Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH/Abt. 44

Pilot Programme for the Promotion of Environmental Management in the Private Sector of Developing Countries (P3U)

Case Study

Environmental Cost Management

at Cairns Foods Limited,

Harare, Zimbabwe 1997

P3U-Working Paper No. 10e **February 1998**

Co-sponsored by by:

Confederation of Zimbabwe Industry (CZI)

Pilot Programme for the Promotion of Environmental Management in the Private Sector of Developing Countries (P3U) of GTZ (German Technical Cooperation)

Advisory Services for Private Business (ASPB) of GTZ

Published by:

GTZ-Pilot Programme for the Promotion of Environmental Management

in the Private Sector of Developing Countries (P3U)

Wachsbleiche 1, 53111 Bonn

Tel.: (+49) 0228 604710 Fax: (+49) 0228 98570-18

E-mail: gtzp3u@aol.com

Homepage: http://www.gtz.de/p3u

Responsible: Dr. Edith Kürzinger (Head of GTZ-Programme P3U)

Author: Hartmut Fischer, Kienbaum Unternehmensberatung, Grolmannstr. 36, 10623 Berlin

Tel.: +49 (030) 8801980, Fax +49 (030) 88019815, E-Mail address: hartmut.fischer@kienbaum.de

Management Summary

Industry in developing countries is under pressure to rapidly improve productivity in order to become more competitive in an ever more global economy. Developing countries as a whole are confronted with the challenge to introduce more effective, yet economically affordable, environmental management with the aim of making a considerable contribution to sustainable development.

The Pilot Programme for the Promotion of Environmental Management in the Private Sector of Developing Countries (P3U) of the German Agency for Technical Cooperation (GTZ) has identified a number of methodologies for addressing these two, apparently conflicting, goals: economic efficiency and environmental sustainability.

One of these methodologies is **Environmental Cost Management (**ECM). It helps companies

- to identify relevant material and energy flows,
- assess their economic costs and environmental impact as well as
- to find options for the improvement of the environmental performance of the company while reducing costs.

Sofar, ECM has been applied in a number of companies in Germany, where the **typical results** have been a net reduction of a company's total cost by 1 – 2 % and a reduction in waste streams (or non-product output, as ECM names it) by 20 –40 %.

Zimbabwe is the first developing country to respond to the offer of P3U to implement ECM under the specific local conditions, namely through the Confederation of Zimbawe Industry (CZI), whose programme „Productivity, Environment and Trade" (PET) is supported by the regional programme of GTZ „Advisory Service for Private Business" (ASPB).

ECM was applied through a 9-day project at the Harare plant of Cairns Foods Limited. The dual objective was

- to generate an improved use of natural resources and the respective cost reductions, as well as

- to build local know-how and capacities in ECM.

The Harare plant of Cairns produces potato chips, coffee, peanut butter, pet-food and other, largely dry goods, employing some 800 persons. As the major non-product outputs (NPO) have been identified waste heat, emissions to air from production processes and raw materials not utilised for the final product.

Since the customer only pays for the product, not the non-product output, any reduction in NPO will directly improve the profitability of the company.These NPOs do not only harm the environment but do also cause considerable costs at Cairns, since they

- are paid for as raw materials in purchasing,
- stored and handled within the company during production
- and, in some cases, they need to be disposed of at a relevant cost.

The results of the application of ECM at Cairns showed similar results as in Germany. The four day analysis of Cairns' NPO flows and their costs (*Phase I*) showed that NPO caused **33 % of the total cost** of Cairns Harare plant. The measures developed subsequently in another four days (*Phase II*) only for a few of the identified NPOs are expected to cut the cost of the selected NPOs by 15 % or 67,000 US$ per year. This implies that the overall cost saving potential of ECM at Cairns is about **5 % of total cost**.

The **environmental effects** include

- potential energy savings of 9 – 61 % (depending on the investment scenario chosen),
- a reduction of emissions to air by some 68 % and
- a reduction of solid waste by 14 %.

In addition, product quality and working conditions may be improved.

The results indicate that ECM is also a viable tool for increasing productivity as well as reducing resource use and pollution when applied in firms in developing countries.

Table of Contents

1. Background

Industry in developing countries is under pressure to rapidly improve productivity in order to become more competitive in an ever more global economy. While the reduction of trade barriers provides improved access to foreign markets it also opens the national markets for international competitors. Successful competition on both national and international markets requires high levels of productivity, product quality and flexibility in responding to changes in the business environment.

Developing countries as a whole are confronted with the challenge to introduce more effective, yet economically affordable, environmental management with the aim of making a considerable contribution to sustainable development.

Another challenge that industry and government in developing countries are facing is to achieve a not only economically but also environmentally sustainable development, thereby maintaining the national, natural resource base for the welfare of today's and tomorrow's population. Command-and-control approaches of environmental policy can make a significant contribution to achieve this objective, but – as experiences all over the world show - they are limited in their scope, especially in developing countries where resources for enforcement of legislation is rather scarce.

Therefore, one attractive strategy for spreading proactive instruments such as environmental management and pollution prevention in industry is to identify (economic-ecological) win-win-options, e.g. technical and organisational measures which allow both the increase of productivity **and** the reduction of pollution. These instruments serve the interests of industry in maintaining and increasing its earnings and the interests of the public in moving towards more sustainable development.

The pilot programme P3U of the German Agency for Technical Cooperation (GTZ) to identify, further develop, test and evaluate methods that are suitable for the reduction of pollution caused by industry in developing countries. One of the methods identified by P3U is Environmental Cost Management.(ECM), which has been proven to be effective in identifying „hidden" win-win-options in industry. Typical results in Germany have been a reduction in pollution levels of 20 – 40 % and a net reduction in total costs of 1 – 2 %. ECM has been developed by Kienbaum, a German management consultancy.

The basic concept of ECM is that every kilogramme of solid waste, every litre of waste water and every cubic meter of emissions do not only harm the environment but do also reduce the company's bottom line. These „non-product outputs" (NPO) were paid for as input materials and cause additional costs while being transported, worked upon and treated in the company. While these NPO cause considerable costs (in Germany typically 5 – 15 % of total cost) they do not generate any significant revenue. A reduction in NPO will therefore directly improve the bottom line - and incidentally improve environmental performance. Although ECM serves the purposes of cleaner production, it is, however, more strongly cost-driven and also simpler in its aplication. At a later stage, however,

ECM can be easily supplemented by the cleaner production methodology or environmental management systems.

2. Objectives

Based on the European experience with ECM, P3U choose to conduct an ECM project at a manufacturing company in a developing country. Objectives of the project were to evaluate the effectiveness of ECM

- in achieving combined cost savings and environmental benefits in the context of a developing country,
- in building local capacities for the application of ECM by training both company personnel and local consultants on the job.

Zimbabwe was chosen because the response to an initial presentation of ECM to industry in July 1997 was clear and positive. The ECM-project was embedded into the ongoing Productivity, Environment and Trade Programme (PET), undertaken by the Confederation of Zimbabwe Industries (CZI) and supported by the Advisory Service for Private Business (ASPB) of GTZ.

3. Company

The evaluation project was conducted at the Harare plant of Cairns Foods Limited. Cairns Foods Limited is one of the major food manufacturers in Zimbabwe and is owned by national capital. Total turnover is roughly 31,000,000 US$ and achieved in the strategic business units Winery, Cannery, Chips and Groceries (the latter are mostly dry goods). Cairns predominantly serves the national market, although it is expanding into neighbouring countries and has some limited exports to the European Union. Customers are predominantly retailers but also include wholesalers.

The total costs of production of the Harare plant run up to 18,000,000 US$, employing 800 persons (predominantly men). It manufactures potato chips, coffee (ground and instant), dry pet foods and a variety of groceries such as cornflakes, peanut butter and spices.

The R&D department performs both product and process development.

Processes

In chips, the production processes entail washing, peeling, slicing, frying and packaging the potatoes. In coffee the production processes consist of roasting, grinding and packaging the coffee. In the elaboration of instant coffee the ground coffee is extracted and spray dried before packaging. In pet foods, the input materials (20 % of which are wastes from the food plants) are ground, formed into biscuits or other shapes, baked and packaged. The production processes of other groceries (e.g. cornflakes, peanut butter, snacks) usually comprise peeling, forming or cutting, followed by roasting, baking or frying and, finally, packaging. In some cases, the processes are limited to mixing and packaging (e.g. spices, vinegar).

After packaging, the products are taken to a central warehouse which also serves other plants of Cairns. Distribution takes place both through the company's own fleet as well as subcontractors. A considerable part of the corrugated cardboard boxes used for storage at the warehouse and distribution are returnable. Returned boxes that are still in good condition are reused (average use: 8 times).

The plant uses electric energy, coal and coke as energy sources. Coal is transformed into steam. Coke is transformed into producer gas. Liquid petroleum and oil do not represent significant energy inputs.

Environmental relevance of processes

Environmentally significant processes are

- the energy use in most production processes, resulting in the consumption of coke and coal, CO_2-emissions and emissions of SO_2 and $NO_;$
- the use of packaging materials which turns into waste at the customers´ home;
- the loss of raw materials in the production process due to off-spec product, occasional spillage, damage of materials in stores and warehouses and other factors;
- water use and waste water generation which is almost completely driven by the potato washing process that is part of producing potato chips.

Environmental management

- Cairns has made some clear environment-related commitments. The latest business report opens with the environmental policy statement of Cairns. In 1996, the company conducted a pre-assessment at its Harare plant together with the Zimbabwe Cleaner Production Center. After the expected certification of the quality management system under ISO 9000, Cairns intends to obtain certification of its environmental management system under ISO 14000 in 1998.

4. Project structure

Project organisation

- The board of directors of Cairns served as the **governing body** for the project.
- The **project managers** were the external foreign expert on ECM and the Cairns technical director.
- The **core team** who worked on the actual project consisted of the produc-tion managers, the manager of technical services (energy, water), the R&D expert and the management accountant concerned. Unfortunately, the environmental manager was off site during the project, otherwise he would have been part.
- The **shell team** (i.e. others involved to a lesser degree) included the managers of quality assurance, stores, warehousing, distribution, marketing and financial accounting.
- In the interest of serving the second project objective (capacity building), three local **consultants** were part of the core team, receiving on-the-job-training in ECM.

This project organisation was complemented by continuous, on-site observation and **evaluation** by the head of P3U in order to make full use of the project experience for further improvement in the application and dissemination of ECM.

Timetable and project steps

During the **preparation** of the project, several members of the core team received an introduction into the concept and basic elements of ECM during a 4-hour presentation. In addition, the local consultants participated in a two-day workshop in ECM. Some limited information was requested by and made available to the external experts in advance.

After this preparatory phase, the project was implemented within eight working days. The **three main project steps** were:

- analysis of NPO streams (which NPOs occur where and why?),
- analysis of NPO costs (which costs are caused by these NPO streams?), and
- development of measures for the reduction of the amounts and costs of selected NPO.

Both parts of the **analysis** (step 1 and 2) were completed in four days and ended with the presentation of its results to the board. The board then selected those NPO streams that were to focus on during the development of **measures**. These measures were elaborated in another four days, with the final results again being presented to the board.

5. Analysis of NPO flows and costs

The **major NPO flows** were identified using a check list of typically relevant NPO flows, by eyesight as well as through questions asked during a tour of the factory and in interviews with company staff. The results of the cleaner production pre-assessment study conducted the year before could be used almost without further adjustments. The resulting overview of NPO and product flows is shown in Chart 1 (Annex).

Subsequently, the **costs caused** by these non value-adding flows of NPO were calculated. The main source for the cost data was accounting:

- As far as the accounting data were structured in a way that costs could be directly and completely allocated to NPO, no further information was required. For example, one NPO stream was „disposal of materials and products“ (from stores and warehousing). The account „stock write-offs“ reflected only this NPO stream. The annual total in the account could therefore be directly allocated to this NPO.

- Where the accounting data were not differentiated with respect to NPO-induced costs and other costs, existing cost data needed to be split up accordingly. A point in case was the loss of raw material due to off-spec product, spillage and other factors. For production cost centres, accounting only showed total raw material usage. The fraction of raw material going to NPO was then derived from production statistics and, in part, from estimates of production managers.

At Cairns, all cost calculations and underlying assumptions were based on statements and data from plant personnel and **cross checked** with them. This assured that the results of the cost analysis was fully backed by plant personnel.

The results showed that NPO causes 33 % of the Harare plant’s total cost, i.e. some 6,000,000 US$ per year (see Chart 2, Annex). In other words, **one third** of all costs of the Harare plant are caused by output that does not generate any relevant revenue of their own. The cost of NPO-related labour costs being hardly significant.

Packaging was the NPO with the highest figure. The cost of packaging material constituted roughly half of all raw material cost. This appeared elevated, even when considering that food packaging has to meet high requirements.

Loss of **raw material** in the various production lines and overfilling caused some 4.4 % of total cost. Energy use caused 3.5 % of total cost. This is expected to rise to close to 5 % due to increases in rates for electric energy.

The cost of NPO was considerably higher than the board had expected and about three times the amount typically found in German companies. In addition, a cursory analysis showed some deficiencies in allocating and controlling NPO costs. The results indicate that NPO costs contain a significant **savings potential** for Cairns.

6. Development of measures

While cost saving opportunities were seen within all cost-relevant NPO streams, the limited time for developing and evaluating measures (4 days) made it necessary to focus on a few NPO streams only. The NPOs chosen were representative of the variety of NPOs at Cairns and were expected to lend themselves to a rapid development and evaluation of measures.

Process	NPO	Annual cost (in 1,000 US $)
Pet food	waste heat from producer gas	21
Coffee roasting	waste heat from producer gas	11
	materials efficiency	57
Packaging	Dispatch packaging for SBU Groceries (products manufactured at Harare)	262
Totals		**351**

Table 1 - NPOs chosen for the development of measures

The development of measures was conducted in **two teams**. The team “Pet food & Coffee“ consisted of the responsible production manager and one line manager from either production area, the manager of technical services, the R&D manager and one of his employees. The team “dispatch packaging“ comprised the R&D manager, the production manager whose products were mainly affected and the purchasing department. The foreign experts and local consultants worked in one of the two teams.

The development of measures started with an approx. 3-hour brainstorming on possible cost-saving and NPO-reducing measures for each of the areas (pet food, coffee and dispatch packaging). During the brainstorming, measures were contributed both by Cairns’ employees and external consultants. The brainstorming was followed by iterative detailing of the (technical and organisational) measures, of their resulting costs and benefits, as well as of the investment they required.

A great number of measures were considered, but only those few that could be evaluated in the available time span and that seemed both practical and profitable were selected and recommended to the board. Measures that didn’t meet at least one of the Cairns’ **standard investment criteria** were dropped (maximum pay back: 2 years, minimum return-on-investment (ROI): 20 %). Again, all evaluations and recommendations were elaborated and agreed upon with the Cairns team members, in order to ensure acceptance of the measures at Cairns. The cost effects of the measures are documented in Chart 3 (Annex), their environmental effects are shown in Chart 4 (Annex).

Pet food

In pet foods, part of the gas was used by the baking oven itself, an old and oversized unit. The remaining part of the gas was consumed by the subsequent drying process, that was necessary because the temperature control inside the oven was not sufficient to assure a fully dried product at the oven output. Combustion fumes from the oven and the drying oven were emitted directly into the production area, having a negative impact on workers´ health.

A **high investment & high savings scenario** was developed, which would entail the replacement of the gas oven by a downsized electric oven with good temperature control. This would eliminate the need for the subsequent drying process, cut down energy costs and production time as well as eliminate most of the unhealthy fumes in the production area. This scenario was recommended in case Cairns decided to actively pursue the product „pet food“. The expected environmental effect would be a profitable 70 %-reduction of both waste heat and emissions from gas use for pet food.[1]

A **low investment & low savings scenario** was developed as an alternative. This entailed improving the energy efficiency of the gas oven and the drying process, as well as closing the leaks in the oven from which combustion fumes escaped into the production area. These measures were recommended in case Cairns decided not to pursue pet food actively. The expected environmental effect would be a profitable 14 %-reduction of both waste heat and emissions from gas use for pet food.

Coffee roasting

In coffee roasting, the **exhaust air** from the gas burners was emitted directly to air. This meant that the energy contained in the gas was used once only. The proposed measure was to recover heat from the exhaust and use it to preheat the air to the burner. To reach the economies of scale necessary for a viable investment, the exhaust of both gas roasters were to be hooked up to the same exhaust duct. The expected environmental effect was a profitable 43 %-reduction of both waste heat and emissions from gas use for coffee roasting.

Roughly **10 % of the roasted coffee** is lost to air in the roasting process. Various options to reduce these losses were considered. The option that remained feasible upon scrutiny and could be evaluated in the available time span was recovery of these very flavour-intensive emissions by means of a water or oil bath. This flavour-rich mixture was then to be added to the instant coffee after spray drying, significantly increasing its flavour appeal and thereby its sales. What was originally considered to be an unavoidable waste stream was discovered to be a valuable resource. The expected environmental effect was a profitable 85 %-reduction of emissions of roasted coffee.

---

1 The off-site heat loss and emissions due to generating electricity for the electric oven were accounted for.

Dispatch packaging

In the project, **product packaging** was defined as the packaging still attached to the product during product use (the cereal box, the peanut butter jar, the vinegar bottle). **Dispatch packaging** was defined as the additional packaging around product packaging, with the main purpose of protecting the product during storage at the warehouse and transport (corrugated cardboard boxes, shrink wrap, card board trays for products to protect them from vertical pressures).

Measures regarding the thickness of trays and cardboard boxes and the returnable container system could not be evaluated in the available time span. Measures for dispatch packaging that were evaluated and expected to be profitable were:

- Reduction of the tray sizes for coffee which opened up the view of the labels on the coffee jars, thereby eliminating the need for printing separate labels on the dispatch packaging that identified the product contained.
- Elimination of trays for cornflakes and another cereal („Pronutro“), since the product packaging itself was expected to have sufficient strength.
- Reduction of shrink wrap use, by not enclosing the product completely at opposing ends of the ordering unit.
- Reduction of the cost of cardboard boxes by switching from multi-colour to single-colour printing on the boxes.

None of these measures requires any investment. The expected environmental effect is a profitable 14 %-reduction of solid waste from dispatch packaging.[2]

7. Overall effects of the measures

Depending on the scenario chosen for pet food, the expected overall effect of the measures was to reduce the cost of those NPOs that were subject to the development of measures by **15 – 19 %** or 53,000-67,000 US$ per year. The expected pay-back on investment was 8 - 14 months. These effects were achieved for the four selected NPOs in the time span of four days.

Extrapolating these results to the Harare plant as a whole, the cost savings which may be achieved by the full application of Environmental Cost Management are expected to be of the order of 5 % of total cost.

It is estimated that the development of measures for all cost-relevant NPO would take the Cainrs core team some 3 - 6 months and that implementation would require another 3 - 6 months.

---

2 The environmental effect of switching to single-colour boxes was not evaluated.

The expected overall **environmental effect** of the implementation of the recommended measures would be

- to cut energy use by 9 % (low investment scenario) or 61 % (high investment scenario),
- to reduce the emissions to air by 62 – 76 %, and
- to diminish the solid waste from dispatch packaging by 14 %.

Other expected effects are

- improved product quality and reduced production lead times for pet food (high investment scenario);
- improved product quality of instant coffee (addition of flavour), and
- improved working conditions in pet food.

8 Evaluation

The project at Cairns showed that ECM is also a **valuable tool** for companies in a developing country like Zimbabwe, as it allows the identification of major NPO streams and the development of measures whose implementation may lead to a considerable reduction of costs and, at the same time, to a mitigation of the environmental effects of the companies´ activities.

The project at Cairns can also be considered as a success as ECM will be **institutionalised** at Cairns: The head of the R&D department will be in charge of the further work on NPO, in cooperation with the technical services (energy, investment etc.).

For the further improvement of ECM, its implementation in other companies and dissemination through local consultants, the following **lessons** will be taken into account:

- The employees to be involved in an ECM project will be informed earlier and more comprehensively in order to make even better use of their capacities;
- Core teams in the participating companies will be designated during a more structured preparatory phase and they will participate in a revised capacity building workshop: By this, the members of the core team can take a still more active role in the various steps of ECM, leaving a facilitating role to the external experts;.
- The experience gained sofar and the didactic materials used will be adjusted and consolidated in form of an **ECM-manual**, which will facilitate the preparation of all participating parties (company employees, local consul-

tants etc.) as well as the implementaion of ECM at the companies;

- The **capacity building workshop** for local consultants will be transformed into a three days training with more interactive components and a case study; it will be complemented by a two days workshop on basic methodological tools necessary for the successful implementation of ECM, such as moderation, presentation and visualisation techniques, as well as the basics of cost accounting and data processing (Excel);

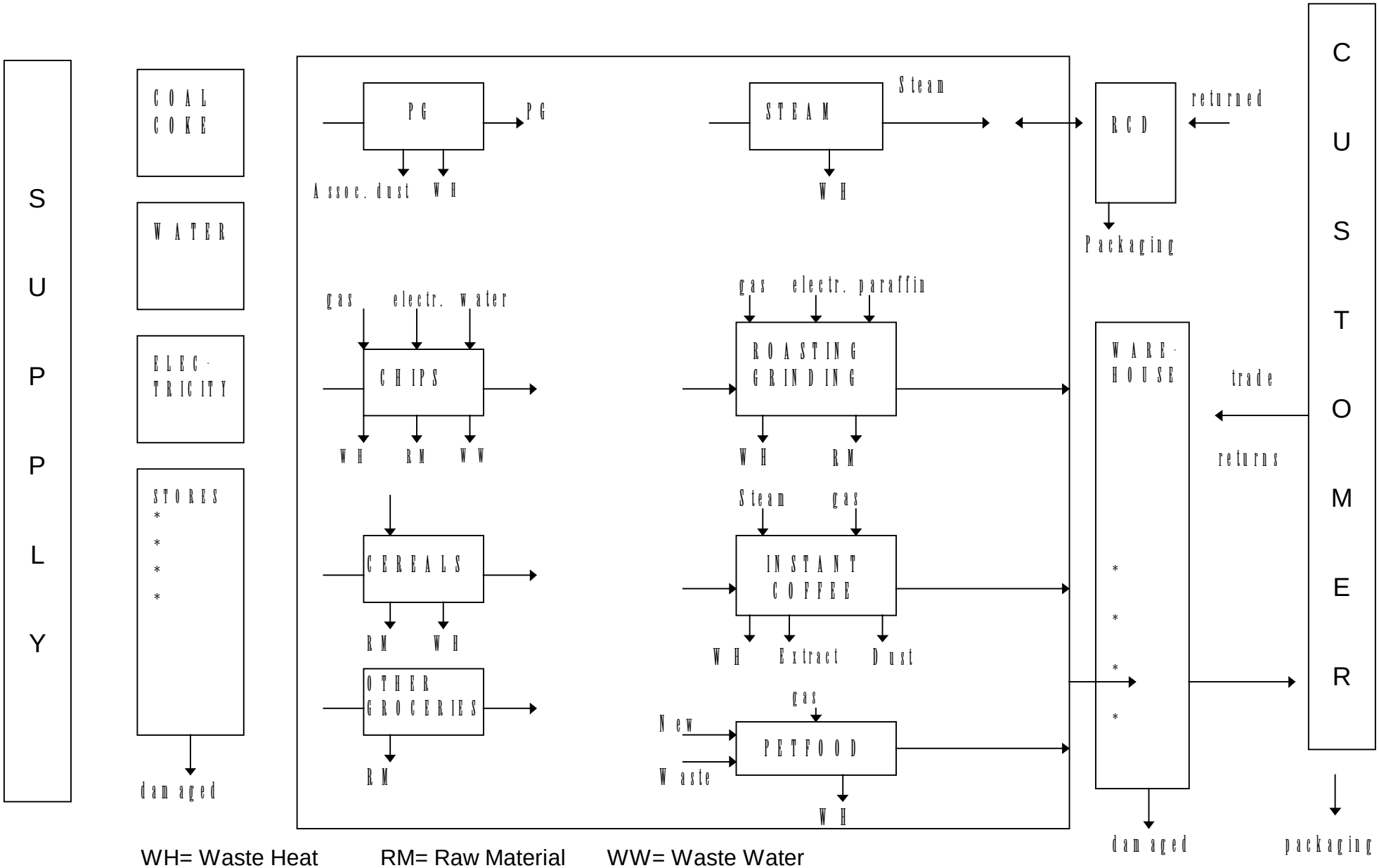
- GTZ-P3U will design a programme which can involve various companies in an additionol ECM project, in order to gain further experience, refine and disseminate the ECM approach in Zimbabwe. It has to be seen how the extremely favourable frame conditions at Cairns (strong environmental commitment, previous efforts on quality management and eco-efficiency, very qualified and motivated staff) may have influenced the outcome of the ECM project.

For more information on Environmental Cost Management, the pilot programme for the promotion of Environmental Management (P3U) at GTZ as well as ASPB-GTZ and the PET-programme please contact:

Mrs. Dr. Edith Kürzinger
Deutsche Gesellschaft für Technische
Zusammenarbeit (GTZ-P3U-Programme)
Wachsbleiche 1
53111 Bonn
Germany
Tel: ++49-228-6047113
Fax: ++49-228-9857018
e-mail: gtzp3u@aol.com
homepage: http://www.gtz.de/p3u
or
Advisory Service for Private Business, ASPB-GTZ
PET-Programme
Mr. Heinz Hoehmann
Fidelity Life Tower, 4th Floor, Crn Raleigh/Luck Str.
Harare
Tel.772 763-7
Fax. 750 953
e-mail: aspbzim@harare.iafrica.com or Dr. Zehender, ASPB, aspb@harare.iafrica.com

Material and Energy Flows

Chart 1



WH= Waste Heat RM= Raw Material WW= Waste Water
PG = Producer Gas RCD= Recycling Container Deposit

Annual costs of non-product output (NPO)

Type of NPO	NPO	Net Costs in financial 1996/1997 (as a percentage of total cost)
Waste water	Waste water	0,8%
Emissions to air	Waste energy from producer gas / handi gas	0,8%
	Waste energy from steam	0,5%
	Waste energy from electric energy	1,3%
	Sum emissions to air	2,7%
Solid waste before shipping	Disposal of materials and products	0,8%
	Materials efficiency-chips	1,0%
	Materials efficiency-groceries/cereals	0,5%
	Materials efficiency-coffee	0,6%
	Consumables	0,4%
	Sum solid waste before shipping	3,3%
Solid waste during/after shipping	Trade returns	0,3%
	Productpackaging	23,9%
	Overfilling	2,3%
	Sum solid waste during/after shipping	26,5%
Sum for all NPO		**33,3%**

Beachte: Abweichungen der Endsummen sind rundungsbedingt

Note: Discrepancies are due to roundings

Recommended Measures

All amounts in 1,000 Z$
Pay back in months

Factory	Non/product output	Measure	Base Cost		Gross savings		Running Cost	Net savings	Invest-ment	Pay back	ROI
			Description	Amount	Percent	Amount					
Pet food - High investment	Waste heat from gas	Electric oven	Gas usage petfood	264	100%	264	48	216	500	28	43%
Pet food - Low investment	Waste heat from gas	Fan for better heat distribution in drying	Gas usage drying	106	20%	21	0	21	5	3	422%
	Waste heat from gas	Closing/reducing gaps at inlet and outlet of oven	Heat loss oven through gaps	32	80%	25	0	25	0	0	n.a.
Coffee roasting	Waste heat from gas	Recovery of stack heat for preheating burner air	Heat loss burner-stack	117	50%	58	0	58	150	31	39%
	Material loss in roasting	Recovery of flavour/ material in emmissions - use for instant coffee	Cost of coffee solids in emissions	700	40%	356	0	356	300	10	119%
Packaging	Shrink wrap SBU Groceries	"open" ends / holes at end	Shrink wrap cost	124	0,05	6,2	0	6,2	0	0	n.a.
	Trays SBU Groceries	Substituting high and angled tray with flat tray for coffee	Tray cost	144	54%	77	0	77	0	0	n.a.
	Trays SBU Groceries	No sleave for pronutro 500 gr.	Sleeve cost	13	100%	13	0	13	0	0	n.a.
	Trays SBU Groceries	No trays for Cornflakes 500 gr.	Tray cost	50	100%	50	0	50	0	0	n.a.
	Boxes SBU Chips	1 colour instead of 3-4 colour boxes	Cost of coloured boxes	261	8%	21	0	21	0	0	n.a.
	Labels SBU Groceries	Elimination of insert labels for coffee	Cost of labels	25	100%	25	0	25	0	0	n.a.
Totals (if petfood is to be actively pursued)						**870**	**48**	**823**	**950**	**14**	**87%**
Totals (if petfood is not to be actively pursued)						**653**	**0**	**653**	**455**	**8**	**143%**

Chart 4

Summary of results for Environmental Cost Management

- Environmental Management -

Factory	Non product output	Measure	Base Amount		Gross savings		Units	Remarks
			Description	Amount	Percent	Amount		
Pet food	Waste heat from gas	Electric oven	Energy usage petfood (gas)	2.650	70%	1.855	MWh	Savings estimated to be 90% at the plant. They are corrected to 75% however to account for energy losses in generating electricity off site.
	Waste heat from gas	Fan for better heat distribution in drying	Energy usage petfood (gas)	2.650	8%	212	MWh	
	Waste heat from gas	Closing/reducing gaps at inlet and outlet of oven	Energy usage petfood (gas)	2.650	6%	159	MWh	
	Emissions to air	Electric oven	Coke usage petfood	283	70%	198	tons	Savings estimated to be 90% at the plant. They are corrected to 75% however to account for usage of fossil fuels in generating electricity off site.
	Emissions to air	Fan for better heat distribution in drying	Coke usage petfood	283	8%	23	tons	
	Emissions to air	Closing/reducing gaps at inlet and outlet of oven	Coke usage petfood	283	6%	17	tons	
Coffee roasting	Waste heat from gas	Recovery of stack heat for preheating burner air	Energy usage coffee roasting (gas)	1.356	43%	586	MWh	
	Emissions to air	Recovery of stack heat for preheating burner air	Coke usage coffee roasting	145	43%	63	tons	0
	Emissions to air	Recovery of flavour/ material in emmissions - use for instant coffee	Coffee solids in emissions from roasting	700	85%	595	tons	
SBU Groceries (Harare plant)	Solid waste from dispatch packaging	"open" ends / holes at end	Dispatch packaging SBU Groceries	53	1%	0	tons	Savings of 300 kg of shrink wrap
	Solid waste from dispatch packaging	Substituting high and angled tray with flat tray for coffee	Dispatch packaging SBU Groceries	53	5%	3	tons	
	Solid waste from dispatch packaging	No sleave for pronutro 500 gr.	Dispatch packaging SBU Groceries	53	3%	1	tons	
	Solid waste from dispatch packaging	No trays for Cornflakes 500 gr.	Dispatch packaging SBU Groceries	53	6%	3	tons	
	Environmental effects of multi-coloured boxes	1 colour instead of 3-4 colour boxes	Dispatch packaging SBU Chips					Environmental effect of using less colors not evaluated
	Solid waste from dispatch packaging	Elimination of insert labels for coffee	Dispatch packaging SBU Groceries	53	0%		tons	Effect in terms of tonnage are neglible

Totals SBU Groceries (Harare plant)	**High investment**	**Waste heat**	**4.006**	**61%**	**2.441**	**MWh**	The high investment option is characterized
		Emissions to air	**1.128**	**76%**	**856**	**to**	by a new electric oven for the petfood factory
		Solid waste	**53**	**14%**	**8**	**to**	
	Low investment	**Waste heat**	**4.006**	**9%**	**371**	**MWh**	The low investment option is characterized
		Emissions to air	**1.128**	**62%**	**697**	**to**	by incremental improvement of the petfood
		Solid waste	**53**	**14%**	**8**	**to**	oven