AGRICULTURAL RESEARCH COUNCIL

TENDER NO: ARC/33/03/2024/3

SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF AN ALTERNATIVE POWER SOLUTION FOR THE GENOMICS LAB AND HPC AT THE ARC'S BIOTECHNOLOGY PLATFORM

Scope of Work and Technical Specifications

1. Scope of Work for the Tender & Mandatory Technical Specifications/Requirements

The Agricultural Research Council is looking for a service provider to assist the institution with the supply, delivery, installation and commissioning of a new "*alternative power solution for the genomics lab and HPC"* at the ARC' Biotechnology Platform Building, situated on the ARC's Onderstepoort Campus, Onderstepoort. The envision solution is a **new solar system with the appropriate battery backups** to manage the critical equipment within the building during power failures and all the required accessories, wiring, breakers, etc. The solution, rolled out over two stages, must be grid tied and accept emergency generator supply and enable continued operations of critical equipment using the PV panels and/or batteries, whether there is generator or grid supply, or not. The solution must include load partitioning to accommodate supply to normal and emergency/critical circuits, with critical circuits prioritised when grid or generator supplies are not available. Any additional PV generated should be supplied to the standard circuits. The priorities are critical/emergency (always – battery, PV, generator, and grid), and then standard supply (sufficient PV and grid are available).

Currently the building has both emergency and standard power supplies, with diesel generator backup for emergency/critical circuits. The building has a main distribution board (DB), 3-phase power supply to a 63A emergency breaker and 3-phase 200A breaker to the standard power supply. Both supplies are then distributed to three sub-DBs (DB-A to DB-C) from which circuits are run to isolators, lights, and plugs.

An energy audit indicated a maximum power consumption of 44kW, on a 30^{o}C maximum day, with an average total draw of ±25kW during the daytime. The Emergency supply accounts for 80% of the daily usage, with ±400 kWh vs ±100kWh (standard). Daytime vs nighttime usages are ±310kWh vs ±200kWh, with a total daily usage of ±480 – 510kWh weekdays. A typical weekday has a bell-shaped power usage pattern which is typical of an office-type business and in line with a solar photovoltaic (PV) system. The work also includes transferring some standard circuits to the emergency circuits.

The work is divided into two (2) phases, with **Phase I** including the supply and installation of a solar solution with battery backup and the transferal of circuit where needed. **Phase 2** only expands on the working Phase I system with additional PV panels and battery storage. *Bidders are required to offer line itemised quotations for each of the phases, i.e. Phase 1 line itemized quote and a Phase 2 line itemized quote.*

Phase 1: Solar energy solution

1.1 Supply, Delivery, Installation, and Commissioning of a Grid-tied, new 3-Phase Solar PV System with Battery Backup

Mandatory Technical Requirements	Compliance	
	Yes	No
• CIDB Grade 3 EP		
• Licenced Solar PV Green Card Practitioner (provide a copy of license)		
• Tier 1, 550W_p monocrystalline PV modules must comply to IEC 61215 and IEC 61730 for the PV modules offered (provide both certificates of the product offered confirming IEC ratings)		
• Inverter must be approved to NRS 097-2-1 (provide certificate of the product offered confirming IEC ratings)		

Scope of Work

- Supply, deliver, install and commission of a new "*alternative power solution for the genomics lab and HPC"* at the ARC' Biotechnology Platform Building situated on the ARC's Onderstepoort Campus, Onderstepoort. The envision solution is a new solar system capable to carry the building emergency and standard loads, with the appropriate battery backups to manage the critical/emergency equipment within the building during power failures. The building has a main distribution board (DB), 3-phase power supply to a 63A emergency breaker and 3-phase 200A breaker to the standard power supply. All the required accessories, wiring, breakers, etc. for a fully functional solution must be included in the offer.

- The solution must be grid tied and accept emergency generator supply and enable continued operations of critical equipment using the PV panels and batteries, whether there is generator or grid supply or not. The solution must include load partitioning to accommodate supply to normal and emergency/critical circuits, with critical/emergency circuits prioritised when grid or generator supplies are not available. Any additional PV generated should be supplied to the standard circuits.

1.1.1 Technical Implications

- The construction must include delivery, installation, certification and commissioning of a new, complete grid tied solar system with battery backup, which would include, solar (PV) modules/panels, cable connectors (MC), solar cable, DC junction boxes, grid tied PV inverter(s), batteries, DC cables, data loggers, distribution boards, communication cables, etc.
- An energy audit recommended a 44 to 66kWh_p PV hybrid system with 90 to 180kWh Li-Ion battery storage, managed by power management system that links two (2) 100kW 3-phase hybrid inverters.

- We will roll this out as two Phases: Phase 1 consisting of fully working 44 kWh_p PV hybrid system with 90 kWh Li-Ion battery storage, managed by power management system that links two (2) 100kW 3-phase hybrid inverters. In Phase 2 an additional 22 kWh_p PV modules 90 kWh Li-Ion batteries will be added.

- Bidders are required to quote for both phases, but separately as Phase 1 (fully functional system) and Phase 2 (additional PV and storage).

- *Phase 1 must take Phase 2 upgrades into account* to allow for additional components to be easily installed in the future, e.g. suitable housing of the system for both Phases 1 and 2, breakers, wiring, etc.

- **Recommended hybrid system comprising of**

  1. 44kW_p roof mounted PV system with 80 (eighty) x Tier 1, 550W_p monocrystalline PV modules.
     - PV Panels/Modules must be SABS tested and complying to IEC 61215 and IEC 61730, locally obtainable and with at least 25 years warranty, e.g. Canadian solar, JA Solar, Trina, Jinko, Longi, or equivalent.
     - Solar PV modules are to be mounted on the main building, with all holes sealed with silicon during installation.
     - The solar panels placement must comply with all building codes.
     - Installation of PV panels to be in most cost/energy efficient location, depending on the space requirement and take the potential to increase the solar day into account.
     - The PV system must be well balanced to supply enough capacity to charge battery to full capacity, with some battery capacity used to manage optimal running during partial cloudy days.
     - The layout and orientation of the modules should allow for the elimination of the shading effect and thus improving energy generation efficiencies. Installation to consider external shade factors to ensure maximum generation for a long as possible.

  2. 90kWh Li-Ion battery storage capacity (±2.5 hours) that has a minimum service life of 5 500 cycles at 80% depth of discharge and a 10-year warranty consisting of:
     - Lithium-Ion (LiFe) (or lithium-Ion Phosphate (LiFePO4) batteries – to be discussed at site visit).
     - The battery bank must be automatically monitored to allow optimal usage, discharge, temperatures, etc. to ensure longevity and prevent potential fires.
     - The battery bank *must allow expansion in the future* to increase possible downtime of the grid and the ability to exchange faulty or poor units – should the need arise. Additional space for Phase 2 to be indicated.
     - Provide a 10-year warranty on the batteries and associated components.
     - Two appropriate LiFe/ LiFePO4 fire extinguishers must be provided and installed with all the required safety signs – wherever required.
     - All circuits, breakers, etc. must be clearly labelled.

  3. One 100kW three-phase grid-tie inverter for converting the DC power from the PV modules to AC power (approved to NRS 097-2-1) with a 10-year warranty.

- *The inverter must have internal phase management to adjust to variations within each phase.*

4. One 100 kW hybrid inverter (with UPS functionality) for recharging the battery storage system and for converting the battery DC power to AC power, with 10-year warranty.
   - *The inverter must have internal phase management to adjust to variations within each phase. Our preferred invertor types are Victron, Deye, SunSynk, or similar inverter.*
5. Power management unit for integrating the battery storage with the solar PV system and provide online access to the power system to users.

Estimated layout of PV modules on the northern facing roof of the building to generate ±41,8kW$_p$

6. Inverter and battery location
   - Indicate (at the site visit) whether the current structure available will be suitable for housing the inverters and the storage batteries, ***including Phase 2 upgrades***, or not.
     - Should the inverters and batteries (including the expansion indicate below) not fit in the current storage room, a new, securable (must be able to be locked), equipment storage room must be provided with at least 16m^2 space available – confirm this is sufficient to accommodate the expansion envision for Phase 2.
   - The room must be properly ventilated and cooled.
     - Ensure proper cooling for solution, i.e. supply and install the appropriate aircon for the full installation, including future expansion.
   - Supply and install the appropriate fire extinguishers and safety signs.

- **Commissioning**
  - The PV system design must be approved and signed off by Professional Engineer (Pr. Eng.) or Professional Technologist (Pr. Tech.)
  - Installation must have been performed under the supervision of a qualified electrician according to the approved design.
  - Electrician must sign a certificate of compliance (CoC) for the installation and ***all associated electrical work***.
  - Pr. Eng. signs off an as-built drawing, after system works as specified.

- Installer or supplier provides any additional documents, warranties, and reports for commissioning the PV system to client (ARC).
- All compliance certificates/ Electrical audit/ Municipality registration/ permission and requirements according to current government regulations (e.g. Eskom) at time of commissioning, must be provided.
- All circuits to be clearly labelled and indicated within plan and within distribution boxes (DBs).
- The system should allow for seamless integration for future expansion of the PV and battery bank.
- This PV plant is seen as an energy saving facility. For the PV plant to function correctly with a grid-tie inverter, it will require synchronizing frequency from the grid.
  - If there is a loss of the grid (power outage), the PV plant shall shutdown in accordance with grid regulations (anti-islanding requirements).
  - The hybrid inverter, together with the battery storage, shall provide the necessary synchronizing frequency for the PV grid-tie inverter to remain operational during power outages.

- **Electrical loads**
  - The electrical loads powered must be well balanced according to the expected solar output.
  - The solution must be grid tied and accept emergency generator supply via the emergency and mains.
  - The system must enable continued operations of critical equipment using the PV panels and batteries, whether there is generator, grid supply or not.
  - The solution must include load partitioning to accommodate supply to normal, emergency/critical circuits, with critical circuits prioritized when grid or generator supplies are not available.
  - Any additional PV generated should be supplied to the standard circuits, with emergency circuits preferentially supplied after critical circuits.

- **Monitoring system**
  - The monitor system of the system must be accessible via mobile phone and computer, i.e. Online/web monitoring and control of the entire solar system. App based systems must allow multiple access – either various phones and/or computers.
  - This system must enable control of all the components, e.g. PV, battery, grid/generator supplies, inverters etc.
  - Controls batteries and monitors accurate battery percentage (state of charge).
  - Enable multiple users on the same account
  - Sends system notifications (e.g. phone, text, or emails)
  - Interactive display on inverter(s)

- **Operation & maintenance**
  - One (1) year cost free operation & maintenance, including optimal usage of the system after being commissioned.
  - User / ARC electrician training to operate the system

- **Standby generator & UPS**
  - The system should allow for seamless integration with the existing standby generator.

- **Guarantees, warranties and Insurance Cover**

- The following performance guarantees workmanship warranties and insurances are required:
  - The PV modules must have 25 years linear power warranty (down to 80% capacity) and a12-year manufacturing warranty (based on pro-rata degradation) – *evidence for the product offered to be supplied.*
  - 10-year product warranty on inverters - extended to 10-years if needed.
  - 10-year product warranty on the batteries
  - 10-years performance guarantee for mounting structures
  - 12-month workmanship warranty on the whole installation.

- **Miscellaneous**
  - All work, including draft technical drawings, must be discussed with ARC personnel before construction begins.
  - Any downtime when connecting new solar power to existing grid should ideally be done after normal working hours (08:00 – 16:30, Monday to Friday) to avoid disruptions to activities on the campus.
  - NOTE: **ALL downtime MUST be cleared with BTP management** at least a week in advance to allow proper shutdown of critical infrastructure and schedule work accordingly.
  - Allow for a 5% contingency fee that is ONLY approved after consultation and internal approval from the ARC's Facilities Team and BTP management.
  - Note: The 5% contingency fee might be omitted should it fall without the project budget and must not be required to provide a fully functional system.
  - Upgrade of electrical circuits, where necessary.
  - Safety file, risk assessment and system design to be included and submitted together with the bid documents.

ARC • LNR
Excellence in Research and Development

2. Phase 2: Solar Energy Solution expansion

2.1 Supply, Delivery, Installation, Commissioning and Incorporation of additional PV and Battery Components

Provide Phase 2 as a separate***, line itemized***, quote with the following items listed:

2.1.1 Supply an additional 90kWh of battery storage, with the installation, commissioning and linking thereof with the Phase I installed system. The total installation for both phases will then be 180kWh.

2.1.2 All components and requirements for the equipment, etc. must be as listed above.

2.1.3 Supply an additional 22kW$_p$ roof mounted PV modules (40 Tier 1, 550W$_p$ monocrystalline PV modules), with the installation, commissioning and linking to the Phase I system, included. The total installation will therefore be 66kW$_p$ (120 Tier 1, 550W$_p$ monocrystalline PV modules).

2.1.4 All components and requirements for the equipment, etc. must be as listed above.

2.1.5 Updated CoC, should the work be done later.

2.1.6 5% contingency line item for Phase 2.

Estimated layout of PV modules on the northern, eastern and western facing roofs of the building to generate ±66kW$_p$

Roof structural report

Point 7 Consulting
15 Orchid Road
Lenasia South
1835
Cell: 082 858 5133

530/01WE

19th June 2024

Botshelo Consulting Engineers (Pty) Ltd
Helvetia House
60 Greenvale Road
Germiston
1401

Attention: Ofentse Makhu

Dear Sir,

Re: ADDITIONAL APPLIED LOADS TO ROOF TRUSSES DUE TO SOLAR PANELS INSTALLATION

This letter serves to state that the existing trusses for the Agricultural Research Council's Biotechnology office, located at 100 Old Soutpan Road, Onderstepoort, Pretoria, is capable of carrying the additional loads from the installation of solar panels.

A site inspection on the 05th June 2024 to assess the conditions of the existing trusses followed up by a design check to confirm the adequacy of the trusses was conducted. The roof is duo pitched roof constructed of timber trusses spaced at +-1400mm with corrugated roof sheeting. The building is in excess of 60 years and the truss member sizes are longer available. All truss member sizes were measure and grade 5 timber was assumed.

The weight of each panel, mounting brackets and fixtures and fittings would not exceed 25kg/m², which would amount to 0.25kN/m². This load will be spread over several trusses.

Although there were no major signs of rust on the sheeting there were instances of rust forming. The sheeting is galvanized therefore we recommend a specialist roof contractor repaint, inspect and repair instances of rust. We would further recommend that the entire roof be repainted.

ARC • LNR
Excellence in Research and Development

The trusses, considering their age are a good condition. Over the area inspected we did not notice any deformation, overburdening, rot or failing members.

We do not envisage this installation to overburden the trusses and subsequently the super structure.

Yours Faithfully

Waseem Ebrahim
PR Eng. 20150258
Point 7 Consulting

ARC • LNR
Excellence in Research and Development