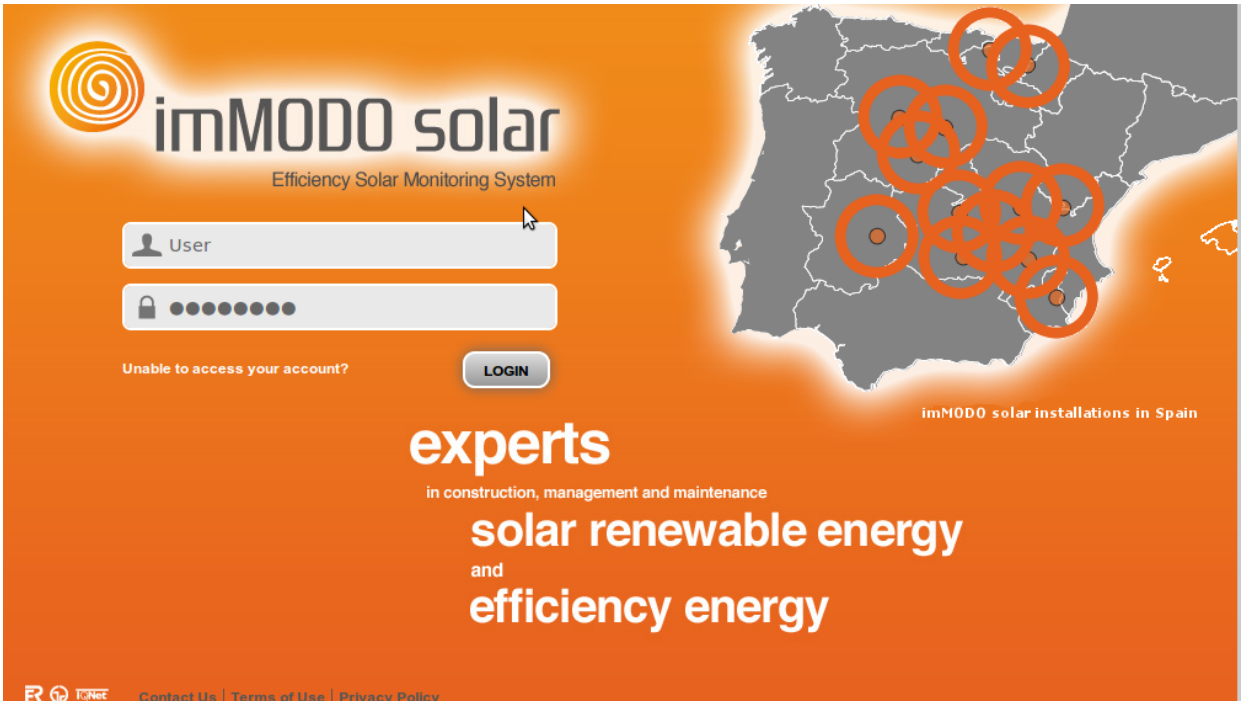
Monitor Version 3

Description and Instruction Manual

Authors: Systems Dept.

1. Start Menu

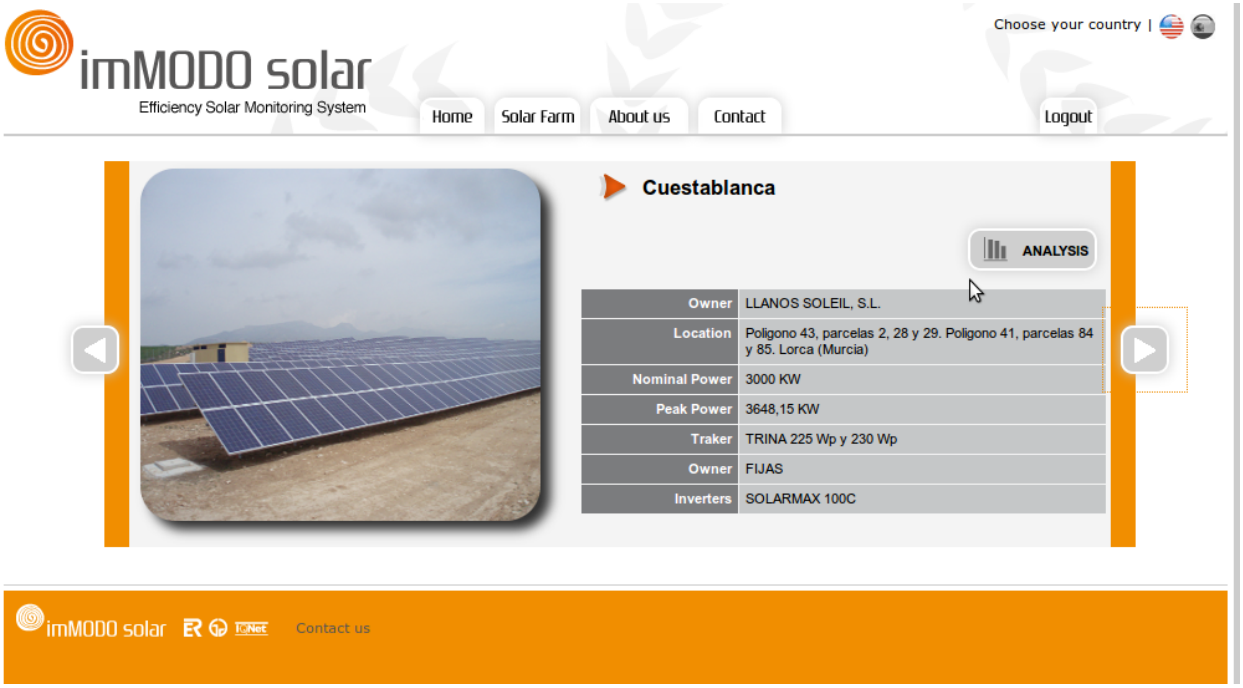
On entering the system you will encounter the screen shown on the following page. Here you need to enter your the details supplied to you by the administrators of the monitoring system (user and password). The plants that you will be able to access will depend on the administrative rights of the user.



2. Navegating between Solar Farms

Once you have entered the system you will see a slider type screen where you will be able to select the plant which interests you. The plant is selected by using the “Solar Farm” menu or by left or right clicking on the image or description or the plant.

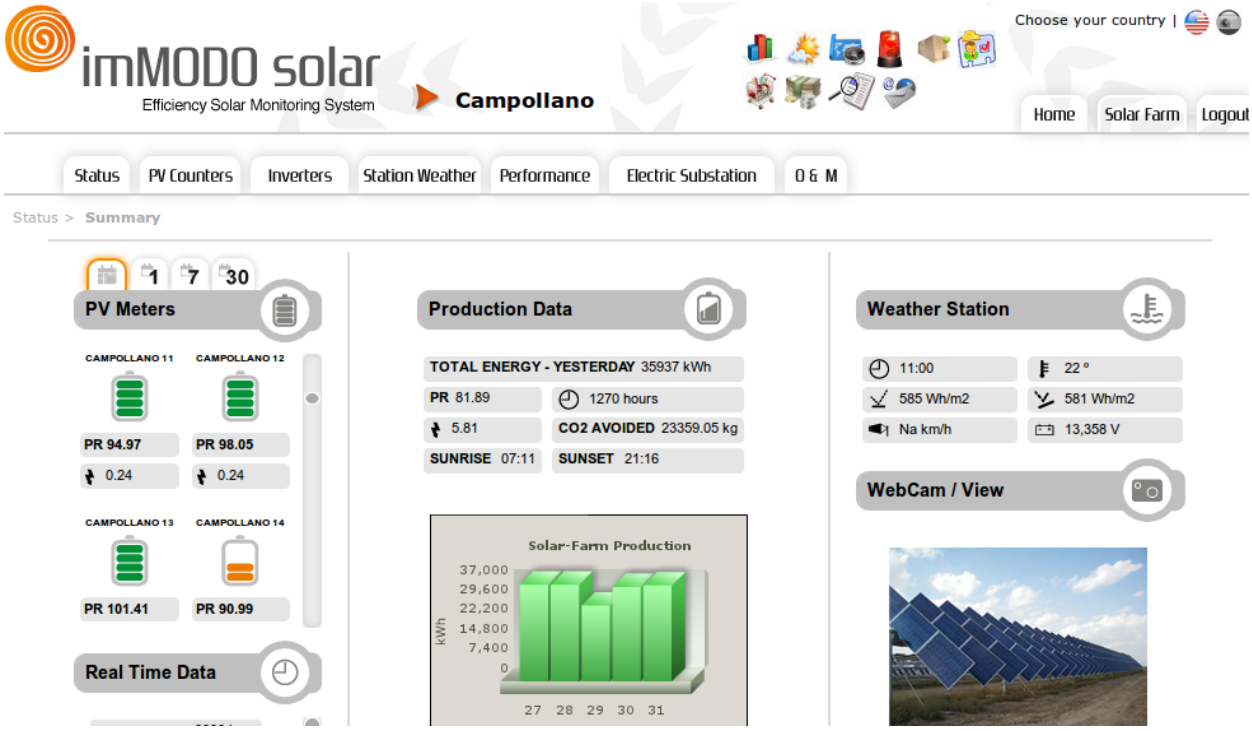
On the same screen you can select the language for the application. If a default language has been set for the navigator this will be used for the whole system. If, on the other hand no language has been selected the language used will be English. In any case, in the upper right part of the screen you will be able to change the language used for any of the screens.
The “About us” tab will lead you to a corporate description of the company. By selecting the “Contact” tab you can get in contact with any of the company’s departments.



To enter the selected plant you should select the “Analysis” button immediately above the description of the plant.

3. Summary Screen.

When you enter the analysis section of the chosen plant you will be able to see the following summary screen where you see a screen like the following which will provide a concise insight into the chosen plant.



In the upper part of the screen you will see the tabs which provide direct access to the main functions of the application. In the section immediately above this you will have drop down menus which will appear according to the characteristics of the plant. For example, if the plant has trackers the menu “Tracker” will also appear although it did not appear in the previous screen shot.

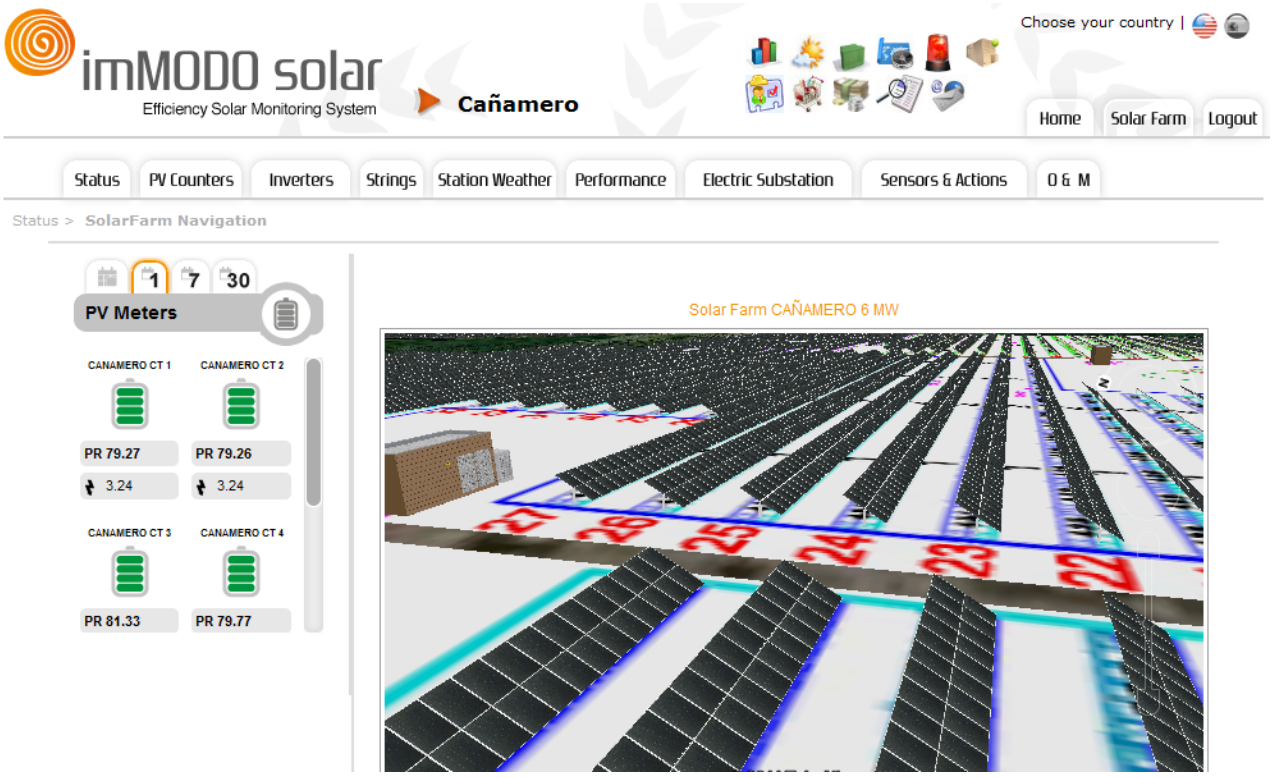
In the central part of the screen you will see a window on the left which will show the data provided by the counters in each installation of the plant. This window is divided in two tabs. You have the current tab where you can see the Performance Ratio and performance of each installation for the last hour. The colors of the icons which represent the installations varies according to the performance of the other plant’s installations. On the tab labeled “1” you will be able to see the previous day’s performance. On the tab labeled “7” you will be able to see the installation’s performance in the last seven days. On the tab labeled “30” you will be able to see the installations’ performance in the last 30 days. If the letters “NA” appear this is because the value has not been collected. In this left hand window you will also see the data of the telemetry in plant real time.

In the center right part of the screen you will be able to see a summary of the whole plant which shows the energy for the previous day, the performance ratio achieved, accumulated hours up to the present time, the performance for the previous day, CO2 saved for the previous day, and the sun rise and sunset times. In addition you will be able to see a graph with the operation of the plant regarding the energy obtained in previous days, and the data received from the weather station and cameras.

4. Menu: Status

In this first tools menu the summary screen is found. It can be selected at any moment by choosing the option “Summary”. In addition to this screen there are various other utilities:

- Access to documents. By selecting this option you will be able to see all the plants documentation such as plans, licences etc..
- 3D Navegation. This allows you to navegate through the plant in 3D.
- Cameras. This provides Access to the plants’ cameras.



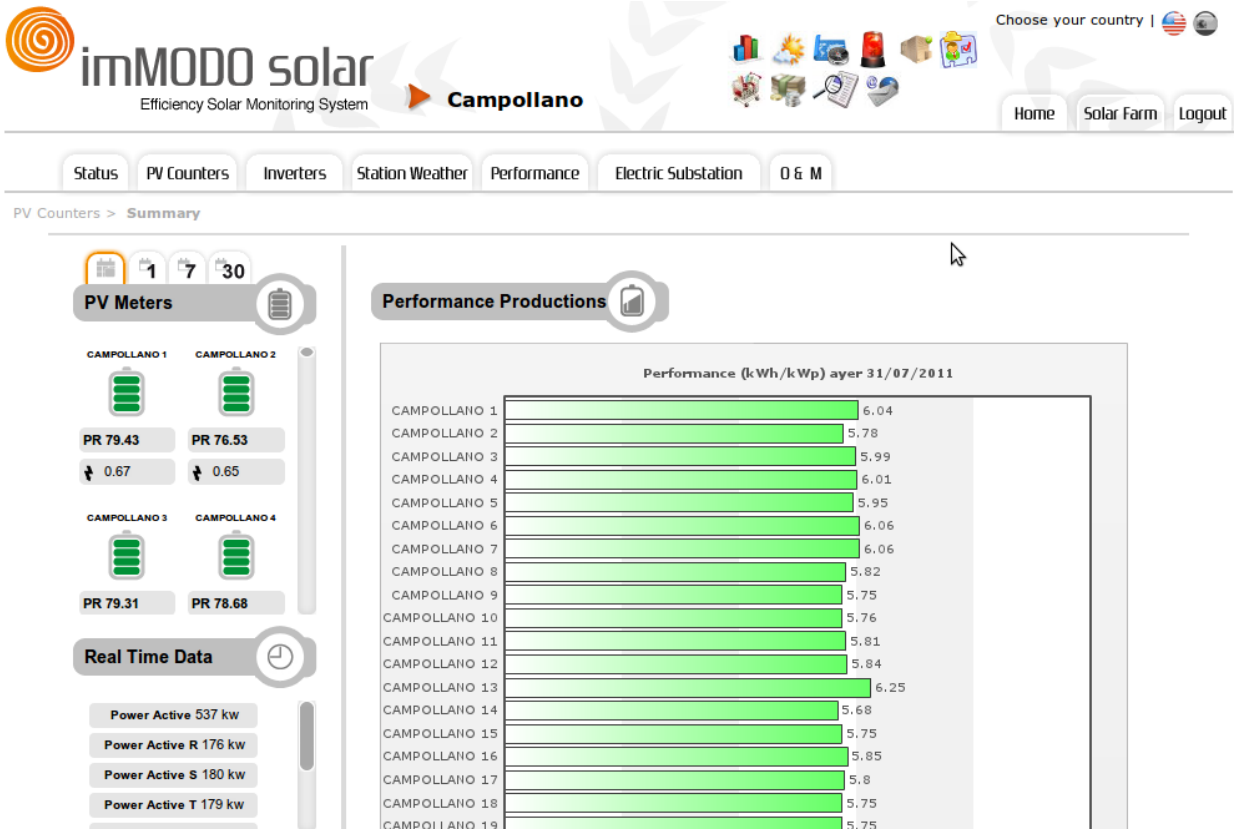
In the previous screen shot you can see the rows of modules of one of the plants.

5. Menu: PV Counters

In this menu various options are provided for analysis of the plant using the readings of data collected in the installations’ counters.

5.1 Summary

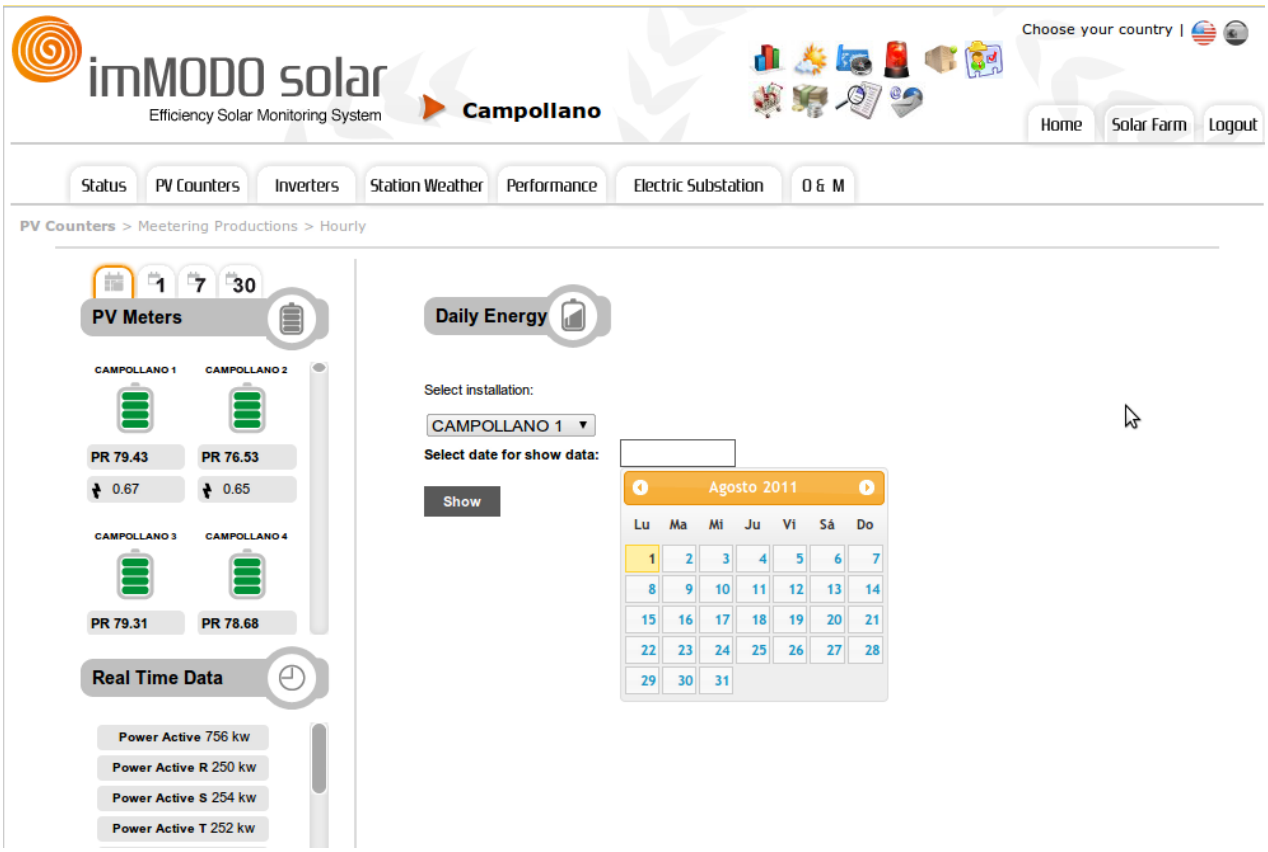
Here you will be able to see a graph with the performances of every installation for the previous day. This performance is calculated dividing the production by the peak power.



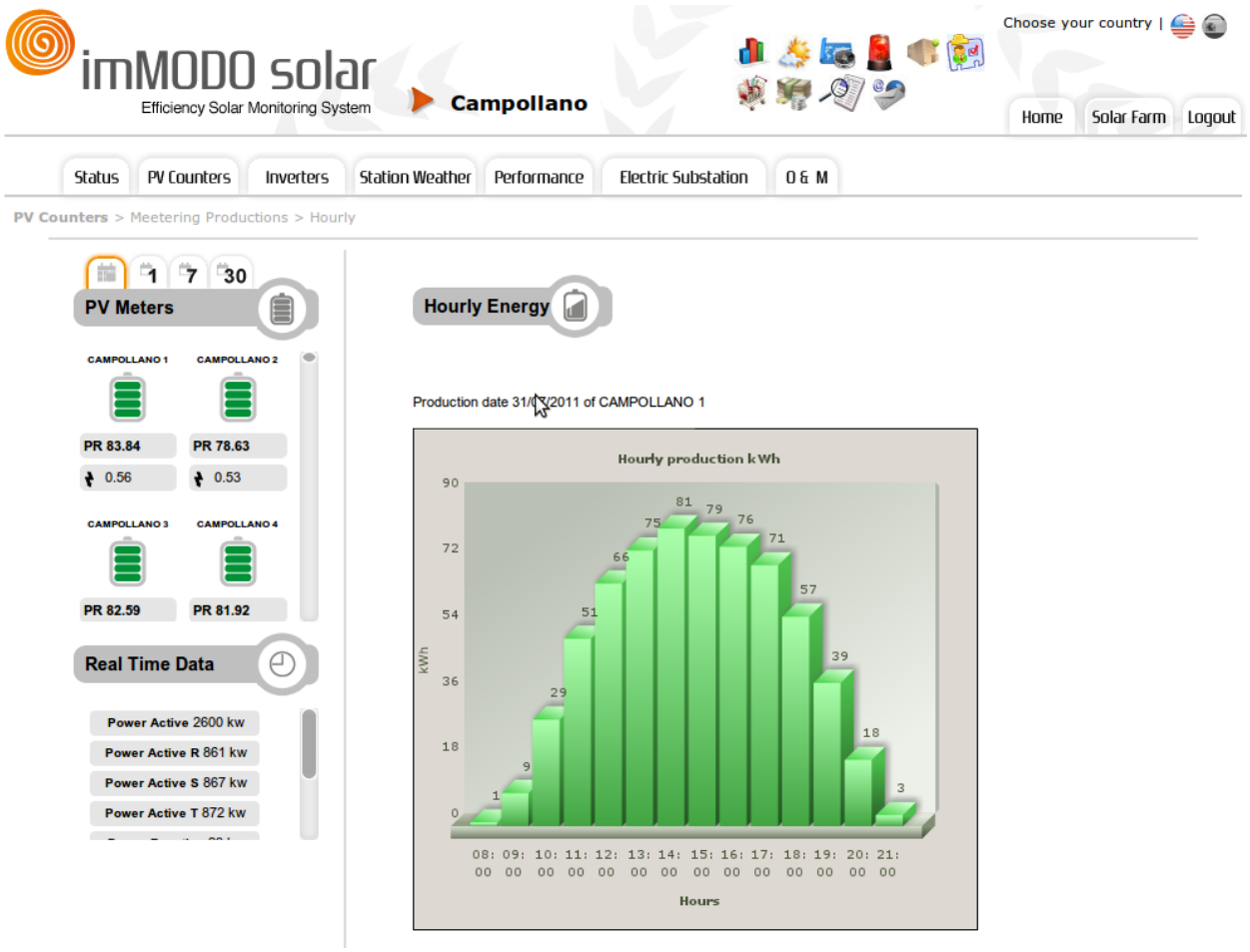
5.2 Meetering Production

In this menu various options will appear in the drop down menu and you will be find hourly, daily, monthly, yearly or overall data in order to be able to study each installation.

All options require you to fill out a form where you will have to choose the installation and period you wish to consult.



As you can see in the previous screen shot the installation that is being consulted is CAMPOLLANO for 1st August 2011.



5.3 SolarFarm Production

In this menu various options will appear as once again you will be able to make an hourly, daily, monthly, annual or overall analysis. On the other hand another series of options is incorporated:

- Monthly Energy (day to day), which allows you calculate the monthly production of the plant through information provided for each day in the month.
- History. This option provides information for the plant between selected dates.
- Yearly Consumption. This shows the annual consumption of the plant.

5.4 Performance

In this option three methods of acquiring performance data are offered: on one determined day, in one month and in one year.
Just as in other options a graph and data is shown accompanied by downloadable data in Excel.

5.5 PR

This menu options provides you with the possibility of analyzing the Performance Ratio of the plant on a daily, or monthly basis or indeed a monthly basis detailed by day.

5.6 Company Counter

This menu offers options for extracting the company's counter data. It is divided into two submenus.

- Data. From this data you can extract daily, montly and annual reports.
- Audits. From this you can extract monthly or annual data identifying all tariffs

The following screen shows an excel sheet generated through one of the above options. This Excel sheet shows the billings of a company counter over the course of a year.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Fecha_inicio	Fecha_fin	Contract	Tariff	ActiveEnergyAbs	ActiveEnergyInc	Excess	MaximumDemand	ReactiveCapacitiveEnergyAbs	ReactiveCapacitiveEnergyInc	ReactiveInductiveEnergyAbs	ReactiveInductiveEnergyInc	QualityActiveEnergy	QualityExcess	QualityMaximumDemand	QualityReactiveCap
2	1/1/2010	1/2/2010	1	0	49346	3075	0	18	543500	35447	0	0	2	130	2	
3	1/1/2010	1/2/2010	1	1	5246	738	0	17	59189	8343	0	0	2	130	2	
4	1/1/2010	1/2/2010	1	2	9000	222	0	11	94576	2712	0	0	2	130	2	
5	1/1/2010	1/2/2010	1	3	20055	1031	0	6	222787	11969	0	0	2	130	2	
6	1/1/2010	1/2/2010	1	4	1208	0	0	0	13719	0	0	0	2	130	2	
7	1/1/2010	1/2/2010	1	5	4747	425	0	16	52147	4955	0	0	2	130	2	
8	1/1/2010	1/2/2010	1	6	9088	660	0	18	101079	7468	0	0	2	130	2	
9	1/1/2010	1/2/2010	2	0	49346	3075	0	18	543500	35447	0	0	2	130	2	
10	1/1/2010	1/2/2010	2	1	6482	799	0	16	74199	9303	0	0	2	130	2	
11	1/1/2010	1/2/2010	2	2	42863	2276	0	18	469300	26143	0	0	2	130	2	
12	1/1/2010	1/2/2010	3	0	6748752	214494	0	2601	209948	6028	320374	19183	2	130	2	
13	1/1/2010	1/2/2010	3	1	6748752	214494	0	2601	209948	6028	320374	19183	2	130	2	
14	1/1/2011	1/2/2011	1	0	79051	3064	0	19	888772	35102	1	0	82	210	82	
15	1/1/2011	1/2/2011	1	1	8644	747	0	18	99076	8321	0	0	82	210	82	
16	1/1/2011	1/2/2011	1	2	13887	244	0	6	150083	2886	0	0	82	210	82	
17	1/1/2011	1/2/2011	1	3	32362	1089	0	6	368706	12566	0	0	82	210	82	
18	1/1/2011	1/2/2011	1	4	1217	0	0	0	13796	0	0	0	82	210	82	
19	1/1/2011	1/2/2011	1	5	8036	392	0	15	89724	4491	0	0	82	210	82	
20	1/1/2011	1/2/2011	1	6	14682	592	0	19	166883	6838	0	0	82	210	82	
21	1/1/2011	1/2/2011	2	0	79051	3064	0	19	888772	35102	1	0	82	210	82	
22	1/1/2011	1/2/2011	2	1	10292	823	0	15	117607	9310	0	0	82	210	82	
23	1/1/2011	1/2/2011	2	2	68759	2241	0	19	771165	25792	0	0	82	210	82	
24	1/1/2011	1/2/2011	3	0	12204629	294221	0	2503	411899	11464	497856	14851	82	210	82	
25	1/1/2011	1/2/2011	3	1	12204629	294221	0	2503	411899	11464	497856	14851	82	210	82	

6. Menu: Inverters

This menu analyses the solar plant using inverters. Various options are provided for the analysis of such.

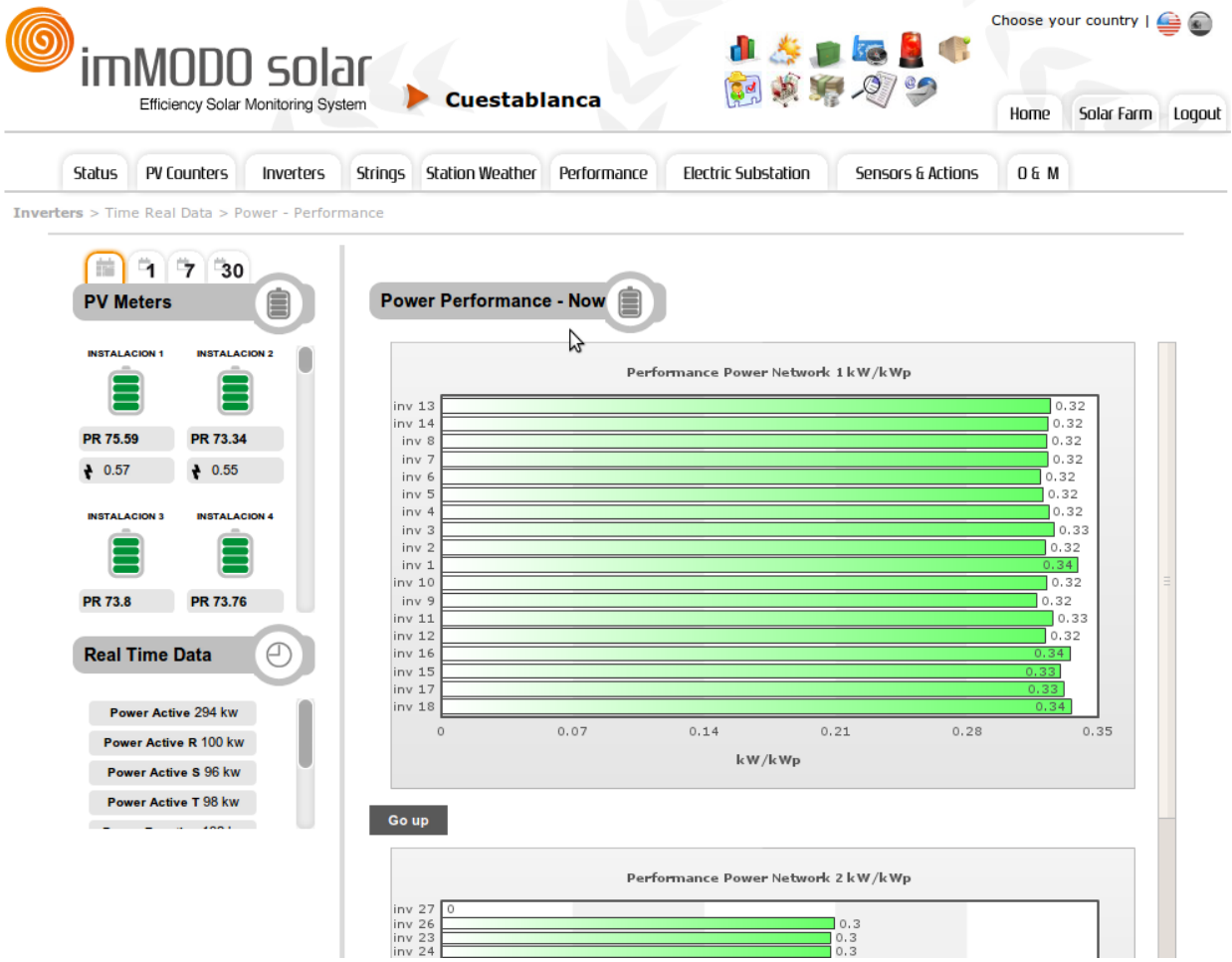
6.1 Summary

A series of graphs are shown where the power of the networks or inverter buses into which the plant is divided is recorded. These graphs help to provide an simple overview of the behavior of all the areas of the plant Here you can see the anomalies in the different areas of the plant by identifying the difference in the power curves as well as the time at which they occurred.

In the previous screen shot you can see that the networks are behaving in a similar way and no one network is working less than any other.

6.2 Real Time

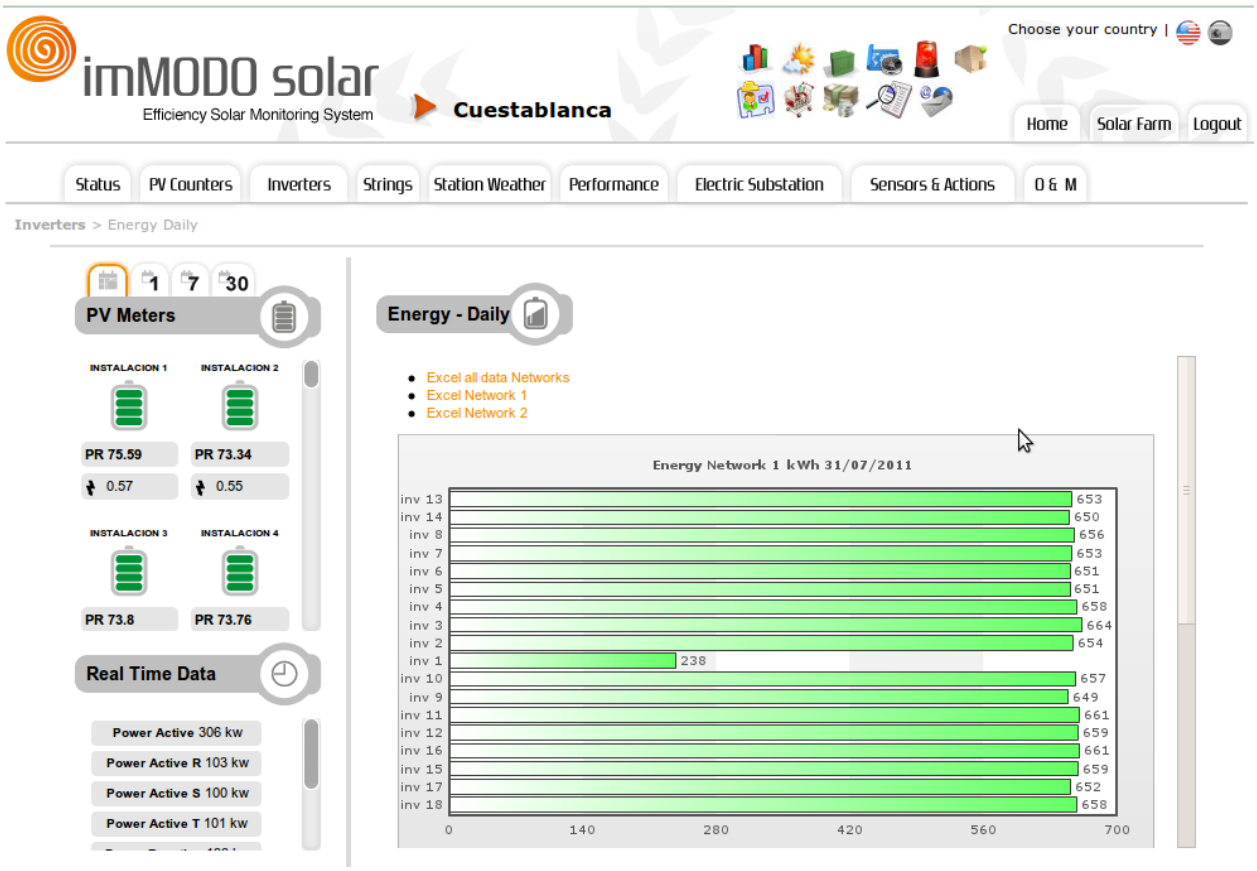
In this menu you will see the data obtained in the last extract of the inverters of the plant. We may be talking here of a maximum time span of between 10 and 15 minutes depending on the characteristics of the plant.
The data which can be consulted in real time are those of power, energy, power performance and energy performance. The data requested will be shown in the form of a graph.



In the previous screen shot you can see that inverter 227 of the Network or Bus 2 is switched off. This error will already have been reported to the operators from the events module.

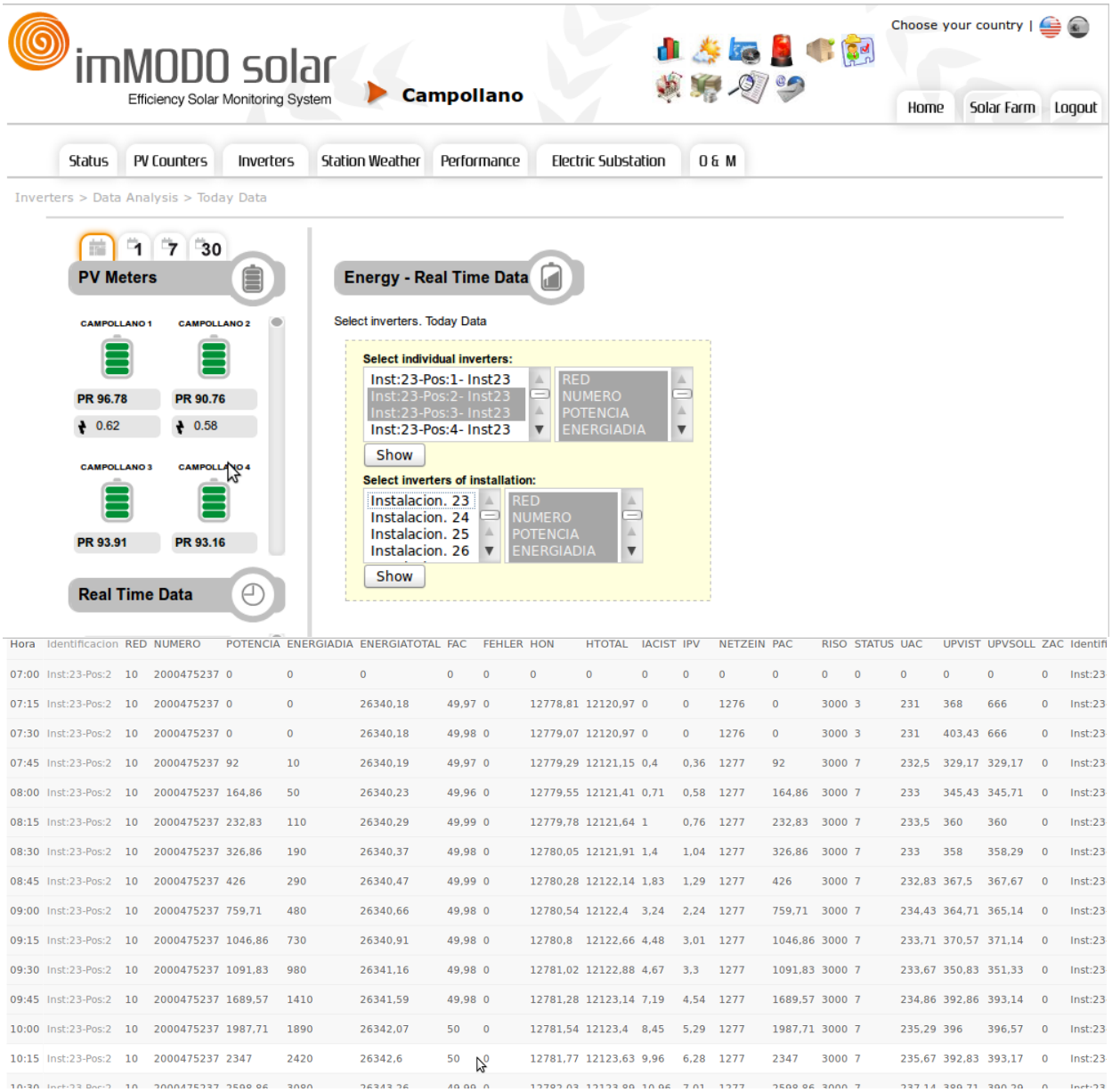
6.3 History

In this menu past days' data can be analyzed. The options offered for such an analysis are: Day's Energy, Month's Energy, Day to Day Energy in a Month, performance in Energy, Day's Availability and Month's Availability.



6.4 Analysis

In this menu a comparative analysis of the data from different inverters is provided. The period of time which can be selected for this analysis is: Real Time, Today and Any Other Day.



Hora	Identificacion	RED	NUMERO	POTENCIA	ENERGIADIA	ENERGIATOTAL	FAC	FEHLER	HON	HTOTAL	IACIST	IPV	NETZEIN	PAC	RISO	STATUS	UAC	UPVIST	UPVSOLL	ZAC	Identifi
07:00	Inst:23-Pos:2	10	2000475237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Inst:23
07:15	Inst:23-Pos:2	10	2000475237	0	0	26340,18	49,97	0	12778,81	12120,97	0	0	1276	0	3000	3	231	368	666	0	Inst:23
07:30	Inst:23-Pos:2	10	2000475237	0	0	26340,18	49,98	0	12779,07	12120,97	0	0	1276	0	3000	3	231	403,43	666	0	Inst:23
07:45	Inst:23-Pos:2	10	2000475237	92	10	26340,19	49,97	0	12779,29	12121,15	0,4	0,36	1277	92	3000	7	232,5	329,17	329,17	0	Inst:23
08:00	Inst:23-Pos:2	10	2000475237	164,86	50	26340,23	49,96	0	12779,55	12121,41	0,71	0,58	1277	164,86	3000	7	233	345,43	345,71	0	Inst:23
08:15	Inst:23-Pos:2	10	2000475237	232,83	110	26340,29	49,99	0	12779,78	12121,64	1	0,76	1277	232,83	3000	7	233,5	360	360	0	Inst:23
08:30	Inst:23-Pos:2	10	2000475237	326,86	190	26340,37	49,98	0	12780,05	12121,91	1,4	1,04	1277	326,86	3000	7	233	358	358,29	0	Inst:23
08:45	Inst:23-Pos:2	10	2000475237	426	290	26340,47	49,99	0	12780,28	12122,14	1,83	1,29	1277	426	3000	7	232,83	367,5	367,67	0	Inst:23
09:00	Inst:23-Pos:2	10	2000475237	759,71	480	26340,66	49,98	0	12780,54	12122,4	3,24	2,24	1277	759,71	3000	7	234,43	364,71	365,14	0	Inst:23
09:15	Inst:23-Pos:2	10	2000475237	1046,86	730	26340,91	49,98	0	12780,8	12122,66	4,48	3,01	1277	1046,86	3000	7	233,71	370,57	371,14	0	Inst:23
09:30	Inst:23-Pos:2	10	2000475237	1091,83	980	26341,16	49,98	0	12781,02	12122,88	4,67	3,3	1277	1091,83	3000	7	233,67	350,83	351,33	0	Inst:23
09:45	Inst:23-Pos:2	10	2000475237	1689,57	1410	26341,59	49,98	0	12781,28	12123,14	7,19	4,54	1277	1689,57	3000	7	234,86	392,86	393,14	0	Inst:23
10:00	Inst:23-Pos:2	10	2000475237	1987,71	1890	26342,07	50	0	12781,54	12123,4	8,45	5,29	1277	1987,71	3000	7	235,29	396	396,57	0	Inst:23
10:15	Inst:23-Pos:2	10	2000475237	2347	2420	26342,6	50	0	12781,77	12123,63	9,96	6,28	1277	2347	3000	7	235,67	392,83	393,17	0	Inst:23

In this menu you can also find the options for comparing the inverter's power with respect to the Day's Radiation. In this manner you can determine a possible performance drop in the inverters in the face of certain climate conditions.

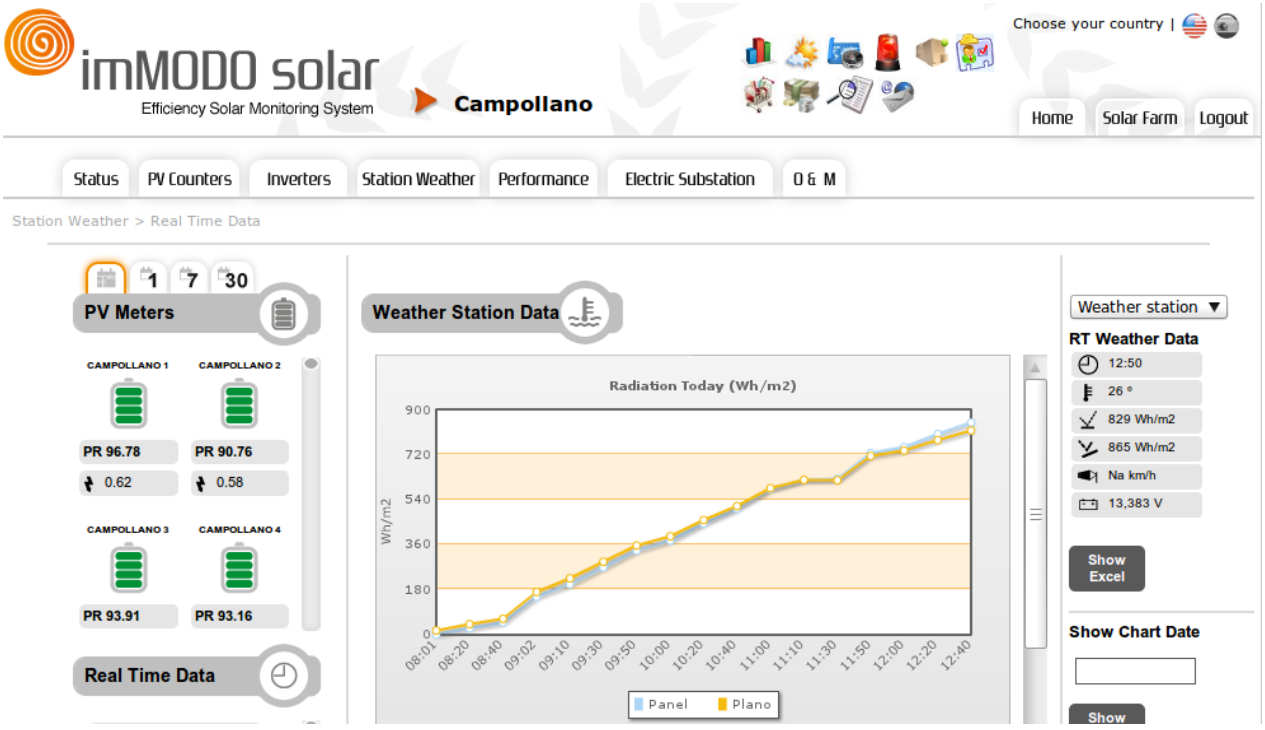
7. Menu: Weather Station

In this section the data from the Weather Station is analyzed both in real time and by history.

If you consult the data in real time, you will see that the central part is divided into two zones. The first shows you the graphs of the day for radiation, temperature and wind values. In these graphs you can observe the chronological changes identified by the different sensors. On the right hand side you can:

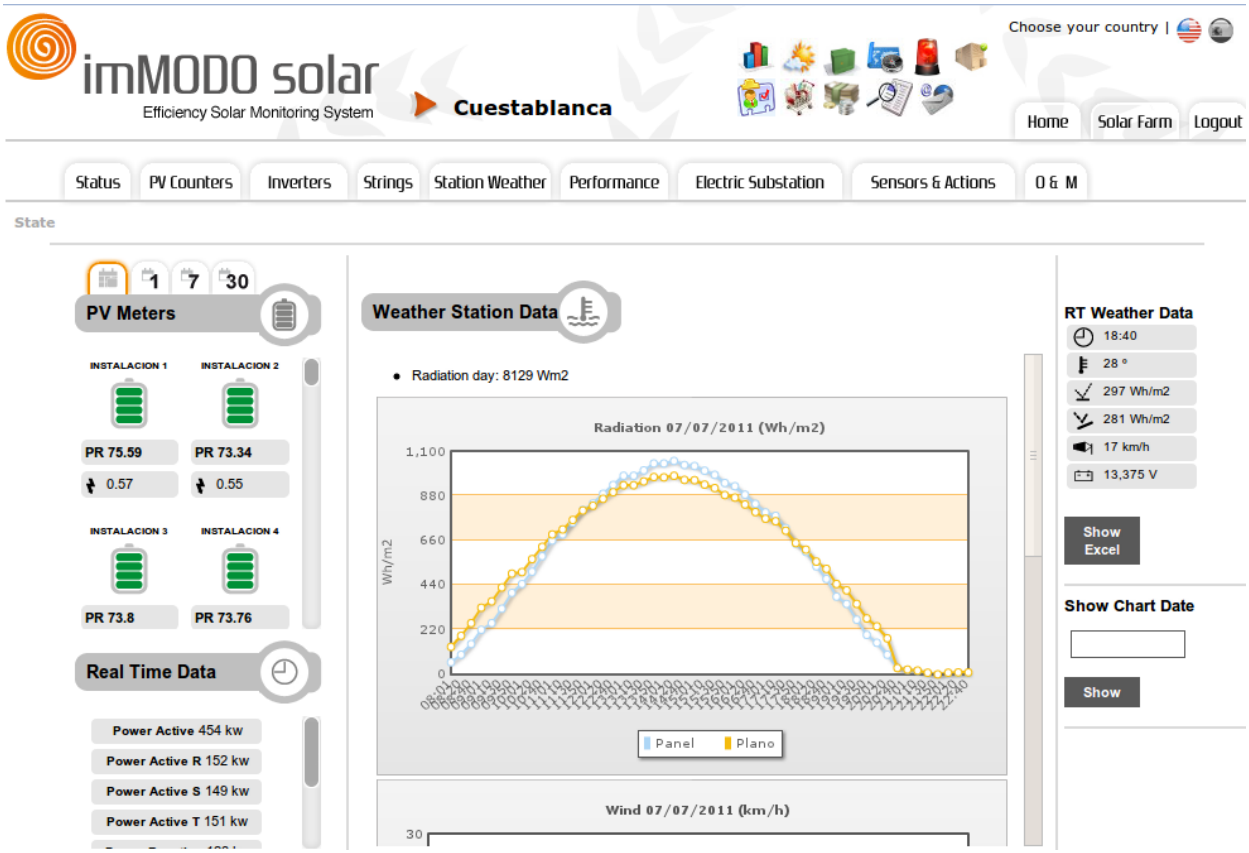
- Change the Station (in the case of having more than one per plant)
- See the current data of the Weather Station
- Access the radiation for a month in question.
- Show data for a certain day in graph form.

If you consult the historical data you can download an Excel spreadsheet by days or selected months.



In the previous screen shot you can see a consultation of the radiation obtained by a plant by the flat sensor and the sensor inclined until 12:40, the time of the last data acquisition. If you scroll down this screen you can see other graphs fro temperature, wind, rainometer or any other sensor which the station has installed.

If you consult the meteorological data of the days which have passed, you can obtain the total radiation registered on that day in the upper part of the screen. This can be seen in the following screen shot.

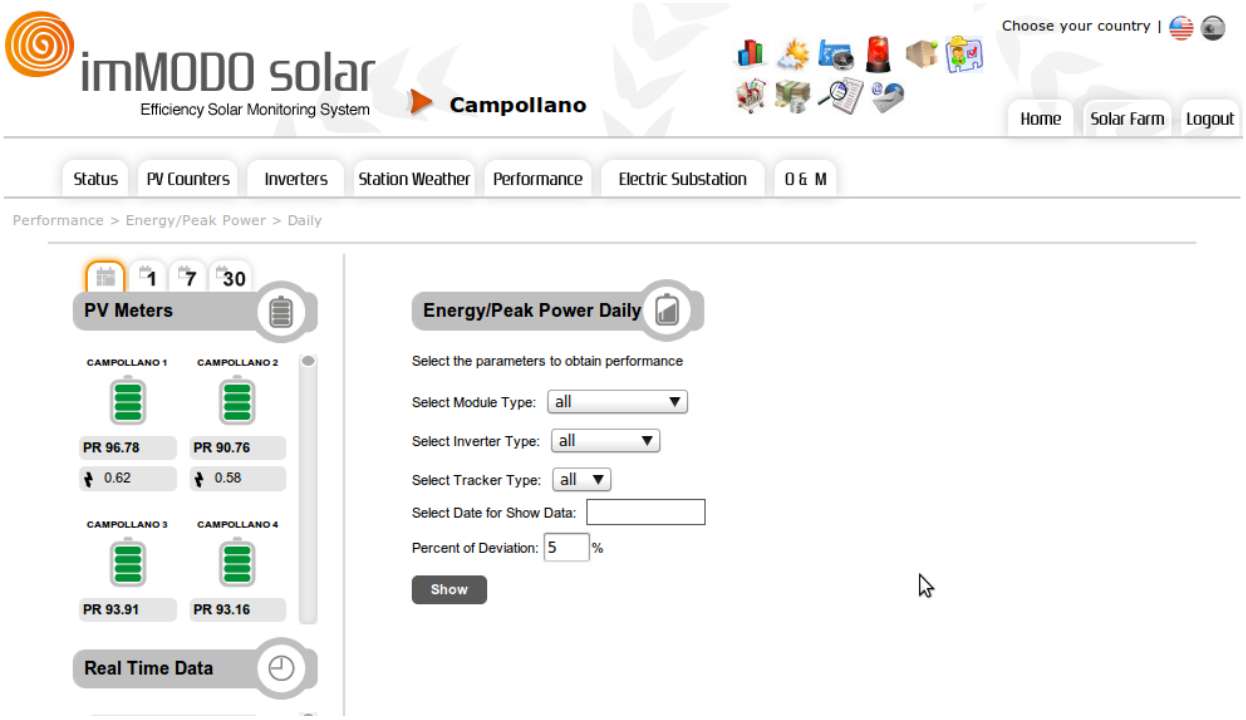

imMODO solar
Efficiency Solar Monitoring System
Cuestablanca
Choose your country |
Home
Solar Farm
Logout
Status
PV Counters
Inverters
Strings
Station Weather
Performance
Electric Substation
Sensors & Actions
O & M
State
1
7
30
PV Meters
INSTALACION 1
INSTALACION 2
PR 75.59
PR 73.34
0.57
0.55
INSTALACION 3
INSTALACION 4
PR 73.8
PR 73.76
Real Time Data
Power Active 454 kw
Power Active R 152 kw
Power Active S 149 kw
Power Active T 151 kw
Weather Station Data
Radiation day: 8129 Wm2
Radiation 07/07/2011 (Wh/m2)
1,100
880
660
440
220
0
Wh/m2
Panel
Plano
Wind 07/07/2011 (km/h)
30
RT Weather Data
18:40
28 °
297 Wh/m2
281 Wh/m2
17 km/h
13,375 V
Show Excel
Show Chart Date
Show

8. Menu: Performance

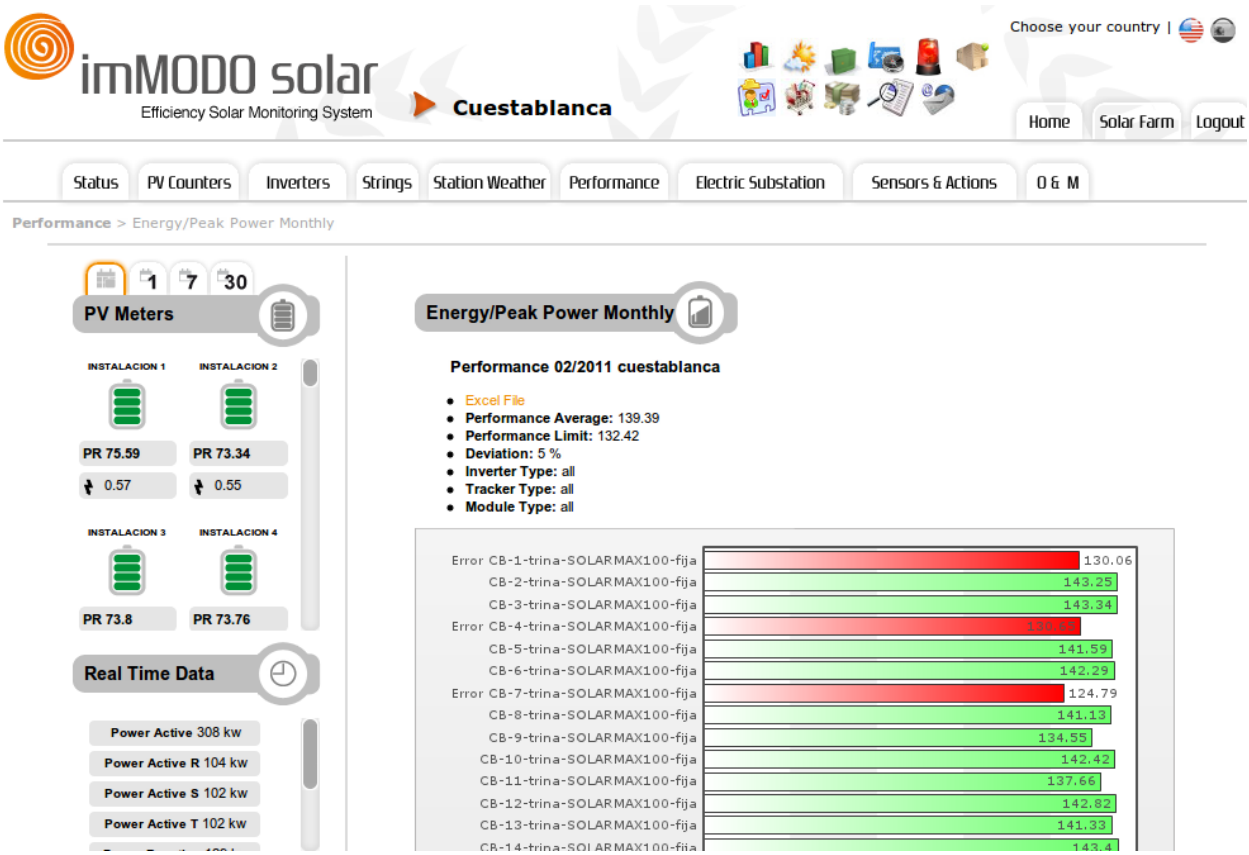
In this option of the application you can analyze the plant's performance, comparing data by module, invertir and tracker type if they are different.

All these comparisons can be made in different periods, such as seperate days, months and years. In addition to this comparisons can be drawn regarding absolute energy or energies divided by peak power.

On the following screen shot you can see the form used to configure a personalized analysis.



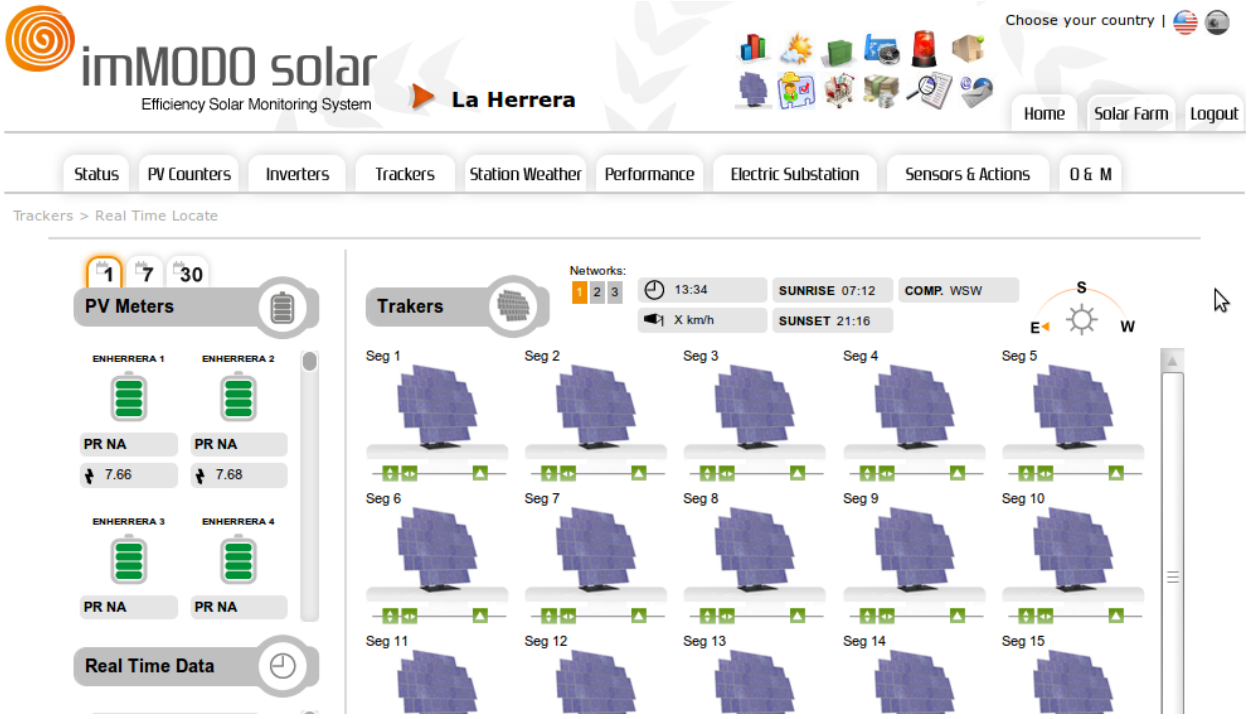
Once the performance study has been configured you will see a screen such as the following.



As you can see, there are installations which are 5% below the performance of the rest in the month of February. Now you would have to use the analysis tools to be able to determine what is happening in these installations. The analysis tools will be explained later in this manual.

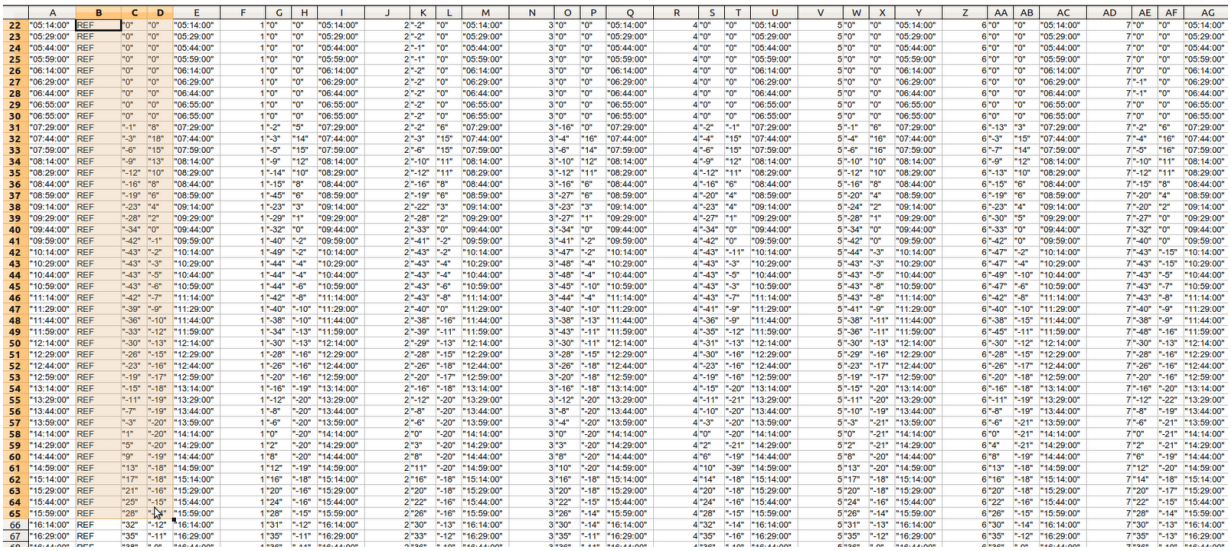
9. Menu: Trackers

This section will only be able to be accessed in those plants which have trackers. You are able to consult the position in real time of any of those through the screen “Real Time”.



If the plant has more than one zone of trackers you will be able to change between them in the Networks Section which is just above the trackers.

In addition, you can download all the historical data from one day or one month about each minute’s position of the trackers.



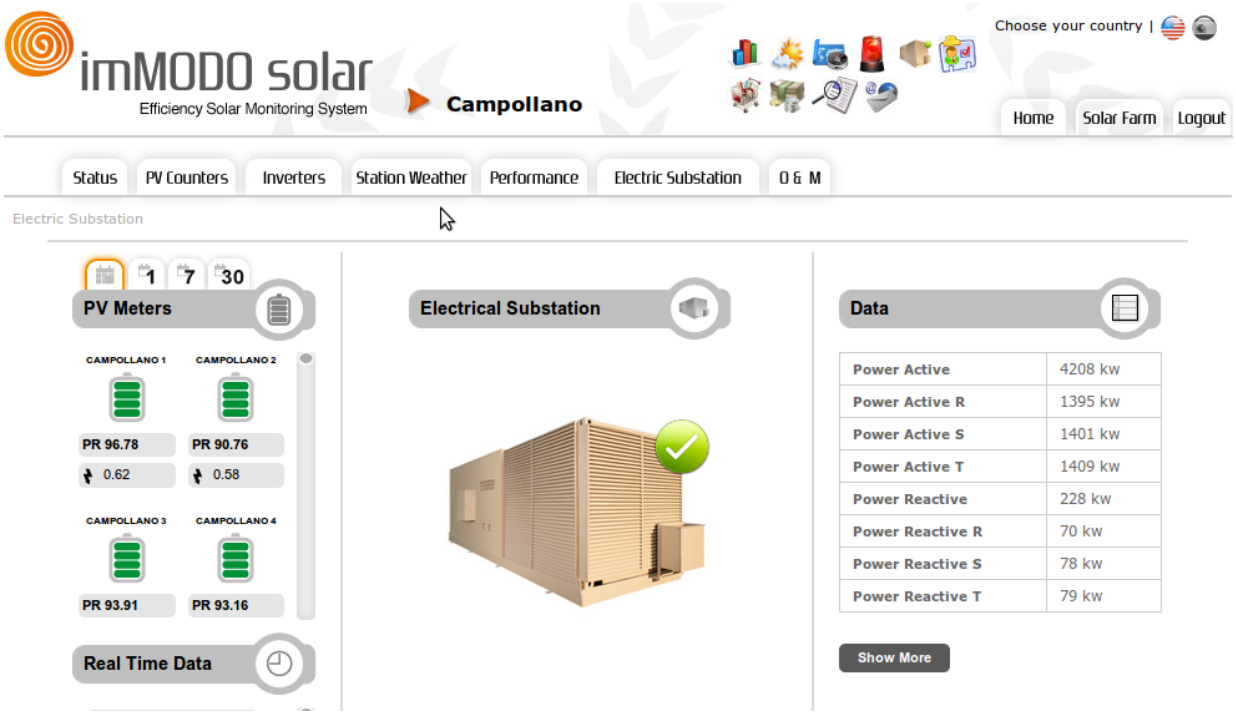
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
22	"05:14:00"	REF	"0"	"0"	"05:14:00"		1"0"	"0"	"05:14:00"		2"-2"	"0"	"05:14:00"		3"0"	"0"	"05:14:00"		4"0"	"0"	"05:14:00"		5"0"	"0"	"05:14:00"		6"0"	"0"	"05:14:00"		7"0"	"0"	"05:14:00"
23	"05:29:00"	REF	"0"	"0"	"05:29:00"		1"0"	"0"	"05:29:00"		2"-2"	"0"	"05:29:00"		3"0"	"0"	"05:29:00"		4"0"	"0"	"05:29:00"		5"0"	"0"	"05:29:00"		6"0"	"0"	"05:29:00"		7"0"	"0"	"05:29:00"
24	"05:44:00"	REF	"0"	"0"	"05:44:00"		1"0"	"0"	"05:44:00"		2"-1"	"0"	"05:44:00"		3"0"	"0"	"05:44:00"		4"0"	"0"	"05:44:00"		5"0"	"0"	"05:44:00"		6"0"	"0"	"05:44:00"		7"0"	"0"	"05:44:00"
25	"05:59:00"	REF	"0"	"0"	"05:59:00"		1"0"	"0"	"05:59:00"		2"-1"	"0"	"05:59:00"		3"0"	"0"	"05:59:00"		4"0"	"0"	"05:59:00"		5"0"	"0"	"05:59:00"		6"0"	"0"	"05:59:00"		7"0"	"0"	"05:59:00"
26	"06:14:00"	REF	"0"	"0"	"06:14:00"		1"0"	"0"	"06:14:00"		2"-2"	"0"	"06:14:00"		3"0"	"0"	"06:14:00"		4"0"	"0"	"06:14:00"		5"0"	"0"	"06:14:00"		6"0"	"0"	"06:14:00"		7"0"	"0"	"06:14:00"
27	"06:29:00"	REF	"0"	"0"	"06:29:00"		1"0"	"0"	"06:29:00"		2"-2"	"0"	"06:29:00"		3"0"	"0"	"06:29:00"		4"0"	"0"	"06:29:00"		5"0"	"0"	"06:29:00"		6"0"	"0"	"06:29:00"		7"-1"	"0"	"06:29:00"
28	"06:44:00"	REF	"0"	"0"	"06:44:00"		1"0"	"0"	"06:44:00"		2"-2"	"0"	"06:44:00"		3"0"	"0"	"06:44:00"		4"0"	"0"	"06:44:00"		5"0"	"0"	"06:44:00"		6"0"	"0"	"06:44:00"		7"-1"	"0"	"06:44:00"
29	"06:55:00"	REF	"0"	"0"	"06:55:00"		1"0"	"0"	"06:55:00"		2"-2"	"0"	"06:55:00"		3"0"	"0"	"06:55:00"		4"0"	"0"	"06:55:00"		5"0"	"0"	"06:55:00"		6"0"	"0"	"06:55:00"		7"0"	"0"	"06:55:00"
30	"06:55:00"	REF	"0"	"0"	"06:55:00"		1"0"	"0"	"06:55:00"		2"-2"	"0"	"06:55:00"		3"0"	"0"	"06:55:00"		4"0"	"0"	"06:55:00"		5"0"	"0"	"06:55:00"		6"0"	"0"	"06:55:00"		7"0"	"0"	"06:55:00"
31	"07:29:00"	REF	"-1"	"8"	"07:29:00"		1"-2"	"5"	"07:29:00"		2"-2"	"6"	"07:29:00"		3"-16"	"0"	"07:29:00"		4"-2"	"-1"	"07:29:00"		5"-1"	"6"	"07:29:00"		6"-13"	"3"	"07:29:00"		7"-2"	"6"	"07:29:00"
32	"07:44:00"	REF	"-3"	"18"	"07:44:00"		1"-3"	"14"	"07:44:00"		2"-3"	"15"	"07:44:00"		3"-4"	"16"	"07:44:00"		4"-4"	"15"	"07:44:00"		5"-4"	"16"	"07:44:00"		6"-3"	"15"	"07:44:00"		7"-4"	"16"	"07:44:00"
33	"07:59:00"	REF	"-6"	"15"	"07:59:00"		1"-5"	"15"	"07:59:00"		2"-6"	"15"	"07:59:00"		3"-6"	"14"	"07:59:00"		4"-6"	"15"	"07:59:00"		5"-6"	"16"	"07:59:00"		6"-7"	"14"	"07:59:00"		7"-5"	"16"	"07:59:00"
34	"08:14:00"	REF	"-9"	"13"	"08:14:00"		1"-9"	"12"	"08:14:00"		2"-10"	"11"	"08:14:00"		3"-10"	"12"	"08:14:00"		4"-9"	"12"	"08:14:00"		5"-10"	"10"	"08:14:00"		6"-9"	"12"	"08:14:00"		7"-10"	"11"	"08:14:00"
35	"08:29:00"	REF	"-12"	"10"	"08:29:00"		1"-14"	"10"	"08:29:00"		2"-12"	"11"	"08:29:00"		3"-12"	"11"	"08:29:00"		4"-12"	"11"	"08:29:00"		5"-12"	"10"	"08:29:00"		6"-13"	"10"	"08:29:00"		7"-12"	"11"	"08:29:00"
36	"08:44:00"	REF	"-16"	"8"	"08:44:00"		1"-15"	"8"	"08:44:00"		2"-16"	"8"	"08:44:00"		3"-16"	"6"	"08:44:00"		4"-16"	"6"	"08:44:00"		5"-16"	"8"	"08:44:00"		6"-15"	"6"	"08:44:00"		7"-15"	"8"	"08:44:00"
37	"08:59:00"	REF	"-19"	"6"	"08:59:00"		1"-45"	"6"	"08:59:00"		2"-19"	"6"	"08:59:00"		3"-27"	"6"	"08:59:00"		4"-20"	"4"	"08:59:00"		5"-20"	"4"	"08:59:00"		6"-19"	"6"	"08:59:00"		7"-20"	"4"	"08:59:00"
38	"09:14:00"	REF	"-23"	"4"	"09:14:00"		1"-23"	"3"	"09:14:00"		2"-22"	"3"	"09:14:00"		3"-23"	"3"	"09:14:00"		4"-23"	"4"	"09:14:00"		5"-24"	"2"	"09:14:00"		6"-23"	"4"	"09:14:00"		7"-20"	"2"	"09:14:00"
39	"09:29:00"	REF	"-28"	"2"	"09:29:00"		1"-29"	"1"	"09:29:00"		2"-28"	"2"	"09:29:00"		3"-27"	"1"	"09:29:00"		4"-27"	"1"	"09:29:00"		5"-28"	"1"	"09:29:00"		6"-30"	"5"	"09:29:00"		7"-27"	"0"	"09:29:00"
40	"09:44:00"	REF	"-34"	"0"	"09:44:00"		1"-32"	"0"	"09:44:00"		2"-33"	"0"	"09:44:00"		3"-34"	"0"	"09:44:00"		4"-34"	"0"	"09:44:00"		5"-34"	"0"	"09:44:00"		6"-33"	"0"	"09:44:00"		7"-32"	"0"	"09:44:00"
41	"09:59:00"	REF	"-42"	"-1"	"09:59:00"		1"-40"	"-2"	"09:59:00"		2"-41"	"-2"	"09:59:00"		3"-41"	"-2"	"09:59:00"		4"-42"	"0"	"09:59:00"		5"-42"	"0"	"09:59:00"		6"-42"	"0"	"09:59:00"		7"-40"	"0"	"09:59:00"
42	"10:14:00"	REF	"-43"	"-2"	"10:14:00"		1"-49"	"-2"	"10:14:00"		2"-43"	"-2"	"10:14:00"		3"-47"	"-2"	"10:14:00"		4"-43"	"-11"	"10:14:00"		5"-44"	"-3"	"10:14:00"		6"-47"	"-2"	"10:14:00"		7"-43"	"-15"	"10:14:00"
43	"10:29:00"	REF	"-43"	"-3"	"10:29:00"		1"-44"	"-4"	"10:29:00"		2"-43"	"-4"	"10:29:00"		3"-48"	"-4"	"10:29:00"		4"-43"	"-3"	"10:29:00"		5"-43"	"-3"	"10:29:00"		6"-47"	"-4"	"10:29:00"		7"-43"	"-15"	"10:29:00"
44	"10:44:00"	REF	"-43"	"-5"	"10:44:00"		1"-44"	"-4"	"10:44:00"		2"-43"	"-4"	"10:44:00"		3"-48"	"-4"	"10:44:00"		4"-43"	"-5"	"10:44:00"		5"-43"	"-5"	"10:44:00"		6"-49"	"-10"	"10:44:00"		7"-43"	"-5"	"10:44:00"
45	"10:59:00"	REF	"-43"	"-6"	"10:59:00"		1"-44"	"-6"	"10:59:00"		2"-43"	"-6"	"10:59:00"		3"-45"	"-10"	"10:59:00"		4"-43"	"-3"	"10:59:00"		5"-43"	"-8"	"10:59:00"		6"-47"	"-6"	"10:59:00"		7"-43"	"-7"	"10:59:00"
46	"11:14:00"	REF	"-42"	"-7"	"11:14:00"		1"-42"	"-8"	"11:14:00"		2"-43"	"-8"	"11:14:00"		3"-44"	"-4"	"11:14:00"		4"-43"	"-7"	"11:14:00"		5"-43"	"-8"	"11:14:00"		6"-42"	"-8"	"11:14:00"		7"-43"	"-8"	"11:14:00"
47	"11:29:00"	REF	"-39"	"-9"	"11:29:00"		1"-40"	"-10"	"11:29:00"		2"-40"	"0"	"11:29:00"		3"-40"	"-10"	"11:29:00"		4"-41"	"-9"	"11:29:00"		5"-41"	"-9"	"11:29:00"		6"-40"	"-10"	"11:29:00"		7"-40"	"-9"	"11:29:00"
48	"11:44:00"	REF	"-36"	"-10"	"11:44:00"		1"-38"	"-10"	"11:44:00"		2"-38"	"-16"	"11:44:00"		3"-38"	"-13"	"11:44:00"		4"-36"	"-9"	"11:44:00"		5"-38"	"-11"	"11:44:00"		6"-38"	"-15"	"11:44:00"		7"-38"	"-9"	"11:44:00"
49	"11:59:00"	REF	"-33"	"-12"	"11:59:00"		1"-34"	"-13"	"11:59:00"		2"-39"	"-11"	"11:59:00"		3"-43"	"-11"	"11:59:00"		4"-35"	"-12"	"11:59:00"		5"-36"	"-11"	"11:59:00"		6"-45"	"-11"	"11:59:00"		7"-48"	"-16"	"11:59:00"
50	"12:14:00"	REF	"-30"	"-13"	"12:14:00"		1"-30"	"-13"	"12:14:00"		2"-29"	"-13"	"12:14:00"		3"-30"	"-11"	"12:14:00"		4"-31"	"-13"	"12:14:00"		5"-30"	"-13"	"12:14:00"		6"-30"	"-12"	"12:14:00"		7"-30"	"-13"	"12:14:00"
51	"12:29:00"	REF	"-26"	"-15"	"12:29:00"		1"-28"	"-16"	"12:29:00"		2"-28"	"-15"	"12:29:00"		3"-28"	"-15"	"12:29:00"		4"-30"	"-16"	"12:29:00"		5"-29"	"-16"	"12:29:00"		6"-28"	"-15"	"12:29:00"		7"-28"	"-16"	"12:29:00"
52	"12:44:00"	REF	"-23"	"-16"	"12:44:00"		1"-26"	"-16"	"12:44:00"		2"-26"	"-18"	"12:44:00"		3"-26"	"-18"	"12:44:00"		4"-23"	"-16"	"12:44:00"		5"-23"	"-17"	"12:44:00"		6"-26"	"-17"	"12:44:00"		7"-26"	"-16"	"12:44:00"
53	"12:59:00"	REF	"-19"	"-17"	"12:59:00"		1"-20"	"-16"	"12:59:00"		2"-20"	"-17"	"12:59:00"		3"-20"	"-18"	"12:59:00"		4"-19"	"-16"	"12:59:00"		5"-19"	"-17"	"12:59:00"		6"-20"	"-18"	"12:59:00"		7"-20"	"-16"	"12:59:00"
54	"13:14:00"	REF	"-15"	"-18"	"13:14:00"		1"-16"	"-19"	"13:14:00"		2"-16"	"-18"	"13:14:00"		3"-16"	"-18"	"13:14:00"		4"-15"	"-20"	"13:14:00"		5"-15"	"-20"	"13:14:00"		6"-16"	"-18"	"13:14:00"		7"-16"	"-20"	"13:14:00"
55	"13:29:00"	REF	"-11"	"-19"	"13:29:00"		1"-12"	"-20"	"13:29:00"		2"-12"	"-20"	"13:29:00"		3"-12"	"-20"	"13:29:00"		4"-11"	"-21"	"13:29:00"		5"-11"	"-20"	"13:29:00"		6"-11"	"-19"	"13:29:00"		7"-12"	"-22"	"13:29:00"
56	"13:44:00"	REF	"-7"	"-19"	"13:44:00"		1"-8"	"-20"	"13:44:00"		2"-8"	"-20"	"13:44:00"		3"-8"	"-20"	"13:44:00"		4"-10"	"-20"	"13:44:00"		5"-10"	"-19"	"13:44:00"		6"-8"	"-19"	"13:44:00"		7"-8"	"-19"	"13:44:00"
57	"13:59:00"	REF	"-3"	"-20"	"13:59:00"		1"-6"	"-20"	"13:59:00"		2"-6"	"-20"	"13:59:00"		3"-4"	"-20"	"13:59:00"		4"-3"	"-20"	"13:59:00"		5"-3"	"-21"	"13:59:00"		6"-6"	"-21"	"13:59:00"		7"-6"	"-21"	"13:59:00"
58	"14:14:00"	REF	"1"	"-20"	"14:14:00"		1"0"	"-20"	"14:14:00"		2"0"	"-20"	"14:14:00"		3"0"	"-20"	"14:14:00"		4"0"	"-20"	"14:14:00"		5"0"	"-21"	"14:14:00"		6"0"	"-21"	"14:14:00"		7"0"	"-21"	"14:14:00"
59	"14:29:00"	REF	"5"	"-20"	"14:29:00"		1"2"	"-20"	"14:29:00"		2"3"	"-20"	"14:29:00"		3"3"	"-20"	"14:29:00"		4"2"	"-21"	"14:29:00"		5"2"	"-21"	"14:29:00"		6"4"	"-21"	"14:29:00"		7"2"	"-21"	"14:29:00"
60	"14:44:00"	REF	"9"	"-19"	"14:44:00"		1"8"	"-20"	"14:44:00"		2"8"	"-20"	"14:44:00"		3"8"	"-20"	"14:44:00"		4"6"	"-19"	"14:44:00"		5"8"	"-20"	"14:44:00"		6"8"	"-19"	"14:44:00"		7"6"	"-19"	"14:44:00"
61	"14:59:00"	REF	"13"	"-18"	"14:59:00"		1"12"	"-19"	"14:59:00"		2"11"	"-20"	"14:59:00"		3"10"	"-20"	"14:59:00"		4"10"	"-39"	"14:59:00"		5"13"	"-20"	"14:59:00"		6"13"	"-18"	"14:59:00"		7"12"	"-20"	"14:59:00"
62	"15:14:00"	REF	"17"	"-18"	"15:14:00"		1"16"	"-18"	"15:14:00"		2"16"	"-18"	"15:14:00"		3"16"	"-18"	"15:14:00"		4"14"	"-18"	"15:14:00"		5"17"	"-18"	"15:14:00"		6"16"	"-18"	"15:14:00"		7"14"	"-18"	"15:14:00"
63	"15:29:00"	REF	"21"	"-16"	"15:29:00"		1"20"	"-16"	"15:29:00"		2"20"	"-18"	"15:29:00"		3"20"	"-18"	"15:29:00"		4"20"	"-18"	"15:29:00"		5"20"	"-18"	"15:29:00"		6"20"	"-18"	"15:29:00"		7"20"	"-17"	"15:29:00"
64	"15:44:00"	REF	"25"	"-15"	"15:44:00"		1"24"	"-16"	"15:44:00"		2"22"	"-16"	"15:44:00"		3"22"	"-15"	"15:44:00"		4"24"	"-16"	"15:44:00"		5"24"	"-16"	"15:44:00"		6"22"	"-16"	"15:44:00"		7"22"	"-15"	"15:44:00"
65	"15:59:00"	REF	"28"	"-14"	"15:59:00"		1"28"	"-15"	"15:59:00"		2"26"	"-16"	"15:59:00"		3"26"	"-14"	"15:59:00"		4"28"	"-15"	"15:59:00"		5"26"	"-14"	"15:59:00"		6"26"	"-15"	"15:59:00"		7"28"	"-14"	"15:59:00"
66	"16:14:00"	REF	"32"	"-12"	"16:14:00"		1"31"	"-12"	"16:14:00"		2"30"	"-13"	"16:14:00"		3"30"	"-14"	"16:14:00"		4"32"	"-14"	"16:14:00"		5"31"	"-13"	"16:14:00"		6"30"	"-14"	"16:14:00"		7"30"	"-13"	"16:14:00"
67	"16:29:00"	REF	"35"	"-11"	"16:29:00"		1"35"	"-11"	"16:29:00"		2"33"	"-12"	"16:29:00"		3"35"	"-11"	"16:29:00"		4"35"	"-16"	"16:29:00"		5"35"	"-12"	"16:29:00"		6"35"	"-12"	"16:29:00"		7"35"	"-13"	"16:29:00"

The shaded columns show the ideal coordinates or the position references which the trackers should have at each time. The data in the same line shows the position of each tracker.

10. Menu: Electric Substation

This utility allows you to monitor many parameters of the electric substation of a plant. In the screen shot you can see how the substation is working and in a box on the right you are shown data in real time which it provides.

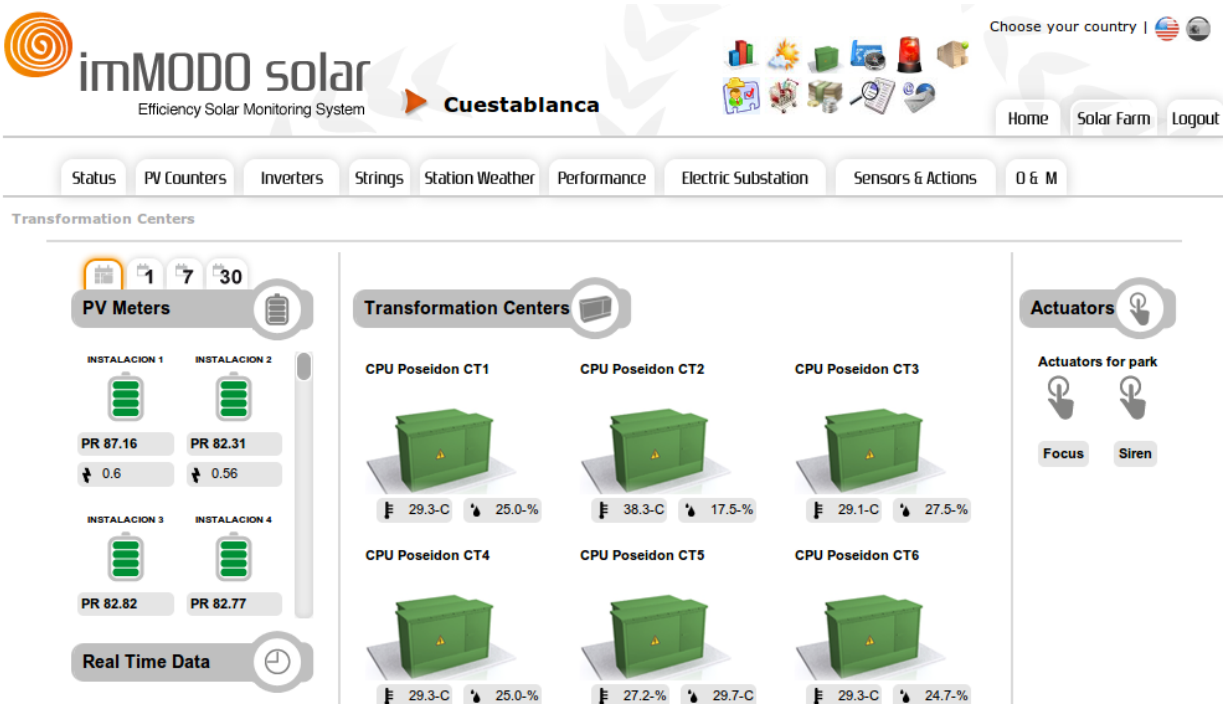
Any type of performance or relay can be activated or visualized using this tool.



Monitoring this station allows you to detect any fault within it, which could mean important financial savings for the company.

11. Menu: Sensors & Actions

This tool allows you to analyze the installed sensors in the transformer centers of the plant, as well as interact with the plant by remote. For example you can establish the temperature and humidity of each center, and thus know if the door is open or closed or if there is smoke in any of them.



As you can see in the right hand part of the screen, it allows you to act on relays which offer different functions. For example in the image you can switch on the plant's flood lights and siren. This screen is completely configurable according to what you have installed in the plant.

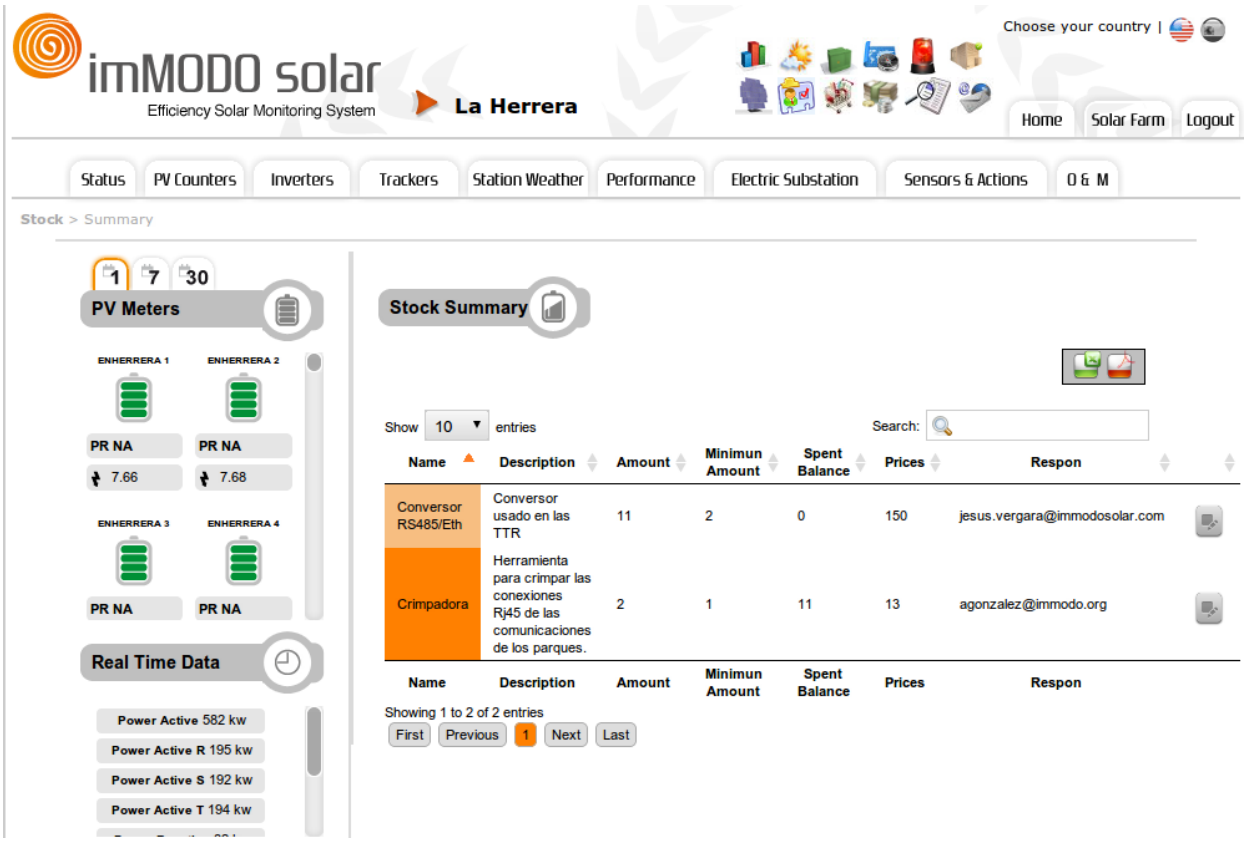
As in the former tools you can consult the history of the values provided by the sensors over the course of a given day. This allows you to analyze different situations in a plant, for example, when and how long each transformer center has been open.

12. Menu: Operation y Maintenance

In this menu various modules have been added to facilitate the task of operating and maintaining said departments. Each of its submenus corresponds to a different module which will now be explained.

12.1 Stock Module

In this menu you can maintain total control over the material which enters and leaves the warehouse. It has a screen for stock summary which offers a table with all the products which you have registered in the warehouse, their current quantity, their minimum quantity (below which a warning message will be sent to the person responsible), the person responsible for the product and its management, the units which have been consumed and their approximate price.

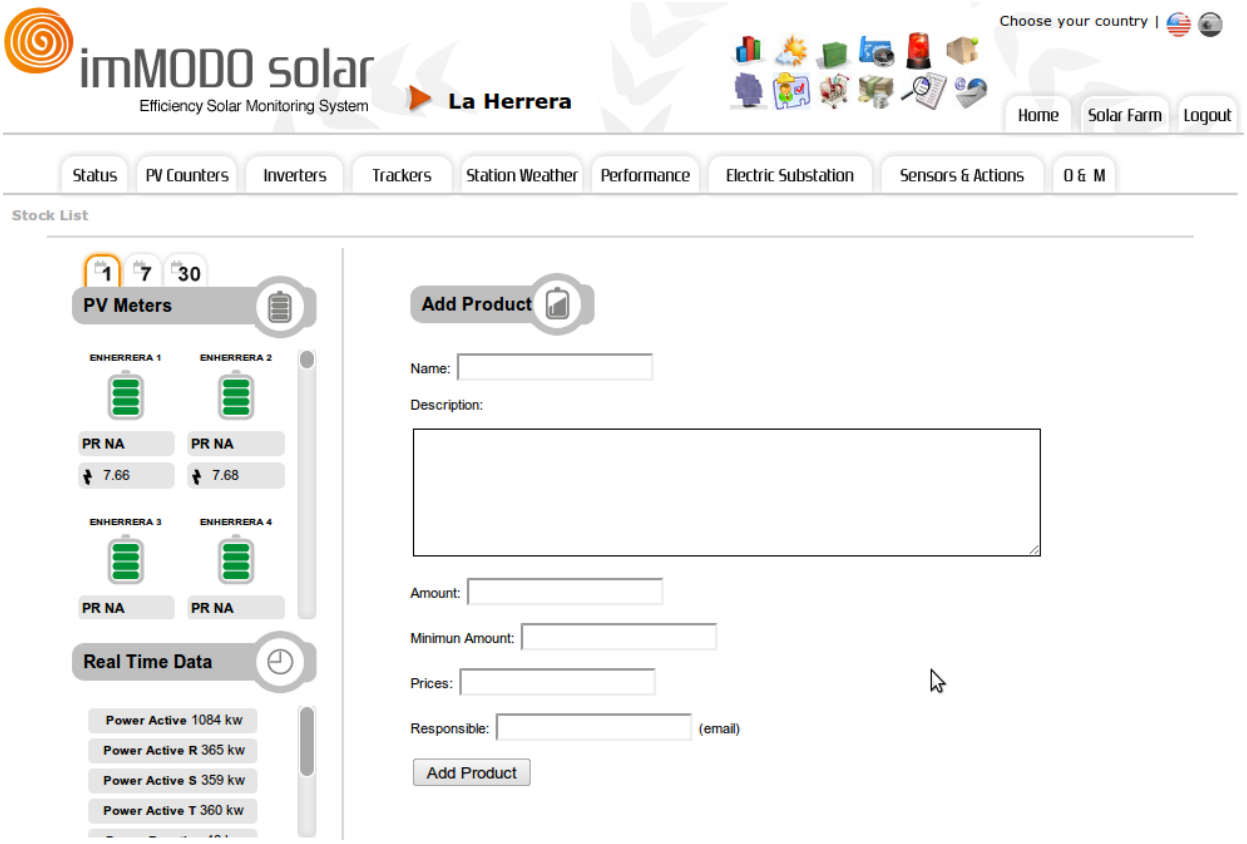


The table allows you to order the objects by any column. In addition this table can be consulted by page number and allows a product search by key word.

As in the whole application, this table can be downloaded into Excel or PDF so it can be printed or sent by E mail.

The stock module allows you to list the product which are found in a critical situation as regards their quantity in stock, i.e those product which fall below the defined minimum. .

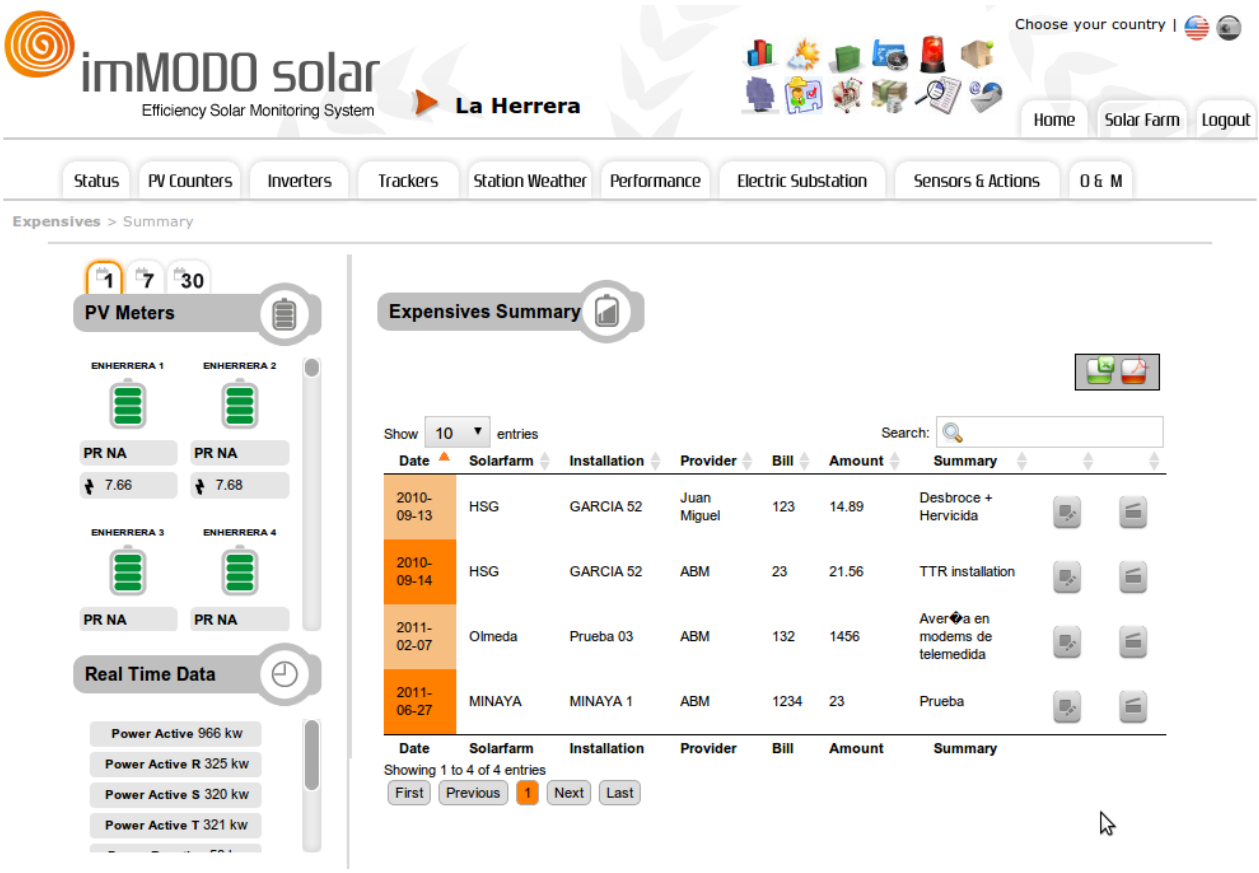
You can register new products which did not formerly exist by filling out the following form.



In addition you can add units to already existent products, remove units (showing the reason and the person responsible for such action) and extract reports for a period of time or a product for which a consumer study is required.

12.2 Expenses Module.

This module allows you to control the expenses assigned to the installations which are being maintained. You can see a screen like the following where a summary of the expenses is shown.



As you can see the table has the same format as that of the former module but with columns related to expenses. In these expenses you have the date of the expense, the plant, the installation to which the expense is attributed, the supplier, the invoice, the amount, and the description. In addition you can edit and delete each of these expenses with the buttons at the end of each line. Once again this can be exported to Excel or PDF using the buttons at the top right of the screen.

The table can once again be ordered by each column and allows you to search the tables for a certain word.

In this module you can create new suppliers or new expenses, as well as extract reports on general expenses, by period or related to a certain supplier or particular installation.
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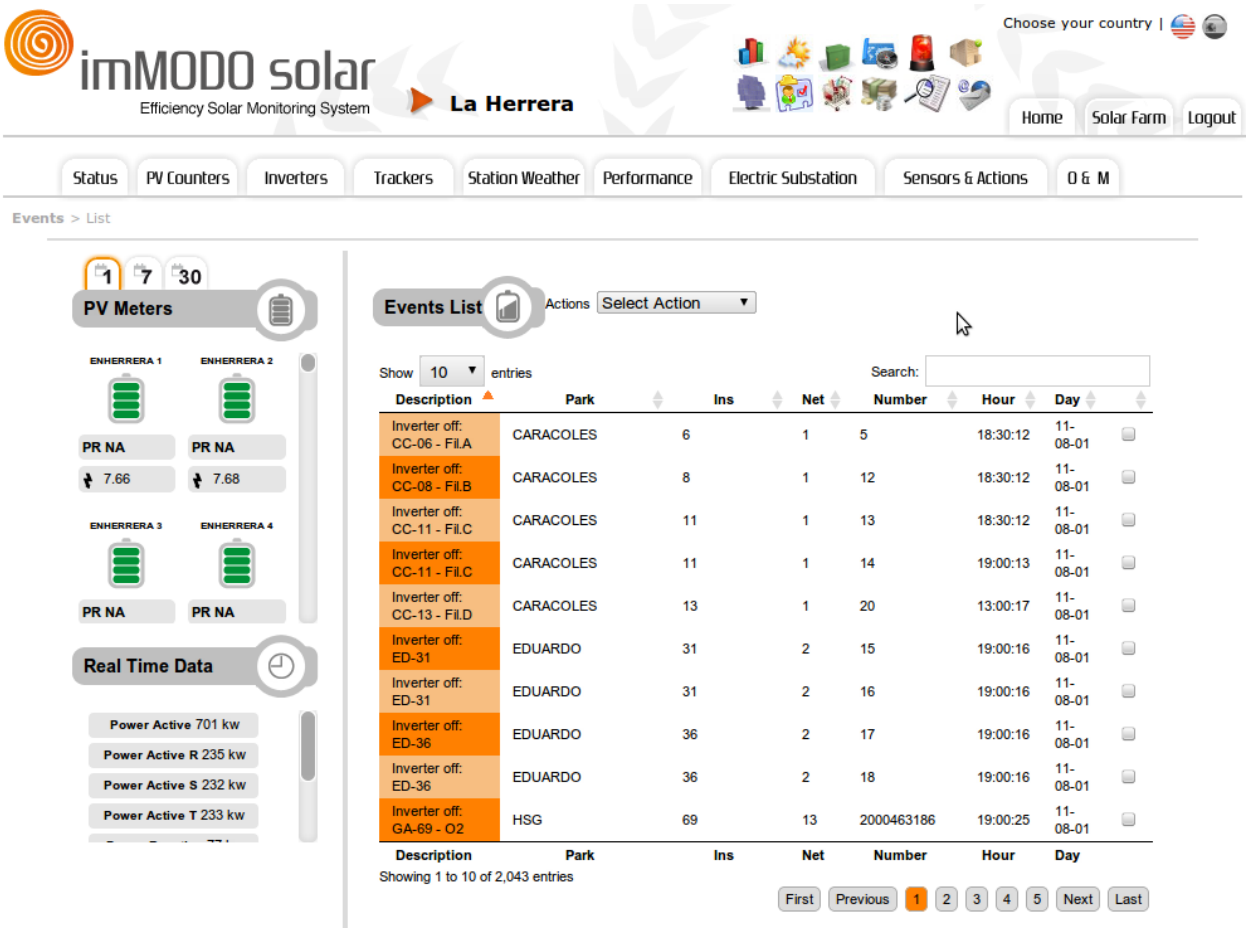
12.3 Events Module

This is one of the most important modules of the system, given that in it you can control all the plants which you have in the application. The errors or alarms which occur in all of such plants are recorded and managed in this module.



Tables are shown with the description of each event, showing a description, the plant, the installation, the network, the component number, the time and the day. This table can be ordered by each column, it is numbered by page and allows you to search by word in the events. In addition, you can select one or various columns, marking them and selecting an action from the drop down menu above. The options to be carried out with an event reported by the system are the following:

1. Ignore for a day. Thus, the event disappears from the list and is not added during the day. For example, if you know that an inverter is switched off because it is being changed, you can decide to omit this event in the management program.
2. Ignore for a week. Thus, the event disappears from the list for 7 days. For example when you

3. Ignore for a month. As above but over a period of 30 days.

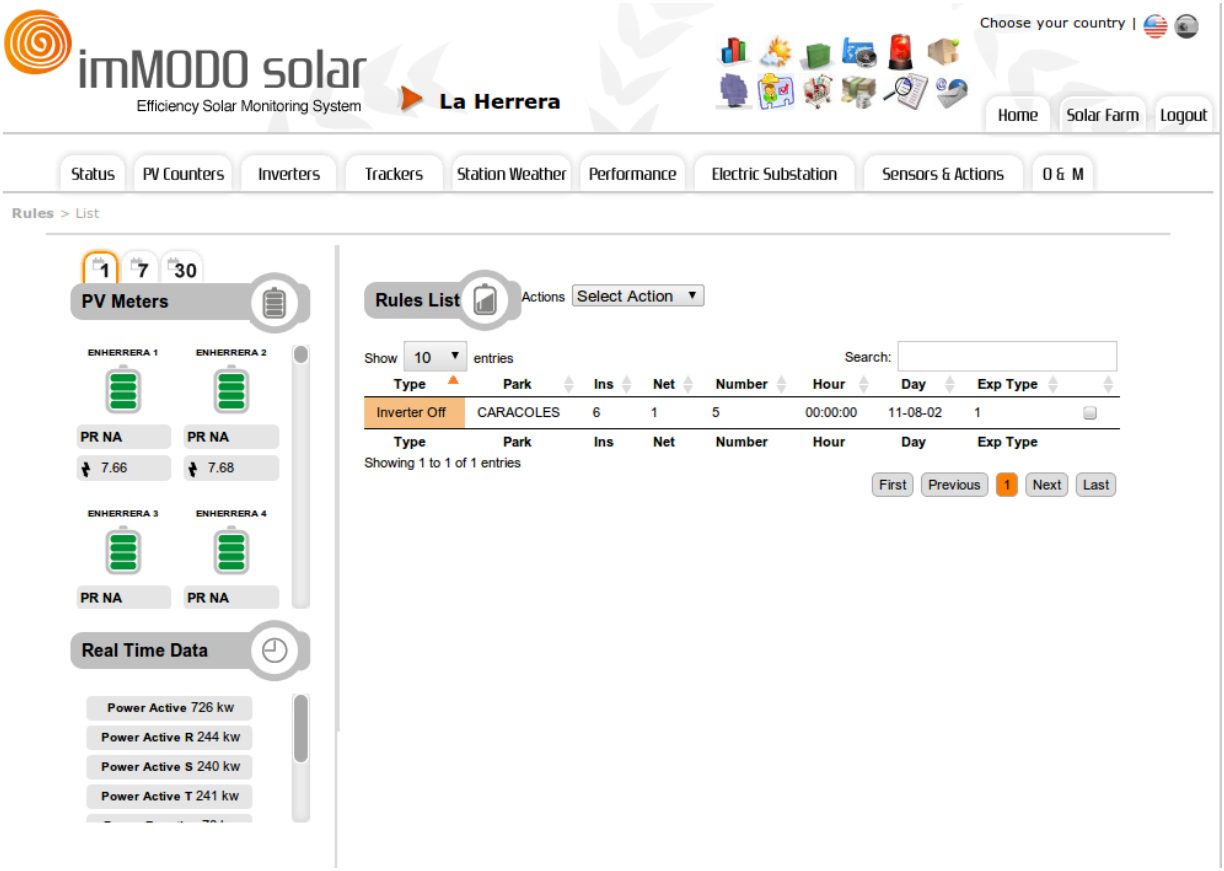
4. Ignore until a given date. Thus, no warning will be given until the given date by the user has come.

5. Ignore indefinitely. This would putt he event in a permanent list of ignored events. This option can be selected when the expected correction of the fault can not be predicted or is long term.

6. Report to Maintenance. This option can be used when the maintenance department is required. A maintenance request will be created for the said event from the list of event. The request will be linked to a person responsible. When the work is concluded the request will be closed.

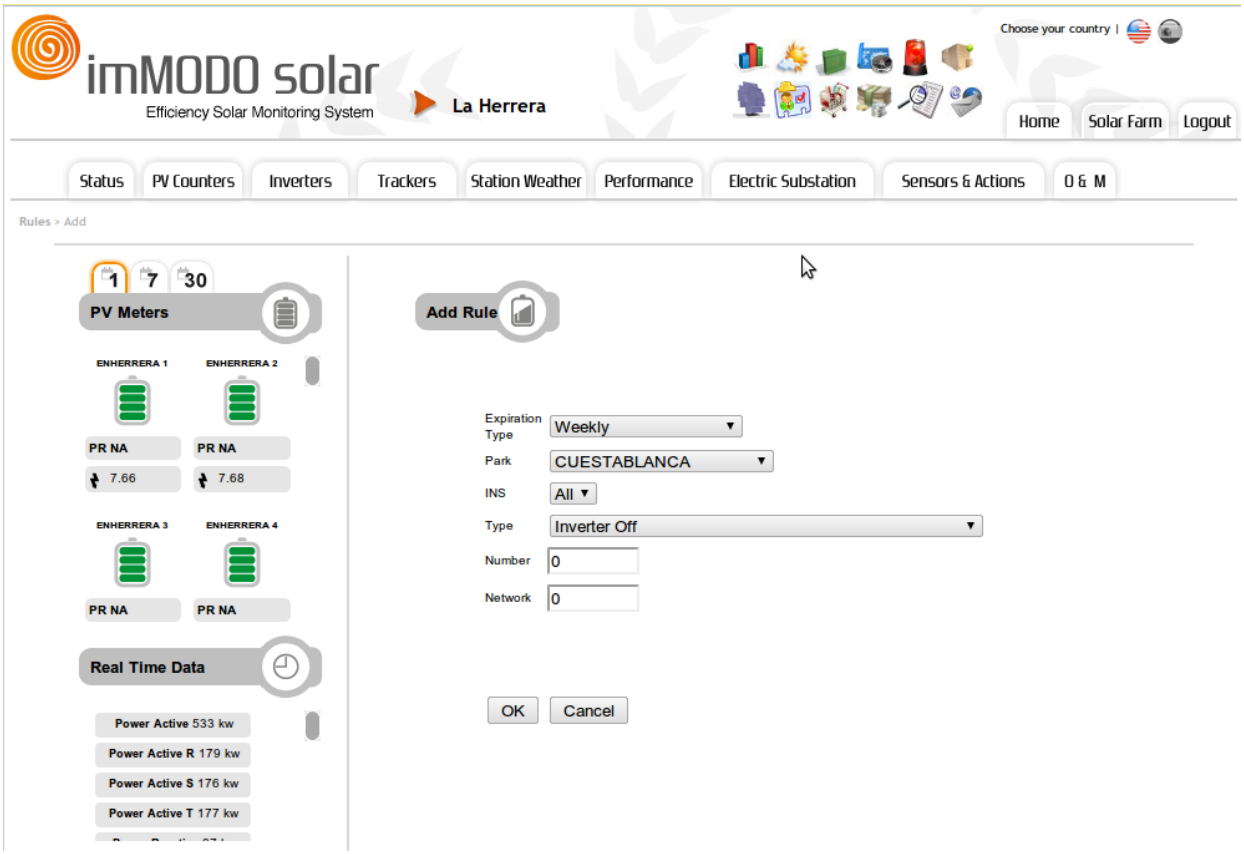
Such requests are of interest because they will be linked to the report on a plant or installation in the reports module.

The events module allows you also to manage the ignore rules for the events tables, i.e. manage those rules which you put in the events table. For example, in the following screen shot you can see how an inverter in the CARACOLES plant is ignored until a given date.



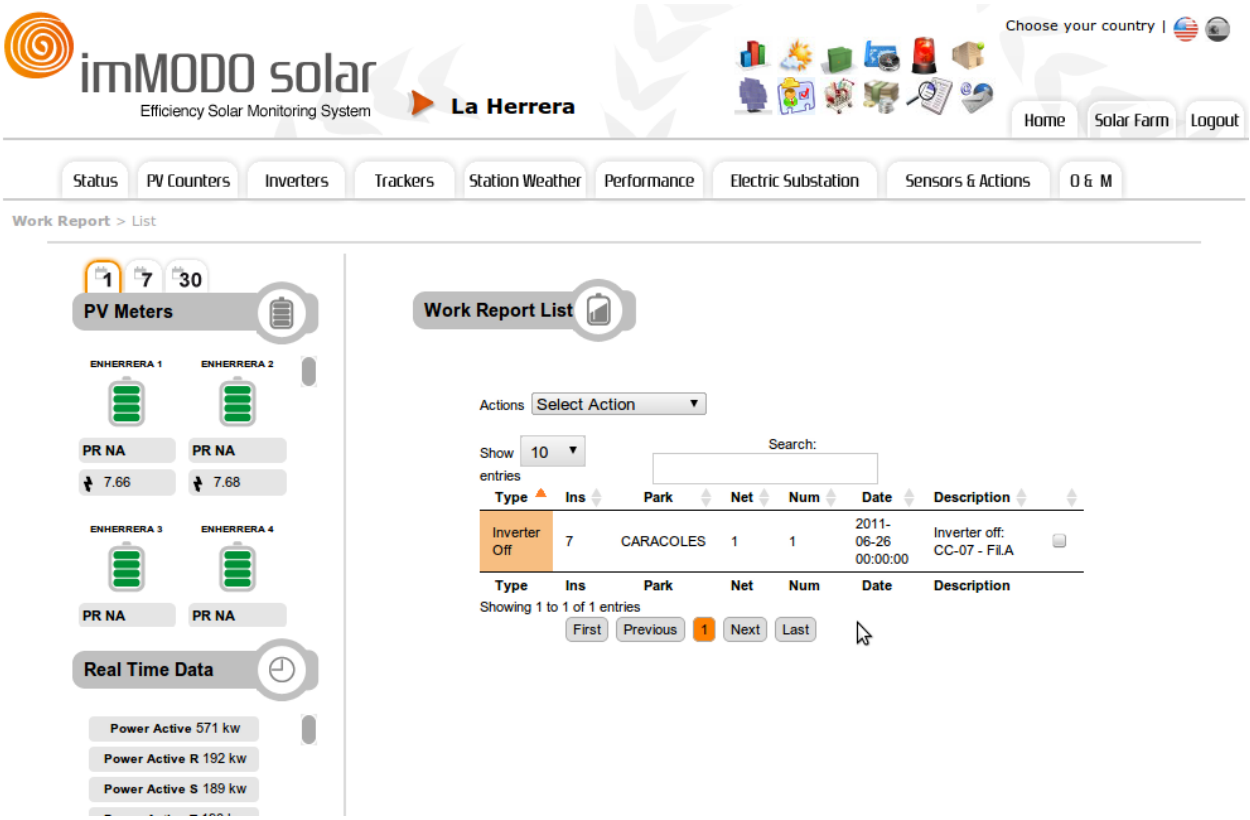
The rules show what you are ignoring, the plant, installation, network and component number to which we are applying the rules and the date and time of expiry.

In addition to editing and deleting rules from this screen you can create new more general rules. For example, if you want to ignore the switched off inverters which there may be in the CUESTABLANCA plant, you can complete the following form accessed through the drop down menu in the upper part of the screen.



Here any switched off inverter has been ignored for a week in all the installations of Cuestablanca. The Number and Network fields are set to 0 and can not be completed. This means that the rule will be applied to all the components of any network.

Another of the tables which can be seen in this module is that of the maintenance requests.

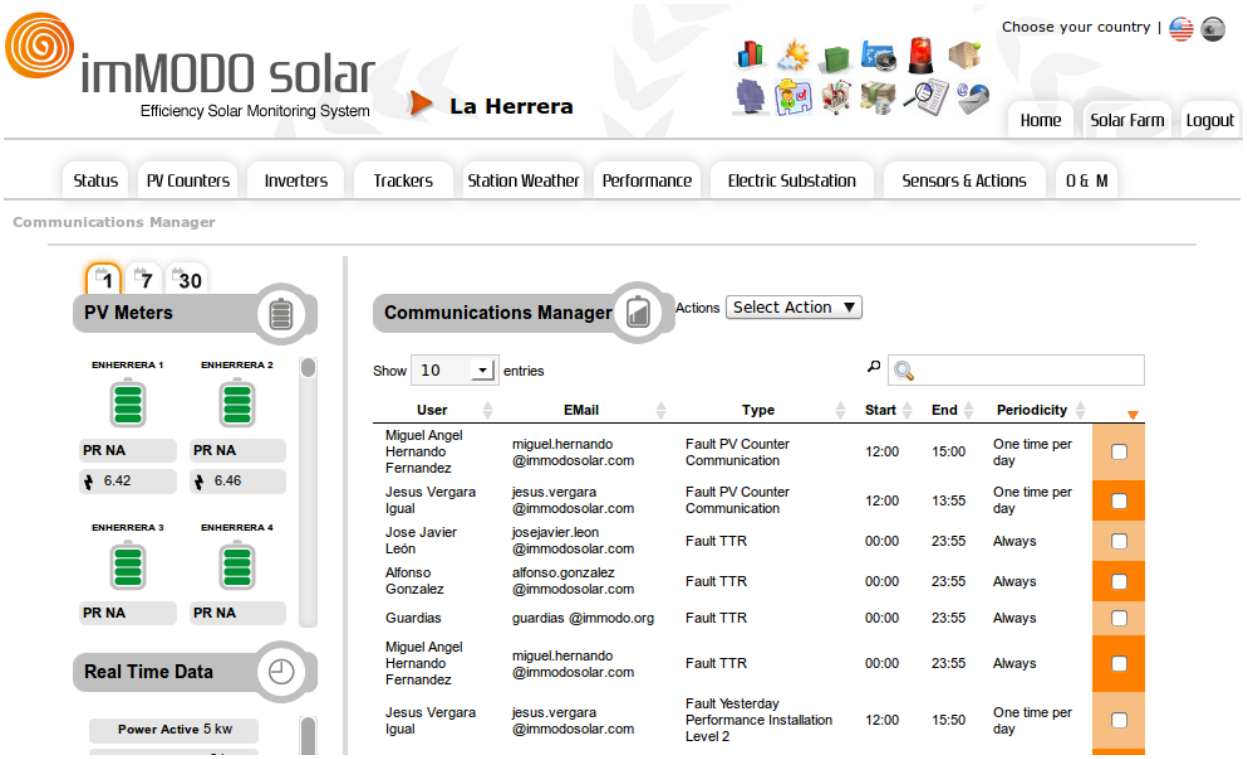


The maintenance requests can be edited, deleted, consulted and exported to PDF to be printed.

As always, you can extract a PDF list of events, rules and maintenance requests in the system.

12.4 Communications Module

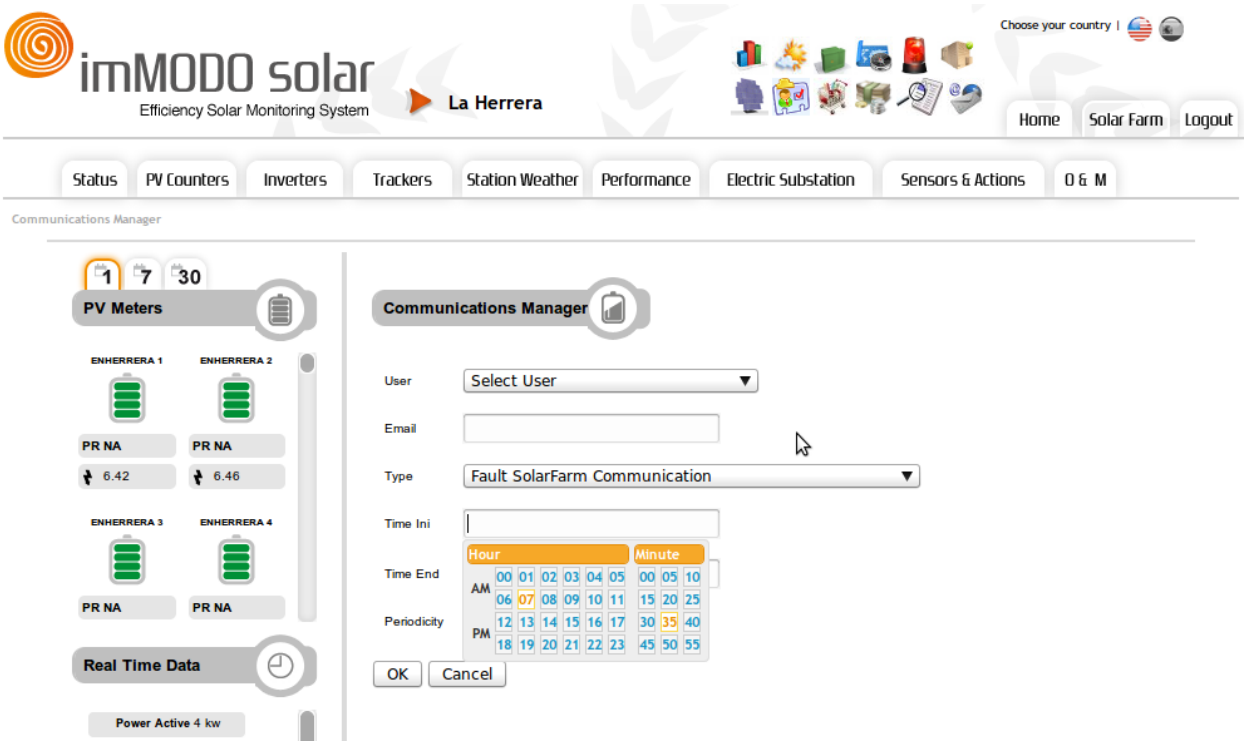
Although it is an independent module this has been integrated as a submenu of the Events module. When accessing this you can view a table of communications.



As you can see in the table there is a row for each warning programmed for events in the system. For example the third row shows that the user José Javier León will have to receive all faults related to the telemetry in real time which occur between 0:00 and 23:55. The column related to periodicity can be of two types: warn once a day or warn every time the fault occurs. The second option is more usual, although the first one may be useful in cases such as low performance of an installation, this can be communicated between 12:00 and 15:50 as can be seen in the last line. If at this time the performance of an installation is below the rest it is already significant and it won´t be necessary to communicate it more times over the course of the day.

Each line can be edited or deleted. This can be done marking the row and applying the required action in the drop down menu above.

New warnings can be added if no option is marked and the option “New Notice” is selected in the drop down. In this case a form such as the following appears.



The user must be created in the system (consult administrator). Once selected the field E-mail will be completed automatically. Regarding the type of fault, you can choose from the following:

- *Fault SolarFarm Communication :* The plant can not communicate with the outside world..

- *Fault Inverters Network Communication:* An inverter network is not communicating or is doing so with a problem.

- *Fault Trackers Network Communication*: A network of trackers is not communicating or is doing so with a problem.

- *Fault PV Counter Communication*: The counter has not been able to communicate to extract the reading of the previous day or the morning.

- *Fault Current Performance Installation*: The installation in question shows a poor performance in the past hour in respect to the rest of the installations of the plant.

- *Fault Yesterday Performance Installation*: The installation in question shows a poor performance on the previous day in respect to the rest of the installations of the plant.

- *Fault Lower Inverter Production*: An inverter is generating an energy performance lower than the rest in the plant.
- *Fault Very Lower Inverter Production*: An inverter is generating an energy performance much lower than the rest in the plant.

- *Fault Level 1 Tracker*: Tracker has deviated from its reference point.
- *Fault Level 2 Tracker*: Tracker has deviated greatly from its reference point.

- *Fault Null PV Counter Production*: Not in use

- *Fault String series at low intensity*

- *Fault String series off*

- *Fault Weather Station File dat*: Weather Station has had no summary files for more than 3 days.
- *Fault Weather Station Current*: Weather Station is not giving data of current sensors.
- *Inverter Off*

- *Inverter with Error*

- *Fault Yesterday Performance Installation Level 2*: The performance of an installation on the previous day was far below the rest of the plant.

- *Fault TTR*: Fault of the telemetry in real time.

- *Fault Reading data of PV Counter for more than 4 hours*

- *Fault Null Production PV Counter Hourly*

- *Fault, Counter without Telemetry*

The management of warnings must be configured and refined by using the rules in the events section. If a rule hides an event, the event will not be reported.

12.5 Reports Module

In addition to being able to obtain Excel or PDF files of each list or result obtained in the application, an events module has been created which takes care of analyzing installations or complete plants over a given period of time. These reports will be generated in PDF.

The options which we have in this module are the following.

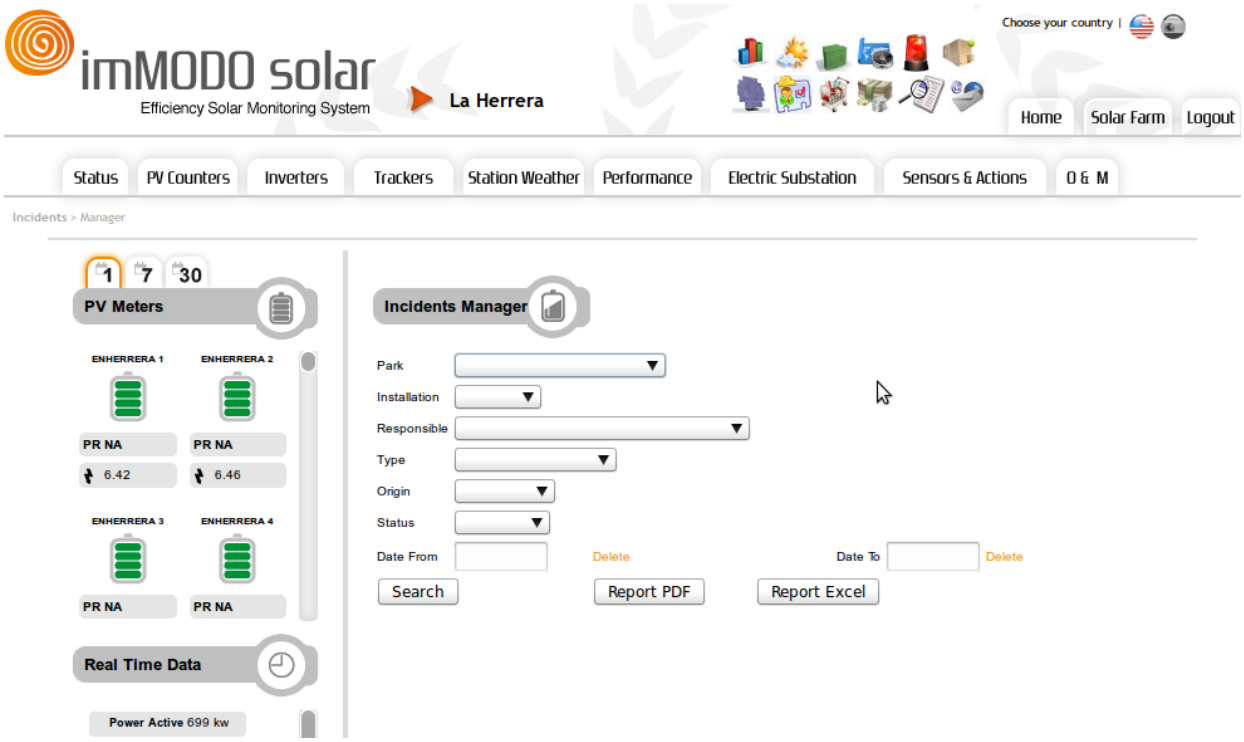
- Report on a plant in a month.
- Report on a plant in a year.
- Report on a installation in a month.
- Report on a installation in a year.

These reports will include data related to production as well as everything related to the expenses modules, maintenance requests etc.. Thus you have a useful tool at your disposal when studying or selling an installation.

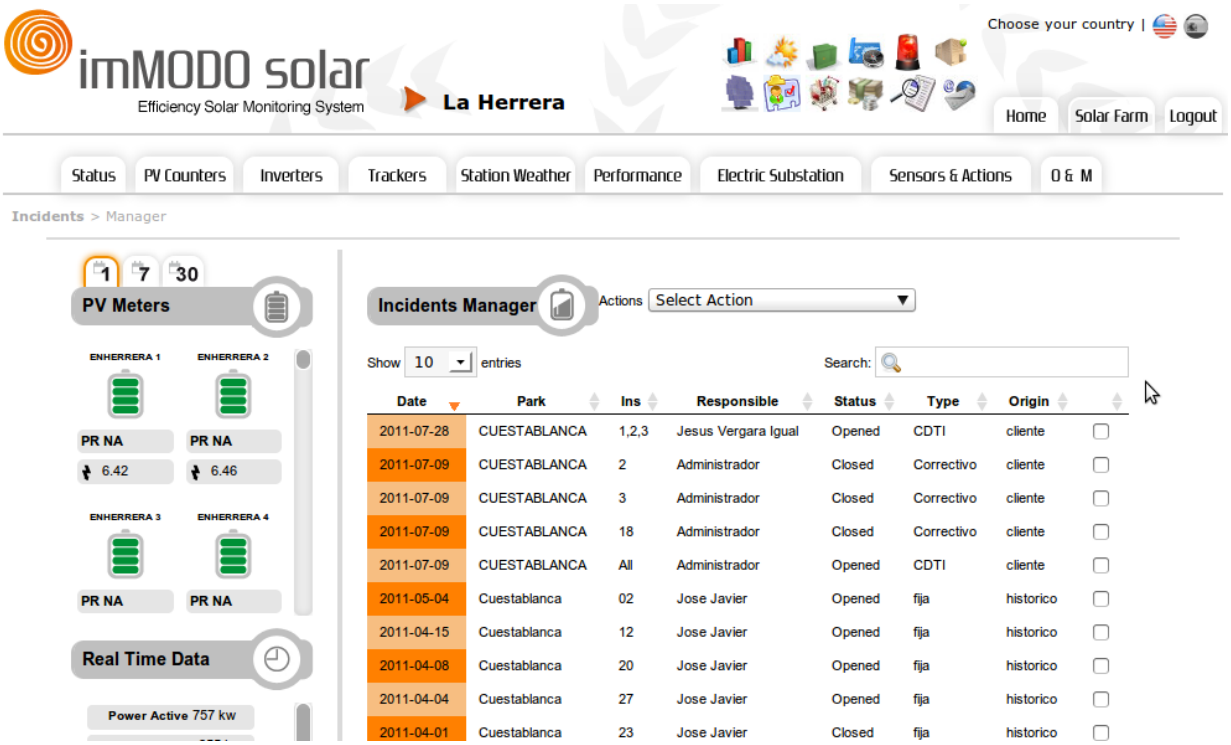
12.6 Incidents Module

This module allows you to manage incidents created by opening a maintenance request or even those managed directly by maintenance personnel.

There are various options offered in the incidents module. You can list opened incidents, closed incidents, all incidents or even make a personalized search of the incidents. This search is done using the following form:

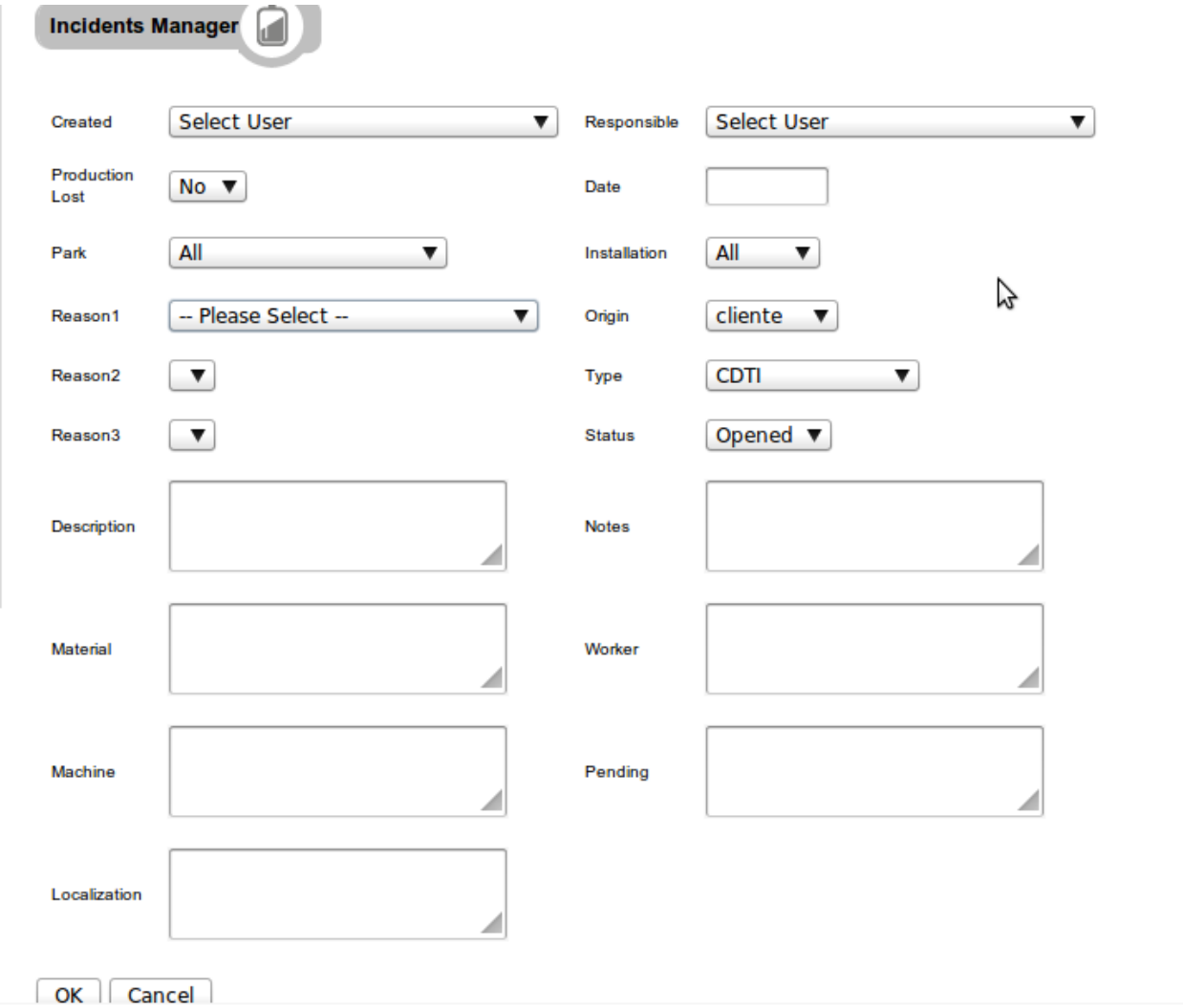


As you can see a search can be completed using different fields. In addition a list can be extracted pressing the button “Search” or a report can be produced in PDF or in Excel. In any case, the result of a search or of a preconfigured list will be as follows:



In this table the rows can be ordered and the incidents can be manipulated according to the options that can be seen in the previous screen shot.

The form which appears when creating an incident forces you to complete almost all fields and there are very few which can be completed freely. This makes things easier in the future regarding the organization and analysis of incidents. The following screen shot shows the screen for creating a new incident.

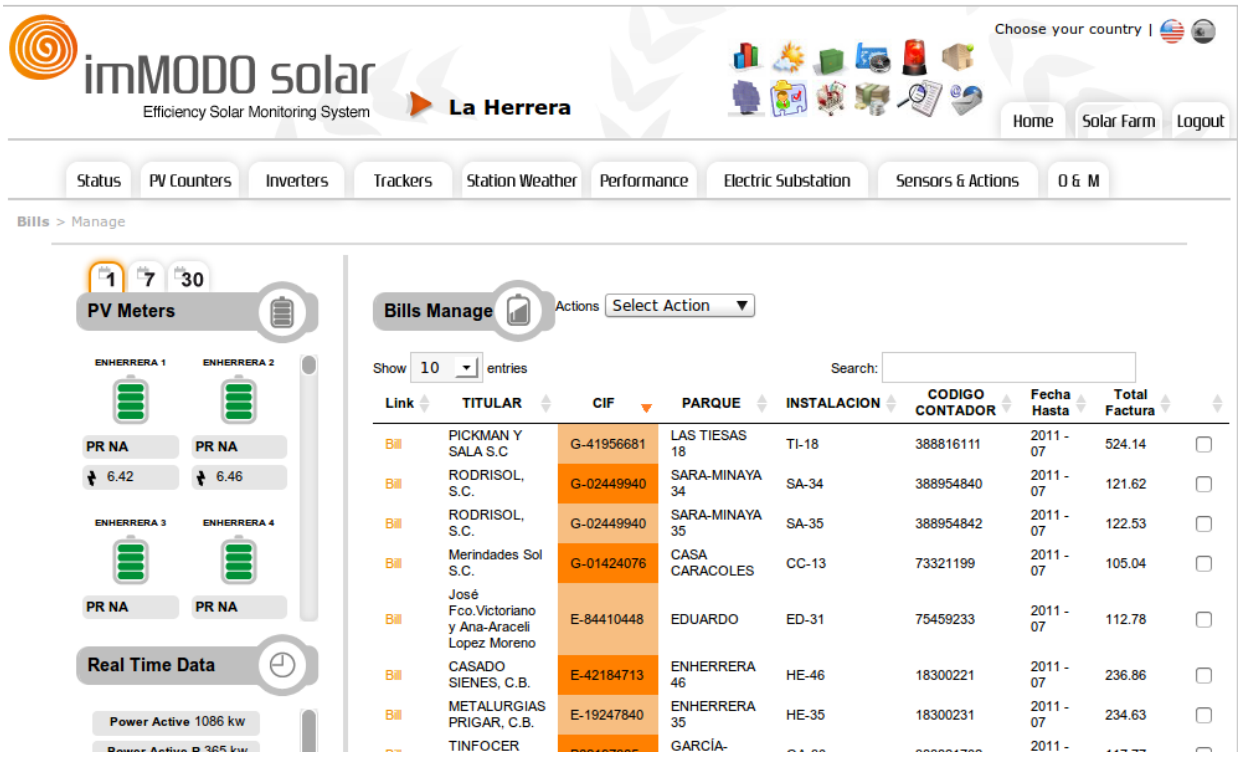


When creating an incident, editing one or closing one an e-mail will be sent to the person responsible.

The reasons for an incident are highly annotated and can be set at three levels. For example, if you select as reason 1 for the incident “MODULE”, a series of possible reasons 2 are available, such as “dirt”, “breakage”, etc. and so follows. The same occurs with the installations affected by the incident, which can be all, certain ones of those existent in the plant or an open field to be completed with various installations.

12.7 Invoicing Module

This module allows you to consult invoices generated for clients for the maintenance carried out in their installations. When accessing the module the following table can be seen.



One line appears for each invoice generated in the system. These invoices are generated automatically on the 2nd of every month. They can be organized by any field required. In the first column you will find a link to a corresponding PDF file.

One or various invoices can be selected and exported to Excel or PDF by selecting the corresponding action.

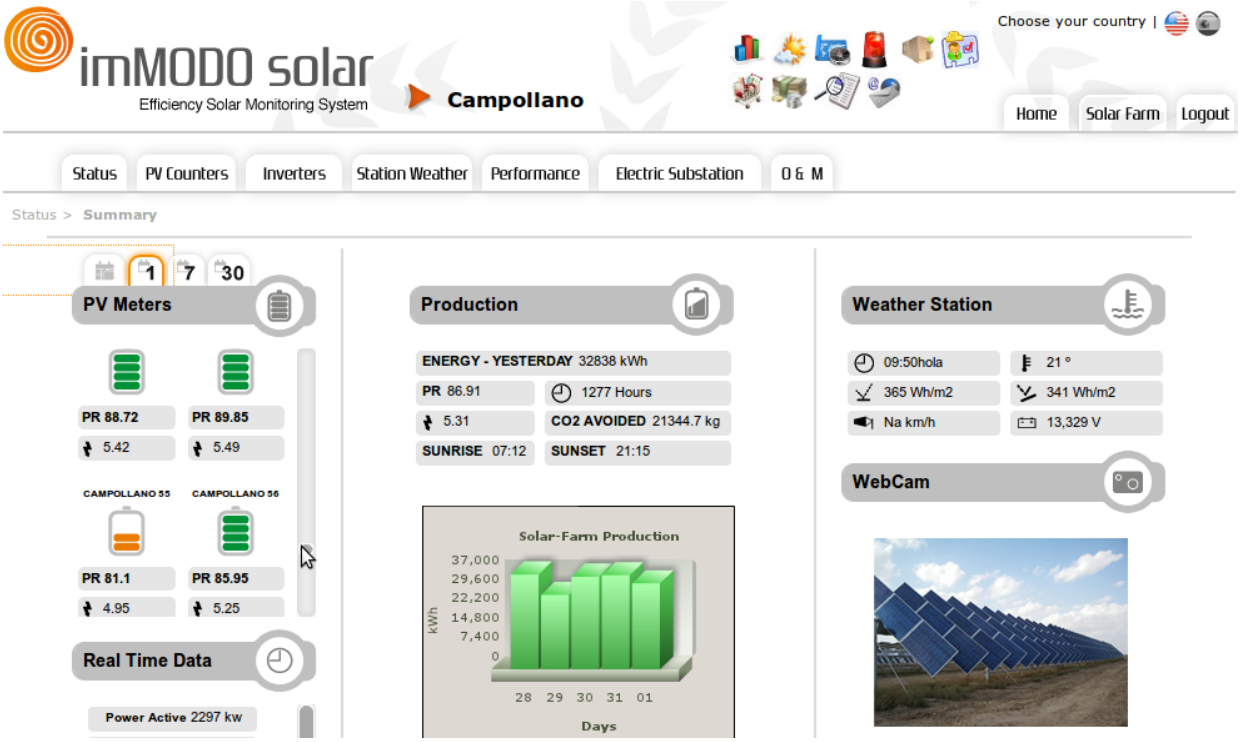
12.8 Accessories

From the Operation and Maintenance menu the sensitivity of the application can be changed. For example the percentage of average deviation for the warnings of low performance of inverters. Similarly the systems sensitivity regarding trackers and counters can be changed.

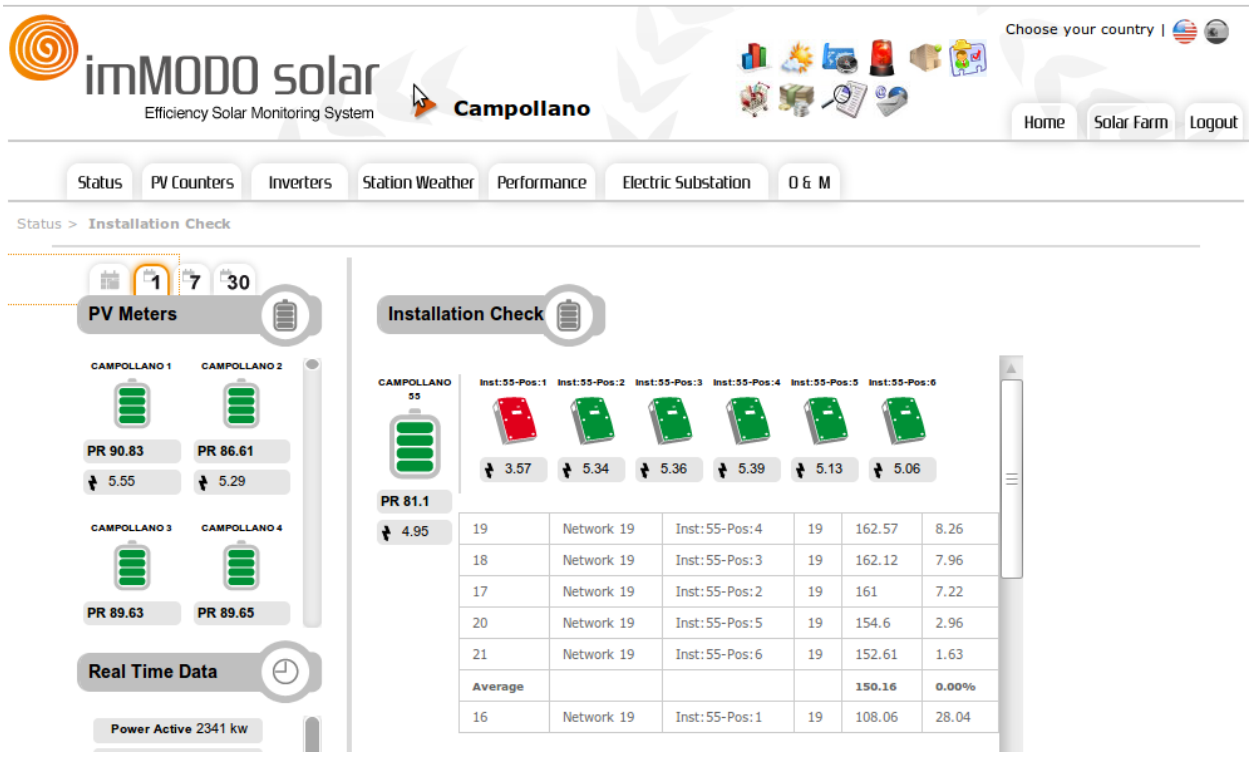
The system offers the option of downloading the file of the events history which have occurred in the system over the course of a day or even the communications of faults which have been sent to maintenance personnel.

13.Installation Study

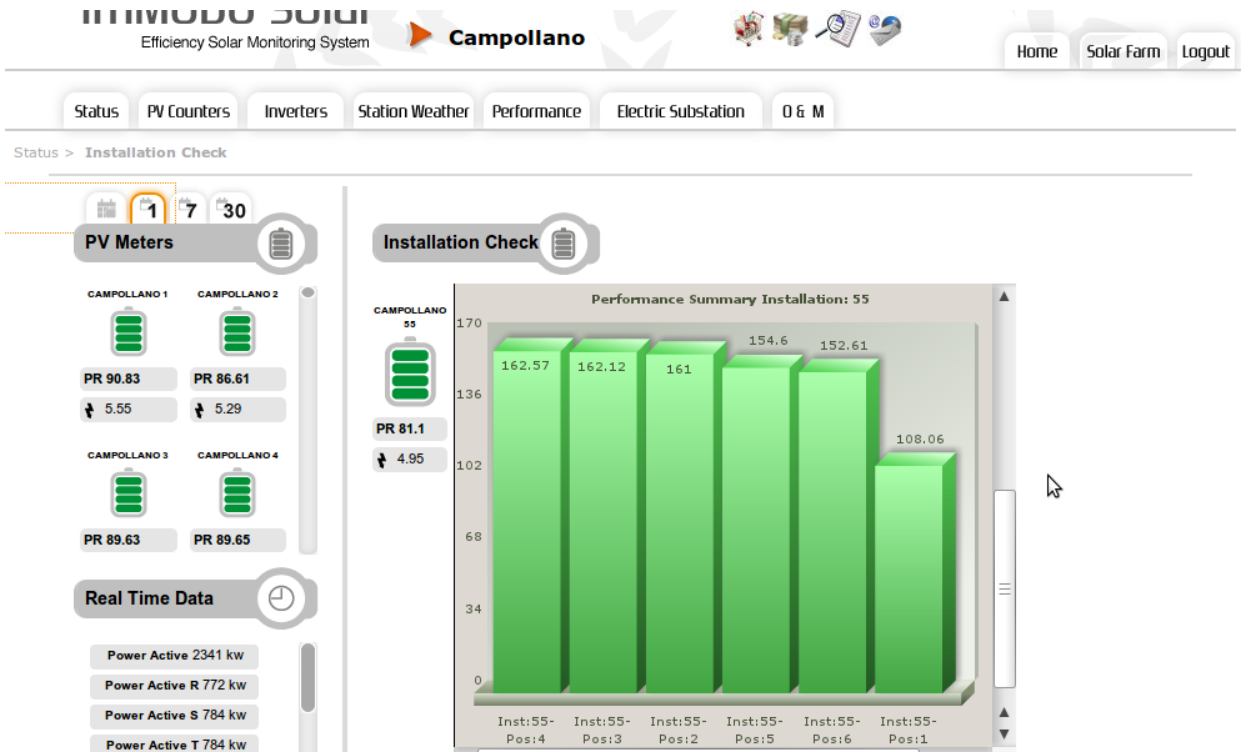
When analyzing a plant, a colour warning may be seen in the area on the left hand side of an installation. When analyzing the CAMPOLLANO plant in the following example you can see that there is an installation with a low performance: CAMPOLLANO 55.



If you select on the installation icon you will enter into the composition of inverters of the installation, showing a screen with the analysis. This allows you to detect which is the inverter or inverters which are proving problematic.



On the previous screen shot you can see that there is an inverter which has a much lower performance than the rest. This is marked in red and in the comparisons table it is shown to be lower than the average by 28.04%. If you scroll down you will also find a comparative graph.



Once the inverter is detected you can enter the study of the series which feed that inverter as long as the plant has the string series monitored. This is done by clicking on the inverter marked

in orange or red.

This tool allows you to analyze the installation’s problem in a few simple steps.