



AO GEP 08/20

SPECIFICATIONS FOR

The acquisition of a Glove Box/Coating System for Perovskite Solar cells Fabrication

Your speakers :

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GENERAL CONDITIONS:

1. TERMS OF THE CONSULTATION :

ARTICLE 1: OBJECT AND TYPE OF THE TENDER

This consultation has as aim the acquisition of a controlled-atmosphere glove boxes (GB) (drop-on-demand) with a Coating Machine Configuration for the fabrication of Perovskite Solar cells devices, thin films manufacturing and semiconductor research.

ARTICLE 2: REFERENCE DOCUMENTS

2.1 LAW

The contract resulting from this tender will be subject to the Moroccan law.

Any disagreement between Green Energy Park and the Provider shall be settled amicably by cooperation between the two parties; otherwise, litigation will be submitted to the competent court in Rabat unless specific clauses figure in the selling engagement of the supplier, in which case they shall prevail.

2.2 CONTRACTUAL DOCUMENTS

The obligation of the supplier for the performance of works that are the subject of this Tender will result in the whole constituent pieces of the engagement designated as bellow:

- *The contract concluded with its annexes and amendments
- *This Document
- *The orders
- *The submission and, where necessary annexes

After its notification, the engagement will be able to be modified only by amendments or letter exchanges accepted by both contracting sides.

ARTICLE 3: DEADLINE AND PLACE OF SUBMISSION OF TENDER

Tenders must be submitted according to conditions and delays planned by these specifications to the purchasing department by September 24th, 2020 before **12 PM GMT**.

Address of submission: IRESEN

16, Rue Amir Sidi Mohamed – Souissi – Rabat, Morocco

Foreign suppliers must establish a price quotation according to the Incoterm DAP Benguerir, disaggregating the cost of transporting the equipment.

Local suppliers must be able to submit a proposal including the shipping. This latter is their responsibility to the delivery place: Benguerir.



As an institute, Green Energy Park benefits from the UNESCO exemption of customs duties. So, Moroccan companies can submit a proposal without customs duties.

ARTICLE 4: SUBMISSION FOLDER

Any tenderer is required to present a folder of submission containing:

4.1. ADMINISTRATIVE FILE:

This folder must contain:

- A declaration on honor
- Excerpt of K-BIS or the certificate of registration in the commercial register for persons subject to the obligation to register in accordance with the legislation in force
- A certificate or its certified copy of the original issued less than a year ago by the competent administration of the place of taxation certifying that the competitor is in a regular tax situation. This certificate must mention the activity under which the competitor is taxed;
- Company presentation
- The document or documents justifying the powers conferred on the person acting on behalf of the tenderer
- These specifications initialed, signed and sealed

4.2. TECHNICAL OFFER

The supplier's technical offer must comply with, or exceed, the specifications described in article 6 "Tasks and deliverables".

The technical offer must also include the references of the tenderer.

4.3. FINANCIAL OFFER

The detailed price schedule must be clearly specified for the equipment as well as for the maintenance contract.

The offer presented by each tenderer is put in a signed and sealed envelope. This folder contains three (03) envelopes:

- The first envelope: the administrative file. This envelope must be sealed and show, in addition to the information on the envelope, the mention "Administrative file".
- The second envelope: contains the technical offer. This envelope must be sealed and bear, in addition to the indications on the envelope, the words "Technical Offer".
- The third envelope: contains the tenderer's financial offer. This envelope must be sealed and bear, in addition to the information on the envelope, the words "Financial Offer".



ARTICLE 5: PROCEDURE FOR AWARDING

This consultation will be sold following the needs of Green Energy Park. The supplier will be chosen based on the equipment's quality, the respect of the formulated needs in article 6 and the financial offer;

2. SCOPE OF DELIVERY

ARTICLE 6: TASKS AND DELIVERABLES

Main features:

The system must include a coating configuration involving a thermal evaporator, a spin coater, a solar simulator, an IV unit, a scale and a hot plate all inside glove box for the fabrication of perovskite solar cells.

Lot 1: Glove Box

The Glove box must provide an absolute control of the gas atmospheres inside the box and an absolute separation of the inside of the box from the outside laboratory environment. The Glove box must be controlled-atmosphere box with an inert gas atmosphere since an oxygen-free atmosphere is necessary to avoid the degradation of the perovskite cells to obtain high efficiency solar cells devices. In addition, the Glove box is needed to protect the inside of the box from common environmental particulates, and to protect laboratory personnel and the surrounding environment from contamination with hazardous and toxic materials such as lead.

It must include:

1. Wet Coating Glove Box (without main Antechamber):

- Design: single-sided glovebox
- Dimensions workspace: Inside depth: 780 (750) mm, Inside height 900 mm, length 1250 (1200) mm
- Specifications:
 - All-welded stainless-steel enclosure
 - Castors for easy moving and fixed levelers to level and stabilize the glovebox
 - Window Scratch resistant polycarbonate
 - 2 Glove ports, 220 mm diameter, O-ring sealed
 - Gloves Butyl, thickness 0.4 mm
 - Front panel with LED lighting (Light Fluorescent lamp)
 - 3 Adjustable shelves hanged on the back (Stainless Steel)
 - High efficiency particulate air (HEPA) dust filters installed on purifier inlet and outlet
 - 4 Feedthroughs (Aluminium, single-sided) and 1 electrical (230V, 1 ph)
 - Minichamber on the right side (Dia.100 (150) mm, length 300 (330) mm) (Type: 1/3 inside, 2/3 outside the box; Operation: manual, 3-way valve Incl. sliding tray)
 - Working gas Nitrogen, Argon and Helium
 - Conform to CE (conformité européenne)

- Optional
- Spin Coater system (lot 6) might need integration at the bottom of the Glove Box depending on the spin coater purchased. This specification must be added as an option in the offer.
- Gas Purification:
 - H₂O content, & O₂ content < 1 ppm; Leakage rate < 0.05 Vol%/h s
 - PLC controller with color touch panel (English as main Language)
 - 0-60 CFM continuously variable blower, with frequency controlled; vibration dampened, without heat load generation.
 - Automatic pressure control w/ Foot Switch (\pm 15mbar)
 - Negative and/or positive pressure operation
 - Oxygen, moisture sensors and purge function included
 - Vacuum Pump: Rotary vane pump with 10 CFM equipped with oil mist filter, with gas ballast control; flow rate: 12 (17) m³ / h.
 - Simultaneous purification and regeneration
 - Stainless Steel Piping
 - Closed loop recirculation
- Purifier unit (auto purging system)
 - Unit for inerting (purging) of the workspace with inert gas Operation: via operation panel of the gas purifier Valves PLC-controlled
 - Flow rate: max. 200 l/min; incl. manual regulation valve for reduction of the gas flow
 - Oxygen removal: (20- 36) l (standard conditions), Moisture removal: (1350-2600) g
 - Purging ON / OFF
- Unit for removal of solvent contaminations
 - A minimum of five (5) kg carbon reagent capacity
 - The solvent removal system shall have an isolation valve, evacuation capabilities, and a vacuum gauge to allow for changing the solvent removal reagent without contaminating the glove box atmosphere.

2. Connecting Antechamber:

- T Type Vacuum chamber with size close to 390 x 600 mm, and Leak Rate 10^{-5} mbar l/s
- Automatic evacuation/refill/ pressure controlled
- Operated on Touch Panel
- Including sliding tray
- Auto control of cycles
- Intermediate vacuum for refill
- Ultimate vacuum

3. Vacuum Coating Glove Box (without main Antechamber):

- Design: single-sided glovebox

- Dimensions workspace: Inside depth: 780 (750) mm, Inside height 900 mm, length 1800 (2000) mm
- Specifications:
 - All-welded stainless-steel enclosure with polycarbonate window
 - Castors for easy moving and fixed levelers to level and stabilize the glovebox
 - Window Scratch resistant polycarbonate
 - 4 Glove ports, 220 mm diameter, O-ring sealed
 - Gloves Butyl, thickness 0.4 mm
 - Front panel with LED lighting (Light Fluorescent lamp)
 - Adjustable shelves hanged on the back (Stainless Steel)
 - High efficiency particulate air (HEPA) dust filters installed on purifier inlet and outlet
 - 6 Feedthroughs (Aluminium, single-sided) and 1 electrical (230V, 1 ph) (adjustable depending on the thermal evaporator integration)
 - Minichamber on the right side (Dia.100 (150) mm, length 300 (330) mm) (Type: 1/3 inside, 2/3 outside the box; Operation: manual, 3-way valve Incl. sliding tray)
 - Working gas Nitrogen, Argon and Helium
 - Conform to CE (conformité européenne)
- Gas Purification:
 - H₂O content, & O₂ content < 1 ppm; Leakage rate < 0.05 Vol%/h s
 - PLC controller with color touch panel (English as main Language)
 - 0-60 CFM continuously variable blower, with frequency controlled; vibration dampened, without heat load generation.
 - Automatic pressure control w/ Foot Switch (± 15mbar)
 - Negative and/or positive pressure operation
 - Oxygen, moisture sensors and purge function included
 - Vacuum Pump: Rotary vane pump with 10 CFM. Rotary vane vacuum pump, equipped with oil mist filter, with gas ballast control; flow rate: 12 (17) m³ / h. (oil mist filter included)
 - Simultaneous purification and regeneration
 - Stainless Steel Piping
 - Closed loop recirculation
- Purifier unit (auto purging system)
 - Unit for inerting (purging) of the workspace with inert gas Operation: via operation panel of the gas purifier Valves PLC-controlled
 - Flow rate: max. 200 l/min; incl. manual regulation valve for reduction of the gas flow
 - Oxygen removal: (20- 36) l (standard conditions), Moisture removal: (1350-2600) g
 - Purging ON / OFF

4. Installation

- Exhaust airflows must be installed with a height of 10.45 ±1m from the lab.



Lot 2: Thermal Evaporator

The evaporator will be used mainly to deposit electrodes on the top of perovskite cell.

- Moisture, contamination and atmospheric control
- Sample size up to 100 mm x 100 mm (if only 50 mm x 50 mm is available it is acceptable)
- Number of sources: at least 3 type (two metal source and one organic source), Boat-type Thermal Evaporator
- Source Shuttles
- Sequential and co-deposition
- Glovebox integrated System
- Substrate holders for different device size
- Layer uniformity $< +/-5\%$
- Temp. range up to 1200°C/ 1400°C for metals
- QCM Rate monitor
- Pre-vacuum Pump and Vacuum Pump
- PC and software with complete control over each element of the deposition process for the evaporator that provides an auto-sequence mode and a manual mode. (if only manual mode is available it is acceptable)
- Basic substrate carrier/ Basic shadow mask/ basic back panel/ spacer layer/ and a designed shadow mask (designed following a discussed layout and compatible with the IV unit)
- Power feedthrough 230V, 1 ph

Lot 3: Solar Simulator and IV unit

1. Solar Simulator

- Software for control of light engine.
- LED-based light source
- Glovebox integrated (might need an upgrade for Solar Simulators Test Windows at the bottom of the Glove Box)
- Recirculation chiller for continuous illumination and fast cycle times ensuring long cycle life of light source
- Spectral match class A++ (AAA)
- Long exposure time for high-efficiency solar cells
- Non-uniformity for intensity $< 2\%$ (uniformity class A).
- Minimum Test area: 51x51mm,
- Solar Simulator Input: 220 VAC
- Line Regulation: 0.01 Percent
- Intensity instability of less than 2%
- The range of attenuation is from 0.75 - 1.25 SUN
- Spectral range from 360 nm up to 1,100 nm.
- Air Mass 1.5G Filter.



2. IV unit

The IV unit is used to characterize photovoltaic devices.

- Computer (PC) and a software to measure the current-voltage curve of a solar cell and then automatically calculates key device properties.
- Parallel JV and stability measurements.
- The temperature of the samples can be controlled.
- Substrate Compatibility: Cell Holder Compatible with the evaporator mask.
- Perform I-V measurements between -10 V and 10 V, with voltage step sizes as low as 333 μ V.
- Measure low currents with an accuracy of ± 10 nA, or high currents up to ± 150 mA.
- Hysteresis I-V option
- Dark current measurement function
- Test data can be output as TXT file and/or .csv file

Lot 4: Precision Balance

The scale will be used to measure the powders needed to prepare the solution for the Perovskite Layer deposition inside the glove box to avoid the contamination of the users and the oxidation of the powders because of air and moisture.

- Stainless steel weighing plate
- Splash Proof Keyboard and Display
- Fully Automatic Self-Calibration
- Touch Calibration
- Easy access Door
- Readability < 0.1 mg
- Pan Size: 90 mm
- Repeatability / Std Dev: 0.0001 g / 0.00002 g
- Weighing capacity measuring range >110g
- Short stabilization time: Steady weight values (approx. 3 sec laboratory conditions)
- LCD display
- Operation in N₂ or Argon atmosphere possible
- Controller Input Voltage: 220V

Lot 5: Hot Plate

The hot plate will be used to anneal the fabricated perovskite samples at the desired temperature inside the glove box.

- Stirring Range: 100 to 1500 rpm
- Shape: Square; Size: 260 x 260 mm
- Dimensions close or similar to: (L x W x H): 415 x 300 x 105mm



- Fixed safety circuit of 550 °C
- Hot Top indicator warning to prevent burns
- Exact temperature setting via digital display (LED)
- Digital error code display
- Control panel for protection against leaking liquids
- Operation in N₂ or Argon atmosphere possible
- Timer function (switch off)
- High uniformity
- Power: 230VAC, 1ph, 50/60Hz

Lot 6: Spin Coater

The spin coater will be used as a wet deposition technique to fabricate the perovskite layer.

- Max Spin Speed: 10,000 RPM
- Speed Resolution: 1 RPM
- Max Spin Time: 3,000 S
- Time Resolution: 1 S
- Chuck diameter: as small as 5 mm up to Ø150 mm (4" x 4" substrates)
- Resistant Transparent Lid
- Power: 200-230V, 1 Phase

Nb: All the requirements cited before are necessary, nevertheless, the provider should absolutely include any other necessary aspects for an efficient installation and operation under the European standards even though they are not cited or specified in this document.

PS: The system can be purchased as one whole system to facilitate the integration and installation of the Equipment. However, it can also be separated and purchased individually, if needed. The supplier has the choice to submit an offer for one lot or several lots.

ARTICLE 7: WARRANTY PERIOD

The equipment and all accessories are warranted on Green Energy Park facilities for **two years** starting from the end of installation, including spare parts and labor ;

Spare parts:

The equipment should be delivered with spare parts deemed necessary for use of at least 1 year.

ARTICLE 8: MAINTENANCE

The offer must contain 3 years maintenance contract after the warranty period, containing:

- Annual Preventive Maintenance Visit
- Spare parts



- Telephonic support and advice
- Annual software update
- Travel

All services and parts mentioned above will have to be delivered to the Green Energy Park facilities (transport and accommodation costs on the supplier's charges).

During the warranty period and maintenance engagement, the whole fees will be charged on the supplier or its representative and include supply of spare parts, labor and transportation fees, accommodation and living expenses.

ARTICLE 9: INSTALLATION AND COMMISSIONING

All the elements required for the installation of the equipment and for its commissioning must be provided by the supplier. Installation, commissioning, good performance and training must be carried out within the deadlines mentioned in Article 12 of these specifications, with the consequences mentioned in case of non-respect of deadlines.

ARTICLE 10: TRAINING

The training must be provided by the installation engineer in Green Energy Park offices in Benguerir on the supplier's charges.

ARTICLE 11: TECHNICAL DOCUMENTATION

The supplier commits to provide, upon delivery, all the necessary documentation for the use, repair and all the technical documentation of the system including the usage software in English, and if available, in French.

ARTICLE 12: TERMS AND EXECUTION CONDITIONS

The equipment must be delivered within a maximum period of 22 weeks from receipt of the purchase order.

If the delivery delay is other than 22 weeks, it must be specified on the offer.

ARTICLE 13: LATE PENALTIES

In case of exceeding the execution time specified in article 12, the supplier is liable to a penalty of 1‰ of the contract amount per day of late, with a maximum cumulative flat rate of 10% of the engagement amount, beyond which are applied dispositions of article 17.

ARTICLE 14: RECEPTION – VERIFICATION

a) Verification

The verification of the equipment subject of this order will take place in Green Energy Park facilities; they will be performed under the supervision of the project leader.

No delivery even if partial is accepted if the whole equipment does not respect the order form.



b) Reception

The reception and installation of the equipment with all components must be done within a period not exceeding one month (30 days).

The final acceptance will be pronounced with Green Energy Park satisfaction according to the following points:

- Installation of the main equipment and its accessories
- Verification of the conformity of the equipment with the purchase order
- Training of Green Energy Park team staff

ARTICLE 15: PAYMENT CONDITIONS

The payment will be made on 30 days end of month after receiving the invoice and the final acceptance receipt.

The Supplier must produce a commercial numbered invoice established in 03 copies signed, dated on letters written. It must indicate the references of the contract of the related order.

These invoices must be addressed to Green Energy Park's Accounting department, located at 16, Rue Amir Sidi Mohamed Souissi, Rabat-Morocco.

ARTICLE 16: HOLDBACK

A 10% holdback is provided upon the purchase of equipment that will be released after the warranty period.

ARTICLE 17: CONTRACT CANCELATION

Regardless of expected cases of common Law, the Contract resulting from these specifications may be terminated with plain rights by Green Energy Park, with Recipient faults, and after formal notice by registered letter within a period of 20 days in the following cases:

- ▶ Fraudulent acts relating to the nature, the quality and reliability of the equipment and services covered by these specifications
- ▶ In case of exceeding the maximum flat rate of late penalties as indicated in article 12.

ARTICLE 18: RISKS INSURANCE

The Supplier declares to be covered by a professional civil insurance against the risks that he incurs during his activity and throughout the duration of the execution of this contract. This insurance must cover all risks that encounter his staff at Green Energy Park. The Client reserves the right to request copies of the insurance policy or certificate of cover.