ENERGY MANUAL FOR SCHOOL JOINTLY DEVELOPED BY JUNIOR AND SENIOR

N. DELIVERABLE D.T. 4.5.1.

Energy Manual for school jointly developed by junior and senior

Version 01

12.2018

Edited by PP6 - UNIBO

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CONTENTS

1. INTRODUCTION

Young people can be defined as significant consumers of energy. Teenagers / teenagers today consume around 30% more energy than the previous generation. Despite the awareness of climate change, 85% of 16-year-olds never pick up the phone charger and 86% of 10-year-olds constantly leave the TV and the PC in standby. These guys can be motivated to change; once the students are engaged in energy education programs included in the course of study, 76% of their families have changed their attitude or have invested in the implementation of actions aimed at saving energy. In fact, kids can become real "energy consultants" for their families and change their habits.

SOURCE: (Towards Effective Sustainable Energy Education for a Low Carbon Future, Energy Efficiency Partnership for Homes, 2007).

The project activity of E @ S aims to go beyond the usual thematic lessons on energy. In fact, educational tools will be adopted that will make children explore the energy issues through demonstrations and practical applications, making them commit to implement positive actions and behaviours in their school and in their future life.

2. WHY A PROJECT ON ENERGY FOR SCHOOLS?

You can perfectly integrate energy-related issues with current disciplines and provide the student with more knowledge and possibilities in the field of work. This would allow a continuous and replicable activity that is certainly more effective.

- Children are great users of energy and a greater awareness of the environmental problems related to it has the purpose of changing their behaviour;
- Young people can develop skills that will enable them to better manage not only energy consumption within their school and home;
- Families are more easily reached by the children, they must guide the behaviour of their parents;
- School education can also play an important role in solving local and global problems associated with energy consumption;
- The children will be the decision makers of the future and it is important for them to become aware of these issues.

To discover the objectives and activities of the European Energy @ School Project, visit:

http://www.interreg-central.eu/Content.Node/ENERGYATSCHOOL.html

3. BENEFITS FOR SCHOOL

The E @ S Project represents an opportunity to enrich schools 'scientific, geographical and civic learning programs and develop students' skills;

Through the work that will be carried out in collaboration with the technical and educational team, teachers will have the opportunity to increase their skills and safety in dealing with energy matters with their students;

The programs and documents related to energy efficiency, carefully developed for the E @ S project, will help to implement energy saving actions, will consequently contribute to lower emissions into the atmosphere and to root these practices in the life of the school, home and in future workplaces;

Within E @ S a series of educational tools and educational material has been developed, which will be made available to all project partners also through a cloud and open source system, TRELLO, available at the site:

https://trello.com/b/w1KXmXls/energyschool-project

- E @ S offers an opportunity to build relationships with the scholastic and working world of other European companies;
- The didactic directions will be able to perceive that, following the results obtained thanks to the methodologies used and the skills acquired by their students and their teachers, the energy consumption of the school (and therefore the economic management costs) have decreased.

4. SCHOOL PREPARATION

Establish the JEg's Team

As part of the E @ S project one of the main priority actions is to establish a school action group, SEG's - Senior Energy Guardian's and JEG's - Junior Energy Guardian's, which includes key local actors in order to engage in the activity design.

The choice of the students to be involved is up to the school, therefore teachers will be required to involve a free number of motivated children belonging to different classes. Schools will be able to select the group of students that will constitute the energetic team by following the following four steps:

- Recruitment - the SEGs collect voluntary nominations among students after they have been presented to the purpose of the ENERGY @ SCHOOL project and the role / responsibilities of JEGS.
- Screening - the SEGs perform an initial screening of candidates. The selection can be done through the development of a specific test.
- Group Interview - the group selected by screening undergoes a group interview to assess the social "behaviour" of the candidates.
- Individual interview - the decisive phase of the selection selected by the group interview. On this occasion, the candidate must adopt the attitude and language of a persuasive communication.

(FOR MORE INFORMATION ABOUT JEG'S SELECTION SEE THE ANNEX A)

5. THE AIM OF JUNIOR ENERGY GUARDIANS

The role of the energetic team will therefore be that of:

- Be a leader in school design activities;
- Take responsibility for data collection, monitoring and updating the information on the project to their classmates;
- Lead the class to make decisions necessary to achieve the reduction of energy consumption in the school;
- Representing the school within the E @ S Project Group, through the implementation of monitoring and periodic reports on consumption trends;
- Try to increase awareness and energy awareness in the school community.

The energy team will have a very important responsibility especially since it will work to examine the energy situation of their school, shall:

1. make an inventory of the consumption of the classrooms present
2. identify the most energizing rooms
3. select the classrooms to be monitored
4. to suggest objectives for the reduction of consumption through the strategic action plan, ECAP, Junior Energy Action Plan;
5. monitor and identify the use of energy, costs and carbon dioxide emissions using the application of E @ S during the Gamification phase.

At the beginning of each activity, it is certainly planned to install sensors for monitoring electrical and thermal consumption, by the technical project team, in each school involved.

6. HOW TO DO THE ENERGY CONSUMPTION BASELINE BY A TRAINING EXERCISE

SEGs have to arrange a training exercise focused on the energy culture in order to develop the Energy Culture Action Plan of the JEGs. The structure of the ANNEX DOCUMENT A 4.3.1 permits to assist SEGs through simple or more technical notions during the different phases of the training exercise:

1 – INVENTORY -, JEGs have to make the inventory of all the energy consumptions of the equipment (lamps, computer, printers..) into the classrooms and common rooms using the specific templates;

4 - ELABORATION – the data from inventory will be elaborated and discussed between SEGs and JEGs in order to decide the classrooms and common rooms having the highest energy consumptions. The energy consumptions in the individual classrooms or common rooms are strictly linked to the presence of persons and to the temperature for a right comfort. JEGs have to organize the monitoring of the school using the specific templates in order to realize the basic energy consumption profile

2 - ORGANIZATION –. JEGs will elaborate a specific map of the entire school complex in which will be evidenced the individual classrooms chosen to be monitored;

3 - EXECUTIVE – this is an operative phase for the data collection for the monitoring of specific consumption (See paragraph).

4 - COMPLEMENTARY – each week the filled templates will be sent to the Joint NOC at the UNIBO research group. Periodically Joint NOC will send back to the school an update of the energy consumption profile a discussion between SEGs and JEGs in order to implement, if it is necessary, the monitoring management;

5 – FINAL – the training exercise will get the basic energy consumption profile of the school and a monitoring management of the highest energy consumption classrooms and common rooms. On the basis JEGs have to elaborate their Energy Action Plan scoped to increase the energy efficiency of the school.

The expected result of the training exercise by JEGs is to fill the template identifying the school energy situation. This is the necessary baseline for playing to the energy simulation game.

Template to identify the school energy situation

In each classroom and common space the JEGs should make the inventory of the equipment energy use. In fact, to become more energy efficient, it is important to know how energy is currently being used.

Equipment and appliances typically account for approximately 20% of a school's energy use. Much of this energy use occurs when the equipment is not in use (in standby mode). Standby loads look small but because they are running continuously they can amount to a large energy use. Reviewing your power bills and checking off -peak energy use, and by using an electronic power usage tool can measure this.

The template 1 assists schools to determine their energy use and type. It will provide the base information for improving both energy efficiency and energy sustainability. Ideally, students use the template as part of their learning. Improving energy efficiency is a gradual process. Once you have identified what energy you use and where, choosing two or three priority areas may best does making change. The JEGs should try to reproduce the energy profile in each classroom and common space.

[ENERGY CONSUMPTION (Wh) vs TIME (hours) for each day of the week]

In order to establish the thermal comfort, in general the vertical distribution of the temperature in the room should be 23°C at the level of the head and 17°C at the level of the feet with a difference of no more than 3°C.

The thermal comfort depends on the specific activities which are carried out into the room (i.e.: lesson, sport, eating, break-time,…).

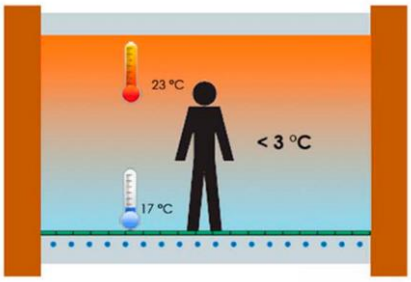


FIGURE 1: **Distribution of the room temperature for an optimization of a thermal comfort.**

SCHOOL:							
ROOM (Specify the type of classroom, for example: computer lab, chemistry lab, meeting room, kitchen, cinema room, class 3B, ...):							
Energy use	**Details**	**How many**	**Load in working**	**Time on**	**Load in stan by**	**Time on**	**Use**
			Watts	**Hours per day**	**Watts**	**Hours per day**	**Kwh per day**
Lighting	Lowenergy lamps						
	High energy lamps						
Equipment	Computers						
	Printers						
	Photocopies						
	Projectors						
	Whiteboards						
	Faxes						
	TVs						
	Video recorders						
	Speakers						
	Others(Power Tools, Fridges, Microwaves ...)						
TOTALE Kwh/ day:							
DATE: __/__/____							
JEG:							

TEMPLATE 1 - INVENTORY: The first template is an inventory, in which it is required to specify the devices present in each of the chosen classrooms, their power and duration of hourly operation per day.

(FOR MORE INFORMATION ABOUT JEG'S TRAINING EXERCISE SEE THE ANNEX B, First and Second Part)

7. HOW TO DO THE JEG's ACTION PLAN

The action plan consist of a set of goals/activities for improving energy efficiency.

Each school can establish a portfolio of energy efficiency goals based on the indications by the ENERGY@SCHOOL technical audits.

Assessing potential energy savings helps determine an appropriate portfolio of goals that are clear and measurable.

Each school has to establish both short-term and long-term goals for improving energy efficiency.

A regularly updated action plan is a necessary roadmap toward meeting portfolio wide energy efficiency goals.

Create an action plan, involves establishing energy performance targets based on the energy consumption inventory.

To promote energy efficiency in schools, the following good rules of conduct are recommended:

- Switch off or not switch on the lights when there is a good condition of natural light.
- Turn on or keep the lights on when there is little natural light (if there are several switches, only one part can be turned on).
- Take care of switching off the lights when changing the classroom and at the end of the lessons.
- Take care of turning off the lights in the bathrooms.
- Turn off the lights left on when the school closes.
- Before the entrance of the students keep the lights off.
- Use the headlights only in conditions of poor natural light.
- At the end of the hours of physical education, turn off all the headlights of the gym.
- Ensure the sustainable use of computers and photocopiers or other electrical equipment by including energy-saving options in PCs.
- At the end of the working day, turn off all the lights and the various electrical equipment, avoiding to keep the standby lights on.

Junior Energy Guardians will describe each action scoping to reduce the energy consumptions by the following scheme:

a) responsible for the action;

b) description of the action;

c) on which consumption falls: electrical or thermal

Action involves changing people practices and behaviour.

All the actions have to be reported in the following template:

JEGs ENERGY ACTION PLAN *(Please, make one for each action identified)*			
Responsible for the action	Description of the action	On which consumption falls	
		Electrical	thermal

(FOR MORE INFORMATION ABOUT JEG'S TRAINING EXERCISE SEE THE ANNEX B, Second Part)

8. HOW TO MONITOR THE RESULTS

The installed smart meter in each school takes electricity and gas data at regular intervals on switchboard and display the data via online portal or display device. However, the data from the smart meter are not generally open data and thus it is difficult takes directly the data from each device to be sent by an online portal to the control cabin at UNIBO. Furthermore, the indicators of the presence of people into the rooms as well as of the temperature into the working places are not generally recovered by specific sensors to be interconnected online and then they have to be collected by a manual procedure.

Smart meter for the collection of general electrical and gas and/or thermal energy data – the smart meter should make an up-date each one hour and the data should be reported on a digital display to be easily checked-out by the Junior Energy Guardians. The data to be collected and transformed in kWh when reported with different unit of measurements in a specific template.

Meter of consumption of electricity for devices in working and stan-by phase - For the compilation of the first table it is also requested to insert the energy absorption of the various devices, which may vary according to their mode of operation. In this regard we can use a small object, very easy to use, known as the meter of consumption of electricity, very easy to find, available in the electricity department of supermarkets or hardware stores, or even online.

It is an electronic device with a display, which is inserted between the socket of our appliance and the electrical outlet in the wall. As soon as it is connected, the device

will measure the current flow, then calculate how much electricity is consumed during the use of the appliance in question.

How does it work?

The display shows the consumption in real time in Watt, in Ampere, the power peaks: the data are automatically saved to review them calmly. On some devices, it is possible to set the cost related to its range of use to directly view consumption expressed in Euros.

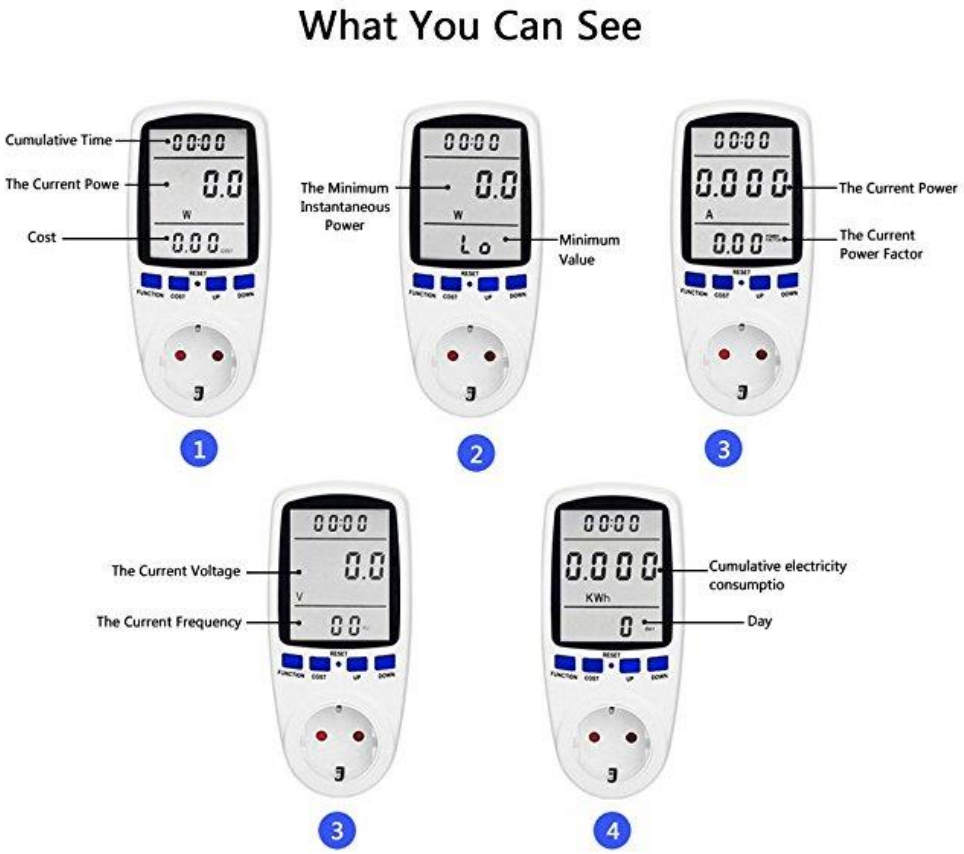


FIGURE 2: Representative image of a meter of electrical consumption.

Presence of people in rooms - this data collection should be organized with a manual reporting using presence or not presence of persons during the working time into the school. The presence of people will be periodically checked by the Junior Energy Guardians and reported in a specific template.

Temperature in the working class - this data collection should be organized with a manual reporting using digital thermometer or a fixed one during the working time into the school. Temperature will be periodically checked by the Junior Energy Guardians and

reported in a specific template. WARNING: do not detect the temperature by placing the thermometer near heat sources (radiators, pc, refrigerators and similar), near windows and doors, because they could alter the actual consumption result, being areas characterized by a strong excursion and / or thermal dispersion.

FIGURE 3: Example of a digital thermometer to be used for the manual monitoring of temperature in the chosen classroom.

FIGURE 4: Example of classic thermometer to be used for the manual monitoring of temperature in the chosen classroom.

The training exercise will permit to normalize a method to collect the data using different smart meter and in the absence of electronic sensors for the presence of people and for the temperature.

9. WHEN TO PERFORM THE RELIEFS

Electricity and gas consumptions provide a variety of information if they are periodically collected that can assist schools to understand their energy usage during the working days and all the detailed analyzes that follow. JEG's are asked to carry out surveys, every day, and more precisely:

1 - in the morning as soon as you before to go into the classroom;

2 - halfway through the day;

3 - in the afternoon before to leave the school.

Therefore, three surveys are requested per day, for four different consumption details, for each of the selected classes!

10. THE JEGs' TOOLS TO MONITORING THE ENERGY ACTION PLAN

The application has been developed in order to convey more easily the energy lessons expected for small Energy Guardians. It was considered, strategic and interesting, the possibility of tackling such important issues through the Game, in fact the youngsters could respond with greater participation and assimilate the teachings with awareness, thanks to the applied theory of Learning by doing.

The application allows you to simplify messages of energy sustainability making them immediate and direct thanks to the operation provided by the different levels established in the game, both for the school and domestic version.

All the children involved in the E @ S Project can really become timeless Energy Guardians, because they can understand effortlessly, also learning specific techniques of monitoring through the game, allowing children and not only, to be Guardians of energy in every action outside and within the scholastic context and at every age of one's life.

11. SCHOOL REGISYRATION FORM

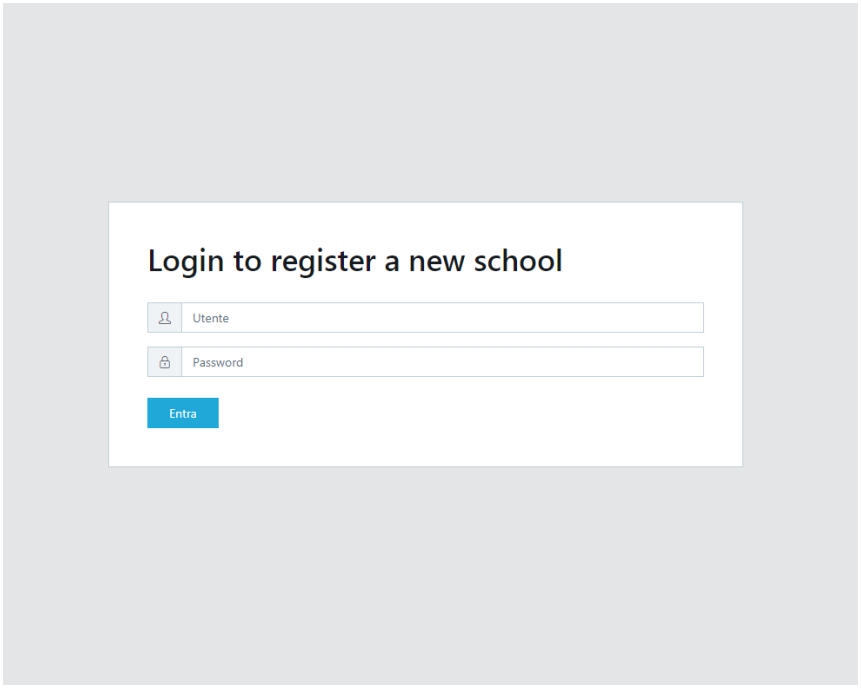
To create a new school you need to access the following URL:

https://energyatschool.finmatica.it/#/registrationlogin/

with the following credentials:

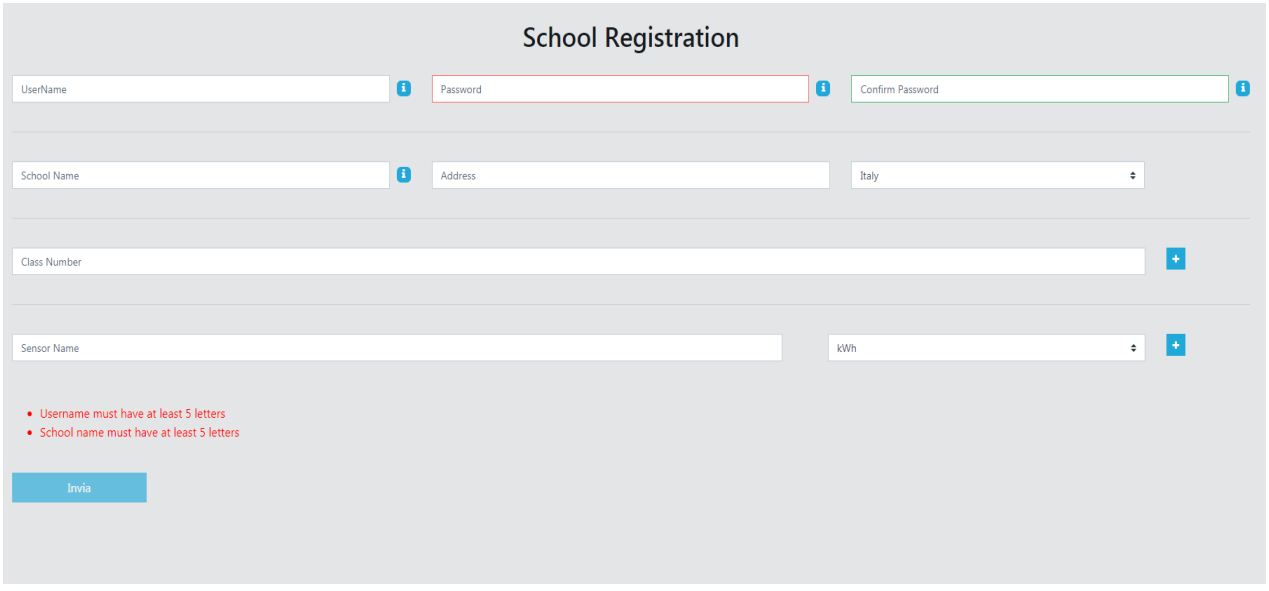
User: registration

Password: europe2018

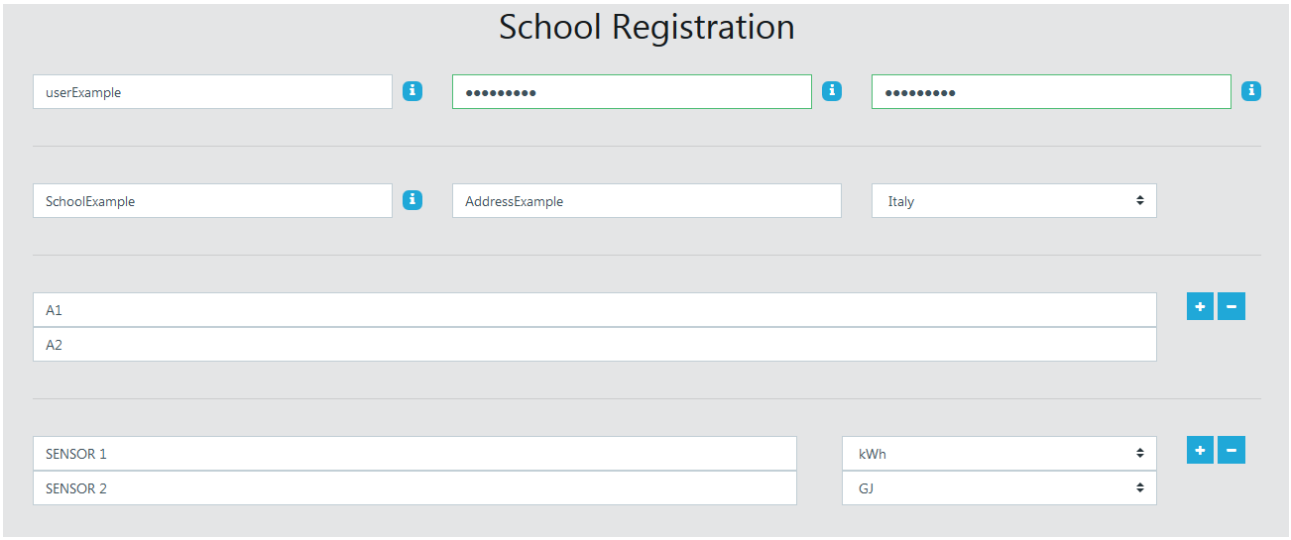


The data that must be provided for registration are as follows:

- Username and password of the user with whom the application will be accessed. It is suggested to use the userNameScuola syntax, in order to avoid creating users with the same name (in this case the system goes into error).
- Name of the school, address of the school, country of belonging
- Class names (with the + on the left a line is added)
- Names of the sensors and relative unit of measure (with + a line is added)

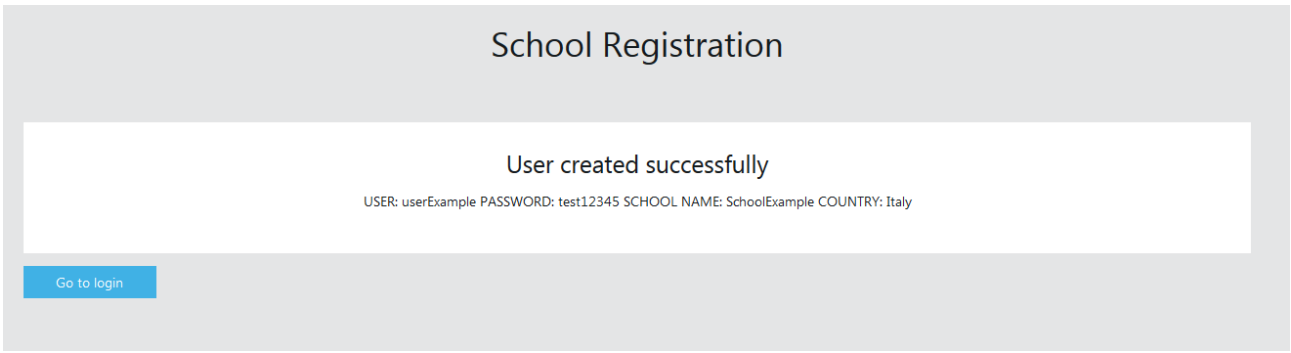


The following is an example of completing the form:



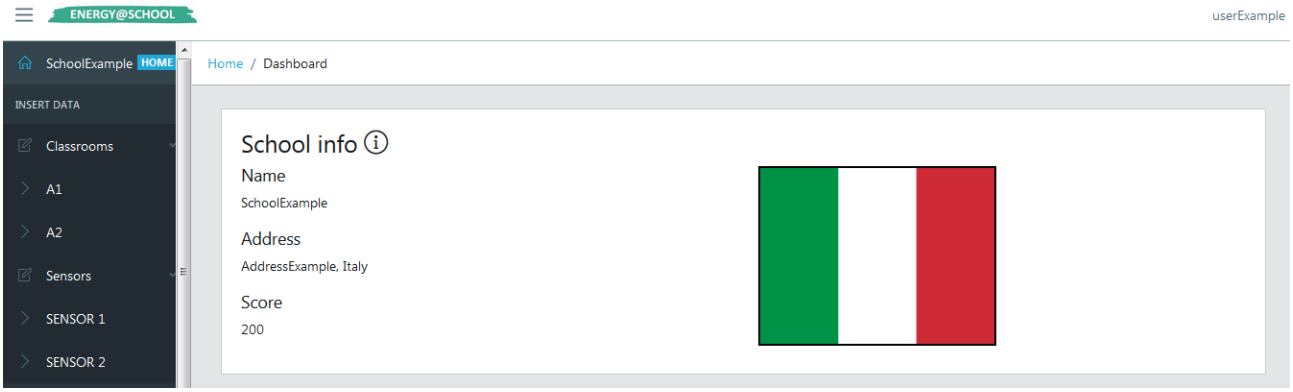
By submitting the form you get the registration of the school (the process can take a few tens of seconds) and the result is displayed in a summary screen that contains

- user
- password
- school name
- country of belonging



Once the user has been created, you can log in using the Go to login button.

In the example, then you will use the credentials userExample / test12345 and you will have access to the SchoolExample school (see the following figure):



NOTE

1) Each school and its user must be created only once. In case of errors in the creation process it is necessary to contact the support group.
2) When creating the class and sensor lines, each line must have a unique name. The system goes wrong if there are:

- two classes with the same name
- two sensors with the same name
- a class and a sensor with the same name

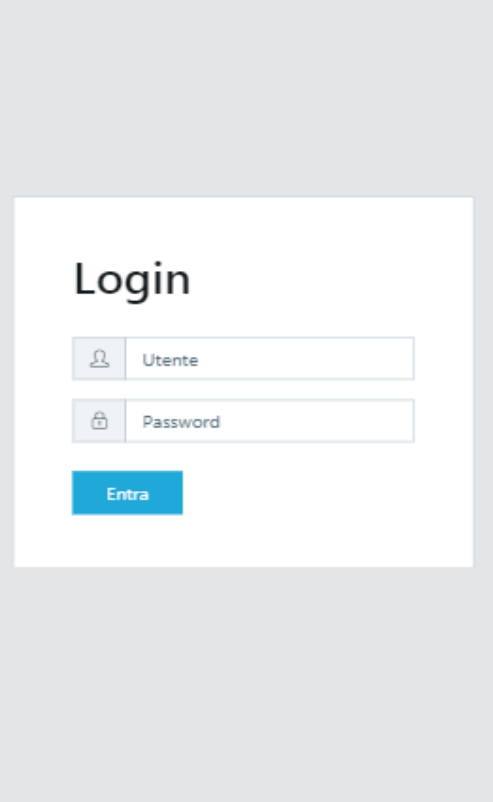
12. AUTHENTICATION AND AUTHORIZATION

LINK TO LOGIN IN THE APP:

https://energyatschool.finmatica.it/#/login/

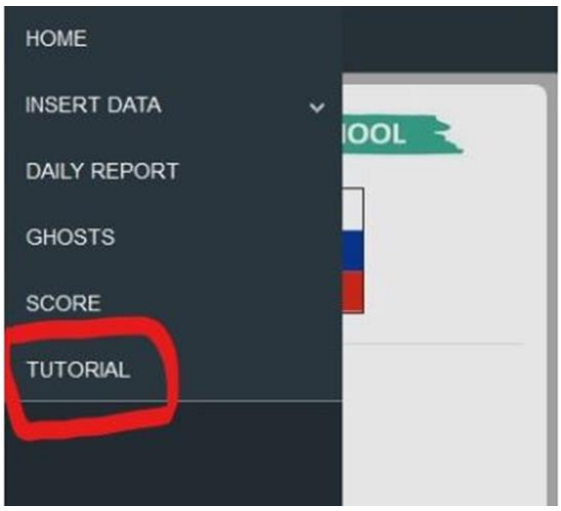
For each school there will be a list of Energy Guardians users, who will be inserted and profiled to access only their school data.

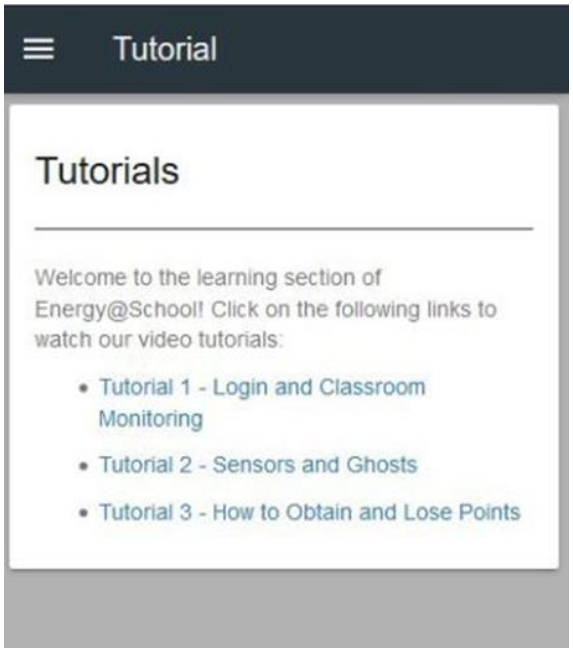
Each Energy Guardians user will have access credentials available to log in:



SCREEN 1: Access to the monitoring system

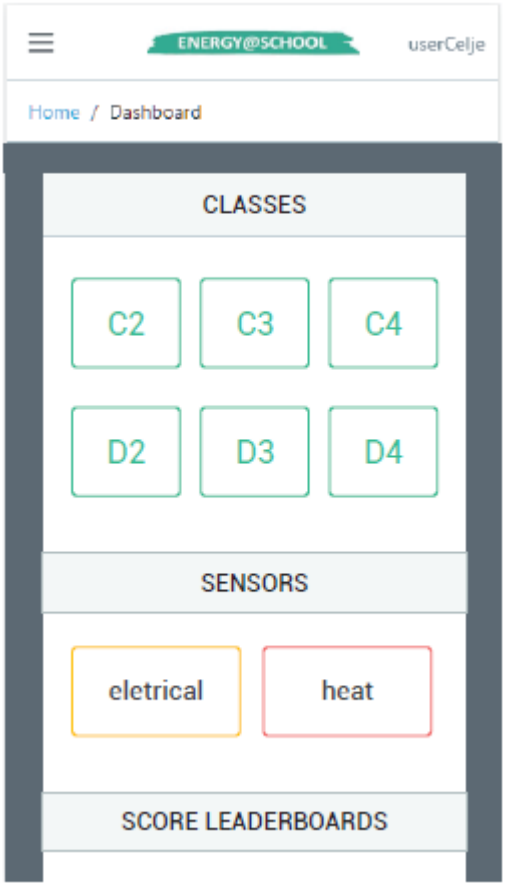
In the Application opening screen, you can find the tutorial tab in the HOME on the left, opening it you will find the reference to the three videos tutorial about HOW TO USE THE APPLICATION FOR MONITORING.





HOME PAGE

The home page will give access to the classes and sensors with colored buttons presented immediately after login (in addition to the access already provided in the menu that can be opened from the burger icon in the upper left).

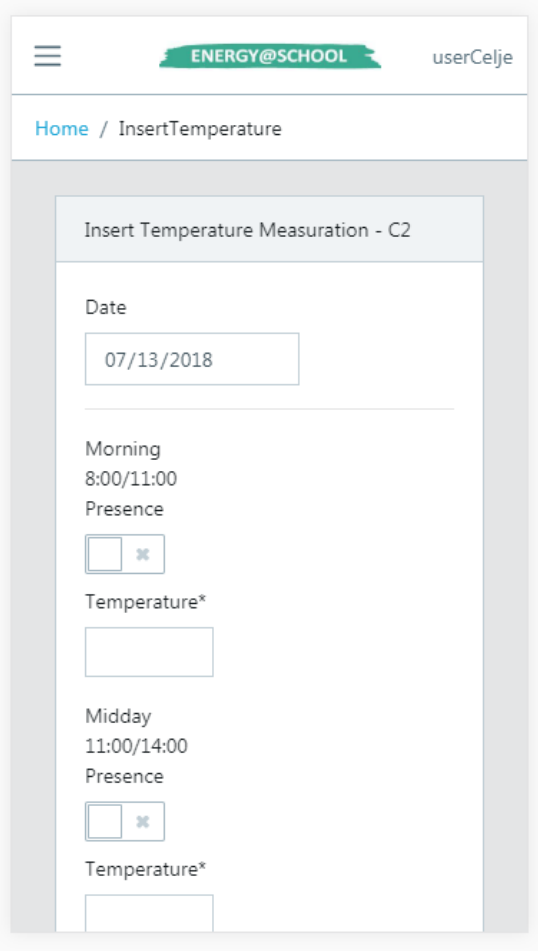


SCREEN 2: Screen of access (HOME PAGE) to detailed information for classes and sensor.

DESCRIPTION OF DATA ENTRY FUNCTIONS FROM THE APP

CLASSROOMS

From this page you can enter the measurements (in degrees Celsius) concerning the temperature inside the various classes monitored day by day.



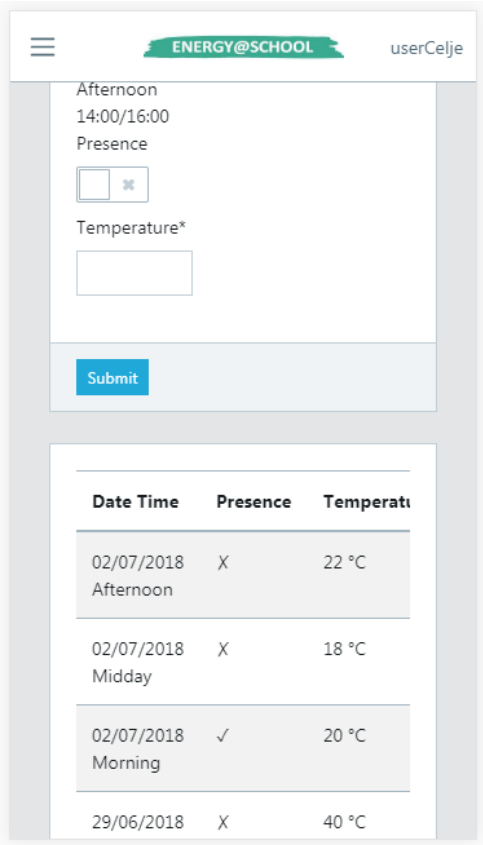
SCREEN 3: Detailed Screen for temperature detection.

The collection of data has no constraint but by entering them on time you can earn a point.

In the entry form you must respect the indicated time slots (Morning, Midday, Afternoon) and signal the presence or absence of people inside the room by ticking the relative box.

In the event that one of the recorded temperatures does not fit into the well-being area (which is between 18 and 22 degrees), a thermal phantom will be created which can then be analyzed and resolved in the dedicated "Ghosts Summary" screen.

Scrolling down you can view the temperature history and clicking on the last day you can correct any errors by changing the values in the form above.

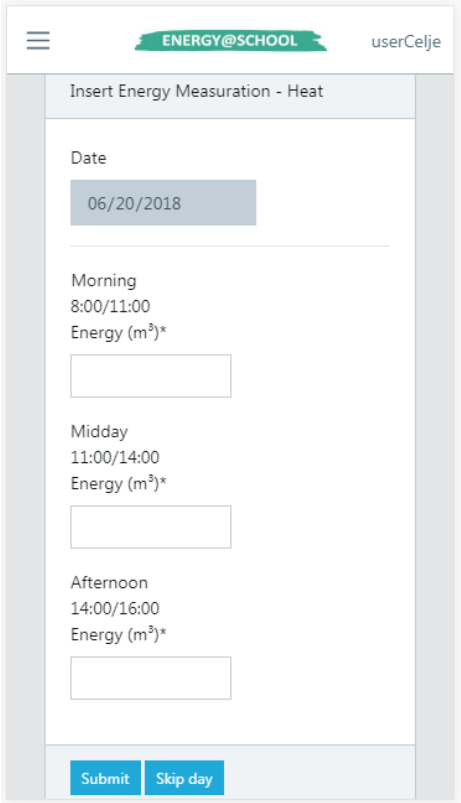


SCREEN 4: Detailed Screen for temperature and presence detection.

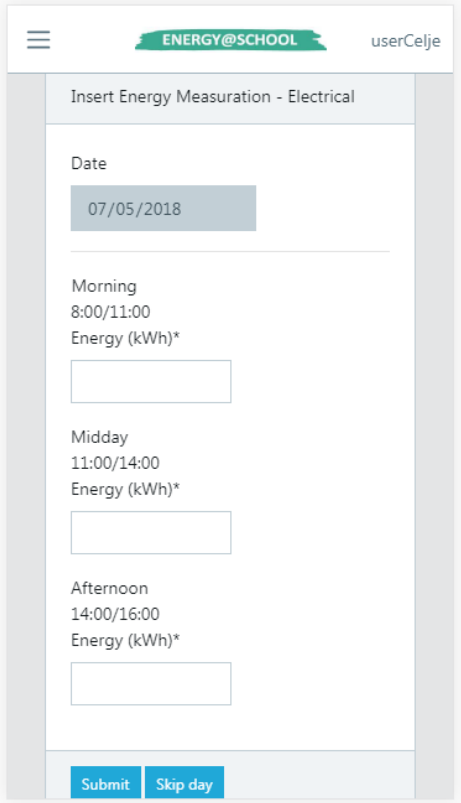
SENSORS

This page presents some differences with the previous one in the following points:

- The data must respect the indicated units of measure (kWh, m^3, Mwh, etc.)
- The data must be the current value and not the already calculated delta
- Data entry must be sequential because the presence of holes would cause incorrect calculations on energy consumption delta and on averages (the date will remain blocked for this purpose)
- Mondays will be estimated consumption on Saturday and Sunday using minimum consumption data
- In case there is a forgetfulness and the data are not available for a certain day it is possible to generate them automatically in order to continue with the following days (NB: this procedure should be avoided as it may distort data collection by creating negative deltas or very large, so every time you use "Skip day" the score will decrease by one point)
- The latest data entered cannot be changed



SCREEN 5: Detailed Screen for heat detection during the three time of the school day



SCREEN 6: Detailed screen of electrical detection during the three time of the school day

DAILY REPORT

The graph of the energy consumption of a sensor (to be selected via the drop-down menu) compares, through the use of a histogram, the average consumption of that sensor with the consumption of the day (chosen on the calendar) divided into the three time slots.

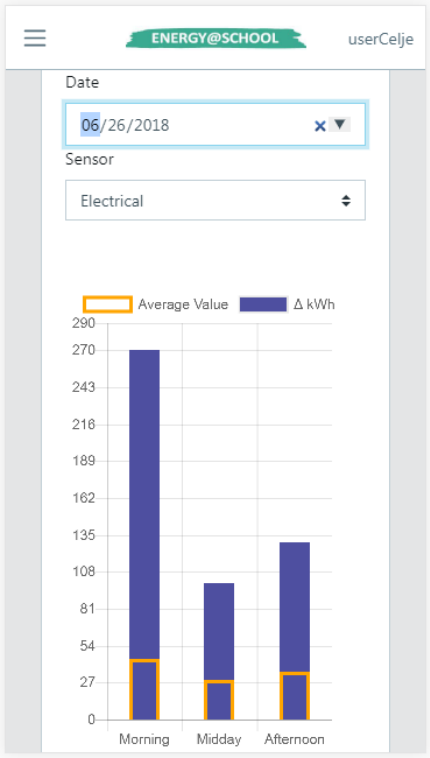
HOW TO READ THIS DATA:

- The blue bar (delta relative to the selected day) when it is lower than the orange line (average value) shows a positive conduct
- If the blue bar exceeds the orange line of a difference greater than a fixed reference value (5%) it means that the behaviour was not optimal and, consequently, a ghost appeared.

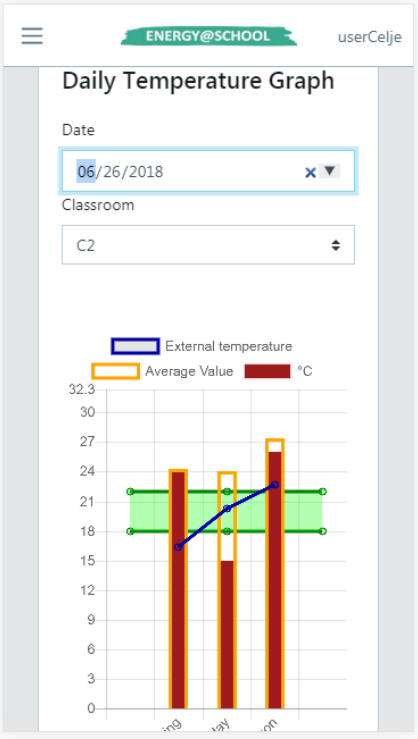
The graph of the daily temperature works in a similar way to the previous one but brings into play two other factors, namely the external temperature (represented by a blue broken) and the wellness band (the green band that extends from 18 to 22 degrees)

HOW TO INTERPRET THIS DATA:

- The outside temperature gives an idea of the situation outside the school during class hours
- The red bars (band temperatures) that are not part of the wellness zone, in addition to causing a ghost indicate a more or less serious problem based on how much difference is present
- Orange lines not within the wellness band indicate a persistent problem present in the selected class to be resolved as soon as possible



SCREEN 9: Detailed screen about daily electrical graph.



SCREEN 9: Detailed screen about daily temperature graph.

13. MANAGEMENT OF A GHOST BY JEG'S

GHOST is the anomaly generated by an increase and / or a reduction in consumption compared to the average of the monitored time band.

The JEG will take care of the investigation, trying to understand what was the room that generated greater consumption or behaviour (lights in the hallway, projection of a movie) that increased electricity consumption.

In case of high consume, a generic ghost is shown, the JEG signals the consumption anomaly to the SEG and will manage together the identified waste, analyzing all the possible determinants of that day; for example, if a high-grade ghost is often reported. The JEG evaluates with the classmates and the SEG the level of comfort of the school and discusses how to reduce energy consumption by reducing the temperatures in the classrooms without reducing comfort.

If the ghost is a warm ghost type, the JEG can evaluate together with the SEG whether to carry out corrective actions such as acting on the convectors if present or on the radiator valves; for example, two ghosts are reported, a warm ghost in class 1B and a frozen ghost in class 3A. Class 1B is aimed at SOUTH while 3A is NORTH. Together with the SEG there are considerations on how the arrangement of the classes with respect to the sun changes the temperature and how the radiators should be regulated accordingly, if possible. (For example, by means of thermostatic valves).

If the ghost is of the frozen ghost type, in addition to corrective actions on the convectors the JEG can signal the problem to the SEG for a possible action on the isolation of the room; for example, a frozen ghost is always reported in the chemistry lab. However, the laboratory is only used a few hours a week, so it is not necessary to heat it even when not in use, thus reducing energy consumption.

Each ghost, identified by daily time slot, constitutes the loss of a point while, in the same way, any accrued savings will constitute the purchase of a point if it has not neglected the state of well-being.

GHOSTS SUMMARY

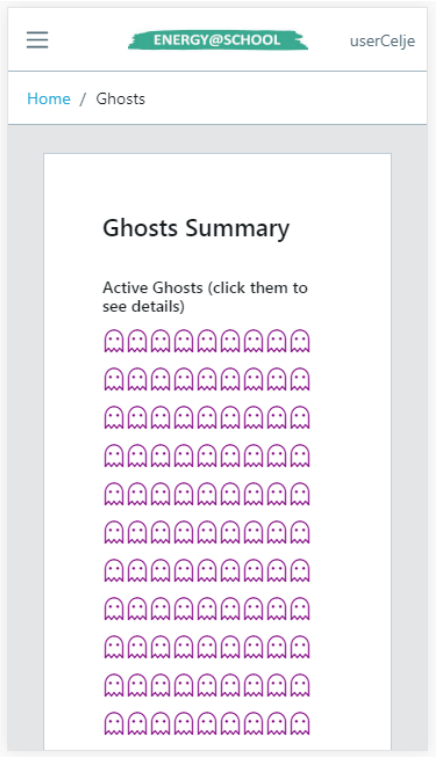
All the ghosts are summarized in this screen, which in addition to offering the details of the various ghosts (both open and closed) gives the possibility to solve them by realigning the score.

In fact, for each ghost created 10 points will be subtracted, while for each "closed" ghost 10 points will be returned to the school.

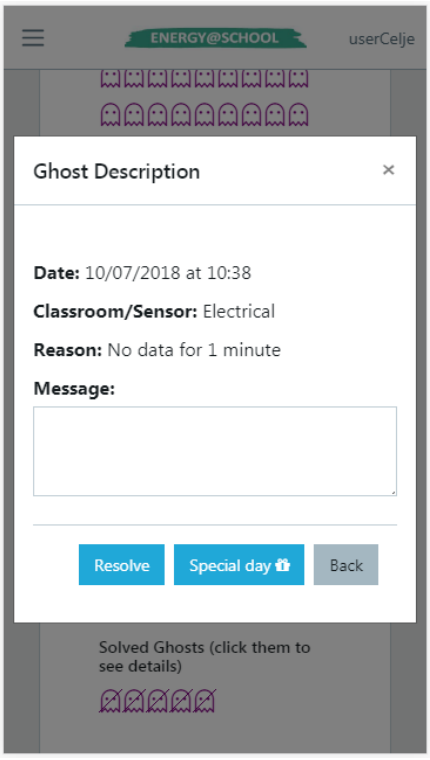
By clicking on the ghost you will have access to all the data necessary to understand the causes and possible methods of resolution; once the data of the current day have been entered, you can try to delete the ghost, clicking on "Solve" there will be a check of the

correctness of the data and if the answer is positive you can close the ghost adding an optional message.

For all special occasions (such as a school party or a screening of a movie) you can close the ghosts without any control by pressing "Special Day".



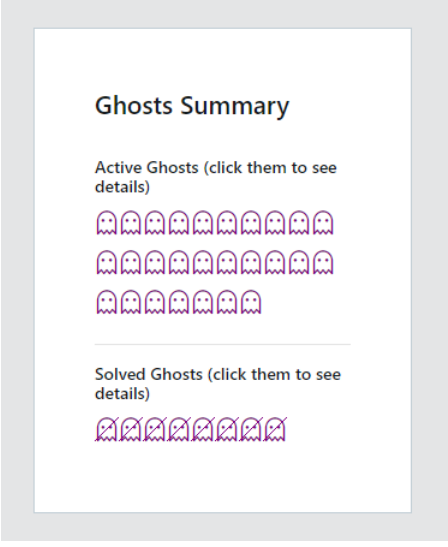
SCREEN 10: Detailed screen of the active ghosts.



SCREEN 11: Detailed screen about open ghosts' s details.

EXAMPLE GHOST MANAGEMENT AND SCHOOL SCORE

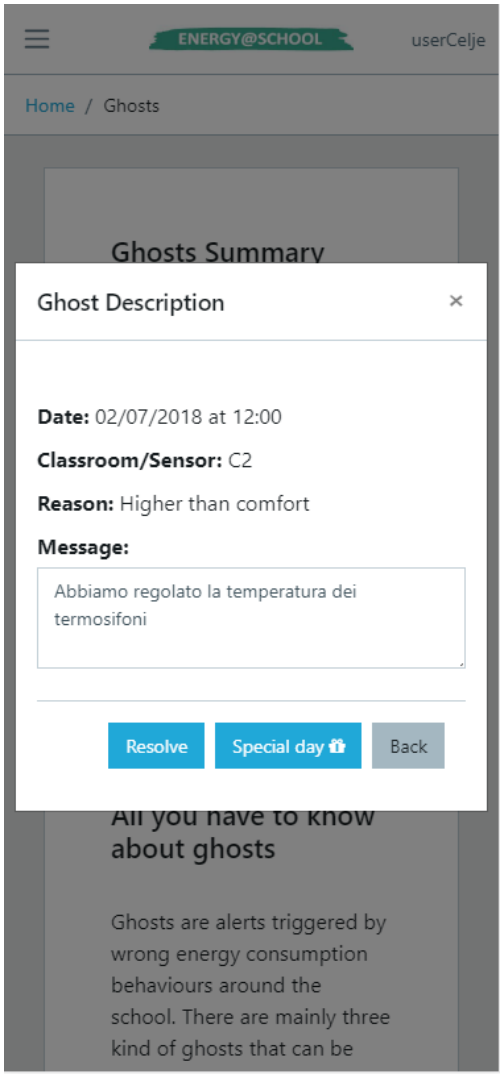
To earn points the JEGs will have to check the ghosts that have been generated and arrange to resolve them. To perform this task the JEGs will have to use the Ghost Summary, in which they can control the situation of the ghosts still open and those already resolved.



SCREEN 12: Detailed screen about Ghosts summary.

Suppose that a JEG intends to solve a thermal ghost like the one in the previous example where the temperature exceeded the zone of well-being **(See: D.T.2.2.4, Paragraph 6, Screen 10 and 11)**.

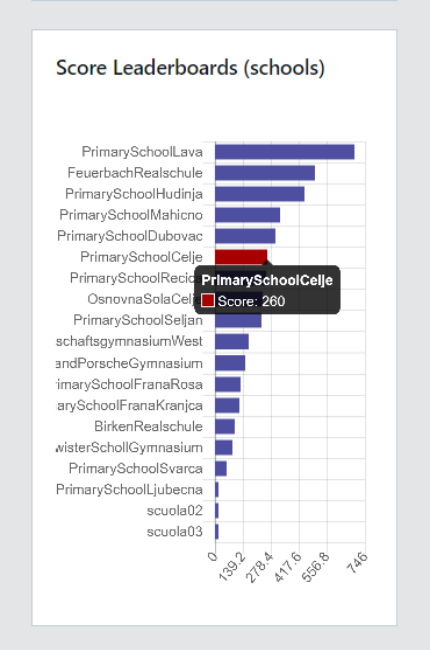
The JEG will have to open the ghost detail and write in the "MESSAGE" section what action has been taken to solve it.



SCREEN 13: Detailed screen about open ghosts' s details.

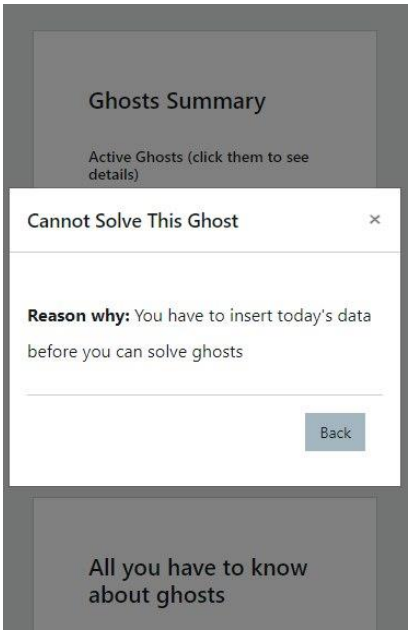
The ghost will be inserted among those resolved only if no other ghost of the same type has been presented on the current date. The resolution of the ghost will bring a positive score of 10 point.

The current score of the single school can be seen in the Score Summary, while the comparison between the scores will be present on the main page:



SCREEN 14: Detailed screen about Score Leaderboards.

In the event that the JEG wants to solve a ghost but the measurement values have not been entered for the current day, then a warning message will be generated to warn that it is not possible to resolve the ghost:



SCREEN 15: Warning message that you see if you have not entered the daily consumption data.

ANNEX A

QUALI-QUANTITATIVE CRITERIA TO SELECT JUNIOR ENERGY GUARDIANS IN EACH SCHOOL

GUIDELINES

N.DELIVERABLE D.T4.1.1.
Version 01
03.04.2017

Edited by PP6 UNIBO and PP4 KSSENA

CONTENTS

1. THE AIM OF JUNIOR ENERGY GUARDIANS

Student interest through the energy team could be raised with projects like ENERGY GAME. The opportunity for students to run an energy game would be an added incentive to focus their work. For participating at the energy game, the students have to carry out further energetic audits by which they can observe that improvements to reduce consumptions could be made through behavioural change. Saving energy sometimes costs nothing, yet derives benefits that may be environmental as well as financial.

To plan for reduce energy consumption; the students have to find out first what kind of pattern of use were for the devices.

The following approach should be use:

a. Gauging the equipment energy use in the school;

b. Meeting with the Senior Energy Guardians;

c. Development of a junior action plan;

d. A student campaign.

This work would develop a junior cultural action plan to be continuously implemented across the school and focused to save energy.

The student time taken in this work is estimated to be about 100 hours and has been undertaken by four students as a voluntary exercise. These four students will be selected by a test and they will constitute the team of Junior Energy Guardians in the school.

Students can carry out this work in future as part of the curriculum.

2. GAUGING THE EQUIPMENT ENERGY USE IN THE SCHOOL

Equipment and appliances typically account for approximately 20% of a school's energy use. Much of this energy use occurs when the equipment is not in use (in standby mode).

Standby loads look small but because they are running continuously they can amount a large energy use. To become more energy efficient, it is important to know how energy is currently being use. The students, coordinated by the Junior Energy Guardians, will have to note where energy is being used filling out the template of the energy consumptions in each classroom. The JEGs will collect all the templates and will determine the energy consumptions in the common area and in the classrooms led by busy teachers filling out the template of the total energy consumption. The template will be supplied in the Junior

Culture Action Plan Guidelines. While the Senior Energy Guardians could delegate or share responsibility for reducing inefficient energy use, this objective need to become part of a school strategy. In this way, students can start the change independently.

3. MEETING WITH THE SENIOR ENERGY GUARDIANS

Junior Energy Guardians will meet with the Senior Energy Guardians to discuss their energy audit and the data of the total energy consumption collected with the template. They have to define a strategy in order to reduce the energy consumption revealing a number of items left on unnecessarily.

4. DEVELOPMENT OF A JUNIOR ACTION PLAN

JEGs have to meet the students in each classroom in order to share and discuss a strategy. They have to plan how raise awareness about energy use among their peers.

JEGs have their focus on the development of a shared Junior Action Plan for improving energy efficiency with a gradual process. Once JEGs have identified and shared what energy the school use and where, the Junior Action Plan should choose two or three priority areas to be changed.

5. A STUDENT CAMPAIGN

The challenge of the JEGs is to tell students that they are wasting energy and encourage them to change.

JEGs should be able to do this:

a. Present initial findings to the students in each class at a meeting without any judgment and suggestions;

b. Canvass students for their opinions through survey

c. Invite students to a follow-up meeting for detailed presentation of an Action Plan.

There is much more to energy efficiency than measuring usage and setting policies. The team of JEGs is essential. For maximum impact, Senior Energy Guardians have to involve periodically JEGs providing them with information and seeking their ideas.

Energy saving is primarily about behaviour change. Discuss this with staff and encourage them to support each other to change the culture of energy use.

SEGs and JEGs should be a ***joint team*** discussing progress regularly for encouraging themselves to support the program.

On the basis, ENERGY@SCHOOL will develop an ***energy game*** in order to stimulate the students by the JEGs to make a competition with the European schools for the reduction of the energy consumptions.

6. CRITERIA TO SELECT JUNIOR ENERGY GURADIANS IN EACH SCHOOL

The team of the Junior Energy Guardians will be selected by the Senior Energy Guardians.

The aim is to select competent and highly motivated young people to create culture of energy in their peers.

JEGs will work together with SEGs for the development of the Junior Culture Energy Plan in order to remove the wasting energy in school as well as to support the general energy plan of the school.

Criteria for the selection is a process to identify four students eligible to fill the role of JEGS based on knowledge and skills but also personal qualities and psychosocial resources.

The selectors are the SEGs who must take into account that does not exist, in general terms, students "right" or "wrong" students to fill the role of JEGs: the selection process should not be aimed at assessing outright student but must identify those candidates that best meet the characteristics of the role to be filled. SEGs and JEGs team must do experience aimed to change and personal growth.

The selection process is necessary to distinguish in four phases:

- **Recruitment** - the SEGs collect voluntary nominations among students after they have explained to them the purpose of the ENERGY@SCHOOL project and the role / responsibilities of JEGS.

- **Screening** - the SEGs perform an initial screening of candidates on the basis of knowledge of the subject and the knowledge of English. The selection can be done through the development of a specific test developed by the school's teachers.

- **Group Interview** - the group selected by screening undergoes a group interview to assess the social "behaviour" of the candidates.

- **Individual interview** - the decisive phase of the selection is for an individual interview with a small group of candidates selected by the group interview. On this occasion, the candidate must adopt the attitude and language typical of a persuasive communication, trying to prove to be adequate to hold the position of JEGs

6.1 Group Interview

The group interview is to take place between a group of 5-10 candidates of the students selected in the screening phase who should be mixed for different types of age because of the activity of JEGs will cross over all classrooms. The group interview has to be managed by one or more teachers in accordance with the SEGs.

The collegial assessment exercises to allow free role to simulate the activities of the team and to achieve a goal through the participation of a group that should select 4 students as representative of the same group of students.

The aim of this phase will be to select a number of representative teams, which will have to participate at the final individual interview.

The purpose of this phase is to observe the way in which the candidates to become JEGs move within a heterogeneous group.

The SEGs will provide a theme that runs from track to begin a discussion with the other members of the group; arguments can be different, such as news stories, fantasy stories and school problems. The topic should not deal with the energy problem.

The selectors observe the candidates in carrying out the task and do not intervene in any way: this allows detecting the interpersonal dynamics and attitudes of individuals. Each group it naturally tends to stratify and to give someone the role of leader.

The methodology used is that of a simplified assessment centre to identify the set of behavioural and individual quality characteristics required the student to enter the JEGs team.

The ability to evaluate is many including:

- Communication skills;
- Power of influence;
- Ability in working group;
- Relational capacity;
- Negotiation and organizational skills;
- Leadership and the power of influence;
- Trend towards collaboration or competition;
- Adaptability;

- Degree of autonomy and independence of thought.

The advantages offered by the assessment centre consist especially in decreasing the incidence of subjectivity of the evaluators. In addition, the exercise must have limited time and offers the possibility of obtaining various information about the candidate that otherwise might not always be evaluated. Such method must represent both the assessor for the candidate genuine moments of learning and growth.

BASIC CRITERIA FOR THE SELECTION

There are no right solutions, there are simply responses that can be considered more appropriate than others: this is precisely the reason that stimulates discussion.

Candidates must not lose sight of the goal, they must find a solution to the problem required, expressing their opinions in a logical and organized.

Make a choice and motivate you when you make a choice you need to make realistic arguments, also useful to explain why other alternatives were discarded.

Speak clearly; we must stay focused on the topic, without getting involved in futile discussions, if you encounter people in very oppositional and aggressive.

Show cooperative attitude, it is advisable to accommodate the views of others, without imposing their own. Urging, if proof were needed, the thought of those people who tend not to express their idea, it can be shown to have positive attitudes and oriented to the group.

Making targeted interventions, incisors and synthetic, which turn out to be one of the best modes of communication in group tests. As the communication is mediated, it can be important to adopt behaviour and a form of communication that are able to capture the attention of both the selector and the other members of the group.

Not always talk a lot is advantageous, in several selections, evaluating different skills, such as listening skills and understanding of others' opinions. Therefore it is useless to force themselves and behave in one way rather than another, for example trying to be leaders at all costs. Candidates must be aware of the role they tried to enter the JEGs team to be able to deal successfully with the selection.

EXAMPLE OF GROUP INTERVIEW

The test involves a group organization being assessed, which are asked to read and then discuss a case that, at the same time, is a simulated situation. At this stage the interviewer is interested in analysing the attitude with which the candidate expresses his opinions (weak, assertive, insecure) and the way in which this occurs (authoritarian, aggressive, collaborative), without the need to understand the degree of mastery of the subjects by the candidate himself. During the exercise session, graders will have the sole task of observing

and recording behaviour of a special form, after which the different evaluations will determine the final comparative nature.

In order to make as clear as possible the modalities of this exercise is proposed a typical case of very widespread in the context of selective processes that will have to be readjusted by the selectors according to the type of school to which they refer (primary, secondary,. ..).

EASY EXERCISE SESSION

ANALYSIS AND DISCUSSION: “ABOARD A SHIP”

Instruction for candidates

Your group should have to do an exercise in which decisions must be made trying to reach consensus among all members of the group. This means that each of them will have to agree with others on the value to give to each thing before it becomes a group decision. The consensus is difficult to achieve, but you have groped to facilitate the achievement.

Insights

Try not to blindly defend your way of seeing things. Present your opinion as clearly as possible. Justify your opinion by invoking the ground that supports your thesis. Listen to the reactions and the contributions of others and consider them carefully before you repeat your position.

Avoid change their minds just to still reach an agreement or to avoid a conflict. Show your attention and your support for any solution with which you can find at least something with which to disagree. Yielding only to positions that demonstrate objective foundations and logically secure.

Avoid procedures that reduce the conflict by voting or draw lots.

Singling differences of opinion, which are natural and inevitable. Try to involve everyone in the decision-making process. The disagreement may improve group decisions because they present a wide range of information and opinions, thus creating an ideal situation to find the appropriate solution.

Do not assume that someone must win and someone must lose when discussion reaches a stalemate. Instead, strive to find the most acceptable alternative for all members.

Discuss emphasizing recruitment, listening to others and encouraging the participation of all members.

Context

You are on board a ship with serious damage. It was not possible to launch the signal for help because the ship's radio is damaged. Is needed to abandon the ship as soon as possible; There is next to an unknown island; the lifeboat can accommodate barely the group, for which it is not possible to bring along other loads.

The group, but having to face problems of survival, bring with him only one option from the following:

- 1 first aid box;
- 1 box of liquors;
- 1 suitcase containing blankets;
- 1 crate of weapon;
- 1 crate of food;
- Some life buoys;
- 1 small field kitchen;
- A dog that is the mascot of the group;
- 1 radio board in the hope of being able to repair it;
- 1 box of tools.

You have to decide what to take with you on the island.

COMPLEX EXERCISE SESSION

ANALYSIS AND DISCUSSION: "IN THE DESERT OF NEW MEXICO"

Instruction for candidates

Your group should have to do an exercise in which decisions must be made trying to reach consensus among all members of the group. This means that each of them will have to agree with others on the value to give to each thing before it becomes a group decision. The consensus is difficult to achieve, but you have groped to facilitate the achievement.

Insights

Try not to blindly defend your way of seeing things. Present your opinion as clearly as possible. Justify your opinion by invoking the ground that supports your thesis. Listen to the reactions and the contributions of others and consider them carefully before you repeat your position.

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Do not assume that someone must win and someone must lose when discussion reaches a stalemate. Instead, strive to find the most acceptable alternative for all members.

Discuss emphasizing recruitment, listening to others and encouraging the participation of all members.

Context

You are a member of a group of geologists engaged in a research study tour in the desert of New Mexico. It's the last week of July and you have travelled on a track far from any road, in order to observe the formation of the land. At 10.30 am on your special minibus overturns and rolls into a hole ten meters, catching fire. The driver and an experienced member die while you survive, albeit with some wound. You know that the nearest farm is located about 70 km to the east of you and there is no nearer home. At the motel they know that when the evening turned out absent is because you are in a camp set up, so that, at least for that night, no one will trigger the alarm. The place is particularly rough and dry. Not far away,

there is a pool of water not very deep, but it was contaminated by the presence of decaying animals. Before leaving, the control of the weather report, it emerged that the temperature would reach 45-55 degrees centigrade. You have wear light clothing, hats and sunglasses. Cell phones do not record any cover. While you were dating from minibuses, each of you managed to save two things: a total of twelve. Your group must now classify these things in order of importance for their own salvation.

Finally, you must consider that the survivors are you and your group who has agreed to remain united.

The available objects are as follows:

- 1 compass;
- 1 robust canvas piece of 6 meters by 6;
- 1 rear view mirror;
- 1 large knife;
- 1 flashlight with four batteries;
- 1 jacket per person;
- 1 transparent plastic sheet of 2 square meter per person;
- 1 gun;
- 1 water bottle with 2 litres of water per person;
- 1 very accurate map of the area;
- 1 very large box of matches;
- 1 book entitled: "The desert plants".

Strategies explained by the selectors

The group is in shock about what happened:

- The first problem - is dehydration, due to sun exposure and the normal of the body sweating. To deal with the group must remain calm, wear as many clothes, reduce the loss of moisture, keep the shade as much as possible, to minimize movement during the day and drink as much water as you can. According calm and shade, the group can survive without water for three days. The jacket is important for the need to dress up, the canvas for the need shade, the water to stay hydrated.

- A second vital problem - it can signal their presence to who was the group's research. Are important for this: mirror, the canvas, the stack, the gun and the matches.

- A third issue to be addressed - is to drink as much drinking water as possible. The water in the bottles is insufficient, but you could get distilled water from the pond contaminated building a distiller with the plastic sheeting. It should be lying on the water holding it a few centimetres above the surface and tilted to one side, so as to be able to collect the drops in the water bottle.

- The fourth problem to survive - is to have to find food, if the group is not saved within a few days. To this end it is important to not eat protein, as these require a lot of water; also it could be useful book on the desert plants.

- Finally, the fifth issue to resist - is given by the anxiety of waiting for someone might decide to go walking at night, the risk of dying within two days as it would not be able to travel more than 60 km. Worse would decide to walk during the day because of the heat. Bear in mind, also, that if the group goes on the road probably could make it much more difficult their discovery by rescue teams.

Classification of objects in order of priority in the opinion of the selectors:

- 1 rear view mirror;

- 1 jacket per person;

- 1 water bottle with 2 litres of water per person;

- 1 transparent plastic sheet of 2 square meter per person;

- 1 large knife;

- 1 very large box of matches;

- 1 robust canvas piece of 6 meters by 6;

- 1 flashlight with four batteries;

- 1 gun;

- 1 book entitled: "The desert plants";

- 1 very accurate map of the area;

- 1 compass.

INDIVIDUAL REPORT CARD

Each selector has to fill a report card for each candidate based on the following standard

INDIVIDUAL REPORT CARD					
Name of selector…….					
Name of candidate……..					
Classroom…….					
Name of group……..					
AREA PERFORMANCE					
CONTRIBUTION	--	-	=	+	++
Quantity					
Quality					
ROLE	--	-	=	+	++
Collaborative					
Influent					
PERSONALITY TRAITS					
	--	-	=	+	++
Assertiveness (convincing, independent)					
Sociability (outgoing, socially secure)					
Empathy (reserved, selfless)					
Control anxiety (laid back, worried)					
Energy (active, competitive, determined)					

NOTE
SUMMARY ASSESSMENT
Excellent **Good** **Normal** **Scarce** **Off profile**

6.2 Individual Interview

The Group Interview has selected different group of four students. Each group could be a possible candidate to become the JEGs team.

The Individual Interview is the decisive moment of the selection, one in which selected groups must demonstrate through their educational history, with their skills, but above all by their attitude, to be the "right" group for a certain location. The aspects covered by the assessment, concern, therefore, not only cognitive skills but also personal qualities, motivation, expectations, the availability of the group.

ANNEX B – First Part

D.T.4.3.1 "GUIDELINES FOR THE MONITORING AND COMPILATION OF TEMPLATES"

GUIDELINES FOR ALL SCHOOLS

Period reported: December 2017

Version 01
31.12.2017

Edited by PP6 UNIBO

D.T. 4.3.1 “GUIDELINES FOR THE EXECUTION OF MONITORING AND COMPILATION OF TEMPLATES”

Version 01

31.12.2017

Edited by PP6 UNIBO

INDEX

7. Abstract

The following document addresses the attention of SEG's and JEG's of the various European schools involved in the Energy@School Project.

This document aims to prepare a training exercise focused on the energy culture in order to develop the Energy Culture Action Plan of the JEGs. The structure of the document was created to assist SEGs through simple or more technical notions during the different phases of the training exercise from January 2018 to May 2018:

a - INVENTORY – JEGs have to make the inventory of all the energy consumptions of the equipment (lamps, computer, printer...) into the selected classrooms and common rooms using the specific templates attached to this document;

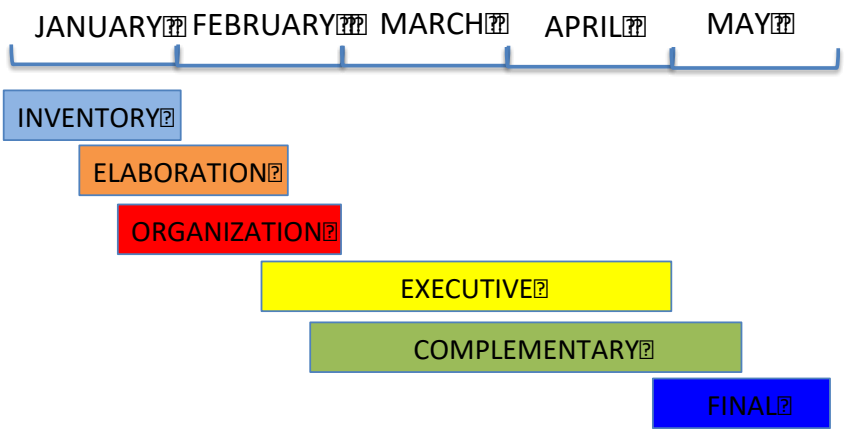
b - ELABORATION – the data from inventory will be elaborated and discussed between SEGs and JEGs in order to select the classrooms and common rooms having the highest energy consumptions. The energy consumptions in the classrooms or common rooms are strictly linked to the presence of persons and to the temperature for a right comfort. JEGs have to organize the monitoring of the school using the specific templates in order to realize the basic energy consumption profile;

c - ORGANIZATION –. JEGs will elaborate a specific map of the entire school complex in which will be evidenced the individual classrooms chosen to be monitored;

d - EXECUTIVE – this is an operative phase for the data collection for the monitoring of specific consumption (See paragraph **"d"**);

e - COMPLEMENTARY – each week the filled templates will be sent to the Joint NOC at the UNIBO research group. Periodically Joint NOC will send back to the school an update of the energy consumption profile for a discussion between SEGs and JEGs in order to implement, if it is necessary, the monitoring management (See paragraph **"e"**);

f - FINAL – the training exercise will get the basic energy consumption profile of the school and a monitoring management of the highest energy consumption classrooms and common rooms. On the basis JEGs have to elaborate their Energy Action Plan scoped to increase the energy efficiency of the school.



TIME TABLE - Time phases of the training exercise

8. How to use the training exercise? And why?

The installed smart meter in each school takes electricity and gas data at regular intervals on switchboard and displays the data via online portal or display device.

Daily monitoring allows schools to immediately measure the results of energy efficiency programs put in evidence any unexpected increases in electricity o gas use.

However, the data from the smart meter are not generally open data and thus it is difficult takes directly the data from each device to be sent via online portal to the control cabin at UNIBO. Furthermore, specific sensors to be interconnected online do not generally recover the indicators of the presence of people into the rooms as well as of the temperature into the working places and then they have to be collected by a manual procedure. Once the sensors have been installed in the various classrooms and workplaces, JEG's will have to monitor electricity and heat consumption and, if necessary, the presence of students or members of the school staff within the identified spaces.

Once the sensors have been installed in the various classrooms and workplaces, JEG's will have to monitor electricity and heat consumption and, if necessary, the presence of students or members of the school staff within the identified spaces.

The JEG’ s will then have to submit weekly, all data generated and organized in a standard table, to the UNIBO research group.

This operation will allow the UNIBO team to engage in the collection, reprocessing and analysis of all data received, in order to identify a consumption profile and subsequently a sustainable behaviour for each school identified by a performance score.

The ultimate purpose of this document is to re-elaborate such monitoring data for computer software programming, which will also be available via smartphones, allowing the development of E @ S game and the final competition between the schools.

E @ S game is a tool to compare a performance score of energy efficiency to the baseline performance score. Once the Energy Guardians have determined the results, they can use this information to evaluate the effectiveness of the action plans both of the Senior and Junior.

3.THE SETTING PHASES OF THE TRAINING EXCERCISE

a. INVENTORY: Template to identify the school energy situation

Knowing where your school's energy comes from and how you use it is a crucial first step to understanding what changes can be made.

Equipment and appliances typically account for approximately 20% of a school's energy use. Much of this energy use occurs when the equipment is not in use (in standby mode). Standby loads look small but because they are running continuously they can amount to a large energy use. Reviewing your power bills and checking off -peak energy use, and by using an electronic power usage tool can measure this.

In each classroom and common space the JEGs should make the inventory of the equipment energy use. In fact, to become more energy efficient, it is important to know how energy is currently being used. The template 1 assists schools to determine their energy use and type. It will provide the base information for improving both energy efficiency and energy sustainability. Ideally, students use the template as part of their learning. Improving energy efficiency is a gradual process. Once you have identified what energy you use and where, choosing two or three priority areas may best does making change. The JEGs should try to reproduce the energy profile in each classroom and common space.

[ENERGY CONSUMPTION (Wh) vs TIME (hours) for each day of the week]

In order to establish the thermal comfort, in general the vertical distribution of the temperature in the room should be 23°C at the level of the head and 17°C at the level of the feet with a difference of no more than 3°C.

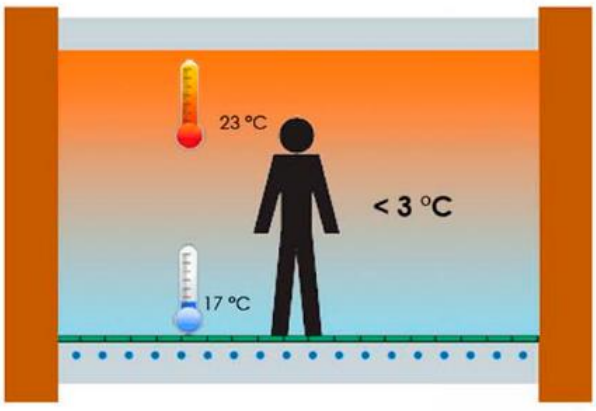


FIGURE 1: Distribution of the room temperature for an optimization of a thermal comfort.

The thermal comfort depends on the specific activities which are carried out into the room (i.e.: lesson, sport, eating, break-time,…).

b. ELABORATION

Once all the inventories of the different classes of the school have been carried out, it will be necessary to proceed with the evaluation of the consumption expected for each of them. Will follow a comparison a comparison of all estimated total consumption in order to identify which, among the classes studied, results to have a greater consumption and therefore results to be an interesting class to be monitored in order to eventually reduce consumption, once implemented energy action plan in the final phase.

c. ORGANIZATION: Maps of the Schools and rooms

This step is necessary for a better understanding and possible verification of the consumptions detected, known that the structures detected and the impiantistic components therein present.

Therefore, the maps of the entire school structure are requested and the classes actually chosen for monitoring are highlighted. It is important to report the name or the identification of these spaces.

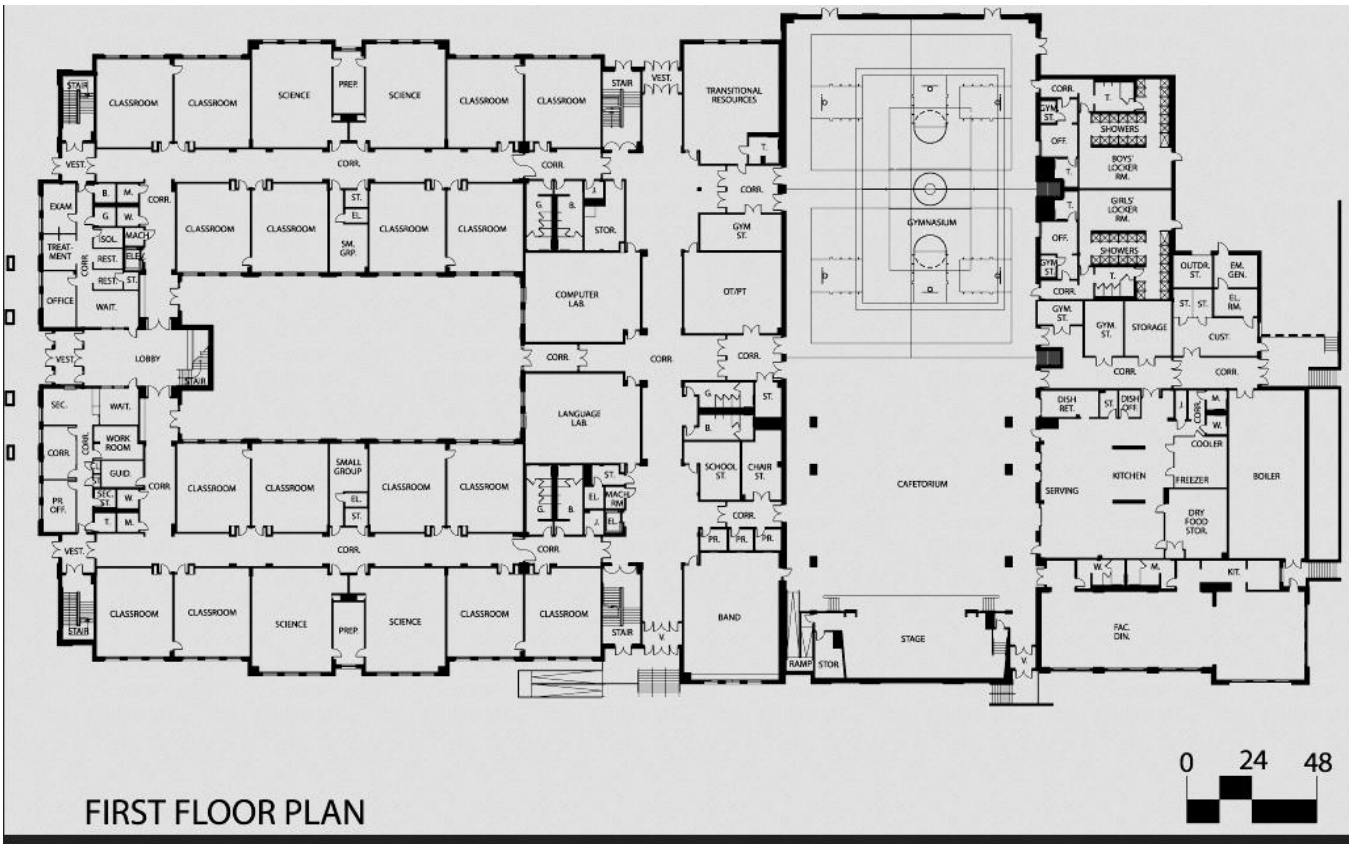


FIGURE 2: Example of hypothetical school structure

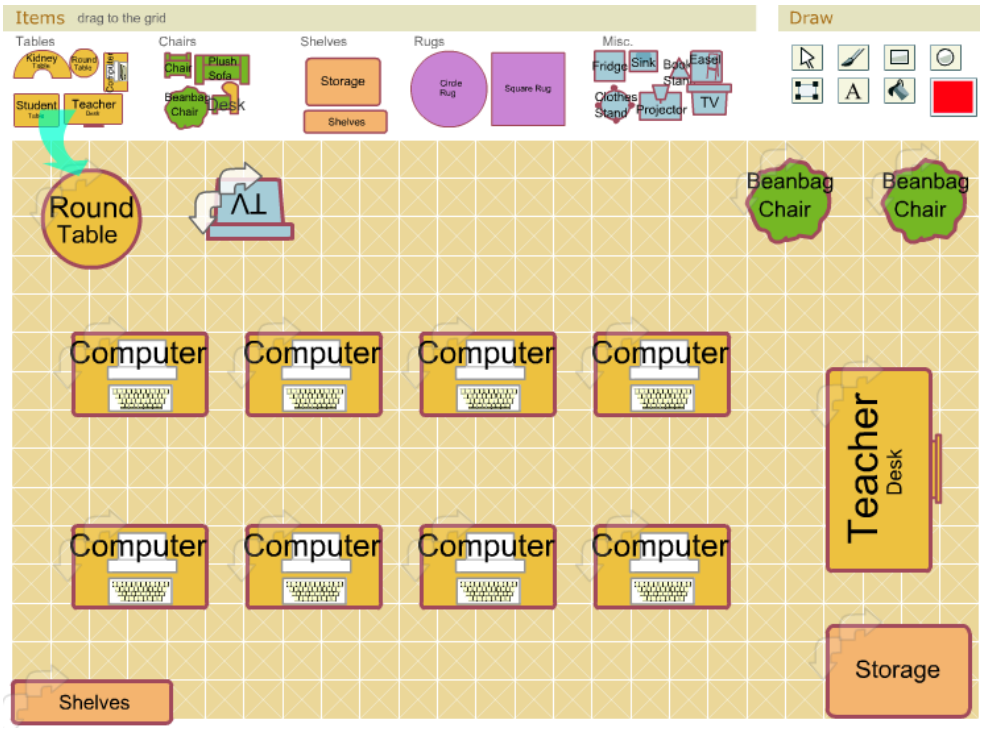


FIGURE 3: Example map of free classroom planner for teacher

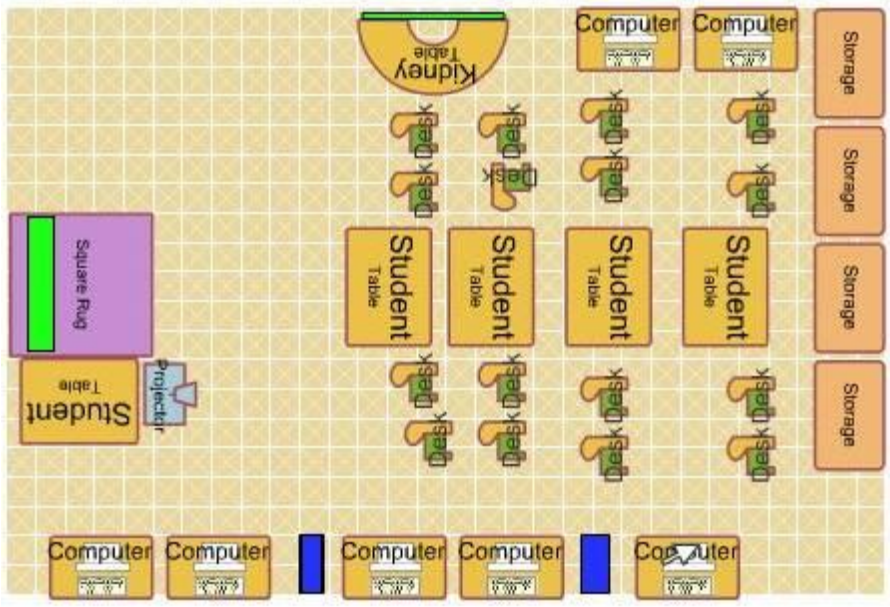


FIGURE 4: Example map for study classroom

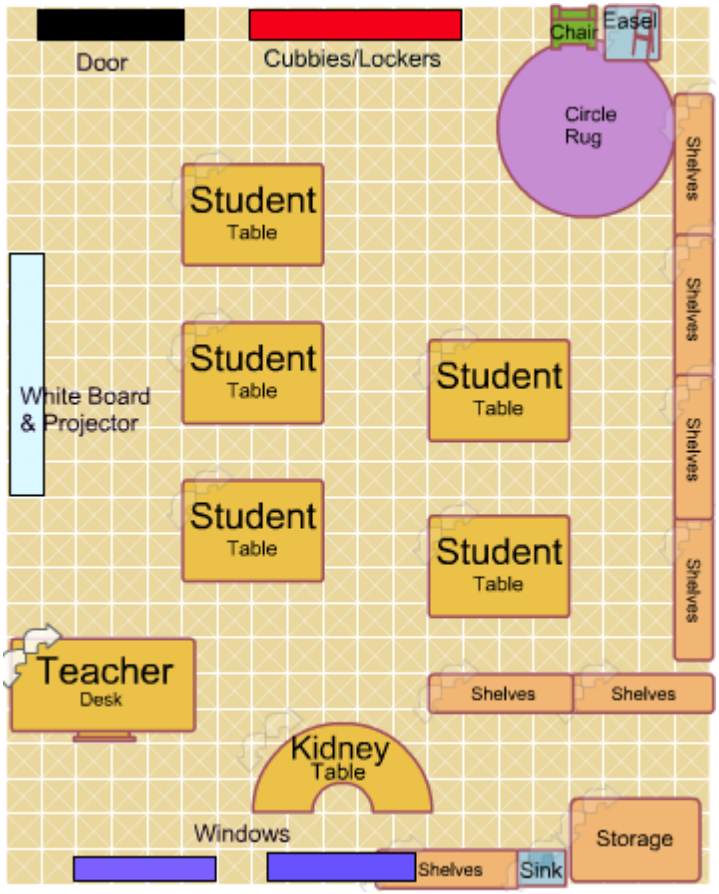


FIGURE 5: Example map of general classroom

d. EXECUTIVE

On the basis of the energy consumption theoretical profile in each space of the school, JEGs have to organize the collection of the real data using the installed smart meter and manual detection of the temperature as well as the presence of persons into the selected spaces. Theoretical profiles are necessary in order to determine the spaces having the highest energy consumptions. Controlling these points will allow to develop an energy action plan which will be able to reduce the wasted energy.

In order to collect the data of the energy usage, the schools, involved in the Energy@School project, have installed online systems or devices to monitor daily electricity and thermal consumptions.

In order to evaluate the waste energy, it is necessary introduce two more indicators such as the presence of persons into the school and the indoor temperature; in fact, the energy consumption is directly connected to the presence of student or staff school into the building while the temperature is a simple well-being indicator.

On the basis, the Joint NOC can evaluate the energy performance of each school developing a performance score, if the following types of measurements will be periodically sent at the joint unit:

1- electrical consumption (kWh);

2- thermal consumption (kWh)

3- presence of persons (0 = no, 1 = yes)

4- Temperature (° C)

HOW TO MONITOR

The installed smart meter in each school takes electricity and gas data at regular intervals on switchboard and display the data via online portal or display device. However, the data from the smart meter are not generally open data and thus it is difficult takes directly the data from each device to be sent by an online portal to the control cabin at UNIBO. Furthermore, the indicators of the presence of people into the rooms as well as of the temperature into the working places are not generally recovered by specific sensors to be interconnected online and then they have to be collected by a manual procedure.

Smart meter for the collection of general electrical and gas and/or thermal energy data – the smart meter should make an up-date each one hour and the data should be reported on a digital display to be easily checked-out by the Junior Energy Guardians. The data to be collected and transformed in kWh when reported with different unit of measurments in a specific template.

Meter of consumption of electricity for devices in working and stan-by phase - For the compilation of the first table it is also requested to insert the energy absorption of the various devices, which may vary according to their mode of operation. In this regard we can use a small object, very easy to use, known as the meter of consumption of electricity, very easy to find, available in the electricity department of supermarkets or hardware stores, or even online.

It is an electronic device with a display, which is inserted between the socket of our appliance and the electrical outlet in the wall. As soon as it is connected, the device will measure the current flow, then calculate how much electricity is consumed during the use of the appliance in question.

How does it work?

The display shows the consumption in real time in Watt, in Ampere, the power peaks: the data are automatically saved to review them calmly. On some devices, it is possible to set the cost related to its range of use to directly view consumption expressed in Euros.

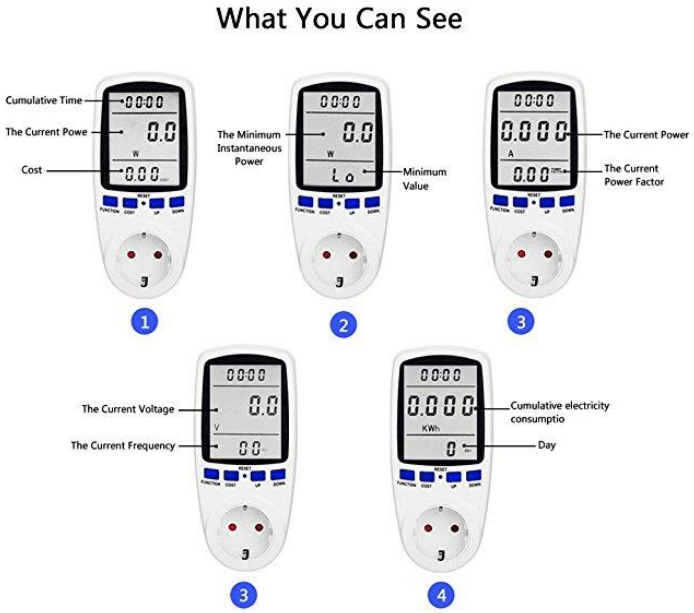


FIGURE 6: Representative image of a meter of electrical consumption.

Presence of people in rooms – this data collection should be organized with a manual reporting using presence or not presence of persons during the working time into the school. The presence of people will be periodically checked by the Junior Energy Guardians and reported in a specific template.

Temperature in the working class - this data collection should be organized with a manual reporting using digital thermometer or a fixed one during the working time into the school. Temperature will be periodically checked by the Junior Energy Guardians and reported in a specific template. WARNING: do not detect the temperature by placing the thermometer near heat sources (radiators, pc, refrigerators and similar), near windows and doors, because they could alter the actual consumption result, being areas characterized by a strong excursion and / or thermal dispersion .

FIGURE 7: Example of a digital thermometer to be used for the manual monitoring of temperature in the chosen classroom.

FIGURE 8: Example of classic thermometer to be used for the manual monitoring of temperature in the chosen classroom.

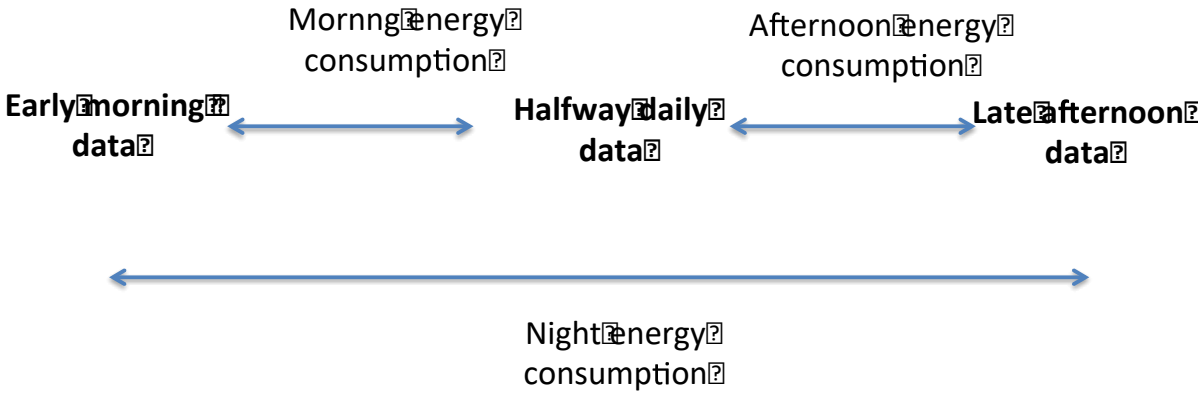
The training exercise will permit to normalize a method to collect the data using different smart meter and in the absence of electronic sensors for the presence of people and for the temperature.

WHEN TO PERFORM THE RELIEFS

Electricity and gas consumptions provide a variety of information if they are periodically collected that can assist schools to understand their energy usage during the working days and all the detailed analyzes that follow. JEG's are asked to carry out surveys, every day, and more precisely:

1 - in the morning as soon as you before to go into the classroom;

2 - halfway through the day;



3 - in the afternoon before to leave the school.

Therefore, three surveys are requested per day, for four different consumption details, for each of the selected classes!

FIGURE 9: Monitoring plan of the energy consumption during the day.

e. COMPLEMENTARY - Format for sending data to the centralized system

At minimum weekly intervals, the school complex will load the sensor values into the data supply interface, with significant intervals between each measurement.

The sending format can be in the following types:

1) Upload from Excel file or CSV file

2) Manual loading on the web frontend

3) Manual upload from mobile device with access to the responsive web interface

4) Loading data via API exposed by the frontend

Upload from Excel / CSV file

The sending format can be an xls sheet or a csv file with the specified structure, the system will load only the measurements with date after the last measurement loaded for each sensor, avoiding double insertions.

Manual upload from the Frontend Web

A web page will be made available which, following a login from an Energy Guardian, will propose a list of the sensors assigned to the plexus in which the Energy Guardian is registered.

The interface will allow you to enter data by presenting a layout similar to a table with the predefined time intervals and the possibility to add columns for each sensor and the related data.

Manual upload from Frontend Web via mobile device

The same page used for the Frontend by Browser is made of Responsive technology to be used also by mobile devices. Internet access is required during data collection.

Loading data via API exposed by the frontend

The data load frontend can also be used for automatic feeding via REST protocol calls. The API specifications will be made public to allow greater automation in the data supply process.

f. FINAL

The training exercise will get the basic energy consumption profile of the school and a monitoring management of the highest energy consumption classrooms and common rooms. On the basis JEG' s have to elaborate their Energy Action Plan scoped to increase the energy efficiency of the school. They will have to decide for some strategies of use, of the various equipment present in the different classes monitored, in order to reduce their impact on the overall consumption of the school, for example, through the meter of electricity consumption it is possible to save on consumption, being able to highlight the different consumption, for example, of an old device with one of the latest generation, which being in class A ++, consumes very little.

Why is it important to measure the consumption of our appliances?

Over time, the appliances lose efficiency; they fail, causing, without our knowledge, a power loss, resulting in an increase in our energy expenditure. At other times, we tend to underestimate certain consumption that apparently may seem harmless, such as the stand-by light. This type of evaluation could be an example of sustainable strategy.

A good solution for energy saving, could be the replacement of an old fridge, which shows on average a daily consumption of 2 kWh, with one of the latest generation, class A +++, which consumes only about 0.35.

This is an important example of sustainable strategy, because the fridge is one of the most impactful appliances on energy consumption, remaining in operation 24 hours a day.

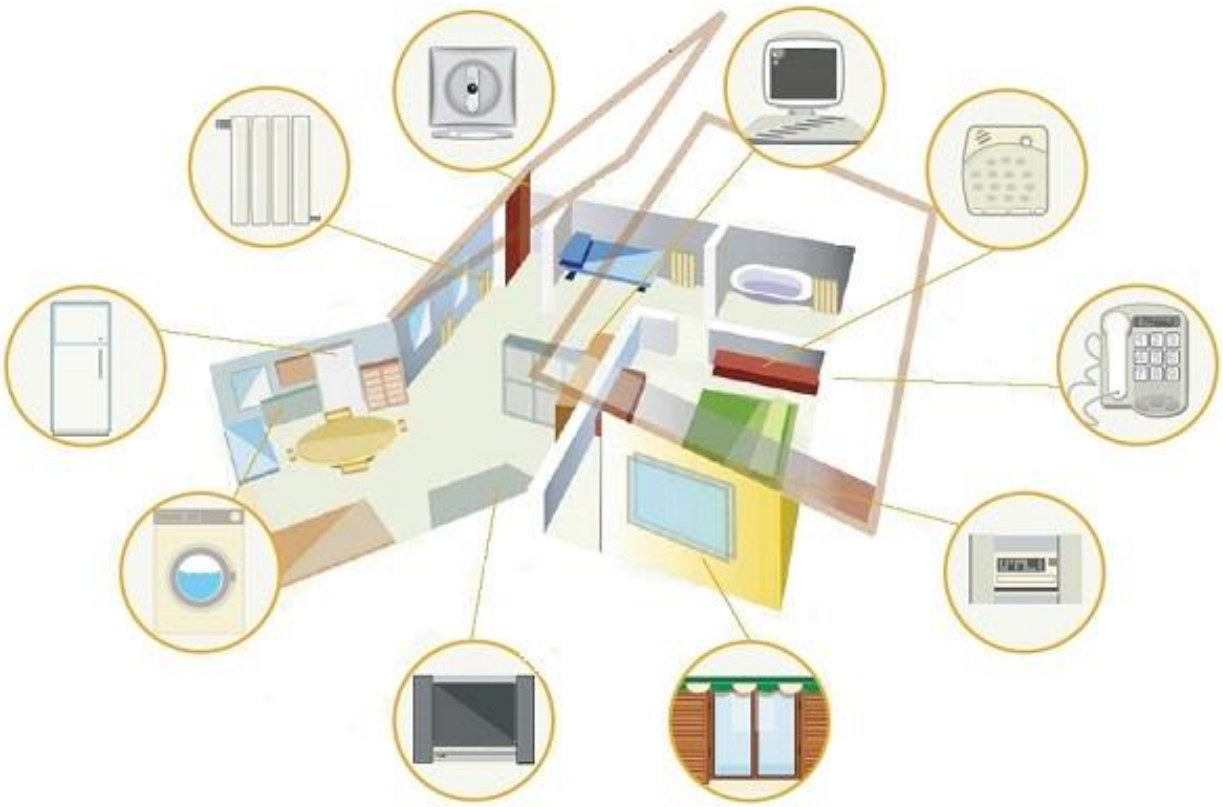


FIGURE 10: Example of some devices to be monitored in schools and in their own homes.

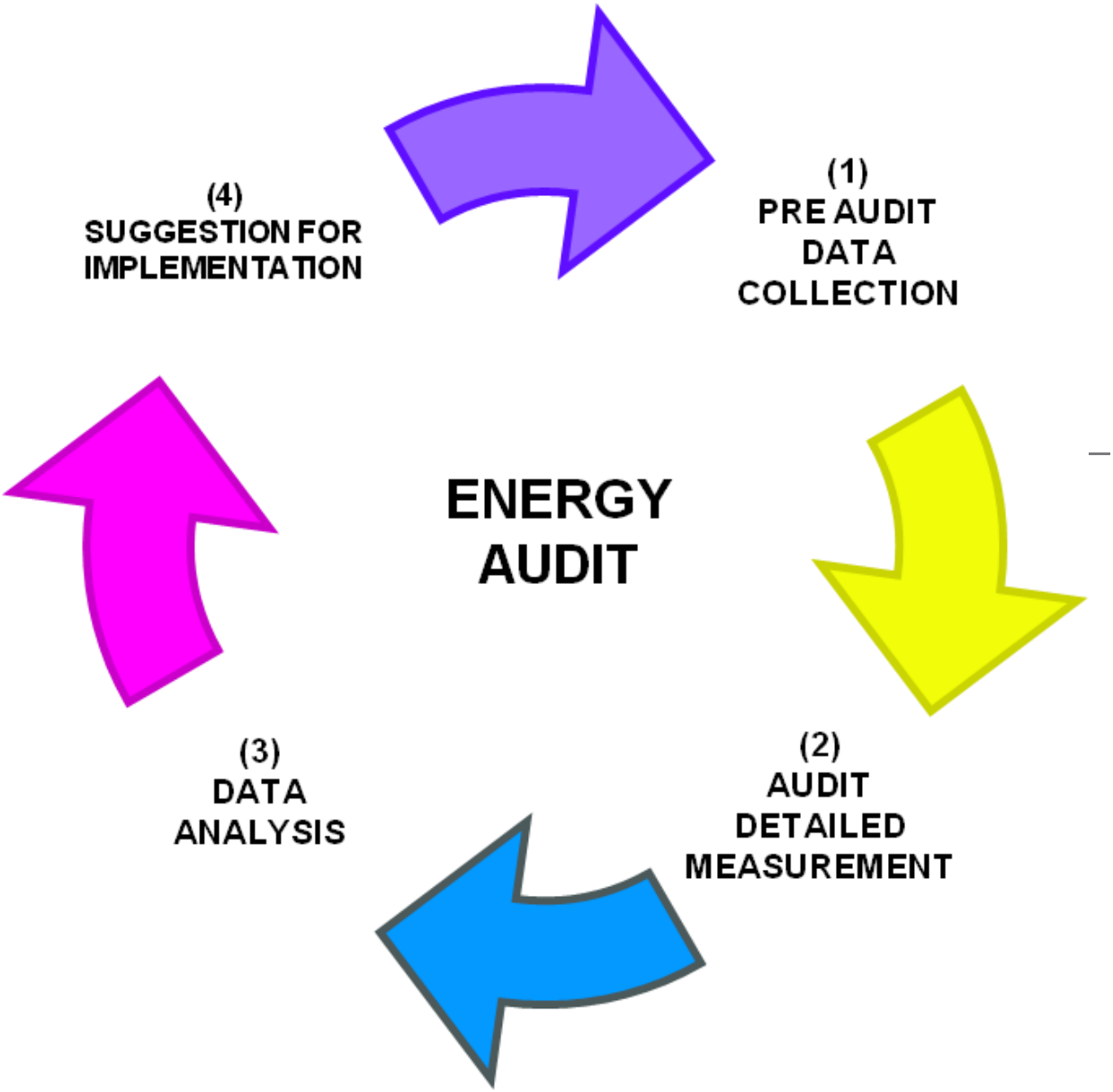


FIGURE 11: Possible operational scheme of an energy-sustainable strategy.

4. INTRODUCTION TO TEMPLATES

Each school will be presented with two templates, cards necessary to collect all the data collected daily, therefore, even weekly. The first template is an inventory, in which it is required to specify the devices present in each of the chosen classrooms, their power and duration of hourly operation per day; for the compilation of the second one, instead, it is required to report the numerical details, for four different types of consumption (See paragraph d).

Each card must contain the name of the JEG's which will carry out the survey, the date and the execution time, together with some specific consumption data and the ID name of the sensor consulted.

Each card must be completed for each of the classrooms chosen for monitoring, and for each school day of the week; sending the completed forms, however, only at the end of the school week just ended.

All the completed files must be sent weekly, and not daily, to the UNIBO research group.

Each school will be presented with an EXCEL file containing seven different sheets, each of which will contain the template dedicated to the daily collection of consumption data detected from time to time.

In the first sheet the template 1 has been prepared, dedicated to the inventory of each class chosen for monitoring; to follow, in the remaining six sheets, template 2 was added, one for each day of the school week, from Monday to Saturday.

The JEGs will have to compile a file every week with the monitoring and then send it to UNIBO at the beginning of the next week when they will begin to compile the new file.

Each file must be named with "school name, class and / or room, week detection number".

TEMPLATE 1

SCHOOL:							
ROOM (Specify the type of classroom, for example: computer lab, chemistry lab, meeting room, kitchen, cinema room, class 3B, …):							
Energy use	**Details**	**How many**	**Load in working**	**Time on**	**Load in stan by**	**Time on**	**Use**
			Watts	**Hours per day**	**Watts**	**Hours per day**	**Kwh per day**
Lighting	Lowenergy lamps						
	High energy lamps						
Equipment	Computers						
	Printers						
	Photocopies						
	Projectors						
	Whiteboards						
	Faxes						
	TVs						
	Video recorders						
	Speakers						
	Others(Power Tools, Fridges, Microwaves …)						
TOTALE Kwh/ day:							
DATE: __/__/___							
JEG:							

TEMPLATE 2

SCHOOL:				
ROOM:(Specify the type of classroom, for example: computer lab, chemistry lab, meeting room, kitchen, cinema room, class 3B, ...)				
SENSOR ID:				
Specify the time slots for which the lesson is scheduled in that classroom. this must be specified in each table for each day of the week.	**Gerneral Power consumptions**	**General Thermal consumptions**	**Presence monitoring**	**Theoretical Temperature**
Time of use (for example: 8-10 am; 10-11,30 am...)	**KWh**	**KWh**	**Put an X if the expected lesson for the specifications, classroom, date and time, is permorfed.**	**°C (detect temperature 1- early morning; 2- mid-morning; 3- good school day)**
__ - __				
__ - __				
__ - __				
__ - __				
__ - __				
__ - __				
__ - __				
__ - __				
MONDAY				
DATE: __/__/____				
WEEK NUMBER OF DETENCTION:				
TIME:__.__				
JEG:				

5. Example of compiling templates

With the aim of facilitating the comprehension of the guidelines for filling the tables for monitoring, we propose the following example, which sees as a reference the class shown in, **Figure 4 - Paragraph c,** of this document. The class in question is a simple and common study room, open to all students, according to the rules laid down by their school structure. We have hypothesized, for the school day on **Monday**, the following timetable, for which, "the study room" is expected to be open to the public:

CLASSROOM "15" - "STUDY ROOM of Scientific High School, Vitruvio Pollione – Avezzano (AQ) ITALY"						
TIME	**MONDAY**	**TUESDAY**	**WEDNESDAY**	**THURSDAY**	**FRIDAY**	**SUNDAY**
08-09		...	...	...	...	...
09-10	X	...	...	...	...	...
10-11	X	...	...	...	...	...
11-12	X	...	...	...	...	...
12-13	X	...	...	...	...	...
13-14	X	...	...	...	...	...
14-15	X	...	...	...	...	...
15-16	X	...	...	...	...	...
16-17	X	...	...	...	...	...
17-18		...	...	...	...	...
18-19		...	...	...	...	...

TABLE 1: Example of the school timetable foreseen for the "classroom 15 - study room - on Monday". The "X" value, indicate, the state of openness of the classroom.

Referring to Figure 12, below, it is possible to notice the devices present in the classroom, such as: a projector and seven computers. Moreover, the presence of a low-consumption LED technology, for the interior lighting of the classroom (SmartForm LED BCS460 / BPS460 - PHILIPS) has been hypothesized.

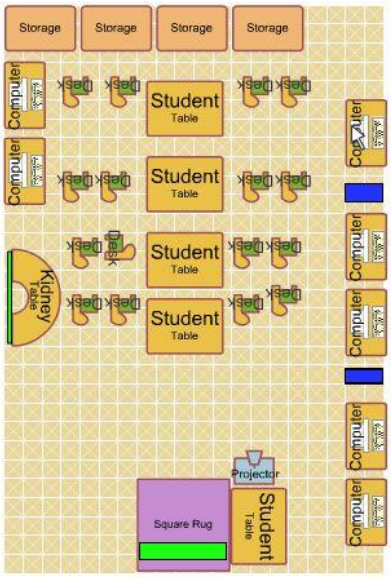


FIGURE 12: Example classroom for compilation simulation.

FIGURE 13: Example of Led technology for the interior lightning of the classroom.

The following specific consumption of the above devices is assumed:

EQUIPMENT	HOW MANY	LOAD IN WORING	LOAD IN STAND-BY
		Wh	Wh
COMPUTER	7	300	30
PROJECTOR	1	353	<0,5
LOW ENERGY LAMP	9	(7,25 W * 9)= 65,25	

TABLE 2: Example for devices consumption.

FIGURE 14: BenQ W1070 Projector 1080p Full HD 3D - Example of a high energy saving projector and environmental protection with sustainable technology. Some features: SmartEco Mode automatically determines the optimal brightness, depending on the input source. This special mode intelligently adjusts the light resource to bring maximum energy savings - providing the best contrast and brightness in performance; Eco Blank Mode obscures the projection screen automatically when the projector is not in use. This feature reduces energy consumption by over 70%.

These can be considered as suggestions for the final evaluation and drafting of the Energy action plans for the final phase (See paragraph f).

Stationary computers are those that consume more energy. Considering a mid-range computer it is possible to assume an hourly consumption that goes from 65-70 Watt at rest up to 200-250 Watt when it works at full capacity. To this must be added the consumption of the monitor, which will be greater as the screen is larger. In general, a normal LCD screen can consume 15 to 70 watts per hour, a little less in the case of LED screens.

One of the most energivorous components is the video card, which alone can take up to 30 watts per hour at rest and up to 100 watts in operation, which can then increase up to 250 watts in the case of extreme configurations from online gaming .

When the computer goes into stand-by, however, the consumption of electricity is very minimal: for this reason it is important to verify that all the computers have the setting for automatic stand-by after a total of inactivity time.

it is important, for the final phase and the elaboration of the energy action plan, to consider the introduction in the technological market of products more and more oriented towards energy saving; if, therefore, a fixed computer with cathode ray tube screen can get to consume 200 w, a desktop computer with an LCD screen only about 125, dropping up to 30 watts consumed by a laptop computer, it might be useful to evaluate the current state of the devices and evaluate their replacement if they are too old.

Finally, with reference to the average statistical data, a mean temperature of 20 ° C was assumed in the intermediate time slot of classroom use, 17 ° C, instead, at the entrance and exit from the school.

Template 1 – Filling Simulation

SCHOOL:							
ROOM (Specify the type of classroom, for example: computer lab, chemistry lab, meeting room, kitchen, cinema room, class 3B, ...):							
Energy use	Details	How many	Load in working	Time on	Load in stand by	Time on	Use
			Watts	Hours per day	Watts	Hours per day	Kwh per day
Lighting	Lowenergy lamps	9	6,25*9=65,25				65,25*8/1000=0,522
	High energy lamps						
Equipment	Computers	7	300*7=2100	8	30*7=210	8	(2100*4)+(210*4)/1000=9,24
	Printers						
	Photocopies						
	Projectors	1	353	8	0,5	8	(353*2)+(0,5*6)/1000=0,0709
	Whiteboards						
	Faxes						
	TVs						
	Video recorders						
	Speakers						
	Others(Power Tools, Microwaves ...)						
TOTALE Kwh/ day:							
DATE: __/__/____							
JEG:							

TABLE 3: Filling simulation for Template 1; it was assumed that the computers were working at full capacity, equal to half of the total opening hours foreseen for that classroom on Monday, and their operation in stand-by mode for the remaining four hours; operation of the floodlight at full power, for two hours of the total expected lighting of the device and for the remaining 6 hours, a stand-by operation; finally, we hypothesized the lighting of the LED lamps for the total hours foreseen for the operation of the classroom in an example, therefore 8 hours on Monday.

Template 2 – Filling Simulation

SCHOOL:				
ROOM:(Specify the type of classroom, for example: computer lab, chemistry lab, meeting room, kitchen, cinema room, class 3B, ...)				
SENSOR ID:				
Specify the time slots for which the lesson is scheduled in that classroom. this must be specified in each table for each day of the week.	Gerneral Power consumptions (viewable on the sensor display)	General Thermal consumptions (viewable on the sensor display)	Presence monitoring	Theoretical Temperature
Time of use (for example: 8-10 am; 10-11,30 am...)	KWh	KWh	Put an X if the expected lesson for the specifications, classroom, date and time, is permorfed.	°C (detect temperature 1- early morning; 2- mid-morning; 3- good school day)
08-09	Value readable from the general meter display	Value readable from the general meter display		17
09-10			X	
10-11			X	
11-12			X	
12-13			X	
13-14			X	20
14-15			x	
15-16			/	
16-17			/	
17-18				
18-19				17
MONDAY				
DATE: __/__/____				
WEEK NUMBER OF DETENCTION:				
TIME:__.__				
JEG:				

TABLE 4: Filling simulation for Template 2; on Monday, the opening of the classroom is scheduled until 5 pm. It has been hypothesized that the classroom will not be used, for example from 3 to 5 pm, in this case the JEG in charge of the inspection will have to note the total absence of people in the classroom, to be able to then verify that consumption is also at the minimum basal, if not so, and should turn out lights and computers in operation, this would be a waste of energy, which will be identified thanks to these surveys.

ANNEX B – Second Part

GUIDELINES FOR JEG'S ENERGY ACTION PLAN

N. DELIVERABLE D.T4.3.1.
Second Part – Jeg's Energy Action Plan
Version 01
04.2018

Edited by PP6 - UNIBO

N. DELIVERABLE D.T4.3.1.
Second part – Jeg's Energy Action Plan
Version 01
04.2018

Edited by PP6 - UNIBO

CONTENTS

9. THE AIM OF THIS GUIDE

E @ S is a European project, aimed at effectively reducing the excessive waste of electricity and, above all, raising awareness on the topics of energy sustainability students, teachers, non-teaching staff, as well as parents and therefore citizens.

This small guide was created to spread the action of energy saving in other schools and homes, describing principles and methods, providing useful advice to address any obstacles to achieving goals and to adapt the action in different school contexts, through different examples practical.

Schools today have the fundamental task of being motors of the change of course of our society towards a sustainable future, reorganizing society so that it is able on the one hand to use renewable energy resources, on the other to recycle material resources non-renewable. This means changing the behaviour of individuals and communities, so that everyone shares this need through daily action.

In the proposed path the knowledge comes after the actions, so that at every step the knowledge is integrated with the actions, supporting the ability of each individual and community to re-direct their daily actions towards sustainability, already from the moment here I'm.

It is a process of co-education, in which the elements of knowledge connected to it are first of all activated by living the experience itself. Furthermore, the teachers of the different disciplines can take back what they have experienced, to develop theoretical insights from the context of experience.

Another important objective of the educational action is to encourage the development of future citizens aware not only of their being individuals, but also part of the community, of the nation, of our planet, thus learning to take care of the common good as their individual good.

This document aims to prepare a training exercise focused on the energy culture in order to develop the Energy Culture Action Plan of the JEGs. The structure of the document was created to assist JEGs through simple technical notions during the different phases:

1. **INVENTORY -** Junior Energy Guardians are involved in the audit process as it is a significant learning opportunity. They have to do the check up of the school in order to determine how the energy is used in the school, measuring the energy use of specific electric items.
2. **ELABORATION -** The data from inventory will be elaborated and discussed between SEGs and JEGs in order to select the classrooms and common rooms having the highest energy consumptions. The energy consumptions in the classrooms or common rooms are strictly linked to the presence of persons and to the temperature for a right comfort. JEGs have to organize the monitoring of the school using the specific template in order to realize the basic energy consumption profile;

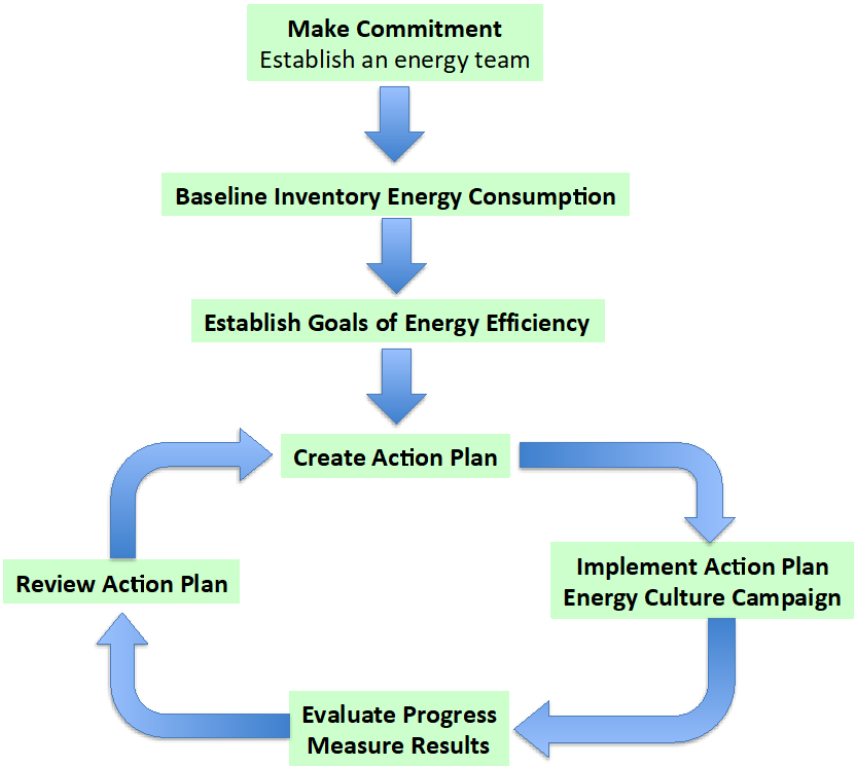
3. **ORGANIZATION** - JEGs will elaborate a specific map of the entire school complex in which will be evidenced the individual classrooms chosen to be monitored;
4. **CREATE AN ACTION PLAN** - The action plan consist of a set of goals/activities for improving energy efficiency.

   Each school can establish a portfolio of energy efficiency goals based on the indications by the ENERGY@SCHOOL technical audits.

   Assessing potential energy savings helps determine an appropriate portfolio of goals that are clear and measurable. Each school has to establish both short-term and long-term goals for improving energy efficiency.

   A regularly updated action plan is a necessary roadmap toward meeting portfolio-wide energy efficiency goals. Create an action plan, involves establishing energy performance targets based on the energy consumption inventory.

The ENERGY@SCHOOL guidelines for the Energy Smart School Management Plan present a seven-step approach:



10. THE PRINCIPLES OF SUSTAINABLE ENERGY

Energy saving, together with the use of renewable energy sources, are the only two paths for the development and maintenance of sustainable energy, or better, of a condition of acceptable energy and environmental sustainability, to contain the current climate changes.

All renewable sources are reconstituted in a time comparable with the time necessary for their consumption and therefore can be considered inexhaustible. They derive directly from the sun, from wind (wind energy), from biomass, from tides (tidal energy), from water (hydroelectric energy) and from geosphere (geothermal energy), do not affect natural resources for future generations and do not involve increase in CO2.

Energy savings can instead be considered "virtually" as the first source of renewable energy, the most immediate and accessible to all. With small actions, for example by turning off the lights turned on unnecessarily, and even minimal investments, it is possible to make all the places where you live energy efficient (homes, offices, schools, etc.) and reduce your energy consumption, saving money economically and efficiently. avoiding the production of polluting and climate-changing gases.

FOR EXAMPLE:

"A 10% REDUCTION IN ELECTRICITY CONSUMPTION" **WHAT DOES IT MEANS?**

Assuming that the sum of the electric consumptions taken from the inventory of all the classrooms of a school, consist of 130,000 kWh, a 10% reduction in consumption means:

- annual electricity savings of 13,000 kWh / year = (130,000 kWh / year x 10) / 100;
- annual economic savings of € 2,600 / year = 13,000 kWh / year x € 0.26 / kWh (for example, taking the average annual price of electricity € 0.26 per kWh)
- CO2 reduction of 7,540 kg CO2 / year = 13,000 kWh / year x 0.58 kg / kWh (assuming an emission of 0.58 kg of CO2 per kWh);
- saving of non-renewable resources (gas, oil, coal) equal to 3120 kg / year = 13,000 kWh / year x 0.24 kg (adopting as a quantity of non-renewable resources consumed for every kWh the value of 0.24 kg).

It is essential to share with all the calculated values, for example creating a billboard, to be displayed in the school building in clearly visible points, where all the results obtained in terms of energy, environmental and economic savings are clearly indicated. Seeing the results achieved can be an incentive for the development of further commitments.

3. INVENTORY

Knowing where your school's energy comes from and how you use it is a crucial first step to understanding what changes can be made.

In each classroom and common space the JEGs should make the inventory of the equipment energy use. In fact, to become more energy efficient, it is important to know how energy is currently being used. The **template 1** assists schools to determine their energy use and type.

For the Inventory Template, is required to specify the devices present in each of the chosen classrooms, their power and duration of hourly operation per day!

To insert on the Template 1, the energy absorption of the various devices, you can use an electronic device with a display, which is inserted between the socket of our appliance and the electrical outlet in the wall.

As soon as it is connected, the display shows the consumption in real time in Watt, in Ampere, the power peaks: the data are automatically saved to review them calmly. On some devices, it is possible to set the cost related to its range of use to directly view consumption expressed in Euros.

The electrical energy consumed in a building is expressed in kWh (kilowatt hours), a very widespread unit of energy, which corresponds to the energy used by a 1 kW power plant that remains in operation for a time now. The unit of measurement of energy in the international system is instead the Joule. The equivalence between the two units is 1 kWh = 3.6 MJ (millions of Joules). In this guide we always refer to the kWh, the unit of measure universally adopted in the electricity sector.

ABOUT MORE DETAILS, PLEASE, READ THE D.T.4.3.1.

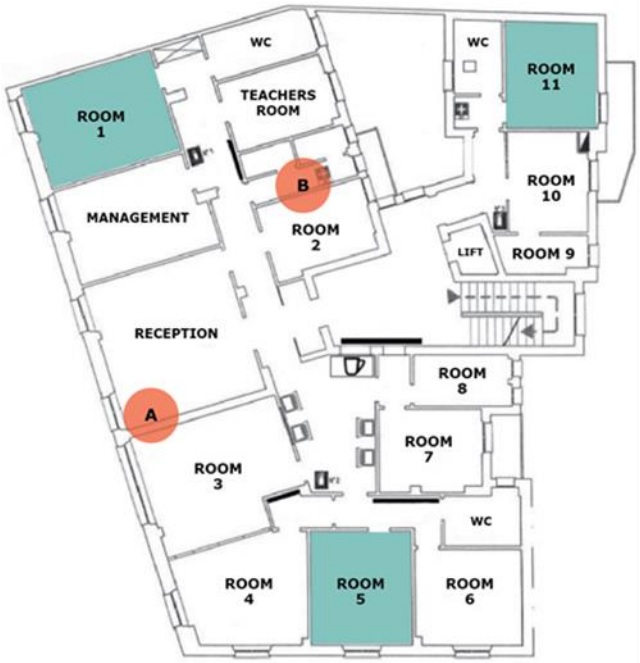
4. ELABORATION

Once all the inventories of the different classes of the school have been carried out, it will be necessary to proceed with the evaluation of the consumption expected for each of them. Will follow a comparison a comparison of all estimated total consumption in order to identify which, among the classes studied, results to have a greater consumption and therefore results to be an interesting class to be monitored in order to eventually reduce consumption, once implemented energy action plan in the final phase.

5. ORGANIZATION: Maps of the Schools and rooms

This step is necessary for a better understanding and possible verification of the consumptions detected, known that the structures detected and the plant components therein present.

Therefore, the maps of the entire school structure are requested and the classes actually chosen for monitoring are highlighted. It is important to report the name or the identification of these spaces.



ROOM 1

ROOM 5

ROOM 11

POWER CONSUMPTION SENSOR A

TERMAL SENSOR B

TABLE 1: Inventory template

SCHOOL:							
ROOM:	example name room						
Energy use	Details	How many	Load in working	Time on	Load in stand by	Time on	Use
			Watts	Hours per day	Watts	Hours per day	Kwh per day
Lighting	Lowenergy lamps						
	High energy lamps						
Equipment	Computers						
	Printers						
	Photocopies						
	Projectors						
	Whiteboards						
	Faxes						
	TVs						
	Video recorders						
	Speakers						
	Others(Power Tools, Fridges, Microwaves ...)						
TOTALE Kwh/ day:							
DATE:							
JEG:							

6. Analysis and evaluation of the current school electrical system

Simultaneously with the start of the survey of energy consumption, for the compilation of the Inventory Template, the action continues with another cognitive phase aimed at identifying:

- **management practices of the current school electrical system;**
- **useful changes for a sustainable management of the school electricity system;**

Analysis of behavioral practices and not, currently adopted for the management of the school electrical system

Identified and shared working methods and tools, the team of JEG's (Energy Guardians) comes into action analyzing and evaluating the current school electrical system. Each member of the team, equipped with the necessary for inspections, must, in a more or less technical way depending on the level of school, examine the school building considering the following aspects:

- styles of electricity consumption adopted by the school population, observing if there are any situations of energy waste (lights on in rooms where there is no one or where the natural light that enters from the windows is sufficient, the lights of the classrooms turned on before arrival of students, laboratory computers with standby on, photocopier on even if not used, gym lights constantly on, etc.) or if there are already good practices in place;
- sources of electricity consumption, wondering about the artificial lighting system (what light bulbs are installed? Are all neon lamps? In the classrooms you can turn off or turn on a single row of lights? How are the headlights of the gym? , after a while, they automatically turn off the lights? etc.) and on the electrical equipment present (how many computers are there ?, in the canteen there are fridges and dishwashers ?, etc.);
- factors of structural obstacle to the use of natural light and the saving of electricity (switches that do not differentiate the lighting of the lights in the classrooms, blackboards that reflect the natural light reducing the visibility of what is written, faulty shutters, lights of entire corridors controlled by a single switch, etc.);

7. Organization and start of the savings phase

From now on, in order for energy saving objectives to be pursued, it is absolutely necessary that the school population is informed and, consequently, committed to respecting the new protocols for the use of electricity. After a first "reserved" passage, in which the methods of application are specified among the organizers, the action becomes public and the phases, to be shared and implemented together with the entire school population, must be:

- presentation of the action to students, teachers, non-teaching staff and citizenship (what was done and what was planned);
- start and respect of the new rules for more sustainable use of electricity;

8. Finding ways to apply energy savings

The contact person / coordinator with the JEG's team and the persons in charge of energy consumption gather together and, based on the considerations contained in the report of the energy team, identify:

- objectives and new rules (protocols) to be applied to school for a more sustainable use of electricity;
- guardians of light (the name can also be different), that is to say the people who, in all the spaces of the school building, will contribute to the application of the new sustainable electricity management rules paying attention to the evolution of the relationship between natural light and artificial light, and taking care of switching on and off switches and other electrical equipment. The guardians of light, like the other operating groups, must be motivated people, with the desire to change.

9. ENERGY ACTION PLAN FOR JEGs

Junior Energy Guardians will describe each action scoping to reduce the energy consumptions by the following scheme:

a) responsible for the action;

b) description of the action;

c) on which consumption falls: electrical or thermal

Action involves changing people practices and behaviour.

All the actions have to be reported in the following template:

JEGs ENERGY ACTION PLAN *(Please, make one for each action identified)*			
Responsible for the action	Description of the action	On which consumption falls	
		Electrical	thermal

The energy action plan for JEGs will be focused on the reduction of **un-systemic and non-systemic energy consumption.**

Non-Systemic Energy Consumption: it is the energy that the school's staff uses directly for working. This consumption generates wasting energy if the school staff has not culture of energy efficiency for example turning equipment off when it is not in use (eg the computer monitor typically uses 67% of the total energy used by the computer system). Junior Energy Guardians should develop good housekeeping practise in their junior action plan using a simple-fix template of life style action to reduce the wasting energy.

Un-systemic Energy Consumption: it is the energy that depends on both systemic and non-systemic energy consumptions for example lighting that is one of school's largest area of energy use. On a part, installing energy efficient lighting is a simple way for schools to reduce their systemic energy consumption while, on the other part, making good use of daylight in a classroom can reduce lighting costs by 20% and then the non-systemic energy consumption: both the action represents an example to reduce a un-systemic energy consumption. Installation of high energy efficiency lights is an action by Senior Energy Guardians while turning off the lights to favour the daylight use is an action by Junior Energy Guardians.

10. EXAMPLES OF ENERGY ACTION PLAN

JEGs ENERGY ACTION PLAN *(Please, make one for each action identified)*			
Responsible for the action	**Description of the action**	**On which consumption falls**	
		Electrical	**thermal**
Students	The entrance of natural light should be maximized, completely opening the roller shutter, unless direct sunlight disturbs anyone. It is sufficient that even just one person requires the lowering of a roller shutter because it must be closed: energy savings must bring well-being, not sacrifice.	x	

JEGs ENERGY ACTION PLAN *(Please, make one for each action identified)*			
Responsible for the action	**Description of the action**	**On which consumption falls**	
		Electrical	**thermal**
Students	Open the windows for short periods, keeping the classroom door closed, to avoid excessive dispersion of the heat contained inside.		x

JEGs ENERGY ACTION PLAN *(Please, make one for each action identified)*			
Responsible for the action	**Description of the action**	**On which consumption falls**	
		Electrical	**thermal**
For non professor staff	At the school entrance at 7.30 am, only the lights necessary for the staff to do their work are turned on. The lights in the classrooms are left out, as are the lights in the side corridors. The light in the two central corridors is switched on only if necessary	x	

JEGs ENERGY ACTION PLAN *(Please, make one for each action identified)*			
Responsible for the action	**Description of the action**	**On which consumption falls**	
		Electrical	**thermal**
Teachers	Professors are responsible for the management of light in the teachers' room, in the laboratories, in the gym, so the production of artificial light, which generates costs and pollution, must be made minimal, respecting the constraint of ensuring the well-being of everyone	x	

To promote energy efficiency in schools, the following good rules of conduct are recommended:

- Switch off or not switch on the lights when there is a good condition of natural light.
- Turn on or keep the lights on when there is little natural light (if there are several switches, only one part can be turned on).
- Take care of switching off the lights when changing the classroom and at the end of the lessons.
- Take care of turning off the lights in the bathrooms.
- Turn off the lights left on when the school closes.
- Before the entrance of the students keep the lights off.
- Use the headlights only in conditions of poor natural light.
- At the end of the hours of physical education, turn off all the headlights of the gym.
- Ensure the sustainable use of computers and photocopiers or other electrical equipment by including energy-saving options in PCs.
- At the end of the working day, turn off all the lights and the various electrical equipment, avoiding to keep the standby lights on.

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