ST-engineering

More value for your energy

www.st-ingegneria.com

EN

ST-engineering

January 2024

Who we are

ST Engineering is born in 2005 by the will of the Eng. Simone Tarantini, electronic engineer, with the strong passion for the renewable energies. Since then active in the field of photovoltaic system, we have designed and realized more than six hundred installations mainly in the South of Italy.

The know-how acquired during our decades of experience has enabled us today to operate in a strategic sector as delicate as is that of the analysis and the maintenance of large-scale renewable energy installations. Our specialized analyses carried out with sophisticated electronic instrumentations are offered to the public and private clients who want to have a valid support on the territory for the study and the analysis of the technical problems found on their own photovoltaic installations due to breakdowns or components deterioration.

Mission

Our mission is to offer an advanced technical analysis services based on the issues related to the photovoltaic installation such as faults and performance deteriorations and we offer simple and complete check-up of all the electric and electronic installation components (including modules and inverters).

Long been engaged in the alternative energy installation design, we are now focused on the research and development and on the study of the main problems such as the PID (Potential Induced Degradation) through instrumental measurement campaigns carried out by highly skilled technicians. Our work experience and the applications on the field are for us source of continuous study and in-depth technical and allow us to achieve a greater degree of awareness of problems related to the large-scale of alternative energy installations.

ST Engineering is able to perform the following instrumental checks on photovoltaic installation:

- Performance analysis of the modules with I-V curve tracer and series resistance (Rs and Shunt) measurement
- Detailed thermal analysis modules, also with the drone, survey of manufacturing defects and hot-spot
- Measuring the insulation resistance of DC and AC on electrical panels, electrical lines, photovoltaic modules, inverters and photovoltaic modules strings
- Electroluminescence on strings and modules for relief cell cracks, PID and broken bypass diodes
- Complete photovoltaic installation testing according to the Norm CEI EN 82-25
- Performance measurement of centralized inverters (PR%) for large photovoltaic installations
- Analysis of the parameters of AC power supply (detection of disturbances, voltage spike, holes etc.)

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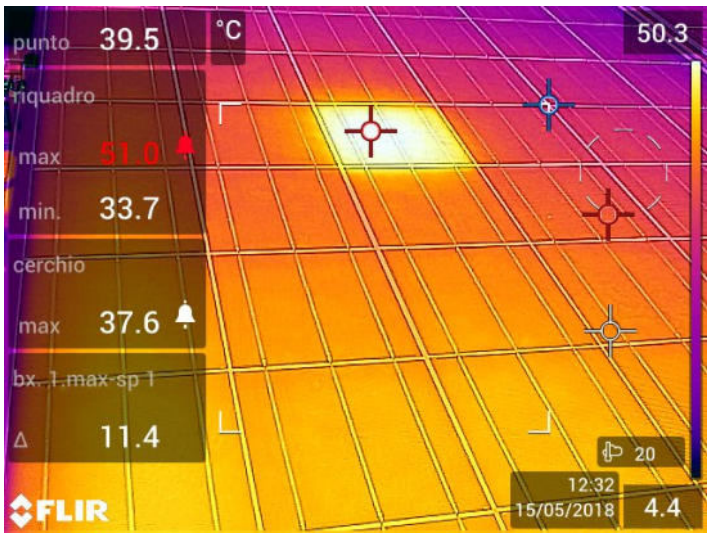
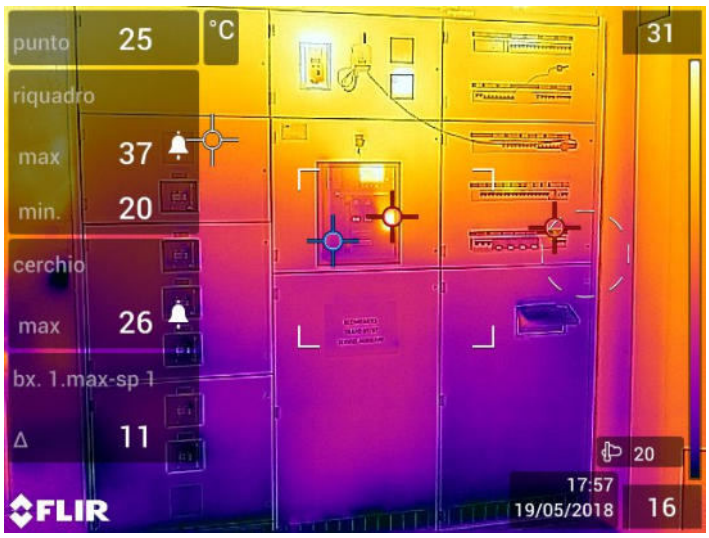
The complete Check-Up of photovoltaic parks with detailed reports on the state of the entire system.

THERMOGRAPHY ON PV FIELDS WITH DEFECTS AND HOT-SPOT DETECTION

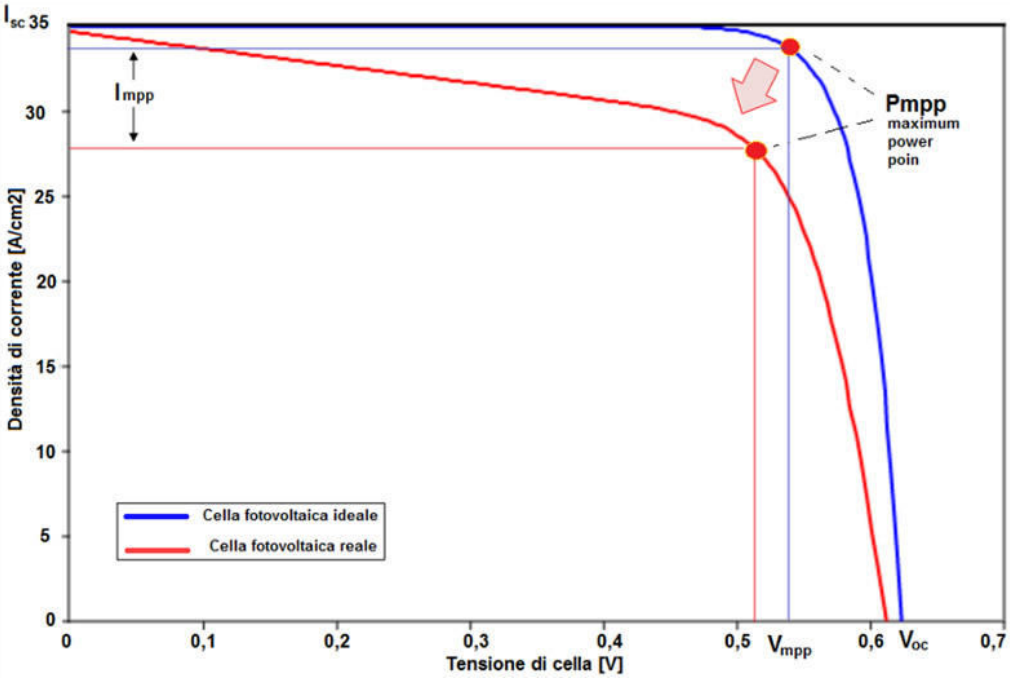
We perform thermographic analysis on your photovoltaic modules, electrical panels, string and centralized inverter in order to find some operating faults or thermal anomalies. We detect the presence of hot-spots on the modules. The cell affected by hot-spot is systematic subjected to a premature aging in the case in which the phenomenon is characterized by a dissipation of energy in the cell lower than the maximum dissipated by the same. The breaking of the same in the opposite case. Due to the strong stress at the local level, the area may also become hot and the cell fuse. In this case, the interruption of the electricity production is unavoidable and in the worst case, the module can catch fire.





ANALYSIS OF PHOTOVOLTAIC MODULES EFFICIENCY AND I-V CURVE TRACER

The I-V curve tracer provides information about the performance decrease, that the module may have suffered over time compared to the characteristics declared by the manufacturer in the technical sheet.

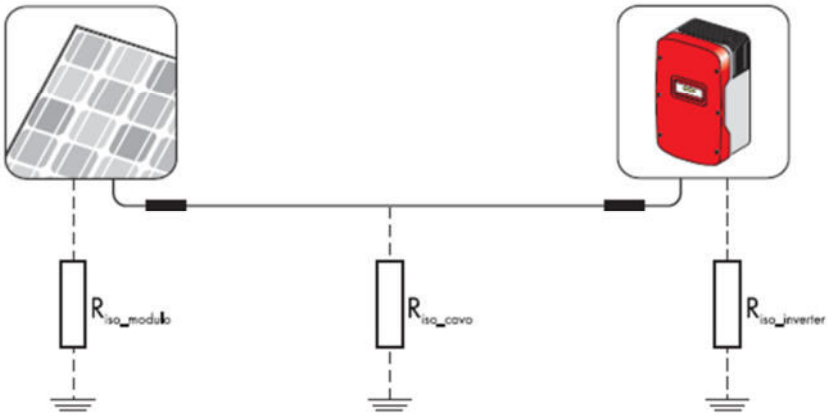


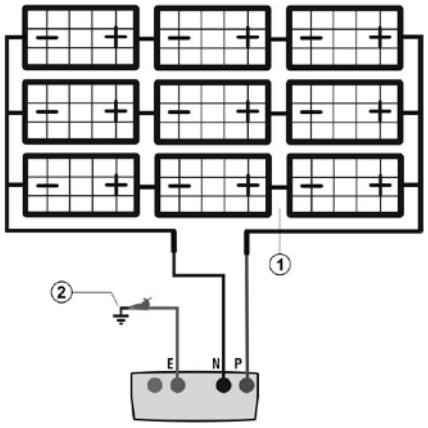
	Pmax	Voc	Vmpp	Impp	Isc	Irraggiamento	Temp. Modulo	FF	Temp	alfa	beta	tol+	tol-
Misura 176	Ok* (-0,28%)												
176 Misure@OPC	192,86	33,71	25,57	7,54	8,23	929	45,0	70	MANU	0,0307	-0,325	3	3
176 Mis Avg@OPC	192,86	33,71	25,57	7,54	8,23	929	45,0	70	MANU	0,0307	-0,325	3	3
176 STC	224,38	36,14	27,64	8,12	8,80	1000	25,0	71	MANU	0,0307	-0,325	3	3
176 Nominale	225,00	37,91	29,28	7,69	8,36	1000	25,0	71	MANU	0,0307	-0,325	3	3

According to the main structural parameters of the photovoltaic modules (such as Impp, Voc, Vmpp, Isc and the losses as a function of temperature of the form), declared in the technical sheet by the manufacturer, it is possible to perform a comparison between the measurements taken and the start module characteristics. The I-V curve test is executable both on the individual modules and on a string of modules which together constitute what is commonly called the "photovoltaic generator", an integral part of a Single-Phase or Three-Phase photovoltaic installation.

PV MODULES AND STRINGS INSULATION RESISTANCE MEASUREMENT

Each photovoltaic system has both before the network connection that the process of placing a different potential than the earth. Only an adequate insulation with respect to earth prevents the current coming from the photovoltaic system to spill into the ground, excluding the danger in case of contact and further losses. The total leakage current of the earth, also called leakage current, is the sum of the dispersion value of the individual components in the installation: photovoltaic Modules, DC cables, Inverter.





N°	Misure		Esito:	Descrizione
58	Inverter020\58 MΩ Stringa 16/05/2015		Ok	18 MODULO SINGOLO
	MΩ Stringa			
	Ri	>200 MΩ	Ok	
	VEP	0 V		
	VPN	34 V		
	Vmis (+)	1.058 V		
	V0 nom	1.000,0 V		
	R Lim	1,0 MΩ		

We carry out the measurement of all the insulation components of the photovoltaic installation. It is easy to imagine how a good insulation resistance of the photovoltaic modules (the norm CEI 64-8 sets a minimum insulation value at 1MOhm with test voltages of 500V or 1000V DC) and a poor insulation of the DC wires in the stretch of photovoltaic modules-inverter, leads to a malfunction of the same, with consequent loss of the energy production.

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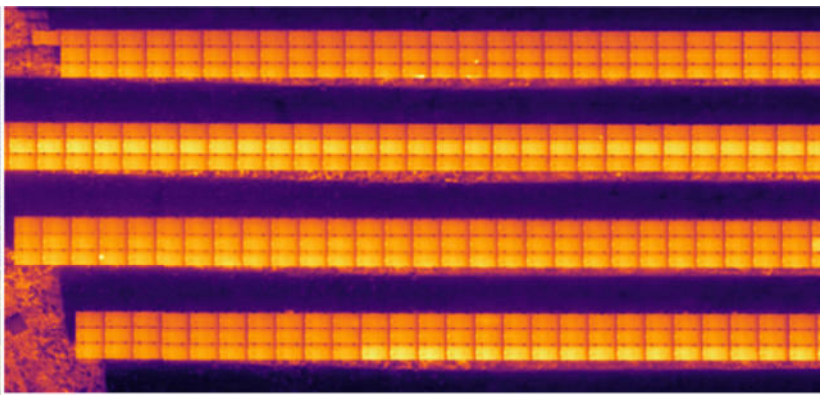
THERMAL IR ANALYSIS WITH DRONE FOR ANY PHOTOVOLTAIC INSTALLATION SIZE

ST Engineering is able to offer aerial and high resolution thermal imaging analysis for easy identification of photovoltaic modules hot-spot or cells breakage for the same module.

Analysis with infrared camera is assuming greater importance in the field of technical verifications on photovoltaic installation. But what is possible to detect by this analysis on the photovoltaic modules? When a cell does not work or does not generate energy because it is not receiving solar radiation, it could be polarized inversely. So it will work like a charger instead of a generator and this could lead in a high heat dissipation. This situation is easily detectable with an infrared thermo-camera and takes the name of "Hot Spot".



The service includes:

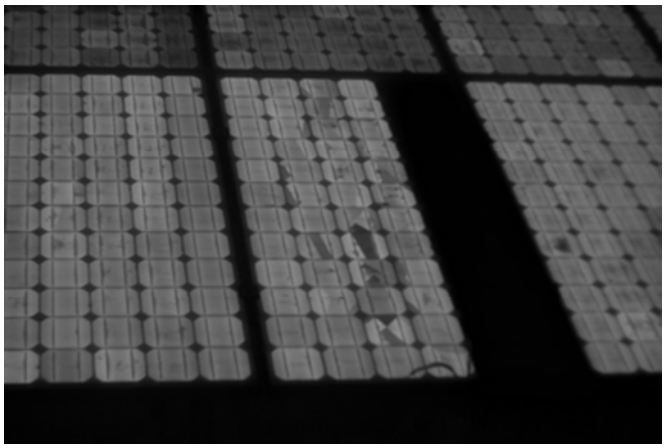
- Thermal infrared analysis of the entire field
- Mapping the installation layout of faulty modules with hot-spot and detailed report with S/N module
- Detailed technical report with high resolution aerial thermography for the faulty modules

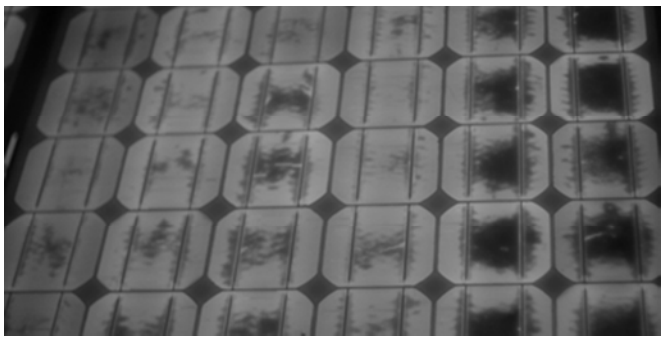
Fast, reliable and detailed, the thermography (or thermal analysis) with drone allows an economic and precise analysis of your photovoltaic installation. Our staff is highly qualified and equipped with the necessary fly permissions/authorizations.

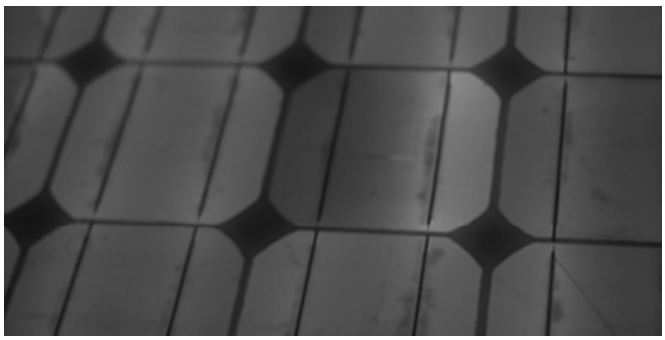
ELECTROLUMINESCENCE ANALYSIS (P.I.D., CELL CRACKS, DIODES)

ST Engineering is able to offer the high-resolution module and string Electroluminescence service for easy identification of the degradation phenomenon such as PID effect (Potential Induced Degradation), bus broken cells connection, cells fracture (cracks), bypass damaged modules diodes and much more.

This test is based on the photovoltaic inverse process. An inverse voltage is applied to verify the current flows while a special IR sensor camera makes visible the infrared light emitted by the cells. The working cells will have a bright appearance, while the damaged ones will appear dark. We can detect, with electroluminescence test, the faulty bypass diodes problem (short circuit), micro-cracks in the solar cells, PID effects (Potential Induced Degradation) and ribbon contact defects (face to face cells contact).



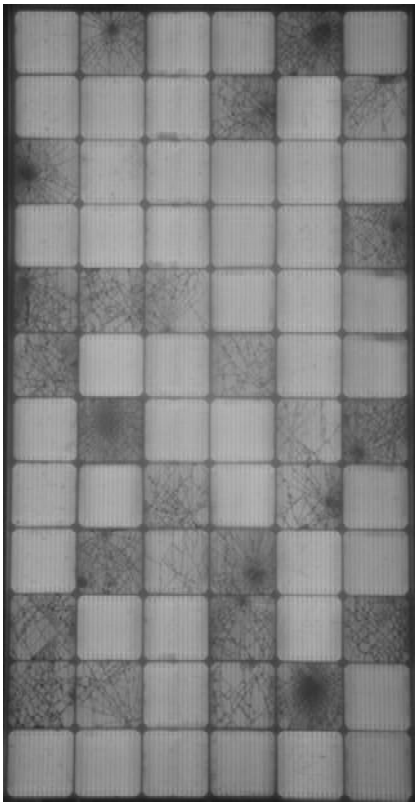


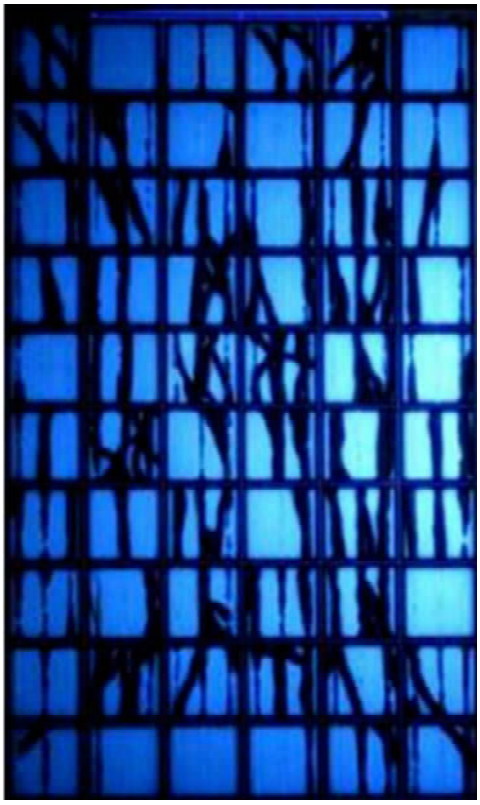


FLUORESCENCE ANALYSIS (CELL CRACKS, EVA DEGRADATION AND OTHER)

ST Engineering is able to offer the high-resolution module and string Fluorescence service for easy identification of the degradation phenomenon such bus broken cells connection, cells fracture (cracks and micro-cracks), EVA degradation and much more.

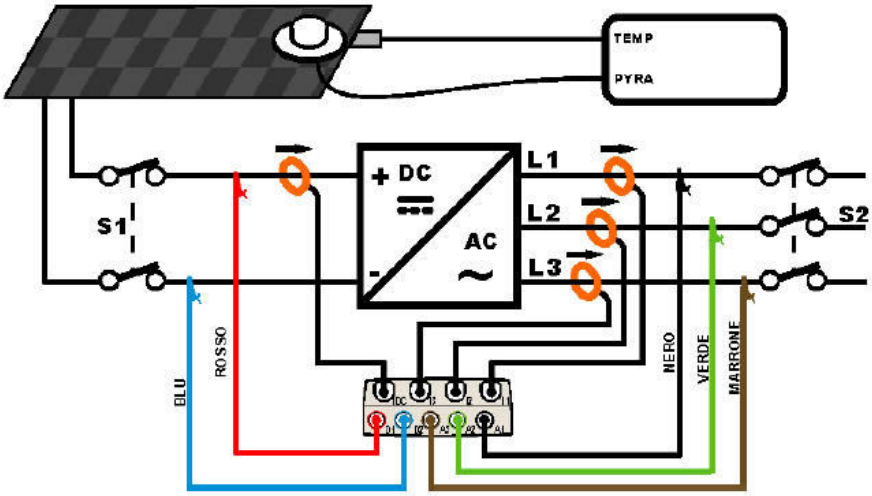
An innovative technique used for the study of defects in photovoltaic modules is the Fluorescence test (FL). This method exploits the homonymous phenomenon of fluorescence which occurs thanks to the presence of some atoms present in the module's EVA. This technique can be used as a complementary technique of the electroluminescence for the identification of defects in module cells. The fluorescence technique is very often used for the assessment of damage from atmospheric agents on photovoltaic modules (eg Hailstorm). The following image shows an example of a photovoltaic module with cell crack due to impact from hailstorm.





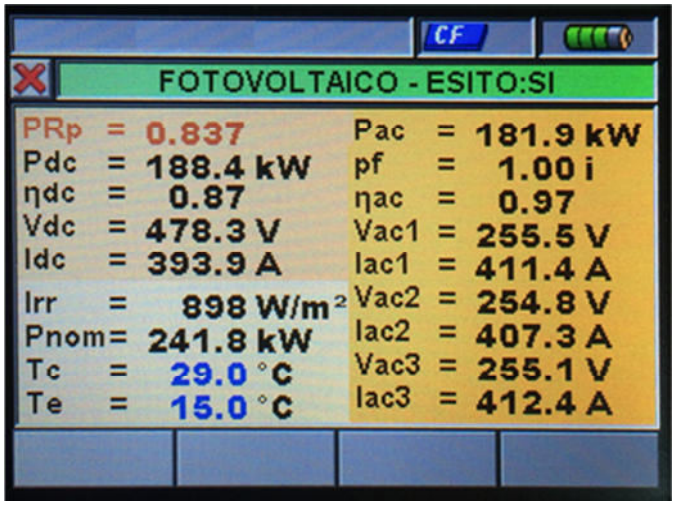
PHOTOVOLTAIC INSTALLATION TEST AND ELECTRICAL/FUNCTIONAL CHECK

We perform the complete testing on your photovoltaic installation. The testing is periodically required, especially when there are some substitutions of component in the system (such as photovoltaic modules, inverters, wiring, etc.) to ensure the correct operation of the same. The testing is carried out with highly professional instrumentations and in accordance with the Guide CEI EN 82-25 V1.



CENTRALIZED INVERTERS PERFORMANCE RATIO MEASUREMENT (PR%)

The Performance Ratio (PR%) is expressed in percentage and defines the relationship arising from the actual and the theoretical yield of the inverter (or PV installation). It indicates the percentage of energy really available once deducted the losses of energy. The PR can be measured both for central inverters and photovoltaic generator (modules).



TEST OF SPI and SPG INTERFACE PROTECTIONS WITH RELAY TEST INSTRUMENT

We perform certifications of interfaces protection calibrations and adjustments to AEEG resolution 786/2016 for photovoltaic systems of any power, interface protections (SPI) and general protections (SPG) of any brand and model. Checks are performed with instrumentation in compliance with CEI 0-16 Edition III of 07-2017 and CEI 0-21 Edition of 07-2016.

TECHNICAL DUE DILIGENCE FOR ANY PHOTOVOLTAIC INSTALLATION

We carries out the complete Due Diligence of a photovoltaic plant in one working day (for 1 MWp plant), providing to our customers a complete and reliable technical status report. Our engineers perform the measurements in the field (according to specific techniques required by the customer) with calibrated and certified equipment of the latest generation.

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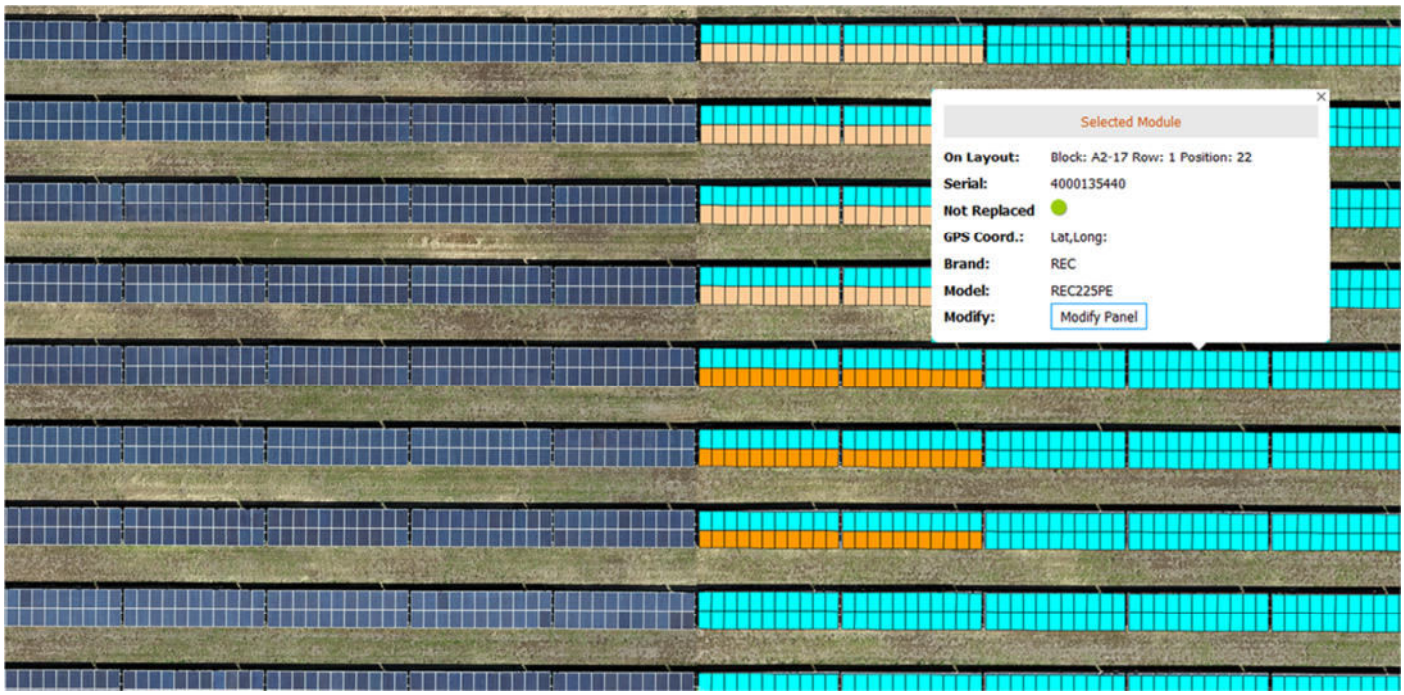
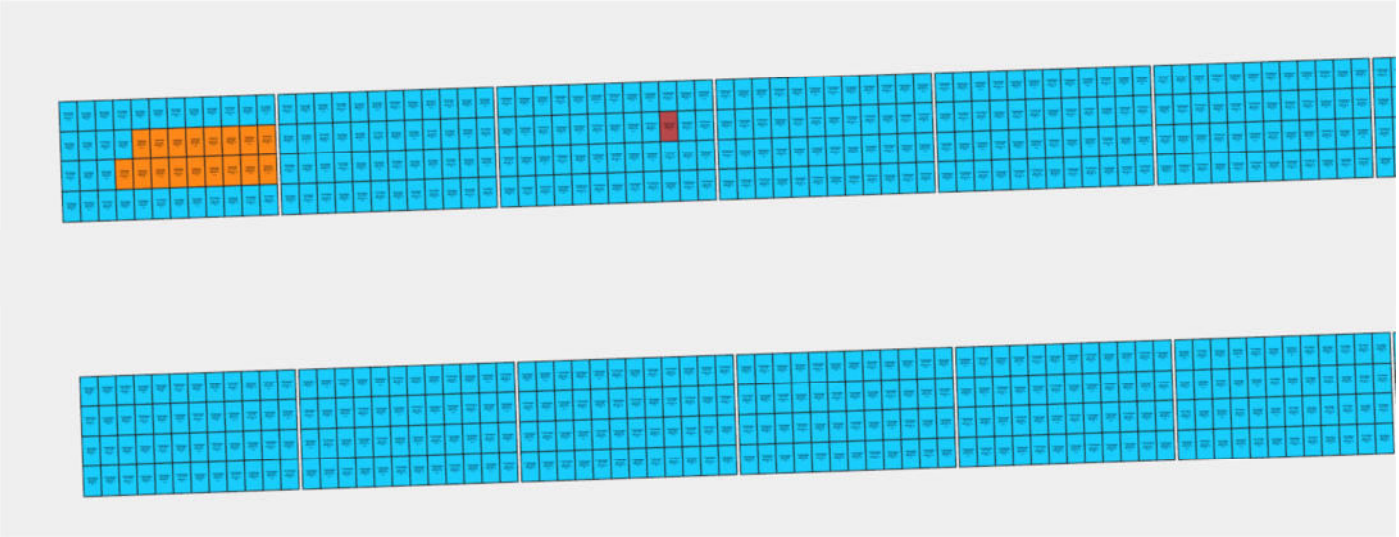
GEO-REFERENCED MODULES SERIAL NUMBERS SURVEY AND AUTOCAD LAYOUT RECONSTRUCTION WITH DRONE

We carry out the survey of the serial numbers of photovoltaic modules on large photovoltaic systems of any power, with reconstruction of the Autocad system layout by drone with centimeter precision.

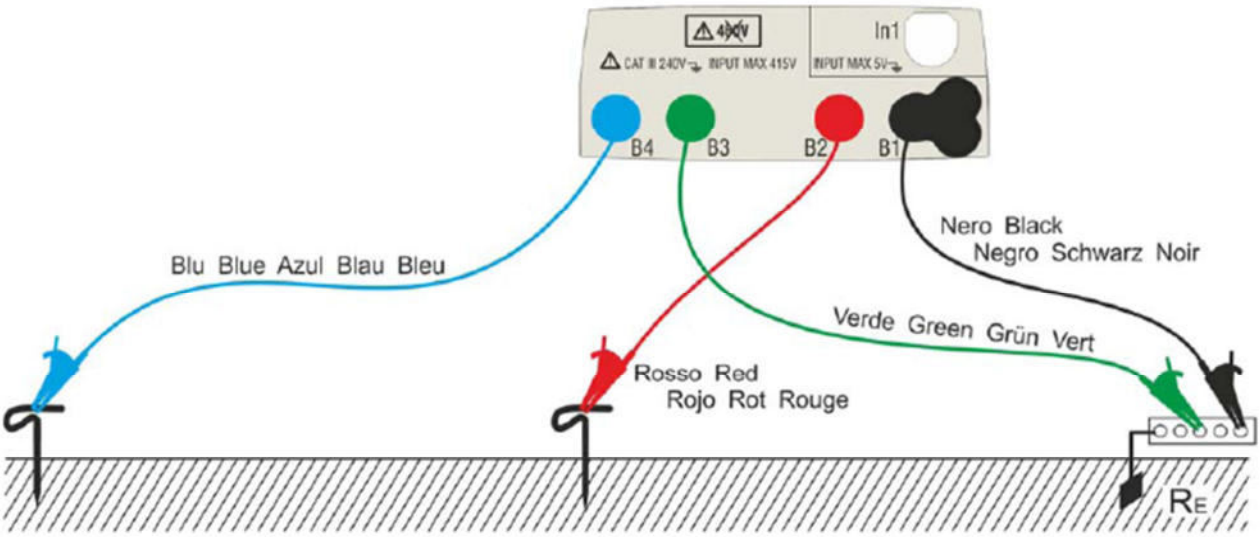
Possibility of scanning the serial numbers of the modules with front / back label, Bar-code / Qr-code and survey of the alphanumeric serial numbers even in the absence of a bar / qr code, with video-photographic recognition and direct OCR conversion. Digital publication of the results on the PV-SCAN portal.





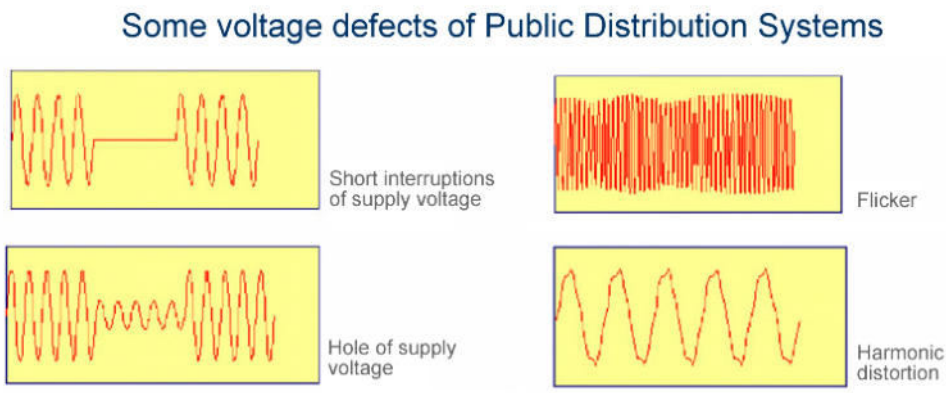
GROUND RESISTANCE AND EARTH RESISTIVITY MEASUREMENTS

We performed the measurement of the earth resistance with voltamperometric (2 or 3 wires) method and the measurement of the earth resistivity (with 4 wires method), useful to define in the design phase, the type of earth electrode that need to be used at the time of the installation. All the measures are performed in accordance with the standards CEI 64.8, IEC 781, VDE 0413, IEC/EN61557-5



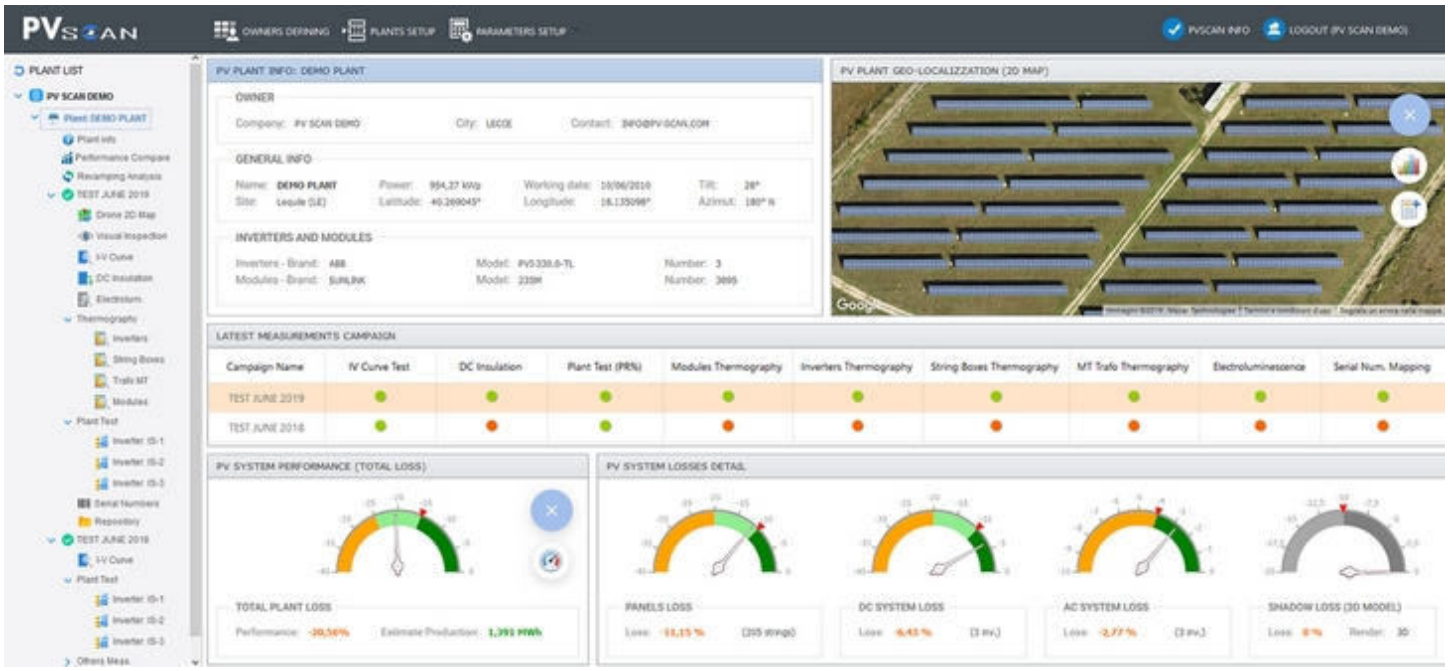
ELECTRICAL CIVIL AND INDUSTRIAL NETWORK PARAMETERS ANALYSIS

ST Engineering performs the electricity network quality analysis, in civil and especially in the industrial sector (in which the electricity quality is crucial). Even more with the advent of renewable energy installations connected to the public electricity grid, they depend on their correct operation from a good quality of the same public network. Here are some of the phenomena detected, measured and studied by our measurement campaigns.



OUR "SMART" WEB PLATFORM *PV-SCAN*

PV-SCAN is the Smart platform for Photovoltaic Performance analysis, Reporting, Measurements data processing, Energy production prediction and Due Dligigence web cloud, for O&M Company and Owners. Use PV-SCAN for monitoring performance trend of your PV plant park. *Join PV-SCAN on* ***www.pv-scan.com****!*



SOME OF OUR MEASURING INSTRUMENTS

Our team, formed by highly skilled electrical and energy technicians, performs the measurement campaigns with the latest and highly professional instruments.

Here are some of the used instruments for our analysis execution:

PV-SERVE

DC power supply for performing analyzes on photovoltaic modules such as Nighttime Electroluminescence Analysis, IV Curves in the Dark (DIV) and Night / Day IR Thermography

PV-VISION

IR camera for capturing photographs with the electroluminescence technique, directly in the field

DJI MATRICE 300 RTK

DJI Matrice 300 RTK is the new industrial drone from DJI that draws inspiration directly from modern aeronautical systems, for inspections of photovoltaic systems, wind farms and high voltage overhead power lines

FLIR XT-2

FLIR XT2 integrates a high resolution FLIR thermal sensor and 4K video camera with the best stabilization technology, for inspections of photovoltaic systems, wind farms and high voltage overhead power lines

HT SOLAR 300N

Verifica dell'efficienza di sistemi fv ed analisi della qualità della rete

HT I-V 500W

Strumento per la manutenzione e la verifica della Caratteristica I-V

HT PVCHECKs / ISOTEST

Verifica della sicurezza elettrica e delle prestazioni di un impianto fotovoltaico

CHAUVIN ARNOUX FTV400

Relay tester for SPI and PG photovoltaic certification an testing

FLIR E95/E75

Termocamera a infrarossi avanzata per ambiti civili ed industriali con MSX.

HT MACROTEST G3

Multifunzione avanzato per la verifica della sicurezza elettrica degli impianti elettrici civili e industriali.

HT GSC57F

Verifiche della sicurezza elettrica ed analisi di rete monofase e trifase

HT PQA 820

Three-Phase Energy Logger & Power Quality Analyzer for electrical systems

In compliance with the applicable regulations, our tools are subjected to the required and periodic checks and calibrations, in order to offer to our customers a precise and reliable service.

OUR SERVICES

Our staff, formed by highly qualified technicians is able to offer the following services to public and private clients:

- Design: preliminary/definitive/executive for renewable energy installations
- Site manager engineer
- Assistance and maintenance services for the alternative energy installations
- Technical reports for legal disputes, CTP and CTU
- Energy Management and Energy Check-Up services
- Instrumental measurement campaigns on renewable energy systems

For more information, please consult our website www.st-ingegneria.com

ST-engineering

More value for your energy

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