



TENDER DOCUMENT

**PHOTOVOLTIAIC SYSTEM
INSTALLATION FOR
RETREAT PUBLIC TRANSPORT INTERCHANGE**

TENDERER : _____

PRICING SUMMARY

TENDER	Retreat – Public Transport Interchange
TENDER No.	C1853/E1/PV1
DESCRIPTION	SUPPLY & INSTALLATION OF A PHOTOVOLTAIC SYSTEM

MAIN OFFER – MOUNTED AT SAME PITCH ANGLE AS ROOF PITCH

TENDERER'S NAME	
TOTAL OF THE PRICES EXCLUSIVE OF VAT	R
TOTAL OF THE PRICES INCLUSIVE OF VAT	R
DATE	
SIGNATURE	

ALTERNATE OFFER – MOUNTED AT OPTIMAL PITCH ANGLE ON ANGLED FRAMES

TENDERER'S NAME	
TOTAL OF THE PRICES EXCLUSIVE OF VAT	R
TOTAL OF THE PRICES INCLUSIVE OF VAT	R
DATE	
SIGNATURE	

TENDERER'S SIGNATURE: _____

CONSULTING ENGINEER:

TRIOCON CONSULTING ENGINEERS (PTY) LTD
PO Box 36573
CHEMPET
7442

Project: C/1853/E1/PV1

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PART 1

NOTES TO TENDERERS

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PART 1 - NOTES TO TENDERERS

1.0 SCOPE OF CONTRACT

The work covered by this document comprises the PV installation and associated works generally, including all equipment, materials, testing, commissioning, temporary storage, protection where required, etc and cleaning down complete.

Tenderers are required to structure their tenders accordingly. Before any work is put in hand all dimensions must be checked on site.

2.0 ACQUAINTANCE WITH TENDER DOCUMENTS

By submission of a tender the tenderer will be deemed to have acquainted himself fully with the tender document, local requirements and laws and all aspects of the work envisaged in the documents prior to the submission of his tender.

3.0 VALIDITY OF TENDER

The tender shall be held valid for a minimum period of sixty (60) days after the closing date for the receipt of tenders.

4.0 ACCEPTANCE OF TENDERS

The lowest or any tender will not necessary be accepted. Any tender, which does not comply with the requirements stated in these documents, may be considered invalid.

5.0 UNCERTAINTIES

Uncertainties and doubts as to the meaning and interpretation of items in these documents must be submitted to the consulting engineer to have them explained, rectified or cleared before tenders are submitted.

6.0 FORM OF PRINCIPAL AGREEMENT – JBCC or RFQ (Indicate which agreement)

The tenderer's attention is drawn to the Preliminaries applicable to the **Principal Agreement**.

No - Yes -

The Preliminaries for use will be those recommended by the Joint Building Contracts Committee, July 2007 5th edition

7.0 FORM OF SUB-CONTRACT– JBCC or RFQ (Indicate which agreement)

The successful tenderer shall enter into a contract with the Client/Employer in terms of the **Selected Sub-contract Agreement**, as recommended by the Joint Building Contracts Committee, July 2007 - 5th edition.

No - Yes -

Note: The tenderer is advised that should there be any conflict between clauses in the abovementioned Agreement and Addendum and the preliminaries of the principal agreement, those of the principal agreement will prevail as no claim of whatever nature arising out of his failure to comply therewith will be entertained.

8.0 CONSTRUCTION GUARANTEE– JBCC or RFQ (Indicate which agreement)

The successful tenderer will be required to provide the Construction Guarantee as recommended by the Joint Building Contracts Committee, (2007 – 5th edition) for use with the JBCC Principal Building Agreement. No - Yes -

9.0 SPECIFICATION

The tenderer's attention is drawn to the Model Preambles for Trades (1999 edition) as published by the Association of South African Quantity Surveyors.

10.0 SCHEDULE OF PRICES AND RATES

Tenderers are required to submit a bill of quantities and rates (priced in black ink) to the Engineer together with his completed tender document.

11.0 PLANT, SCAFFOLDING, ETC

The Tenderer must provide all plant, scaffolding, rigging, ladders, etc and must make due allowance in his tender therefore.

12.0 VIEWING OF SITE

The Tenderer must view the site, structures, etc and acquaint himself thoroughly with the conditions under which the works are to be executed. Any conditions or defects which may adversely affect the execution and/or performance of the works is to be reported to the architect, in writing, before any work is put in hand, as no claim of whatever kind arising, out of his failure to do so, will be entertained.

13.0 START AND COMPLETION DATES

The final start and completion dates of the works are to be agreed with the Tenderer prior to commencing any work and/or before signing the contract.

Provisional starting date:

Provisional completion date:

No claim will be entertained for the working of overtime, disruption, out of sequence activities, additional supervision and/or plant, which might be necessary to achieve the programme dates.

14.0 CONTRACT PRICE ADJUSTMENT PROVISIONS

Notwithstanding anything, to the contrary in any offer or tender, the tenderer is advised that the tender must include for any fluctuations in cost of any reason whatsoever, i.e. tender is to be **"fixed price"**.

15.0 COST CONTROL

The Tenderers attention is specifically drawn to the Principal Agreement regarding the application of cost control budgeting as no claim of whatever nature will be considered due to his failure in complying with these procedures.

16.0 MATERIALS OFF-SITE

Notwithstanding the options given in the principal agreement and application for payment for materials stored off-site will only be considered upon receipt of an approved guarantee from an approved bank or financial institution for the full value thereof.

17.0 VALUE ADDED TAX

The Tenderer shall ensure that all items tendered for are priced exclusive of Value Added Tax (VAT). VAT shall be added to the exclusive amount to arrive at the total tender amount (inclusive of VAT) and the tenderer is required to complete the form of tender as set out.

18.0 RETURNABLE DOCUMENTS

The returnable documents in part 4 of this tender must be completed in full by the tenderer and submitted as part of the tender. The tenderer may, however, provide additional information or provide the information in a different format as produced by the design software.

19.0 TENDERER'S TRACK RECORD

The Tenderer's must submit a schedule of their track record to date and the track record must indicate at least three projects of the similar size and nature completed successfully. A full financial model must be made available to the client indicating the actual costs of electricity purchased from the supply authority versus that produced by the PV system over the last three financial years. The model must also indicate the savings over the last three years compared to that predicted at tender stage.

20.0 PERFORMANCE GUARANTEE

The successful tenderer must supply a performance guarantee for the installed system to ensure that the savings and payback period claimed by the tenderer prior to the installation are achieved after an operational period of at least three years after completion of the project.

The start of the performance guarantee period will be the date of signature of the “Take over certificate” by the Client, Engineer and Tenderer, stating that the system is operational and taken over to the client. The release of the performance guarantee will be after a period of three calendar years after signature of the “Take over certificate”.

The value of the performance guarantee will be for the total savings predicted in the tender issued and will be reduced by the annual savings amount realised.

21.0 GENERAL

The Tenderer's attention is drawn to the fact that the tender for this contract work is to be NET and must not contain (directly or indirectly) any allowance, discount, payment or refund in favour of any person, company or concern whatever, nor will any such allowance, discount, payment or refund be made, or credited.

The roof has been designed by the Structural Engineer to accommodate the PV panel installation. The pitch of the roof is 5 degrees. A cat-walk ladder will be installed by the client for access onto the roof for installation purposes and long term maintenance. A permanent safety cable will be installed by the client near the pitch of the roof for installation and long term maintenance purposes.

The actual walkway (400mm wide minimum) between the panels will be installed by the PV system supplier on purpose made brackets approved by the roof manufacturer and the Engineer.

Tariff information:

The new proposed building and site will be on the TOU commercial tariff and the billing information is published on COCT's website or alternatively can be obtained directly from their treasury department. Metering is at 11kV via municipal metering unit.

PART 2

FORM OF TENDER

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PART 2 - FORM OF TENDER

TO:	Employer's Name	: City of Cape Town
	Project Name	: Retreat– Public Transport Interchange
	Contract No.	: C1853/E1/PV1
	Short Description of Works	: Photovoltaic System Installation
	Type of Tender	: Fixed Price
	Closing date for Tenders	: See Part 1 – Notes to tenderer's
	Time	: See Part 1 – Notes to tenderer's

I/We the undersigned hereby offer to undertake, perform and complete the above-named works in accordance with the Scope of Works, Drawings, Specifications and Schedules save as amended by the statement set out in Part (A) of this Form of Tender attached hereto* for the sums as follows:

- (A) Supply, delivery, offloading, handling, storage, installation, erection, testing, commissioning, guarantee and handover of all equipment and material as specified and listed in this document and on the drawings except for free issue items specifically noted (carried forward from tender price breakdown schedule)

R

(B) Contingency Amount..... R 100,000.00

(C) Sub-total..... R

(D) Value Added Tax (14%)..... R

(E) TOTAL TENDER SUM (Incl. VAT)..... R
 (Carried over to pricing summary page)

(In Words):

SIGNATURE OF TENDERER:

In the event of there being any errors of extension or addition in the Schedule of Prices and Rates, I/We agree to their being corrected, the rates being taken as correct.

This tender shall remain in full legal force for a period of 60 (sixty) days from the tender closing date.

I/We undertake to complete and deliver the whole of the Works within a period ofweeks after appointment in writing to this Contract.

Unless and until a Formal Agreement is prepared and executed, this Tender, together with the written acceptance thereof by yourselves or the Engineer acting on your behalf, shall constitute a binding Contract between us.

I/We enclose herewith the following supporting or explanatory documents:

- (1) Letters:
- (2) Catalogues:
- (3) Drawings:
- (4) Other (Specify):

I/We submit herewith further information, as required in Parts (A), (B) and (C), which form part of this Form of Tender.

I/We understand that you are not bound to accept the lowest or any tender you may receive.

TENDERER (Signature)

NAME (Block Letters)

ADDRESS

.....

DATE

BANKER:

BRANCH:

WITNESSES

1.

2.

PART 2 (A)

STATEMENT OF COMPLIANCE OR OF QUALIFICATIONS BY TENDERER

This Tender complies in every respect with the Specification, Schedules and Drawings-* (YES/NO)

If (NO), detail qualifications hereunder. Failure to detail qualifications shall signify compliance:

QUALIFICATIONS		
PART NO	CLAUSE NO	AMENDMENTS

DATE:

SIGNATURE OF TENDERER:

* Delete whatever is not applicable

PART 2 (B)

PRICE ADJUSTMENT SCHEDULE

The Tenderer shall detail hereunder any adjustments to which prices stated in the Schedules are subject (see Requirements for Tendering and Conditions of Contract).

If prices are not subject to adjustment the Tenderer shall enter "NIL" in the Schedule hereunder:

NIL - THIS IS A FIXED PRICE CONTRACT, FOREX COMPONENT INCLUDED
--

DATE:

.....
SIGNATURE OF TENDERER

PART 2 (C)

SCHEDULE OF SUB-CONTRACTORS

PROPOSED BY THE TENDERER

The Tenderer shall state in the schedule below the names of all Sub-contractors he wishes to employ in the Works and shall define their duties and outline their experience.

NAME OF SUB-CONTRACTOR	PROPOSED DUTIES	EXPERIENCE

DATE:

.....
 SIGNATURE OF TENDERER:

PART 3

PV GRID TIE SYSTEM PERFORMANCE SPECIFICATION

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PV GRID-TIE SYSTEM PERFORMANCE SPECIFICATION

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PART 3 - PV GRID TIE PERFORMANCE SPECIFICATION

1.0 SITE

The site is located at the Retreat Public Transport Interchange in Retreat, Western Cape .The PV system is to be installed on the new building roof space. The roof has been designed to accommodate the PV system.

2.0 VISIT TO SITE

Tenderers shall acquaint themselves with local site conditions such as access to the site, size and type of site, supply of labour, workshop space, transport, loading and unloading facilities, scaffolding, tackle and tools needed for the safe erection of the installation. Additional claims by the Tenderer, which may arise from ignorance of the site conditions, will not be considered and tenderers are requested to visit and inspect the site, before submitting a tender.

3.0 COMPLIANCE WITH REGULATIONS

The installation shall be erected and carried out in compliance with:

1. The Occupational Health and Safety Act 85 of 1993 and incorporated regulations.
2. The local Municipal by-laws and regulations as well as the regulations of the local Supply Authority.
3. The local Fire Regulations.
4. The Standard Regulations of any Government Department or public service company where applicable, such as Telkom, Neotel etc.
5. All regulations and standards as indicated in the scope of works.
6. The installation must comply with **IEC 60364-7-712**

The tenderer shall at his cost issue all drawings and notices in respect of modification of the installation to the local authorities and shall indemnify and exempt the Employer/Client from all losses, costs or expenditure which may arise as a result of the Photovoltaic (PV) Specialist Contractor's negligence to comply with the requirements of the regulations stipulated above. No work shall commence by the Photovoltaic (PV) Specialist Contractor prior to the approvals by the local authority, of the relevant drawings or applications to perform work.

It shall be assumed that the Photovoltaic (PV) Specialist Contractor is conversant with the abovementioned requirements. Should any requirement, by-law or regulation, which contradicts the requirements of this document, apply or become applicable during erection of the installation, such requirement, by-law or regulation shall overrule this document and the Photovoltaic (PV) Specialist Contractor shall immediately inform the Employer of such a contradiction. Under no circumstances shall the Photovoltaic (PV) Specialist Contractor carry out variations to the installation in terms of such contradictions without obtaining the written permission to do so from the Employer.

4.0 SUPPORTING SPECIFICATIONS

The following supporting standards and regulations shall apply as well as any additional national and local by-laws:

SABS 150	Insulated wire	EMR 2011	Electrical Machinery Regulations
SANS 1091	Colour standards for paint	EIR 2009	Electrical Installation Regulations

SANS 507-1		CR 2014	Construction Regulations
NRS 034-1		SANS 0142-1	Wiring code of practice
SANS 62305		SANS 1065	Metal conduits and fittings
NRS 097	Grid interconnection of Embedded Generation	SANS 1411	Materials of insulated electric cables and flexible cords
SANS 10199	Earth Electrodes	SANS 1574	Electrical cables – flexible chords and flexible cables.

5.0 PHOTOVOLTAIC SYSTEM SCOPE OF WORKS

System Description

The Photovoltaic (PV) Specialist Contractor shall be a direct contractor to City of Cape Town and shall undertake the design, supply, delivery, installation, testing and commissioning of a fully functioning fixed PV system installation.

Any direct coupling onto the existing electrical installation or alterations to the existing electrical installation shall be done by or with the approval of City of Cape Town's appointed electrical contractor.

This does not exempt the PV specialist contractor from issuing a certificate of compliance for his intended works, according to SANS 1012 Part 1.

The points of interface between this work package and other works are as follows:

The PV Specialist Contractor shall co-ordinate with the Electrical Contractor and other relevant contractors to ensure compatibility:

Item	Description of Works – PV Specialist Contractor	Action / Responsibility		
		Electrical Contractor	Building Contractor	Others
LV Distribution				
1	Free issue of electricity meters for incorporation into LV Switchboards	To PPP		
Lightning Protection				
1.	The PV frames shall be provided with suitable lugs for the connection of lightning protection bonds at two locations on each unit. Provision for the connection of 2No M6 or 1No M10 bolted connections to be provided.			
2.	Lightning protection bonds to PV frames.			Lightning Protection Specialist

The PV arrays shall provide an approximate total output of **20kWp and be a PV grid-tied system with associated communication and display elements.**

The PV installation shall operate in parallel with the council electrical supply from the supply authority, City of Cape Town Municipality. Any excess solar electricity produced shall be exported to the supply authority.

It is the responsibility of the PV Specialist Contractor to make the required application to the supply authority on their standard documentation and to ensure that the system installed complies with their standards and specifications. See **appendix A** for the supply authorities standards and specifications and **appendix B** for their standard application form for embedded generation.

The PV Specialist Contractor must ensure that the complete system, including the equipment and installation conforms to the Occupational Health and Safety Act and its associated regulations.

Also, the systems and their components shall be manufactured and designed to the appropriate standards, including but not limited to:

1. SANS 10142 Part 1, Wiring of Premises – Electrical Installations.
2. SANS 10142 Part 3, Wiring of Premises – Embedded Generation.
3. SANS 10142 Part 5, Wiring of Premises – Direct Current and Photovoltaic.
4. NRS 097-2-1 (Part 2: Small Scale Embedded Generation, Section 1).
5. NRS 097-2-2.
6. NRS 097-2-3 (Part 2: Small Scale Embedded Generation, Section 3).
7. COCT Municipality Guidelines for Embedded Generation.
8. COCT Municipality's Electricity By-Law 2014.
9. NERSA Regulatory Framework on Small Scale Embedded Generation.
10. IEC 61215.

The PV arrays shall be mounted on the roof sheeting of the new taxi roof structure at Retreat. The following drawings and information is attached to support the design of the PV system:

1. **Appendix C** : Site plan
2. **Appendix D** : Section
3. **Appendix E** : Load profile – 18 Jan 2016 until 24 Jan 2016
4. **Appendix F** : CSV data of load profile
5. **Appendix G** : GRS Klip-Tite clamp product sheet.

The overall installation shall include, but not be limited to:

- PV array: Modules of poly-crystalline, positively sorted, minimum 20-year manufacturer warrantee, to fit on available roof space. Each array shall be supplied with a suitably sized disconnect switch.
- PV array support structure: All required supporting framework for the system and attachment to roof is to be provided and installed by supplier. Support system weight, requirements and layout to be coordinated with roof system and structural drawings. Any and all mounting points of the supporting framework to the roofing structure shall be made waterproof and conform to any and all design suggestions made by the structural engineer.
- Modular grid-tie inverter: Three (3)-phase grid-tie inverters which comply with any and all local and national by-laws with regard to PV grid-tie systems shall be used. An isolated connection point shall be provided by the Electrical Contractor. The inverters shall be installed in the equipment room or as indicated by the electrical engineer or architect.
- Batteries:

- Maximum power point tracking (MPPT): The inverters must have MPPT incorporated for power optimization of the system and these modules must be compatible with the manufacturer's specifications.
- Modular communication: The inverters shall be connected to a data acquisition and control unit so that the system can be monitored and adjusted locally and remotely. A data point shall be provided by the Electrical contractor which will have access to the internet. Both the Client and the Engineer shall require full access to the recorded data, locally and remotely, via the data collection portal.
- Metering monitors: Meter interfaces shall be installed along with the main metering for the building.
- PLC: A PLC unit may be installed (specification to be forwarded to the Engineer prior to tendering). This unit may need to be interfaced by means of a Power Reducer box or similar approved. It will be required to liaise with the meter programmer to achieve the desired operation of the system.

Additional requirements include the following:

- Permanent walk way structure on roof sheeting to service solar panels
- DC cabling and containment
- AC cabling and containment

The PV Specialist Contractor shall liaise with COCT Municipality to ensure that the system is designed, installed and commissioned in accordance with their requirements and ensure that the necessary arrangements are in place for connection to and operation in parallel with the municipal supply.

The PV Specialist Contractor shall liaise with the Electrical Contractor in conjunction with the LV switchboard manufacturer to ensure that the correct equipment is installed and coordinated in accordance with their requirements.

Equipment Description

PV Modules & frames

The PV Modules shall comply with the international standards IEC 61215 and carry a CE mark.

The modules shall be installed on purpose made support frames to ensure that the cells are inclined at the optimum tilt to maximise their output over the course of a year.

The frames shall be constructed and secured to the building to meet the environmental conditions as well as aesthetic conditions when mounted on the roof. The fasteners on the roof must be protected against galvanic-rust/corrosion.

The roof has been designed to accommodate the PV installation and has been supplied by Global Roofing Solutions. The mounting brackets to be used must be as per their specification, namely the GRS Klip-Tite Clamp product range. The use of any other bracket will not be acceptable, as it will nullify the roof sheeting guarantee.

A permanent walk way structure mounted on the roof sheeting must be installed to aid with the installation and service of the solar panels and ancillary equipment. It must be erected by the PV Specialist Contractor prior to the installation of the panels. Details of the proposed walk way structure must be submitted with the tender and must be approved by the Engineer before manufacture and installation.

DC Cabling

The PV modules shall be wired in strings to the invertors via DC cabling.

The DC cabling between the solar arrays and the invertors shall consist of purpose designed 80°C photo voltaic cables” with purpose made PV plug and socket connectors.
The cables shall be UV stable, water resistant and multi-stranded to allow for thermal/wind movement of arrays/modules.

The DC component ratings (cables, isolators/ disconnectors, switches, connectors, etc) of the system shall be sized to suit the maximum voltage and current of the PV arrays (and individual modules) taking into account the system voltage/currents of the series/parallel connected modules making up the array. Standard de-rating factors (temperature, solar gain grouping etc) shall be applied in accordance with SANS 10142 part 1.

The DC elements (wiring, connectors etc) of the PV system shall incorporate Class II insulation (double insulation). DC junction boxes with negative and positive parts shall be separated and protected by barriers, or by utilising separate enclosures.

The cable runs should be kept as short as practicably possible. Labels shall be installed along the DC cables with the following wording: “Danger solar PV array cable – high voltage DC - live during daylight”.

The PV Specialist Contractor shall design and install all the containment to support and protect the DC cabling. The cables shall be installed in earthed galvanised trunking to provide mechanical protection. The trunking shall be fixed to the frames. Bonding of all steel structures must be in accordance with SANS 10142.

DC Switch

DC isolation switches shall be installed to provide a means of manually isolating each PV string.

The switches shall be located adjacent to, or integrated into the associated invertors.

The switches shall be double poled and suitable for DC operation (load-break rated) to effectively isolate both PV string positive and negative poles.

The DC switches shall be rated for the maximum system voltage and current.

The DC switches shall be labelled ‘PV array DC isolator’, with the ON and OFF positions clearly marked.

The enclosures shall also be labelled with ‘Danger - contains live parts during daylight’.

Invertors

Invertors shall be installed, in the main distribution board room or alternatively in a room above the main distribution board room, to convert the DC voltage & current into AC voltage & current.

The invertors shall be capable of withstanding the maximum array voltage and current they may encounter.

The inverters shall carry the IEC Type Test certificate (or from a recognized approval body as approved by the Engineer), or to the requirements of the Engineer (this approval must be in writing).

The invertors shall be in IP 65 rated enclosures and mounted so that they are easily accessible for maintenance.

The invertors shall automatically disconnect from the LV distribution system during a mains outage to prevent the photovoltaic systems working in island mode.

The front of the inverter enclosures shall incorporate the following sign 'Inverter - isolate AC and DC before carrying out work'.

AC Cabling

The invertors shall be connected to dedicated local 3-phase distribution boards which shall connect each PV installation to the low voltage network.

The PV Specialist Contractor shall select and install the AC cables between the invertors and distribution boards in accordance with SANS 10142, Part 1.

The AC cables connecting the invertors to the distribution boards shall consist of XLPE/SWA/LSOH cables.

The distribution boards shall be located within adjacent risers or on the frame of the PV cells (within an IP 65 enclosure). If the distribution boards are not installed by the clients Electrical Contractor, the PV Specialist Contractor must supply a COC for each distribution board.

The PV Specialist Contractor shall provide and install the MCBs within the distribution boards and be sized to suit the requirements of the PV installations.

Suitably rated IP 65 manual isolators shall be mounted adjacent to each of the invertors to isolate the AC output of the invertors to facilitate the maintenance of the AC cable runs and invertors.

The isolators shall switch the live and neutral conductors.

The isolators shall clearly indicate the ON and OFF positions and be labelled as 'PV system – AC isolator' and be securable in the OFF position only. The isolator shall be secured using a standard padlock.

The AC cables shall be installed in or on containment provided and installed by the client's Electrical Contractor, but the cables themselves shall be part of the PV installation.

Metering

The PV Specialist Contractor shall free issue any approved export meters to the Electrical Contractor for incorporation into the main LV Switchboard, which are supplied from the PV installation.

The meters shall measure and record kWh and instantaneous power output (kW). The meters shall be installed to display/record the energy delivered by the PV system. The metering system must be in accordance with the local supply authority requirements and specifications.

The main switchboard is located within the security office area as indicated on the floor plan layout in [Appendix H](#).

Testing & Commissioning

The PV specialist shall undertake the testing and commissioning of the PV installation in accordance with the requirements of the applicable standards and the Engineer.

Tests shall be undertaken to verify the system performance and check for faulty modules. All tests required to satisfy the requirements of the distribution Network Operator shall be undertaken and the necessary documentation provided.

The PV installation shall be earthed in accordance with the applicable regulations to minimise the risk of electric shock to people in the vicinity of the installation under fault conditions.

The frames holding the PV cells shall be bonded to the lightning protection system by the Lightning Protection Sub-Contractor. PV Specialist Contractor shall liaise with the lightning protection specialist to ensure that adequate connection points are available to ensure that the lightning protection system conforms with SANS or IEC 62305.

The PV Specialist Contractor shall be responsible for liaising with the COCT Municipality to ensure that the necessary arrangements are in place for connection to and operation in parallel with the COCT Municipality supply.

Operation and Maintenance Manuals (O&Ms)

The O&Ms shall also include the following specific information for the PV installation:

- a. Basic system information.
- b. Single line electrical system schematic.
- c. Manuals, data sheets and other relevant product documentation for the system components.
- d. Copy of the test & commissioning documentation.
- e. Table of inverter protection settings (under/over voltage, under/over frequency, etc).
- f. Procedures for verifying correct system operation.
- g. A checklist of what procedures to undertake in case of a system failure.
- h. Shutdown/isolation and start up procedures.
- i. Maintenance & cleaning recommendations (if any).
- j. Considerations for any future building works adjacent to the PV array (eg roof works) to avoid potential damage or shading of the PV array.
- k. Warranty Information.

Tender Information

Tenders shall as a minimum include the following information:

- a. Nominal peak power output from system.
- b. Proposed PV module type and range.
- c. Electrical efficiency.
- d. Estimate of annual average output.
- e. Physical dimensions of array.
- f. Recommended maintenance space allowances.
- g. Proposed inverter type/details.

- h. Outline design of array and connection to building electrical supply, including proposed number and arrangement of inverters and connection arrangements.

Design Parameters

AC and DC cables shall be selected in accordance with SANS 10142 Part 1 and must satisfy the following maximum overall voltage drops:

<u>Connection</u>	<u>Maximum Voltage Drop</u>
DC wiring between the arrays and the inverters	< 3%
AC wiring between inverters and distribution boards	< 1 %

System Logic

System operation while grid is connected

Energy from PV panels must be used in preference to grid energy and be fully utilized by the load (i.e. non-essential daytime loads like air conditioners, with excess energy requirements of these loads provided by grid energy). Solar PV energy must be available on all three phases. Energy may be fed back into the grid. A PLC may be installed to deregulate the inverter by means of the manufacturer’s specific equipment or similar approved equipment.

System operation when grid fails

When the grid fails, all grid-tie inverters must disconnect from the grid to prevent energy from being fed back into the electrical system, in accordance with local by-laws. When the grid voltage becomes available again, the inverters must reconnect automatically.

Logic of potential approaches

Tenderers are welcome and invited to propose alternative proprietary solutions with comprehensive explanation to meet the system logic as specified above in the event they wish to do so. Technical information, equipment brochures, alternative layouts and special conditions must be included with the main and alternative proposal. The alternative proposal must accompany a priced bill for the described system and its specifications.

Testing, commissioning and handover of the PV grid-tie system installation shall be completed as described in this document to the complete satisfaction of the Engineer.

6.0 OTHER CONTRACTORS AND SPECIALISTS

The PV system sub-contractor shall be employed as a direct contractor to the Client/Employer.

It will be required of the PV system sub-contractor to work according to the Client’s programme, in close liaison with the other contractors and specialists appointed by the Client or nominated by the Client. Other specialist’s contractors shall in no way exonerate the PV system sub-contractor from his obligations in terms of this contract.

7.0 PROGRAM

A copy of the Client’s construction programme shall be issued to the successful tenderer. The PV system sub-contractor shall be expected to conform to the overall milestones as contained in this programme.

Contract completion date: See part 2

8.0 **BUILDER'S WORK**

The Client shall also provide the following:

1. The supply and installation of all manholes and sleeves or ducts.
2. Isolated electrical connection and data points for connection to the local/internal grid and internal data network.
3. The removal and replacement of ceiling tiles, where required, to allow the PV system contractor access to perform work in ceiling spaces.
4. The repairs to brick work, plaster and paint where required.
5. Cable trays in existing ceiling spaces.

The PV system contractor shall liaise closely with the Electrical Contractor in the above regard and the PV system contractor shall remain responsible for the correct and accurate location of manholes, sleeves, and penetrations.

9.0 **ELECTRICAL SUPPLY**

The electrical supply at all isolated connection points shall be 4-wire, 420V, 50 Hz, 3-phase supply.

10.0 **WORKMANSHIP**

The PV system contractor shall employ (if necessary) only competent artisans to perform construction and installation work on the site.

The contract shall be executed with the best workmanship in a workmanlike manner to the satisfaction of the Employer. Should any workmanship not be to the satisfaction of the Employer, it shall be rectified at the cost of the PV system contractor.

The PV system contractor shall remain responsible for the correct and complete delivery of the installation. Inspection by the Employer shall not release the PV system contractor from his responsibility.

11.0 **QUALITY OF MATERIAL**

Only material of high quality and suitable for the climatic conditions of the site shall be used and shall be subject to approval of the Employer and Engineer. All material shall conform in respect of quality, manufacture, tests and performance, with the requirements of the SANS or where no such standards exist, conform to the appropriate current IEC Specifications. Materials manufactured in South Africa shall as far as possible be used and where applicable shall bear the SABS mark. Imported materials shall comply with the requirements of the appropriate I.E.C. specification. All materials shall be suitable for the conditions under which the materials are installed and used.

Should the materials or components not be suitable for temporary use under site conditions, then the PV system contractor shall at his own cost provide suitable protection until these unfavourable site conditions cease to exist.

12.0 **AMBIENT OPERATING CONDITIONS**

- | | |
|------------------------|---------------|
| 1. Ambient Temperature | -5°C to 40°C+ |
| 2. Relative Humidity | 0 to 100% |
| 3. Altitude | 441 meter ASL |

Over and above the normal exposure to dust and other particles of pollution typically found in an industrial setting, it must be taken that the air is extremely corrosive. All equipment that may be affected by such

circumstances shall be shielded, properly sealed and effectively and efficiently treated to withstand the dusty and corrosive environments.

13.0 GUARANTEE AND MAINTENANCE

The PV system contractor shall guarantee the complete plant for a period of twelve months after first delivery has taken place.

If during this period the plant is not in working order, or not working satisfactorily owing to faulty material, design or workmanship, the PV system contractor will be notified and immediate steps shall be taken by him to rectify the defects and/or replace the affected parts on site at his own expense.

The PV system contractor shall maintain the plant in good working condition for the full twelve month period to the final delivery of the installation. The tenderer must also price for an additional 2 year SLA as part of the tender. However, should the PV system contractor fail to hand over the plant in good working order on the expiry of the specified twelve months and SLA period, the PV system contractor shall be responsible for further monthly maintenance until final delivery is taken.

During this period the PV system contractor will undertake to arrange that the plant be inspected at regular intervals (whatever number of visits the PV system contractor deems necessary to fully maintain the equipment) by a qualified member of his staff who shall:

1. Check the mechanical soundness of all parts.
2. Check and adjust all the output and control parameters of the system (voltage, frequency, control voltages, etc.).
3. Take control measurements on the major system components and record these measurements.
4. Replace all defective components.

14.0 INSPECTION AND TESTING

After completion of the works and before first delivery is taken, a full test will be carried out on the installation for a period of sufficient duration to determine the satisfactory working thereof. During this period the installation will be inspected and the contractor shall make good, to the satisfaction of the Representative/Agent, any defects which may arise.

Note:

1. All instrumentation necessary for testing shall be provided by the PV system contractor.
2. The results of the above tests must be clearly recorded, signed and handed to the Engineer.
3. Once the Engineer has inspected the complete installation and satisfied himself that all testing has been completed and the Contract is complete in all respects, the Engineer may be approached in writing with the above documentation with a view to arranging a hand-over date.
4. On completion of the Contract, the PV system contractor shall provide the Engineer with a complete and signed Certificate of Compliance for Electrical Installations as required by the Occupational Health and Safety Act as amended.

15.0 TESTING AND COMMISSIONING DOCUMENTATION

On completion of the installation and after testing and commissioning, a set of documents shall be compiled and presented to the Engineer. This set shall include the following:

1. CAD copy of all drawings marked up "as built"
2. Completed set of workshop drawings.
3. Completed set of test and commissioning sheets.
4. Set of schematic wiring and function diagrams
5. 3 sets of Operating and Maintenance Instruction Manuals on all electrical equipment.

16.0 **SUBMITTALS**

The following information ***MUST*** accompany the tender documents at submission:

1. A paragraph by paragraph schedule of compliance with detailed description of any deviations from this specification.
2. A clear description of the operating characteristics and special features of the equipment.
3. Descriptive and illustrated brochures and other information pertaining to the solar PV panels, framing system, LED monitor and computer.
4. The proposed layout.
5. A sample test report as stated.
6. A list of successful installations completed in the Republic of South Africa and abroad (if any).

PART 4

RETURNABLE DOCUMENTS

INDEX RETURNABLE DOCUMENTS

ITEM	DESCRIPTION	PAGE NO.
1.0	SYSTEM DESIGN CRITERIA	31
2.0	EVALUATION OF DESIGN	32
3.0	SYSTEM MONITORING	33
4.0	SELF-CONSUMPTION	34
5.0	MONTHLY VALUES	35
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7.0	EFFICIENCY ANALYSIS – COST STRUCTURE	37
8.0	DESIGN GUIDELINE / CRITERIA	38

1.0 SYSTEM DESIGN CRITERIA

Grid Voltage : _____ V	Azimuth angle : _____ °	
Tilt angle : _____ °	Mounting type : _____ Roof	Mounting type : _____ Tilted brackets
Peak power : _____ kWp		
Solar panels : _____ Qty	Make : _____	Type : _____
Solar panels : _____ Qty	Make : _____	Type : _____
Solar panels : _____ Qty	Make : _____	Type : _____
Inverters : _____ Qty	Make : _____	Type : _____
Inverters : _____ Qty	Make : _____	Type : _____
Inverters : _____ Qty	Make : _____	Type : _____

System Monitoring

Controller : _____

Monitor type : _____ Monitor name : _____ Monitor size : _____ cm

Energy meter : _____

Hardware type : _____ Hardware name : _____ Monitor role : _____

Hardware type : _____ Hardware name : _____ Monitor role : _____

Hardware type : _____ Hardware name : _____ Monitor role : _____

Software type : _____ Software name : _____ Software role : _____

Software type : _____ Software name : _____ Software role : _____

Software type : _____ Software name : _____ Software role : _____

Technical Data

Total Number of PV modules : _____	Annual energy yield (approx. %) : _____ MWh
Peak Power : _____ kWp	Energy usable factor : _____ %
Number of inverters : _____	Performance ratio (approx. %) : _____ %
Nominal AC power : _____ kW	Spec. energy yield (approx. %) : _____ kWh/kWp
AC active power : _____ kW	Line losses (in % of PV energy) : _____ %
Active power ratio : _____ %	Unbalanced load : _____ VA

Notes :

2.0 EVALUATION OF DESIGN

PV system section 1		
Inverters	Inverter type : _____ Inverter qty : _____	Inverter type : _____ Inverter qty : _____
Peak power	_____ kWp	_____ kWp
Total number of PV modules	_____	_____
Number of inverters	_____	_____
Max DC Power (cos ϕ = 1)	_____ kW	_____ kW
Max AC active power	_____ kW	_____ kW
Grid Voltage	_____ kV	_____ kV
Nominal power ratio	_____ %	_____ %
Displacement power factor cos ϕ	_____	_____
Technical Data		
Input A : PV array 1		
PV panel make	: _____	PV panel type : _____
Number of PV panels	: _____	Azimuth angle : _____ Tilt angle : _____
Mounting type	: _____	
Input A : PV array 2		
PV panel make	: _____	PV panel type : _____
Number of PV panels	: _____	Azimuth angle : _____ Tilt angle : _____
Mounting type	: _____	
	Input A	Input B
Number of strings	_____	_____
PV modules per string	_____	_____
Peak Power (input)	_____ kWp	_____ kWp
Typical PV voltage	_____ V	_____ V
Min PV voltage	_____ V	_____ V
Min DC voltage	_____ V	_____ V
Grid voltage	_____ kV	_____ kV
Max PV voltage	_____ V	_____ V
Max DC voltage	_____ V	_____ V
Max current of PV array	_____ A	_____ A
Max DC current	_____ A	_____ A

3.0 SYSTEM MONITORING

(Complete a separate sheet for each of section 2, 3 etc. if applicable)

PV system	System monitoring	
<i>Subsection 1</i>	<i>Within the PV system</i>	<i>External</i>
<p>PV system section 1:</p> <p><u>Inverters</u></p> <p>Name : _____</p> <p>Qty : _____</p>	<p>1. Universal acquisition of measured values for intelligent energy management:</p> <p>Name : _____</p> <p>Qty : _____</p> <p>2. PC software for professional plant presentation:</p> <p>Name : _____</p> <p>Qty : _____</p> <p>3. PC software for management of PV system and display of PV system data:</p> <p>Name : _____</p> <p>Qty : _____</p> <p>4. Weather station for PV systems:</p> <p>Name : _____</p> <p>Qty : _____</p> <p>5. Professional Monitoring and control of decentralized large scale PV systems:</p> <p>Name : _____</p> <p>Qty : _____</p> <p>6. Data logger for Retrieval, storage and transmission of inverter data:</p> <p>Name : _____</p> <p>Qty : _____</p>	<p>Internet portal for monitoring PV systems and for the visualization and presentation of PV system data:</p> <p>Name : _____</p> <p>Qty : _____</p>

4.0 SELF-CONSUMPTION

Information on self-consumption		
Load profile : State – Weekdays _____ to _____ Saturday _____ to _____ Sundays _____ to _____ Energy consumption per annum : _____ MWh		
Increased self-consumption		
Result		
Without increased self-consumption		
Self-sufficiency quota: _____ % Self-consumption quota: _____ %	Distribution of PV energy Energy yield : _____ MWh Grid feed-in : _____ MWh Self-consumption : _____ MWh Purchased electricity : _____ MWh	Details Energy consumption PA : _____ MWh Energy yield of PV system : _____ MWh Grid feed-in : _____ kWh Purchased electricity : _____ MWh Self-consumption : _____ MWh Self-consumption quota (% of PV energy) : _____ % Self-sufficiency quota (% of energy consumption) : _____ %

5.0 MONTHLY VALUES

Diagram / graph

Table

Month	Energy yield (kWh) + %	Self-consumption (kWh)	Grid feed-in (kWh)	Purchased electricity (kWh)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

6.0 EFFICIENCY ANALYSIS

Details

Electricity cost savings in the first year (approximately) : _____

Total electricity cost savings after 20 years (approximately) : _____

Total revenue from grid feed-in after 20 years (approximately) : _____

Expected amortization period in years (approximately) : _____

The total investment is : _____

The specific capital expenditure costs are : _____

Effective savings - Graph

Comparison of cumulative electricity costs – Graph

Comparison of annual electricity costs

Today without PV system : _____

In 20 years without PV system : _____

Today with PV system : _____

In 20 years with PV system : _____

7.0 EFFICIENCY ANALYSIS – COST STRUCTURE

Cost structure	
PV system costs	
The total costs for the PV modules are	: _____ R
The average power degradation of the PV modules is	: _____ %
The total cost for the inverters and PV system monitoring are	: _____ R
The cost for planning and installation are	: _____ R
The annual fixes costs are	: _____ R
The total investment is	: _____ R
The specific capital expenditure costs are	: _____ R / kWp
Financing	
The currency is	: _____ R
The equity ratio is	: _____ %
The debt ratio is	: _____ %
The grant amount is	: _____ R
The inflation rate is	: _____ %
The analysis period of efficiency is	: _____ Years
Selected type of credit	: _____
The credit period is	: _____ Years
The redemption-free period is	: _____ Years
The interest rate is	: _____ %
Electricity purchase costs and feed-in tariff	
The electricity purchase price is	: _____ R / kWh
Specific tariffs such as TOU must be taken into account	: _____
The annual rate of electricity price increase is	: _____ %
The feed-in tariff is	: _____ R / kWh
The duration of the feed-in tariff is	: _____ Years
Deduction or feed-in tariff in case of self-consumption	: _____ R / kWh
The feed-in revenue on expenditure of the remuneration period is	: _____ R / kWh
Comparison of annual electricity costs	
Today without PV system	: _____
In 20 years without PV system	: _____
Today with PV system	: _____
In 20 years with PV system	: _____

8.0 DESIGN GUIDELINE / CRITERIA

(To be completed by tenderer)

Design Parameters:		
	Triocon - Guideline	Tenderer - Actual
Standards	SANS IEC	
Type	Hybrid, Mono Crystalline surrounded by ultra-thin amorphous silicon layer.	
Latitude	34.22° South Latitude	
Longitude	19.42° East Longitude	
Temperature – minimum (°C)	-5 °C	
Temperature – maximum (°C)	40 °C	
Maximum wind speed (m/s)	12 m/s	
Mean annual wind speed (m/s)	8.63 m/s	
Peak power (kWp)	20 kWp	
Nominal AC power (kW)	20 kW	
AC active power (kW)	98 kW	
Active power ratio	95.7 %	
Wind speed (m/s)	Refer to Met Data for Du Noon	
Snow load (kg/m²)	To suit location / application	
Impact resistance	High	
Open circuit voltage (V)	< 1000 V	
Annual energy yield (app)	169.1 MWh	
Energy usable factor	99.9 %	
Tilt angle	5 °	
Azimuth angle	39.7°	
Performance ratio	86.2 %	
Specific energy yield (app)	1651 kWh / kWp	
Line losses	0.27 %	

Notes:-

1. PV specialist to include for all steelwork framing & supports.
2. The mounting frames shall be designed for flat roofs.
3. PV specialist to include for all electrical containment and wiring from the PV cells to the local distribution boards.
4. Panel area quoted is active PV area and excludes framing.
5. To protect the DC system, surge suppression devices shall be fitted at the inverter end of the DC cabling and at the arrays.

PART 5

PRICING SCHEDULES

(Note: Tenderer may issue Price Schedule in own format – this is minimum information required)

**MAIN TENDER - INSTALLATION PRICING SCHEDULE
 (WESTERN PRECINCT – BUILDING C)**

(Note : These prices shall be firm and not subject to price adjustment)

Item	Description	Unit	QTY	Supplied Rate	Installed Rate	Amount
1	<u>Preliminary and General items</u>					
1.1	Site personnel	sum	1			
1.2	Supervisory staff	sum	1			
1.3	Guards	sum	1			
1.4	Transport	sum	1			
1.5	Insurance	sum	1			
1.6	Cost of Guarantee	sum	1			
1.7	Financing of Retention	sum	1			
1.8	Running costs e.g. telephone, electricity, cleaning, services, printing, stationery, etc.	sum	1			
2	<u>GENERAL COSTS</u>					
2.1	Allow an amount if required for expenses incurred to tender	sum	1			
2.2	Loading and off loading of material and equipment	sum	1			
2.3	Setting out of Works.	sum	1			
2.4	Cleaning of site upon completion of Contract.	sum	1			
2.5	Critical Path/Schedule.	sum	1			
2.6	Marking up "As Built" drawings	sum	1			
2.7	Issuing Cadded "As Built" drawings on completion	sum	1			
2.8	Test and commissioning of complete Works.	sum	1			
2.9	Costs to comply fully with main contractors P&Gs	sum	1			

3	<u>EQUIPMENT</u>					
3.1	PV Solar Panels 10kW	sum	1			
3.2	Solar Panels Brackets and Frame	sum	1			
3.3	Walk Way, brackets and frame	sum	1			
3.4	Cabling (tenderer to determine length)					
	a) Solar Cable (4mm ²)	m				
	b) Surfex (6mm ² x 4 core)	m				
	c) Red & black single 50mm ²	m				
	d)	m				
3.5	Inverters – 10kW SMA Sunny Tripower STP 10 000TL-10 400V AC or similar	item	1			
3.6	Multi-cluster box (to extend battery backup time)	item	1			
3.7	Victron Quattro Inverter/Charger 48V/10000VA/140A or similar	item	3			
3.8	Victron Color Control Monitor or similar	item	1			
3.9	Cell interconnector set	sum	1			
3.10	2 Pole fuse holders (Push-in type)	item	3			
3.11	Batteries and battery housings					
	2V 4140Ah FLA Hoppecke 36 OSP, XC4140 or similar.	item	12			
3.12	Battery Box/strap to hold cells together	item	1			
3.13	Building/manufacturing costs for plinth frame	item	1			

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3.14	AC cable between inverters and emergency DB	item	1			
3.15	Miscellaneous items (cable tray, trunking, power skirting for battery leads and communication wires, fixings, ets)	item	1			
3.16	SLA for 24 months	item	1			
3.17	Other works required to make the system operational	item	1			
Total carried forward to Part 2 (excl VAT)					R	

(Note: Tenderer may issue Price Schedule in own format – this is minimum information required)

**MAIN TENDER - INSTALLATION PRICING SCHEDULE
(EASTERN PRECINCT – BUILDING A)**

(Note : These prices shall be firm and not subject to price adjustment)

Item	Description	Unit	QTY	Supplied Rate	Installed Rate	Amount
1	<u>Preliminary and General items</u>					
1.1	Site personnel	sum	1			
1.2	Supervisory staff	sum	1			
1.3	Guards	sum	1			
1.4	Transport	sum	1			
1.5	Insurance	sum	1			
1.6	Cost of Guarantee	sum	1			
1.7	Financing of Retention	sum	1			
1.8	Running costs e.g. telephone, electricity, cleaning, services, printing, stationery, etc.	sum	1			
2	<u>GENERAL COSTS</u>					
2.1	Allow an amount if required for expenses incurred to tender	sum	1			
2.2	Loading and off loading of material and equipment	sum	1			
2.3	Setting out of Works.	sum	1			
2.4	Cleaning of site upon completion of Contract.	sum	1			
2.5	Critical Path/Schedule.	sum	1			
2.6	Marking up "As Built" drawings	sum	1			
2.7	Issuing Cadded "As Built" drawings on completion	sum	1			
2.8	Test and commissioning of complete Works.	sum	1			
2.9	Costs to comply fully with main contractors P&Gs	sum	1			
3	<u>EQUIPMENT</u>					
3.1	PV Solar Panels 10kW	sum	1			
3.2	Solar Panels Brackets and Frame	sum	1			

3.3	Walk Way, brackets and frame	sum	1			
3.4	Cabling (tenderer to determine length)					
	e) Solar Cable (4mm ²)	m				
	f) Surfex (6mm ² x 4 core)	m				
	g) Red & black single 50mm ²	m				
	h)	m				
3.5	Inverters – 10kW SMA Sunny Tripower STP 10 000TL-10 400V AC or similar	item	1			
3.6	Multi-cluster box (to extend battery backup time)	item	1			
3.7	Victron Quattro Inverter/Charger 48V/10000VA/140A or similar	item	3			
3.8	Victron Color Control Monitor or similar	item	1			
3.9	Cell interconnector set	sum	1			
3.10	2 Pole fuse holders (Push-in type)	item	3			
3.11	Batteries and battery housings					
	2V 4140Ah FLA Hoppecke 36 OSP, XC4140 or similar.	item	12			
3.12	Battery Box/strap to hold cells together	item	1			
3.13	Building/manufacturing costs for plinth frame	item	1			
3.14	AC cable between inverters and emergency DB	item	1			
3.15	Miscellaneous items (cable tray, trunking, power skirting for battery leads and communication wires, fixings, ets)	item	1			

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3.16	SLA for 24 months	item	1			
3.17	Other works required to make the system operational	item	1			
Total carried forward to Part 2 (excl VAT)					R	

PART 6

APPENDICIES

INDEX APPENDICIES

ITEM	DESCRIPTION	DOCUMENT NO.
1.0	APPENDIX A – COCT STANDARDS & SPECIFICATIONS	AA
2.0	APPENDIX B – COCT APPLICATION FORM	AB
3.0	APPENDIX C – SITE PLAN	AC
4.0	APPENDIX D – ROOF PLAN & SECTION	AD
5.0	APPENDIX E – LOAD PROFILE	AE
6.0	APPENDIX F – CSV DATA OF LOAD PROFILE	AF
7.0	APPENDIX G – GRS KLIP-TITE PRODUCT SHEET	AG
8.0	APPENDIX H – SLD 1 PC COMMS GUIDELINE	AH