

Resource Efficient & Cleaner Production Experiences

better enterprises – cleaner environment – green economy



Gujarat Cleaner Production Centre

ENVIS Resource Partner on: Cleaner Production & Clean Technology

Supported by: Ministry of Environment, Forest & Climate Change
Government of India

Gujarat Cleaner Production Centre (GCPC), 2019

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better enterprises – cleaner environment – green economy*

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Foreword



Gujarat Cleaner Production Centre (GCPC) was established in the year 1998, by the Department of Industries and Mines, Government of Gujarat with technical support of United Nations Industrial Development Organization (UNIDO).

GCPC is a regular member of Global Resource Efficient and Cleaner Production Network (RECPnet) of UNIDO. GCPC as a regular member of RECPnet is promoting RECP Concept conducting orientation and awareness programmes, training programmes, conducting RECP Assessment Projects and Dissemination Programmes through its knowledge, experience and expertise.

The centre also provides assistance to overcome financial barriers for successful RECP Implementation in the industries, which industry mostly faces while implementing RECP in their enterprises.

GCPC has compiled success stories of 'Resource Efficient and Cleaner Production' (RECP) implementation in different industrial sectors by various RECPnet members across the globe, with the objective to replicate and disseminate the technologies adopted in the different countries.

This publication may be useful to industries as a reference material for RECP implementation in their respective industries, to improve their environmental and economic performance. It helps in developing approaches towards 'pollution prevention' rather than its control or treatment at the end-of-pipe.

We hope that this will be useful to all concern.

Dr. Bharat Jain
Member Secretary
Gujarat Cleaner Production Centre

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RECP Experience at Plásticos Europeos – Honduras.

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Plásticos Europeos

Achievements at a Glance

Production plant in Plásticos Europeos



Overview

Plásticos Europeos is a company dedicated to produce plastics package, specifically in the development of polyethylene bags high and low density; it has 150 workers. Its sales are made through large distributors, major chain supermarkets, pharmacies and shops in the country, among others. Also exports its product to Puerto Rico, Nicaragua and the United States.

The company has an installed capacity to process approximately 1.2 million pounds per month capacity bag. Among the weaknesses that were found in the company they are:

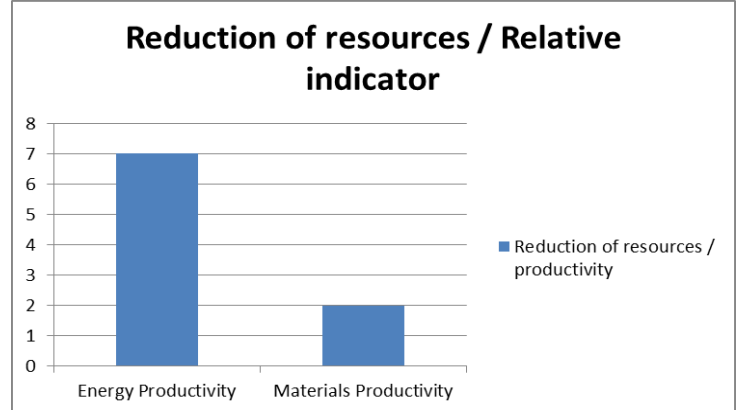
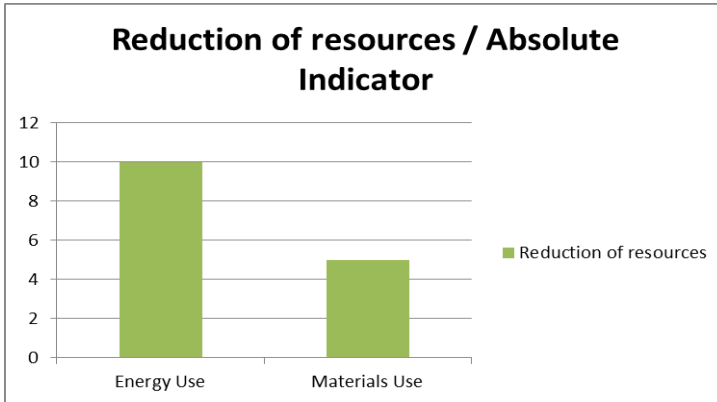
- * High energy consumption in compressed air system.
- * Opportunities for improvement in handling solvents.
- * Reduction of losses during the processes.

Benefits

- Increase the efficiency in the company Plásticos Europeos.

Absolute Indicator	Change (%) Year 1	Change (%) Year 2	Relative Indicator	Change (%) Year 1	Change (%) Year 2
Resource Use			Resource Productivity		
Energy Use	12		Energy Productivity	7	
Materials Use	5		Materials Productivity	2	
Water Use	N/a		Water Productivity	N/a	
Pollution Generated			Pollution Intensity		
Air emissions (global warming, CO ₂ equivalent)	7 Ton per year		Carbon Intensity	4%	
Waste-water	N/a		Waste-water Intensity	N/a	
Waste	N/a		Waste Intensity	N/a	
Production Output					

RECP Profile



Resource Efficient and Cleaner Production (RECP)

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RECP addresses three sustainability dimensions individually and synergistically:

- *Production efficiency*

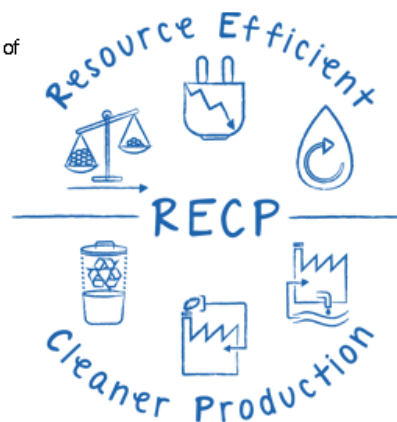
> Through improved productive use of natural resources by enterprises

- *Environmental management*

> Through minimization of the impact on nature by enterprises

- *Human development*

> Through reduction of risks to people and communities from enterprises and supporting their development



Success Areas

The company implemented the following options:

Principal Options Implemented	Benefits			
	Economic		Resource Use	Pollution generated
	Investment [USD]	Cost Saving [USD/yr.]	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
Replacing compressed air system	\$21,150.54	\$ 6,500 / year	12 %	7 Ton / year
Repairing compressed air leaks in the pipes.	\$ 2000.00	\$ 3,000.00 / year		
Installation of pumping system for solvents	\$ 70.00	\$ 100 / year	5%	N/a.

Approach taken

The principal approach was:

- Reduce the consumption of energy.
- Review of the compressed system.

Business case

As initial diagnostic stage, we worked on the identification and damping of the main environmental aspects related to the operation of the company:

- Energy efficiency: after an inspection in engines, compressors and air conditioners, they could identify potential energy saving measures; these measures consisted of replacing the system of compressed air and leak repair system.
- Reduce materials: after the analysis we recommended measures to optimize the use of solvents. For this we recommend the Installation of pumping system for solvents.

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English Abstract (where applicable)

ABOUT RECP EXPERIENCES

Through the joint Resource Efficient and Cleaner Production (RECP) Programme, the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) cooperate to improve the resource productivity and environmental performance of businesses and other organizations in developing and transition countries. The Programme is implemented in partnership with the Global Network for Resource Efficient and Cleaner Production (RECPnet). This series of enterprise success stories documents the resource productivity, environmental and other benefits achieved by enterprises in developing and transition countries through the implementation of RECP methods and practices.

These successes were achieved with the assistance of the National Cleaner Production Centers, which are part of RECPnet established with support of the UNIDO and UNEP. The success stories employ the indicator set described in *Enterprise Level Indicators for Resource Productivity and Pollution Intensity*, UNIDO/UNEP, 2010. The primer with accompanying calculator tool and further case studies are available at www.recpnet.org, as well as on www.unido.org/cp and www.unep.fr/scp/cp.

RECP Experiences at [Arabian Steel Pipes Manufacturing]

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Arabian Steel Pipes Manufacturing Jordan.


Achievements at a Glance

Resource Efficient and Cleaner Production (RECP) implementation in the Arabian Steel Pipes Manufacturing led to annual savings of USD 33'000, and improved product quality.

The audit focus areas were set to the galvanizing section and the cooling emulsion system. These focus areas were discussed and agreed upon with the company management during the meeting held with the CP team.

The focus areas were selected due to the following reasons:

1. Galvanizing plant: this plant has been selected in order to improve chemical consumption, wastewater management, and energy consumption and to minimize air pollution. Some chemicals and materials used in this line are expensive in addition, there is a room for improvement in many areas such as the technologies of some of its units are inefficient and old; like heating of the degreasing bath, drying of the pretreatment pipes which is operated by flue gas and the use of compressed air (for agitation) for the galvanization pretreatment baths. And also the wastewater resulted from this line is not complying with the Jordanian Standards (high Total Dissolved Solids (TDS)).
2. Cooling emulsion: it has been selected to improve cooling emulsion process due to its high amount of spillages and its expensive cost.

production capacity of 30000 tons per year. The company has a total of 125 employees working in its different departments. There are 13 workers in the production section (Tube Mill), 17 workers in the galvanization section and 4 laboratory workers

(wastewater and baths testing, preparation of baths solutions). In addition, the company got ISO 9000 since 1995 and ISO 14000 since 2003.

The company sells its products to the local market, in addition to Germany, France, Iraq, Syria, Libya, Sudan, Lebanon, Yemen and Saudi Arabia.

Benefits

The CP team focused on the galvanizing unit, where many options have been identified. Some of these options have been implemented such as: minimizing losses from degreasing bath, repairing the isolation of the steam pipes, preventing leakages in steam valves and junctions, using a new additive material to prevent ash formation, using organic passivation material instead of chromium, and conducting training for employees to improve process quality control.

Resource Efficient and Cleaner Production (RECP)

Resource Efficient and Cleaner Production (RECP) entails the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

RECP addresses three sustainability dimensions individually and synergistically:

- *Production efficiency*

> Through improved productive use of natural resources by enterprises

- *Environmental management*

> Through minimization of the impact on nature by enterprises

- *Human development*

> Through reduction of risks to people and communities from enterprises and supporting their development



Success Areas

The results were achieved through the implementation of the following measures:

- Decrease the oil and water consumption.
- Improve the environmental conditions: reduce the probability of bacteria growth and thus reduce the toxic H2S emissions (rotten egg odour).
- Improve the environmental conditions inside the working area.
- Reduce occupational health risk.

Principal Options Implemented	Benefits		
	Economic		Resource Use
	Investment [USD]	Cost Saving [USD/yr]	Reductions in energy use, water use and/or materials use (per annum)

<p>Minimize energy and water losses from degreasing bath By using blower instead of compressed air, installing temperature control device, and using plastic balls to cover the bath surface.</p>	3642.8	4171	260 m ³ of water/ year 19400 L of diesel/ year 9100 KWh/ year
<p>Minimize energy consumption of boiler By repairing isolation of the steam pipes and preventing steam leakages from valves and junctions of the boiler.</p>	1657	2657	66 m ³ of water/ year 13100 L of diesel/ year
<p>Prevent ash formation A new additive material is used to reduce ash formation and energy consumption.</p>	19700	26800	80 ton of ash/ year 1150 L of diesel/ year

Approach taken

The CP program comprised of capacity building and in-plant application in a modular form in addition to experts mission. A joint team from RSS CP Unit and the Company worked cooperatively to implement CP assessment for the company. The work included detailed company visits, identifying and evaluating CP options, implementing a number of options and setting an action plan for the follow up of CP at the company.

Applying cleaner production principles that result in the best utilization of available resources and the production of products in an environmentally friendly manner, this reflects the determination of our team members in complying with company's mission of protecting the environment and serving the local community.

Business case

RECP not only allows companies to achieve savings from decreased resource use, but also decreases pollution to the environment, which benefits the surrounding community.

Testimony Box
National Cleaner Production Centre (NCPC)
The CP-Unit of RSS was established in February 2004 with the support of the Swiss State Secretariat for Economic Affairs (SECO). CP-Unit is well recognized among the Arab world in CP services. During the past years, the CP-Unit has gained recognition through its comprehensive and diverse record of achievements
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RECP Experiences



ABOUT RECP EXPERIENCES

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RECP Experiences at [Jordan Valley Food Industrial Company]

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Jordan Valley Food Industrial Company, Jordan.

Achievements at a Glance

Resource Efficient and Cleaner Production (RECP) implementation in the Jordan Valley Food Industrial Company led to annual savings of USD 24'500, and improving product quality. The company has a total of 75 employees working in different departments. The company is in compliance with the standard criteria for assessment of Hazardous Analysis Critical Control Points (HACCP) and has approval of the US-FDA.

Jordan Valley Food Industrial has demonstrated that taking care of materials, energy, water, waste and emissions makes good business sense.



Overview

Jordan Valley Co. produces hummus (chickpeas) and fowl (broad beans) in addition to mixed vegetables, eggplant, green peas, carrots, red beans, white beans, tomato paste.

Benefits

Jordan Valley Industrial Company implemented most of the feasible generated options. For example, the company insulated all steam pipes, cookers, brine cookers and sterilizers. The expected annual saving was 50'678 liter of diesel. Also the company started to use hard water to soak hummus instead of using soft water. This option didn't need any investment and save around 170 m³ water/year

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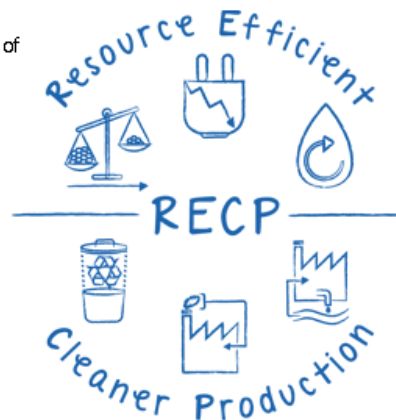
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Success Areas

The results were achieved through the implementation of the following measures:

- Reduce soft water consumption.
- Reduce water consumption.
- Insulating all pipes and cookers and Reduce diesel consumption.

Principal Options Implemented	Benefits		
	Economic		Resource Use
	Investment [USD]	Cost Saving [USD/yr]	Reductions in energy use, water use and/or materials use (per annum)
Put covers over Hummus cookers	No investment	1351	Reduce energy consumption
Install water jets on hoses (pressurized cleaning)	35	1500	Reduce water consumption by 710 m ³ of water / year
Insulating all steam pipes, brine cookers, and sterilizers.	5500	21'700	Reduce diesel consumption by 48300 L of diesel / year
Reduce load on softener by using hard water to soak hummus instead of soft water.	No investment	364	Reduce water consumption 170 m ³ water/year

- Preheat the cleaning water by recovering heat from the hot water coming out from the sterilizer.
- Recycle water by using RO membrane.

Approach taken

The CP program comprised of capacity building and in-plant application in a modular form in addition to expert mission. A joint team from CP Unit and the Company worked cooperatively to implement CP assessment for the company.

The work included detailed company visits, identifying and evaluating CP options, implementing a number of options and setting an action plan for the follow up of CP at the company.



RECP Experiences



By participating with the cleaner production program, Jordan Valley Food Industrial Company enhanced its productivity by following and implementing the suggested options from the cleaner production team.

Business case

RECP not only allows companies to achieve savings from decreased resource use, but also decreases pollution to the environment, which benefits the surrounding community.

Testimony Box
National Cleaner Production Centre (NCPC)
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RECP Experiences at [Quality Food Co. Ltd]

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Achievements at a Glance

Resource Efficient and Cleaner Production (RECP) implementation in the Quality Food Co. Ltd Industrial Company led to annual savings of USD 30'000, and improved product quality.

The audit focal areas are energy and water flows with special focus on: cleaning processes, sterilization, pasteurization, water ring vacuum pumps and the refrigeration system.

In summary the focal areas were selected due to the following reasons:

1. Cleaning processes

The cleaning process is one of the major activities that almost done in a daily manner. It is one of the most water consuming activities as shown clear in the company records, so it is an appropriate area to reduce water consumption.

2. Sterilization

In spite of the 60% recycling of the cold water used in this process, this area still consumes a large amount of water, so there is an opportunity to save more water. Also there is a room to reduce energy consumption in this area, since significant amounts of diesel (for steam generation) and electricity (for cooling) are consumed to produce the needed hot and cold water.

3. Pasteurization

There is a significant consumption of water in the cooling process which is done by semi-soft water (TDS 60 mg/l) showers and since there is no recycling of this water, there is a possibility for water recycling.

4. Water ring vacuum pumps

The water used in these vacuum pumps is disposed daily without recycling and also these pumps consume a lot of energy, especially the vacuum pumps of the cans filling and seaming machines which are running full time (installed capacity of 18.5 kW/each pump of two). So this area has possibilities to save water and energy.

5. Refrigeration system

A large amount of energy (electricity) is consumed for cooling the storages of raw materials and end products (including the freezers), production hall, trolleys room, receiving room and tempering room, etc. It is therefore important to save energy in this area. This can be done through in-depth study of required temperatures, sizes of the necessary cooling areas, temperature controls, maintenance and the possibility of heat recovery (e.g. from NH3 compressors).



Overview

Quality Food Co. Ltd, a member of the Nuqul Group, was established in 1995 for production of processed canned luncheon meat product under the famous brand name "UNIUM" which previously was produced in Holland by UNILEVER Co. and distributed since the late 50s in Jordan by Nuqul Bros. another subsidiary company of the Nuqul Group. The factory trials started late 1996, and started production in January 1997 and since then continual expanding and improvements covered production processes and trading of canned luncheon meat; therefore today Quality Food Co. Ltd, produces diversified range of processed meat products in canned, chilled and frozen forms.

Quality Food Co. Ltd, aims to fulfill customer satisfaction by ensuring the highest quality products and ongoing improvement. A concern and responsibility for company's products quality, wholesome and safety has been foremost in all aspects of the production and till the customer. All meat products are produced with high quality ingredients and through strict adherence to Good Manufacturing Practice (GMP). The company adopts Food Safety, Quality, Jordanian Quality Mark and Environmental systems to get the utmost benefits could be obtained from each system to achieve its objectives. It got ISO 9001 since 2001, ISO 14001 since 2001, ISO 22000 since 2005, HACCP since 1999, Quality Mark since 1999 and efsis "setting standards" since 1999

Benefits

Quality food Company implemented most of the feasible generated options. For example, the company Fixed water leakages, Fiting Guns to unfitted hose pipes, Apply the cleaning system for small cans (empty and filled) by change the location of the installed system for large cans, Check damaged packaging materials when delivered and discuss with supplier.

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Success Areas

The results were achieved through the implementation of the following measures:

- Reduce water consumption and wastewater by connecting the shower drain to the water recycle project
- Reduce energy consumption by replacing the use of compressed air for cans drying by a blower
- Reduce electricity consumption by inserting electronic ballast for fluorescent lamps
- Use a steam heat exchanger instead of direct steam injection to reduce diesel, water and chemicals consumptions

Principal Options Implemented	Benefits		
	Economic		Resource Use
	Investment [USD]	Cost Saving [USD/yr]	Reductions in energy use, water use and/or materials use (per annum)
Heat recovery from NH3 refrigeration system by installing a new plate heat exchanger between the compressed ammonia hot gas and water to be used for cleaning and employees shower	25'471	22'800	56'600 liter of diesel
Apply the cleaning system for small cans The installed large cans cleaning system is modified and its location is changed to clean small cans also.	7'714	2'142	1'670 m ³ of water 8'750 liter of diesel 310 liter of chemicals
Use variable speed drivers for water ring vacuum pumps of HEMAS 1&2 to prevent vacuum losses and reduce electricity consumption	2'228	5'242	39'030 kWh

Approach taken

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RECP Experiences



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Business case

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RECP Experiences at Bajío Cleaner Production Center (2014-2015)

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of BAJIO CLEANER PRODUCTION CENTER OF GUANAJUATO, MEXICO.

Today Mexico and the state of Guanajuato recognize that currently applied science, innovation and sustainability are the tools to improve both social and corporate welfare at the national and state levels. Therefore, the BCPC has been working on these three strategic lines. The projects has differents ways, training and implementation of projects of productive efficiency and pollution prevention

Business Breakfast Conference

One of the activities we have done is to organize breakfast conference, by which employers and audience were discussing topics of general interest and development. These breakfasts take place in a time of 3 hours and 3 specialists talking about a central theme but from different perspectives and areas of expertise involved.

The issues we have discussed in these two years are:

- a) Expectations Mexico free trade agreement with North America
- b) Integration of production chains with fiscal reform
- c) Entrepreneurship
- d) Promote the internationalization of your company
- e) Technology and effective decision making
- f) The drivers of growth industrial parks
- g) Environmental Liability Act

Benefits: participation of expert speakers from companies such as TIBA, VITRADE, PIRELLI, Kansas City Southern de Mexico, COFOCE, Buffete International, Guanajuato state government, Goodrich Riquelme, Puerto Interior. Breakfast attendance is 50 people, above 350 people have participated in these activities.





Training

An essential part of the activities of CPLB to be in the "state of the art" in terms of innovation, production efficiency and sustainability. For this reason, we share what we learn and do this through providing training for entrepreneurs, students and the general public.

The training we have given in these two years is

- a) Course of Corporate Social Responsibility
- b) Sales Training
- c) Exporter's guide
- d) The art of negotiation
- e) Cleaner Production and Energy Efficiency with a focus on Socia Responsibility
- f) Innovation and sustainability
- g) Integrated waste management

The benefits achieved include:

- 1) trained 280 people
- 2) government subsidy for teaching courses for \$ 20,000 USD
- 3) Recognition participants with curricular value



Forum Sustainability and Social Responsibility, factors that drive profitability in the organizations

In 2014 the BCPC organized and conducted the first forum on Sustainability and Social Responsibility. The goal of the Forum was to present to attendees tools and actions regarding Sustainability and Social Responsibility that can be implemented in business process and services to make them more profitable economically, technically more efficient, more environmentally friendly and that generate better quality of life for its employees and the community.

The Forum was held in the city of Leon, Guanajuato, under the dynamic 4 conferences, 2 panel discussions and a space for the exchange of ideas among participants. With an attendance of just over 100 participants, 16 sponsors and top-level speakers from Guatemala, Miami, Mexico City and the state of Guanajuato (belonging to the business sector and government) issues were discussed; State for Social Responsibility (RS) in Mexico, living the experience of being sustainable (two case studies), State of the RS in the hotel industry, global standards of sustainability in the service industry, cleaner production and energy efficiency and business adoption program hectares for conservation of protected natural areas.

The commitment of the Chamber Guanajuato Chapter and CPLB now is to make this Forum a reference in the state of Guanajuato, annually and useful and interesting for the business and social sector. This 2015, on July 22 will be held the Second International Forum on Sustainability and RS. This year we will have the participation of 160 attendees and 20 sponsors.



Projects

The backbone of CPLB is the implementation and development of strategic projects in production efficiency and pollution prevention. With these projects CPLB links with business and government and contributes to the development of strategies, tools and mechanisms that provide benefits in the economic, technical, environmental and social.

The projects are:

Carbon neutral. This program aims to create alternatives to assist the problem of climate change by reducing pollutant emissions into the atmosphere through the use of sustainable practices, allowing the necessary adjustments to reduce and offset the carbon footprint of the state of Guanajuato and Leon municipality. They involved a total of 61 companies in the Carbon Neutral program. The participating companies were from various sectors (services, tanneries, footwear, chemical, government offices, hospitals, educational, etc.). Some of the results obtained by the participating companies were:

Initial value

Electric consumption (Kw/h)	Power consumption (l)	Gas consumption (l)	Fuel consumption (l)	Diesel consumption (l)	CO ₂ emissions (ton)
36,496,251	5,654,887	36,000	71,869	33,692	

Ending value

Electric consumption (Kw/h)	Power consumption (l)	Gas consumption (l)	Fuel consumption (l)	Diesel consumption (l)	CO ₂ emissions (ton)
25,764,512	4,443,977	27,000	64,521	24,589	

Annual savings:

Electric consumption (Kw/h)	Power consumption (l)	Gas consumption (l)	Fuel consumption (l)	Diesel consumption (l)	CO ₂ emissions (ton)
10,731,739	1,210,910	9,000	7,348	9,103	

In the final data corresponding to companies in the Carbon Neutral program:

- The annual savings of Kw / h (29.5% of the original consumption)
-equivalen To supply energy to 3,699 families per year.
- Reduction in the total annual consumption of LP gas (21.5% of initial consumption).
- Reduction in the total annual consumption of gasoline (25% of the initial consumption).
- Reduction in the total annual consumption of diesel (10% of initial consumption).
- Reduced total annual Tons of CO₂ emitted into the atmosphere (27% of total emissions) -equivale emissions to stop issuing 1,772 compact cars a distance of 30 000 km a year.

However, adopted more than 25,000m² of green areas in the city of Leon, Guanajuato., Today programs were implemented without car and more than 2,000 trees were reforested.

Environmental leadership. The objective of this program is to develop skills to improve competitiveness by increasing the efficiency of production processes in large enterprises (leaders or managers), medium and small, making better use of raw materials and energy, and a reduction of pollutant loads that these processes generate. This program is based on learning by doing methodology. Therefore, workgroups of 15 companies led by a tractor company comply. This project takes about three months and each participating company must generate at least a productive project. We work with 45 companies divided into three working groups and (2 Guanajuato and 1 in Mexico City).

Benefits:

- 1.- The total number of projects submitted by companies was 112.
2. The total investment for these projects is \$2,088,489.48 USD
3. The economic savings to the implementation of 112 projects is \$ 2,223,107.80 USD annually.
4. The Simple payback period is 11.3 months
5. With respect to environmental issues, we have:
 - a) 4,693,243.38 Kw / year (equivalent to stop emitting into the atmosphere 3,069 tons of CO₂ and energy bastecer 1,617 homes per year) will be saved.
 - b) Saving fuel (diesel) 2172.40 m³ / year (equivalent to stop emitting into the atmosphere of CO₂ 6026.40 TON)
 - c) fuel economy (gasoline) 7.63 m³ / year (equivalent to stop emitting into the atmosphere of CO₂ TON 18.43)
 - d) fuel economy (LPG) of 154.63 m³ / year (equivalent to stop emitting into the atmosphere of CO₂ TON 60.88)
 - e) drinking water saving 165.219 m³ / year (equivalent to supply water to 1,628 people in a year)
 - f) non-potable water savings of 88.894 m³ / year
 - g) Saving raw material 440.18 TON
 - h) Paper Saver 9.23 tonnes / year (equivalent to 166.14 not cut trees)
 - i) I am saving wood 333 tonnes / year
 - j) Saving plastic TON 92.67 / year
 - k) No generation of solid waste 1,453 tonnes / year (equivalent to 3,981 inhabitants do not generate waste in a year)
 - l) No generation of hazardous waste 90.49 TON / year.

Note: The total emissions of CO₂ left to issue -9174.71- (equivalent to the emissions to stop issuing 1,786 compact cars a distance of 30 000 km a year).

ABOUT RECP EXPERIENCES

Through the joint Resource Efficient and Cleaner Production (RECP) Programme, the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) cooperate to improve the resource productivity and environmental performance of businesses and other organizations in developing and transition countries. The Programme is implemented in partnership with the Global Network for Resource Efficient and Cleaner Production (RECPnet). This series of enterprise success stories documents the resource productivity, environmental and other benefits achieved by enterprises in developing and transition countries through the implementation of RECP methods and practices.

These successes were achieved with the assistance of the National Cleaner Production Centres, which are part of RECPnet established with support of the UNIDO and UNEP. The success stories employ the indicator set described in *Enterprise Level Indicators for Resource Productivity and Pollution Intensity*, UNIDO/UNEP, 2010. The primer with accompanying calculator tool and further case studies are available at www.recpnet.org, as well as on www.unido.org/cp and www.unep.fr/scp/cp.

RECP Experiences at Helados Tonny

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Helados Tonny in Colombia.

Achievements at a Glance

DURANGO & CIA S. EN C. is a company located in the urban area of the municipality of Urrao - Antioquia dedicated to the production of ice cream in different forms based on milk or water such as cone covered with chocolate, cookie ice cream cup, cream per liter, and fruit ices; whose trademark is Helados Tonny. This company is very representative for the municipality of Urrao that it contributes significantly to the generation of employment and the local economy

Durango y Cia S en C., improved their production process and energy efficiency in its refrigeration system by conducting a piston compressors system replacement by screw compressors, improving insulation in the cold rooms, and changing the refrigerant NH₃ by R507, these changes allowed savings of 64% on their energy consumption and removed the risk involved by the use of ammonia.

Thanks to the optimization of refrigeration system at Helados Tonny reduces 99,45 ton of CO₂ per year.



illustration 1: Before: piston compressors area of refrigeration system



illustration 2: After: screw compressors that were implemented

Overview

Inicialmente el frío para todos los procesos de elaboración de helado en Durango y Cia S en C., se producía con un equipo de compresión tipo pistón de amoníaco de dos etapas, que entregaba las temperaturas ideales de trabajo en cada área. Éste sistema de refrigeración era altamente ineficiente, de alto consumo de energía, obsoleto tecnológicamente pues tenía varias de décadas de antigüedad, y con llevaba a realizar purgas de aire y de aceite en las cuales era posible se libera amoníaco al aire. El amoníaco

es un refrigerante comúnmente usado en los sistemas de refrigeración en la industria colombiana, pero que sin embargo obliga a implementar fuertes protocolos de seguridad industrial donde es usado ya que es una sustancia corrosiva y tóxica que puede generar problemas en la salud de los trabajadores y comunidad cercana.

Durango y Cia S en C., en búsqueda de mejorar su proceso productivo y su desempeño energético, identificó que sustituir en su sistema de refrigeración los compresores de pistón por compresores de tornillo, mejorar el aislamiento en las cámaras de frío, y reemplazar el refrigerante NH₃ por R507, le permitiría obtener ahorros significativos en sus consumos energéticos y eliminar el riesgo existente por la utilización del amoníaco.

El nuevo sistema de refrigeración funciona con refrigerante R507 y a diferencia del NH₃ no requiere purgas lo que minimiza las pérdidas y disminuye los costos de operación. Las nuevas batidoras TEKNOIZE operan con sistemas independientes de refrigeración por lo cual los compresores de tornillo serían utilizados para refrigerar los túneles y las cavas de conservación.



illustration 3: máquinas llenadoras en operación

Otra de las ventajas obtenidas en el cambio de compresores es la disminución del consumo de agua porque se retira del sistema un grupo de condensadores evaporativos que están asociados al sistema de refrigeración de amoníaco NH₃ y que tiene un gasto promedio de 8,5 m³/día, ya que las batidoras asociadas a la máquina llenadora poseen un sistema mejorado de condensación en más baja temperatura, que garantiza una reducción en la evaporación del agua de un 90%, y respecto al consumo mensual total de la empresa se presenta una reducción del 53% de agua.

Durante el acompañamiento que realizó el CNPMLTA se generaron varias recomendaciones de tipo operativo a los administradores de la planta con el fin de obtener un mayor rendimiento y bajo desperdicio del frío al interior de las cavas, obteniéndose una reducción en el consumo de energía mayor a la estimada al inicio del proyecto traduciéndose en un aumento en la reducción tCO₂. Finalmente gracias a la optimización de su sistema de refrigeración, Helados Tonny evita 99,45 tCO₂e/año, proyectándose un total de 497,25 tCO₂e a reducirse en 5 años.

Benefits

Adicional a la reducción de gases efecto invernadero debidos a los ahorros en el consumo de energía alcanzado por Helados Tonny, se identificaron otros beneficios directos que se generaron por la optimización del sistema de refrigeración, entre los cuales sobresalen:

- Disminución del consumo de agua, ya que se retiró del sistema un grupo de condensadores evaporativos que estaban asociados al sistema de refrigeración de amoníaco NH₃ y que tenían un gasto promedio de 8,5 m³/día.

- Las nuevas batidoras asociadas a la máquina llenadora poseen un sistema mejorado de condensación en más baja temperatura, que garantiza una reducción en la evaporación del agua de un 90%, y respecto al consumo mensual total de la empresa es de una reducción del 53% de agua
- Mejoramiento de las condiciones laborales del personal que se desempeña en el área de cavas y maquina llenadora de helado. Antes del proyecto el personal estaba expuesto a la manipulación de altas cargas debido al movimiento frecuente y repetitivo de peso. La situación actual hace que los operarios realicen un menor esfuerzo y tienen una buena percepción frente a los cambios tecnológicos que se dieron.
- Incremento de la capacidad de almacenamiento de producto terminado pasando de una capacidad de 514 m3 a 1546 m3.
- Instalación de túneles de enfriamiento rápido que permiten la reducción del porcentaje de segundas en las líneas de bicono y boconito principalmente.
- Eliminación de riesgo de fugas de refrigerante tóxico.
- Disminución de costos de energía en la fabricación del helado.
- Incremento de la capacidad de producción de la empresa.
- Helados Tonny ha adquirido mayor capacidad para implementar acciones relativas al cambio climático y el personal percibe un mejoramiento en sus condiciones laborales.

La empresa ha avanzado con la implementación de algunas de las oportunidades adicionales de ahorro de energía identificadas por el CNPMLTA durante el desarrollo del proyecto optimización de su sistema de refrigeración tales como:

- Mejoramiento del proceso de almacenamiento de producto terminado: Helados Tonny ha implementado el manejo de producto terminado a través de una banda transportadora, a través del cual se ha generado un ahorro aproximado del 4% de energía.
- La empresa realizó una modificación de la línea de vapor actual, donde se obtuvo una disminución del 30% en el consumo de carbón.

Se ha estimado que estas mejoras en la empresa disminuirán en 38 toneladas de CO2 adicionales a las 99,45 tCO2e/año evitadas gracias a la optimización de su sistema de refrigeración.

Respecto a los indicadores de monitoreos ambientales, Helados Tonny obtuvo una reducción del 64% del consumo de energía por litro de helado producido asociados a la reducción de 99,45 tonCO2 por año y se eliminó el consumo del 8,5 m3 de agua por día que se utilizaba en los condensadores evaporaditos.

Indicator	Ex ante evaluation	Ex post evaluation	Reduction
Resource Use			
Energy Use (kWh/liter of ice cream)	0,264	0,094	64%
Water Use (m3/day)	8,5	0	100%
Pollution Generated			
Air emissions (global warming, CO ₂ equivalent) (tCO ₂ /year)	114,35	14,9	99,45

La reducción en el consumo de energía y agua generaron para la empresa ahorros anuales cercanos a 540.640 USD, permitiendo recuperar la inversión en un periodo de 13 meses dado que el monto total de la inversión fue de 603.460,45 USD.

Resource Efficient and Cleaner Production (RECP)

Resource Efficient and Cleaner Production (RECP) entails the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

RECP addresses three sustainability dimensions individually and synergistically:

- *Production efficiency*

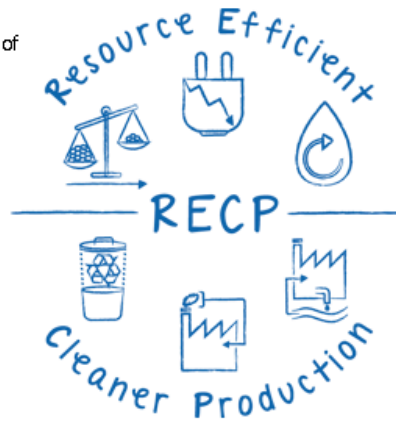
- > Through improved productive use of natural resources by enterprises

- *Environmental management*

- > Through minimization of the impact on nature by enterprises

- *Human development*

- > Through reduction of risks to people and communities from enterprises and supporting their development



Testimony Box

National Cleaner Production Centre (NCPC)

This project was financed by the Green Credit Line by SECO and the Colombian Clean Energy Program By USAID. CEP For more information go to <http://www.lineadecreditoambiental.org/lca/en> and www.ccep.co

The investment made by the company on the new equipment was 603.460,45 USD and the company got reimburse of 150.865,11 USD thanks to the Green Credit Line.

The Green Credit Credits has granted since 2003 until middle of 2015 over US\$ 12,433,431 and the total of reimbursement have been around US\$ 3,403,841.

Contact Details

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English Abstract (where applicable)

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RECP Experiences



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RECP Experiences in the Project Lake Victoria Environmental Management Programme (LVEMP II), Ken Knit Factory

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Ken-Knit (K) Ltd, Eldoret- Uasin Gishu County, Kenya.

Achievements at a Glance

Ken-Knit (K) Ltd is a textile manufacturing industry established in 1966 in Eldoret in Kenya. The company deals with the manufacture of school sweaters & uniforms, suits. Blazers, trousers. Ladies skirts, wool/polyester/viscose suiting materials, blankets, wool tops, bed sheeting, Maasai shukas, baby shawls, kikois, pillows, bed covers, hospital blankets, hand knitting & hosiery yarn. With a capacity of 70 000 pieces of sweaters, 100000 pieces of blankets and 60000 kgs of hand knitting and hosiery yarn per month. The company employs over 1200 skilled workers.

Ken-knit productivity improvement has led to further expansion of the current production in terms of quality which has attracted new and sustained old customers. The company has also expanded its product range to other more competitive and quality goods. One year ago Ken-Knit in line with RECP solution implementation, has started an expansion phase especially in knitting department whereby about 250 low waste generating and low energy consuming computerized power machines has been commissioned with over 120 new job vacancies created and has boosted production efficiency, quality as well as waste reduction. Due to the RECP programme, the company has significantly excelled in product quality, waste management, occupational health and safety and general environmental performance.

 <p>Un-lagged steam supply pipes before RECP assessment</p>	 <p>Lagged steam pipes after RECP</p>	 <p><i>Leaking steam in the bulking chamber before CP</i></p>
 <p>Steam bulking chamber after CP, no steam leakages</p>	 <p>Twin lighting fluorescent tubes before CP was implemented</p>	 <p><i>After: Transparent sheeting providing natural light instead</i></p>

Overview

RECP has been achieved by applying acquired knowledge on CP technology, continuous change of technology, continuous audits on RECP solutions, training and continuous creation of CP awareness for capacity building. The company after implementing the 'no and low cost investment options' such as delamping of twin lighting, disconnection of power to idle machines, process monitoring to reduce waste generation, preventive maintenance, installation of translucent iron sheeting, waste water recycling and condensate collection for reuse, and surface water harvesting and recycling as well as disposal of high power consuming machines and motors that became a ladder to the second phase of the project whereby the company has initiated a water purification, filtration treatment process.

Through CP implementation, the Company has realized the following; reduced cost of production, maximum output verses input i.e. waste reduction solid, liquid, power and manpower. Cleaner environment, clean product and reduced work illnesses due to low cost CP solutions that have been implemented like proper housekeeping and hence the Company has realized a reduced rate of absenteeism than was before.

Benefits

Principal Options Implemented	Resource Use	Environmental Impact
Option 1: Water Management Continuous water harvesting, condensate collection, water recycling and water filtration.	Water resource consumption has been increased by 30.1% hence water saved is by 18%.	Underground water harvested, has been put into use in our sanitary facilities,
Option 2: Wastewater Management reuse of same bath water to dye same colour lots as much as possible in older machines but not for the new hanks dyeing machines.	Waste water has been recycled for reuse and all condensate harnessed for further reuse.	Effluent clarity, ph & temperature have been attained but BOD and COD cannot be ascertained at the moment. Dyeing effluent has gone up with the same percentage.
Option 3: Materials Management Improve handling and training on material use.	Waste generation percentage has been reduced and at present there is minimal reworking.	Production efficiency has improved since waste generation has been reduced from 8.5 tons to 4.5 tons per month.
Option 4: Energy Management Continuous delamping of twin lighting, installation of low wattage consuming machines and motors. Disconnection of power to idle machines and Installation of translucent sheets.	Energy consumption savings has led to further purchase and installation of low power consuming machines and job creations.	Improved production efficiency and reduced resource wastage. Less co2 emissions since high powered machines has been disposed. Less firewood consumption in our boilers.
Option 5: Solid Waste Management Continuous training on material handling and fabrication of machines and equipment	Material input has been efficiently used. Installation of low waste generating machinery. Attitude change training program put in place	Improved production quality and capacity output which has resulted in change from seven day working system to six days working system. Efficient manpower.
Option 6: Air emissions Disposal of high power consuming machines	Reduced co ₂ emitting machinery.	Reduced environmental pollution.

Total of ALL implemented Options	<i>(Almost 45% of the high cost options has been implemented)</i>
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Resource use indicator

Indicator	Unit	Baseline (after intervention) (B)	CP (After implementation of 'all' feasible CP options) (A)	Improvement (I) (I=100* (B-A)/B [%])
Resource use				
Energy Use: E	[kWh/m]	199052kwh/m	164006 kwh/m	4.9 %
Materials Use: M	[t/m]	39372 tons/m	37480.65 tons/m	7.2 %
Water Use: W	[m ³ /m]	3249 m ³ /m	4226.95 m ³ /m	30.1 %
Environmental impact				
Air Emissions: A (global warming)	[ton CO ₂ -eq/m]			
Waste Water: WW	[m ³ /m]	2080 m ³ /m	2706.08 m ³ /m	30.1 %
Waste: Wa	[t/m]	13t/m	8.5t/m	34.6%
Productive output				
Production: P <i>(choose one indicator for production)</i>	[ton/m];	30872 t/m	34792.75 t/m	12.7 %

RESULTS AT A GLANCE

Thematic Areas	Benefits			Resource Use	Environmental Impact
	Economic				
Principal Options Implemented	Investment [\$]	Cost Saving [\$/Yr]	Pay Back Period (Yrs)	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
Water Management <ul style="list-style-type: none"> Continuous water harvesting, Condensate recovery Water recycling Water filtration. 	44,326.9	9,850.4	4.5 Yrs	Water resource consumption has been reduced by 30.1% hence water saved is by 18%.	Underground water harvested, has been put into use in our sanitary facilities,
Wastewater Management Reuse of same bath water to dye same colour lots as much as possible in older machines but not for the new hanks dyeing machines.				Waste water has been recycled for reuse and all condensate harnessed for further reuse.	<ul style="list-style-type: none"> Effluent clarity, Ph & temperature have been attained. Dyeing effluent has gone up with the same percentage.
Solid Waste and Materials Management <ul style="list-style-type: none"> Improved material handling procedures. Installation of low waste generating machines. Modification of yarn carriers. Continuous monitoring of material flow. Repair and maintenance of machines Intensified training on material handling procedures, storing and processing steps. Controlled waste generation. Attitude change trainings. Trimming used to make blankets 	3,500,000	1,242,353		<ul style="list-style-type: none"> Reduced material wastage & rework from 8.3% to 5.7%. Increase in production since less material was wasted. Reduced trimming waste in spinning from 13 tons/month to 3 tons/month saving about 37.5% on material consumption. Production output went up to 92.5%. 	Production efficiency has improved since waste generation has been reduced from 8.5 tons to 4.5 tons per month.
Energy Management <ul style="list-style-type: none"> Fabrication of bulking chamber. Lagging of steam supply pipes. 	200,000	20,864		<ul style="list-style-type: none"> Improved production efficiency by 	<ul style="list-style-type: none"> Less CO₂ emissions since high

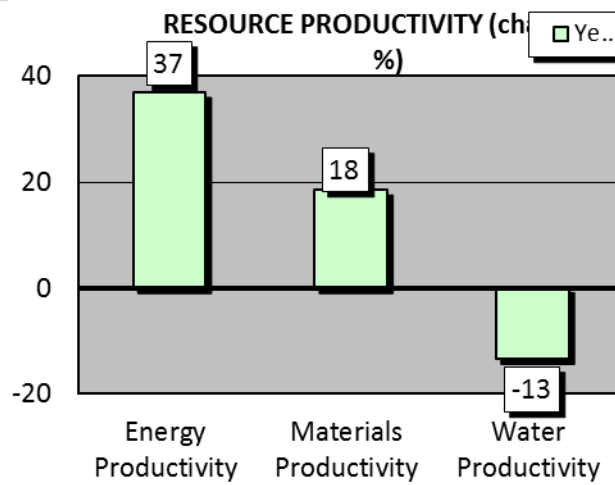
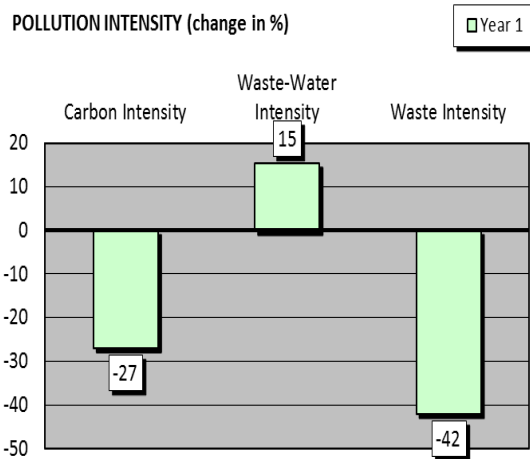
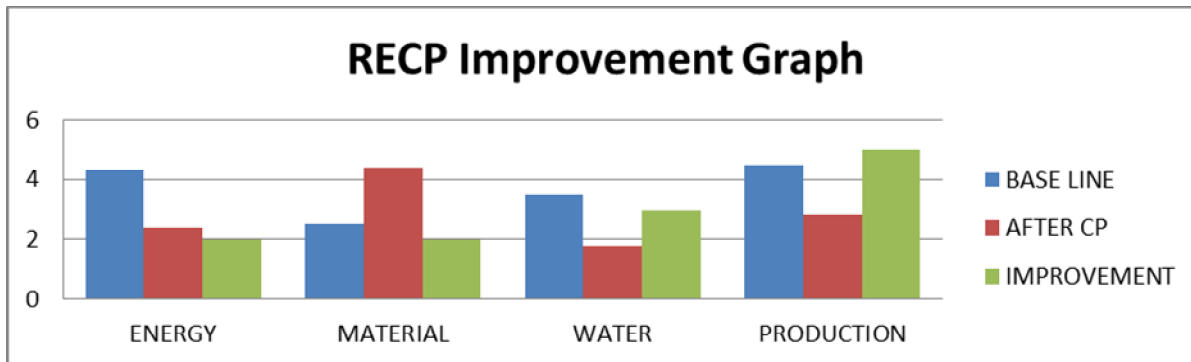


RECP Experiences



<ul style="list-style-type: none"> • Fabrication and installation of new drying chambers • Installation of new steam traps and continuous repair of leaking valves. • Collection and recycling of condensate for steam production. • Delamping of twin lighting. • Disposal of old high power consumption machines. • Change of high power consumption motors to low Kw motors. • Disconnection of power from idle machines. • Installation of translucent sheets and wall painting brighter. • Fabrication and modification of machinery. • Installation of new technology machines. <ul style="list-style-type: none"> • Installation of five new dyeing machines • Boiler heater recovery • Increased number of machines with low power consumption capacities in the entire mill. (i.e. in dyeing from six machines to nine machines and in blanket from fifty four to eighty six machines while in knitting we have commissioned an additional department of over two hundred power driven machines) 				<p>27.5%.</p> <ul style="list-style-type: none"> • Reduced time cycle between batches from 20 minutes to 8 minutes per batch which is 60% save on bulking time. • Increased working batches from 10 batches to 12 batches of 230kgs from 200kgs each in 7.5 hours which is 38% increased production capacity. • Reduced firewood consumption from 12.4tons to 9.5 tons per day. 	<p>powered machines has been disposed.</p> <ul style="list-style-type: none"> • Less firewood consumption in our boilers meaning less cutting of trees
<p>Air emissions Disposal of high power consuming machines</p>				<p>Reduced emitting machinery. CO₂</p>	<p>Reduced environmental pollution.</p>
<p>Total of ALL implemented Options ()</p>	<p>3,744,326.9</p>	<p>1,273,067.4</p>			

RECP Profile



Resource Efficient and Cleaner Production (RECP)

Resource Efficient and Cleaner Production (RECP) entails the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

RECP addresses three sustainability dimensions individually and synergistically:

- *Production efficiency*

- > Through improved productive use of natural resources by enterprises

- *Environmental management*

- > Through minimization of the impact on nature by enterprises

- *Human development*

- > Through reduction of risks to people and communities from enterprises and supporting their development



Success Areas

Resource	Action taken	Gains
Water	<ul style="list-style-type: none"> • Repair of leaking valves and supply pipes • Fabrication of steam bulking chamber. • Servicing and repair of steam traps. • Lagging steam pipes. • Installation of new dyeing machines with high production capacities • All cooling and condensate water harnessed and recycled. • Construction of water reservoirs and water harvesting. • Installation and initiation of water filtration. 	<ul style="list-style-type: none"> • Reduced water leakages. • Reduced Eldowas water consumption rate. • Optimum use of steam. • Improved heating and yarn bulking efficiency. • Increase production and improved quality. • Reduced reworking (redyeing). • Optimum utilization of manpower. • All these gains sums up to 48.1% save on the total production cost. • After the installation of the new machines, the above saving was affected by high rate of water consumption which led to the decline to 18% • Reworking and water wastages has drastically reduced and has led to reduced water consumption from Eldowas by about 40% • Reduced liquor wastages.

<p>Energy</p>	<ul style="list-style-type: none"> • Fabrication of bulking chamber. • Lagging of steam supply pipes. • Fabrication and installation of new drying chambers • Installation of new steam traps and continuous repair of leaking valves. • Collection and recycling of condensate for steam production. • Delamping of twin lighting. • Disposal of old high power consumption machines. • Change of high power consumption motors to low Kw motors. • Disconnection of power from idle machines. • Installation of translucent sheets and wall painting brighter. • Fabrication and modification of machinery. • Installation of new technology machines. 	<ul style="list-style-type: none"> • Improved production efficiency by 27.5%. • Reduced time cycle between batches from 20 minutes to 8 minutes per batch which is 60% save on bulking time. • Increased working batches from 10 batches to 12 batches of 230kgs from 200kgs each in 7.5 hours which is 38% increased production capacity. • Reduced firewood consumption from 12.4tons to 9.5 tons per day. • Increased boiler efficiency. • Reduced drying time and increased production capacity in our dryers. • From 1017 de-lamped lights to 890 pcs of 4feets of 36kwh. • Reduced unnecessary lighting. • Increased number of machines with low power consumption capacities in the entire mill.(i.e. in dyeing from six machines to nine machines and in blanket from fifty four to eighty six machines while in knitting we have commissioned an additional department of over two hundred power driven machines). • As from our baseline of about 172038 Kwh/h in June 2012 to 164006 Kwh/h this is equivalent to 4.67% which is a save of Kshs 147788.8 per month as reflected by October 2013 bill even though it fluctuates.
<p>Materials management</p>	<ul style="list-style-type: none"> • Improved material handling procedures. • Installation of low waste generating machines. • Modification of yarn carriers. • Continuous monitoring of material flow. • Repair and maintenance of machines which led to increase efficiency. • Intensified training on material handling procedures, storing and processing steps. • Controlled waste generation. <ul style="list-style-type: none"> • Attitude change trainings. 	<ul style="list-style-type: none"> • Reduced material wastage and reworking from 8.3% to 5.7%. • Tremendous increase in production since all the material that used to go to waste was converted to output production. • A notable percentage of solid waste as from the previous 13 tons of off cut wastes from knitting department to an average of 8.5tons per month to about 3 tons which is about 37.5% save on material consumption hence production percentage versus waste is 92.5%. • This save was reflected directly on production as from June 2012 to September, 2013 consecutively.

Approach taken

Ken-knit (k) ltd is a textile manufacturing industry which majorly deals with the production of textile assorted goods. As part of its RECP programme the company installed new technology that enabled an expansion of production capacity and an improvement in production quality and work safety. Annual RECP benefits include savings which fuelled company expansion and great migration from high power consumptions machines to modern generation machines of less power consumption.

The success was achieved with the assistance of the Kenya National Cleaner Production Centre, which is part of the global RECP networks which trained continuously and tirelessly monitor the progress of the whole project. The trained team set out a no cost and low cost baselines and of which after the implementation they are now on the second phase of the RECP implementation the high cost options.



RECP Experiences



What motivated the entire Ken-knit management to engage themselves in the RECP processes are factors like; Tireless participation of the KNPCPC experts, the KNPCPC's award ceremony held in December 2012 in Kisumu where the Company became the first runners up in waste reduction category.

Due to the improved relationship between KNPCPC and Ken-Knit management, it has led to other bodies recognizing the efforts that the Ken- Knit management has put in place towards the attainment of the RECP goals in line with Vision 2030 which has also attracted support from other Government bodies to the KNPCPC initiated projects towards Cleaner Production.

Business case

Ken-knit productivity improvement has led to further expansion of the current production in terms of quality which has attracted new and sustained old customers. The company has also expanded its product range to other more competitive and quality goods. One year ago Ken-Knit in line with RECP solution implementation, has started an expansion phase especially in knitting department whereby about 250 low waste generating and low energy consuming computerized power machines has been commissioned with over 120 new job vacancies created and has boosted production efficiency, quality as well as waste reduction. Due to the RECP programme, the company has significantly excelled in product quality, waste management, occupational health and safety and general environmental performance.

Testimony Box
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Contact Details
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English Abstract (where applicable)
N/A

ABOUT RECP EXPERIENCES

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These successes were achieved with the assistance of the National Cleaner Production Centres, which are part of RECPnet



RECP Experiences



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RECP Experiences in the Project Lake Victoria Environmental Management Programme (LVEMP II), Kibos Sugar and Allied Industries Factory

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Kibos Sugar and Allied Industries Factory, Kisumu County Kenya

Achievements at a Glance

Kibos Sugar & Allied Industries was established in October 2007. It produces Sugar and the by-products include bagasse, molasses, filter cake and ash. It has a crushing capacity of 1600TCD using the most modern vacuum pan technology. It is currently in the process of expanding this capacity to 3500 TCD. At present, the factory is crushing at 2200 TCD. The company boasts of the best wastewater treatment plant in the region, reducing BOD loads of up to 400mg/l to permissible levels of below 30mg/l. The company was able to realize huge savings on water and waste water (Reverse Osmosis used for waste water treatment), overall reduction on energy use (Energy savings of up to 37% on overall energy use), 16% reduction in GHG emissions and 38% in water use reduction leading to a reduction in the amount of water used from 125,000 m³ to 75,000 m³ per year.

 <p><i>Dark Waste water before treatment (BOD=112 & COD=242mg/l)</i></p>	 <p><i>Clear Wastewater after Treatment (BOD=10mg/l & COD=32mg/l)</i></p>	 <p>Reverse Osmosis plant used for waste water treatment. Water is recycled for Non-production use</p>
 <p>Before: Sugar dust accumulation on process shop floor</p>	 <p>After: Sugar dust recovered for melting</p>	 <p>50kg bags of sugar dust being recovered from packaging roof</p>

Overview

Since the formation of Resource Efficiency and Cleaner Production (RECP) and Energy Management Team, the company has been able to make savings on a number of areas which include energy savings of up to 37%, raw material savings in terms of cane and juice leakage elimination, reduced; water use, effluent load, effluent treatment costs and effluent quantity. The commitments of

the top management has enabled quick implementation of the low hanging fruits and further into developing policies i.e. Environmental policy, Energy Management policy, Health and Safety policy. Diversion of storm waters from the effluent line contributed a lot in lowering effluent quantity and amount of chemical used hence reduced cost of effluent treatment. It is notable that through implementation of Cleaner Production Technologies, savings of up to 50% can be made in a number of areas that contribute to production and eventually improves the bottom line. As a management tool, improvements made must be continually enhanced. Diversion of storm waters from the effluent drain line also contributed a lot in lowering effluent quantity and quantity of chemical used hence reduced cost of effluent treatment.

Benefits

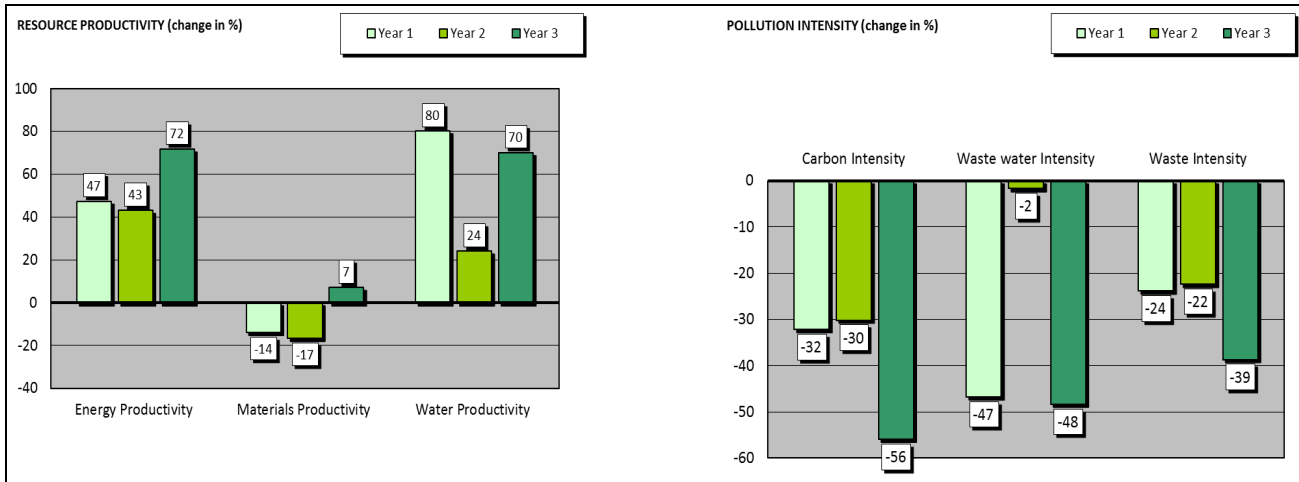
Through RECP implementation, Kibos Sugar Company has realized the following economic, environmental and social benefits namely;

1. By replacing 57 pieces of 400w bulbs with 57 pieces of 22w energy saving bulbs for street lighting in February 2011, The Company realized a saving estimated at KShs 2,792,364 per annum in electricity consumption which is 37% of the total energy cost. The extra savings enabled power connection to additional staff houses and other utilities.
2. Sugar juice leakages have been managed through repair of all leaking glands hence resulting into more sugar being produced per ton of cane and reduced cost of effluent treatment in terms of chemical use.
3. The environmental performance has also improved. The improvement in the quality of effluent discharge with BOD of approximately 10mg/l and COD of approx. 30mg/l has reduced the hue and cry of the neighboring community downstream since the quality of the waste water released meets the national standards.
4. Implementation of a closed loop has ensured that the company is now utilizing treated effluent for construction and road maintenance, which reduced the amount of water used for these purposes.
5. Sugar dust settling on the hand rails, sugar bins, pipes and other surfaces around the sugar house are recovered by scraping, sweeping and cleaning with hot dampened clothes monthly and the large quantities of dry sugar dust, and the sugary warm waters and are emptied in the sugar melter vessel for reprocessing, thereby enhancing significant sugar recovery of up to 18 (50Kg) bags of finished product per month, translating to a saving of Kshs 108,000.00.

RESULTS AT A GLANCE

Absolute Indicator	Change (%) year 1	Change (%) year 2	Change (%) year 3	Relative Indicator	Change (%) year 1	Change (%) year 2	Change (%) year 3
Resource Use				Resource Productivity			
Energy Use	-24	-21	-2	Energy Productivity	47	43	72
Materials Use	31	0	57	Materials Productivity	-14	-17	7
Water Use	-38	-9	-1	Water Productivity	80	2	70
Pollution Generated				Pollution Intensity			
Air Emissions (global warming, CO2 eq.)	-24	-21	-26	Carbon Intensity	-32	-30	-56
Waste Water	-40	12	-13	Waste-water Intensity	-47	-2	-48
Waste	-14	-12	3	Waste Intensity	-24	-22	-39
Product Output	13	14	68				

RECP Profile



Resource Efficient and Cleaner Production (RECP)

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Success Areas

1. Before RECP intervention, glands of most pumps that transfer syrup and molasses had leakages. At the time, mitigation measures involved placing a can to collect the leakages and empty back to the respective recycling tanks. This practice had challenges since syrup spillages still occurred whenever the collecting containers filled up in the absence of an attendant. RECP team thereafter made follow ups have the glands replaced to stop leakages. Such leakages could end up into the effluent treatment plant and sharply increase the BODs and CODs. These parameters are now consistently low below prescribed NEMA quality standards.
2. Kibos sugar aims at ensuring that all cane arriving at the factory ends up in the mill for production .Cane trampling at the cane yard by trucks has been greatly minimized by employing the use of shovels and manual cane picking. This is still an area of continuous improvement.

3. Pedestrians pulling cane from tractors are a major concern, resulting in cane spillages. However, the company is putting into use cane carriers that are fully covered around the sides slowly replacing the open ones. This will completely eliminate pedestrians pulling out cane from the trucks and incurring losses and waste. Pollution of the roads will also cease.
4. Delamping has led to massive reduction on energy consumption. The company replaced some iron sheets with transparent sheets, allowing for plenty of light in the factory during the day, thereby eliminating use of lighting.
5. The company mainly uses its own generated power for sugar milling. Bagasse from cane milling is used to fire a 35-ton boiler to produce steam at high pressure. Steam turns turbine alternator, producing 3MW of electricity. A 90-ton boiler is being installed to boost energy production to 18MW. However, grid electricity is used whenever there is a repair or temporary breakdown in the boiler. In such events, milling is stopped and grid power is used for minor operations and lighting. With over 60 pieces of 400w bulbs previously in place before the RECP intervention, consumption from lighting alone in an hour would cost the company KShs 720.00 more, considering just sixty such bulbs compared to KShs 42.00 per hour after replacement with 22w bulbs (take average cost per kW at kshs30.00).
6. Capacitors at power house were found to be consuming power in the range of 11 to 28 Watts/kVAR. Replacing the Capacitors with new energy efficient capacitors was proposed and has now been installed. Saving potential was estimated at 141,926 kWh and KShs. 1.28 million respectively per year, with a payback period of one year and an investment of KShs 1.2million (US\$14,000). This was a major area of improvement on energy efficiency.
7. Steam leakages and heat losses have been minimized by replacement of leaking valves and proper lagging of all steam pipes. Education of staff on need for energy conservation through notices and posters have made employees more conscious of energy savings than before. This is a continuous process. RECP team keeps working continuously on areas where improvement opportunities are feasible with minimum modifications and costs.
8. On water conservation, all process water is recycled back to the plant for cooling purposes. Hot water from process is directed to cooling tower where they are pumped up to three feet high and slowly runs back to plant over a 180m distance back to plant for cooling purposes. All leaking water pipes and taps have been replaced. Hose washing have also been eliminated. KSAIL installed a Reverse Osmosis water purifier, capable of changing treated effluent into portable water for drinking.
9. In general, most low cost investment interventions have already been implemented.

Electrical Improvements based on RECP interventions

10. Pre-Mills:-
New cane kicker installed 55kw/75HP current 96 Amps
Benefit: - Energy efficient motor installed
Old chopper of 100HP which was squarell cage induction motor was replaced by 200HP slip ring motor with automatic liquid resistance starter (efficient motor)
11. Cane Carrier: - as was recommended by RECP to install energy efficient motors
The cane carrier was enlarged in width to accommodate more cane feeding to mills. The 37KW/40HP motor was replaced with a new energy efficient motor 45KW/60 HP 81 Amps using variable frequency drive (VFD). The motor rating is 64 Amperes and is taking 44Amps on actual load because of VFD - a saving of 50%.
12. Mills
 - i. Rake Elevator:- modified awaiting 3rd phase final which shall be PLC System along with VFD.
A new energy efficient motor for rake elevator was installed 37 KW/40HP, 81 Amps a variable frequency drive (VFD) drawing 44 Amps only - a saving of 31%

- ii. Mill No 5:
- A new energy efficient AC motor 450KW/600HP rated 850 Amps was installed with a variable frequency drive (VFD) drawing 700 Amp a saving of 12%.
 - A new energy efficient AC motor for top roller pressure feed (TRPF) was also installed on the 5th mill as well which is operating with variable frequency type (VFD) Motor rating is 110 KW/150 HP with current of 184Amps drawing 66Amps which is 64% energy saving .

iii. Lighting Mills:-

After installation of translucent sheets on the factory mill house which is catering for 25% energy reduction plus a replacement of 250 watts instead of 400watts on high bay, high pressure mercury vapor lamp on the mill house six (6) numbers a reduction of 3% making a total of 27% energy saving.

Principle Options Implemented	Benefits		
	Economic	Resource Use	Environmental Impact
	Investment(\$) Cost Saving(\$/yr)	Reductions in energy use ,water use and /or materials use(per annum)	Reductions in waste water, air emissions and /or waste generation(per annum)
Option 1: Water Management: <ul style="list-style-type: none"> • Repair of tap leakages • Leaking water pipes and hoses replaced • Pipe diameter reduction for car washing • Ban of hose washing • Flow meters fixed • Recycling of process water • Maximization of steam recovery. 	Investment of US\$ 5,625 Approx US\$ 1,875 in cost savings per yr.	<ul style="list-style-type: none"> • Water use reduction from 400 m³ /day to 250 m³ /day i.e. 120,000m³ to 75,000 m³ /yr 	<ul style="list-style-type: none"> • Reduction in wastewater. • Improved waste water quality • Reduced electricity costs
Option 2: Waste Water Management: <ul style="list-style-type: none"> • Reduced wet washing • Elimination of hose use to clean juice and molasses spills • Redirection of storm waters away from effluent drainage line • Constructed waste water storage tank for wastewater reuse 	Investment Costs of US\$ 4,200 Cost Savings US\$ 1,606 p/a	<ul style="list-style-type: none"> • Reduction in waste water discharge • Less chemical use • Reduced usage of treated water for construction and road watering during dusty weather. 	<ul style="list-style-type: none"> • Standard wastewater quality attained with reduced costs in terms of chemical in-put. • Zero waste water discharge achieved
Option 3: Materials Management: <ul style="list-style-type: none"> • Re-use of wooden wastes • Use of bagasse for firing boiler to enhance power generation. • Filter mud used as fertilizer. 	Nil as per the time of baseline data.	<ul style="list-style-type: none"> • Low material waste load • Larger storage area due to extra available space 	<ul style="list-style-type: none"> • Aesthetic balance of the environment
Option 4: Energy Management: <ul style="list-style-type: none"> • Energy management team formation • Awareness creation to staff regarding energy management via posters and notices. • Instill culture of turning off 	Delamping Investment – US\$ 8,047 Cost Savings US\$ 32,851p/a	<ul style="list-style-type: none"> • Energy use reduction by up to 24% • Lower KVA demand • Optimum power factor of 9.6 on average. 	<ul style="list-style-type: none"> • Less fossil fuel use hence lower green house gas emissions

<p>equipment and lights when not in use.</p> <ul style="list-style-type: none"> • Delamping to rid off high energy consuming bulbs i.e. 400w to 22w energy saving bulbs • Additional transparent polycarbonated sheets installed at mill house provide adequate light during the day, eliminating use of six (6) bright 250watt bulbs.-100% E saving day time. • Capacitors installed for power storage • New energy efficient cane kicker of 55kw/75hp installed. The old one was inefficient. • Old 100HP squirrel cage induction motor for the cane chopper was replaced by more efficient 200HP slip ring motor with automatic liquid resistance starter. The old one being small, had a big load hence consumed much energy, with high inefficiency/ performance • Old Cane carrier motor (37kw/40hp) was replaced by an energy efficient 45kw/60hp, 81 Amps, fitted with a VFD. Because of the VFD, the motor is only taking44Amps on actual load- a 46% energy saving. • Another new efficient motor: 37kw/40hp/64 with VFD was installed for the Rake carrier, drawing only 44Amps, another 31% saving. • New EE AC motor (450kw/600hp/ 850 Amps with VFD fixed for Mill 5and drawing only 700amps- 12%saving. • Top roller pressure feed (TRPF) motor (110kw/150hp/184 Amps) also installed for Mill 5 and draws only 66Amps-64% E savings. 	<p>US\$445 investment US\$1,826 savings p.a.</p> <p>Investment US\$ 14,000 Cost Saving of US\$ 15,028 p.a.</p> <p>US\$4,705 investment US\$13,065 savings/yr</p> <p>US\$5,588 investment US\$4,749.8 savings/yr</p> <p>US\$12,235 investment US\$19,823 savings/yr</p> <p>US\$2941 investment US\$10,715 savings/yr</p> <p>US\$9411 investment US\$80364 savings/yr</p> <p>US\$4705 investment US\$65,327 savings/yr</p>		
<p>Option 5: Solid Waste Management:</p> <ul style="list-style-type: none"> • Re-use • Recycling • Donations /Free issuance to willing users i.e. filter mud, bagasse, waste concrete and ash 	<p>Investment cost US\$ 212 (Manual labour)per month –US\$ 2,544 per year</p> <p>Returns of US\$ 1,000</p>	<ul style="list-style-type: none"> • Activated recycling hence low solid waste buildup 	<ul style="list-style-type: none"> • Cleaner environment

<ul style="list-style-type: none"> Collection of sugar dust instead of waste 	per month (US\$ 12,000 per year)		
Option 6: Air Emissions: Monitoring of stack emissions annually (tests)	Test costs of US\$ 882.7	<ul style="list-style-type: none"> Environmental monitoring 	<ul style="list-style-type: none"> Environmental monitoring Reduced ozone depleting gases
Total of all Implemented Options.	Investment US\$ 72,996.7 Estimated cost savings of US\$ 259,229.8		

Approach taken

With the incorporation of RECP practices into the factory production, employees have been made conscious of resource management and waste minimization. Educative posters are constant reminders to the employees i.e. on turning off electrical equipment and water taps when not in use, reporting leaks, etc. Through RECP incorporation, the company has realized benefits in terms of energy savings, wastewater management, excellent waste water quality, lower waste treatment costs and elimination of environmental penalties.

Business case

Before RECP implementation, approximately 3 tons of cane could be trampled on in a month leading to loss of 300kgs of sugar hence about KShs 315,000 (USD 3705). Furthermore, the company still incurred costs in treatment of sugar-loaded effluent due to losses of sucrose through gland leakages, and hose washing; further aggravating losses of sugar. Sugar dust was not considered a major avenue of losses until information on resource efficiency brought about a change in thinking and management. Losses in electricity through the use of high voltage appliances and lighting were never quantified nor taken care of due to the mistaken idea that the company was generating its own power and therefore, KPLC use was not efficiently managed.

RECP implementation has led to a reduction of electricity cost hence making it possible to provide lighting to staff quarters from the generated power. Reduction in losses of sugar juice from trampling and gland leakages from minimal improvements and change of management systems, considerably saved raw material loss that would never have been recovered, and recorded savings in the treatment of effluent improving on the quality of effluent discharged. This has also improved our relations with the local community downstream.

Recovery of sugar dust through the employment of manual labour has ensured savings of KShs 984,000.00 p.a (USD 11576). which would hitherto have been lost. If extrapolated, KSAIL has thus reaped benefits from RECP interventions particularly in taking advantage of the low hanging fruits. The current estimation of savings is approximately KShs 22 million/yr (USD 258,823) For continued benefits, more interventions and continued observation of progress made is being enhanced. The 90-ton boiler installation program planned will eliminate extra bagasse currently stored as solid waste. Energy production will also go up by 600%. Once the boiler is installed, the installation of 11kg mortar of 750KW (2No.) (Fibrizer) will draw less current at a tune of 35 to 40 AMP each which is 70 to 80 amps. This will further reduce energy demand. The company's allied industries include the installation of a pulp and paper industry to mop up all the bagasse which will further enhance Cleaner Production and Resource Efficiency by ensuring complete use of waste material generated for value addition.

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RECP Experiences



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Contact Details

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English Abstract (where applicable)

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The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Kitumbe Tea Factory, Kericho County Kenya.

Achievements at a Glance

Kitumbe Tea Factory, one of the four James Finlays group of companies was built in 1934. It is the largest black tea Factory in East and Central Africa. It produces CTC and Orthodox black tea with a daily capacity of 196, 000 green leaves for CTC and Orthodox manufacture. The factory capacity is about 8, 000,000 Kgs of Made Tea (MT)/Year.

After the training on RECP for the tea sector in 2010, the factory adopted RECP programme in the production and embarked on identifying areas of improvement on water, energy raw materials and waste management. The company has put in place structures to ensure continuous improvement through comprehensive training and awareness raising sessions on regular basis in line with the company sustainability requirements. As a result of RECP programme; operational improvements, better process control, equipment modification and good-housekeeping options have been implemented at low or no cost. The RECP strategies employed at company level include; monitoring water consumption and wastewater generation through metering and sub-metering of all usage points; development of key performance indicators and monitoring productivity levels, implementation of preventive maintenance program to control leakages, spills and overflows.

 <p>Rain water harvesting to substitute factory fresh water intake from the dam</p>	 <p>Receding waste water due to introduction of Nile cabbage</p>	 <p>Reduced & cleaner waste water after introduction of reduced generation.</p>
 <p>Installation of Solar power panels to power the tea rope way</p>	 <p>LED lights installed in the shop floor</p>	 <p>Solar withering CTC installed to reduce on energy costs</p>

Overview

In 2011 the company recorded a 45.5% decrease in factory wash down water compared to 2010. A further 23% reduction was recorded in 2012 between the months of January-August compared to 2011. Further, the company has installed three 10, 000L water tanks for rain water harvesting and recover condensate to up 80% by installing efficient steam traps.

Energy use efficiency has been achieved by implementing sub-metering of electricity at key usage points; data analysis, monitoring trends and development of key performance indicators; matching motors with machine capacity , steam pipe lagging, and switching off machines not in use.

Waste management practices implemented include minimization of waste generation at source, waste segregation, and quantification of generation levels by employing effective monitoring procedures.

Benefits

Water: The RECP strategy to reduce water consumption included the following measures; monitoring water consumption through metering and sub-metering of all usage points; development of key performance indicators, implementation of preventive maintenance program to control leakages, spills and overflows, implementation of dry cleaning option and use of water saving pressure cleaners, rain water harvesting and steam condensate recovery. The total amount saved between the months of Jan-Oct 2012 compared to the same period in 2010 is a 36% reduction in volumes of water consumed.

Energy: Energy efficiency has been achieved by implementing sub-metering of electricity at key usage points; data analysis, monitoring trends and development of key performance indicators; matching motors with machinery capacity & steam pipe lagging, Use of energy efficient machinery (CPW, motors, bulbs, boilers etc), implementation of preventive maintenance programs to minimize stoppages and switching off machines not in use. The Electrical energy consumption has reduced by 53% over the same period in 2012 compared to 2010. The cost of electricity over the same period has reduced by Kshs. 10,503,502 while the cost of firewood over the same period has reduced by Kshs. 2,871,206.

Materials Management: With the Implementation of RECP plans, an increase in outturn percentage from 22.57 to 22.87 has been realized. The expectation is to achieve >23% outturn in the coming years. Effective process monitoring approach was implemented. Re-design of the bulking chamber to contain tea dust, dry cleaning of process lines, use of PVC mesh in the withering troughs, new sacks to curb wasteful spillages and timely recoveries have been some of the measures put in place to improve the outturn percentage.

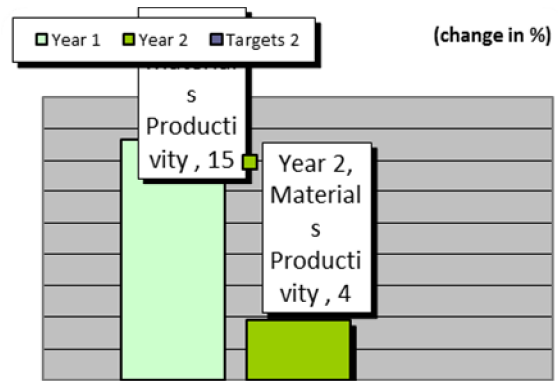
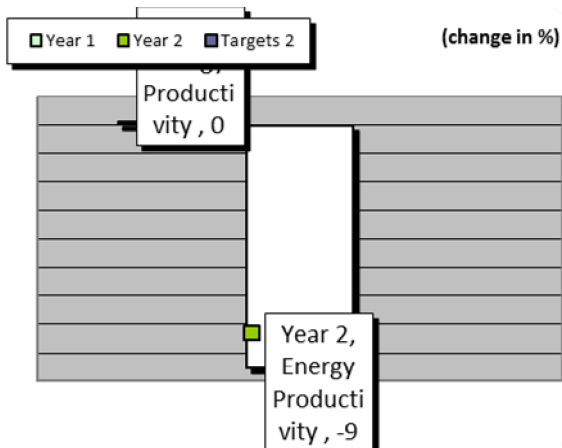
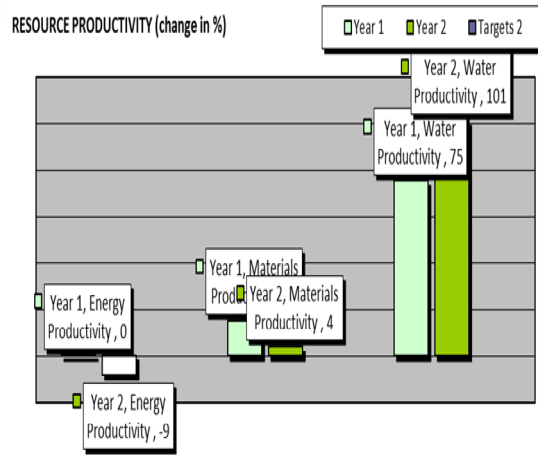
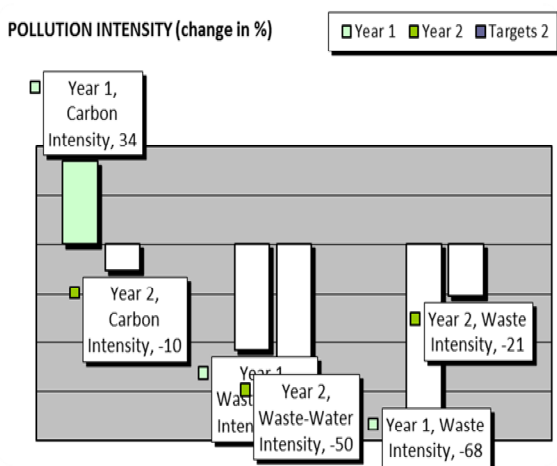
RESULTS AT A GLANCE

Principal Options Implemented	Benefits			
	Economic		Resource Use	Environmental Impact
	Investment [\$]	Cost Saving [\$ /yr]	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
Water Management. <ul style="list-style-type: none"> • Metering and sub-metering of usage points • Development of key performance indicators • implementation of preventive maintenance program to control leakages, spills and overflows • Implementation of dry cleaning option and use of water saving 	59,123.84	33,333.84	<ul style="list-style-type: none"> •Reduction in water use from 32.25L/Kg MT in 2010 to 13.95L/Kg MT in 2013. •Reduction in the cost of treatment chemicals. •Reduction in pumping cost. •Reduced transport cost 	<ul style="list-style-type: none"> •Reduction in waste water generation volumes. •Improvement of waste water quality. •Reduced abstraction of water. •Reduced carbon GHG emission •Reduced cost of waste

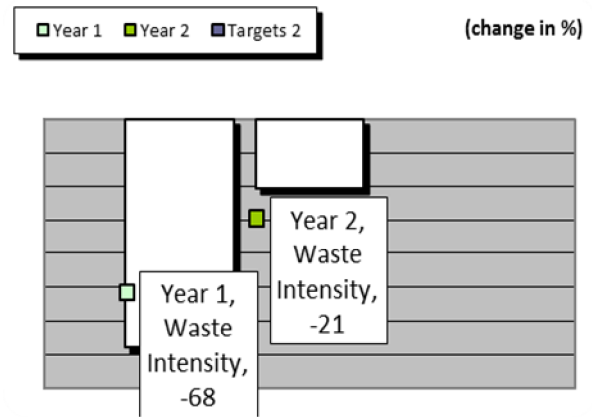
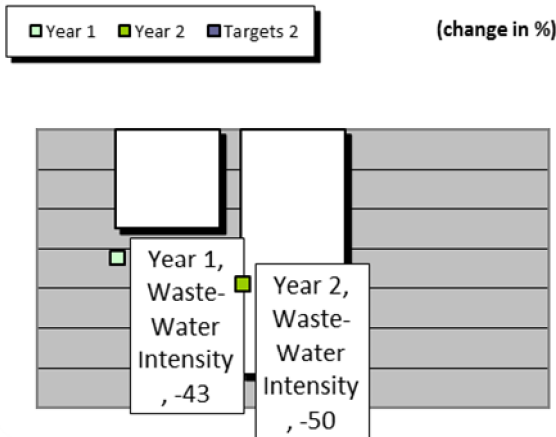
<p>pressure cleaners</p> <ul style="list-style-type: none"> • Rain water harvesting and steam condensate recovery. • Training of employees on water conservation programs. 			<p>for treatment of chemicals.</p>	<p>water treatment</p>
<p>Materials Management</p> <ul style="list-style-type: none"> • Modifying process lines to minimize spillages. • Improved process control- frequent cleaning of fermenter modules & cyclone ducts. • Modification of the bulking chamber. • Redesign of the withering troughs. • Training of employees. 	<p>95,414.93</p>	<p>90, 225.88</p>	<p>Improved Outturn percentage outlook from 21.93% to 22.80%</p>	<p>Reduction in waste Generation by 77,000 Kgs MT</p>
<p>Energy Management</p> <ul style="list-style-type: none"> • Metering of electricity at usage points. • Installation of ropeway system for tea transportation. • Development of key performance indicators. • Data analysis and improved system of monitoring & recording. • Sensitization of staff to switch off machines when not in use. • Introduction of energy saving LED lights. • Introduction of transparent sheeting. • Servicing of steam traps & installation of new more efficient steam GEM traps in 2014 • Fixing steam leaks. • Installation of MCBs in staff houses • Installation of stack withering • Installations of solar panels for withering & drying in CPW • Installation of solar panels to drive the rope way system • Development of key performance indicators. • Data analysis and improved system of monitoring & recording. • Sensitization of relevant staff on use of cheaper options and impact on factory operations, profitability & environment. • Servicing of steam traps. • Fixing steam leaks. • Installation of stack withering • Use of waste biomass i.e. tea roots 	<p>1,696,938.88</p>	<p>479,429.03</p>	<ul style="list-style-type: none"> • Improved electrical consumption per kg of made tea i.e from 0.48 kg of made tea per Kwh to 0.38 • Improved firewood consumption from 1.62kg firewood per kg made tea to 1.89 	<ul style="list-style-type: none"> • Reduction in carbon dioxide emissions. • Reduced felling of trees.

Solid Waste Management <ul style="list-style-type: none"> Provision of well labelled waste disposal containers in all sections of the factory Training of employees on waste separation. Implementation of concepts to reduce waste at the source. 	4,117.64			<ul style="list-style-type: none"> Reduction in waste generation Reduced wastes to landfill
Option 5: Air emissions				
Total of ALL implemented Options ⁽¹⁾	1,855,595.29	602,988.75		

RECP Profile



¹ Note that the total of ALL options can be greater than the some of the three to five key options detailed in the table 2.



Resource Efficient and Cleaner Production (RECP)

Resource Efficient and Cleaner Production (RECP) entails the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

RECP addresses three sustainability dimensions individually and synergistically:

- Production efficiency

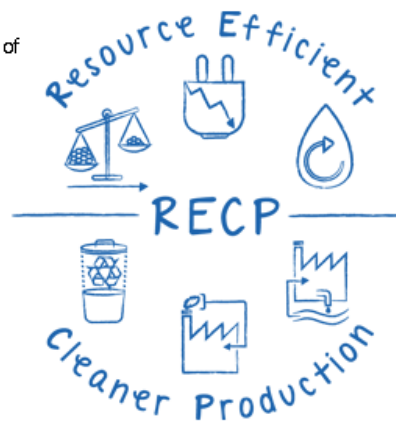
- > Through improved productive use of natural resources by enterprises

- Environmental management

- > Through minimization of the impact on nature by enterprises

Human development

- > Through reduction of risks to people and communities from enterprises and supporting their development



Success Areas

Water Management

- Metering and sub-metering of usage points
- Development of key performance indicators
- implementation of preventive maintenance program to control leakages, spills and overflows

- Implementation of dry cleaning option and use of water saving pressure cleaners
- Rain water harvesting and steam condensate recovery.
- Training of employees on water conservation programs.

Materials Management

- Modifying process lines to minimize spillages.
- Improved process control- frequent cleaning of fermenter modules & cyclone ducts.
- Modification of the bulking chamber.
- Redesign of the withering troughs.
- Training of employees.

Energy Management

- Metering of electricity at usage points.
- Installation of ropeway system for tea transportation.
- Development of key performance indicators.
- Data analysis and improved system of monitoring & recording.
- Sensitization of staff to switch off machines when not in use.
- Introduction of energy saving LED lights.
- Introduction of transparent sheeting.
- Servicing of steam traps & installation of new more efficient steam GEM traps in 2014
- Fixing steam leaks.
- Installation of MCBs in staff houses
- Installation of stack withering
- **Installations of solar panels for withering & drying in CPW**
- **Installation of solar panels to drive the rope way system**
- Development of key performance indicators.
- Data analysis and improved system of monitoring & recording.
- Sensitization of relevant staff on use of cheaper options and impact on factory operations, profitability & environment.
- Servicing of steam traps.
- Fixing steam leaks.
- **Installation of stack withering**
- Use of waste biomass i.e. tea roots

Solid Waste Management

- Provision of well labeled waste disposal containers in all sections of the factory
- Training of employees on waste separation.
- Implementation of concepts to reduce waste at the source.

Approach taken

Kitumbe factory upholds sustainability as one tool with which to enter the future. RECP offers a broader opportunity with which this valued virtues are to be achieved. By mapping out RECP strategies the Company is committing itself to undertaking RECP concepts to its fruition & conclusion. Regular trainings, improving technologies, better process control and technology change, low cost investments, process monitoring and preventive maintenance programs have achieved economic benefits from cost-cutting measures in addition to ensuring compliance with the legal and statutory requirements. Kitumbe factory has so far saved over Kshs. 58 308 673.06, due to the implementation of various CP programs.

Business case

A benefit analysis of the savings made from implementation of RECP projects are as follows;

1. Water-Kshs. 1662924.86
2. Energy- Kshs. 25301809.2 (Firewood & Use of energy efficient equipment)
3. Energy- Kshs. 23 674 739 (Ropeway conveyance)
4. Made Tea- Kshs. 7669200 (Bulking chamber only.)

Testimony Box
Kenya National Cleaner Production Centre (K NCPC)
<p>The Kenya National Cleaner Production Centre (KNPC) is a Trust under the Ministry of Industrialization and Enterprise Development. It was established in July 2000 as part of the global UNEP/UNIDO National Cleaner Production Centre program under the UNDP-Government of Kenya Country Co-operation Framework of 1999-2002. Currently, it is being transformed into a semi-autonomous government agency. The Centre is a nodal Government agency in building capacity and providing advisory services in Resource Efficient and Cleaner Production (RECP) so as to increase the productivity of enterprises by reducing wastage of resources (water, energy and raw material) and their associated negative environmental impacts. The Centre offers consultancy and training on environmental impact assessment, environmental audit, energy management training and audit, Clean Development Mechanism and climate change (CDM), amongst others. These programmes are implemented in service and manufacturing enterprises including hotels, hospitals, households, municipalities, water services and sewerage companies, supermarkets among others.</p>
Contact Details
<p>KENYA NATIONAL CLEANER PRODUCTION CENTRE Kenya Industrial Research and Development Institute (KIRDI) Kapiti Road - Off Mombasa Road, Nairobi South 'C' P.O. Box 1360-00200 - City Square, Nairobi- Kenya Tel. +254-020-604870/1, 603842, 0734 412 402. E-Mail: info@cpkenya.org Fax: +254-020-604871/607023/555738 Web: www.cpkenya.org</p>
English Abstract (where applicable)
N/A

ABOUT RECP EXPERIENCES

Through the joint Resource Efficient and Cleaner Production (RECP) Programme, the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) cooperate to improve the resource productivity and environmental performance of businesses and other organizations in developing and transition countries. The Programme is implemented in partnership with the Global Network for Resource Efficient and Cleaner Production (RECPnet). This series of enterprise success stories documents the resource productivity, environmental and other benefits achieved by enterprises in developing and transition countries through the implementation of RECP methods and practices.

These successes were achieved with the assistance of the National Cleaner Production Centres, which are part of RECPnet established with support of the UNIDO and UNEP. The success stories employ the indicator set described in *Enterprise Level Indicators for Resource Productivity and Pollution Intensity*, UNIDO/UNEP, 2010. The primer with accompanying calculator tool and further case studies are available at www.recenet.org, as well as on www.unido.org/cp and www.unep.fr/scp/cp.

RECP Experiences at KNJAZ MILOS Arandjelovac

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Knjaz Milos, Arandjelovac, Serbia

Achievements at a Glance

Cleaner production activities are aimed at energy saving and waste water return to the treatment facility and its repeated use in the process, as well as better water utilization. The majority of the solutions proposed refer to the technological modification and good housekeeping measures. Some of the proposed improvements have been implemented during the project realization. Implementation of the said measures provided CO₂ emission reduction of 436 t/y and water consumption saving of 90,000 m³/a.



Overview

The company Knjaz Milos has already existed for 200 years, with a vision of becoming a regional leader in the production of mineral water. The mission of the company is developing, producing and placing its goods onto the market of natural, healthy water and beverages offering consumers the vitality throughout the day.

With about 900 employees of which 230 are in production process at ten production lines, two syrup plants and two water treatment units including auxiliary services for electric machine maintenance, energy and preparation of water and juice, Knjaz Milos makes more branded products (carbonated mineral water Knjaz Milos, 65%, non-carbonated mineral water Aqua Viva – 20%, Energy beverages, fruit juices and other drinks represent 15% of the total production volume.

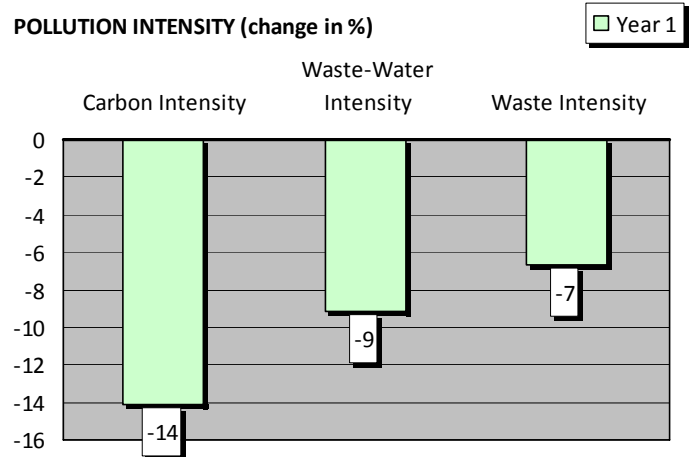
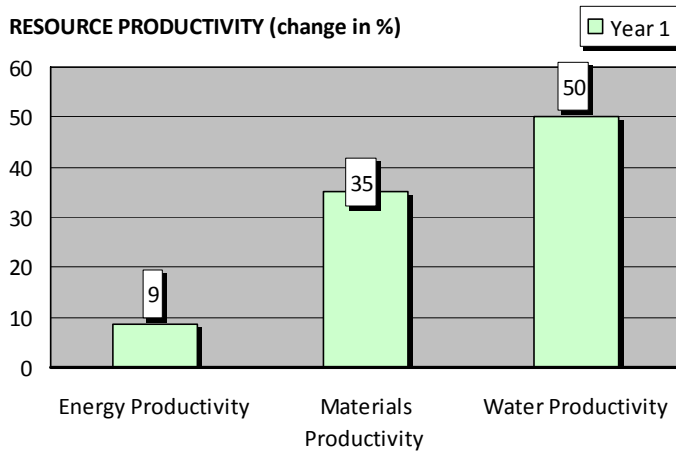
Benefits

Due to the complexity of production, it was decided to implement cleaner production project as a pilot project for line for the production of carbonated mineral water Knjaz Miloš. Given the comprehensiveness of company energy supply, it was decided to visit all the energy systems and to do the energy analysis at the level of the whole company. The company allocates substantial funds for water and energy (electricity and natural gas).

The total investment for all proposed options will be around 700,000 EUR and evaluated savings 260,000 EUR/a, which means that payback period is 3 years.

Absolute Indicator	Change (%) Year 1	Relative Indicator	Change (%) Year 1
Resource Use		Resource Productivity	
Energy Use	-1	Energy Productivity	9
Materials Use	-21	Materials Productivity	35
Water Use	-29	Water Productivity	50
Pollution Generated		Pollution Intensity	
Air emissions (global warming, CO ₂ equivalent)	-8	Carbon Intensity	-14
Waste-water	-3	Waste-water Intensity	-9
Waste	-0	Waste Intensity	-7
Production Output	0		

RECP Profile



Resource Efficient and Cleaner Production (RECP)

Resource Efficient and Cleaner Production (RECP) entails the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

RECP addresses three sustainability dimensions individually and synergistically:

- Production efficiency

> Through improved productive use of natural resources by enterprises

- Environmental management

> Through minimization of the impact on nature by enterprises

Human development

> Through reduction of risks to people and communities from enterprises and supporting their development



Success Areas

The results were achieved through the implementation of the following measures:

Principal Options Implemented	Benefits			
	Economic		Resource Use	Pollution generated
	Investment [USD]	Cost Saving [USD/yr]	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
Collecting of rinsing water from one of the lines for washing new bottles and its further use as make up water for steam boilers and supply for cooling towers for compressor	14,000	25,000	Reduction of city water consumption by 17,000 m ³ /year.	
Pre-heating boiler feed water by using solar energy	10,000	9,000	Raising the inlet temperature of boiler feed water reduces the required amount of natural gas, as a non-renewable natural resource for heating, evaporation and overheating of boiler water or steam;	Reduction of natural gas consumption by 30,000 m ³ /year and reduction of CO ₂ emissions by 64 t / yr.
Collecting water in the exhaust lines 1,2,3 PET and cans and further use for cooling sugar syrup and partial supply of cooling towers of high pressure compressors	35,000	68,000	Reducing consumption of city water for cooling sugar syrup in PET's syrup plant,; - water saving by 39,000 m ³ /year.	
Exhaust cooling water collecting after cooling of the PET's pasteurizer 2 and the use as a power option of the "Berkefeld" system	20,000	53,000	By reusing water on the Berkefeld system, consumption of city water is reduced by 34,150 m ³ /year.	
Installation of system for heating of sanitary water by recuperation of waste heat of flue gases from steam boilers	50,000	9,000		- Reducing consumption of natural gas by 30,000 m ³ /year Reducing CO ₂ emissions by 64 tons / year. - Reduced emissions of waste heat.
Installation of system for heating of sanitary water by recuperation of waste heat from production lines PET 1, 2, 3, 4 and Cans	49,000	7,000	- Reducing electricity consumption by 140 MWh / year;	Reduced CO ₂ emissions by 135 t / yr.
Chemical leasing for dry lubrication of conveyor belts	12,000	6,000	- Reduced consumption of chemicals for lubrication of belts by 70% by changing to the system DRYEXX; - eliminated consumption of water for lubricating conveyor belts (savings 1,500 m ³ /year).	
Chemical leasing for CIP - "Advantis"	9,000	4,250	- Reduced consumption of chemicals for CIP compared to	Reduced CO ₂ emission by 230 t

Principal Options Implemented	Benefits			
	Economic		Resource Use	Pollution generated
	Investment [USD]	Cost Saving [USD/yr]	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
			the previous MIP funds VL by 40%; - Reduced energy consumption for heating of CIP; - less time preparing agents for CIP.	

Approach taken

RECP is a great cost-saving tool that has enabled the company to reduce CO₂ emission and savings in investments in waste treatment and savings in utility raw materials/chemicals. The implemented measures lead to decrease of energy consumption by 1% , raw material (mineral water) use for 21 % and decrease of greenhouse gas emissions by 436 t CO₂e. Also, Company improves product quality and recover a part of materials that were wasted. Special attention is paid to good housekeeping measures such as insulation of pipelines, valves and flanges, replacement of malfunctioning condensate separators, condensate return, or repairs of water steam leakage, which is one of the results of this RECP project. Chemical Leasing business model application reduced usage of chemicals by 40 %.

Business case

In the case of Knjaz Milos resource efficient and cleaner production methodology was used, but adopted to the conditions and needs of the plant. The company continues to work on RECP activities, especially related to usage of chemicals, where Chemical Leasing business model principles have been introduced in company procurement procedures.

Testimony Box
National Cleaner Production Centre (NCPC)
<p>Cleaner Production Centre of Serbia (CPCS) started to work on September 1, 2007 and it is located on the Faculty of Technology and Metallurgy, University of Belgrade as its host-institution. CPCS represents a Faculty department with an Advisory Board, composed of representatives of all stakeholders (government, academia, industry, consulting companies). The Centre, with specialization in resource efficiency, works with number of educated and highly specialized national and international experts on different projects in Serbia and in the Region.</p> <p>The CPCS offers a broad service portfolio, including, amongst others RECP trainings, plant assessments and audit services for companies, water and energy efficiency audits, Ecoprofit projects for municipalities using the RECP methodology, IPPC consulting services etc. The Serbian Cleaner Production Center has worked for over 70 companies (large enterprises and SMEs) from a variety of industrial sectors, has trained more than 60 consultants on RECP methodology and has conducted Ecoprofit Projects with two Municipalities. Furthermore, since 2010, the Centre's representatives have also been working as experts in resource efficiency and cleaner production of the International Finance Corporation (IFC) on projects in Serbia, Russia, Croatia, Bosnia and Herzegovina, Ukraine and Kazakhstan. The CPCS works with the support of the Ministry of Environment and Serbian Chamber of Commerce and has good cooperation with different organisations, academia, consulting companies etc.</p>
Contact Details
<p>Cleaner Production Centre of Faculty of Technology and Metallurgy, University of Belgrade Karnegijeva 4, 11000 Belgrade Phone number: +38111 3370 427 e-mail: office@cpc-serbia.org</p>
English Abstract (where applicable)

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RECP Experiences at Moravia Lacto, a. s.

Achievements at a Glance

Moravia Lacto is a leading Czech dairy which was one of the pioneering companies in implementation of new methodology developed by the Czech NCPC EMPRESS – Initial Review for RECP and SCP. This complex initial assessment enables in an effective way to identify potentials for improvement within the whole enterprise management pyramid and to propose a set of optimal need driven innovations for exploration of these potentials. Methodology can be utilised also by companies advanced in area of RECP with limited or no external technical assistance which is in agreement with NCPC strategy for promotion of RECP.

Overview

The company is located in the Czech Republic in Jihlava. Moravia Lacto produces fresh milk products, cheeses, powdered milk, butter, semi-hard and hard cheeses and whey. The company employs almost 200 employees.

Enterprise had already in place best available techniques and did not have any problem with environmental legislation. Its goal was to explore opportunities for further improvements in area of RECP.

Benefits

Identification of potentials for RECP within the whole management pyramid and

- a) integration of resource efficiency into enterprise values and strategy at its control level
- b) installation of management system for resource efficiency for energy (natural gas and electricity) and water at its information level
- c) increase of resource efficiency and reduction of produced pollution (decreased CO₂ emissions, amount of waste water and production of sludge) at physical level of the enterprise.



Facility of Moravia Lacto in Jihlava

Success Areas

Cleaner production

The implementation of cleaner production principles brings more effective environmental friendly company operation. In this case it brought reduction of produced sludge, improvement of water efficiency and reduction of CO₂ emissions. Efficiency of milk processing was found being already beyond best available techniques benchmarks. There were identified opportunities also for further reduction of use of cleaning chemicals.

Energy management

As most effective innovation in area of RECP was identified introduction of monitoring and targeting which is one of the tools of energy management. Its base is systematic monitoring of energy efficiency and implementation of improvement measures. Implementation of energy management into the production process of the company enables setting up energy efficiency baseline at the level of particular cost centres and to get control over the continuous improvement of energy and water efficiency.

Resource Efficient and Cleaner Production (RECP)

Resource Efficient and Cleaner Production (RECP) entails the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

RECP addresses three sustainability dimensions individually and synergistically:

- *Production efficiency*

> Through improved productive use of natural resources by enterprises

- *Environmental management*

> Through minimization of the impact on nature by enterprises

Human development

> Through reduction of risks to people and communities from enterprises and supporting their development



Table: Major implemented measures

Principal Measures Implemented	Benefits			
	Economic		Resource Use	Pollution generated
	Investment [USD]	Cost Saving [USD/yr]	Reductions in energy use, water use and/or materials use	Reductions in waste water, air emissions and/or waste generation
Introduction of flow management system based on monitoring and targeting led among others to:	80,000	110,000	Reduction of energy use	Reduction of CO ₂ emissions
Optimisation of use of compressors	Non investment measures	35,000	Reduction of energy use	Reduction of CO ₂ emissions
Optimisation of heating system				
Replacement of oil utilised for heating of machine for drying milk and heat recuperation	60,000	75,000	Reduction of energy use within milk drying	Reduction of CO ₂ emissions
Systematic water management	Non investment measures	7,000	Reduction in water consumption	Reduction of waste water, reduction of production of sludge

Approach taken

The above mentioned results were achieved with a very limited technical assistance implemented within Initial Review of Innovation Opportunities for Resource Efficiency and Sustainable Consumption and Production (IR) – new methodology developed by the Czech NCPC EMPRESS for promotion and for an integrated implementation of RECP in industry. IR is suitable also for enterprise which are already advanced in their RECP activities. As a major result enterprise implemented management system for flows.

Within IR all levels of an enterprise's management pyramid are assessed in a systematic way from the perspective of possible RECP and Sustainable Consumption and Production (SCP) opportunities for improvements which could enhance enterprise's value. IR is implemented at four basic levels: products, processes, systems and stakeholders, proposing the most effective RECP/SCP innovations and projects for the given company to be further evaluated within development of innovation projects which are also part of IR. The main benefit of this new methodology is the holistic approach. If comparing IR with other methodologies for a complex diagnosis in the field of sustainability of industrial enterprises:

- IR provides a complex review thus not omitting any significant opportunity for improvement
 - IR is based also quantitative analysis thus pointing out the most effective priorities
 - instead of comparing assessed enterprises with an ideal site assuming that all RECP/SCP tools should be utilized (as other similar tools do), IR focuses on opportunities for improvements and innovations within the given enterprise
- IR focuses on opportunities for improvement first; suitable instruments for improvements and innovations are assigned to these opportunities only after completion of this initial analysis (thus ensuring need driven approach).

Major challenge in implementing IR is need for proactive involvement of enterprise members in its implementation.



Scheme of an assessment procedure throughout the company's management pyramid within IR: The arrow symbolizes a systematic diagnosis focusing on opportunities for effective RECP/SCP innovations first. Appropriate instruments are allocated to the identified opportunities within the second step only. The management pyramid is situated in the middle with its basic system levels indicated on the left. Examples of RECP/SCP instruments are given on the right side of the scheme.



RECP Experiences



Business case

Company CEO summarised experience from IR as follows: “RECP approach become part of company values and it enables to secure its long-term performance. Implemented system for management of flows is utilised for further increase of energy and water efficiency.”

Testimony Box
The Czech National Cleaner Production Centre (NCPC) EMPRESS
<p>The Czech NCPC was established in 1994 as a NGO promoting interests of industry, government and other stakeholders in area of RECP in the Czech Republic. It succeeded to build RECP capacities in the Czech Republic and to export its new know-how within international projects.</p> <p>The Centre develops and disseminates knowledge and tools for RECP and SCP. Among the most important are ‘No cure, no pay’ arrangements for RECP, integrated implementation of RECP tools and Initial Reviews for RECP/SCP.</p>
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ABOUT RECP EXPERIENCES

Through the joint Resource Efficient and Cleaner Production (RECP) Programme, the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) cooperate to improve the resource productivity and environmental performance of businesses and other organizations in developing and transition countries. The Programme is implemented in partnership with the Global Network for Resource Efficient and Cleaner Production (RECPnet). This series of enterprise success stories documents the resource productivity, environmental and other benefits achieved by enterprises in developing and transition countries through the implementation of RECP methods and practices.

These successes were achieved with the assistance of the National Cleaner Production Centres, which are part of RECPnet established with support of the UNIDO and UNEP.

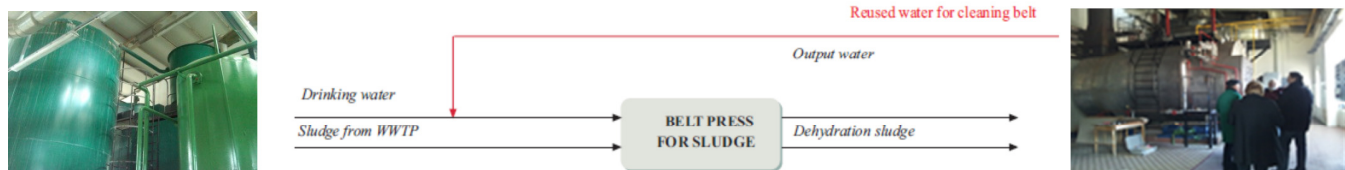
RECP Experiences at SIRELA Bjelovar

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Sirela, Bjelovar Croatia.

Achievements at a Glance

The Resource Efficient and Cleaner Production (RECP) project in DUKAT factory SIRELA included the Waste Water Treatment Plant. RECP implementation in the SIRELA led to annual savings of EUR 115,000, by investing EUR 15,000 and payback time of 55 days.

RECP project in SIRELA resulted in reduction of waste water amount by 55.800 m³/year (27%), waste water pollutant load (COD) by 18% and savings of fresh (drinking) water by 55,800 m³/year.



Overview

DUKAT is the biggest producer of milk and dairy products in Croatia. DUKAT factory SIRELA in City of Bjelovar (established 1950) is the biggest Croatian cheese producer, with tradition of (First Dairy Association of Bjelovar) founded 1901.

After privatization in 1992, SIRELA became a joint stock company, and later on the DUKAT Group member. SIRELA's product range today includes almost 70 products, mostly cheeses, which thanks to the Dukat distribution system can be found throughout Croatia and Bosnia and Herzegovina, and also in the markets of Slovenia, Macedonia, Italy, Denmark, USA and other countries.

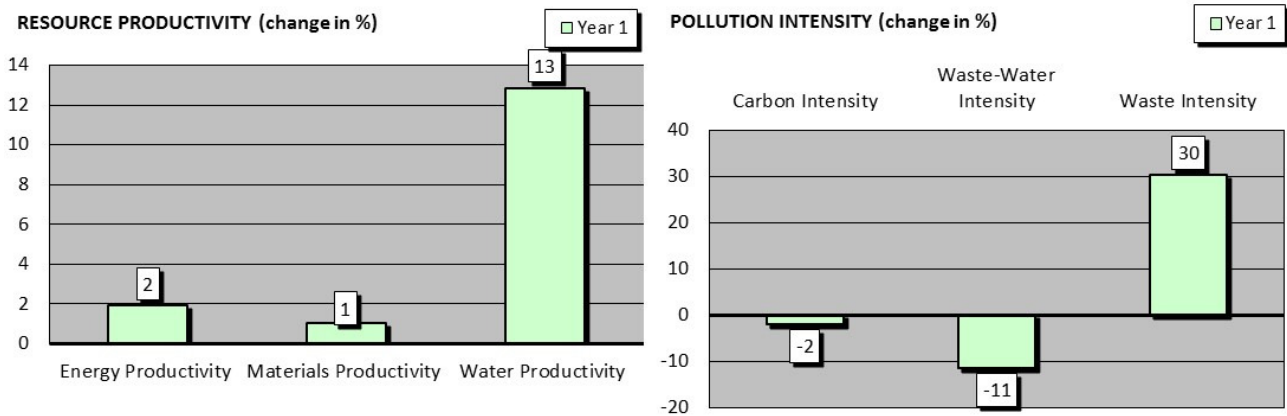
Benefits

The factory implemented the following measures to achieve its pollution prevention and water and energy saving objectives:

- Reducing water consumption in the WWTP by replacing the use of drinking water for cleaning the belt press for sludge in the WWTP with purified water from the plant.
- Reducing cooling water consumption, with recirculation and repeated cooling in the evaporation condenser.
- Reducing water consumption by using condensers.
- Installation of "washing pistols" on washing hoses.

Absolute Indicator	Change (%) Year 1	Relative Indicator	Change (%) Year 1
Resource Use		Resource Productivity	
Energy Use	-6,06	Energy Productivity	2
Materials Use	-5,25	Materials Productivity	1
Water Use	-15,18	Water Productivity	13
Pollution Generated		Pollution Intensity	
Air emissions (global warming, CO ₂ equivalent)	-6,08	Carbon Intensity	-2
Waste-water	-15,18	Waste-water Intensity	-11
Waste	24,79	Waste Intensity	30
Production Output	-4,27		

RECP Profile



Resource Efficient and Cleaner Production (RECP)

Resource Efficient and Cleaner Production (RECP) entails the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

RECP addresses three sustainability dimensions individually and synergistically:

- *Production efficiency*

- > Through improved productive use of natural resources by enterprises

- *Environmental management*

- > Through minimization of the impact on nature by enterprises

- *Human development*

- > Through reduction of risks to people and communities from enterprises and supporting their development



Success Areas

The results were achieved through the implementation of the following measures:

Principal Options Implemented	Benefits			
	Economic		Resource Use	Pollution generated
	Investment [EUR]	Cost Saving [EUR/yr]	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
Reducing water consumption in the WWTP by replacing the use of drinking water for cleaning the belt press for sludge in the WWTP with purified water from the plant.	15,000	115,000	Reducing water consumption of 50,000 m ³	Reducing waste water of 50,000 m ³
Reducing cooling water consumption, with recirculation and repeated cooling in the evaporation condenser.			Reducing water consumption of 5,000 m ³	Reducing waste water of 5,000 m ³
Reducing water consumption by using condensers.			Reducing water consumption of 750 m ³	Reducing waste water of 750 m ³
Installation of "washing pistols" on washing hoses.			Reducing water consumption of 50 m ³	Reducing waste water of 50 m ³

Approach taken

RECP is a great cost-saving tool that has enabled the company to reduce CO₂ emission and savings in utility raw materials/chemicals. The implemented measures lead to reduction of waste water amount by 15,18 % and waste water pollutant load (COD) by 18%, savings of fresh (drinking) water by 15,18%.

Business case

In the case of SIRELA resource efficient and cleaner production methodology was used, but adopted to the conditions and needs of the plant. The company continues to work on RECP activities, especially related optimization of water consumption.



RECP Experiences



Testimony Box

National Cleaner Production Centre (NCPC)

Croatian Cleaner Production Centre (CRO CPC) was founded as non-governmental, non-profit institution in year 2000.

It is a member of the Global Network for Resource Efficient and Cleaner Production (RECP net).

Centre's core business lies in providing consulting services and trainings related to environmental protection, with a focus on:

- Training and implementation of cleaner production in industrial companies and service sector
- Implementation of Environmental Management System and HACCP
- Best Available Technology Assessment (BAT; BREF)
- Implementation of Corporate Social Responsibility (CSR) and monitoring of achievements by utilising UNIDO REAP software tool
- Consultancy services for the industry (Environmental Impact Assessments, Environmental permits)

For the work and achievements in the field of environmental protection the Croatian Cleaner Production was awarded with the National Environmental Award in 2004.

Contact Details

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English Abstract (where applicable)

ABOUT RECP EXPERIENCES

Through the joint Resource Efficient and Cleaner Production (RECP) Programme, the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) cooperate to improve the resource productivity and environmental performance of businesses and other organizations in developing and transition countries. The Programme is implemented in partnership with the Global Network for Resource Efficient and Cleaner Production (RECPnet). This series of enterprise success stories documents the resource productivity, environmental and other benefits achieved by enterprises in developing and transition countries through the implementation of RECP methods and practices.

These successes were achieved with the assistance of the National Cleaner Production Centres, which are part of RECPnet established with support of the UNIDO and UNEP. The success stories employ the indicator set described in *Enterprise Level Indicators for Resource Productivity and Pollution Intensity*, UNIDO/UNEP, 2010. The primer with accompanying calculator tool and further case studies are available at www.recenet.org, as well as on www.unido.org/cp and www.unep.fr/scp/cp.

RECP Experiences at Suprema Aços Indústria e Comércio Ltda.

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Suprema Aços Indústria e Comércio Ltda. in Brazil.

Achievements at a Glance

The implementation of RECP at Suprema Aços Indústria e Comércio Ltda. generates four case studies covering: changing the type of solder nozzle used; replacing the gas supply cylinder by implementing integrated station to the gas distribution network; substitution of disposable textile rags by using reusable towels used in the cleaning of operators and parts contaminated with oil and grease; changing the type of oil used in the plasma cutting table. These actions provided an annual economic benefit of US\$ 102,355.16, where only action regarding the implementation of the gas station demanded investment by US\$ 26,927.87 with payback of 3.3 months. The environmental benefits provided by the RECP total annual reduction in the generation of 1,223.76 kg of solid waste, annual emission reduction of 90.00 kg of CO₂ and reduce the annual discharge of 300 liters of waste oil.

Overview

The Suprema Aços Indústria e Comércio Ltda., located in Belo Horizonte/Minas Gerais, develops and carries out projects for various industries such as steel, mining, cement, pulp and paper, oil and gas, power, petrochemical, among others. The company has 150 employees and generates a monthly output of 170 tons. Its main field of activity are engineering projects involving machining processes, boiler shop and welding in the manufacture of parts, equipment and metal constructions. Productive activities that combine to form the process have a varied configuration being dependent on the type of product to be developed within the company.

Benefits

The welding process of the Suprema Aços Indústria e Comércio Ltda. was one of the focal points of RECP during its evaluation were checked that the low durability of welding nozzles used generates a large number exchanges causing a low productivity of operators. To solve this problem many studies have been performed considering the following characteristics of welding nozzles: utility, physical characteristics and workability. The company chose to conduct the welding process with increased productivity and less waste. For this was held several daily measurements, simulations with various types of welding nozzle, during 22 days. Comparisons were made between the various types of nozzles and their respective constitutions and it was decided to replacement of Copper welding nozzle for a Copper-Chromium-Zirconium welding nozzle. The comparative analysis shows that the use of 2,112 units / year of copper welding nozzle will reduce to 528 units / year of Copper-Chromium-zirconia welding nozzle. Although Copper-Chromium-Zirconium welding nozzle has a unit cost of US \$ 4.15 and the copper nozzle costs \$ 2.24, reducing the amount consumed and reducing nozzle exchange operation provide economic gain annual by US\$ 2,919.62. Along with economic gain, less waste will be generated by avoiding the generation of 23.76 kg / year of copper waste.



Figure 1: Before Cleaner Production:
Copper welding nozzle



Figure 2: After Cleaner Production:
Copper-Chromium-Zirconium welding nozzle

Before RECP the supply of gases (Argon, CO₂, LPG and oxygen) was conducted through cylinders and bottles, as demand. It has been found the high cost of these inputs and noted that the value offered by the supplier is greatly change depending on the form of packaging, as well as other factors that influence the final price, such as: logistics, administrative costs and cost of packaging. For improvement was studied the possibility of constructing a gas station, eliminating the supply through cylinders and bottles. This measure required an initial investment of US\$ 26,927.87 and provided an annual reduction of costs by US\$ 97,875.99 and eliminates the transport of gases in cylinders, avoiding the annual emission of 90 kg of CO₂ into the atmosphere.



Figure 3: Before Cleaner Production:
Gas supply by cylinders and bottles



Figure 4: After Cleaner Production:
Gas Station

Throughout the manufacturing process of the Suprema Aços Indústria e Comércio Ltda. There manipulating parts, machinery and equipment which employ various types of oil and grease. Aimed at cleaning of operators and improved operating processes every day they are distributed to workers rags for this purpose. This material after use results in waste contaminated with oils and greases and thus require a specific management, since it is a residue class I - dangerous according to NBR 10.004. Monthly are purchased 100 kg of rags generating a cost of US\$ 147.63 per month. After the rags are destined for landfills monthly cost allocation of US \$ 89.07 in addition to generating environmental liabilities.

The associated costs and the environmental liability issue led to the change of rags for returnable industrial towels. The team set a trial period, where for a month of work contracted to supply 700 units of industrial towels, with the cost of US \$ 177.16. With this procedure has eliminated the cost of acquisition of rags and disposal of waste used rags, since the industrial towels are returned to the providing company. This measure provided an annual economic benefit of US\$ 714.51 and prevented the annual shipment of 1,200 kg of hazardous waste to landfill.



Figure 5: Before Cleaner Production: Disposable rags



Figure 6: Before Cleaner Production: Industrial

The plasma cut in the Suprema Aços Indústria e Comércio Ltda. takes place at a table where there is an oil mirror for better operation of the equipment and for the absorption of sludge and smoke. The opportunity to exchange oil used for other with greater durability has been identified, reducing the number of annual annual changes and therefore the generation of the oil residue (class I). Currently is used in the plasma table an oil of the poor quality (PLAC 3020), which generates, as well as sludge, excessive smoke and dirt in the machine components. This oil should be changed every six months performed. This oil was replaced by higher quality oil (Houghto GRIND 22). This oil has longer life, becoming necessary to change each year as well as producing fewer grounds, reducing smoke and dirt components. With this action we obtained an economic benefit of US\$ 845.04 and has avoided the annual discharge of 300 liters of waste oil.

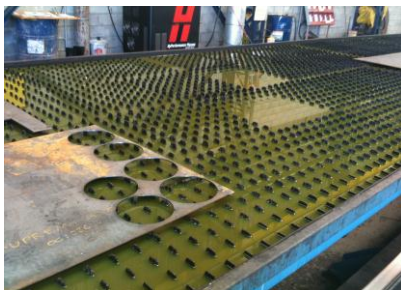


Figure 7: Before Cleaner Production: Low-quality oil in the plasma cutting table

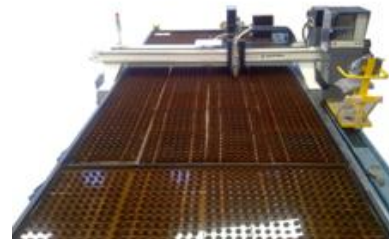
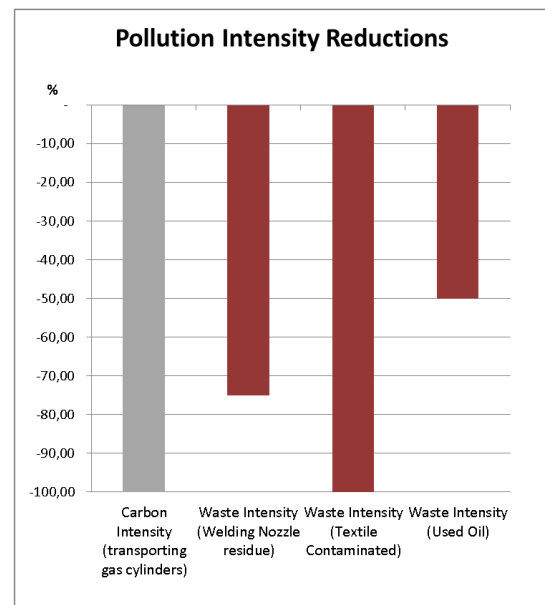
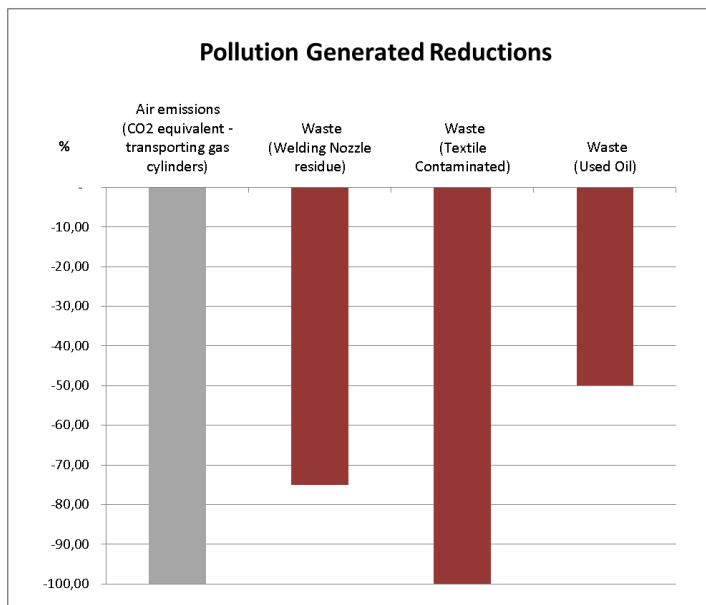
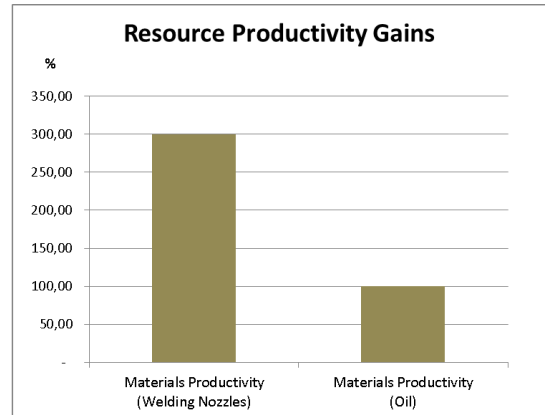
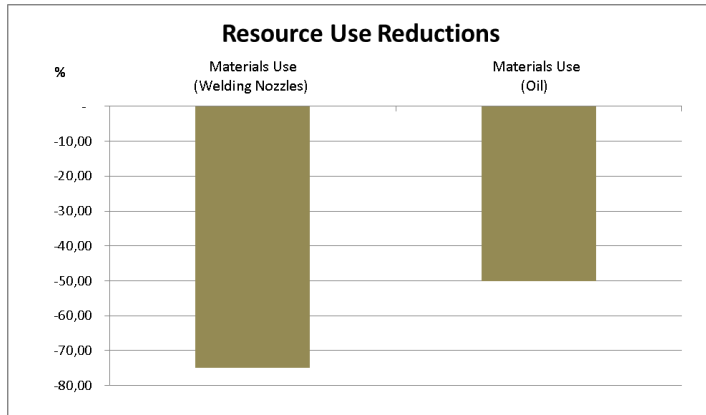


Figure 8: After Cleaner Production: Top quality oil in the plasma cutting table

Absolute Indicator	Change (%) Year 1	Relative Indicator	Change (%) Year 1
Resource Use		Resource Productivity	
Energy Use	-	Energy Productivity	-
Materials Use (Welding Nozzles)	- 75,00	Materials Productivity (Welding Nozzles)	300,00
Materials Use (Oil)	- 50,00	Materials Productivity (Oil)	100,00
Water Use	-	Water Productivity	-
Pollution Generated		Pollution Intensity	
Air emissions (CO ₂ equivalent - transporting gas cylinders)	- 100,00	Carbon Intensity (transporting gas cylinders)	- 100,00
Waste-water	-	Waste-water Intensity	-
Waste (Welding Nozzle residue)	- 75,00	Waste Intensity (Welding Nozzle residue)	- 75,00
Waste (Textile Contaminated)	- 100,00	Waste Intensity (Textile Contaminated)	- 100,00
Waste (Used Oil)	- 50,00	Waste Intensity (Used Oil)	- 50,00

RECP Profile



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Testimony Box

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The SENAI National Cleaner Technologies Centre was created in July 1995, upon the accepted candidature of SENAI Rio Grande do Sul to nest the National Cleaner Production Centre of Brazil, through a UNIDO/UNEP call for candidate institutions to establish a NCPC in developing countries. CNTL was the 10th NCPC implanted in the world and the 1st in Latin America. Since 2002, we are the national focal point for Cleaner Production matters by appointment of the Brazilian Government to UNIDO/UNEP.

SENAI CNTL integrates the network of Units of SENAI-RS, a branch of SENAI (National Service of Industrial Education), a nationwide institution with a tradition of 62 years of professional education and services for industries. CNTL responds for the technical coordination of the Cleaner Production Network of CNI (the National Confederation of the Industry).

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RECP Experiences



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RECP Experiences



RECP Experiences at Tivoli Hotel

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Achievements at Tivoli Hotel

The implementation of Resources Efficiency and Cleaner Production (RECP) will contribute to continuous improvement of Tivoli Hotel performance indicators, where was expected reduction in the overall power consumption of approximately 33% because of the on-going energy conservation measures at the hotel, covering replacement of high energy consumption bulbs, by energy savings ones and LED lights technology, installation of presence and movement sensor detectors in the corridors, and public bathrooms, including workers' awareness raising and training program, on conservation and efficient resources use, in term of monetary savings on electricity bill achieved by the hotel is equivalent to USD 19,782/year.

Tivoli Hotel has demonstrated that taking care of the environmental impact of its Hotel activities, make it more competitive, ensuring that guests can spend more their time at Tivoli Hotel complex , in proper hygienic conditions, and showing alternatives to the hotel management that highlights options, to minimize the environmental impact that might arise from the effluents generated in the hotel area.

Overview

Tivoli Maputo Hotel, located in the downtown area of Maputo City, at the corner of Avenues, 25 de Setembro and Vladimir Lenine, which is one of the prime shopping area and businesses center of Maputo.

Its main targeted costumers are nationals and foreigners markets who seek comfort and quality of services. It has been recently refurbished in 2012, by TD group that is one of the best international contractor for civil works based in Portugal and this Hotel is a part of it the, it has a rating of 3 stars hotels classification with 88 rooms: being 51 standards rooms, 17 single rooms, 16 junior suites, 4 suites, bar, restaurant and five conference rooms up to 90 participants.

It was defined as priority and concerns of the company as follows: reduce water consumption, reduce energy consumption and reduce solid waste management generation by looking for

measures to exploit the waste recovering and recycling initiatives, including training and workers awareness raising on resources conservation needs.

Benefits

The RECP programme was mainly focused on reduce water consumption, energy consumption and for waste management reduce its generation looking for measures to exploit the waste recovering and recycling initiatives, including training and workers awareness raising on resources conservation needs.

The benefit gained by replacement of 123 incandescent bulbs of 60 W by energy saving bulbs of 11 W to reduce the energy consumption consisted in improvement of energy efficiency and reduction of hotel's electricity bill.

A number of energy saving bulbs are in place in the hotel and still existing in the hotel around 8% of conventional bulbs but when fused are replaced by energy saving bulbs.



Figure 1: Energy saving bulbs

The benefit gained by replacement of 113 halogen spots of 50 W, by Led lights of 3 W to reduce the energy consumption were improvement of energy efficiency and substantial reduction on energy bill.

The LED lights technology are the best solution to reduce the electricity bill particular in the accommodation sector, as they use a lot of halogen spots for lighting and decoration but the halogen spots consumes a lot of energy and create heat causing AC demand that its also create additional electricity consumption.

LED lights are still expensive in Mozambique and also there are very few suppliers of good quality products due this reasons the hotel is doing the replacement gradually and importing the bulbs from Lisbon.



Figure 2: Led lights in place

Were introduced 3 waste containers: Organic waste, glass bottle and Pet to cover the hotel waste streams: paper, cardboard paper, aluminum cans and plastic. Environmental benefits recovering for recycling of 72% of recyclable materials taken to the landfill site equivalent to 4 tons of solid waste equivalent to USD 777.34/year of financial savings from sale of recyclable materials.



Figure 3: Waste containers with waste segregated labelling of containers to be improved

The benefit gained by staff training and awareness raising on resource conservation was their substantial improvement in good housekeeping practices, waste management in also added value to the internal Hotel employees training done once per year by international Consultant from TD group HQ in Portugal the training is covering other hospitality management issues, the workers have been trained to switch off the AC and Lights in vacant rooms, close the taps and shower unnecessarily open and other several good housekeeping and operational issues.



Figure 4: Use of natural lights use in the Figure 5: Staff training and

restaurant

awareness raising meeting

The benefit gained to installation of water-saving devices in the appropriate places (e.g water flow sensors, self-closing taps, *etc.*) consist to reduce water consumption in bathrooms.



Figure 6: Dual flush tanks and water flow regulators in taps and shower caps

Table 1: Results at Tivoli Hotel

Indicator	Unit	Year 2013) Baseline (B (Before RECP intervention)	Year 2014 A (After RECP implementation)	Change (C) C=100*(A-B)/B [%]
Resource use				
Energy Use	[MJ/yr]	32.772.256,67	48.453.098,50	47,85
Materials Use	[ton/yr]	0,00	0,00	0,00
Water Use	[m3/yr]	5.477,30	5.575,58	1,79
Pollution				
Carbon dioxide	[ton CO2-eq/yr]	1.925,76	3.057,31	58,76
Waste-Water	[m3/yr]	0,00	0,00	0,00
Waste	[ton/yr]	4,32	3,60	-16,67
Product Output				
Product Output: Guest	[Number of guests /yr]	18.584,00	16.993,00	-8,56

Note: The *absolute indicators* provide a measurement of how much resource use/pollution output has changed in absolute terms e.g. units of energy used or tons of waste generated. A negative percentage indicates a decrease and a positive percentage indicates an increase. The *relative indicators* provide a

measurement of changes in resource use/pollution in relation to production output. *Resource productivity* provides a measurement of how much product output can be produced per unit of resource use, from a sustainability perspective, productivity should increase. *Pollution intensity* provides a measurement of how much pollution is generated per unit of production output, from a sustainability perspective, intensity should decrease.

RECP Profile

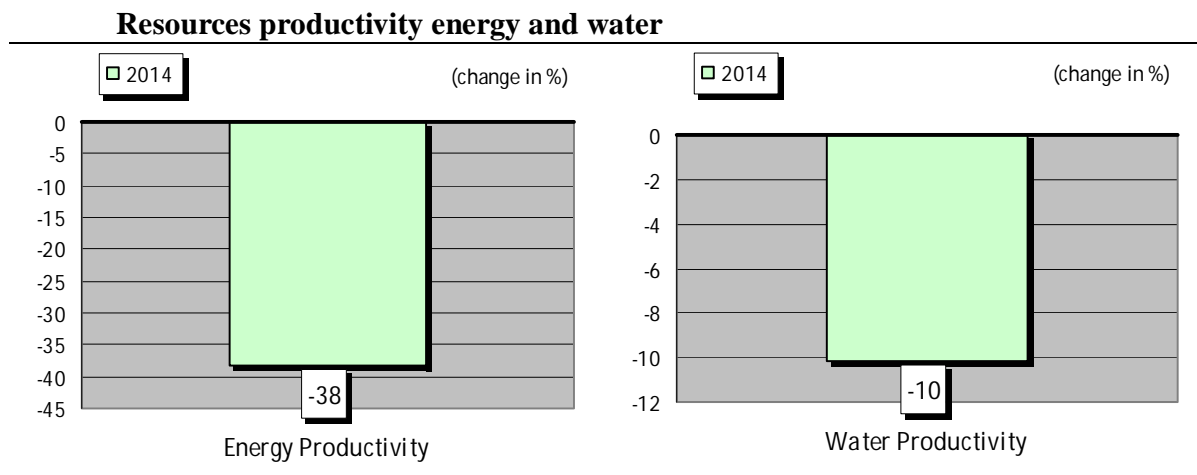


Figure 7: Resources productivity energy and water

Because of different energy saving devices implemented in the hotel, under the RECP recommendations in specifically, the energy-saving bulbs, LED lamps, presence and movement sensors detectors, the Tivoli Hotel Maputo had reduction on electricity consumption of 33.8%, but because of gas and diesel consumption increase the energy resources productivity decreased to around 38%, and the water productivity was also decreased by 10% as shown in the chart above.

The reason for increase in gas diesel and water consumptions, is associated with hosting of several conferences and workshops, where the participants were not accounted in the hotel occupancy rate.

In future years it's expected that the water productivity will also increase once the Tivoli Hotel Maputo has already installed the water saving devices (namely: water flow rate regulators in the tapes and showers caps, including dual flush cisterns in bathrooms) to minimize the water consumption.

The employees have been also already trained and raised their awareness on water and energy resources conservation so this will also contribute to the Hotel continuously improvement

meeting good performance on efficient resources utilization in mid and long term and gets very good financial savings.

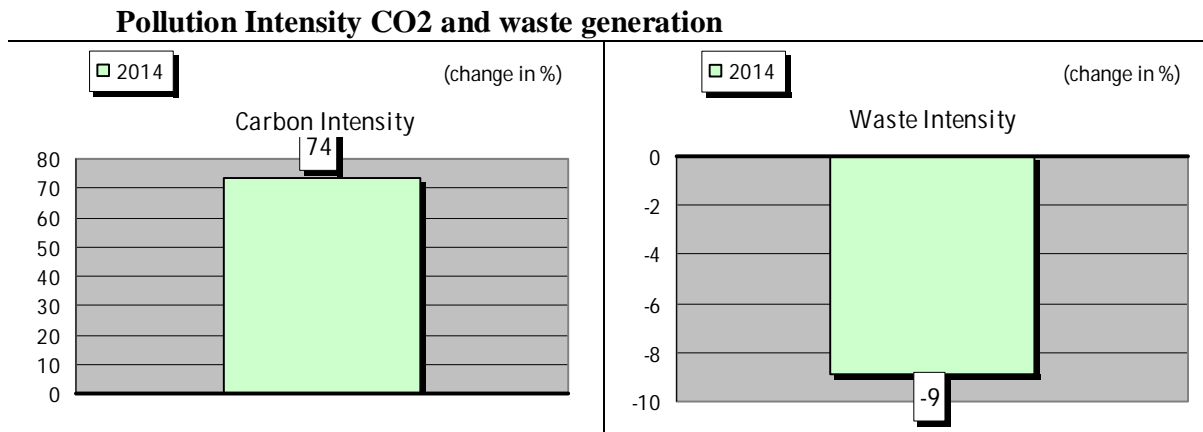


Figure 8: Pollution Intensity CO2 and waste generation

The CO2 emissions intensity from energy consumption increased by 74% because of the increased gas and diesel consumptions, associated with conferences and workshops and with all energy conservation measures in place at Tivoli hotel Maputo we believe that it will decrease in the coming years.

Regarding the pollution intensity from solid waste generation decreases by 9% and is related to decrease in the number of guests in 2014.

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Success Areas

- Replaced 123 conventional incandescent bulbs of 60W by energy saving bulbs of 11 W to reduce the energy consumption;
- Replaced 113 halogen spots of 50W, by Led lights of 3W to reduce the energy consumption;
- Introduced waste segregation system to recovered 72% of recyclable materials;
- Hotel Staff were trained on awareness raising on resource conservation;
- Distributed brochures and flyers, or post stickers and posters, inviting guests to save water;
- Installed water-saving devices in the appropriate places (e.g water flow sensors, self-closing taps, etc.).

Table 2: Option Implemented

Principal Options Implemented	Benefits			
	Economic		Resource Use	Pollution generated
	Investment [USD]	Cost Saving [USD/yr]	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
Replaced 123 incandescent bulbs of 60 W by energy saving bulbs of 11 W to reduce the energy consumption	351,78	2.543,03	Environmental benefits reduction in hotel's energy consumption of 26.398,26 kwh/year	Reduction of 14% of CO2 emission
Replaced 113 halogen spots of 50 W, by Led lights of 3 W to reduce the energy consumption	2,260.00	2,240.92	Environmental Benefits reduction in hotel's electricity consumption of 23,262.18 kwh/year	Reduction of CO ₂ emission and reduce costs of electricity bills

Approach taken

The Tivoli Hotel Maputo management as concerned on resource efficiency and environment conservation issues, in their complex. For this purpose the Mozambique National Cleaner Production Center (MNCPC), offered assistance and conducted RECP in plant assessment through the MNCPC team of national experts together with hotel CP team and several no and low cost measures, were recommended and successfully implemented, the high cost investment

were related to the installation of solar thermal water heating system in the guest rooms, and Installation of 88 master switch key cards, to control the electricity for lighting and AC in the guest rooms not implemented yet.

So that the Solar thermal water heating system could reduce electricity consumption for water heating, with consequent reduction of the Environmental impact.

Master switch cards could also control electricity consumption when the guest leaves their room and this avoid to have the AC and lights on in the guest vacant rooms.

The financial savings expected from implementation of the master switch key cards is around USD 13,875.84/year. With estimated investment of USD 2, 240.92.

The economic benefit expected from implementation solar thermal water heating system is equivalent to financial savings of USD 4,944.00/year and with estimated investment of around 13,033.00 USD.

Business case

The RECP not only allows companies to achieve savings from decreased resource use, but also decreases pollution to the environment, which benefits the surrounding community.

Testimony Box

National Cleaner Production Centre (NCPC)

The Mozambique National Cleaner Production Centre (MNCPC) was officially established in 2001, and operates as the executive arm of FEMA - Business Forum for the Environment, under the policy advice component is the focal point of Ministry of Land, Environment and Rural Development (MITADER) and with the support and expertise from UNIDO and UNEPs RECP net.

The Centre offers service in the areas of Resource Efficiency and Cleaner Production, Waste Management, Energy Efficiency and Renewable Energy, and Sustainable Management.

Summary of MNCPC achievements 2010-1014

- **18** Awareness Raising Seminars and Training were carried out for the national experts, managers and company technicians, public officials and the municipalities of Maputo and Matola representatives.
- **33** National experts trained on UNIDO methodology RECP toolkit;
- **65** Hotel Managers, companies technicians, government officials and Municipalities of Maputo and Matola representatives have attended the Awareness Raising Workshops on Resources Efficiency Use and Cleaner Production and **146** Hotel and company technicians



RECP Experiences



trained on RECP;

- Wide Seminars for dissemination of RECP concepts delivered for **165** students and teachers of Instituto Industrial de Maputo (IIM) and Escola Superior de Hotelaria e Turismo de Inhambane (ESHTI) that is Eduardo Mondlane University Branch;
- Awarding Ceremony Workshop and Presentation of Results of the First Round of RECP assessments conducted and Awards of 7 hotels by good performance and commitment on environmental conservation and resource efficiency use in 3 of November 11 at VIP hotel Maputo jointly organized by UNIDO, MICOA, MITUR and MNCPC.

Total of **21** companies being (16 hotels and 5 supply chain industries of food products to the tourism sector) were subjected to the RECP assessments and their respective RECP reports document the results have been delivered with financial savings options, including investments, environmental and technical benefits.

Contact Details

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English Abstract (where applicable)

N/A

ABOUT RECP EXPERIENCES

Through the joint Resource Efficient and Cleaner Production (RECP) Programme, the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) cooperate to improve the resource productivity and environmental performance of businesses and other organizations in developing and transition countries. The Programme is implemented in partnership with the Global Network for Resource Efficient and Cleaner Production (RECPnet). This series of enterprise success stories documents the resource productivity, environmental and other benefits achieved by enterprises in developing and transition countries through the implementation of RECP methods and practices.

These successes were achieved with the assistance of the National Cleaner Production Centres, which are part of RECPnet established with support of the UNIDO and UNEP. The success stories employ the indicator set described in *Enterprise Level Indicators for Resource Productivity and Pollution Intensity*, UNIDO/UNEP, 2010. The primer with accompanying calculator tool and further case studies are available at www.recpnet.org, as well as on www.unido.org/cp and www.unep.fr/scp/cp.

RECP Experiences at Vale S.A. – Usina de Vargem Grande

The efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Resource Efficient and Cleaner Production (RECP) is a way to achieve this in a holistic and systematic manner. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production. Benefits are eminent in many enterprises, regardless of sector, location or size, as demonstrated by the experiences of Vale S.A. – Plant of Vargem Grande in Brazil.

Achievements at a Glance

The implementation of RECP in the company Vale SA, Vargem Grande Plant, generated several improvement actions where two initiatives are highlighted: the first is related to the effluents generation reduction with losses of raw materials and the second is related to reduce electricity consumption with lighting due to behavioral changes. These two actions have provided an annual cost savings of US \$ 167,607.00 and demanded a total investment of US \$ 4,582.00. The environmental benefits achieved covered the reduction of energy consumption, reduction of water consumption, reduction in the generation of effluent and reduction of ore fine's losses.

Overview

Vale is the world's leading producer of iron ore and pellets, and second largest nickel producer. Operating through offices, operations, holdings and joint ventures, it is the second largest diversified mining company in the world and the largest in the Americas by market value. Headquartered in Brazil, operates in 38 countries on five continents and employs more than 115,000 people, including employees and contractors, worldwide.

The Plant of Vargem Grande Mine, founded in 2001, is one of the iron ore processing plant of Vale and has 300 employees. All processing of the plant is carried out wet, being generated, on average, 17.6 Mt of products annually, including pellets Lump Ore and Hematitinha, Sinter Feed and Pellet Feed Fine, the latter supplies the pelletizing plant in flow continuous.

The processing of the products is accomplished by means of steps: feed, screen classification stacking, desliming, concentrate thickening, flotation, filtration, sludge thickening, and as auxiliary all maintenance.

Benefits

In the Vargem Grande plant the screening is performed wet and a major concern in the classification of products is the efficiency of this phase (separation quality that sieve provides). If the formed pulp is very dense, occurs clogging of the meshes which difficult classification and causing the over sized contamination. Before the implementation of RECP, the low efficiency of the washing product screening system hindered the screening performance, demanding large consumption of water and promoting the overflow of the washing tank. The focus of the RECP implementation was to map the gaps and look for ways to reduce losses from the tank overflow, as these are environmentally significant, had not yet been properly mapped, they provide cost reduction opportunities, allow the capture of measurable quantitative data and generate major negative visual impact.

Change driven: Item prioritized in the inventory of waste and effluents of the Vargem Grande plant due to high volume of sludge (water + ore) generated in the screening step being sent to the dam.



Figure 1: Before Cleaner Production: Large volume of sludge being sent to the barrage of Vargem Grande

Picture after cleaner production is not available

Another check performed in the implementation of RECP was the percentage of lamps lit during the daytime operation of some areas in the Vargem Grande Plant. Except for the areas of transporters and compressors, where there isn't natural lighting and lamps sectors must remain constantly connected, other locations may optimize the lighting use. With a behavioral change, using the lighting system only when necessary, there will be a reduction of about 40% of the time of use, practically doubling the life of the lamp and reducing consumption. This change was motivated by the easy implementation, with immediate returns.



Figure 2: Before Cleaner Production: lamps lighted during the daytime period

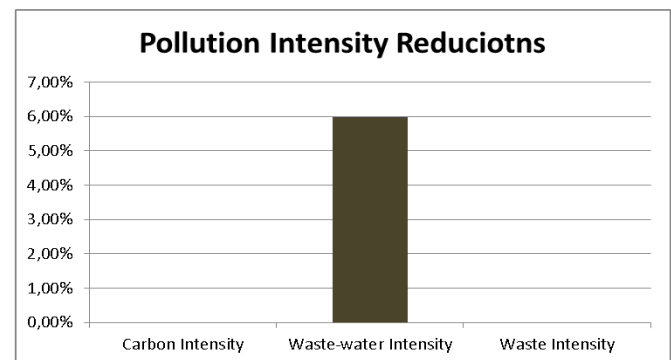
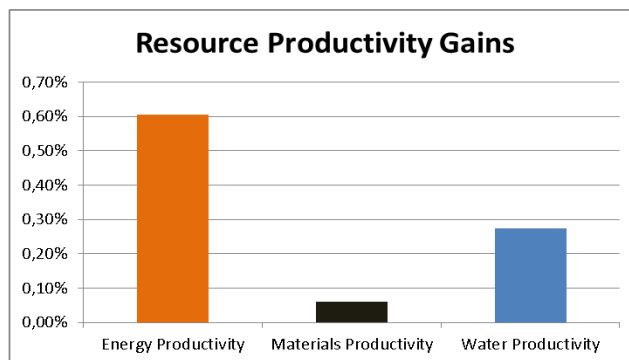
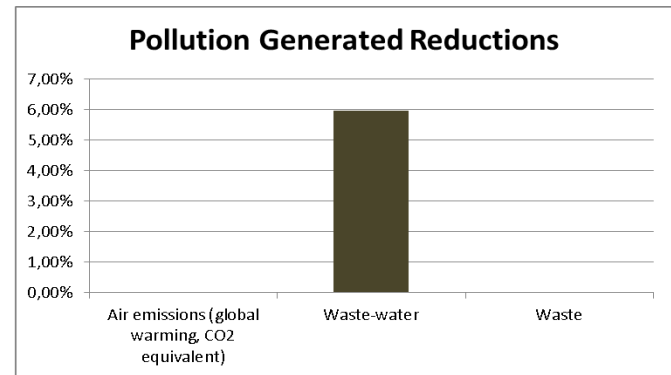
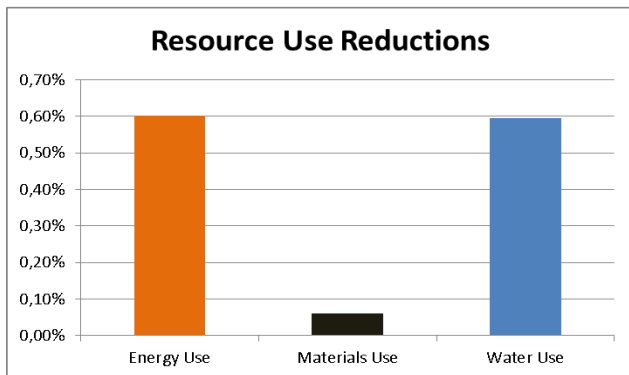


Figure 3: After Cleaner Production: With a behavioral change, it uses the illumination system only when necessary

Absolute Indicator	Change (%) Year 1	Relative Indicator	Change (%) Year 1
Resource Use		Resource Productivity	
Energy Use	-0,602%	Energy Productivity	0,61%
Materials Use	-0,06%	Materials Productivity	0,06%
Water Use	-0,596%	Water Productivity	0,27%
Pollution Generated		Pollution Intensity	
Air emissions (global warming, CO ₂ equivalent)	N/A	Carbon Intensity	N/A
Waste-water	-5,98%	Waste-water Intensity	-5,98%
Waste	N/A	Waste Intensity	N/A
Production Output	N/A		

Note: The absolute indicators provide a measurement of how much resource use/pollution output has changed in absolute terms e.g. units of energy used or tons of waste generated. A negative percentage indicates a decrease and a positive percentage indicates an increase. The relative indicators provide a measurement of changes in resource use/pollution in relation to production output. Resource productivity provides a measurement of how much product output can be produced per unit of resource use, from a sustainability perspective, productivity should increase. Pollution intensity provides a measurement of how much pollution is generated per unit of production output, from a sustainability perspective, intensity should decrease.

RECP Profile



Resource Efficient and Cleaner Production (RECP)

Resource Efficient and Cleaner Production (RECP) entails the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

RECP addresses three sustainability dimensions individually and synergistically:

- *Production efficiency*
 - > Through improved productive use of natural resources by enterprises
- *Environmental management*
 - > Through minimization of the impact on nature by enterprises
- *Human development*
 - > Through reduction of risks to people and communities from enterprises and supporting their development



Success Areas

The set of actions taken to improve the indicator index that measures the amount of water used to make the ore washing in the sieves were:

- Maintenance and/or replacement of the nozzles of the water sprays of screens to increase the pressure and cleaning efficiency
- To analyze the mechanical condition of bombs aimed at maximizing water pressure in the supply line of water of screens and pumping the reuse dam water
- Install pressure monitors in the lines
- Standardize operating conditions, to work in an ideal pressure.

The set of actions taken to improve the index of unnecessarily lighted lamps included:

- Visual examination of the need for illumination of sites
- Practice of weekly audits to quantify the number of lit lamps
- Switch off the lighting in the daytime hours.
- Awareness to behavioral change
- Preparation of procedure guiding for switching on / off the lamps.

Principal Options Implemented	Benefits			
	Economic		Resource Use	Pollution generated
	Investment [USD]	Cost Saving [USD/yr]	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
Replacing of the nozzles of water sprays of screens and Installation of pressure monitors lines	US\$ 4.582,00	US\$ 143.200,00	Reduction in energy consumption 135,351.00 kWh Reduction in water consumption 30,000.00 m ³ Reduction in ore fine's losses 12,300.00 t	Reduction in effluent generation 300.782,00 m ³
Behavioral change, using the lighting system only when needed	0	US\$ 24.407,00	Reduction in energy consumption 280.429,19 kWh	

Approach taken

From the design of flow charts and analysis of inputs and outputs of the phases of the plant's processes, areas were identified most likely to implement RECP actions, leading to identification of the most important focus for the case studies. One of the focus identified as RECP potential was screening step consisting in size classification or separation of a material into two or more particle size fractions through a perforated surface. Another focus of research was related to lighting, due to the number of lamps lit during the daytime operation in some sites of Vargem Grande Plant, this fact was identified as a potential application of the RECP method. It was identified that the lighting systems were turned on 24 hours a day, resulting in a waste of energy and reduced lamp life.



RECP Experiences



Testimony Box

National Cleaner Production Centre (NCPC)

The SENAI National Cleaner Technologies Centre was created in July 1995, upon the accepted candidature of SENAI Rio Grande do Sul to nest the National Cleaner Production Centre of Brazil, through a UNIDO/UNEP call for candidate institutions to establish a NCPC in developing countries. CNTL was the 10th NCPC implanted in the world and the 1st in Latin America. Since 2002, we are the national focal point for Cleaner Production matters by appointment of the Brazilian Government to UNIDO/UNEP.

SENAI CNTL integrates the network of Units of SENAI-RS, a branch of SENAI (National Service of Industrial Education), a nationwide institution with a tradition of 62 years of professional education and services for industries. CNTL responds for the technical coordination of the Cleaner Production Network of CNI (the National Confederation of the Industry).

Contact Details

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ABOUT RECP EXPERIENCES

Through the joint Resource Efficient and Cleaner Production (RECP) Programme, the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) cooperate to improve the resource productivity and environmental performance of businesses and other organizations in developing and transition countries. The Programme is implemented in partnership with the Global Network for Resource Efficient and Cleaner Production (RECPnet). This series of enterprise success stories documents the resource productivity, environmental and other benefits achieved by enterprises in developing and transition countries through the implementation of RECP methods and practices.

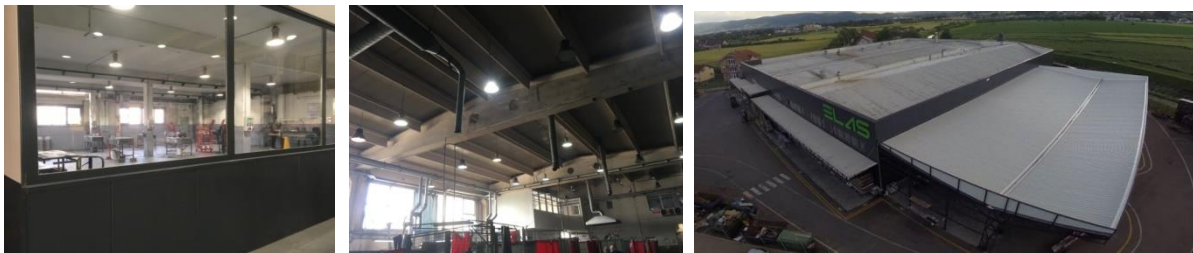
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RECP Experiences at ELAS Metalexpert

The efficient and environmentally sound use of materials, energy and water, coupled with the minimization of waste and emissions, makes good business sense. Using Resource Efficient and Cleaner Production (RECP) this can be achieved in a holistic and systematic manner. RECP applies preventive management strategies to improve natural resources productivity, minimize generation of waste and emissions, and foster safe and responsible production. As experiences of ELAS Metalexpert Bosnia and Herzegovina show, benefits are obvious in many enterprises, regardless of their line of business, location or size.

Achievements at a Glance

The Resource Efficient and Cleaner Production (RECP) project in ELAS Metalexpert sheet metal processing industry will achieve annual savings of EUR 96,601.46 , with investment of EUR 68,615.38 and payback time of 9 months. By application of the RECP measures, a total energy consumption will be reduced by 27 %.



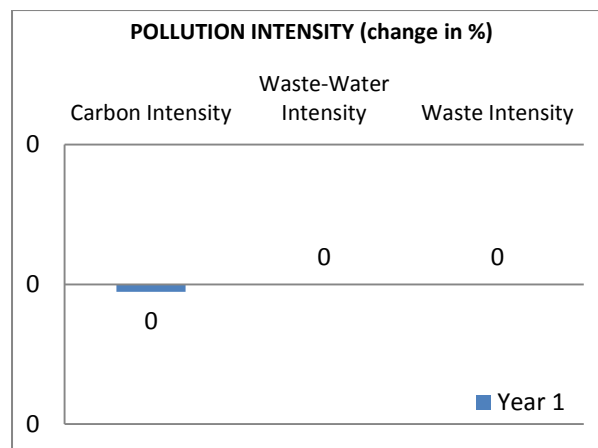
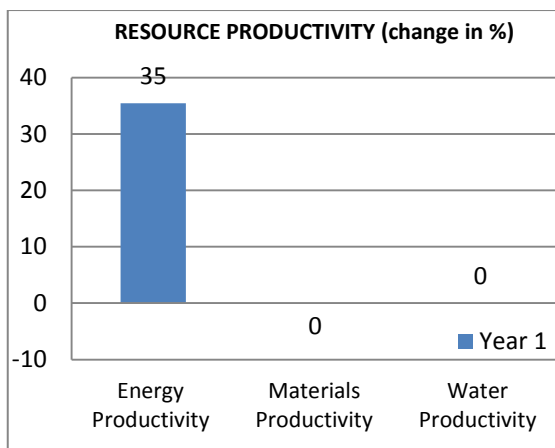
Overview

ELAS Metalexpert was founded in 1994 with the focus on sheet metal processing. The company now expands on 5500 square meters and has 110 employees. With our design and project teams we provide full service, from customer idea to 3D model and project prototype.

Benefits

Absolute Indicator	Change (%)	Relative Indicator	Change (%)
Resource Use		Resource Productivity	
Energy Use	-26.18	Energy Productivity	35.47
Water Use	0	Water Productivity	0
Pollution generated		Pollution Intensity	
Air Emissions (global warming, CO2 eq.)	-0.02	Carbon Intensity	-0.02
Waste-Water	0	Waste-Water Intensity	0
Waste	0	Waste Intensity	0

RECP profile



Resource Efficient and Cleaner Production (RECP)

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Success Areas

RECP measures	Benefits				
	Economic			Resources	Waste flow
	Investment (EURO)	Savings (EURO/year)	Pay back period	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
Utilization for rainwater	1,636.13	58.28	28 year and 1 month		
Installation of soft starter	5,624.21	6,442.27	11 months	Electric energy 1.030 kWh	
Installation of biomass boiler	25,564.60	58,645.19	5 months	Energy 663.60 MWh	
Installation of Termopanel	23,008.14	12,018.42	1 year and 10 months	Electric energy 117.530 kWh	
Utilization of waste heat from the plastification plant	5,112.92	364	14 years	3.562 MWh	
Utilization of waste heat from the compressor plant	7,669.38	19,437.27	5 months	Electric energy 190.080 kWh	



RECP Experiences



Approach taken

The Company participated in the National Cleaner Production Program in Bosnia and Herzegovina as one of the ten selected companies. The RECP assessment was performed by the company team and national experts trained in RECP methodology. The RECP assessment was supervised by international experts. The purpose of assessments made at the beginning of the project was to prepare a material balance, an energy balance and balances of water consumption and wastewater. After consultation with expert teams the company management selected the RECP measures to be implemented. The selected RECP options will be implemented in following years (management of company did not specify timeline).

Testimony Box

National Cleaner Production Program in Bosnia and Herzegovina

The program is designed to foster expertise, service delivery capacity and implementation of RECP practices and policies in the country, building on UNIDO's experience in supporting National Cleaner Production Programmes (NCPPs) and Centres (NCPCs), in collaboration with UNEP, under the global joint RECP Programme. The program that was officially launched in 2015, contributes to improve the resource efficiency and environmental performances in terms of sensible use and management of natural resources in businesses and other organizations in Bosnia and Herzegovina. Applying a systematic RECP approach, the project aims at providing:

- Training to national experts on UNIDO's RECP methodology
- Assessment services to companies
- Information dissemination and awareness raising

Contact Details

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RECP Experiences at Srebreničanka.

The efficient and environmentally sound use of materials, energy and water, coupled with the minimization of waste and emissions, makes good business sense. Using Resource Efficient and Cleaner Production (RECP) this can be achieved in a holistic and systematic manner. RECP applies preventive management strategies to improve natural resources productivity, minimize generation of waste and emissions, and foster safe and responsible production. As experiences of “Srebreničanka” d.o.o. Bosnia and Herzegovina show, benefits are obvious in many enterprises, regardless of their line of business, location or size.

Achievements at a Glance

The Resource Efficient and Cleaner Production (RECP) project in Srebreničanka potatoes processing industry will achieve annual savings of 865.000 EUR with investment of EUR 179,000.00 and payback time of 4 months. By application of the RECP measures, a total energy consumption will be reduced by 62 % and the carbon dioxide emissions by 62%.



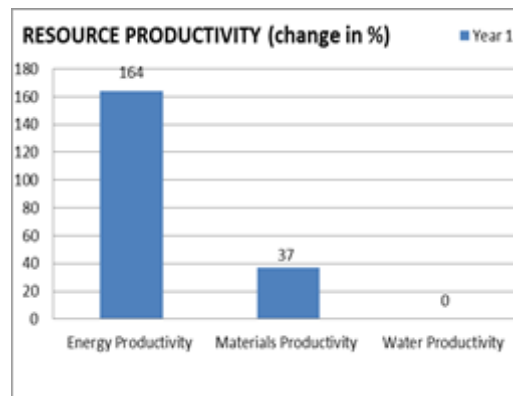
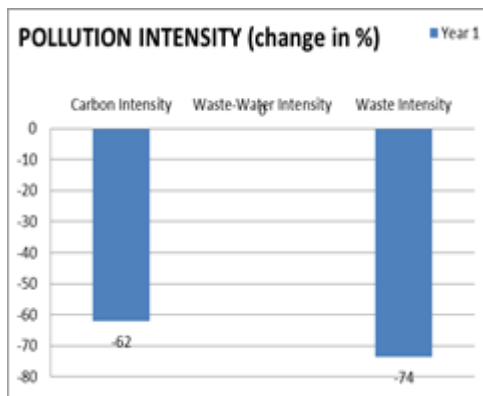
Overview

Srebreničanka processes potatoes in to different form of sliced potatoes, which is then frozen packed and distributed to commercial centres. The company is established in 2015. Factory for French fries production from Srebrenica was launched as a strong need to carry out a substitution of imports significant quantities of French fries and other potato products quality domestic product.

Benefits

Absolute Indicator	Change (%)	Relative Indicator	Change (%)
Resource Use		Resource Productivity	
Energy Use	-62	Energy Productivity	164
Materials Use	-27	Materials Productivity	37
Water Use		Water Productivity	0
Pollution generated	0	Pollution Intensity	0
Air Emissions (global warming, CO2 eq.)	-62	Carbon Intensity	-62
Waste-Water	0	Waste-Water Intensity	0
Waste	-74	Waste Intensity	-74

RECP profile



Resource Efficient and Cleaner Production (RECP)

Resource Efficient and Cleaner Production (RECP) entails the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

RECP addresses three sustainability dimensions individually and synergistically:

- *Production efficiency*
> Through improved productive use of natural resources by enterprises

- *Environmental management*
> Through minimization of the impact on nature by enterprises

- *Human development*
> Through reduction of risks to people and communities from enterprises and supporting their development



Success Areas

RECP measures	Benefits				
	Economic			Resources	Waste flow
	Investment (EURO)	Savings (EURO/year)	Pay back period	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
Peeling potatoes with steam	n.d.	n.d.	n.d.	n.d.	Waste 3,356 t
Production of biogas	10,225.84	65,007.20	2 months	Electric energy 1,935 .337 kWh	
Production of biodiesel	48,572.74	360,767.65	2 months	-	-
Installation of biomass boiler	120,000.00	440,000.00	4 months	5800 MWh	CO ₂ 3,042.35 t

n.d. – not defined



RECP Experiences



Approach taken

The Company participated in the National Cleaner Production Program in Bosnia and Herzegovina as one of the ten selected companies. The RECP assessment was performed by the company team and national experts trained in RECP methodology. The RECP assessment was supervised by international experts. The purpose of assessments made at the beginning of the project was to prepare a material balance, an energy balance and balances of water consumption and wastewater. After consultation with expert teams the company management selected the RECP measures to be implemented. The selected RECP options will be implemented in following period (management of company did not specify timeline).

Testimony Box

National Cleaner Production Program in Bosnia and Herzegovina

The program is designed to foster expertise, service delivery capacity and implementation of RECP practices and policies in the country, building on UNIDO's experience in supporting National Cleaner Production Programmes (NCPPs) and Centres (NCPCs), in collaboration with UNEP, under the global joint RECP Programme. The program that was officially launched in 2015, contributes to improve the resource efficiency and environmental performances in terms of sensible use and management of natural resources in businesses and other organizations in Bosnia and Herzegovina. Applying a systematic RECP approach, the project aims at providing:

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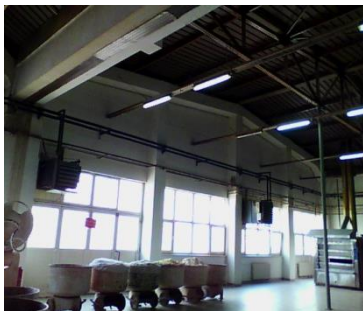
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RECP Experiences at Klas d.d. Sarajevo

Efficient and environmentally sound use of materials, energy and water - coupled with the minimization of waste and emissions - makes good business sense. Using Resource Efficient and Cleaner Production (RECP) this can be achieved in a holistic and systematic manner. RECP applies preventive management strategies to improve natural resources productivity, minimize generation of waste and emissions, and foster safe and responsible production. As experiences of Klas d.d. Sarajevo from Bosnia and Herzegovina show, benefits are obvious in many enterprises, regardless of their line of business, location or size.

Achievements at a Glance

The Resource Efficient and Cleaner Production (RECP) project in Klas d.d., a commercial bakery products manufacturing industry, will achieve annual savings of EUR 33,813 with investment of EUR 102,075 and payback time of 36 months. Implementation of all suggested resource efficiency measures will reduce electric energy consumption by 7.7% and fuel consumption by 3.6%. Total energy consumption reduction is 4% and water consumption reduction is 11%. Carbon footprint of 5,526 t CO₂/a will be reduced by 6% and amount of waste water will decrease by 21%.



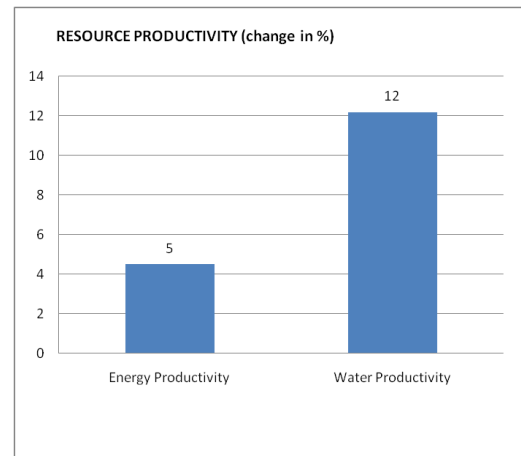
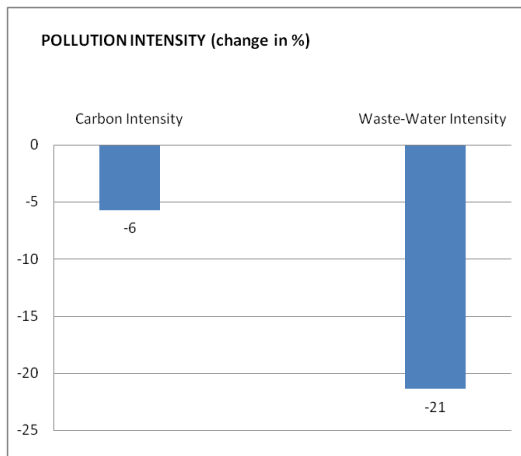
Overview

“Klas” d.d. Sarajevo develops, produces and sells grain-based food: flour, bread, rolls, pasta, confectionery products, etc. It has its own mills, bakery plants, shops and shopping centres where domestic products prevail in overall range of products. Klas offers its own products at the market for final users, industrial consumers and other bakeries, via its own retail and wholesale network. “Klas” exports its products at the markets of the region, EU, USA, and Middle East countries. “Klas” is the company whose business operations rest on the top-quality products and services through consistent application of the guidelines and requirements of internationally acknowledged systems and norms of quality management – ISO 9001:2000, ISO 14001:2004, HACCP, KRAV, HALAL.

Benefits

Absolute Indicator	Change (%)	Relative Indicator	Change (%)
Resource Use		Resource Productivity	
Energy Use	-4	Energy Productivity	5
Water Use	-11	Water Productivity	12
Pollution generated		Pollution Intensity	
Air Emissions (global warming, CO ₂ eq.)	-6	Carbon Intensity	-6
Waste-Water	-21	Waste-Water Intensity	-21
Waste	0	Waste Intensity	0

RECP profile



Resource Efficient and Cleaner Production (RECP)

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- *Environmental management*

> Through minimization of the impact on nature by enterprises

- *Human development*

> Through reduction of risks to people and communities from enterprises and supporting their development



Success Areas

RECP measures	Benefits				
	Economic			Resources	Waste flow
	Investment EURO	Savings (EURO/year)	Payback period		
				Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
Installing thermostatic radiator valves	1,350	495	2 years and 9 months	Fuel 1,383.8 m ³	2.6 tCO ₂
Repair of pipeline and heat insulation on distribution channels of refrigeration machines, replacement of sealed tire in cold storage rooms	4,264	3,183	1 year and 4 months	Electric energy 41,504.9 kWh	65.2 tCO ₂
Installing plastic curtain for cold storage	383	2,387	2 months	Electric energy 327,2 kWh	48.9 tCO ₂
Replacement of fluorescent tube T12 with T8 in production plant; and replacement of magnetic with electric damper	7,737	2,403	3 years and 3 months	Electric energy 31,326.9 kWh	49.3 tCO ₂
Installing variable	3,579	1,254	2 years	Electric energy	25.7 tCO ₂

RECP measures	Benefits				
	Economic			Resources	Waste flow
	Investment EURO	Savings (EURO/year)	Payback period	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
frequency drives (VFD) on line ones mixer at bread production line			and 10 months	16,352.0 kWh	
Automatic boiler (Toplota Zagreb) blowdown system and installing heat exchanger and tank for blowdown wastewater utilization	14,316	3,218	4 years and 5 months	Fuel 7,897.8 m ³ Water 233 m ³ vode	Waste water 272.2 m ³ 14.7 tCO ₂
Insulating condensate receiver in boiler room	92	465	2 months	Fuel 1,299.8 m ³	2.4 tCO ₂
Replacing thermal insulation of Toplota Zagreb boiler	818	1,322	7 months	Fuel 3,692.8 m ³	6.9 tCO ₂
Installing economizer in Toplota Zagreb boiler	33,234	7,725	4 years and 4 months	Fuel 21,584.4 m ³	40.2 tCO ₂
Installing high-pressure blowers for pan cleaning in Velepekara plant	511	655	9 months	Electric energy 8,541.0 kWh	13.5 tCO ₂
Installing VFD on compressors' motors	5,113	3,359	1 year and 6 months	Electric energy 43,800.0 kWh	65.2 tCO ₂
Utilization of rainwater from rooftop of Velepekara plant	20,452	5,147	4 years	Water 3,216.5 m ³	
Utilization of rainwater from silo's rooftop	10,226	2,198	4 years and 8 months	Water 1,378.0 m ³	



RECP Experiences



Approach taken

The Company participated in the National Cleaner Production Program in Bosnia and Herzegovina. The RECP assessment was performed by the company team and national experts trained in RECP methodology. The RECP assessment was supervised by international experts. The purpose of assessments made at the beginning of the project was to prepare a material balance, an energy balance and balances of water consumption and wastewater. In consultation with expert teams the company management selected the RECP measures to be implemented. Installing variable frequency drives on air compressors proved to be the major contributor to electric energy savings, and when it comes to fuel savings; installing boiler economizer is the leading contributor to fuel consumption reduction. Installing plastic curtain for cold storages is the suggested measure with the shortest payback period which, at the same time, contributes to electric energy consumption savings by 18%. Two major CO₂ reduction come from (1) installing VFD on compressors' motors and (2) repairing of pipeline and heat insulation on distribution channels of refrigeration machines, and replacement of sealed tire in cold storage rooms.

Testimony Box

National Cleaner Production Program in Bosnia and Herzegovina

The program is designed to foster expertise, service delivery capacity and implementation of RECP practices and policies in the country, building on UNIDO's experience in supporting National Cleaner Production Programmes (NCPPs) and Centres (NCPCs), in collaboration with UNEP, under the global joint RECP Programme. The program that was officially launched in 2015, contributes to improve the resource efficiency and environmental performances of businesses and other organizations in Bosnia and Herzegovina. With the application of a systematic RECP approach, the project aims at providing:

- Training to national experts on UNIDO's RECP methodology
- Assessment services to companies
- Information dissemination and awareness raising

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‘Cleaner Production is a journey, not a destination’



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