Rectification Works for Lumapas and Berakas R&D Solar PV System

Scope of Work and Bill of Quantities

Introduction

The Solar PV System in Lumapas Substation comprises of a total of 900 pieces of Solar Panels each producing 535Wp(DC). These panels are located at the open area of BPC Lumapas 66/11kV Substation. The Solar Panels are connected to 4 Solar Inverters (110kW) each with a maximum of 12 strings of PV Arrays. Each string consists of 20 Solar Panels. These Solar Panels are ground mounted in a modular 2 x 5 Panels in portrait arrangement.

In Berakas R&D, there are a total of 80 pieces of Solar Panels each producing 540Wp(DC) located at the open area of BPC Berakas R&D. These Solar Panels are connected to 2 Solar Inverters (25kW) each connected with 4 strings of PV Arrays. Each string consists of 10 Solar Panels. These Solar Panels are ground mounted in a modular 2 x 5 Panels in portrait arrangement.

The installation works of these Solar PV System were completed in December 2022. However, there are a number of findings raised regarding the installation works carried out that need rectification. All rectification works details will be described under the scope of work below.

In addition, during rectification works at the R&D solar installation at Berakas, there were also a few findings raised which requires rectification similar to Solar PV System at Lumapas Substation. These issues will affect the safety, longevity and maintainability of the installation, and should be rectified.

Scope of Works

The scope of work for this project is to supply & deliver of manpower, tools, equipment, materials for the rectification works of the PV System in Lumapas Substation (Appendix 1 No 1) and Berakas R&D (Appendix 1 No 2). This Scope of Works contain all the work sequence and specification for this project and must be read in conjunction with the Bill of Quantities.

1. Inverter Mounting Shed.

   This scope is to install metal plate to the sides of the Inverter Shed as shown in Appendix 1 No 3. The metal plate shall be aluminium or galvanised metal type with 2mm thickness. The size of this metal plate required approximately 1640mm by 1640mm. Each Inverter Shed requires 2 metal plate to be installed on the sides. These metal plates shall be supplied, delivered and installed by the contractor. There are 4 nos of Inverter Sheds in Lumapas Substation and 2 nos in Berakas R&D.

2. Cable Laying, Cable trench replacement

   This scope is to replace the existing covered cable trays with open-type cable tray and to add on cable trays under the cable trench cover in Lumapas Substation as shown in Appendix 1 No 4. The cable trays will be free issued to the Contractor. The Contractor shall supply tools, manpower and miscellaneous materials to remove and replace the existing covered cable trays and to add on cable tray under the cable trench cover with the free issued open-type cable trays and terminate the cables back to its designated location. The Contractors shall perform proper cable management for this cable laying work. The cable entry point under the cable trench cover shall be sealed using expansion foam to prevent small animals and rodents from nesting inside of the cover.

   The contractor shall supply stainless steel cable tie with rubber sleeves. This cable tie will be used to secure the cables to cable trays. Contractor shall replace all existing cable ties with the new metal cable ties. (Refer to Appendix 1 No 5)

   For Lumapas substation and Berakas R&D, all exposed outdoor cables (except DC cables) shall be placed inside a proper metal flexible conduit suitable for outdoor use. The Contractor shall supply metal flexible outdoor type conduit and replace all the flexible conduits (See Appendix 1 No 6). The Contractor shall secure any exposed fibre patch Cable (See Appendix 1 No 7) and placed inside the metal flexible conduits. These conduits shall be secured on the structure using rust-free metal clamps such as G.I or stainless steel suitable for outdoor use (See Appendix 1 No 8). This mounting will be supplied by the Contractor.

   In Berakas R&D, all cable entry shall be rearranged by the Contractor to allow the cable to entry from the bottom side (See Appendix 1 No 9) and the cable entry shall be secured using metal cable glands. The Contractor shall seal any unused cable entry of solar inverter (Refer to Appendix 1 No 10) with blanking plugs (PVC or Metal).

3. Cleaning all Earthing Bars

   This scope is to supply manpower and tools to clean the corroded Earthing Bars to ensure good/lower contact resistance in Lumapas Substation. The Contractor shall provide wire brush and cleaning liquid for this scope. Upon reinstating back the earthing bars, the Contractor shall supply and use stainless steel bolt and nuts with spring washer of the same size. (Refer to Appendix 1 No 11)

4. Rectify wrong connections/wrong labelling on MCB box.

   This scope is to rectify and correct the cable markers for Lumapas Substation. The Contractor shall provide cable markers and replace the existing cable marker with the correct information. (Refer to Appendix 1 No 12)

   The Contractor shall provide correct labels for each MCB to be placed on the MCB for identifications. (Refer to Appendix 1 No 13)

5. Sealing of Hollow Structural Beams

   This scope is to supply end caps to seal Open-ended structural elements in Lumapas Substation. The Contractor shall supply and install the correct end caps for the existing structure. (Refer to Appendix 1 No 14)

6. Install Heat Shrink Tube on DC Cable

   This scope is to supply and install Heat Shrink Tubing (according to their respective colour which is red & black and size of 6mm^2) to cover and protect DC Cables that are exposed to sunlight in Berakas R&D(Refer to Appendix 1 No 15). The contractor shall also supply cable marker tube and install on the heat shrink for cable identification.

7. Replacement of Fiber Patch Panel

   This scope is to replace the existing non-IP rated fibre patch panel in Berakas R&D as shown in Appendix 1 No 7 to an IP65 rated fibre patch panel. This includes re-splicing of the fibre optic cable after the re-installation of IP65 rated fibre patch panel. The Contractor shall supply all manpower, tools and equipment for the installation and re-splicing of fibre cable.

8. Install Spring Washer/Star Washers

   This scope is to supply and install Spring Washers or Star Washers for all earth loops on the Solar Panels and the mounting structure in Lumapas Substation (Refer to Appendix 1 No 16).

9. Material Supplying Scope

   This section lists out the materials required to be supplied by the Contractor. The Contractor shall supply, deliver and install the following materials for this project:

   a) Consumable materials such as Cable Lugs/Ferrules and etc.
   b) Metal Plate 2mm thick size approximately 1640mm x 1640mm (Aluminium / galvanised)
   c) Stainless Steel Bolt and nuts (With spring and plain washers).
   d) Cable Glands
   e) Metal Cable Ties with rubber sleeves.
   f) Heat Shrink Tubing.
   g) Label markers (Sticker type).
   h) Insulating foam sealant.
   i) End Caps
   j) Flexible Metal conduits complete with metal glands and conduit mountings (Rust-free) suitable for outdoor use (Water resistant/ UV Resistant).

   Materials proposed and suitability is subject to BPC's agreement and approval. Bidders to submit proposed materials during bid submission.

10. Transportation

    The Contractor shall provide a certified Hiab truck and/or any necessary lifting equipment or machinery for all the lifting activities required in Lumapas Substation and Berakas R&D.

11. Testing & Commissioning

    After the installation, the Contractor shall test every cable laid. The test shall include Insulation Test (IR) test and Continuity Test. Reports of the tests shall be produced and submitted to BPC for approval before the commissioning of the PV system as a whole.

    The Contractor shall assist BPC during inspection, testing, commissioning and test reporting of the solar PV rectification works in accordance with manufacturer's or vendor's recommendations. The rectifications are deemed complete only after BPC issues a Practical Completion Certificate (PCC)

HSE

1. Non-standard tools such as home-made or improvised tools are not allowed. Power plugs and sockets must be of the waterproof industrial type with a Residual Current Device protection system. The condition of power tools

should be acceptable to BPC; any power tools with heavy signs of wear and tear, or some other physical damage or defects shall not be used.

2. The Contractor's PIC is to always ensure that his workers do not intrude into areas not authorised for their workers. A proper covered rest area with portable toilet facilities must be provided by the Contractor for his workers. The cost of this setup is to be borne entirely by the Contractor and is deemed to be included in the bid offer.

3. A repeated HSE offence or non-compliance by the PIC or his workers will result in the PIC card(s) and work pass(s) being withdrawn by BPC and the person(s) affected by this sanction will not be allowed to work inside BPC premises.

4. The Contractor's employee for electrical work shall be registered with a valid minimum category E01 to ensure and meet local authority and electrical safety requirements.

5. The Contractor must comply with all site safety rules and requirements inclusive of the following:

   a) Attendance to the safety induction course by all Contractor personnel working on the work site.

   b) Submission of a Risk Assessment and Method Statement (RAMS) document for the works for approval prior to the commencement of the works.

   c) Conduct daily toolbox talk prior to the commencement of site activities. All daily toolbox talk is to be recorded and signed off by those who attended to ensure the complete understanding of the site activities as planned.

   d) Provision and use of Personal Protective Equipment (PPE), portable toilet, rest area, proper tools (strictly no homemade tools) and certified equipment at the work site at all times.

   e) Full compliance with all relevant safety rules and regulations implemented by the relevant Government Authorities (i.e., Ministry of Development Health Safety & Environment Manual, Workplace Safety and Health Order 2009, and all its subsequent regulations, etc.) including all relevant BPC HSE procedures and requirements at all times.

Note: BPC has the right to stop the work should there be any non-compliance of HSE procedures by the Contractor and their personnel.

Commercial

1. The quoted bid shall be firmed in BND and shall be in accordance with this **RFQ Document**.

2. The Bidder's bid prices shall be fixed price lump sum and represents the full cost to the Client for the performance and completion of works by the Contractor. The rates in these bills shall include supply, transportation, installation, labour costs, all taxes/duties, all materials required, and any other costs deemed necessary to complete the works as stated.

3. The Bidder must undertake mandatory site visit to fully understand the scope of work prior to submitting the bid. No claims shall be entertained for incorrect and insufficient information after award.

4. The Bidder notes that the materials, quantities, and measurements indicated in the Bid Documents are provisional estimates. The Bidder shall verify these during the site visit to offer a firm LUMP SUM bid price. No additional claims or re-measurement will be accepted after award.

5. The Contractor shall allow for any costs associated with limited or restricted working hours imposed by the BPC where applicable. BPC office hours are currently Mondays to Fridays, 7:30AM to 4:30PM. Saturdays, Sundays and Public Holidays are off days.

6. This bid shall also include testing, commissioning, test reporting, and document submittals. Any need to communicate with the Solar PV manufacturer or vendor for technical assistance is included in this scope.

General Information

1. The intent of the Bill of Quantities (BQ) is not to provide an exhaustive list of equipment, materials or works description, but nonetheless the complete scope must be included and correctly installed by the Contractor in compliance to industry standards for solar PV installations.

2. All details and quantities shown in the BQ or Drawings are not to be construed as the final measurements, but as an estimate. Bidders are required to carry out due diligence to perform a site survey and take site measurements to satisfy themselves as to the accuracy and sufficiency of their bid offer needed to complete the works. BPC will not entertain additional claims after award of bid to the successful bidder.

3. The BQ, drawings and specifications are intended to complement each other, should any part of the documents and drawings appear to be ambiguous between the two, the client reserves the right to make the final judgement, unless prior clarifications had been obtained from the client in writing.

4. All incidental but unspecified necessary works, materials, fittings, accessories, consumables, equipment, tools, workmanship, labour, transportation, customs duties and taxes are all deemed to be included in the final offer. No variation order will be issued.

5. The successful Contractor shall undertake to complete this work on time according to the agreed work schedule from the date of PO issued by BPC for the works. The Contractor shall provide all necessary documents including but not limited to HSE RAMS (Risk Assessment Method Statements), proposed construction drawings, work and safety plans, detailed project schedule, organigram, HSE controls, etc.

6. If there are works unclear from this BQ or the attached documents, the bidder must obtain a written clarification from BPC before submitting his bid; after bid submission, the scope is deemed to be confirmed and the bidder have satisfied himself as to the accuracy and completeness of his offer. Additional claims are not allowed post-award of the bid.

7. BPC to free issue the following items to Contractor for installation work. Non listed items such as accessories and consumables are supplied by the Contractors as part of their work:

    - Cable Trays
    - Fiber patch panel IP65

8. BPC HSE Induction costs,
    a) HSE Induction – BND 20
    b) Person-In-Charge-N (PIC-N) – BND 30
    c) Person-In-Charge-G (PIC-G) – BND 120
    d) Person-In-Charge-E (PIC-E) – BND 250 (Minimum requirement for this project)

Bill of Quantities

PRELIMINARIES

Item (A)	Description	Qty	Unit	Unit Rate BND	Amount BND
1.	***General & Preliminaries*** Mobilization & Demobilization of qualified manpower and equipment to site Inclusive of, 1) Provision of HSE officer with WHSC registered under SHENA. 2) Provision of **PIC-E** for supervision of works 3) Submission of risk assessment and method statement (RAMS) and Job Hazard Analysis (JHA) for the works for the Client's approval prior to start of works. 4) Compliance with all relevant safety rules and regulations implemented by the relevant Government Authorities (i.e., Ministry of Development Health Safety & Environment Manual, Workplace Safety and Health order 2009, and all its subsequent regulations, etc) and all relevant BPC HSE requirement at all times. 5) Provision and use of Personal Protective Equipment at site at all times, safety barrier, safety cones, hazard lights and etc. 6) Provision and use of proper scaffolding, ladder, equipment, tools on site for use. 7) Provision of Portable Toilet and Rest Area 8) Daily disposal of waste materials from site for waste generated by the worker. 9) Keep the site tidy and free from rubbish, debris and the like. Provide all necessary containers like metal 'skips' and remove all rubbish, debris and the like from the site to approved dumping areas at regular intervals. Burning of rubbish on the site will not be allowed under any circumstances. 10) Attendance to Safety Induction Course of all working personnel working on site, including attendance to the PIC course of the Bidder's site supervisor. 11) BPC Safety Induction is compulsory prior to Works and costs are to be borne by Bidder.	1	Lot		
				T O T A L (A)	

EQUIPMENT, MATERIAL SUPPLY & DELIVERY SCOPE (LUMAPAS SUBSTATION)

Item (B1)	Description (FOR LUMAPAS SUBSTATION)	Qty	Unit	Unit Rate BND	Amount BND
1.	Metal Plate Cover for inverted shed.	4	Sets		
2.	Stainless Steel Bolt and nuts (various sizes according to site requirement) - With spring and plain washers	1	Lot		
3.	Metal Cable Gland and metal flexible conduits (Various sizes according to site requirement) **Note: Bidder to propose the sizing according to site visits.**	1	Lot		
4.	Metal cable ties with rubber sleeves	1	Lot		

Item (B1)	Description (FOR LUMAPAS SUBSTATION)	Qty	Unit	Unit Rate BND	Amount BND
5.	Label markers. - Sticker type for MCBs (Refer to Appendix 1 No 13) - Metal cable marker for outdoor use (Refer to Appendix 1 No 17).	1	Lot		
6.	Insulating foam sealant (expansion foam)	1	Lot		
7.	End Caps	1	Lot		
				T O T A L (B1)	

EQUIPMENT, MATERIAL SUPPLY & DELIVERY SCOPE (BERAKAS R&D)

Item (B2)	Description (FOR BERAKAS R&D)	Qty	Unit	Unit Rate BND	Amount BND
1.	Heat Shrink Tubing (red and black and size of 6mm^2)	1	Lot		
2.	Cable marker tube (Various sizes according to site requirement).	1	Lot		
3.	Blank Plugs	1	Lot		
4.	Metal Cable Gland and metal flexible conduits (Various sizes according to site requirement) **Note: Bidder to propose the sizing according to site visits.**	1	Lot		
				T O T A L (B2)	
				TOTAL OF B (B1 + B2)	

INSTALLATION & COMISSIONING SCOPE (LUMAPAS SUBSTATION)

Item (C1)	Description	Qty	Unit	Unit Rate BND	Amount BND
1.	Installation of metal plate cover at the sides of existing inverter enclosure (4 sets) at Lumapas Substation (Refer to Appendix 1 No 3). Removal of existing covered cable trays, replace with Open cable trays and add on of open cable try under the cable trench cover. - The cable trays will be free issued to the Contractors. - Refer to Appendix 1 No 4 - Expansion foam shall be used to seal the entry point under the cable trench cover. - The Contractor shall provide Engineering Design for this scope. - Inclusive of minor excavation of dirt. - Inclusive of re-arranging of all cables. Replace and install conduit and mountings for outdoor use. - Any indoor flex conduit used shall be removed and replaced with metal flexible conduit and metal cable glands (if required).	1	Lot		

Item (C1)	Description	Qty	Unit	Unit Rate BND	Amount BND
	- Conduit ends near to ground shall be replaced with longer conduits and sealed with expansion foam to prevent water from entering. - Conduit mountings shall use proper metal mountings suitable for outdoor use (Rust free). - Refer to Appendix 1 No 6 to No 8. Any unused cable entry of solar inverter shall be secured with blanking plugs (PVC or Metal) (Refer to Appendix 1 No 10). All rusty Bolts and Nuts which are connected to earthing bars to be replaced with stainless steel type. - All rusty Copper Earthing Bars to be clean to ensure good contact resistance. - Refer to Appendix 1 No 11. Replace and correct all safety warning labelling on all MCB Box - Install proper labelling/markers on all MCBs. - Refer to Appendix 1 No 12 for safety warning label. - Refer to Appendix 1 No 13 for Sticker Marker. Installation of plain and spring washers to all bolt and nut installations at earth loops on the mounting structure and solar panel (Refer to Appendix 1 No 16). Metal cable tie need to be replaced with metal cable tie with rubber sleeves.				
2.	After the replacement of cable trays are completed, the Contractor must conduct IR test for all cables, voltage check for solar panels and record all the results in a test report. All tests must be witness by BPC.	1	Lot		
3.	Assist BPC during inspection, testing, commissioning and test reporting of the rectification works. The rectification is deemed complete only after BPC issues a Practical Completion Certificate(PCC)	1	Lot		
				T O T A L (C1)	

INSTALLATION & COMISSIONING SCOPE (BERAKAS R&D)

Item (C2)	Description	Qty	Unit	Unit Rate BND	Amount BND
1.	Install proper conduit and mountings for outdoor use. - Any indoor flex conduit used shall be removed and replaced with metal flexible conduit and metal cable glands (if required). - Conduit ends near to ground shall be replaced with longer conduits and sealed with expansion foam to prevent water from entering. - Conduit mountings shall use proper metal mountings suitable for outdoor use (Rust Free) (Refer to Appendix 1 No 6 to No 8). All cable entry shall be rearranged by the Contractor to allow the cable to entry from the bottom side (See Appendix 1 No 9). The Contractor shall seal unused cable entry of the solar inverter using blank plugs. (Refer to Appendix 1 No 10).	1	Lot		

Item (C2)	Description	Qty	Unit	Unit Rate BND	Amount BND
	Heat shrinks tubing to be installed on DC cables that are exposed to sunlight to prevent damage to cable insulation. Contractors to provide suitable cable markers on the tubing (Refer to Appendix 1 No 15). Replacement of existing Fibre Patch Panel with IP65 rated Fibre Patch panel inclusive of manpower, tools and equipment for splicing of Fibre Optic Cables.				
2.	After the replacement of cable trays are completed, the Contractor must conduct IR test for all cables, voltage check for solar panels and record all the results in a test report. All tests must be witness by BPC.	1	Lot		
3.	Assist BPC during inspection, testing, commissioning and test reporting of the rectification works. The rectification is deemed complete only after BPC issues a Practical Completion Certificate(PCC)	1	Lot		
				T O T A L (C2)	
				TOTAL OF C (C1 + C2)	

SUMMARY OF PRICES

Item No.	Description	Amount (BND)
A	PRELIMINARIES	
B	EQUIPMENT, MATERIAL SUPPLY & DELIVERY SCOPE	
C	INSTALLATION & COMISSIONING SCOPE	
	Grand Total	

Amount in words (BND)……..

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Completion Time: …..…. weeks for completion of successful rectification of the Solar PV System starting from Contractual Date and ending on date of Practical Completion Certificate signed by the Client (inclusive of time for RAMS submission and approval, safety induction training of PIC and personnel, material and equipment supply, site setting out, etc).

APPENDIX 1 List of Figures

NO.	LIST OF FIGURES
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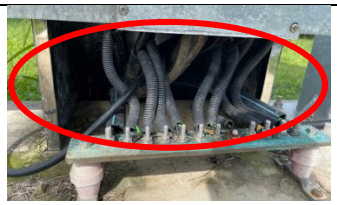
4	 
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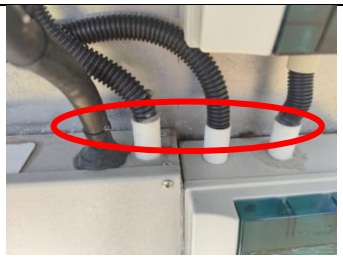
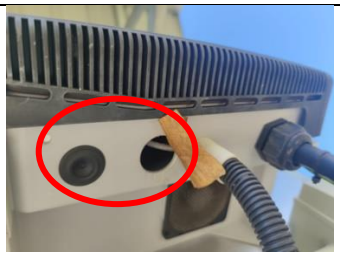
9	
10	
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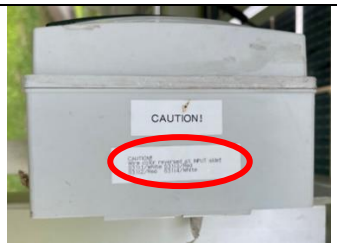
12	
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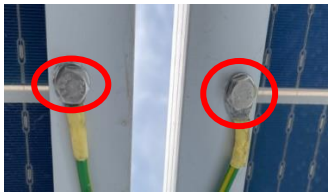
16	
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