Work Package 2

Pilot's solution set data analysis

Deliverable D2.3

Data collection active from all pilot hospitals

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List of abbreviations

AHU: Air Handling Unit

AVG: AVeraGe

BMS: Building Management System

COP: Coefficient Of Performance

GUI: Graphical User Interface

HVAC: Heating, Ventilation and Air Conditioning

I/O: Input/Output

ICT: Information and Communication Technology

M&V: Measurement and Verification

PLC: Programmable Logic Controller

ppm: parts per million

PSP: Policy Support Program

PUE: Power Usage Effectiveness

RDBMS: Relational DataBase Management System

SCADA: Supervisory Control And Data Acquisition

SQL: Structured Query Language

VPN: Virtual Private Network

Web-EMCS: Web Energy Management and Control System

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1. Introduction

This deliverable represents an intermediate step in the development of Task 2.3-Energy saving potential hypothesis and benchmarking model definition. After solution sets identification, meters installation (Task 2.1) and ICT infrastructure data collection (Task 2.2) the first part of Task 2.3 has been focused on the identification of the I/O which need to be collected and stored in order to calculate the energy saving potentials for each solution set.

Furthermore the main requirements of the database in which the collected data will be stored have been defined: this task has been carried on in strong cooperation with Task 3.2 - GUI development and database design. A key reference in the development of this task has been the deliverable published in the framework of the eeMeasure project D1.2-Non-residential methodology [1]. This document presents the Measurement and Verification (M&V) methodology common to all the ICT PSP projects. It defines the requirements to be respected in the data collection and data validation phases and the procedure needed to calculate the project results.

Chapter 2 lists for each solution set the type of I/O measured and stored. Chapter 3, on the other hand, presents the structure of the database implemented and the I/O lists with all the channels names.

2. I/O available for each solution sets

Nine energy saving solution sets have been identified in the four pilot hospitals after the energy audit carried on in the framework of Tasks 2.1 and 2.2. The main features of these solution sets have been described in Deliverable 2.2-Energy saving solution set description and the strategy followed to integrate them in the Web-EMCS has been described in Deliverable 3.1-Communication driver development [2][3]. In the following paragraph the list of I/O available for each solution set is presented. Each list is the sum of I/O already available before the starting of the project and of I/O added during the project implementation.

2.1. AOR

Two solution sets have been selected to be tested in the "Azienda Ospedaliero Universitaria Ospedali Riuniti Umberto I – G.M. Lancisi – G. Salesi" (AOR): the first consists in the optimization of the control strategies of the data centre cooling system. The main objective is to increase the PUE (Power Usage Effectiveness) value reducing the energy consumption due to non IT load.

The second solution concerns lighting: a smart lighting system including hardware and software energy saving solutions will be tested.

The first sub-system is already monitored and the existing ICT architecture, as described in D2.2-Energy saving solution set description, is made of two PLCs and a Securebox. This monitoring architecture has been integrated in the Web-EMCS and pre-installation data, collected since September 2011, have been uploaded in the Web-EMCS database which since February 2013 is collecting data directly from the field.

Concerning the second sub-system, two different monitoring strategies have been selected for the pre-installation and for the post-installation monitoring. The pre-installation monitoring campaign has started the 18th of January 2013: a movable monitoring kit has been assembled with the aim to create a usage pattern for each of the rooms considered in the pilot. Presence, luminance, light state, power and energy have been the parameters measured for one week at least in each of the selected areas. The monitoring equipment has been moved every week from one room to the other and, at the end of the monitoring campaign, data have been uploaded into the Web-EMCS.

2.1.1. Data centre cooling optimization

The I/O collected from this solution set have been organized in a complex tree structure. I/O are classified in two main categories:

- Thermal power plant: it collects the parameters monitored in the water cooling system installed in the mechanical room. These parameters are acquired by one of the two PLCs that have been integrated in the Web-EMCS
- Data Center: it collects all the parameters monitored in the data centre. These parameters are acquired by the second PLC and the Secure box.

The parameters belonging to the Thermal power plant category are listed in Table 1. Note that some parameters have been grouped in subcategories because they refer to the same functional area.

Parameters	**Categories**
Outdoor average temperature	Thermal power plant general parameters
Cold water from chiller or dry cooler average temperature	
Hot water from chiller or dry cooler average temperature	
Energy consumption from UPS	
Energy consumption from normal line	
Condenser inlet water average temperature	Chiller unit 1
Condenser outlet water average temperature	
Evaporator inlet water average temperature	
Evaporator outlet water average temperature	
Dry cooler 1 average fan speed	
Dry cooler 2 average fan speed	
Condenser inlet water average temperature	Chiller unit 2
Condenser outlet water average temperature	
Evaporator inlet water average temperature	
Evaporator outlet water average temperature	
Dry cooler 3 average fan speed	
Dry cooler 4 average fan speed	

Table 1 Thermal power plant parameters

The parameters belonging to the Data centre category are listed in Table 2. Note that in this case some parameters have been grouped in subcategories also because they refer to specific functional area.

Parameters	**Categories**
Total power	Data center general parameters
Total power AVG	
Inrow outlet water temperature	
Fibre rack average temperature	
Copper rack average temperature	
Fibre rack average humidity	
Copper rack average humidity	
PUE	
PUE AVG	
Hot corridor temperature AVG	Enviromental parameters
Cold corridor temperature AVG	
Inrow outlet air temperature AVG	
Inrow inlet air temperature AVG	
Normal line energy	IT room
UPS line energy	
Total IT energy	
IT power	
IT power AVG	
Total power	
Total power AVG	
Valve opening	In row (one subcategory for each of the four In Row units)
Water flux	
Air flux	
Required power	
Outgoing power	
Fan speed	
Inlet water temperature AVG	
Outlet water temperature AVG	
Inlet rack air temperature AVG	
Outlet rack air temperature AVG	
Rack inlet temperature AVG	
Normal energy	Rack (one subcategory for each of the 10 racks)
UPS energy	
Cold temperature AVG	
Cold humidity AVG	

Table 2 Datacenter parameters

All the channels having the AVG suffix present the average measure of the parameter. The average is calculated on a temporal interval of fifteen minutes. For the other channels providing instant measures, the Web-EMCS will give the possibility of calculating the average value on an hour, a day or a week period.

Channels can be classified also in real and virtual ones. The real channels collect data directly taken from the field, whereas virtual channels contain data obtained from the calculation among other real channels (e.g. total energy is a virtual channel, obtained summing all the single energy real channels). The virtual channels are written using the italic style.

2.1.2. Smart lighting system

Even if two different monitoring strategies are adopted for the pre-installation and for the post-installation monitoring campaign, the same set of data is measured or calculated starting from sensors and meters. The database structure reflects the layout of the monitored rooms. The hierarchy levels are presented below:

- Floor
- Department
- Room

The chosen hierarchy permits an easy expandability of the database in case of upgrade of the monitoring system. The parameters collected for each of the selected areas are listed in the following table.

Parameters
Presence
Lighting power AVG
Lighting energy
Luminance
Lighting state (on/off)
Dimmer percentage
Breakdown alarm

Table 3 Lighting parameters

Note that in certain rooms more than one presence detector is foreseen to be installed and, in these cases multiple Presence and Luminance channels are available. Moreover more than one lighting switch is available in certain rooms, controlling separately different groups of luminaries. In this case multiple channels are created for the following parameters:

- Lighting power AVG
- Lighting energy
- Lighting state
- Dimmer percentage
- Breakdown alarm

2.2. HVN

There are three solution sets selected for the "Hospital Vigen de las Nieves" (HVN), belonging to the HVAC system. The first solution set refers to the emergency zone air handling unit control, the second to the surgery theaters air unit control and the third to the data center cold water production management.

All data are locally stored in the hospital SCADA which has enough memory to store ten days of data. After this period the system overwrite data relative to ten days before. This limitation has been overtaken from the 10^{th} of June 2013, when all the steps needed for enabling the communication with the Green@Hospital server (VPN network creation, Communication Framework installation, queue creation) have been correctly completed. In fact from that date, all the data are saved in the Web-EMCS server database and consequently they are also available to be plotted and analyzed.

2.2.1. Emergency zone Air Handling Unit Control

The I/O for this solution set are addressed to the AHU number three following the hospital nomenclature. The collected parameters refer to energy consumption, air temperature and valve position. The complete list of parameters is reported in Table 4. All these channels are real.

Parameters
Active energy
Reactive energy
Thermal meter cooling energy
Thermal meter power
Outdoor temperature
Supply air temperature
Return air temperature
Free cooling damper position

Table 4 Emergency zone AHU parameters

2.2.2. Surgery theaters Air Unit Control

The second solution set concerns the surgery theaters air unit control. The I/O collected can be organized in one main category, named following the hospital nomenclature AHU 1. Under this macro category a more accurate distinction has been made adding three sub-categories, the AHU 1 coil 1, 2 and 3. The parameters collected are:

- AHU 1: it collects the parameters monitored in the rooms and in the AHU system. The types of the data measured are energy consumption, air temperature and valve position.
- AHU 1 coil 1, 2 and 3: they collect data monitored in the first, second and third coil of the AHU system. The types of the data are power and energy consumption.

The complete list of parameters belonging to the AHU category and AHU coils sub-categories are reported in the Table 5. All the channels referred to the surgery theaters solution set are real.

Parameters	**Categories**
Active energy	AHU1
Reactive energy	
Pretreatment chamber air temperature	
Post-heating chamber air temperature	
Supply ducts air temperature	
Rooms temperature	
Mix air damper ducts position	

Preheating coil valve position	
Cooling coil valve position	
Heating coil valve position	
Heat energy consumption	AHU1 C1
Power	
Cooling energy consumption	AHU1 C2
Power	
Heating energy consumption	AHU1 C3
Power	

Table 5 Surgery theaters AHU parameters

2.2.3. Data centre cold water production management

The third solution set deals with the data center cold water production system. Although there are some parameters connected to the general "data center" category, the I/O have been classified in three categories:

- Chillers: in this category the parameters directly monitored in the chillers are collected. These parameters are related to active and reactive energy consumptions.
- AHUs: here, data measured from the three AHUs systems are stored. Parameters are chosen for monitoring energy consumptions.
- Technical rooms: it collects parameters related to the temperature and the humidity.

Regarding chillers and AHUs categories, there are some sub-categories to allow a more clear classification of the parameters. Chillers are sub-divided in Chiller 1, 2 and 3, whereas AHUs are sub-categorized in AHU 1, 2 and 3. It is important to note that the three AHU sub-categories contain more specific measures than the general AHU group. In fact the following data are collected for monitoring:

- Temperature
- Humidity
- Valves position

The classification which has just been described, can be schematized in Table 6 where the main categories are reported:

Parameters	**Categories**
Air humidity	Chillers
Air temperature	
Active energy	AHU 1-3
Reactive energy	
Air humidity	Technical rooms
Temperature humidity	

Table 6 Datacenter main categories parameters

In Table 7 the parameters belonging to the sub-categories are listed:

Parameters	**Categories**
Active energy	Chiller 1
Reactive energy	
Active energy	Chiller 2
Reactive energy	
Active energy	Chiller 3
Reactive energy	
Temperature setpoint	AHU 1
Humidity setpoint	
Return air temperature	
Supply air temperature	
Return air humidity	
Supply air humidity	
Outside air humidity	
Outside air temperature	
Valve 1 opening grade	
Freecooling damper	
Temperature setpoint	AHU 2
Humidity setpoint	
Return air temperature	
Supply air temperature	
Return air humidity	
Supply air humidity	
Outside air humidity	
Outside air temperature	
Valve 1 opening grade	
Freecooling damper	
Temperature setpoint	AHU 3

Humidity setpoint	
Return air temperature	
Supply air temperature	
Return air humidity	
Supply air humidity	
Outside air humidity	
Outside air temperature	
Valve 1 opening grade	
Freecooling damper	

Table 7 Datacenter sub-categories parameters

In this solution set all the channels report real data, directly measured from the field.

2.3. SGH

Two solution sets have been selected for the "Chania St. George Hospital" (SGH). The two solutions are referred to the three selected rooms of the pediatric clinic. The first one is applied for managing the fan coils and the second one to manage the artificial light.

The first group of meters installed is used for monitoring:

- Power consumption (current , power) for lighting and fan coil operation
- Thermal consumption in the fan coils (thermal energy, temperature of the inlet and outlet fluid of the fan coils)

These meters have been completely installed on the 12th of April 2013, day when the data started to be stored.

The second group of meters installed monitors:

- Temperature
- Humidity
- CO_2 ppm
- Luminance
- Presence
- Window contact signals

for each selected room. The installation of these meters finished on 17th May 2013, and from that the storing data in local database started too.

Some modifications to the system have been made, so the data stored present some temporal discontinuities. The effective start day can be considered the 1st of June 2013, when storing starts in a continuous way.

2.3.1. Fan coils management in selected rooms of the pediatric clinic

This solution set is characterized by I/O signals which can be divided in three categories. This distinction is made to differentiate the signals which allow to observe the general electric consumption of the system and the signals positioned for monitoring the thermal consumption. The environmental parameters are:

- Fan coils consumption
- Fan coils thermal consumption
- Environmental parameters

The same parameters are measured for each room selected, such as:

- Patient room
- Doctors' office
- Doctors' restroom

The parameters measured for this sets are reported in Table 8.

Parameters	**Categories**
Energy consumption	Fan coils
Heat energy consumption	Fan coils thermal
Cooling energy consumption	
Power	
Temperature	Environmental parameters
Humidity	
CO_2 ppm	

Table 8 Fan coils parameters

2.3.2. Artificial lighting management in selected rooms of the pediatric clinic

Regarding the artificial lighting solution set, the I/O signals can be conceptually classified according to the room where the meter is installed. For this reason the categories are three:

- Patient room
- Doctors' office
- Doctors' restroom

The types of data measured and the category distinction described above are reported in Table 9:

Parameters	**Categories**
Room luminance	Patient room
Presence in the room	
Light Power	
Emergency light power	
Room luminance	Doctors' office
Presence in the room	
Light Power	
Emergency light power	
Room luminance	Doctors' restroom
Presence in the room	
Light Power	
Emergency light power	

Table 9 Artificial lighting paramenters

All these signals are real, because they are directly measured on the field.

Finally, there are three other signals also: the outside temperature, the outside relative humidity and the solar radiation. They cannot be inserted in any solution set classification, but they are important for a constant monitoring of the external environmental parameters useful to control the energy consumptions. For these reason they are stored under a general category named "External parameters".

2.4. HML

In Mollet Hospital (HML) two solution sets have been identified:. the first regards the heating and cooling generation system including the geothermal plant and the traditional heating and cooling production systems. The second solution is applied to improve the surgery room ventilation, monitoring environmental parameters and particles in suspension.

For the first system, which includes boilers, chillers and geothermal devices, data measured are stored in local databases from the 1st of June 2013. Regarding the other solution set, the signals measured in the surgery rooms, the data collection system has been set on the 8th of July 2013.

2.4.1. Heating and cooling generation system optimized management

The I/O of this solution set are grouped in three main categories, which allow to recognize the main device used for data measurement. These categories are:

- Heat pumps: it collects the parameters arriving from the meters monitoring the performances of the heat pumps connected to the geothermal system.
- Boilers: it collects set points and measured data referring to boilers.
- Chillers: it collects set points and measured data referring to chillers.

Some general parameters are taken from the field and, for clarity, they are assigned to a main group named Geothermal. These variables are reported in Table 10. The virtual signals, obtained from real signals making mathematical operation, are written in italic.

Parameters
Geothermal operating mode
Outside temperature
COP geothermal system
Electric consumption geothermal system
Geothermal temperature set point
Heat collector outdoor temperature
Cold collector outdoor temperature

Table 10 Geothermal parameters

The heat pumps parameters are further divided in two subsets, to point out better the presence of two pumps.

The parameters belonging to the heat pumps are reported in Table 11.

Parameters	**Categories**
Temperature heat	Heat pump 1
Temperature cold	
Heat setpoint	
Status (ON/OFF)	
Temperature heat	Heat pump 2
Temperature cold	
Heat setpoint	
Status (ON/OFF)	

Table 11 Heat pumps parameters

The Boilers category is divided in two sub-categories. The variables connected are shown in Table 12, where the virtual channels are written using italic characters.

Parameters	**Categories**
Setpoint	Boiler 1
Status (ON/OFF)	
Gas consumption	
COP	
Setpoint	Boiler 2
Status (ON/OFF)	
Gas consumption	
COP	

Table 12 Boilers parameters

Finally the third category is Chillers. This category has three subsets, one for each chiller installed in the hospital. In Table 13 the relative variables are reported.

Parameters	**Categories**
Setpoint	Chiller 1
Status (ON/OFF)	
Electric consumption	

COP	
Setpoint	Chiller 2
Status (ON/OFF)	
Electric consumption	
COP	
Setpoint	Chiller 3
Status (ON/OFF)	
Electric consumption	
COP	

Table 13 Chillers parameters

Most of the parameters stored for this solution set are real parameters, measured directly on the field through meters installed. However, some of them are the results of formulas applied to real channels (e.g. for COP, coefficient of performance, the real channels are the heating or cooling provided over the electrical energy consumed). In the table above the virtual channels are written in italic style.

2.4.2. Optimized control strategies for Surgery Rooms ventilation

The surgery room ventilation solution set is structured to differentiate five main parameters categories, given by the type of data and the position of the meters. These categories are:

- Heat/cold: it collects data from the AHU controller.
- Fan: the I/O relative to the air unit fans.
- Humidifier: valves position and environmental parameters are reported here for managing the humidifier devices.
- AHU: consumption and internal environmental parameters are reported here.
- Environmental parameters: temperatures, humidity, pressures and chemical air analysis are here reported for surgery rooms.

The type of I/O introduced for the surgery room are reported in Table 14.

Parameters	**Categories**
State cleaning room	Surgery rooms general parameters
Type of surgery	
Valves position	Heat/Cold
Return air temperature	
Return air humidity	
Max valve opening	
Heat energy	
Cold energy	
Control drive input air	Turbine
Control drive output air	
Valve position	Humidifier
Max input	
Max and min input air temperatures	Air unit
Electric consumption	
Temperature dead zones	Environmental parameters
Humidity dead zones	
Pressure	
Max and min pressure	
Percentage particles in suspension	

Table 14 Surgery rooms parameters

All the I/O are directly connected to the field, they are not the result of some mathematical operations. For this reason they all can be defined as real channels.

3. Database development

The Communication Framework placed in each hospital is the tool used to concentrate data. To allow the Web-EMCS reading these data it is necessary the creation of a database in the same machine. The chosen technology is SQL, a special-purpose programming language designed for managing data held in a relational database management system (RDBMS). The program used to develop the SQL database has been the Windows SQL Server 2008 [4]. This choice has been made for three main characteristics of this product:

- Reliability: the SQL Server ensures high protection level and scalability for the business critical applications.
- Productivity: SQL Server tears down management time and costs of the applications.
- Intelligence: it is possible to save and recall all the information is needed.

There is one database for each pilot and a general one. These databases are implemented in the same PC where the Web-EMCS portal and services are running. The structure described can be represented in a hierarchical architecture as shown in figure below.

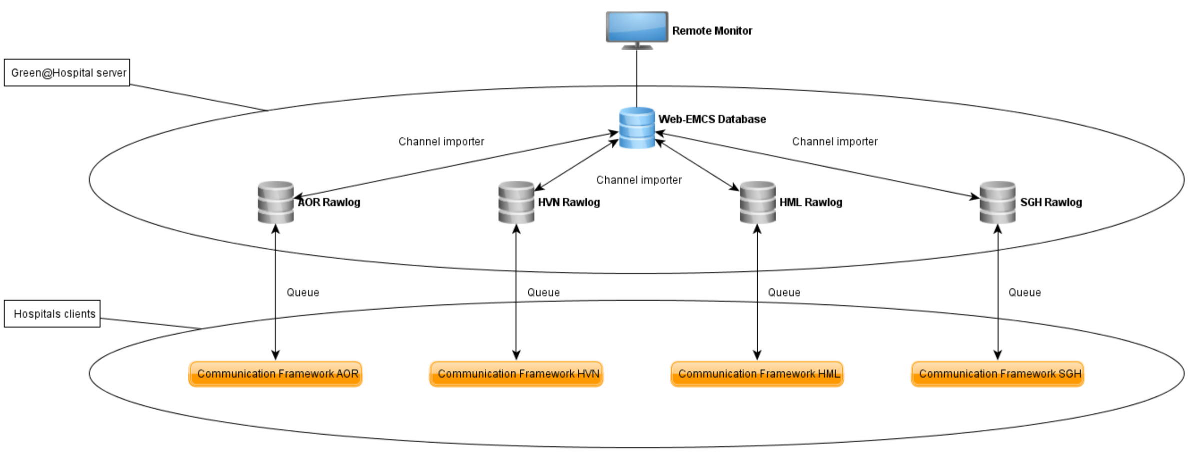

Figure 1 Database architecture

Data taken by the Communication Frameworks installed in each hospital are sent to the Green@Hospital server using a VPN connection.

In each hospital client PCs queues mode for sending data has been implemented. Data are lined up, following the arriving order from the framework, and one by one are sent to the Rawlog. This approach increases the reliability of the system since if the connection is not working data will not be lost, they will just be saved in the queue, which, once the connection is available again, will send them to the Rawlog.

In the Rawlogs data are stored in the same way as they arrive from the queues. For having a more readable data, a Web-EMCS service called Channel Importer is used to periodically read data from the Rawlog and write them to the Green@Hospital database, applying algorithms where there are some lost or evidently wrong parts.[3]

The Green@Hospital Web-EMCS database is the final data collector allowing web services application and data visualization in the portal in the form of graphs.

As already described in Deliverable 3.1, in the database data are organized in channels. In the Web-EMCS the structure of trees and nodes is a simply and intuitive architecture which allows the user to understand the positioning in the field of each device relative to each channel. In the following sub-sections the trees structure for each hospital will be presented.

3.1. AOR

AOR signals could be divided in categories and sub-categories, following a logical distinction given by the physical position of each meter in the solution sets. It is very important to note the hierarchical classification, illustrated in chapter 2, which has been used to create the tree in the Web-EMCS.

The schematic representation of the AOR tree is shown in Figure 2.

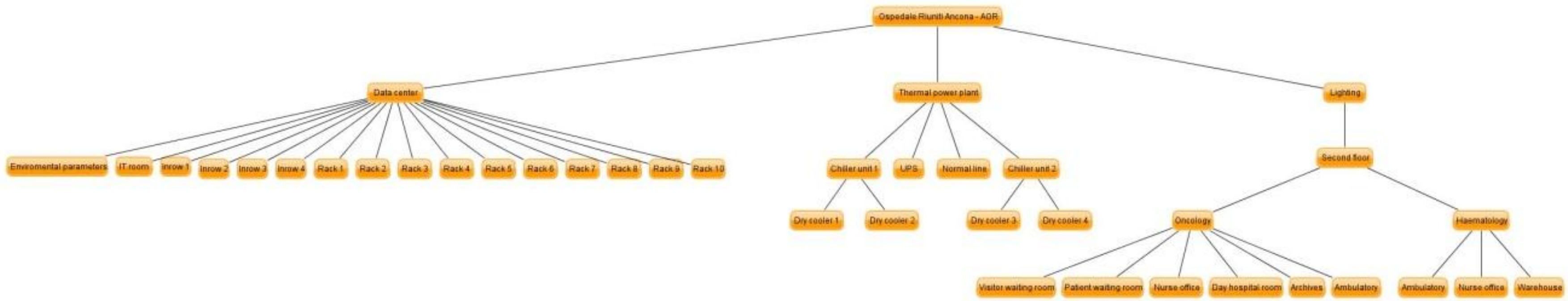

Figure 2 AOR tree architecture

Each node which forms the tree has one or more signals connected, commonly named channels; each channel take data directly from the correspondent signal stored in the AOR database placed in the server. In Table 15 all the channels for the AOR hospital are reported.

Place	Main node	BMS channel name	Description
Thermal power plant	Thermal power plant	Variabili_Ambientali|AO_Temperatura_esterna_AVG	Outdoor average temperature
Thermal power plant	Thermal power plant	Variabili_Ambientali|AO_s15_AVG	Cold water from chiller or dry cooler average temperature
Thermal power plant	Thermal power plant	Variabili_Ambientali|AO_s16_AVG	Hot water from chiller or dry cooler average temperature
Thermal power plant	Chiller unit 1	Variabili_Ambientali|AO_s07_AVG	Condenser inlet water average temperature
Thermal power plant	Chiller unit 1	Variabili_Ambientali|AO_s08_AVG	Condenser outlet water average temperature
Thermal power plant	Chiller unit 1	Variabili_Ambientali|AO_s11_AVG	Evaporator inlet water average temperature
Thermal power plant	Chiller unit 1	Variabili_Ambientali|AO_s12_AVG	Evaporator outlet water average temperature
Thermal power plant	Drycooler 1	Drycooler_1|AO_Velocita_Ventole_AVG	Average fan speed
Thermal power plant	Drycooler 2	Drycooler_2|AO_Velocita_Ventole_AVG	Average fan speed
Thermal power plant	Chiller unit 2	Variabili_Ambientali|AO_s09_AVG	Condenser inlet water average temperature

Place	Main node	BMS channel name	Description
Thermal power plant	Chiller unit 2	Variabili_Ambientali|AO_s10_AVG	Condenser outlet water average temperature
Thermal power plant	Chiller unit 2	Variabili_Ambientali|AO_s13_AVG	Evaporator inlet water average temperature
Thermal power plant	Chiller unit 2	Variabili_Ambientali|AO_s14_AVG	Evaporator outlet water average temperature
Thermal power plant	Drycooler 3	Drycooler_3|AO_Velocita_Ventole_AVG	Average fan speed
Thermal power plant	Drycooler 4	Drycooler_4|AO_Velocita_Ventole_AVG	Average fan speed
Thermal power plant	Thermal plant UPS	Misure_Elettriche_Centrale_Termica|AO_ass_gruppo_elettrogeno_energy	Energy
Thermal power plant	Thermal plant normal line	Misure_Elettriche_Centrale_Termica|AO_ass_linea_ordinaria_energy	Energy
Data center	Data center	Totali|AO_Potenza_Totale	Total power
Data Center	Data Center	Totali|AO_Potenza_Totale_AVG	Total power AVG
Data Center	Data Center	Totali|AO_Temperatura_Acqua_Inrow_Uscita	Inrow outlet water temperature
Data Center	Data Center	Variabili_Ambientali|AO_Temperatura_Rack_Fribre_AVG	Fibre rack average temperature
Data Center	Data Center	Variabili_Ambientali|AO_Temperatura_Rack_Rame_AVG	Copper rack average temperature
Data Center	Data Center	Variabili_Ambientali|AO_Umidita_Rack_Fribre_AVG	Fibre rack average humidity

Place	Main node	BMS channel name	Description
Data Center	Data Center	Variabili_Ambientali|AO_Umidita_Rack_Rame_AVG	Copper rack average humidity
Data Center	Data Center	Totali|AO_Pue	PUE
Data Center	Data Center	Totali|AO_Pue_AVG	PUE AVG
Data Center	Enviromental parameters	Variabili_Ambientali|AO_Corridoio_Caldo_AVG	Hot corridor temperature AVG
Data Center	Enviromental parameters	Variabili_Ambientali|AO_Corridoio_Freddo_AVG	Cold corridor temperature AVG
Data Center	Enviromental parameters	Variabili_Ambientali|AO_s18_AVG	Inrow outlet air temperature AVG
Data Center	Enviromental parameters	Variabili_Ambientali|AO_Temperatura_Mandata_AVG	Inrow inlet air temperature AVG
Data Center	IT room	Misure_Elettriche_CS2|AO_ass_linea_ordinaria_energy	Normal line energy
Data Center	IT room	Misure_Elettriche_CS2|AO_ass_linea_ups_energy	UPS line energy
Data Center	IT room	Totali|AO_Energia_IT	Total IT energy
Data Center	IT room	Totali|AO_Potenza_IT	IT power
Data Center	IT room	Totali|AO_Potenza_IT_AVG	IT power AVG
Data Center	IT room	Totali|AO_Potenza_Totale	Total power
Data Center	IT room	Totali|AO_Potenza_Totale_AVG	Total power AVG
Data Center	InRaw 4	InRow_4|AO_Apertura_Valvola	Valve opening
Data Center	InRaw 4	InRow_4|AO_Flusso_Acqua	Water flux
Data Center	InRaw 4	InRow_4|AO_Flusso_Aria	Air flux
Data Center	InRaw 4	InRow_4|AO_Potenza_Richiesta	Required power

Place	Main node	BMS channel name	Description
Data Center	InRaw 4	InRow_4|AO_Potenza_Uscita	Outgoing power
Data Center	InRaw 4	InRow_4|AO_Velocita_Ventole	Fan speed
Data Center	InRaw 4	InRow_4|AO_Temperatura_Acqua_Ingresso_AVG	Inlet water temperature AVG
Data Center	InRaw 4	InRow_4|AO_Temperatura_Acqua_Uscita_AVG	Outlet water temperature AVG
Data Center	InRaw 4	InRow_4|AO_Temperatura_Aria_Ingresso_Rack_AVG	Inlet rack air temperature AVG
Data Center	InRaw 4	InRow_4|AO_Temperatura_Aria_Uscita_Rack_AVG	Outlet rack air temperature AVG
Data Center	InRaw 4	InRow_4|AO_Temperatura_Ingresso_Rack_AVG	Rack inlet temperature AVG
Data Center	InRaw 3	InRow_3|AO_Apertura_Valvola	Valve opening
Data Center	InRaw 3	InRow_3|AO_Flusso_Acqua	Water flux
Data Center	InRaw 3	InRow_3|AO_Flusso_Aria	Air flux
Data Center	InRaw 3	InRow_3|AO_Potenza_Richiesta	Required power
Data Center	InRaw 3	InRow_3|AO_Potenza_Uscita	Outgoing power
Data Center	InRaw 3	InRow_3|AO_Velocita_Ventole	Fan speed
Data Center	InRaw 3	InRow_3|AO_Temperatura_Acqua_Ingresso_AVG	Inlet water temperature AVG
Data Center	InRaw 3	InRow_3|AO_Temperatura_Acqua_Uscita_AVG	Outlet water temperature AVG
Data Center	InRaw 3	InRow_3|AO_Temperatura_Aria_Ingresso_Rack_AVG	Inlet rack air temperature AVG
Data Center	InRaw 3	InRow_3|AO_Temperatura_Aria_Uscita_Rack_AVG	Outlet rack air temperature AVG

Place	Main node	BMS channel name	Description
Data Center	InRaw 3	InRow_3|AO_Temperatura_Ingresso_Rack_AVG	Rack inlet temperature AVG
Data Center	InRaw 2	InRow_2|AO_Apertura_Valvola	Valve opening
Data Center	InRaw 2	InRow_2|AO_Flusso_Acqua	Water flux
Data Center	InRaw 2	InRow_2|AO_Flusso_Aria	Air flux
Data Center	InRaw 2	InRow_2|AO_Potenza_Richiesta	Required power
Data Center	InRaw 2	InRow_2|AO_Potenza_Uscita	Outgoing power
Data Center	InRaw 2	InRow_2|AO_Velocita_Ventole	Fan speed
Data Center	InRaw 2	InRow_2|AO_Temperatura_Acqua_Ingresso_AVG	Inlet water temperature AVG
Data Center	InRaw 2	InRow_2|AO_Temperatura_Acqua_Uscita_AVG	Outlet water temperature AVG
Data Center	InRaw 2	InRow_2|AO_Temperatura_Aria_Ingresso_Rack_AVG	Inlet rack air temperature AVG
Data Center	InRaw 2	InRow_2|AO_Temperatura_Aria_Uscita_Rack_AVG	Outlet rack air temperature AVG
Data Center	InRaw 2	InRow_2|AO_Temperatura_Ingresso_Rack_AVG	Rack inlet temperature AVG
Data Center	InRaw 1	InRow_1|AO_Apertura_Valvola	Valve opening
Data Center	InRaw 1	InRow_1|AO_Flusso_Acqua	Water flux
Data Center	InRaw 1	InRow_1|AO_Flusso_Aria	Air flux
Data Center	InRaw 1	InRow_1|AO_Potenza_Richiesta	Required power
Data Center	InRaw 1	InRow_1|AO_Potenza_Uscita	Outgoing power
Data Center	InRaw 1	InRow_1|AO_Velocita_Ventole	Fan speed

Place	Main node	BMS channel name	Description
Data Center	InRaw 1	InRow_1|AO_Temperatura_Acqua_Ingresso_AVG	Inlet water temperature AVG
Data Center	InRaw 1	InRow_1|AO_Temperatura_Acqua_Uscita_AVG	Outlet water temperature AVG
Data Center	InRaw 1	InRow_1|AO_Temperatura_Aria_Ingresso_Rack_AVG	Inlet rack air temperature AVG
Data Center	InRaw 1	InRow_1|AO_Temperatura_Aria_Uscita_Rack_AVG	Outlet rack air temperature AVG
Data Center	InRaw 1	InRow_1|AO_Temperatura_Ingresso_Rack_AVG	Rack inlet temperature AVG
Data Center	Rack 10	PDU_FM_RACK_10|AO_Energia	Normal energy
Data Center	Rack 10	PDU_UPS_RACK_10|AO_Energia	UPS energy
Data Center	Rack 10	Variabili_Ambientali|AO_Temperatura_Rack_10_Freddo_AVG	Cold temperature AVG
Data Center	Rack 10	Variabili_Ambientali|AO_Umidita_Rack_10_Freddo_AVG	Cold humidity AVG
Data Center	Rack 9	PDU_FM_RACK_9|AO_Energia	Normal energy
Data Center	Rack 9	PDU_UPS_RACK_9|AO_Energia	UPS energy
Data Center	Rack 9	Variabili_Ambientali|AO_Temperatura_Rack_9_Freddo_AVG	Cold temperature AVG
Data Center	Rack 9	Variabili_Ambientali|AO_Umidita_Rack_9_Freddo_AVG	Cold humidity AVG
Data Center	Rack 8	PDU_FM_RACK_8|AO_Energia	Normal energy
Data Center	Rack 8	PDU_UPS_RACK_8|AO_Energia	UPS energy
Data Center	Rack 8	Variabili_Ambientali|AO_Temperatura_Rack_8_Tetto_AVG	Roof temperature AVG
Data Center	Rack 8	Variabili_Ambientali|AO_Umidita_Rack_8_Tetto_AVG	Roof humidity AVG

Place	Main node	BMS channel name	Description
Data Center	Rack 7	PDU_FM_RACK_7|AO_Energia	Normal energy
Data Center	Rack 7	PDU_UPS_RACK_7|AO_Energia	UPS energy
Data Center	Rack 7	Variabili_Ambientali|AO_Temperatura_Rack_7_Caldo_AVG	Hot temperature AVG
Data Center	Rack 7	Variabili_Ambientali|AO_Temperatura_Rack_7_Freddo_AVG	Cold temperature AVG
Data Center	Rack 7	Variabili_Ambientali|AO_Umidita_Rack_7_Caldo_AVG	Hot humidity AVG
Data Center	Rack 7	Variabili_Ambientali|AO_Umidita_Rack_7_Freddo_AVG	Cold humidity AVG
Data Center	Rack 6	PDU_FM_RACK_6|AO_Energia	Normal energy
Data Center	Rack 6	PDU_UPS_RACK_6|AO_Energia	UPS energy
Data Center	Rack 5	PDU_FM_RACK_5|AO_Energia	Normal energy
Data Center	Rack 5	PDU_UPS_RACK_5|AO_Energia	UPS energy
Data Center	Rack 4	PDU_FM_RACK_4|AO_Energia	Normal energy
Data Center	Rack 4	PDU_UPS_RACK_4|AO_Energia	UPS energy
Data Center	Rack 4	Variabili_Ambientali|AO_Temperatura_Rack_4_Freddo_AVG	Cold temperature AVG
Data Center	Rack 4	Variabili_Ambientali|AO_Umidita_Rack_4_Freddo_AVG	Cold humidity AVG
Data Center	Rack 3	PDU_FM_RACK_3|AO_Energia	Normal energy
Data Center	Rack 3	PDU_UPS_RACK_3|AO_Energia	UPS energy
Data Center	Rack 3	Variabili_Ambientali|AO_Temperatura_Rack_3_Caldo_AVG	Hot temperature AVG
Data Center	Rack 3	Variabili_Ambientali|AO_Temperatura_Rack_3_Freddo_AVG	Cold temperature AVG

Place	Main node	BMS channel name	Description
Data Center	Rack 3	Variabili_Ambientali|AO_Temperatura_Rack_3_Tetto_AVG	Roof temperature AVG
Data Center	Rack 3	Variabili_Ambientali|AO_Umidita_Rack_3_Caldo_AVG	Hot humity AVG
Data Center	Rack 3	Variabili_Ambientali|AO_Umidita_Rack_3_Freddo_AVG	Cold humidity AVG
Data Center	Rack 3	Variabili_Ambientali|AO_Umidita_Rack_3_Tetto_AVG	Roof humidity AVG
Data Center	Rack 2	PDU_FM_RACK_2|AO_Energia	Normal energy
Data Center	Rack 2	PDU_UPS_RACK_2|AO_Energia	UPS energy
Data Center	Rack 2	Variabili_Ambientali|AO_Temperatura_Rack_2_Freddo_AVG	Cold temperature AVG
Data Center	Rack 2	Variabili_Ambientali|AO_Umidita_Rack_2_Freddo_AVG	Cold humidity AVG
Data Center	Rack 1	PDU_FM_RACK_1|AO_Energia	Normal energy
Data Center	Rack 1	PDU_UPS_RACK_1|AO_Energia	UPS energy
Data Center	Rack 1	Variabili_Ambientali|AO_Temperatura_Rack_1_Freddo_AVG	Cold temperature AVG
Data Center	Rack 1	Variabili_Ambientali|AO_Umidita_Rack_1_Freddo_AVG	Cold humidity AVG
Lighting	Hematology	Hematology|Nurse_room_block_1_energy	Energy
Lighting	Hematology	Hematology|Nurse_room_block_1_power	Power
Lighting	Hematology	Hematology|Nurse_room_block_1_ON_OFF	State (ON/OFF)
Lighting	Hematology	Hematology|Nurse_room_block_1_dimmer	Dimmer percentage
Lighting	Hematology	Hematology|Nurse_room_block_1_alarm	Failure state alarm
Lighting	Hematology	Hematology|Nurse_room_block_2_energy	Energy
Lighting	Hematology	Hematology|Nurse_room_block_2_power	Power
Lighting	Hematology	Hematology|Nurse_room_block_2_ON_OFF	State (ON/OFF)

Place	Main node	BMS channel name	Description
Lighting	Hematology	Hematology|Nurse_room_block_2_dimmer	Dimmer percentage
Lighting	Hematology	Hematology|Nurse_room_block_2_alarm	Failure state alarm
Lighting	Hematology	Hematology|Nurse_room_sensor_1_luminance	Room Luminance
Lighting	Hematology	Hematology|Nurse_room_sensor_1_presence	Presence in the room
Lighting	Hematology	Hematology|Warehouse_block_1_energy	Energy
Lighting	Hematology	Hematology|Warehouse_block_1_power	Power
Lighting	Hematology	Hematology|Warehouse_block_1_ON_OFF	State (ON/OFF)
Lighting	Hematology	Hematology|Warehouse_block_1_dimmer	Dimmer percentage
Lighting	Hematology	Hematology|Warehouse_block_1_alarm	Failure state alarm
Lighting	Hematology	Hematology|Warehouse_block_2_energy	Energy
Lighting	Hematology	Hematology|Warehouse_block_2_power	Power
Lighting	Hematology	Hematology|Warehouse_block_2_ON_OFF	State (ON/OFF)
Lighting	Hematology	Hematology|Warehouse_block_2_dimmer	Dimmer percentage
Lighting	Hematology	Hematology|Warehouse_block_2_alarm	Failure state alarm
Lighting	Hematology	Hematology|Warehouse_sensor_1_luminance	Room Luminance
Lighting	Hematology	Hematology|Warehouse_sensor_1_presence	Presence in the room
Lighting	Hematology	Hematology|Warehouse_sensor_2_luminance	Room Luminance
Lighting	Hematology	Hematology|Warehouse_sensor_2_presence	Presence in the room
Lighting	Hematology	Hematology|Doctor_room_block_1_energy	Energy
Lighting	Hematology	Hematology|Doctor_room_block_1_power	Power
Lighting	Hematology	Hematology|Doctor_room_block_1_ON_OFF	State (ON/OFF)
Lighting	Hematology	Hematology|Doctor_room_block_1_dimmer	Dimmer percentage
Lighting	Hematology	Hematology|Doctor_room_block_1_alarm	Failure state alarm
Lighting	Hematology	Hematology|Doctor_room_block_2_energy	Energy

Place	Main node	BMS channel name	Description
Lighting	Hematology	Hematology|Doctor_room_block_2_power	Power
Lighting	Hematology	Hematology|Doctor_room_block_2_ON_OFF	State (ON/OFF)
Lighting	Hematology	Hematology|Doctor_room_block_2_dimmer	Dimmer percentage
Lighting	Hematology	Hematology|Doctor_room_block_2_alarm	Failure state alarm
Lighting	Hematology	Hematology|Doctor_room_sensor_1_luminance	Room Luminance
Lighting	Hematology	Hematology|Doctor_room_sensor_1_presence	Presence in the room
Lighting	Analysis lab	Analysis_lab|Internal_room_block_1_energy	Energy
Lighting	Analysis lab	Analysis_lab|Internal_room_block_1_power	Power
Lighting	Analysis lab	Analysis_lab|Internal_room_block_1_ON_OFF	State (ON/OFF)
Lighting	Analysis lab	Analysis_lab|Internal_room_block_1_dimmer	Dimmer percentage
Lighting	Analysis lab	Analysis_lab|Internal_room_block_1_alarm	Failure state alarm
Lighting	Analysis lab	Analysis_lab|Internal_room_block_2_energy	Energy
Lighting	Analysis lab	Analysis_lab|Internal_room_block_2_power	Power
Lighting	Analysis lab	Analysis_lab|Internal_room_block_2_ON_OFF	State (ON/OFF)
Lighting	Analysis lab	Analysis_lab|Internal_room_block_2_dimmer	Dimmer percentage
Lighting	Analysis lab	Analysis_lab|Internal_room_block_2_alarm	Failure state alarm
Lighting	Analysis lab	Analysis_lab|Internal_room_sensor_1_luminance	Room Luminance
Lighting	Analysis lab	Analysis_lab|Internal_room_sensor_1_presence	Presence in the room
Lighting	Analysis lab	Analysis_lab|Internal_room_sensor_2_luminance	Room Luminance
Lighting	Analysis lab	Analysis_lab|Internal_room_sensor_2_presence	Presence in the room
Lighting	Analysis lab	Analysis_lab|External_room_block_1_energy	Energy
Lighting	Analysis lab	Analysis_lab| External _room_block_1_power	Power
Lighting	Analysis lab	Analysis_lab|External_room_block_1_ON_OFF	State (ON/OFF)

Place	Main node	BMS channel name	Description
Lighting	Analysis lab	Analysis_lab|External_room_block_1_dimmer	Dimmer percentage
Lighting	Analysis lab	Analysis_lab|External_room_block_1_alarm	Failure state alarm
Lighting	Analysis lab	Analysis_lab|External_room_block_2_energy	Energy
Lighting	Analysis lab	Analysis_lab|External_room_block_2_power	Power
Lighting	Analysis lab	Analysis_lab|External_room_block_2_ON_OFF	State (ON/OFF)
Lighting	Analysis lab	Analysis_lab|External_room_block_2_dimmer	Dimmer percentage
Lighting	Analysis lab	Analysis_lab|External_room_block_2_alarm	Failure state alarm
Lighting	Analysis lab	Analysis_lab|External_room_sensor_1_luminance	Room Luminance
Lighting	Analysis lab	Analysis_lab|External_room_sensor_1_presence	Presence in the room
Lighting	Analysis lab	Analysis_lab|External_room_sensor_2_luminance	Room Luminance
Lighting	Analysis lab	Analysis_lab|External_room_sensor_2_presence	Presence in the room
Lighting	Oncology	Oncology|External_waiting_room_block_1_energy	Energy
Lighting	Oncology	Oncology|External_waiting_room_block_1_power	Power
Lighting	Oncology	Oncology|External_waiting_room_block_1_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|External_waiting_room_block_1_dimmer	Dimmer percentage
Lighting	Oncology	Oncology|External_waiting_room_block_1_alarm	Failure state alarm
Lighting	Oncology	Oncology|External_waiting_room_block_2_energy	Energy
Lighting	Oncology	Oncology|External_waiting_room_block_2_power	Power
Lighting	Oncology	Oncology|External_waiting_room_block_2_ON_OFF	State (ON/OFF)

Place	Main node	BMS channel name	Description
Lighting	Oncology	Oncology|External_waiting_room_block_2_dimmer	Dimmer percentage
Lighting	Oncology	Oncology|External_waiting_room_block_2_alarm	Failure state alarm
Lighting	Oncology	Oncology|External_waiting_room_block_3_energy	Energy
Lighting	Oncology	Oncology|External_waiting_room_block_3_power	Power
Lighting	Oncology	Oncology|External_waiting_room_block_3_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|External_waiting_room_block_3_dimmer	Dimmer percentage
Lighting	Oncology	Oncology|External_waiting_room_block_3_alarm	Failure state alarm
Lighting	Oncology	Analysis_lab|External_waiting_room_sensor_1_luminance	Room Luminance
Lighting	Oncology	Analysis_lab|External_waiting_room_sensor_1_presence	Presence in the room
Lighting	Oncology	Analysis_lab|External_waiting_room_sensor_2_luminance	Room Luminance
Lighting	Oncology	Analysis_lab|External_waiting_room_sensor_2_presence	Presence in the room
Lighting	Oncology	Analysis_lab|External_waiting_room_sensor_3_luminance	Room Luminance
Lighting	Oncology	Analysis_lab|External_waiting_room_sensor_3_presence	Presence in the room
Lighting	Oncology	Oncology|Patients_waiting_room_block_1_energy	Energy
Lighting	Oncology	Oncology|Patients_waiting_room_block_1_power	Power
Lighting	Oncology	Oncology|Patients_waiting_room_block_1_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|Patients_waiting_room_block_1_dimmer	Dimmer percentage

Place	Main node	BMS channel name	Description
Lighting	Oncology	Oncology|Patients_waiting_room_block_1_alarm	Failure state alarm
Lighting	Oncology	Oncology|Patients_waiting_room_block_2_energy	Energy
Lighting	Oncology	Oncology|Patients_waiting_room_block_2_power	Power
Lighting	Oncology	Oncology|Patients_waiting_room_block_2_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|Patients_waiting_room_block_2_dimmer	Dimmer percentage
Lighting	Oncology	Oncology|Patients_waiting_room_block_2_alarm	Failure state alarm
Lighting	Oncology	Analysis_lab|Patients_waiting_room_sensor_1_luminance	Room Luminance
Lighting	Oncology	Analysis_lab|Patients_waiting_room_sensor_1_presence	Presence in the room
Lighting	Oncology	Oncology|Day_hospital_room_block_1_energy	Energy
Lighting	Oncology	Oncology|Day_hospital_room_block_1_power	Power
Lighting	Oncology	Oncology|Day_hospital_room_block_1_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|Day_hospital_room_block_1_dimmer	Dimmer percentage
Lighting	Oncology	Oncology|Day_hospital_room_block_1_alarm	Failure state alarm
Lighting	Oncology	Oncology|Day_hospital_room_block_2_energy	Energy
Lighting	Oncology	Oncology|Day_hospital_room_block_2_power	Power
Lighting	Oncology	Oncology|Day_hospital_room_block_2_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|Day_hospital_room_block_2_dimmer	Dimmer percentage
Lighting	Oncology	Oncology|Day_hospital_room_block_2_alarm	Failure state alarm
Lighting	Oncology	Analysis_lab|Day_hospital_room_sensor_1_luminance	Room Luminance

Place	Main node	BMS channel name	Description
Lighting	Oncology	Analysis_lab|Day_hospital_room_sensor_1_presence	Presence in the room
Lighting	Oncology	Oncology|Nurse_room_block_1_energy	Energy
Lighting	Oncology	Oncology|Nurse_room_block_1_power	Power
Lighting	Oncology	Oncology|Nurse_room_block_1_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|Nurse_room_block_1_dimmer	Dimmer percentage
Lighting	Oncology	Oncology|Nurse_room_block_1_alarm	Failure state alarm
Lighting	Oncology	Oncology|Nurse_room_block_2_energy	Energy
Lighting	Oncology	Oncology|Nurse_room_block_2_power	Power
Lighting	Oncology	Oncology|Nurse_room_block_2_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|Nurse_room_block_2_dimmer	Dimmer percentage
Lighting	Oncology	Oncology|Nurse_room_block_2_alarm	Failure state alarm
Lighting	Oncology	Analysis_lab|Nurse_room_sensor_1_luminance	Room Luminance
Lighting	Oncology	Analysis_lab|Nurse_room_sensor_1_presence	Presence in the room
Lighting	Oncology	Oncology|Doctor_room_block_1_energy	Energy
Lighting	Oncology	Oncology|Doctor_room_block_1_power	Power
Lighting	Oncology	Oncology|Doctor_room_block_1_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|Doctor_room_block_1_dimmer	Dimmer percentage
Lighting	Oncology	Oncology|Doctor_room_block_1_alarm	Failure state alarm
Lighting	Oncology	Analysis_lab|Doctor_room_sensor_1_luminance	Room Luminance
Lighting	Oncology	Analysis_lab|Doctor_room_sensor_1_presence	Presence in the room
Lighting	Oncology	Oncology|Archive_block_1_energy	Energy
Lighting	Oncology	Oncology|Archive_block_1_power	Power
Lighting	Oncology	Oncology|Archive_block_1_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|Archive_block_1_dimmer	Dimmer percentage

Place	Main node	BMS channel name	Description
Lighting	Oncology	Oncology|Archive_block_1_alarm	Failure state alarm
Lighting	Oncology	Oncology|Archive_block_2_energy	Energy
Lighting	Oncology	Oncology|Archive_block_2_power	Power
Lighting	Oncology	Oncology|Archive_block_2_ON_OFF	State (ON/OFF)
Lighting	Oncology	Oncology|Archive_block_2_dimmer	Dimmer percentage
Lighting	Oncology	Oncology|Archive_block_2_alarm	Failure state alarm
Lighting	Oncology	Analysis_lab|Archive_sensor_1_luminance	Room Luminance
Lighting	Oncology	Analysis_lab|Archive_sensor_1_presence	Presence in the room
Lighting	Oncology	Analysis_lab|Archive_sensor_2_luminance	Room Luminance
Lighting	Oncology	Analysis_lab|Archive_sensor_2_presence	Presence in the room

Table 15 AOR channels

3.2. HVN

The HVN solution sets are divided in subcategories which are used for creating the tree in the Web-EMCS. This conceptual structure is reported in Figure 3.

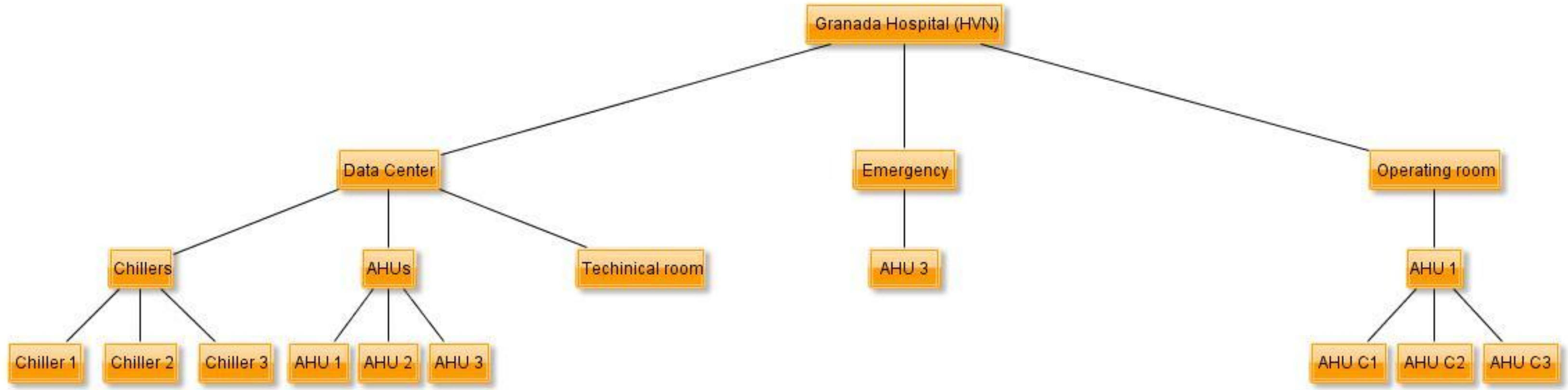

Figure 3 HVN tree architecture

Each node is associated to one or more channels. All the channels stored in the database in the Web-EMCS are reported in the following table.

Place	Main node	BMS channel name	Description
Data Center	CHILLER1	EG_CPD_CHILLER1_Electric_AE_import	Activ Energy import
Data Center	CHILLER1	EG_CPD_CHILLER1_Electric_RE_lag_import	Reactive Energy inductance - lag import
Data Center	CHILLER2	EG_CPD_CHILLER2_Electric_AE_import	Activ Energy import
Data Center	CHILLER2	EG_CPD_CHILLER2_Electric_RE_lag_import	Reactive Energy inductance - lag import
Data Center	CHILLER3	EG_CPD_CHILLER3_Electric_AE_import	Activ Energy import
Data Center	CHILLER3	EG_CPD_CHILLER3_Electric_RE_lag_import	Reactive Energy inductance - lag import
Data Center	AHU 1-3	EG_CPD_AHUS_Electric_AE_import	Activ Energy import
Data Center	AHU 1-3	EG_CPD_AHUS_Electric_RE_lag_import	Reactive Energy inductance - lag import
Data Center	CHILLER1	EG_CPD_CHILLER1_Thermal_cooling_energy	Thermal Meter cooling energy
Data Center	CHILLER1	EG_CPD_CHILLER1_Thermal_power	Thermal Meter power
Data Center	Chiller2	EG_CPD_CHILLER2_Thermal_cooling_energy	Thermal Meter cooling energy
Data Center	Chiller2	EG_CPD_CHILLER2_Thermal_power	Thermal Meter power
Data Center	Chiller3	EG_CPD_CHILLER3_Thermal_cooling_energy	Thermal Meter cooling energy
Data Center	Chiller3	EG_CPD_CHILLER3_Thermal_power	Thermal Meter power
Data Center	AHU1	EG_CPD_U1_Temp_sp	Unit setpoint temperature day
Data Center	AHU1	EG_CPD_U1_HR_sp	Unit setpoint humidity
Data Center	AHU1	EG_CPD_U1_Temp_ret	Unit return air temperature

Place	Main node	BMS channel name	Description
Data Center	AHU1	EG_CPD_U1_Temp_imp	Unit supply air temperature
Data Center	AHU1	EG_CPD_U1_HR_ret	Unit return air humidity
Data Center	AHU1	EG_CPD_U1_HR_imp	Unit supply air humidity
Data Center	AHU1	EG_CPD_U1_Temp_ext	Unit outside air temperature
Data Center	AHU1	EG_CPD_U1_HR_ext	Unit outside air humidity
Data Center	AHU1	EG_CPD_U1_Valvula1_OA	GE/CW-valve opening grade 1
Data Center	AHU3	EG_CPD_U3_Freecooling_OA	GE/CW-valve opening grade 1
Data Center	AHU2	EG_CPD_U2_Temp_sp	Unit setpoint temperature day
Data Center	AHU2	EG_CPD_U2_HR_sp	Unit setpoint humidity
Data Center	AHU2	EG_CPD_U2_Temp_ret	Unit return air temperature
Data Center	AHU2	EG_CPD_U2_Temp_imp	Unit supply air temperature
Data Center	AHU2	EG_CPD_U2_HR_ret	Unit return air humidity
Data Center	AHU2	EG_CPD_U2_HR_imp	Unit supply air humidity
Data Center	AHU2	EG_CPD_U2_Temp_ext	Unit outside air temperature
Data Center	AHU2	EG_CPD_U2_HR_ext	Unit outside air humidity
Data Center	AHU2	EG_CPD_U2_Freecooling_OA	Unit freecooling-damper
Data Center	AHU2	EG_CPD_U2_Valvula1_OA	GE/CW-valve opening grade 1
Data Center	AHU3	EG_CPD_U3_Temp_sp	Unit setpoint temperature day
Data Center	AHU3	EG_CPD_U3_HR_sp	Unit setpoint humidity
Data Center	AHU3	EG_CPD_U3_Temp_ret	Unit return air temperature
Data Center	AHU3	EG_CPD_U3_Temp_imp	Unit supply air temperature

Place	Main node	BMS channel name	Description
Data Center	AHU3	EG_CPD_U3_HR_ret	Unit return air humidity
Data Center	AHU3	EG_CPD_U3_HR_imp	Unit supply air humidity
Data Center	AHU3	EG_CPD_U3_Temp_ext	Unit outside air temperature
Data Center	AHU3	EG_CPD_U3_HR_ext	Unit outside air humidity
Data Center	AHU3	EG_CPD_U3_Freecooling_OA	Unit freecooling-damper
Data Center	AHU3	EG_CPD_U3_Valvula1_OA	GE/CW-valve opening grade 1
Data Center	Data Center	EG_CPD_CPD_HR	CPD air humidity
Data Center	Data Center	EG_CPD_CPD_Temp	CPD air temperature
Data Center	Tech Room	EG_CPD_SalaT_HR	Technical room air humidity
Data Center	Tech Room	EG_CPD_SalaT_Temp	Technical room air temperature
HMI_Emergency	AHU3	HMI_P0_UTA3_Electric_AE_import	Activ Energy import
HMI_Emergency	AHU3	HMI_P0_UTA3_Electric_RE_lag_import	Reactive Energy inductance - lag import
HMI_Emergency	AHU3	HMI_P0_UTA3_Thermal_cooling_energy	Thermal Meter cooling energy
HMI_Emergency	AHU3	HMI_P0_UTA3_Thermal_power	Thermal Meter power
HMI_Emergency	AHU3	HMI_P0_UTA3_est_te	Outdoor temperature
HMI_Emergency	AHU3	HMI_P0_UTA3_est_ti	Supply air temperature
HMI_Emergency	AHU3	HMI_P0_UTA3_est_tl	Room air temperature
HMI_Emergency	AHU3	HMI_P0_UTA3_est_tr	Return air temperature
HMI_Emergency	AHU3	HMI_P0_UTA3_est_fc	Free cooling damper position
HMI_Operating Room	AHU1	HMI_P1_UTA1_Electric_AE_import	Activ Energy import

Place	Main node	BMS channel name	Description
HMI_Operating Room	AHU1	HMI_P1_UTA1_Electric_RE_lag_import	Reactive Energy inductance - lag import
HMI_Operating Room	AHU1_C1	HMI_P1_UTA1_COIL1_Thermal_heat_energy	Thermal Meter heat energy
HMI_Operating Room	AHU1_C1	HMI_P1_UTA1_COIL1_Thermal_power	Thermal Meter power
HMI_Operating Room	AHU1_C2	HMI_P1_UTA1_COIL2_Thermal_cooling_energy	Thermal Meter cooling energy
HMI_Operating Room	AHU1_C2	HMI_P1_UTA1_COIL2_Thermal_power	Thermal Meter power
HMI_Operating Room	AHU1_C3	HMI_P1_UTA1_COIL3_Thermal_heat_energy	Thermal Meter heat energy
HMI_Operating Room	AHU1_C3	HMI_P1_UTA1_COIL3_Thermal_power	Thermal Meter power
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_tprh	Pretreatment chamber air temperature
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_tpsh	Postheating air temperature
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_ts1	Supply duct 1 air temperature
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_ts2	Supply duct 2 air temperature
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_ts3	Supply duct 3 air temperature
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_ts4	Supply duct 4 air temperature
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_tr1	Room 1 temperature
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_tr2	Room 2 temperature
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_tr3	Room 3 temperature
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_tr4	Room 4 temperature
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_dp1	Mix air damp duct 1 opening position
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_dp2	Mix air damp duct 2 opening position
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_dp3	Mix air damp duct 3 opening position

Place	Main node	BMS channel name	Description
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_dp4	Mix air damp duct 4 opening position
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_vc1	Preheating coil three-way valve position
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_vc2	Cooling coil three-way valve position
HMI_Operating Room	AHU1	HMI_P1_UTA1_est_vc3	Heating coil three-way valve position

Table 16 HVN channels

3.3. SGH

The I/O related to SGH will be stored in the Green@Hospital portal database following a well structured tree. It differentiates parameters taken from outside, parameters referred to each room and the AHU. This structure is reported in Figure 4.

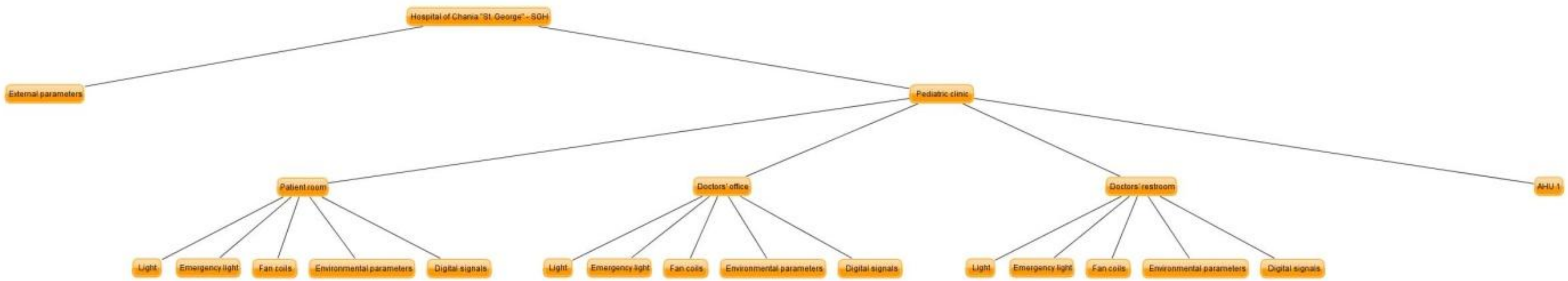

Figure 4 SGH tree architecture

All the signals that will be shown in the portal are listed in Table 17.

Place	Main node	BMS channel name	Description
Outside	External parameters	AIR_TEMP	Outside temperature
Outside	External parameters	AIR_HUM	Outside humidity
Outside	External parameters	SOL_RAD	Solar radiation
Pediatric clinic	Patient room	201_AD1	Humidity
Pediatric clinic	Patient room	201_AD2	Temperature
Pediatric clinic	Patient room	201_AD3	CO_2 ppm
Pediatric clinic	Patient room	201_AD4	Room luminance
Pediatric clinic	Patient room	201_BD1	Presence in the room
Pediatric clinic	Patient room	201_BD2	Window contact 1
Pediatric clinic	Patient room	201_BD3	Window contact 2
Pediatric clinic	Patient room	NVE_PowerMeter1nvoPowerL2	Light energy consumption
Pediatric clinic	Patient room	NVE_PowerMeter2nvoPowerL2	Emergency light energy consumption
Pediatric clinic	Patient room	NVE_PowerMeter3nvoPowerL2	Fan coils Energy consumption
Pediatric clinic	Patient room	NVE_Heatmeter2nvoE1_HeatV1	Heat Energy consumption V1
Pediatric clinic	Patient room	NVE_Heatmeter2nvoE7_HeatV2	Heat Energy consumption V2
Pediatric clinic	Patient room	NVE_Heatmeter2nvoE3_Cool	Cooling Energy consumption
Pediatric clinic	Patient room	NVE_Heatmeter2nvoPowerV1	Power V1
Pediatric clinic	Doctors' office	202_AD1	Humidity
Pediatric clinic	Doctors' office	202_AD2	Temperature

Place	Main node	BMS channel name	Description
Pediatric clinic	Doctors’ office	202_AD3	CO_2 ppm
Pediatric clinic	Doctors’ office	202_AD4	Room luminance
Pediatric clinic	Doctors’ office	202_BD1	Presence in the room
Pediatric clinic	Doctors’ office	202_BD2	Window contact 1
Pediatric clinic	Doctors’ office	202_BD3	Window contact 2
Pediatric clinic	Doctors’ office	NVE_PowerMeter1nvoPowerL1	Light energy consumption
Pediatric clinic	Doctors’ office	NVE_PowerMeter2nvoPowerL1	Emergency light energy consumption
Pediatric clinic	Doctors’ office	NVE_PowerMeter3nvoPowerL1	Fan coils Energy consumption
Pediatric clinic	Doctors’ office	NVE_Heatmeter1nvoE1_HeatV1	Heat Energy consumption V1
Pediatric clinic	Doctors’ office	NVE_Heatmeter1nvoE7_HeatV2	Heat Energy consumption V2
Pediatric clinic	Doctors’ office	NVE_Heatmeter1nvoE3_Cool	Cooling Energy consumption
Pediatric clinic	Doctors’ office	NVE_Heatmeter1nvoPowerV1	Power V1
Pediatric clinic	Doctors’ restroom	203_AD1	Humidity
Pediatric clinic	Doctors’ restroom	203_AD2	Temperature
Pediatric clinic	Doctors’ restroom	203_AD3	CO_2 ppm
Pediatric clinic	Doctors’ restroom	203_AD4	Room luminance
Pediatric clinic	Doctors’ restroom	203_BD1	Presence in the room
Pediatric clinic	Doctors’ restroom	203_BD2	Window contact 1
Pediatric clinic	Doctors’ restroom	203_BD3	Window contact 2
Pediatric clinic	Doctors’ restroom	NVE_PowerMeter1nvoPowerL3	Light energy consumption
Pediatric clinic	Doctors’ restroom	NVE_PowerMeter2nvoPowerL3	Emergency light energy consumption

Place	Main node	BMS channel name	Description
Pediatric clinic	Doctors' restroom	NVE_PowerMeter3nvoPowerL3	Fan coils Energy consumption
Pediatric clinic	Doctors' restroom	NVE_Heatmeter3nvoE1_HeatV1	Heat Energy consumption V1
Pediatric clinic	Doctors' restroom	NVE_Heatmeter3nvoE7_HeatV2	Heat Energy consumption V2
Pediatric clinic	Doctors' restroom	NVE_Heatmeter3nvoE3_Cool	Cooling Energy consumption
Pediatric clinic	Doctors' restroom	NVE_Heatmeter3nvoPowerV1	Power V1
Pediatric clinic	AHU1	AI_1	Temperature
Pediatric clinic	AHU1	AI_2	Humidity
Pediatric clinic	AHU1	ALARM_1	Pollution filter alarm
Pediatric clinic	AHU1	ALARM_3	Activation of fire diaphgram alarm
Pediatric clinic	AHU1	ALARM_4	Manual supply alarm
Pediatric clinic	AHU1	ALARM_5	Manual return alarm
Pediatric clinic	AHU1	ALARM_6	Fail start alarm
Pediatric clinic	AHU1	ALARM_7	Fail stop alarm
Pediatric clinic	AHU1	ALARM_8	Fail start return alarm
Pediatric clinic	AHU1	ALARM_9	Fail stop return alarm

Table 17 SGH channels

3.4. HML

The HML pilot has two solution sets, as described in previous sections. Each solution set can be divided in more categories and subcategories, considering the places and devices from where the signals arrive. The concept of tree used in Web-EMCS well describes this classification. The HML tree is reported in Figure 5.

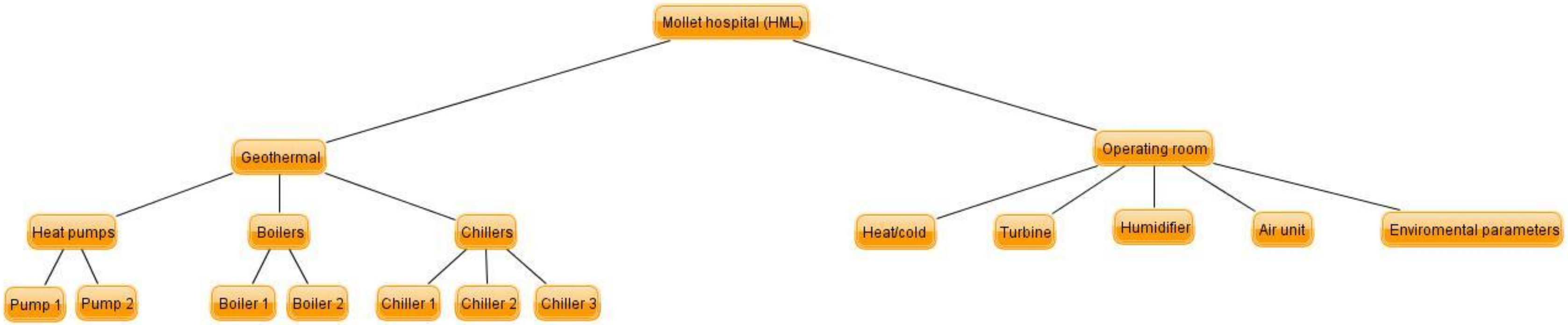

Figure 5 HML tree architecture

All the channels connected to the nodes correspond to the signals stored in the database and are reported in Table 18.

Place	Main node	BMS channel name	Description
Geothermal	Heat pumps	geotermia.Temperatura_retorno_circuito_calor	Return temperature heat collector
Geothermal	Heat pumps	geotermia.Temperatura_impulsion_circuito_calor	Flow temperature heat collector
Geothermal	Heat pumps	geotermia.Temperatura_impulsion_circuito_frio	Flow temperature cold collector
Geothermal	Heat pumps	geotermia.Temperatura_retorno_circuito_frio	Temperature cold collector
Geothermal	Heat pumps	Colector_AC_Temp_impulsion	Hot flow collector temperature
Geothermal	Heat pumps	Enfriadoras_Temp_Colector_retor_AF	Cold flow collector temperature
Geothermal	Heat pumps	sp_limite_calor_geotermia	Heat Pumps hot Working setpoint
Geothermal	Heat pumps	sp_limite_frio_geotermia	Heat Pumps cold Working setpoint
Geothermal	Boilers	Caldera_1.Temperatura_impulsion_caldera	Boiler 1 Working setpoint
Geothermal	Boilers	Caldera_2.Temperatura_impulsion_caldera	Boiler 2 Working setpoint
Geothermal	Chillers	Enfriadora_1.Temperatura_impulsion_enfriadora	Chiller 1 Working setpoint
Geothermal	Chillers	Enfriadora_2.Temperatura_impulsion_enfriadora	Chiller 2 Working setpoint
Geothermal	Chillers	Enfriadora_3.Temperatura_impulsion_enfriadora	Chiller 3 Working setpoint
Geothermal	Geothermal	GEO-OPM	Geotherm operating mode
Geothermal	Environmental parameters	Temperatura_exterior	Outside Temperature
Geothermal	Environmental parameters	Humedad_relativa_exterior	Outside humidity
Geothermal	Boilers	BOI1-COP0	Instant COP Boiler 1
Geothermal	Boilers	BOI1-COP1	Average COP Boiler 1
Geothermal	Boilers	BOI2-COP0	Instant COP Boiler 2
Geothermal	Boilers	BOI2-COP1	Average COP Boiler 2
Geothermal	Chillers	CHI1-COP0	Instant COP Chiller 1
Geothermal	Chillers	CHI1-COP1	Average COP Chiller 1
Geothermal	Chillers	CHI2-COP0	Instant COP Chiller 2

Place	Main node	BMS channel name	Description
Geothermal	Chillers	CHI2-COP1	Average COP Chiller 2
Geothermal	Chillers	CHI3-COP0	Instant COP Chiller 3
Geothermal	Chillers	CHI3-COP1	Average COP Chiller 3
Geothermal	Geothermal	GEO-COP0	Insant COP Geotherm System
Geothermal	Geothermal	GEO-COP1	Average COP Geotherm System
Geothermal	Boilers	BOI1-GAS0	Gas Consumption Boiler 1 (m^3)
Geothermal	Boilers	BOI2-GAS0	Gas Consumption Boiler 2 (m^3)
Geothermal	Boilers	BOI1-GAS1	Gas energy Consumption Boiler 1
Geothermal	Boilers	BOI2-GAS1	Gas energy Consumption Boiler 2
Geothermal	Chillers	CHI1-E	Electric Consumption Chiller 1
Geothermal	Chillers	CHI2-E	Electric Consumption Chiller 2
Geothermal	Chillers	CHI3-E	Electric Consumption Chiller 3
Geothermal	Geothermal	GEO-E0	Electric Consumption Geothermal System 1
Geothermal	Geothermal	GEO-E1	Electric Consumption Geothermal System 2
Geothermal	Boilers	BOI1-HE	Hot energy consumption boiler 1
Geothermal	Boilers	BOI2-HE	Hot energy consumption boiler 2
Geothermal	Geothermal	GEO-HE	Hot energy consumption
Geothermal	Geothermal	GEO-CE	Cold energy consumption
Geothermal	Chillers	CHI1-CE	Cold energy consumption chiller 1
Geothermal	Chillers	CHI2-CE	Cold energy consumption chiller 2
Geothermal	Chillers	CHI3-CE	Cold energy consumption chiller 3
Geothermal	Heat pumps	GEO-HP1-ST	Heat Pump 1 ON/OFF
Geothermal	Heat pumps	GEO-HP2-ST	Heat Pump 2 ON/OFF
Geothermal	Boilers	BOI1-ST	Boiler 1 ON/OFF
Geothermal	Boilers	BOI2-ST	Boiler 2 ON/OFF
Geothermal	Chillers	CHI1-ST	Chiller 1 ON/OFF

Place	Main node	BMS channel name	Description
Geothermal	Chillers	CHI2-ST	Chiller 2 ON/OFF
Geothermal	Chillers	CHI3-ST	Chiller 3 ON/OFF
Geothermal	Boilers	BOI1-T0	Inlet temperature Boiler 1
Geothermal	Boilers	BOI1-T1	Outlet temperature Boiler 1
Geothermal	Boilers	BOI2-T0	Inlet temperature Boiler 2
Geothermal	Boilers	BOI2-T1	Outlet temperature Boiler 2
Geothermal	Chillers	CHI1-T0	Inlet temperature Chiller 1
Geothermal	Chillers	CHI1-T1	Outlet temperature Chiller 1
Geothermal	Chillers	CHI2-T0	Inlet temperature Chiller 2
Geothermal	Chillers	CHI2-T1	Outlet temperature Chiller 2
Geothermal	Chillers	CHI3-T0	Inlet temperature Chiller 3
Geothermal	Chillers	CHI3-T1	Outlet temperature Chiller 3
Geothermal	Geothermal	GEO-T0	Inlet temperature cold
Geothermal	Geothermal	GEO-T1	Outlet temperature cold
Geothermal	Geothermal	GEO-T2	Inlet temperature hot
Geothermal	Geothermal	GEO-T3	Outlet temperature hot
Geothermal	Boilers	BOI1-FL	Hot flow temperature boiler 1
Geothermal	Boilers	BOI2-FL	Hot flow temperature boiler 2
Geothermal	Chillers	CHI1-F	Cold flow temperature chiller 1
Geothermal	Chillers	CHI2-F	Cold flow temperature chiller 2
Geothermal	Chillers	CHI3-F	Cold flow temperature chiller 3
Geothermal	Geothermal	GEO-FL1	Cold flow temperature
Geothermal	Geothermal	GEO-FL0	Hot flow temperature
Geothermal	Boilers	Calderas_Temp_Colector_retor_AC	Return temperature heat collector
Geothermal	Boilers	Calderas_Temp_Colector_impuls_AC	Flow temperature heat collector
Geothermal	Chillers	Enfriadoras_Temp_Colector_retor_AF	Return temperature cold collector
Geothermal	Chillers	Enfriadoras_Temp_Colector_impuls_AF	Flow temperature cold collector
Geothermal	AHU	SURG-HE0	Hot energy consumption 1

Place	Main node	BMS channel name	Description
Geothermal	AHU	SURG-HE1	Hot energy consumption 2
Geothermal	AHU	SURG-CE0	Cold energy consumption
Operating room	AHU	SURG-FL0	Hot flow temperature 1
Operating room	AHU	SURG-FL1	Hot flow temperature 2
Operating room	AHU	SURG-FL2	Cold flow temperature
Operating room	AHU	SURG-T0	Inlet temperature hot 1
Operating room	AHU	SURG-T1	Outlet temperature hot 1
Operating room	AHU	SURG-T2	Inlet temperature hot 2
Operating room	AHU	SURG-T3	Outlet temperature hot 2
Operating room	AHU	SURG-T4	Inlet temperature cold
Operating room	AHU	SURG-T5	Outlet temperature cold
Operating room	AHU	CI62_S1_D9.Temperatura_retorno	Return air Temperature
Operating room	AHU	CI62_S1_D9.Humedad_relativa_retorno	Return air humidity
Operating room	Environmental parameters	CI62_S1_D9.Consigna_zona_muerta_temp_ocupacion	Temperature dead zone occupation
Operating room	Environmental parameters	CI62_S1_D9.Consigna_zona_muerta_temp_no_ocupacion	Temperature dead zone NO occupation
Operating room	AHU	CI62_S1_D9.Consigna_temperatura_impulsion_maxima	Maximum impulse air temperature
Operating room	AHU	CI62_S1_D9.Consigna_temperatura_impulsion_minima	Minimum impulse air temperature
Operating room	Environmental parameters	CI62_S1_D9.Consigna_zona_muerta_humedad_ocupacion	HR dead zone occupation
Operating room	Environmental parameters	CI62_S1_D9.Consigna_zona_muerta_humedad_no_ocupacion	HR dead zone NO occupation
Operating room	Environmental parameters	Quirofano_5.Cons_lim_max_HR_impuls	Maximum impulse HR
Operating room	Heat pumps	CI62_S1_D9.Consigna_limite_Valvula_frio_deshumecta	Maximum valve opening DRY cold
Operating room	Environmental parameters	SURG-FL	Impulse flow

Place	Main node	BMS channel name	Description
Operating room	Environmental parameters	Quirofano_5.Sobrepresion_sala	Ambient Pressure
Operating room	Environmental parameters	Quirofano_5.Cons_lim_max_Sobpresion_Amb	Maximum ambient pressure alarm limit
Operating room	Environmental parameters	Quirofano_5.Cons_lim_min_Sobpresion_Amb	Minimum ambient pressure alarm limit
Operating room	Environmental parameters	SURG-ST	State use / no use / cleaning operating room
Operating room	AHU	SURG-E	Electric Consumption Air Unit
Geothermal	Heat pumps	GEO-GHE	Heat Energy
Geothermal	Heat pumps	GEO-GCE	Cold Energy
Operating room	Environmental parameters	SURG-PC1	Percentage of particles in suspension 1
Operating room	Environmental parameters	SURG-PC2	Percentage of particles in suspension 2
Operating room	Heat pumps	CI62_S1_D9.valvula_precalentemento	Heat Valve 1
Operating room	Humidifier	CI62_S1_D9.Mando_Humectador	% Opening Humidifier
Operating room	Heat pumps	CI62_S1_D9.valvula_frio	Cold Valve
Operating room	Heat pumps	CI62_S1_D9.valvula_calor	Heat Valve 2
Operating room	Fan	SURG-IAT	Control drive impulse air turbine
Operating room	Fan	SURG-EXAT	Control drive extraction air turbine
Operating room	Environmental parameters	Quirofano_5.Consigna_Temperatura_Ambiente	Operating room temperature

Table 18 HML channels

4. Conclusions

Through this deliverable, the I/O available for each hospital solution set and the databases structures are illustrated.

For reaching this purposes and making the explanation as clear as possible, the I/O are divided in categories and sub-categories. Those distinctions have been made observing the signals and grouping them considering which the parameters in common are. The parameters could allow a spatial classification, if the distinction is given by the zone where the meters are installed, or a type classification, if what changes from a set to another is the type of data represented. Stored parameters will be used to define time models and to calculate energy savings.

For each solution set the dates when the database storing started are reported. This is a very important information because it gives the correct time from when it is possible searching data relatively to each signal. For some solution sets, all which are in AOR and HVN, the saving in the final database where the portal will take data has already started, and graphical representation in the portal demo version is so already available. For these important reasons those dates are reported too.

The portal database structure is fully described. As already written in Deliverable 3.1 this database is created dividing the signals (channels) in groups of nodes, which make the classical tree architecture. All the channels which are and will be inserted in the portal are specified in different tables, one for each pilot, together with the relative BMS names.

An important characteristic of the system created is the expandability, in fact it is thought allowing adding new pilots in the future. The Web-EMCS takes data from a single database, but this database is periodically filled up using data which are stored in more databases, one specific for each hospital. Consequently, to add a new pilot, it will be simply necessary to create a new database where its data will be stored. To increase this openness towards other potential pilots, all the meters used for monitoring the solution sets follow the standardization characteristic, being all of them the most standard and common sensors available.

5. References

[1] eeMeasure project Deliverable D1.2 - Non residential methodology

[2] Green@Hospital project Deliverable D2.2 – Energy saving solution set description

[3] Green@Hospital project Deliverable D3.1 – Web-EMCS drivers

[4] Microsoft SQL Server, http://www.microsoft.com/italy/server/sql/2008/default.mspx