TEMPLATE

Investment report

Version 1

I1- energy monitoring system and upgrades linked to 20 pilot buildings in Treviso (PA1)

Project index number and acronym	CE51 TOGETHER
Responsible partner (PP name and number)	Province of Treviso
Linked to pilot action (number and title)	PA1 – deliverable D.T3.2.1
Project website	http://www.interreg-central.eu/Content.Node/TOGETHER.html
Delivery date	31.11.2017

Description of the investment (including technical characteristics) explaining its embedding into the linked pilot action

The monitoring system installed It is a mixture of sensors, connections, hardware and software that automatically carries out the measurement of the buildings energy consumption. The quantity that is measured is the energy CONSUMPTION (electric or thermal) of a building. The SAVING is the DIFFERENCE (subtraction) of the consumption registered in the same period. If by METERING we mean the method for accounting for a physical "quantity" in a traditional way, through a common "meter" in which the final user is in charge of the punctual registration of the "accounted" value, instead the SMART METERING is different because the communication to the final user is done AUTOMATICALLY by the meter itself by using "modern" technologies: SMART.
The investment allows to measure and display almost in real time (maximum intervals of 3 hours between measurements), the electricity and heat consumption in a cluster of 20 public buildings belonging to the Province of Treviso and to 10 Municipalities in the provincial territory that represents the Italian Pilot Arena of the TOGETHER project.
Two modes of system interventions were carried out:
A) Installation of BASIC metering devices carried out in the 12 buildings belonging to the 10 Associated Municipalities

- n. 1 Data-logger XMETER measuring electric consumption
- n. 1 Quantometer measuring thermal consumption
- n. 1 Monitor TV – Showcase dissemination of the consumption data

To favour the dissemination of the results achieved through the project and published on the WEB, in every "BASIC metering installation" a "Monitor TV – SHOWCASE" was placed, directly connected to a personal computer connected to the Internet. The PC is a compact model with preinstalled O.S. Windows 10 Home. It is placed on the wall behind the TV set and it is directly connected to it. It does not have keyboard and mouse: it is equipped with a remote control software that allows to access it only for maintenance purposes by the staff in charge of maintaining all the SMART METERING equipment present in the building, until the end of the project TOGETHER. It is configured so that, when it starts, it automatically accesses Windows with non-administrator credentials.
B) ENHANCEMENT of the EXISTING metering devices carried out in the 4 buildings belonging to the Province of Treviso (Connected to the EXISTING XMETER)

- n. 1 Electric Energy Cost Allocator measuring electric consumption
- n. 1 Flowmeter with temperature probes measuring thermal consumption

In these buildings the thermal consumption includes both the value of the main building (e.g. school) and the one referred to other annexed buildings (e.g. gym). Thus, it was necessary to identify and measure one single thermal flow through a flowmeter, in order to obtain, by difference, the consumption of the single buildings.
The success of the project is ensured not only by the availability of technological tools, but also by their understanding. The installed technological package is completed by the transferring of the knowledge that is necessary to make the most of the opportunities provided by technology. In order to analyse consumption data and consequently define the energy performance of a building, it is necessary to establish **a BASELINE**.
The THERMAL and ELECTRIC Baselines are calculated:
1. starting from the consumption information retrieved through the energy audit of the building (carried out at the beginning of the project TOGETHER).
2. dividing the consumption information described above by weeks and then by days proportionally to the average weather conditions over the last 3 years

The Smart metering system defined as "direct feedback measure" (excerpt from "Achieving energy efficiency through behaviour change: what does it take?" from EEA), provides the building players with the concrete possibility to have a direct and immediate feedback of the incidence of their behaviour and consumption practices on energy consumption.
Feedback systems based on smart metering devices are therefore strategic in Energy Efficiency programmes based on Demand Side Management (DSM) measures and users' involvement.
A strict control of energy expenditure and the optimization of energy efficiency in the activities carried out can improve the reliability of the data/feedback and can, above all, lead to savings.

Investment location		
NUTS 3	**Address (Street, house number, postal code, city, country)**	**GPS coordinates**
ITH34, Treviso	Sede comunale Via Roma 27 - 31030 Carbonera	Latitude: 45°40'53.94"N Longitude: 12°17'19.84"E
ITH34, Treviso	Scuola Primaria Gianni Rodari, Via Vittorio Veneto 94 - 31032 Casale sul Sile	Latitude: 45°35'42.44"N Longitude: 12°19'27.19"E
ITH34, Treviso	Scuola Media Antonio Vivaldi Via Peschiere 12 - 31030 Casier	Latitude: 45°37'56.51"N Longitude: 12°15'32.98"E
ITH34, Treviso	Scuola Media Casteller Viale Panizza 4 - 31038 Paese	Latitude: 45°40'44.81"N Longitude: 12° 9'31.16"E
ITH34, Treviso	Scuola Media A. Brustolon Via Einaudi - 31015 Conegliano	Latitude: 45°52'16.4"N Longitude: 12°16'29.6"E
ITH34, Treviso	Sede comunale (succursale Piazzale Beccaria 1 - 31015 Conegliano	Latitudine: 45.883102 Longitudine: 12.293605
ITH34, Treviso	Scuola Primaria Aldo Moro, Via Nicolò, Tommaseo 1 - 31047 Ponte di Piave	Latitude: 45°43'4.24"N Longitude: 12°27'48.37"E
ITH34, Treviso	Scuola Primaria Antonio Canova, Piazza Unità d'Italia - 31025 Santa Lucia di Piave	Latitude: 45°38'44.52"N Longitude: 12° 9'21.67"E
ITH34, Treviso	Scuola Primaria Dante Alighieri, Via - Torino 3 - 31021 Mogliano Veneto	Latitude: 45°50'58.22"N Longitude: 12°16'57.89"E
ITH34, Treviso	Scuola Primaria Diego Valeri, Ragusa 18- 31021 Mogliano Veneto	Latitude: 45°39'13.18"N Longitude: 12°17'57.96"E
ITH34, Treviso	Scuola Media Guglielmo Ciardi, Via Donatori di Sangue 1 - 31055 Quinto di Treviso	Latitude: 45°33'43.62"N Longitude: 12°13'33.60"E

ITH34, Treviso	Scuola Primaria Antonio Vivaldi Via Roma 79 – 31057 Silea	Latitude: 45°33'6.64"N Longitude: 12°15'12.69"E
ITH34, Treviso	Istituto Tecnico Statale Turismo e Relazioni internazionali "Giuseppe Mazzotti", Via Alessandro Tronconi, 1 – 31100 Treviso	Latitude: 45,680812 Longitude: 12,220031
ITH34, Treviso	Istituto d'Istruzione Superiore Palladio Via Alessandro Tronconi, 22 – 31100 Treviso	Latitude: 45,678852 Longitude: 12,222021"
ITH34, Treviso	Istituto Professionale Statale per l'Industria e l'Artigianato Galileo Galilei Via Avenale, 5 -31033 Castelfranco Veneto	Latitude: 45,679403 Longitude: 11,925395
ITH34, Treviso	Liceo Da Vinci Viale Europa, 32 31100 Treviso	Latitude: 45,680812 Longitude: 12,220031

Duration and process of investment implementation

Start date	End date
02.2017	05.2017

Major milestones of investment implementation

The major milestones of the investment implementation are:

- Verification of the electric and thermal systems of the pilot buildings;
- On-site visits and inspections for creating the list of the material, cables etc. to be ordered;
- Installations of the thematic equipment;
- Registration in the Inventory of the Province of Treviso;
- Signature of the Bilateral Agreements with the 10 Municipalities owners of 12 out of 20 pilot buildings, regulating the ownership and maintenance duties both after the project closure and for the 5 years following the last ERDF payment;
- Collection of the master data for creating an INFOCAD Module of INFOCAD, containing the following information: General information, plants / systems, OI hierarchy, attachments, photo gallery, OC, Documents, contacts and static cartography;

Moreover, the contracted company has to carry out a training session with the owners and managers of all the buildings affected by the investment.

Investment costs (Total costs and ERDF in EUR) including a break-down of main cost items

The investment is made of up of 2 core parts:

- BL5 that is thematic equipment for a total amount of € 60.538,55 (VAT included)
- BL6 that is works for the installation of the procured thematic equipment for a total amount of € 21.829,50 (VAT included). Moreover, the contract includes the terms of reference for a service of:
- support and service for constantly monitoring the on-line monitoring system and its correct functioning
- training and assistance for a total amount of € 9.387,66 (VAT included, covered by BL4)

The total investment (including only the thematic equipment and related works) costs 82.368,00 euro covered by the ERDF for the amount of 65.894,40.

WORKS	costs per unit	units	subtotal	VAT	total
works related to the integration of a new sensors in existing smart meters	€ 570,00	4	€ 2.280,00	€ 501,60	€ 2.781,60
installation of new smart	€ 1.180,00	12	€ 14.160,00	€ 3.115,20	€ 17.275,20
security social charge	€ 527,50	1	€ 527,50	€ 116,05	€ 643,55
works for completing the installations	€ 925,53	1	€ 925,53	€ 203,62	€ 1.129,15
Subtotal					€ 21.829,50
THEMATIC EQUIPMENT					
pulse counter	€ 311,10	4	€ 1.244,40	€ 273,77	€ 1.518,17
electromagnetic flowmeter:	€ 1.332,00	4	€ 5.328,00	€ 1.172,16	€ 6.500,16
pair of xm9:	€ 273,00	4	€ 1.092,00	€ 240,24	€ 1.332,24
pair of sensors	€ 154,40	4	€ 617,60	€ 135,87	€ 753,47
flowmeter interface for Xmeter	€ 496,00	4	€ 1.984,00	€ 436,48	€ 2.420,48
metering software	€ 125,00	4	€ 500,00	€ 110,00	€ 610,00
X meter in a junction box	€ 1.499,50	12	€ 17.994,00	€ 3.958,68	€ 21.952,68
Quanto-meter	€ 600,00	12	€ 7.200,00	€ 1.584,00	€ 8.784,00
Monitor and PC	€ 420,00	12	€ 5.040,00	€ 1.108,80	€ 6.148,80
Monitoring software	€ 716,67	12	€ 8.600,04	€ 1.892,01	€ 10.492,05
other related material	€ 21,72	1	€ 21,72	€ 4,78	€ 26,50
Subtotal					€ 60.538,55

Ownership and durability of the investment (e.g. maintenance, financing)

Treviso retains the ownership (during and after the project) of all the investments located in its own buildings and in the buildings belonging to the ten involved municipalities. Treviso includes all the investments in its inventory. The Province of Treviso and the involved municipalities (Municipalities of Casier, Conegliano, Casale sul Sile, Mogliano, Conegliano, Ponte di Piave, Paese, Santa Lucia di Piave, Silea and Quinto di Treviso) have signed a joint, official agreement concerning the use of the investment (regulated according to the existing rules), specifying the mutual duties for the proper use of the devices, their maintenance and maintenance costs. Treviso will take care of the maintenance of all the investments through its Facility Contractor (the new call for tender for the facility contractor will be launched and awarded in 2018). After the project closure, the annual management costs (software fee + monitoring) of each smart meter will be covered by the municipalities themselves, as planned and agreed in the 10 signed bilateral agreements covering in total 12 buildings.

Transnational effect and added value of the investment to the partnership

The **transnational relevance of the investment** is embedded in the value of the pilots: the monitoring of the consumption is carried out by all PPs in all regions with either similar or different means and methods, thus PPs can compare and benchmark their results and the effectiveness of the feedback measures combined with integrated tools, including DSM. Managers/owners need reliable data to propose EE measures, at the same time, consumers need appropriate frames in order to determine whether their energy consumption is excessive.
The investment will allow in terms of **added value** to improve the management of the time and use of the buildings, as it is possible to retrieve the consumption data of single parts of the building: the knowledge generated by this special operation is an added value to the project and will be shared with target groups and project partners.

Expected impact and benefits of the investment for the concerened territory and target groups and leverage of additional funds (if applicable)

The new technical equipment installed give a concrete opportunity to improve their current energy monitoring system that is practically based on a “passive” payment of the monthly bills, without a critical verification of the real consumption and the reasons leading to a specific energy consumption.
The investment supports the introduction of the concept of Behavioural and analytical demand-side management (DSM). Behavioural DSM tends to focus on educating consumers and encouraging individual participation to achieve energy savings, whereas analytical DSM finds opportunities for savings through equipment monitoring and data analytics.
It involves the project target groups, i.e. the buildings’ owners/managers/users, who can strongly benefit of such investments in terms of opportunities to reduce, and keep under control, energy consumption and to enhance the opportunity to foresee and therefore prepare the ground for future investments.
In terms of leverage effect

1. 3 Municipalities (i.e. Casale sul Sile, Paese and Quinto di Treviso) out of 10 have decided to invest own resources to improve the energy efficiency of their buildings with an investment the lightning system put in evidence by the energy audits provided by the project for a total amount of about 60.000 euros. The funds are already planned in their respective balance with the name “TOGETHER”.
2. 5 Municipalities out of 10 (i.e. Silea, Mogliano, Paese, Conegliano and Casier) had to invest own resources for adjusting the pilot buildings’ heating system for a total leveraged funds of 18.000 euros an average amount of € 2.500,00
3. Municipality of Ponte di Piave has already invested 5.325,30 for integrating the new monitoring system with another sensor monitoring the water.

If applicable, compliance with relevant regulatory requirements (e.g. environmental, building regulations, authorisations)

The characteristics of the systems and of their components must comply with the laws and regulations in force at the date of the contract and, in particular, must comply with:
- the requirements of the fire department and local authorities;
- the requirements and indications of ENEL (DSO) and the gas company;
- the provisions of the Law (DM 37/2008), IEC standards, EC conformity.

The works concerning the installation of the equipment must be carried out by subjects with the appropriate requirements: SOA qualification (OS30 - Cat. 1^) or technical-organizational requirements described in the former article 90 of the DPR (Presidential decree) 207/2010; Prior to the execution of the works, appropriate documents proving the possession of the above mentioned requirements must be provided, together with a copy of the Operational Security Plan.

Contribution to sustainable development - potential effects of the investment on the environment and climate. In case of negative effects, mitigation measures conducted

We can exclude the investment might have any potential negative effect. The installation of SM and related devices will contribute - together with the tested social measures to EE – to improving the environmental well-being by reducing the energy demand, the GHG emissions and local pollution. In addition, by adopting a multiple benefits approach, this typology of investment could have a positive impact across different spheres (e.g. health, public budget)& targets (e.g. private stakeholders).
This kind of investment can benefit the market, by stimulating the uptake of EE & related devices, as the public sector can play a key role in stimulating private investments and be of example for other public administrations. The investment is preparing the ground for new investments in such technologies, including the water monitoring. As matter of fact, some of the involved municipalities are already thinking about the opportunity to introduce the energy monitoring platform in other owned buildings

Consideration of other horizontal principles such as equal opportunities and non-descrimination (e.g. barrier-free accessibility)

Sustainable development: the investment contributes to: stimulating market transformation towards more efficient buildings; mobilising public & private investments, rationalizing public expenditure; participants will be stimulated to adopt more efficient behaviour that can be replicated in other contexts (e.g. at home).
Equal opportunity: The use of monitors for the visualization of the consumption data (real-time based) does not exclude the possibility that disabled people, such as the visually impaired, can be involved in the use of the energy monitoring data, as it is possible to remotely extract the data and transform them into excel tables and graphs that can be explained by other colleagues and/or schools fellows.
Equality between men and women: Any activity based on understanding/targeting differences in patterns of consumption for women and men (e.g. awareness raising activities, design of key messages etc.) will guarantee the respect of non-discrimination and will be not used against the gender equality principle.
Environment: a profitable use of the smart meters can leverage EE retrofit investments, that could create conditions to improve the users well-being and environment conditions.

References to relevant deliverables (e.g. pilot action report, studies) and web-links If applicable, additional documentation, pictures or images to be provided as annex

References to the relevant deliverables:

- D.T3.1.1 preparatory analysis of the technical and management requirements for instilling smart meters
- D.T3.2.1 PA1 design for 20 building in Treviso – Ital

Additional documentation:

- Pictures of the installations
- Power point presentation

Pictures related to the smart meters installation


Interreg
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TOGETHER
PROGETTO TOGETHER
PER L'EFFICIENZA ENERGETICA
Il progetto TOGETHER punta a migliorare l'efficienza energetica negli edifici pubblici, responsabilizzando gli utenti che li gestiscono e li vivono quotidianamente.
L'installazione di monitor collegati a sensori di consumo offre a tutti gli utenti la visualizzazione in tempo reale di come i propri comportamenti incidano sui consumi e quindi sulle bollette energetiche degli enti proprietari.
Gli edifici pubblici sono di tutti. Lavoriamo insieme per ridurre i loro consumi energetici!
2.330.175,75
Budget del progetto in EUR
€
1.958.559,62
Finanziamento FESR in EUR
06.2016 - 05.2019
Durata del progetto
www.interreg-central.eu/together
Contatti
Provincia di Treviso
U.O. Rapporti e Relazioni U.E.| europa@provincia.treviso.it


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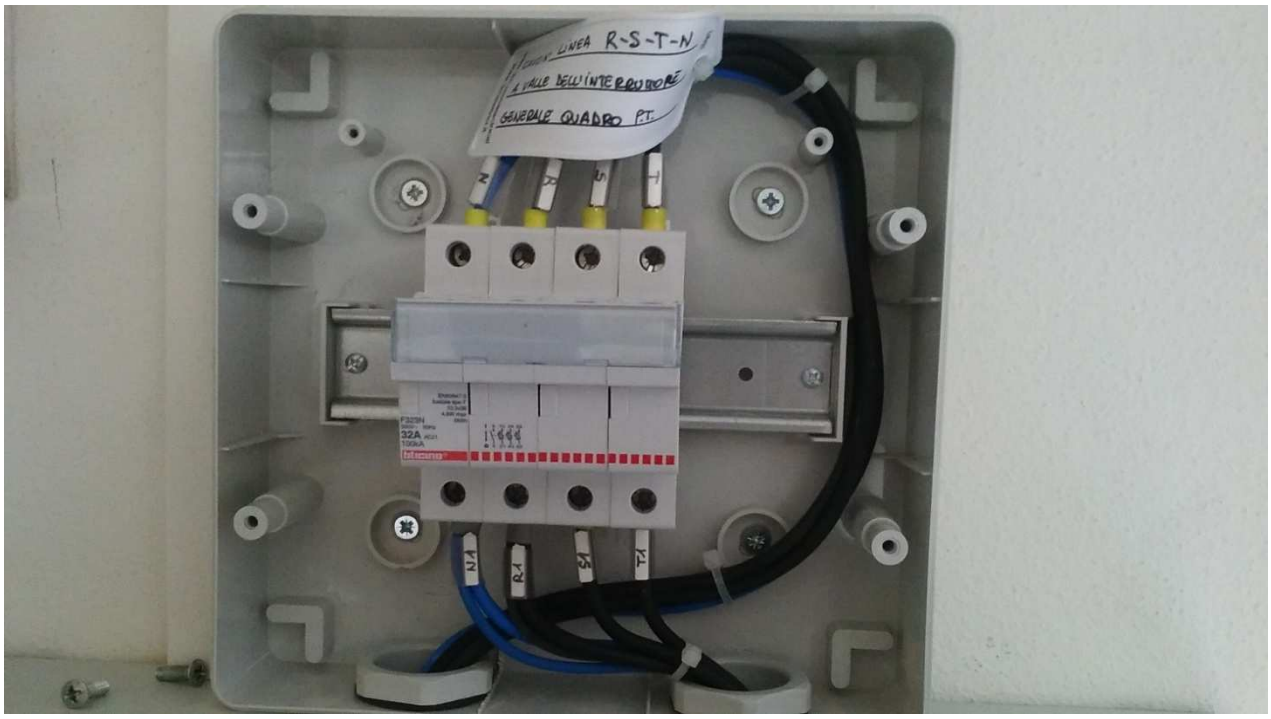
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X-METER PROGETTO TOGETHER


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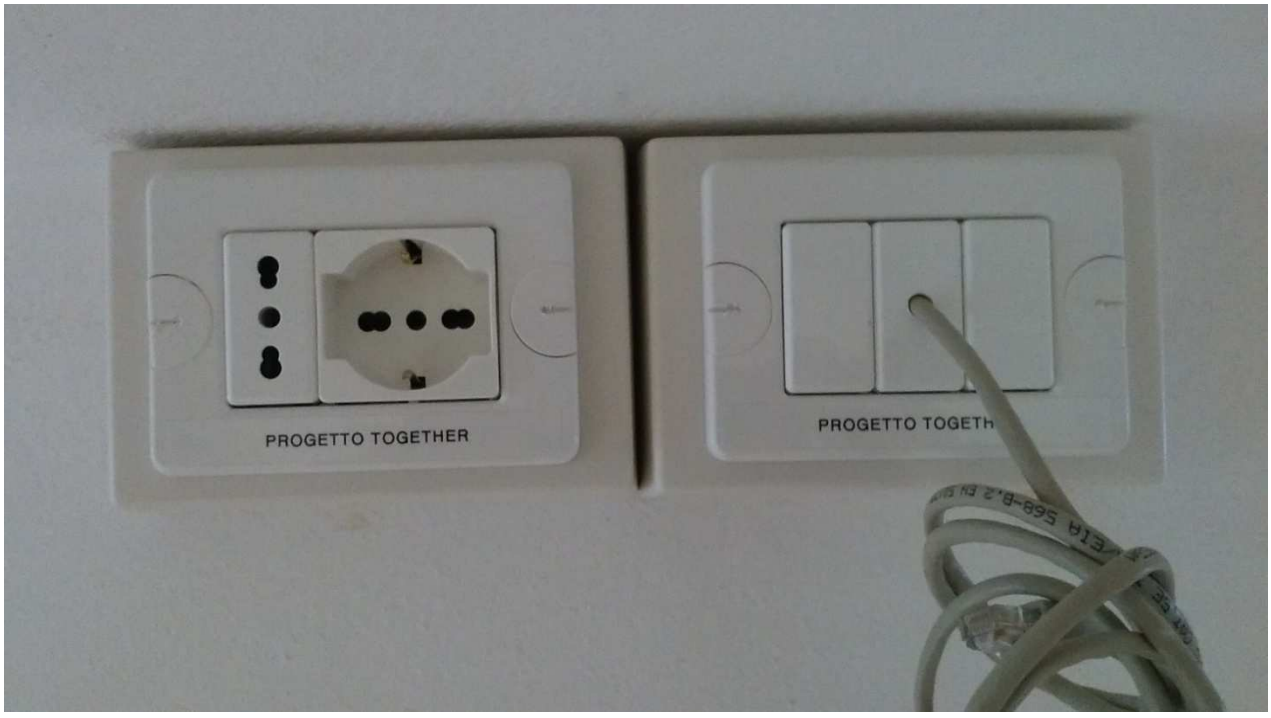
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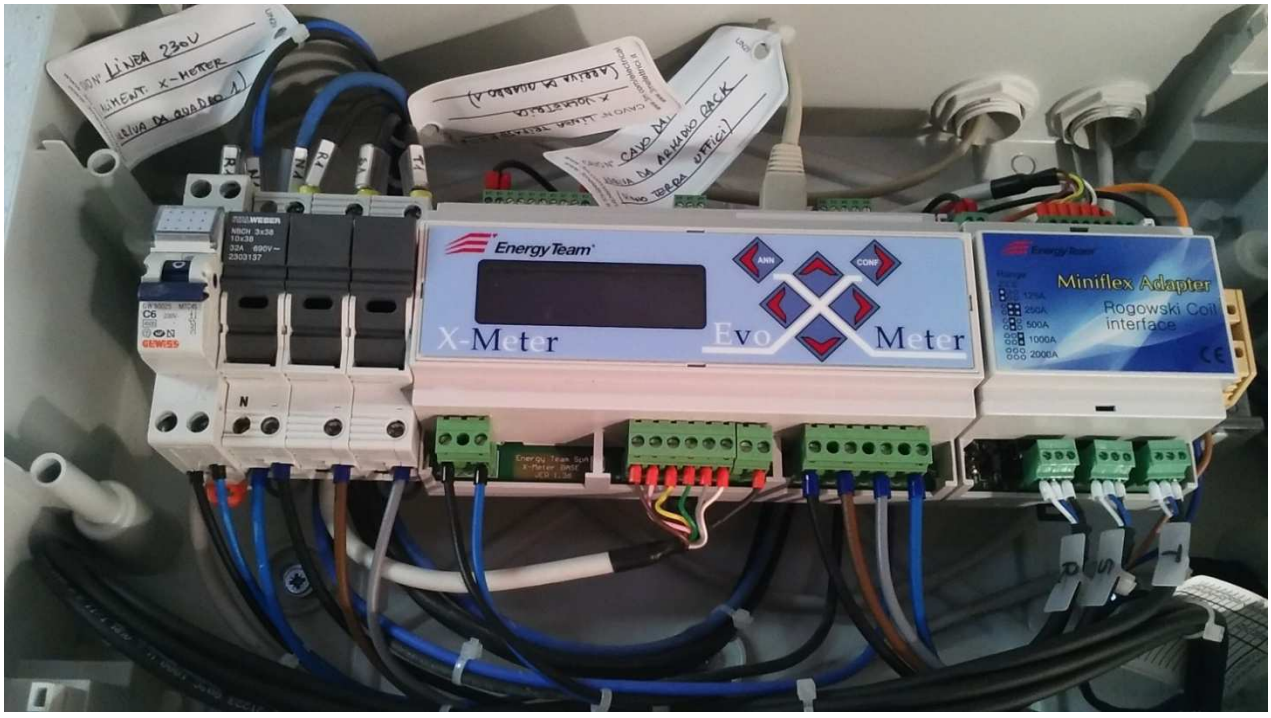

COMPONENTS OF THE SYSTEM

For DATALOGGER we mean a digital electric device that records a physical quantity (quantity of water, gas, electric energy, temperature, humidity…) through one or more sensors and is equipped with an internal memory that can historicize in time the recorded values.

The XMETER is the datalogger installed within the project TOGETHER that must retrieve and record the physical data "in the field" through some sensors connected to it.

The XMETER is a SMART datalogger, i.e. it is a SMART METER as, if adequately equipped and configured, it can automatically send the values recorded over time to a centralized archiving system.

QUANTOMETER: measures the flow of a gas passing through a pipe with a predefined diameter.

Within TOGETHER, the quantometer is used to measure the flow of METHANE GAS consumed by the thermal system. The cm of methane gas are then converted into thermal energy consumption (cm*pc* coeff k).

FLOWMETER: It measures the quantity of a liquid passing through a pipe with a predefined diameter. Within the project TOGETHER, the flowmeter, in conjunction with input and output temperature probes, is used to measure the thermal energy consumed by the system (the monitoring over time of the temperatures and of the liquid flow passed through the pipe allows the calculation of thermal energy).

BASELINE: The BASELINE is the energy consumption of reference of a building, expressed in kWh.

Within the project TOGETHER, a thermal and electric baseline was defined for each
building.

The DASHBOARD allows to display in a schematic, but direct and effective way, one or more indicators. Within the project TOGETHER the dashboard collects and displays the thermal and electric consumption data recorded in a building. These data are represented according to certain well defined "rules" (algorithms), and the result is integrated in an internet website.

The monitoring system: retrieving/archiving flow of the data recorded by the SMART METERS

STEP 1 – Measurement;
STEP 2 – Transmission;
STEP 3 – Files export in XML format and transmission to a FTP server;
STEP 4 – Files transmission in XML format from the FTP server to the «Infocad» server;
STEP 5 – Data processing within the Energy module of the Infocad.fm application;

STEP 1: measurement
The Xmeter is a HC device (data-logger) that registers an electric consumption load (kW/V/A/cosphi). The measurement of heat consumption is done through one or more electromechanical devices installed in each heat system: the quanto-meter. For every cubic metre of methane passing through it, the device emits an electric pulse picked up by the data-logger "Xmeter".
The device is installed in the main electric panel/energy delivery point, or right after the provider's electric/gas meter. The device is connected via LAN (data network) to the ADSL connection (Internet) of the school. The device interacts according to some set rules (port 9000) and thus needs to be configured on each ADSL it is connected to (according to procedures provided during the execution phase).
STEP 2 Transmission
The data of each "Xmeter" are picked up through POLLING (at set intervals), according to a proprietary protocol, from a linux SERVER ("Xmeter" server) dedicated to the data collection of each "Xmeter". This server allows, through a proprietary graphic interface, to consult via web the archived data. The data are visible in 2
STEP 3: Creation of the XML files and transmission to the FTP server.
7 times a day, with a 3 hour interval, the server processes a XML file with proprietary route (data standardisation) containing the data collected during the latest time interval. This file is sent via the Internet to a FTP server that acts as a xml files concentrator.
Once a day (at 01.00) the "Xmeter" server processes a XML file with proprietary route (data standardisation) containing all the data collected by all the "Xmeters" during the previous day (00.00 ' 24.00). This file is sent via the Internet to a FTP server that acts as a xml files concentrator. This operational redundancy is necessary in order to exclude possible minimal daily data losses.
STEP 4: Transmission of the XML files from the FTP server to the "Infocad" server 8 times a day (7+1). A function specifically developed by the "Infocad.FM" information system (parser), downloads in the IT system the XML file held in the FTP server.
The same function (parser) processes the data contained in the XML file just downloaded and archives them in the Infocad.FM DATABASE.
In the case of measurements concerning gas consumption, the value expressed in gas Nmc is transformed in KWh by multiplying it by the inferior heat power of the methane gas expressed in kWh/Nmc.
STEP 5: data processing through the "Energy" module of the "Infocad" application.
Thus, from the Energy module of the Infocad.FM application it is possible to consult, through a WEB interface, the data archived in the database either in the form of dashboard or in analytical/table form. The data are updated with a maximum interval of 3 hours.

with a maximum interval of 3 hours.

The investment allows to measure and display almost in real time (maximum intervals of 3 hours between measurements), the electricity and heat consumption in 16 public buildings belonging to the Province of Treviso (4 buildings) and to 10 Municipalities in the provincial territory. The interested buildings together with further 4 buildings belonging to the Province of Treviso represent the Italian Pilot Arena.
The measurement of consumption is done through the installation of smart meters that can register, in real time, both the electric and heat values, taking into account the system condition of each selected building.
As for the electric consumption, the smart meter was installed downline of the delivery point of the national electric grid and of the possible energy produced by renewables, in order to register both types of consumption. As for heating, we point out that in some selected buildings consumption includes both the values of the main building (e.g. school) and of other surrounding buildings (e.g. the gym), thus it will be necessary to 'pick up' and register one single heat flow. The situations existing in 4+12 buildings can be summarized as follows:
Basic metering installation: one electric energy flow + one heat energy flow per building. The buildings located in the following municipalities are in such situation: Casale sul Sile (1) , Casier (1), Paese (1), Mogliano Veneto (2), Ponte di Piave (1), Santa Lucia di Piave (1 only electric), Carbonera (1), Conegliano V. (2).

Upgrading of existing metering: one electric energy flow + one heat energy flow destined to different buildings. Gyms of the following schools: ISISS Palladio di Treviso, IS Mazzotti in Treviso, Liceo Da Vinci in Treviso and IPSIA Galilei in Castelfranco Veneto.
modalities: real time or historical.

Treviso, 25 September 2017 09.00 - 13,30

The electric and thermal monitoring system in the pilot buildings of the project TOGETHER

AGENDA OF THE DAY

1. Introduction

2. The monitoring system

3. Why are we measuring?

4. How can we achieve our goal?

5. Technical critical aspects

6. Coming soon

7. Debate

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7. Debate

Project Interreg 2014-2020 CENTRAL EUROPE “TOGETHER - Towards a Goal of Efficiency THrough Energy Reduction”

The project aims at developing methodologies to achieve energy savings also by changing the users’ behaviour and the management mode of the building-system complexes with the aid of systems displaying in real time (or, in practice, in almost-real time) both electric and thermal consumption.

Project Interreg 2014-2020 CENTRAL EUROPE "TOGETHER - Towards a Goal of Efficiency THrough Energy Reduction"

Such methodologies, in scientific literature, have been grouped under the common concept of *Demand Side Management* (DSM) as they **aim at achieving energy efficiency through the reduction of energy demand; a goal to be reached with behavioural, management and technological activities.**

Project Interreg 2014-2020 CENTRAL EUROPE "TOGETHER - Towards a Goal of Efficiency THrough Energy Reduction"

For the institutions participating in the project the activity consists in the automatic and punctual measuring and in the ensuing analysis of the electric and thermal consumption of some buildings. The measurements are carried out through technological devices installed in the systems of these buildings.

The full operativeness of these devices **will be ensured** by the cotractor, which was appointed of the devices installation (Sinergie S.p.A.), for the period following the installation/start and until the end of the project TOGETHER (planned for May 2019).

AGENDA DELLA GIORNATA

1. Introduction

2. The monitoring system

3. Why are we measuring?

4. How can we achieve our goal?

5. Technical critical aspects

6. Coming soon

7. Debate

What is the monitoring system set up within the project?

It is a mixture of sensors, connections, hardware and software that automatically carries out the measurement of the buildings energy consumption.

What do I measure?

The quantity that is measured is the energy **CONSUMPTION** (electric or thermal) of a building.

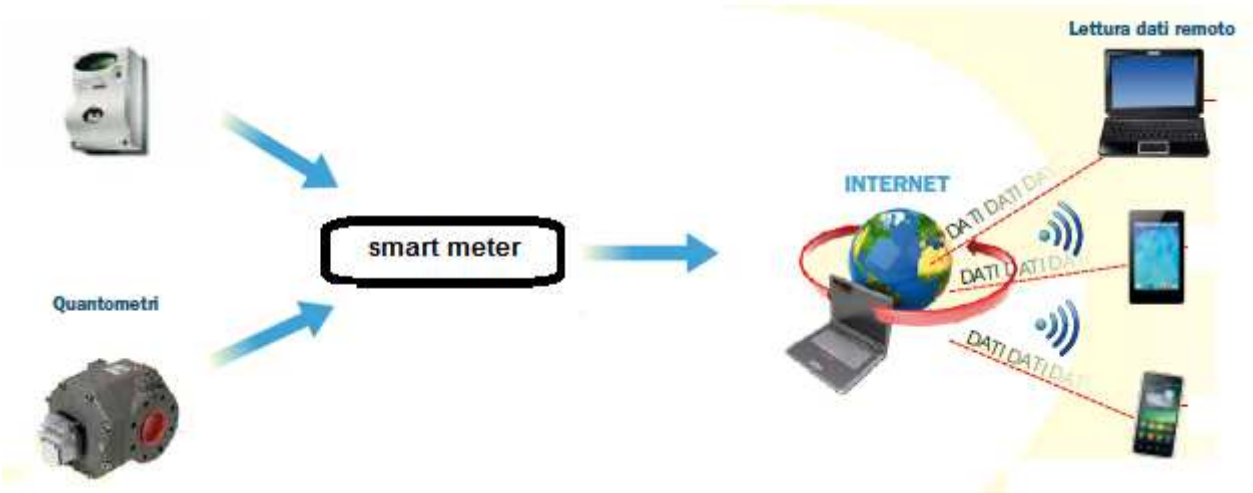
What is SAVING?

The DIFFERENCE (subtraction) of the consumption registered in the same period.

Before going on… some keywords:

METERING and SMART METERING:

If by METERING we mean the method for accounting for a physical “quantity” (water, gas, electric energy…) in a traditional way, through a common “meter” in which the final user is in charge of the punctual registration of the “accounted” value, instead the SMART METERING is different because the communication to the final user is done AUTOMATICALLY by the meter itself by using “modern” technologies: SMART



Some keywords:

DATALOGGER and XMETER:

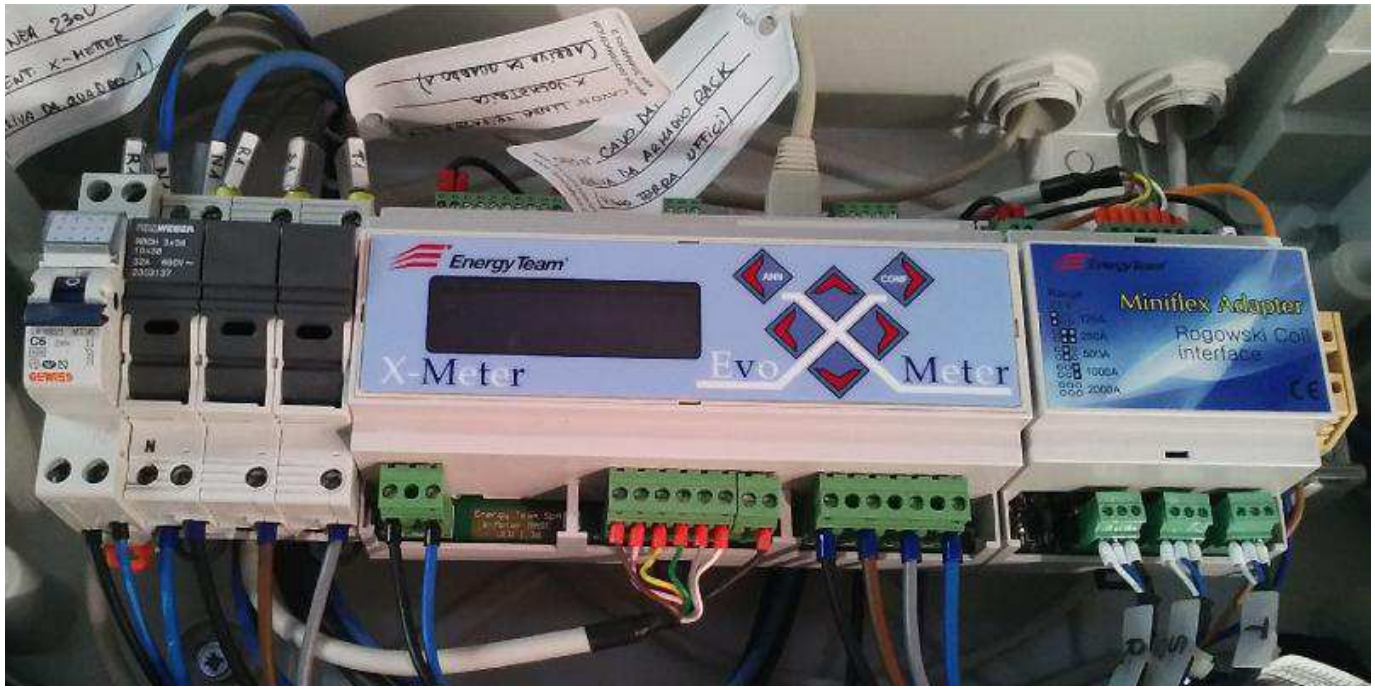
For DATALOGGER we mean a digital electric device that records a physical quantity (quantity of water, gas, electric energy, temperature, humidity…) through one or more sensors and is equipped with an internal memory that can historicize in time the recorded values.

The XMETER is the datalogger installed within the project TOGETHER that must retrieve and record the physical data “in the field” through some sensors connected to it.

The XMETER is a SMART datalogger, i.e. it is a SMART METER as, if adequately equipped and configured, it can automatically send the values recorded over time to a centralized archiving system.

Some keywords:

XMETER:



Some keywords:

QUANTOMETER:

It measures the flow of a gas passing through a pipe with a predefined diameter.

Within TOGETHER, the quantometer is used to measure the flow of METHANE GAS consumed by the thermal system. The cm of methane gas are then converted into thermal energy consumption (cm*pc* coeff k).

Some keywords:

FLOWMETER:

It measures the quantity of a liquid passing through a pipe with a predefined diamter.

Within the project TOGETHER, the flowmeter, in conjuction with input and output temperature probes, is used to measure the thermal energy consumed by the system (the monitoring over time of the temperatures and of the liquid flow passed through the pipe allows the calculation of thermal energy).

Some keywords:

BASELINE:

The BASELINE is the energy consumption of reference of a building, expressed in kWh.

Within the project TOGETHER, a thermal and electrc baseline was defined for each building.

DASHBOARD:

The DASHBOARD allows to display in a schematic, but direct and effective way, one or more indicators.

Within the project TOGETHER the dashboard collects and displays the thermal and electric consumption data recorded in a building. These data are represented according to certain well defined “rules” (algorithms), and the result is integrated in an internet website.

Buildings where the SMART METERS were installed:

The institutions participating in the project identified one or more buildings where the measurements are going to be carried out and where, consequently, the SMART METERS were installed.

On the whole, there are 20 buildings being tested, subdivided as follows:

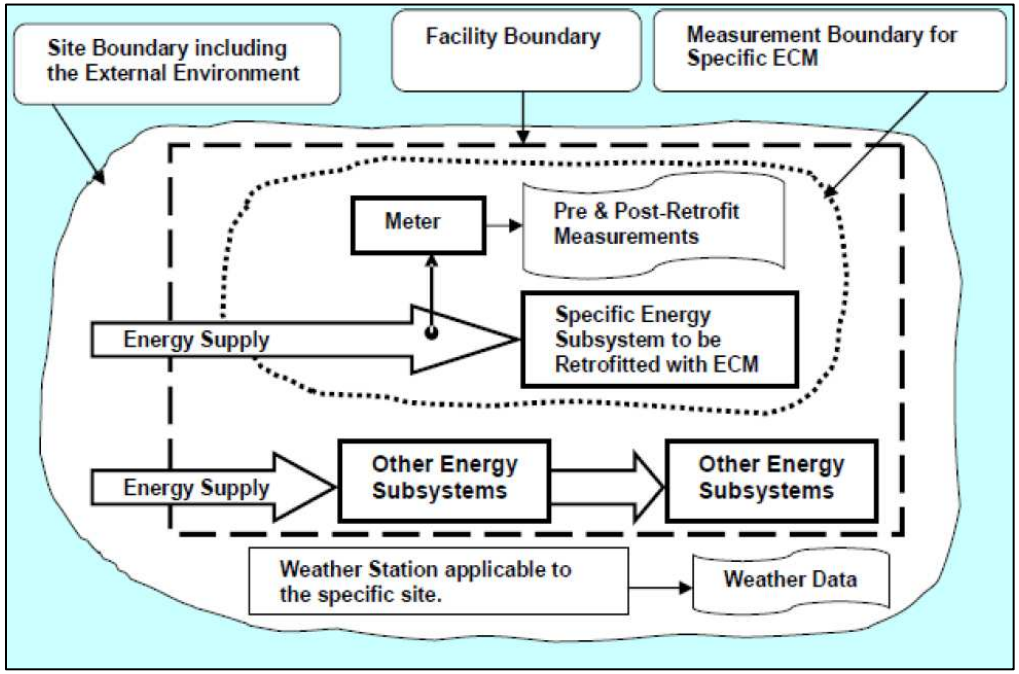
- 8 belonging to the Province of Treviso (4 already equipped with devices)

- 12 belonging to 10 municipalities located in the provincial territory

For some buildings the thermal consumption includes both the value of the main building (e.g. school) and the one referred to other annexed buildings (e.g. gym). Thus, it was necessary to identify and measure one single thermal flow through a flowmeter, in order to obtain, by difference, the consumption of the single buildings.

Measurement perimeter:

In defining the (electric or thermal) consumption of a building we always have to take into account the "physical point" where the measurement is taken, otherwise there is the risk of overrating or underrating the value referred to the examined building.



Typology of SMART METERING installation:

Taking into accoint the situation of the systems of each selected building and as the Province of Treviso already has a system for measuring and displaying in real time the energy consumption of 92 buildings, some of them also involved in the project TOGETHER, **different** technological components were installed in order to ensure for each building the measurement of:

- n.1 electric energy «flow» (*)
- n.1 thermal energy «flow» (*)

(*) system implementable and expandable with the add of other meters that can select portions of the building/system.

Typology of SMART METERING installation:

2 modes of system interventions were carried out:

A) Installation of BASIC metering devices carried out in the 12 buildings belonging to the 10 Municipalities of the provincial territory

- n. 1 Datalogger XMETER → measuring electric consumption
- n. 1 Quantometer → measuring thermal consumption
- n. 1 Monitor TV – Showcase→ dissemination of the consumption data

B) ENHANCEMENT of the EXISTING metering devices carried out in the 4 buildings belonging to the Province of Treviso (*)

- n. 1 Electric Energy Cost Allocator → measuring electric consumption
- n. 1 Flowmeter with temperature probes → measuring thermal consumption

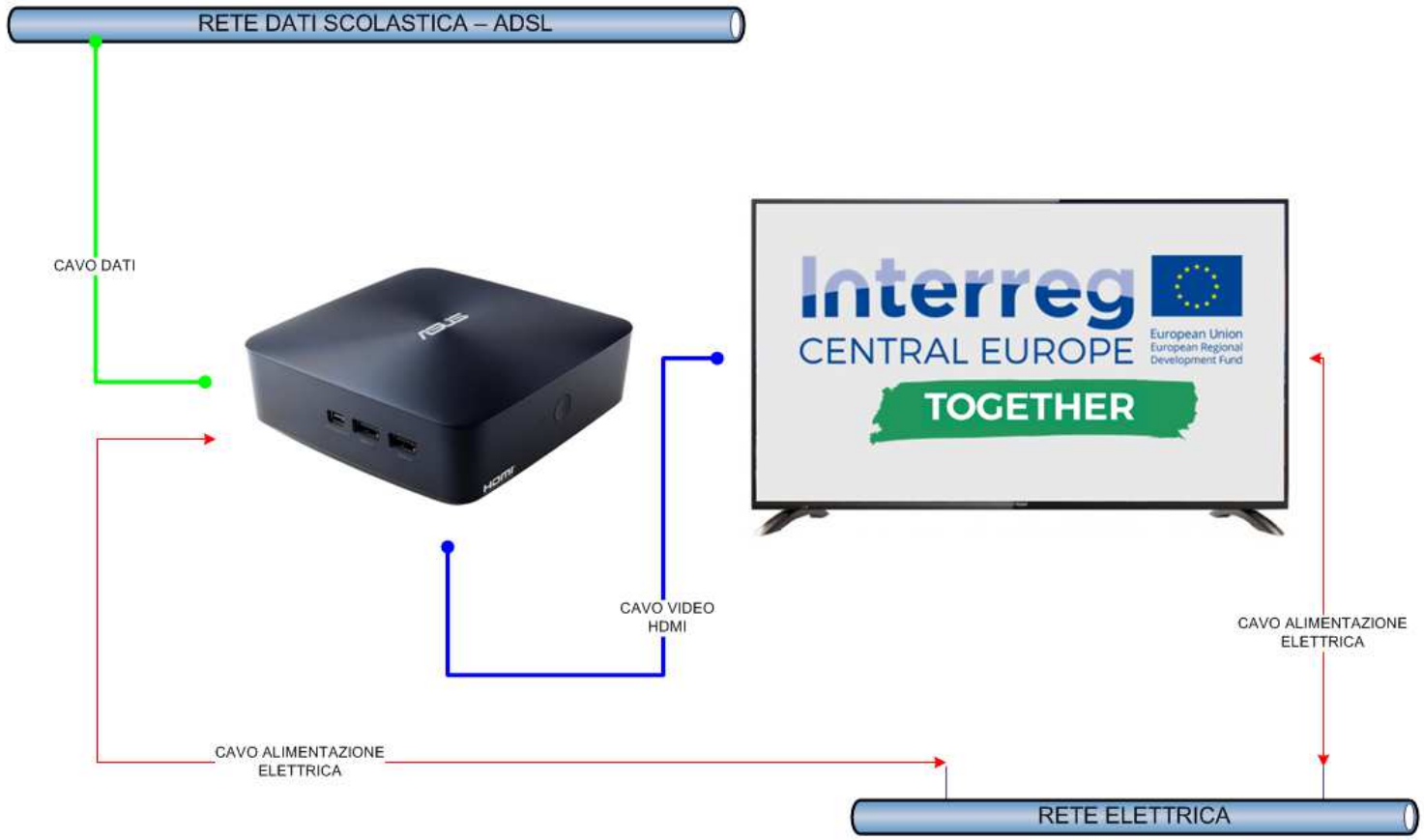
(*) Connected to the EXISTING XMETER

Monitor TV - Showcase:

To favour the dissemination of the results achieved through the project and published on the WEB, in every “BASIC metering installation” a “Monitor TV – SHOWCASE” was placed, directly conneceted to a personal computer connected to the Internet.

N.B. in the “enhancement of existing metering”, the “Monitor TV – SHOWCASE” had already been installed.

Monitor TV - Showcase:

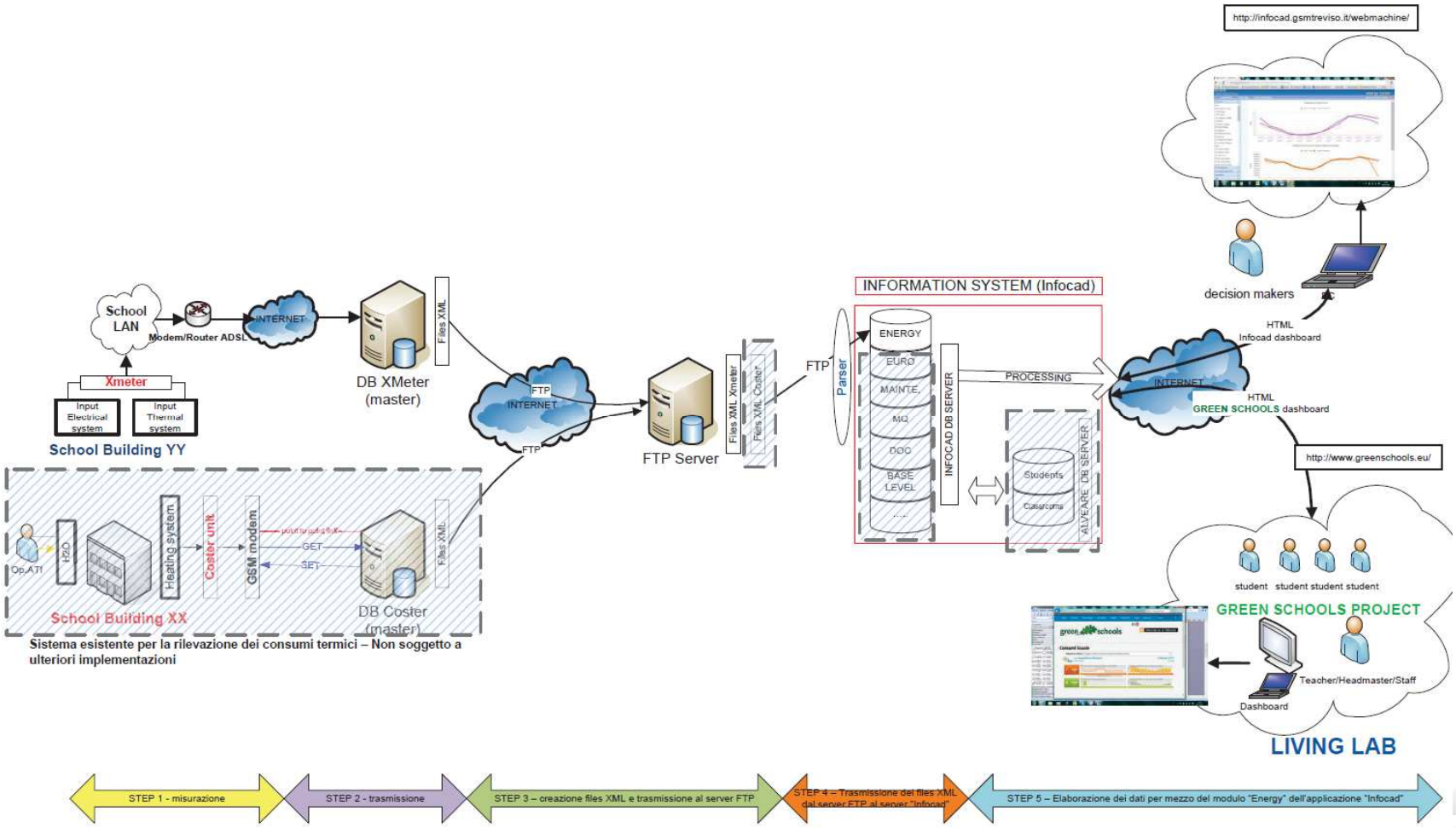


Functioning of the OC and of the Monitor TV - SHOWCASE :

The PC is a compact model with preinstalled O.S. Windows 10 Home. It is placed on the wall behind the TV set and it is directly connected to it. It does not have keyboard and mouse: it is equipped with a remote control software that allows to access it only for maintenance purposes by the staff in charge of mainteining all the SMART METERING equipment present in the building, until the end of the project TOGETHER.

It is configured so that, when it starts, it automatically accesses Windows with non administrator credentials. At the end of the start

Retrieving/archiving flow of the data registered by the SMART METERS :



Retrieving/archiving flow of the data registered by the SMART METERS :

STEP 1 – Measurement;

STEP 2 – Transmission;

STEP 3 – Files export in XML format and transmission to a FTP server;

STEP 4 – Files transmission in XML format from the FTP server to the «Infocad» server;

STEP 5 – Data processing within the Energy module of the Infocad.fm application;

Activation of the data recording

BASIC Metering

(electric and thermal consumption)

Enhancement of the EXISTING metering

(electric consumption)

(thermal consumption)

Consultation of the recorded data

The success of the project is ensured not only by the availability of technological tools, but also by their understanding.

The installed technological package is completed by the transferring of the knowledge that is necessary to make the most of the oppotunities provided by technology.

Consultation of the recorded data: definition of the BASELINE

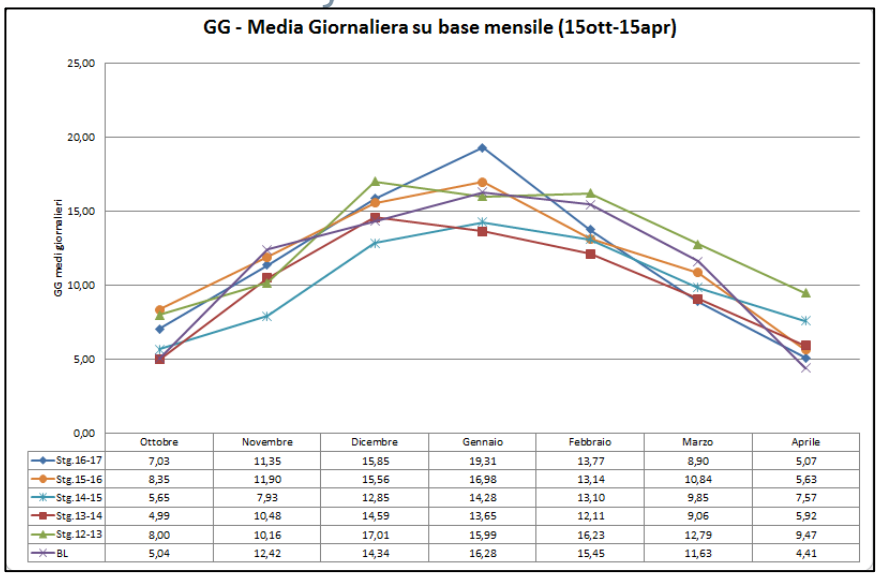
In order to analyse consumption data and consequently define the energy performance of a building, it is necessary to establish a BASELINE

Reading and Analysis of the recorded data: definition of the BASELINE

The THERMAL and ELECTRIC Baselines are calculated:

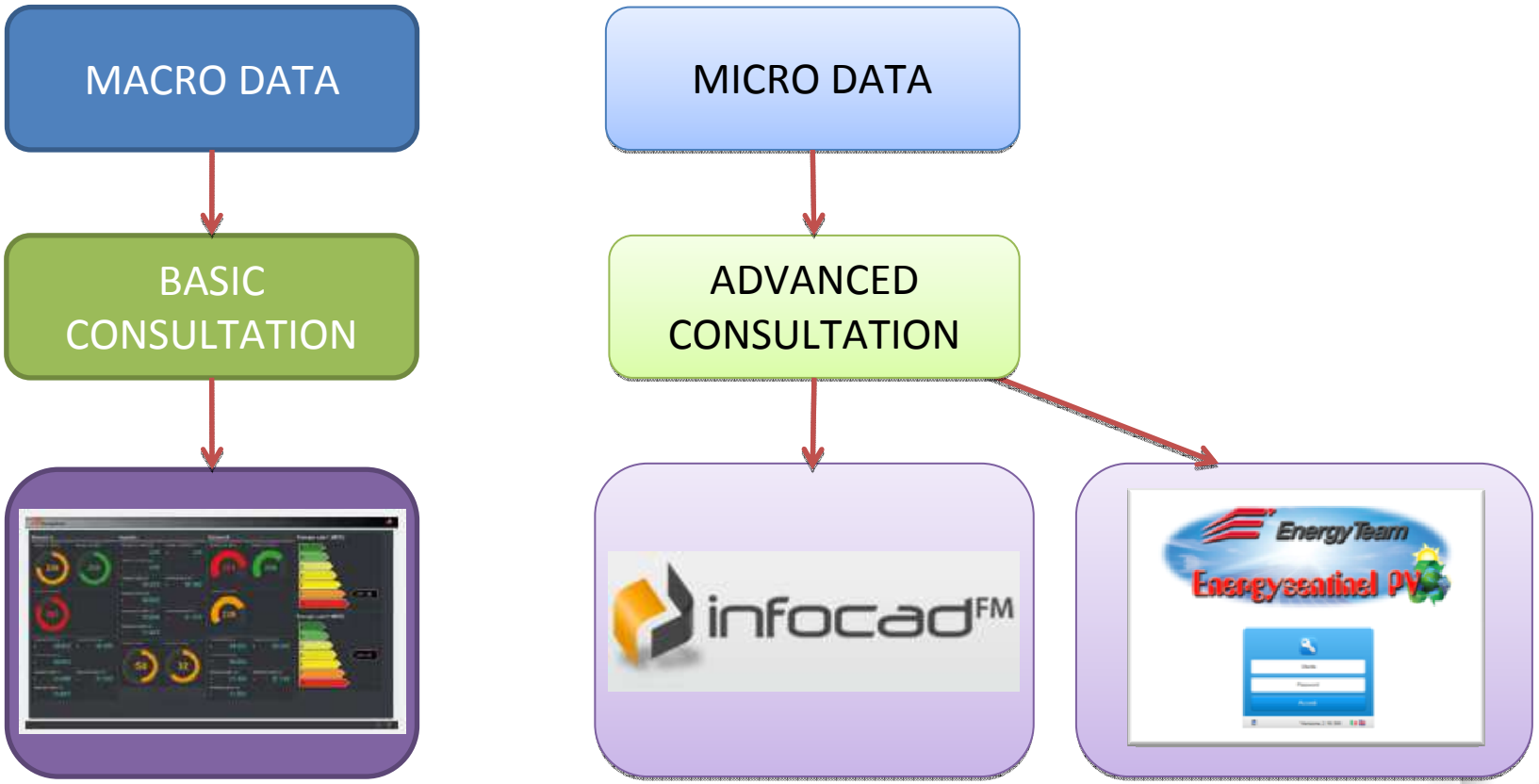
1. starting from the consumption information retrieved through the energy audit of the building (carried out at the beginning of the project TOGETHER).

2. dividing the consumption information described above by weeks and then by days **proportionally to the average weather conditions** (area of Treviso and Conegliano) over the last 3 years.



	Ottobre	Novembre	Dicembre	Gennaio	Febbraio	Marzo	Aprile
Stg.16-17	7,03	11,35	15,85	19,31	13,77	8,90	5,07
Stg.15-16	8,35	11,90	15,56	16,98	13,14	10,84	5,63
Stg.14-15	5,65	7,93	12,85	14,28	13,10	9,85	7,57
Stg.13-14	4,99	10,48	14,59	13,65	12,11	9,06	5,92
Stg.12-13	8,00	10,16	17,01	15,99	16,23	12,79	9,47
BL	5,04	12,42	14,34	16,28	15,45	11,63	4,41

Types of Consultation of the recorded data



Types of Consultation of the recorded data: DASHBOARD

The logic of the DASHBOARD

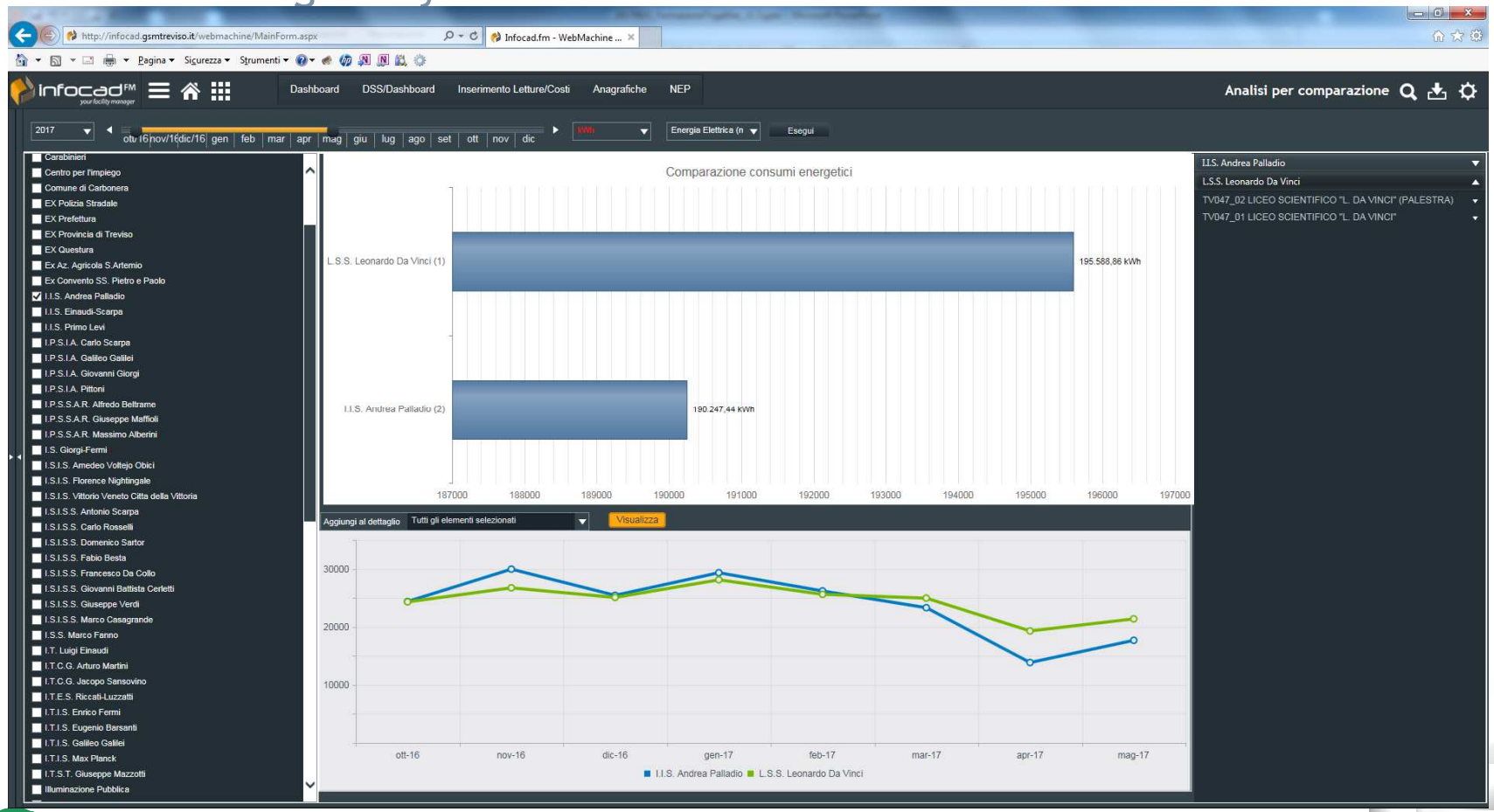
	ESERCIZIO				
Consumo da Baseline (kWh)	2000				
Soglia Obiettivo (%)	8%				
Consumo obiettivo di soglia (kWh)	160				
fascia calcolata	106,6666667				
Consumo misurato (kWh)	**2220**				
Risultato DASHBOARD	Pessimo				
		2160,00	2053,33	1946,67	1840,00
	Pessimo	Scarso	Discreto	Buono	Ottimo
	***				

Infocad.FM®: the information system to process the data

All the data retrieved by the SMART METERS are transferred into the Infocad.FM® information system which makes available a specific area (Energy Center) where it is possible to carry out advanced queries on the single consumption data that have been recorded.

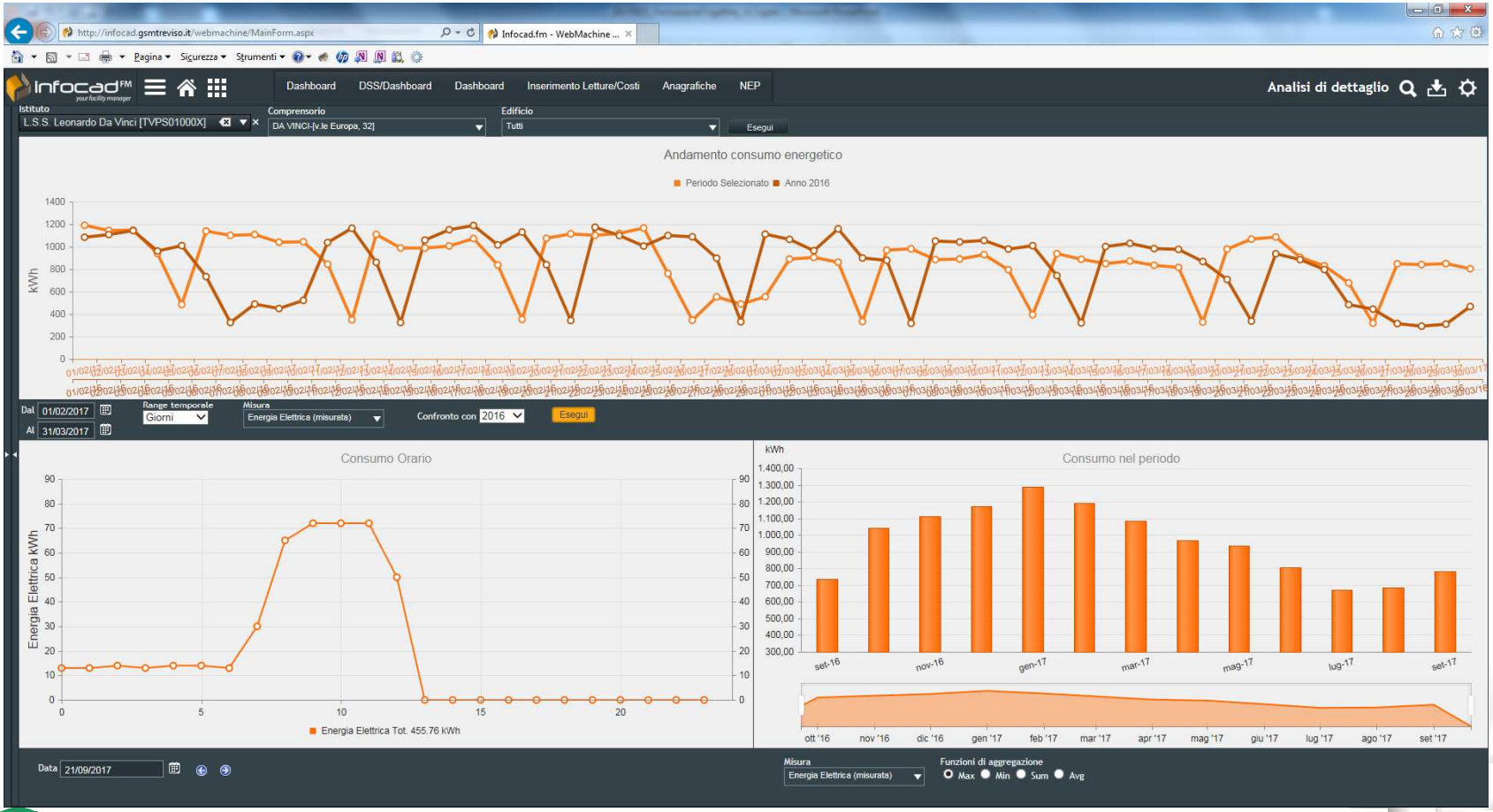
Infocad.FM®:http://infocad.gsmtreviso.it – Energy Center

«Benchmarking analysis»



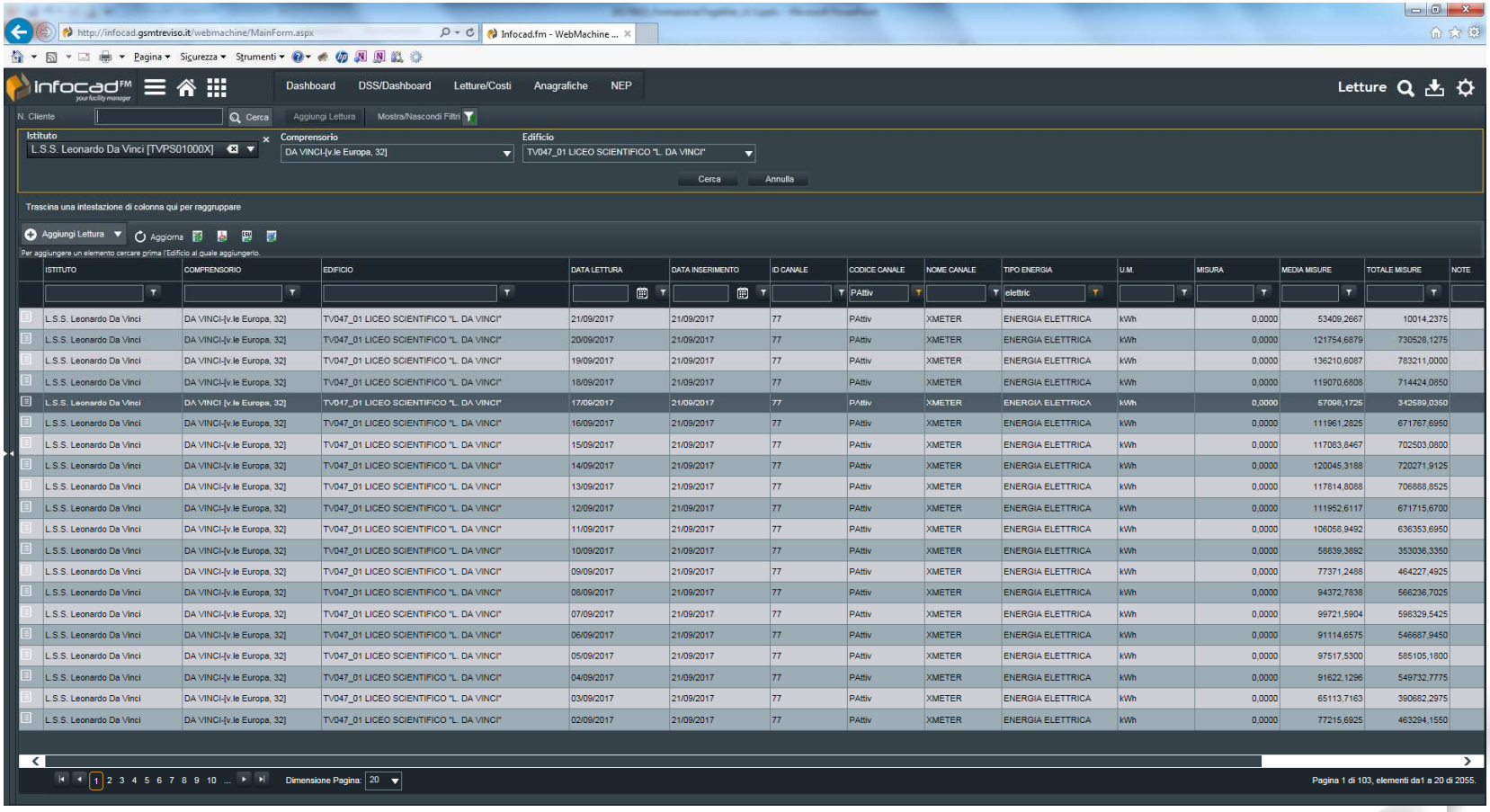
Infocad.FM®:http://infocad.gsmtreviso.it - Energy Center

«Detailed analysis»

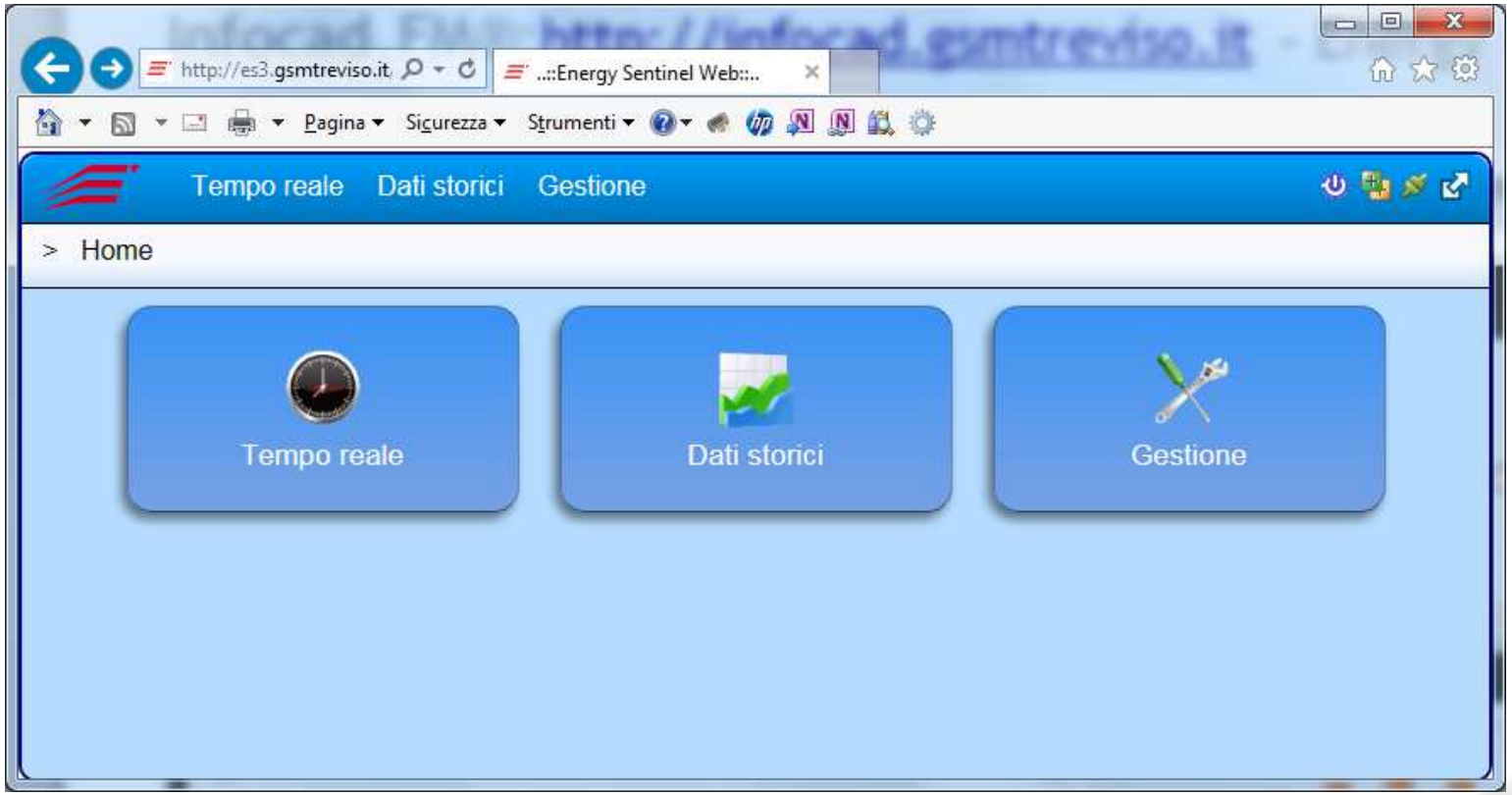


Infocad.FM®:http://infocad.gsmtreviso.it - Energy Center

«Table analysis»

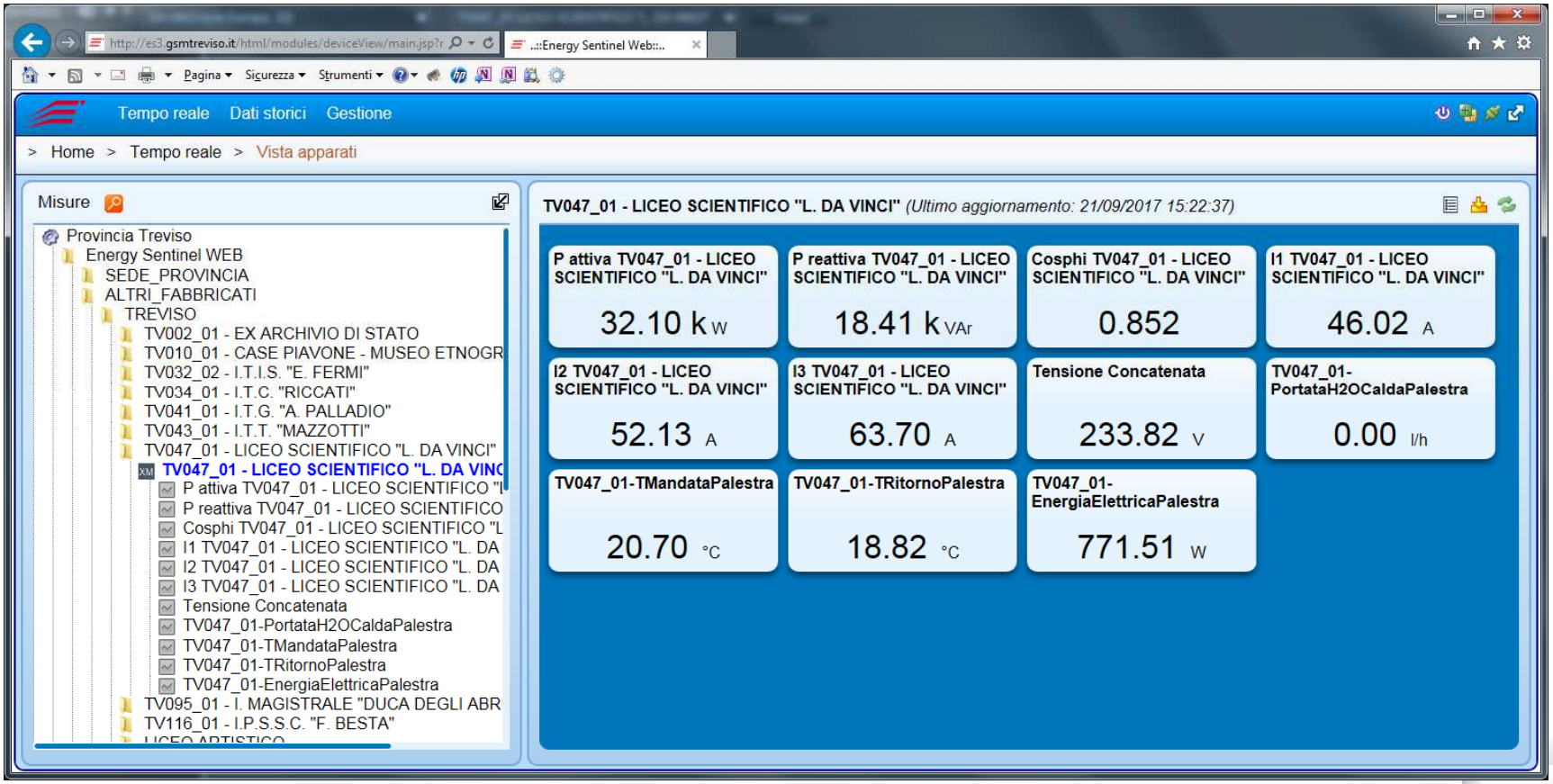


EnergySentinelWEB®: http://es3.gsmtreviso.it



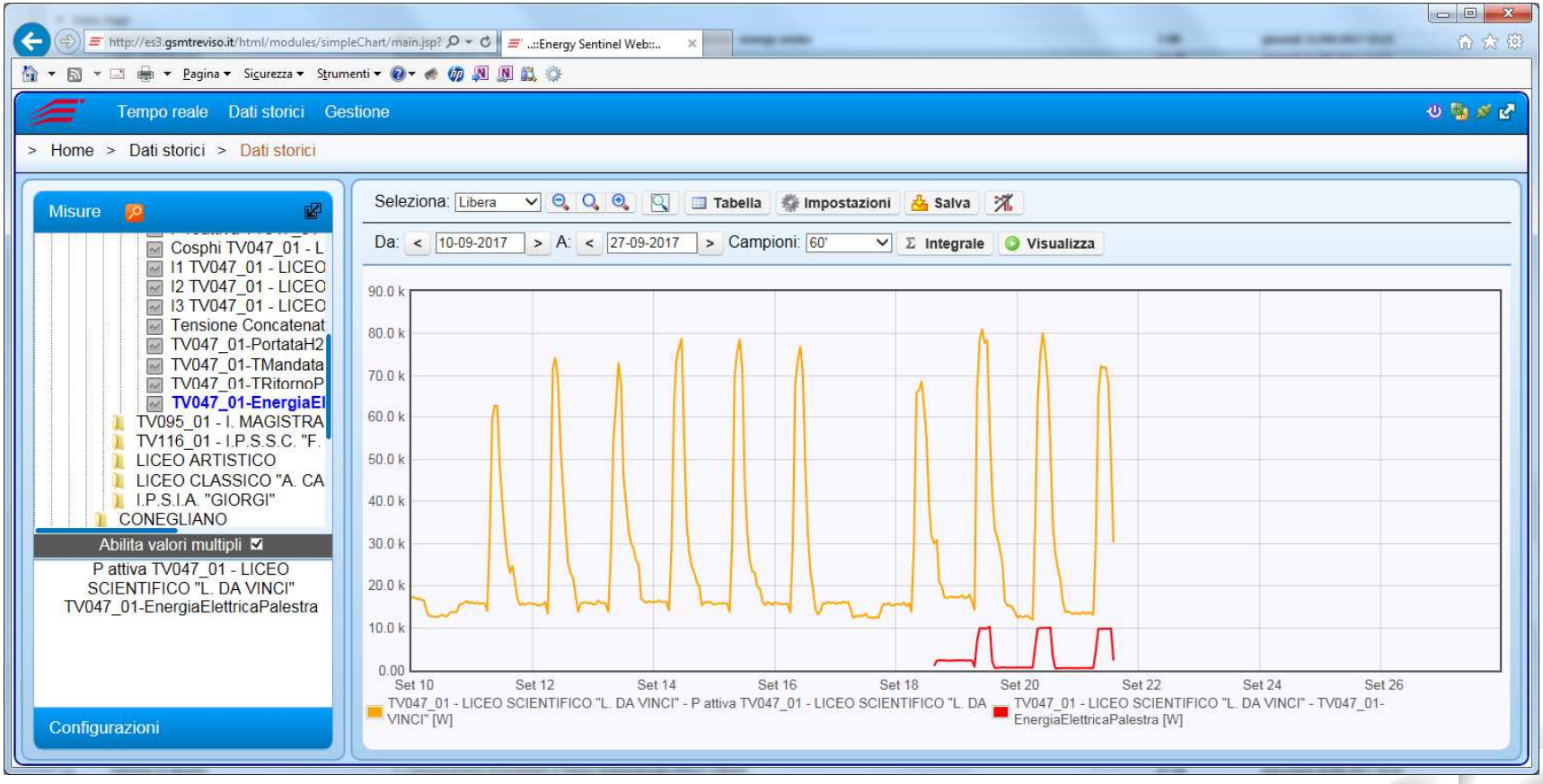
EnergySentinelWEB®: http://es3.gsmteviso.it

Displaying of the consumption values in «Real Time»



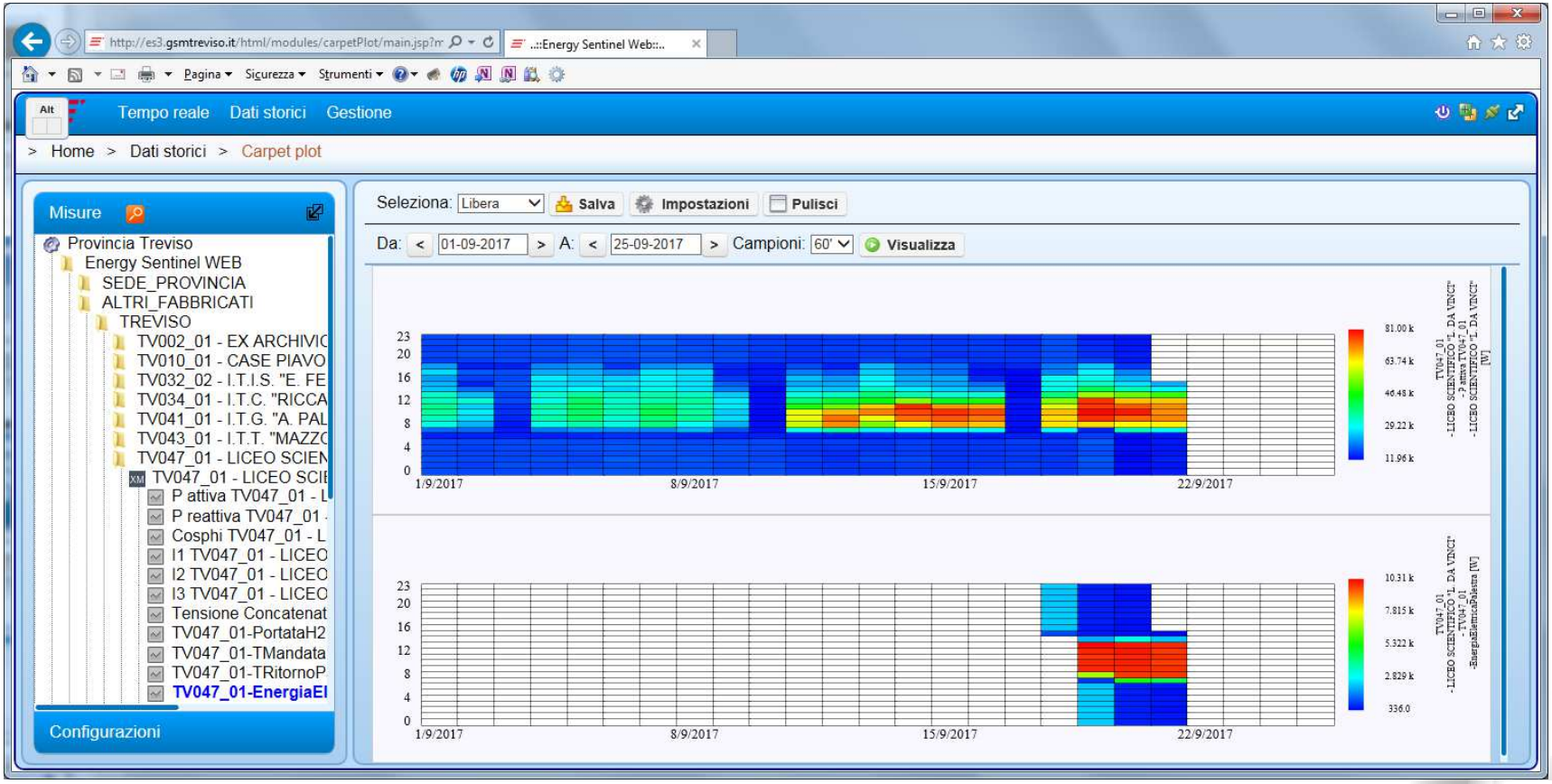
EnergySentinelWEB®: http://es3.gsmteviso.it

Displaying of the “historical” consumption values



EnergySentinelWEB®: http://es3.gsmteviso.it

Displaying of the consumption values in the «CARPET PLOT» mode



What do we want to know about our buildings?

The advanced consultaton interfaces are the tools through which it is possible to get a deeper knowledge of the energy performance of the examined buildings.

However it is intrinsic that the commitment in studying and using these platforms is directly proportional to the depper detail of the studied information.


coffee
time

1. Introduction

2. The monitoring system

3. Why are we measuring?

4. How can we achieve our goal?

5. Technical critical aspects

6. Coming soon

7. Debate

Why are we measuring?

In order to start ACTIONS to reduce consumption, it is necessary to have a goal.

By L. Frasson – M. Pallaro – E. Santinon / Liceo GIORGIONE

1. Introduction

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We don’t have to forget the goal of the project TOGETHER:

*…**the development of methods of energy saving** based on the capacity to change the users’ behaviour and the management modes of the building-system complexes with the support of systems displaying electric and thermal consumption in real time (or, in practice, in almost real time)…*

How can we achieve our goal?

a. Looking at and interpreting the result of the measurement of consumption through the DASHBOARD.

b. Looking at and interpreting the result of the measurement of consumption through the interfaces for ADVANCED consultation.

c. Defining possible actions for energy efficiency aimed at reducing the energy consumption of the buildings participating in the project.

d. VERIFYING the effectiveness of the actions undertaken by punctually measuring, through the available system (with its variuos components), the resulting consumption and the SAVING achieved.

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“You cannot endow even the best machine with initiative; the jolliest steamroller will not plant flowers.”

-Walter Lippmann-

a. A SMART METER NOT connected to the internet, is not «SMART»

The internet connection is essantial to allow the collection of the measured data: **without this component, the measured consumption cannot be transferred to the specific system and made available for consultation.**

b. Variation of the inte[SMART METER]cts in the buildings

The SMART METER exploits the public IP of the connection that is present in the building to connect to the IT system collecting data. **Every time the provider changes, also the public IP address changes,** thus it is necessary to adequately **update** the connection configurations set in the security devices (firewall) of each building.

c. The «Rules of the FIREWALL»: why do we need them?

In an IT network, the FIREWALL is a perimeteral defence component that protects the devices connected through the network itself from potential viruses, theft of information… the implementation of the monitoring system requires the dialogue between the SMART METER and the data collection system through a specific “PORT” (9000) that has to be set in the FIREWALL by specialized IT technicians.

d. Functioning of the «Monitor TV – SHOWCASE»

The **basic consultation** of the consumption measured is done through the DASHBOARD displayed in the «Monitor TV – SHOWCASE» to reach out and raise the awareness of all the building users. For this reason the PC sending the informtation to the monitor (DASHBOARD included) must be ALWAYS on and connected to the Internet. However, it is possible to switch ON or OFF ONLY the monitor in order to reduce the electric consumption of these devices.

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a. **WE HAVE TO FINALIZE THE SETTING UP OF THE IT CONFIGURATION OF THE DEVICES AND OF THE FIREWALL RULES, without which it is not possible to conclude the SMART METER configuraton and, consequentely, it is not possible to start the measurement of consumption.**

b. The DASHBOARD customization is in progress.

c. Setting up and delivery of the credentials to access the advanced INFOCAD.fm ® and EnergySentinelWEB® platforms.

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THANK YOU FOR YOUR ATTENTION AND PARTICIPATION

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CE51 TOGETHER

D.T3.2.1 Definition of the baseline consumption for display on the Dashboard

Summary

1 DEFINITION OF THE BASELINE ELECTRICAL AND THERMAL CONSUMPTION

1.1 Foreword

The baselines relative to electrical and thermal consumption were calculated starting from the values specified in the energy audits and reported on the "DIAGNOSIS" sheet, of the Excel file, attached to this document:

		FABBRICATO	CONSUMI ELETTRICI kWh	COSUMI TERMICI Sm3	COSUMI TERMICI Kwh	ANNO DI RIFERIMENTO
CB804_01	88CM0001	Municipio di Carbonera	51415	8053	76504	2015
CS805_01	TVIC82200L	Scuola "G. Rodari" di Casale	34954	25300	240350	2014
CA806_01	TVIC82300C	Scuola "Vivaldi" di Casier	32614	31386	298167	2015
PA807_01	TVIC868002	Scuola "Casteller" di Paese	96446	35825	340338	2015
CN808_01	TVIC86600A	Scuola media "Brustolon" di Conegliano	60596	67759	643711	2015/2016
CN809_01	88CM0002	Municipo di Conegliano	50525	21689	206046	2015
PP810_01	TVIC861007	Scuola "Moro" di Ponte di Piave	23125	25398	241281	2015
QT814_01	TVIC82600X	Scuola "Ciardi" di Quinto	44780	20613	195824	
SL811_01	TVIC853008	Scuola "Canova" di Santa Lucia	53262		0	2015
SI815_01	TVIC83400V	Scuola "Vivaldi" di Silea	21259	16885	160408	2015
MV812_01	TVIC87800L	Scuola "Alighieri" di Mogliano	30297	7508	71326	2015
MV813_01	TVIC87700R	Scuola "Valeri" di Mogliano	22314	76000	722000	2016 (elettrici) 2015 (termici)
TV047_01	TVPS01000X	Liceo "Da Vinci" di Treviso	252300	69649	661666	2015
CV087_01	TVRI010005	Ipsia "Galilei" di Castelfranco	216600	62604	594738	2016
TV041_01	TVIS019001	Istituto "Palladio" di Treviso	236000	56246	534337	2016
TV043_01	TVTN01000N	Istituto "Mazzotti"di Treviso	310700	57138	542811	2016
CN048_01	TVIS00200G	Liceo "G. Marconi" di Conegliano	140200	50263	477499	2016
CV046_01	TVPC02000B	Liceo "Giorgione" di Castelfranco V.	83200	16709	158736	2015
CN028_01	TVIS00800E	Edificio Sede A ITAS "Cerletti"	147900	31996	303962	2016
CV104_01	TVIS018005	Istituto "Sartor" di Castelfranco V.:	184470	41899	398041	2014/2015
		tutto il complesso senza convitto	97820	23288	221236	2015
		solo convitto	86650	18611	176805	2014

1.2 Definition of the weekly percentage incidence

The first step consists of expressing the baseline (BL) on a daily basis to allow the "*smileys*" to change every day; therefore a BL value must be specified for each day of the year. The total annual consumption - thermal and electrical - reported on the "DIAGNOSIS" sheet must be attributed to a daily value and the percentage of all 52 weeks of the year is determined on the total annual value of 100.

Example:

annual value = 100% of the diagnosis value
week 4: BL-ELE→ 2.53% * diagnosis value; BL-TERM → 4.35% * diagnosis value
week 5: BL-ELE→ 2.48% * diagnosis value; BL-TERM→ 4.21% * diagnosis value
week no.: BL-ELE→ x% * diagnosis value; BL-TERM y% * diagnosis value
Total of the 52 weeks: BL-ELE=100% * diagnosis value; BL-TERM=100% * diagnosis value

The percentage values to attribute to each week are generated differently depending on the type of baseline: thermal and electrical and their method of calculation are illustrated in points 1.4 and 1.5 below.

1.2.1 Definition of the weekly percentage of electrical consumption

With reference to the "PERC_SETT_ELE" sheet of the attached file, a proportion is made based on the recordings obtained from the installations of xmeter in the school buildings performed at the beginning of the GSI.

Hence the **proportionate breakdown per week** of the average consumption of the last 4 years (from December 2013 to November 2017) obtained from exportation by the Energy Sentinel Web system of the values measured for the school buildings (non institutional) is reported on the "PERC_SETT_ELE" sheet. Note that the sample buildings are only school buildings and they were active in all 4 years considered.

1.2.2 Definition of the weekly percentage of thermal consumption

With reference to the "PERC_SETT_TERM" sheet of the attached file, a proportion based on climate is used instead.

Hence the **proportionate breakdown per week** of the average of the degree days of the last 4 years of the Arpav control units in Treviso and Conegliano (column E) is reported on the "PERC_SETT_TERM" sheet: the degree days for each day are found on the "INFOCAD_GG_ELAB" sheet.

1.3 Definition of the daily percentage incidence

After obtaining the percentage of each of the 52 weeks on the annual total, it is necessary to specify the daily value (or incidence), proportioned as follows:

daily value = weekly incidence / 7 * **K**

where K is a "weight" or multiplier assigned to the single day of the week defined as in the following table, starting from the decades of experience of the Province of Treviso, which takes into consideration the startup of the heating plant (multiplier 1.4 on Monday) and the closing of the school buildings on Sunday.

DAYS of the week	Multiplier K	
	Thermal	Electrical
Monday	1.4	1.133
Tuesday	1.1	1.133
Wednesday	1.1	1.133
Thursday	1.1	1.133
Friday	1.1	1.133
Saturday	1	1.133
Sunday	0.2	0.202
Tot	7	7

1.4 Dashboard operation

The "smileys" displayed on the Dashboard are changed based on the consumption value obtained for the day just elapsed (yesterday) compared to the daily baseline value.

For each baseline - thermal and electrical - a "threshold" value is defined a priori expressed in percentage defined at 10% for the electrical and 35% for the thermal.

In order to obtain 5 different types of "smileys" (Excellent, Good, Moderate, Poor, Bad) the value of a specific day of the baseline is taken and the percentage indicated above is applied to define the ranges of values with which to associate the respective smiley, as follows:

1		ESERCIZIO				
2						
3	Consumo da Baseline (kWh)	1000				
4	Soglia Obiettivo (%)	10%				
5	Consumo obiettivo di soglia (kWh)	100				
6						
7	fascia calcolata	66,66666667				
8						
9	**Consumo misurato (kWh)**	**950**				
10						
11	Risultato DASHBOARD	Buono				
12						
13						
14			1100,00	1033,33	966,67	900,00
15						
16		Pessimo	Scarso	Discreto	Buono	Ottimo
17					**950**	