



TERMS OF REFERENCE For the

SUPPLY, DELIVERY AND TESTING OF SOLAR RADIATION MONITORING EQUIPMENT

A. BACKGROUND

Measurement of solar radiation is important for a wide range of applications such as agriculture, electricity generation, engineering and architecture among others. Further, it is also essential in monitoring the effects on plant growth, analysis of evaporation and irrigation, design of solar heating systems, predictive models of weather and climate and many other applications.

B. OBJECTIVE

The National Solar Radiation Center (NSRC) of PAGASA has initiated for the network expansion and to update its solar radiation monitoring system network by upgrading of equipment that will be installed to the designated synoptic and agromet stations. Some stations will be gathering and transmitting data every 15 minutes intervals. The stations are the following:

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|---------------------------|-------------------------|
| 1. UPLB | 6. Legazpi |
| 2. CLSU, Muñoz | 7. Dumaguete |
| 3. Ambulong | 8. Iloilo |
| 4. Tuguegarao | 9. Davao |
| 5. San Ildefonso, Bulacan | 10. General Santos City |

C. APPROVED BUDGET FOR THE CONTRACT

The Approved Budget for the Contract (ABC) is **TWO MILLION THIRTY THREE THOUSAND THREE HUNDRED PESOS ONLY (Php2,033,300.00)** inclusive of VAT and other applicable taxes prescribed by law.

D. TECHNICAL SPECIFICATIONS

10 units Pyranometer

Specifications:

ISO 9060
WMO performance level

spectrally flat Class C pyranometer
second class pyranometer
moderate quality pyranometer



Calibration uncertainty	< 2.4 % (k = 2)
Calibration traceability	to WRR
Spectral range	285 to 3000 x 10 ⁻⁹ m
Rated operating temperature range	-40 to +80 °C
Analogue output	millivolt
Sensitivity (nominal)	10 x 10 ⁻⁶ V/(W/m ²)
Response time (95%)	18 s
Sensitivity range	7 to 30 x 10 ⁻⁶ V/W/m ²
Zero offset a (response to 200 W/m ² net thermal radiation)	< 15 W/m ²
Zero offset b (response to 5 K/h change in ambient temperature)	< ± 4 W/m ²
Non-stability	< ± 1 % change per year
Non-linearity	< ± 1 %
Directional response	< ± 25 W/m ²
Spectral selectivity	< ± 5 %
Temperature response	< ± 3 % (-10 to +40 °C)
Tilt response	< ± 2 % (0 to 90 ° at 1000 W/m ²)
Field of view angle	180°
Measurement range	0 to 2000 W/m ²
No sun shield required	
Bubble level must be on the pyranometer for levelling purposes	
Pyranometer shall come with a unique ball levelling mechanism (instead of levelling feet) for quick and easy levelling of pyranometer	

10 rolls CABLE-25

Specifications:

Cable, 25 m length, with female M12-A connector at sensor end
Contacts: 5
Shield
Molded cable
IP67

20 units DATALOGGER / HANDHELD READER

Includes carrying case and USB cable

With 10 boxes of AA alkaline batteries (24 pieces/box, high end)

Specifications:

Output on display
Input
Conversion
Display definition
Display refreshment rate
Calibration uncertainty
Temperature dependence

heat flux solar radiation
analogue voltage
division by the sensor sensitivity
4 digits with sign
1 s⁻¹
0.1 %
< 0.5 % + 3 x 10⁻⁶ V
over rated range



Sample rate	2 s^{-1}
Rated input range	$6.25 \text{ to } 200 \times 10^{-3} \text{ V}$ (selectable)
A/D conversion	16 bits
Stored measurement definition	minimum maximum and average over storage interval with conversion to W/m^2
Storage capacity	3518 measurements
Storage interval range	2 to 65535 s (selectable)
Battery type	2 x AA
Internal power supply voltage	3 VDC
Rated operating temperature range	-10 to +40 °C
System requirements for use with PC	Windows XP and higher
Connection to PC	USB 1.1 / 2.0 low speed
Connection to sensor	2 x (female chassis plug for 4 mm banana with screwed signal wire clamp)

E. DELIVERY

The winning bidder must supply, deliver and test solar radiation equipment for a period of **Sixty (60) calendar days**, commencing upon receipt of the Notice to Proceed (NTP). The delivery must be free of charge and inclusive of all government taxes. All the equipment must be delivered to PAGASA Science Garden Compound, Senator Miriam P. Defensor-Santiago Avenue, Brgy. Central, Quezon City.

The winning bidder must inform the end-user in writing of the schedule of their delivery at least three (3) working days prior to the delivery date. This is to allow the end-user sufficient time to notify the PAGASA Inspection Team.

F. INSPECTION, TESTING AND ACCEPTANCE

The winning bidder shall deliver and test the item to determine its functionalities, benefits, and compliance with the standard specifications. This must be done in the presence of the End User. All other deliverables mentioned above shall be checked by the PAGASA Inspection Team and must be complied with by the winning bidder before the final acceptance of the equipment.

Testing will be conducted at the NSRC and the End User shall have the right to reject and return the unit(s), if unit(s) delivered are defective, incomplete, or non-compliant to the specifications herein specified.



G. DOCUMENTATION

On the day of delivery, the winning bidder must provide a Warranty Certificate covering the equipment delivered.

H. WARRANTY

All equipment shall be warranted by the winning bidder for two years. The winning bidder shall provide replacement of new units within 30 calendar days from the date of notification for all defective and factory defect equipment at no cost to PAGASA. The winning bidder shall arrange and pay for the return of the defective unit(s) and the shipping of new replacement unit(s) to PAGASA.

