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# Clean Technologies and Energy Efficiency in SMEs

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## 1 – UNTREF

*A strategic association has been made between the National University of Tres de Febrero (UNTREF) and the Municipality of Tres de Febrero. These institutions jointly analyzed SMEs (small and medium-sized enterprises) located in the mentioned district, with the aim of designing and analyzing the implementation of clean technologies. Firstly, based on the information provided by the Industry Department, the SME sector was surveyed. Three manufacturing companies from different industries were selected, in order to carry out the proposed study. In this connection, a diagnosis tool was designed for each case, in order to detect possible areas for improvement to optimize the resources required for the process, implement renewable energy sources, minimize waste and improve the working environment, among others. This tool is designed to be used through the whole SME sector, and not exclusively for the analyzed cases. Based on the results achieved, a working team has been constituted with representatives of the associated sectors, in order to design different alternatives to be implemented in each case. Said alternatives aim at minimizing or mitigating the environmental impact caused by the Companies manufacturing processes. The objective is to incorporate technologies and practices following the premise of sustainable development, promoting the environment care, thus improving companies competitiveness.*

**Keywords:** Environment; Clean Technologies; Energy Efficiency

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## 1 Introduction

Through the last years, the society has begun to become aware of the manner human activity cause continuous damage to the environment. Mostly, this degradation is generated by the industrial manufacturing processes. Therefore, it results essential to promote practical knowledge on the way of reducing its impact on the environment, improving energy efficiency and reducing emissions.

Currently, many industries consider sustainability as a key aspect in their processes, considering the rational use of strategic resources, whether fossil fuels, water or soil fuels. At the same time, the aim of this project is to minimize the impacts caused by industrial waste, whether in liquid, solid or gaseous state.

Chen et al. (2013) report that there are significant opportunities for small and medium-sized enterprises (SMEs) in developing countries, which could generate growth and jobs, while providing solutions to the challenges that exist in the climate topic. The droughts, erosion, floods and high levels of pollution in the world have become a real problem that affects economies and societies in all continents of the planet. The climate change issue has led countries to take measures to avoid a future environmental catastrophe, and that is the reason why addressing this problem presents an economic opportunity for developing countries like Argentina.

Encouraging local industries in developing countries to have clean technologies in their production processes can stimulate sustainable economic growth and generate wealth, since they will be able to simultaneously work on the urgent priorities presented by development, such as access to energy, clean and potable water, without affecting the climate.

In recent years, clean technologies have grown as an important global market. Klewitz et al. (2010) estimate that US \$ 6.4 billion will be invested in developing countries in the next few years. For the release of this environmental and economic potential, it is necessary to support the ecological companies. SMEs that dedicate themselves to clean technologies confront enormous challenges, especially when it comes to obtain an initial financing in the growth phase. Countries can help by creating specific policy incentives that could help support SMEs in areas such as innovative financing mechanisms, acceleration of businesses and entrepreneurship, market and technological developments, and legal and regulatory framework.

However, despite the efforts made by some social and government sectors in Argentina, tending to direct industries towards a sustainable profile, the SME sector of the Province of Buenos Aires is still relegated due to the trouble experienced by these companies to keep on developing and standing during economic instability periods. This project seeks to raise awareness and to perform specific cases (cases of study) for the introduction of cleaner processes, developing a tool that may provide a sustainability diagnosis, revealing non-sustainable processes, sub processes and policies, in order to generate one or more solutions to increase sustainability in these companies. This idea has been developed by Quintero et al. (2007).

The objective of this work is to promote the implementation of clean practices and technologies in SMEs through the design of a tool that provides a quick and low-cost sustainability assessment, being able to locate manufacturing sectors that generate waste, as well as the consumption of raw materials and energy. These aspects will be used to detect areas of improvement in terms of optimization of resources, minimization of waste, mitigation of negative impacts caused by the activity, introduction of renewable energy sources, care of the working environment and the environment itself, among others variables.

## 2 Proposal

A strategic association was made between the National University of Tres de Febrero (UNTREF) and the Municipality of Tres de Febrero. Science and Technology Institute, Research and Development Secretariat and Degree Careers in Hygiene and Safety and Environmental Engineering of the UNTREF, including the Municipality represented by the Industry Department. This Association will visit and conduct a diagnosis on the voluntaries SMEs, with the purpose of designing and analyzing the implementation of clean technologies in these companies. Firstly, the SMEs were surveyed pursuant to the information provided by the Department of Industry. Three manufacturing companies from different industries were selected in order to carry out the proposed study. The selected companies were intended to serve as pilot cases and drivers for other companies, in view of promoting clean production process.

For this reason, a diagnosis tool was designed for the selected cases, in order to detect possible areas for improvement to optimize the resources required for the process, implement renewable energy sources, minimize waste, and improve the

working environment, among other aspects. A similar view is held by Owodunni (2016).

This tool was designed to be applied by technicians from the District's Department of Industry. As from the tool's application in the selected cases, some adjustments have been made based on the diagnosis results, applying specific improvements according to the needs of each case. These proposals aimed at mitigating the environmental impact generated in the companies manufacturing processes. The objective was to incorporate technologies and practices following the sustainable development premise, and the environment care, thus improving companies' competitiveness. The alternatives designed were introduced to each company with the aim of making a selection pursuant to the interests and possibilities in each case.

### 3 Methodology

Four instances from the design to the final report, and other intermediate instances were established for the layout of the working tool. These four instances are depicted as follows:

In the first one, a survey form was prepared with the purpose of assessing facilities, consumption of raw material and inputs, generation of waste, machinery used, sustainable policies of the company, future plans, and desire for improvement. The method used should accept any value response setting the context of the respective value, so that during data processing, all the values can be compared with the standard. It requires key questions with short answers that are processed after the interview, in order to obtain the required data.

The survey is divided into seven different sections such as company identification, internal organization, operational processes, energy consumption, sustainable practices, relationship with the community and long-term projections.

For the first release of information and for practical reasons, it was used a printed form with questions about companies administration, number of employees, duration of the working day and the occupied surface. Furthermore, the questions referred to a productive process, its distribution in the production chain and, supplies used for each process. Finally and very important for the project, knowing about waste generated and any kind of sustainable practice they were applying in the production process.

The second step consisted on the evaluation of the tool through by visiting and surveying three SMEs, contacted and selected by the Municipality. The purpose of this step was to determine the use easiness of the tool and the need to add or remove questions. The survey data was processed and focused on raw material consumption, energy inputs and waste generation. In case that the data was insufficient it was planned a second visit and survey.

In the third step included sustainability report has been conducted, spotting the areas and improvement alternatives, according to the data gathered in the interview.

In the last step, a detailed report of the improvement alternatives was prepared together with a budget and possible financing to carry it out. This final report was delivered, along with the data processing and the survey, including the possible improvement alternatives where each company chose the most appropriate ones to provide a detailed report later on.

## 4 Results

By using the tool, the amount of waste produced by each company was first analyzed. As we can see in Table 1, the largest amount of waste is produced by the company with the largest number of employees and the largest total surface.

However, the percentage of waste surface compared to the total surface of the company is very small. In the three companies analyzed this percentage is less than 1%, therefore this does not represent a problem to consider in the analysis of clean technologies of the companies studied. These results agree with the information obtained through the surveys. None of the three companies studied had waste problems.

With respect to the consumption of electrical energy, the three companies have a normal consumption of energy under the norms of the Argentina industry. The company with the highest energy consumption is SME 3. This company is a craft brewery that consumes 22090 kw/month due to the equipment used during the process.

Table 1: SMEs information

	SME 1	SME 2	SME 3
Number of employees	4	45	10
Total Surface [m2]	337	1400	600
Waste Surface [m2]	3	6	2
Energy Consumption [Kw/month]	5548	18704	22090

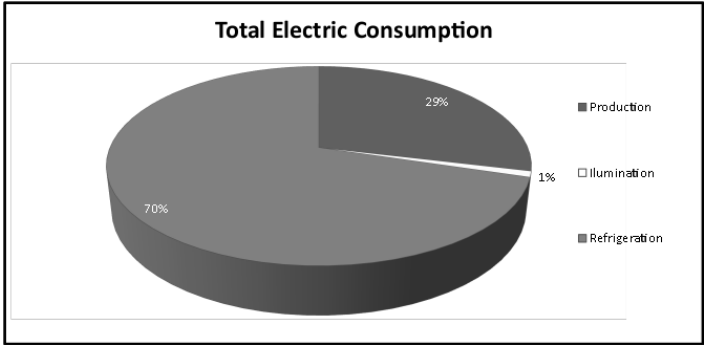


Figure 1: SME 3 – Total Electric Consumption

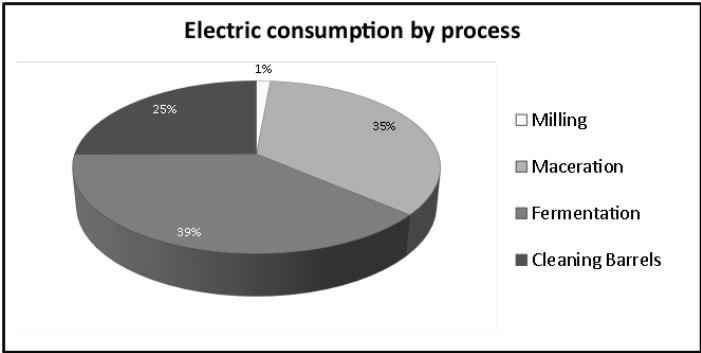


Figure 2: SME 3 – Electric Consumption by process

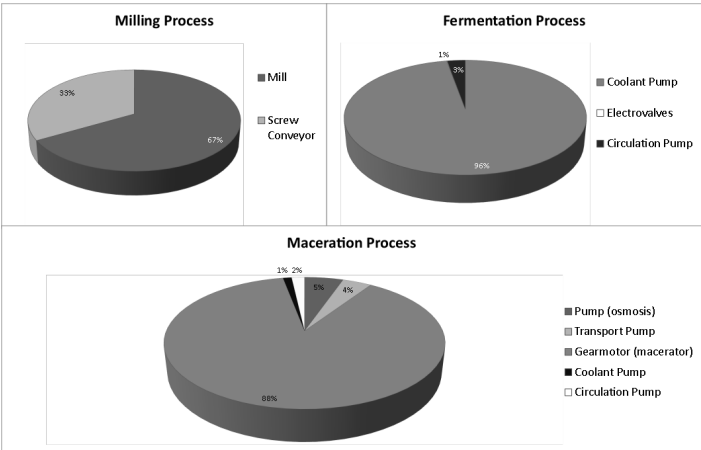


Figure 3: SME 3 – Electric consumption by machine



According to the survey made, the high consumption of energy represents a problem for this company. A detailed study of the electrical consumption of this SME was carried out.

As can be seen in Figure 1, the total electric consumption is classified according to where it comes from. The electrical consumption due to the lighting of the industry represents 1% of the total consumption, while the consumption due to the manufacturing process and to the refrigeration of the products represents 29% and 70%, respectively.

Using the clean technologies tool, the electric consumption of each process of the craft beer company was analyzed. Figure 2 shows the electric consumption by process of the company.

The milling process does not cause a problem in the electrical consumption. The barrels cleaning process represents 25% of the total consumption due to the use of a pressure washer to clean the barrels. The process of maceration represents 35% and the process of fermentation and maturation of beer 39% of the total energy consumption. By the use of the tool, energy consumption was classified according to the power consumed by each machine in each process.

Figure 3 shows the percentages of the energy consumption of each machine for the processes of mixing, maceration and fermentation. As we can see, in the processes of mixing and maceration the high levels of energy consumption are due to the power of the mixer and the motor, respectively. To reduce the consumption of these processes the engine used should be changed.

Fermentation is the process that consumes most electrical energy due to the power of the cooling pump. The beer fermentation process requires a proper cooling system to keep the temperature constant. The energy consumption of the fermentation cooling system could be reduced by using thermal insulators in the equipment. In this way, heat losses in the equipment could be avoided, generating lower energy consumption.

## 5 Conclusions

The results after the implementation of the diagnostic tool were satisfactory and it did not require a second visit or additional request in order to identify the points of generation of pollutants, that use a largest consumption of supplies. For example,

it can be observed just in the processing of electricity consumption data that in the company that produce craft beer its processes and machines are the highest electricity consumption.

Alternative options were analyzed to reduce the relevant consumption of the process, for example, a correct isolation of the refrigeration system would reduce the losses due to heat input, which would reduce the electrical consumption of the refrigeration system that represents 70% of the consumption total electric.

From the results we obtained of the study, it was possible to have in statistical numbers, the little training and knowledge that the owners and employees of the companies have about clean technologies. For this reason, it is planned in the future to offer a course aimed at the different SMEs of the municipality of Tres de Febrero so that the transfer to clean technologies can be carried out.

These courses will be held in theoretical and practices sessions, where a methodology will be presented to determine the aspects of the process of a company that must be addressed first to improve the quality of the product without inferring in the environment. Through the transfer of clean technologies to SMEs they could improve the quality and competitiveness in the production of goods and services.

A diagnosis and analysis tool was developed for the implementation of clean technologies in SMEs, which will be transferred to the Industry Department of the Municipality of Tres de Febrero. In this sense, the technical team of the Municipality will be able to carry out these diagnosis and analysis actions. At the end of this project, the participating SMEs obtained alternatives of ideas and projects to be developed with the purpose of implementing clean practices in their most relevant companies in terms of planning.

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