EController
Remote Supervision & Energy Management

i-EM

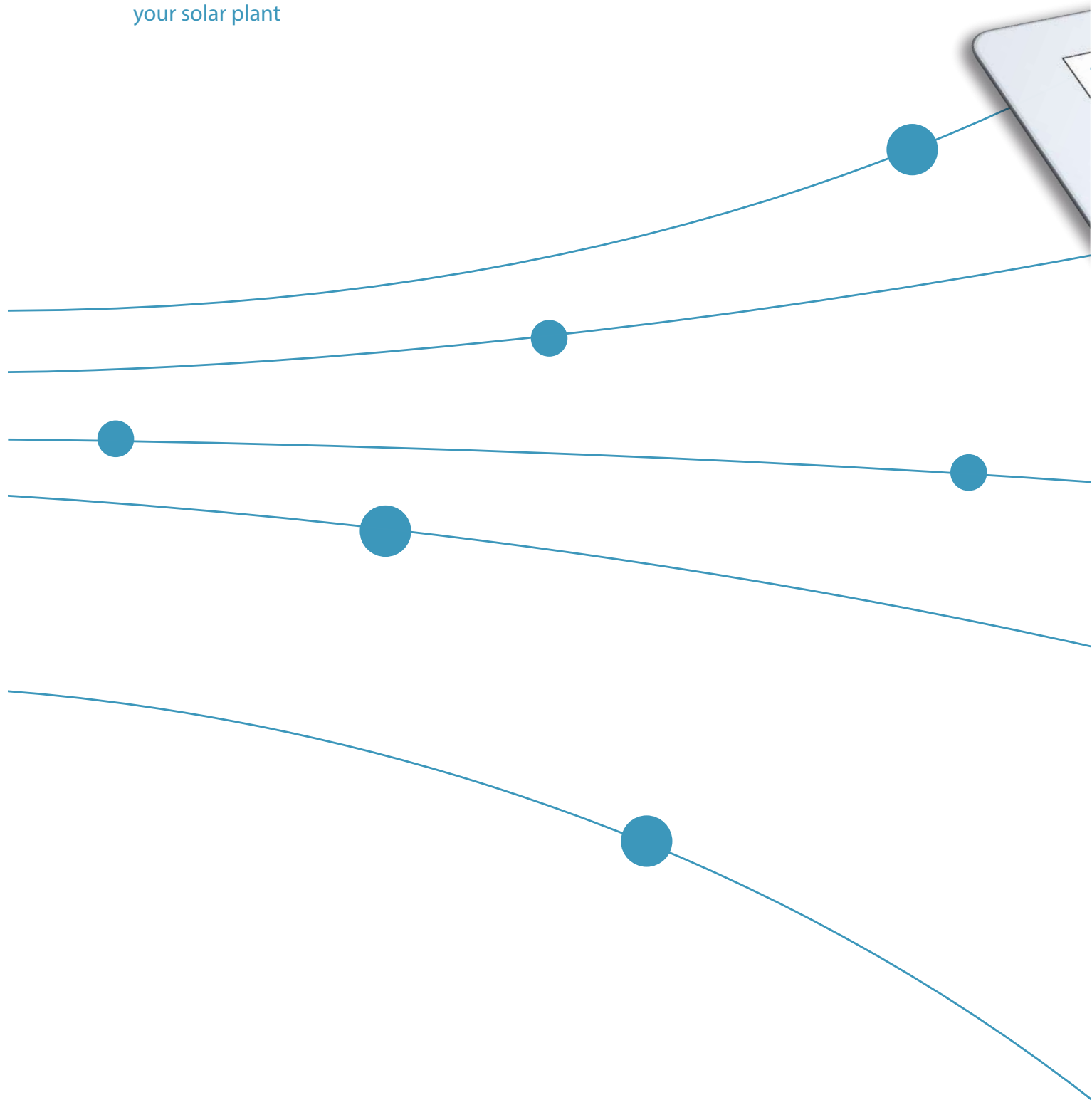*Intelligence in Energy Management*

From real time to predictive maintenance: EController optimizes the performance of your solar plant

ⴹController
Remote Supervision & Energy Management

EController is the solution for renewable energy plants owners and operators: it is the ideal tool both for prosumers and market operators.

Thanks to an advanced big data analysis approach, Econtroller is your decision support tool providing accurate, updated and necessary information (Business Intelligence) such as performances, diagnostics and energy production predictions.

Competitive advantages:

› self-consumption optimization systems: forecast and nowcast data are used in combination with storage system information.
› Simple and effective web-monitoring interface, customer-customizable, unique for different kind of plants located in different geographical areas.
› Easy installation instructions and ready-to-use systems.
› Alarm generation system: in case of difference between real and expected energy production.
› Advanced diagnostic service: for malfunctioning warnings.
› Save money, get more efficiency and reliability by using satellite-based information.

Business Intelligence & Analytics

The entire i-EM infrastructure has been developed following the philosophy of Business Intelligence (BI) in order to transform data into knowledge and provide decision support systems.

The success of this implementation is the use of techniques of historicizing, analysis and presentation of data in order to support decision making of Energy Management.

The i-EM Business Intelligence technology consists of three layers: the data layer, the analysis layer and the presentation layer.

i-EM adopts systems of Big Data Analytics to manage all the information acquired and processed (georeferenced within spatial database).

i-EM services run on an IaaS (Infrastructure as a Service) powered by following feature:
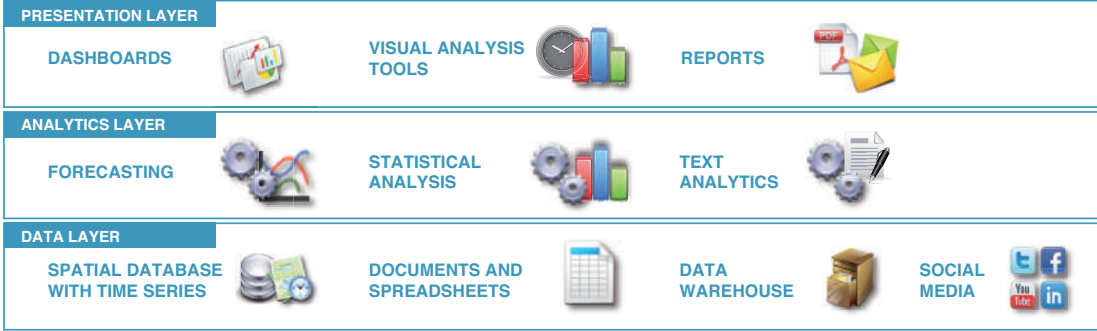› Scalable, adaptable to the customer needs
› High reliability: SLA of 99.9%
› Redundant: distributed architecture in the cloud across multiple servers in different geographic world regions
› High performances guaranteed for the provision of services (i.e. Bandwidth)

EController is a customizable solution and is provided as Software as a Service (SaaS)
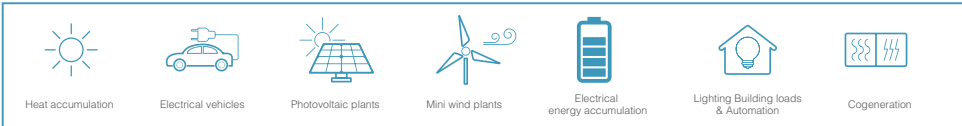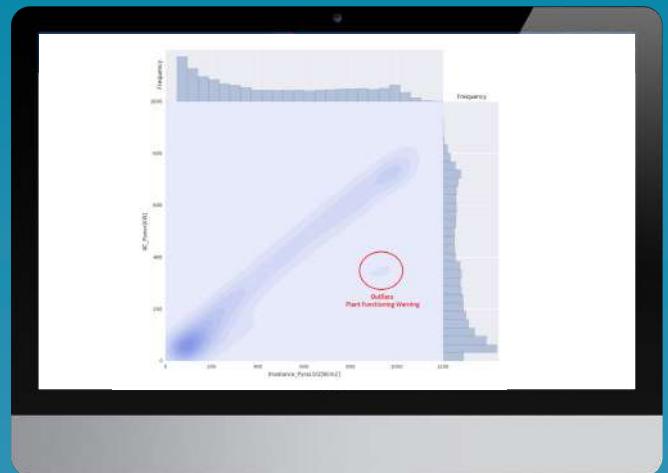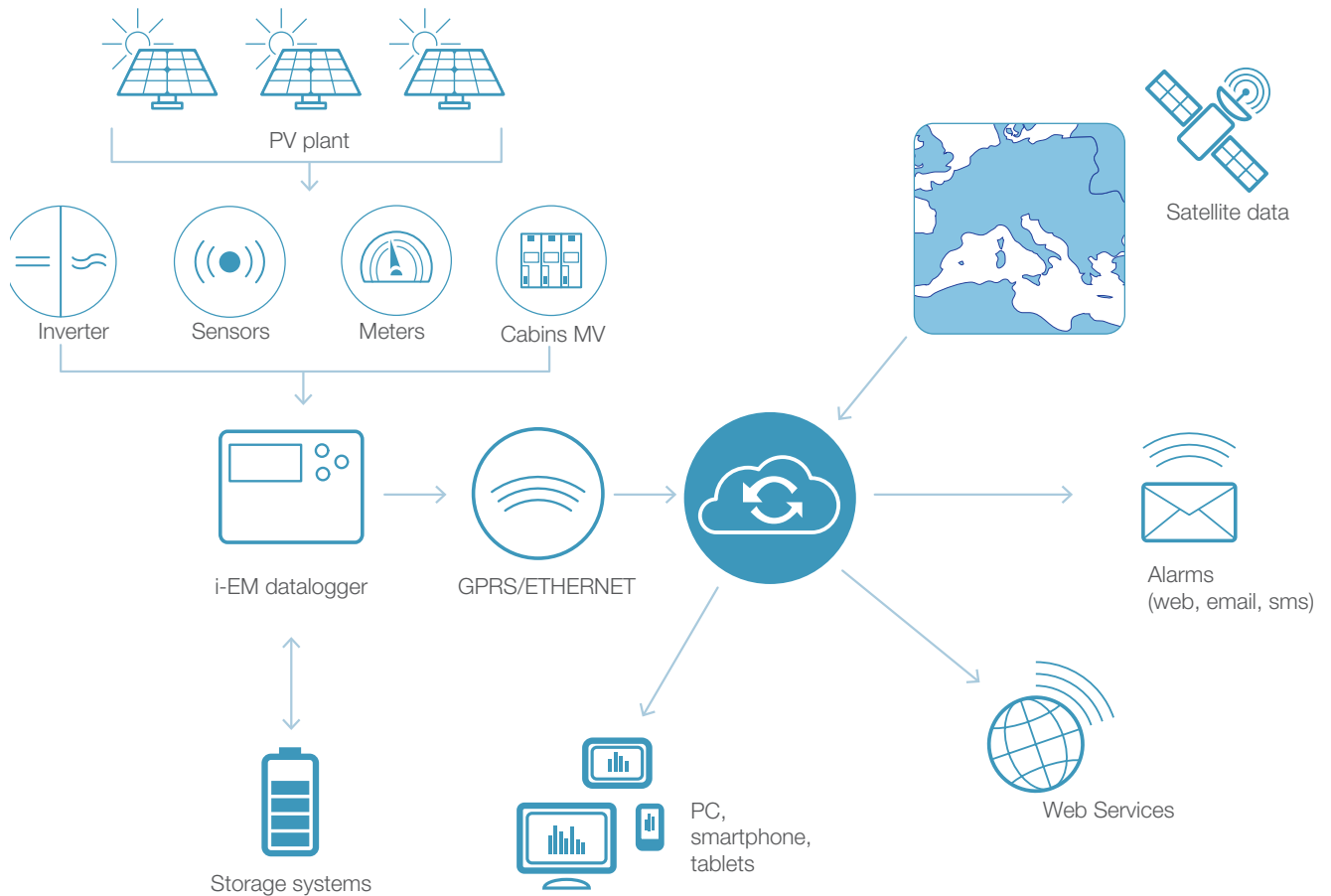
CUSTOMER

Cloud

i-EM infrastructure

WEB SERVICES

PRESENTATION LAYER

DASHBOARDS

VISUAL ANALYSIS TOOLS

REPORTS

ANALYTICS LAYER

FORECASTING

STATISTICAL ANALYSIS

TEXT ANALYTICS

DATA LAYER

SPATIAL DATABASE WITH TIME SERIES

DOCUMENTS AND SPREADSHEETS

DATA WAREHOUSE

SOCIAL MEDIA

Heat accumulation   Electrical vehicles   Photovoltaic plants   Mini wind plants   Electrical energy accumulation   Lighting Building loads & Automation   Cogeneration

External datasources

PRINCIPLE SCHEME

PV plant

Inverter
Sensors
Meters
Cabins MV

i-EM datalogger
GPRS/ETHERNET

Storage systems

PC,
smartphone,
tablets

Satellite data

Alarms
(web, email, sms)

Web Services

Features

DATA ACQUISITION:
› electrical parameters (inverters, energy meters, string boxes etc.)

› environmental variables (irradiance, wind, temperature, rainfall, air pressure)

› from our dataloggers, from third party systems - SCADA, inverters datalogger – and automation protocols

› data transmission from datalogger to the remote system using two modality: GPRS and Ethernet

› data stored on a scalable server farm in cloud

DATA VISUALIZATION:
› energy production

› measurements from plant inverters (powers, currents, voltages, alarms)

› environmental variables (irradiance, module temperature, environmental temperature, wind speed and direction)

› historical production data of the plant and the sub-fields level even from meters

› visualization on desktop, laptop, smartphone, tablet

› secure and diversified data access for the user typology (e.g. O&M Manager, Business Manager)

› intuitive alarms management produced by:
  · installed devices on the plant
  · differences with estimated production
  · conditions after data elaboration

DATA ANALYSIS:
› daily, weekly and monthly analysis of the plants performances on the DC and AC side

› Performance Ratio (PR) based on measured data of the plant production and/or based on satellite observations (in agreement with CEI 61724 norm and using internal models)

› evaluation of economic yield of the plants exploiting production data

› evaluation of actual CO_2 saving

› performance comparison of systems with different technologies, or of the same system, in different days
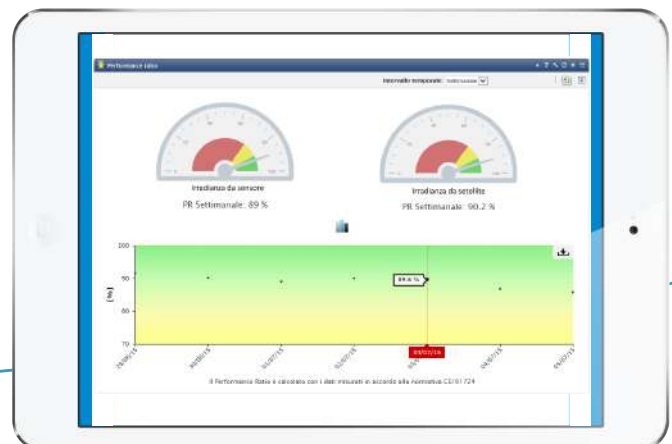
Advanced Diagnostic

Diagnostic service for an advanced management of the malfunctions affecting a plant, a specific sub-field and sensors in-situ.
This service is based on artificial intelligence algorithms analyzing data from devices (sensors, inverters, energy meters) installed on the plant and from satellite-based observations.

Provided information:
• Kind of failure;
• Failure location on the plant;
• Failure description.
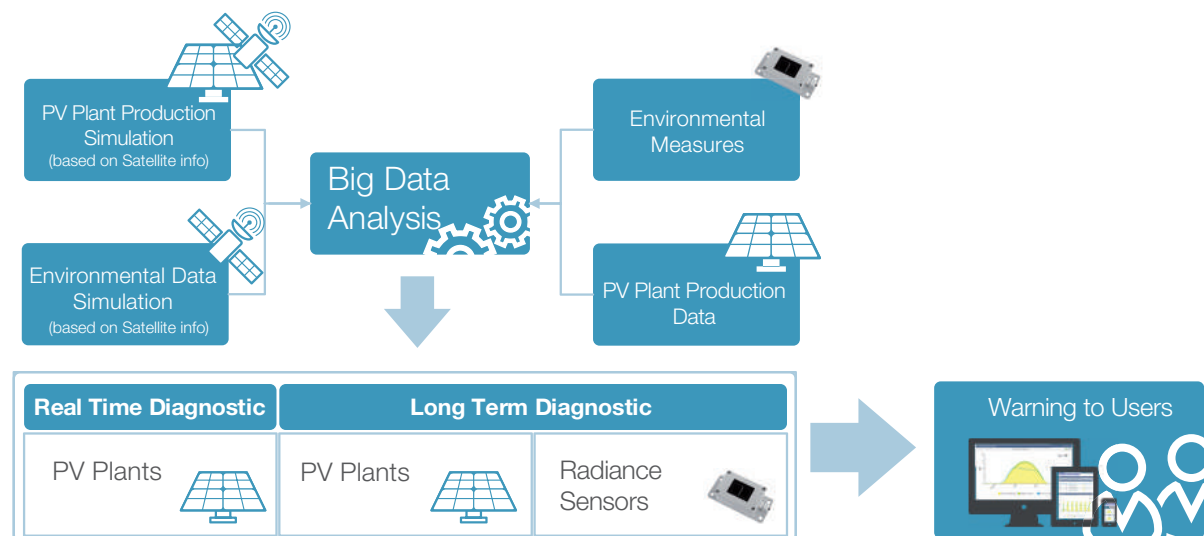
Benefits:
› Automatic fault detection from remote
› Maintenance time and cost reduction
› Plant performance improvement

› Real time mode: sub-fields analysis with a time horizon of 2 hours.
Detect covering, soiling, shadows, faulting MPPT on the plant.

› Long term mode: sub-fields analysis with a time horizon of 20 days.
Detect covering, soiling, shadows, faulting MPPT on the plant, , thermal problem of the inverters and malfunctions of the irradiance sensors installed in-situ.

System Features

| Real Time Diagnostic	Long Term Diagnostic	
PV Plants	PV Plants	Radiance Sensors
Detectable Failures: • Soiling or shading • Cover • Faulty MPPT • Thermal Problem **Timing:** • 2 hours back performances analysis updated every 1 hour **Outputs:** • Malfunction • Lost Production • Alert to Users	**Detectable Failures:** • Shading • Cover • Thermal Problem **Timing:** • 20 back days performances analysis updated every day **Outputs:** • Malfunction • Lost Production • Alert to Users	**Detectable Failures:** • Shading • Cover • General Malfunction **Timing:** • 20 back days performances analysis updated every day **Outputs:** • Malfunction • Alert to Users
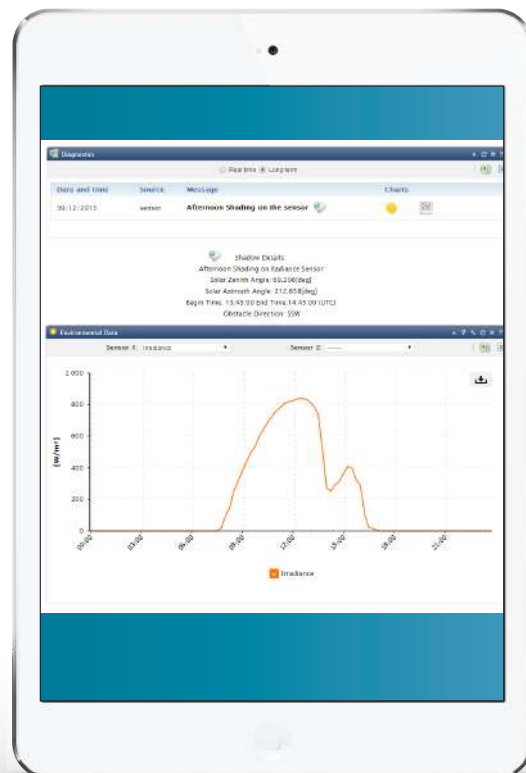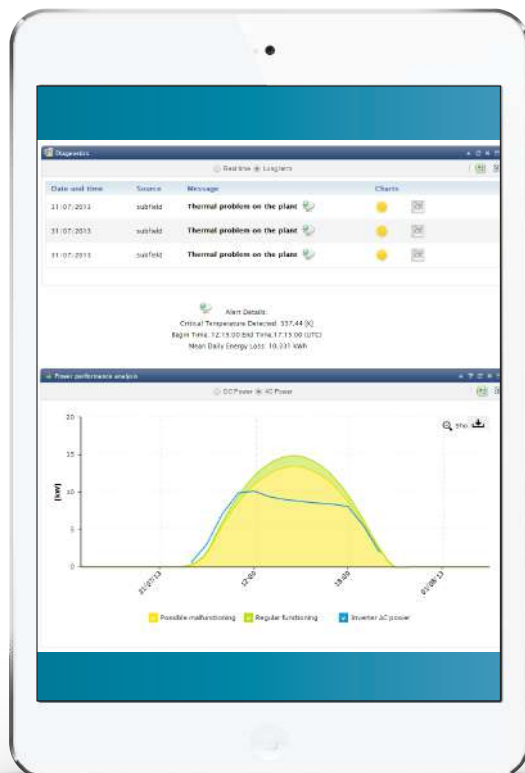
4D-REDSS

4D RENEWABLE PLANTS DECISION SUPPORT SYSTEM
From construction to the operation and maintenance: keepyour plant always under control
4D-REDSS remotely monitors the construction status of the PV plant and enables users to know the plant status, supporting the decision-making processes.
4D-REDSS collects and process Big Data for plant diagnostics and predictive analysis displaying results in a coherent 4D (space + time) user interface.

Provided services:
• Satelite Low and High Resolution service for monitoring the Plant construction status;
• Drone Video Processing for detection of panels, poles, trackers;
• Drone IR Video Processing for hotspot detection.
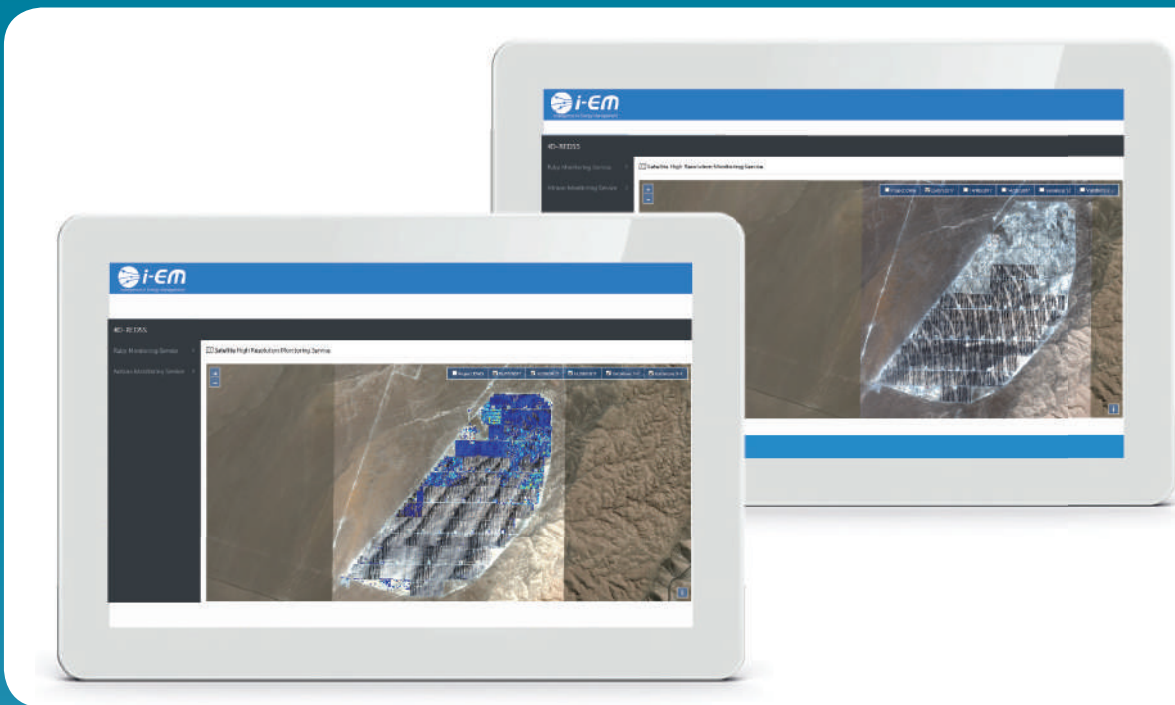
Benefits:
› Cost reduction for plant implementation by means of a better management of the operations
› Cost reduction in the management of the plant documentation

SATELLITE LR MONITORING SERVICE

The service monitors the work status during the development phase of new PV plant, processing Low Resolution (10m at ground) satellite images to evaluate the process of the entire construction process.

Service Features

Service Time Resolution	>> 5 days (depending on satellite data availability)
Information Provided	>> Satellite imagery of the plant area (10m resolution at round) >> Construction Process percentage (area completion) >> Detection of the areas changed from the last acquisition

SATELLITE HR MONITORING SERVICE

The service supplies the customers advanced Key Performance indicators for the main relevant building phases of new PV plant, exploiting High Resolution (0.3m - 0.5m at ground) satellite images.

Service Features

Service Time Resolution	>> 1 months (depending on satellite data availability and customer need)
Information Provided	>> Satellite imagery of the plant area (0.3m and 0.5m at ground depending on acquisition angle of the satellite) >> Detection of the areas changed from the last acquisition >> Construction Process percentage (area completion) >> Detection of poles, trackers, panels and cabin units installed (in percentage respect to the total)

DRONE VIDEO PROCESSING AND IR VIDEO PROCESSING

The drone video processing service detects and counts panels, poles, trackers and cabin unit.
IR video processing detects hotspost on the panels of the plant and provides different information and data.
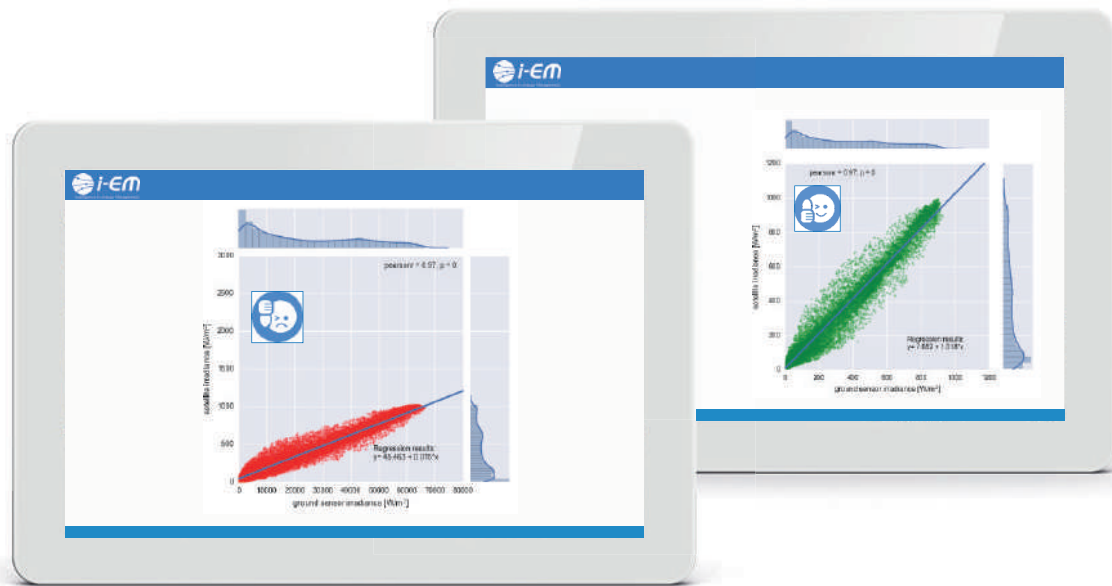

Georeferenced hotspot detenction

Sensor Check

REMOTE SOLAR RADIATION SENSOR CHECK:

During the plant operation keeping appropriate and accurate solar radiation measurements is crucial.
The real-time monitoring of the sensor measurements allows a early detection of sensor malfunctions and a more efficient and targetd recalibration planning.

Key Features

› Automatic remote sensor condition based check-up

› Sensor statistical remote recalibration

› PV plant time-dependent drifting deviation
  assessment from nominal behaviour

Benefits

› Increases PV plant performance assessment reliability

› Save time and cost for O&M resources

› Advanced diagnostics of PV plant

Predictive Maintenance

PHOTOVOLTAIC PREDICTIVE MAINTENANCE SERVICE:
The real-time service able to continuously monitor the current status of the plant and perform the real-time failure prediction. The i-EM predictive maintenance service PREDICO is able to predict inverter faults status before they actually occur, allowing the customer to take action to reduce plant underperformances.
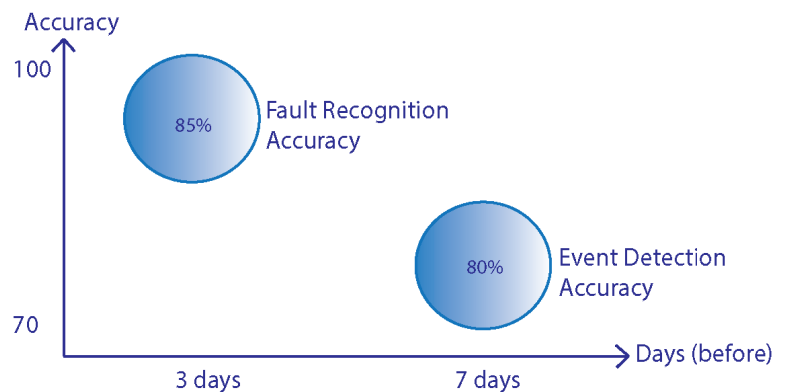

Key Features
› Event Detection - prediction of inverter deviations from nominal behaviour
› Advanced Fault Recognition - prediction of a specific class of fault

Benefits
› Keep optimal performance of PV plants over time
› Avoid Loss Production period
› Allow for O&M procedures efficient planning

Forecast solutions

YIELD FORECAST:

Since 2012, i-EM has been developing advanced solutions to model and predict the energy production of renewable plants, to improve the reliability and sustainability of the electrical grid. Plant operators, DSO, energy traders and scientific facilities trust our expertise in forecasting. I-EM provides a service for the prevision of feed-in power for renewable energy plants, in particular of the photovoltaic plants, with several time horizons.

KEY FEATURES

› NOWCasting: the prediction of solar energy power plants production, hourly-based data, up to 6 hours ahead.

› FORECasting: the prediction of solar and wind power output, hourly-based data, up to 72 hours ahead

› LTFORECasting: the prediction of solar and wind power output, hourly-based data, up to 15 days ahead.

Intuitive and interactive web interface:

› Power forecast versus measured power plots

› Forecasting performance up-to-date plots, automatically reporting uncertainty information such as bias, RMSE, NMAE, coefficient of determination R^2 values.

Self-consumption and storage management

i-EM developed advanced statistics analysis tools and computational intelligence approaches able to optimize the kind and size of the system storage based on user's consumption and on the plant features.

In addition, from the prediction of power produced by the plant for the hours (nowcasting) and for the days (forecasting) ahead, it is possible to define a strategy to minimize the energy exchanges with the grid for the following days.
In this way, i-EM created an integrated decision support system combining forecast and storage systems.

Advantages
› save money, optimizing the kind and size of the system storage;
› avoid imbalance penalties, correcting in real time possible forecasting inaccuracies using charge-discharge systems;
› be able to monitor and manage the system storage behaviour;
› guarantee a reliable energy feed-in management, thanks to an intelligent dynamic control system, reducing possible energy losses.
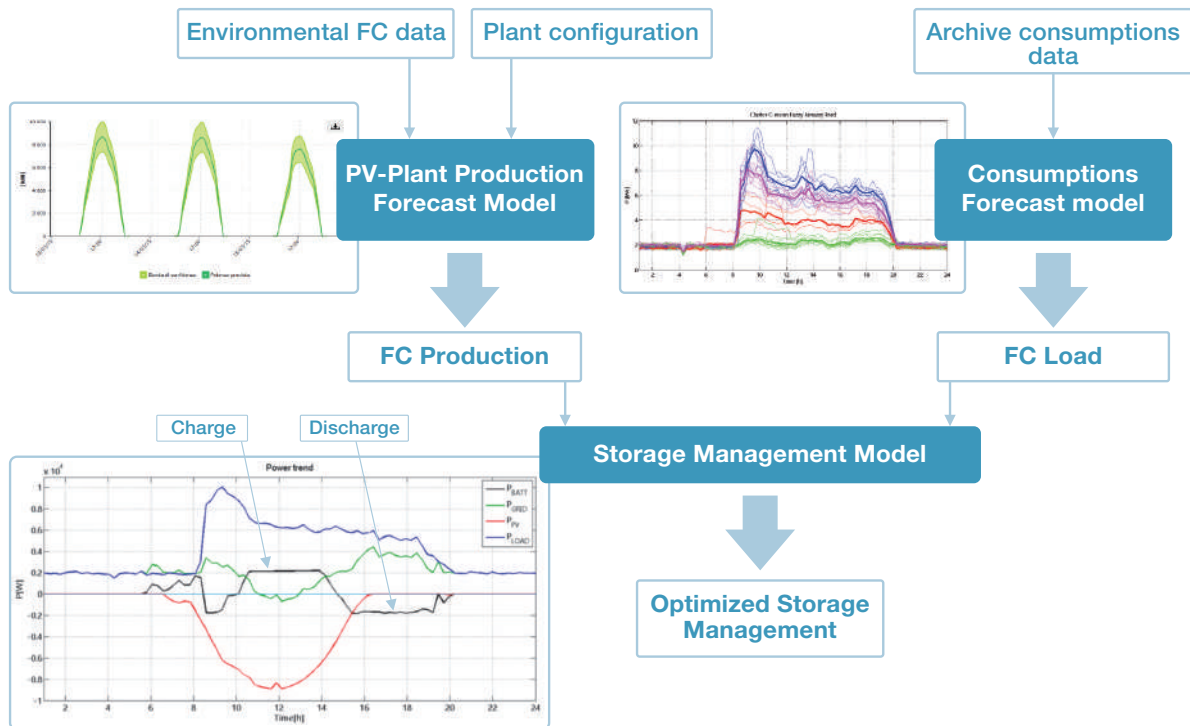

Since August 2014 is active a forecast
(up to 72h) and nowcast (up to +6h) service
to Enel Green Power for installation in Upington
(South Africa)
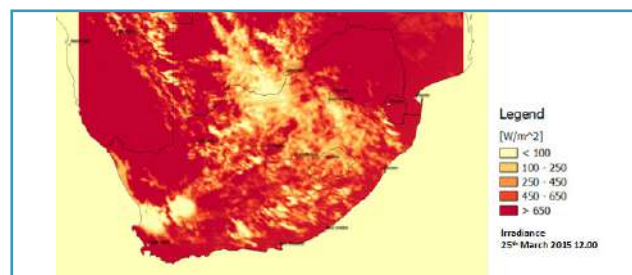
Comparative Analysis

	Features	i-EM	Other solutions
OT (Operational Technology)	Data acquisition system (datalogger)	✓	✓
	Third party systems acquisition	✓	
	Home and industrial automation protocols	✓	✓
	Environmental data acquisition (irradiance, temperature, etc)	✓	✓
IT (Information Technology)	Data visualization on web portal and mobile devices (smartphone & tablet)	✓	✓
	DC and AC power monitoring system	✓	✓
	PV model plant exploiting opto-electronic model	✓	
	Historical DBMS data: daily, weekly, monthly and yearly	✓	✓
Business Inttelligence	Measured and expected energy monitoring system (daily, weekly, monthly, yearly)	✓	✓
	Advanced alarm management system	✓	
	Nowcasting and forecasting (up to 72h, hourly based)	✓	
	Exploitation of satellite data for simulation and PR evaluation	✓	
	Advanced diagnostics system based on statistical analysis and A.I. methods	✓	
	Scatter plot analysis: measured Vs estimated value (power, irradiance tilted etc), monthly based	✓	
	Data fusion techniques exploiting satellite data	✓	
	Remote sensor check and calibration exploiting satellite data	✓	
	spatial database usage	✓	
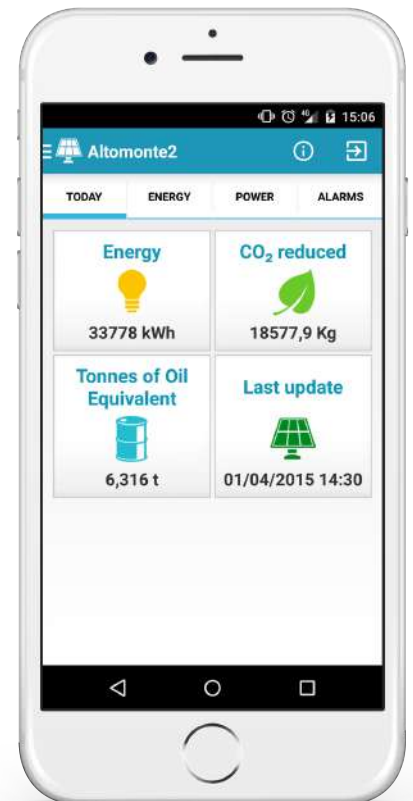
Multi level access

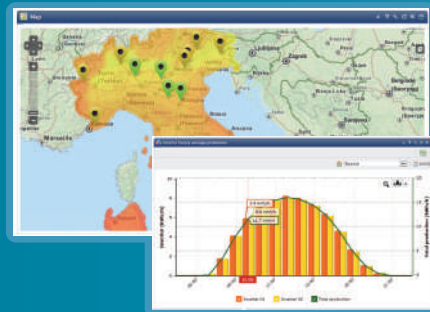### PV plant owner
› Economical information
› Standard reports and notifications

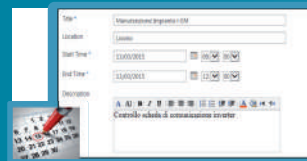### EPC contractor
› Status of all PV plants
› Detailed energy information, notifications and alarms
› All energy parameters view (current, voltage etc)
› Custom reports

O&M
› Aggregate information
› Monthly energy report
› Custom visualization

Different kind of information

OUR CUSTOMERS

EPC Contractor e System Integrator
» Enel Green Power
» Martifer Solar
» Enerray
» Global Power Service
» Energie del Sole / Solarlight - Gruppo Angelantoni

Electrical Energy Distributors
» Enel Distribuzione

Installers
» Manutencoop
» Magaldi

Manufacturers
» Nidec ASI

Public Administrations
» Regione Lombardia
» Università di Pisa
» Assolombarda

OUR SERVICES

Support

Need help? Save time by using our web-ticketing service: you can directly make online requests.
In case of on-field need, we'll connect you by phone to an expert.
In case of immediate need, phone assistance is available 24 hours!

Ad-Hoc solution

All our energy-management solutions are fully customizable. Thus, customers are able to configure personal settings according to their user level.

i-Em

Intelligence in Energy Management

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