

ECOTEC - ECONOMY, ECOLOGY AND TECHNOLOGY. A RATIONAL APPROACH TO THE RESOURCES MANAGEMENT PROBLEM

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Abstract. *The ESTV is a school of engineering and management that started its activity in 1987. The faculty members are mostly within their 30-40s, which provides most of the time a young environment and allows novel approaches to old problems. This and the fact that it has a polytechnic nature, thus recruiting a considerable number of personnel within the industrial and services activities, brought some (common) good practices into the institution.*

Since the very beginning there were very strong concerns with facilities maintenance, as well as a progressive empowerment of departments (the school basic division). It was intended both to allow creating a quality organization culture, cherishing the building, facilities and materials, and giving a sense of property to all those using them. It allowed also departments own budget management.

The Portuguese difficulties with the deficit rules of Maastricht made the successive governments, especially since 2000, to undertake some (arbitrary) measures of severe costs reduction, which naturally reached the higher education sector. ESTV reacted to this with a rational approach to its resources management. One of the main areas was the energy consumption. It was decided by the top direction to create a study group, made of representatives of all the departments interested in joining the initiative. Its mission was to rationalize energy use, rewarding and publicizing good practices, involving faculty, students and staff members. The commission was named EcoTec- ECONomy, ECOlogy and TEChnology. Soon after it began its activities a decision was made to incorporate global stationary expenses. It was designed to bring together the rational, economical use of goods and resources and the ecological feeling. Providing technical and technological data made possible that some consciousness about the issues at stake was acquired. In the end the results show the virtuous nature of that marriage. The lesser result would not be the attitude shift towards enjoying and improving quality of the whole community's workplace. This paper relates how this was done, which were its major achievements and drawbacks. The evolution of the last three years of EcoTec's most significant activities is reported.

Keywords: Resources, Management, Ecology, Energy

1. Introduction

In October 2001, the Scientific Council of the Technology School of Viseu created a Commission named EcoTec which main purpose is to implement a rational approach to the resources management problem (COM(2001)264 final). This commission should incentive the reduction of the inflated costs, mainly concerning the energy consumption (COM(2003) 829 final) and stationery, rewarding and publicizing the good practices.

Once the school is divided in departments some of the actions must be taken at this level. Therefore, in order to achieve the best results, EcoTec is formed by representatives of each department that take into practice the measures proposed and return the feedback of their fellow colleges into the study group. The nominated commission was composed by representatives of the different teaching departments and representatives of the maintenance and academic services. In order to reinforce the role of the commission, its first leader was the president of the scientific council of the School (at the time). Later on, the elections to choose a new president took place.

Since the very beginning, EcoTec has the necessary support from all School's entities. This support has been of central important since most of the measures proposed by this study group reflects on the entire school functioning. However, not all the staff and students are totally involved and motivated for the actions implemented.

From its nomination, the EcoTec commission has been conducting meetings with periodicity defined by the availability of the different members of the commission and by the needs of reflection and/or intervention in the areas that were attributed to EcoTec.

2. Ecotec's activities

The first resolution of EcoTec was to assess the consumptions of paper and ink/toner from each department and the electricity and propane needs from the entire school. The main concern of this action was to inform each department about their own consumption (ink/toner and paper) and the global electricity and propane utilization. Another objective was to establish a reference that would allow future comparisons.

Each department was informed that from this point on there was going to be a yearly evaluation of its performance. This evaluation was made considering four categories of items: energy items, non energy items, recycling capability and improvement achieved. The two first categories are intended to compare the performance of the departments concerning the consumption of resources. The third one was considered to motivate the "ecologic consciousness". The last category was planned to encourage the evolution of the departments in what refers to the rational use of the resources. This indicator was considered because of the existing conscience that all departments can achieve important progression in a small amount of time (it works as an improvement catalyst). Each one of those categories includes one or more items to be evaluated, as showed on Tab. 1.

Table 1. Assessed items

Category	Item	Observations
Energy items	Electricity	
	Propane/natural gas	Mainly used to central heating of the ESTV building
Non energy items	Paper	
	Ink/toner	
Recycling ability	Recycled paper	
	Recycled ink/toner cartridges	
Evolution	Variation of the value of consumed paper	Variation in € related to the preceding year
	Variation of the value of consumed ink/toner cartridges	

The assessment of the comparative performance was planned to be made in a department and item basis. However, once the departments share some physical spaces in the school and there is no method to split the electricity and propane/natural gas consumption between the departments, those items were considered in a global way.

The remaining items were accounted in an individual mode to each department. The performance of each department on each individual item was obtained dividing its global consumption by the number of persons that belong to the staff of the department. This allows reflecting the different dimension of the existent departments (in what refers to number of courses and staff). In the first approach it was also intended to account the number of students of each department. However, interlink between departments (in what refers to pedagogical activities) would make the evaluation of each department's students a complex task.

The performance of each department in each one of the six individual evaluation items was considered. Based on such results, the departments were graded in six merit order ranks which reflect their comparative behaviour. This

allows the departments managers to compare the performance of their department with de one of their peers. Furthermore, those ranks were used to establish one final global department rank, which tries to reveal the overall performance of each department. In order to obtain the final position, the behaviour of the departments on each one of the six individual evaluation items were weighted and summed. Different weights were used to each one of the evaluation items in order to avoid perverse signs. For instance, the paper and ink/toner consumption item had a greater weight than recycled paper and the empty cartridges one. Still, the weight of the recycling items was significant to incentive the “ecologic spirit”. Furthermore, the weight of the consumed paper is lower than the one of the consumed ink/toner. This was made, mainly in order to induce the use of the printers on “draft mode”, which is sufficient for the most of the printed works that are needed. In what refers to recycled ink/toner cartridges, its weight was near the one of the recycled paper.

The evolution items had different weights, being the evolution of the value (monetary values) of ink/toner consumption greater than the one of the paper consumption. This intentional discrimination has to do with the encouragement of the use of more economic ways of printing. In fact, each department has, at least, one laser printer located at a common room (meeting room) that can be used by all people that belong to the department staff. Also, this inequity is intended to incentive the buy of printers with cheaper ink cartridges, when there is a need to buy a new printer.

The departments’ evaluation made by the EcoTec group, results into two kinds of rewards/penalties. The first kind is related with the image (in what refers to ecologic and rational attitude) of the department on the academic community. Using a pondered method, the final rank is defined and the results presented, to the entire academic community, in an annual event called “The EcoTec Awards”. At this event three special awards are delivered to the departments with best and worst performances and to the department that has the better collecting procedures.

The second kind of reward/penalties has economic consequences to the departments. In accordance with the top direction of the school, a money prize/penalty was created, which takes into account the evolution items previously referred and the decrease/increase of electricity and propane/natural gas bills. A merit unit, named Eco Points (1 Eco Point = €1), was created to express the prizes/penalties of each department. The Eco Points (positive or negative) won by each department have two origins. The first one has to do with the increase/decrease of the individual departments’ bills concerning paper and ink/toner. The second one reflects the increase/decrease of the departments’ bills concerning global electricity and propane bill. In this case, the variations are uniformly divided by the departments. The positive Eco Points earned by a department is transformed in Euros that can be used to buy some material thought to be useful (books, hardware, congress’s financing, etc).

Since there was no implemented collection system of used paper and ink/toner cartridges, another Ecotec’s main activities was to put it into practice. This was achieved with the help of the maintenance services. In a trimester basis, used ink cartridges and paper are gathered and stored until they are sent to the recycling centre. For three years Ecotec demanded, to the proper authorities, the installation of a drop-off recycling point within the school perimeter. In March 2005, the longing drop-off recycling point finally arrived to ESTV, still the batteries container has been forgotten!

Throughout its activity, EcoTec has regularly presented to the school Executive Council some measures to control expenses concerning stationery and energy. The most recent proposed measures were:

- The acquisition of a laser printer which, connected to the school LAN, made possible the stop of abusive printings at no cost (such as CD and DVD covers). Before this measure was implemented, the students had free access to printers installed in the computers labs. The new printer ended this situation, yet allowing the students to print their works at a symbolic price.

- The replacement of propane by natural gas in the heating system of the school.

Also, during the year, Ecotec sends e-mails to all teachers and staff, urging the school community to the need of sparing use of the available resources. It is not Ecotec’s objective that people stop using whatever materials they may need, but to make people think before using them. For instance: “Do I really have to print this document?”; “Why don’t I only backup the document?”; “If I must print the document, why not use both sides of the sheet?”

3. Results and discussion

The following tables and graphics present data regarding the evolution of the previously referred items in the last four years (since the beginning of EcoTec). Figures 1 and 2 depict the progress of electricity and propane/natural gas consumption.

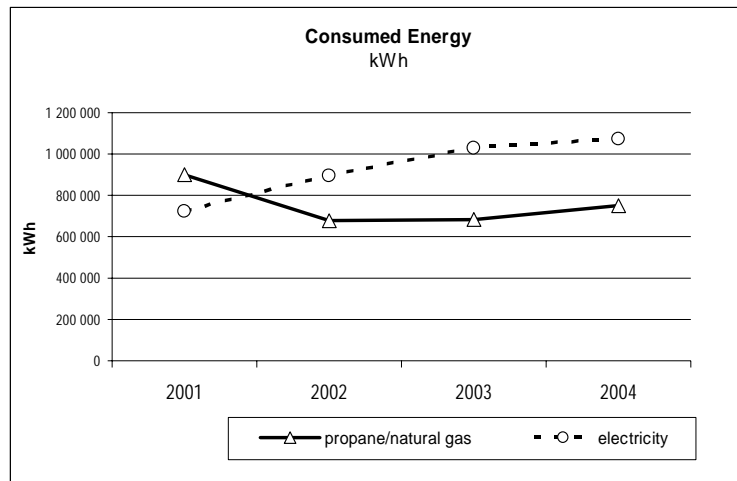


Figure 1. Energy consumption

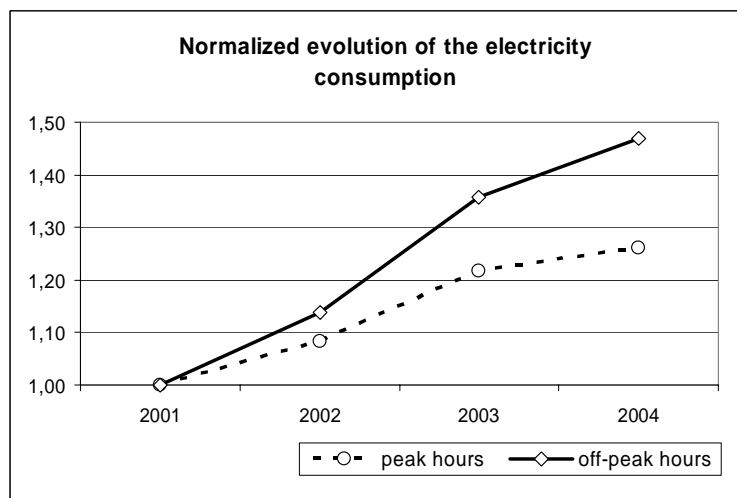


Figure 2 – Energy consumption evolution

The electricity consumption increased 24% between the years 2001 and 2004. This fact is partially justified by the intensification of classes after six p.m., which began on 2001. These classes imply a more intensive use of artificial lighting. This can be confirmed on Fig. 2 which shows a greater increase on electricity consumption at off-peak hours (47%) than at peak-hours (26%). It is essential to stress that the off-peak hours occur between ten p.m. and eight a.m. on winter time and between eleven p.m. and nine a.m. in summer time. Some periods after 6 p.m. are also “peak hours”, which means that some of the increase on electricity consumption, at “off-peak hours”, is also due to the classes that take place after six p.m..

Another issue that contributed to the electricity consumption increase was the augment of 5.8 % on the physical space of the school (new offices for teachers and class rooms) that begun to be used in 2002. It is central to stress that an important part of the electricity consumed on off-peak hours is used to supply the chillers used in the refrigeration system of the school.

The consumption off propane/natural gas for the heating system had a large reduction in the first year of EcoTec’s activities, stabilizing in 2003 and increasing 10.5% in the next year (year in which the environmental temperatures reached historical low values).

In 2004, the medium kWh price has been reduced 26.3%. This value was obtained by the conversion of the heating system from Propane to Natural gas, applied in April 2003.

The implemented measures and sensibility procedures targeting the academic population over the 2001-2004 periods, concerning the rational consumption, were successful in terms of natural gas.

Regarding the heat system conversion from propane to natural gas, the initial investment has an estimated payback time of three years (considering the average consumption and the actual medium kWh price of the natural gas).

Figure 3 represents the paper consumption of all the departments in the last four years. The year of 2002 should be disregarded, since it doesn’t translate an accurate tendency. This was the first year after the Ecotec began its activity,

therefore this reduction in the consumptions should be interpreted more as a reaction to the classifications each department received, than a real concern with the efficient use of resources.

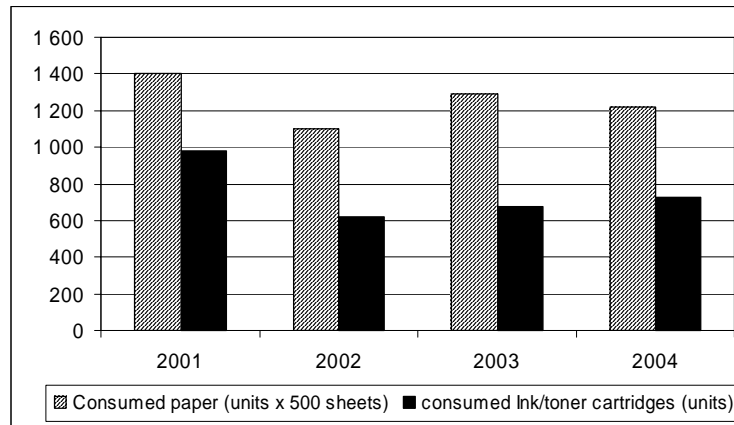


Figure 3. Stationery consumption

Nevertheless, 2003 and 2004 show a tendency for a decrease in the consumptions although seminars and conferences, within the school, increased in the last two years. This reduction is in part a result of Ecotec's actions. People weren't aware of the numbers involved in the school resource's management. After they were alerted, a new consciousness seems to be developing. Paper consumption and ink cartridges costs were reduced in 27% and 6% respectively over the 2001-2004 period.

Another important reduction occurred in the use of ink cartridges by the students. Once aware, the school's executive council decided to implement a more effective method of controlling unnecessary printing: a new printer was acquired and connected to the school LAN. This printer is operated by school personnel only. Students must send their files into the central printing, and confirm the print order with the operator. This prevents students from printing non-school related documents. The number of ink cartridges used decreased 72%.

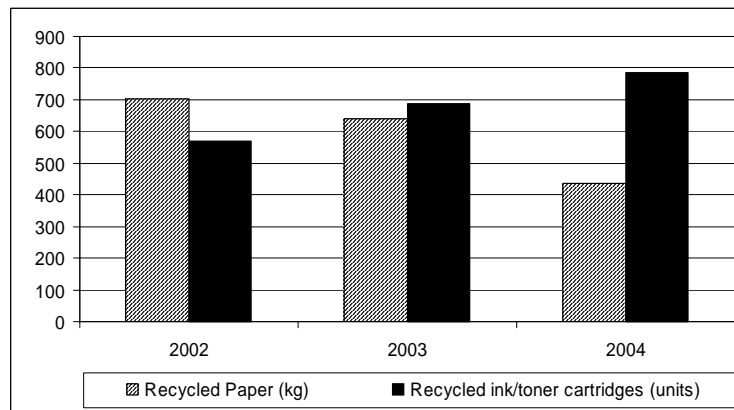


Figure 4. Recycling evolution

By looking to Fig. 4 is possible to see that the amount of paper collected to recycle has been decreasing over the last few years despite the small reduction of paper consumption. For such fact the commission finds the following explanations: the lack of interest of the school's staff and the fact that in 2004 the paper collect was made only in eight strategic points (normally the meeting room of each department), unlike the previous method in which the paper was collected from each and every teacher's office.

The collection procedure of ink/toner cartridges and paper to recycle is made in the same day and in a similar way, paradoxically the number of collected ink/toner cartridges has increased every year. This may be due to the fact that, for some departments, in order to obtain a new cartridge one must deliver the used one.

4. Future work

Ecotec will keep improving the already implemented measures in order to achieve its original goals. In what concerns the electricity bill some measures are already planned:

- Automation of some illumination systems.
- Implementation of a different schedule for the laboratory classes (the classes with major energy consumption), in order to change these activities from peak hours to off-peak hours.
- Finding different solutions for electricity provider: Finally the Portuguese electricity market liberalization allows ESTV to purchase electricity from a private company. The first study made reveals that changing supplier will reduce the electricity bill in 10%. However, some bureaucracy is still hindering the shift of electricity supplier. While this situation is not resolved, a reduction of 4.28% in the actual bill can be achieved by changing the actual tariff of the public supplier from the “Medium uses tariff” to the “Extended uses tariff”).

The following year’s activity plan includes the enrolment of the students in this process of consciousness increase and resources optimization.

5. Conclusion

Although the majority of the Portuguese population is still not motivated by ecological or environmental concerns, the public campaigns have been multiplied in the last few years. Unfortunately, some contradictions are still present in this process. Currently most cities have programs for residues selection and management; nevertheless some residues are still being placed in landfills without any sort of selection or management.

It is in this paradoxical reality that EcoTec tries to play an important role, by trying to motivate all the school personnel to environmental and ecological concerns. This has proven to be a very fastidious task because, besides the academic community motivation lack, the EcoTec commission is still restrained by the slow and bureaucratic relations that are established with external entities to Superior School of Technology.

Another problem is the small number of departments’ representatives in the commission. At the present, the commission is reduced to the representatives of the Department of Mathematics, Civil Engineering, Mechanical Engineering and Industrial Management, Environmental Engineering, Electricity Engineering and Maintenance Services. This situation tends to cause some divergence with the departments that have chosen not to be represented. Despite these small adversities, each year EcoTec is becoming more active and noticed in the school community.

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