inAccess
NETWORKS

inSolar

PhotoVoltaic Plant Monitoring Solution

November 2010

Overview

- Integrated solution for monitoring, control and management of Solar Parks
- Features
  - Support of multiple and geographical distributed Photovoltaic (PV) plants through a common control center in real time
  - Production/interconnection monitoring – Performance measurements
  - Alarm detection - Operational failure diagnosis
  - SMS/email notification
  - Security and access control - CCTV integration
  - Historical data statistical analysis & presentation
  - Provision of integrated reports
  - Support of solar park equipment from multiple vendors

Total Control

A lot more than inverter monitoring:

Production Elements Monitoring
(Strings, Inverters)

PCC Elements Monitoring
(Substation, Transformers, Protection Devices, Meters)

Weather Measurements
(Solar irradiation, Temperature, Wind, …)

Performance Measurements,
Real Time **Failure Diagnosis**

Management of Supportive Electromechanical Equipment (pillars, shelters, ...)

CCTV, Access Control (RFID), Perimeter Control (infrared beams)

Problems solved

- Varying networking options
- Varying mix of data / video
- Manual or Semi-automatic data collection
- Manual or Semi-automatic compilation of data
- Limited capability to produce reports
- Difficulty to justify penalties
- Different inverters
- Different inverter models
- Different e/m equipment
- Different protocols
- Different access control
- Different topologies
- Different alarm systems per epc / partners / country / area
- Huge data sets

System Benefits

Production monitoring	• Readily detects **failures and performance degradation to** minimize equipment/park downtime or underperformance and to maximize profit • Records the **energy finally sold** to the utility & the **actual revenues** • Provides **on-line performance measurements**
Grid inter-connection monitoring	• Identifies **problems originating from the utility provider** • Monitors **the output power quality characteristics**
Security & safety	• Secures **the solar park perimeter** and **shelters** • Allows **the entrance** to certain solar park facilities **only to accredited personnel** and **monitor their presence** • Readily detects **fire** and **flood conditions in the solar park shelters or pilars**

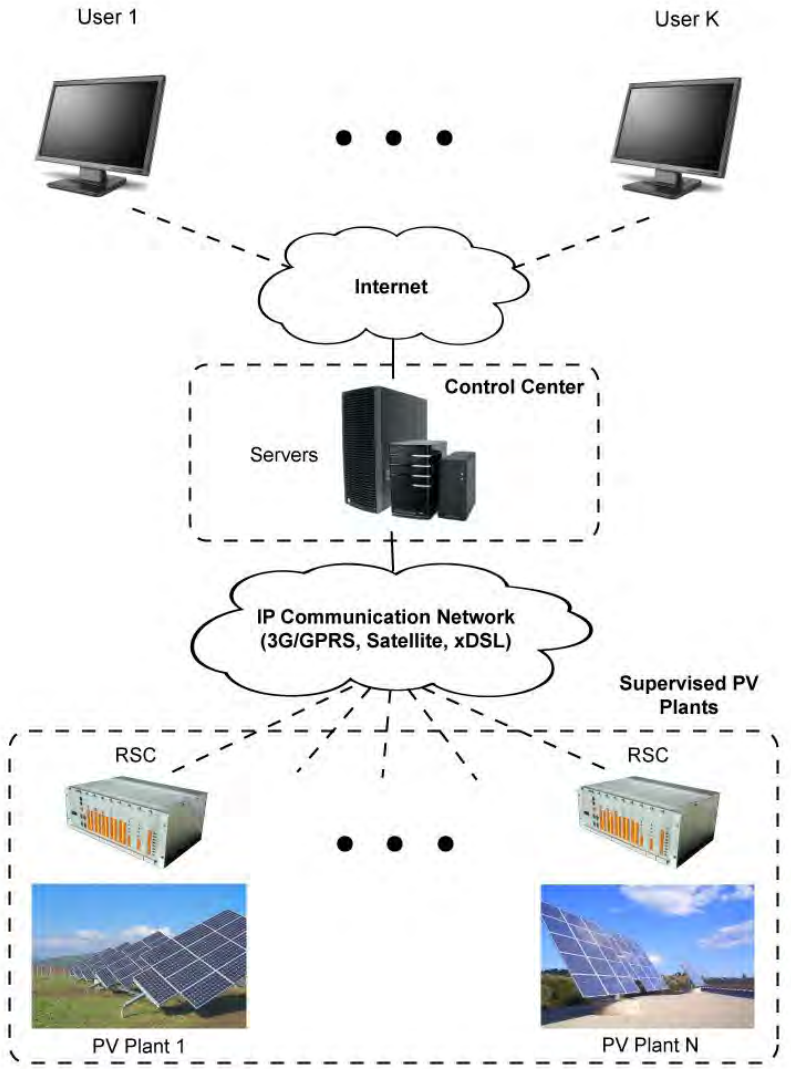
Vendor Independent

Support of solar park equipment from multiple vendors:

- Inverters
- Power Meters
- Protection Devices
- Meteorological devices
- Various Sensors
- Other E/M Equipment

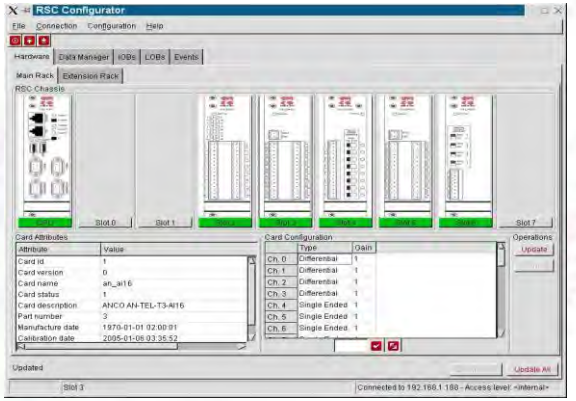
System Architecture

- **Control Centre** (CC): operator platform for managing all PV Sites
- **Solar Park Subsystem**: all peripheral monitoring and supervising systems (controller, sensors, cameras etc)



Solar Park subsystem

- RSC10: The intelligent Remote Site Controller
  - Embedded Linux operating system
  - Advanced control platform adopting modular application structure
  - Extensive control logic library tailored to solar park management
  - Network transparent control architecture with full networking and TCP/IP support
  - Native support of several field instrumentation buses including Modbus, Lonworks, BACnet, and EIB
  - Remotely managed software
- Sensors, actuators and measurement devices



Control Center

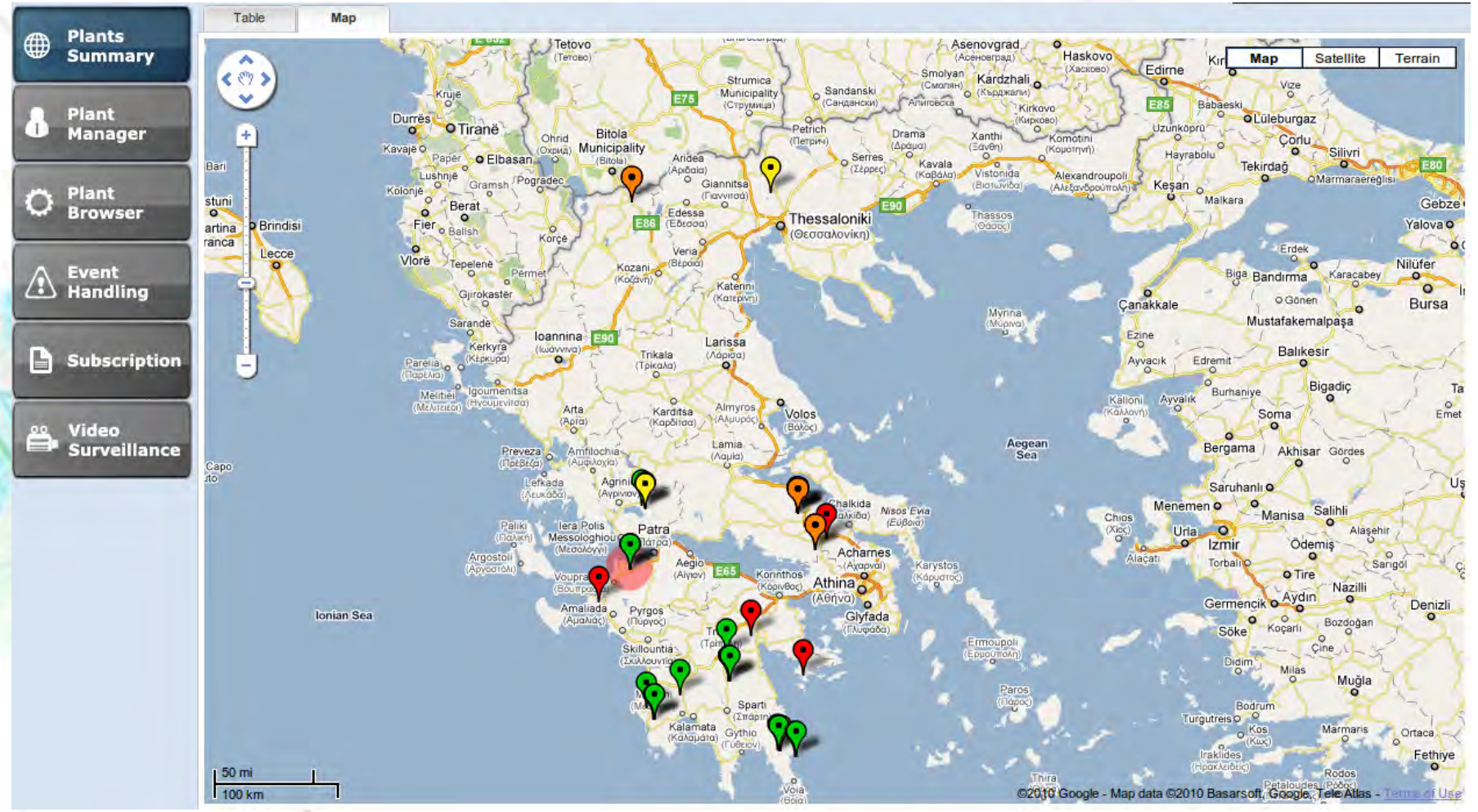
- Centralized management of all connected solar parks
- Based on web technologies
- Multilingual portal accessible over internet / intranet
- Database support for historical data
- Capability for SCADA connectivity
- System management tools
- Main and backup servers

Reference installations

- in operation since **2008**, 60 parks of 100KWp – 4.3MWp, **25MWp in total**
- Major new release mid 2009
- **>50%** GR market share in large solar parks (from 150KW to several MWp)
- Project Pipeline of **~60MWp** for the next 12 months in Greece
- **~100MWp** under discussions in several European Countries (Germany, France, Czech Republic)
- **Reference grid connected PV plants**:
  - 4.3 MWp in Florina, 2 MWp in Argolida, 2 MWp in Arcadia,2 MWp & 1.25 MWp in Viotia, 5 MWp in Viotia under construction

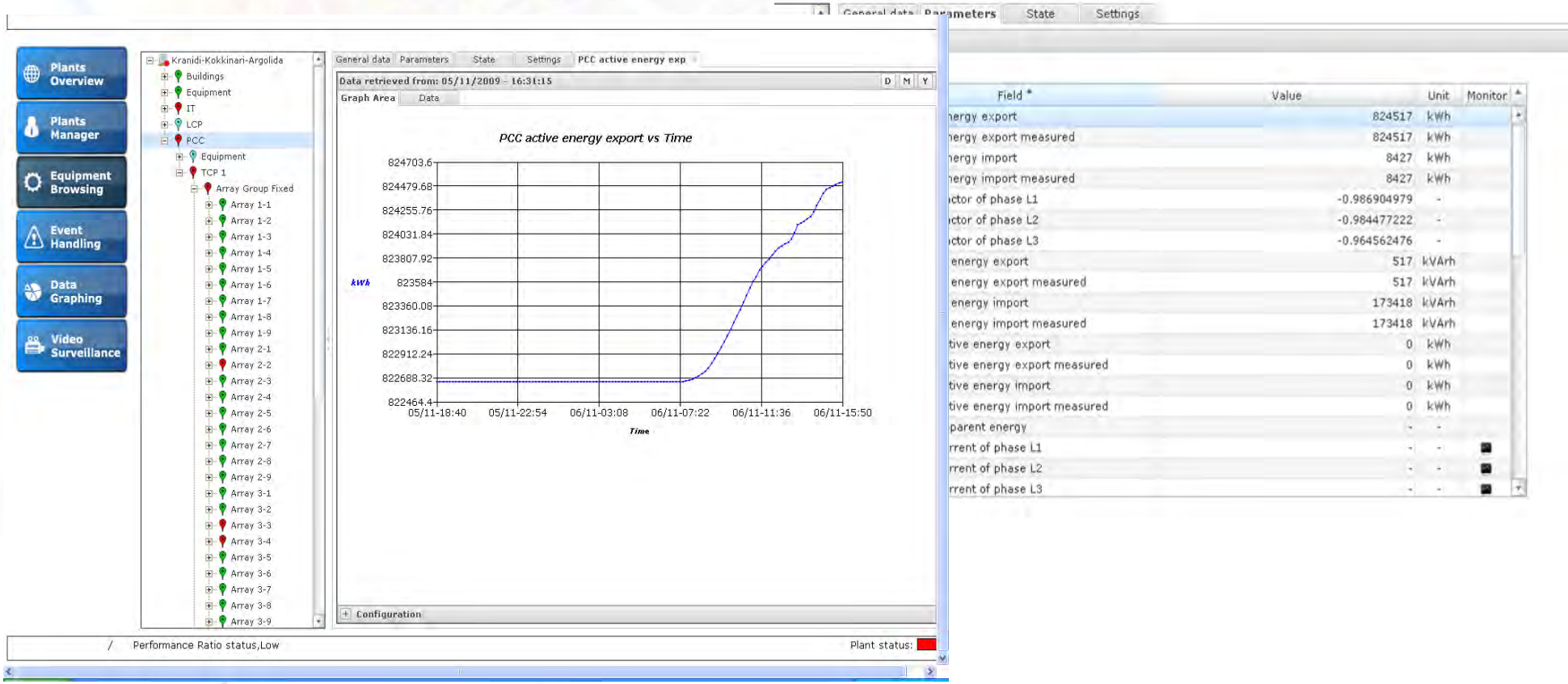
Centralized Management

- Support of multiple and geographical distributed PV plants through a common control center & internet portal in real time



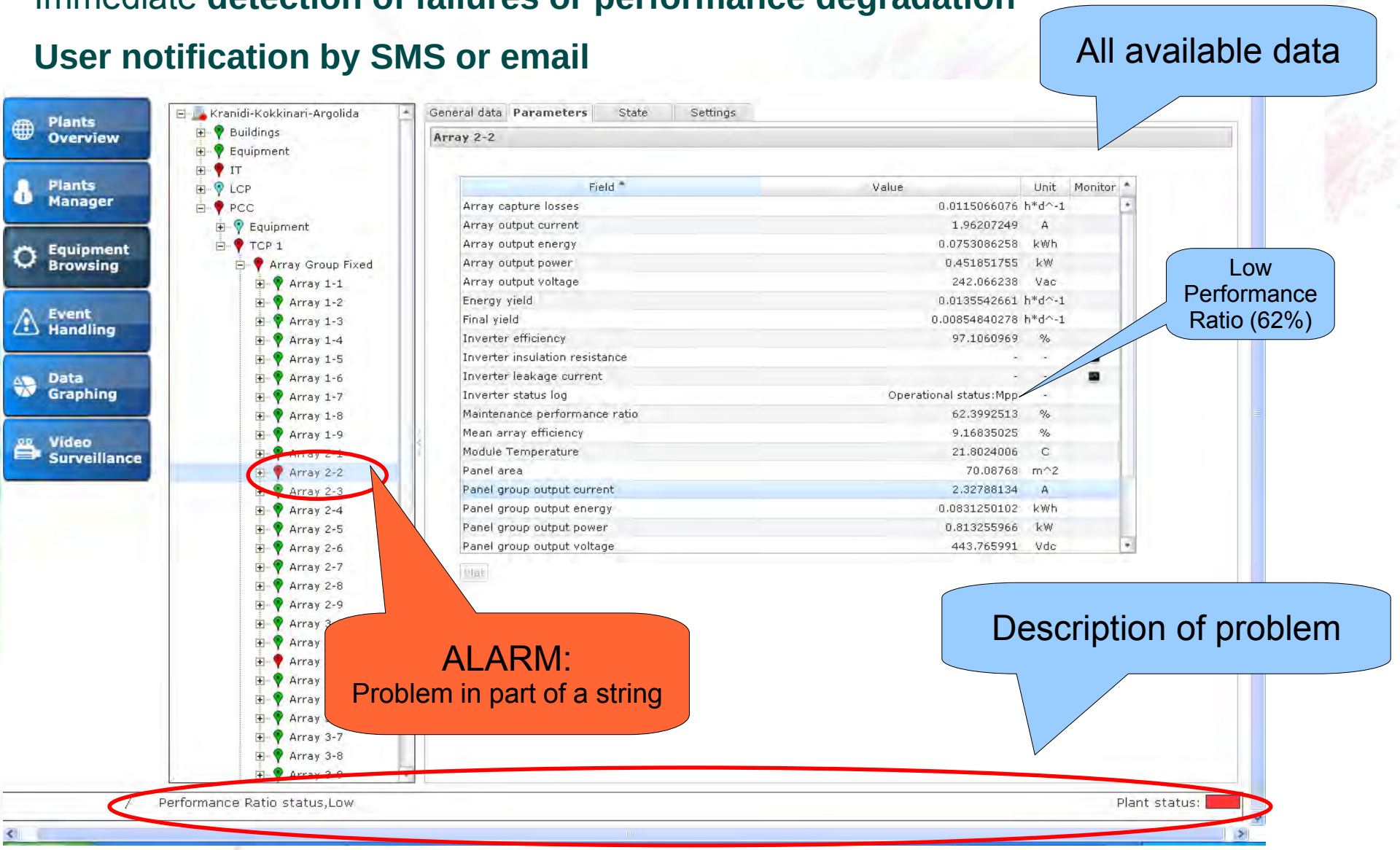
Production/grid interconnection monitoring

- **On line** production monitoring
- Recording of the **energy finally sold** to the utility & the **actual revenues**
- Monitoring of **the output power quality characteristics**
- Identification of **problems originating from the utility provider**



Alarm detection – SMS /email notification

- Immediate **detection of failures or performance degradation**
- **User notification by SMS or email**

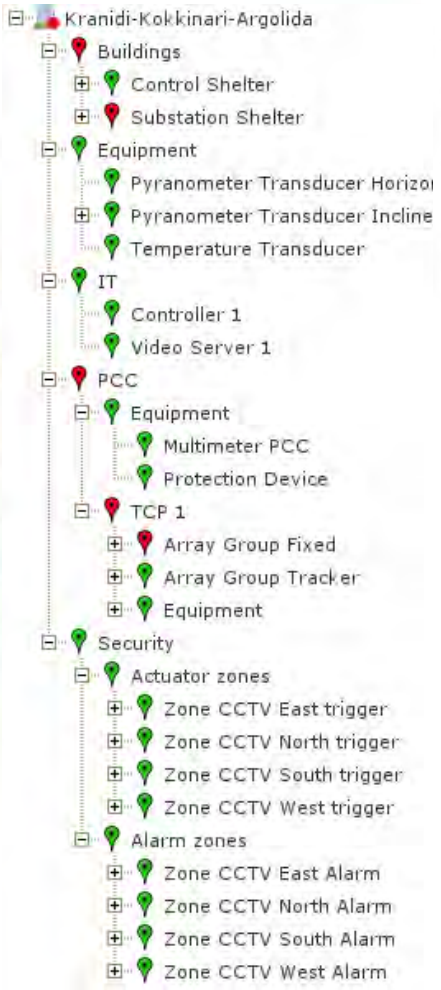


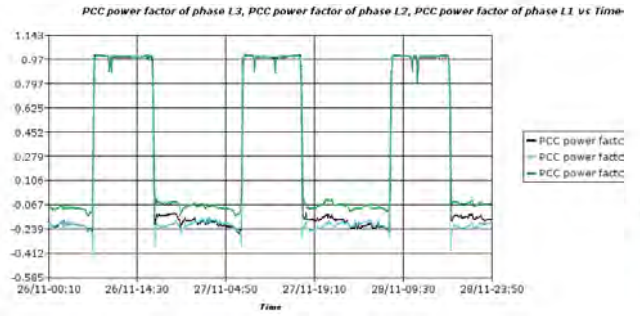
Security and access control

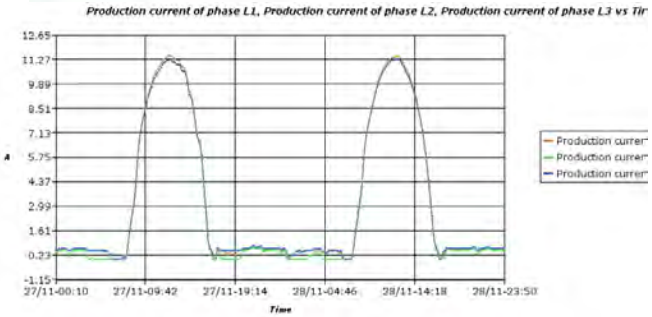
- Secures the solar park perimeter and shelters
- Allows the entrance to certain solar park facilities only to accredited personnel and monitor their presence
- Readily detects fire and flood conditions in the solar park shelters or pilars
- **CCTV integration** with **Live** Video Feed

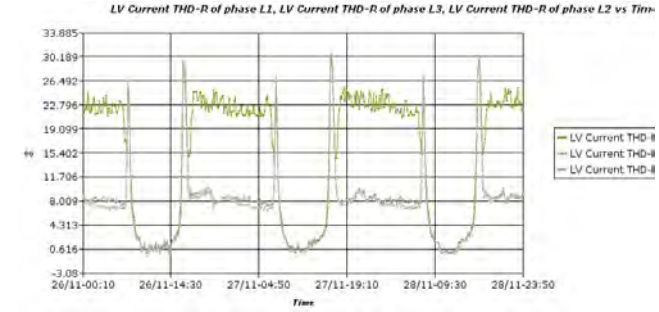
Value Added Online Services

- Detailed Hierarchical Browsing
- Alarms, Notifications
- Custom Severity Levels
- Primary Data / Derived KPIs for each park element
- Online Functions:
  - Exporting
  - Importing
  - Reporting
  - Graphing
  - Processing









Stakeholder Benefits

- **Management reporting**: easy, timely & accurate
- **Park performance optimization**: detailed engineering info
- Stakeholder relationship management:
  - Maintenance Subcontractors
  - Security Companies
  - Guarantees
  - Penalties
  - Billing disputes
  - Insurance