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Work package: **WP3 – Strengthening schools capacities in the energy sector**

D3.2
Initiatives to build capacities of schools in the energy sector: best practices from the EGS project.

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1 Executive Summary

The deliverable D3.2. “Initiatives to build capacities of schools in the energy sector: best practices from the EGS project” describes all the activities of workpackage 3 aimed at building capacities at school except training activities to which a specific deliverable is dedicated (see the D3.1).

The chapter 2 of this deliverable summarises the EGS project’s contents to allow the reader to know the project objectives and actions before knowing the results achieved by schools from 9 EU countries.

The project Energy Education Governance Schools (EGS) aims to involve local communities in tackling energy issues and improving energy efficiency counting on school’s position in the society.

The chapter 3 illustrates activities done and results achieved to improve the school’s management skills and capacities. The CEI EN 16001 standard, even if not fully adopted, was an important point of reference to define organisational and procedural improvements.

The involved schools implemented a light energy management system inspired by the 16001 involving internal staff and, in some cases, pupils, focusing also on educational and training aspects.

In particular, ideas and methodological tools for energy analysis, policy, planning, training, monitoring have been written down to be used by the EU schools.

All the involved schools from 9 EU countries adopted some solutions in their organisations. Monitoring, energy policy and education were the favourite elements.

The chapter 4 describes activities aiming at awareness raising and education of pupils and also their families.

Almost 60 best practices was collected from 9 countries and organised in a data base which is open to the public at the EGS web site (www.egs-project.eu)

Best practices concerns for instance:

- energy saving;
- renewables;
- contests and other initiatives;
- contamination of non-scientific curricula.

The chapter 5 illustrates teaching activities carried out at schools to improve pupils knowledge and C.V.

In all nine countries involved, 34 schools made lectures for their students. In total, almost 10.000 pupils participated in lectures at their school.

More than 1200 hours of teaching activities was provided + 2000 hours of laboratory on renewables and energy saving.

2 Introduction

2.1 The project EGS

The project Energy Education Governance Schools (EGS) aims at involving local communities in tackling energy issues and improving energy efficiency. The EGS project hypothesis is that the main actor that can contribute to involving the whole community and at the same time train the younger generation is the school. Consequently the main target group of the project are schools. Some consortium members are schools and additional schools will be involved in the project activities, so all partner countries are covered. Beyond the primary target group schools (teachers, students, administrative staff) other related groups are addressed by the project and will benefit from the project results: parents/families, local entrepreneurs, local communities and stakeholders. When using the term “EGS target group” in this document we always refer to this wider definition of the target group.

Besides the preparation of an energy state of the art assessment in schools, general awareness raising and mainstreaming of the project results and good practices found, the project plans to develop/integrate new educational content for students, to elaborate and support training for schools staff and to initiate pilot activities. These pilot activities shall be selected and defined by a bottom up approach involving all different target groups (teachers, students, administrative staff, parents/families, local entrepreneurs, interested locals, community stakeholders etc.) addressed by the EGS project.

The first output of EGS is a **Manifesto** in which schools declare their willingness to improve in terms of “energy”, what can have very different implications. The manifesto is widely promoted. Furthermore energy management systems and audits in schools are carried out, training for students and teachers elaborated. Local forums, is promoted and facilitated aiming at outlining and formalising priorities and pilot projects (at least one in each local community/school) to be implemented.

In general the monitoring and documentation of good practices is of high relevance in the project EGS because especially well documented good practice examples can be easily adapted and transferred also beyond the project consortium.

The project is organised in seven work packages whereas WP1 is the project management and WP6 and WP7 are dedicated to dissemination activities.

WP2 organises the initial survey to define the state of the art in terms of energy in general and energy education in the schools.

WP3 will raise the schools capacities by initiating new educational offers for students, teachers and schools staff.

WP4 and WP5 are closely related: In WP4 local community forums (local communities at schools) will be build up inviting all relevant target groups to participate in a discussion process in which action plans targeting important challenges and highlighting priorities shall be defined.

In WP5 on the one hand methods and tools will be defined on how to select the most feasible priorities and topics for more detailed feasibility studies and finally the pilot actions for which also monitoring and evaluation methods will be elaborated. On the other hand the pilot actions will be implemented by the forums, local communities or responsible stakeholders during WP5.

2.2 WP3 Overview

The WP3 aims at building the internal capacities of schools and allowing them to play a leading role in addressing their communities toward energy efficiency.

In particular the WP3 consists in:

1. explicit a political vision of schools for energy efficiency;
2. raising the skills of teachers for improving the quality of teaching;
3. making available documentation and best practices to enrich the lessons for students and to sensitise their communities;
4. improve the schools organisation for better address their energy efficiency.

2.2.1 The Manifesto

For what concerns the first item, the Manifesto for energy efficiency in schools communities has been produced and widely disseminated. More than 100 schools signed it throughout Europe.

The Manifesto is a sort of act of commitment with which the signing schools will agree to follow a path of continuous improvement of their energy performance and of energy contents in educational programmes.

The signers have the right to access EGS best practices, information on events, new projects related to the EGS project etc. On the other hand they agree with the objectives and goals of the Manifesto and use the results of the project to reach such goals.

This deliverable concerns training of teachers, teaching of students and energy management in schools.

Training courses for schools staff and courses for students have been designed and then tested. The Deliverable D 3.3 covers in detail the results of training activities for teachers.

2.2.2 Internal skills improvement

Actions have been undertaken in all 13 schools directly involved in the project and proposed to all schools signing the Manifesto

Training needs of the school staff have been analysed

Training courses for school staff (at least 3 proposals for different targeted participants and needs) have been designed based on existing best practices at EU level and elaborated in order to be implemented in the different countries depending on national/regional/county requirements and existing educational programmes.

Training activities have been carried on and validated involving personnel different than the partners one

The effectiveness of the training courses have been monitored by using a test.

2.2.3 Integration of schools courses with energy items

Best practices related to education on energy efficiency have been selected and collected in the EGS data base. Based on them, lessons are addressed to thousands students.

Proposals for integrating different schools courses (e.g. technical, history, math, national and foreign languages, etc.) for students with energy items are formalised

Such courses are proposed to competent Authorities for making possible their adoption in national and regional schools programs

The scope of a EC Directive or an other act is defined for integrating energy items in the national/regional schools program. This is included in D3.3 as part of comments and proposals to be addressed to EU policy makers

2.2.4 Energy management systems

The creation and implementation of an energy management system, as already happens in many schools with environmental management systems, is a way to improve the energy performance of schools and it is also coherent and synergic with teacher training and lessons for pupils on energy efficiency. In fact the designing of the energy management system requires an active participation of teachers and students who take direct measurements, understand what energy efficiency is. Specific lessons are organised in order to explain what a management system is and what are its objectives and results.

Education and learning are the right ways for interpreting the management system in schools.

Activities related to the introduction of energy management system in a school are:

- Identification and assessment of Schools activities directly and indirectly related to energy efficiency (transports, consumes, supply, etc.).
- Designing the energy management system (policy, efficiency program, procedures).
- Energy Statement and system auditing

3 Energy management

3.1 Background

The WP3 aims at providing schools with organisational models for improving the energy management control both from energy saving and renewable sources points of view.

After the EGS project approval and kick off, the new standard EN 16001:2009 “Energy management systems. Requirements with guidance for use” has been approved by CEN.

EN 16001 specifies requirements for an energy management system to enable organisations to develop and implement a policy, objectives and procedures which take into account legal requirements and information about significant energy aspects. It is a useful document for all types and sizes of organizations. This standard concerns activities under the control of an organization which aims to:

a) Improve energy performance in a systematic way
b) Establish, implement, maintain and improve an energy management system
c) Improve energy efficiency performances
d) Reduce energy costs
e) Ensure that it conforms with its stated energy policy
f) Demonstrate such conformance to others
g) Seek certification of its energy management system by an external organization
h) Make a self-evaluation and self-declaration of conformance with the standard.

In the EGS project 13 energy management systems (EMS) are established in many based on guidelines included in this deliverable and described in next chapters.

EMS are not conform to all EN 16001 requirements since these are too much challenging for schools which are not familiar with organisational standards (in fact the EGS project doesn’t mention the EN 16001 which was not approved when the project has been proposed).

Guidelines are based on EN 16001 implementation in the Liceo Tron supported by the project partner Sogesca srl. The Liceo Tron is already certified according to EN ISO 9001, 14001 and EMAS Regulation so it is familiar with standards and the integration and testing of programmes, objectives and procedures for increasing the energy efficiency has been viable.

3.2 Goals of the Guidelines

The guidelines for implementing an Energy Management System in schools are proposed with the following goals:

- To define the specific scope of the EN 16001 in schools for allowing a correct interpretation of the standards according to the schools mission.
- To provide EMS elements for supporting the redaction of EMS components such as a policy scheme, programme structure,

  The presented framework should outline the background information and refer to methods which are proposed for the selection process. The aim is to provide a framework which supports and guides decision processes. The decisions have to be

taken by individuals/groups based on their subjective experiences, backgrounds, information etc. Based on objective information, indicators have to be weighted and prioritised based on the goals of EGS and the local experience and requirements in the forums (or of the users). So the framework we propose here can be used flexible and has to be adapted and prioritised also based on local conditions.

- To provide indicators which can be used to decide on priorities:

  Part of the whole framework will be qualitative and quantitative indicators. Since these evaluation guidelines shall address a wide range of different activities and priorities, the indicators have to be generic enough to not exclude priorities which shall be checked but at the same time have to be specific enough to provide meaningful information. The set of indicators shall be limited and of reduced complexity to allow a first check. More details on the indicators and if necessary additional indicators can be elaborated and applied in the feasibility studies.

- To provide evaluation tools for practical application:

  Tools will be proposed which can easily be used and shall guide the decision processes in order to make the indicators applicable. The tools will mainly be checklists which can be used to evaluate a certain idea or priority and to document the decision processes. We intend to make these tools as easy to use and self-explaining as possible and follow a more practice oriented and less academic approach in evaluation. So a clear priority is the usefulness of the results for the school, forums and local community.

- To provide a structure to report findings:

  The used/filled in checklists are one component for reporting the decision processes. Additionally a template for reporting the decision processes will be elaborated based on the same criteria as the tools: easy to use and self-explaining.

3.3 Designing the Energy Management System (EMS)

The creation and implementation of an energy management system has already happen in many schools with environmental management systems. In order to facilitate and integrate the actual and future systems this Energy management system is based in the **UNI EN 16001:2009**.

An Energy Management System (EMS) enable an organization to go in a systematic way to the continuous improvement for energy efficiency. This is a more efficient and sustainable path independent from the kind of energy used.

1. Introduction to energy management system (EMS). Main definitions.
2. Identification and analysis of energy aspects.
3. Definition of an energy policy
4. Nomination of a referent person or group
5. Improvement plan (energy objectives, targets)
6. Competences, training and awareness
7. Communication
8. EMS documentation
9. Operational control
10. Monitoring and measurement
11. Nonconformity, corrective action and preventive action
12. Internal audit
13. Review of the energy management system by top management

3.3.1 Introduction to Energy Management System (EMS). Main definitions.

Some definitions are given in order to clarify concepts about how to apply an EMS.

- Energy aspect: element in the organization's activities, goods or services that can influence the energy use or consumption. An energy aspect is significant if it accounts for a high proportion of total energy consumption and has a potential for one or more of the following:
  - ✓ More efficient energy use;
  - ✓ Increased use of embedded renewable energy;
  - ✓ Increased energy exchange with the rest of society.
- Energy efficiency: ratio between an output of an organization's activities, goods or services, and an input of energy

- Energy objective: overall energy goal, consistent with the energy policy that the organization sets itself to achieve
- Energy Policy: an organization declaration that defines their own purposes and principles related to the overall energy performance. It's a framework for action.
- Energy Management System: set of set of interrelated or interacting elements of an organization to establish energy policy and objectives and to achieve those objectives
- Energy Performance: measurable result of the organization's energy management system.
- Energy management program: Action plan specifically aimed at achieving energy objectives and targets.
- Energy Performance indicator: the ratio chosen by the organization to monitor energy performance.
- Energy target: Detailed energy performance requirement, quantifiable, applicable to the organization or part thereof, that arise from energy objective and that need to be set and met in order to achieve those objectives.

[source UNI EN 16001:2009]

3.3.2 Identification and analysis of energy aspects

The school will conduct an initial analysis of the energy aspects that will always be regularly updated and documented.

This analysis will define the scale of priority of energy aspects relevant to further evaluation keeping a record of energy savings opportunities.

The identification of energy aspects and their analysis is a process that can be divided into four steps:

1. **To select the activities, products and services**. This action mustn't be of an excessive size to allow the correct analysis.
2. **To identify energy aspects** of the activities, products and services. It's necessary to identify the most energy aspects through an analysis of energy consumption. The various techniques to enable this are: questionnaires, interviews, checklists, inspection or direct measures, analysis of available recording. To retrieve data the organization can rely on various external entities such as public administration, local archives and/or regional (preferably computerized), trade associations, manufacturers of equipment used, business contacts (users office for energy suppliers), support from professionals.
3. **To identify indicators of energy performance.** In order to become aware of the potential effects of reducing energy consumption, appropriate energy performance indicators should be determined. Some examples are: cubic meters of gas heating / square or cubic meters of building, kWh / kg of product, etc. It's preferred to use commonly indicators used by the industry to allow the organization to compare its performance with those of similar companies or industry standards.

4. **To compile a list of energy saving opportunities.** Preferably have a table where consumption and indexes described above are clustered by activities, buildings (where applicable) or unit of production. These should be combined to the potential savings, required or expected. Alternative energy carriers should be indicated as well.

Experience shows that the probability of successful implementation of an EMS is based on the contribution of at least 6 factors:

1. Energy Policy
2. Organization (in terms of system of responsibilities and delegation)
3. Motivation (in terms of internal operational communications)
4. Information (in terms of data access)
5. Promotion (in terms of communication: information/training, internal/external)
6. Investments (in terms of management mode of the system)

The objective of the initial analysis is to collect all information concerning the energy aspects (elements of the school's activities, goods or services that can affect energy use) directly (i.e. the consumption of electricity) and indirectly (i.e. suppliers consumption) linked to the activities of the school.

The initial analysis focuses mainly on collecting and evaluating data on the consumption of electricity, heating fuel, etc. for at least three years before the current year, taking into account the factors that most influence energy consumption: see **ANNEX 1-A STUDENTS EXERCISES**.

The activities foreseen in the **ANNEX 1-A STUDENTS EXERCISES** depends on the working group that will decide, based on opportunities, which ones will be developed in classes. (level A+, A, B, and C).

The initial analysis provides an identification of areas with the most significant energy consumption, possible improvements in performance and an estimation of energy consumption for the next evaluation period (i.e.: the following school year).

Moreover, the initial analysis provides the identification of all the people who work on behalf of the school (in particular, the managing body of the building/structure) whose actions may lead to significant changes in energy consumption

Activities with students will enable to identify energy aspects: see **ANNEX 1-C RECORD OF ENERGY SAVING OPPORTUNITIES – EVALUATION ASPECTS**

Evaluation criteria for energy aspects: see **ANNEX 1 - B RECORD OF ENERGY SAVING OPPORTUNITIES - EVALUATION CRITERIA.**

The energy aspects' analysis should also include:

- Past and present consumption based on direct measurement or other available data;
- Identification of areas of significant energy consumption, in particular of significant changes in energy use during the past period;
- An estimate of the expected consumption in the following period;
- Identification of all persons whose actions may lead to significant changes in energy consumption;
- Identification and definition of the priority scale of the opportunities for improving energy efficiency.

Energy aspects are evaluated according to evaluation criteria. If the total result of an aspect exceeds the set threshold, the issue is considered to be significant.

When one aspect is significant, the response of the system is an objective/target for improvement , the adoption of best practices (operating instructions or monitoring) or data monitoring.

To do a good analysis people should be prepared and competent. Please refer to paragraph 6 of the guidelines, this is only a list of topics to be included in the formation of the Workgroup regarding to:

- Energy Efficient lighting;
- Energy efficiency in ventilation systems;
- Energy efficiency in boilers and heating systems;
- Energy efficiency in air conditioning systems;
- Energy efficiency the use of hot water;
- General principles of energy audit.

For those with Environmental management system (EnvMS): Starting from the Environmental initial Review (EIR), identify in the environmental aspects those energy aspects (Energy consumption, fuel consumption, traffic, transport) to provide more details; or

If the EIR is a document continuously updated, it should be integrated ensuring that performance indicators identified are appropriate to the objectives of improving energy efficiency in line with the Energy Policy. Otherwise more appropriated energy performance indicators should be defined.

If the EIR document is dated, work to integrate the environmental aspects assessment matrix (as provided in 4.3.1 ISO 14001) and the list of energy conservation mentioned above in point 4, paragraph 2.

See **ANNEX 1:** **A - STUDENTS EXERCISES**
B - C- RECORD OF ENERGY SAVING OPPORTUNITIES

Finally, during the initial analysis it is appropriate to verify that the school complies with current energy legislation (particularly important in view of certification according to EN 16001).

First of all, it's needed to know the energy legislation applicable in your country. Then set a record law stating the applicable law and also information about the regulatory compliance organization.

It is shown as an example an extract of register of laws applicable in Italy (in Italian). See **ANNEX 1 F- REGISTRO LEGGI**.

For those with Environmental management system (EnvMS): See if the environmental legislation register contains all applicable energetic law (some examples from the Italian law: Presidential Decree 412/93 and Legislative Decree 192/2005 obligations to thermal plants). It should also be mentioned all legislation non mandatory but which provides incentive to develop systems of energy saving and renewable energy. The document should be integrated.

See **ANNEX 1 F- REGISTRO LEGGI**

3.3.3 Definition of an Energy Policy

The EGS Manifesto represents the initial commitment shared by the various schools participating in the project.

The Energy policy is the document showing how the school wants to specifically commit to meet the objectives of the manifesto. Thus, it is important that the school Energy Policy involves also the relationship with stakeholders and interested parties of the school territory.

A Policy in line with the EN ISO 16001 standard:

- is appropriate to a school
- is a document formalized and approved by the School Board which has to be regularly reviewed and properly amended
- must summon the characteristic energy aspects of the School
- includes a commitment to continuous improvement through explicit definition of an improvement plan with objectives and targets

- complies with legal requirements
- includes basic internal communication (to all those who work for the school)
- includes strategic external communication (with all the stakeholders of the territory)

For those with Environmental management system (EnvMS): It is not possible to disregard an Environmental Policy already approved and disseminated. It is possible to include the Energy Policy within the same document.

See **ANNEX 1 - G EXAMPLE OF SCHOOL ENERGY POLICY**

3.3.4 Nomination of a referent person or group

School management will ensure the availability of resources essential to establish, implement, maintain and improve the energy management system. Resources include human resources, specialized skills, technology and financial resources.

Roles and responsibilities will be defined, documented and communicated.

School management instructs one or more persons (the ENERGY MANAGEMENT SYSTEM GROUP) for the implementation of the energy management system in order to cover all the skills and knowledge necessary. I.e.: one or two teachers of technical/scientific subjects with specific skills, a teacher for the integration of educational and training activities in the existing didactic offer, a teacher / administrative management of external relations and the operator of the facility.

The group should report to the top management therefore it should include someone from the Principal Office. The group may also include one or more student representatives.

Where necessary, the group will receive the appropriate training.

Operational activities (data collection, records collection, meter reading, etc.) are very interesting to do with the students. Optionally other additional degrees of involvement should be set. (e.g. choice of indicators / aspects, instructions for monitoring, etc.) See the analysis of paragraph 2.

For those with Environmental management system (EnvMS): The personnel involved within the environmental team not necessarily should be energy expert. The energy manager system group should be included in the environmental team. Other students could be involved in the energy management system.

3.3.5 Improvement plan (Energy objectives, targets)

Improvement goals must be consistent with the school Energy Policy.

For each improvement objective, there must be the identification of measurable targets and actions, a timeline, resources and responsibilities.

When this objectives and targets are set it's necessary to consider the energy aspects identified in the analysis as well as technological, financial and operational possibilities as well as business conditions, legal requirements and the views of stakeholders.

For those with Environmental management system (EnvMS): See if the environmental improvement program includes objectives, targets and actions relating to energy aspects. The document should be integrated.

See **ANNEX 1 - D RECORD OF ENERGY SAVING OPPORTUNITIES**

3.3.6 Competences, training and awareness

Until now the activities have been run by a small working group. Now, the initial analysis is presented to the school and the players involved:

- Presentation of the initial analysis (this is a closed document)
- Evaluation of energy aspects and laws, school energy policy, improvement plan (these are open documents)
- Awareness rising within the school about the EMS
- School FORUM as a tool for the presentation of the EMS in the territory and involvement of local stakeholders

Starting of activities:

- Didactic planning (see the collection of EGS good practices)
- Teachers training (see EGS training plan and contents)
- Training of all school workers

All persons working for the school must be familiar with the energy efficiency principles, energy policy and energy management programs. Particularly, each one must take very seriously the importance of achieving the goals and targets which responsible. The training system should demonstrate that people whose work could impact on significant energy consumption is competent.

For those with Environmental management system (EnvMS): Use the EnvMS procedure integrating general training in UNI EN 16001 and specific energy training for the energy manager system group.

3.3.7 Communication

Relevant Information on energy performance should be regularly communicated to all levels of the organization (minutes of meetings, attendees, internal circulars, websites, email, etc)

- Existing internal Communication suitable to EMS (school documents, boards, etc.)

Decide if the organization wants to communicate its energy performance to the external stakeholders and properly set the selected communication channels.

- External Communication (School Forum)

For those with Environmental management system (EnvMS): Use the EnvMS procedure and / or the Environmental Statement to highlight the EMS improvement process.

3.3.8 EMS documentation

Selection of documentation to be shared (ie. improvement program with objectives). Assessment on how to involve students and teachers in drawing, verification and approval of documents.

Determine where will be the system files, who can read, edit and file them. There must be a clear list of all the EMS files.

Strengths: students are very good at managing and sharing information by computer.

Critical points: Avoid to keep updated documentation in the possession of the person who prepared it. Establish clearly what formalizes the passage of a document form draft state to final and official state.

For those with Environmental management system (EnvMS): Integrate the existing documentation as possible. It's important to retrieve technical documentation form systems and facilities in order to have an updated picture of the energy performance of the school.

3.3.9 Operational Control

Establish operational instructions for checking the significant energy aspects. The decision to draw as many or as few instructions depend on many factors: the experience and ability of people who work, the complexity and value of energy subject to operational control.

Formalized operational instructions can also be used to change bad habits. (Integration with EGS good practices).

Determine the equipment with significant impact on energy consumption under maintenance. Instructions for turning on/off of plants, supplies; instructions for reading monitoring devices (thermometers, electricity meters, etc.)

Determine if energy consumption is considered when purchasing materials and equipment. (Green procurement). To inform clearly to providers.

Energy aspects related to building design criteria are responsibility of the manager of the facility. Important collaboration between manager (provincial Administrator) and building user (school).

Specific ATTENTION to the INTERACTION with the OWNER/MANAGER of the BUILDING/STRUCTURE: plants, plans/contracts of the building, heating procurement contract etc.

Activity	**Responsibility**
Lighting in rooms, gym, etc. (involvement of students, school workers, etc.)	User (a lot)
Electricity consumption	User (a lot)
Heating consumption	Manager (a lot)
Hot water	User
Energy for transport	User
Renewable energy	Manager

For those with Environmental management system (EnvMS): Check for operating procedures already energy oriented (e.g. Temperature control, meter reading, etc.) Consider to integrate them with other operational actions consistent with the greater detail developed during the initial analysis.

3.3.10 Monitoring and measurement

An energy monitoring plan shall be defined and implemented.

The organization shall ensure that the accuracy and repeatability of monitoring and measuring equipment used is appropriate to the task. Keep records of the data!

Selection of measuring tools

The organization shall, in each practicable instance, establish the relationships between energy consumption and its associated energy factors and shall, at defined intervals, assess actual versus expected energy consumption.

Selection of energy indicators for the school

The organisation shall wherever possible compare their energy performance indicators against similar organisations or situations, externally and internally.

COMPARISON WITH OTHER SITUATIONS that have NOT been MANAGED (ie. differences between two classrooms, two wings, two similar buildings etc..) as a control group.

Thus it may be appropriate not to apply all operational procedures everywhere from the beginning

For those with Environmental management system (EnvMS): Check for operating procedures already energy oriented (eg. Energy consumption tables, temperature charts, , etc.) Consider to integrate them with other operational actions consistent with the greater detail developed during the initial analysis.

See **ANNEX 1 – E - RECORD OF ENERGY SAVING OPPORTUNITIES**

3.3.11 Nonconformity, corrective action and preventive action

Put into action the planning system and carrying out corrective and preventive actions.

Review nonconformities causes to avoid recurrence. The timing and characteristics of the corrective actions are appropriate to the nature and size on the nonconformity.

Preventive actions are taking extrapolating corrective actions in areas not yet identified as nonconformity. The process must ensure the verification of effectiveness of corrective actions.

For those with Environmental management system (EnvMS): The management process of nonconformities, correctives and preventives actions is already systematized with the EnvMS. It's sufficient to clarify what are the nonconformities for the Energy Management System (EMS).

3.3.12 Internal audit

Internal audits of EMS are conducted at planned intervals (at leas once a year) to provide useful information to the Principal Office about the conformity of the system.

The internal audit will verify if the EMS has been properly implemented and maintained, and will focus on processes, functions and areas related to energy aspects.

The competence of the auditors / technical experts should be sufficient to achieve the audit purposes and provide security on the reliability of results.

OPPORTUNITY TO TRAIN PEOPLE oriented to internal auditing.

The EMS audit could require deeper analysis in the energy audit of the building.

Critical point: Which is the way to consolidate the EMS despite students and teachers change frequently over the years?

For those with Environmental management system (EnvMS): Use the same audit procedure incorporating new energy auditors competences.

3.3.13 Review of the energy management system by the Principal Office

The Principal Office review the EMS adequacy at least once a year including all energy aspects.

The review implies that the individual elements and overall operation of the energy management system are evaluated in a critical manner in relation to the ability of the system to comply with the energy policy and achieve the energy targets. In the case of large investments this evaluations must take account of a serious costs-benefits evaluation.

In this review will participate the Principal Office and it should be decided if all or only some of the workgroup.

For those with Environmental management system (EnvMS): Formalize the management review system with the Environmental System.

3.4 Case studies

Energy management systems have been implemented in all project areas according to EN 16001 and to guidelines proposed during the EGS project by Sogesca. Guidelines have been considered useful since the EN 16001 was considered too much challenging for schools.

Thanks to the simplified approach to EN 16001, schools have been enabled to exploit very useful inputs to improve the energy management.

According to these considerations, schools chose some items of EN 16001 and they have implemented it.

First of all, they have refined or realised an analysis of the energy consumption both in terms of power and heating.

This is the so called “Initial analysis” to evaluate the performances of successive years.

To allow this evaluation, schools have defined indicators and adopted procedures (not necessarily formalised) to monitor and to take note of consumes.

Energy policy adopted, specifically defined or Manifesto

Working group composition: principal, teachers + other staff school and students in some cases.

Some schools planned to involve students in the next year when the energy management system is implemented

4 Education on energy efficiency

4.1 Background

The EGS project is coordinated by a school and between partners there are many other schools.
So the energy issue is treated mainly from the perspective of cultural and educational. Energy efficiency is now considered a priority for economic, social and environmental issues at the beginning of the third millennium. The economy is switching, renewable spreading permanently, solutions for energy savings are now a choice rooted businesses, consumers, local authorities, etc..

The EGS project therefore provides good practices, contents and information sources that schools and teachers can adopt by including them in educational programs compatibly with the mandatory teaching contents.

The good practices, contents and sources are collected in the data base of site-www.egs-project.eu.
It is considered that, until the energy issue is not included in mandatory training programs, not part of the profile of students and is not included in the system of final assessment, the discussion of energy efficiency in schools will remain a voluntary practice carried out in short space of time.

For this reason, the EGS project will give added value by translating good practice in recommendations addressed to public authorities with the aim of incorporating the theme of “Energy efficiency” in national/regional mandatory teaching programs and evaluation systems.

According to the EGS, energy issue should not be included in programs only as such but it can be integrated into other disciplines such as history, foreign language, physics, etc.. So the awareness raising can increase in humanistic and other no-technical schools as well.

The usefulness of best practices and content of the database is tested throughout the school years 2009-2010 and 2010-2011 according to the schools involved and the participating countries.
The results of the lessons will be commented in the final report and incorporated in this Deliverable

4.2 The EGS data base

The EGS data base collects 57 best practices related to on education energy efficiency and on energy saving and renewables at school.

Best practices have been selected in 9 countries (Italy, Germany, Bulgaria, Romania, Finland, Portugal, France, Netherlands, Greece) and have been carried out by schools themselves, educational and energy agencies, local bodies, etc.

The collection provide users with a wide range of case studies related to:

- ⇨ Energy saving
- ⇨ Building efficiency
- ⇨ Renewables such as solar, photovoltaic, wind
- ⇨ Education
- ⇨ Energy management
- ⇨ Climate protection
- ⇨ English
- ⇨ History
- ⇨ Physics

Being part of the www.egs-project.eu website, the data base address is http://www.egs-project.eu/index.php?option=com_sobi2&Itemid=28.

Best practices can be selected thanks to some predetermined categories, by countries or by a free search.

In the following section best practices are illustrated and commented. For more details, please visit our data base.

4.3 Short description of best practices

4.3.1 Energy saving

Main objectives of proposals in this section are: increasing the awareness of students that can be active part in energy savings; integrate the curriculum with items that are not yet included like weather.

Activities have been selected in order to involve students to do analysis, design and audit.

Typically students are engaged to analyse the energy situation of their schools, checking different aspects of energy consumption and trying to identify causes and relationships with their activities.

This process is carried out at different levels, sometimes more simple and not necessarily less effective, checking the results of analysis carried out by authorities or public

administration (eg. project “Thermographic investigation into heat loss” in Germany) or acting direct analysis of single aspects (thermometers in classrooms, check of electricity usage), sometimes carrying out complex audits (eg. Projects “Sustainability Audit” in Germany, “Energy Audit”, in Italy) which is a particularly effective tool to engage students on issues of energy efficiency and the classification efficiency of buildings for the purpose of certification and developing proposals of improvement.

Another way is to join initiatives organized by governments as the project for the “Environmental Certification of schools” in Finland and “SAGE _Agenda 21” in France, where criteria and certification have been created as tools and incentives for the development of operation and quality of teaching without any intention of applying for the certificate. In the” 50:50 Düsseldorf” project if a school conserves energy water or waste of its own initiative, it receives in return 50% of the costs saved for its own use. Also related with "Renewables" section the “Solar Panels for Düsseldorf schools” project describes different methods developed by the city in which a school can achieve technical, economic and managing support to install a solar panel on its roof.

Even structural intervention in school buildings can be used to start using energy responsibly during everyday life: it’s the case of “Double Glazing Windows in School” project in Romania in which students realized the great importance of double glazing windows as there was more heat in the classrooms than with the previous windows.

4.3.2 Renewables

Typically proposals connected to the study of energy alternatives consist of two types of activities. On one hand **Workshops and practical activities** in which students experience designing and constructing functional objects with sources of renewable energy, that is the case of the “Solar Electronic Kits” or “Solar cooker” projects that help people who are new to solar energy, or even “Kid Wind project” which uses turbines for educational proposes using small electrical devices like LED bulbs and mini water pumps.

On the other hand **Visit to location and existing facilities** to observe operation and understanding mechanisms: projects like “Visit to energy locations**”** to go a place where students can see directly that have been explained in the classroom by experts or by teachers. Or “Libera Route of Energy”, guided visits to different renewable energy plants

There can be a mix of the two approaches just described called **Mobile laboratories.** In fact these are portable structures created to support schools in energy issues education as the “Environment Mobiles” in Germany. The Energy Mobile**,** a car fuelled by rapeseed oil with a trailer full of materials for experiments and demonstrations. Under the direction of an expert, the students can perform age-appropriate crafts and experiments relating to renewable energy and energy efficiency.

Another good example is “Grasping of Climate in Theory and Practice” this project aim to increase the awareness and knowledge among teachers and pupils about how our lifestyle

has influence on the environment and climate, and in theory and practice show how they by small changes in their daily behaviour can have influence on the development to a neutral and sustainable climate.

4.3.3 Educational sources

This can be a precious support for teaching energy issues: the basis is a series of ready lessons with notes, pictures and free downloadable videos of experiments that can be reproduced in school laboratories or even interviews with industry experts, films or events, etc. It can be found also more original and advanced teaching ideas: chat, e-learning platform, software, games, dramas, etc.

Re-Energy.ca. It is a site with educational purpose where there are lesson plans for teachers to help students to understand renewable energy technologies and their importance in providing clean energy resources.

FuturEnergia. Among other proposals in this project, periodically free registration chat are organized, on specific topics, where students can interact with energy experts and other foreign students.

E.on UK. Also this site offers a lot of material on energy conservation and alternative energy (Energy Experience section), there are interesting interactive games in which different situations are simulated and students are asked to take decisions on energy issues: they can be reporters that have to write an article on wind turbines or CEO of a power company that must take decisions on the development of the company itself.

Enercities. This site is the result of an European project, it has a sophisticated simulated game as Sim-City in which the student has to deal with building a sustainable city.

Eurenergy. As well as different educational materials, it offers an interesting e-learning platform with ready-made lessons, complete with material that can be used, after free registration, to organize lectures at distance, also between classes of different countries.

4.3.4 Research and reflections

It is not possible for all schools to organize events, laboratories or visits to the territory. In these cases the most immediate way is to involve students in projects that include a phase of research and a conceptual design of new solutions, interventions, devices, management

changes.
Some ideas and results of such projects are:

- *The Houses of the Future***:** in this project, students, after making some research, learn how the solar energy can be used in a house. They made a model of a house supplied with solar panels. They also made a Power Point presentation about the advantages of using of that source of energy.
- *Energy Sources The Sun Our Friend / Water Power***.** In this case Bulgarian students were given a task to make research and find out which are the most ecologically friendly ways to produce solar energy and building solar power stations. Then they had to present their research results to the other students from the class.
- *Energy and environment***.** In this Italian project, the students made researches about energetic footprint. They were also introduced to the calculation of the energy foot print of the class and, by extrapolation, of the whole school. Finally they tried to suggest changes in behavior on a personal level, class level and school level, for example, using public transport systems for mobility instead of scooter, calculating the savings in fossil fuels and the corresponding reduction of CO2 emitted.
- *Renewable energy in its regional context***.** The topic of the project is to encourage students to research alternative energy sources in Cyprus, in France paying particular attention to the Poitou-Charente region.

4.3.5 Contamination of non-scientific curricula

In this selection has been paid particular attention to those projects that fit the energy items in non-scientific courses and that are usually away from these matters.

"Energy and climate in the subjects" is a project that aims to develop the competence of students to research in the media, using sources that are not especially prepared for pupils and evaluate the information they find Finally they should present their results and in this way extend their oral, written, artistic or graphic presentation skills. "Let's save energy together" is a multidisciplinary proposal in which three girls in Bulgaria wrote and played a screenplay about energy savings. Other initiatives like this are "Alternative energies to learn" - how to use sources which can be found on the internet and "Climate Detectives Campaign", a project that tries to integrate into the curriculum German climate issues, a topic that does not formally take part but whose knowledge by the students is very important.

Other examples are **GSES project** (GSES organizes public events and provides information material for dissemination and education on the History of energy, particularly solar energy and is also currently working on the history of The National Archives) and Solar Energy **"Extreme Oil"** a course exploring the role oil has played throughout human history and science.

On the website teachers could find lesson plans ready-to-use that present teachers with opportunities to bring the project into the classroom through both science and history.

4.3.6 Contests

An effective method to involve students and for this reason widely used in the field of Edu Energy, is to organize or simply participate in a competition dedicated to schools.

Among other proposals include:
ENI, in Finland, with 500 official ENO schools in 105 countries, about 20.000 active participants (school year 2008-09),

Junior Solar Sprint Competion Teams work together building solar and/or hydrogen fuel cell cars for the JSS/HFC (Energy's Junior Solar Sprint/Hydrogen Fuel Cell) car competitions to generate enthusiasm for science, technology, engineering and math (STEM) skills at a crucial stage in the development of young people.

Energy Efficiency Video Clips A project idea from 4 pupils of the Viscardi Gymnasium which organized, produced and presented their results on a website and entered a national contest.

4.3.7 Events organized by the local administrations

In some countries the government organizes national or local events specifically targeted for schools. They are targeted at different energy issues which a school can join as: **National energy awareness week in Schools** in Finland, an annual themed week which is held in October right across the country. It involves school classes to participate by organising events on the theme of energy saving: day without electricity, saving materials, saving water, etc . It can also culminate in a competition.

Energy School Upper Bavaria Energy Efficiency, Renewable Energies in all subjects within a project week at primary schools with a final public presentation of the results by the pupils for an auditory with representatives from local authorities (e.g. mayor and local politicians).

5 Teaching on energy efficiency

5.1 Foreword

This section of D3.2 illustrates teaching activities carried out at schools by teachers aiming at increasing knowledge and skills of students.

During the WP3 of the EGS project, teaching activities have been carried out valorising the knowledge and best practices developed.

32 schools + 2 training institutes (ROC and IEBA) carried out teaching activities. Below some tables illustrates figures related these activities in each country.

Almost 10.000 pupils participated in lectures at their school. This number includes pupils who participated in more lectures on different topics.

More than 1200 hours of teaching activities was provided + 2000 hours of laboratory on renewables and energy saving at ROC.

Main topics discussed during teaching activities are:

- Energy efficiency of buildings
- Energy certification of buildings
- Energy efficiency behaviours (at home and at school)
- Energy efficiency planning
- Energy efficiency in professional services such as tourism, catering etc.
- Renewable energy sources (solar, wind, biomasses)
- Energy saving of driving

The teaching methodologies used are different: traditional classroom lessons, games, exercises, visits have been adopted by schools involved. By this way, a number of best practices are available to be shared among partners and with other interested schools throughout Europe.

Some partners preferred to concentrate in one or few schools a lot of hours of lesson while other partners gave lectures of few hours to more schools.

Almost all schools included energy efficiency topics in their teaching offer and such topics are included in the evaluation process of pupils.

Project partners provide local Authorities with proposals to included energy efficiency topics in teaching programmes of all high schools.

The next school year results will be visible.

5.2 Case studies

Austria

In Austria (Styria) three high schools have been involved in teaching activities:

- LFS Grottenhof-Hardt
- LFS Gleisdorf
- LFS Schlierbach

The following table summarise data and information related to teaching in Austria

School's name	N. of students	Topics	Average hours per student	Other comments/information
LFS Grottenhof-Hardt	45	Clever driving competition	4	Project with John deere an medium "modern farmers"
LFS Gleisdorf	58	Week of bioenergy	38	Project week for the 1.and 2. Class
LFS Schlierbach	100	Energy saving in tractor fuels	4	Seminar in agricultural lesson

More than 200 students have been trained.

Teaching courses have been included in the official teaching offer of the three schools and the learning of students is verified like the other traditional topics.

Bulgary

Teaching activities have been carried out for about 160 students of First Private Mathematical Gymnasium. 49 hours of lesson have been held. A lot of students participated in 2 or more lessons.

In total 1723 hours of lesson have been provided.

First Mathematical Gymnasium introduced the topics in its institutional teaching programmes and the students learning is included in the evaluation process.

School's name	**N. of students**	**Topics**	**Average hours per student**	**Other comments/information**
First Private Mathematical Gymnasium class 5 Subject: Science	44	Topic: Energy aspects related to air emissions (CO2, wind energy)	4	The topic, which is part of national curriculum is upgraded with facts about air pollution; ways to produce wind energy

First Private Mathematical Gymnasium class 5 Subject: Science	44	Topic: Energy aspects of water management	4	The topic, which is part of national CV is upgraded with facts about water, its significance in our lives and its usage; water energy
First Private Mathematical Gymnasium Class 6 Subject: Science	44	Topic: Electricity; Electrical conduction; Electrical current	6	The topic, which is part of national curriculum is upgraded with facts about renewable energy sources, ways to save electricity
First Private Mathematical Gymnasium Class 7 Subject: Physics	44	Topic: Electricity; Electrical conduction; Electrical current	6	The topic, which is part of national curriculum is upgraded with facts about renewable energy sources, ways to save electricity
First Private Mathematical Gymnasium Class 8 Subject: Physics	11	Topic: Energy; Thermal processes	4	The topic, which is part of national curriculum is upgraded with facts about renewable energy sources, ways to save electricity
First Private Mathematical Gymnasium Class: 5,6,7,8,10,11 Subject: Science, Chemistry	155	Topic: Energy and Environment: Renewables, Energy saving at home and school	2h – class 5 2h- class 6 4h – class 7,8,10, 11	The series of lessons are developed and implemented in the school's curriculum by our Science teacher. The lesson is published on the EGS site.
First Private Mathematical Gymnasium Class 6 Bulgarian lesson	44	Topic: Text and its sense Comprehension of texts related to the topic *Energy saving and renewable sources of energy*	1	The lesson is published on the EGS site.
First Private Mathematical Gymnasium Math	44	Topic: Math Test The energy issues are included in exercises	1	The lesson is published on the EGS site.
First Private Mathematical Gymnasium Subject: English	44	Topic: **Eco-friends - Energy Star®**	1	The lesson is published on the EGS site.

Class 5				
First Private Mathematical Gymnasium Subject: English Class 11	9	Topic: **Eco-friends - The Answer is Blowing in the Wind**	1	The lesson is published on the EGS site.
First Private Mathematical Gymnasium Subject: English Class 7	44	Topic: **Eco-friends - 3Rs: Reduce, Reuse, Recycle**	1	The lesson is published on the EGS site Other lessons are foreseen within the 2010-11 schools year (about 100 students)

Finland

Teaching activities have been carried out for 400 students of Keuda Institute. Lessons lost 30 hours.

Starting from the EGS experience, the Institute introduced these topics in its institutional teaching programmes and there are included in the evaluation process of the students' learning.

School's name	Topics	Other comments/information
Keuda Services	Practical project week; Energy Week Energy Guide to Energy efficiency in school Renewable energy sources Energy aspects in professional processes (Catering, Restaurant)	All students (about 400) are trained by teachers of KEUDA (2009-2010). Specific aspects of individual professional areas – e.g., cooking and washing – are given due consideration, so that the core concept of energy efficiency can be integrated into the individual training courses and the graduates can also apply what they have learned in their future professional life. Other lessons will be done within the 2011-12 schools year (yearly about 120 new students).

France

In France training activities was concentrated in the «Les Fontenelles» high school in Louvier / France Teachers was some representatives of AREHN and IUFM.

The following table summarise main information on teaching activities.

N of students	Topics	Average hours per student	Inclusion in institutional school's teaching program	Topics included in students evaluation
120	Conference on climate change and awareness about CO2 balance Questions, answers and discussion	2	YES	YES
90	Conference on energy efficiency using aerial thermography,	2	NO	NO
120	Sustainable transport/ Clim City game	2	NO	NO
30	Awareness about energy efficiency through Communication actions (a photographic workshop)	1h	NO	NO
300	Visit to a mobile technical platform on Renewable energy at school (explanation about Use and principal components for solar thermal Energy, photovoltaic energy, wind turbines)	1h	Yes	Yes
10	visit and comments for a photovoltaic installation using trackers at upper Normandy	3h	Yes	Yes

Almost 700 pupils participated in teaching activities on energy efficiency.
Climate change and visits at renewables plants was chosen as topics to be included in the institutional teaching programmes.

Germany - UBN

Good practice in teaching – Germany

As a part of the co-operation with the Comenius schools network, the EGS partner UBN carried out the plane game "triCO2lor" (www.trico2lor.ch) in the Hanseatic Grammar School in Stralsund. 25 secondary students and their teachers from Austria, France and Germany took part.

In general, plane games aim at active and constructive learning. The participants have to play pre-defined roles in a pre-defined game arrangement, but they are free to act in their own fashion. They, thus, *simulate* real life, and they can experience the impacts / consequences, their actions would have in real life. These experiences are discussed / reflected afterwards, under moderation of the trainee. This, hopefully, should lead to a deeper insight into real life systems, and it should enable the participants to act in a more reflected and responsible fashion in the future.

A very nice plan game is "Fishbanks" by Dennis Meadwos, where the participants simulate the fishing industry as an example of the not sustainable use of renewable resources. UBN has used Fishbanks many times with big success and has experienced, how powerful plane games can be. (More information in German: www.umweltschulen.de/net/fishbanks.html)

In the special case, triCO2lor is a plan game on our energy consumption. The participants act as consumers, which are purchasing energy. They can purchase fossil energy (including nuclear energy), renewable energy, or they can improve energy efficiency and, thus, consume less. For all that, they have to pay, and the winner is the player, who does so in the most economic way and, thus, has the most money at the end of the game.

This is not easy, because the prices for the different kinds of energy are changing during the game, and because the actions of the participants influence each other. And of course, the consumers decisions have environmental impacts (=emission of CO2 and, as a consequence, global warming), which are calculated by computer.

It should be mentioned, that the participants in triCO2lor are divided in (e.g.) four groups. Each group stands for one generation of human beings. The consumer decisions of one generation will influence the next generation.

The plane game can make the students aware the environmental impacts of production and use of energy, and it can stimulate them to consider their own role in the energy revolution.

UBN could **experience**, that the plane game triCO2lor "does work", even under challenging conditions (the participants came from three nations and had to communicate in a foreign language + it was the first time for UBN to use this plane game). The students (and teachers) acted very actively, and their feedback was positive.

As a consequence, UBN used triCO2lor another two times during the following months.

After a **deeper reflection** of the game, UBN draw the consequence, that triCO2lor is far away from being an optimal plane game:

– The game system does not represent the real life system in an appropriate fashion: There is a plan with an oval – like in a sports stadium. To represent the progressive consumption of energy, the players put their coins at this oval (see

picture). This is not a catchy metaphor / picture, and this is really a crucial aspect, because many youngsters are not able to act at an abstract level – they would need catchy metaphors.

– The environmental impacts have to be calculated at the platform www.trico2lor.ch. The global warming is there illustrated at a coloured world map. This is not user friendly: The colours do only represent the actual situation (not the development since the beginning of the game), and it is impossible to display the whole website at a beamer (too big).
This problem was fixed by UBN, we created our own Excel-sheet, which is much better to use than the website.

– In the reality, global warming will influence the human civilisation – and every human being – very strict. This is not represented in triCO2lor sufficiently.

As a consequence, UBN introduced occurrences/incidents into the game. At certain levels of global warming, incidents occur, the participants are informed by incidents sheets – and they are free to review their strategy as individuals, in their generation or as the whole community.
We introduced such incidents already at the second use of triCO2lor. In general, it works well, because it leads to strong discussion between the participants and to a deeper reflection of consumer strategies. But the incident sheets should be further improved.

Germany – Ziel21

Seven schools have been involved. 120 hours was provided to some thousands of students in a number of teaching sessions. The table below details the work done in Ziel 21 area.

The environmental topics are already included in CV in Germany. So contents of lessons provided during the EGS project will be repeated in the future maybe following a different organization and recurring to external experts whether internal teachers aren't updated enough.

School's name	N. of students	Topics	Average hours per student
Viscardi Gymnasium 01/12/08 02/12/08	110 students 6 teachers	Climate (Climate Expedition)	2
Gymnasium Gröbenzell 03/12/08 04/12/08	112 students 5 teachers	Climate (Climate Expedition)	2
Gymnasium Gröbenzell 18/12/08	52 students 5 teachers	Presentation Climate Change, Dr. Maiken Winter	3

Gymnasium Gröbenzell 10/02/09-11/02/09	210 students 14 teachers	Climate (Climate Expedition)	2
Gymnasium Puchheim 27/05/09	200 students 10 teachers	Climate (Climate Expedition)	2
Carl-Spitzweg Gymnasium Germering, Realschule Germering 20/04/09	500 students 15teachers	Multivision Show Climate, Energy Efficiency	3
Gymnasium Puchheim	200 students 4 teachers	Project days RE and EE	7
Viscardi Gymnasium 09/11/09	34 students 2 teachers	Training Energy and sustainability manager (2 students per class)	8
Gymnasium Gröbenzell 16/11/09	35 students 2 teachers	Training Energy and sustainability manager (2 students per class)	8
Viscardi Gymnasium	200 students	Renewable Energies	4
Viscardi Gymnasium 20/01/10	130 students 5 teachers	Green Economy, Green Jobs	2
Viscardi Gymnasium	200 students	Sustainability and Energy shown at the example of recycling paper	6
Viscardi Gymnasium	1000	Recycling paper, project presentation	0,5
Viscardi Gymnasium	120 10 teachers	Forum preparation, workshops	10
Viscardi Gymnasium 20/01/10-22/01/10	120 students 4 Teachers	Exhibition Green Jobs	1
FOSBOS Fürstenfeldbruck 05/10/09-06/10/09	200 students 8 teachers	Climate (Climate Expedition)	2
Viscardi Gymnasium 26/10/09-27/10/09	110 students 7 teachers	Climate (Climate Expedition)	2
Gymnasium Gröbenzell 28/10/09-29/10/09	108 students 9 teachers	Climate (Climate Expedition)	2

Viscardi Gymnasium 22/10/09 – 28/10/09	260 students 20 teachers	Exhibition Lifestyle and Energy (Energy Efficiency)	2
Viscardi Gymnasium FOSBOS	250 students	Exhibition within the Climate + Energy Week of the District (info on buildings, energy efficiency)	3
FOSBOS Fürstenfeldbruck	200 students 5 teachers	Filmpresentation and discussion “Energy Autonomy”	3
Gymnasium Gröbenzell	100 students 3 teachers	Filmpresentation and discussion “Energy Autonomy”	3
Montessori School Olching	100 students 4 teachers	Filmpresentation and discussion “Energy Autonomy”	3
Viscardi Gymnasium	100 students 2 teachers	Filmpresentation and discussion “Energy Autonomy”	3
Graf Rasso Gymnasium 02/02/10	15 students 1 teacher	Climate (Climate Expedition)	2
Gymnasium Gröbenzell 03/02/10	70 students 4 teachers	Climate (Climate Expedition)	2
Montessori School Olching 04/02/10	50 students 4 teacher	Climate (Climate Expedition)	2
Max Born Gymnasium 10/02/10	38 students 3 teachers	Training Energy and sustainability manager (2 students per class)	8
Max Born Gymnasium 03/03/10	500 students 15 teachers	Multivision Show Climate, Energy Efficiency	3
Viscardi Gymnasium	10 2	International Conference Stralsund	15
Viscardi Gymnasium 18/02/11-18/02/11	135 students 2 teachers	Climate (Climate Expedition)	2
Max Born Gymnasium 2/11	124 students 4 teachers	Climate (Climate Expedition)	2

As an EGS follow up, Ziel 21 participates in a new IEE projects “SHEEP” which deals with the energy efficiency of products.

New training activities will be realised on topics such as energy label, ecodesign, life cycle assessment, life cycle costing, etc.

Italy – Liceo Scientifico Statale “N. Tron”

The teaching activity durig the project was useful to set up new lessons for students.

The lecture on “Eco-buildings and renewable” is included in the teaching offer for the school year 2011-2012.

Since 2011 about 800 students of Liceo Tron will get knowledge on energy efficiency.

School’s name	N. of students	Topics	Average hours per student
LICEO TRON (Schio) ITALY	24	Course on “Energy management system and ISO 16001 certification” (with practical activities)	14
LICEO TRON (Schio) ITALY	86	Eco-buildings and renewable	4
LICEO TRON (Schio) ITALY	4	International school congress "Energy efficiency in schools" in Stralsund (Germany)	14

Italy – ISIS “Andrea Ponti” from the village of Gallarate (Province of Varese)

The ISIS “Andrea Ponti” carried out teaching activities for its students but also for pupils of two secondary schools of its territory: “Ponti” secondary school and “Majno” secondary school.

600 students in total have been involved. The secondary schools’ courses lost 2 hours while the high school’s one lost 10 hours.

In all cases topics have been included in the official teaching offer of schools and they are included in the evaluation process.

School’s name	N. of students	Topics	Hours per student	Other comments/information
1. Scuola Media Majno	250	What is energy- Different sources of energy	2	A proposal has been sent to competent local authority to

2. Scuola Media Ponti	300	What is energy- Different sources of energy	2	include energy topics in teaching programmes.
ISIS Ponti	50	Course on Photovoltaic	10	ISIS Ponti will activate a curricular course on energy

Italy – Province of Mantova

Students of the Manzoni technical high school in Suzzara (Mantova) was involved in teaching activities.
Almost all topics have been included in teaching offer of the school and in pupils' evaluation process.

N. of students	Topics	hours per student	Inclusion in institutional school's teaching programme	Topics included in students evaluation
22 (1 class)	Energy, Energy efficiency and Savings	6	NO	YES
27 (1 class)	Solar Energy, Greenhouse Effects, Insulating Materials, Energy Consumption of Household appliances, etc. (Student Training Course on Sustainable Development). The course ended with a visit to MASTeR (Mantova Environment Science Technology and Research), an interactive laboratory for education, where students have conducted a deconstruction activities of computer components, discussing the possibility of reuse and recycling for energy savings	11	Partially	YES
27 (1 class)	Sustainable development at the city Market (communication activities on sustainable development forward citizens)	8	YES	YES

25 (1 class)	3 Forum sessions concerning energy and school buildings and energy life and mobility, and co-operation with local companies to implement an energy monitoring system at school	6	NO	YES
45 (2 classes)	Energy animations in classes and measurements of temperature and lighting in all classrooms.	5	Partially	YES
45 (2 classes)	Student Training Corse on Energy Monitoring System (managed by IVECO company Energy Manager and staff). The course will end with a visit to the company, to understand how energy is monitored and managed practically	6	YES	YES
45 (2 classes) + 920 (all the school classes)	ENERG-ETICA! School event on energy efficiency, savings and renewable energies based on 3 points of interest: 1- n. 14 stations where students and experts use exhibits on topics such as solar radiation and its use to produce renewable energy, global warming and its consequences on global warming, building insulation to save energy, building thermal analysis, hydrogen production and use in mobility and static energy production through fuel cells, energy consumption measurement of electricity consumption by lighting and small appliances, etc. 2- A conference on sustainable development (repeated 3 times	5	YES	YES

	in the morning) 3- A movie on the consequences of the climate change, repeated 3 times in the morning All the school students and teachers took part in the event. Great example of collaboration between school and its community			
45 (2 class)	5 Meetings to understand and use the Energy Monitoring System and implement the Energy Management System at school	15	YES	YES

Almost 300 pupils participated in lectures and all school's students were involved in a schools event on energy efficiency.

Italy - Associazione dei Comuni Trasimeno - Medio Tevere

The "Associazione dei Comuni Trasimeno Medio Tevere" during the project involved the High school "Cavour-Marconi" from the village of Piscille in the Province of Perugia.

The Associazione preferred to concentrate teaching activities on this schools adopting a systematic approach.

About 900 students have been trained on different topics. Four classes

The following topics have been included in the official teaching offer of the high schools:

- energy efficiency of buildings;
- good practice to reduce power consumption, home automation, building automation, power generation from renewable sources (wind, solar, geothermal);
- energy recovery through recycling of organic wastes which are essentially plant (biogas, compost, distillation, combustion);
- renewable energy sources.

A proposal has been sent to competent local authority to include energy topics in teaching programmes.

Other lessons are planned by the school year 2010-2011.

Classes	N. of	Topics	Average hours

involved	students		per student
More classes	100	Energy saving of buildings	4
More classes	400	Presentation of the model of “ecological house” and the car working by self-generated hydrogen by electrolysis of H2O powered by its solar cells.	2
I C- D2 a.s. 2008/09	32	Collecting data from energy consumption bills	6
I C- D2 a.s. 2008/09	32	Good practice for reducing energy consumption for heating	4
I C- D2 a.s. 2008/09	32	Energy recovery through recycling of organic wastes which are essentially plant (biogas, compost, distillation, combustion)	4
I C- D2 a.s. 2008/09	32	Energy recovery through recycling of organic wastes which are essentially plant (biogas, compost, distillation, combustion)	4
IV C a.s. 2008/09	18	Energy recovery through recycling of organic wastes which are essentially plant (biogas, compost, distillation, combustion)	30
IV C a.s. 2009/10	18	Collecting data from energy consumption bills	6
V C a.s. 2009/10	17	Energy recovery through recycling of organic wastes which are essentially plant (biogas, compost, distillation, combustion)	30
III E1 a.s. 2009/10	20	Energy recovery through recycling of organic wastes which are essentially plant (biogas, compost, distillation, combustion)	4
III E2 a.s. 2009/10	20	Energy recovery through recycling of organic wastes which are essentially plant (biogas, compost, distillation, combustion)	4
III E1 a.s. 2009/10	20	Good practice to reduce power consumption, home automation, building automation, power generation from renewable sources (wind, solar, geothermal)	30
III E2 a.s. 2009/10	20	Good practice to reduce power consumption, home automation, building automation, power generation from renewable sources (wind, solar, geothermal)	30
IV D2 a.s. 2009/10	12	Good practice to reduce power consumption, home automation, building automation, power generation from renewable sources (wind, solar, geothermal)	30
IV E1 a.s. 2009/10	20	Good practice to reduce power consumption, home automation, building automation, power generation from renewable sources (wind, solar, geothermal)	90

IV E2 a.s. 2009/10	20	Good practice to reduce power consumption, home automation, building automation, power generation from renewable sources (wind, solar, geothermal)	90
III T1 a.s. 2009/10	20	Good practice for reducing energy consumption for heating, heat balance of buildings	20
III T2 a.s. 2009/10	15	Good practice for reducing energy consumption for heating, heat balance of buildings	20
V C a.s. 2010/11	12	Collecting data from energy consumption bills	6
V C a.s. 2010/11	12	Renewable electrical energy sources (biogas, wind, solar, geothermal)	10
IV E1 a.s. 2010/11	19	Good practice to reduce power consumption, home automation, building automation, power generation from renewable sources (wind, solar, geothermal)	50
IV E2 a.s. 2010/11	19	Good practice to reduce power consumption, home automation, building automation, power generation from renewable sources (wind, solar, geothermal)	50

Nederland

ROC Nijmegen acted as a school and organized teaching activities at its headquarters. ROC's courses are added to those of schools and they are areas of specialization.

ROC Nijmegen organized three courses for 5, 12 and 5 students. The table below summarises main aspects.

School's name	N. of students	Topics	Average n. of hours per student
ROC Nijmegen	5	Compile a long term maintenance plan for the ROC school buildings	(4 month x 4,5 weeks x 16 hours per week) = **256** hours per student
ROC Nijmegen	12	Building a watch tower (Lent Mark 1) of used materials	(5 months x 4,5 weeks x 32 hours per week) = **729** hours per student
ROC Nijmegen	5	2 student created a website and 3 students are creating a documentary about the construction of the tower	2 students (4 months x 4,5 weeks x 8) = **288 hours** **+** 3 students (5 months x 4,5, weeks x 16 hours) = **1080 hours**

All the courses are included in the teaching offer of ROC and students learning is evaluated to provide them with the diploma.

Portugal

EBA tested a new course on environmental technical course on Energy efficiency, Renewable energies, sustainable buildings. 33 students have been involved for 4 h.

This course has been included in the official teaching offer of the school.

Romania

Teaching lessons have been carried out at economic high school of ARAD. 950 students have been involved. On the average lessons lasted 2 hours dedicated to some aspects of energy efficiency, mainly energy savings in buildings and renewables

A proposal has been sent to Arad County School Inspectorate to include energy topics in teaching programmes.

Other lessons are foreseen within the 2011-12 schools year.

Slovakia

In Slovakia KlubKonTiki carried out a short teaching course (2 hours) on energy efficiency in buildings at 17 schools. 772 students have been involved.

Other lessons are foreseen within the 2010-11 schools year.

All the schools have included this lesson in their teaching programmes and students learning is evaluated. The following table summarises schools and pupils involved.

School's name	N. of students
SOS Gresakova	66
Hotelova akademia Liptovsky Mikulas	20
Secondary Technical School	19
Spojena skola Kollarova	109
Gymnazium M.R. Stefanika Kosice	84
Cirkevna stredna odborna skola sv. Jozefata	25
Spojena Skola Nizna	17
Spojena Skola Internatna	38
Spojena skola internatna	44
Stredna zdravotnicka skola	18
Stredna zdravotnicka skola	44
Evanjelicke gymnazium Juraja Tranovskeho	41
SPS stavebna a geodeticka	27
SPS dopravna	52
Gymnazium Varsavska cesta	87
Cirkevna spojena Skola A. Radlinskeho	10
Gymnázium L. Stura	18
SOS Drevarska	31
Gymnazium Rajec	22

6 Annex

6.1 Annex 1-A STUDENT EXERCISES

This appendix elaborates the proposed student exercise and describe in detail the various activities to do in collaboration with students. This is an adaptation from the "**Guide for an Integrated Sustainable Energy Education, First steps to climate neutral schools, for secondary schools"**. Students Exercises, developed by the members of ManagEnergy Thematic Group on Education: Eddy Deruwe (BE), Susanna Ceccanti (IT), Malte Schmidthals (DE), Andrea Piuaru (RO), Eva Stroffekova (SK) and Alan Morton (Uk). DG Energy and Transport. European Commission.

These exercises are divided into 6 tabs:

1. DATA GATHERING FROM BILLS AND METER READINGS
2. ACTIVITIES FOR LOWERING THERMAL DEMAND
3. ACTIVITIES FOR LOWERING ENERGY OF LIGHTING
4. ACTIVITIES FOR ELECTRICAL EQUIPMENT
5. ACTIVITIES FOR RENEWABLE ENERGY
6. ACTIVITIES FOR SUSTAINABLE TRANSPORT

See table references with student exercises.

Each exercise has a description and a series of activities to be performed. They are divided into three levels (A, B, C) in difficulty order and from simple to more complex. An A+ activity is defined specifically for training.

1. DATA GATHERING FROM BILLS AND METER READINGS

For knowing the precise figures of energy consumption of a school we shall setup an energy audit based on invoices / bills. For students this exercise is an excellent opportunity for making energy calculations and contribute to the curriculum of **mathematics and statistics**.

Arrange for energy utilities to provide energy usage information over the past two-year

period. Negotiate with your School Office Manager to have copies made of all energy bills when they arrive and create a separate file for them.

All specific data of the sub-sectors should be looked to:

- Heating
- Hot water
- Lighting
- Electrical equipment
- Renewable energy

Member of the Energy Management Team or a class can draw graphs of consumption versus months and publicise the results. Record details of fuels used, account numbers, contacts at energy utilities and fuel suppliers. Record details of energy usage over the last two years as shown on bills for each Fuel and for each meter.

Calculate and draw bar graphs of energy use and cost per day, for billing periods recorded.

Compare the real energy use and not only the cost. Those cost can vary immensely and can even lead to increases of energy consumption, cost and greenhouse gas emissions.

Ask students to mark on school energy graphs important changes such as holiday periods,

record hot or cold spells, the opening of new buildings, extended operating hours, etc. Can they find any links between these and the energy use? If so, why? If not, why not?

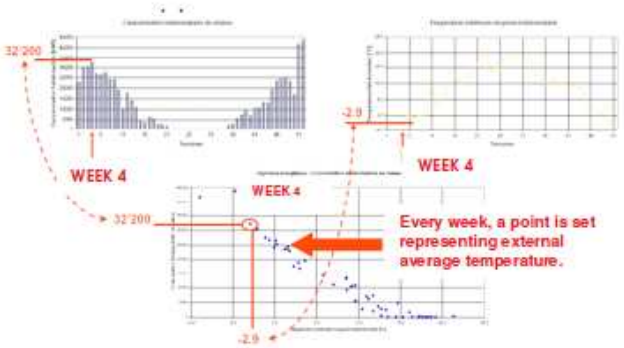
Students can graph the amount the school pays for electricity and gas as consumption

increases. They should repeat the exercise using residential tariffs and observe the

differences.

Students could set up a computer program or graph that calculates energy costs based on different tariffs for different energy usage patterns.

Activities

Activity	Notes	Level
Training sessions by subject	Training session on energy efficiency and CO2 balance	A+
Gathering past consumption	To collect monthly data from past bills (at least 3 years) - Kwh Electricity - m3 methane or gas oil Calculate greenhouse gas emissions (CO2 ton)	A
Performance analysis of daily consumption	Activate the reading of the energy meters throughout the day (08 am, 11 am, 2pm and 5 pm) for 4 days a year (e.g. February 15, June 1, September 30, November 15). Verify the energy consumption performance during the day, particularly with the school open (school hours) and closed.	B
Calculation of the "energy signature"	Activate a weekly reading of heat consumption (read the gas meter and transform cubic meter of gas in KWh of heat). In the same week record the weekly average temperature. Make a graphic as indicated by the "energy signature" card 	C

2. ACTIVITIES FOR LOWERING THERMAL DEMAND

The aims of the thermal demand should be to reduce space-heating demand and maintain steady comfortable internal environment.

Heating cost are the most important energy use and cost. Those costs can be reduced by several actions, from no-cost to investments. (58% of energy use for space heating and 45% in costs (ref. UK- carbon trust).

Building insulation has improved over the last decade. Loft insulation remains the most common form of insulation. There has been rapid growth in the use of double-glazing.

Measures of good practice of lowering energy use for heating show that appropriate actions to take:

1. Attitude related: changing habits of energy use
2. Efficient control of temperature
3. Appropriate zoning of temperatures
4. Systems: installing new more efficient boilers

Ask students to draw the layout of their classroom or building, paying special attention to:

- Where furniture is placed
- What equipment is present and where it is located
- The position of heating vents / radiators
- The position of windows
- The position of students tables and teacher's desk

Ask them to make suggestions about how the furniture could be better placed so that vents / radiators are not obstructed and so that the warmth of equipment does not affect students, teachers or thermostats. The best group could present their findings to the class.

Furthermore students could make an energy tour of the school and enquire with the caretaker some technical details of the heating system / boiler, for example its power, the time it is working and the fuel used; they could also check the temperature of the thermostat. All rooms should be checked (if double glazed windows and thermostatic valves are present) and thanks to a thermometer the temperature of each room should be registered , possibly day and night.

Activities

Activity	Notes	Level
Training sessions by subject	To plan training session on energy efficiency applied to space heating	A+
Measure classroom temperature	The students identify areas where temperature measurement is significant considering the following criteria: size, local details, conditions of use (hall, gym, laboratories, offices) equal number of rooms by floor solar exposure (north, south…) Measurements are taken with a probe thermometer for instantaneous measurements of air temperature in the center of the room at 1,5 meter	A

	high. Measurements are carried out in winter once a week and recorded in a form with: date time name of the person outdoor temperature local conditions (e.g. open windows). Report exceptional situations such as breaking windows, blocking boilers, additional heating appliances,, etc. Record the readings in Excel tables to prepare appropriate graphs to represent temperature trend on each room. Analyse the relationship between internal average temperature and the variable external temperature, the temperature trend for any significant deviations caused by a change of consumption.	
School building inspection	Inspect the school to gather information on building envelope and heating system. Adopt a checklist to collect information on energy efficiency (e.g. double glazing or single glazing, thermostatic valves, etc). This can be prepared by each school according to their needs.	B
Economic Assessment	Evaluate possible energy savings as a result of technical improvement measures (replacement single glazing, insulation cover) o management (set point temperature control)	C

3. ACTIVITIES FOR LOWERING ENERGY OF LIGHTING

Schools activities need appropriate lighting. Lighting accounts for 20 to 25 % of the total energy use, with a cost of thousand of euros a year. Yet school is operating during daylight and most classrooms have large windows.

Analysis of lighting use can be divided into:

- Classrooms (general lighting and specific task lighting).
- Corridors and passageways.
- Special purpose areas such as the library, workshops, gymnasium, canteen and administration block.
- Toilets and changing rooms.
- Indoor and outdoors security lighting.

Classroom Lighting:

Table for lighting audit should be completed for all locations in the school.

Alternatively if this is not practical, choose a typical classroom and multiply by the number of similar classrooms in the school.

Record the:

- Number of lamps.
- Type of lamps (incandescent or fluorescent).
- Size of lamps (number of watts).
- Type and size of curtains (if present at windows.

- Estimate the daily hours of usage.
- Check the school's timetable to see if rooms are used at night.
- Ask the cleaner how long lights are on during cleaning.
- Try to take into account weather conditions on the day of the survey; on a dull day, lighting use will be above average, and on a bright day, below average.

1. Carry out a lighting inspection of the various rooms in your school. You will need one set for each room you inspect. Once you have done this for the whole or part of the school, go through all your answers and write in your own words what you think of the lighting situation in the areas you have audited (with lights off is it too dark? Is it ok?). Use a luxmeter to check the level of lighting in each room and compare your results to the standard ones: i.e in a classroom light level must be not lower than 300 lux, in the corridor 100 lux are sufficient, in the stairs 150 lux are sufficient etc)

2. If your school has a trade or technology training area it may be possible to design and make your own reflectors with assistance from the physics and/or trade teachers. This is a very practical application of optics.

3. Students could carry out a range of simple and then complex activities in a range of light conditions. They can record their experiences and compare them.

4. Investigate whether the school should purchase daylight and/or movement sensors.

Activities

Activity	**Notes**	**6.1.1.1 Level**
Training sessions by subject	To plan training session on energy efficiency applied to lighting.	A+
Waste control	Observe, take note and act turning off the lights in all apparent waste situations. Attention to the lighting on common spaces (corridors, etc.). Ask the specific staff about on/off rules.	A
School building inspection	Inspect the school to gather information about lighting in the different rooms. Adopt a checklist to collect information on energy efficiency (e.g. number of lights, power by light, time of using, etc). This can be prepared by each school according to their needs.	B
Economic Assessment	Evaluate possible energy savings as a result of management improvement measures (operational instructions for reducing lighting time)	C

Support Documents

Example of table for Lighting audit

Room	Room Description	Types of equipment			Operating time/days	Daily consumption	Comments
		Number	Type	Consumption (Watts)			
Total							

4. ACTIVITIES FOR ELECTRICAL EQUIPMENT

The aim to significantly reduce electricity consumption of electrical equipment s increasingly used teaching. Computers, photocopiers, printers, audio-visual equipment and other office equipment are now standard in every high school. Also other facilities like libraries, laboratories, canteens and offices uses large quantities of electric energy.

Using nameplate ratings provides an alternative for determining energy consumption. They give an upper limit measure of the consumption. However, please note that nameplates are fit to equipment to ensure that supply systems are not overloaded rather than as an accurate measure of consumption.

Nameplates are found:

- On the back of an appliance.
- Underneath small appliances.

Nameplates are not located inside appliances. Do not look inside appliances as there may be dangerous bare wires.

Activities

Activity	Notes	6.1.1.2 Level
Training sessions by subject	To plan training session on energy efficiency applied to electrical equipment	A+
Waste control	Observe, take note and act turning off the lights in all apparent waste situations. Attention to the lighting on common spaces (corridors, etc.). Ask the computer lab teacher about machines on/off rules.	A
School	Inspect the school to gather information about equipment in	B

building inspection	the different rooms. Adopt a checklist to collect information on energy efficiency (e.g. number of equipment, power by equipment, time of using, etc).	
Economic Assessment	Evaluate possible energy savings as a result of equipment improvement in the school. Discuss about energy performance equipment (Green procurement)	C

Three main strategies are identified to reduce electricity demand: supply, operational management and maintenance strategies. For each strategy specific learning activities can be developed.

1. Supply

- buy appliances with high energy efficiency labels
- buy appliances with low standby power consumption.

2. Operational management

- Turn off equipment when not in use.
- Switch off equipment instead of using stand by for several hours.
- Check all appliances and turn off before the school is closing.
- Install timers.
- Use a program to active monitors in a sleep mode.
- To inform everyone about how to implement energy saving strategies.

3. Maintenance

- Regular maintenance plan

Support Documents

Table for audit electrical equipment.

Example of Table for Electricity appliances

Room	Room Description	Types of equipment	Power rating (Watt)	Operating time per day (estimated hours)	Daily consumption (Kwh)	Comments
Total						

5. ACTIVITIES FOR RENEWABLE ENERGY

Schools should aim to satisfy a maximum of energy needs from renewable resources instead of fossil fuels. The best time to invest in renewables is the design of a new school or major restructuring. Renewable energy facilities may be used for educational purposes during class demonstration.

The most popular renewable technologies for schools are:

- Solar thermal: costs vary widely but heating water for general purposes is cost-effective.
- Wind: Feasibility will depend on average wind speed and quality, the size of the available site and any planning considerations.
- Solar PV: is not cost-effective without funding, but is a popular technology for demonstration/education purposes and relative ease of installation.
- Biomass: wood pellet fuel is being used only in a few locations.

The most important thing is that any renewable application is put in the school must have great visibility among the school community. The RES application must act as a didactical tool since it's no use having on the school's roof a solar PV panel without knowing how it works, how much energy it produces, how much CO2 emission avoids in the atmosphere.

Activities

Activity	Notes	6.1.1.3 Level
Training sessions by subject	To plan training session on specific subjects. Visit sites where renewable energy technologies are developed.	A+
School building inspection	Inspect the school to gather information and make a preliminary draft to implement renewables.	B

6. ACTIVITIES FOR SUSTAINABLE TRANSPORT

Transport is the fastest growing contributor to CO2 emissions in Europe. It's estimated that road transport makes up around 25% of the man-made CO2 emissions. Schools can do a lot to reduce transport use, by promoting and taking measures that are in fair of walking and cycling. Walking or cycling for short journeys could reduce the footprint by about 4%.

In the school sustainable energy action plan a part of it can be devoted to transport. A School Transport Management Team can be set up by the school.

A good practice STP (Sustainable Travel Plan) will be a written document with the following features:

- Background: including location, size and type of school and age range and numbers of students.
- Travel Survey: to identify the mode, direction and number of children currently travelling to/from school and how they would like to travel.
- Description: of the travel patterns and problems faced by the school, incorporating after-hours and associated travel.
- Objectives, targets and measures with a detailed timetable for implementation. These actions will be a combination of hard measures, such as engineering works or new facilities, and soft measures, such as timetable changes or pedestrian schemes.
- Monitoring and review. The minimum recommended monitoring is to re-survey travel patterns once a year.

The goal is that students become aware of how their contribution to CO2 emissions depends on their choice of transport to school.

Activities

Activity	**Notes**	**6.1.1.4 Level**
Training sessions by subject	To plan training session on sustainable transport.	A+
Statistical survey about school transport	Survey among students in relation to the mode of transportation from home to school.	B
Promote improvement actions	Encourage walking Encourage bicycle Promote public transport Use the car pooling system	C

6.2 Annex 1-B RECORD OF ENERGY SAVING OPPORTUNITIES - EVALUATION CRITERIA

N.	Criterium	Criterium	Rating = 1	Rating = 2	Rating = 3
1	Present and past consumption based on direct measurement other available data	a) past and present energy consumption and energy factors based on measurement and other data;	Small Impact	Medium impact	Significant impact
2	Consumption area particularly significant	b) identification of areas of significant energy consumption, in particular of significant changes in energy use during the last period;	One or two significant areas	Some areas	All areas
3	Consumtion expected in the following period	c) an estimate of the expected energy consumption during the following period;	Lower consumption expected	Equal consumption expected	Higher consumption expected
4	Involved people whose actions may lead to significant changes in energy consumption	d) identification of all persons working for and on behalf of the organization whose actions may lead to significant changes in energy consumption;	One involved person	Few people involved	Many people involved
5	Priorities in the improvement opportunities	e) identification and prioritisation of opportunities for improving energy efficiency.	Modest room for improvement	Discrete benefits compared to limited investment	Considerable room for improvement

6.3 Annex 1-C RECORD OF ENERGY SAVING OPPORTUNITIES – EVALUATION ASPECTS

Activity	Energy Aspect	Assesments elements	Criterium 1	Criterium 2	Criterium 3	Criterium 4	Criterium 5	TOTAL	Outcom	improvement goal
School building use	Heating energy consumption	Exercise 1 Levels A, C. Exercise 2 levels A, B and C.						0	NS	X
School building use	Lighting Electricity consumption	Exercise 1 Levels A, B. Exercise 3 levels A, B and C.						0	NS	
School building use	Equipment electricity consumption	Exercise 1 Levels A, B. Exercise 4 level A.						0	NS	
School building use	Production and use from renewable sources	Exercise 5 level B.						0	NS	
Home-school transport	Transport energy consumption	Exercise 6 levels B, C.						0	NS	
School activities - training	Energy efficiency	Exercises 1, 2, 3, 4 level A+.						0	NS	
School activities - training	Renewable energies	Exercise 5 level A+.						0	NS	
School activities - training	Sustainable transport	Exercise 6 level A+.						0	NS	
Purchase of equipment and materials (suppliers)	Energy consumption	Exercise 4 levels B, C.						0	NS	

Note 1 Threshold of significance: If greater than or equal to 10 then the aspect is significant

Note 2 : If Outcome S (significant) choose the most appropriate response of the SGE and enter one or more X in the corresponding boxes. (Objective, Operational Instruction,

Note 3:
If X in Objective then complete the Improvement Plan on sheet 3
If X in Operational Instruction then make an operational instruction
If X in Monitoring, then complete the Monitoring Plan on sheet 4

6.4 Annex 1-D RECORD OF ENERGY SAVING OPPORTUNITIES –- IMPROVEMENT PLAN

Activity	Energy Aspect	Data	energy performance indicator	Objective	TARGET	Action	Resources	Responsible	Time
School building use	Heating energy consumption	m3	m3 gas / m3 building	Reduce thermal consumption	10%	Change boiler, adjustement, optimizing building use	Money if the boiler is changed. Staff if management actions.		x months
School building use	Lighting Electricity consumption								
School building use	Equipment electricity consumption								
School building use	Production and use from renewable sources								
Home-school transport	Transport energy consumption								
School activities - training	Energy efficiency								
School activities - training	Renewable energies								
School activities - training	Sustainable transport								
Purchase of equipment and materials (suppliers)	Energy consumption								

6.5 Annex 1-E RECORD OF ENERGY SAVING OPPORTUNITIES - MONITORING PLAN

Activity	Energy Aspect	Internal Stakeholders involved	External Stakeholders involved	Tools- control methods	Variable to monitor, with corresponding data unit	Referent person for data collection	Update rate	data location
School building use	Heating energy consumption	School Technical Office, EMS Workgroup	Municipal/Province/County/Regional Technical Office	Meter reading	m3	Surname, Name	monthly, weekly, etc.	Server/folder/data/etc
School building use	Lighting Electricity consumption							
School building use	Equipment electricity consumption							
School building use	Production and use from renewable sources							
Home-school transport	Transport energy consumption							
School activities - training	Energy efficiency							
School activities - training	Renewable energies							
School activities - training	Sustainable transport							
Purchase of equipment and materials (suppliers)	Energy consumption							

6.6 Annex 1-F - REGISTRO LEGGI

Atto normativo	Titolo	Obblighi / adempimenti	Note	Scadenze	Referente
EPBD 2002/91/CE	Energy Performance of Buildings Directive				
Legge n. 10 del 9 gennaio 1991	Norme per l'attuazione del P.E.N., di risparmio energetico e di sviluppo delle fontyi rinnovabili di energia				
DPR 26.8.93 n. 412 e D.P.R. 551/99	Norme per la progettazione, l'installazione, l'esercizio e la manutenzionedegli impianti termici degli edifici ai fini del contenimentodei consumi di energia				
D.L.gsv 192/2005 e D.L.gsv 311/2006	Attuazione della direttiva 2002/91/CE relativa al rendimento energetico nell'edilizia				
Legge 27/12/2006	Disposizioni per la formazione del bilancio annuale e pluriennale dello Stato (legge finanziaria 2007)"				
DM 19/02/2007	Disposizioni in materia di detrazioni per le spese di riqualificazione energetica del patrimonio edilizio esistente, ai sensi dell'articolo 1, comma 349, della legge 27dicembre 2006, n. 296.				
DECRETO 05/03/2007	Applicazione della direttiva n. 89/106/CEE sui prodotti da costruzione, recepita con decreto del Presidente della Repubblica 21 aprile 1993, n. 246, relativa alla individuazione dei prodotti e dei relativi metodi di controllo della conformita' di «Isolanti termici per edilizia».				
Legge 24/12/2007	Disposizioni per la formazione del bilancio annuale e pluriennale dello Stato (legge finanziaria 2008).				
DM 07/04/2008	modifiche al DM 19/02/2007 a seguito delle disposizioni della Finanziaria 2008				
DM 11/03/2008	Definizione dei valori limite di fabbisogno di energia primaria (Finanziaria 2008)				

6.7 Annex 1 - G EXAMPLE OF SCHOOL ENERGY POLICY

Possibly invoke EGS Manifesto.

Given the need of energy more efficient use, with the goal of reducing our emissions of CO2, we will:

- Identify and repot the actual energy performance and all energy efficiency measures;
- Identify the energy efficiency measures for the future and keep them updated on progress;
- Ensure competence in energy management of the building and the equipment:
- Ensure that improvements in energy efficiency and new technologies are taken into account when new investments;
- Promote professional development of all those involved in energy, with particular attention to training some teachers and students;
- Promote awareness of all school staff and students in relation to energy saving aspects;
- Acquire everyday practices and behaviors that minimize energy waste.

Place, date

The Principal