Winter | 10

EMS for a 2.0 Education

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10th Semester M.Sc. In Environmental Management

Sustainability is a challenge for humanity and therefore a challenge for education.

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This project is the culmination of a wonderful experience that started in September 2006. The personal and academic experiences lived in Aalborg University will mark the rest of my live. I just want to thank Ivar and Javi for their help not only at this project but also during all my *Danske erfaringer*.

Thanks also to all the computing teachers and management of IES La Ferreria for their support.

Preface

The unit of research of this project will be the environmental management at IES La Ferreria. Within the following lines my relationship with the school is analysed to justify the choice of this case for study.

I did my traineeship at the Technical University of Catalonia (UPC), one of the largest universities in Catalonia and Spain. UPC's commitment with sustainability is remarkable. I was working on the development of a plan called "Let's be sustainable 2015" that is being developed to achieve high environmental goals. My traineeship was involved in the first phase of one of the most ambitious goals of this project: To become compliant with the Eco-Management and Audit Scheme (EMAS) in all their campus. (UPC 2009)

My experience at UPC has been key in the development of this project. And the valuable amount of experiences about sustainability at the university have been applied both in my ninth semester project and also in this one.

For my ninth semester I worked on sustainability for Knowledge Organisations (KO) analysing the special case of high schools. I interviewed responsibles from high schools, and researchers as professor Enric Pol that detected disruption in the education for sustainability during the years of high-school. (Pol 2009) (Ramirez 2009)

I am a telecommunications engineer and I have been a computing teacher during the last three years. I arrived to IES La Ferreria last September 2009. My

sensations of a week organisation concerning EMS push me to raise the matter until the point that it became my tenth semester project.

During my traineeship and also during my projects at AAU I have had the opportunity of working on Environmental Management projects that were already started. But the lack of EMS at IES la Ferreria made me think on a great opportunity for my last project about EMS at Education. With this project I have had the chance of starting a new environmental system, relaying on the total support of the school's headship and the teachers in charge of the IT support.

This report is intended for use in the interaction with the school and the research methodology used is chosen in this sense to make research a common issue between the researcher and the unit of analysis. The School and their staff is both the unit of analysis and an allied within the research project development. All technical/theoretical aspects have tried to be explained in an easily understandable way to warrantee this collaboration with all levels of school.

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Chapter 1 Introduction

We are in a period of big changes, and these changes are affecting directly education as a fundamental period in people's live. On one side society is going digital. Technologies of Information (IT) are nowadays a key aspect for development. From University to Primary School is difficult to imagine a classical education without IT tools as computers, projectors or Internet.

On the other side Sustainability is increasing to be considered a goal for humanity. Governments and companies are introducing green policies in theirs activities. Knowledge Organisations[1] (KO) need also to adapt to this new reality considering sustainability in their four areas of action (UPC 2008).

Figure 1 The Four Pillars of Universities (UPC 2008)

The role of education institutions in the promotion of sustainability has gained importance since the declaration of the United Nations Decade of Education for Sustainable Development. (UNESCO 2009) This declaration encourages

[1] In this project, a Knowledge Organisation (KO) is defined as a public or private organisation, which is responsible for the education of students at any level or age.

Knowledge Organizations (KO) around the world to improve the implementation of sustainable values in the education they provide.

Sustainability and IT are therefore two goals of education. Students need knowledge on these two areas as a key factor of their educational process and this knowledge will be applied in their professional future regardless of their area of expertise. But these are not only goals, they are also the way to ensure a proper educational process and all knowledge organisations need to consider both concepts as a tool in their daily work.

1.1 What is IT impact on Environment?

Although IT adds to the problem of energy consumption on Knowledge Organisations, it can also be a partner in the sustainability solution if their implications are considered properly. (Cromwell, Hanks and Engel 2009)

According to Tom O'Donnell from the University of Maine an average computer consumes over $100 worth of electricity per year.(O'Donnell 2009). In 2009, the final report from JISC's SusteIT estimated that 623 U.K. colleges and universities will produce 500,000 metric tons of CO2, generated by one and a half million computers, 250,000 printers, and 240,000 services. The electricity used by these devices will cost around £116 million in 2009. (James and Hopkinson 2009)

A 2007 research paper issued by the United Kingdom's Global Plan Action sentence that IT accounts for 10 percent of the electrical usage in UK. Stanford University estimates that IT accounts for 15 percent of its overall electrical use (Cromwell, Hanks and Engel 2009). A recent report from the Stamford, Connecticut based IT research company Gartner Inc says that more than 30 percent of an organization's energy consumption can be attributed simply to PCs and their peripherals. (Gartner 2009)

"IT's Voracius consumption of energy means IT organisations must be part of sustainability efforts."

• (Cromwell, Hanks and Engel 2009)

Energy consumption is the highest but not the only impact of IT. Life cycle of IT equipment is getting shorter day after day and the lack of scalability of some equipment involves some times a huge amount of electronic waste that needs to be treated in a proper way.

On the optimistic side there are also positive impacts related to IT use. The reduction of paper consumption and savings in transportation are the main advantages on the increase of information technologies.

1.2 What is being done?

The greening of IT departments is a hot topic in environmental plans nowadays. Results from a December 2008 survey by Gartner indicate that more than one third of the 620 organization respondents worldwide anticipate spending more than 15 percent of their IT capital budgets on green IT projects. (Hignite 2009)

The fast evolution of IT since a decade ago has change the way of approaching "green computing". The financial benefits or energy-efficient computing can actually make IT departments save money, or at least cover the costs of more responsible computer usage. (O'Donnell 2009)

Gartner, an IT consulting company, calculated that an organization with 2,500 PCs can realize $6,500 annually in decreased energy costs by turning off and also unplugging machines (to avoid power drain)(Gartner 2009)

"Energy efficiency isn't just low-hanging fruit; it's fruit lying on the ground."

• U.S. Energy Secretary Steven Chu (U.S. Department of Energy 2009)

In the Joint Information Systems Committee (JISC) Podcast #69 Peter James, director of the SusteIT project and professor of Environmental Management at the University of Bradford says IT is the lowest-hanging fruit with regard to sustainability and estimates that quick returns can be made in one to two years. (James, Podcast: Green ICT for Further and Higher Education 2009)

Chapter 2 Scope

In the following pages this project aims to take a look at the interactions and synergies of these two areas looking especially at the IT department of a High School located in Barcelona, Spain.

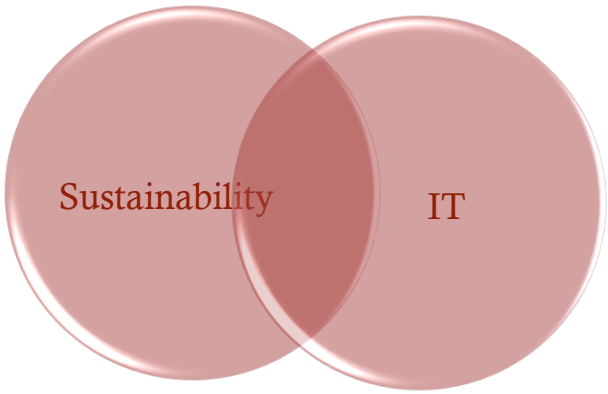


Figure 2 Synergies between Sustainability and IT

Student awareness on environmental issues is worst in the case of high-school students (Pol 2009). This makes high-school sustainable performance look very bad. This bad performance could be due to adolescents being in a period of huge changes in values and emotions, but it is certainly not the only cause. Some changes in educational plans and strategies towards sustainability will need to be considered in the years to come. The Catalan Government is introducing new plans to encourage High-Schools to improve their Environmental performance and Strategy, the *Escoles Verdes Plan* is the most important of them. (Mediambient-Generalitat de Catalunya 2009) (Ramirez 2009)

This project will consider how to implement this plan, and which actions could be recommended for high schools to include into this plan to promote a more environmentally friendly use of Information Technologies and Green Computing.

2.1 Research question

The project's research question is:

- How should IES La Ferreria plan the launch of his Environmental Plan making especial attention at Information Technologies?

In order to answer the main research question, the following sub-questions have been formulated:

- How should high schools form their EMS to deal with the growing impacts of IT?
- What is the environmental situation of IES La Ferreria?
- What are the hot spots of environmental impacts in terms of IT and how can they be reduced?
- What are the potential for reducing environmental impact by enhancing synergies between education and IT?

2.2 Structure of the report

The following graph shows the structure of the report. Including both the documentation phase (in red) and the Analysis and Action (in blue)

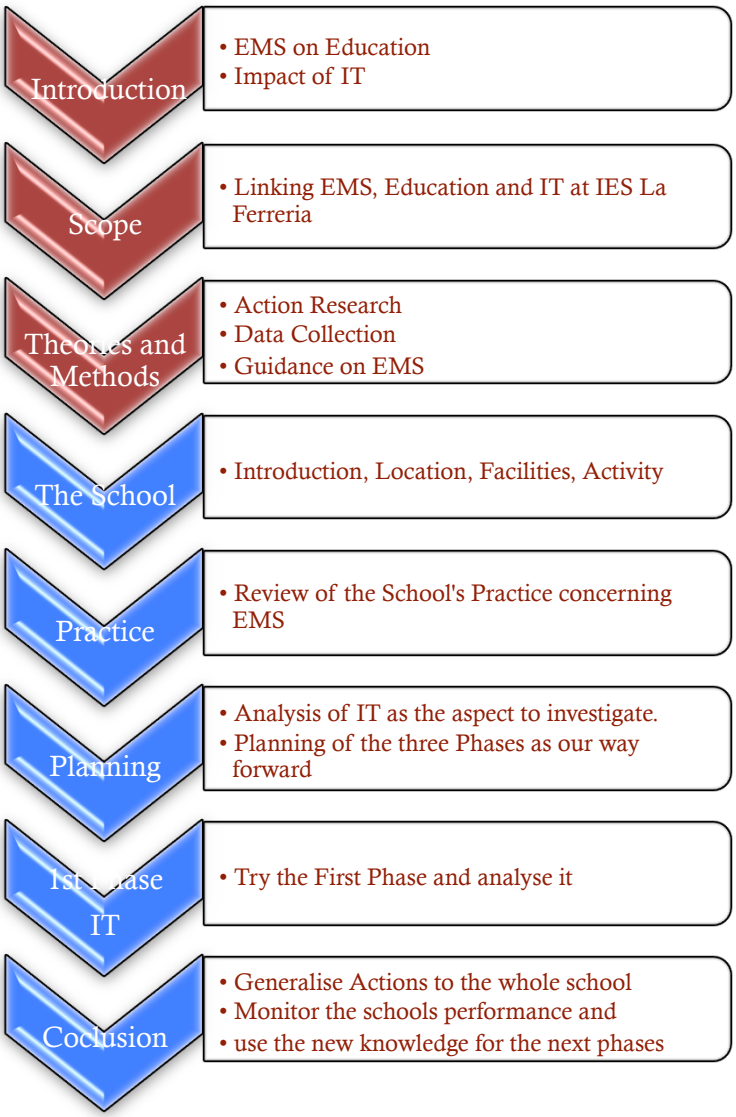


Figure 3 Structure of the report

Chapter 3 Theories and methods

This chapter presents the main methodologies and data collection methods used in this report.

3.1 Research design

The research process chosen for this project is Action Research. Action Research is a reflective process of progressive problem solving led by individuals working with others in teams or as a part of a "community of practice" to improve the way they address issues and solve problems. Kurt Lewin (1946) described action research as "a comparative research on the conditions and effects of various forms of social action and research leading to social action" that uses "a spiral of steps, each of which is composed of a circle of planning, action, and fact-finding about the result of the action".

> *"Knowledge is always gained through action and for action."*
>
> • (Torbert 2001)

The fact that I am working at the school makes difficult a traditional research "on" people but opens great opportunities for a research "with" people. John Heron (1971) defined this "research with people" as Collaborative Inquiry or Cooperative Inquiry where all active participants are fully involved in research decisions as co-researchers.

According to Jean McNiff and Jack Whitehead (McNiff 1995) the basic steps of an action research process constitute an action plan that is compared with our action plan in the following graph

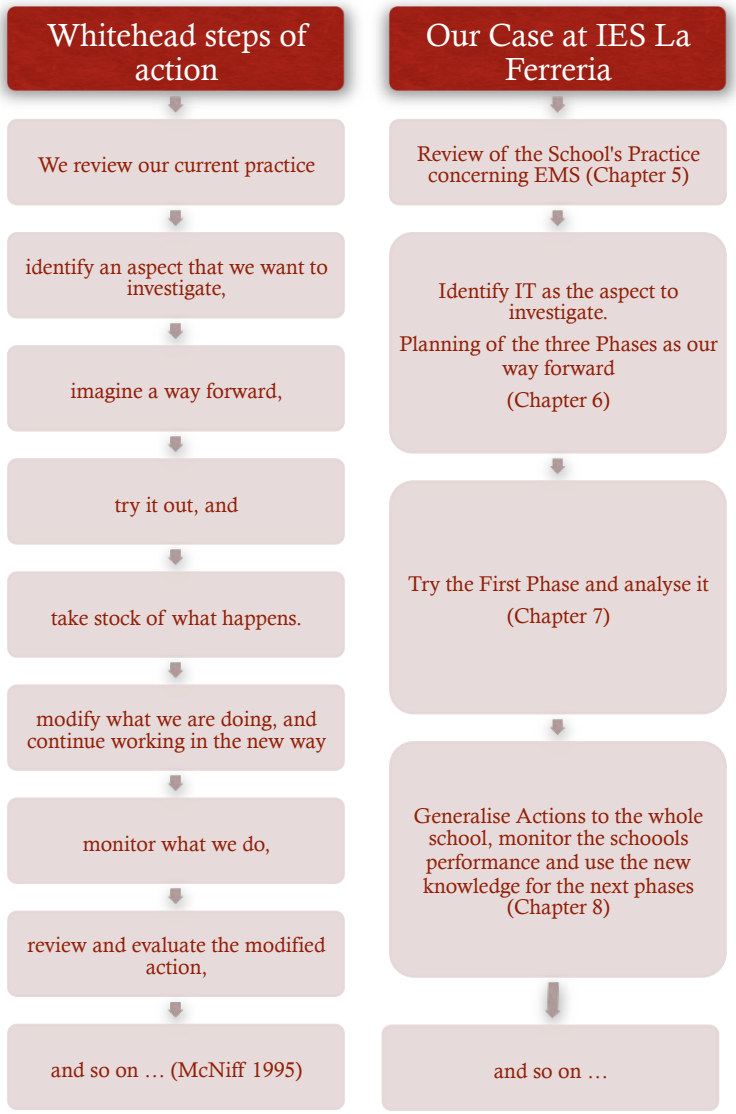


Figure 4 Steps of an Action Plan and Structure of the Research

There are also some threats related to Action Research that need to be considered to guarantee a proper research, according to Eden and Huxam (1996) the sponsoring organisation cannot necessarily be expected to be concerned with general research and would often be concerned, quite naturally, with ensuring that it gets value for the specific project, within this particular project I have tried to distinguish clearly the school management goals and the research goals, giving priority to the research and knowledge generation in front of specific objectives of

the organisation.

3.2 Data collection methods

According to the sources of evidence proposed by Yin (2002), the collected data were identified as mention in figure 5:

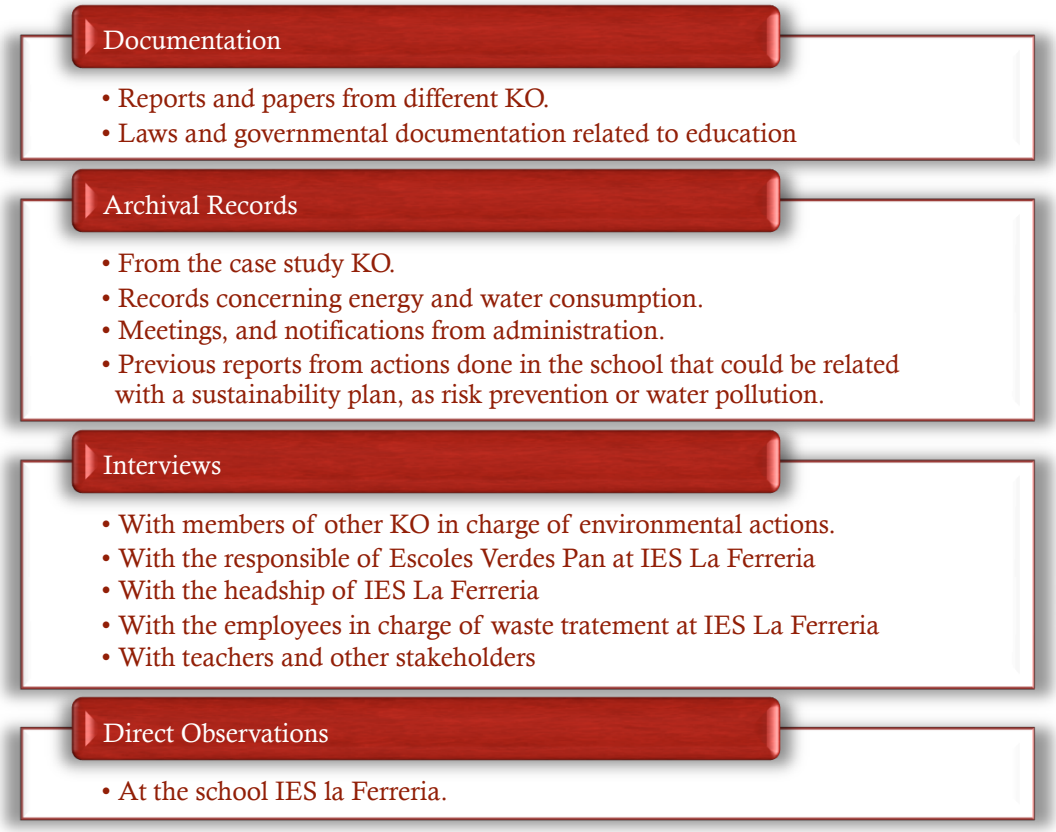


Figure 5 Data collection methods

3.3 Review on EMS

An Environmental Management System (EMS) is the part of the overall management system that includes organizational structure, planning activities,

responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy.

> An environmental management system is "A number of interrelated elements that function together to achieve the objective of effectively and efficiently managing those activities, products and services of an organization which have (or can have) an impact on the environment"
>
> • (Strakey, 1999, p. 61)

There are multiple standards and regulations concerning EMS. EMAS and ISO 14001 are the most common but each institution can create its own EM system by adapting the principles of EMS to its particular requirements.

EMS is based on a continuous improvement strategy, or Plan-Do-Check-Act strategy that starts with the definition of an environmental policy that directs the environmental work of the company.

Figure 6 Continuous improvement wheel of EMS

Every action within an environmental plan needs to be considered in three levels: Strategic, Tactic and Operational.

Figure 7 Three levels of an EMS

3.3.1 The Environmental Policy

The environmental policy is the first step in the improvement of environmental performance as a basis for setting targets and objectives and a tool for communicating the company's commitment and level of ambition towards improving its environmental performance.

The environmental policy is also a symbol for the employees and members of the organisation then needs to be publicly available. Needs to be documented and communicated to all employees.

3.3.2 Planning

In the planning phase the "environmental aspects" need to be revised. Also the legal requirements need to be considered to establish a set of targets and an environmental programme.

Targets

There are three different kinds of targets to be considered:

Control targets: that will ensure the minimum performance of the organisation, in compliance with regulation or with the internal code of conduct.

Improvement targets: Targets set to improve the performance by reducing energy or water consumption for instance. These targets need to be reviewed constantly to ensure a continuous improvement.

Investigations and feasibility studies: A different kind of targets are the ones that allow improvement in a higher range, investigation will allow a company or institution to better know its procedures and therefore will create new areas of improvement. Investigation options for substitution of personal computers for thin clients could be included into this kind of targets.

Environmental programme

The environmental program is a direct evolution of Targets, and must easily reflect the targets. An environmental plan includes a set of tasks that will allow a company to achieve their targets.

Each task appearing on an environmental plan needs to include these specifications:

- Tasks
- Responsible persons and departments
- Timeframes
- Operational controls or other steps
- Monitoring and measurements (assessments)
- Procedures for the specific task
- Instructions if needed

3.3.3 Implementation and Operation

During this phase the environmental programme is implemented and maintained. Training, communication and awareness of employees need to be considered as key factors to achieve success in this phase.

3.3.4 Checking and corrective action

A proper definition of measurements in the planning phase is basic to evaluate the success or failure of the implementation. Corrective and preventive actions need to be defined if necessary.

An EMS audit needs to be performed to determine whether or not the EMS conforms to the requirements of the EMS defined.

Internal Audit

A periodically audit of the system shall secure:

- That the planned improvements are implemented
- That the system is maintained
- That all relevant information is given to the management (and the audit team)

Preparation:

- The content of the internal audit shall relate to the specifications in the environmental handbook
- Review of the EMS
- Former audit-reports
- Checking and corrective action
- Other information…
- Normally a list of relevant topics are made and used in the audit.

3.3.5 Certification

During the 1990s, efforts were made in order to formalise and standardise the procedures prescribing an EMS which resulted in Eco-Management and Auditing Scheme (EMAS) promoted by EU and the ISO 14001 promoted by the International Standardisation Organisation (EVANGELINOS and HALKOS 2002)

ANALYSIS

An EMS

for the IT Department

of IES La Ferreria

Chapter 4 Introduction to the school

The origin of the school was placed in 1962. Severe flooding on September 25th 1962 swept over much of the *Vallès Occidental* Area. The actions of reconstruction carried out over the years facilitated the creation of better infrastructure and facilities for the areas affected by floods, making possible the birth of the school that was named *September 25th*. (IES La Ferreria 2009)

Figure 8 Flooding 1962 Montcada

Initially the center was a College of Primary Education, but in 1976 it was converted into Vocational Training Institute.(IES La Ferreria 2009)

Figure 9 Building IES La Ferreria

Almost after 20 years of uninterrupted operation, the school is moved to the Industrial Estate of *La Ferreria* at the course 95/96. The inauguration of the new building is on October 30th 1995, offering people the chance to take all levels of the new educational system.

These new facilities IES September 25 can be considered as one of the most modern of all Catalonia at the moment. Design and functionality are combined into the new building.

Since 2002 the school changed its name from "IES September 25th" on the "IES La Ferreria", picking a common practice adopted by the citizens of the municipality.

4.1 Location

The IES La Ferreria is located in *La Ferreria Industrial Estate*, between the Sant Cugat River and the Ripoll River.

Street	3 Progress
Postcode	08110 Montcada i Reixac
Phone	93 575 21 84
Fax	93 575 27 85
eMail	ieslaferreria@xtec.cat

Figure 10 Location and Contact IES La Ferreria

4.2 General facilities

The IES La Ferreria is located in a new building that combines functionality with design. The combination of materials used during construction, colors and textures of these, give the center its own personality and characteristic.

Considered at the time of its opening in 1995 as one of the most modern schools is Catalonia, have recently made improvements and adjustments in daily practice that complement and reinforce this assertion. These actions stress the permanent connection to the Internet of the 14 computer classrooms, 10 teaching departments, secretaries, staff room... Besides, all the computers are networked to facilitate information exchange and streamline the administrative work. In addition, dentures and oral hygiene workshops are newly built and provide the latest technologies in this sector.

4.3 IT Facilities

This section discusses the specific facilities that can be found in computer equipment. It analyzes the evolution of introduction of computer equipment in the centre over the past 10 years.

In 2000 the school had around 55 computers with 55 CRT monitors, since them the amount of IT equipment has increased very fast until the 300 computers that can be found now. In this chapter some data is presented to better understand the evolution of IT equipment at the school. Only the amount of computers has been considered to simplify the data, but it needs to be considered that these computers will imply also networking equipment, printers, slide projectors…

Teachers at their departments and secretaries mainly used 55 computers at 2000; there was only one classroom with computers to be used by students. The average of students per computer was 7,6. The increase of computer equipment was huge until 2006 when the amount of computers reached 180, 140 of them with CRT monitors and 40 LCD monitors, implying one computer per each 2,1 students. 2006 marked also the highest electrical consumption of the school in the last 10 years, reaching 14.000€ and an average consumption of 36€ per student.

Since 2006 the progressive substitution of CRT monitors by LCD and TFT monitors changed the consumption patterns and in 2009 even with a huge increase of students (around 800) and computers (around 300) the consumption per student was reduced to 28€.

Computers are not the only IT equipment at the school. Some other devices need to be considered as slide projectors, wireless access points and networking

equipment. Currently there are 13 networking switches at the core installation with a consumption of 25w each and 26 wireless access points with a consumption of 20w.

A more detailed analysis will be necessary to directly link the power consumption with the IT equipment, but in a broad perspective the evolution of computers seems to be related somehow to the electric expenses.

4.4 Offered Studies

The studies offer of IES la Ferreria is broad covering students from 12 to 20 years old and including general education and vocational training in computing, health and administration. The total amount of students has increased since 2006 in a 100% as shown in the following graph relaying this increase mainly in the vocational training studies.

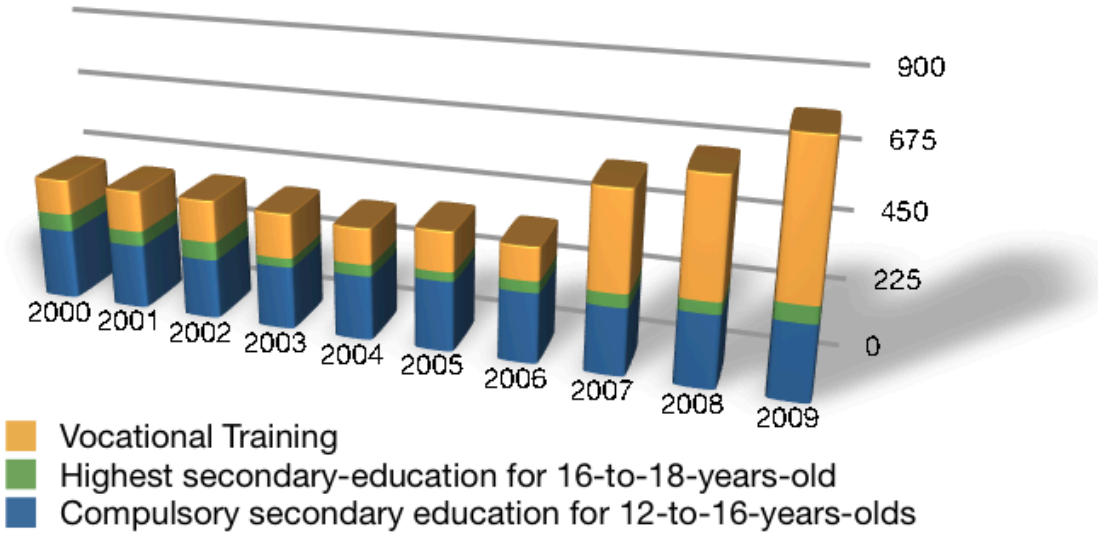


Figure 11 Evolution of students since 2000

Chapter 5 Environmental Performance and Strategy at IES La Ferreria

As a first step into the Environmental Plan the environmental Performance and Strategy of the School is analysed.

The Main Data Collection methods used in this area have been: interviews with the responsible of Environmental Management at the school and with the leadership; archival records analysis of consumption data and internal documentation concerning EMS; and direct observations.

The chapter is sub-divided in two parts: the first one considers the present Performance of the School, its consumption patterns and the actions done in this last years to improve its environmental performance; and the second one called Environmental Strategy analysing the global strategy of the school into the environmental area but also in some other areas that could be related as the Quality System, some other initiatives involving all the community and special factors the will be key points in the deployment of an environmental Strategy as internal communication or involvement in different initiatives of teachers and students.

5.1 Environmental Performance of the school

Now, a brief revision of the present status of the school's environmental performance is shown. It is a broad analysis that aims to show a general picture of the school's status concerning EMS.

5.1.1 Consumption Patterns

The consumption data available at the school is weak nowadays but it's easy to understand in the following graph that the main increase during the last 10 years has been in electricity. The electrical consumption has been duplicated since 2000 and has experienced a huge increase from 2007 to 2008.

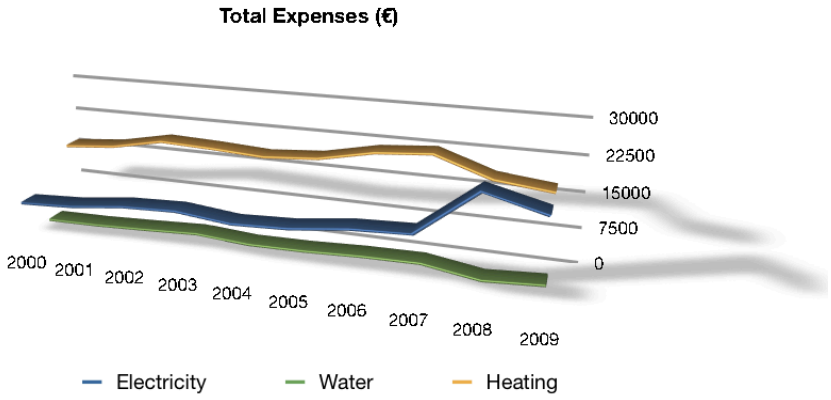


Figure 12 Total Expenses 2000-2009

On the other side if the increase of electricity consumption is compared with the increase of students the results are less dramatics.

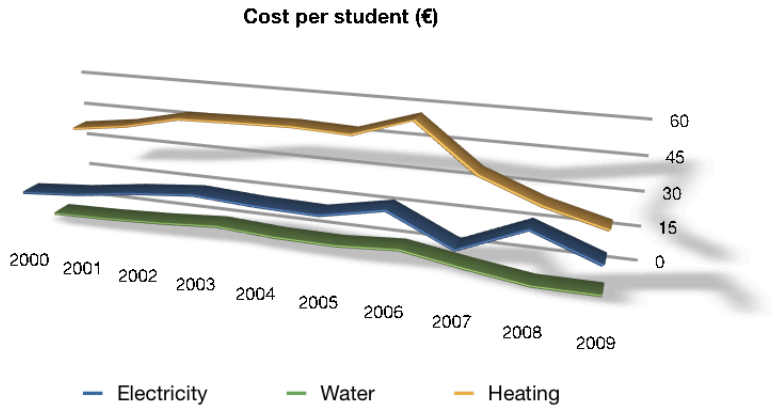


Figure 13 Expenses per student 2000-2009

This data is obviously too broad to get conclusions and an initial audit in water, electricity and heating should be performed as an initial step into the further environmental management system.

5.1.2 Waste management

Waste and Pollution is one of the priorities of management. Their concern about dirtiness in the corridors and playground is increasing every day, but until now this concern about dirtiness had not included environmental concepts as selective waste treatment and recycling.

There is a Paper waste container at the teachers' main room but there are not any at the classrooms or teachers' offices. The city council is in charge of the waste collection differencing from common waste and paper.

5.1.3 Atmospheric emissions

The canteen emissions are the only ones to consider within this sub-section. The canteen cannot be considered as a significant factor and will be considered if necessary in further analysis.

5.1.4 Mobility

As in many other cases there is a huge impact on transportation that needs to be considered, the school is located in an Industrial Estate but not far away from the city of Montcada-i-Reixac. Scholar Bus is the chosen transportation by most of the 12-16 years old students that live in surrounding areas of other towns and cannot walk to the school. Public Bus and Train are the most popular transportations for secondary and vocational training students. Private transportation, cars and motorbikes, are also an alternative for teachers and adult students.

There is no data about mobility habits. This aspect should be considered in a future environmental management project.

5.1.5 Noise and vibration

The especial location of IES La Ferreria, into an Industrial Estate, pushes the Noise and Vibration section into the front row. No sound analysis has been performed by now but it will be a key issue into the EMS of the school. Sound measurements need to be taken to determine how the external sound is affecting the daily activities of the school.

5.1.6 Curriculum Greening

Curriculum Greening has not been considered at any level until now. Individual activities at different subjects could be considered as valuable for the creation of an environmental concert in students but these isolated actions have never been considered as part of a whole plan.

5.2 Environmental Strategy of the school

Environmental Management is not one of the strategic goals of the school, on the other side the headship considers that EM importance could increase if it comes from a

5.2.1 "Escoles Verdes" Plan

Since 1990, the law of education in Spain defines a framework favourable to the promotion of environmental education. The second article of the *law 1/1990 form October 3rd* known as LOGSE defines as a key principle of education their relation with the social, economic and cultural environment and the education in the respect and defence of environment. (Jefatura del Estado 1990)

The administrative responsibilities in education are partially transferred to each autonomous region. The Education Department of the Catalan Government is therefore the agency in charge of the regulation into the educational sector and is in charge of deploying the initiatives to improve the quality of education in Catalonia. (Education Department - Catalan Goverment 2009)

The Program *Escoles Verdes* (Green Schools) is a program from the Environmental Department and the Education Department of the Catalan government. This program helps schools into their challenge for a more sustainable education. Provides materials and it is used as a platform where schools can share knowledge and experiences. By now there are 227 KO included into the program that has been working for 10 years. (Mediambient-Generalitat de Catalunya 2009)

Figure 14 Award given to the schools into the *Escoles Verdes* program

Two interviews with environmental managers of schools working within the *escoles verdes* plan show different conclusions. The main conclusion is that this program doesn't ask for great results in performance. The schools included into the program have access to training and materials, but there are no economical resources assigned, that means that the success of the plan is in hands of teachers that get in charge of an environmental plan without getting any economical advantage. Even considering that, the education sector is traditionally a proactive sector and good results have been seen in different schools. (Mediambient-Generalitat de Catalunya 2009) (Plà 2009)(Vives 2009) (Ramirez 2009)

IES La Ferreria has recently joined the *Escoles Verdes* program, this is the second year within the program and training is the main goal, the Catalan government organises two years of courses in order to train new schools at the program. At the end of this course, June 2010, the school will have finished the mandatory documentation required by the program, as the initial diagnosis and the environmental planing for next year.

The *Escoles Verdes* plan needs to be considered as a good framework, but never as the only tool to approach sustainability. The *Escoles Verdes* plan, includes documentation with a continuous improvement system aimed to push schools for a more sustainable strategy and can be considered as a middle run goal ion the way to a more complete EMS.

5.2.2 Other factors to consider

In this subchapter some issues concerning the organisation and strategy of the school are discussed. This could be minor issues but will help to create an idea about the way of doing of the school in actions that could be related to an EMS.

Standardisation of procedures and Quality System

The school is developing a Quality System and should become compliant with ISO 9001 in about 2 years. This standardisation plan is promoted and guided by the Catalan government throw the Education Inspector in charge of the area and is directly coordinated from the Headship of the school as a priority in the strategic plan of the school. Teachers' involvement can be considered low, but their implication is required in some punctual situations.

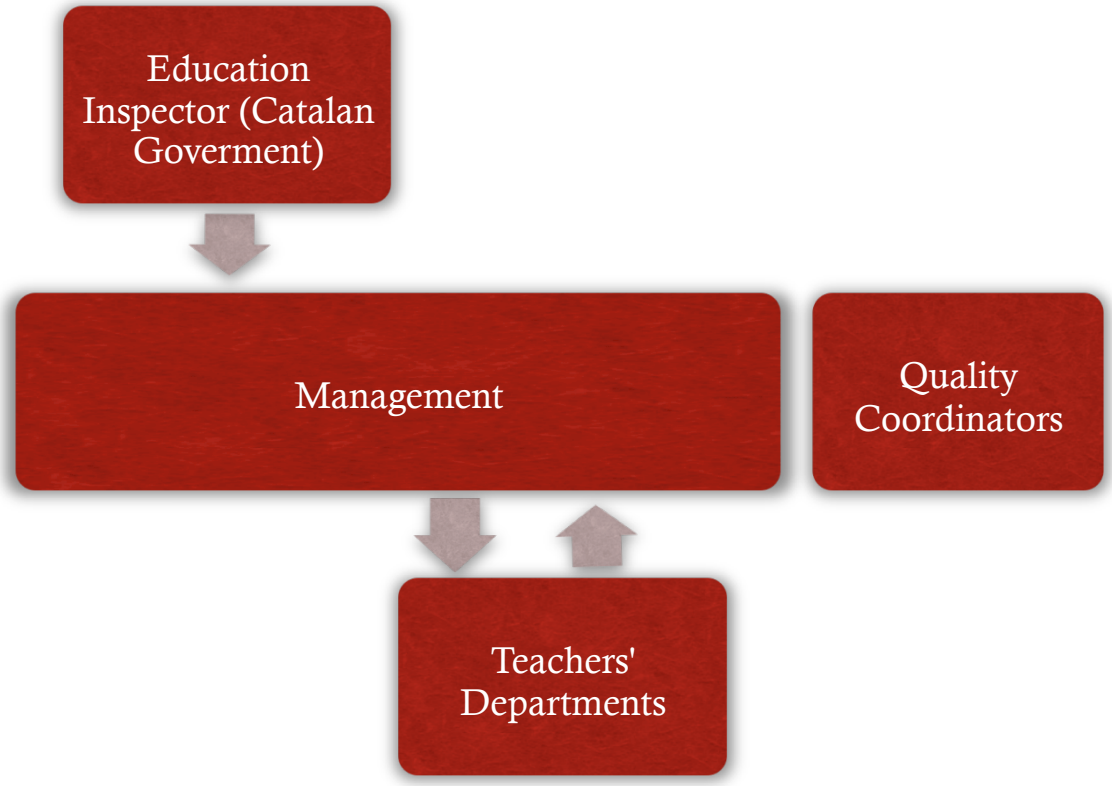


Figure 15 Quality Plan Top-Down Approach

The approach to the quality system is clearly Top-Down; the Dean of the School considers that this is the proper approach because it allows starting the quality process without having a total support from the teachers' community. (Caamaño 2010) The launch of the quality plan was approved in a staff meeting with a weak support from teachers but management considered that the result was enough to guarantee the launch of the project due to the Top-Down approach, that allows a good start without the commitment of all teachers.

People Involvement and Initiative

As shown before people involvement is not a critical issue for the quality system according to management due to the top-down approach but it should be for the environmental management system if a different approach wants to be adopted.

There are different teachers' departments that coexist at the school and each department use to present initiatives related to their particular areas of expertise. There are also some trans-disciplinary initiatives as the Peace Day that are promoted from management and receive the support of teachers. According to the Dean is not difficult to get teachers involved in trans-disciplinary projects but it is difficult to make the start them in a proactive way.

Chapter 6 Planning the Launch of EMS at IES la Ferreria

Considering the previous findings a set of recommendation will be considered for the further work.

The management of the school does not identify Environmental Issues as a strategic goal at any point. EM does not appear at any of the goals of the school. On the optimistic side management is open to a change of this fact if the requirement for the increase of Environmental actions came from the teachers or even from students. On the other side the management's working style used to be very Top-Down oriented and a Bottom-Up approach could demonstrate that other way of doing things is possible.

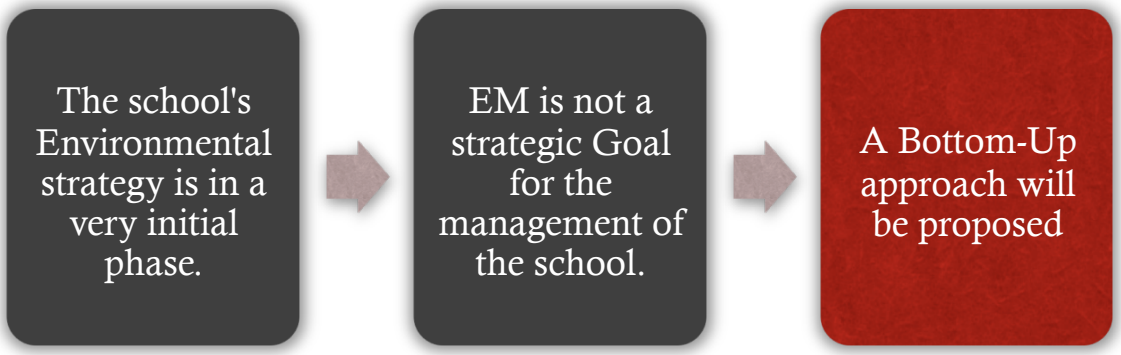


Figure 16 Bottom-Up Approach

Teachers' involvement into the school's strategy and decision-making has not been optimum during these last years. The Top-Down oriented decision-making of management, which can be positive in some aspects, is not the best to motivate participation from teachers. The suggestion of a Bottom-Up approach could find in this aspect a huge barrier. A great participation from teachers has been found in several isolated actions usually concerning to the areas of expertise of each

teacher. The suggestion in this sense is to start the environmentally-related actions with a preliminary plan based on low-hanging fruits focussing on communication and involving little by little as many people as possible. With this preliminary plan teachers that are not proactive in actions related to environment will see that is easy to get things done and will probably jump into the train of sustainability.

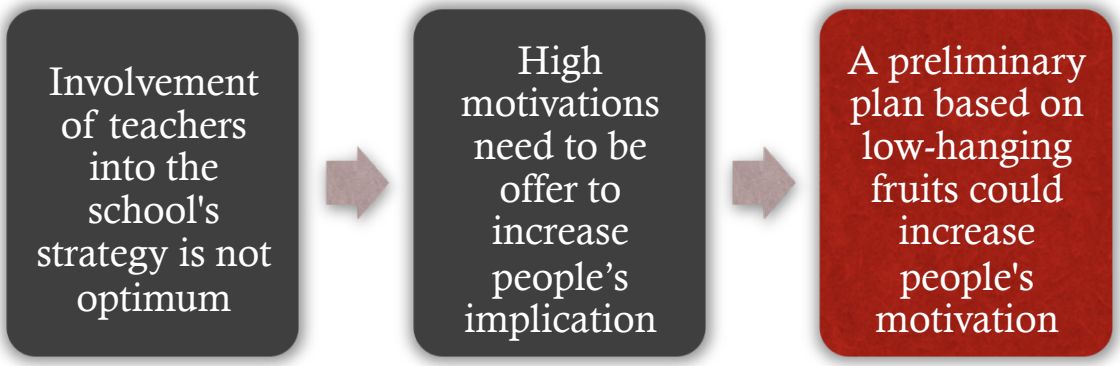


Figure 17 Plan Based on low-hanging fruits

The importance of IT facilities at Knowledge Organisations have been discussed in the previous chapters and its possibilities as low-hanging fruit are obvious considering the previously shown data. These great opportunities and the special conditions of IES La Ferreria concerning IT equipment due to teaching of computing vocational training studies make IT a candidate for the preliminary plan.

Figure 18 IT as a hot-spot

Considering these three recommendations an action plan is defined for the school. Mainly three phases are considered. These three phases are explained into this chapter, and then the first phase will be considered in the following chapter.

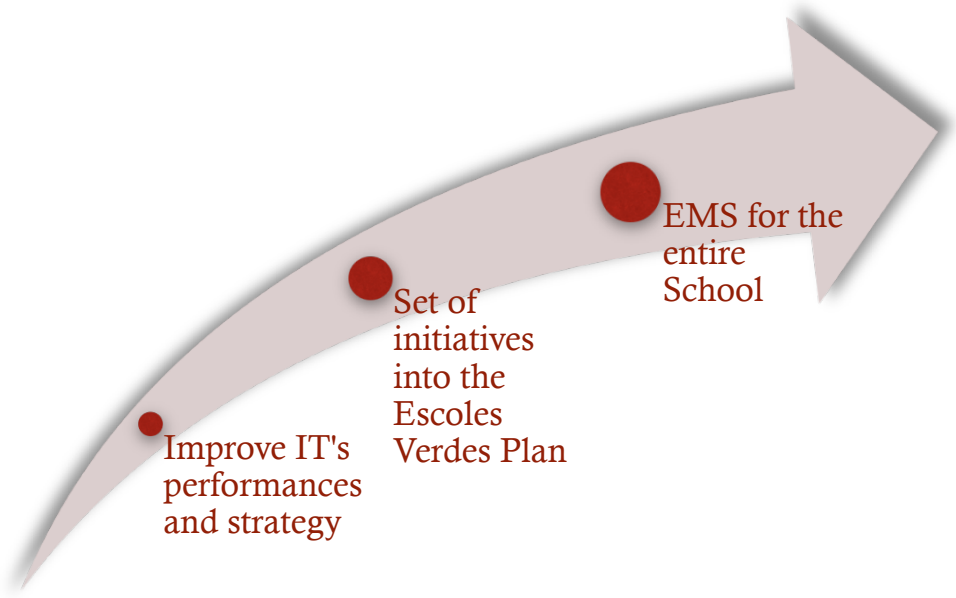


Figure 19 Three phases for an EMS at IES La Ferreria

6.1 Phase 1: The IT perspective

This first phase will set the basic essentials for all the future work on EMS. The IT perspective is used as a tool not as the main goal of the phase that will be setting the pillars for an EMS proper development.

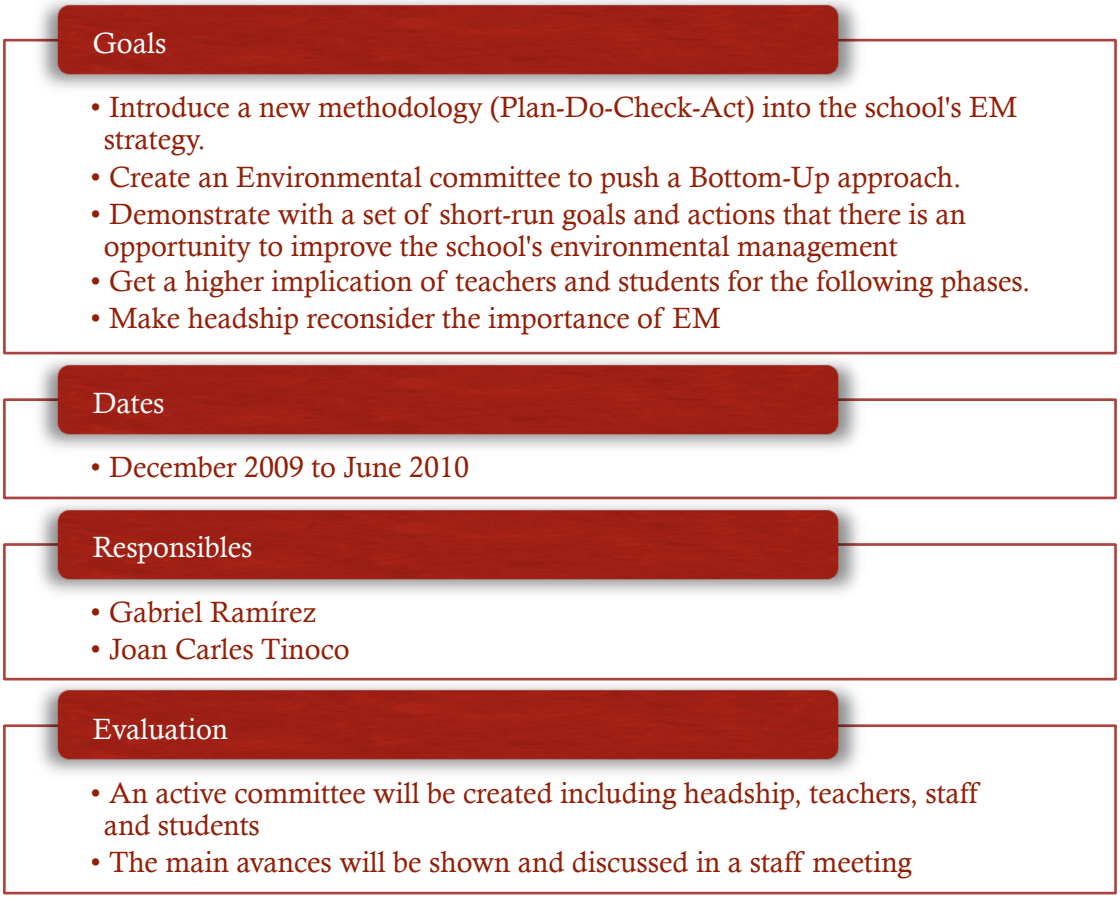


Figure 20 Phase 1: The IT Perspective

6.2 Phase 2: *Escoles Verdes* Plan

Within this phase a set of isolated but coordinated initiatives should be performed as reply of the IT first phase, but considering different areas of the schools, and different departments. If the communication of the 1st phase is proper, other departments (out of the computing department) should increase their proactiveness starting isolated actions that will be coordinated from the Environmental Committee. All this isolated actions should be considered within the *escoles verdes* plan.

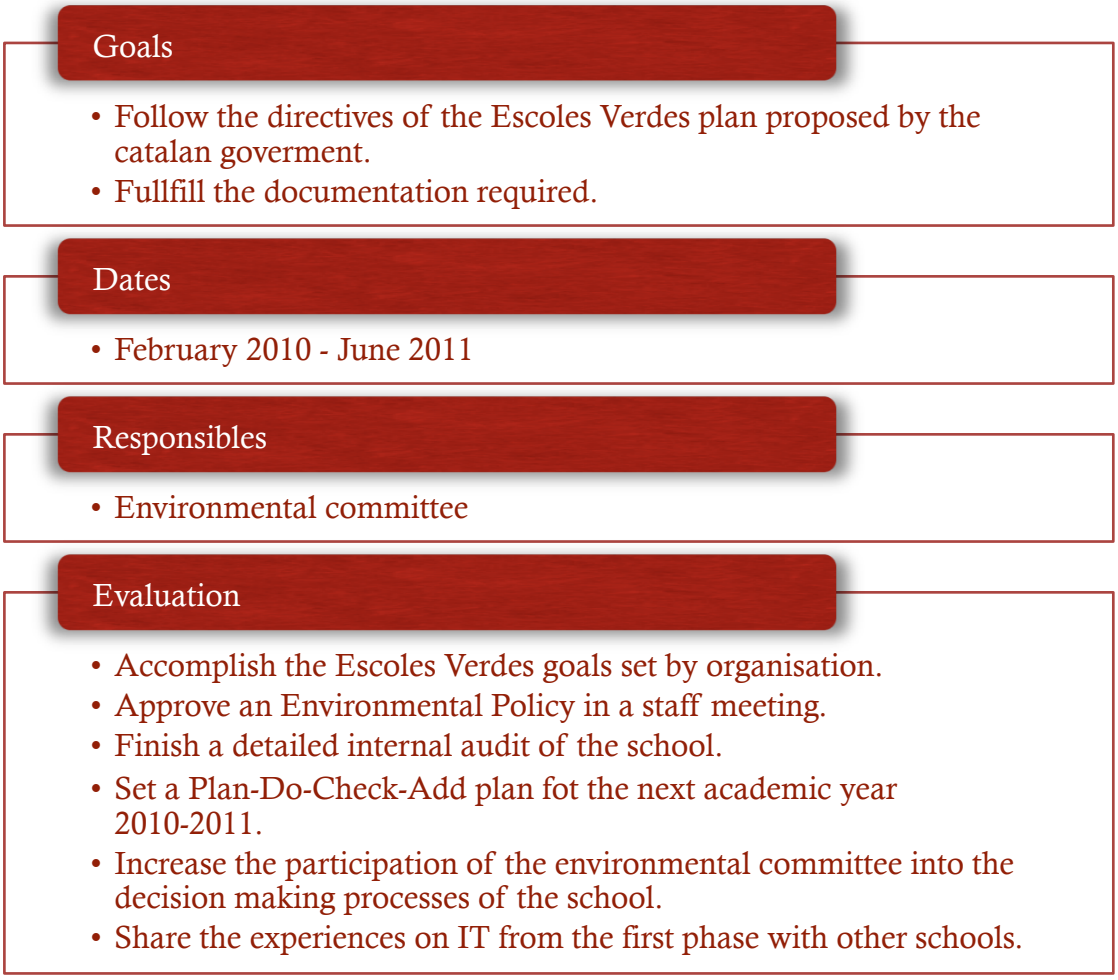


Figure 21 Phase 2: *Escoles Verdes* Plan

6.3 Phase 3: EMS

The 3rd phase is the most ambitious and aims to create an EMS for the whole school. This EMS will rely in a firm ground set during the previous phases.

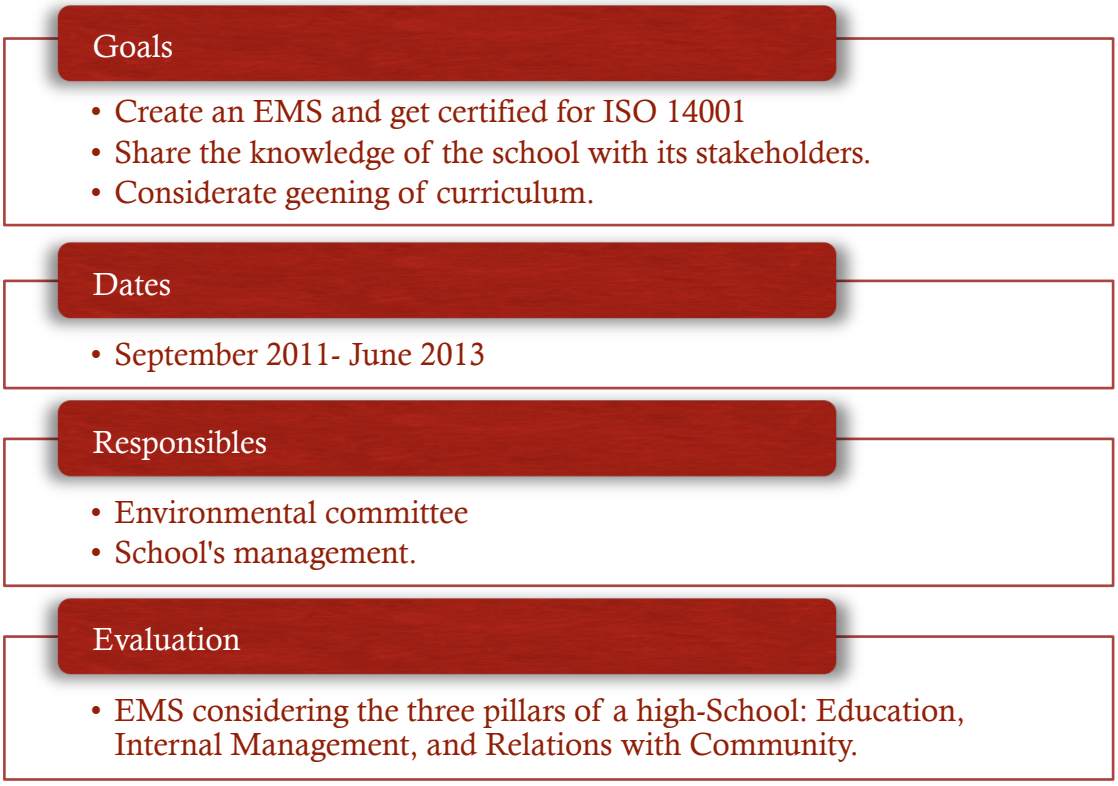


Figure 22 Phase 3: Global EMS

Chapter 7 Phase 1: The IT perspective

The first of the three phases discussed in the previous chapter will be considered now. An action plan will be considered to launch EMS at the school.

7.1 Strategy

This first phase aims to generate the bases for a further EMS. The focus on IT has been chose to allow a fast environmental improvement based on low hanging fruits.

A strong and clear strategy will allow interpolation and extension to adapt for the next phase. The key factors to consider will be:

- A Bottom-Up approach will be proposed.
- The first phase will be understood as an internal agent for change to push a change of strategy in the whole schools system concerning environment.
- Communication will be a key factor considering that this will be the first approach to sustainability of the school.

7.1.1 Environmental Policy

As a first step the environmental policy has been defined for the Phase 1. This environmental policy will require changes before it becomes a real Policy for the global school.

The policy was developed between November and December 2009 as a first document where the goals of this first phase were established. This was discussed with Juan Carlos Tinoco (as responsible of the *escoles verdes* plan at the school) and with the management. The school council at their next meeting will approve the Policy.

ENVIRONMENTAL POLICY STATEMENT TO THE IES LA FERRERIA

IES La Ferreria understands that, like any human organization, it makes an impact on the environment through the use of natural resources and the production of various wastes and emissions. Similarly, IES La Ferreria understands that as a Knowledge Organization, it assumes a significant responsibility in education, training, awareness and dissemination of personal and professional responsibilities of students and workers who pass through its facilities. In addition, IES LA Ferreria takes part into the modernisation of education and implementation of Learning and Knowledge Technologies (IT) as a teaching tool. Consistent with this, IES La Ferreria in total agreement with the values, principles and social responsibilities in the world and within the Escoles Verdes Plan adopts and assumes the following commitments and principles to allow the inclusion of sustainable new technologies for learning within their curriculum:

Commitment and environmental objectives:

- IES La Ferreria is committed to fulfilling all applicable environmental legislation and regulations in force and at same time being proactive in adapting to future requirements.
- IES La Ferreria is committed to promoting and carrying out all necessary efforts to minimize their negative environmental impact and improve continuously and permanently, the environment in the school. In addition, the school agree to periodically monitor the environment to determine the degree of improvement.

ENVIRONMENTAL POLICY STATEMENT TO THE IES LA FERRERIA (cont.)

Basic Actions to fulfil commitments:

- Integrating and assuming an Environmental Management System in the field of TAC considering the planning and decision-making procedures.
- Make an efficient use of natural resources and materials necessary to carry out activities related to the management of computer equipment throughout its life cycle.
- Continuously reduce waste production and emissions due to new equipment for TAC, and promote proper management.
- Develop training, awareness and participation of the educational community, staff and students, in order to get them involved in this Environmental Policy.
- Communicate to contractors and suppliers the need to adopt environmental policies consistent with these principles.
- Disseminate this Environmental Policy at the entire educational community.

For the realization of these principles and commitments IES La Ferreria starts the implantation of an Environmental Management System in the field of IT. This statement of Environmental Policy must be known, understood and applied by all employees and students of the School and its headship is committed to ensuring that happen.

7.1.2 Environmental Targets

The mail goal of the first phase is create a proper environment to start with the second and third phase. Communication will be therefore one of the key aspects but also some short-run targets will be defined:

- Increase Teachers' awareness and involvement.
- Increase Students' awareness and involvement.
- Create an Environmental Committee that represents all profiles of the school's staff.
- Create consumption maps identifying hot spots of electric, water and heating consumption.

- Create a set of actions to improve environmental performance within the IT sector.

7.1.3 Environmental Program

The following environmental program shows a briefing of the tasks designed to accomplish with the set targets.

Task	Responsible	Timeframe	Evaluation
Creation of the Environmental Committee	JC: Tinoco	Nov 09 – Jan 10	Meeting in January
Powering Down from the Bottom-Up	G. Ramirez	Jan 10	Posters at all the computer rooms.
Thin-Clients analysis	M.Muñoz	Jan 10	Evaluate if thin clients could be a solution for computing at the school
Configure Power saving settings at the new O.S. images	IT coordinator (F.Gómez)	Jan 10	Find a proper way to administrate power saving settings at the computers.
Promote e-mail in front of paper print	G. Ramirez	Jan 10	Posters in all the departments and teachers room
Document and communicate all improvements	G. Ramirez	Jan – Feb 10	The maximum number of teachers and student should be aware of the environmental initiatives.

Figure 23 Environmental Program

7.2 Performance

This section analyses the first actions proposed in the Environmental Program.

7.2.1 Environmental Committee

The creation of an environmental committee is one of the first steps into the environmental plan. The committee has representation from all levels of the school, including, teachers, students from different levels, staff and management.

The Environmental Committee will be also, as recommended by Jean McNiff (2002) part of a "Validation Group" for the active research. This group (or part of it) agreed to meet with me once a week during the last period of my project (since the end of December to the delivery day) to listen to my progress reports and to scrutinise my data (although they were not entirely familiar with the research)

Apart of the Environmental Committee, the Computing Department needs to be considered also into the Validation Group. This research process have been considered in the weekly meetings of the department and the professional judgements about the validity of the report and critical feedback have been considered to define the Environmental Program related with IT improvements.

7.2.2 Powering Down from the Bottom-Up

This task includes a set of actions inspired mainly by the paper "Powering Down From the Bottom Up" published by EDUCASE in 2009 where Tom O'Donnell analyses the energy savings obtained at the University of Maine at Farmington by considering not expensive strategies, such as power management, raising user awareness, and switching to energy-efficient computers. All of them from a Bottom Up approach that also has been suggested as the proper approach for IES la Ferreria.

Power Management Tools

One of the actions suggested by Tom O'Donnell at his report is the introduction of power management tools at the Operative Systems installed in all the campus computers. This action was analysed in one of the periodical meetings with the IT Department and Fatima Gómez, IT support coordinator, was designed in charge of its analysis.

Desktop Best Practices

Also a contest between students was proposed to find a proper design for a poster to make the campus community aware of the best practices related to the usage of computers and printers. The poster will be based in the Climate Savers Computing initiative and will include similar concepts as the poster at Maine University.

Figure 24 Poster at Maine University

7.2.3 Thin Clients

Thin Clients are a very common issue in greening of IT in Knowledge Organisations. The Lower power requirements (and therefore low heat production) of thin-client devices and the centralisation of servers plus a well-engineered power supply and well-designed cooling would handle the heat more efficiently. (Bristow and Samuels 2009)

There are many cases of KO introducing thing client technologies in the last years, and many of them did it considering the change from an environmental perspective. Queen Margaret University in Edinburgh, Oxford University, University of Michigan or Lourdes College have generated extended documentation about the opportunities of this client technology in KO. (Stuenkel 2009) (Howard Noble 2009)(Bristow and Samuels 2009)(Butler 2009)

There are as many approaches as cases, Lourdes College converted computers in common areas with simple computing needs to thin clients and this virtualization effort saved 60 percent of the cost that the college dedicated to computers used in common areas on campus. The following table shows, as an example, the power consumption savings at Lourdes College with the introduction of Thin Clients technology: (Butler 2009)

	Standard Desktop	Virtual Desktop
Computer power (in watts)	255	10
Monitor power (in watts)	32	32
Number of computers	30	30
Computer power consumption	8,610	1,260
Server power requirements (in watts)	0	800
Power consumption per computer	287	68.7
Total power consumption	8,610	2,060

Figure 25 Lourdes College Power Savings using Thin Clients (Butler 2009)

Thin Clients alternative was discussed in one of the periodical meetings with the IT department, and Miguel Muñoz was designed in charge of analysing the real possibilities of this technology at IES La Ferreria.

7.2.4 More Email → Less Paper Print

The use of e-mail continues to explode. Students and Teachers mostly use e-mail to communicate and coordinate its work. Only at the Computing Department of the school, more than 300 e-mails are sent between teachers every month. The good news is that e-mail can be considered "green" because it reduces paper use when used to distribute documents electronically, thus shrinking carbon footprints and costs. (Thompson 2009)

We have set some recommendations for the school to start reducing their paper print consumption progressively. Mainly three actions have been started: changing the institutional communications from paper to e-mail, promoting a "virtual campus" where teachers can publish information and students can deliver their works and increase teachers concern about the necessity of printing e-mails and documents. The goals and procedures of each of these three actions are discussed in the following lines:

Institutional Communications from Paper Print to e-Mail

To reduce the reliance on paper some schools have try changing the institutional communications from paper in the mailbox to e-mail. The results of this initiative use to be weak because of the variety of profiles between teachers and staff. E-Mail is a proper communication tool within the computing department, but, even nowadays, it is difficult to ensure that some teachers will check their e-mail daily.

Some schools have start changing their habits transferring the communications system of one section to e-mail, for instance IES Castellet uses e-mail for communicating changes and new events in the school library. This method is not entirely worthy and the library responsible admits that e-mail have reduced some teachers awareness about shat is going on at the library. (Castellet 2008)

The proposal for IES La Ferreria is different in this sense; an initiative called "The Green Stick" is aimed to change communication habits from a bottom-up approach.

Nowadays the main areas of communication between teachers or from management to teachers are mailboxes at the teacher's room.

The Green Stick consist literally in a green stick at the teacher's mailbox that indicates that this teacher would like to receive an e-mail in instance of paper print copies of the communications.

This system allows a slow evolution from paper print to e-mail ensuring that all teachers will get the information. It is also a bottom-up approach where teachers will force other teachers and management to communicate with them via e-mail reducing the paper print impact and creating an environmental concern.

The results of this proposal can not be shown by now because of it's experimental phase but the expectative are high considering the agreement of management on the initiative.

Promoting the "virtual campus"

IES La Ferreria has had a "virtual campus" for many years, and its usage have been increasing during the last times. The application is hosted by a computer at the school and is used by a high amount of teachers at their lectures.

There are no recommendations in this sense, but it is important to consider the virtual campus as a green tool that contributes positively to the greening of the school.

Responsible printing posters and banners

With the mission of increasing people awareness a set of posters will be designed and distributed in all the printers and desktop areas as shown in the section 7.2.2 Desktop Best Practices. Also a banner will be designed and attached in all the institutional e-mails to encourage receivers to reconsider if it is necessary to print that e-mail.

7.2.5 Promotion and communication

As discussed previously the main goal of the first phase is create a proper climate for change in the school, to achieve this goal some actions have been designed including mainly meetings and discussions with teachers and students and promotion with posters and contests that aimed to increase participation of teachers. The following lines describe the planning of these actions that will be executed in the following weeks of the delivery of this project.

Lecture: Environmental Management for computing students

Meetings with the different groups of students of Vocational Training have been scheduled for February. This meeting will cover the following three parts:

- Explain the basics of environmental management.
- Show the impacts of IT installations in companies.

- Workshop: Discuss initiatives and ideas to reduce environmental impacts at the school in relation with IT.

All the groups of computing students at the school will have this lecture as a multidisciplinary activity and will do the workshop in collaboration with computing teachers. In total seven meetings will be done and the results of these will be shown at the presentation of this project at Aalborg University.

Contest: A logo for the Green School

A contest announced in December at the schools' website called students participation to find an appropriated logo for the Green School initiative. The period to deliver works ended in January 31st and now the Environmental Committee will choose the winner and using this design will prepare the posters and "Green Sticks" for the teachers' mailboxes explained in the previous sections.

Exposition at the "Escoles Verdes" course: "Bottom-Up approach in IT: An ally in the way to EMS at IES La Ferreria"

Since October and once a month, The Catalan Government organises a Course for the schools that are getting prepared to get into the *Escoles Verdes* program. In the following meeting of this course, on March 9th, the results of this project will be shown as an example of how to deal with EMS with a Bottom-Up approach and paying special attention to IT.

Presentation of the Environmental Plan in a Staff Meeting.

The whole planning will be discussed with the management and if approved presented in the next Staff Meeting to all the teachers of the school. This presentation will be the last of the steps so the teachers will have noticed the posters and communications related to environment before it. This meeting will try to encourage teachers from other departments rather than computing about the high possibilities for working on environmental projects within their areas of expertise.

Chapter 8 Conclusion and Future Lines of Work

The results of this project are favourable, the research question has been answered and the methodology chosen have been perfectly valid. The three phases plan has been designed to perfectly fit within the characteristics of the school using IT as a starting motor to switch on the complex engine of an Environmental Plan.

How should IES La Ferreria design the launch of his Environmental Plan making especial attention at Information Technologies?

• Reserarch Question

Bottom-Up is selected as a proper approach even considering its barriers due to the lack of experiences using this approach at the school and the mainly Top-Down organisation used by headship at other projects. Environmental Management is not view as a key issue from headship but they agree to change their order of priorities if the school's community pushes for this change from a Top-Down perspective.

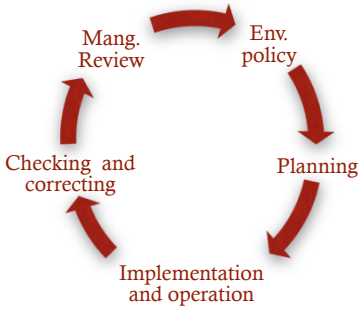
IT have been identify as a key factor at Environmental Plans and several actions have been suggested on this field to help IES La Ferreria and any other high school dealing with the growing impacts of IT.

The synergies between education, IT and Environment have been discussed and some actions, as the environmental lectures for computing students have been designed to obtain the maximum of these synergies.

The plan also warrantees a change from reactivity to proactivity at the school and an important example of this change will be the participation at the *Escoles Verdes* course but now not only as a listener but also as a speaker sharing our experience with other schools that could have similar situations.

In future projects, a more quantitative analysis of IT impacts at knowledge organisations could be performed, IES La Ferreria will buy some measurement equipment to analyse the reductions on energy consumption by introducing power management tools at the operative systems and also by increasing students awareness about best practices on computer usage. A quantitative analysis of paper usage at the school will show also the benefits of using IT tools as e-mail or the virtual campus that are supposed to reduce considerably the use of paper print.

Epilogue



This project needs to be locater mainly at the first part of the continuous improvement weal of EMS (Fig 6). Most of the actions suggested are just entering into the Implementation and Operation phase and results therefore cannot be shown by now. The support from management and the agreement of a big validation group, as described at the section 7.2.1, warrantees a correct Implementation.

The schedule for the next weeks is clear but ambitious. The environmental committee will have a meeting and will agree on the designs for the logo, posters, banners and "green sticks" that will be printed and distributed at the school.

Technical initiatives as Thin Clients and Power Management Tools for the operative systems, keep their analysis phase with the target set to next course when this initiatives will start their deployment.

The lectures and expositions for the computer students, and the *Escoles Verdes* course will be performed in the following month. And their results will hopefully help the development of the plan generating new ideas.

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