



Training on PV

Focus on maintenance, fault research and plant performance optimization

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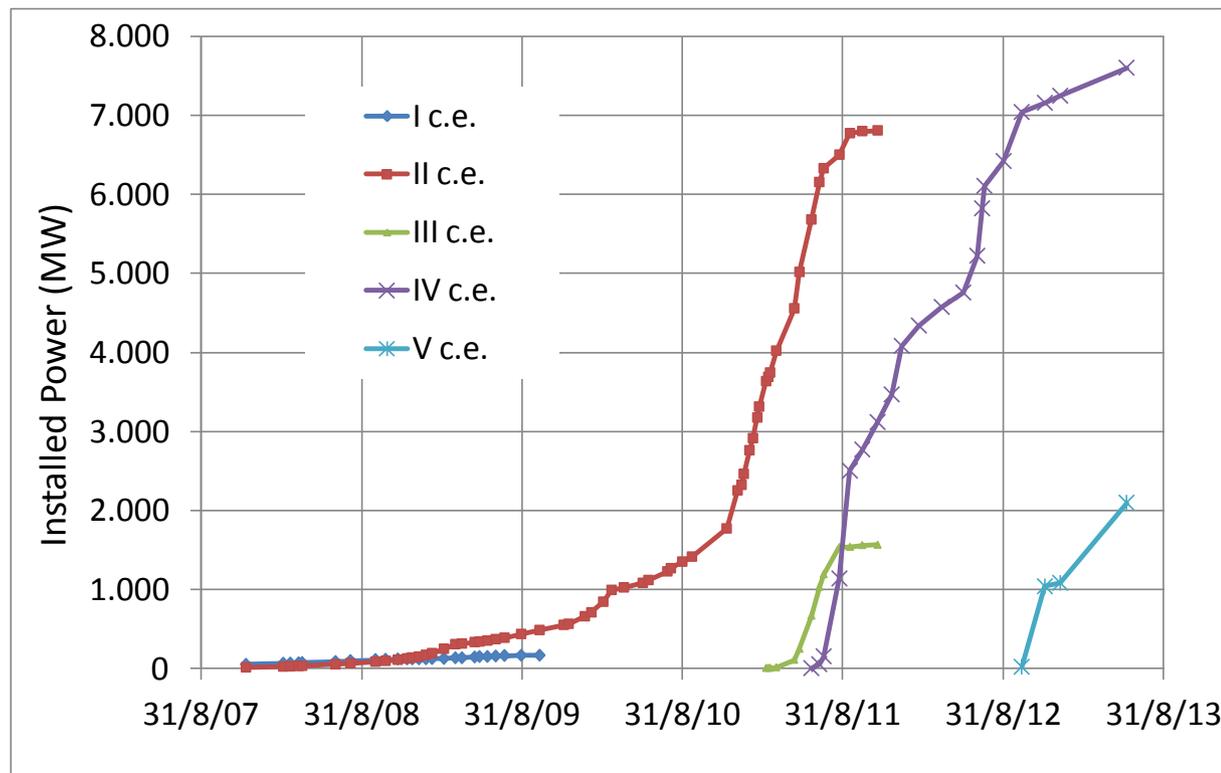
ENEA* | Mesos" | Sorgenia solar°

27th European Photovoltaic Solar Energy Conference and Exposition

Paris - France, 30 September to 4 October 2013

STATUS OF PV MARKET IN ITALY

- The national market stimulation initiative in operation from July 2005 to August 2013 has been the “Conto Energia” Program
- The Program has been articulated in 5 phases during which about 530.000 plants corresponding to 18.2 GW have been installed



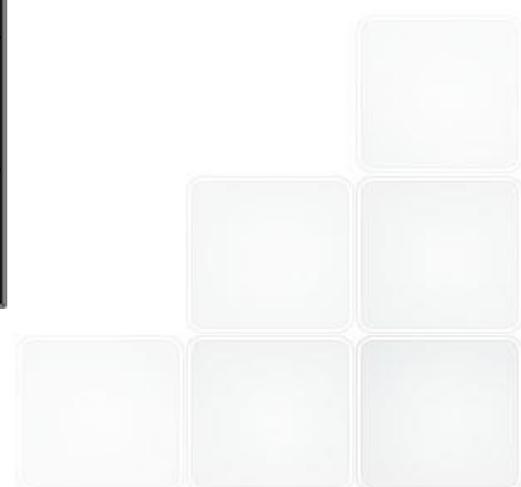
Trend of the installed power during the five phase of the Conto Energia

THE POST INCENTIVE PHASE

- PV installations will not be stopped because:
 - the Italian Authority for Electricity and Gas has updated the rules for exchanging energy with the grid
 - the Ministry of Finance has approved 50% tax deductions for PV plants up to 20 kW for residential applications.
- Taking into account the good values of solar radiation, the high electricity bill and the sharp component cost decrease:
 - the pay back time still remains attractive:

<i>application</i>	<i>prices per W</i>	<i>pay-back time</i>
3 kW on roof top (30% self consumption; 50% tax credit)	1.8 – 2.5 €	8 years
500 kW on industrial building (total self consumption)	1.3 - 2.2 €	9 years
utility scale multi MW on ground (Energy sale)	1 – 1.4 €	10 years

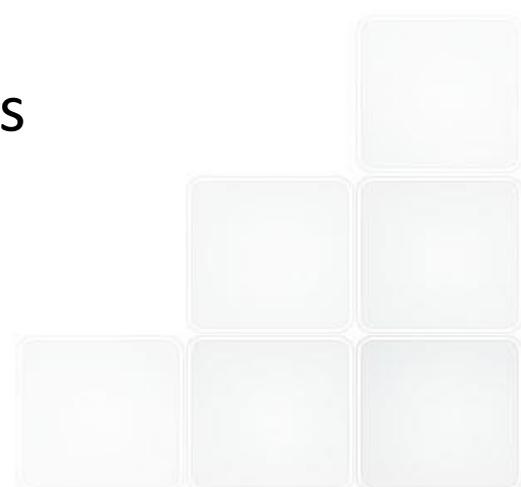
Pay back time for different applications



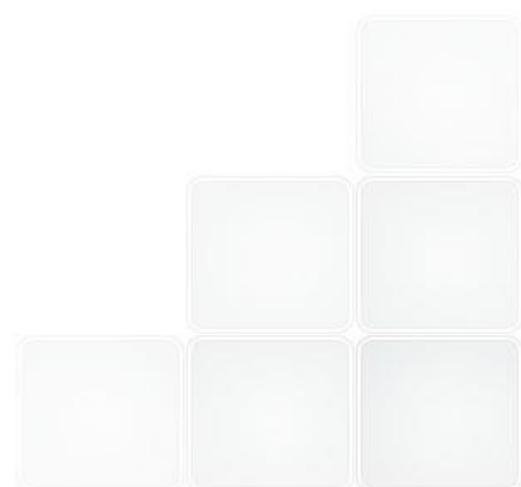
THE IMPORTANCE OF MAINTENANCE



- The huge number of PV installations in Italy must be **properly managed** in order to **maximize the benefit of the incentive tariff** for a period of 20 years
 - Neglecting the maintenance of PV system can lead to:
 - significant **energy production losses**
 - exposition of the plant to the risk of **future failures**
- O&M activities focused on monitoring, operations procedures and maintenance techniques should be adopted in order to **maintain the plant in its original functionality and safety**
 - reducing the frequency and duration of failures
 - minimizing repair time
 - optimizing the availability of spare parts



- The **monitoring** of plants is aimed at managing and optimizing performance and allow:
 - real-time access to data acquired
 - analysis of data for the identification of possible improvements
 - resetting remotely in order to minimize losses
- In order to identify actions to **upgrade plant performance** it could be necessary to perform
 - tests on site
 - verification of all system components
 - measurements for a limited period
 - tests on components



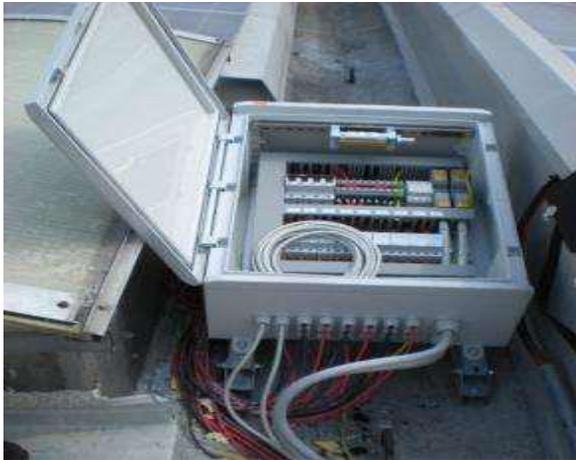
THE IMPORTANCE OF TRAINING

- Training of skills for handling **O&M** of existing solar PV systems **is becoming more and more important**
- Now O&M has been performed in some cases in an empiric way by plant designers or installers that very often are the only reference of plant owner.
- In this contest MESOS training is aimed to **convert those professionals into maintenance operators** specialized in the identification of failure causes, to resolve them and, if necessary, in plant performance optimization.



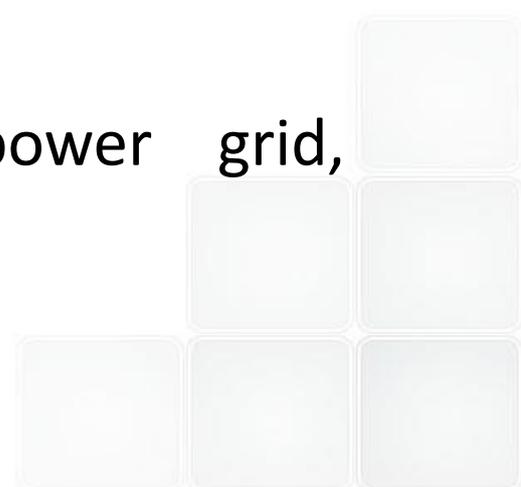
TRAINING ON PV: FAULT SEARCHING

- An emerging issue in Training on PV is the so-called **“Fault searching”**



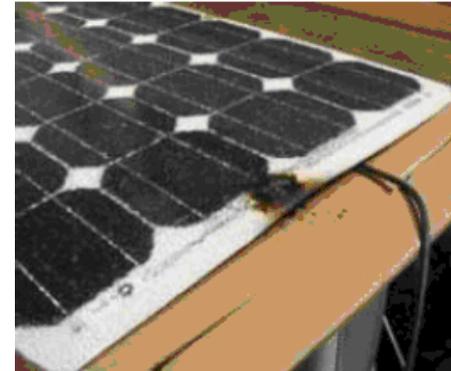
PV Systems are subject to **different types of faults:**

- ◆ Components failures (typically modules and inverters)
- ◆ Poor design
- ◆ Poor installation
- ◆ External events (power grid, lightning, ...)



TRAINING ON PV: FAULT SEARCHING

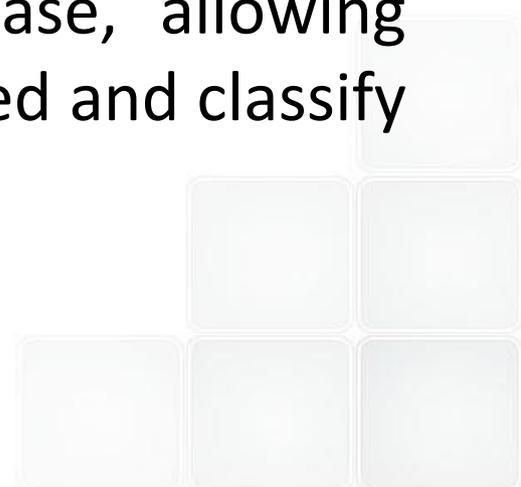
- When a fault occurs it is very important to locate and fix it as soon as possible
- For faults detection in PV plants, three approaches are normally used :
 - Visual inspection
 - The remote monitoring
 - The instrumental detection



SURVEY ON O&M



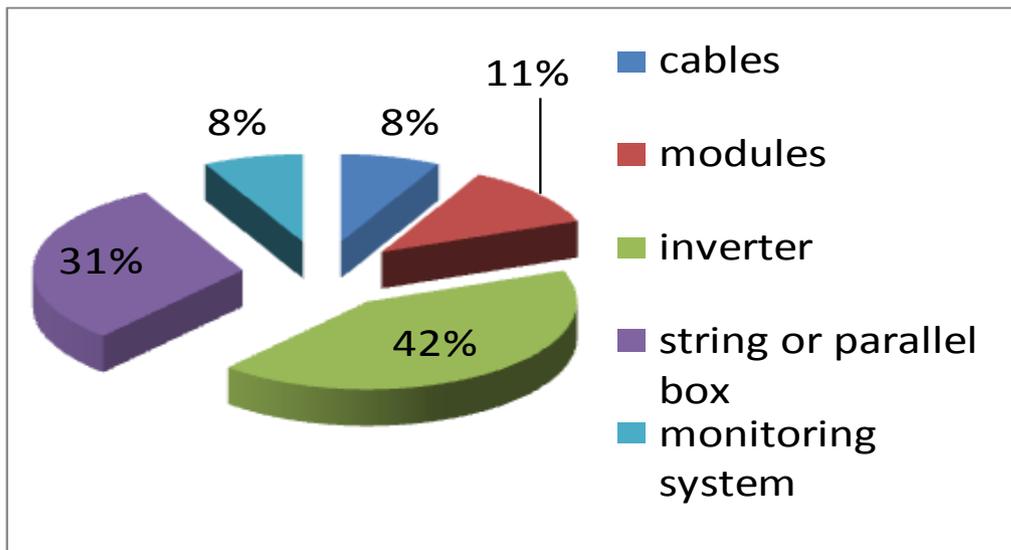
- To improve the skills of professionals that could be involved in O&M of PV plants, Mesos is going to organize **training courses mainly focused on photovoltaic plant failures and their possible solutions.**
- In order to dispose of valid and meaningful teaching material, corresponding to real cases, **a survey of failures occurred in PV Plants** was launched among the network of qualified professionals and installers who, in the last 6 years, attended Mesos courses.
- **The results** have been reported in a database, allowing installers to describe the type of failures occurred and classify them univocally.



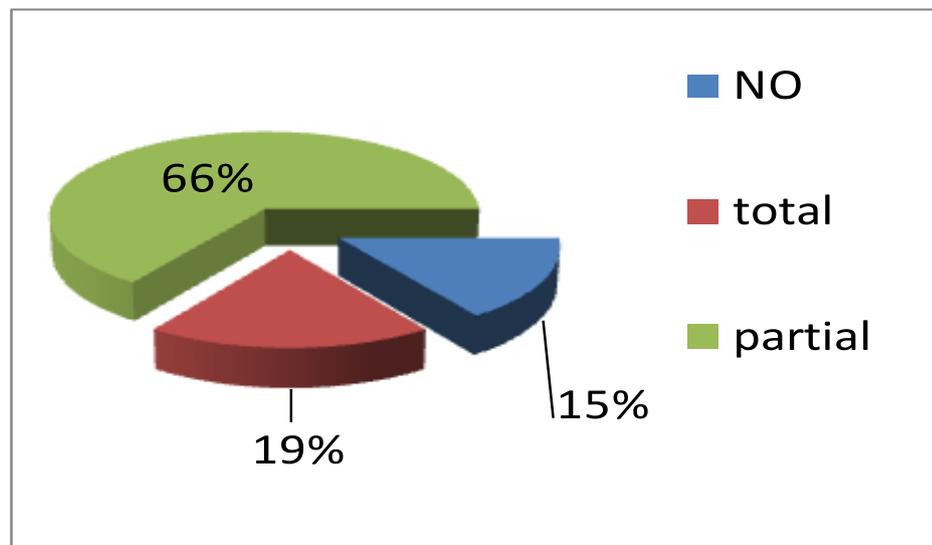
PRELIMINARY SURVEY'S RESULTS

Small - Mid plants installed in the period 2011 – 2013

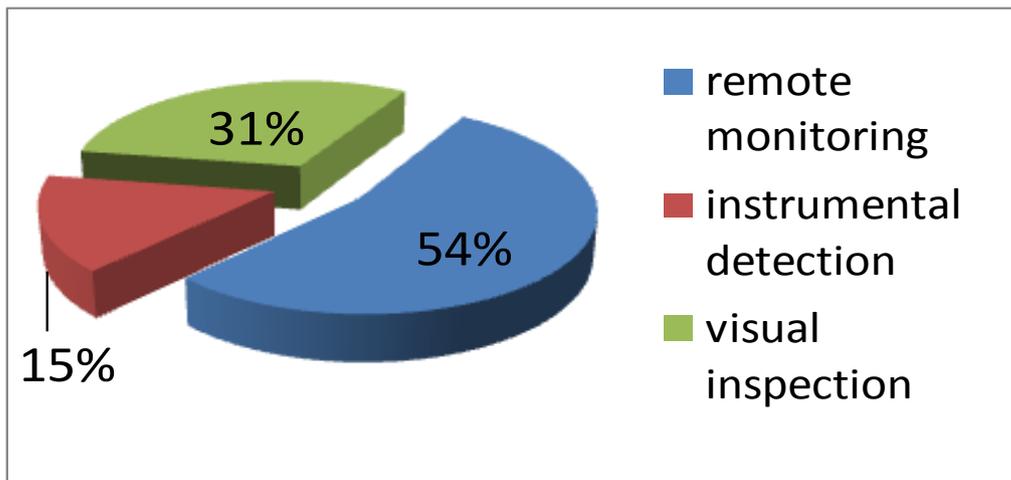
Failure rate of plant components



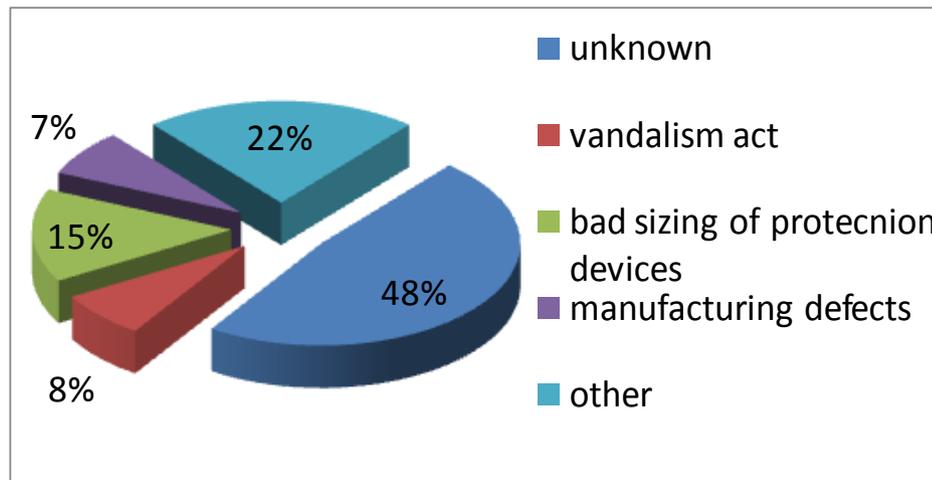
The effect of failure on plant operation



How have faults been detected



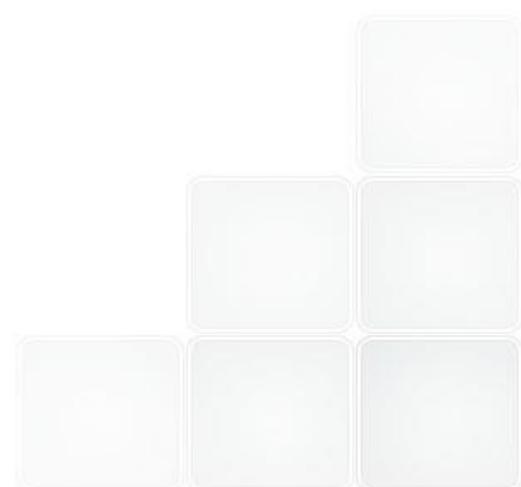
The causes that generate faults



PRELIMINARY SURVEY'S RESULTS



- The most **interesting information included in the survey** regard:
 - type of fault and component involved
 - fault identification method and identification of possible causes
 - fire involved
 - consequences: partial or total plant shutdown
 - duration of failure detection, of repair and of component supply
- Further **malfunctions or critical situations** highlighted:
 - ***excessive module pollution***
 - early degradation of the modules
 - ***theft of components and their consequences***
 - site careless
 - data acquisition system failure
 - malfunctioning or degradation of sensors



REQUIREMENTS

- Article 15 of the **Decree Law. 28/2011** and article 17 of the **Decree Law 63/2013** state that the **professional qualification for the installation and maintenance of photovoltaic plants** on buildings is achieved with the possession of technical and professional requirements (set out in **Decree 37/2008**) consisting in working periods carried out in enterprises of the photovoltaic sector the duration of which depends on the educational qualifications.
- **By October 31, 2013**, the Italian Regions will **activate a training program for installers of renewable energy systems** or shall approve training providers and that the same Regions may recognize, to the subjects participating in training, credits equivalent to working periods.
- Those who have obtained a professional qualification are obliged to participate in **training activities to update their skills**. The duration of those training courses is about **16 hours** every 3 years.



A NEW COMPETENCE NEEDED IN PV SECTOR

- The market of PV plants requires today a new professional, the "**Manager of Operation and Maintenance**"
- In this framework **three main types of operators** can be identified :
 - ✓ EPC that have started to invest and refocus their business model, providing O&M services through **the integration of these services** in their bids
 - ✓ Operators who traditionally operated in the electric and electronic fields, now available to **diversify their business model in PV sector**
 - ✓ Asset management companies, which carried out their activities on renewables and now tend to increasingly extent, **in directly managing O&M activities, in the past usually outsourced by subcontractors**



A NEW COMPETENCE NEEDED IN PV SECTOR

- In order to optimize maintenance and resources, **Professionals must be able to:**
 - **Implement monitoring systems and asses data collected**
 - Perform **corrective maintenance** in case of component breakdown
 - **Mitigate** unplanned downtime

“Faults Research” on PV plants is a new requirement for professionals and installers.

- The courses are suitable **for installers with proven experience** compelled by the Italian law to attend updating training courses.
- Even installers with a long experience in PV have found those courses dealing with system management and in particular **faults research very useful .**

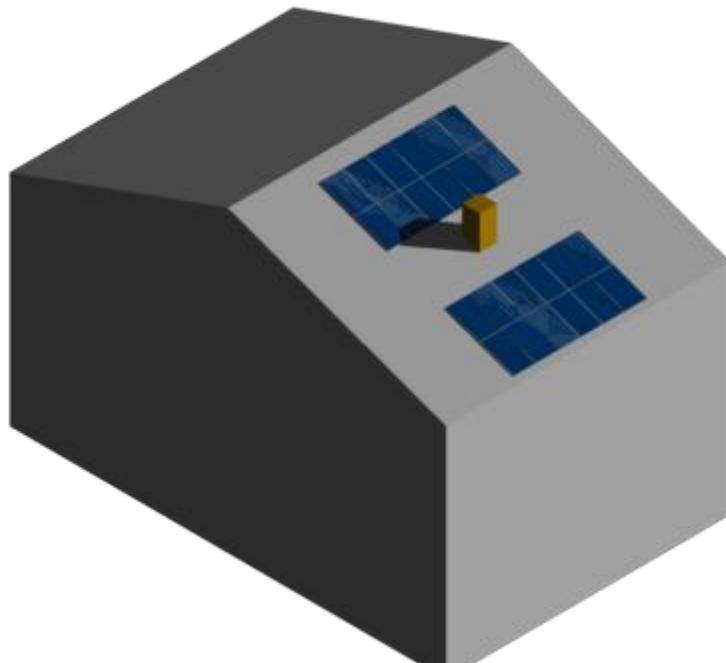
TRAINING ON PV PLANTS OPTIMIZATION

- In Italy, with an installed capacity of over 18 GW it is needed to assess the possibility to improve the energy performance of photovoltaic systems.
- To meet this need, Mesos provides **courses** that address in detail this issue by presenting **several case studies of retrofit optimization** of photovoltaic systems.
- Annual yield improvement is calculated in order to evaluate whether optimization is convenient or not

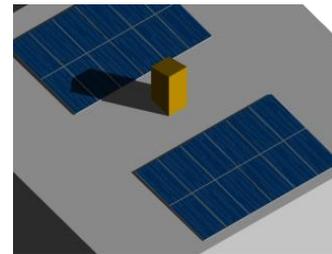


CASE STUDY

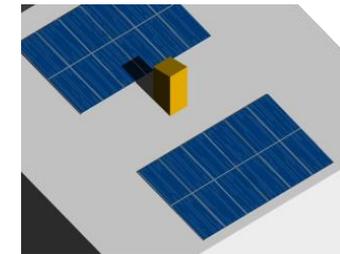
Optimization of 6 kWp PV system composed by two parallel strings of 12 modules each with centralized conversion and an object shading.



Shading analysis on 21th December



9.00 a.m



12.00 p.m

Optimization Results

Type of DC/AC conversion	Annual energy yield improvement (*)
Multi MPPT conversion	+ 2,5 %
PV module conversion	+ 3,4 %

(*) respect to centralized conversion

TRAINING METHODOLOGY AND COURSE CONTENTS



- **ENEA**, thanks to its participation in working groups and European **projects** has **developed a qualification scheme for RES installers**.
- The training courses developed by Mesos, ENEA's spin off and skilled training provider, are based on results of those European project's.
- Starting from 2007, ENEA and MESOS, have obtained the **certification for the training courses in the photovoltaic sector**, issued by CEPAS, a national Certification Body for Personnel and Training courses.
- They also follow international standards of training and certification of professionals, both the **certification of third parties according to ISO IEC 17024 and the European Qualification Framework (EQF)**.
- One of the most qualifying aspects of this methodology **is the structure of blended courses, combining e-learning and classroom**, and designed to facilitate access to specialist training of learners in the classroom.

*The availability of **qualified personnel** in PV field **is a guarantee** for the consumer and for the growth of photovoltaics.*



TRAINING METHODOLOGY AND COURSE CONTENTS

Mesos course on "*Management of PV systems: operation, maintenance and optimization of existing facilities*" provides:



- skills and expertise in faults research
- suggestions of measures to implement and optimize the plant efficiency
- **lectures, hands-on and theoretical work conducted in indoor/outdoor simulation areas and with well-advanced tools.**
- evaluation the various opportunities for economic return,
- new regulations and in particular those relating to **fire prevention**
- approaches to management and maintenance of the systems and the **analysis of a real case.**
- **case studies of the most common failure and their resolution**
- Implementation of typical troubleshooting procedures.
- **tests and measurements through advanced instrumentation**

CONCLUSIONS 1/2



Today, the Italian PV market requires new professionals on Operation and Maintenance of plant *because*:

- plants booming in the past years have already exceeded the **warranty period** (two years)
- the absence of incentives brought down the investor interest on large systems, **moving the market towards small size plants**, geographically distributed
- the maintenance of such plants is performed by **numerous local professionals, often with short experience and expertise.**
- owing to market reduction, many professionals returned in their core business of civil and industrial electrical installations, opening new opportunities for **technicians who want to continue operating in PV sector**

CONCLUSIONS 2/2

- **The formative process and the continuous technical updating of the operators plays a fundamental role**, for the achievement of European objectives on Renewables
- **It must be performed** through training processes aimed at providing skills:
 - necessary for a proper design and installation, but also
 - pertinent to the management and maintenance of the plants
 - necessary for plant efficiency optimization



FOR MORE INFORMATION



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