INVITATION TO TENDER MR39/2016

SUPPLY and Install 2 × 2units 110V DC BATTERY BANKS and CHARGERS for Rakiraki and Levuka Power Station

Fiji Electricity Authority seeks reputable Manufacturer/Supplier to supply and install **2 × Dual (2)** units N+1 switch mode 110V DC 60A, 600AHr battery bank complete with battery charger, 4 × IP55 DC Distribution boards, complete with physical automatic Change over and Training and manuals for the installation, maintenance and troubleshooting of battery banks, battery chargers settings. The Bidder to provide As Built Drawings after completion of the cutover.

The Scope of Work includes the following:

a) Four (4) Battery Banks rated at 110V DC, 60A (Full Load) and minimum 600AHr capacity.
   I. 2 × Battery banks for 11kV Rakiraki Power Station/Substation (Bank 1 and 2)
   II. 2 × Battery Banks for 11kV Levuka Power station/Substation (Bank 1 and 2),
b) Four (4) × battery bank chargers suitable for above item (a) with N+1 rectifier (minimum 7 X 10A rectifier.
   I. 2 × Charger for 11kV Rakiraki Power Station/Substation (bank 1 and 2)
   II. 2 × Charger for 11kV Levuka Power station/Substation (Bank 1 and 2),
c) Four (4) × 110V DC Distribution switchboards with 5 X 8A, 25 × 16A, 6 × 32A DC miniature circuit breakers, bus bar rating minimum 200A and main switch 200A.
d) Four (4) × batteries stand suitable cubicle/rack for item (a) and (b).
e) Two (2) 415V DC **Automatic** Changeover switch complete with LV enclosure housing. The changeover shall be complete with physical isolators and switch and not software based.
f) Recommended Spares
g) Installation, Testing and commissioning of the new battery banks.
h) Discharge to 60A, (600AHr) and for minimum 10 hours
i) Removal and transfer of existing batteries and to approved fea site.
j) Training course for DC battery and charger system including trouble shooting by Manufacturers representative.
k) Scope of Training to be provided with tender for assessment.

1.0 GENERAL

All batteries, chargers and distribution equipment shall be suitable for switchgear tripping and closing duties, alarm and indications, emergency lighting, and all other items of equipment covered by this specification.

Battery and battery charger systems must be designed for the purpose intended and to meet the requirements of all applicable AS/NZ standards. Minimum design life of 15 years. The primary role of the substation battery system is to provide a source of energy that is independent of the primary ac supply, so that in the event of the loss of the primary supply the substation control systems that require energy to operate can still do so safely.

The battery is required to supply the DC electrical requirements of the substation, including SCADA, control, protection indication, communications and circuit breaker switching operations when there is no output from the battery charger. This may be due to a loss of AC supply to the substation or a fault in the battery charger. Under these conditions the battery shall supply the DC loads for a minimum period of 10 hours after which time the battery should then be able to supply trip-close-trip operations of a HV circuit breaker which would typically restore supply to the battery charger.

Namely, each battery charger and battery shall be capable of delivering the entire rated load of 60A for 10 hours and at the end of the 10 hours the following emergency loads such as Two operations of tripping of all 132kV and 33kV feeders and subsequent restoration (auto re-closing and/or busbar change for all feeder isolators whichever is the maximum load), plus spring charging motors (10 coils) used for breaker closing.

The above shall be accounted for **by an additional 10% reserve AHr** capacity on top of the required minimum AHr capacity calculated for supplying the rated full load amps (60A) for the stipulated duration (10Hr).

Additionally, the battery bank shall be oversized by an additional 20% spare capacity in order to cater for ageing of the battery.

The capacity of each battery bank shall be on the basis that when charged to 80% of its rated capacity at the start of the following duties, it shall be sufficient to supply the following demands simultaneously with the charger disconnected

a) The normal DC load of the Protection/Controls/Metering systems of 10 Amperes for 24 hours.
b) The nominal DC loading of the SCADA system of 10 Amperes for 24 hours.

The battery charger(s) and DC distribution board shall be provided in separate self contained units housed in separate cubicles of minimum IP55 or NEMA 12 rating. The battery bank shall be modular and suitable for indoor installation in a separate battery room.

The batteries will be located in battery rooms which are naturally ventilated and not air-conditioned. The battery rooms will not be providing a controlled and conditioned atmosphere to the batteries. The battery rooms will be having natural ventilation and an exhaust system to cycle out air in the room. The batteries will be exposed to dust and ambient atmospheric conditions. The typical ambient conditions are:

The temperature range : 10^0C - 50^0C
Relative Humidity: 60% - 95%

In any event, the DC load voltage shall not drop below 90% of its nominal value, after the battery has taken the full continuous load for 10 hours and at the end of 10 hours, the above emergency load.

The battery under boost charge and the corresponding charger shall be disconnected from the distribution board by use of selector switches and power contactors.

Metering circuits shall be wired for remote & SCADA indication. The batteries shall be protected against over-discharging. Earth fault detectors for each DC busbar shall be provided.

2.0 Operating Tolerances

The battery/charger/distribution equipment shall be designed such that the voltage at the distribution board terminal is always within ±5% of nominal voltage (110V) using voltage-dropping diodes in multiple stages. The ripple content of the DC voltage shall not exceed 3.0% peak to peak with the battery disconnected and shall be less than 1.0% with the battery connected.

3.0 TYPE OF BATTERIES

The batteries shall only be manufactured in EUROPE and USA. The batteries shall be rugged and high performance, sealed type, maintenance free batteries complying with IEEE 1189-1996 and/or IEC.60623 and shall be designed for a life expectancy of at least 20 years under the conditions of service likely to be encountered by the equipment as mentioned in this specification. The batteries shall be sealed batteries type Nickel. The batteries shall be designed to be mounted in both vertical and horizontal orientations for normal operation.

The electrolyte capacity and general design of the batteries shall be such that inspection and maintenance shall be at intervals of not less than twelve months. A complete set of:

Each set of 100% duty battery with 600 AH minimum capacity normally operating in parallel each rated to give 100% of the entire DC load on a Ten (10) hour discharge rate basis and under the site environmental conditions. The battery bank shall be oversized by an additional 20% spare capacity in order to cater for ageing of the battery. The battery bank sizing shall meet all requirements of IEEE 485-1997 and shall meet or exceed the requirements as detailed by this document.

1. Test and manufacture accessories suitably boxed, shall be provided for each.
2. Instruction schedules shall be included in each set.
3. The batteries must have provision for carrying out partial discharge test.
4. Battery cases are of high impact translucent plastic.
5. Cells shall be permanently marked with the following information.
    - Manufacture's reference number and code
    - All batteries shall be numbered.
    - Year and month of manufacture
    - Voltage and nominal capacity at the 10 hour discharge rate

The cell containers shall be of robust, impact resistant construction in translucent material permitting visual inspection of electrolyte and shall be having built-in vent caps.

They shall be mounted on appropriate steel stands while ensuring that

- a minimum floor area is taken up and a ground clearance of 300 mm from the floor is provided
- each cell is readily accessible and can be removed from its position without having to remove or shift adjacent cells
- the lead or nickel plated intercell connectors as well as the cell terminals are suitably insulated by PVC shrouds, sleeving or cover plates

4.0 Battery Earthing

110V DC station batteries shall operate unearthed. Means shall be provided to detect low insulation resistance of all the wiring connected to the battery by the following method and to give an earth fault alarm. Separate alarm indications shall be given for both positive and negative poles. The earth fault detection circuit shall consist in principle of a resistance connected across the battery output on the distribution side of the fuses with a relay connected between the centre point of this resistance and the earth terminal. Any unbalanced leakage current due to the low insulation resistance of the wiring connected to either pole of the battery shall cause a current to flow in the relay, which will operate at a predetermined value. The earth fault relay shall be equipped with a minimum of six normally open contacts for local indication and remote alarm circuits for each bank.

5.0 BATTERY FUSES / CIRCUIT BREAKERS

Cartridge fuses shall be provided in both positive and negative leads and positioned as close to the battery as possible and shall be rated for at least three times the maximum rated battery discharge current at the highest operating voltage. The fuses shall be mounted on the end of the battery stand or rack. Fuses shall be inside a transparent box and cables must be insulated. These fuse links shall comply with BS.88 Class DC.40 and shall be bolted in position without carriers. A warning label shall be fitted to warn personnel of the dangers of removing a fuse whilst the load is connected. Circuit breakers may be provided, upon prior approval, in lieu of fuses if they satisfy all the above requirements.

6.0 BATTERY CHARGERS + DNP3.0 SCADA control

The Battery Charger shall operate on 415V three phase AC @ 50Hz with instruction card for each set. Means shall be provided using diodes to prevent excess voltage causing damage to connected apparatus when a battery is being charged.

Each battery charger and battery bank shall be capable of delivering the entire rated load of 60A for 10 hours and in any event, **the DC load voltage shall not drop below 90% of its nominal value of 110V**, after the battery has taken the full continuous load for 10 hours. The battery under boost charge and the corresponding charger shall be disconnected from the distribution board by use of selector switches

and power contactors. The batteries shall be protected against over-discharging. Earth fault detectors for each DC busbar shall be provided. Metering circuits shall be provided and wired for remote & SCADA indication.

Separate identical 100% duty charger having boost & float facilities shall be offered for each battery. Each charger unit shall be suitable for supplying the initial charging requirements, boost charging the battery subsequent to an emergency discharge and supplying the maximum load whilst on float. The chargers shall each be housed in a separate cubicle, which shall at least be of Protection Class IP 56. The equipment shall satisfy the requirements of corrosion protection as specified. For wiring, contactors, terminals, etc. reference shall be made to the respective sections of the Specification. The chargers shall be provided with natural ventilation. Forced ventilation is not acceptable. Cubicle sizes and overall views shall be co-ordinated with DC distribution panels as they could possibly be erected in the same room.

6.1 Switch mode (N+1) with SCADA DNP3.0 protocol with Ethernet

FEA is embarking on condition monitoring of the battery banks using the intelligent chargers therefore is seeking:

(a) Switch mode (N+1) with SCADA DNP3.0

Each battery charging equipment shall comply with the requirements of BS.EN 60146-1-1, BS EN 60146-1-3 (IEC. 60146).

The charger system all housed in one cabinet consisting of includes:

- Rectifiers
- Contactor coil
- Current transducer
- Minirack
- CT Cable
- Operates with 110V DC
- Necessary Software and Training
- Battery breaker
- All Auxiliary contact
- Battery cell condition monitor unit
- Site Monitor module
- Vented blanking panel

All details and necessary information regarding above must be provided for evaluation process.

The condition based chargers to have at least the following functions:

1. Communication protocol DNP3.0
2. Ethernet and able to have fibre connectivity
3. Current and voltage monitoring for each cell
4. ability to perform discharge test on its own
5. Temperature compensation
6. N+1 switch mode

Chargers of high efficiency, short control response time, low output ripple without battery being connected and rated for continuous output short circuit operation, shall be of solid state full wave fully controlled using silicon and N+1 rectifiers and complete with all switches, miniature CBs, fuses, contacts and instruments. The output voltage shall be regulated from 0 to 100% load even with ±10% variations in input AC supply voltage and ±5% frequency variations. The battery chargers shall be of the constant voltage float type each with boost charge facilities. Each charger shall be capable of maintaining the battery fully charged and delivering the DC load output when operating alone but will normally work in parallel in case of double battery bank system. For single battery system, the charger shall be capable of maintaining the battery fully charged and delivering the DC load output. The charger shall:

1. Be designed for ambient temperature 50^{o}C.
2. Have the possibility to adjust and set the charger output voltage and current
3. Limit values separately for each operating mode of the charger. The adjustable range shall be the limits of maximum and minimum outputs.
4. Automatically switch into the boost charging mode when the battery has discharged above a preset value. A battery charge/discharge ampere-hour sensing device shall be provided to control the boost mode on/off switching as well as the boost charging time.
5. Be capable of recharging within ten hours the battery bank to a condition enabling the battery for another cycle of emergency discharge.
6. Simultaneously, the charger shall be capable of feeding the rated load of the entire DC busbars.
7. Have alarms grouped and connected to the alarm fascia locally and to the remote control panel & SCADA DNP3.0 protocol, as required by FEA during design.
8. Indication of the signal "Charger faulty" shall be suppressed in case of a failure of the AC supply to the charger.
9. Have operating characteristic in accordance with DIN 41772/DIN 41773 or equivalent. The charging characteristic shall be to the approval by FEA.
10. However, the battery manufacturers recommendations for float/trickle, equalizing and boost charging shall be taken into consideration.
11. Have output voltage failure detection insensitive to switching surges or transient loss of voltage due to faults on the power system, or during auto changeover of the input AC supply.
12. Have load sharing and current limiting circuits built-in each module.
13. Have a soft start feature.
14. have RFI- Interference protection at least equal to mode "N" according to DIN
15. VDE 0875.
16. Maintenance and operation instruction manuals and spare parts reference list shall be supplied.

6.2 BATTERY CHARGER ALARM DEVICES

The following shall be provided:

1. **Over voltage detection** equipment to give local indication and remote alarm when the charger voltage rises more than two volts above its normal automatic float

voltage. This alarm shall be disconnected whenever the charger is operating on boost charge.

2. **Under voltage detection** equipment to give local indication and remote alarm when the system voltage falls below 90% of its normal automatic float charge. A time delay shall be incorporated to prevent initiation during temporary voltage drops caused by transient conditions including circuit-breaker closing operations.
3. **Charger fails detection** equipment to give local indication and remote alarm if the voltage from the charger falls below the nominal floating charge voltage. Suitable blocking diodes shall be provided to prevent the battery voltage being supplied to the equipment so that only the charger voltage is effective in causing the alarm. The device shall not operate on switching surges or transient loss of voltage due to faults on the AC system. The voltage at which the alarm operates shall be adjustable for operation over a range to be approved by the Employer's Representative.
4. **Rectifier: fuse operation detection** equipment to give local indication and remote alarm of diode/thyristor and surge circuit protection fuse operation.
5. **Earth leakage detection** equipment to give local indication and remote alarm of the occurrence of an earth fault and to give discrimination between positive and negative earth faults. Test circuits shall incorporate to simulate positive and negative faults by-operation of test pushbuttons. Provision of "local Indication" by lamps on the front of the charger cubicle and provision for "Remote Alarm" by changeover contacts (rated at 5A for voltages between 30 and 250V AC or DC) on the devices to energise a group alarm relay.

6.3 BATTERY CHARGER INSTRUMENTATION AND CONTROLS

In addition to the necessary controls for float and boost charging, the following are to be provided on the front of the cubicle:

1. Charger Output/ battery Voltmeter with Changeover Switch.
2. Charger D.C. Load Ammeter.
3. Centre Zero Battery Ammeter with Retroactive Switch.
4. AC Supply MCB. A link shall be provided in the supply neutral.
5. Charger operating on Boost Charge indicating lamp (Amber).
6. Isolating switches for each battery bank.

7.0 DC SWITCHBOARD

The distribution switchboard shall be of the cubicle type or otherwise incorporated in the cubicles for battery chargers. Two-pole miniature Schneider type circuit breakers shall be fitted to the D.C. Switchboard required by substation services. The DC installation should comprise the control panel and battery charging equipment. The DC Switchboard shall be of metal clad type 2.5mm thickness and complete with indication instruments, controls, protective devices (battery earth fault protection, ect.) and switches as necessary, including battery earth fault alarm reset switch.

Each circuit shall be adequately labelled with its requirement function. The switchboard shall comply with the requirements of BS.EN 60439-1 (IEC. 60439). DC bus-bar voltage shall be monitored continuously and shall give an alarm (operated by AC) in the event of DC failure. Digital monitoring device will be preferred.

8.0 Factory TEST AT MANUFACTURE'S WORK Site for approvals

Battery - Type test in accordance with IEC 60623. - In addition the Manufacturer shall demonstrate that the battery will perform the duties specified.
Battery Charger - Type and Routine Tests according IEC 60146
DC Switchboard - Type and Routine Tests according to IEC.60439

9.0 TEST AT SITE pre-commissioning and commissioning

Battery – charge and discharge test with load bank of 60A
Battery Charger - Routine Tests according IEC 60146, and to be agreed by FEA
DC Switchboard - Routine Tests according to IEC.60439 and to be agreed by FEA

10.0 Warranty

A guarantee to fea of batteries will be free of defects in materials and workmanship for a period of 5 years from the date of installed, operated and maintained as per the manufacturers Operation and Installation Instructions and as per Australian Standard 2676.2 – 1992.

A guarantee to fea of battery charger will be free of defects in materials and workmanship for a period of 5 years from the date of installed, operated and maintained as per the manufacturers Operation and Installation Instructions and as per Australian Standard 2676.2 – 1992.

11.0 Applicable Standards

IEC 623:Vented nickel cadmium rechargeable single cells
BS 5634: Testing potassium hydroxide used in alkaline cells.
BS 381C: Specification for colours for identification coding and special purposes.
BS 4417: Specification for semiconductor rectifier equipments.
IEC 146: Semiconductor convertors.
BS 88: Cartridge fuses for voltages upto and including 1000V AC and 500V DC
IEEE 1189-1996: Guide for Selection of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications

12.0 SPARES

A list of all spares required to be provided with the tender and inclusive of the quotation.

13.0 Mandatory requirement and weighting for analysis

	Mandatory Requirement	Weight (%)
1	TECHNICAL specification and SCHEDULE	30%
2	Price	20%
3	Lead time for Batteries and Chargers of 12 weeks	5%
4	Training manuals	5%
5	Warranty Certificate Proposal – 5years	10%
6	Other successful projects/utilities with the same type of battery bank and chargers	5%
7	Customer listing with contact person for reference	5%
8	Full battery and charger Design, Drawings, Manuals and brochure relevant to the type of Battery and Charger being proposed	5%
9	Design, drawings material list and enclosure size for the Automatic Changeover	5%
10	Type Test reports	5%
11	No advance payment and design payment. Payment after arrival of the battery and charger on site	5%

14.0 Lodgments of Tenders

Deadline for Submission of Bids

14.1 Bids must be received by the Employer at the address specified above no later than **1600 hours (local Fiji Time) Wednesday, 18th May, 2016**

14.2 The Employer may, at its discretion, extend the deadline for submission of bids by issuing an addendum in accordance with Clause 11, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will thereafter be subject to the deadlines extended.

Sealing and Marking of Bids

14.3 The bidder shall seal the original copy of the technical proposal, the original copy of the price proposal and each copy of the technical proposal and each copy of the price proposal in separate envelopes clearly marking each one as: "ORIGINAL" and "COPY", etc as appropriate.

14.4 The bidder shall seal the original bids and each copy of the bids in an inner and an outer envelope, duly marking the envelopes as "ORIGINAL" and "COPY".

14.5 The inner and outer envelopes shall

(a) be addressed to the Employer at the following address:

Tuvitu Delairewa
General Manager Commercial
2 Marlow Street,
Suva,
FIJI.
Phone: 679 3224 185
Facsimile: 679 331 1882
Email: TDelairewa@fea.com.fj

and

(b) bear the following identification:

- Bid for SUPPLY OF 2 × Dual (2) units 3Ø, 110V DC BATTERY BANKS and CHARGERS
- Bid Tender Number: MR 39/2016
- DO NOT OPEN BEFORE Thursday, **19th May, 2016**.

(c) The bids shall have mandatory the following at the back of the envelope or carton

1. Company name
2. Address
3. Unmarked envelopes without bidders name and address on the reverse shall be returned to the bidder.

15.0 TECHNICAL SCHEDULE

The tender shall submit with his bid the completed schedule together with a compliance statement. The tender shall be valid for 6 month or effective till up to May 1st 2012.

1. DC switchboard

Overall Dimension of unit	
Height	mm
Width	mm
Depth	mm
Weight of switchboard and charger	kg

2. Batteries

Type	
Manufacturer	
Number of cells	
Discharge capacity at one-hour rate	
Discharge capacity at ten-hour rate	
Normal charging rate	
Maximum charging rate	
Battery Dimension	
Length	
Width	
Height	
Battery sealed and maintenance free	
Expected value of life under service in section (1)	
Warranty period	
Some examples where this battery has been used in Substation duty and contact.	

3. Battery Charger

Type	
Manufacturer	
Continuous rated output	
Nominal output voltage	
Efficiency	
Input voltage	
Output voltage adjustment range	
- Float voltage	
- boost voltage	
Number of out going circuits	