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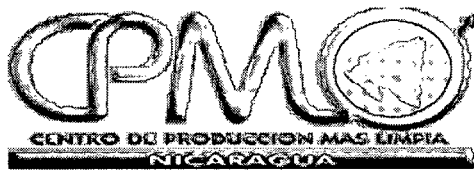
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ECOPRO: Key Issue for municipal Development



**Increasing of the Eco efficiency and Productivity
ECOPRO:**

Key Issue for Municipal Development

Final Report

December, 2003.

I. Executive Summary

The project "Increase of Eco efficiency and Productivity (ECOPRO)" is developed in Granada City in coordination with the Municipality and collaboration with the Ministry of Environment and Natural Resources (MARENA) and the Cleaner Production Center as technical executor. Ten Companies take part in the project.

The objective of the project is the economical strengthening of Enterprises and reduction of environmental impact in the municipality of Granada, through the application of preventive environmental protection techniques. This approach improves the municipal environmental performance fostering the sustainable development of the city.

ECOPRO is presented as a mean to build a local capacity among enterprises that allows CP to be a key issue in the productivity and competitiveness for the improvement of municipalities.

ECOPRO is in close relationship with other initiatives that are developed in the municipality of Granada such as the project of Sanitary Sewage System improvement. This project does not include Industrial wastewater treatment. For that reason, implementing CP is crucial for industries and the Sanitary Sewage System. One additional benefit of ECOPRO project is awareness rising on the obligation of companies to install water treatment plants where needed.

The objective of this report is to summarize the activities carried out between March - October 2003. In this period 9 Training workshops have been carried out. These workshops provide the CP tools and assignments to the participants which have completed for the participant companies, so that the companies perform CP self-assessments and an Environmental Management System (EMS) Introduction was also provided.

Some barriers have been identified. Companies are not used to this kind of evaluation and methodology. Companies have poor records of Production Data. Lack of time availability of Work team. These barriers were surpassed using a very strong Follow up strategy and data recompilation by the CPC-N consulter. All these in order to finished all activities on time.

In November all Companies Drafts will be checked while the awarding ceremony is being organized and all the parameters and procedures are accomplished. The Awarding Ceremony will take place on December 16th, 2004.

ECOPRO project has been a very positive experience among all participants; new ways of communication among companies, municipality and governmental institutions have result.

For companies, the benefits are the creation of a capacity to monitor the results achieved in the CP assessments and the development of an Environmental Management System.

CP methodology implementation at enterprises identified 68 CP options which generates savings of 72,820.11 \$/year. They will save 453,425.9 kg/year of raw materials, 101,571.36 Kwh (aprox 8.3% of all companies consumption).

The environmental benefits will be the reduction of **104,743.01** kg of CO₂, **78,778.85** m³/year of water (which represents 38.6 % Of all companies consumption). The investment required to implement these options is **US \$15,980.24** and the payback period is **2.6 months**.

II. Project Objectives

2.1 General Objectives

- Economical strengthening of enterprises in Granada Municipality through implementation of Environmental prevention techniques that improve the environmental situation of the Municipality.

2.2 Specific Objectives

- Creation of local capacity at municipal and company level so that they can implement CP methodology as a key issue of continuous improvement
- Provide technical assistance in the implementation of CP methodology.

III. Activities

Implementation of ECOPRO 4 stages:

- **Creation of Project steering committee:** In charge of organizing the activities and motivating companies in the project. Supervising companies methodology implementation explained in the workshops. This team evaluates companies performance during the implementation and is in charge of the award ceremony.
- **Calling and Selection of Participating Companies:** these companies are selected to be representative of the municipality situations and have to be able to apply what they have learn in the workshops.
- **Workshops and Follow up:** The workshops are designed to transfer to the attendants the methodology of analyzing the main problems at enterprises in order to find innovative ways to approach to solutions: bearing in mind the economical and environmental benefits. These workshops have to be applied at company level to ensure the learning process applied to solve actual problems at enterprises. There is also, a technical follow up by CPC-N consulters.
- **ECOPRO AWARD:** An award has been established for those enterprises that fulfill the project activities and are able to prove the implementation of CP options. Besides, they will have to have an environmental improvement plan for next year.

At this moment, the project is at the third stage. The award ceremony is being prepared taking into account the reality of the enterprises and it will take place on December 16th of 2003.

3.1 Creation of Project steering committee

In order to develop CP methodology at enterprises, a group including the municipality, MARENA, ENACAL, CPML has been conformed. This group is in charge of directing and organizing the different stages of the project.

Its Duties are:

- To ensure content and quality of meetings and training workshops
- To Perform training workshops and monitoring activities.
- To provide Enterprises the technical assistance in carrying out duties assigned.
- To Monitoring correct implementation of Activities
- To Organize and Implement the Award Ceremony.

3.2 Calling and selection of participating companies:

The enterprises considered in this project were selected to be the most representative ones in the municipality, medium or small size enterprises. The selection of companies was made following the Granada Municipality and MARENA criteria.

The companies selected are listed below:

Companies	Sector	Size	Products
Reptiles de Nicaragua:	Tanneries	Big enterprise	Wet blue cow leather
Tenería Aguilera	Tanneries	Small enterprise	Cow leather
Cooperativa de Marroquinos de Granada (MADGRA)	Tanneries	Small enterprise	Man Kraft exotic leather, purses, briefcases, wallets and belts.
Callejas Sequeira S.A.	Food manufacturing	Medium enterprise	Jellies, marmalades, nectars and tomato sauce and vinegar elaboration
Aserrio Santa Rosa	Wood processing	Small enterprise	Sawed Wood
Trillo Santa Rosa	Agro industry enterprise	Small enterprise	Rice
Rastro Municipal	Slaughtering house	Small enterprise	Cow and pig meat.
Hotel La Ceiba	Services	Small enterprise	Hotel Services
Hospital Cocibolca	Services	Big company	Hospital services
Hospital Japón Nicaragua	Services	Big company	Hospital services

Next a percentage of participation by each sector is presented:

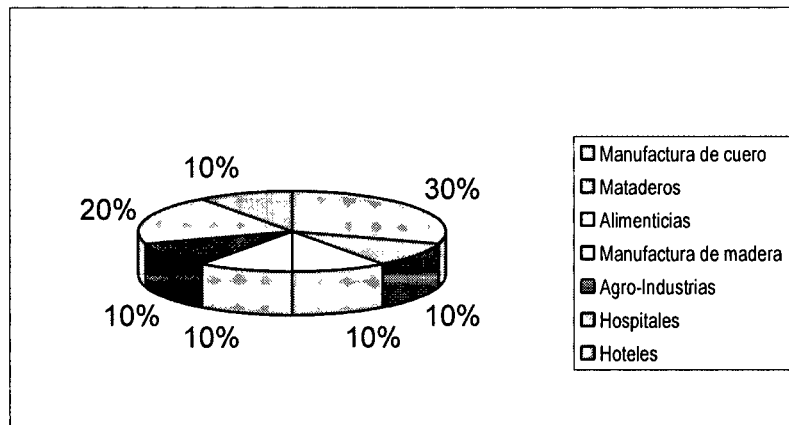


Figure 3.1 Companies Classification

Anexus I, present the location of the enterprises at Granada City.

Duties for Enterprises:

- To attend the workshops
- To organize a work team to carry out CP activities in companies. Although, it will be necessary to designate a person to attend the workshops.
- To perform all the activities assigned in the workshops.
- To submit to the technical advisors the results of the assigned activities and also to present them at the workshop discussion panels.
- To compile all information available so that the technical advisors can follow up the implementation of CP activities in a efficient way.
- To carry out all activities planned in the project schedule.
- To implement the CP options work plan

3.3 Training Workshops and Technical Follow up:

The companies selected a work team to attend the training workshops so that the team could implement CP methodology at the company.

Table 3.1 ECOPRO Cleaner Production Training Workshops

Workshop	Topics	Imparted by:	Participants Number	Duration (hours)
"Introduction to CP Methodology"	<ul style="list-style-type: none"> • CP principles • Management Involvement. • Compliance Legal Issues • Team conformation and work assignments • Data recollection methodologies. 	César Barahona Lesbia Rodríguez	10	4

"Flow Material Balance"	<ul style="list-style-type: none"> • Material Flow Analysis Process • Material Flow Balance: Input – output analysis • Raw materials Indicators management. 	César Barahona Lesbia Rodríguez	8	4
"Flow material Balance II"	<ul style="list-style-type: none"> • Case studies • Revision and Discussion of real results in companies 	Lesbia Rodríguez Maya Uriarte	6	4
"Water Balance and Effluent Generation"	<ul style="list-style-type: none"> • Water Flowchart analysis. • Pipelines inventory • Water consumption and Effluent generation • Indicator Management. 	Maya Uriarte Gabriela Córdoba	6	4
"Water Balance and effluent generation I"	<ul style="list-style-type: none"> • Presenting results achieved in Water Balance from companies 	Lesbia Rodríguez Maya Uriarte	9	4
"Energy Balance" and Energy Consumption Analysis	<ul style="list-style-type: none"> • Energy Sources • Types of Energy Used in the Industry • Electric tariffs in Nicaragua • Practical examples on Energy Consumption 	César Barahona Luis Avellán	8	4
"Energy Saving"	<ul style="list-style-type: none"> • Energy Savings • Operational Measures • Modification and Improvement. • Recommendations for Energy Saving 	Luis Avellan	8	4
"CP Options"	<ul style="list-style-type: none"> • What are CP Options • How to Generate CP options • Feasibility analysis • Options Summary • Practical Exercises 	Maya Uriarte	8	4

"Environmental Management Systems (EMS)"	<ul style="list-style-type: none"> • Introduction • Definition • Purpose of a EMS • Benefits in a company • Establishment of Environmental performance Indicators • Implementation of a EMS 	Gabriela Cordoba	11	4
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ECOPRO has a total of 10 Training Workshops to be imparted in the period March – November 2003, with a schedule of 40 hours.

Last Workshop is scheduled for November 18th, which will be about Environmental Management Systems (EMS). EMS integrates identified CP Options and good house keeping monitoring as part of the project. In this last workshop, the participants will evaluate the project and the goals achieved.

Enterprises participants had the support of a CPC-N consulter who had guided the performance of the duties assigned in each workshop. The participation level of the company have made the consulter indispensable for data recompilation and analysis of information.

CPC-N consulter assignation by company:

Table 3.2 Consulter's Assignation

No.	Institution	Consulter
1	Callejas Sequeira S.A.	Luis Avellán
2	Hospital Cocibolca	Maya Uriarte
3	Hospital Japón Nicaragua	Lesbia Rodríguez
4	MADGRA	Nohely Castellón
5	Aserrío Santa Rosa	Maya Uriarte
6	Rastro Municipal	Lesbia Rodríguez
7	Trillo Santa Rosa	Luis Avellán
8	Hotel La Ceiba	Luis Avellán
9	Tenería Aguilera	Nelly Betanco
10	Reptinic S.A.	Nohely Castellón

Other benefits the companies have acquired as a result of the workshops are: awareness, Innovation desire, formation of work teams, Environmental Policies Declaration in each company, personnel involvement in the assigned activities to carry out the project.

3.4 Results of Workshops implementation

According to the companies report all balances are completed (materials, water and energy). CP options were generated from these balances. These options have been integrated to an implementation program in which responsibilities and monitoring and follow up are defined.

This program with a Environmental policy developed in each company by the CP workteam conform the first steps to develop the EMS. The introduction given in the workshops for EMS was a base so that the companies can implement what they learned in the project throughout the implementation of any Environmental Management System. This will contributes to the improvement of the environmental performance of the municipality.

It is important that once the project is over, the companies, the municipality and the environmental delegation of the Ministry of the environment and Natural Resources develop a follow up program to ensure the commitments application of the project. All these with the finality of motivate other companies to get involved in productivity improvement and environmental aspects considerations.

Currently, all the final drafts of the companies assessments have been finished, and they are being checked by the CPC-N staff.

3.5 ECOPRO AWARD

The awarding ceremony is the end of the project. Its finality is to stimulate the participating companies to continue with the Implementation Program. This award is given to CP implementation to contribute to the Sustainable Development of Granada Municipality.

The awarding ceremony is also a very strong dissemination channel to obtain peoples recognition for environmental conservation contributions and sustainable use of natural resources.

It is important to mention that in Latin America and specially in Nicaragua, is the first time that an awarding ceremony of this kind is carried out. That is why, this project is a challenge for Nicaraguan enterprises and for the Cleaner Production Center of Nicaragua.

The awarding issues are:

Awarding Commission Conformation:

The commission that evaluated the proposals presented in order to get the award, was constituted by five personalities of different institutions. These persons will be picked according to their studies, experiences and personal merits in the environmental field.

The commission was in charge of the awarding process once they checked all the documents presented by the enterprises. These documents have been elaborated in collaboration with the CNC-P consultants and the companies personnel.

Inspections was scheduled to ensure the Options Implementation.

The commission is conformed by the following institutions:

- Environment Department of Granada Municipality.
- Ministry of Environment and Natural Resources (MARENA)
- Ministry of Development, Industry and Commerce (MIFIC)
- Cleaner Production Center of Nicaragua.
- STENUM Consulter

CPC-N presented the commission's list to Granada Municipality and MARENA on **November 20th** of 2003. Once the commission's list is ratified the Inspections in the companies were scheduled.

Presentation of the results to the Awarding Commission:

The companies presented their results and Environmental Measures they have implemented.

After that, the companies were inspected at least one hour for three consecutive days (**November 26th, 27th and 28th**) to evaluate their improvement measures.

In case the commission needed extra information to evaluate the companies proposals, the Cleaner Production Center of Nicaragua made all the clarifications needed.

The Awarding Commission had one week to evaluate and decide which companies will be awarded. After that, the commission will have to present a report to Granada Municipality.

The commission's decision is finally and unquestionable and is presented in a public Awarding Ceremony. Winners will be known until the Ceremony. Awarding Ceremony is planned for December 16th of 2003.

Awarding requirements:

Requirements are:

- An Environmental policy established and documented.
- Pollution prevention plan for fulfilling the national regulations approved by local authorities, based in CP options identified and evaluated.
- At least, one implemented option.

Enterprises Documentation

Based on awarding requirements, the participating companies on **ECOPRO Award**, had to present the following documents:

1. To document the implemented option and present it to the awarding commission. This document has to describe what this option is about, savings estimated, the investment and the real data obtained. This document have to include environmental benefits quantification. This document could include photograph, figures, schemes, etc. that help to identified and clarified

the most relevant aspects of the option, specially those that have to do with environmental benefits generated and competitiveness of the company.

2. Since the documentation is presented in the awarding, the companies have to authorize the publication of the information contained in the document.
3. The company has to present its environmental policy and its CP implementation program to the commission. Companies data obtained through in plant assessments, are not part of the documentation, at least the company considers it to be relevant. All these with the finality of save the confidential information of each company and its productive activities.
4. The documentation has to be delivered with a letter signed by the Manager of the company where they expressed their interest in participating in the awarding process.

Recognitions and Awards

The awards will be commemorative medals allusive to the event where the participation and commitment level that the company has with the environment is exposed.

Besides, CP certificates will be given to the companies work team for having attended the training workshops.

Awarding Process Results

To know which are the deserving companies of the ECOPRO Award, the examining jury visited each and every company. The visits occurred the days of December 2nd and 3rd of the present year.

All the companies had to comply with the requirements listed above. Every company that hasn't implemented any kind of Cleaner Production Measure, will not be considered for the ECOPRO Award.

The Examining Jury proceed with the application of the evaluation matrix. In order to obtain the award, the companies have to reach at least a total of 70 points. The total score will be based on a total of 100 points, distributed as follows:

Table 3.3: Award Criteria Matrix

Nr.	Evaluation Criterion	Score
1	Options Implementation	20
2	Implemented Options Format given to the evaluating commission	20
3	Interview, motivation and assimilation	20
4	Company's workgroup involvement	20
5	Environmental Management Plan	10
6	Company's Environmental Policy	10
Total		100

Table 3.4 The ECOPRO Award Deserving Companies out of ten participants are the following:

Nr.	Company
1	Callejas Sequeira e Hijos S.A
2	Hotel La Ceiba
3	Marroquinería Mar Dulce (Asociado a Marroquineros de Granada)
4	Trillo Santa Rosa
5	Reptiles de Nicaragua S.A (Reptinic, S.A)

Every person that participated in 60% or more training workshops, will be awarded with a Participation Certificate. They are:

Nr.	Name	Company
1	Lic. Mirna Vega	Callejas Sequiera e Hijos S.A
2	Lic. Jorge Lacayo	Reptiles de Nicaragua S.A
3	Dr. Mariano Cruz	Rastro Municipal
4	Lic. Wiston Bermúdez	Madgra
5	Sr. Geral Rodríguez	Tenería Aguilera
6	Lic. Daniel Rodríguez	Trillo Santa Rosa
7	Ing. Torres	Hospital Japón Nicaragua
8	Lic. Cecilia Mora	Hospital Japón Nicaragua
9	Ing. Ricardo Cruz	Marena
10	Lic. Nubia Aragón	Marena

Awarding Ceremony

The awarding ceremony:

- Location: **Casa de los Tres Mundos** (very known place at Granada city for its cultural value and where all the major events take place)
- Exhibition of representative poster of the companies
- Granada Major speech
- Ministry of Environment and Natural Resources representative speech
- Cleaner Production Center Nicaragua Speech
- Short presentations of environmental improvements at Enterprises.
- Experiences exchange among assistance.

Later, a brochure will be elaborated with all the companies experience and the improvement measures and it will be presented at the awarding ceremony. This will be a great merchandising tool.

The event will be covered by the media. A video of the ceremony will be shown in future national conferences and at international meetings.

Shortly, all the information will be available at internet to facilitate the results dissemination.

The project will identified as "Successful cases of CP Methodology implementation" to the winners, exposing them in national en international forums where the project could be involved.

IV. Barriers

The achievement of the objectives has been affected due to some barriers during the development activities. These barriers can be summarized as follows:

- Limited time availability to attend to the Training workshops.
- Poor leadership to fulfill the activities assigned in each workshop
- Difficulties in the work team conformation and Methodology implementation
- Lack of data records
- Lack of Information availability
- The advisor is spending much more time than planned in the project design.

Against these barriers, measures have been taken in order to motivate enterprises and to help them to surpass obstacles during their participation in the project. e.i. workshops have change dates and length to adapt companies advances. Also, technical advisors interact even more with the companies so that companies can implement what they have learn.

V. Next Steps

The results obtained by the application of ECOPRO in Granada City, have developed an interest on the continuous implementation of this experience, involving new companies and motivating the actual companies group for the follow up of the CP methodology in their processes, and implementation of their CP plan.

The Municipality and the Environmental Local Authorities have the responsibility to promoting the companies and to check the implementation of CP plans. Granada City can become itself in an example of a Sustainable City, if more companies reproduce the experience and new awards processes are developed.

The CPC has developed a Manual named "**Implementation of ECOPRO Program as a Municipal Initiative for the industrial Development**", which describes all the steps for reproducing the ECOPRO experience based in the Granada application. This manual takes in account all the solutions that were given to each problem that was found during the development of the pilot project in Granada City. Currently, the Manual is in the review period and will be finished before the end of the year.

However, the new implementation of ECOPRO (taking into account all the recommendation included in the Manual) needs to complete the following aspects:

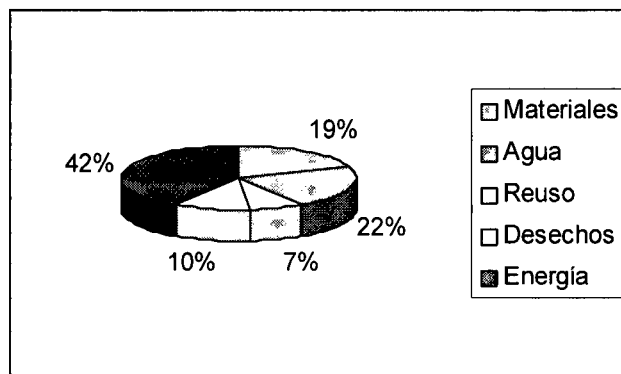
- Publications of the successful results of the first experience in Granada City, in order to motivate the development of the project in other municipalities.
- Marketing of the project idea in other municipalities and other important stakeholders.
- Financial help for development of the training courses and all the technical assistance needs for the companies, according with the real efforts demanded by the companies. This help must consider the barriers explained before.
- Financial help for technical assistance in the follow up step, in the case of Granada City, in order to measure the real results of the application of CP.

VI. Improvement Potential Summary obtained in Pilot project in Granada City.

According to Nicaraguan classification for enterprises the companies are:

- 1 micro Enterprise,
- 5 small Enterprises
- 2 medium Enterprises
- 2 big enterprises

It is important to mention that savings and investments presented in this report are only for 8 companies. The other two companies are in the draft revision process (Matadero Municipal and Aserrío Santa Rosa). 68 options were recommended and are classified as the following:



Graph 6.1 Options comparison

Energy consumption is where there is a major improvement potential with 42%, follow by water optimization (22%), material optimization (19%), wastes reduction (10%) and reuse (7%).

6.1 Water Consumption

Water consumption average of all companies is **204,131.31 m³ / year**. Water is used in the different processes (Equipment cleaning, steam generation, cooling, etc.). Recommendations are focus to fresh water optimization throughout good house keeping and reuse. Implementation of these options will generate **78,778.85 m³ / year** of fresh water (aprox. **38.6%**), which implies **25,547.94 \$/year**. The final investment is **10,130.08 \$ / year** with a payback period of 5 months.

6.2 Energy Consumption

The companies uses electricity provided by the local grid for illumination systems, acclimatization systems, pump systems and different kinds of equipment that uses Induction motors. Electricity average consumption of all companies is **1,225,601.63 Kwh**. Measures implementation will represent savings on energy consumption of **101,571.36 Kwh** (aprox 8.3 %), and economical savings of **12,472.78 \$/year**. The investment require is **US\$ 1,528.6**. In oil consumption the values are 7,591.75 gallons; Options will reduce this consumption in **531.42 gallons** (aprox 7%). Investment required is recover in 1.5 months.

6.3 Materials

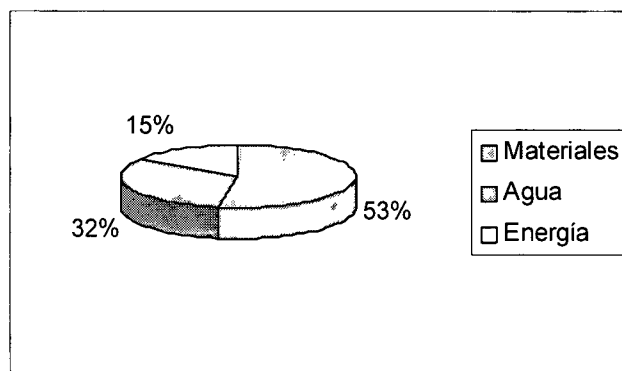
Reduction on chemical products will be **453,425.9 kg/year**, that will result of implemented measures. The measures will avoid that chemical products reach the disposal waters of the different processes. This will generate savings of **42,649.97 \$/year** and will need an investment of **US\$4,504.53**; The payback period is 1.2 months.

The total investment to implement all recommendations is almost **15,980.24 \$**. The implementation will generate savings of **72,820.11 \$/year**; the total payback period will be 2.4 months.

Table 6.1, present a summary of the economical benefits per item

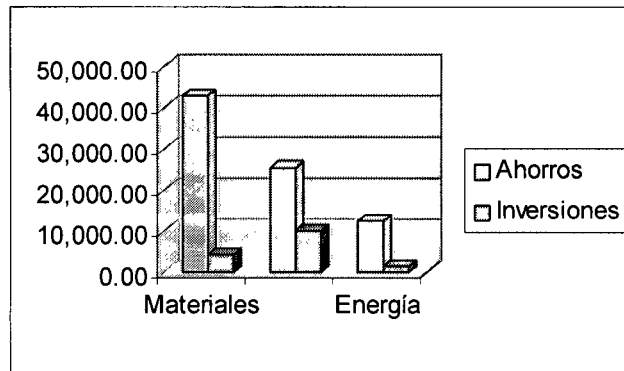
Table 6.1 - Economical Benefits Summary

Area	Economical Benefits
Materials	42,649.97
Water	25,547.94
Energy	12,472.78
Total	72,820.11



Graph 6.2 Economical Benefits per Area

Graph 6.2 shows the situation presented in table 6.1, while graph 6.3 shows savings and investment needed per area.



Graph 6.3 Comparison between savings and investments

The companies belong to the following Industrial Sectors: tanning, meat and food, Wood industries, Hospitals and Hotels.

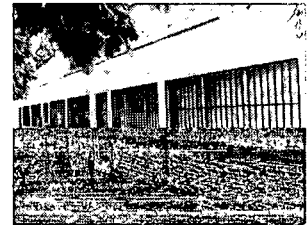
VII. Companies Description

Sector: Tanning and leather finishing

1. Reptiles de Nicaragua S.A. (REPTINIC S.A.)

Main Activity: tanning and cow leather finishing at a industrial level. This company is consider a big Enterprise.

Generalities: REPTINIC S.A. is located at Granada City, km 51 ½ Nandaimé road. It has been at the market since 1976 and deliver wet blue leather to international markets. At a local level the company works on finish leather and lether shoes.



Raw materials: Cow skins, chrome, sulfuric acid, cal, etc.



Cow skins in unhairing Process



Chemical Products in Storage



Sulfuric Acid Storage

Description	Observations
Water source	The plant has its own well for water provision
Wastes generated	The organic solid Wastes such as ears, tails, hair, grease, etc. Water waste from de hairing process is filtered, afterwards the water goes through a sedimentation process. After this pre treatment this water goes with all the wastewater from the other processes to Oxidation lakes.

Improvement potentials are the following:

Improvement Potentials per Area

No	Option	Technical Feasibility	Investment (U\$)	Savings/year (U\$)	Environmental Benefits
Materials					
01	Water Reutilization of De hairing process	This option only needs some accessories that can be found in the local market to be implemented. The company already has a recirculation pump and channels and storage systems.	24.29	8,210.75	Diminution on water consumption of 69,127 m ³ /year, besides the diminution of around 7,291.87 Kg of sodium sulfurate that will not reach the water sources. Reduction of 9,722.5 Kg of lime
02	Chrome Recycling Plant Re design	This option only required the acquisition of some accessories that can be found in the local market to be implemented and to prepare the floor to facilitated chrome harvesting in barrels. The company has the system necessary for chrome recycling.	99.14	2,123.9	The chrome will not go with the effluent to the treatment plant. 3,170 Kg. Of Chrome will be reduced. This will improve the water treatment system
03	Skins New measurement system	New measurement systems of at least 500 kg of capacity are needed and available in the national market (Casa de las Pesas)	4,140.00	29,215.55	Reduction of 157,275.23 kg of chemical that will not go to the effluent
Sub total Materials			4,263.43	39,550.2	69,127 m³/year 177,459.6 kg raw materials
Water					
04	Elimination of leakages	The company has external personnel trained to do the leakages reparation	5,758.36	6,455.45	Savings of 28,115 m ³ of water per year. Diminution of chemical in the effluent

Improvement Potentials per Area

No	Option	Technical Feasibility	Investment (U\$)	Savings/year (U\$)	Environmental Benefits
Water					
05	Installation of a Flow meter	The meters can be found in local market	242.00	Intangibles	Intangibles
06	Adjust water consumption in all processes according to work norms.	No investment required	0.00	16,851.90	Savings of 73,269 m ³ per year
07	Acquisition of water analysis equipments for de hairing and tanning process effluents	Equipments can be acquired at LORBA QUÍMICOS S.A.	358.71	Intangibles	Intangibles
Sub total			6,359.07	23,307.35	101,384 m³/year
Energy					
08	Analyze the Energy balance of the Tanning Drums in order to reduce Energy consumption and charge for Demand.	Maintenance area in coordination with the administration can elaborate a plan for the Tanning Drums consumption reduction scheduling them according to the capacity and usage rate. Although, the company needs to schedule the machinery functioning to reduce extra charge for maximum demand. This option is very feasible in low seasons.	0.00	4,667.23	55,364.5 kg of CO ₂
Sub total			0.00	4,667.23	55,364.5 kg of CO₂
TOTAL			10,622.5	67,524.78	170,511 m³ of water 177,459.6 kg of raw materials 55,364.5 kg of CO₂

2. Tenería Aguilera Enterprise

Main Activity: Cow Leather Tanning

Generalities: the company produces leather in different colors. At present, the company produces ejector rod leather depending on the demand. They produce 1,920 strips of ejector rod leather. It is distributed in the local market.

Raw Materials: Cow skins, cal, natural colors, chrome, sulfuric acid, etc.

Description	Observations
Water source	The plant has its own well for water provision. The main water use are in washing, skinning and de hairing areas.
Solid Wastes	Solid wastes are collected by the municipality and waste water goes to the sewage system

Improvement Potentials per Area

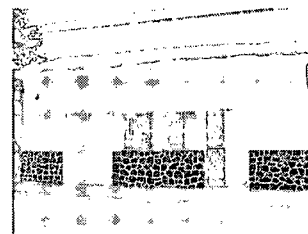
No	Option	Technical Feasibility	Investment (U\$)	Savings/year (U\$)	Environmental Benefits
01	Adequate chemical consumption to the international standards.	The company needs to perform tests to know what percentages to apply.	0.00	160.00	Contributes to cost reduction of the Future Disposal Water Treatment Plant.
02	To implement input/output control formats for raw materials, materials for finishing and storage.	Feasible, the study shows a format the company could use.	0.00	Intangibles	Better control for future acquisition of chemicals.
Sub Total			0.00	160.00	
Water					

03	Installation of grids in discharge channels to avoid excessive solids in the effluent.	Feasible, the company can get the grids in the local market and can hire extra personnel who will install the grids	376.00	Intangibles	Reduction of 30% of the solids and minimize costs for a Water Treatment System
1	Reuse of de hairing disposal water in a 10%	The company already reuse water obtaining very good benefits	0.00	210.00	Better usage of the chemicals present in the de hairing process disposal water. Reduction of Water and Chemical consumption
2	Reuse of Chrome water until 5%	The company already reuse water obtaining very good benefits	0.00	867.85	Better usage of the chemicals present in the process.
Sub total			376.00	1,077.85	
Energy					
4	Diminution of Ablandado Process operation time	Feasible, this process has to be scheduled	0.00	112.00	Reduction of 772.42 Kg. of CO ₂
5	Develop Tanning process in wells (artisan way)	Feasible, the company has the equipments and materials needed for this operation	0.00	437.50	Reduction of 1,150.00 Kg. Of CO ₂
Sub Total			0.00	549.5	1,922.42 kg of CO₂
Total			376	1,787.35	1,922.42 kg of CO₂ Reduce in Water and Chemical Consumption

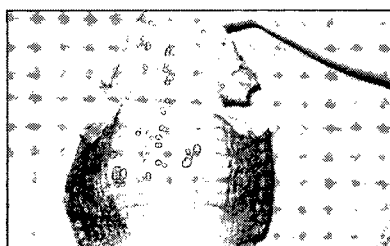
3. Marroquinera José María Bermúdez (MADGRA) Enterprise

Main Activity: Man Kraft exotic skins tanning (cuajipal, snakes, toads) for purses, briefcases, wallets and belts.

Generalities: The company marroquinera José María Bermúdez, is located at Granada city. All production goes to international markets such as Europe (Spain) and United States. The company processes around 1000 skins annually depending on the authorizations the company receives from Environmental Authorities. It has 10 employees.



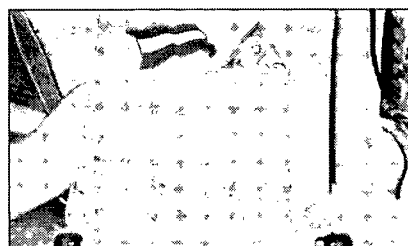
Raw Materials: Skins (They come from Atlantic Coast Jungle), sodium sulfurate, cal, Natural colors, etc.



Cuajipal skin in de hairing process



Workshop



Finished Product

Description	Observations
Water source	The water is obtained from National Service, local grid network.
Solid Wastes	All the effluents go into a river. Solid wastes are collect by municipal service.

Improvement Potentials are:

Improvement Potentials per Area

No	Option	Technical Feasibility	Investment (U\$)	Savings/year (U\$)	Environmental Benefits
Materials					
01	Improvement of Chemical Product Management	The company has an area that can be prepared for Chemical storage finalities.	0.00	Intangible	Stop spilling chemicals that go down the drain once the floor is cleaned.
02	Chemical Products Inventory	The company has the administrative personnel to develop this activity	0.00	Intangible	-
03	Adjust the chemical doses to standard doses	Acquisition of adequate measurement systems	134.55	2,458.56	Reduction of 1,452.00 kg of Chemicals
Sub total			134.55	2,458.56	1,452.00 kg
Water					
04	Reduction on Water Consumption	Acquisition of Plastic Pistol for ½ " valve is available in the local Market	6.14	17.8	Reduction of 38.71 m ³ of water
Sub total			6.14	17.8	38.71 m³

Energy					
05	Reduction on Energy consumption due to Illumination Optimization	It is necessary to take 6 T12x40 lamps off and to install two T12x20 lamps.	8.95	89.856	Reduction of 622.08 kg of CO ₂
Sub total			8.95	89.856	622.08 kg CO ₂
TOTAL			149.64	2,566.22	1,452.00 kg of chemical 38.71 m ³ of water 622.08 kg CO ₂

Slaughtering House

4. Rastro Municipal

Main Activity: Slaughtering (cows and pigs)

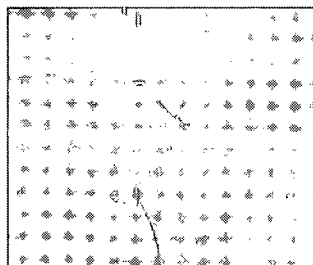
Generalities: Pig slaughtering is done every day and an average of 1,100 pigs are killed monthly. Cows are kill in a average of 20 days a month. An average of 280 cows are Killed. The company has 16 employees



Raw Materials: Cows and Pigs



Pigs



Cows



Wood

Description	Observations
Water source	Water is provided by local Network. Water is widely used in slaughtering process and Plant cleaning process. Cleaning process is higher consumer
Solid wastes	The company generates lots of effluents. This effluent contains organic grease, wool, hair, bones, blood, etc. The company has its own treatment system. Solid wastes are recollected by the municipality.

Hanging business	The final Drafts corrections are being done. Only improvement potentials will be mentioned
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Improvement Potentials:

Improvement Potentials per Area

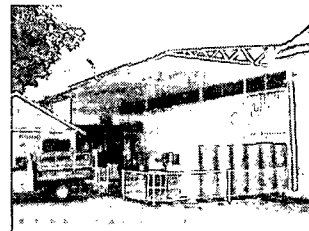
No	Option	Technical Feasibility	Investment (U\$)	Savings/year (U\$)	Environmental Benefits
<u>Water</u>					
01	Utilization of Ball valves	Available in the local market	300.00	5,854.5	Diminution of 6,969.6 m ³ /year on water consumption
Sub-Total			300.00	5,854.5	6,969.6 m³/year
<u>Wastes</u>					
02	Clean all residues before final Washing without using water.	Materials are available in the local market	32	604.8	Diminution of 720 m ³ /year on water consumption
03	Installation of Grids to reduce solid wastes in the effluent	Materials are available in the local market	371	Intangible	Diminution of Solid Wastes in the effluent
04	Improvement of Drain System to ensure health conditions in the slaughtering area.	Materials are available in the local market	6.50	Intangible	Improvement of Health and Hygiene conditions
05	Store the cattle to be sacrificed.	Personnel training is required	ND	Intangible	Reduction of organic wastes in the effluent water.
<u>Sub-total</u>			<u>409.5</u>	<u>604.8</u>	<u>720 m³/year</u>
<u>Energy</u>					
06	To repair the energy Transformer supporting structure	Ask Energy Company to do so.	<u>ND</u>	<u>Intangible</u>	Avoid pollution due to dielectric liquid spilling which is contained in the transformer
07	Installation of Energy Saving lamps in Pig slaughtering area	Materials are available in the local market	<u>16</u>	<u>500</u>	Reduction of 3664.6 kg of CO ₂
<u>Sub-Total</u>			<u>16</u>	<u>500</u>	<u>3,664.6 kg of CO₂</u>
<u>Total</u>			<u>725.5</u>	<u>6,959.3</u>	<u>7,689.6 m³/year</u> <u>3664.6 kg of CO₂</u>

Sector: Food Company

5. Jaleas Callejas Sequeira S.A

Main Activity: Jellies, marmalades, nectars and tomato sauce and vinegar Elaboration.

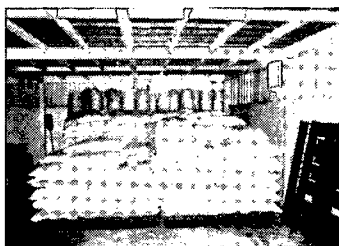
Generalities: The company Callejas Sequeira e Hijos S.A., its located at Granada City next to Hielera El Yanqui. National and International Market. The company produces 40,000 Kg. Per Month and has 33 employees.



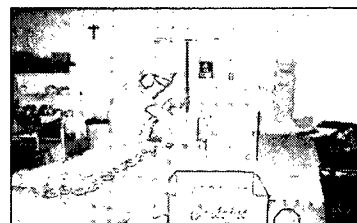
Raw materials: Fruits (guavas, mango, pineapple, y strawberries which are collected every day), sugar, peptine, citrium acid, ascorbic acid, and preservatives. When the fruits are available they are stored. Guavas are raised by the company itself. Pineapple, mango and strawberry are provided by different suppliers in the country.



Fruit Juice



Sugar



Packing

Description	Observations
Water source	The company has its own well to provide water to the plant. Water for human consumption is provided by ENACAL
Wastes generated	Effluents and solid wastes are the Product residues elaborated. Organic solid wastes are used as plant and cow food. Wastewater is thrown in the sewage system.

Improvement Potentials:

Improvement Potentials per Area

No	Option	Technical Feasibility	Investment (U\$)	Savings/year (U\$)	Environmental Benefits
Materials					
01	Improvement of raw material transportation	The company has the necessary sources.	10	800.64	Reduction of annual lost of 576 Kg of guava pulp
Sub total			10	800.64	576 kg

Water					
02	Cooling Water Reuse	The only requirement is coordination between operators	0.00	51.61	Diminution of 992.63 m3 of water per year
03	Water Spilling Supervision	The only requirement is to improve supervision during the process	0.00	10.60	Diminution of 203.89 m3 of water per year
04	Reduction on Storage area Water consumption.	Coordination between operators is required.	1.5	4.88	Diminution of 93.97 m3 of water per year
05	Installation of automatic refill system in the storage water tank	There are national companies that can solve this issue.	Not Determine Yet	ND	ND
06	To install a water flow meter	There are national companies that can solve this issue.	27.36	Intangible	To calculate the water consumption indicators will help to reduce water consumption
Sub Total			28.86	67.09	1,290.49 m3
Energy					
07	To Isolate condensate pipes	There are national companies that can solve this issue.	336.71	628.56	Reduction of 9,366.19 Kg of CO2
08	To Isolate condensate tank	There are national companies that can solve this issue.	15	305.29	Reduction of 2,526.39 Kg of CO2
09	Change Incandescent lighting for Fluorescent Lamps	There are national companies that can solve this issue.	44.77	94.15	Reduction of 740.26 Kg of CO2
10	To turn off Computer's monitors	Feasible	0.00	26.11	Reduction of 228.09 Kg of CO2
11	To turn off Boilers room Lights	Feasible		20.60	Reduction of 162 Kg of CO2
12	To unplug the Oasis during the night	Administrative personnel can do this.		22.11	Reduction of 173.88 Kg of CO2
Sub Total			396.48	1,096.82	13,196.81 kg of CO2
Total US\$ / year			435.34	1,964.55	576 kg. Raw materials 1,290.49 m3/year 13,196.81 Kg of CO2

Sector: Wood Enterprises

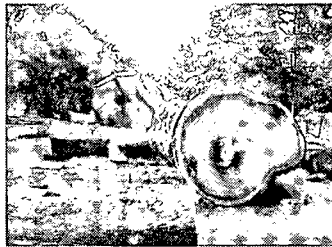
6. Aserrío Santa Rosa

Main Activities: Wood processing

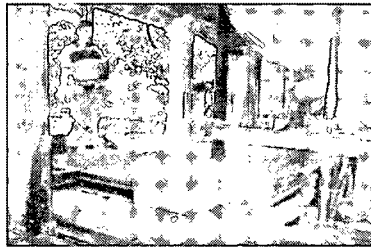
Generalities: The aserrío Santa Rosa is located in Granada, 47 Km from Managua. The company has 10 employees. The raw materials processes at the company belongs to the customers.



Raw Materials: Wood, the company process 50 m³ every day. 60% is Guanacaste Wood.



Raw wood



Wood Processing



Wood dust residues

Description	Observations
Water sources	Provided by ENACAL for Human utilization only.
Solid Wastes	Solid wastes are: crust that constitutes 10 to 12 % of the volume of the wood piece. Secondary residues such as: debris, dust, etc. Sawdust is the result of every mechanic operation in wood handcrafting.
Observations	Draft Final corrections, options in the improvement potentials will be listed.

Improvement Potentials:

Improvement Potentials per Area

Company Name		Aserrio Santa Rosa			
Raw Materials					
No	Option	Technical Feasibility	Investment US \$	Savings/year (US\$)	Environmental Benefits
Energy					

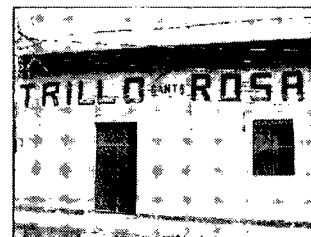
<u>01</u>	Reduction and Control of Energy Demand	Feasible. The only requirement is to schedule the motor ignitions.	None	1,378.04	Reduction of Maximum demand in 25%
<u>02</u>	To Increase the Power Factor	A Capacitator is needed and it is available in the local market.	491.34	858.60	To eliminate fees due to low Power Factor
<u>03</u>	To substitute an air conditioner unit for a split unit	Splits units are available in the local market	971.75	Estimated savings: 1,094.4 kWh per year equivalent to 96.3 U\$/year.	Reduction of 984.96Kg of CO ₂
Total (US\$/year)			1,463.09	2,332.94	

Sector: Agro Industry Enterprises

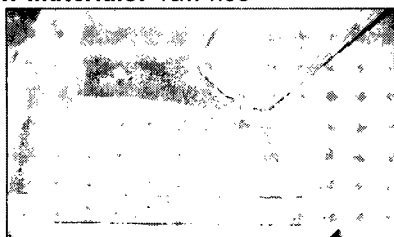
7. Trillo Santa Rosa

Main activity: rice mill and dry

Generalities: This company produce 4,000 qq¹ in the high season and 1,500 qq in low season. It has 15 employees.



Raw Materials: raw rice



Milling Process



Mill rice



Packing

Description	Observations
Water source	Provided by ENACAL. Water is for human consumption only
Solid Wastes	Solids such as: rice husk, dust, etc are picked and dispose in a special storage area. Some rice husk is given to the employees.

Improvement Potentials:

Improvement Potentials per Area

No	Option	Technical Feasibility	Investment (U\$)	Savings/year (U\$)	Environmental Benefits
01	To Sell Rice husk	Feasible if there is a possible customer.	0.00	1,567.42	Avoid Burning of 273,938.27 kg of rice husk
Sub Total			0.00	1,567.42	273,938.27 kg
Energy					

¹ 1 quintal equals to 45.36 Kg.

02	Reduction and control of Demand Charge	Motors usage need to be scheduled	0.00	1,378.04	Demand reduction of 25%
03	To increase Power Factor	There are national companies that can solve this issue.	491.34	858.60	Elimination of extra charges due to low Power Factor
Sub Total			491.34	2,236.64	
Total			491.34	3,804.06	273,938.27 kg

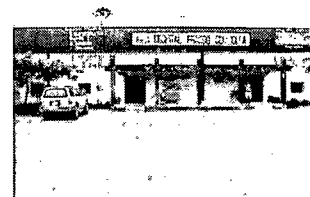
Sector: Services

8. Cocibolca Hospital

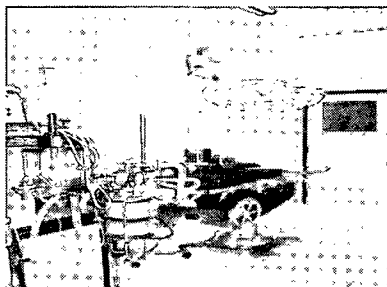
Main Activity: Medical Attention, surgeries external consultation and emergency room

Generalities:

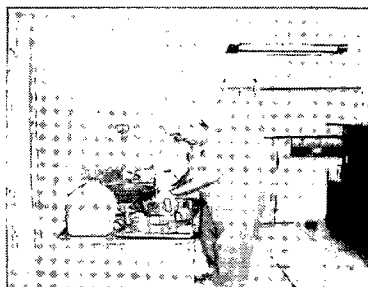
Cocibolca Hospital is located in Granada, 45.5 km from Managua. It has 35 employees. It is a private company and gives its services to people belong to the insure agency "INSS". It was created in 1978.



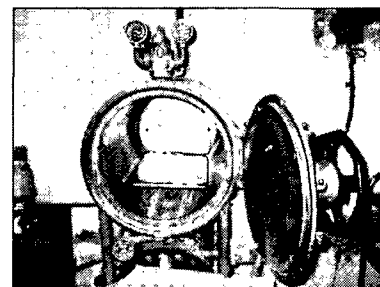
Raw Material: Office devices, pharmaceuticals, detergents, disinfect agents.



Operation Room



Equipment cleaning



Equipment Central

Description	Observations
Water source	ENACAL local network
Solid Wastes	Solid wastes are burned in a small incinerator

Improvement Potentials:

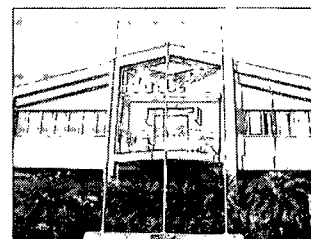
Improvement Potentials per Area

No	Option	Technical Feasibility	Investment (U\$)	Savings/year (U\$)	Environmental Benefits
Raw Materials					
01	Material consumption indicators for Operation Room	Feasible, the hospital has a computer system to develop this indicators	0.00	ND	Raw materials optimization
02	Establish a better management system for pharmaceutical materials	Regularly supervision is needed. This way a better budget can be assigned to this area.	0.00	Intangibles	
Sub Total			0.00	0.00	
Water					
03	Cancel one connection	The company has to ask for the cancellation of the water service	0.00	ND	-----
Sub Total			0.00	0.00	0.00
Energy					
04	Isolate the Autoclave	The isolation material is available in the local market and the maintenance personnel can do this job.	10.71	98.93	Reduction of 693.96 Kg of CO2
05	Substitution of a air conditioning system for a Split Unit system	Equipment is available in the country and the maintenance personal can do the job.			
Sub Total Energy			10.71	98.93	693.96 Kg of CO2
Total US\$ / year			10.71	98.93	693.96 Kg of CO2

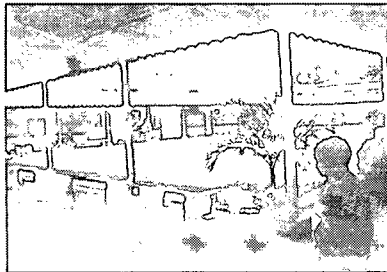
9. Amistad Japón Nicaragua Hospital

Main Activity: Services such as: Emergency room, general surgery, orthopedic, otorrinolaringology, ophthalmology, anesthesiology, plastic surgery, internal medicine, urology, pediatric unit, neurology, gynecology, radiology, Special Care Unit, neonatology.

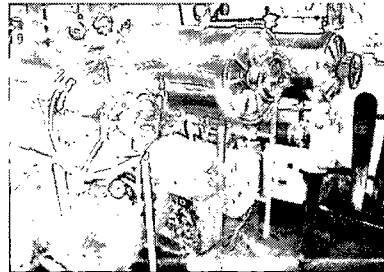
Generalities: The hospital is located at 44 ½ km Granada- Masaya road, it was funded in 1998, June 12th. Has 320 employees.



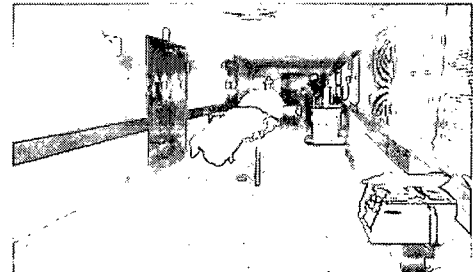
Raw materials: Office devices, pharmaceuticals, detergents, disinfect agents.



Pediatric Area



Equipment Sterilization



Operation Room

Description	Observations
Water Source	Water is provided by ENACAL. The hospital has water feeding problems that is why they storage water in 2 tanks.
Solid Wastes	Solids are incinerated. Effluents go to the water treatment system, then the Waste water is sent to the sewage system to end up in the Nicaragua Lake.

Improvement Potentials:

Improvement Potentials per Area

No	Option	Technical Feasibility	Investment (U\$)	Savings/year (U\$)	Environmental Benefits
Water					
01	Use a bigger container to storage water in operation room	Containers are available in the local market	2,992.44	Intangible	Intangible
Sub total			2,992.44	-	-
Energy					
02	Avoid using small sterilizers	-	500	1,079.78 \$/year	Reduction of 10,111.50 Kg of CO ₂
03	To unplug the air conditioning unit located at X Ray Room	-	0.00	600.99 \$/year	Reduction of 5,627.70 Kg of CO ₂
04	To reduce air conditioning units operation time located at operation dress rooms.	-	0.00	1089.88 \$/year	Reduction of 10,206 Kg of CO ₂

05	To turn off operation room lamps when idle.	-	0.00	470.55 \$/year	Reduction of 4,406.40 Kg of CO ₂
Sub total			500	3,241.2	30,351.6 kg of CO₂
Solid Waste					
06	To use plastic bags for infectious wastes gathering.	Plastic bags are available in local market	62.25	Intangible	Correct final disposition of hazardous wastes. Reducing environmental risks.
07	Reuse plastic containers (bottles, etc.) for sharpen wastes recollection.	Feasible, the containers are available at the hospital	0.00	Intangible	Correct final disposition of hazardous wastes. Reducing environmental risks.
08	Acquisition of close containers for operation room wastes gathering.	Available at local market	34.30	Intangible	Ensure Workers, patients and community health and security and Pollution prevention.
Sub total			96.55	-	
TOTAL			3,588.99	3,241.2	30,351.6 kg of CO₂

10. La Ceiba Hotel

Main Activity: Hotel Services

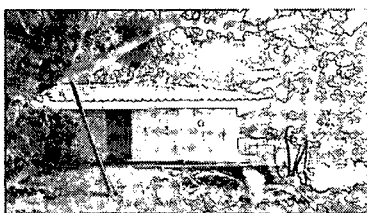
Generalities: "La Ceiba" hotel, is located at Las Isletas de Granada and is a NICARAO LAKE RESORT tourist center. It has 10 rooms for 4 persons. It has 10 employees.



Raw Materials: Office materials, purified water and combustible



Hotel Transportation



Rooms



Pool

Description	Observations
Water sources	The water use at the hotel is taken from the lake and pour in three storage tanks for distribution by gravity in the hotel. Water for Human consumption is bought in bottles.
Solid wastes	Waste water is sent to septic wells

Improvement Potentials:

Improvement Potentials per Area

No	Option	Technical Feasibility	Investment (US\$)	Savings/year (US\$)	Environmental Benefits
Materials					
1	To Substitute Calcium Hip chlorine for Sodium Hip chlorine	It can be found in local market	0.00	113.15	To avoid Calcium hip chlorine gas emissions
2	Material Inventory	The hotel personnel can carry out this activity.	0.00	Intangible	
Sub Total			0.00	113.15	Nd
Water					
3	Installation of a Water flow meter.	It can be found in local market	184.57	Intangible	
Sub Total			184.57	Intangible	Intangible
Energy					
4	Change incandescent lighting for Fluorescent lighting	Availability in the local market	108.12	116.53	Reduction of 803.16 Kg of CO ₂
5	To change light bulbs of external lamps	Availability in the local market	13	257.60	Reduction of 972 Kg of CO ₂
6	Freezer and refrigerators control systems	The personnel can do this activity	0.00	118.48	Reduction of 816.48 Kg of CO ₂
7	To control the Measurement system reading to control Energy Consumption	The personnel can do this activity	0.00	intangible	Intangible
Sub Total			121.12	492.61	1,775.16 kg of CO₂
Total US\$			305.69	605.76	2,591.64 Kg of CO₂