



SOLAR DEMAND REQUISITION APPENDICES

Appendix A: Functional Requirements

Function	Requirement
1. System Performance and Efficiency	<ul style="list-style-type: none"> a) The system shall be designed to achieve the maximum possible power output based on available roof space, orientation, and tilt angles. b) The system should be capable of maximizing the energy yield per square meter of roof space, considering local solar irradiance and environmental conditions. c) Inverter Efficiency: Use high-efficiency inverters to ensure minimal energy loss during DC to AC conversion.
2. Structural Integrity	<ul style="list-style-type: none"> a) The mounting system must be compatible with the roof structure and materials at each airport, ensuring no compromise to the structural integrity. b) The system must withstand local wind speeds and other environmental stresses.
c) Safety and Compliance	<ul style="list-style-type: none"> a) Ensure all electrical components comply with relevant safety standards and codes (e.g., SANS, IEC standards). b) Implement fire-resistant materials and designs to minimize fire risks. c) Include lightning protection measures to safeguard the system against lightning strikes.
d) Monitoring and Control	<ul style="list-style-type: none"> a) Real-Time Monitoring: Equip the system with real-time monitoring capabilities to track performance, detect faults, and optimize operations. b) Remote Control: Allow remote control and configuration of the system to facilitate maintenance and troubleshooting. c) Data Logging: Maintain detailed data logs for performance analysis, reporting, and compliance.
d) Integration with Existing Infrastructure	<ul style="list-style-type: none"> a) Grid Connection: Ensure seamless integration with the local electrical grid, including compliance with grid connection standards and regulations. b) Building Management Systems (BMS): Integrate with existing BMS for coordinated energy management and optimization. c) Backup and Redundancy: Provide backup power solutions to ensure continuity of critical airport operations during outages
e) Maintenance and Accessibility	<ul style="list-style-type: none"> a) Maintenance Access: Design the system to allow easy access for maintenance and cleaning without compromising safety. b) Durability: Use durable materials and components with long lifespans to minimize maintenance needs and replacement costs.
c) Environmental and Aesthetic Considerations	<ul style="list-style-type: none"> d) Visual Impact: Design the system to minimize visual impact and blend with the existing architecture of the airport. e) Noise Minimization: Ensure that inverters and other components operate quietly to avoid disturbing airport operations.

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Function	Requirement
	f) Sustainability: Use environmentally friendly materials and design practices to reduce the carbon footprint of the installation
d) Regulatory and Compliance Requirements	a) Permits and Approvals: Ensure the system complies with all local and national regulations, including obtaining necessary permits and approvals. b) Insurance Requirements: Meet insurance requirements for liability, property damage, and other risks associated with the installation and operation of the system. c) Energy Regulations: Comply with energy generation and efficiency regulations specific to South Africa and the aviation sector
d) Economic and Financial Considerations	Cost-Effectiveness: Optimize the design for cost-effectiveness, balancing initial investment with long-term operational savings. The TCO offer to ensure the project delivers a positive ROI, contributing to the airport's sustainability and financial goals.



Appendix B: Technical Requirements

Requirement	Technical Specification
1. Minimum System Design output	<p>ORTIA \geq 5 MW CTIA \geq 2.5 MWp KSIA \geq 2 MWp This is based on the available rooftop spaces and should be maximised by each design depending on the module size used.</p>
2. Modules	<p>Type: Mono - Crystalline Efficiency: Minimum 22% Certifications: IEC 61215, IEC 61730 Warranty: Minimum 25 years performance warranty Output power – min 400Wp per module Operating temperature IP Rating – IP67 (high ingress protection) Annual Degradation - <0.5% Optimised tilt angle and spacing to minimise shading</p>
3. Inverters	<p>Type: String inverters, Hybrid / Grid Tied type that shall enable energy storage on phase 2 of this program later in the years. Efficiency: \geq 98% Certifications: IEC 62109 Warranty: Minimum 10 years Energy Storage capabilities MPPT (maximum power point tracker to optimise energy harvested from the panels)</p>
4. Mounting Structures	<p>Type - Roof mounting systems (ballasted or fixed) Material - Galvanized steel. Mechanical confirmed that galvanized is sufficient for coastal areas. Wind Load Resistance - Designed to withstand local wind speeds as per SANS standards</p>
5. Monitoring and Control	<p>Monitoring System: Real-time monitoring for performance, fault detection, and energy yield Data System: Integrated with the airport's energy management system/ BMS Communication Protocols: Ethernet / Wifi</p>
6. Performance Metrics	<p>Expected Energy Yield - Calculated using solar irradiance data for the location Capacity Factor - min 15% Performance Ratio - Targeting > 80% Degradation factor – less than 1% per annum</p>
7. Integration with Existing Infrastructure	<p>Grid Connection - Compliance with utility interconnection requirements Energy Storage - Provisions for future energy storage integration and compatibility Backup Power - Ensuring system does not compromise existing airport power stability</p>
8. Regulatory and Compliance Requirements	<ul style="list-style-type: none"> Registration and Licensing - Projects exceeding 1 MW must be registered with NERSA. The cost for this registration to be provisioned for on the tender offer. Grid Connection - Compliance with local bylaws requirements
9. Economic and Financial Considerations	<p>IRR > 11.5% Positive NPV Payback < estimated useful life</p>

Appendix C: Engineering, Risk, and Technical Information (part of the technical proposed solution)

ACSA Requirement	Rationale for request	Additional Comments/Guideline to Bidders
C.1 Contingency planning to prevent interruption of airport operation	Outline the situations that can cause business interruption during the installation of Solar PV systems and mitigation there-of.	<ul style="list-style-type: none"> Describe the situations/incidents that could occur during the installation and the contingency plan to prevent business interruption. At a minimum, contingency planning for the following should be contained in the bid: equipment damage during installation; deviations in the rigging plan; environmental occurrence; damage to building; injury to staff and/or passenger. ACSA further expects that the Estimated Maximum Loss (EML) of these occurrences will be covered by the insurance program of the Bidder. Bidders confirm this.
C.2 Detailed engineering, technology and quality management plans	ACSA receives assessments of the suitability of the terminal infrastructure and obligations to ensure that the quality management program is executed	<ul style="list-style-type: none"> ACSA expects a Class 2 cost estimate for this proposal. Estimate classifications explained under Appendix G Engineering and structural due diligence, method statements, process and instrumentation diagrams, battery limit conditions, and assurance plan. This should be approved by a Professional Engineer
C.3 Plans for commissioning	Ensuring the Airport Operations value chain functions during the program as well as assurance on technology performance without negative impact to health and airport	<ul style="list-style-type: none"> The duration of the program is important for each airport to enable ACSA to alert stakeholders and provision for movement of materials to and from the staging area Plans for the decommissioning During commissioning, the key is to segment the plan and first test each section. Then you test the key processes and then the overall installation Testing at both hydraulic capacity and various operating conditions up and down of the optimal performance
C.4 Risk management and safety plan to enable issue of works permits	Risk assessment to enable suitable insurance coverage and to understand the likely occurrences plus their mitigation	<ul style="list-style-type: none"> ACSA has OHS processes for construction and stakeholders. These should be adhered to and will be provided in the tender data-room. A risk assessment should be performed, and all risks be evaluated from a monetary perspective to enable determination of the loss events that can occur. This



ACSA Requirement	Rationale for request	Additional Comments/Guideline to Bidders
		is crucial in determining whether the insurance claims procedure and recurrences are properly stipulated.
C.5 Insurance program for the replacement plus policy wording	ACSA and Stakeholders are name insured. Suitable coverage and coverage areas indicated	<ul style="list-style-type: none"> • ACSA requires the policy wording for the Builders All Risk program and Third-Party Liability that would be project specific. • ACSA also expects to receive a copy of the underwriting technical manuscript. This will be a submission that will form part of the work permit.
C.6 Maintenance Regime and Cost	Determine the maintenance program and associated cost	<ul style="list-style-type: none"> • Provide detail of the preventative maintenance regime to be followed over the useful life of the equipment. Provide indication of cost and duration to perform such work. • Assessment of the top 10 recurring failures on such equipment. The time taken to repair and the components replacements for such work. Provide cost estimate in each case. • View of the maintenance team required to provide maintenance services on such equipment. • Training and development program plus costs to capacitate staff to maintain/operate such equipment
C.7 Life Cycle Costing	Assess the total cost of ownership for the equipment	<ul style="list-style-type: none"> • Capital cost (Equipment) • Preventative maintenance cost estimate for the duration of the useful live • Reactive Maintenance cost estimate for the duration of the equipment • List of critical spares (panels & inverters) and spares holding cost per site • Establishment/Set-up costs to enable the maintenance and oversight of equipment. • Operating overheads to enable the asset management program. • Cost to inspection and certify equipment from time to time

Appendix D: Solar PV Components with associated useful life

Component	Purpose	Useful Life ¹
Solar Panels	Convert sunlight into electricity through the photovoltaic effect. Made up of individual solar cells, usually composed of semiconductor materials like silicon	25 - 30 years
Inverter	It converts DC electricity generated by solar panels into AC, which is suitable for use in the reticulation electrical grid	10-20 years
Monitoring System	sensors and software to monitor the performance of the solar PV system, providing real-time data on electricity production and system efficiency.	10-20 years
Transformers	Adjusts voltage levels for efficient transmission and distribution within the electrical grid	25 – 40 years
DC Power Cables	Connects solar panels to the inverter, transmitting the generated DC electricity for conversion into AC	20 – 25 Years
AC Power Cables	Transmits converted AC electricity from the inverter to the point of interconnection with the electrical grid or end-user	20 – 25 Years

Appendix E: Finance

¹ These are guidelines and ACSA will ensure this is “guaranteed” through its bid specification.



APPENDIX F²: Cost Estimate Input Checklist and Maturity Matrix

S – Specific, P – Preliminary, C – Complete	ESTIMATE CLASSIFICATION				
	CLASS 5	CLASS 4	CLASS 3	CLASS 2	CLASS 1
MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES	0% to 2%	1% to 15%	10% to 40%	30% to 75%	65% to 100%
General Project Data					
Project Scope Description	General	Preliminary	Defined	Defined	Defined
Plant Production / Facility Capacity	Assumed	Preliminary	Defined	Defined	Defined
Plant Location	General	Appropriate	Specific	Specific	Specific
Soils & Hydrology	None	Preliminary	Defined	Defined	Defined
Integrated Project Plan	None	Preliminary	Defined	Defined	Defined
Project Master Schedule	None	Preliminary	Defined	Defined	Defined
Escalation Strategy	None	Preliminary	Defined	Defined	Defined
Work Breakdown Structure	None	Preliminary	Defined	Defined	Defined
Project Code of Accounts	None	Preliminary	Defined	Defined	Defined
Contracting Strategy	Assumed	Assumed	Preliminary	Defined	Defined
Engineering Deliverables					
Block Flow Diagrams	S/P	P/C	C	C	C
Plot Plans		S/P	C	C	C
Process Flow Diagrams (PFD'S)		P	C	C	C
Utility Flow Diagrams (UFD's)		S/P	C	C	C
Piping & Instrument Diagrams (P&ID's)		S/P	C	C	C
Heat & Material Balances		S/P	C	C	C
Process Equipment List		S/P	C	C	C
Utility Equipment List		S/P	C	C	C
Electrical one-line drawings		S/P	C	C	C
Specifications and Datasheets		S	P/C	C	C
General Equipment Arrangement Drawings		S	C	C	C
Spare-parts Listings			P	P	C
Mechanical Discipline Drawings			S/P	P/C	C
Electrical Discipline Drawings			S/P	P/C	C
Instrumentation/Control System Discipline Drawings			S/P	P/C	C
Civil/Structural/Site Discipline Drawings			S/P	P/C	C

² Owner Cost Estimate Reviews, Allen C Hamilton, Final Paper ICEC, 2014



Appendix G1: Comparison of Cost Estimate Classification Practices

AACE Classification Standard	ANSI Standard Z94.0	AACE Pre-1972	Association of Cost Engineers (UK) ACoStE	Norwegian Project Management Association (NFP)	American Society of Professional Estimators (ASPE)
Class 5	Order of Magnitude Estimate -30/+50	Order of Magnitude Estimate	Order of Magnitude Estimate Class IV -30/+30	Concession Estimate	Level 1
				Exploration Estimate	
				Feasibility Estimate	
Class 4	Budget Estimate -15/+30	Study Estimate	Study Estimate Class III -20/+20	Authorization Estimate	Level 2
Class 3		Preliminary Estimate	Budget Estimate Class II -10/+10	Master Control Estimate	Level 3
Class 2	Definitive Estimate -5/+15	Definitive Estimate	Definitive Estimate Class I -5/+5	Current Control Estimate	Level 4
Class 1		Detailed Estimate			Level 5
					Level 6

INCREASING PROJECT DEFINITION

Appendix G2: Estimation Classification Matrix

AACE Estimate Class	End Usage Typical Purpose	ANSI Standard Z94.0
Class 5	Concept Screening	Order of Magnitude (OOM) Estimate
Class 4	Study or Feasibility	Budget Estimate
Class 3	Budget, Authorization, or Control	
Class 2	Control or Bid	Definitive Estimate
Class 1	Check Estimate or Bid	



APPENDIX H: KSIA Load Profiles

KSIA Electricity Consumption FY2024/25					
Month	DEMAND (kVA)	ENERGY CONSUMPTION (kWh)			
		Peak	Standard	Off-Peak	Total Energy
Apr-24	4 784	376 476	949 732	1 095 168	2 421 376 kWh
May-24	4 432	369 564	960 024	1 049 636	2 379 224 kWh
Jun-24	3 532	287 884	768 632	1 008 200	2 064 716 kWh
Jul-24	3 416	339 852	841 488	908 240	2 089 580 kWh
Aug-24	3 940	341 572	908 616	1 065 140	2 315 328 kWh
Sep-24	3 620	312 484	798 812	997 496	2 108 792 kWh
Oct-24	3 956	364 288	898 464	979 612	2 242 364 kWh
Nov-24	4 340	361 100	922 760	999 596	2 283 456 kWh
Dec-24	4 920	377 972	982 272	1 446 552	2 806 796 kWh
Jan-25	4 788	450 548	1 110 900	1 308 888	2 870 336 kWh
Feb-25	5 004	415 200	1 045 760	1 175 876	2 636 836 kWh
Mar-25	5 004	415 200	1 045 760	1 175 876	2 636 836 kWh



Appendix I: CTIA Load Profile

CTIA - Sub Alpha Load - Nov 2024 to Feb 2025		
Month	Period	CONSUMPTION (kW)
	Start	
November	02/02/2024	4 153 kWh
December	01/04/2024	4 375 kWh
January	01/05/2024	4 628 kWh
February	01/06/2024	4 606 kWh
Total		17 761 kWh

Note: CTIA has two PODs
 1 – Sub A feeding from Airport Sub
 2 – Power & Lighting feeding from Airfranc sub

CTIA Energy Consumption			
Period	2021-2022 (kWh)	2022-2023 (kWh)	2023-2024 (kWh)
Apr	4 242 064 kWh	4 595 031 kWh	4 648 954 kWh
May	4 087 742 kWh	4 210 654 kWh	4 255 891 kWh
Jun	4 060 921 kWh	4 435 190 kWh	4 334 110 kWh
Jul	3 907 177 kWh	4 146 184 kWh	4 098 596 kWh
Aug	4 022 214 kWh	4 371 876 kWh	4 234 586 kWh
Sep	4 137 703 kWh	4 382 481 kWh	4 238 919 kWh
Oct	4 083 503 kWh	3 962 854 kWh	4 321 013 kWh
Nov	4 280 681 kWh	4 526 806 kWh	4 787 904 kWh
Dec	3 287 677 kWh	4 489 328 kWh	3 992 433 kWh
Jan	5 615 542 kWh	4 829 864 kWh	4 829 864 kWh
Feb	4 719 034 kWh	5 025 296 kWh	5 025 296 kWh
Mar	4 374 344 kWh	4 259 036 kWh	4 259 036 kWh



Appendix J: ORTIA Load Profile

ORTIA Energy Consumption				
Period	2020-2021 (kWh)	2021-2022 (kWh)	2022-2023 (kWh)	2023-2024 (kWh)
Apr	5 083 560 kWh	6 901 807 kWh	8 004 090 kWh	8 317 090 kWh
May	5 019 480 kWh	6 597 797 kWh	7 574 990 kWh	7 670 340 kWh
Jun	5 462 520 kWh	6 906 536 kWh	8 037 800 kWh	8 067 450 kWh
Jul	5 728 200 kWh	7 194 010 kWh	8 132 440 kWh	7 928 940 kWh
Aug	5 569 880 kWh	7 414 607 kWh	7 773 270 kWh	7 802 215 kWh
Sep	5 588 280 kWh	7 162 899 kWh	7 819 009 kWh	7 802 215 kWh
Oct	6 582 840 kWh	6 775 422 kWh	7 365 260 kWh	7 802 215 kWh
Nov	6 874 680 kWh	7 233 261 kWh	8 305 110 kWh	8 305 110 kWh
Dec	7 218 414 kWh	7 328 749 kWh	7 907 340 kWh	7 907 340 kWh
Jan	6 244 977 kWh	7 592 840 kWh	8 340 000 kWh	8 076 180 kWh
Feb	6 088 051 kWh	7 573 740 kWh	8 489 250 kWh	8 937 510 kWh
Mar	6 033 092 kWh	7 115 880 kWh	7 461 450 kWh	7 461 450 kWh