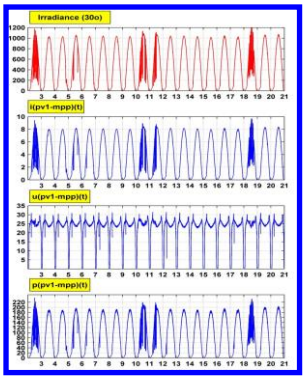
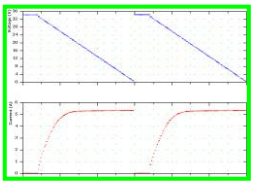
• PV Module Long Term Testing

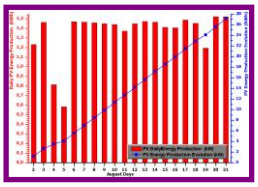
The aim of the PV Module Long Term Testing is the investigation of the PV Module annual energy yield, in various locations (under real conditions), as well as the temperature coefficients calculation.

Test procedure:

- Two PV module pairs (up to 350W each one and with maximum current and voltage values 12A and 145V respectively) are measured in parallel field tests. One third module of each pair is stored in darkness and serves as a comparison module. The PV modules are installed in an optimal inclination and orientation angle. The CRES premises direct distance from the sea is 6km.
- Every 15 seconds the PV module short-circuit current and open circuit voltage as well as the current and voltage at the MPP are measured and recorded, while the PV module entire voltage and current characteristic curves are captured in 1 min intervals (one minute cycle). Between two successive measurements the PV modules forced to work near to the MPP for high irradiation levels. In addition, the irradiance on module level and the rear module surface temperature and well as the field meteorological data are measured and recorded in the same time stamp (15 seconds).
- All instant measurements are saved in memory card in order to be processed on PC. A ten-minutes average is calculated and it will be available for the customer. The annual energy yield calculation will be provided at the end of the measurement period. The data are available as ASCII files. The period of measurement is at least one year).







Testing Equipment:

	Equipment	Accuracy
PV Module Electrical Characteristics: **Measurement of : I_{SC}, I_{MPP}, U_{OC} and U_{MPP}** **Capture of: $i_{PV}(t)$ & $u_{PV}(t)$**	Maximum voltage measure capability: $145V_{DC}$ Maximum current measure capability: $12A_{DC}$ Custom voltage & current scale adjustment capability Electronic load for the I-V characteristic capture	I_{MPP}, I_{SC},V_{MPP}, V_{OC}: ±1% at STC (estimated accuracy)
T_{Mod} Rear surface temperature	Foil sensor platinum, pt 100 class B	± 0.3K + 0.005 x |t|
I-V-curves at outdoor conditions	$i_{PV}(t)$ & $u_{PV}(t)$ measuring points: 150 (for each one) PV module measurement period:≈ 600ms	Data logger Measured values resolution (V_{PV}, I_{PV}): 16 Bit
Irradiance - global, diffuse	Global: Kipp&Zonen pyranometer CM11	(secondary standard according to the classification of WMO)
	Diffuse: Kipp&Zonen pyranometer CM11 mounted on a shadow ring stand	(secondary standard according to the classification of WMO)
Irradiance - direct	Kipp&Zonen pyrheliometer CH11 mounted on a 2 axis solar tracker, sci-tecinstruments	(first class)
Irradiance in the module plane Reference cell	ISET Sensor (mono/poly crystalline & amorphous)	< ± 4% crystalline < ± 5% amorphous
$T_{Reference\ cell}$	Pt1000 (embedded in ISET Sensor)	± 0,315K + 0,002 x |t| < +/- 0,5°C
Ambient temperature T_{amb}	Delta OHM-HD9009TR	±0.1%
Wind velocity, Wind direction	NRG 40 Anemometer	± 0.1 m/s
	F460 Wind Direction	$\pm 2^{o}$
Relative Humidity	Delta OHM-HD9009TR	±2%
Air pressure	Vaisala PTB 101B Analog Barometer	±1.5 hPa (20°C)
Data logger	CAMPBELL SCIENTIFIC 3000 SERIES	Measured values resolution: 16 Bit