Intention to Award and the notification to unsuccessful bidders.
- 3.2.2.5 Assist and advise the PIT during contract negotiations, signing of contracts, and compliance by the contractors with contractual conditions (advance payment guarantee, performance bond, etc.) and secure contract effectiveness.
- 3.2.2.6 The other necessary task includes;
 - Review in cooperation with the PIT all contractors' implementation schedules and follow up as required.
 - Prepare in cooperation with the PIT the detailed implementation schedule for the entire project showing interactions between the respective EPC contracts and others as well as major milestones.
 - Perform any other tasks that the PIT reasonably requests and that OE can reasonably implement (recognizing that this is a time-based contract)

3.1.3 Construction, Supervision, and Guarantee Period

- 3.2.3.1 Assist and advise the PIT in the overall management and contract administration of the physical implementation phase of the project, including general coordination of the EPC contractors in charge of the respective contract packages.
- 3.2.3.2 Keep accurate and systematic records and accounts in respect of the works in such a form and detail as is customary and as shall be sufficient to establish accurately that the costs and expenditures have been duly incurred in line with the requirements of the World Bank.

- 3.2.3.3 Advise the PIT in a timely manner on progress of works, potential risks, variations or potential variations in technical or cost items, and the like, on the project as well as such additional information as OE may from time to time be requested. This shall be done through the OE's monthly reports, comments on communications to and from the EPC contractors and minutes of meetings held in connection with the implementation of the project.
- 3.2.3.4 Advise and assist on the establishment and maintenance of a system of filing and storing permanent records of the project correspondence and document for PPL PM and PIT, including all the EPC contractor's drawings submitted for approval and required for the effective operation and maintenance, reports, computations, operating and maintenance manuals, commission test results and as-built drawings. These permanent records shall be the property of the PPL and any in the possession of OE shall be handed over to the PM within 30 days of each project package completion.
- 3.2.3.5 Help PM in preparing the Implementation Completion Report within three months of the completion of the whole project.
- 3.2.3.6 Anticipate and resolve conflictive situations with EPC contractors to try avoiding disputes.
- 3.2.3.7 Register and evaluate all disputes related to time extension and inform the PM without delay.
- 3.2.3.8 Make recommendations to the PM to resolve disputes and try to resolve disputes in coordination with the PM and other PIT consultants.
- 3.2.3.9 Participate in all meetings and assist with all negotiations considered necessary to resolve disputes.
- 3.2.3.10 Review, comment and recommend for approval in accordance with the terms of the respective EPC contracts the following:
- EPC Contractors' detailed design and drawings/diagrams.
 - EPC Contractors' construction and erection methodology, procedures, practices and schedules
 - EPC Contractors' testing and commissioning procedures.
 - EPC Contractors' Environmental and Social Management Plan.
- 3.2.3.11 Follow up major equipment and materials. The cost of those activities will be included in the Employer's Requirement of the Bidding document.
- Attend factory witness test for the selected major equipment such as power transformers and high voltage circuit breakers in cooperation with the PPL's engineering team, and help PPL's engineering team issue the test report on all factory tests.
- 3.2.3.12 Familiarise with the Environmental and Social Management Plan (ESMP) and with the Resettlement Action Plan (RAP) for the project if applicable. Alert PIT if any breach and conflict arise or may arise.
- 3.2.3.13 Supervise the EPC contractors' works mainly from remote basis and by visiting construction sites when visiting PNG or when requested. Coordinate construction supervision tightly with staff from the field and the PPL staff and other PIT consultants. The following activities will include:
- Liaise with PM who may conduct site meetings at least once every month to monitor progress on EPC contractors' works and assess adherence to agreed construction schedule. Identify arising technical and commercial issues in connection with each EPC contract and propose remedial actions.
 - Review minutes prepared by EPC contractor at the site meeting and provide written comment/recommendations (if any) to PM.
 - Obtain required information to assess EPC contractors' site quality management programme and provide written comments/recommendation (if any).

- With the assistance of PM and PPL staff, assess quality of EPC contractors' construction and installation works and fulfilment of EPC contractors' contractual obligations (among others conformity to specifications, codes, standards, approved drawings and diagrams) under the respective EPC contracts.
- Support PPL staff and PIT consultants in charge of Health and Safety to perform the Health and Safety monitoring of all implementation works and support PIT consultants to guide the EPC Contractors to fulfil their HSE responsibilities according to the applicable laws and contractual requirements.

3.2.3.14 Environmental Monitoring

- Review the adherence to EPC contractors' Environmental and Social Management Plan (ESMP) and support PIT consultants in charge during the whole construction period.
- Support PIT consultants in charge to monitor the proper implementation of the ESMP.
- Support PIT consultants in charge to monitor conformity of works with Environmental Permits.
- Support PIT consultants to prepare relevant Environmental and Social reports as needed.

3.2.3.15 Testing and Commissioning of the works

On substantial completion of works in the respective EPC contracts, OE should

- Assist PM to perform checks and verify completeness and compliance of facilities with contractual requirements.
- Together with the PM and PPL staff witness all final testing of mechanical and electrical systems including system interlocks and safety features, and review the test reports.
- Review and recommend PM to approve the contractors' procedures for switching, performance and acceptance testing.
- Coordinate switching and testing.
- Witness the site acceptance testing (after energisation), review the result and report on all test results with respect to contractual requirements.
- Prepare or cause to be prepared a report on any changes made to the installation to meet the requirements of the acceptance tests.

3.2.3.16 Project completion

On the completion of each EPC package, OE should perform the following:

- Obtain O&M manuals from the Contractor.
- Review for completeness and adequacy, and recommend PM to approve equipment operating and maintenance manuals prior to the issue of the final certificates at the least six (6) months before the commissioning of the project. OE shall ensure that preliminary O&M manuals are handed over to the PPL's Transmission & Distribution division being charge of operation and maintenance.

3.2.3.17 As-built drawings

- Expedite preparation of as-built drawings by the Contractor, review and support PPL staff to file a permanent record within one (1) month on project completion.

3.2.3.18 Taking Over certificates

- After receiving the EPC Contractors' application for the contract, recommend PM to issue Taking Over certificates (alternatively reject the Contractors'

application giving reasons for the rejection) and any other final certificates in accordance with contractual requirements.

3.2.3.19 Punch lists

- Follow up on any punch list in issued certificates and expedite timely clearing of outstanding items.

3.2.3.20 Support during the guarantee period

During the guarantee period (defects liability period) of the respective EPC contracts, OE should assist and advise PM to:

- Verify on a regular basis pending issues and rectifications carried out.
- Issue final certificates at the end of the guarantee period.
- Review statistical information related to the operation of the transmission line and substations, including protection systems, fault records and communications.
- Identify causes and find solutions to any observed operating anomalies or problems.

3.2.3.21 General requirement to provide support and advice.

- OE is expected to perform any other tasks that PM may reasonably request and that the OE can reasonably implement (recognising that this is a time-based contract).

3.2 CONTROLS & PROTECTION ENHANCEMENTS

- 1) Assist PM and PPL staff in reviewing tender documents (request for tender documents and contracts), and provide comments/ recommendations if any,
- 2) Assist and advise PM and PPL staff in the overall management and contract administration of the physical implementation phase of the project, including general coordination of the EPC contractors in charge of the respective contract packages.
- 3) Advise PM and PPL staff in a timely manner on progress of works, potential risks, variations or potential variations in technical or cost items, and the like, on the project as well as such additional information as he may from time to time be requested. This shall be done through the OE's monthly reports, comments on communications to and from the EPC contractors and minutes of meetings held in connection with the implementation of the project.

3.3 PROJECT MANAGEMENT SUPPORT

OE will be required to assist and support PM in any Project Management matters as requested by the PM.

3.4 TRAINING & PPL CAPCITY BUILDING

- 1) Provide and impart skills and knowledge to PPL staff whilst working on the project.
- 2) Help PPL staff upskill the contract and construction management.
- 3) Other training needs identified by PM.

4.0 OUTPUTS AND REPORTING

The outputs and reports for Substation Upgrade works are mandatory and OE is be required by PM to submit the below outputs and reports.

The output and reports include preparation and submission of reports, plans and documentation in a timely manner the different types of report in draft and final form and where required, reports will include section on Environment & Social Monitoring provided by the relevant consultants within PIT. Editable electronic

versions will be made available together with the final reports. The OE should to provide:

4.1 Inception Report

A Concise draft Inception Report shall be issued within four (4) weeks from the date of commencement of services and the final version that incorporates any comments received shall be issued three (3) weeks after. The Inception Report shall focus on planning of implementation of the TOR.

4.2 Monthly Progress Report

A Concise Monthly Reports summarising the Consultant's activities during the period under review. Monthly reports shall be issued within the last week of the calendar month.

4.3 Site Test Report

Review and complete Site Test report covering inspection and test of installed equipment at theat the site.. Such reports shall be issued within 10 calendar days after report issue. .

4.4 Project Commissioning Report

Review and complete Project Commissioning Report drafted by the Contractor, covering the tests witnessed, site test, procedures followed, record of equipment settings and initial operational performance, results of the tests, verification that the test results meet contractual requirements and recommendations. Such report shall be issued within ten (10) days of the completion of the commissioning tests.

4.5 Project Implementation Completion Report

Review and complete Project Implementation Completion Report that summarises the Project history, final cost, documentation, and outstanding contractual items that the PIT should follow-up. The format of the report should be acceptable to the PIT and the financing agencies involved in the project and be issued within 30 days of the completion of each project package.

4.6 Special Report s/ Documents

- 1) Support of Project Implementation Manuals revision, PPSD, PP, Annual Work Plan and Budget (AWPB)
- 2) The OE shall flag the PM and PPL staff and be required to submit a report to the PM on any issues that may have a significant impact on the Project
- 3) Incident Reports. Any incident taking place during the physical implementation of the project shall be immediately reported to the PM.
- 4) Basic Design reports for Bid. The basic design reports shall consist of engineering design memoranda, engineering calculations, economic and financial calculations, drawings, etc. Electronic documents shall be provided in MS Office software and the drawings in AutoCAD, or compatible software.
- 5) Risk assessments and mitigation plans
- 6) Any other report that may be reasonably required by the PM.

5.0 CONTRACTUAL INTERFACE AND SPECIAL TASKS

The OE shall cooperate closely with the PM and the other PIT consultants, and PPL staff. Specifically for PPL staff, this cooperation aims to provide the on-the-job training.

The PM will assign one PPL's Power Engineer (PE) to work with OE in carrying out the assigned tasks. The OE will work closely together with the assigned PE and train and mentor the PE to increase to enhance the PE project implementation skills. The OE and PE will have almost daily contact to coordinate their work.

6.0 REPORTS AND DATA AVAILABLE

The following reports and data are available:

- Project Appraisal Document
- Urgent Rehabilitation Plan
- Simple system studies

7.0 TIME SCHEDULE

A Contract shall be signed at the conclusion of the selection process between the individual consultant as the OE and PPL. Consultancy services for the function as OE are expected to commence as soon as possible after the signing of contract.

8.0 DURING IMPLEMENTATION

The estimated duration for the assignment is three hundred fifty (350) person-days over three (3) calendar years. Eight (8) hours constitute one working day and for each calendar day a maximum of 8 hours can be claimed. OE will visit PNG at least 6 time over the duration of the assignment to support PM and other PIT consultants and visit project sites for supervision. OE, if resident in PNG, should work with other PIT consultants, and PPL staff at PPL office and closely supervise construction needed

Task 1 – Preparation

OE shall spend the first 10 - 30 days after award of contract in PNG with the PM in PPL National Office to review documents, prepare plans and initiate procurement for this component's activities.

Task 2 - Supervision

- 1) OE shall make one trip to supervise the installation of substation works from Implementation to test & commission and 30 days after operations.
- 2) OE shall make one other trip to support the PIT full time during installation of MV network activities from implementation to test and commission and 30 days after operations as requested.

Task 3 – Project Closing

OE shall make one trip for 10 - 30 days for the closing of the project and submitting all project closing reports.

OE shall include 2 additional trips to PNG. The timing of will be agreed with PM.

9.0 DELIVERABLE AND REPORTING OBLIGATIONS:

The Consultant will be engaged for the duration specified in the contract. Payment will be done monthly after the consultant's submission of invoice with the supporting timesheet to the PM. The Consultant will report to PM.

10.0 SUPPORT BY PPL

PPL will support the consultant with;

- Office space
- PPL working team – PM, other PIT consultants, Transmission & Distribution division.
- Administrative Assistance
- Access Passes
- PPL Network usage
- Transport to and from work sites.

11.0 SELECTION REQUIREMENTS

Followings are mandatory qualification and experience requirements.

- Engineering Degree in Power engineering, Electrical or similar
- Fifteen (15) years of experience in electric industry with ten (10) years in Substation works or similar.
- At least managed one project with the minimum contract value of US \$8 million.

Desirable:

- Some experience in distribution line system studies and design etc.
- Some experience in SCADA and radio networks.

Attributes:

- Proven record of managing, designing, installing, and commissioning power transformers, switchgears, power factor corrections and controls in substations.
- The number of projects which comply with the criterion of the technical experience above and have been implemented in developing countries.
- The corresponding value of the works contracts supervised.