

# Profits from Cleaner Production

**A Self-Help Tool for Small to  
Medium-Sized Businesses**



New South Wales  
Department of State and  
Regional Development



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# Foreword

Small to medium enterprises are engines of economic growth and job creation in New South Wales. They are the largest source of new jobs, accounting for around 60% of all new jobs, and are at the forefront of innovation, product development, service delivery and exports which are underwriting the State's reputation as a high-growth, low-unemployment economy.

Sustaining and enhancing the growth of these enterprises is a key objective of the Carr Government and a central element of the Government's Post 2000 Jobs Plan.

The **Profits from Cleaner Production Pilot Program** is a New South Wales Government initiative, developed by combining resources and expertise in the NSW Department of State & Regional Development and the NSW Environment Protection Authority.

It is designed to alert businesses to the potential for reducing costs and boosting productivity by integrating environmentally sustainable practices and processes into the everyday running of their businesses.

This self-help tool is a vital part of the **Profits from Cleaner Production Pilot Program**. It outlines, in easy-to-understand terms, what a small to medium enterprise can do to minimise waste and reduce environmental impacts, and demonstrates the strong links between environmental and financial performance.

Consumers, suppliers, governments and the market at large are increasingly demanding environmental responsibility by the business community. Businesses ignoring this trend and rejecting the opportunity to improve their environmental performance may find themselves left behind in the highly competitive global marketplace.

Cleaner production is set to become an integral part of the business strategies of enlightened companies that want to embrace the ongoing challenges of industry leadership and continuous improvement.

We commend to you this self-help tool, to assist you in incorporating cleaner production into your business.



**SANDRA NORI MP**  
Minister for Small Business



**BOB DEBUS MP**  
Minister for the Environment

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### **Your Feedback is Welcome**

**This self-help tool is intended to be progressively refined by drawing from users' experiences. To contribute to this process, please send us your feedback on the sheet provided at the back of this document.**

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# About this Self-Help Tool

This self-help tool was developed by the NSW Department of State and Regional Development (DSRD) and the NSW Environment Protection Authority (EPA) as part of a joint Cleaner Production Pilot Program.

The tool has been developed to help small to medium-sized enterprises reduce their operating costs through a systematic process of identifying cleaner production opportunities and implementing cost-effective measures.

The tool:

- takes you through a process to help uncover hidden costs in your business
- outlines five stages to develop and implement a cleaner production program to improve efficiencies and reduce costs.

It will help you to win senior management's commitment to cleaner production, and to integrate cleaner production plans and actions into your company's business plan.

Cleaner production focuses on minimising resource use and avoiding the creation of pollutants, rather than trying to manage pollutants after they have been created. It involves rethinking products, processes and services to move towards sustainable development.

## Voluntary Environmental Audits

Cleaner production audits done with the aid of this tool may be regarded as 'voluntary environmental audits' under the *Protection of the Environment Operations Act 1997*. As such, they should be treated as confidential internal documents of the business.

The *Protection of the Environment Operations Act 1997* provides that documents prepared solely for a voluntary environmental audit are not admissible in evidence against any person in any proceedings connected with the administration or enforcement of environmental protection legislation. This protection is lifted if the person asserting or relying on the protection uses or relies on the whole or any part of the documents in those proceedings.

## Disclaimer

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## Further Copies

Further copies of this document are available from the NSW EPA's Pollution Line, phone 131 555 (local call cost when calling from within NSW). For publications and information requests email: [info@epa.nsw.gov.au](mailto:info@epa.nsw.gov.au).

This tool can also be accessed through the NSW DSRD Small Business web site at [www.smallbiz.nsw.gov.au](http://www.smallbiz.nsw.gov.au) or the NSW EPA's web site at [www.epa.nsw.gov.au](http://www.epa.nsw.gov.au).

## Acknowledgments

This self-help tool is based on material developed by Enproc Pty Limited for the NSW Department of State and Regional Development and the NSW Environment Protection Authority, as part of a joint Cleaner Production Pilot Program *Profits from Cleaner Production*. The contribution of Arek Sinanian (Enproc Pty Ltd) is gratefully acknowledged.

# Initial Checklist

The following simple checklist will assist in identifying initial cleaner production opportunities likely to lead to cost savings and increased profitability.

- 1 Does your company provide services or manufacture goods which use:
  - energy (particularly for process or space heating)
  - water
  - raw materials
  - packaging? Yes     No
  
- 2 Are the costs of one or more of these a significant proportion of your operating costs?  
 Yes     No
  
- 3 Does your company generate solid, liquid, gaseous or chemical wastes?  
 Yes     No
  
- 4 Does your company generate odour or noise?  
 Yes     No
  
- 5 Are the costs of waste management in your operations a significant proportion of your operating costs? (Include all costs of waste management such as in-house handling, on-site and off-site treatment, storage and disposal.)  
 Yes     No
  
- 6 Do any of the products you manufacture become a 'problem' for disposal at the end of their life?  
 Yes     No

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**If the answer to any of the above is Yes, then read on.  
Cleaner Production could offer a great opportunity to  
reduce your costs, improve your environmental  
performance and increase your profitability.**

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# Stages in the Cleaner Production Program

<b>Stage 1</b>	<b>Planning and organising</b>  Task 1a      Obtaining management commitment Task 1b      Organising a Cleaner Production Team Task 1c      Setting objectives  <b>Stage 1 outcome: framework</b>
<b>Stage 2</b>	<b>Initial assessment</b>  Task 2a      Collecting existing data Task 2b      Developing a material flow assessment  <b>Stage 2 outcome: focus area</b>
<b>Stage 3</b>	<b>Generating cleaner production options</b>  Task 3a      Undertaking detailed assessments: waste, energy and environmental audits Task 3b      Identifying cleaner production options  <b>Stage 3 outcome: set of options</b>
<b>Stage 4</b>	<b>Evaluating cleaner production options</b>  Task 4a      Technical, economic and environmental feasibility  <b>Stage 4 outcome: list of feasible options</b>
<b>Stage 5</b>	<b>Implementing cleaner production, continuous improvement</b>

# Why Cleaner Production?

Manufacturing goods and providing services use resources and generate waste. These are costs to your business that can be significantly reduced by:

- improved management of materials, processes and operations
- waste minimisation, including waste avoidance, reuse and recycling
- careful design and selection of products and services
- optimisation of processes, operations and resource usage through appropriate choice of technologies and design.

In the past, regulatory control and legal requirements were the forces compelling organisations to minimise pollution and waste. Today, due to the ever-increasing costs of waste management and the business imperative to minimise operating costs through efficiency, cleaner production has become a necessity rather than an option.

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**Quite simply, cleaner production is just a part of good business management.**

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## Cleaner Production and the Triple Bottom Line

### Financial

Cleaner production improves your **financial** bottom line by:

- increasing efficiency and productivity
- reducing costs for waste disposal and treatment
- reducing raw material, energy and water costs
- reducing liability risks.

### Environmental

Cleaner production improves your **environmental** bottom line by:

- reducing pollution of waterways, air and land
- reducing risk of non-compliance with regulatory requirements.

### Social

Cleaner production improves your **social** bottom line by:

- enhancing corporate profile and marketing edge by demonstrating environmental responsibility (also indirectly improving your financial bottom line)
- reducing health and safety risks
- improving staff morale and service.

# Stage 1 Planning and Organising

## Task 1a Obtaining Management Commitment

If your senior management are not already committed to cleaner production, it will be necessary to gain their commitment for the project to be a success. One of the most effective ways for senior management to see the benefits is by example. Look for case studies of similar companies that have become more efficient and saved money through cleaner production. Some sources and contacts for more help are listed on pages 38 to 41.

### Overhead Presentation

The material in Attachment 1 (overhead presentation) can be copied onto transparencies to make a presentation to management and staff. This can help to gain their commitment to cleaner production. Once you have commitment from management and enthusiasm from staff, you are well on the path to cleaner production.

#### HYPOTHETICAL EXAMPLE

##### ABC Foods Pty Ltd

*(While this is a hypothetical company, the circumstances and details have been based on real situations and experiences. We will continue using the hypothetical company throughout this document to demonstrate the principles of cleaner production and its implementation.)*

ABC Foods Pty Ltd is located near Sydney and produces a range of jams and preserves. The plant employs approximately 50 people and supplies wholesalers, for ultimate retail through supermarkets. The plant has a manufacturing capacity of 750,000 kg of jam per year. Apart from the normal range of jams, special recipes are also produced for large users such as bakers, jam tart and pie makers such as the Superlative Pies Company.

### Task 1a Management Commitment

Over the past few years, the Plant Engineer had implemented a number of process and operations improvement programs, including upgrading some of the equipment. The Plant Engineer then wanted to formalise an overall assessment of operations to identify opportunities for savings through waste minimisation and process optimisation.

Because such an assessment would involve all departments of ABC Foods, he approached the Managing Director to seek approval to proceed with the idea. The Managing Director complimented the Plant Engineer on his initiative, and was enthusiastic about the concept of a Cleaner Production Program.

They discussed the basic approach and agreed on the following:

- all departments would be involved in the project and a Cleaner Production Team would be formed, coordinated by the Plant Engineer
- the Team would identify, investigate and evaluate cleaner production options
- there would be regular reports to the Managing Director, keeping him in touch with progress
- all cost-effective proposals (with less than two-year payback) would be budgeted for in the following financial year.

The Managing Director wrote a Memo to all staff expressing his commitment to the project, and asked all departments to provide the Plant Engineer with support and assistance. He also called a meeting of all department heads, to explain the project and to seek their commitment. The Plant Engineer made a presentation at this meeting.

## **Task 1b Organising a Cleaner Production Team**

Set up a Cleaner Production Team to coordinate assessments and develop options for improvement. Try to include a cross-section of staff on the team, from major business functions such as manufacturing, purchasing, marketing, distribution, human resources, finance/accounting, and research and development. Include an outsider on the team, if possible, such as a staff member from a related business or a supplier or customer, for an independent point of view.

Some companies use expert consultants to facilitate the team activities in the first few months. It is useful also to rotate staff through the Cleaner Production Team annually. This will build widespread expertise and ownership within the staff.

For smaller businesses, try to involve at least a couple of people in the cleaner production initiative.

### **Team Approach**

Taking a team approach means that:

- staff have ownership of the process, making implementation easier
- different viewpoints and knowledge of the business are shared
- assessments are based on what actually happens in the business, rather than on assumptions or theories.

### **Champion**

Nominate a project leader or 'champion'. It is this person's role to:

- organise the team and its meetings
- assign duties
- control the progress of assessments and implementation of changes
- report progress to the rest of staff and to management; obtain management approvals.

### **Quality Management**

It may also be beneficial to train the team in the use of Total Quality Management tools. These increase members' effectiveness in meetings, brain-storming, analysis, presentations and reporting.

## **Task 1c    Setting Objectives**

The Cleaner Production Team should set some basic objectives that will help guide the direction of cleaner production activities. The objectives could cover areas such as:

### **Overall Cost of Production**

Objective:

- reduce overall production cost per unit output by, say, 5% within 6 months.

### **Waste**

Objectives:

- reduce costs of waste handling and disposal
- reduce money lost through waste materials
- increase product output
- reduce trade waste charges
- find efficient ways of segregating different wastes
- find higher price buyers/alternative uses of waste.

### **Resource Conservation**

Objectives:

- improve the efficiency of production
- reduce the use of hazardous materials
- reduce energy costs
- reduce use of water.

As the Cleaner Production Team becomes more focused, and cleaner production opportunities become better known, the objectives can be refined, such as 'decrease solid waste output by 20% over the next 12 months'. In setting objectives and targets, remember to set achievable targets, as reaching those targets will be crucial in encouraging staff and management towards further effort.

### Task 1b ABC Foods Cleaner Production Team

The Plant Engineer met with department heads and obtained nominations for a team, which included the:

- Assistant Marketing Manager
- Warehouse Manager
- Engineering Manager
- Assistant Financial Controller
- Line 1 Production Foreman, who was also the OH&S Representative.

During the first meeting of the Cleaner Production Team, the Plant Engineer was nominated as the Project Champion.

### Task 1c ABC Cleaner Production Objectives

The team then developed the following objectives to give direction to their work:

- reduce water usage
- reduce wastewater generation and discharge
- reduce energy usage.

It was expected that these objectives would be refined once cleaner production opportunities became better known. The team felt that they would need to engage specialist expertise for certain aspects of the study. The Project Champion was confident that he could obtain management approval to engage a consultant.

### Meeting outcome

Each member of the team left the meeting with a list of agreed actions to complete:

<b>Action</b>	<b>Resources</b>	<b>Start</b>	<b>Complete</b>
1 Process Flow Diagram	J Graff, F Chart	1 August	1 September
2 Inputs and Outputs	N Ventry, V Goodall	1 August	1 October
3 Waste Audit	G Arbidge, F Luenti + Ext. Consult.	1 October	15 December
4 Energy Audit	H Waters + Ext. Consult.	1 October	1 December
5 Develop Options	Entire team	To be advised	To be advised
6 Cost Benefit Analyses	F Ruegel, P Backer	To be advised	To be advised

## Stage 2 Initial Assessment

The Cleaner Production Team now needs to collect or develop some basic process information. This allows the team to select focus areas for detailed assessment of cleaner production opportunities. Where information is not available the team may need to set up monitoring programs to collect the data.

### Task 2a Collecting Existing Data

**Work sheet 2.1** can help you summarise what information exists about your operations. There is usually some existing operational data on the business that can be useful in understanding the operations, such as production reports, audit reports and site plans. Trend analysis is useful in most instances, particularly with cost data. To do this effectively you will need data spanning several years.

#### Benchmarking Data

Benchmarking data is also very useful — this is information about the performance of similar operations run by competitors, or other plants in the same group. Sometimes international 'best practice' data is available.

Benchmarking involves comparing operations and/or financial data of one plant with the same performance measures at one or more other plants. Even though their circumstances may not be exactly the same, this comparison can provide useful pointers for improvement.

## Work sheet 2.1 Collecting existing data

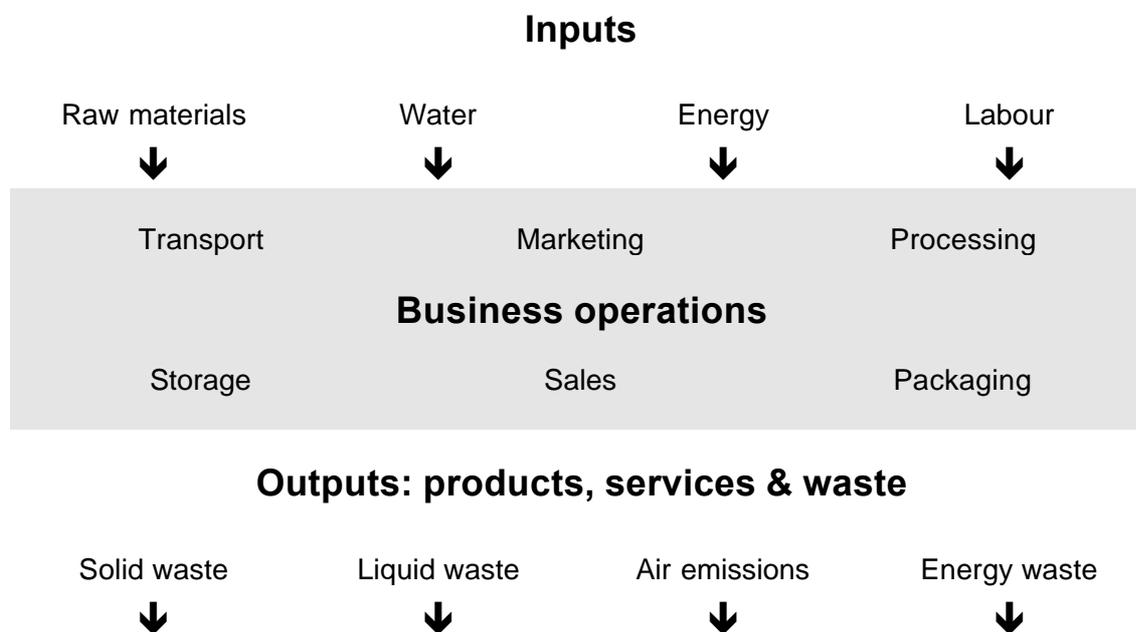
### Checklist: Background Information

<i>Type of information</i>	<i>Available</i>	<i>Not available</i>	<i>Requires updating</i>	<i>Not applicable</i>
<b>Process Information</b>				
Process flow diagram				
Material balance data				
Energy balance data				
Site plans				
Drainage diagrams				
Operating procedures*				
Equipment list & specifications				
<b>Regulatory Information</b>				
Waste licence(s)				
Trade waste agreement(s)				
Environmental monitoring records				
EPA licence(s)				
Environmental audit reports				
<b>Raw Material/Production Information</b>				
Material safety data sheets				
Product & raw material inventories				
Production schedules				
Product composition & batch sheets				
<b>Accounting Information</b>				
Waste handling, treatment & disposal costs				
Water & sewer costs				
Product, energy & raw material costs				
Operating & maintenance costs				
Insurance costs				
<b>Benchmarking data:</b>				

\* Note whether the plant is ISO 9001 or ISO 14001 certified.

## Task 2b Developing a Material Flow Assessment

Next, develop a material flow diagram outlining the main processes performed in the operations of the business, showing their associated inputs and outputs. Check that what goes in comes out somewhere. All inputs should have related outputs (as products, byproducts, wastes or emissions) and all outputs should be able to be traced back to inputs. Each process is a potential source of various waste streams.



### Walk Through

It may be helpful for the Cleaner Production Team to physically walk through the plant and review the processes, considering all aspects of waste, resource use and efficiency.

Record all the waste problems and improvement ideas the team identifies on **Work sheet 2.2**, for each plant/process in the business.

### Material Balance

The 'full picture' relating to the flow of materials can be obtained by undertaking a material balance of operations and processes. Simply expressed, material or mass balance calculations are based on the following equation:

$$\begin{aligned} \text{Total material in} &= \text{material out (product)} \\ &+ \text{material out (wastes)} \\ &+ \text{material out (emissions)} \\ &+ \text{material accumulated.} \end{aligned}$$

Use **Work sheet 2.3** to record the details of all the inputs and outputs for each equipment, plant or process. This will give you a good understanding of the operations and will help identify the cause of any waste streams and emissions.

Consolidate the various individual equipment input and output sheets into **Work sheet 2.4** and **Work sheet 2.5** to record the details of all the inputs and outputs.

To ensure that there are no unexplained losses or emissions, it is advisable to undertake a material balance for all major materials used on site (including water). This can also be useful in estimating fugitive emissions, such as evaporation from a solvent tank.

The balances relating to equipment, and the balances for the major materials and water, need to be cross-checked against purchasing, production and dispatch records. Evaluating the inputs and outputs will highlight areas for further investigation. For example, if the operation uses high amounts of energy, you may consider carrying out a full energy audit, for which the team may require external support.

## Work sheet 2.2 Checklist for Walk-through Process Review

Company \_\_\_\_\_

Plant/Process \_\_\_\_\_

<b>Questions</b>	<b>Yes</b>	<b>No</b>	<b>Notes</b>
Are storage areas and work areas clean and well organised?			
Are products stored and handled appropriately?			
Are containers properly labelled?			
Are there any drips, leaks or spills or emissions?			
Is all equipment operating properly at design capacity/efficiency?			
Is layout of the plant efficient?			
Are there any bottlenecks where production is held up?			
Are energy, water or raw materials being wasted?			
Are there any noise or odour issues?			
Are hazardous materials and wastes stored appropriately?			
Are different wastes kept separated?			
Are wastes labelled?			
Are wastes necessary?			
Are there any opportunities for reuse or recycling on site?			
Are employees trained on the safe handling of materials and wastes?			
Are procedures available in a simple form?			
Could any hazardous raw materials or consumables be substituted for less hazardous materials?			
Could solvent-based cleaners be substituted for detergent-based or water-based cleaners?			
Others?			







### Task 2a Collecting Existing Data

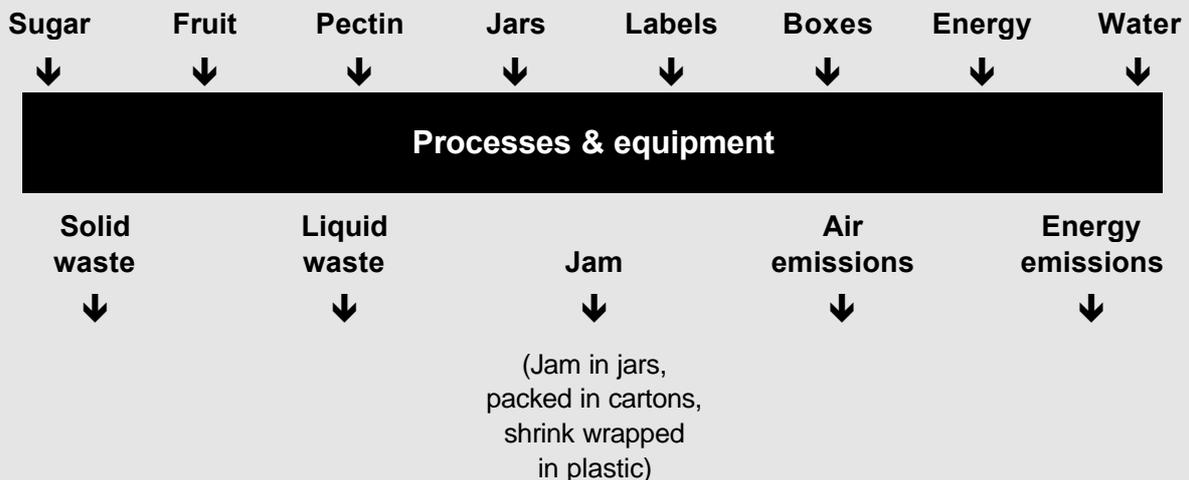
The nominated personnel from the ABC Foods Cleaner Production Team (J Graff and F Chart) searched through the company's records and found the original process flow diagrams and pipework diagrams dating back to the construction of the plant (1970). All of the diagrams and drawings were out of date and did not reflect current processes, equipment or pipework.

The team updated the drawings, and in the process discovered numerous unused pipes and unidentified valves. They also used this opportunity to update the floor waste and stormwater drainage diagrams.

### Task 2b Developing a Material Flow Assessment

The nominated personnel (N Ventry and V Goodall) began with the site material inventory list and compiled a list of materials currently used for jam production. They also obtained material purchase records from the Accounts Payable Department and sales records from the Marketing Department.

Using the above records, the team could draw a simple material flow diagram as follows:



The most difficult task was quantifying the actual flow of materials in terms of mass and volume. As a starting point, the team agreed to monitor and assess the flows of the following:

*Inputs per year  
(all purchased)*

- kg of fruit
- kg of sugar
- kg of pectin
- litres of water
- kg of caustic soda
- no. of jars
- no. of cardboard boxes
- kWh of electricity

*Outputs per year*

- kg of jam in product sold
- numbers of pallets used/reused
- number of product in jars sold
- kg and composition of solid waste generated (& disposed of)
- litres & composition of wastewater generated (& disposed of)
- number of damaged boxes recycled

# Stage 3 Generating Cleaner Production Options

## Task 3a Undertaking Detailed Assessments

Depending on the findings of your initial assessment, you may need to find out more specific details about your wastes or energy use by conducting a detailed audit. Whichever audit tool you use, it is important to record your steps so that you can revisit your findings and measure your future performance.

### Waste Audit

A waste audit shows your current patterns and costs of waste generation. This can be used to identify opportunities for waste avoidance, reuse or recycling. How complex your waste audit is depends on how complex your operations and services are.

It is usually necessary to look more carefully at the waste streams identified in Work sheet 2.5. This can be done using **Work sheet 3.1**, where you can characterise the waste streams and the waste management data:

- Look at types of waste, sources or causes, special characteristics such as toxicity, liquid, solid or gaseous.
- Note the rate and pattern of generation (such as intermittent or continuous), treatment requirements (on-site or off-site) and treatment costs.
- Detail all your costs associated with waste management, such as treatment, storage, labour, special handling requirements and cleaning operations, costs of raw materials in the waste and disposal costs.
- Evaluate what caused the waste in the first place. Causes could be product specification, type of inputs, technology factors (such as process design, equipment, piping), operating practices (such as planning or training), or waste handling procedures.



### Example Work sheet 3.1 ABC Foods Waste Characterisation and Management Data

1	2	3	4	5	6	7	8	9	10
<i>Waste stream</i>	<i>Waste source/cause</i>	<i>Waste characteristics</i>	<i>Generation pattern</i>	<i>Generation rate</i>	<i>Treatment requirements</i>	<i>Treatment cost (\$)</i>	<i>Storage requirements</i>	<i>Disposal Method</i>	<i>Disposal cost (\$)</i>
Wastewater	Jam Line 1 cleaning	High BOD, SS and sulfates	Continuous	3,000 kL/y	Settlement	1,000	Underground pit	Sewage under a TWA	16,000
Wastewater	Jam Line 2 cleaning	High BOD, SS and sulfates	Continuous	4,000 kL/y	Nil	Nil	Nil	Sewage under a TWA	25,000
Solid waste (cardboard)	Production and warehouse	All recyclable	Continuous	1 m <sup>3</sup> /week	Baling for recycling	35,000 for internal labour	Warehouse	Contractor to landfill	***
Solid waste (glass)	Production	Some broken All recyclable	Continuous	1 t/y	NA		External bin	Contractor to landfill	***
Solid waste (paper)	Office	All recyclable	Continuous	1 t/year	NA		External bin	Contractor to landfill	***
Solid waste (labels)	Production	Recyclable?	Occasional, due to faulty labels or machine setup	Minor (but costly)	NA		External bin	Contractor to landfill	***
Solid waste (product)	Production (QA/QC)	Out of spec. product	Occasional	Minor (but costly)	NA		External bin	Contractor to landfill	***
Solid waste (domestic)	Canteen & site management	General garbage	Continuous	3 m <sup>3</sup> /week	NA		External bin	Contractor to landfill	3,600

\*\*\* Included in the overall cost of domestic waste disposal

- 1 All waste streams which are recycled or require treatment, and/or disposal such as glass, sludge, or reject product
- 2 Provide specific sources and causes of the waste including processes, equipment, piping, spillage, location, department, site or activity
- 3 Special characteristics including toxicity; liquid, solid or gaseous
- 4 Indicate whether occasional, intermittent or continuous
- 5 Provide rate of generation such as L/day, ML/year, m<sup>3</sup>/day, kg/week or tonnes/year
- 6 Indicate current requirements for treatment on-site or off-site including reprocessing or recycling
- 7 On-site or off-site handling and treatment costs per year (including labour)
- 8 Indicate storage requirements before treatment or disposal
- 9 Indicate method of disposal, such as sewage treatment plant or landfill
- 10 Provide costs of disposal per year

## Task 3a, continued

### Energy Audit

Using less energy cuts operating costs and benefits your bottom line. An energy audit shows your current patterns and costs of energy consumption. This can be used to identify opportunities for reducing or eliminating inefficient use of energy, as well as for looking at alternative fuel sources which could be cheaper.

To carry out a basic energy audit you should:

- examine current energy consumption patterns through historical usage data for all forms of energy (natural gas, electricity, LPG and other fuels)
- gather information on energy costs and compare them to production or business activity so that energy performance indicators can be established and monitored, such as energy (MJ) used per tonne of product
- review current contractual arrangements, particularly relating to electricity tariffs and power factors.

**Work sheet 3.2** is a good starting point for a simple energy review. Annual usage of the main sources of energy to the plant should be related to the output achieved (e.g. total MJ/tonne of product). If this is done for a set of periods (years/months/weeks) — past or future — the changes in energy usage rates will reveal questions and suggest answers to help minimise energy consumption.

Australia now has a competitive electricity supply market, which enables substantial users of power to obtain competitive bids and enter into period contracts. To enable you to explore your options, a list of suppliers is provided by the Electricity Supply Association of Australia at [www.esaa.com.au](http://www.esaa.com.au) (including links to Association members).

Once you know your current energy consumption patterns and costs, you can identify and eliminate inefficiencies and also look at alternative fuel sources. As heating and cooling are usually the most energy-intensive operations, special attention should be given to these areas. On the other hand, lighting and appliances can often offer simple and cost-effective means of saving on energy costs.

### Further Information

Additional guidance on energy audits is found in Australian Standards:

- *AS2725 – 1984 Guidelines for reporting energy use as part of the energy audit*
- *AS3598 – 1990 Energy management programs – Guidelines for the preparation of an energy audit brief.*

Further information can also be sought from the relevant agencies listed on p 40 of this document.

## Work sheet 3.2 Simple Energy Review

What are the main forms of energy used in your plant/site?  
What are their annual usage rates and costs?

<i>Form of energy</i>	<i>Annual usage rate</i>	<i>Annual cost (\$)</i>
Natural gas	GJ	
Electricity	kWh	
LPG	kg	
Coal	tonnes	
Fuel oil	kL	
Petrol	kL	
Other		

Nominate the major energy users in your plant/site

<i>Energy used by</i>	<i>Max. electrical demand <sup>1</sup> (kW or kVa)</i>	<i>Energy consumption <sup>2</sup> (kWh)</i>
Steam and hot water generation		(kWh/GJ)
Refrigeration		
Pumps		
Air compressors		
Fans		
Conveyors		
Lighting		
Electric heating		
Vacuum pumps		
Mixing & agitation		
Other		

<sup>1</sup> obtained from equipment plate

<sup>2</sup> obtained from sub-meters (if installed), or calculated

## Task 3a, continued

### Environmental Audit

Environmental audits are a means of identifying the overall environmental impacts made by your business, so that changes in processes and practices can be assessed and implemented. Environmental audits can cover:

- noise and air emissions and wastewater discharges to the environment
- contamination of land
- storage and handling of hazardous and toxic substances
- environmental reporting and recording systems
- environmental management procedures and staff training.

An environmental compliance audit is an assessment of activities that determines whether the business is meeting regulatory requirements. It is usually performed by an independent auditor. However, you will find it useful to carry out your own review of environmental compliance from time to time. Environmental compliance has environmental, financial and social benefits that contribute to your triple bottom line.

A simple environmental review checklist is provided in **Work sheet 3.3**.

### Further Information

Additional guidance on environmental audits can be found in the Australian Standard *AS/NZS ISO 14010 – 1996 Guidelines for environmental auditing – General principles*.

Further information can also be sought from the relevant agencies listed on page 40 of this document. The NSW EPA website ([www.epa.nsw.gov.au](http://www.epa.nsw.gov.au)) provides links to online environmental legislation provided by the Australasian Legal Information Institute.

## Work sheet 3.3 Simple Environmental Review Checklist

	<b>Questions</b>	<b>Yes</b>	<b>No</b>	<b>Notes</b>
1	Does the site require a licence issued by the NSW EPA under the Protection of the Environment Operations Act?			
1a	If so, is the licence current?			
2	Does the site require a licence issued by WorkCover under the Dangerous Goods Act?			
2a	If so, is the licence current?			
3	Are there any underground tanks on site for the storage of dangerous goods such as petrol?			
3a	If so, are they regularly monitored for leaks?			
4	Are toxic chemicals stored and used on site?			
4a	If so, are they stored in bunded areas and precautions taken to minimise spillage and discharges to the environment?			
5	Does the site generate and emit high levels of noise?			
5a	Has the site had any noise complaints from nearby residents?			
6	Does the site discharge any wastewaters or stormwater to nearby creeks or waterways?			
6a	If so, are such discharges monitored and controlled?			
7	Does the site generate and discharge process wastewaters (trade waste)? If so, are they:			
7a	a) stored and discharged through appropriate means (such as to sewer under a Trade Waste Agreement)			
7b	b) stored and disposed of through a licensed contractor?			
8	Are solid and other wastes (other than wastewater) stored appropriately and disposed of through licensed contractors?			
9	Does the site generate hazardous wastes?			
9a	If so, are they properly labelled, stored and disposed of through licensed contractors?			
10	Does the site have any air discharges such as odours, gas, dust or process vents?			
10a	If so, are such discharges monitored and controlled?			
11	Are there any emergency response procedures?			
12	Are employees trained in environmental awareness and management?			

## Task 3b Identifying Cleaner Production Options

Once the causes of the wastes, emissions and energy losses have been identified, look at options to eliminate, reduce or control these causes. Determining the most appropriate option will often involve creative thinking and brainstorming by the Cleaner Production Team. Ideally the project leader or champion should encourage the Team to question current methods and technologies, and explore new and different ideas. The following questions might be asked:

- Can we minimise or eliminate waste generation by modifying the product in any way?
- Which input (e.g. toxic or hazardous material) needs to be substituted to minimise or eliminate waste generation?
- Can we modify the technology (e.g. process design, equipment or piping) to minimise or eliminate waste generation?
- Can we improve our housekeeping (e.g. procedures or training) to minimise or eliminate waste generation?
- Can we reuse or recycle our wastes on site?
- What is the 'best practice' within industry, in Australia and overseas?

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**Remember, it is generally better to reduce or eliminate the cause of the waste, rather than reuse or recycle.**

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Any ideas generated should be recorded, but not judged or evaluated at this point. It is important that idea generation is done in a positive environment, where all members can contribute freely without criticism.

### Station Control

One of the best practice techniques used for housekeeping is 'station control' whereby operators or shop floor teams are given ownership of their space. The occupants are given responsibility for organising the workspace and keeping it tidy. They dispose of the waste, rather than relying on cleaners. This provides an incentive to minimise waste in the operations. To obtain information on sources of advice, please contact the NSW Department of State and Regional Development (see page 40 of this document).

### Education and Training

Educating and training staff is also a popular option. As many staff as possible may be encouraged to participate in cleaner production teams, and thereby become familiar with the material and methodology. Consultants can be commissioned to conduct in-house training. Environment Australia maintains an environmental education database on Australian environmental courses at tertiary level accessible via the internet (see page 38 of this document).

### Environmental Management Systems

Businesses with the ability to operate formal management systems can consider adopting an environmental management system. Such a system locks good environmental practices into the formal operating procedures of the business. Responsibilities, records and reporting requirements are clearly defined, and the system is subject to audit and could be certified to the International Standard ISO 14001. (Contact details are provided on page 39 of this document.) Establishing such a system can give confidence to multinational and government customers, and can result in these attractive markets opening up to the business.

## Waste

### Task 3a Detailed Assessment: Waste Audit at ABC Foods

At ABC Foods it was considered important to compile a comprehensive list of all waste streams. With the assistance of production personnel, the Site Manager, Warehouse Manager and the Accounts Department, a work sheet characterising the waste was completed (See **Example Work sheet 3.1** on page 22).

Poor record-keeping meant many vital pieces of information were not available. From efficiency and productivity points of view, there was virtually no data on, and certainly no assessment of, the efficiency of material utilisation. In other words, there was no way of calculating how much fruit was used for each kilogram of jam produced. Nor was there any data on quantities of water and chemicals needed for each kilogram of jam. The company assessed the *total cost of production* for marketing and pricing of the products sold, but did not break down the various elements of cost, particularly in terms of material utilisation and wastage.

The comprehensive waste auditing exercise, completed over two months, gave the Cleaner Production Team a much better understanding of material flow. In some instances the Team were surprised about the quantities of waste generated, and the costs of waste management (see **Example Work sheet 3.1**). In particular, there were considerable volumes of wastewater generated. More importantly, each litre of wastewater took with it quantities of:

- product (jam) which included the raw materials such as sugar and fruit
- energy (heat)
- chemicals.

### Task 3b Identifying Cleaner Production Options from the Waste Audit

During one of the brainstorming sessions following the audit, the high costs of discharging (wasting) these resources to the sewer motivated the Team to consider a number of options for reducing wastewater generation (and the pollutants within the wastewater streams), including:

- examining housekeeping practices and operating procedures, and making improvements as required
- examining staff awareness of environmental issues and cleaner production techniques, and preparing a training program where required
- upgrading the washing system to use alternative chemicals and less water
- installing a dissolved air flotation (DAF) system, to treat the wastewater before discharge to sewer.

At another brainstorming session, the Team suggested developing a waste-tracking system, whereby each department would record the waste generated each day in terms of type and quantity. This data would be used in monitoring the following key performance indicators:

- wastewater generated per kg of jam produced
- solid waste — glass generated per kg of jam produced
- solid waste — packaging generated per kg of jam produced
- solid waste — 'out of spec' product generated per kg of jam produced
- overall cost of waste management as a proportion of production cost.

## Energy

### **Task 3a Detailed Assessment: Simple Energy Audit at ABC Foods**

At ABC Foods, a simple energy audit was carried out by the nominated staff. This took one month to complete. They started by obtaining electricity usage data from the electricity bills for the past three years. Unfortunately, the bills covered all of the site and did not separate the administration from the production areas. To get a better idea of the energy usage in production, the team estimated the energy usage in the administration building by carrying out an energy audit of all lighting and air conditioning loads, to arrive at the net consumption by production.

The team was also able to obtain the typical load profile of the site from the power supply company. The total load peaked mid-afternoon at about 50 kW above the average level over the day. The supplier's engineer also reported that the power factor was relatively low at the plant.

The most important finding was the relatively high energy used in the cooking and refrigeration processes. The other high user of energy was the washing of jam kettles and piping, which used hot water. These preliminary findings gave the Team a focus for identifying opportunities for improvement.

### **Task 3b Identifying Cleaner Production Options from the Energy Audit**

Following the audit, the Team held a brainstorming session and identified many opportunities for energy savings including:

- altering the production schedule to alternate the loading of the coolers. This would also result in the washing loads being spaced out, with a net effect of levelling the load and reducing the demand components of the monthly power bill
- installing a capacitor bank to improve the power factor, further lowering the power bill
- installing a heat exchanger, to use the heat in the washwater to preheat the cooking batch. This would reduce the energy needed in the cooking process by 15%
- using alternative cleaners for washing some equipment, to reduce the amount of hot water required
- replacing the electric jam cooking system with natural gas cookers
- separately metering the energy usage in production areas
- using a lower temperature of hot water for washing (providing health standards are met)
- time control of air conditioning so that the system is not used unnecessarily
- using more energy-efficient lighting in the offices and plant room
- using more spot lighting in critical production areas instead of excessive general lighting
- using more natural light by installing clear panels in the roof
- staff education to improve housekeeping (for example, turning lights and machinery off when not in use).

At a separate meeting the Team developed a set of key performance indicators for future monitoring, as follows:

- the overall energy used in the plant (MJ) per kg of jam produced
- the amount of hot water used for washing per kg of jam produced
- the monthly maximum demand of the plant (kVA).

# Stage 4 Evaluating Cleaner Production Options

## Task 4a Technical, Economic and Environmental Feasibility

Once the Cleaner Production Team has a set of options, it's time to decide those to be considered further. Viable options need to be ranked. Some may not be feasible at present, so these should be set aside for consideration in the future. Next, the technical, economic and environmental feasibility of the options should be examined.

### Technical Feasibility

Technical feasibility examines whether the technology is available to the firm, is appropriate, and can achieve the required changes. This may involve talking to manufacturers or providers of services.

### Economic Feasibility

Economic feasibility compares current savings with costs of implementing the option. The likely payback period for any capital investment is often the simplest method for assessing economic feasibility.

The payback period is the time it will take to save the money spent to change or improve a process or operation, and is expressed as:

$$\text{Payback period (years)} = \frac{\text{Capital investment and project costs}}{\text{Net savings in operating costs per year}}$$

Make sure that all relevant implementation costs and possible operating cost savings are accounted for.

### Environmental Feasibility

Environmental feasibility determines the environmental benefits or effect (positive or negative) of each option on the company's environmental objectives, regulatory requirements, customers, employees and the general community.

### Setting Priorities

Based on these considerations, re-screen the viable options and set priorities for implementation. Priorities may be based on greatest return, urgency or simply availability of financial resources. If an option is beyond current financial resources, in some cases you may be able to divide the option into a number of affordable stages. Use **Work sheet 4.1** to record your findings.

The Cleaner Production Team should present these options to management and staff. Priorities should be consistent with the Company's business and operating plans.

Management approval of the options chosen for implementation, and the related budget, usually needs to be recorded in writing and announced internally in the company (through circulars, newsletters and notice boards). Creating wide awareness of cleaner production projects brings about smooth implementation and provides recognition to the Cleaner Production Team. Usually these types of initiatives also win improved staff morale and customer support.



## Example Work sheet 4.1 ABC Foods Technical, Economic and Environmental Feasibility

<b>Item No.</b>	<b>Action</b>	<b>Estimated cost (\$)</b>	<b>Estimated annual benefit (\$)</b>	<b>Payback period (years)</b>	<b>Technical feasibility</b>	<b>Economic feasibility</b>	<b>Environmental feasibility*</b>	<b>Priority</b>
1	Housekeeping and staff training	1,000	5,000	0.2	Very High	Very Good	Very Good	1
2	Washing system (change washing chemicals, change spray nozzles)	500	1,000	0.5	High	Good	Good	1
3	Install DAF system (to reduce trade waste discharge of pollutants)	51,000	17,000	3.0	High	Fair	High	2
4	Heat recovery (from boiler flue)	5,000	5,000	1.0	Fair	Good	Good	2

\* include any regulatory requirement

#### **Task 4a Technical, Economic and Environmental Feasibility**

At ABC Foods, a number of the potential options were assessed in terms of their technical feasibility, payback period and environmental benefits (see **Example Work sheet 4.1** on previous page). The Team initially considered the feasibility of options with little or no capital expenditure, as follows:

- improving housekeeping and operating procedures and raising staff awareness of environmental issues and cleaner production techniques
- upgrading the washing system to use alternative cleaners and less water and energy
- installing a DAF system to treat the wastewater before discharge to sewer
- installing a heat exchanger to use the heat in the washwater to preheat the cooking batch.

#### **Housekeeping and Staff Training**

Improving housekeeping, developing formal operating procedures and training staff in cleaner production techniques presented a very low-cost opportunity to provide substantial annual savings. Specific measures included a waste and energy tracking system, cleaner production training program and better housekeeping strategies, to minimise waste and energy use. These measures were expected to yield immediate benefits (\$5,000 per annum) for an outlay of \$1,000, with the majority having a payback period of less than four months and significant environmental performance improvements.

#### **Washing System**

After contacting chemical suppliers it appeared that an alternative cold water cleaner was technically feasible, and still met health requirements, when used in conjunction with more efficient spray nozzles. The estimated cost of upgrading the washing system was \$500 with an expected payback period of 6 months. This would also lead to ongoing savings of \$1,000 per annum, improvements in wastewater quality and lower water and energy use.

#### **DAF System**

Installation of the DAF system was assessed to be technically feasible but involved a capital outlay of \$51,000. Current economic constraints meant that this option, even though it lowered discharge pollutants and resulted in annual savings of \$17,000, was postponed for further consideration at a later date.

#### **Heat Recovery**

Heat recovery from the boiler flue gas, to preheat the cookers, required a payback period of 1 year, giving annual savings of \$5,000. The project is expected to provide substantial reductions in heat loss (and greenhouse gas emissions) and was budgeted for implementation in the next year.

# Stage 5 Implementing Cleaner Production, Continuous Improvement

Now you have a list of approved options, it's time to implement them. For the Team's preferred options set some targets based on current performance, and prepare an implementation plan using the checklist on **Work sheet 5.1**. If equipment changes are involved, outline the planning, scheduling, design, purchase and installation of the equipment. Depending on the complexity of the option, external assistance may be required.

The options to be implemented first should be those involving operational or procedural changes with least cost. This will provide speedy results and greater impetus for implementing other options. This approach will also highlight the need for a new discipline in the operations, and the need to establish a cleaner production culture in the business. Without this cultural change, isolated measures (such as installing equipment or instruments) will not be fully effective, and will not yield long-term improvement.

The Cleaner Production Implementation Plan should be integrated into the company's business and operating plans. Resources needed for these initiatives need to be provided for in the company's budgeting process.

HYPOTHETICAL EXAMPLE: ABC FOODS PTY LTD

At ABC Foods, the Implementation Plan involved developing a list of actions, starting with those which did not require any capital outlay.

## ABC Foods Cleaner Production Implementation Plan

### Waste and energy tracking system

**Record** on a monthly basis the amounts of waste generated and recycled by type:

- solid waste — food (including 'out of spec' jam)
- solid waste — glass
- solid waste — packaging
- wastewaters being discharged to sewer

Start date	Immediate
Resources required	12 person hours per month
Person responsible	Warehouse Manager
Target completion date	Ongoing

**Record** on a monthly basis the costs of:

- trade waste to sewer
- disposing of solid waste
- electrical energy used
- water usage

Start date	Immediate
Resources required	12 person hours per month
Person responsible	Assistant Financial Controller
Target completion date	Ongoing

**Compare** the records from the waste and energy tracking system to the key performance indicators developed in Task 3b.

Start date	Immediate
Resources required	12 person hours per month
Person responsible	Production Manager
Target completion date	Ongoing

### Staff Training

**Implement** a staff training program to make all staff more aware of the company's environmental responsibilities, as well as cleaner production techniques.

Start date	Within the next 3 months
Resources required	External consultant (\$4,000 quotation received)
Person responsible	Human Resources Manager
Target completion date	All relevant staff trained by end of year

### Housekeeping

**Implement** better housekeeping strategies to minimise water and energy usage, including procedures for washing operations, switching machinery and lights off.

Start date	Within the next four months
Resources required	20 person hours per month
Person responsible	Production Manager/Engineering Manager
Target completion date	Procedures completed by end of year

**Experiment** with lower cooking temperatures to reduce energy usage.

Start date	Immediate
Resources required	20 person hours
Person responsible	Production/Technical Managers
Target completion date	One month

**Obtain** costs of the following for future feasibility:

- replacing the electric cookers with natural gas cookers
- installing better temperature controls for the cookers
- installing a false ceiling in the manufacturing building
- upgrading the administration building air conditioning system, and installing better insulation and thermal barriers.

Start date	Immediate
Resources required	24 person hours
Person responsible	Engineering Manager
Target completion date	Two months

## Washing System

**Upgrade** the washing system by:

- installing more efficient spray nozzles
- using less toxic chemicals, requiring less rinsing and lower water temperatures.

Start date	This financial year
Resources required	\$500 and 100 person hours
Person responsible	Engineering Manager
Target completion date	Within this financial year

## DAF System

**Install** a DAF System to reduce the loadings on the trade waste discharges.

Start date	Reconsider next financial year
Resources required	\$51,000 and 60 person hours (plus consultants to develop specifications)
Person responsible	Engineering Manager
Target completion date	Within the next 2 years

## Heat Recovery

**Install** a heat exchanger to recover heat from boiler flue, to preheat the batch cooking vessels.

Start date	Next financial year
Resources required	\$25,000 and 40 person hours (including consultants for design of system)
Person responsible	Engineering Manager
Target completion date	Within the next 12 months

## Continuous Improvement

The cleaner production exercise undertaken by ABC Foods demonstrated that, although production and operations appeared to be well run, there were always opportunities for continuous improvement. Indeed, the more the Team implemented cleaner production techniques and achieved positive results, the more enthusiastic the entire organisation seemed to become in rethinking their operations and in being open to change. Over the next year or two, many additional options presented themselves for future consideration, such as those below.

### Product Waste

The Team realised that for every jar of 'out of spec' jam discarded (due to poor quality), not only were raw materials and energy added to the waste stream, but there was an opportunity cost in the wasted material. This gave an incentive to continuously look for opportunities to improve production techniques and procedures, to result in 'zero defects'.

Implementing better product control, through formal procedures and staff training, had virtually no initial capital cost and presented significant opportunities for minimising waste and increasing production efficiency.

## **Cooking Processes**

Cooking consumed considerable amounts of energy (and money). Therefore, there was significant incentive to continuously review the costs and benefits of better temperature control and improved cooking techniques. With government assistance, ABC Foods commissioned a university graduate to carry out a research project for one year, to determine an optimised energy-cooling process.

## **Air Conditioning**

This was a high-cost item and required reassessment in terms of:

- upgrading the current offices and redesigning the air conditioning system, which was old and inefficient
- improving space heating in the production area by lowering the ceiling (installing a false ceiling)
- installing better insulation systems, including additional doors and partitions, to reduce heat loss and thermal loading.

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**Remember, cleaner production practices open up new opportunities for further savings and benefits. Keep track of improvements by monitoring agreed performance measures, so that progressively higher management targets can be set. Also remember to provide feedback to personnel, particularly on positive achievements, to encourage enthusiasm and further effort.**

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## Work sheet 5.1 Implementation Plan and Ongoing Activities Checklist

1 Have you established your current baselines and performance indicators?

These would typically relate material/energy/water/waste quantities to the size of the operation, to arrive at indices that could possibly be compared with other operations and establishments. Some common ones are:

- kg of solid waste per tonne of product sold
- kL of wastewater per L of product packaged
- cost of all waste disposal per month
- m<sup>3</sup> of paper waste per employee per year
- kWh per tonne of product sold
- kWh/m<sup>2</sup> of office floor space.

2 Your plan for implementing the preferred (cost-effective) options or projects should include:

- targets
- actions to be taken
- resources required for implementation (human resources, finance and equipment)
- person(s) responsible for the implementation
- timing
- performance measures
- potential dollar savings.

3 Do you have a system for reviewing and reporting the progress of the project from start to completion?

4 Do you have a system for reviewing the performance indicators based on the actual performance of the project?

5 Do you have a system for reporting the results of the project and its benefits to management and staff?

6 Do you have a plan to assess the outcomes of the project and transfer the lessons learnt to other areas of your operations, and perhaps to extend its benefits to your whole organisation?

7 Are the implementation plans included in your company's business plan and budget?

# Further Reading, Case Studies and Assistance

There are numerous documented case studies demonstrating the benefits of implementing a cleaner production program. Case studies and further information can be obtained from a number of national and international government agencies, including:

## Australian Case Studies

Environment Australia	<a href="http://environment.gov.au/net/environet.html">http://environment.gov.au/net/environet.html</a>
Victorian Environment Protection Agency	<a href="http://www.epa.vic.gov.au/cleanprod">http://www.epa.vic.gov.au/cleanprod</a>
UNEP Working Group Centre for Cleaner Production in the Food Industry	<a href="http://www.geosp.uq.edu.au/emc/cp/">http://www.geosp.uq.edu.au/emc/cp/</a>
EcoRecycle Victoria	<a href="http://www.ecorecycle.vic.gov.au">http://www.ecorecycle.vic.gov.au</a>
Business Victoria	<a href="http://www.dsd.vic.gov.au">http://www.dsd.vic.gov.au</a>
The Sustainable Industry Division	<a href="http://www.env.qld.gov.au">http://www.env.qld.gov.au</a>
NSW Environment Protection Authority	<a href="http://www.epa.nsw.gov.au">http://www.epa.nsw.gov.au</a>
Sustainable Development Energy Authority	<a href="http://www.seda.nsw.gov.au">http://www.seda.nsw.gov.au</a>

## Overseas Case Studies

(Note that many publications and information sources in the USA refer to 'pollution prevention' rather than 'cleaner production'.)

US EPA EnviroSense Case Studies	<a href="http://es.epa.gov/ep3/ep3300.html">http://es.epa.gov/ep3/ep3300.html</a>
USA Cleaner Washington Centre	<a href="http://www.cwc.org">http://www.cwc.org</a>
Environment Canada Pollution Prevention Success Stories	<a href="http://www.mb.ec.gc.ca/pollution/e00s05.en.html">http://www.mb.ec.gc.ca/pollution/e00s05.en.html</a>
United Nations Environment Program (UNEP)	<a href="http://www.unep.org">http://www.unep.org</a>
World Business Council for Sustainable Development	<a href="http://www.wbcsd.ch/eedata/eecshome.htm">http://www.wbcsd.ch/eedata/eecshome.htm</a>

## Further Reading

*Environment Management Handbook for Small Industry*, Australian Chamber of Manufactures

*Cleaner Production Manual: Environment & Business: Profiting from Cleaner Production*, Environment Australia

*Environmental Information for Small Business*, NSW Environment Protection Authority.  
Booklets for: Auto dismantlers; Auto servicing & mechanical repairers; Builders; Food Sense (hospitality industry); Marinas, boatsheds and slipways; Photographic film & paper processors; Printers; Retail food businesses; Service stations; Shopping centre management; Smash repairers; and Small Factories.

*Cleaner Production and Eco-efficiency. Complementary Approaches to Sustainable Development*. United Nations Environment Program and the World Business Council for Sustainable Development.

*Journal of Cleaner Production*, Elsevier Science

*Energy Smart Allies Directory 2000*, Sustainable Energy Development Authority

*Energy Smart Toolbox*, Sustainable Energy Development Authority

## Australian Standards

### Environmental Standards

AS/NZS ISO 14001:1996

*Environmental management systems — Specification with guidance for use*

AS/NZS ISO 14004:1996

*Environmental management systems — General guidelines on principles, systems and supporting techniques*

AS/NZS ISO 14010: 1996

*Guidelines for environmental auditing — General principles*

AS/NZS ISO 14011:1996

*Guidelines for environmental auditing — Audit procedures, Auditing of environmental management systems*

AS/NZS ISO 14031(Int): 1998

*Environmental management — Environmental performance evaluation — Guidelines*

AS/NZS ISO 14040:1998

*Environmental management — Life cycle assessment — Principles and framework*

AS/NZS ISO 14041:1999 *Environmental management — Life cycle assessment — Goal and scope definition and inventory analysis*

### Energy Audit Standards

AS2725-1984

*Guidelines for reporting energy use as part of the energy audit*

AS3598-1990

*Energy management programs — Guidelines for the preparation of an energy audit brief*

### Standards Australia Contact Details

1 The Crescent, Homebush NSW 2140

Phone 1300 65 46 46

Fax 1300 65 49 49

Email [Sales@standards.com.au](mailto:Sales@standards.com.au)

Web page [www.standards.com.au](http://www.standards.com.au)

## Contacts

### NSW Department of State and Regional Development

Level 43, Grosvenor Place  
225 George Street  
Sydney NSW 2000 Australia

Phone 02 9338 6600  
Fax 02 9338 6705, 02 9338 6755  
Web page <http://www.business.nsw.gov.au>

The Department has a number of industry assistance programs — including High Growth Business Program, Technology Diffusion Program and Small Business Expansion Program — to help companies become internationally competitive.

### NSW Environment Protection Authority

Cleaner Industries Unit  
59-61 Goulburn Street  
PO Box A290  
Sydney South NSW 1232 Australia

Phone 02 9995 5000 (switch)  
Fax 02 9995 5999  
Web page <http://www.epa.nsw.gov.au>

Publications are available from EPA Pollution Line  
Phone 131 555 (local call cost when calling from within NSW)

Email [info@epa.nsw.gov.au](mailto:info@epa.nsw.gov.au)

### Environment Australia

EnviroNET Australia Project Officer  
Environment Protection Group

GPO Box 787  
Canberra ACT 2601

Phone 02 6274 1781  
Fax 02 6274 1640

Web page <http://www.erin.gov.au/net/environet.html>

### AusIndustry Hotline

AusIndustry is the Commonwealth Government's central point for business information and assistance.

Phone 132 846  
Web page <http://www.business.gov.au>

### CRC for Waste Management and Pollution Control

Phone 02 9385 4886  
Fax 02 9662 1971  
Web page <http://www.crcwmpc.com.au>

### Beverage Industry Environment Council

'The Stables'  
Rear 117 Harris Street  
Pymont NSW 2001

Phone 02 9518 6566  
Fax 02 9518 6577  
Email [biec@biec.com.au](mailto:biec@biec.com.au)

### Australian Industry Group

51 Walker Street  
North Sydney, NSW, 2060

Phone 02 9466 5566  
Fax 02 9466 5599

### Australian Business

Australian Business Centre  
140 Arthur Street  
North Sydney NSW 2059

Phone 02 9927 7500  
Fax 02 9955 6495

### Plastics & Chemicals Industry Association (PACIA)

4th floor, 380 St Kilda Road  
GPO Box 1610M  
Melbourne VIC 3001

Phone 03 9699 6299  
Fax 03 9699 6717

### Printing Industries Association of Australia

Level 10, 99 York St  
Sydney NSW 2000

Phone 02 9248 7300  
Fax 02 9299 0087

### Environment Management Industry Association of Australia Limited

217 Northbourne Avenue  
Turner ACT 2612

Phone 02 6230 1011  
Fax 02 6230 6814  
Web page <http://www.emiaa.org.au/>

### Sustainable Energy Development Authority

Level 6, 45 Clarence Street  
Sydney NSW 2000

Phone 02 9291 5260  
Fax 02 9299 1519  
Web page <http://www.energysmartallies.com>

### Buy Recycled Business Alliance

Phone 02 9212 5222

## Waste Planning and Management Boards

### Central Coast

(Gosford, Wyong Councils)

PO Box 345  
Gosford NSW 2250

Phone 02 4323 4343  
Fax 02 4325 3711  
Email [ccwasteb@acay.com.au](mailto:ccwasteb@acay.com.au)

### Hunter

(Cessnock, Lake Macquarie, Maitland, Newcastle, Port Stephens Councils)

PO Box 307  
Waratah NSW 2298

Phone 02 4940 0400  
Fax 02 4940 0399  
Email [hwpmc@hunterwaste.nsw.gov.au](mailto:hwpmc@hunterwaste.nsw.gov.au)

### Illawarra

(Kiama, Shellharbour, Shoalhaven, Wollongong Councils)

PO Box 460  
Dapto NSW 2530

Phone 02 4262 2200  
Fax 02 4262 2533  
Email [illawarra@wasteboards.nsw.gov.au](mailto:illawarra@wasteboards.nsw.gov.au)

### Inner Sydney

(Ashfield, Auburn, Burwood, Concord, Drummoyne, Leichhardt, Strathfield, Sydney Councils)

Suite 2, Level 11  
Town Hall House  
456 Kent Street  
Sydney NSW 2000

Phone 02 9261 2777  
Fax 02 9261 2577  
Email [iswb@wasteboard.nsw.gov.au](mailto:iswb@wasteboard.nsw.gov.au)

### Macarthur

(Camden, Campbelltown, Wollondilly, Wingecarribee Councils)

PO Box 1441  
Campbelltown NSW 2560

Phone 02 4628 4588  
Fax 02 4628 9925  
Email [mwb@macwaste.org.au](mailto:mwb@macwaste.org.au)

### Northern Sydney

(Hornsby, Hunters Hill, Ku-ring-gai, Lane Cove, Manly, Mosman, North Sydney, Pittwater, Ryde, Warringah, Willoughby Councils)

Suite 1  
47A Penrose St  
Lane Cove NSW 2066

Phone 02 9428 5673  
Fax 02 9428 5674  
Email [nswb@bigpond.com](mailto:nswb@bigpond.com)

### Southern Sydney

(Botany, Canterbury, Hurstville, Kogarah, Marrickville, Randwick, Rockdale, South Sydney, Sutherland, Waverley, Woollahra Councils)

Locked Bag 300  
Botany NSW 1455

Phone 02 9316 9199  
Fax 02 9316 9586  
Email [wastesth@mpx.com.au](mailto:wastesth@mpx.com.au)

### Western Sydney

(Bankstown, Baulkham Hills, Blacktown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith Councils)

PO Box 1101  
Blacktown NSW 2148

Phone 02 9676 6299  
Fax 02 9676 6363  
Email [team@wswaste.nsw.gov.au](mailto:team@wswaste.nsw.gov.au)

# **Attachment 1: Cleaner Production Overhead Presentation**

The following presentation is available as a PowerPoint file, or you could copy the following pages onto overhead transparencies.

# **Cleaner Production in Small to Medium- Sized Businesses**

# **Cleaner production**

## **A holistic approach**

- **Improving the efficiency of resource utilisation**
- **Minimising creation of waste and pollution**
- **Cost reductions and marketing advantage**

# **Cleaner production**

## **Examples of cleaner production techniques**

- **Improve housekeeping**
- **Materials substitution**
- **Change process or technology**
- **Reformulate or redesign products**
- **Reuse and recycle materials on site**

# **Improve housekeeping**

- **Reduce raw material and product loss due to leaks and spills etc**
- **Improve monitoring of operations and maintenance**
- **Schedule production to reduce equipment cleaning**
- **Train employees in cleaner production**
- **Improve management inventory of raw materials and products**

# **Materials substitution**

- **Replace toxic solvent-based coatings with less toxic, water-based coatings**
- **Eliminate hazardous materials**

# **Change process or technology**

- **Use mechanical cleaning devices**
- **Reduce high pressure lines to reduce fugitive emissions of air toxins**

# **Reformulate or redesign products**

- **Formulate paint without lead**
- **Analyse impact created by products over their life cycle**

# **Reuse and recycle materials on site**

- **Utilise wastewater and energy**
- **Reuse product rejects**
- **Separate waste streams**

# **Where are we at?**

## **Pollution control**

**Pollutants controlled by filters and waste treatment**

**Pollution control is evaluated when processes and products have been developed and when problems arise**

**Pollution controls and environmental improvements are considered to be always cost factors for the company**

# **Where are we at?**

## **Cleaner production**

**Pollutants prevented at source through integrated measures**

**Pollution prevention is an integrated part of product and process development**

**Pollutants and wastes are considered potential resources and may be transformed into useful products and by-products**

# **Cleaner production solutions**

- **Minimise waste**  
reduce, reuse, recycle, evaluate needs, refill, fix, maintain equipment
- **Minimise pollution**  
design, process control, procedures, emergency measures, spill control
- **Minimise use of resources**  
water, energy, paper, chemicals, plastics

# **Cleaner production**

## **What's in it for us?**

- **Improved efficiency**
- **Improved productivity**
- **Reduced operating costs**
- **Enhanced public image and marketing advantage**
- **Reduced environmental risks**
- **Regulatory compliance**

# Cleaner production

Improved financial  
performance



# **Cleaner production**

## **Key issues**

- **Openness to change**
- **Continuous improvement**
- **Long term objectives**
- **Constant review of operations — always looking for a better way**
- **Asking the right questions**

# **Cleaner production**

## **How and where?**

**Water usage — where can water usage be reduced?**

- **washing operations**
- **cleaning and rinsing**
- **gardening**
- **processes**
- **heating, steam generation**

# How and where?

## Wastewater generation — what is in our wastewater?

- **heat**
- **raw materials**
- **pollution**
- **recoverable/reusable  
products or by-products**

# How and where?

**Solid waste — how can we reduce, reuse and recycle?**

**Can any of the waste be avoided?**

- **packaging**
- **office paper use**
- **raw materials and products**
- **reject products**
- **improve manufacture and management**
- **use recycled materials**

# How and where?

**Chemicals — can any of them be substituted or eliminated?**

- **manufacturing processes**
- **cleaning operations**
- **air conditioning**
- **garden**
- **laundry**
- **machinery and equipment**

# How and where?

## Energy usage

- **process heating**
- **boilers, steam and hot water**
- **air conditioning**
- **lighting**
- **pumps**
- **kitchens**
- **laundry**
- **machinery and equipment**

# Cleaner production

Pollution control		Waste management		Cleaner production	
Disposal	Treatment	Energy recovery	Use/reuse	On-site recycling	Source reduction
		Off-site recovery	Reclamation	Energy & raw materials conservation	Resource recovery

➔ Shifting emphasis to sustainable development ➔

# Feedback Form

Please photocopy this form and send us your comments. We are keen to hear about your experiences using this self-help tool because this will help us improve and refine it as part of a continuing process.

Company \_\_\_\_\_

Contact name \_\_\_\_\_

Phone no. \_\_\_\_\_

1 Have you found this document useful or not?

yes  no

For what reasons?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2 Which aspects were most useful?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3 Which aspects were least useful?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4 How could this Self-Help Tool be improved?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5 What further information could be provided to help you implement cleaner production?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Thank you.

Please return this form to:  
Cleaner Production Self-Help Tool  
Cleaner Industries Unit  
NSW Environment Protection Authority

Mail PO Box A290  
Sydney South NSW 1232  
Fax 02 9995 5912  
Email [cleanind@epa.nsw.gov.au](mailto:cleanind@epa.nsw.gov.au)