EREP Toolkit

Module 2 of 5:
A management systems approach to resource efficiency

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CONTENTS

DEFINITIONS AND TERMS

TERM	DEFINITION
The Act	*Environment Protection Act 1970*
Baseline data	The average resource use for each resource stream (water, waste, energy) in the reference period (i.e., before undertaking EREP actions), excluding abnormal seasonal variations.
Benchmarking	Comparing your own performance against relevant markers (e.g., other sites in your business or your industry sector, or known best practice markers) for the purpose of establishing your relative positioning.
Energy	Energy or energy sources specified in Schedule 1 of the Regulations used at premises in accordance with the criteria described in regulation 6 of the Regulations. Includes: (a) electricity (not generated at the site) whether from renewable or other sources (b) steam (not generated at the site) used to provide energy (c) compressed air (not generated at the site) used to provide energy (d) combustible fuels (e) reductants.
EPA	Environment Protection Authority Victoria.
EREP	An Environment and Resource Efficiency Plan.
EREP program	The statutory program under which a business may be required to prepare an EREP, as set out in the Act and Regulations.
Premises	The site that is being assessed for resource efficiency. The legislated scope of an EREP assessment is the operations within the site boundary. A wider assessment scope may be used voluntarily.
The Regulations	*Environment Protection (Environment and Resource Efficiency Plans) Regulations 2007.*
Resources	In this document, the use of energy, water and materials and the generation of waste.
Resource efficiency/ resource use efficiency	Generally interchangeable terms meaning the efficiency of the use of resources (energy, water, materials) and the generation of waste, measured against a site activity indicator (e.g., production rate, net lettable area).
Resource management/ resource efficiency management	Generally interchangeable terms meaning the management of resources (energy, water, materials) and the generation of waste. Aspects of this may include resource use in total, as well as the efficiency of resource use.
Resource use threshold	A threshold level of energy or water use that, if exceeded at a site, means that the site must participate in the EREP program.
Water	Water includes mains water, groundwater, surface water, recycled (or reused) water, desalinated water, rainwater, harvested stormwater and grey water, but does not include seawater.
waterMAP	A water Management Action Plan, prepared under a program defined by the Department of Sustainability and Environment, Victoria.
Waste	Waste includes: • general waste (putrescible, solid inert or prescribed industrial waste) • liquid waste (trade waste, domestic sewage, licensed wastewater discharge or prescribed industrial waste); whether disposed of (on site or off site), reused or recycled.

UNITS

Joule	A unit of energy.
Megajoule (MJ)	One million (10^6) joules.
Gigajoule (GJ)	One thousand million (10^9) joules.
Terajoule (TJ)	One million million (10^{12}) joules, and equivalent to 0.278 GWh.
Litre	A unit of water.
Kilolitre (kL)	One thousand litres.
Megalitre (ML)	One million (10^6) litres.

1. PURPOSE OF THIS DOCUMENT

This document is Module 2 of an Environment and Resource Efficiency Plans (EREP) Toolkit. The EREP Toolkit consists of five modules designed to assist businesses to manage their resource efficiency. Figure 1 1 shows the relationship between Module 2 and the overall EREP Toolkit, and the key points covered in this module.

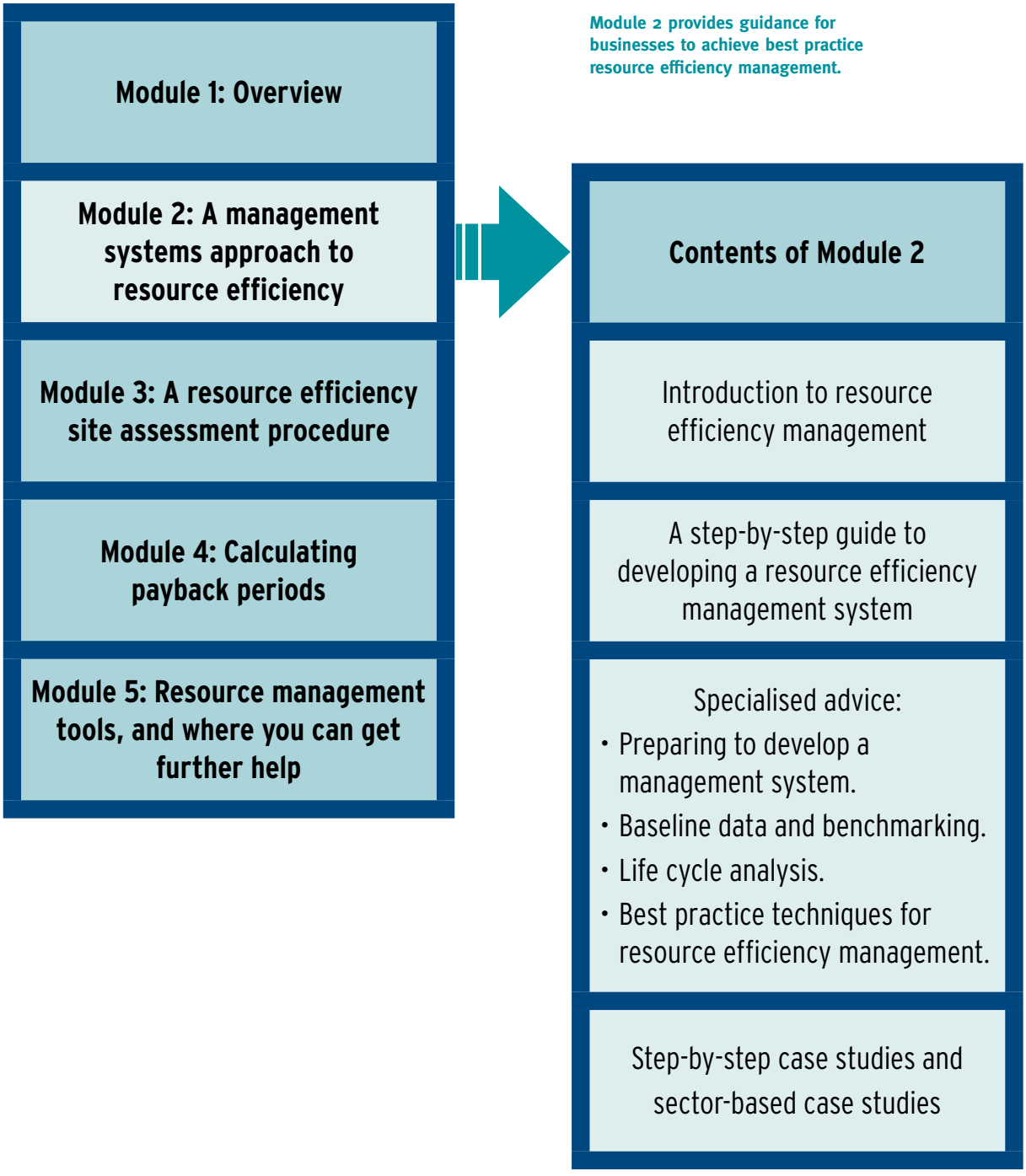

FIGURE 1.1: KEY ELEMENTS OF THE EREP TOOLKIT

The purpose of this module is to:

- assist businesses to manage their resource use by establishing a management system, or using an existing management system such as an EMS, to implement a continuous improvement program for resource efficiency
- demonstrate (by case study examples) how using best practice approaches to resource efficiency management can identify business opportunities
- provide specialised information about some key aspects of a resource efficiency management process.

1.1 How to use this module

The main sections of this module introduce the concept of resource efficiency management and provide a step by step guide that can be followed to establish and operate a basic management system. The steps also explain how resource efficiency can be incorporated into an existing management system that a business may already operate.

Several appendices provide more specialised advice about key aspects of the management system approach. These include organisational aspects as well as aspects relating to data management and analysis, and case studies that demonstrate how some businesses have approached the various tasks involved.

Guidance note

This module describes a generalised management system approach and provides only a basic level of information about site assessment procedures and financial feasibility analysis. More detailed information on these topics can be found in Modules 3 and 4 of the Toolkit respectively.

Additional references to best practice design techniques and best practice technologies, including for specific business sectors, are provided in Module 5 of the Toolkit.

This module can help any business to improve its resource efficiency management. While it is not specific to the EREP Program, the module will also help EREP participants that do not currently operate an effective resource management system to meet the EREP Program requirements.

2 INTRODUCTION TO RESOURCE EFFICIENCY MANAGEMENT

The environmental performance of products and processes is a key issue in today's business environment. Businesses are constantly investigating ways to minimise their impacts on the environment, and they often find that improving their environmental performance through better resource efficiency can also improve their competitiveness by leading to lower costs.

In order to achieve best practice, resource use and resource efficiency (encompassing energy, water and materials use and waste generation) should be managed through a formal management system. Many businesses use a Quality Management System and/or an Environmental Management System, and such systems can be used to manage resources in a well-structured manner. Section 3 of this module provides detailed step by step guidance about how this can be done.

Opportunities for manufacturing or process improvements in resource efficiency can be identified through a site assessment process of analysing energy, water and waste efficiency. Using a whole-of-business evaluation (not just direct resource related costs and benefits) of the likely impacts of each resource efficiency improvement opportunity that has been identified, the business can manage any trade-offs and achieve the most beneficial outcome. The site assessment process is described in more detail in Module 3 of the Toolkit.

The resource efficiency evaluation can be undertaken in a more comprehensive manner by the use of Life Cycle Analysis (LCA). This approach evaluates the upstream and downstream impacts of a product or service, not just those impacts that occur on the specific site that the business operates. In other words, the LCA includes the impacts of:

- the production and supply of raw materials to the site
- the use of the manufactured product (or service) by the site's customers.

LCA is described in more detail in Appendix C of this module of the Toolkit.

The likelihood of successful implementation of the improvement opportunities that are selected through the site assessment process will be enhanced if that process has included thorough consultation and involvement of people at all levels of the business. Ways to achieve this are described in some detail in Module 3 of the Toolkit.

Successful implementation also requires the involvement of those staff in corporate areas (e.g., finance, marketing, design, procurement) who can help to refine the business case, develop recommendations and sell concepts internally. The business case should be consistent with the evaluation methodologies and processes normally used for capital expenditure approvals, as explained in Module 4 of the Toolkit.

Resource efficiency gains that are achieved through this process can improve the efficiency of operations and generate value throughout the business, contributing in a very substantial way to the bottom line of the business.

The development and implementation of a successful action plan that will enable a business to achieve the available resource efficiency improvements and cost reductions will require it to undertake a process that needs to be supported by:

- strong leadership and management commitment
- supportive policy and business systems
- quality data management processes
- broad involvement of a range of people from across the business
- clear communication of outcomes.

A starting point for resource efficiency management is to establish the company's current capacity for and approach to resource management. The resource management performance indicator, detailed in Appendix A of this module, is a tool that will enable a business to assess, and present in a simple diagram, its relative strengths and weaknesses in the five key phases of the management system process. (Note: these phases are shown in Figure 2.1 below and further described in Section 3.)

Guidance note

This module includes case studies that demonstrate the application of a structured approach to resource efficiency management, and the benefits that have been obtained. Appendix G illustrates the application of particular step by step components of the management system, while Appendix H presents case studies in a sector-based manner.

2.1 Environmental management systems

The international standard ISO 14001 is a voluntary standard relating to the implementation of environmental management systems (EMS), and is a very useful standard to benchmark system performance across industry sectors. The framework of the ISO 14001 standard is suitable for the management of a range of environmental and similar issues relating to business operations, including resource use efficiency. The EMS standard is briefly described here to assist in the understanding of general management systems operation.

An EMS is a tool that provides businesses with a method to systematically manage environmental impacts related to its activities, products and services. It will help the business to achieve the environmental obligations and performance goals required under a range of regulatory frameworks. An EMS follows a "Plan, Do, Check" cycle, and is a model that can be used by a wide range of businesses, from manufacturing facilities to service industries, delivering a method of maintaining a cycle of continuous improvement. Many businesses have chosen to adopt an EMS based on ISO 14001, in order to formalise their management systems and structure under an internationally recognised framework.

An EMS does not in itself establish additional environmental compliance requirements or any performance levels, but instead provides the framework for a business to meet its own environmental goals and objectives. ISO 14001 requires the establishment of an Environmental Policy that is fully supported by senior management and publicly outlines the policies of the business. The policy needs to seek or surpass compliance with environmental legislation that may affect the business, and stress a commitment to continuous improvement.

The business will need to establish environmental objectives and targets for the aspects of its operations that can have the most environmental impact. These will become the primary areas of consideration within the company's improvement process and its wider environmental program.

The EMS provides further detail on the environmental program. It establishes procedures, work instructions and controls to ensure that implementation of the policy and achievement of the targets can become a reality. Communication is a vital factor, enabling people in the business to be aware of the objectives of the program and their responsibilities and to contribute to its success.

The EMS requires a planned, comprehensive, periodic audit to ensure that its operation is effective and is meeting specified goals, and that the system continues to perform in accordance with relevant regulations and standards. In addition to the audit, there is a requirement for management review of the system to ensure that it is suitable (for the business) and effective in operation. The management review is an ideal forum to make decisions on how to improve for the future, and closes the loop in terms of establishing a process for continuous improvement across the business.

2.2 Continuous improvement

A resource management system should be able to deliver a process of continuous improvement, as shown in Figure 2.1. The performance of the business should be regularly evaluated against its resource management policy, objectives and targets.

The continuous improvement process should:

- establish the current performance of the business and evaluate this in relation to the policy, objectives and targets that have been set
- identify areas of opportunity for improved resource efficiency, including detailed consultation with staff
- consider when improvements can be made within the business cycle

- assist with developing and implementing an action plan
- reward achievers
- measure the effectiveness of the resource efficiency measures and periodically document any changes in procedures resulting from improvements to the management process
- make comparisons with objectives and targets, and revise these as appropriate.

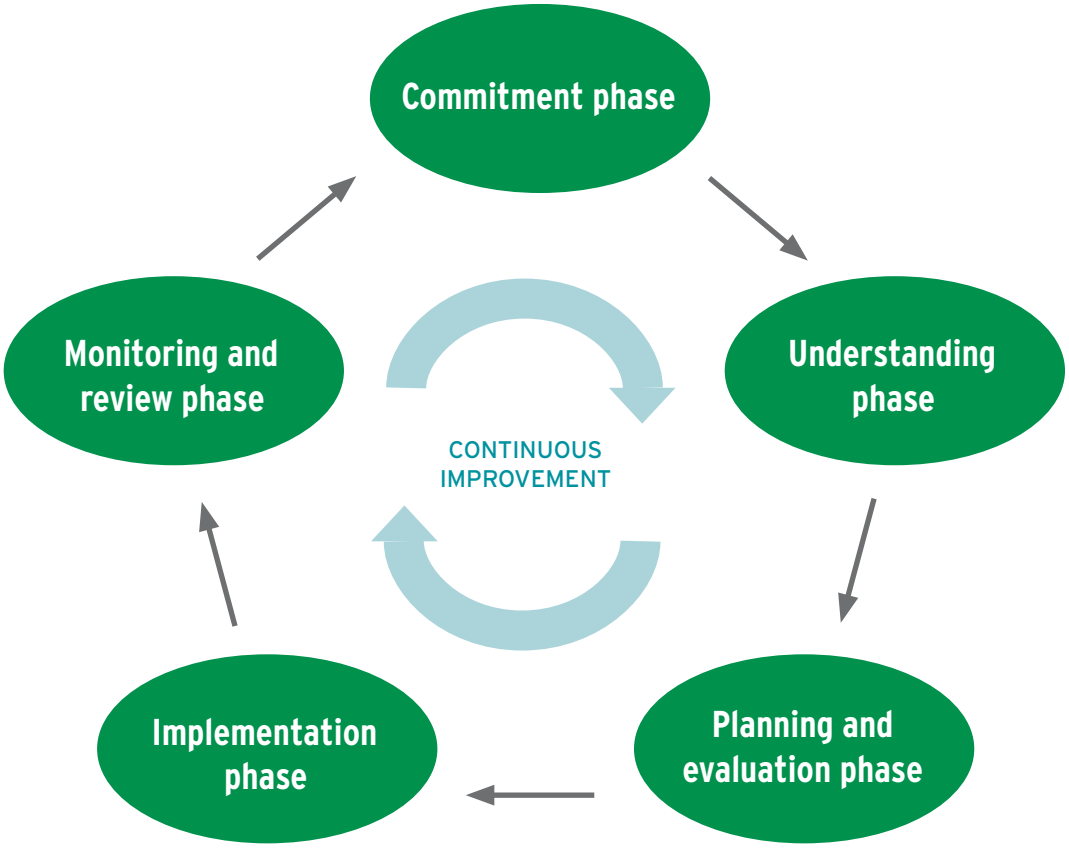

FIGURE 2.1: CONTINUOUS IMPROVEMENT CYCLE

Effective resource efficiency management is consistent with ISO 14001 principles, as discussed previously, and the business should seek to align or integrate its resource management activities with existing management programs.

Through annual review, all aspects of resource efficiency management can be assessed to determine which areas are being implemented successfully and which ones require further attention.

The regular review process also provides the flexibility to assess new resource efficiency opportunities that may not have been identified previously. It also enables those opportunities previously regarded as unviable to be revisited and reassessed, as factors such as technology development, economic impact, payback period, etc may have changed since the last review.

3 A STEP-BY-STEP GUIDE TO DEVELOPING A RESOURCE EFFICIENCY MANAGEMENT SYSTEM

A structured resource efficiency management system consists of a set of well planned steps aimed at reducing resource consumption (and production costs), and increasing productivity.

When establishing a structured resource efficiency management system, there is a clear sequence of events that brings the best results, as shown in Figure 3.1. Businesses, whether introducing resource management for the first time or upgrading existing efforts, need to be aware of this and adapt their activities accordingly.

Ongoing benefits can be obtained when the following phases are implemented, completing a cyclic process of continuous improvement as shown in Figure 2.1, and is more effective when its policies and procedures are reviewed annually.

A number of steps are required within each phase of the resource management program. It is important to ensure that the business is aware of, and committed to, each phase of the program and the following gives a step-by-step guide to actions required within each phase.

3.1 Commitment phase

Step 1: Establish organisational position

- Gain an understanding of the current level of commitment to, and the systems currently used for, resource management within the business. Useful tools that are available to assist with this understanding include the Resource Management Performance Indicator, which is discussed in more detail in Appendix A of this module.
- Obtain commitment from senior management to establishing a business wide position on resource management, as discussed in Appendix B of this module.

Step 2: Commit resources, formalise policy statement

- Develop a resource management policy that is consistent with the business direction and goals.
- Provide funding and personnel for the development of the desired resource efficiency management system and improvement program (e.g. EREP). Consider the necessary skills, authority, time and interest that the key people to be involved can bring to the process.
- Incorporate resource management throughout the business via policy and operational documentation, and develop suitable two-way communications programs to inform and engage with the wider workforce.

Outcome:

Resource management policy is established and action plan development and regular review have commitment from senior management. The concept of integrated resource management is embedded into management structure. Resources are allocated, personnel at all levels are engaged and progress is communicated throughout the organisation. After senior management has committed to the development of an action plan that reflects the corporate goals, the resource goals are integrated into existing policy statements or a stand-alone resource management policy is developed.

A resource management policy is not necessarily a new policy document, but rather a position on resource management is integrated into existing policy statements. This is then supported by new strategies for resource management decision making and improvement planning.

3.2 Understanding phase

Step 3: Understand your resource use

- Measure resource use to determine the current status of all inputs and outputs, including possible recycling opportunities. Investigate materials reuse as part of the integrated resource management investigation (see Appendix C - Baseline Data and Assessment Process).

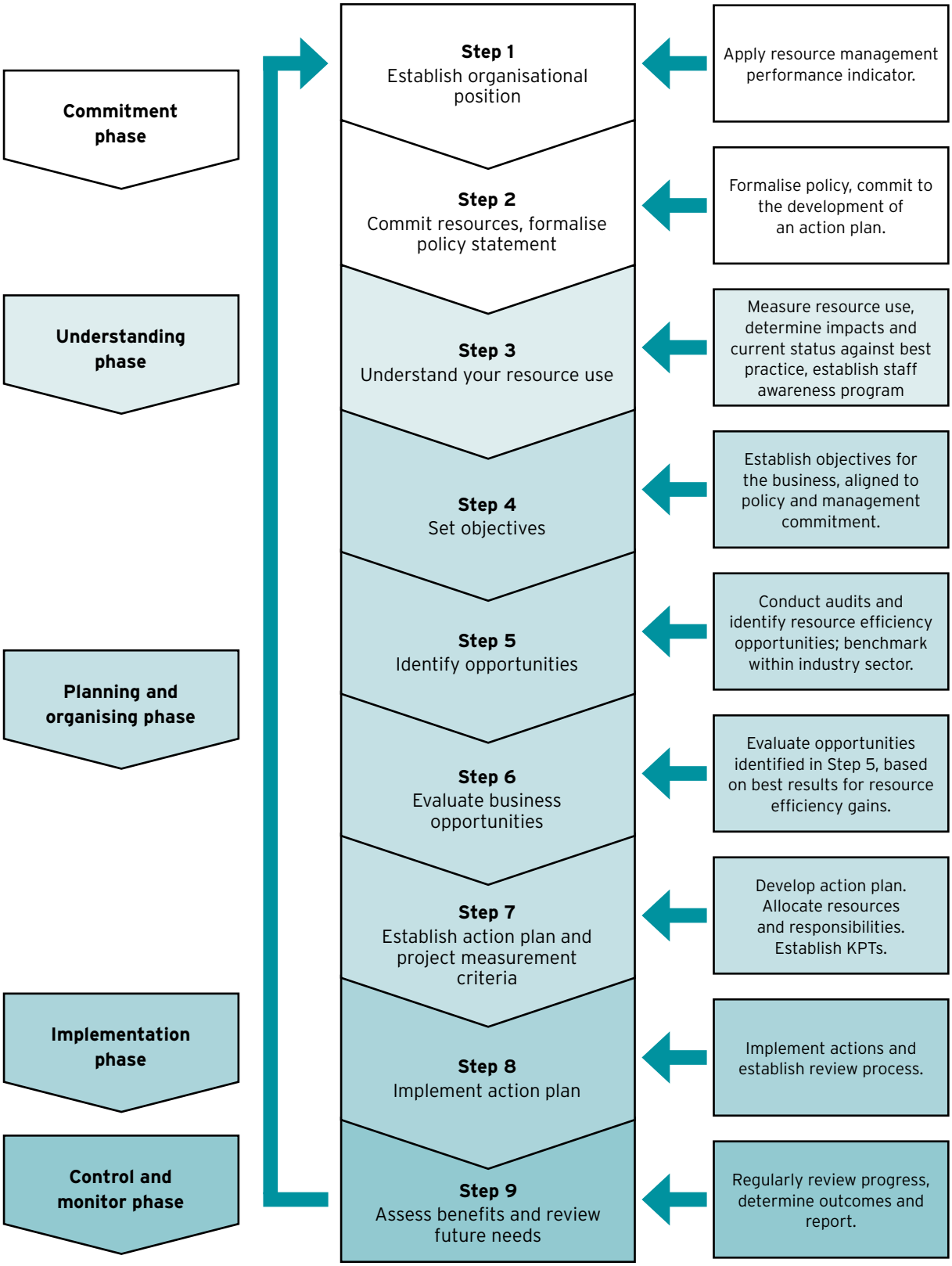

FIGURE 3.1: BEST PRACTICE INTEGRATED RESOURCE MANAGEMENT PROCESS

- Consider the environmental impact of your current operations (and Life Cycle Analysis of your products and services) and compare them to current best practice within your industry sector (see Appendix D - Life Cycle Analysis and Appendix F - Best Practice Techniques & Technologies).
- Investigate current systems and procedures in order to determine their suitability to capture resource management data and identify areas of environmental/ resource risk.
- Identify areas for staff involvement and establish a staff awareness program.
- Use existing environmental management systems (if any) to manage an integrated resource efficiency program. One way to do this is to include resource efficiency issues in the aspects and impacts register, after which the EMS can be used to help manage them.

Outcome:

Resource use in the business has been investigated and is understood in terms of efficiency and broader environmental impact. A Life Cycle Analysis of resource use would contribute to understanding the options for resource efficiency across the business. In particular, the resource efficiency program has been incorporated into any existing EMS. In addition, a program has been investigated to monitor the consumption of resources across the business. Examples of best practice have been reviewed.

3.3 Planning and organising phase

Step 4: Set objectives

- Review the impacts identified in step 3 and develop relevant objectives across the business, based on meaningful measures for the business. This may include measures such as:
- percentage reduction in resource use across the business;
- reduction in dollar cost per unit of activity (production etc.)

Step 5: Identify opportunities

- Engage staff in the program to reduce resource use and maximise awareness across the business.
- Identify opportunities for integrated resource efficiency gains via assessments of resource use across the business (see Appendix C: Baseline data and assessment process).

Guidance note

Refer to Module 3 of the Toolkit for detailed 'how to' information on site assessments.

Step 6: Evaluate business opportunities

- Evaluate the resource efficiency gains for each opportunity, using integrated multi-criteria technical and financial evaluation techniques where possible. The inclusion of life cycle analysis techniques will assist in identifying broader areas of resource impact and possible trade-offs between different options.
- Determine the expected capital expenditure to implement each opportunity.
- Determine the annual cost savings and pay-back periods, considering all business-wide direct and indirect cost impacts for each opportunity.

Guidance note

Refer to Module 3 of the Toolkit for detailed technical evaluation methods, and to Module 4 for detail on assessing the financial feasibility of your resource efficiency opportunities.

Step 7: Establish action plan and project measurement criteria

An action plan guides the implementation of efforts to improve resource efficiency. It represents a commitment to saving resources and improving efficiencies across the business. It creates a management and operational system through which resource efficiency objectives and requirements can be developed, monitored and achieved.

The scope and detail of the plan will depend upon the business resources available, especially time. The plan should initially focus on resource saving practices and procedures that can be adopted in normal operation. Make sure priorities are assigned to the various actions and a structured timeline is included. Activities like developing a basic understanding of resource use patterns, awareness raising, and housekeeping improvements will be early actions if resource efficiency management has not been adopted previously.

Activities and projects requiring significant funding will need more detailed planning and take a little longer. The development of reporting formats will also take some time. Make sure activities needing pre-requisite actions are not done until the pre-requisite activities have been completed.

Improved resource saving technologies can be adopted when there are opportunities for an upgrade, maintenance or other changes to plant and equipment. The incorporation of LCA techniques will usually provide valuable input at this stage.

The following activities will help with preparing an action plan:

- Consult staff involved in finance, purchasing and management across the business.
- Consult internal technical experts and, if necessary, external experts.
- Arrange for training and awareness raising on resource management.
- Ensure managers are aware of the importance of the planning process for resource management. This will secure their input on appropriate priority of the tasks including housekeeping and reporting.
- Seek support from the implementation team, particularly the senior manager on the team.
- Select and prioritise opportunities to be implemented as part of the action plan.
- Allocate personnel, funding and responsibilities for implementation of the action plan.

Outcome:

Core resource management objectives and improvement targets have been set, agreed upon by management and understood across the business. Preliminary options have been identified for further analysis and aligned to policy and management commitment. Resource audits have been conducted and LCA investigations completed.

The business has been benchmarked against others within its industry sector.

Expected implementation costs, annual savings and payback periods, along with the technical and commercial viability, have been determined on a business-wide basis for each opportunity. Priorities for implementation have been determined.

An action plan has been prepared, with set timeframes and milestones for measuring the success of implementing the resource management opportunities.

3.4 Implementation phase

Step 8: Implement the action plan

- Where necessary, update and develop more detail for each opportunity that has been selected for implementation. This may include:
  - the tasks involved in implementation
  - accountabilities
  - timetable for implementation
  - engagement with stakeholders.
- Implement the actions according to the schedule in the action plan.
- Continue staff awareness raising and provide updates on action plan implementation.

Outcome:

Implementation and delivery of the action plan, resulting in resource and cost savings for the business.

3.5 Control and monitor phase

Step 9: Assess benefits and review future needs

- Ensure monitoring of outcomes against action plan targets and industry targets. Assess the benefits that the actions implemented to date have achieved.
- Undertake regular reporting (both internal and external to the organisation) in order to communicate outcomes and champion successes (see Appendix B: Preparing to develop a management system).
- Conduct annual review and return to the commitment phase as part of a continuous improvement cycle (see Section 2.2 – Continuous improvement).

As the implementation process proceeds, the integrated resource management plan may need to be reviewed and updated. Regular reporting to line managers will help monitoring and revision of the progress. Resourcing needs should also be reviewed periodically to ensure they are adequate. Ensure that reporting is included in planning for continuous improvement. Evaluating your activities and undertaking regular (e.g., annual) reviews are essential for ongoing success and are an integral part of the continuous improvement process. The results of these reviews should be built into the plan for subsequent years.

An annual review of the resource management system will require you to:

- review and evaluate progress over the past 12 months
- note any changes in the strategic plans for the business
- evaluate any new projects and ideas from staff or external experts.

The development of a new action plan for the next 12 months should be informed by quantitative data on your progress towards meeting targets and delivering action plan outcomes, and information showing actual cost and resource savings made from implementation of the action plan to date.

Ensure that any review and reporting requirements under relevant programs (e.g. EREP Program) are completed.

Outcome:

A process for continuous improvement is in place and ongoing monitoring is now embedded in the business. Reviews of progress confirm whether benefits have been achieved, and reports allow regulatory obligations to be fulfilled.

APPENDIX A: RESOURCE MANAGEMENT PERFORMANCE INDICATOR

Resource management performance indicators are an effective way to gain a snapshot into a business's approach to resource management performance. They can be used to identify important activities that can improve the resource efficiency of a company. An example of an indicator is shown in Figure A.1.

A.1 Resource management phases

Each column of the indicator deals with one of five crucial resource management phases.

- Commitment phase.
- Understanding phase.
- Planning and organising phase.
- Implementation phase.
- Control and monitor phase.

Within each phase a number of issues will need to be addressed; these are explained in detail in Section 3 of this module.

A.2 How to use the indicator

The levels 0 to 4 represent an increasingly sophisticated response to these issues.

The aim should be to move through the levels towards current best practice (Level 4) and, in doing so, develop an even balance across all columns. The various ratings represent the current level of commitment within the business to that phase of the resource management process. Figure A.1 indicates that company A has a relatively mediocre to average commitment for each phase, while company X performs fairly well in the first, fourth and fifth phases but could improve its efforts in the second and third phases.

Levels of development	Commitment phase	Understanding phase	Planning and organising phase	Implementation phase	Control and monitor phase
Level 4 (Best practice)					
Level 3	X			X	X
Level 2	A	AX	A	A	A
Level 1			X		
Level 0 (Lack of commitment)					

What level of commitment exists in your business?

FIGURE A.1: RESOURCE MANAGEMENT PERFORMANCE INDICATOR

The following statements provide an indication of possible levels for the five phases.

Commitment phase — level 0

Resource efficiency is not on the company's agenda. There is no resource management policy, no formal resource management structure, no means of reporting, and no specific person in charge of resource management or reporting.

Commitment phase — level 1

While there is no official resource efficiency policy, a manager may have been appointed. The manager may promote an awareness of resource matters via a loose network of informal contacts with those directly responsible for consumption. This person also responds to requests for advice on an ad-hoc basis.

Commitment phase — level 2

Resource efficiency is acknowledged as important by senior management, but there is limited active commitment or support for resource efficiency activities.

Commitment phase — level 3

Senior managers acknowledge the value of an integrated resource efficiency program. Consumption and waste generation issues are therefore integrated into the business' structure. There is an information system and established system of reporting. There is also an agreed system for resource management and investing in resource efficiency.

Commitment phase — level 4

Resource efficiency is a major priority throughout the business. Actual performance is monitored against targets and the benefits of resource efficiency measures calculated. Achievements in resource management are well reported and consumption is related to its impact on wider environmental issues. Senior management is committed to resource efficiency.

Understanding phase — level 0

There is little or no contact with users within the business. No information system (such as an EMS) exists to help identify performance and provide feedback on implementation.

Understanding phase — level 1

Informal contact is maintained between resource manager and / or resource team and a few users within the business. There is very limited understanding within the business of life cycle analysis considerations.

Understanding phase — level 2

A resource manager has been appointed, reporting to ad-hoc committee, but line management and authority is unclear. There may be contact with major users through an ad-hoc committee chaired by senior departmental manager or similar.

Understanding phase — level 3

A resource manager is accountable to a resource committee representing all users, chaired by a member of the managing board. The resource manager (and resource committee, if established) is used as the main communication channel, together with direct contact with major resource users.

Understanding phase — level 4

There is a clear delegation of responsibility for resource management identified throughout the business. There are formal and informal channels of communication in the business and between facilities, regularly exploited by the resource manager and staff at all levels. Resource use in the business has been investigated and is understood in terms of efficiency and broader environmental impact. A Life Cycle Analysis of resource use may have been used to help understand the options for resource efficiency across the business. In particular any existing EMS has been incorporated into the resource efficiency program. In addition, a program has been investigated to monitor consumption of resources across the business. Examples of best practice have been reviewed.

Planning and organising phase — level 0

There are no set objectives, based on meaningful measurements, for the business. There is no engagement of staff in programs to reduce resource use and maximise awareness across the business. Opportunities for integrated resource efficiency gains through audits of resource use across the business and staff feedback are not clearly understood. There has been little or no effort to determine direct and indirect savings and cost reductions that can be achieved through resource efficiency gains, the expected capital expenditure and payback periods. There has been no allocation of personnel, funding and responsibilities for implementation of an action plan.

Planning and organising phase — level 1

Some objectives have been identified, based on measurements outside the function of the business. Selected staff have been engaged in programs to reduce resource use, but there is limited focus on raising awareness amongst others. Audits of resource use within the business are undertaken, with limited allocation of personnel and funding. There is a general focus on capital expenditure rather than understanding payback periods.

Planning and organising phase — level 2

Some objectives have been identified based on meaningful measurements for the business. Some staff have been engaged in programs to reduce resource use. There has been an approved allocation of personnel, funds and responsibilities within the site, but limited exposure across the business, making opportunities for truly integrated analysis difficult. The business may have been benchmarked within its industry sector, resource audits may have been conducted, and core resource management objectives set. Some preliminary options may have been identified for further analysis. Limited resources are likely to have been committed for determining payback periods and savings.

Planning and organising phase — level 3

Limited options will have been identified for further analysis and aligned to policy and management commitment. Staff would be engaged in programs to reduce resource use and maximise awareness across the business. LCA investigations are possibly undertaken. An action plan has been started, with set timeframes and milestones identified. Personnel and funds are committed to determining payback periods and savings, and assessing the commercial viability of each opportunity.

Planning and organising phase — level 4

Preliminary options will have been identified for further analysis and aligned to policy and management commitment. Resource audits have been conducted, and LCA investigations completed. Core resource management objectives have been set and agreed upon by management and understood across the business. The business has been benchmarked against others within its industry sector. Resources are committed to determining payback periods and savings, as well as the technical and commercial viability of each opportunity. An action plan with set timeframes has been established, and milestones for measuring the success of implementing the resource management opportunities have been set.

Implementation phase — level 0

There is no promotion of resource efficiency across the business, with little commitment or understanding toward an integrated approach to resource management. There is no investment in increasing resource efficiency at the site.

Implementation phase — level 1

Informal contacts within the business are used to promote resource efficiency. Only low-cost measures identified in the planning and organisation phase are implemented throughout the business.

Implementation phase — level 2

Integrated resource initiatives have ad-hoc involvement in budget considerations, and some ad-hoc staff awareness and training are undertaken. There is some investment in resource efficiency actions, using short-term payback criteria only.

Implementation phase — level 3

A program of staff training, awareness and regular publicity campaigns is implemented. Payback criteria have been used to determine actions, as for all other investments. The business undertakes cursory appraisal of new building, equipment, process and refurbishment opportunities.

Implementation phase — level 4

The business is marketing the value of resource efficiency and measuring the performance of resource management both within and outside the business. There is positive discrimination within the business

in favour of resource reduction and efficiency schemes, with detailed investment appraisal of all new building, equipment, process and refurbishing opportunities. Implementation and delivery of action plan requirements are resulting in resource savings for the business.

Control and monitor phase — level 0

There is no accounting for resource use across the business.

Control and monitor phase — level 1

The resources manager compiles reports for use within the technical department, but information is not widely dispersed and follow-up actions are isolated and ad-hoc.

Control and monitor phase — level 2

Monitoring reports are based on supply meter data (energy, water) and waste discharge records. There is little shared understanding of resource use based on accurate energy, water, waste, and production data that could provide the basis for identifying potential opportunities to improve resource management at the site.

Control and monitor phase — level 3

Monitoring reports for individual sites and activities are based on sub-metering, but savings may not be reported effectively to users. Initiatives are undertaken to reduce resource use, however efficiency outcomes may not be well aligned across resources. There may be individual programs for energy, water and waste, with some attempt to understand any connectivity between the resource streams.

Control and monitor phase — level 4

A comprehensive system is used to set targets, monitor consumption, identify faults, quantify savings and provide budget tracking.

A.2 How to develop your own indicator

Consider each column individually. Place a mark in each row that best describes where the business is currently placed. A glance at these will provide an overall indication of the balance of resource management within the business.

The resource management performance indicator will be scored higher where your current effort is most sophisticated. Lower scores show where the business is less advanced and indicate opportunities to focus improvement efforts.

Don't be concerned if the ratings are uneven; this is not unusual and is the case in most businesses. Figure A.2 shows again that company X displays a variable performance across the management system phases, indicating that the application of a more systematic resource management system should be applied.

Levels of development	Commitment phase	Understanding phase	Planning and organising phase	Implementation phase	Control and monitor phase
Level 4 (Best practice)					
Level 3	X			X	X
Level 2		X			
Level 1			X		
Level 0					

FIGURE A.2: VARIABLE RESOURCE MANAGEMENT PERFORMANCE

APPENDIX B: PREPARING TO DEVELOP A MANAGEMENT SYSTEM

B.1 Resource management team

A team dedicated to developing and implementing a resource efficiency management program is recommended, to ensure that all facets of the business are considered as part of the process.

There are a number of advantages in establishing a resource management team to plan, implement and communicate resource efficiencies across the business.

For example, a resource management team:

- encourages greater ownership of the process by influential personnel
- involves management (at site or corporate level) who may not be able to be involved in the detailed aspects of the project
- provides a forum for review and monitoring of progress as efficiencies are implemented
- shares the workload
- helps develop strategies that can be integrated into ongoing business objectives in the long term.

A team may be set up in one of many different ways, for example:

- as a formal committee or taskforce that meets regularly and is recognised by management
- as an informal support group or network that meets as required, communicates by email, or discusses issues informally (e.g., over lunch).

The business may not need to establish a totally new team. It could build on an existing EMS team or modify the terms of reference of another group such as a Health and Safety Team, if the skills of the team are appropriate.

The Resource Management Team members could include:

- site and other managers, who have experience in the industry and can encourage cooperation and adopt a whole-of-business perspective from staff
- operators, who are familiar with the day-to-day issues involved in the present operation and can help identify problems and opportunities
- technical staff, who have detailed experience and knowledge of plant, equipment and operational issues, as well as insights into why certain priorities or procedures have evolved
- sub-contractors and service providers, who are likely to be familiar with the detail of on-site issues and who, through their use or knowledge of equipment, may have ideas about how new or changed practices can improve resource utilisation and bring other benefits
- finance staff, who can assist in developing proposals so that they are suitable for consideration by management, and who may identify mechanisms (such as tax arrangements and financing options) that facilitate implementation. They may also help clarify and overcome internal and external financial barriers to action, such as separation of capital and operating budgets, tax and contractual issues
- marketing and public relations staff, who can provide input on the importance of various product attributes, assist with presentation of proposals to management and other staff, and provide advice on building relationships, organisational and behavioural change, effective communication, and raising the profile of resource efficiency programs
- business improvement staff or external consultants, who have analytical and facilitation skills and a broad perspective on strategies for identifying opportunities and creatively capturing them across the site.

Early establishment of a team means that it can become directly involved in planning for resource efficiency and ensure integration of the program.

B.2 Senior management commitment

Demonstrated top-level support is an important part of changing attitudes and operating practices. Management commitment is critical to the success of an effective resource management program, and is

best demonstrated by the preparation of a clear policy statement that is signed by the CEO or the senior manager on site.

Once senior management has made a commitment to a resource management system, it is important to define and document all roles, responsibilities, authorities and the inter-relating functions that affect resource use across the business. An appropriate allocation of financial and personnel resources is also needed.

B.3 Communication

Key milestones in the program should be clearly communicated across the business, particularly to those who have been directly involved in the program. In developing a communication plan the business will have defined a range of communication channels such as emails, notice boards, meetings and newsletters. Site-level communication is typically done on a regular basis from the start of the process, with updates on progress following the identification of savings and efficiency gains.

It may also prove useful to prepare an external communication plan, which may involve communications with:

- regulatory authorities and other government agencies
- shareholders and customers
- the local community (e.g. school groups, service groups) and the general public
- industry groups.

Some of the points at which the business might communicate progress include:

- at the start of the program
- during the assessment phase
- when an action plan has been committed to
- as actions are implemented and benefits quantified
- at regular milestones, in conjunction with external reporting requirements.

Communication to staff is vital for obtaining their commitment and involvement. Staff should be provided with the opportunity to contribute to the process at all stages, so that communications are two-way between staff and senior management.

Means of gathering information and input include:

- a suggestion box in lunch rooms/tea areas
- the resource efficiency manager attending staff meetings
- staff volunteering to join the resource management team.

The business should also consider the type of information that needs to be communicated and via what means, and some suggestions are shown in Table B.1.

TABLE B.1: DOCUMENTING STAFF COMMUNICATIONS

Information	Target staff	Timing	Method
Ideas for reducing resource usage in the office	Office staff	Monthly	Staff meeting, information bulletin, email
Recognition of staff whose resource efficiency ideas have been implemented	All staff	Quarterly	Staff newsletter / meeting, presentation of gift

It is important to link communicated outcomes to the objectives set by senior and operational management.

APPENDIX C: BASELINE DATA AND ASSESSMENT PROCESS

The following section gives an overview of the assessment process that is used to identify opportunities for further investigation, and informs steps 4 and 5 of the resource management process. The Resource Efficiency Site Assessment procedure is discussed in greater detail in Module 3 of the Toolkit.

C.1 Resource efficiency site assessment process

A resource efficiency site assessment will quantify current resource use, establish a baseline of resource use and resource efficiency for the site, and identify opportunities for resource efficiency improvements.

It is important to understand resource use and measure improvements by considering the likely outcome on all resource streams as well as other areas important to the business. For example, a resource saving in one area of operations may not provide an overall business benefit if it involves increased resource use in another area of the business.

An assessment's scope can vary widely and can include the resource use associated with an entire site, a building or plant, or a specific process. It is best to consider the types of assessments available that are relevant to your specific industry sector, and your capacity to fund or support the assessment process.

In addition to a resource efficiency site assessment, it is also important to consider aspects of product design as a method for optimising resource use. Life cycle considerations are often useful in determining a more holistic assessment of resource use, and will assist in developing an integrated resource model.

A site assessment will usually involve the following actions:

- investigate the use of all types of resources consumed, wastes generated and technologies applied
- benchmark these against known industry standards, where possible
- identify cost effective measures to improve the efficiency of resource use
- estimate the potential savings, indicative budget costs and payback periods for each of the identified measures
- review the company's resource management strategies, including monitoring systems and processes.

The results from the resource efficiency site assessment will assist the development of the resource efficiency action plan and inform the business' efforts to improve resource efficiency. This information will also assist in planning for potential plant acquisitions and possible plant upgrades, which usually provide more convenient opportunities to incorporate resource efficiency improvements.

C.2 Baseline data

The baseline data requirements that should be considered include:

- energy used, by energy source/fuel type
- water used, by water source
- waste generated, by waste type
- raw material used, by type.

Baseline information should be established for a 24-month period where this is available, as this will serve to highlight any seasonal trends in resource use and waste generation. As a minimum, your baseline should consist of at least a 12-month data set.

Potential sources of data are detailed in Module 3 of the Toolkit.

Establishing a good understanding of resource use based on accurate energy, water, waste, and production data provides the basis for identifying potential opportunities to achieve best practice resource management.

> **Guidance note**
>
> More detailed information about resource efficiency site assessments and data analysis techniques are provided in Module 3 of the Toolkit, while techniques for calculating financial payback periods are detailed in Module 4 of the Toolkit.

APPENDIX D: LIFE CYCLE ANALYSIS

Often described as a 'cradle to grave' approach, Life Cycle Analysis (LCA) is a method of assessing the environmental impact of a product, activity or service over its entire life.

The purpose of LCA is to define the impact on the environment of a product or service by considering all of the associated environmental loads. For a product, this includes the design, raw materials, production, distribution, use and disposal or recycling. It also takes into account peripheral issues involved in the life cycle, such as any associated energy (e.g. transport) that is used.

Adopting a life cycle perspective helps ensure that your choices as a business are environmentally sound. At the same time it helps you to identify opportunities to gain a stronger competitive advantage, reduce costs, improve strategic decision-making, design better products, identify new business opportunities and markets, and improve relationships with key stakeholders and even manage any inherent risks - both up and down your supply chain.

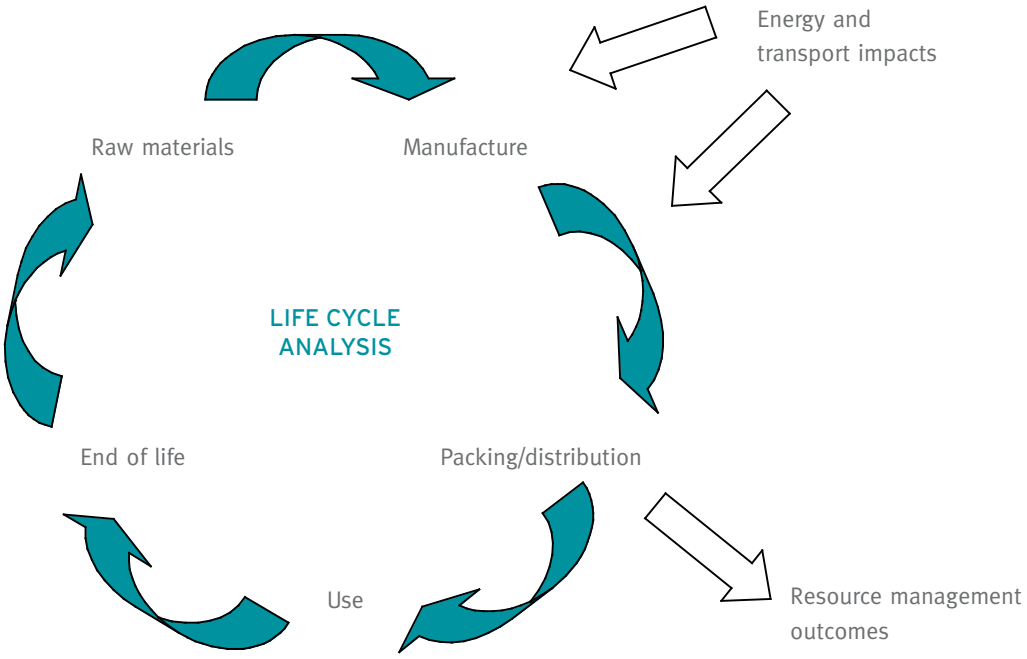

FIGURE D.1: LIFE CYCLE DIAGRAM

Figure D.1 shows the use of energy at each stage of the life cycle of a product. LCA is best used as a tool to compare the environmental load of various products or processes. It is not just a way of being resource efficient but can also provide marketing and manufacturing advantages as follows:

- Competitive advantage – Improved public image, marketing tool, better access to large consumers, facilitates borrowing and attracts investors.
- Cost reductions – Reduced raw materials, natural resources, reduction in waste treatment, disposal cost.

LCA is a quantitative assessment tool that requires information about the environmental impacts of a product, but need not be complex or expensive to undertake. Various methods have been developed to streamline and simplify the process to make it more accessible.

Through stages of goal definition, boundary setting, inventory and analysis, LCA uses a systems approach to identify and quantify the environmental impacts of a product or service, from raw materials

extraction through to processing, transport, use, reuse, recycling or disposal. For each of these stages, the impact is measured in terms of resource used and environmental impacts caused. Importantly, LCA relates environmental impact to a function.

In order to develop a consistent approach to LCA that can be used by all, an international standard was established. This resulted in the generalised methodology detailed in the ISO 14040 series, providing the basic approach that is accepted worldwide. It falls under the international standard on Environmental Management Systems ISO 14001 and can be used as a tool to assist with achieving accreditation to this. Establishing the ISO 14040 standard has made it easier for all businesses to reduce environmental impacts.

LCA can help business identify the most effective improvement than can be made in terms of environmental impacts and use of resources. LCA can also be a powerful tool for comparing the environmental credentials of similar products and services and thus, for marketing 'green goods'. LCA is also commonly applied to comparatively assess the environmental impact of two (or more) products or services.

APPENDIX E: BENCHMARKING

Benchmarking is a tool for analysing relevant performance indicators at your site (or in your business) and comparing them to the same indicators for:

- similar sites or businesses elsewhere
- theoretical 'ideal' performance
- original design specifications
- known 'best practice' sites or businesses.

By establishing your performance relative to one or more of these and highlighting where possible weaknesses exist, the process can lead to an improvement in your own performance. Benchmarking can effectively help a business achieve better performance by learning from 'best-in-class' businesses.

Although most benchmarking initiatives concern financial and management issues, resource efficiency benchmarking is becoming a major element in the management of businesses as a part of integrated resource management processes. Resource efficiency benchmarking analyses resource related practices and indicators and can lead to superior resource utilisation and performance, while also enhancing economic performance.

The scope of resource efficiency benchmarking should include all areas of activities, and not be restricted solely to those activities that have an obvious resource impact. Therefore it may include an assessment of resource management systems, management performance, resource accounting, product quality, environmental education and training, customer relations and emergency response.

Benchmarking actual performance against design calculations can provide a basis for identifying deviations from design resulting from poor installation, commissioning or maintenance, from faults or through operating in ways different from those envisaged by the designer.

Benchmarking against theoretical ideal performance helps to identify where waste is occurring. This approach often facilitates radical changes that may lead to dramatic efficiency improvements through adoption of alternative approaches. This approach identifies 'stretch' targets and also encourages analysts to track down where resource optimisation can be applied; this may involve waste re-use and/or alternative production processes.

Benchmarking is best done between very similar processes or sites, to avoid the effects of obvious process or site differences. Other businesses in your sector will have many characteristics in common with you so comparisons can teach you about work practices in the industry that may lead to a competitive edge for your business. You can compare to an equivalent business, a larger business or even a hypothetical 'ideal' business for the industry.

Although benchmarking against industry best practice helps to identify what is possible at present, there may be difficulties in finding direct comparisons. Different types of best practice can be used as the reference point depending on the type of analysis that is being undertaken. But it should be kept in mind that today's industry best practice is the result of decisions taken several years ago and application of technologies that could now be several years old.

Comparisons with other businesses of the same size as yours can be just as useful as industry benchmarks. For a sole trader, benchmarking other sole traders may show you a more efficient way of handling smaller volumes of materials used in the production cycle. For a bigger business, it could be used to show better staff management practices and broader integration of more complex processes.

Benchmarking should not be a one-off event but an interactive, continuous and dynamic process for improving performance. This involves monitoring the process, introducing continuous learning and providing input for continuous improvement.

You can also track changing performance at your site by time-based comparisons, regardless of external benchmarks. This ties in with tracking resource use and provides a means to quantify resource costs and consumption against site activity. This type of benchmark can be developed from units of a particular

resource per unit of various activity measures such production, production days, sales, indicator product, number of employees, building area, number of services delivered etc.

You can benchmark your business for a variety of characteristics, depending on your industry and current needs. It can be limited to one area of your business (e.g., energy) or be a general overview, focusing on truly integrated resource management.

Two examples of benchmarking techniques are:

- performance benchmarking
- process benchmarking.

Performance benchmarking is the collection of (generally numerical) performance information and making comparisons with other compatible businesses. Ideally performance benchmarking is repeated over two or three years, so that progress can be effectively monitored.

Characteristics:

- Focus: a number of performance indicators, possibly covering a range of activities in the business.
- Partners: a number of separate businesses agree at the beginning of the project to share data.
- Form of comparison: data gathered from each partner is circulated in a report.
- Confidentiality: the identity of partners as a group is known, but each partner's data is usually masked in the report by a code. Each partner knows their own code but not the codes representing the other partners

Performance benchmarking can lead directly to improvements, but often it is an ideal pointer to specific processes that may be improved through in-depth study using process benchmarking.

Process benchmarking is the comparison of practices, procedures and performance, with specially selected benchmarking partners, studying one business process at a time.

Characteristics:

- Focus: a single process at a time.
- Partners: not chosen until after undertaking a thorough analysis of your own practices and performance.
- Form of comparison: whenever possible, by actually visiting the partners' places of business.
- Confidentiality: the identity of partners is known, and the exchange of information is protected by a code of ethics.

Process benchmarking can lead you to effectively implement major improvements to the process that was benchmarked, and/or may lead to process benchmarking studies of other business processes.

> Guidance note:
>
> Further information on sector based resources and links to technical information is available in Module 5 of the Toolkit.

APPENDIX F: BEST PRACTICE TECHNIQUES AND TECHNOLOGIES

The application of best practice is a key part of integrated resource management, and informs step 6 of the resource management process. As resource use can represent a significant part of the total cost of operations, improved resource management can significantly reduce costs to the business. Striving to adopt best practice can bring valuable benefits by reducing operating costs, improving productivity and profitability, and enhancing competitiveness.

Best practice means the current best combination of integrated resource management, methods, processes or technologies in use anywhere in the world. It means producing more goods and services with fewer resources, resulting in less waste and pollution.

Businesses should seek to employ best practice across operations to minimise resource use, minimise waste and improve efficiency and profitability. What is regarded as best practice will vary between industry sectors; what is appropriate for one industry sector may not be appropriate for another, however benchmarking within the sector may provide assistance.

Resource use for all inputs, outputs and processes of an operation should be determined. Then best practice technologies and operational procedures should be researched at local and international levels. Once best practice has been identified, the application of cost effective new technologies and processes relevant to the business can be reviewed and implemented. To ensure continuous improvement, the review process should be repeated regularly to keep abreast of new developments.

This module outlines the principles of best practice for resource management and can assist in establishing benchmarks. It provides case studies to demonstrate actual best practice examples. A comprehensive list of other resources to assist in researching best practice is provided in Module 5 of the Toolkit.

Guidance note

See Appendix H of this module for specific best practice examples in various industries and Module 5 of the Toolkit for a list of references where best practice information can be found.

APPENDIX G: CASE STUDIES FOR STEP-BY-STEP GUIDE

Key elements of the resource efficiency management system are represented via a phased approach, as described in earlier sections of this module:

- Commitment phase.
- Understanding phase.
- Planning and evaluation phase.
- Implementation phase.
- Monitoring and review phase.

The following examples are provided to illustrate how businesses are meeting the intent and key requirements of the resource efficiency management process, and aim to demonstrate:

- the intent of each phase of the resource management system, and what it could look like in practice
- that different approaches to assessments can be taken
- that existing systems and processes can be used and built upon.

> **Guidance note**
>
> More complete details on each case are presented in Appendix H of this module. Further information about best practice for specific industry sectors may also be found at the web sites shown in Module 5 of the Toolkit.

G.1 Introduction to case studies

The following business case studies have been selected to represent a cross section of business, covering the food and beverage, plastics and chemicals, and commercial building sectors. In the following sections, the cases provide examples of actions within each phase of the resource efficiency management process.

DEXUS Property Group

DEXUS is one of Australia's largest diversified property groups, with total properties under management as at 31 March 2008 of approximately $15 billion. DEXUS manages over 125 industrial, office and retail properties in Australia, and over 120 industrial and office properties in the United States, Germany and France. DEXUS has introduced a Green Building and Resource Management System (GBRMS) to manage its environmental footprint and reduce energy, water and waste use across the commercial portfolio.

DEXUS takes a three-tiered approach to resource efficiency: *reduce* the use of resources, *reuse* resources through projects such as water harvesting and recycling, and *offset* some resource use through projects such as purchasing renewable energy products.

To assist in the environmental monitoring and management process, DEXUS is progressively installing smart meters throughout the office portfolio for real time monitoring of all electricity, gas and water use. DEXUS produces monthly resource management reports to enable property management teams to monitor resource use (electricity, gas, water and waste) and to track the rollout of initiatives against targeted reductions at a portfolio-wide and property-specific level.

Office buildings consume more energy than any of the other property sectors in which the company operates. A large amount of energy is consumed in providing base building services, such as heating, ventilation, air conditioning, lifts and underground car parks. Consequently, the office sector is the focus of energy efficiency initiatives.

BASF

BASF manufactures a range of polymer dispersions, with significant volumes of water used throughout the process. Materials used in the polymer product end up in the wastewater stream, which is currently sent off site as trade waste. An ultra filtration process is being piloted at BASF to remove lost product and enable recycling of the water stream, generating potential savings of 40,000 kL water per year.

Kraft Foods Limited

Kraft's Port Melbourne facility manufactures a range of products, including Vegemite, salad dressing and peanut butter. Through consolidation of operations in 2003–4, Kraft achieved savings in water and energy use and wastewater generation. These savings led to Kraft initiating a cleaner production study to identify other resource efficiency opportunities.

G.2 Commitment phase

Integrated resource management policy, action plan formation and regular review have commitment from senior management as part of an organisational strategy. The concept of resource efficiency is fully integrated into the management structure.

DEXUS Property Group

DEXUS has committed to reducing resource use across the commercial portfolio, through the integration of a number of sustainability initiatives. The group has implemented a Technical Asset Management project and a Green Building and Resource Management System to reduce the overall impact of the commercial portfolio and minimise resource use across the group. These programs are fully integrated into DEXUS's portfolio management structure and influence portfolio planning and asset management.

Senior management and facility staff at site level participate in the program, identifying resource efficiency actions and initiating implementation, ensuring senior management participation and facility management expertise within each site.

BASF

BASF has committed to a joint venture study with City West Water to assess opportunities to improve water use and recovery efficiencies. The study looks at assessing the technology and conducting onsite pilot trials. This initiative is supported at the highest levels within the business, and involves significant commitment between both businesses to ensure outcomes are communicated across both groups and acted on.

G.3 Understanding phase

Resources used within the business are identified and a comprehensive system is established to monitor consumption of resources across the organisation.

Kraft Foods Limited

Through assessment of Kraft's operations, the production of Vegemite was identified as the largest source of water use (60 per cent) and trade waste generation (80 per cent) on site. Water was therefore selected as the key focus of the study.

The three key aims of the study were:

- reduce water consumption
- reduce the generation of trade waste
- improve the quality of trade waste generated and discharged.

DEXUS Property Group

A vital step in the path of future-proofing the existing stock of properties is determining where those properties, and the assets they contain, are within their life cycle.

This step involved DEXUS committing to a project titled 'Technical Asset Management'. This project delivers the following:

- detailed and up-to-date asset register
- life cycle assessment of each asset
- condition assessment of each asset
- capital expenditure forecasts
- replacement cost assessments
- tax and depreciation schedules.

The objectives of the program include:

- provide consistent and independent capital expenditure forecasting, life cycle costing and condition assessments
- enable the Asset and the Property Management teams to determine with greater accuracy when major works and refurbishments should be planned
- ensure assets reach their effective lives by tracking their condition more closely
- enable a better understanding of the impact of the asset's maintenance and service delivery to ensure the asset's physical and financial performance is maximised
- optimise tenant and leasing strategies.

This information is then coupled with the property's overall asset strategic plan, including its leasing profile, to understand in an integrated manner the property's repositioning strategy. The Green Building and Resource Management System (GBRMS), as further detailed in the Planning and Evaluation Phase (Section G.4), is then used to minimise resource use and develop a strategy and implementation plan to improve each building's performance.

BASF

Water is used during the production of polymer dispersions, in a range of actions such as:

- steam stripping
- cleaning of intermediate bulk containers (IBCs)
- equipment cleaning.

Historically potable water has been used, with significant volumes of trade waste generated annually. This trade waste represents a loss of both water and product for the company.

The current levels of water use are required to maintain product quality as it is vital to minimise the possibility of any contamination. The focus of resource efficiency opportunities was therefore directed towards recovery of product and reuse of the water stream.

G.4 Planning and evaluation phase

Core resource management objectives are set and agreed upon (identify, evaluate, assess, prioritise). An action plan with set timeframes and milestones for measuring the success of implementing the resource management opportunities is prepared.

DEXUS Property Group

DEXUS operates a Green Building & Resource Management System (GBRMS) in order to assess and manage initiatives being undertaken to reduce its resource use and overall footprint. An overview of the system is detailed below.

Green Building & Resources Management System

The GBRMS primarily aims to establish how commercial properties perform when measured using industry based environmental rating tools, and to provide a path for increasing their performance. It consists of three steps:

Step one – Green profiling

This identifies the current resource (energy, water and waste) consumption as well as rating each property against the Australian Building Greenhouse Rating (ABGR) and Green Star environmental rating tools.

The outcomes for this stage are:

- an accredited ABGR rating
- an indicative Green Building Council–Green Star (Office Existing) assessment
- a record of historical consumption/generation (energy, water, waste)
- a monthly consumption data monitoring process

- establishment of monthly sustainability reporting, and incorporation into the existing environmental management program.

Step two – Green project opportunities

This identifies projects that can be undertaken at the properties to reduce their consumption of energy and water and their waste generation.

The outcomes for this stage are:

- costed projects for the reduction of resource consumption
- an indication of project impact on ABGR and Green Star ratings.

Step three – Implementation planning

This involves the property asset and management teams undertaking detailed analysis of the project opportunities identified in step two; the integration of the adopted opportunities within the asset strategic plans, and the planning of an implementation program.

The outcome for this stage is the schedule of project opportunities with associated implementation plan:

BASF

BASF investigated opportunities to recycle water on site and recover product currently lost in trade waste. Ultrafiltration was assessed as a potential technology that could provide a technical and economic solution to recovering lost water and product, without generating new waste streams or consuming significant levels of other resources (including energy).

To fully assess the viability of this resource efficiency opportunity, BASF is now conducting on-site trials of this technology.

G.5 Implementation phase

Implementation and delivery of action plan requirements resulting in resource efficiency savings for the business.

BASF

The ultra filtration project has been divided into three stages: stages 1 and 2 involve pilot trials of the technology on the BASF site. These trials, which are currently underway, are being conducted in real time to assess the economic and technical viability of the technology. This information will also be used to validate the estimated savings in potable water and trade waste.

Stage 3 is a risk management workshop to highlight any issues associated with onsite wastewater recycling.

Kraft Foods Limited

Kraft is committed to implementing the opportunities identified in the study, and has allocated $3.2 million over a three-year period to help achieve this outcome.

Kraft, EPA and South East Water will also continue to work together to identify other resource efficiency opportunities at the Port Melbourne site.

DEXUS Property Group

The Green Building & Resource Management System is used to manage the implementation of the selected projects. The GBRMS helps property asset and management teams to develop tailored and comprehensive environmental management projects for each property. Having identified a list of projects to be implemented, each project is then considered against the overall strategic asset plan of each property and then progressively implemented.

G.6 Monitoring and review phase

Quantitative data on progress towards meeting targets and delivery of action plan outcomes is obtained, a process for continuous improvement is in place and ongoing monitoring is now embedded in the business.

DEXUS Property Group

All office properties are incorporated into the Green Building and Resource Management System.

DEXUS is progressively installing smart meters for real-time monitoring of all electricity, gas and water usage throughout the office portfolio. To assist in the monitoring and management process 'Monthly Resource Management Reports' are produced, enabling property management teams to monitor resource use and to track the rollout of initiatives against targeted reductions both at a portfolio-wide level and at a property-specific level. Annual updates on progress are assessed against key performance measures and a process for ongoing review is in place to ensure the portfolio has the capacity to report annually.

Opportunities implemented during the year are measured against the company's objectives for resource efficiency gains, with trial data being used to justify portfolio wide implementation. The process is captured within a cycle of continuous improvement, to review and implement best practice as it is identified.

APPENDIX H: SECTORAL CASE STUDIES

H.1 Plastics and chemical industries

The plastics and chemicals industries represent a wide range of companies that can benefit from implementing resource efficiency through reduced waste costs, reduced energy and water requirements and increased productivity.

The two case studies presented here highlight opportunities for:

- water recycling and reduction in trade waste generation through technology implementation
- changing a by-product from a waste into a saleable resource through design change.

H.1.1 BASF – Ultrafiltration technology

Integrated resource efficiency highlights

- Polymer dispersions production generates 40,000 kL wastewater per year.
- Ultrafiltration technology will reduce wastewater volume by 80%, or 32,000 kL per year.
- Up to 40,000 kL of potable water per year will also be saved.
- Product recovery is expected with the installation of the ultrafiltration technology, with no new waste streams generated.
- The ultrafiltration plant is expected to have minimal energy requirements.

Background/summary

Production of polymer dispersions at the BASF Altona plant generates approximately 40,000 kL of wastewater per year. Polymer product is also lost to the wastewater.

Ultrafiltration provides a means of removing polymer from the wastewater. Lost product from cleaning, spills etc can be recovered and, more importantly, the water which would normally go to sewer can be recovered and re-used in the production process.

Studies into the viability of ultrafiltration plants to treat the wastewater reported an estimated 80% reduction in wastewater generated. As a result potable water use on the site will be reduced and polymer product recovered.

Objectives

Due to product quality considerations the volume of water used in production cannot be reduced, and thus a study into wastewater treatment was commenced.

Objectives of the study were to assess the ultrafiltration technology to:

- enable reuse of wastewater onsite
- reduce the volume of wastewater discharged as trade waste
- reduce potable water requirements
- recover lost polymer product.

Methodology

This study consists of 3 stages. Stages 1 & 2 involve running a pilot unit on site in real time to determine the feasibility of using ultrafiltration to treat the wastewater. At the completion of the first 2 stages, the supplier will have enough information to provide a proposal for a full scale ultrafiltration plant.

Stage 3 is a risk management workshop which will highlight any issues associated with the recycling of the wastewater on site.

Resource efficiency outcomes achieved

The initial stage of the study identified the following resource savings including:

- reduction of trade waste discharge to sewer by 80 per cent (estimated 32,000 kL/year)
- reduction of potable water use by 40,000 kL/year.
- recovery of lost polymer product, thus improving production efficiencies.

Trialling of a pilot scale plant at the Altona site is now underway to record the results in real time to confirm the economic and technical viability of membranes as a treatment option.

Looking forward

A full-scale ultrafiltration plant would halve potable water use (saving of approx. 40,000 kL/year) and reduce the trade waste volume by 80 per cent (saving of approx 32,000 kL/year). No new waste streams would be created from the process and energy requirements would be minimal.

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H.1.2 Qenos – Material efficiency

Integrated resource efficiency highlights

- Polyethylene (PE) resin production formerly created 600 tonnes per annum of PE wax, a prescribed industrial waste (PIW).
- Resource efficiency investigation determined that changes to the production process could make the PE wax a saleable product.
- Process and packaging changes have now diverted 600 tpa PIW from landfill.
- Disposal cost savings of $195,000 per annum and increased new product revenue of $150,000. Payback period: 1 year.
- Resource efficiency savings – elimination of waste stream from the site, and reduction of raw material usage at the site where the wax is reused as a product.

Background/summary

Qenos Pty Ltd supplies and manufactures polyethylene products for the Australian market, with its Victorian site located in Altona. A by-product of the polyethylene resin manufacturing process was 600 tonnes per year of polyethylene wax material (PE wax), disposed of as prescribed industrial waste (PIW) to landfill.

In order to achieve a PE wax product that would meet the needs of potential customers, changes to the production line and process were required. By changing the specification of the PE wax and presenting it in a new form of packaging, this material is now a saleable product.

Objectives

The key objective of the project was to investigate options for reducing / eliminating the disposal of the PE wax to landfill. In considering these options, the design, water and energy requirements were taken into account.

Methodology

PE wax was disposed of as PIW to landfill, and was forming up to 50% of Qenos' PIW stream. Investigations into the opportunities for PE wax saw a number of uses identified, including use as fuel, conversion to a transport fuel and sale as a product. All options would remove this material from the waste stream. Use of the wax as an industrial or transport fuel was not pursued, due to concerns with potential emission limits.

While alternatives to disposal had been identified, the current packaging of the wax posed a new issue. The wax had been stored in steel containers (capacity 500 kg), which inhibited its reuse as retrieval from this type of container is difficult.

The design of the resin production line required alteration to enable the wax material to be packaged in material that would facilitate its use. Process controls also required improvement to ensure a consistent output of wax that met product specification.

Resource efficiency outcomes achieved

A number of resource efficiency outcomes were achieved from this project, including:

- elimination of 600 tonnes of PIW going to landfill (and associated transport and disposal costs) as well as a reduction in the virgin material supply of PE wax at customer sites
- creation of a new product and revenue stream for Qenos, achieving anticipated sales of $150,000 p.a.
- acknowledgement by Qenos that the material is a product, and that other potential savings can be made by investigating other waste streams.

Looking forward

Qenos is continuing to implement this project and is considering supplying the wax as a bulk product. Other waste streams are also being investigated to determine what options exist for reducing waste disposal to landfill.

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H.2 Food and beverage processing industries

Resource efficiency opportunities for the food and beverage processing industries need to complement the current operating constraints of a business, such as food safety standards. A range of technology and process design resource efficiency opportunities exist that can assist companies to reduce their resource use and improve their overall productivity.

The case study presented here highlights opportunities for:

- optimising equipment cleaning efficiencies to reduce water use and trade waste generation
- reusing water in the same and other site processes, thus reducing the volume of water required
- improving productivity through reduced product losses and reduced energy costs.

H.2.1 Kraft – Vegemite resource efficiency

Integrated resource efficiency highlights

- Vegemite production accounted for 60% of water use and 80% of trade waste generation at Kraft's Port Melbourne site.
- Resource efficiency investigation identified a range of options to reduce the energy, water and waste volumes associated with production of Vegemite.
- Cleaning-In-Place systems reduced trade waste and water consumption.
- Recirculation of equipment safety water and reuse of water in non-food processes reduced potable water use and trade waste generation.
- Trade waste disposal cost savings of $370,000 per year, energy savings of $80,000 per year and water savings of $100,000 per year. Payback period: 1.5 years.
- Resource efficiency savings and increased productivity.

Background/summary

The production of Vegemite at Kraft's Port Melbourne site accounted for 60% of the site's water use and 80% of trade waste. A range of initiatives including Clean-In-Place systems, reticulation of equipment safety water and reuse of water in non-food production processes has resulted in significant energy, water and trade waste savings across the site.

Objectives

The aim of the project was to reduce water consumption, reduce generation of trade waste from production processes and improve the quality of trade waste generated and discharged (focussing on Total Dissolved Solids, Biological Oxygen Demand and Suspended Solids).

Methodology

Consolidation of Kraft's Vegemite production to the Port Melbourne site achieved significant energy, water and wastewater savings across its Australasian sites. Following an initial identification of resource savings, Kraft commenced a cleaner production study to identify further potential savings. This project was conducted in conjunction with South East Water and EPA Victoria.

A consultant was engaged to review Kraft's operations, focussing on areas where resource efficiency improvements could be made to optimise water use, reduce trade waste generation and improve the quality of trade waste generated.

The opportunities identified that would achieve these improvements related to reducing product loss, and optimising equipment use and equipment cleaning efficiencies.

Resource efficiency outcomes achieved

A number of resource efficiency outcomes were achieved from this project, including:

1. Optimising clean-in-place (CIP) systems.
   - Water reductions 11,800 kL/year.
   - Trade waste reductions 11,800 kL/year.
2. Recirculation of equipment safety water.
   - Water reductions 10,000 kL/year.
   - Trade waste reductions 10,000 kL/year.
3. Uncontaminated production water reuse for non-food processes.
   - Water reductions 25,700 kL/year.
   - Trade waste reductions 25,700 kL/year.

Looking forward

Kraft has committed $3.2 million over the next 3 years to implement opportunities identified by the project that will reduce its annual potable water use by 39%, trade waste discharge by nearly 90 million litres and inorganic salt discharge by 180,000 kilograms.

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H.3 Commercial buildings

The commercial buildings sector comprises a wide range of businesses that can benefit from implementing resource efficiency through reductions in waste costs and energy and water charges.

The case study presented here highlights opportunities for:

- water recycling and reduction through technology implementation
- energy reduction through efficiency initiatives across a portfolio wide program.

H.3.1 DEXUS Property Group

Green building and resource management system

- Collected environmental data for all properties in the portfolio through the rollout of a Global Resource Reporting Initiative.
- Completing Green Star rating assessments for all existing office properties in Australia.
- Completing GHG emissions / ABGR benchmarking for all office properties in Australia.
- Integrating sustainability considerations into all new developments and capital projects.
- Introducing smart metering (electricity, gas and water) in all office properties in Australia.
- Establishing targets for resource consumption, GHG emissions and property-specific improvements to environmental performance ratings.

Background/summary

DEXUS's aim is to minimise the overall environmental impact of operations, both in the development of new properties and the management and refurbishment of existing properties.

DEXUS recognises that investment in environmental management not only reduces its footprint, but adds value to the services on offer and attracts potential tenants and employees. It also brings direct commercial advantage via reduced resource consumption and competitive insurance premiums, bringing financial savings to tenants as well as environmental benefits. In addition, investment in sustainability can bring positive social benefits such as a reduced environmental footprint, tenant and employee satisfaction and positive corporate citizenship.

DEXUS believes the greatest challenge and opportunity facing the property industry is future-proofing. Significant effort has been applied to determining how and what needs to be done to existing properties to ensure they meet the challenges of climate change and appropriate resource management as well as the demands of future tenants.

DEXUS assesses each new development and acquisition to ensure that it will meet or exceed the expectations of its stakeholders by identifying and understanding each project's sustainability and green credentials, and identifying cost-effective opportunities to improve these credentials while ensuring the development is future-proofed.

Objectives

The objectives of the program include:

- to provide consistent and independent capital expenditure forecasting, life cycle costing and condition assessments
- to enable the Asset and the Property Management teams to determine with greater accuracy when major works and refurbishments should be planned
- to ensure that assets reach their design lives by tracking their condition more closely
- to enable a better understanding of the impact of the asset's maintenance and service delivery to ensure the assets' physical and financial performance is maximised
- to optimise tenant and leasing strategies.

This information is then coupled with the property's overall asset strategic plan, including its leasing profile, to understand in an integrated manner the property's repositioning strategy. The Green Building and Resource Management System (GBRMS) is then used to minimise resource use and develop a strategy and implementation plan to improve each building's performance.

Methodology

The GBRMS primarily aims to establish how commercial properties perform when measured using industry based environmental rating tools, and to provide a path for increasing their performance. It consists of three steps:

Step one – Green profiling

This identifies the current resource (energy, water and waste) consumption as well as rating each property against the Australian Building Greenhouse Rating (ABGR) and Green Star environmental rating tools.

Step two – Green project opportunities

This identifies projects that can be undertaken at the properties to reduce their consumption of energy and water and their waste generation.

Step three – Implementation

This involves the property asset and management teams undertaking detailed analysis of the project opportunities identified in step two; the integration of the adopted opportunities within the asset strategic plans; and the planning and implementation of the selected opportunities.

Resource efficiency outcomes to be achieved

Stage one:

- An accredited ABGR rating.
- An indicative Green Building Council – Green Star (Office Existing) assessment.
- A record of historical consumption/generation (energy, water, waste).
- A monthly consumption data monitoring process.
- Establishment of monthly sustainability reporting, and incorporation into the existing Environmental Management Program.

Stage two:

- costed projects for the reduction of resource consumption; and
- an indication of project impact on ABGR and Green Star ratings.

Stage three:

- Schedule of project opportunities with associated implementation plans
- Implementation of selected project opportunities

Looking forward

The GBRMS is currently being rolled out across the DEXUS commercial building portfolio in Australia. Plans are also being made to capture industrial and retail sites, and apply emerging green profiling tools to each sector. Rainwater harvesting is being trialled and will be rolled out across the industrial portfolio.

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