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NATIONAL CLEANER PRODUCTION CENTRE SA

NCPC
national cleaner production centre
South Africa

CONTRACT REPORT

QUICK-SCAN SUMMARY PREMIER FOODS (PTY) LTD

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17 August 2007

DOCUMENT CONTROL

Degree of Confidentiality:	Client Confidential	
Title:	Quick-Scan Summary Premier Foods (PTY) LTD	
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Date of Issue:	17 August 2007	
No. of Pages	21	
Issuing Organisation: National Cleaner Production Centre PO Box 395 0001 Pretoria RSA	Telephone: (Nat) (012) 841 3754 (Int) + 27 12 841 3754 Telefax: (Nat) (012) 841 5039 (Int) + 27 12 841 5039	
Contract Name:	UNIDO Demonstration Cleaner Production Programme	
Project Number:	HY7AGRO	
Keywords:	Wheat Milling	
Issue Number:	001	
Copy Number:	1	
Project Leader:	Mr M Ram Reddi	
	APPROVED BY:	
Responsibility	**Name**	**Signature**
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	DISTRIBUTION:	
Company	**Contact Person**	**Copy Number**
Premier Foods (Pty) Ltd	Mr G Prinsloo	1 - 2
NCPC (File: 086DG / HY7AGRO)		3
	FILENAME, TEMPLATE AND VERSION CONTROL	
I:\NCPC\Efiles06_07\Sectors Projects\Agro Processing -Mano's files\UNIDO AGRO PROCESSING SECTOR\UNIDO Agro Plan\Reports\UNIDO Contract Report\Quick Scan Premier Foods 17 August 2007.doc		

EXECUTIVE SUMMARY

Premier Foods Pretoria Wheat Mill runs a dry wheat milling process, whose primary outputs are flour and bran. The organisation receives wheat from various local and international sources, and supplies a variety of customers in the food and wholesale/retail sectors.

The objectives of the Quick scan were to identify opportunities for improvement and/or optimisation in so far as the processes and operations of the company are concerned, which would be of benefit from both a financial and an environmental impact perspective.

The plant is highly automated and efficiently run. Opportunities for improvement with regards energy usage were identified in the following areas:

1. Electrical energy usage
2. The Compressed air system

The systems require further investigation in order to facilitate quantification of the opportunity for improvement as well as the assessment of various improvement options.

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1. PREFACE

This Cleaner Production Quick-Scan Summary Report of Premier Milling Foods was performed as part of an awareness and pilot NCP project out by the South African National Cleaner Production Centre (NCPC - SA). The NCPC was established in 2002 within the framework of UNIDO/UNEP[1] Cleaner Production Centres

The programme has been designed for the needs of companies ready to analyze and optimize their internal business processes with a view to developing Cleaner Production (CP) techniques and to implement Environmentally Sound Technologies. This will allow the companies to reduce both their operating costs and improve their environmental performance, thus increasing their productivity and competitiveness. The project provides opportunities for staff training and technical consulting. It is targeted at executives and technically skilled employees (such as managers with a special brief for environmental affairs).

Further information can be found on the internet www.ncpc.co.za. Before a company is analyzed in detail, a *Quick-Scan* is usually conducted. The Quick-Scan is a short analysis which assesses the quality of the crucial processes, material- and energy flows in order to identify the *potentials* for CP. I.e. with the Quick-Scan the process areas with good optimising potentials are found and a possible focus for further analysis can be defined. On the basis of the Quick Scan, the company will decide whether or not and in which process areas an in-depth analysis (the CP Assessment) shall be conducted.

2. PROCEDURE

Premier Foods declared an interest in conducting a Quick-Scan performed in its premises during discussions with the NCPC. The Quick-Scan was subsequently performed at the company's premises in Waltloo, Pretoria.

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[1] UNIDO – United Nations Industrial Development Organisation
UNEP – United Nations Environment Programme

The following persons participated in the exercise.

Table 1: Quick Scan Participants

Name	Organisation	Designation
P. Kritzinger	Premier Foods	Head Miller
G. Prinsloo	Premier Foods	Regional Engineer
A. Ebrahim	Environmental Science Associates	Lead Consultant
S. Moletsane	Tsebo Consulting	Professional Consultant
T. Mutshatshi	Naledzi Environmental Consulting	Professional Consultant
M. Ram Reddi	National Cleaner Production Centre	Project Manager
Dr T. Burki	Energy Ecology Policy Consulting	CP Specialist

An initial visit and familiarisation tour were conducted giving the external participants a broad understanding of the operations and processes conducted at the site. The objectives of the initial tour were:

I. To establish the scope of the project
II. To familiarise participants with the process and operations of the plant
III. To identify potential areas for implementation of CP strategies

Subsequent to the identification of potential areas for implementation of CP, further information was requested from the organisation, research into the selected areas/processes was conducted and a follow up visit was carried out to collect data and audit specific areas and activities.

An analysis of the potential for CP was then undertaken using the UNIDO Eco-Inspector toolkit.

3. SHORT ANALYSIS

3.1 The Enterprise

Premier Foods Pretoria Wheat mill (hereafter referred to as the plant) was established in 1994. The plant produces various grades of wheat flour (hereafter referred to as flour) through the dry milling of wheat grain. The plant runs 24 hours a day, 365 days a year. Supplying flour to Premier Food's bakeries and various customers including Famous Brands (Debonnairs Pizza), Romans Pizza, Kellogg's, Natural Brands, Wholesalers and Retailing Chains (e.g. Pick'n Pay, Shoprite, Checkers etc.)

The plant receives wheat from both domestic and foreign suppliers. Wheat is transported to the premises by rail and road truck. Imported wheat is shipped by sea to local ports and then trucked to the site. The wheat is initially stored in onsite bulk silos by AgriSA, and transferred to the plants own silos on demand.

The main products from the milling process are flour and bran. Approximately 90 000 tonnes per annum of wheat is milled producing approximately 72 000 tonnes of flour and 18 000 tonnes of bran.

Various grades of flour are produced through the milling and blending of different wheat varieties as required by customers. Additives such as Vitamin supplementation, fats (for pizza/pastry manufacture) and sodium bicarbonate (for self raising flour) are blended into the product as required. Bran is sold in bulk to various buyers mostly for use as animal feed.

The plant is located in an established industrial area in the North West of Pretoria. The area is neither environmentally nor socio-economically sensitive.

3.2 Manufacturing Processes

3.2.1 Overview

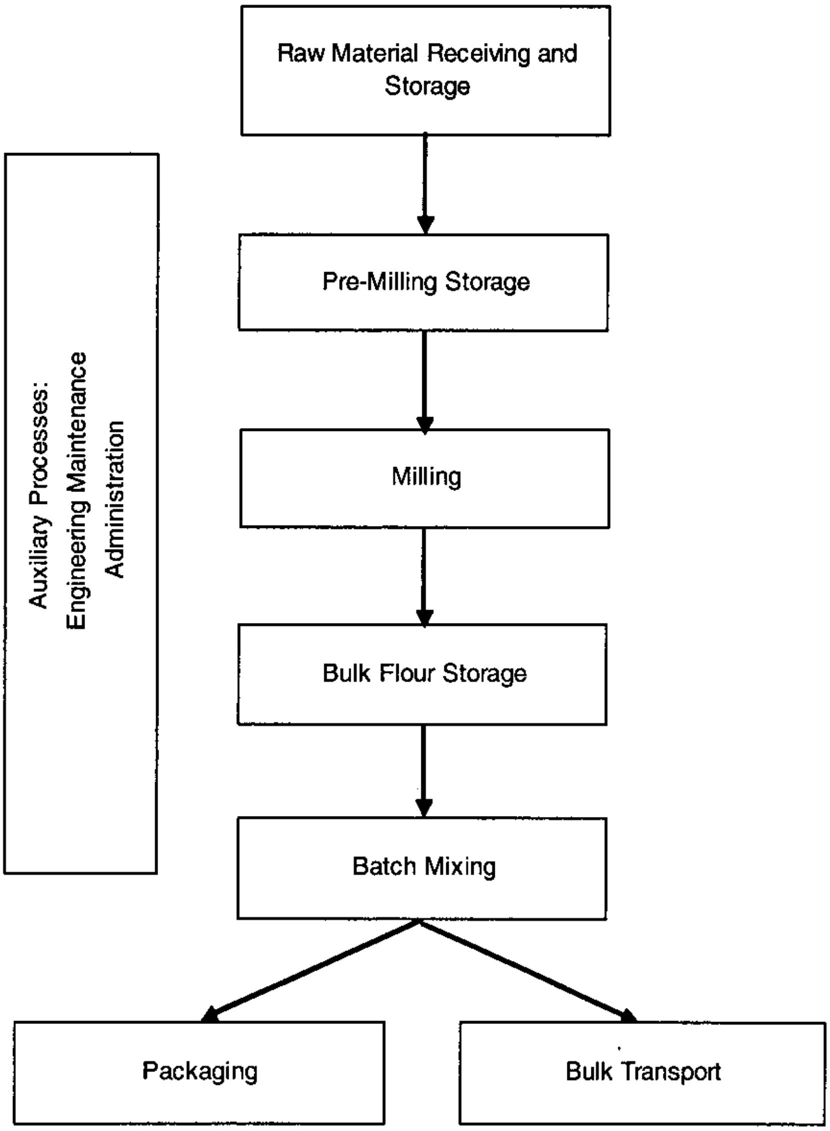


Figure 1: Plant Overview

During the Quick Scan, the individual processes were discussed in general terms only. The essential stages of the manufacturing process will briefly be explained in the ensuing sections.

3.2.2 Raw Material Receiving and Pre-Milling Storage

Wheat is received by rail and road truck. The trucks pass over a weighbridge before and after offloading. The wheat is offloaded manually from trucks but tipped from rail trucks. The grain falls the through a chute onto a belt conveyor system that carries the wheat to a bucket conveyance system which subsequently deposits the wheat into bulk silos (referred to as Raw Wheat Storage Bins). The site has 10 grain silos altogether with a total storage capacity of 15 000 tonnes.

Foreign matter is separated from the wheat by means of screening and magnetic separation. Large screens (+10mm gauge) are used to remove material larger than the wheat grains such as leaves, sticks and stones, while small screens (-3mm gauge) are used to remove smaller particles such as sand and small seed. The total mass of foreign matter removed is minimal, and is either passed through a hammer mill and pneumatically conveyed to the bran silos or disposed of as general waste.

Dust and Suspended particles are extracted from the system via an aspiration system. It was noted that the aspiration system extracts from the conveyance system as well as the silos and distribution systems above the silos, consequently the system is running as long as there is transfer of grain in some section of the offloading and storage sections. The systems extracts from all points simultaneously.

The moisture content of the wheat is measured and water is added to condition the wheat to the desired target moisture by means of an inline spray system with remote fixed flow rate control. Conditioning is the adjustment of the moisture level of the grain to facilitate maximum separation of bran from endosperm. A manually operated system is then used to fine tune the moisture input.

At present tap water is used for moisture addition; however the plant will in the future install a water purification plant. This plant will incorporate fungicides and bactericides into the conditioning water to mitigate fungal and bacterial infection. From time to time wheat is received with elevated fungal and bacterial counts, which in turn result in high counts in the flour produced, the installation is intended to ensure that fungal and bacterial counts in flour produced meet customer expectations at all times. The wheat is fumigated periodically to prevent/control pest infestation.

Wheat is transferred from the raw wheat storage bins to the dirty wheat storage bins on demand from the plant. Up to this stage in the supply chain, the wheat still belongs to the supplier, the ownership is transferred only when the wheat is transferred to the dirty wheat storage bins.

3.2.3 Milling

Wheat from the storage bins is elevated to the top of the mill via bucket conveyors, from where it is gravity fed through the ensuing screening, crushing and separation machinery. The wheat is then passed through several cleaning mechanisms which remove foreign matter by means of size screening and density separation using air classification. The material removed (mostly organic material such as sticks, maize, grass seeds etc) is hammer milled and transferred to the bran silos.

The objective of the milling section is separate the endosperm from the bran. The cleaned wheat is ground in rolling mills be means of cast iron rollers. The wheat is passed through several grinding stages. At each stage a portion of flour is extracted and the remaining bran with residual endosperm attached is passed on to the next grinding stage. The flour is separated from the bran by sifting (size screening). The extraction efficiency is dependant on the quality of flour required. The higher the proportion of bran allowed in the flour the higher extraction efficiency i.e. more flour is produced per tonne of wheat milled due to the higher percentage of bran in the flour. The output bran and flour are pneumatically transferred to their respective holding silos.

3.2.4 Bulk Storage, Batch Mixing and Packaging

Various grades and varieties of packed flour are produced by mixing different proportions of the bulk flour produced from the milling of different cultivars of wheat milled. The quantities of ingredient flour are controlled via batch weighers and fed through to final holding bins after mixing. The final bins discharge into bulk truck containers for transport to the various customers. Alternatively flour is packages in individual packs via an automated packing system. The flour is packed in paper bags, or laminated aluminium foil bags which are heat sealed. The small units are assembled into larger units which are subsequently wrapped in polyethylene packaging, and subsequently passed through an oven to set the plastic wrap.

4. QUICK SCAN DATA

4.1 Environmentally Relevant Substances

There are no substances of environmental significance incorporated into the product. There are small quantities of hazardous waste produced by the facility mainly from maintenance activity these include fluorescent tubes, used oil, and lead-acid batteries from the forklifts, for example.

4.2 Energy Management

The most significant source of energy is electricity. Ancillary sources of energy include diesel fuel for road and rail trucking, and lead acid batteries for forklifts. The use of electricity and potential for improvement are covered in the ensuing section of this report. At present energy consumption is not continuously monitored and assessed. The introduction of an energy management system to track energy usage and costs and identify any trends or assignable variation is a potential source of improvement for Premier Foods.

4.2.1 Energy provision – Electrical energy

Electricity is the primary source of energy for the plant. The plant sources electricity in 3-phase at 380kV stepped down from 11kV grid source. With the exception of bills issued by the Tshwane Metro Council electricity usage is not monitored on a continuous basis. The average consumption of electricity is 78kWH/tonne of wheat milled based on data derived from electricity bills for the months September 2005 to August 2006. The average peak half hourly demand is 1227kVA. From figures 2 and 3, it can be observed that the electrical energy consumption and peak demand appear to be steadily increasing over the duration of measurement.

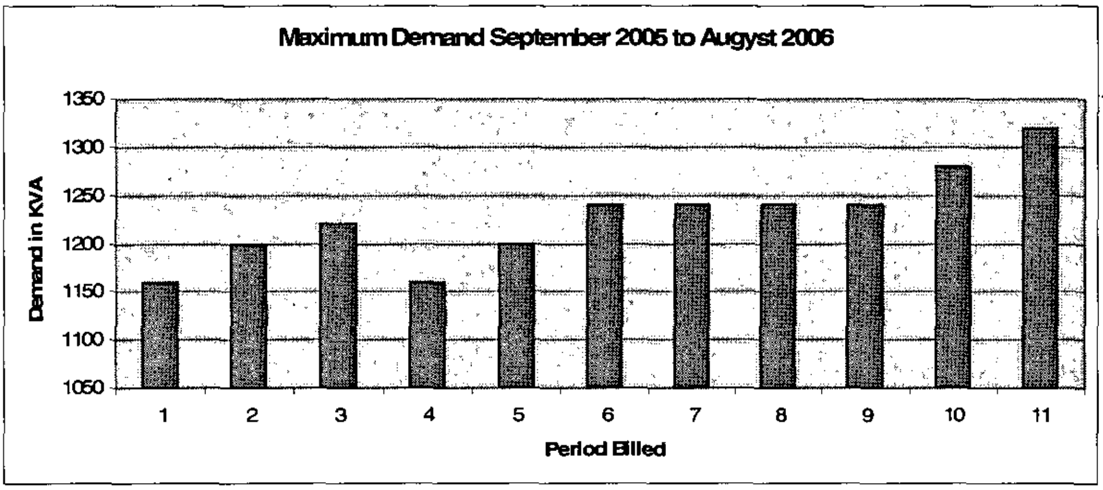


Figure 2: Maximum Demand Sept '05 to Aug '06

Table 2: Maximum Demand Sept '05 to Aug '06			
Billing period	**Start**	**End**	**Demand (KVA)**
1	2005/08/27	2005/09/21	1160
2	2005/09/22	2005/10/24	1200
3	2005/10/25	2005/11/16	1220
4	2005/11/17	2005/12/20	1160
5	*2005/12/21*	*2006/01/26*	1200
6	2006/01/27	2006/03/07	1240
7	2006/03/08	2006/03/24	1240
8	2006/04/25	2006/05/19	1240
9	2006/05/20	2006/06/23	1240
10	2006/06/24	*2006/07/21*	*1280*
11	2006/07/22	2006/08/18	1320
Average			**1227**

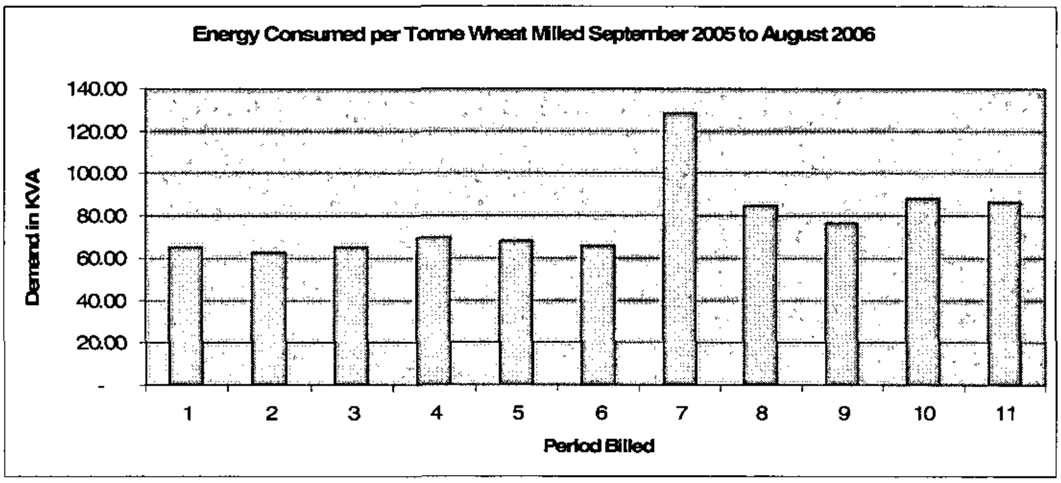


Figure 3: Maximum Demand Sept '05 to Aug '06

Table 3: Electrical Energy Usage Sept '05 to Aug '06							
period	**start**	**end**	**energy KWH**	**Number of Days billed**	**Energy/day**	**energy/hour**	**energy/tonne of wheat milled**
1	2005/08/27	2005/09/21	414000	26.00	15,923	663.46	65.05
2	2005/09/22	2005/10/24	508000	33.00	15,394	641.41	62.88
3	2005/10/25	2005/11/16	366000	23.00	15,913	663.04	65.00
4	2005/11/17	2005/12/20	582000	34.00	17,118	713.24	69.93
5	*2005/12/21*	*2006/01/26*	618000	37.00	16,703	695.95	68.23
6	2006/01/27	2006/03/07	642000	40.00	16,050	668.75	65.56
7	2006/03/08	2006/03/24	534000	17.00	31,412	1,308.82	128.32
8	2006/04/25	2006/05/19	518000	25.00	20,720	863.33	84.64
9	2006/05/20	2006/06/23	656000	35.00	18,743	780.95	76.56
10	2006/06/24	2006/07/21	606000	28.00	21,643	901.79	88.41
11	2006/07/22	2006/08/18	592000	28.00	21,143	880.95	86.37
Average			**548727.27**		**19,160**	**798**	**78.3**

N.B: The energy usage per tonne of wheat milled is calculated based on the following information provided by the company:

1. Milling capacity: 12 tonne/hr
2. Plant Availability: 85%
3. Operating schedule: 24 hr/day, 365 day/year

It is thus assumed that an average of 224 tonnes/day of wheat is milled. It appears that the specific electricity consumption is steadily rising, with one significant isolated spike in period 7, this however coincides with the shortest billing period thus should be treated with caution.

It would appear that the bulk of energy consumption may be attributed to pneumatic transport and separation/classification systems. A detailed assessment of these systems may reveal potential for improvement. Potential for improvement in the compressed air system should also be investigated as noted in section 4.2.3.

Lighting within the plant building was on during the audit; however there is significant incidence of daylight through the windows in the building. It is recommended that the adequacy of daylight and the management of artificial lighting systems be investigated.

4.2.2 Energy provision – Process Heat

With the exception of heat for thermo-setting packaging material, there is no heat supplied to the process. The oven used for setting the wrapping package wrapping in the packaging section should be investigated for potential improvement. It takes the oven approximately 1 hour to reach operating temperature. The oven nameplate indicates a temperature of 250℃ (it is assumed that this is the operating temperature) and current rating of 50A (380V), and is thus a significant energy user. The long warm-up period implies that the oven must be switched on an hour before commencement of packing and also that it cannot be switched off during product changes. Note that a changeover from brown to white flour may take as long as 1½ due to the stringent cleaning requirements for preventing cross contamination of the white flour. It is recommended that the oven be investigated for potential improvement.

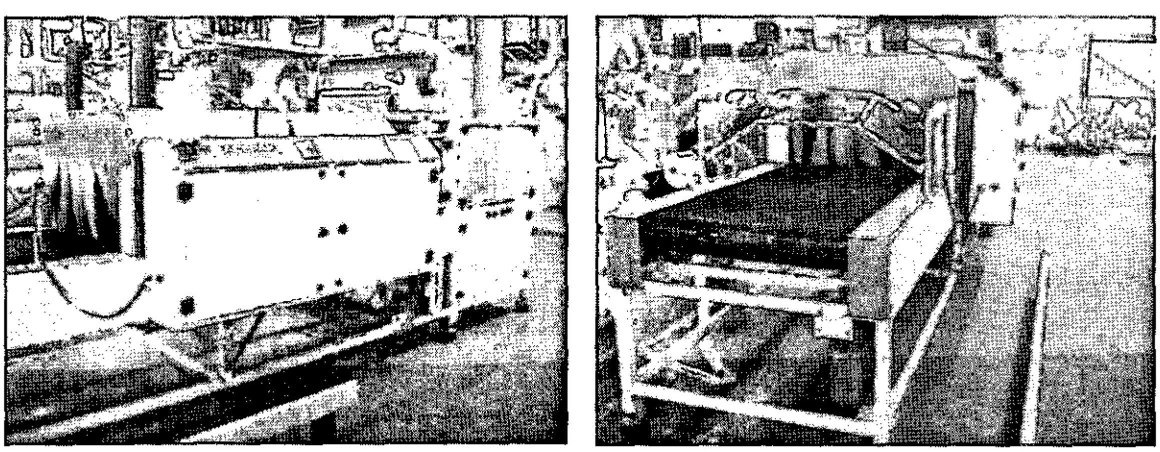


Figure 4: Packaging Oven

4.2.3 Energy provision – Compressed Air

The plant has 2 air compressors. Only one of these is operated at any time, with the other compressor off, on standby. Only one compressor has a nameplate. The nameplate indicates a rating of 7 bar, 10m^3/min, and power rating of 64kW. The compressed air is generated at 7 bar passed through an air dryer and then to a header tank at which point the pressure is 6.5 bar. The header tank has a capacity of 0.925m^3 and a design rating of 8bar. The compressed air demand is not monitored thus it could not be immediately determined what the plant demand is nor the nature of the compressor's real-time response patterns. This may be a potential area for

improvement as well, and an assessment of the demand and response of the systems may be used to optimise the system design.
No obvious leaks of compressed air were observed during the plant visits. The compressors are located outside the building in a shaded open area, this is ideal in terms of efficiency related to intake air parameters.

4.3 Working Methods

Generally employees were observed to be wearing personal protective clothing. Regular safety awareness meetings are conducted and training is provided on a periodic basis. The working areas observed throughout the mill were immaculately clean.

5. FINDINGS OF THE QUICK SCAN

5.1 Data Evaluation: Estimation of CP Potentials

5.1.1 Assessment of processes

The data collected during the company visit were evaluated with the software-tool *Eco Inspector*. The CP potential of individual process steps, including those covering energy provision and storage management, was examined in accordance with the following criteria:

Inputs:
- Are there any problem materials which are hazardous to the environment or to health?
- Are large volumes of raw, auxiliary and operating materials used?
- Is the level of energy consumption high?

- Are major costs incurred on the input side (materials or energy)?

Outputs:
- Are large volumes of (problematic) waste, special waste, wastewater, wastewater components or emissions generated?
- Are high internal/external preparation and disposal costs incurred?

Technology:
- Is the applied technology state of the art?
- What is the level of automation?
- Are there losses incurred through faulty batches or scrap?
- How are the systems serviced or cleaned?
- Are high costs incurred for maintenance, cleaning, and stoppages?

Each process step was qualitatively checked on these criteria and was classified according to the following scale:

Table 4: Potential Points – Assessment of Potential Level for Each Criterion

Criterion not applicable to this process area, or no CP potential	Zero points
Moderate CP potential anticipated	1 point
Significant CP potential anticipated	2 points

The next step examines each sub-process as an entity according to the scale in Table 2 to determine the actual level of optimisation already achieved; i.e. whether or not the CP potential is already exhausted. Thus the "relevance" of the identified potentials is described and a weighting factor is defined. This is a qualitative estimate and draws on the experience of the person conducting the Quick-Scan (expert opinion).

Table 5: Potential Points Scale for Estimating the Level of Optimisation of the Current Process

Level of optimisation "high"	Optimisation potential largely exhausted	0 Points
Level of optimisation "high to medium"		0.5 Points
Level of optimisation "medium"	Optimisation potential not fully exhausted	1.0 Point
Level of optimisation "medium to low"		1.5 Points
Level of optimisation "low"	Non-optimised process step	2.0 Points

The product of the potential point and weighting factor indicates the *current CP potential* for each criterion point of each sub-process.
The average of points for the individual categories (Inputs, outputs, technology and cost) gives a benchmark for the CP potential of individual process steps. This enables a rapid comparison of the sub-processes and facilitates selection of the processes for more detailed analysis.

5.2 Assessment of the S&H, material handling, transport and energy

5.2.1 Management aspects

The procedural principle for the processes is also followed when evaluating the aspects of safety, health, energy management, material handling, transport and storage. The points average gives a benchmark for the level of CP potential and is used as basis for decision to determine whether or not the relevant aspects are to be incorporated in a more detailed analysis.

5.3 Results

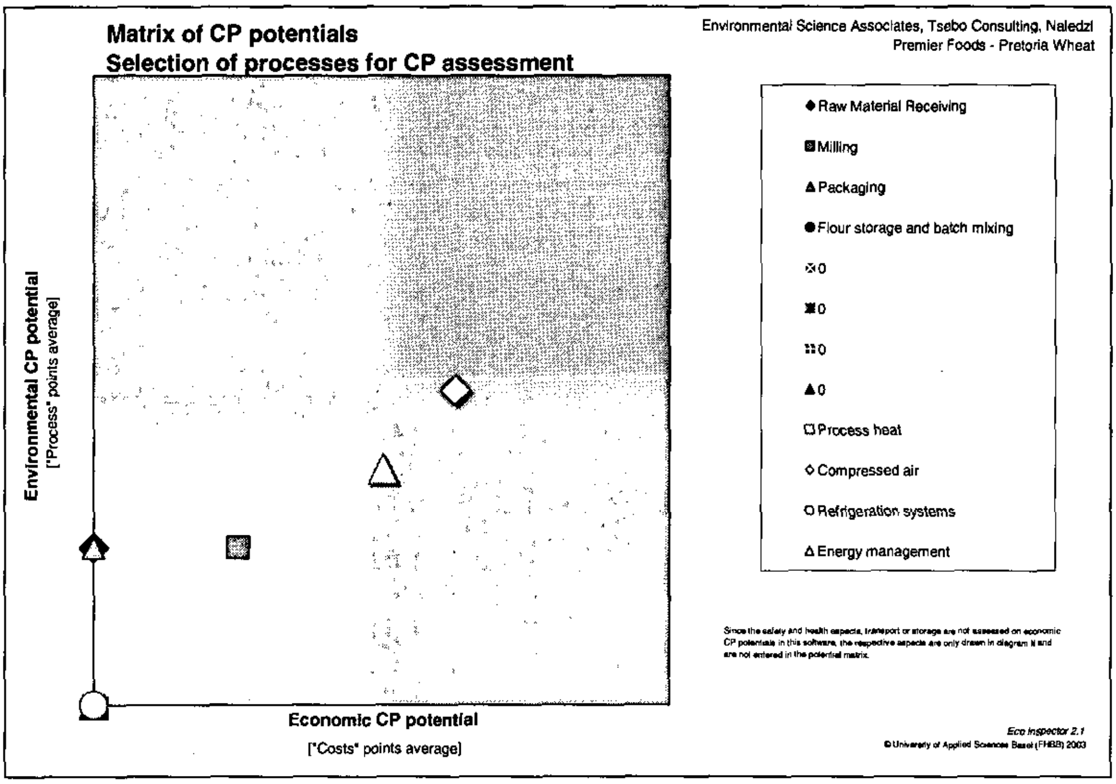


Figure 5: Matrix of the CP potentials at Premier Foods

The tables and charts enclosed in Appendix 1 show how the individual component processes have been evaluated. Appendix 2 provides a summary of the results. Figure 1 (below) contrasts economic- and environmental potentials. The values given correspond with the points average of the individual component processes (see Appendix 2).

5.4 Discussion of the Results

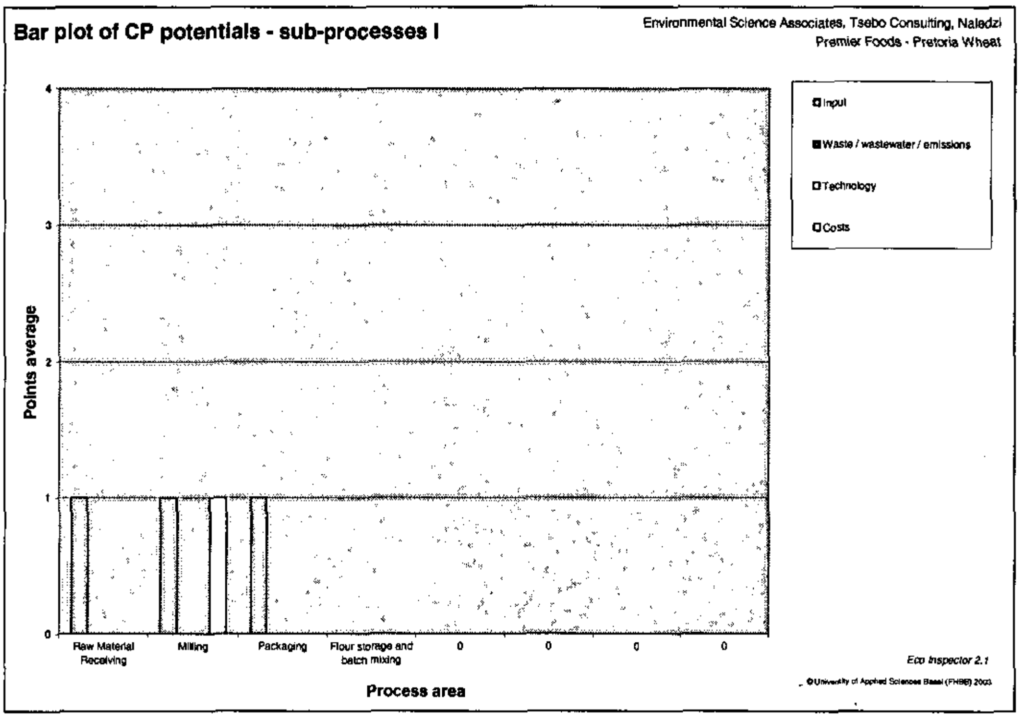
The survey identified savings potentials in the areas of compressed air management and energy management.

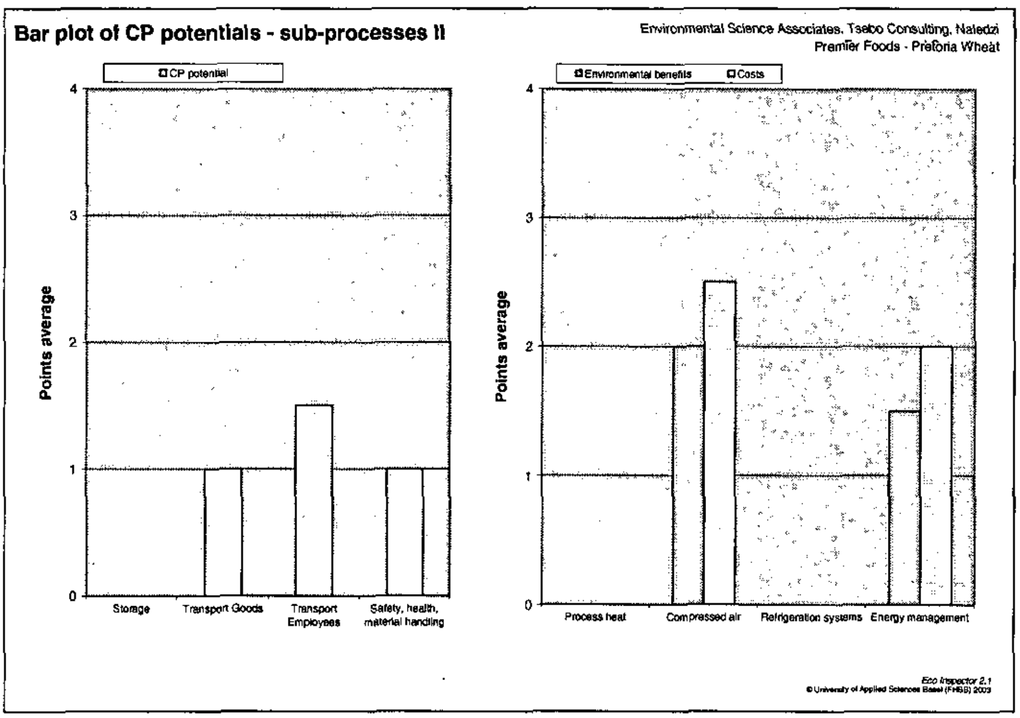
6. RECOMMENDATIONS AND FOLLOW UP

It is recommended that the following areas be further investigated:

1. Electrical energy usage and trends
2. Electrical maximum demand trends
3. Lighting requirements in the mill plant
4. Packaging area oven
5. Compressed air system design and trends

APPENDIX 1: ESTIMATED POTENTIALS OF COMPONENT PROCESSES





APPENDIX 2 : SUMMARY OF RESULTS

Process	CP potential environmental benefits (process)												CP potential economic benefits			Estimation of CP potential*			
	Input			Waste / wastewater / emissions					Technology				Costs						
	(Eco-) toxic problem materials	Raw, auxiliary, operating materials	Energy consumption	Solid waste	Special waste	Wastewater (flow, amount)	Wastewater components	Airborne emissions	Status of technology	Level of automation	Faulty batches, scrap	Maintenance, servicing, cleaning	Input materials, energy	Disposal, preparation	Maintenance, stoppages	Points average of environmental benefits (process)	Points average of economic benefits (costs)	Environmental CP potential	Economic CP potential **
P1 Raw Material Receiving	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1.0	0.0	X	-
P2 Milling	-	-	1	-	-	-	-	-	-	-	-	-	1	-	1	1.0	1.0	X	X
P3 Packaging	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1.0	0.0	X	-
P4 Flour storage and batch mixing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	-
P5 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	-
P6 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	-
P7 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	-
P8 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	-	-
P9 Storage	No CP potential anticipated															0.0		-	
P10 Transport Goods Employees	Moderate CP potential anticipated. Additional analysis of goods transport system recommended. Low CP potential available for further analysis															1.5 1.0		XX X	
E1 Process heat	No CP potential anticipated															0.0	0.0	-	-
E2 Compressed air	Moderate CP potential for environmental benefits or financial savings. Additional analysis of the 'compressed air provision' processes recommended.															2.0	2.5	XX	XX
E3 Refrigeration systems	No CP potential anticipated															0.0	0.0	-	-
E4 Energy management	Moderate CP potential for environmental benefits or financial savings. Additional analysis of the energy management system recommended.															1.5	2.0	XX	XX
Safety, health, material handling	Low CP potential for more detailed analysis															1.0		X	

* Estimation of CP potential	X	low CP potential	Points average "environmental benefits" or "economic benefits"	0.0	to	1.3
	XX	moderate CP potential	Points average "environmental benefits" or "economic benefits"	1.3	to	2.7
	XXX	high CP potential	Points average "environmental benefits" or "economic benefits"	2.7	to	4.0

** The value of "Process points average" corresponds to the environmental CP potential, the value of "points average of environmental benefits" corresponds to the "Economic potential"
The calculation of the points average covers all positions with a value. Positions without CP potential (value = "-") are not taken into account.

Eco Inspector 2.1