PNG POWER Ltd

REQUEST FOR TENDER

FOR THE SUPPLY AND DELIVERY OF ONE (1) x 500 KW 415V CUMMINS DIESEL GENERATING SET COMPLETE WITH FREE STANDING CONTROL/SWITCHBOARD, FOR KEREMA DIESEL POWER STATION.

Tender No 26/2017

PNG POWER Ltd

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Authorised by	:	Vincent Pilakvue
Date	:	18/09/2017

Contents

1. Invitation to Tender

PNG Power Ltd (PPL) invites Tender for the Supply and Delivery to Site of one (1) x 500kWe 415V 50 Hz Cummins Generating set complete with free standing control/switchboard for its Diesel Power Station in Kerema, Gulf Province, Papua New Guinea.

Tender close with:

PNG Power Ltd
P.O. Box 1105
BOROKO, N.C.D
Papua New Guinea

at 4:00 PM on **Friday 20th October**, 2017.

The Tender Submission shall consist of the original of each of the following, all duly completed:

- Form of Tender
- Price Schedules
- Specific information as requested
- Any additional information or priced variations offered by the Supplier to aid evaluation of the Bid.

Enquires during the Tender period shall be in writing and addressed to:

PNG Power Ltd
P.O. Box 1105
BOROKO, N.C.D
Papua New Guinea

Attention: Mr. Vincent Pilakvue
Manager Project Delivery
Asset Development Business Unit

Telephone: (675) 324 3260
Facsimile: (675) 323 4974

Or through Email: vpilakvue@pngpower.com.pg

2. Form Of Tender

Companies tendering are required to complete the blank spaces in this Tender Form and complete the Schedules included.

PNG Power Ltd
PO Box 1105
BOROKO, N.C.D
Papua New Guinea

____/____/2017

Gentlemen,

1. Having examined the content of the Tender Document for the Supply and Delivery of the above named equipment, we, the undersigned, offer to supply the equipment for the sum of (words & figures)

   ……
   ……..……..(K…….)

2. We undertake, if our Quotation is accepted, to complete and deliver the equipment to its required site within _____ days subject to the said conditions.

3. We agree to abide by this Tender for the period of _____ days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before expiration of that period.

5. This Tender, together with your written acceptance thereof, shall constitute a binding Contract between us.

6. We understand that you are not bound to accept the lowest or any Tender you may receive and that you reserve the right to select and accept only some items from our Tender.

Signed and sealed for and on behalf of

.....)
.....)
.....)
by .....) .....
the .....)
of the said Company therein)
authorised in the presence of) .....
Address of Company Tender:)
.....)
.....)
.....)

3. Price Schedules

Line No.	Price Category	*Currency*	1 X 400 KWe Generating Set including all Associated Auxiliaries	1 X Control/Switch board including Accessories	1 X 500 kVA Step-up Transformer including Accessories	1 x 500m drum 300mm^2 XLPE cables
1	Overseas Manufacture FOB					
2	Freight					
3	Marine and War Risk Insurance					
4	Total Lines 1 - 3					
5	PNG Kina Equivalent Line 4					
6	Delivery to site – (Local Transportation)					
7	Total Lines 5 - 7					

Rate of exchange used to calculate the amount shown on Line 5 is K1.00 = _____.

Company Name: .....

Name: .....

Signature: .....

Position: .....

Name of Witness: .....

Signature: .....

Date: .....

4. Technical Specification

One (1) x 500KWe 415V Cummins Generating Set complete with free standing control/switchboard is required under this contract for Kerema Power Station in the Gulf Province. The generating set must be able to synchronise and share load with the existing generating sets in the Power Station.

4.1 Design and Service Conditions

The diesel engine shall have speed not exceeding 1500 RPM, four stroke cycle, in-line or Vee configuration and be designed for continuous operation on light fuel oil to BS 2869, class "A", under the following service conditions:

Ambient Temperature	45 ºC
Height above Sea Level (Altitude)	100 m
Maximum Relative Humidity	100 %
Minimum Relative Humidity	45 %

The diesel engine shall have proven records of at least three years satisfactory service as stationary generating unit under base load conditions and shall be currently in Production. Prototypes will not be accepted. The minimum full load rating of the plant at the designated site shall be according to the respective required rated capacity.

4.2 Purpose of Plant

The diesel generating set is intended for continuous base load duty for power supply to the existing system. It is expected that the plant will be operated at, or near, its maximum continuous output for all or most of its operational life.

The plant offered must be capable of running in parallel with existing generating sets as base load units. The list of units installed in the Power Station is shown in table below.

Station	Unit #	Engine/Make	Type/Model	Year of Manufacture
Kerema	5	Cummins	KTA19-G3A	2015
Kerema	3	Cummins	KTA19-G3A	2015

The whole of the plant supplied shall be in every way suitable for the purpose herein described and shall be to the satisfaction of the Engineer.

4.3 Generator and Auxiliaries

Protective Function

The following protective functions shall be provided for the generator as a minimum:

- Voltage controlled Over Current
- Earth Fault
- Current Differential
- Reverse/Low Forward Power
- Loss of Field or Reactive Power

4.3.1 Engine Technical Details

Manufacturer _____

Model	_____
Make	_____
Nameplate Rating	_____
Speed	_____
Engine Age	_____
Design life for base load generation	_____ years
Does the Commission have any sets in service of a similar type	_____
Is a return tank required	_____
Rating at full load	_____ kW
Weight of complete unit including skid base	_____ kg
Delivery time to site from offer of contract	_____

4.3.2 Alternator Details

Manufacturer	_____
Model	_____
Make	_____
Nameplate Rating	_____
Generator ratings (kW) at 100% continuous	_____ kW
Rated terminal voltage (AC)	_____
Rated Speed	_____ RPM
Rated 3phase Voltage/Frequency	_____Volts/_____ Hz

4.4 Switchboard Cubicles

4.4.1 General

The cubicles shall be entirely suitable for operation in conjunction with the 500 kW generating set and shall be able to withstand all voltages and currents which would occur during transient faults.

The control compartment of the cubicles shall be provided with internal lighting and heating and the isolating switch shall be readily operable from the door opening.

4.4.2 Cubicle Construction

The cubicle shall:

(a) Be a free standing type, suitable for separate floor mounting away from the generating set.

(b) Be of robust construction and completely enclosed in steel sheeting in such a way as to prevent entry of insects, snakes and dust and shall have hinged, lockable, rubber sealed panel doors for front access.

4.4.3 Switchboard Compartment

(a) Busbar

Busbars capable of carrying the **full** machine output at 10% overload (550kW) shall be provided between the circuit breaker line and load terminals, and the alternator and load connecting points.

All busbars and busbar joints connected to the 415 Volts circuit breaker shall be insulated with an approved phase colour coded heat-shrink insulation suitable for 600 Volts.

(b) Neutral Earthing

Provision shall be made for the connection of the alternator neutral point, solidly to earth through a hand operated heavy duty Neutral Earthing Switch (NES) to be mounted on the switchboard panel.

The NES shall be rated at 600V AC with an uninterrupted duty current rating of 2000 A and suitable for terminating cables of up to 400 mm^2 cross sectional area.

(c) Cable Entry

Cable entry into the switchboard and control compartments shall be through gland plates made of 5 mm thick aluminum plate located at the bottom of the cubicle. The switchboard base shall be of sufficient area to permit entry of four (4) 400 mm^2 copper cable per-phase for incoming and outgoing cables, plus two (2) 400 mm^2 copper cable for neutral conductor, i.e: a total of approximately 14 cables plus control and alarm cables.

Copper Bars shall be suitable for the connection of four (4) 400 mm^2 cables per phase, minimum.

(d) Current and Voltage Transformers

All current transformers supplied shall comply with AS 1675.

Current limiting fuses shall be fitted to the copper conductors on each side of the 415V main circuit breaker to supply voltage sensing equipment.

For AC components and equipment, refer to Drawings attached in the specification.

Metering current transformers shall be;

- Ratio 1800/1 amps, Class 1M, Output 10 VA.

Protection current transformers shall be:

- Ratio 1800/1 amps, Class 10P100 for reverse power relay.
- Ratio 1800/1 amps, Class 10P200 for voltage control overcurrent.
- Ratio 1800/1 amps, Class 0.02PL50RCT for differential relay.
- Ratio 1800/1 amps, Class 10PL150 for earth fault relay

Voltage transformer shall be;

- Category A, Class 5P, Ratio 415/110/63.5V AC, Rated output 12 VA.

4.5 415 Volt Main Circuit Breaker

(a) Circuit Breaker Type

The circuit breaker shall be of the indoor, enclosed, withdrawable, 3 pole, TERASAKI AT28 type or equivalent, fully complying with AS 1930. Built-in microprocessor type overcurrent/earth fault protection is **NOT REQUIRED** as protection functions are to be met by the numerical protection relay. However the propriety Under voltage Trip Mechanism shall be retained.

(b) Ratings

The circuit breaker shall be suitable for operation on a 415V, 3 phase, 4 wire, 50 Hz, AC system. It shall be able to break a symmetrical fault current of 65 kA and make a symmetrical fault current of 145 kA without damage of any kind due to thermal or mechanical stress. Uninterrupted duty current rating shall be nominally 1800 A.

(c) Operating Mechanism

Circuit Breaker closing shall be by springs automatically charged by a 24V DC motor every time they are discharged. Facilities required for closing shall be:

(i) Manual spring release on the Breaker.

(ii) 24V DC Latch Release Coil operated via the synchronising/electric push - button closing system.

(iii) Manual spring-charging facility for emergencies (loss of charging motor).

Circuit Breaker tripping shall also be by springs. The trip initiation devices required are:

(i) Manual spring release on the Breaker.

(ii) 24V DC Shunt trip coil operated by a Control Compartment push button and the specified Protection and Control Relays.

(iii) Under-Voltage Trip Device fitted to the ACB.

(iv) The closing circuit shall be arranged to avoid any danger of "pumping" action, especially when the breaker is closed on a fault.

(d) Interlocks and Safety Features

Protection and tripping circuits shall be fully operative when closing the circuit breaker on to "live" or "dead" equipment.

The following interlocks shall be provided:-

(i) To prevent the circuit breaker being racked in or out when it is "closed".

(ii) To ensure that the circuit breaker can only be electrically closed in the "Service" or "Test" positions.

(e) Auxiliary Switches

The circuit breaker shall be fitted with sufficient normally open and normally closed auxiliary switches for all status indicating lights, trip coils, latch release coil, protection operated and interlock circuits. In addition, at least two spare normally open & two spare normally closed auxiliary switches shall be provided. The trip circuit auxiliary switches shall make before the main circuit breaker contacts make during a closing operation.

4.6 Control Compartment

(a) Automatic Voltage Regulator

The automatic voltage regulator (AVR) suitable for use with permanent magnet generator complete with voltage adjustment potentiometer shall be installed in the Control Panel. The remote control switch for “raise and lower” operation of the voltage adjustment potentiometer shall be installed on the control panel door as shown on **Attachment M11606 Sheet 9 of 9**. The voltage adjustment potentiometer shall be capable of adjusting the alternator terminal voltage over a range of ± 5% of nominal voltage, with the frequency remaining at 50 Hz.

The Contractor shall install on the terminal of the generator a current transformer required for droop operation of the AVR and also supply sufficient lengths of cables to run between the PMG, AVR and the droop CT.

(b) Electrical Protection Relays

Control Function

The table below lists the minimum control inputs that must be provided for on the relay and the signal type:

OUTPUT SIGNAL	SIGNAL FORMAT
Start Generation	Voltage free contact or via Software Bus
Emergency Shutdown	Voltage free contact or via Software Bus
Normal Shutdown	Voltage free contact or via Software Bus
Protection Reset	Voltage free contact or via Software Bus

(c) Control Relays

The Contractor shall supply all necessary relays, timers, etc., in accordance with the drawings attached as part of this Specification. The circuit schematics are indicative of what is required, but a proven manufacturer's circuit may be used, provided it is of "fail-safe" design, i.e: the engine shut-down solenoid must be **energised to run** and **de-energised to stop**, in any event.

The Contractor's schematics and other drawings shall be submitted to the Engineer for approval prior to construction.

Relay bases shall be suitable for din-rail mounting.

If required, the Contractor may use programmable controllers in the control, indication and alarm controls. However, only control relays must be used in the circuit breaker trip circuit and engine shutdown circuit. The programmable controller output shall be of the relay type and must be capable of switching loads of 24 VDC.

The Contractor shall also supply the software programs, hand held programmer, literature and all the associated equipment to program the PC.

(d) Meter Relays

The contractor shall supply three electronic meter relays (refer to **Attachment M11606 Sheet 1 and 9**) required for the following functions:

- Engine Water Temperature Indication and Temperature High Alarm.
- Engine Oil Temperature Indication and Temperature High Alarm.
- Engine Oil Pressure Indication and Pressure Low Alarm.

The meter relays shall comply with AS 1042 and the requirements of 4.8(e) below and shall be constructed of a single compact unit, housing the indicator, set point pointers and adjusters with normally open/normally closed output contacts. The unit shall have an auxiliary power supply rating of 24 VDC and shall be suitable for flush mounting on the control panel fascia.

(e) Battery Alarm Relay

A battery alarm relay shall be supplied to monitor the state and performance of the 24V DC battery system. The alarm relay shall be of a proven type capable of monitoring High voltage, Low voltage, Extra Low voltage (battery discharged) and positive/negative earth leakage conditions.

An alarm output relay contact shall provide indication on the control panel audible alarm and annunciator. (refer to **Attachment M11606 Sheets 1, 5, 7, and 8 of 9**).

(f) Instruments and Metering - General

Indicating instruments shall comply with AS 1042 and be of "industrial" grade, Accuracy Class 1.0 and they shall be flush-mounted on the door. Scales shall have a deflection range of 240 degrees.
Meters and instruments shall be provided as outlined in the relevant drawings.

The kW-hour meter shall comply with AS 1284 and preferably be 98 mm of Email type or similar and must be flush mounted, withdrawable and calibrated for use with its respective instrument transformers. The meter must be **direct reading** - no multiplying factor is acceptable.

The Following meters shall have red line indication:-

Voltmeter	at	415 V
Frequency meter	at	50 Hz
kW meter	at	1000 kW

Ammeter at 1800 A

All meters and instruments shall be constructed to suit a three phase, four wire, 50 Hz system, and shall have a nominal fascia size of 96 mm x 96 mm.

The Wattmeter shall have a range of 0 - 1000 kW

The Ammeter shall have a range of 0 - 1800 A

The Power Factor meter shall have a range of 0.5 lead - 1.0 - 0.5 Lag.

The Frequency Meter shall have a range of 45 - 55 Hz.

All panel meters shall be self-contained (i.e: no external transducers).

(g) Alarm and Shutdown Systems

Each alarm signal shall be activated by the appropriate remote sensing device located on the generating set. All circuits shall be 24V DC operated. The alarm system shall **not** be of the solid-state type.

When initiated, each alarm shall illuminate its own annunciator window. The engraved lens of the window shall be coloured Red for shutdown/trips and Orange for alarms. Two lamps shall be provided for each window.

The annunciator window sizes shall be approximately 55 mm wide by 25 mm high with the legend engraved on the inside. The legend shall be legible even when the windows are not lit. When illuminated the inscription shall be legible at a distance of 2 metres. The character height shall be 3.2 mm. The legend shall be spread over no more than three lines.

Details of the nomenclature shall be submitted to the Engineer for approval before manufacture commences.

Two lamps shall be included in each window and these shall normally be partially lit so that a faulty lamp can be readily detected. All lamps shall be accessible from the front of the unit control panel.

The lamp test push button shall be included which when pressed shall illuminate all windows at once and revert to normal when released.

A bell (for audible warning alarms), siren (for audible trip/shutdown alarms) and Red flashing beacon (for visual indication of all alarms) shall be fitted to the top of the cubicle as shown in the relevant drawings in Section 4 of this specification.

(h) Alarm and Shutdown Operating Sequence

When an alarm contact is made the following sequence shall occur:

- Alarm contact is made, the audible device sounds, the red beacon flashes and the appropriate annunciator flashes.
- On pressing the “ALARM ACKNOWLEDGMENT” push button, the audible device is stopped, the flashing red beacon is extinguished and the flashing annunciator changes to a steady light.
- The steady annunciator light is extinguished only after the alarm condition has been cleared, the alarm contact broken and the “ALARM CANCEL/RESET” push button is pressed.

- Should the alarm contact break before the above actions are taken, the audible device is stopped, the flashing red beacon is extinguished and the flashing annunciator light changes to a steady light and shall remain so until the “ALARM CANCEL/RESET” push button is pressed which shall revert the system to normal.

- An ALARM TEST push button shall enable testing of the whole system. Its operation shall cause the audible device to sound and allow windows to flash. Pressing the appropriate buttons will revert the system to normal, retaining all alarms that still exist.

  The following alarms shall be provided on the Control Board:

Alarm State	ACB Trip	Engine Shutdown	Audible Alarm	Visual Alarm
Jacket Water Temp High	No	No	Warning Bell	Orange Annunciator Red Flashing Beacon
Jacket Water Temp Too High	Yes	Yes	Shutdown Siren	Red Annunciator Red Flashing Beacon
Lube Oil Temp High	No	No	Warning Bell	Orange Annunciator Red Flashing Beacon
Lube Oil Temp Too High	Yes	Yes	Shutdown Siren	Red Annunciator Red Flashing Beacon
Lube Oil Press Low	No	No	Warning Bell	Orange Annunciator Red Flashing Beacon
Lube Oil Press Too Low	Yes	Yes	Shutdown Siren	Red Annunciator Red Flashing Beacon
Generator Differential	Yes	Yes	Shutdown Siren	Red Annunciator Red Flashing Beacon
Reverse Power	Yes	No	Warning Bell	Red Annunciator Red Flashing Beacon
Over Current	Yes	No	Warning Bell	Red Annunciator Red Flashing Beacon
Earth Fault	Yes	Yes	Shutdown Siren	Red Annunciator Red Flashing Beacon
Engine Overspeed	Yes	Yes	Shutdown Siren	Red Annunciator Red Flashing Beacon
Engine Overcrank	_	_	Warning Bell	Orange Annunciator Red Flashing Beacon
Battery Alarm	No	No	Warning Bell	Orange Annunciator Red Flashing Beacon

***** Note: In addition to the above, a further four active and four spare windows shall be provided in the Annunciator Lamp Unit, as shown in **Attachment M11606 Sheets 1, 6, 7, 8 and 9 of 9** in this Specification.

(i) Synchronising

Synchronising of the unit shall be via the governor control when the control switch is in the AUTO mode. In the MANUAL mode, synchronising shall be by push-button in conjunction with the synchronising check relay. The prefered type of synchronising check relay is Crompton 244-14DG as shown on the **Attachment M11606 Sheet 3 of 9** (Dead bus closing).

"Canon" plug socket shall be conceded. The plug socket shall be of the 12 pin type 28-9 (Female). Insertion of an existing plug (trolley mounted panel) into this socket shall bridge all connections.

(j) Test-Links and Fuses

Separate metering and protection circuit test blocks with matching test plugs shall be of GEC type **MMLG** with matching test plug GEC type **MMLB01** or approved equivalent.

Fuses shall be **HRC** cartridge design of **GEC type NS** or approved equivalent.

4.7 Battery Charger

The Battery Charger shall provide stable and continuous 24V DC supplies for control alarms and protection facilities associated with Diesel Generating sets, in particular:-

(a) Closing, tripping and spring-charging of 415V AC main circuit breaker.

(b) Visual and audible alarms.

(c) Each permanently energised electro-magnetic relay/timer and governor shutdown solenoid.

(d) Engine Starting.

A Portable battery charger, preferably **GAYRAD** type R14D, 24V, 10A unit shall be provided at the Control Cubicle.

The charger shall be capable of recharging its batteries within 16 hours following discharge conditions. The input supply for the charger units shall be 240V AC, single phase, 50 Hz.

4.7.1 Batteries for Control, Alarm and Indication

The Contractor shall supply a set of batteries required for control, alarm and indication of the generator set.
These batteries shall be separate and distinct from the ones used for the engine starting.

5. Technical Instructions

The Generator, transformer and all its auxiliaries shall be supplied with four (4) complete sets of installation, operating and maintenance instructions including all necessary drawings.

6. Validity Period

The validity of the Quotation shall be stated in the Form of Quotation however, a validity period of not less than ninety (90) days is required.

7. Warranty

Bidders shall offer a warranty for the supplied equipment for a period of 12 months from the date of delivery.

8. Terms of Payment

Terms of payment will be stated in the Letter of Acceptance to the successful bidder.

9. Attachment