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AN EXAMPLE OF ENERGY CONSUMPTION OPTIMIZATION

The Concept

This project presentation it's a way to back up one's talk with an idea for an ECO Solution project. This example promotes our Integration Solutions starting from our personal and corporate experience and our products portfolio:

- It's a step forward to better understand the 'integration' concept we promote
- It's a package of devices to install to save energy
- It's an integral part of the Energy Solution promotion

The Targets

- Propose to you a high energy efficiency solutions because we care for the environment and to your energy bill
- Help you to create not only a single prj, but a 'showroom' and a business through connection to PlantVisorPRO and RemotePRO
- This project it's a training-on-field
- As a final result generate more sales



The products portfolio

RemotePRO

A powerful and effective ally for maintenance managers who want to keep the situation under control at all times. Any malfunctions are promptly signalled, and can be managed over a remote connection without physically needing to go on site:

- notifications via email and SMS;
- documents and notes relating to the system can be shared;
- different system access profiles;
- continuous control of correct system operation via sign-of-life;
- centralised management of units by corresponding local supervisors.



PlantVisorPRO

PlantVisorPRO is the CAREL monitoring and management system for complete control and optimisation of refrigeration and air-conditioning systems. The interface can be customised for displaying and configuring the system. PlantVisorPRO guarantees remote access to all the devices in the system: the web server function makes internet connection easy.



The products portfolio

pLoads

pLoads is the innovative CAREL controller for intelligent management of energy consumption; it significantly reduces waste, bringing considerable savings in terms of costs for the end user.

- Planning of connected loads
- Load cutoff
- Multiple energy meter and consumption management



pChrono

pChrono is the innovative CAREL controller for managing supermarket lights. It can also be used to manage other loads that require precise and customised scheduling. pChrono is completely integrated into the PlantVisorPRO supervisory system

- Lighting management
- Timed device management
- Pump management
- 10A power socket management
- Universal functions



The products portfolio

ECO-HVAC & ENERGY, plugin

Supermarkets are complex systems of independent devices, often integrated into a supervisory system. ENERGY provides local reports, while ECO-HVAC ensure interaction between these within the system:

- HVAC Smart Start
- Smart night purge
- Geo-Lighting



Energy meters

They are useful additions to the Retail sistema range. These energy meters are precise measuring instruments designed to monitor the main electrical parameters and instant and total power consumption of the connected loads.

- Single phase
- Three phases
- Wireless sockets



Energy optimization project

The CAREL system here proposed provides different standard controllers, as:

- **PlantVisorPRO**, as BMS system
- **pChrono**, lighting and generic loads management
- **pLoads**, energy solution for cut-loads needs
- **emeters** (emeter1, emeter3, wireless plug)
- **Wireless sensors**, for an easy and fast installation
- **Energy plugin**, for local energy data analysis

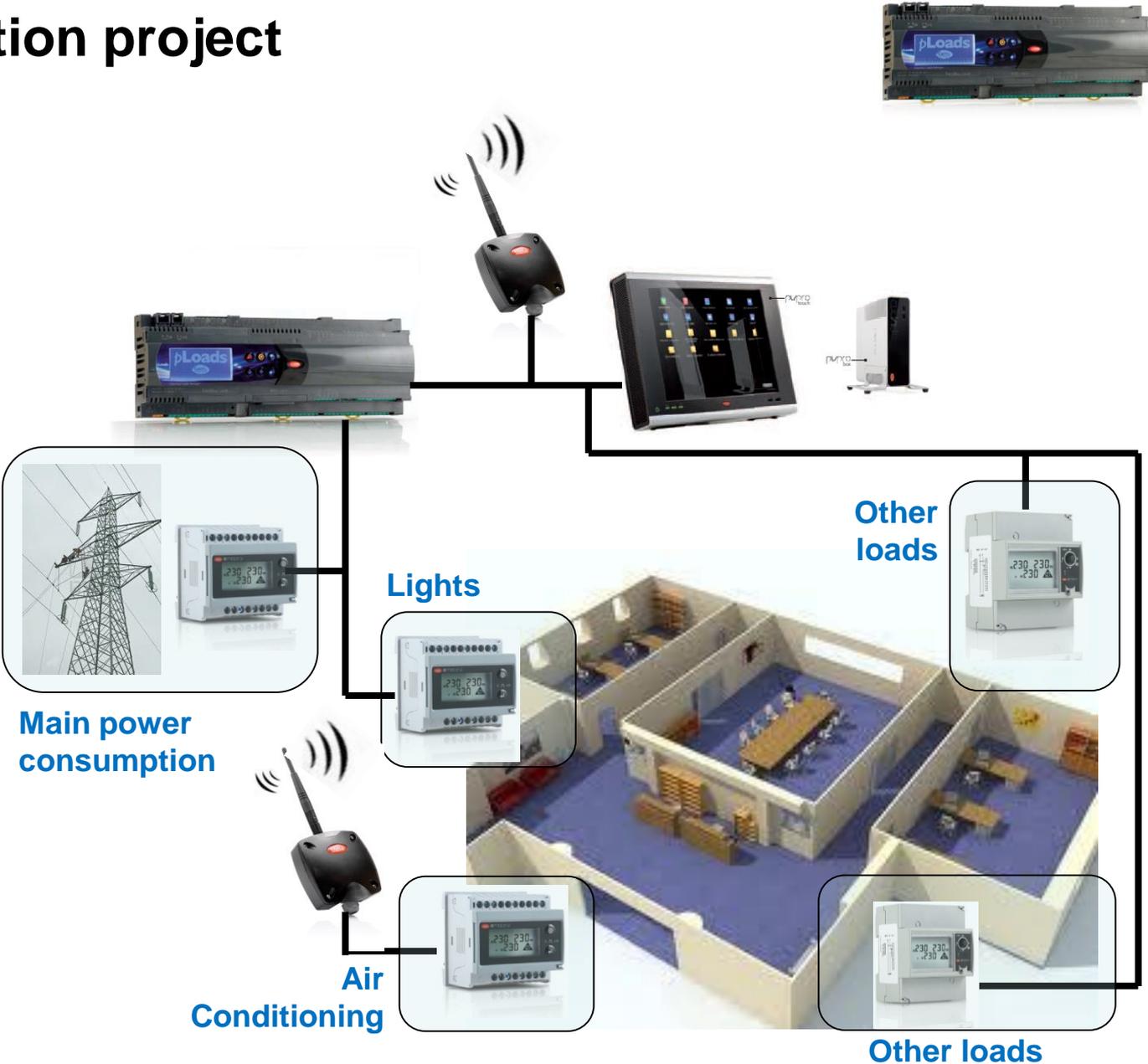
RemotePRO for data analysis



Energy optimization project

pLoads overview

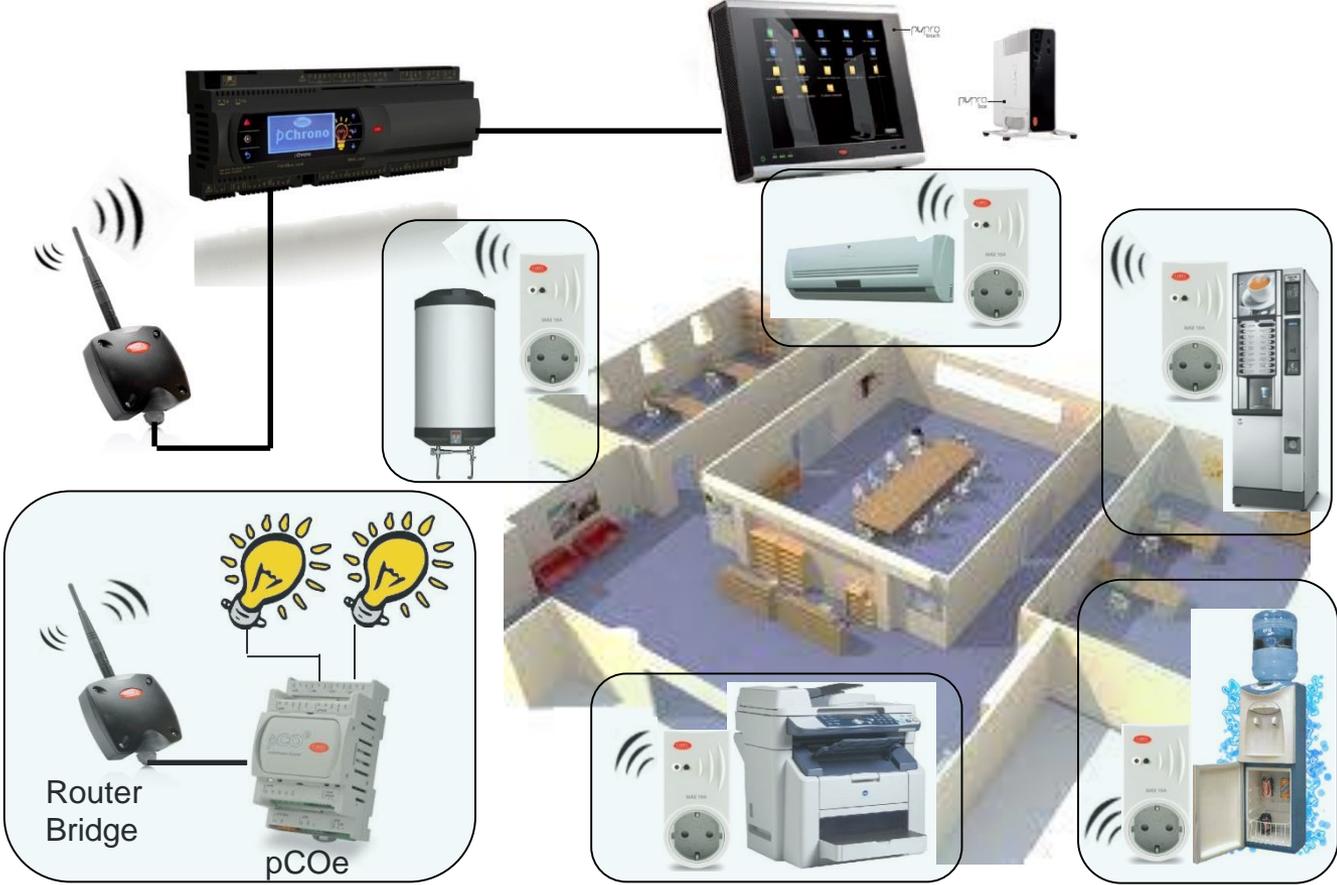
pLoads, for the energy monitoring...
CAREL emeters connect to our BMS, PlantVisorPRO, also by wireless



Energy optimization project

pChrono overview

pChrono, for loads monitoring and optimization, lights scheduling, alarm management, etc...



Energy optimization project



The Maps (1/4)

PlantVisorPRO

Supports jpg for customized user interface that can be populated with sensitive areas, information as Total Power consumption, External temperature and humidity, etc.

By a browser different user can access to, by different profiles.

The screenshot shows the PlantVisorPRO web interface. At the top, it displays the user name 'Gabriele', the system 'ECO_SUBs_CareHQ', the date '2015/09/08', and the time '16:27'. A 'Link Maps' button is visible on the left. The main area features a 3D architectural rendering of a building with three levels: '2° piano' (top, yellow), '1° piano' (middle, red), and 'Piano terra' (ground floor, blue/green). A green banner on the left says 'High Efficiency Solutions.' and 'Energy consumption' is highlighted in green. On the right, there is contact information for 'CAREL INDUSTRIES S.p.A.' and real-time data: '615 kW (TR1 + TR2) Total Power Consumption', '24.6 °C Outside Temperature', and '38 % Outside Humidity'. A bottom navigation bar contains icons for Plant, Alarm/Event, Report, Configuration, Activity, Energy, ECO-HVAC, and a home icon.



Energy optimization project



The Maps (2/4)

Details, step by step...

Piano terra

615 kW
(TR1 + TR2)
Total Power Consumption

24.6 °C
Outside Temperature

38 %
Outside Humidity

Palazzina Uffici & Ufficio Tecnico

Laboratorio HVACR

Magazzino Merci

Produzione Umidificazione

Laboratorio Umidificazione

Link Maps

Gabriele ECO_SUBs_CarelHQ 2015/09/08 16:31

Torna alla Mappa principale

Plant Alarm/Event Report Configuration Activity Energy ECO-HVAC

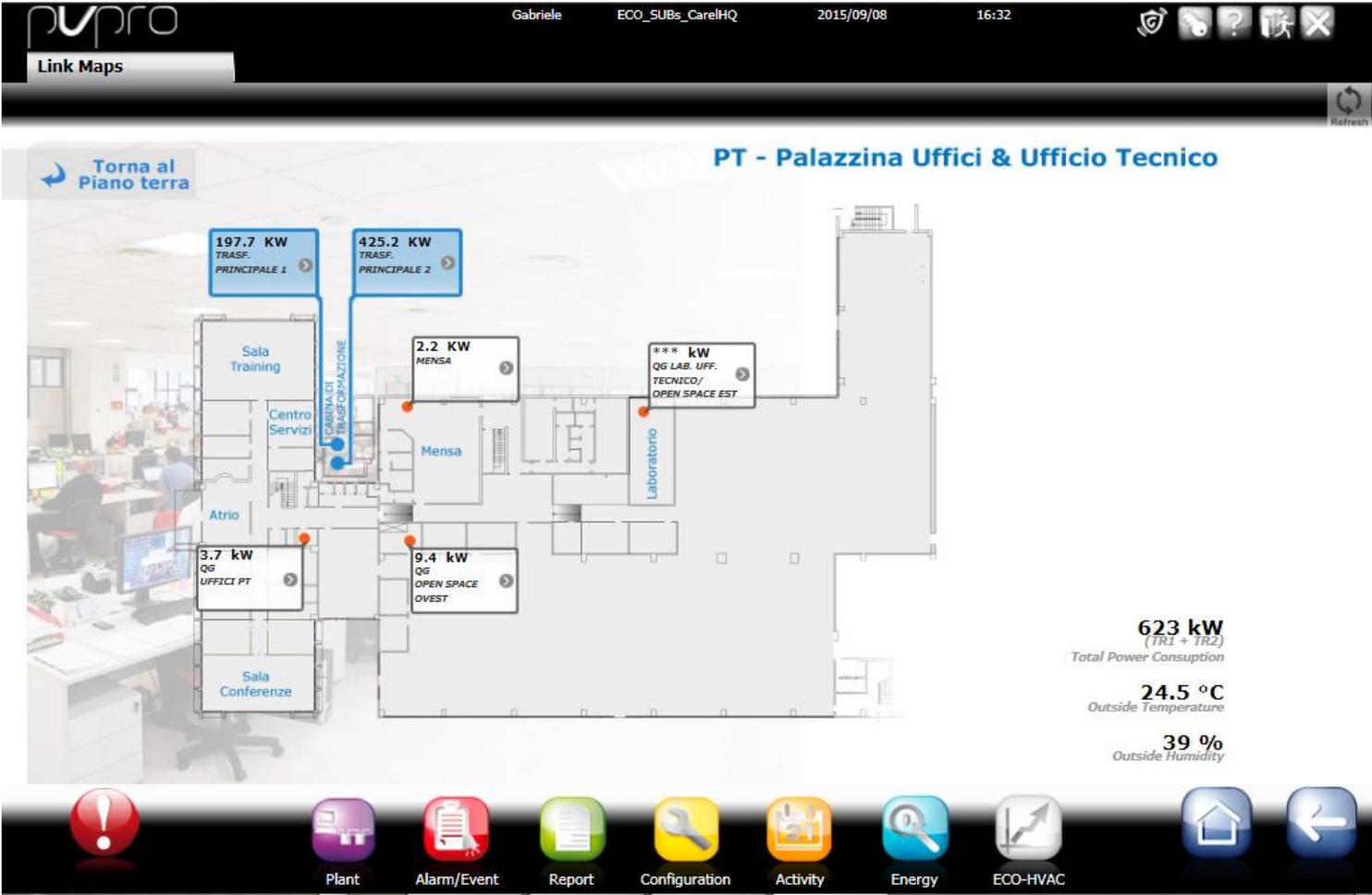


Energy optimization project



The Maps (3/4)

Sensitive areas can link the specific energy meter that collect power consumption of the that specific load.



Energy optimization project



The Maps (4/4)

Energy analysis

PlantVisorPRO has dedicated standard pages to show the performance of each single CAREL emeters, providing information of daily consumption

Energy Meter - CAREL emeter3 - 45

Value	Short desc	Description
50 Hz	Hz	Frequency
394.5 V	V L-L	Average phase-phase voltage
0.99	PF	Power Factor System
14.280 A	A L1	Phase 1 current
14.490 A	A L2	Phase 2 current
16.920 A	A L3	Phase 3 current
2.985 kW	kW L1	Phase 1 power
3.062 kW	kW L2	Phase 2 power
3.303 kW	kW L3	Phase 3 power

Read/Write variables table

Value	New value	Short desc	Description
0	<input type="text"/>	System	System type and connection (0=3P-N; 1=3P-1; 2=2P; 3=1P; 4=3P)
30	<input type="text"/>	Ct ratio	Current transformer (Ct) ratio

Active energy - current day
97 [kWh]

Active energy - current week
233 [kWh]

Active energy - previous week
831 [kWh]

Power
9.5 [kW]

Active energy
56,920.1 [kWh]

Active alarms

Date Time	Device	Description	Priority
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Plant Alarm/Event Report Configuration Activity Energy ECO-HVAC



Energy optimization project



The PlantVisorPRO Energy Plugin provides information of total and group loads consumptions; you can group different energy meters and deep on analysis

Dashboard | Graph | Export | Groups | Configuration | Meter Models

Start | Stop | Refresh | Reset

ENERGY

First sample available is on 19/12/2013 15:00:00
Last sample is on 08/09/2015 16:00:00

kWh

Description	kW	kWh	Kg CO2	Operation
Sviluppo Prodotto	***	2,925,250	1,541,607	<input type="checkbox"/>
Energy Meter - CAREL emeter3 - 45	9.6	36,913	29,993	<input type="checkbox"/>
Energy Meter - CAREL emeter3 - 56	***	39,738	31,482	<input type="checkbox"/>
Palazzina Uffici	11.3	59,328	31,266	<input type="checkbox"/>
Energy Meter - CAREL emeter3 - 54	3.7	22,293	11,748	<input type="checkbox"/>
Energy Meter - CAREL emeter3 - 55	6.0	28,226	14,873	<input type="checkbox"/>
Energy Meter - CAREL emeter3 - 57	1.6	8,810	4,643	<input type="checkbox"/>
Produzione Elettronica	196.2	1,645,758	867,314	<input type="checkbox"/>
Energy Meter - CAREL emeter3 - 50	28.3	294,537	134,151	<input type="checkbox"/>
Energy Meter - CAREL emeter3 - 44	123.1	1,067,362	362,603	<input type="checkbox"/>
Energy Meter - CAREL emeter3 - 43	44.9	323,639	170,538	<input type="checkbox"/>
Magazzino	6.9	21,002	11,068	<input type="checkbox"/>
plloads (Modbus) - 1	6.9	21,002	11,068	<input type="checkbox"/>

Total energy current month

42,932 [kWh]

Total energy previous month

139,197 [kWh]

Total energy current week

9,940 [kWh]

Total energy previous week

39,887 [kWh]

Current time slot

T1 / 20 [euro]

CO2 current month

22,625 [Kg CO2 per kWh]

CO2 current week

5,238 [Kg CO2 per kWh]

Plant
Alarm/Event
Report
Configuration
Activity
Energy
ECO-HVAC



Energy optimization project



Daily/Mountly/Yearly view, day by day, group by group energy consumption analysis...

Software interface for energy optimization project. The interface includes a navigation bar with options like Dashboard, Graph, Export, Groups, Configuration, and Meter Models. It features a search bar and utility icons for Preview, Print, and Print All.

The main section displays a 'kWh consumption detail' chart and a corresponding data table. The chart is a stacked bar chart showing kWh consumption over 31 days, categorized by group. The data table below the chart provides a detailed breakdown of kWh consumption for each group across the 31-day period.

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Tot	
Sviluppo Prodotto	156	110	286	303	309	135	243	140	140	140	140	140	139	115	89	85	232	267	289	276	270	145	144	292	310	317	308	291	152	152	332	6,448	
Palazzina Uffici	33	28	163	135	132	46	117	34	25	51	49	57	53	45	32	23	153	133	152	142	139	34	29	164	177	141	155	140	39	33	146	2,800	
Produzione Elettronica	2,030	310	3,487	3,459	3,398	1,205	3,382	648	344	1,748	1,418	1,363	1,342	705	626	305	3,383	3,408	3,469	3,390	3,396	1,641	335	3,641	3,644	3,656	3,621	3,581	2,099	447	3,665	69,146	
Magazzino	25	27	49	92	142	78	61	5	4	4	4	4	4	4	4	4	45	65	68	90	76	28	29	32	29	26	29	30	27	26	31	1,144	
Lab. Termodinamico	671	555	1,111	1,297	1,449	1,290	1,577	793	240	375	382	232	213	211	211	209	702	921	537	525	489	486	496	203	694	822	795	1,040	942	649	1,169	21,286	
Mensa	40	42	108	110	105	38	82	24	25	24	23	22	22	23	23	23	88	102	100	104	98	41	42	106	109	107	109	109	44	45	111	2,047	
Lab. Umidificazione	2,170	2,074	2,322	2,510	1,564	28	27	29	31	30	30	30	30	30	30	30	32	1,090	1,975	2,149	2,128	2,036	1,922	1,918	1,975	1,280	1,334	1,376	1,647	1,605	1,484	1,441	36,327

The interface also includes a navigation bar at the bottom with icons for Plant, Alarm/Event, Report, Configuration, Activity, Energy, and ECO-HVAC.



Energy optimization project



An **xls** file can be downloaded from PVP to to analys deep the consumptions and schedule future actions

	A	B	C	D	E	F	G	H	I	J
1	User	Gabriele								
2	Site name	ECO_SUBS_CarelHQ								
3										
4	Energy global configuration									
5	kWh Cost	20	13		0	0	0	0		0 0
6	Currency	euro								
7	KgCO2 per kWh	0.527								
8										
9	Report type	Site								
10	From	2015-08-01 00:00:00.0								
11	To	2015-09-01 00:00:00.0								
12	Step	Day								
13										
14										
15	kW	18.709.338								
16	kWh	139197.47								
17	Cost	0.0euro								
18	Kg CO2	73357.07								
19										
20		Sviluppo Prodotto	Palazzina Uffici	Produzione Elettronica	Magazzino	Lab. Termodinamico	Mensa	Lab. Umidificazione		
21	Percentage	4.6%	2.0%	49.7%	0.8%	15.3%	1.5%	26.1%		
22	kW	8.7	3.8	92.9	1.5	28.6	2.8	48.8		
23	kWh	6,448	2,8	69,146	1,144	21,286	2,047	36,327		
24										
25										
26		Sviluppo Prodotto	Palazzina Uffici	Produzione Elettronica	Magazzino	Lab. Termodinamico	Mensa	Lab. Umidificazione		
27		01/08/2015								
28	kW	6.5	1.4	84.6	1.1	28.0	1.7	90.4		
29	kWh	156	33	2,03	25	671	40	2,17		
30		02/08/2015								



Energy optimization project



Focus on pChrono device (1/4)

pChrono device user interface on PlantVisorPRO. The SI wireless sensors read information of T/H/LUX, while the wireless plugs optimized the consumption of the loads as coffee machine, boilers, etc. by pChrono integrated scheduler

Addr.	Temp.	Humid.	Light	Status	Power	Energy
21	24.8	38	251	ON	46	1,881,340
22	28.2	31	530	ON	93	2,140,025
23	25.1	37	271	OFF	0	0
24				ON	27	1,476,489
25				OFF	0	0
26				ON	0	0
27				ON	0	0
28				ON	0	0
29				ON	0	0
30				OFF	0	0
31				ON	0	1,594,709
32				ON	0	19,676
33				ON	19	99,733
34				OFF	0	0
35				ON	13	9,829



Energy optimization project



Focus on pChrono device (2/4)

pChrono user interface for wireless plug scheduling, manual operating mode, etc.

The screenshot displays the pChrono user interface with the following details:

- Header:** nupro logo, user 'Gabriele', system 'ECO_SUBs_CarelHQ', date '2015/09/08', time '16:43', and navigation icons.
- Navigation:** Main, Parameters (selected), Alarms, HACCP graph, Log graph, Notes.
- Device Selection:** pChrono - 15
- Function Tabs:** Schedulers, Exceptions, Lights, Pumps, Loads, Functions, SOCKETS (selected), Wireless.
- Device #1 (P3sald1):** Addr.: 26, Power: 46 W, Energy: 1,881,340 Wh, Status: ON, Cycle Time: 20 sec.
- Device #2 (Caffe'dx):** Addr.: 27, Power: 93 W, Energy: 2,140,025 Wh, Status: ON, Cycle Time: 20 sec.
- Device #3 (P3sald2):** Addr.: 28, Power: 0 W, Energy: 0 Wh, Status: OFF, Cycle Time: 0 sec.
- Device #4:** Addr.: 29, Power: 27 W, Energy: 1,4 Wh, Status: ON, Cycle Time: 0 sec.

Each device panel includes settings for Time Band, Period, and a weekly schedule grid (Mon-Sun).

Bottom Bar: Plant, Alarm/Event, Report, Configuration, Activity, Energy, ECO-HVAC, Home, Back.



Energy optimization project



Focus on pChrono device (3/4)

pChrono user interface for wireless sensors to collect information of temperature, humidity, brightness managing alarms when thresholds is overwite. You can name the sensors to identify where they are located.

#1	SMD-VS2	#2	SMD-VS3	#3	SMD-VS1
Addr.:	21	Addr.:	22	Addr.:	23
Temp.:	24.6 °C/°F	Temp.:	28.1 °C/°F	Temp.:	25.1 °C/°F
Humid.:	38 %rH	Humid.:	31 %rH	Humid.:	37 %rH
Light:	243 lux	Light:	515 lux	Light:	271 lux
Cycle Time:	600 sec	Cycle Time:	600 sec	Cycle Time:	600 sec
High Threshold:	29.0 °C/°F	High Threshold:	29.0 °C/°F	High Threshold:	29.0 °C/°F
Low Threshold:	0.0 °C/°F	Low Threshold:	0.0 °C/°F	Low Threshold:	0.0 °C/°F
High Threshold:	100 %rH	High Threshold:	100 %rH	High Threshold:	100 %rH
Low Threshold:	0 %rH	Low Threshold:	0 %rH	Low Threshold:	0 %rH
High Threshold:	1,500 lux	High Threshold:	2,000 lux	High Threshold:	1,500 lux
Low Threshold:	0 lux	Low Threshold:	0 lux	Low Threshold:	0 lux



Energy optimization project



Focus on pChrono device (4/4)

pChrono supports special functions as alarm log, DIN reading, dampers management, ect.

The screenshot shows the pChrono web interface with the following details:

- Header: nupro logo, user 'Gabriele', location 'ECO_SUBs_CarelHQ', date '2015/09/08', time '16:45', and navigation icons.
- Navigation tabs: Main, Parameters, Alarms, HACCP graph, Log graph, Notes.
- Device selection: 'pChrono - 15' dropdown menu.
- Function categories: Schedulers, Exceptions, Lights, Pumps, Loads, **FUNCTIONS**, Sockets, Wireless.
- Device #1: 'Server' (Thermostat).

Value:	24.8	Temp.-SA4
Function type:	THERMOSTAT	
Thermostat out:	0	NO3 - pChrono
Output type:	DIRECT	
Setpoint:	25.0	<input type="text"/>
Diff ON:	5.0	<input type="text"/>
Diff OFF:	0.0	<input type="text"/>
Alarm high:	0	
Enable alarm:	Enable <input checked="" type="radio"/>	Disable <input type="radio"/>
Alarm high setp:	32.5	<input type="text"/>
Delay:	300	<input type="text"/>
Alarm low:	0	
Enable alarm:	Enable <input checked="" type="radio"/>	Disable <input type="radio"/>
Alarm low setp:	10.0	<input type="text"/>
Delay:	0	<input type="text"/>
- Device #2: 'AltaTemp' (Generic Alarm).

Value:	---	
Function type:	GENERIC ALARM	
Alarm:	<input checked="" type="radio"/>	
Delay:	0 sec	<input type="text"/>
- Footer: A row of icons for Plant, Alarm/Event, Report, Configuration, Activity, Energy, ECO-HVAC, Home, and Back.



Energy optimization project

Data consumption collection (1/3)

By **RemotePRO** you can merge all Data Consumption from different sites to make analysis, comparison and provide reports to different users...



Energy optimization project



Data consumption collection (2/3)



NRG - Benchmark



from	17-dic-2013	period	daily
open		area	Carel World
plant type			

plant	plant type	opening	area	value (kwh)	refrigeration	lights	air cond.	loads	other
Sub. Carel SZ	Other	24/7	Carel World	3876.00	-	-	-	3876.00	-
Sub. Carel 3	Other	24/7	Carel World	1162.00	-	-	-	1162.00	-
Sub. Carel AU	Other	24/7	Carel World	186.00	-	-	-	186.00	-
Sub. Carel FR	Other	24/7	Carel World	134.00	-	-	-	134.00	-
Sub. Carel TH	Other	24/7	Carel World	39.00	-	-	-	39.00	-
Sub. Carel UK	Other	24/7	Carel World	3.90	-	-	-	-	3.90
Sub. Carel ZA	Other	24/7	Carel World	0.10	-	-	-	-	0.10
average				771.57				1079.40	2.00
total				5401.00				5397.00	4.00

■ maximum value
 ■ over the average value
 ■ average value
 ■ under the average value
 ■ minimum value



Energy optimization project



Data consumption collection (3/3)

Loads

Others



AN EXAMPLE OF ENERGY CONSUMPTION OPTIMIZATION



High
Efficiency
Solutions.

CAREL
