

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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Washington DC 20433
Telephone: +1-202-473-1000
Internet: www.worldbank.org

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CSP Services GmbH, Köln, Germany

CSPS Technical Documentation

**ESMAP Tier1 Meteorological Station
Installation Report:
Quaid-e-Azam Solar Park, Punjab, Pakistan**



Responsible Authors

Birk Kraas
Roman Affolter

Author Contact Information:
CSP Services GmbH
Friedrich-Ebert-Ufer 30
51143 Köln/Cologne, Germany
E-Mail: b.kraas@cspservices.de

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CSP Services
Concentrating Solar Power Services

CSP Services GmbH, Köln, Germany

CSPS Technical Documentation

CSP Services GmbH

Office Cologne:

Friedrich-Ebert-Ufer 30, 51143 Cologne, Germany

Phone: +49 2203 959003 0

Office Almería:

Birk Kraas, Roman Affolter

Paseo de Almería 73 – 2º, 04001 Almería, Spain

Phone: +34 950 27 89 92

b.kraas@cspservices.de

r.affolter@cspservices.de

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Summary

The CSP Services (CSPS) ESMAP Project Tier1 meteorological station CSPS.MT.14.213 has been installed and tested for its correct operation by CSPS scientific staff between Oct. 15th and 17th, 2014. The station has been installed and commissioned on the roof of the central office at Quaid-e-Azam Solar Park (QASP) in Bahawalpur, Punjab Province, Pakistan (29.325°N, 71.819°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 pyrheliometer 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 10 m above the roof top.

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

Power supply is provided by QASP. It consists of a 230 VAC surge-protected main 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 QASP operating company. 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

None, works completed

Measured Meteorological Parameters

- 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

Inspection Details and Comments

Site: Quaid-e-Azam Solar Park, Bahawalpur, Pakistan		Date of installation: 2014-10-17		
Coordinates: 29.325°N, 71.819°E		Tracker SN#: Solys2 140072		
Station SN#: CSPS.MT.14.213		CHP1 SN#: 140125		
Control Box SN#: CSPS.CA.14.207.0001		GHI CMP SN#: 140325		
Battery Box SN#: CSPS.CA.14.208.0001		DHI CMP SN#: 140324		
Component		Checked/ approved		Comments
		yes	no	
Founda- tions, fence	Foundations correctly prepared	x		No fence required, guarded non-public site
	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#: E12539
	Sensor probe with filter cap inserted	x		
	Sensor Serial No.	x		
	Cable connected to control box	x		

Component		Checked/ approved		Comments
		yes	no	
Pressure sensor	Mounted inside control box	x		Model: Setra 278 SN#: 5948996
	Pressure exchange tube to outside box	x		
	Cables connected	x		
Solar PV panel	Fixed to PV mounting bar			N/A
	Inclination angle			
	Facing south?			
	Visual examination (no cracks, clean)			
	Operability (V>12 V in sunlight)			
Wind tower, wind speed and direction sensors	Cable connected to panel and box			Extended to length of 10 m Model: NRG#200 SN#: N/A Model: NRG#40C SN#: 1795-00229372
	Tower extended	x		
	Guy wires safely attached and tense	x		
	Grounding cable connected	x		
	Wind sensors installed	x		
	Wind direction sensor serial No.	x		
	Wind speed sensor serial No.	x		
	North orientation of WD sensor	x		
	Cable fixed to sensors, tower and box	x		
Operability of sensors	x			
Modem	SIM card inserted	x		Provider / number: Telenor
	APN, username, password of provider	x		APN: internet Username: Telenor Password: Telenor
	LED blinking code	x		
	Signal strength (AT+CSQ)	x		AT+CSQ value: 26,0
Datalogger	Operation system installed	x		Version: Std.27
	Datalogger configuration saved	x		Filename: Pk-QASP_2014-10-16.xml
	IP visible in logger configuration	x		IP: 10.233.177.227 (dynamic)
	Correct sensor constants in program	x		
	Correct coordinates in program	x		
	Datalogger program installed	x		Prog. name: Pk-QASP_2014-10-17.CR1
	Program set to “run always”	x		
	Datalogger clock correct	x		Local standard time, no daylight saving time: UTC+5
	Measurement values present	x		
	Measurement values plausible	x		
	Error detection codes functional	x		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

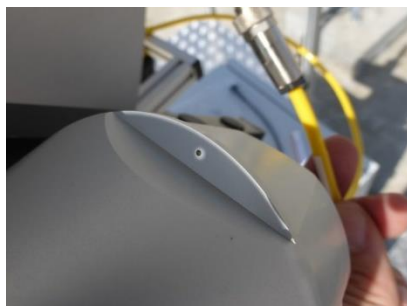


Figure 5: CHP1 alignment target



Figure 6: Sun sensor for active tracking control



Figure 7: Temperature sensor in protective case



Figure 8: UPS and 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 breakers and automatic switches



Figure 13: Tracker mounting

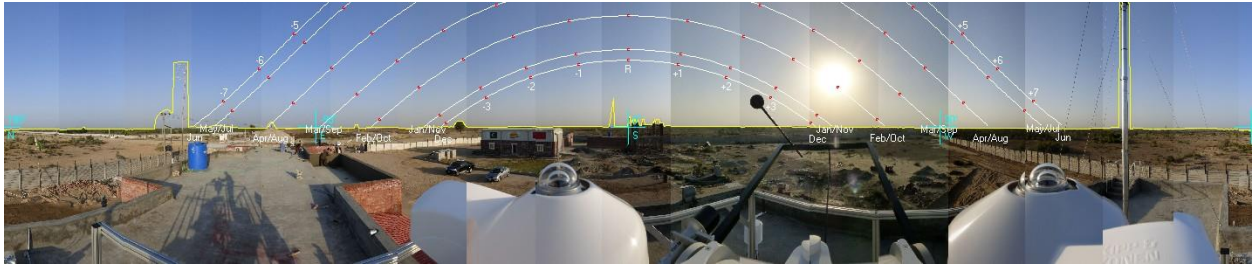


Figure 14: Tracker support and maintenance platform



Figure 15: 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.