

Solar Resource Mapping in Pakistan

SITE INSTALLATION REPORT

July 2015



This report was prepared by [CSP Services](#), under contract to [The World Bank](#).

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This document is an **interim output** from the above-mentioned project. Users are strongly advised to exercise caution when utilizing the information and data contained, as this has not been subject to full peer review. The final, validated, peer reviewed output from this project will be the Pakistan Solar Atlas, which will be published once the project is completed.

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CSPS Technical Documentation

**ESMAP Tier1 Meteorological Station
Installation Report:
NUST University, Islamabad, Pakistan**



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CSPS Technical Documentation

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Summary

The CSP Services (CSPS) ESMAP Project Tier1 meteorological station CSPS.MT.14.214 has been installed and tested for its correct operation by CSPS scientific staff between Oct. 23rd and 25th, 2014. The station has been installed and commissioned on the roof of the exams hall building at the National University of Science and Technology (NUST) campus in Islamabad, Pakistan (33.642°N, 72.984°E).

The station is fully operational and taking the measurement values listed in the section below. It is equipped with a Solys2 Tracker with a CHP1 pyrhelimeter and two ventilated CMP21 pyranometers for global and diffuse irradiation measurement (all manufactured by Kipp&Zonen), a Campbell Scientific CR1000 data logger, temperature and relative humidity sensor and barometric pressure sensor.

A wind tower is installed at the station. The wind speed and wind direction sensors (manufactured by NRG) are on a total height of 8 m above the roof top (due to reduced available area on the rooftop and resulting difficulties with guy wire lengths).

All sensors are integrated into the Tier1 meteorological data acquisition system.

Power supply is provided by NUST. It consists of a 230 VAC surge-protected power grid connection. The measurement system includes a UPS and batteries for continuing operation of at least 24 h in case of main power failure.

Station maintenance will be done by local staff of NUST. The local personnel have been briefed on how the maintenance has to be done. The main task is to clean all three irradiance sensors on a daily basis. Upon request, further tasks as checking the levelling of the sensors, stability of the equipment, etc. might be carried out. Regular inspection and maintenance visits will be performed on a six-monthly interval by the company PITCO, local partner of the ESMAP solar vendor consortium.

Calibration certificates for the installed sensors will be handed over to Alternative Energy Development Board of Pakistan (AEDB) and World Bank (WB) together with the station documentation and manual.

Data retrieval will be done by CSPS via GPRS data transmission on a daily schedule, starting with the first day after installation; data will be provided to AEDB, WB and approved stakeholders on a daily basis by email in Excel format as well as on a data publication platform provided by WB.

Completed Tasks

1. Mounting post and measurement control box installed, battery box connected to the main control box.
2. Main control box connected to 230 VAC power supply.
3. Solys2 tracker and irradiance sensors installed, connected, levelled and aligned.
4. 10 m wind mast with wind speed and wind direction sensors installed and connected, wind direction sensor oriented towards north.
5. GPRS connection to CSP Services server installed and verified. SIM card with dynamic IP provided by Telenor.
6. Irradiation sensors cleaned.
7. Measured parameters checked for correctness of values.
8. Maintenance and cleaning instruction given to the attending staff.
9. Site surroundings analyzed for possible external influences on the measurement data.

Pending Tasks

- Fence with door around the perimeter (will be installed by NUST)

Measured Meteorological Parameters and Instruments

- Global horizontal irradiance (GHI) in W/m^2 : Kipp&Zonen CMP21 Pyranometer with CVF4 ventilation unit
- Diffuse horizontal irradiance (DHI) in W/m^2 : Kipp&Zonen CMP21 Pyranometer with CVF4 ventilation unit
- Direct normal irradiance (DNI) in W/m^2 : Kipp&Zonen CHP1 Pyrheliometer
- Wind speed in m/s : NRG #40 Anemometer
- Wind direction in $^\circ\text{N}$: NRG #200 Wind vane
- Barometric pressure in hPa : Setra 278
- Ambient temperature in $^\circ\text{C}$: Campbell Scientific CS215
- Relative humidity in %: Campbell Scientific CS215

(Serial numbers see below table)

Installation Details and Comments

Site: NUST University Campus, Islamabad, Pakistan		Date of installation: 2014-10-25		
Coordinates: 33.651°N, 73.158°E (WGS84)				
Station SN#: CSPS.MT.14.214		Tracker SN#: Solys2 140073		
Control Box SN#: CSPS.CA.14.207.0002		CHP1 SN#: 140126		
Battery Box SN#: CSPS.CA.14.208.0002		GHI CMP SN#: 140308		
		DHI CMP SN#: 140326		
Component		Checked/ approved		Comments
		yes	no	
Founda- tions, fence	Foundations correctly prepared	x		Fence will be installed by NUST
	Threaded bolts correctly prepared	x		
	Fence correctly prepared		x	
	Door can be locked		x	
Tracker Support and Control box	Fixed to ground and leveled	x		
	Control box installed and secured	x		
	Grounding cable connected	x		
	All bolts tightened	x		
Maint. Plat- form	Platform installed and fixed to ground	x		
	Platform leveled	x		
	All bolts tightened	x		
	Warning signs attached	x		
Wiring, ca- bles	Visual examination	x		
	Fuses ok	x		
	Power cable connected	x		
	All sensors connected	x		
	All cables orderly fixed	x		
Tracker	Mounted to tracker stand	x		
	Horizontally leveled	x		
	Sun Sensor installed	x		
	Azimuth and elevation adjusted	x		
	Sensors installed and aligned	x		
	Cables attached to sensors & tracker	x		
	Cables properly installed	x		
T _{amb} / RH	Irradiation shield fixed to platform	x		Model: CS215 SN#: E12538
	Sensor probe with filter cap inserted	x		
	Sensor Serial No.	x		
	Cable connected to control box	x		
Pressure sensor	Mounted inside control box	x		Model: Setra 278 SN#: 5948998
	Pressure exchange tube to outside box	x		
	Cables connected	x		

Component		Checked/ approved		Comments
		yes	no	
Solar PV panel	Fixed to PV mounting bar Inclination angle Facing south? Visual examination (no cracks, clean) Operability (V>12 V in sunlight) Cable connected to panel and box			N/A
Wind tower, wind speed and direction sensors	Tower extended Guy wires safely attached and tense Grounding cable connected Wind sensors installed Wind direction sensor serial No. Wind speed sensor serial No. North orientation of WD sensor Cable fixed to sensors, tower and box Operability of sensors	x x x x x x x x x		Extended to length of ~8 m (wire length restrictions due to smaller area on roof) Model: NRG#200 SN#: N/A Model: NRG#40C SN#: 1795-00229373
Modem	SIM card inserted APN, username, password of provider LED blinking code Signal strength (AT+CSQ)	x x x x		Provider / number: Telenor APN: internet Username: Telenor Password: Telenor AT+CSQ value: 28,0
Datalogger	Operation system installed Datalogger configuration saved IP visible in logger configuration Correct sensor constants in program Correct coordinates in program Datalogger program installed Program set to "run always" Datalogger clock correct Measurement values present Measurement values plausible Error detection codes functional	x x x x x x x x x x x		Version: Std.27 Filename: Pk-Isb_2014-10-25.xml IP: 10.65.118.169 (dynamic) Prog. name: Pk-Isb_2014-10-25.CR1 Local standard time, no daylight saving time: UTC+5 Checked with error codes list
Installation performed by (person): Birk Kraas (CSP Services), Muhammad Umer Kamal (PITCO)				

Site Layout

See site layout drawing

Photographs of sensors and mountings



Figure 1: Wind Speed and Direction Sensor



Figure 2: Solar tracker with shading ball assembly, without sensors



Figure 3: CMP21 close-up, w. heating element of vent. unit



Figure 4: CMP21 w. CVF4 ventilation unit



Figure 5: CHP1 on tracker



Figure 6: Sun sensor for active tracking control



Figure 7: Temperature sensor in protective case (white), GPRS antenna (black)



Figure 8: Setra 278 pressure sensor



Figure 9: Control box with datalogger, UPS and electric equipment



Figure 10: Backup battery box



Figure 11: Datalogger



Figure 12: Circuit breaker and power surge protection



Figure 13: Tracker mounting



Figure 14: Wind sensors on mast close-up



Figure 15: Tracker support and maintenance platform

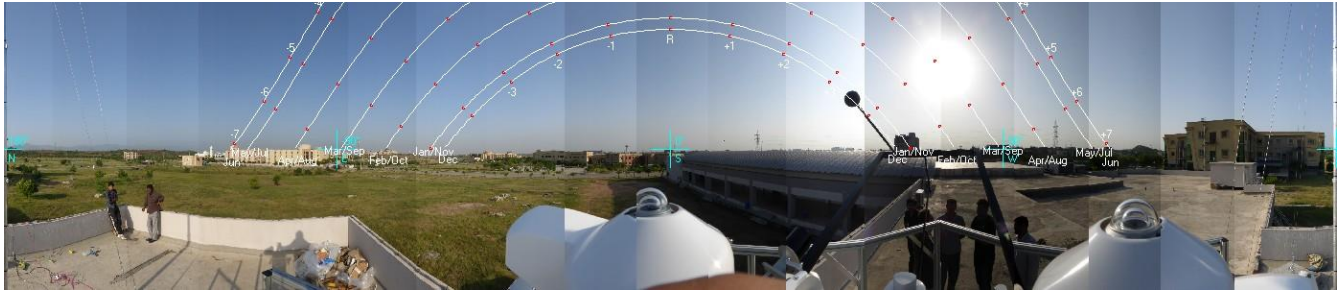


Figure 16: Wind tower base



Figure 17: Site overview

360° view from the solar tracker with sun paths throughout the year



Only minor and uncritical influences by obstacles near horizon at sunrise and sunset, as predicted in site evaluation report.