Environmental Management Accounting

An introduction and case studies for Australia

Chartered Accountants

CA. Employ Our Thinking

www.icaa.org.au

About this report

This report has been prepared by Professor Craig Deegan FCA of RMIT University in Melbourne. The material provided in this report relating to specific case studies is directly based on materials provided by the respective case study participants, each of whom is identified within this report. The material in this report, as well as the material provided by the case study participants, benefited from the input of Mr David Pinch from Environment Australia, Ms Gabrielle McCorkell from EPA Victoria, and Mr Jim Malins from the Institute of Chartered Accountants in Australia.

Sponsoring organisations

Environment Australia (www.ea.gov.au)

Environment Australia advises the Commonwealth Government on policies and programs for the protection and conservation of the environment, including both natural and cultural heritage places. It also manages a number of major programs, the most significant of which come under the umbrella of the Natural Heritage Trust.

Environment Australia administers environmental laws, including the Environment Protection and Biodiversity Conservation Act 1999. It is responsible for Australia's participation in a number of international environmental agreements.

EPA Victoria (www.epa.vic.gov.au)

EPA Victoria is a statutory authority, reporting to the Victorian Parliament through the Minister for Environment and Water. Established under the Environment Protection Act 1970, EPA has a charter to protect and enhance Victoria's environment by protecting the beneficial uses of air, water and land from the adverse impacts of waste and unwanted noise.

EPA takes an integrated approach to delivering its mission by providing environmental leadership, promoting public awareness and working with all sectors of business and the community. It also provides best practice guidelines and standards, together with regulation and policing where required.

The Institute of Chartered Accountants In Australia (www.icaa.org.au)

The Institute of Chartered Accountants in Australia (ICAA) is the Australian professional body for Chartered Accountants (CAs), the recognised title of accountancy professionals throughout much of the English-speaking world. It has more than 37,000 members working in public practice, the business community, academia and government, both within Australia and abroad. The designation CA is earned by satisfying the ICAA's rigorous admission requirements, including the postgraduate CA Program.

The ICAA sets ethical, technical and professional standards for its members and provides leadership to the profession. It plays a very important role in government and legislative processes, especially with regard to issues such as accounting standards and regulation, financial reporting, taxation, superannuation and financial services. The ICAA acknowledges the role accountants should play in assisting organisations to monitor and improve their environmental performance, and in promoting related accountability and transparency. In this regard, the ICAA established a Triple Bottom Line Special Interest Group – one of four Special Interest Groups within the ICAA.

Published by Institute of Chartered Accountants in Australia February 2003 ISBN 0-9750481-0-4

Foreword

In September 2002 leaders from around the world met at the World Summit on Sustainable Development in Johannesburg, South Africa. The Summit was a timely reminder for us to think about our responsibility towards the environment and the impact we have as a global community.

The issues discussed in Johannesburg show that our substantial economic wealth has been generated at the expense of some of our natural assets. These assets need to be protected in order to ensure they continue to generate positive returns and to meet the aspirations of future generations.

The level of business involvement in the World Summit shows that business has a key role to play in achieving the goal of sustainable development. This role is increasingly accepted by the wider community, as is the need for practical initiatives to move forward.

The challenge is for all organisations, of all sizes and across all sectors, to find ways to reduce their impact on the environment. Stakeholders, such as customers and financiers, increasingly want to see that business is working to reduce environmental risks and impacts before continuing to offer support.

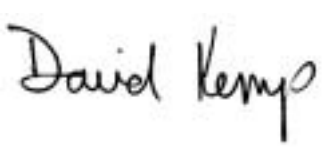
At both the government and business level we have struggled with notions of how to integrate environmental and economic priorities. However, we are entering a new era where a number of environmental accounting initiatives are finding ways to make a better link between environmental and financial performance. This guidebook shows how environmental management accounting can be a valuable tool for business in responding to environmental challenges whilst still focusing on bottom-line imperatives.

With the global push to reduce environmental impacts, some organisations have started to address their environmental performance by establishing environment management policies and systems. Despite this, the evidence shows that generally management have little understanding of their environmental costs – simply because their accounting systems do not supply them with this information. Accountants need to respond to this challenge by finding ways to accommodate environmental costs within their accounting systems – environmental management accounting does this.

This guidebook shows that environmental management accounting does not have to be difficult and that the benefits are simple, including – identifying cost saving opportunities, better decisions with regard to product mix and pricing, and avoiding future costs through better investment decisions. The case studies in this guidebook show how – across a range of sectors and sizes of enterprise.

Leading companies around the world are starting to use environmental management accounting to better integrate the environment into their business strategies. This guidebook reflects a cooperative effort between governments, business and accounting professionals to introduce and promote the concept within Australia.

We hope that this guidebook encourages accountants to work with others in their organisation to apply environmental management accounting, and find ways to reduce costs, manage risks and seek out new business opportunities presented by the environment. We commend the guidebook to all manner of business.



Dr David Kemp MP
Federal Minister for the Environment and Heritage

John Thwaites MP
Victorian Minister for Environment and Water

David Smith FCA
ICAA President

ENVIRONMENTAL MANAGEMENT ACCOUNTING

AN INTRODUCTION AND CASE STUDIES FOR AUSTRALIA

Executive Summary

In recent years, environmental management accounting has been attracting increasing attention throughout the world. There are various definitions of environmental management accounting, but essentially, an environmental management accounting system can be thought of as a management accounting system that has been refined so as to enable users of the system to be provided with information that reflects the environmental performance of the organisation. The United Nations Division for Sustainable Development has referred to environmental management accounting simply as "doing better, more comprehensive management accounting, while wearing an environmental hat that opens the eyes for hidden costs".

The information generated from an environmental management accounting system might be of a financial nature (for example, the quantification of environmental costs), or it might be provided in physical terms (such as the amount of electricity used within a particular process). Either way, the motivation for developing such a system would be to provide a foundation for an organisation to improve both its environmental and financial performance.

Whilst there have been a number of publications released in countries such as the USA and UK about environmental management accounting, including references to particular case studies, there is only a limited amount of Australian material. In 2001 it was decided, to stimulate the debate, that a consortium involving Environment Australia, EPA Victoria, and the Institute of Chartered Accountants in Australia would fund and administer the development of four case studies. These case studies would explore the introduction of environmental management accounting systems within four Australian organisations.

This report provides the results of the environmental management accounting case studies undertaken between March and September 2002. Four different teams of consultants undertook these case studies, and the case studies involved a variety of organisations. The organisations participating in this project were involved in education (Methodist Ladies College, Perth); plastics manufacturing (Cormack Manufacturing Pty Ltd, Sydney); the provision of office services (a service division of AMP, Australia-wide); and, in wool processing (GH Michell & Sons Pty Ltd, Adelaide). While the organisations operated in quite different industries, there were many similarities in the deficiencies that were found within the respective accounting systems. There were also similarities in the suggestions made to improve the accounting systems, and in the 'lessons learned' from the various case studies.

Part A of this report provides background information on environmental management accounting. The available evidence shows that the majority of managers within organisations have very little knowledge about the environmental costs associated with conducting their operations (although some accountants and other managers might not believe this to be the case) and this lack of information is, in large part, due to deficiencies in the accounting systems. It is clear than many cost saving opportunities are being lost because of the lack of information about environmental costs.

Some of the major contributory reasons for existing accounting deficiencies are shown to relate to the common use of overhead accounts. One lesson that comes out of the case studies, which are detailed in Part B, is that overhead accounts provide a major hurdle to monitoring and controlling environmental costs. The allocation bases associated with overhead accounts are also often questionable, with some products or processes with better environmental credentials effectively subsidising products that have greater negative environmental implications. Organisations often fail to acknowledge and properly measure the cost of waste and this is seen as a major limitation of most accounting systems. Organisations are generally found to ignore the acquisition costs associated with wasted resources, and instead restrict their recognition to waste disposal costs. Again, many opportunities for improving financial and environmental performance are being missed because of a lack of information.

Whilst problems exist in how organisations account for their environmental impacts and associated costs, this report shows that it is not difficult or expensive to implement some effective changes. Indeed, the four case studies discussed in this report emphasise this point. The case study organisations, of different sizes and from different industries, all benefited from the suggestions provided by the case study consultants. The results of the case studies clearly show that various accounting changes, such as changes to the use of overhead accounts, and to how waste costs are calculated and disclosed, can in turn inform strategies, aid decision making and result in financial savings.

The case studies also emphasise that the way accounting systems allocate environmental costs (such as costs relating to energy usage, water consumption, materials consumption, or waste generation) to products often bears little resemblance to the actual consumption of the resources. The importance of practices such as materials tracking exercises, and activity based costing are emphasised. Capital investment decisions were also shown to be impacted when environmental cost implications were factored into decision making.

From a financial perspective, capital investment decisions that ignore environmental costs are found to be relatively more costly in the long run. The case studies stress that organisations need to be clear about how they define environmental costs, and the scope of environmental costs to be considered in the early stages of an environmental management accounting project need to be kept within manageable limits.

It is considered that the insights provided within this report will be of relevance to managers from organisations of different sizes and across a variety of industries. Given that stakeholders increasingly want to see that organisations are taking steps to reduce their environmental impacts and risks, the lessons learned from these case studies can ill afford to be ignored.

Introduction

It is generally accepted that managers within organisations are coming under increasing pressure to not only reduce costs, but also to minimise the environmental impacts of their operations. This pressure is coming from a broad group of stakeholders, including government, media, consumers, investors, employees, finance providers, and non-government organisations. To help minimise the environmental impacts of an organisation, individuals need to be provided with information about the environmental costs associated with their operations.

Although there has been an increasing tendency for organisations to implement environmental management systems (EMS), these systems typically do not extend to providing accounting information to assist in various production or resource allocation decisions. Recent studies (for example, Parker 2000) indicate that the magnitude of environmental costs, however defined, is often ignored or misunderstood by managers because of a lack of information being supplied by the organisations' accounting systems. Environmental management accounting provides a tool through which organisations can modify their existing accounting systems to ensure that environmental costing information is made available.

In light of the above, during 2001/2002, a consortium consisting of Environment Australia, EPA Victoria and the Institute of Chartered Accountants in Australia agreed to administer and fund a number of environmental management accounting case studies. The chosen case studies, listed below, examined the implementation of environmental management accounting initiatives within four different Australian organisations:

- **Services@AMP**, a division of the financial services company AMP, providing shared services to its Australian operations;
- **Cormack Manufacturing Pty Ltd**, a manufacturer of plastic caps and bottle tops, Western Sydney;
- **Methodist Ladies College**, a primary and secondary school, Perth; and
- **GH Michell & Sons Pty Ltd**, a wool and leather processing company, Adelaide.

As can be seen from the above list, the organisations studied came from quite different industries. Nevertheless, as this report will demonstrate, there were common themes and lessons learned from the environmental management accounting initiatives implemented within each organisation.

Target audience

This report has been written principally for accountants to help them understand how existing management accounting systems can be modified to help improve both the financial and environmental performance of their organisations. The explanations and descriptions provided in this document have been formulated in a way that should also enable non-accountants to understand the material that is provided. As a consequence, it is hoped that a mix of people, including environmental managers and production managers, will find the material within this report of use when considering potential environmental and financial improvements in the management of their organisations' operations.

By showing how environmental management accounting can be used as a tool to improve environmental performance it is hoped that environmental management accounting can provide a link between environmental managers and accountants, and will motivate both to work together towards improving the environmental and financial performance of their organisation.

Motivation

Most organisations do not separately identify environmental costs. As the United Nations Division for Sustainable Development (2001, p.1) states:

> Information on environmental performance of organizations might be available to some extent, but, internal company decision-makers, as well as those in public authorities, are seldom able to link environmental information to economic variables and are crucially lacking environmental cost information.

This is a situation that can be alleviated, in part, by refining existing management accounting systems[1]. This refinement, which can be made through environmental management accounting, can often be undertaken at relatively minimal cost by many organisations, including small and medium sized organisations, as the four case studies described in this document will demonstrate. Cost effective strategies can be implemented across a variety of organisations, including those involved in manufacturing, or in providing services.

Therefore, a motivating factor in sponsoring the four environmental management accounting case studies, and in subsequently releasing this report, is the apparent lack of awareness and understanding that people within an organisation generally have with respect to the magnitude of environmental costs being generated by their organisation. This in turn means that many opportunities for costs savings through good environmental management are being lost.

Further, it is hoped that this document will help to highlight the fact that, contrary to many managers' views, organisations typically do not have a good understanding of the magnitude of their environmental costs. As Ditz, Ranganathan, Banks (1995, p. 30) state in relation to a number of case studies undertaken elsewhere:

> Firms seeking a keener appreciation of their environmental costs may find some managers resistant. In part, their scepticism reflects a mistaken belief that environmental costs are already well known. At the outset of these case studies, a number of individuals indicated that they already knew where most environmental costs originate. But, more often that not, they were seeing only part of a much larger, more complicated picture. If the focus on sources and magnitudes of costs is limited, opportunities for improving environmental and economic performance will be missed.

The parties associated with producing this report were also motivated to produce this report because of the belief, based on past experience and research, that modest and relatively low cost changes to existing management accounting systems can lead to significant financial and environmental performance improvements.

Objectives

The primary objective of this Environmental Management Accounting Project is to promote improved practices and reform in management accounting so that organisations are able to improve profitability by reducing costs, whilst achieving better environmental outcomes. This objective was to be achieved by undertaking practical case studies that show the benefits from, and to provide practical 'how to' examples of, environmental management accounting within organisations operating within Australia. The use of environmental management accounting overseas is increasingly being documented, and the sponsoring organisations were keen to facilitate development of this field within Australia.

[1] Broadly speaking, a management accounting system can be defined as a system that involves "identifying, collecting, and analysing information principally for internal purposes" (US EPA, 1995, p. 5).

The case studies involved trialing environmental management accounting for 6 months within each organisation. This required the identification of environmental costs that could be captured within the management accounting system (which in itself lead to the development of what was considered to be an environmental management accounting system), and investigating how the information generated by the revised system can be applied to improve both financial, and environmental decision-making within the organisation.

The purpose of this report is to firstly introduce the concept of environmental management accounting and secondly to summarise experience derived from the case studies. It is hoped that this report will promote environmental management accounting within Australia as a practical tool for organisations to address the dual goals of improving environmental and financial performance. To achieve this, the report seeks:

- To explain what an environmental management accounting system can or might represent;
- To explain different approaches to defining and measuring environmental costs;
- To provide readers with insights into work that has been performed in the area of environmental management accounting;
- To demonstrate how an organisation can practically and feasibly implement an environmental management accounting system, by refining its existing management accounting systems;
- To highlight how consideration of environmental costs can lead to the identification of cost reduction and revenue raising opportunities; and
- To emphasise that improvements in the financial and environmental performance of an organisation can often occur with relatively modest modifications to existing management accounting systems.

Part A
Overview of
Environmental Management Accounting

1 Background

1.1 Key definitions

Two key terms to be used in this report, and by the case study participants, are environmental management accounting and environmental cost. This Section provides some definitions and an explanation as to how the terms are used within the case studies undertaken within this project, and how they relate to the more broader term, environmental accounting.

1.1.1 Environmental accounting

The term environmental accounting is frequently used within the accounting and environmental management literatures. Environmental accounting is a broader term that relates to the provision of environmental-performance related information to stakeholders both within, and outside, the organisation. According to the US EPA (1995, p. 18):

> An important function of environmental accounting is to bring environmental costs to the attention of corporate stakeholders who may be able and motivated to identify ways of reducing or avoiding those costs while at the same time improving environmental quality.

Whilst environmental accounting can be 'corporate-focussed', it should also be appreciated that environmental accounting can also be undertaken at a national or regional level. For example, the Australian Bureau of Statistics (see its website at www.abs.gov.au) provides information on environmental protection expenditures made within Australia, energy and emission accounts, national fish accounts, national water accounts, as well as a variety of other environment-related information. In this Environmental Management Accounting Project we focus on environmental accounting at the corporate level.

1.1.2 Environmental management accounting

Environmental management accounting is a subset of environmental accounting. It is generally used to provide information for decision making within an organisation, although the information generated could be utilised for other purposes, such as for external reporting[2].

The International Federation of Accountants (1998) defines environmental management accounting as:

> The management of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices. While this may include reporting and auditing in some companies, environmental management accounting typically involves life-cycle costing, full-cost accounting, benefits assessment, and strategic planning for environmental management.

The United Nations Division for Sustainable Development (UNDSD) (2001, p. 1) provides a slightly different definition of environmental management accounting. Its definition emphasises that environmental management accounting systems generate information for internal decision making, where such information can be either physical or monetary in focus. As the UNDSD states:

> The general use of environmental management accounting information is for internal organizational calculations and decision making. EMA (environmental management accounting) procedures for internal decision making include both physical procedures for material and energy consumption, flows and final disposal, and monetarized procedures for costs, savings and revenues related to activities with a potential environmental impact.

[2] The view that environmental management accounting predominantly relates to proving information for internal decision making is consistent with the definition provided by the US EPA (1995) which describes environmental management accounting as "the process of identifying, collecting and analysing information about environmental costs and performance to help an organisation's decision making."

Environmental management accounting can therefore, depending upon the system implemented, provide a broad range of information about financial and non-financial aspects of an organisation's environmental performance[3]. According to definitions such as those provided above, environmental management accounting systems have the dual purpose of managing and improving the financial and environmental performance of an entity[4]. These broad definitions of environmental management accounting are consistent with the approach to developing an environmental management accounting system adopted by this project's case study participants.

It should be appreciated that environmental management accounting can generate information about how the use of resources with environmentally related impacts affects the financial position and performance of organisations. Environmental management accounting can also consider how organisational operations impact environmental systems (see Burritt, Hahn and Schaltegger, 2002). In the case studies discussed in this document, prime consideration tended to be given to accounting for the economic impacts associated with using certain resources, and how reassessments of resource usage (with environmental implications) can positively impact economic performance.

1.1.3 Environmental costs

Discussion of environmental accounting and environmental management accounting generates reference to environmental costs—a term that can take on a variety of meanings. Environmental costs have traditionally been thought of as being the 'end-of-pipe' costs, such as the costs associated with cleaning up sites after production, or waste-water treatment costs. Environmental management policies that focus on these end-of-pipe costs and technologies can generate short run returns, but such a focus will be costly in the long run as it will ignore the consumption of resources within the organisation. A broader interpretation, and one that is consistent with the definitions applied by this project's case study participants, would see the term environmental cost also encompass material and energy used to produce goods and services (particularly from non-renewable sources), the input costs associated with wastes being generated (including the capital costs, labour costs, materials and energy costs used to produce the waste) plus any associated disposal costs, storage costs for particular materials, insurance for environmental liabilities, and environmental regulatory costs including compliance costs and licensing fees, inclusive of any fines.

For a minority of organisations, the environmental costs might also include the environmental and social impacts caused to other entities by the organisation's operations[5]. These 'externalities' are typically referred to as 'societal costs' – costs imposed on individuals, society and the environment for which the organisation is not directly held accountable. Most organisations would restrict their attention to 'private costs' – those costs for which the entity is held accountable and which in turn impact the organisation's financial bottom line. The 'private' versus 'societal' cost dichotomy will be revisited when the scope of costs considered by the case study participants are looked at.

What should be stressed is that there is no single accepted definition of environmental costs such that different organisations will employ different definitions. To minimise potential ambiguity, an organisation using the term environmental cost should provide a definition that clearly delineates the scope of costs included[6]. At this stage it is not essential that a single definition of environmental costs be developed. Indeed, much time could potentially be wasted arguing about the semantics of what should be included in environmental costs – many people will have different opinions. As long as the

---

[3] With the growing prevalence of environmental (and social) performance indicators being used as a basis for assessing an organisation and its managers (for example, in management remuneration plans) there is a need to have a mix of both financial and non-financial indicators to assess an organisation's environmental performance. For example, some managers might be rewarded in terms of dollar savings in waste costs (a financial measure), whereas other managers might be rewarded in terms of reduction in spillage rates (a non-financial measure).

[4] This can be contrasted to conventional management accounting systems typically in use within organisations. Such systems do not give separate recognition to environment-related costs or impacts, but instead, focus on particular issues on the basis of their economic or financial decision making relevance.

[5] With very few exceptions (and these exceptions typically originating in Europe would include BSO/Origin, Ontario Hydro, Interface Europe, Anglian Water, Wessex Water), organisations do not tend to account for the negative externalities caused to other entities as a result of the organisation's activities. Most costing systems only consider the costs that arise within the boundaries of the organisation (referred to in financial accounting as the application of the 'entity concept').

[6] By contrast, in financial accounting, central terms such as assets, liabilities, expenses, revenues and equity are clearly defined (within Australia, they are defined within Statement of Accounting Concept 4: Definition and Recognition of the Elements of Financial Statements issued by the Australian Accounting Standards Board). Hence, within financial accounting, there is limited ambiguity about the meanings of these terms and there is no need for an organisation to provide a definition – this is in contrast to a term such as environmental cost.

processes involved in classifying and measuring environmental costs are logical and appropriately communicated, and as long as significant and relevant costs are considered when decisions are made, then progress should result. What is important is that environmental costs are not ignored[7]. Obviously, some consistency in how an organisation defines environmental costs from period to period will enable more meaningful inter-period comparisons.

One lesson that has been learned from the case studies is, particularly in the early stages of implementing an environmental management accounting system, that the scope of environmental costs to be examined should be restricted to a manageable number (for example, restricted to energy consumption, water consumption, and materials consumption). This point will be revisited later in the report.

1.2 Perceived limitations of many existing management accounting systems

It is generally accepted that the vast majority of management accounting systems in place within organisations pay little or no attention to attributing any form of environmental cost to an organisation's operations. This has meant that many opportunities for reducing environmental costs (however defined) are being lost. As the United Nations Division for Sustainable Development (2001, p. 8) states:

> Experience shows that the environmental manager barely has access to the actual cost accounting documents of the company and is only aware of a tiny fraction of aggregate environmental costs. On the other hand, the (financial) controller does have most of the information but is unable to separate the environmental part without further guidance. In addition, he or she is limited to thinking within the framework of existing accounts. Also, the two departments tend to have a severe language problem.

Apart from the problems associated with poor communication between the environmental department and the accounting department (that is, they typically do not 'talk'), quite often, opportunities for reducing environmental costs are lost. This can be because of the poor communication between the environmental department and the accounting department, or as the case study participants in this project found, due to the common practice of accumulating an assortment of costs (often very dissimilar in nature) within overhead accounts, or the allocation of environmental costs to wrong costing categories. This was found to be the case in both the manufacturing and non-manufacturing (service) organisations. Each of these major limitations will be considered in turn.

1.2.1 Allocating costs to overhead accounts

Overhead accounts, which are used in the vast majority of organisations, often tend to accumulate an assortment of costs. In doing so, they can also tend to 'hide' various costs. Many of the costs accumulated in overhead accounts, are product or process specific and have environmental consequences – for example, energy and water costs, waste treatment costs, stationery costs, insurance pertaining to holding volatile substances, or regulatory costs associated with particular emissions or releases.

The opinion that overhead accounts can conceal or even distort information relating to environmental costs is not new and is consistent with the views of the United Nations Division for Sustainable Development, which states (2001, p. 1):

[7] With this said, there is work being undertaken towards the establishment of a uniform classification system for environmental costs. As Osborn (2001) notes, "the Classification of Environmental Protection Activities (CEPA) is the most developed element within the UN's System of integrated Environmental and Economic Accounting (SEEA) …. The UN's CEPA has been developed to pool financial transactions into activities according to their environmental impact …. The Australia Bureau of Statistics is one among many national statistical agencies using the CEPA to construct national environmental protection expenditure accounts." The CEPA provides classifications of costs at a fairly high level and individual organisations will break the major cost-classifications into lower level categories to satisfy their specific information requirements. For details of the SEEA see http:/unstats.un.org/unsd/environment. Within Australia, the Eurobodalla Shire Council (its website is www.esc.nsw.gov.au) has undertaken environmental management accounting based on the CEPA classifications. In many respects, Eurobodalla Shire Council is a leader at the local government level in environmental management accounting.

> Conventional management accounting systems attribute many environmental costs to general overhead accounts, with the consequence that product and production managers have no incentive to reduce environmental costs and executives are often unaware of the extent of environmental costs …. A rule of thumb of environmental management is that 20 per cent of production activities are responsible for 80 per cent of environmental costs. When environmental costs are allocated to overhead accounts shared by all product lines, products with low environmental costs subsidize those with high costs. This results in incorrect product pricing which reduces profitability.

Therefore, reviewing overhead accounts is a key procedure when embarking on a project aimed at identifying and subsequently reducing environmental costs. This will be the case for service-based organisations as well as for those organisations involved in manufacturing. Indeed, the experience of the case study participants in this project clearly shows that when costs are 'hidden' in overhead accounts (which, again, is a common practice) fairly simple questions pertaining to the waste costs of an organisation, or to the water or energy used to produce particular products or to provide particular services cannot be easily answered.

Overhead accounts are used to accumulate an assortment of costs. For example, they often include rent, property taxes, repairs and maintenance, training costs, auditing or verification costs, waste removal and disposal, transportation costs, water costs, factory cleaning, licensing fees, stationery costs, packaging costs, indirect material and labour, and insurance. Energy costs also are often either included in overheads without any attempt to attribute them to particular products, or simply treated as a period cost without any allocation to products. For example, in research undertaken in the UK, Gray et al (1998) found that the majority of UK companies did not allocate energy costs to specific products meaning that the pricing of their products did not reflect the energy consumed by the products.

Costs pertaining to packaging and other 'auxiliary' materials are also frequently accumulated in overhead accounts, although their usage may be relatively higher for a limited number of products. Overhead accounts are used as a result of simplistic direct and indirect costing dichotomies being employed within an organisation.

Where a variety of costs are being accumulated in overhead accounts, subsequent allocation of the accumulated costs to particular products are frequently made in terms of such bases as sales volume, production output, floor space occupied by particular departments, machine hours, or labour hours. For example, one of the case study participants within this project (Services@AMP) accumulated costs related to rent, maintenance, signage, cleaning, electricity, water, and waste into an account which was then charged to cost centres by way of a 'Single Office Service Charge'. This charge was levied back to cost centres on the basis of the square metres of floor space the centres occupied. Arguably, such methods of allocation provide limited incentives for managers to reduce their centre's levels of resource consumption (and hence, environmental impact).

Whilst making the task of allocation easier, using such allocation bases can lead to the misallocation of many costs, including those relating to the environment. Consider the following example from US EPA (2000, p. 6):

> Take the case of a company's waste-water treatment facility. The costs of operating the facility are predominantly caused by a few of the company's products whose production generates significant quantities of waste-water. If the costs of operating the treatment facility are accumulated into an overhead account and allocated equally to all of the company's products, the waste-water costs are obscured and product cost information is misleading. In this case, a product appears to be less expensive to produce than it actually is.

This is consistent with Bennett et al (1996, p. 34) who suggest:

> It is not uncommon for a small number of products to generate a large proportion of emissions or wastes. If these costs are not allocated to individual products but treated as a general overhead, then clean products will appear to have higher costs than is actually the case while dirty products will appear to be cheaper to produce than they really are.

It should be noted that some 'overhead costs' are more appropriately traced and allocated to specific products or services than others. As US EPA (1995, p. 20) indicate:

> Separating environmental costs from overhead accounts where they are often hidden and allocating them to the appropriate product, process, system, or facility directly responsible reveals these costs to managers, cost analysts, engineers, designers, and others. This is critical not only for a business to have accurate estimates of production costs for different product lines and processes, but also to help managers target cost reduction activities that can also improve environmental quality.

1.2.2 Misallocation of environmental costs

Apart from the potential problems inherent in using overhead accounts, many costs are also 'hidden' because they are wrongly included in particular costing categories. For example, 'waste' costs can be quite significant, yet are either unrecorded or are greatly understated. In relation to waste, Glad (1996, p. 26) states:

> From a financial perspective it (waste) has a much wider connotation, and represents one of the most significant (hidden) costs in organisations. It will not be surprising to find that 30% of an organisation's resources are wasted.

Waste costs are often included in the cost of a particular product when in fact, particular materials did not make it in to the final product. For example, in many organisations it is simply accepted that in making a particular product a certain percentage of material will be wasted (perhaps an off-cut) and as such, the product will simply bear the cost of the waste without any separate identification of the financial (and environmental) implications of the waste. Because waste costs are understated, no remedial action might be taken through an ignorance of the magnitude of the costs.

What is common in many organisations, including within the organisations participating in this project, is that the costs attributed to waste are simply the costs paid to have the waste removed and dumped (for example, waste paper removed by a contractor), or if waste is going to the sewer, the sewerage costs being paid[8]. This ignores the costs of the raw material, paper, labour, depreciation of machinery, energy, and so on that actually go into generating the waste. These 'additional' waste costs are frequently referred to as 'non-product output'. According to the United Nations Division for Sustainable Development (2001, p.2):

> The largest part of all environmental costs lies in the material purchase value of non-product output and can come up to 10 to 100 times the costs of disposal, depending upon the business sector.

One finding which became apparent from the Australian case studies was that organisations really do seem to need a separate account for waste which records the costs that have been incurred in producing the waste stream – not simply the waste disposal costs. Introducing an environmental management accounting system which 'simply' refines how waste is accounted for might, on its own, provide the necessary impetus for significant financial and environmental improvements[9].

As will be seen subsequently in this report, many of the suggestions made to the respective organisations by the case study consultants related to simply suggesting changes to how various costs

[8] Obviously, wastes can take various forms, for example, solid waste, liquid waste, or gaseous wastes some of which might be hazardous.

[9] According to United Nations Division for Sustainable Development (2001, p. 15), a further survey of several companies, mainly in Germany and Austria has shown that the costs of waste disposal are typically 1 to 10 per cent of total environmental costs, while the purchase costs of the wasted material represents 40 to 90 per cent of environmental costs depending on the business sector examined.

were being allocated to products. In doing so, greater use was made of activity based costing. Activity based costing (ABC) is not new to management accountants. However, its use is more limited than perhaps it should be. The objective of ABC is to direct management attention to the activities incurring those overheads rather than to fully recover the overheads. To do this, it is necessary to first identify the major activities being performed by the organisation and assess the resources (such as labour, occupancy, IT network, power costs etc) actually consumed by each activity. It is then necessary to establish what causes or 'drives' each activity and the relationship between the driver and the activity. The organisation would then apportion the cost using that driver.

1.3 Benefits derived from embracing environmental management accounting

As the discussion above has indicated, and as the four case studies to be shortly discussed demonstrate, refining existing management accounting systems (for example, 'rejigging' how overhead accounts are used, or how waste costs are calculated and disclosed) can lead to changes in strategies that improve both financial and environmental performance. Initiatives that refine existing management accounting systems (which are what the four case studies discussed in this document are), so as to enable the accounting systems to focus on environmental costs can lead to what are considered to be environmental management accounting systems. As the United Nations Division for Sustainable Development (2001, p. 3) notes:

> Doing environmental management accounting is simply doing better, more comprehensive management accounting, while wearing an "environmental" hat that opens the eyes for hidden costs.

Given the infancy of environmental management accounting, the design of a particular system is really about incremental progress. A number of benefits should follow. These benefits can span from the more direct (tangible) to the more indirect (intangible) and include:

- **More informed decision making:** explicit consideration of particular costs that are otherwise obscured by traditional accounting approaches – for example, obscured in overhead accounts will lead to more informed decision making, with consequent implications for improved profitability;
- **Uncovering opportunities:** an analysis of environmental costs might reveal opportunities, some of which might lead to revenues through recycling, or use of 'waste' in other activities;
- **Improved pricing of products:** explicit consideration of particular costs will enable more informed pricing of products;
- **Assist with internal and external reporting:** identifying environmental costs will help organisations collect data about their environmental impacts for internal and external reporting purposes;
- **Increased competitive advantage:** given the infancy of environmental management accounting, explicit consideration, and associated publicity, might provide an organisation with a competitive advantage;
- **Improved reputation:** efforts to reduce environmental costs and related impacts will have reputation implications;
- **Staff retention and attraction:** it has also been argued that by showing that an organisation is trying to manage and account for the environmental implications of its operations this may in turn enable it to retain and attract better staff, as well as improve staff morale; and
- **Generation of societal benefits:** efforts to reduce environmental costs and impacts (which will assist in creating a cleaner environment) will generate human benefit.

1.4 This project in the broader context of work being undertaken in the area

There is a lot of work being undertaken in relation to developing the practice of environmental management accounting. Below is a list, which is far from exhaustive, of other organisations that are doing work in this area. This sample of references will provide an insight into the extent and variety of work being undertaken in relation to environmental management accounting.

United Nations Division for Sustainable Development
The United Nations Division for Sustainable Development is developing different frameworks for environmental management accounting as well as continuing the development of classification systems for environmental costs. Its website can be found at www.un.org/esa/sustdev/estema1.htm.

The Environmental Management Accounting Research and Information Centre
The Environmental Management Accounting Research and Information Centre (EMARIC) was formed to take over the work, known as the Environmental Accounting Project, that the US EPA was doing in relation to environmental accounting. Some of the work undertaken by the US EPA can still be found on its website, which is www.epa.gov. EMARIC provides a very useful website which documents details of various activities being undertaken in the area of environmental management accounting. Its website can be found at www.emawebsite.org. This website is hosted by the Tellus Institute.

Environmental Management Accounting Network
As the website of the Environmental Management Accounting Network (EMAN) states, EMAN is a network of researchers, consultants, business people and policy advisors interested in environmental management accounting as a tool of corporate environmental management. The network aims to provide a medium through which those interested can contact others with similar interests, and to organise regular events for the dissemination and exchange of news and ideas. The website, which can be found at www.eman-eu.net, provides useful links to various environmental management accounting research projects that are being conducted throughout the world.

Professional Accounting Bodies
Various professional accounting bodies are also undertaking research into the issue of environmental management accounting. One example of this is the work that was recently funded by the Chartered Institute of Management Accountants (CIMA). It released a document in September 2002 entitled Environmental Cost Accounting: An Introduction and Practical Guide. This document explores issues associated with costing the environmental externalities (including 'societal costs') being generated by organisations. These costs, which we will shortly refer to as Tier 5 costs, are generally not costed by organisations, and as indicated earlier in Section 1.1.3, were not deemed to be within the scope of the costs investigated in the four case studies discussed in this report.

The approach described by CIMA relies on a procedure that generates estimates of the costs that would either be incurred to prevent environmental damage, or to restore the environment as a result of the operations of the entity. It is based around the notion of sustainability (although the current work ignores social costs which a true approach to sustainability would not do). A total sustainability cost is calculated which is then subtracted from the profit calculated for financial accounting purposes. The net figure is referred to as environmentally sustainable profit. This approach acts to internalise, for reporting purposes, the notional costs assigned to various externalities. This is consistent with recent calls by the European Union for actions and policies that internalise many otherwise ignored environmental costs. Since calculations related to the determination of the sustainability cost are based on many estimates (and guesstimates), and because it considers costs which in many cases will not actually be incurred in financial terms, there is some reluctance from accountants to embrace the practice of costing externalities. CIMA's website can be found at www.cimaglobal.com.

Apart from CIMA, a number of other professional accounting bodies throughout the world periodically involve themselves in environmental accounting projects. For example, the European Federation of Accountants (website is www.fee.be) and the Association of Chartered Certified Accountants (website is www.accaglobal.com) will, from time to time, provide results of environmental accounting research. The Institute of Chartered Accountants in Australia's website (website is www.icaa.org.au) also provides references to Australian work undertaken in relation to triple bottom line reporting.

External reporting initiatives

Whilst this report is focused on environmental management accounting, which typically restricts its attention predominantly to internal reporting processes, it is important to appreciate that a great deal of work is progressing in the area of external environmental, social, sustainability and triple bottom line reporting. The most significant development in external environmental and sustainability reporting is the work being undertaken by the Global Reporting Initiative (GRI) in respect of its Sustainability Reporting Guidelines. Details of the guidelines, and other activities being undertaken by the GRI can be found at its website which is located at www.globalreporting.org. Further information on public environmental reporting can be found at Environment Australia's website, located at www.ea.gov.au/industry/sustainable/per/index.html.

Information generated from an environmental management accounting system can be used to generate key performance indicators that can be used to assess environmental performance. These indicators can be both monetary and physical in nature and can be used to assess segments of an organisation, or the managers responsible for particular activities. Knowledge of the types of performance indicators that are being used elsewhere (as developed by such organisations as the GRI) can also impact the types of information that an organisation elects to collect from its environmental management accounting system. For example, many performance indicators relate to the inputs and outputs of an organisation, which as we argued in Section 1.1.3, also have environmental costs associated with them, and hence are likely to have relevance to environmental management accounting.

It is recommended that organisations that are considering the development of environmental management accounting systems should make themselves aware of some of the various environmental performance indicators that are in use in various organisations as such indicators could be incorporated within an environmental management accounting system. See Table 1 for a list of some organisations involved in developing environmental performance indicators.

Table 1: A sample of organisations involved in developing environmental performance indicators

Organisation	**Web address**	
Global Reporting Initiative	www.globalreporting.org	Sustainability Reporting Guidelines
The International Organization for Standardization	www.iso.ch	ISO 14031 Environmental Performance Evaluation
Electricity Association (UK)	www.electricity.org.uk	Environmental Benchmark Indicators
EPI Finance 2000 (involving a consortium of many European Banks)	www.epifinance.com/project.htm	Environmental Performance Indicators for the Financial Industry
New Zealand Ministry for the Environment	www.environment.govt.nz/indicators	Environmental Performance Indicators Programme
The OECD	www.oecd.org	OECD Environmental Indicators: Towards Sustainable Development 2001
Environment Australia	www.ea.gov.au/industry/sustainable/per/indicators.html	Indicators and Methodologies for Public Environmental Reporting, an Australian Guide

2 Overview of Four Environmental Accounting Case Studies

2.1 Case study participants

As already indicated, four separate case studies were undertaken as part of this Environmental Management Accounting Project. The case study partnerships are described in the following table.

Table 2: Case study organisations

Participating organisation	Consultant/investigator	Brief description of organisation
Services@AMP (A shared services division of AMP in Australia)	KPMG, Melbourne	Provides shared services to AMP operations throughout Australia which employs 5,000 staff
Cormack Manufacturing Pty Ltd	PricewaterhouseCoopers, Sydney	Manufacturer of plastic caps and bottle tops. Located in Sydney and employs 90 staff
GH Michell & Sons Pty Ltd	Professor Craig Deegan FCA RMIT University, Melbourne	Australia's largest processor of wool with operations in various states of Australia and employs approximately 800 staff
Methodist Ladies College, Perth	BDO Consultants Pty Ltd, Perth	Perth school with over 1,000 students and 240 employees

Although the organisations involved are diverse, there were a great deal of similarities between the case studies in relation to the findings – particularly in terms of suggestions for improvements to the existing management accounting systems. Indeed, some suggestions for improvements to the accounting systems were relevant to all the organisations. Further, the limitations in their existing accounting systems seemed to be similar and whilst the focus of attention was decided individually by the case study participants, the case studies all concentrated to some extent on revising existing bases of cost allocations, and in assessing how well the existing systems were accounting for waste costs.

2.2 Scope of the case studies

The scope of an environmental management accounting system can be as narrow or as broad as an organisation decides. To make the case studies manageable it was necessary to limit the scope of the environmental management accounting initiatives that were to be implemented. When considering scope, the case study participants needed to consider the organisational level at which the environmental management accounting system would be implemented, and the extent of the environmental costs to be examined.

2.2.1 Organisational level

An environmental management accounting system might be implemented for a specific product or process, for a particular division or location, or across an entire organisation. In the initial stages of implementing an environmental management accounting system it would typically be advisable to restrict the focus to a manageable part or process within the organisation. For example, in the GH Michell & Sons Pty Ltd case study, the initiative was restricted to one form of processing used for wool (the carbonising process) as undertaken within the Salisbury, South Australia plant. The Cormack Manufacturing Pty Ltd case study was limited to the manufacturing business unit generally (other business units excluded) and focused on two comparable production processes. In the other case studies, the initiatives tended to relate to the whole organisation, but were restricted to a limited number of processes or activities.

2.2.2 Scope of environmental costs

As already noted in Section 1.1.3, depending upon the chosen 'scope' of the accounting system, it is possible that environmental costs might be calculated to include the environmental (and social) effects that the organisation's operations create, such as the impacts releases to water have on river systems, or the effects particular emissions have on human health. This might be the case even if the organisation does not directly pay for the impacts they are causing. Such effects might be referred to as externalities (or 'societal costs'). As discussed in Section 1.4, CIMA has recently released a report relating to accounting for externalities.

The US EPA has developed a useful dichotomy - private versus societal costs. According to US EPA (1995, p. 1), the term environmental cost has at least two major dimensions: it can refer solely to costs that directly impact a company's bottom line (termed "private costs"), or it can also encompass the costs to individuals, society, and the environment for which a company is not directly accountable (termed "societal costs" by the US EPA, but typically referred to as externalities). Externalities generated by an organisation, although possibly ignored from an accounting perspective, are often recognised as costs by other entities.

In relation to 'scope considerations' associated with defining and measuring environmental costs, US EPA (1995) discusses the range of environmental costs an entity might choose to consider, ranging from the easier to measure, to the more difficult to measure. This range (in ascending order of difficulty) is detailed in Table 3.

Table 3: The range of environmental costs an entity might chose to consider

Tier	Description
Tier 1	**Conventional costs** Include costs of direct raw materials, utilities, labour, supplies, capital equipment and related depreciation.
Tier 2	**Hidden costs** Include up front environmental costs, such as search costs relating to finding environmentally-conscious suppliers, initial design costs of environmentally preferable products, regulatory costs which are often obscured in overhead costs, future decommissioning or remediation costs.
Tier 3	**Contingent costs** Defined in probabilistic terms and include fines for breaching environmental requirements, clean up costs, law suits relating to unsound products.
Tier 4	**Relationship and image costs** These costs are difficult to determine and would seldom be separately identified within an accounting system. However, they could be expected to have some influence on the value of some intangible assets, such as goodwill, brand-names, and so forth. The sum of the costs in Tiers 1 to 4 can be referred to as "private costs" and they can directly impact an organisation's reported profits.
Tier 5	**Societal costs** These costs are often referred to as externalities and represent costs that an organisation imposes upon others as a result of their operations, but which are typically ignored by the organisation. Could include environmental damage caused by the organisation for which they are not held accountable, or adverse health effects caused by organisation-generated emissions for which the organisation is not held responsible. It is difficult and sometimes controversial to put a cost on these effects and with the exception of a few organisations worldwide, most entities ignore these costs when calculating profits. However, physical measures can be developed, and related KPIs can be used to assess performance.

Tiers 1 to 4 above have been classified as private costs, costs that directly impact a company's bottom line, as distinct from societal costs, (costs to individuals, society, and the environment) for which a company is not directly accountable. This distinction is not one that is fixed across time, or across state or countries. Many costs that were once societal are becoming private. For example carbon taxes will be levied in many countries and additional 'clean-up' requirements, environmental levies, and so on, are being introduced across time. As costs become 'private' there is an expectation that they would tend to be captured within accounting systems.

Accounting for externalities or 'societal costs' is a very difficult task and was not recommended to the case study organisations who were embarking on the journey towards measuring the environmental costs of their operations. It is simply too ambitious for most managers – particularly in the early phases of developing an environmental management accounting system (although any claim of sustainability cannot really be made without a consideration of such costs). Nevertheless, it does show how far the definition of environmental costs can extend.

Positive benefits, both in financial and environmental terms, can be generated by considering more traditional 'private costs' such as direct material and labour costs (referred to earlier as conventional costs) and potentially hidden costs (those often included in overheads). The four case studies reported herein have restricted their focus predominantly to Tier 1 and Tier 2 costs (applying the US EPA classification scheme). This was considered logical in light of the infancy of the environmental management accounting systems and the timeframe the case studies needed to work within (that is, six months). As the work matures, the scale and scope of the accounting measurements can be extended. Table 4 below describes the specific environmental costs that were investigated in the respective case studies.

Table 4: Environmental costs analysed within this project

Organisation	**Costs analysed**						
	Energy	Water	Paper	Raw Material	Packaging	Transportation	Waste
Services@AMP	✓	✓	✓				✓
Methodist Ladies College	✓	✓	✓				✓
GH Michell & Sons Pty Ltd	✓	✓		✓		✓	
Cormack Pty Ltd	✓			✓	✓		✓

As the above table shows, energy costs were one environmental cost that all case study participants considered was worthy of attention, regardless of their respective industries. Experience shows that 'utility costs' (for example, costs relating to energy, water, and waste services) tend to be obscured in overhead accounts, or allocated on a basis which does not reflect their underlying use.

In relation to the scope of the case studies, the following points should be noted:

- The case studies have only considered the costs being incurred within the boundaries of the organisation, hence initiatives such as lifecycle analysis and associated costing was not undertaken;
- Using the schema provided by the United Nations Division for Sustainable Development (2001, p. 9), the data being generated in the case studies tended to be relatively more 'past oriented' rather than 'forward oriented' (although there was some capital budgeting decisions that under the revised accounting approach would take into account future environmental costs – such as relative differences in energy usage)[10]. As the environmental management accounting systems within the organisations 'mature' this orientation would be expected to change; and
- These case studies also did not attempt to provide any frameworks pertaining to the development of environmental performance indicators (such as those provided by the GRI, or

[10] 'Past oriented' environmental management accounting would include the calculation of environmental costs pertaining to past production, whereas 'future oriented' environmental management accounting would include capital investment appraisal decisions.

within ISO 14031), nor did they attempt to contribute towards the development of uniform environmental cost classifications (such as the Classification of Environmental Protection Activities being developed within the United Nation's System of Integrated Environmental and Economic Accounting).

2.3 Steps to be followed when implementing environmental management accounting

In summary, borrowing from the experience of the case study participants, we can now provide a very broad overview of the steps an organisation could take if it is to implement an environmental management accounting system. These steps include:

1. Gaining support from senior management
From the beginning it was imperative to be able to signal to employees that senior management support the project.

2. Defining the boundaries of the proposed system
Are we to look at a product, a division, or an entire organisation? What is the scope of the costs to be considered (will we ignore, for example, 'societal costs')?

3. Ascertaining what are the organisation's significant environmental impacts
Refer to material supporting any existing environmental management systems. Ensure the environmental management team is involved. Can dollar values be put on the impacts?

4. Determining, how if at all, environmental impacts are being accounted for
Identify, if at all, where costs are being recorded for each environmental impact. Some of the information may be of a quantitative form, whereas other is qualitative. Note which costs do not seem to be recorded. Apply some form of process mapping (See Section 3.2 for further details). What waste-streams appear significant enough to justify additional review?

5. Defining environmental costs
Defining environmental costs early in the process will minimise any ambiguity that might arise for interested stakeholders both internal and external to the organisation.

6. Determining who will be in the 'review team'
You will need a mix of expertise, with the mix being somewhat dependant upon the boundaries of the proposed system. A typical project team would include:

- an individual with accounting expertise who understands the existing accounting system;
- an individual who understands how environmental management accounting can be used within the organisation and what opportunities it can provide;
- an individual with environmental expertise who is able to explain the significant environmental impacts of the organisation;
- an individual who understands the resources consumed, or environmental costs being generated, by the processes or activities to be investigated;
- an individual with information technology expertise who is able to advise on whether particular IT suggestions are practical and feasible; and lastly,
- an individual from senior management who is able to 'champion' the project within the organisation.

Some people might have a mix of skills, such that the number of people to be involved would not necessarily be the same as the number of dot points shown above.

7. Reviewing existing accounting systems
Determine how environmental costs are presently accounted for. Are the costs attributed to products by way of arbitrary allocations or by some form of activity based costing? Clearly list the environmental costs to be analysed and the bases of allocation currently being employed. This task will require close work with the accounting staff. Remember to consider what costs might be 'hidden'.

8. Identify environmental revenue or cost cutting opportunities currently being ignored
Where can improvements be made? Can waste be better sorted and recycled? Is waste being generated because of inferior materials being acquired? Is packaging currently being recycled and if not, why not? Could alternative suppliers who accept responsibility for packaging be used? How would such initiatives influence costs?

9. Suggest changes to existing accounting system
The changes need to be clearly documented and it is essential that all implications of the changes be considered. For example, it is necessary to advise all users of the system about the changes, and why they are being made. Where possible, the process should include input from the people involved in preparing and using the data to ensure that suggested changes are practical. For example, if additional measurements are required, it would be useful to obtain opinions on what is the best way to incorporate the measurements.

10. Trial system by way of a pilot test
As with all information systems, it is necessary to trial a system and to 'iron out the bugs' before the system goes 'live'.

Note:
Continual communication and education about the project is extremely important to ensure its success and that staff understand the importance and benefits associated with being more environmentally focused.

3 Summary of the Case Studies' Outcomes and Findings

In is not the intention of this section to provide full details of the findings from the various case studies. Greater details are provided in Part B of this report. This section will provide a broad summary of the findings.

3.1 Results/outcomes

An obvious difference between the various case studies were the industries in which the organisations operate. At the outset this might have suggested that very different approaches to accounting would be needed, and that very different findings would be generated. However, a review of the reports from the individual case studies shows that there were a great deal of similarities between the case studies in terms of what limitations were found in existing systems, and in terms of what improvements were suggested. The following were common across the case studies:

- The methodologies all focused on considering how existing accounting systems accounted for environmental costs, and whether improvements could be made to make the allocations of environmental costs to products or process more reflective of the actual use of resources. It was generally agreed that once a determination is made of what environmental costs should be monitored, then some form of activity based costing would be worthwhile to attribute the environmental costs to the activities that generated them. As indicated in Section 1.2.2 of this report, activity based costing (ABC) is something that management accountants would already be familiar with. ABC is a management accounting tool for understanding and allocating costs.
- Initial investigations were limited to Tier 1 and Tier 2 costs (using the classification scheme provided by the US EPA, as summarised in section 2.2 of this report).
- Certain environmental costs, for example, costs that arise in relation to the use of energy, water, or other resource consumption were hidden (commonly accumulated in overheads) by the existing accounting systems. Consequently costs were being allocated to processes or products in a manner that did not necessarily reflect their actual usage and therefore some operations or processes were effectively subsidising others because of limitations in existing accounting information.

  For example, within the carbonising process being used at GH Michell & Sons Pty Ltd it was found that all types of wool were being allocated the same processing costs when further examination revealed that 'dirtier' wools consumed more resources in processing. By failing to take this into account, cleaner wools were subsidising dirtier wools.

- It was generally found that the waste costs of organisations were either not reported, or were grossly understated because they did not consider the costs of bought in resources which were included within the waste. Waste costs typically reflected the amount paid to subcontractors to remove the waste.

  In the case of AMP it was found that waste costs were, in most cases, included within the rental charge paid by AMP, which provided further difficulties in terms of monitoring waste costs. At MLC waste costs were included ('hidden') within 'administrative and general overheads'.

- Failure to properly account for environmental costs had meant that numerous opportunities for improving the financial performance of the organisations had been lost.

- Fairly minor and low cost changes to existing systems of accounting could lead to significant improvements in how the business conducted its operations.
- The inclusion of an additional field into the accounting system to provide non-financial information could also provide benefits in terms of being able to monitor resource consumption.

  For example, when amounts are paid for electricity or water, we could also include a data field to record the amount of the resource actually consumed.

- Failure to allocate particular environmental costs, such as electricity and raw material costs, to particular processes had implications when capital budgeting decisions were being undertaken.

  At Cormack Manufacturing Pty Ltd it was found that factoring in expected future environmental costs (for example, to do with energy consumption) impacted decisions with regards to acquisitions of new compressors and even the decision as to whether factory walls should be painted (painting the walls lighter colours meant less lighting was required). At MLC the choices made when considering air-conditioning capital works would have been influenced had such costs, as future energy costs, been considered.

- Failure to consider environmental costs was found to have implications where choices could be made to manufacture a product using alternative available machines.

  For example, at Cormack Manufacturing Pty Ltd it was shown that once environmental costs are taken into account then a switch might be made from the 'cold runner' process to the 'hot runner' process to produce bottle tops. At MLC, the choice of whether to distribute newsletters via email or by mail was based on incomplete information in the absence of including the resource costs associated with preparing hard copies. At MLC the choice relating to whether to maintain the existing swimming pool, or to use a neighbouring pool were also influenced once environmental costs were taken into account.

3.2 Lessons learned

There were a number of lessons learned from the case studies. Generally speaking, the following points related to all the case studies:

- It was important that agreement was reached very early on within the project in how environmental costs were to be defined and exactly what they would include, and exclude. The determination of environmental costs was determined after a consideration of the environmental impacts of the business, and which environmental costs contribute most to that impact. It was essential that the scope of costs considered in the early phases of the project be reasonably limited. Environmental management accounting is probably more successful when it is introduced in an incremental manner.
- It was imperative to have the support of senior personnel and that this support is clearly communicated to people involved in the process of implementing environmental management accounting. Some consideration should be given to educating staff about the importance and benefits associated with being more environmentally focused. It was found that such a message could actually have secondary impacts in terms of positive implications for the morale of employees.
- It was important that a team of people be involved in developing the environmental management accounting system. This team should include people who understand accounting and the existing accounting systems; people who have an environmental background and are able to identify the significant environmental impacts of the business; and, somebody who understands how resources are being used within the various activities of the business.

- Without a coordinated strategy, it is likely that the accounting staff, the production staff, and the environmental staff will not 'talk'.
- It was important to undertake some form of material tracking in relation to those resources that contributed most to the environmental impacts of the organisation. The information gathered from this process was then used as the basis for applying activity based accounting. Accountants were generally comfortable with activity based costing as it is a costing approach that is generally accepted within the accounting profession.
- Consistent with previous research in the area of environmental management accounting, the use of overhead accounts generally contributed towards an organisation's failure to monitor and control its environmental costs. Overhead accounts were found to hide many environmental costs, as well as hiding many opportunities to improve the financial and environmental performance of the organisation. It is suggested that organisations using overhead accounts (which would be the vast majority of organisations) should consider reviewing such accounts to see what types of costs they are effectively hiding, and how the use of an overhead account could lead to some products effectively subsidising other products.
- It is not to be assumed that accounting systems reflect the actual use or flow of resources. Simplifying assumptions might have been made in relation to allocating costs, including environmental costs, to particular products or processes. As the costs of certain resources increases, and the importance of sound environmental performance increases, such simplifying assumptions may no longer be appropriate and can have the potential to be damaging to an organisation (both from a financial perspective, as well as from a reputational perspective).
- Organisations did not generally fully account for their waste. The analysis suggests that all organisations should establish a separate account for waste, and apart from including waste disposal costs within the account, other costs such as the cost of purchased resources that are wasted, should also be included.
- Modifications to existing management accounting systems can be relatively inexpensive, yet generate significant financial and environmental benefits. Some of the suggestions within the case studies simply involved the introduction of an extra field within the accounting system to provide physical information about the resources being acquired (for example, the amount of electricity or water that was consumed), or a modification to how costs are allocated to processes or products. Such modifications were based on insights provided through implementing materials tracking (which is discussed further at the end of this section), which in turn informs activity based costing.
- Related to the above point, environmental management accounting should initially, where possible, be integrated into the existing management accounting systems and processes for data collection. Essentially, an environmental management accounting system can simply involve 'rejigging' existing management accounting systems so as to identify relevant environmental cost data.
- Some systems of accounting which provide relevant management information might be outside the direct control of the organisation. This might particularly be the case in an office environment where a building manager provides an assortment of services (for example, cleaning, waste removal, provision of electricity) which are all part of a combined office charge. This was the case in the AMP case study. In such circumstances, tenants could request a break-up of charges and the ability to negotiate for reductions in charges should they be able to initiate activities which reduce the amount of resources or services required. Also, where services are outsourced, the organisation also can tend to lose control of the ability to reduce the environmental implications of its activities. Where services are being provided by other organisations, then management should consider asking for these external parties to provide information which enables the organisation to have information about related environmental costs and performance.

- In an office environment, where environmental costs are relatively low compared to labour, IT and residency costs, it does appear to be more difficult to make a business case for implementing systems to reduce environmental costs. Reference should be made to the absolute (rather that the relative) magnitude of environmental costs. The case for environmental management accounting can also be strengthened by referring to other 'intangible benefits', such as potential impacts on employee morale, reputation, value of brand-name, legal compliance, and associated risks.

In concluding this section of the report it is important to again reinforce the view that there is clearly sufficient evidence to suggest that where overhead accounts are being used to accumulate a mix of costs for subsequent allocation to products, processes, or centres, then it would be a worthwhile activity for a team from within the organisation (perhaps made up of people with accounting, environmental management and production/operating knowledge) to review the overhead accounts. The team can attempt to ascertain whether the basis of subsequent allocation is reasonable given insights into the resource usages within the organisation. It is very important to understand current costing systems – including the overhead accounts - before suggesting new systems.

Existing accounting systems might be well accepted and have been in place for many years, and therefore it is important that the strengths and weaknesses of existing systems are known before suggesting changes. What was found to be useful was to construct diagrams to understand how costs are currently being allocated or treated. It was useful to then ask: does what is currently being done from an accounting perspective actually make sense if one also considers the physical flow of resources?

It is suggested that all significant environmental costs (and impacts) be traced to the responsible product (as opposed to the use of overhead accounts). That is, material tracking could be used for materials costs and other related product costs (such as energy, water use, and so on), as well as for waste streams. Some form of material tracking was utilised within the four case studies which are summarised in Part B of the report. The process of material tracking (also referred to as 'process flow mapping' – Bennett et al, 1996) has been defined by US EPA, (2000, p. 14) as:

> An assessment of what, where, why, and how much material is used, incorporated into products and co products, and channelled into waste streams. The initial analyses are often limited to the largest or most regulated material steams because these are most likely to generate the highest costs. Regardless of the scale of the analysis, the result is a better understanding of material flows through the facility…. Materials tracking activities commonly highlight larger than anticipated material losses and uncover unexplained waste streams. For example, a recent study at a semiconductor manufacturing facility revealed that roughly 12% of chemical inputs were wasted during machine set-ups and other non-productive uses.

Where tracking does identify costs, these should be clearly identified with the tasks or processes generating the costs. In the process of finding the 'drivers' of costs, US EPA (2000, p. 17) suggests that a number of sources should be used, including:

- Production records for material usage rates;
- Invoice records for disposal rates and quantities;
- Observations of activities and discussions with operators;
- Training records for personal training hours;
- Maintenance logs for both labour costs and the frequency and length of production shutdowns;
- Utility bills for the costs and usage of water and energy;

- Facility blueprints for the warehouse space requirements; and
- Procurement records for the costs of specialised handling equipment.

Having gone through the process of material tracking, and perhaps diagrammatically depicting the materials flows it is then insightful to compare this with a diagram of how the accounting system currently accounts for the flow of resources. As already indicated, the use of activity based costing, informed by the results of materials tracking exercises, can be used to make suggestions for new approaches to allocating the environmental costs that are generated by an organisation.

3.3 Skills required

A clear message that came from the case studies was that it is essential that a team with a mix of skills be involved in developing the environmental management accounting system. Knowledge of existing accounting systems, as well as potential accounting systems is necessary. It is also necessary to involve a person who understands the resources used within the various activities of the organisation, a person with environmental skills, IT skills (to help provide feasible changes to data collection procedures) and a person associated with senior management (who could 'champion' the project).

3.4 Transferability of insights

It is believed that the suggestions derived from the four case studies can be utilized by a variety of organisations. A number of suggestions are made in relation to the use of overhead accounts – or more to the point – to reduce the use of overhead accounts. As most organisations use overhead accounts to accumulate a variety of costs, then the recommendations would tend to have general applicability. Suggestions relating to the use of activity based costing informed by some form of material or resource flow tracking, and to introducing accounts to account for wastes, also have general applicability.

At a more specific level, it is believed that the findings from the AMP case study will have relevance to other organisations operating within an office environment, particularly perhaps to financial institutions, professional service firms, and government departments. All such organisations will have issues associated with electricity usage, paper usage, and waste disposal. Conceivably, some of the limitations found within the AMP accounting systems would also apply to the accounting systems of other service-based organisations.

The results from the MLC case study would also be of relevance to organisations operating within a service environment. The MLC case study also raised issues associated with energy usage, paper usage, water usage and waste management.

The Cormack Manufacturing Pty Ltd case study will have direct relevance to other manufacturing organisations, particularly in relation to initiatives undertaken to assign environmental costs to different products being produced within an organisation. The review of stock management and related accounting would also be useful to retail organisations having large stock transactions.

The Michell & Sons Pty Ltd case study considered the environmental costs associated with wool processing. However, the results of this case study would have relevance to other organisations involved in processing primary produce which has variations in yield.

Part B
Detailed information on case studies

The following discussion provides a summary of the work undertaken, and the results generated, within the respective case studies. The full text of the materials provided by each of the four case study consultants can be found on the websites of Environment Australia, EPA Victoria, and the ICAA.

4 Services@AMP

4.1 Background

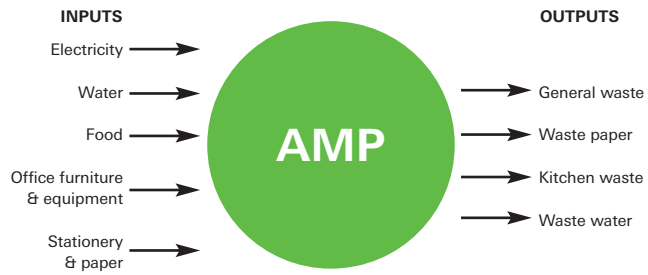
AMP Ltd is a financial services organisation operating in a number of countries around the world including Australia, New Zealand and the United Kingdom. AMP has approximately 14,500 employees, 5,000 of whom work in Australia across the AMP International, Henderson Global Investors, and AMP Financial Services businesses.

This case study focuses on the Services@AMP division which provides a number of shared services to AMP in Australia (further references to AMP in this case study refer to AMP in Australia), including human resource and employee services, facilities management, administration services, procurement and contract management. AMP in Australia has about 70 divisions, and about 350 departments (cost centres) within these divisions that are located in more than 70 buildings throughout Australia.

4.2 Environmental impacts associated with operations

Based on Services@AMP's activities, the most important environmental impacts identified in the study, either directly or through AMP, relate to the use of electricity, water and other resources, and the generation of solid waste (general waste, kitchen waste, waste paper), wastewater and emissions. This is represented in Figure 1 below.

Figure 1. Main environmental impacts as they relate to the inputs and outputs of Services@AMP and AMP



4.3 How the environmental impacts are accounted for within the management accounting system

AMP produces management accounts on a divisional basis derived from a PeopleSoft general ledger system and various other product systems. These are submitted to the Corporate Office for consolidation.

The initial high-level analysis of the management accounting system (general ledger) and processes, as they relate to activities undertaken within Services@AMP, indicated the following:

- The accounts in the general ledger are broadly categorised by type of spend (e.g. building services, wages) and are further broken down by vendor.
- The system provides information on costs by vendor, but does not provide information on the type or quantity of goods or services procured (e.g. electricity).
- Costs for many of the building services provided or paid for by Services@AMP are combined for each building and charged back to cost centres in the form of a Single Office Service Charge (SOSC). This is based on the office space occupied, rather than actual consumption (see figure 2 and table 5). This charging system includes rent, maintenance, signage, cleaning, electricity, water, wastewater and waste within individual buildings.

- Services@AMP pays invoices for paper, office stationery, publications and marketing materials, office furniture and equipment and food, ordered or leased by cost centres. Costs are subsequently charged back to the cost centres on an order basis (see figure 2 and table 5).
- Services@AMP generally purchases electricity, water and resources for AMP. However, for certain buildings the building manager conducts the procurement (see figure 2 and table 5). The building manager may be AMP Henderson Global Investors or a third party.
- In most instances, the building manager controls the cleaning contract, which includes waste collection and disposal, and pays for the wastewater bills. These costs are included in the rent paid by AMP, but are generally not specified as separate cost items.
- Electricity, water, paper recycling and shredding are included in a current review of building services to reduce the number of vendors in each state. In addition, the processing of invoices will be outsourced, which will impact the current accounting system.

The general ledger does not provide for the automatic generation of total costs for specific goods or services (for example, electricity) – instead, it uses a combined 'building services cost'. Nor does it allow determination of, for instance, the quantity of resources purchased or waste outputs produced (for example, the amount of electricity consumed or the number of recycling bins collected). The main reason for this is that there has been no prior focus on the need for environmental input and output information and the increased cost associated with increasing data storage and processing. This consequently has tended to obstruct the management of environmental performance.

Figure 2. Current treatment of environmental costs in AMP's accounting system (general ledger)

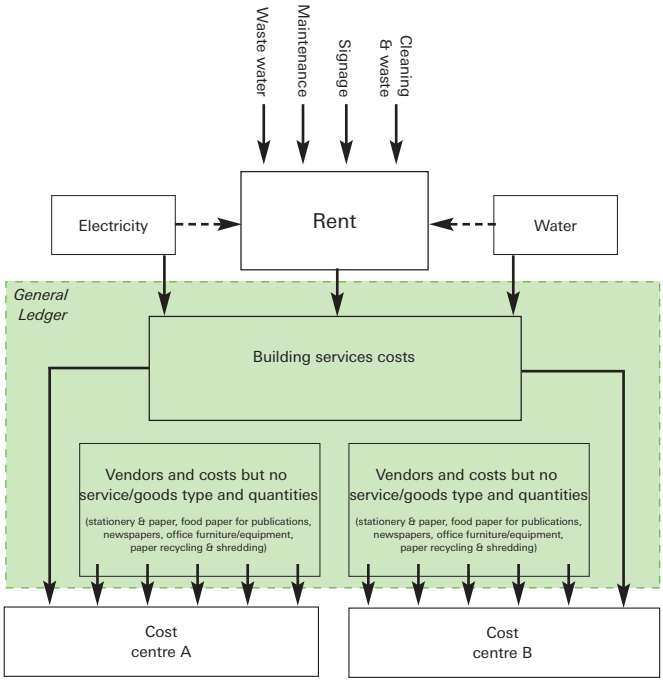


Table 5: Accounting for environmental inputs and outputs of services by Services@AMP provided to AMP

Environmental impact	Contract held and invoices paid by	Basis of charge to AMP	Basis of charge to AMP cost centres
Electricity	Building manager or Services@AMP	Actual use or included in rent	SOSC*
Water	Building manager or Services@AMP	Actual use or included in rent	SOSC*
Office stationery and paper	Services@AMP	Quantity ordered by cost centres	Quantity ordered by cost centres
Paper: publications / marketing	Services@AMP	Quantity ordered by cost centres	Quantity ordered cost centres
Newspapers	Services@AMP	Quantity ordered by cost centres	Quantity ordered by cost centres
Food: cafeterias in main centres	Services@AMP (subsidy), staff pay for food at subsidised rates	Cafeteria subsidy based on consumption	Number of staff
Food:kitchens/ catering/ functions	Services@AMP	Quantity ordered by cost centres	Quantity ordered by cost centres
Office furniture	Services@AMP	Quantity ordered by cost centres	SOSC*
Office equipment	Services@AMP	Lease per copier / fax / printer	SOSC*
Paper recycling and confidential shredding	Cost centres (contracts), Services@AMP (invoiced)	Bin rental and collection (number of bins)	Bin rental and collection (number of bins)
Waste	Building manager (in cleaning contracts)	Included in rent	SOSC*
Waste water	Building manager	Included in rent	SOSC*

* Single Office Service Charge (SOSC) – collective costs for each building AMP occupies are charged to individual cost centres based on m^2 office space occupied, rather than actual use.

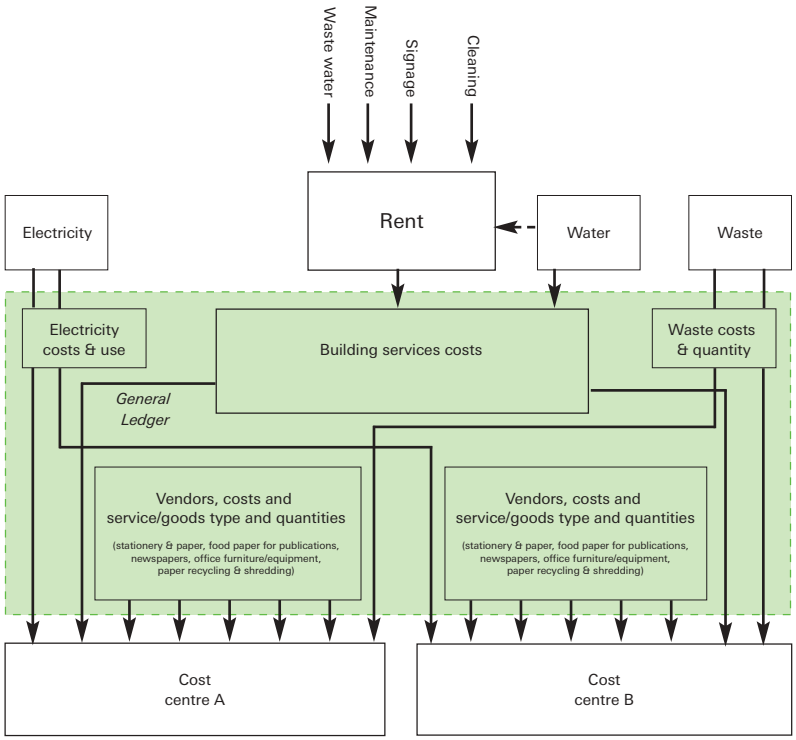
4.4 Suggested changes to the management accounting system, and results of subsequent trialing

Based on the high level analysis, it was identified that the key opportunities for changing the management accounting system relate to improving the availability of information on the costs and quantities associated with AMP's main environmental impacts. This would allow AMP to identify potential opportunities for cost savings and environmental impact improvements. This is done by trying to draw this information from the accounting system and subsequently allocating costs to cost centres.

The key changes that would be made, and how these initiatives were trialed in practice are described below. The study considered the staff time required, the possibility of trialing options within the project timeframe, the required involvement of building managers, vendors or contractors, and the potential for cost savings in selecting options for trial.

The impact of these options, if implemented, on the way environmental costs are treated in the management accounting system is shown in figure 3.

Figure 3. Revised treatment of environmental costs in AMP's accounting system based on options trialed



Initiative 1: Introduce an additional field in the accounting system to identify amounts spent on particular types of goods and services

Suggestion:
An additional field could be added in the accounting system coding for the types of goods and services provided by the vendor by using a unique identifier. This would enable the classification of goods and services to be provided with more detail, and group costs associated with environmental inputs and outputs to be determined.

It was possible to identify costs through the accounts payable system for all environmental impacts identified in Table 5, except for wastewater and waste collection and disposal. The cost for the latter, and in some instances for water and electricity, are paid for by the building manager and included in the 'rent'.

Results of trialing:
Vendors were identified in the accounting system for electricity, water, office stationery and paper, newspapers, office furniture and equipment, food/catering, publication and marketing materials, and paper recycling and shredding. Amounts paid for these goods and services were consolidated and reviewed.

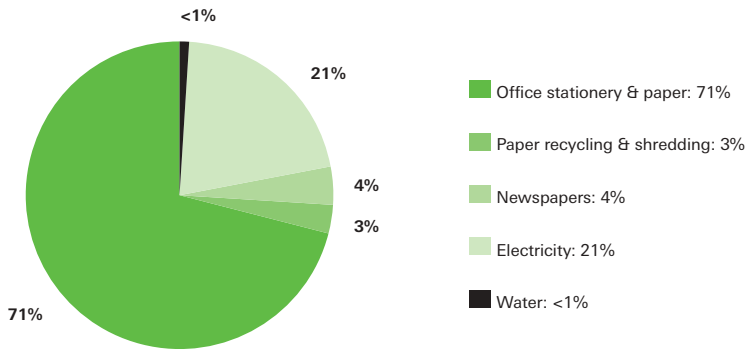
Figure 4 illustrates the cost breakdown for those items identified as having an environmental impact, with the highest costs being for office stationery, paper and electricity. A further review of the approximately 1,250 stationery items purchased over a 5-month period showed paper and toner cartridges account for approximately one third of stationery costs. This information is currently not included in the management accounting system, although the supplier provides stationery data in separate reports to Services@AMP.

Costs of office equipment, food/catering, and publication and marketing materials include a large service component, for example, the costs of producing a marketing brochure involves mainly labour. Investigating and reducing environmental costs and impacts associated with these services were therefore not included in this case study.

The study acknowledges the cost of these inputs and wastes are relatively low compared to many other costs incurred by AMP, for example, they are less than 2% of operating expenses. Whilst the actual quantities of resources involved, and the absolute cost in dollar terms is quite significant, because these costs are quite a small percentage of total expenditure, they have tended to attract limited attention. Further, costs tend to be considered on the basis of their relative size, hence costs pertaining to energy costs do not attract much attention. Perhaps more attention should be directed at the absolute amount of the costs, particularly in the wider context of growing community concern for all manner of businesses to minimise environmental impacts and the adverse impacts on reputation and brand image that not doing so might create.

This type of information could be automatically generated if the accounting system coding contained an additional field for the type of goods and services purchased. It could assist AMP in identifying costs reduction opportunities but would also be used as input for a public environmental report, in particular if combined with information on quantities used.

Figure 4. Relative costs for selected environmental inputs and outputs for AMP



Initiative 2: Introduce an additional field in the accounting system for recording quantities of particular goods and services being acquired

Suggestion:
An environmental management accounting system can be used to generate information in relation to costs as well as quantities. Therefore, an additional field of a physical nature could be included in the accounting system coding for quantitative information in relation to the purchase of goods and services with environmental impacts. This information can be used to supplement cost information, and is particularly useful where costs for items do not directly correlate with quantities used, or are different between buildings. For example, different electricity rates can apply to different buildings, or can vary over a 24-hour period between day and night.

This suggested initiative would enable AMP to monitor quantities of resources used and waste and wastewater generated. It would also enable comparisons between buildings, divisions and cost centres. This in turn would allow AMP to identify where the greatest opportunities for cost and environmental savings lie.

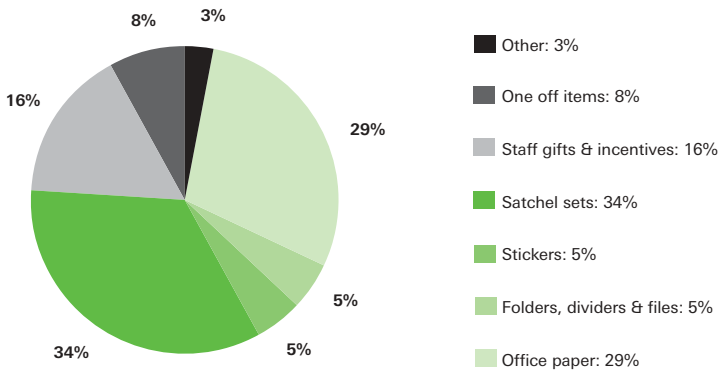
At a practical level, given the purchasing power of AMP, it is highly likely that vendors will be willing to break down invoices into a format requested by AMP. For this study, invoices, invoice processing

systems, and contracts were reviewed in relation to stationery and paper purchases to determine what quantitative information could be incorporated in the accounting system. Stationery and paper were selected for this trial because these items represent the highest environmental cost for AMP and because AMP has one preferred supplier with a separate ordering and billing system.

Results of trialing:
The addition of a new field for quantities of goods and services provided was trialed for stationery and paper use by reviewing invoices, invoice processing systems and contracts. The trial found that AMP has access to quantitative information in relation to stationery and paper that could be included in the accounting system in an additional field. This information is gathered through the online process for ordering and billing, which is summarised in the preferred vendor's monthly reports, and includes item numbers, description, quantities ordered, costs per unit and total costs. This information would enable AMP to obtain a further breakdown of the office and stationery costs (and quantities) in figure 4. An analysis of the top 50 stationery items ordered by Services@AMP cost centres over a 5-month period, showed that:

- A few items dominate stationery purchases as illustrated in figure 5;
- Stationery costs can vary due to irregular purchases and other one off purchases. It is noted that paper comprises a smaller proportion of stationery costs for Services@AMP cost centres compared to other AMP cost centres because of irregular purchases; and
- Costs per item vary significantly between items. For example, stickers cost a couple of cents and a ream of paper about five dollars. For this reason, quantitative information in addition to costs is required to determine potential environmental savings.

Figure 5. Breakdown of costs for the top 50 items ordered by AMP cost centres for a 6-month period



The current accounting and contract management process is directed towards minimising costs associated with stationery. However, additional opportunities to reduce costs and environmental impact may include:

- Establishment of a baseline for resource use and waste generation and the ability to monitor deviations against the baseline;
- Inclusion of environmental key performance indicators in the monthly management report (for example, number of paper reams and toner cartridges ordered);
- Determination, communication and application of relevant environmental criteria in the compilation of the preferred items list (e.g. recycled material content of stationery items); and
- Use of the vendor's monthly reports to compare stationery use between cost centres and locations and determine trends, to identify areas for potential reduction in costs and consumption.

None of these activities are currently undertaken, however an analysis of the contract with the stationery provider suggests Services@AMP can take action to address these issues with little or no additional costs.

Initiative 3: Amend the accounting system to enable the identification of environmental inputs and outputs separately from the rent

Suggestion:
In many cases, costs for waste collection and disposal, wastewater, and sometimes water and electricity are included in the rent expense paid for buildings. For example, waste collection is generally included in cleaning contracts that are managed by the building manager. All of the costs included with the building rent are charged to the cost centres through the SOSC system.

The aggregation of services costs by suppliers reduces the ability to identify opportunities to reduce the consumption and costs of particular resources. Ideally, costs should be charged separately from the rent, so that AMP can track costs and quantities for these items. Because these costs are included in the rent, AMP currently cannot actively manage these costs, especially waste costs, and determine the potential for waste reduction or recycling.

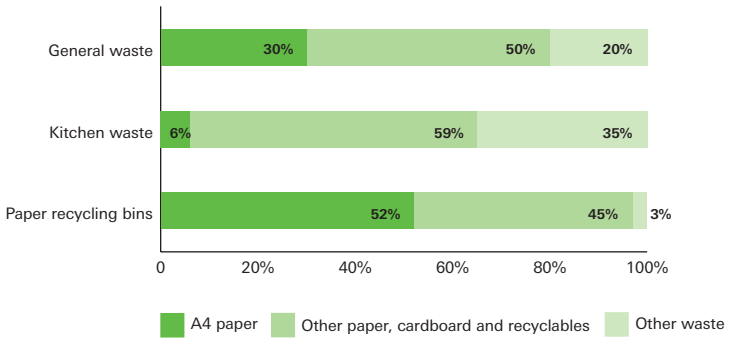
Waste costs are currently included in the rent and often represent a large cost item for companies, whereas costs for water and wastewater are relatively low. Therefore, a waste audit conducted for one of AMP's offices was reviewed to obtain an insight into the feasibility for AMP to request that building managers identify waste costs as a separate item in the rent. An additional waste audit was conducted for the building in which Services@AMP resides. This information was analysed to identify opportunities for potential cost savings associated with waste reduction and recycling.

Results of trialing:
The waste audit conducted for the floors occupied by Services@AMP showed that (figure 6):

- General waste can be reduced by up to 80% in volume through recycling.
- Kitchen waste can be reduced by up to 65% in volume through recycling.
- Waste paper recycling is currently limited to office paper, and paper recycling bins were, based on volume, 48% contaminated with other recyclables and other waste, and less than 5% of office paper is used on a double-sided basis.

It was also noted that on one floor where desks were provided with individual recycling boxes, the general waste bins contained only 5% of A4 paper compared with the 30% average for all floors.

Figure 6. Composition of waste by volume for Services@AMP offices



An audit of general waste and recycling streams at a one of AMP's main Sydney offices found (Waste Audit & Consultancy Services (Aust) Pty Ltd 2002):

- A reduction potential of 33% for general waste, with potential savings of thousands of dollars. It should be noted that a co-mingled recycling system had been introduced in the surveyed office, which explains the lower reduction potential compared to the office occupied by Services@AMP.
- If tenants were to print or copy double-sided (e.g. by setting print option defaults to double-sided) or reuse single-sided paper, approximately $177,800 could be saved per year based on the current amount of single-sided paper disposed of in bins.

The above findings have potential for direct impact on the financial bottom line. A logical next step would be to investigate if waste costs can be highlighted separately in invoices from building managers. This would preferably be combined with the separation of waste costs from the SOSC and charging waste costs as a separate item to cost centres. These options would encourage changes in behaviour in relation to recycling and waste reduction because cost reductions would be passed on to AMP and the cost centres rather than the building manager.

An alternative option is to design a reporting system for building managers to collect information on waste collected and the cost of waste collection.

A review of tenancy contracts may then be undertaken, to determine if reductions in waste costs could result from reduced waste generation and improved recycling. This information could be included in the system as part of outsourced processing of invoices for building services.

Initiative 4: Separating environmentally related costs from the SOSC

Suggestion:
The single office service charge (SOSC) is the charging method for the collective building service (including rent, electricity, water, maintenance, cleaning, signage, wastewater and waste) between AMP cost centres, which is based on the office space (m^2) occupied in that building. Where organisations use such a charging system, efforts to reduce resource use and waste generation can be hindered.

Ideally, cost centres should be charged a fee based on their actual use of electricity, water, generation of wastewater, and collection and disposal of waste. This would allow cost centres to monitor these environmental impacts and stimulate improved environmental behaviour. In addition, AMP could compare different buildings and cost centres to identify if and where opportunities to reduce electricity costs and consumption may exist. This information would also be useful to AMP in the negotiation process when contracts are established or renewed for preferred electricity suppliers.

However, the SOSC system was introduced to minimise the time and administrative labour costs associated with charging individual cost centres for building associated costs. Consequently a change to the management accounting system to charge cost centres the actual costs for their office space was, at this point in time, deemed to be administratively burdensome and therefore not financially feasible. However, the obvious limitations associated with this system from an environmental cost control perspective might mean that this view might change at some point in the future.

As an alternative, electricity and water costs could be highlighted as a separate item in the SOSC when charged to cost centres, whilst these charges would still be based on the average costs per m^2 for the building. This would still achieve the benefits outlined above at a building level (rather than at cost centre level).

This change to the accounting system was simulated for electricity by combining the information on floor space and electricity costs from the accounting system to calculate the electricity costs per m^2 of office space for different buildings. Water was not included in the trial because of its relatively low costs.

This electricity cost initiative was trialed in the case study with an extract of electricity costs being taken from the accounting system for seven large buildings in Sydney for which Services@AMP pays the electricity bills. In addition, electricity invoices for these buildings were reviewed to determine if pricing structures and rates were comparable, and to determine the nature of quantitative information on electricity use provided by suppliers.

The timing of this trial was relevant as it coincided with the transfer to the outsourced invoice processing system and the rationalisation process for electricity suppliers mentioned previously.

Results of trialing:
Based on the extracts from the accounting system, the highest electricity costs (including all charges) per m^2 was five times that of the lowest costs per m^2 and almost twice as high as the average costs per m^2. These findings suggest if the average were to be taken as a benchmark, the electricity bill could be reduced by up to 50% for certain buildings via a combination of vendor rationalisation, contract negotiations and/or energy reduction options. It should be noted that the age of the building and/or equipment used also impact on the usage and would need to be considered in a further review.

The study's analysis of a sample of electricity invoices further supports these findings. The price structure and rates vary between suppliers and off-peak, shoulder and peak rates for electricity use are often applied. As a result of this complexity, analysis of costs alone is not enough to evaluate the reasons for trends in energy use, or the way offices are charged for electricity.

Therefore AMP may benefit from inserting quantities of energy used (in MWh and daily average use for the invoice period and for the year to date) as a new field in the accounts payable system for update into the system and further analysis and monitoring. Electricity retailers can also provide a wide range of information in their invoices in addition to total costs. These include:

- The breakdown of charges into energy, regulated, meter and distributor charges.
- Quantity of electricity used, unit price and total costs.
- Daily use, average daily use and comparison with the last bill, the same period last year or per two-month period for the past year.
- Greenhouse gas emitted to produce the energy used in kg CO_2.
- Regulated charges.

Although not all suppliers provide the same information, all invoices reviewed included the total quantity of energy used.

The nature of specific information required may be further evaluated as part of the transfer to outsourced processing of invoices for building services. An alternative option is to design a reporting system for suppliers to capture information on electricity usage. This option could also be applied to water and to waste if waste were to be separated from cleaning costs and highlighted as a separate item under rent.

Initiative 5: Vendor rationalisation

Suggestions:
At the time Services@AMP were involved in the environmental management accounting project they were also undertaking an exercise to rationalise the number of vendors for the provision of a range of office services. The consultant identified that the process of rationalising vendors could be utilised to implement a number of environmental management accounting improvements, including the insertion of additional fields in the accounting system and the separation of electricity costs from the SOSC. A limited number of preferred vendors for different goods and services could further enhance the transparency of the accounting system and facilitate obtaining information on costs and quantities used. The concern is, that with many different vendors it will be more difficult to obtain this information and therefore to identify opportunities to reduce resource consumption and costs.

AMP conducted a major vendor spend analysis exercise, which involved an analysis of payments over a 6-month period to identify the type of purchases and number of vendors involved. Goods and services were given priority based on the size of spend and available opportunity. For major spend areas preferred suppliers were selected through a tender process based on staff needs, costs and service quality.

Electricity, water, paper recycling and shredding are included in a current review of building services to reduce the number of vendors in each state. In addition, the processing of invoices in relation to building services will be outsourced.

As part of this environmental case study, a similar review of vendors and payments was conducted for electricity, stationery and paper, paper recycling and shredding, newspapers, office equipment and food. Waste and wastewater were excluded, as these costs are generally included in the building rent. The process involved an investigation of the vendor review already undertaken by AMP in relation to electricity, paper recycling and shredding, and stationery and paper.

Results of trialing:
The analysis of vendors (table 6) illustrated the number of vendors for electricity, water, newspapers, and food were significant, as contracts are determined on an individual location or building basis. Services@AMP has a preferred vendor for stationery and paper following the vendor rationalisation process. However, although use of this vendor is strongly encouraged, it is not mandatory and therefore cost centres still use other suppliers for smaller orders or specific products. An alternative system for stationery is a "pay-as-you-use" system for stationery and paper where the vendor manages the stock of the bulk of stationery and paper items (e.g. notepads, pens, post it notes) in a centralised locked cupboard in the office, and one-off items are ordered separately (e.g. staplers, scissors). This is combined with a recycling cupboard for surplus stationery items.

Stationery use and costs are reduced because people will search for stationery items in the recycling cupboard and the office, prior to obtaining new items from the locked cupboard or ordering new items.

More than 25 vendors are currently providing paper recycling and confidential shredding services to AMP. The main reason is paper recycling and shredding was introduced by individual cost centres over several years, rather than across AMP at one point in time and were not included in the recent rationalisation. An analysis of paper recycling and shredding services conducted on behalf of AMP in October 2001 found for the Sydney area, this service is covered by 94 agreements with varying rental and collection charges for almost 500 bins. This represents a significant opportunity for operational efficiency and cost reduction.

Table 6: Review of vendors for services provided by Services@AMP to AMP

Environmental input / output	Number of vendors (approximately)	Comments
Electricity	>10	Different vendors based on buildings
Stationery and paper	>100	More than 95% of costs were attributed to the top two vendors
Paper – publications / marketing and with different specialisations	10	Preferred vendors for different locations
Newspapers	100	Different vendors based on location
Food – cafeterias in main centres	1	One vendor per cafeteria
Food – kitchens/ catering/ functions	65	Different vendors based on buildings and cost centres
Office equipment	5	Preferred vendors covering copiers, printers, computers, fax machines
Paper recycling and shredding	25	Different vendors based on location, with contracts held by cost centres

The study found that reducing the number of vendors would provide a better insight into costs and cost reduction opportunities and lead to a number of possible benefits:

- **Reduced prices.** The vendor rationalisation process has resulted in price reductions of between 5–50%. This has been achieved by taking advantage of AMP's bulk purchasing power. The specific example highlighted that reducing the number of vendors for paper recycling and shredding would also make it easier for AMP to identify where the number of bins or collection frequency can be reduced, which could also result in cost savings;
- **Reduced labour costs in accounts payable.** A 10–15% cost reduction was achieved through the reduction of vendor numbers, as fewer resources are required in the process;
- **Improved environmental performance.** The largest impact from the vendor rationalisation process is the reduced number of vendors used by AMP, which makes it more practical to monitor, for example, trends in energy and stationery costs and use, and identify where the biggest costs and environmental reduction opportunities can be achieved. Without the vendor rationalisation, carrying out the trial to identify environmental costs would have been more time consuming. Another direct environmental benefit from the vendor rationalisation process is the reduced paper use (due to a reduction in contract management, order forms and invoice processing);
- **Improved contract management.** For instance, in order to better manage paper recycling and shredding expenses and ensure AMP is getting value for money, the number of agreements is being reduced. Bins are also being given an ID number to be registered against its location allowing easier verification of vendor invoices. A reduced number of vendors would also make it easier for AMP to assess and monitor the environmental credentials and performance of their suppliers; and
- **Reduced risk of fraud.** Fewer vendors and an expense classification field in the Accounts Payable system will increase visibility into the nature of payments made. This subsequently reduces the risk of incorrect invoicing and fraudulent claims.

Greater benefits would be achieved if further vendor rationalisation were combined with adding an additional field in the accounts payable system describing the type or category of the goods or services provided by the vendor. This should be considered in light of the planned outsourcing of invoices processing for building services.

The costs and benefits of changing the system to include a greater degree of classification require further evaluation. Costs would include greater processing time and data storage requirement.

AMP could also consider a supplier's environmental policy when selecting new suppliers.

4.5 Lessons learned

The following barriers for environmental management accounting and solutions were found during this case study:

- **Staff time:** due to high labour costs, staff time is probably the biggest barrier in conducting a review of environmental costs. This is accentuated, as financial benefits are not always visible and achievable in the short term. In order to overcome this, a cost benefit analysis should be undertaken for recommendations raised in this study.
- **Limited control and influence:** companies that operate in an office environment are often not directly in control of environmental goods and services consumed. This case study illustrated that many services, such as cleaning, waste collection, and sometimes electricity, are provided through the building manager. In addition, as companies increasingly outsource services that do not form part of their core business (such as building management), their potential to influence costs and the associated environmental impact is significantly reduced.

  This study recommends appropriate clauses need to be considered and inserted in outsourced vendor contracts to enable the company to have access to environmental costs and performance data.
- **Hidden environmental costs:** environmental costs are one of the many costs incurred by businesses and are often hidden in other costs, such as electricity costs included in a SOSC. For this reason, reducing environmental costs is likely to be most successful when environmental costs are evaluated as part of a broader cost analysis or change in business processes or systems.
- **Environmental costs are relatively low:** although environmental costs can be high, for a company focussed on service provision within an office environment, these costs are relatively low compared to other costs, in particular labour, IT and tenancy costs. This makes it more difficult to build a business case for environmental accounting for financial reasons alone. Other company drivers and benefits, such as reputation, management or legal compliance in relation to the company's environmental performance, and enhanced company culture and employee morale can assist in building the business case for environmental accounting.
- **Ability to leverage:** more time was required to conduct this case study because AMP's environmental policy and management systems are evolving. For AMP, environmental accounting can therefore serve as a good starting point to enhance a company's environmental performance through the identification of "green office" options to reduce resources and wastes, and through the gathering of quantitative data for a green office program, environmental management system or a public environmental report. For other companies, environmental accounting could be a natural extension of existing environmental initiatives.

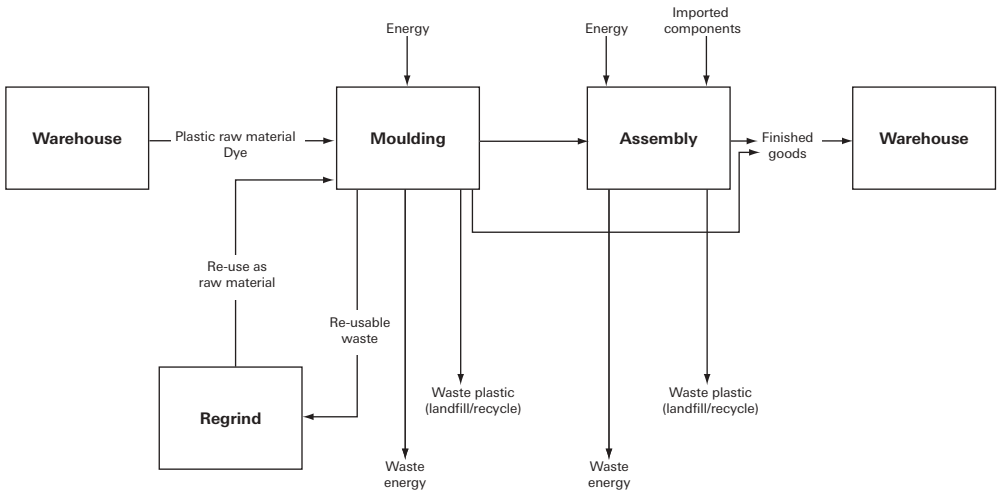
5 Cormack Manufacturing Pty Limited

5.1 Background

Cormack Manufacturing Pty Limited is a plastic injection moulding business based in Western Sydney. It manufactures and assembles a range of polypropylene, polystyrene and polyethylene plastic caps and tops for the cosmetic, food, sports and pharmaceutical industries. The business has a turnover approaching $40 million and employs 90 staff. It is well run and controlled. Staff have continuously sought operational improvements and refinements; they recycle almost all waste and operate effective housekeeping and maintenance services around the workplace. The manufacturing process is certified to quality standard ISO 9002.

The manufacturing business unit undertakes two main processes: plastic injection moulding and assembly. The materials flow for the manufacturing business unit is shown in figure 7. The waste produced by these two processes is fairly homogenous, consisting of different grades of polypropylene, polystyrene and polyethylene (as there are little or no additives other than dye). Most of this is collected and ground up and can be re-used as raw material (through re-grinding[11]). There are no toxic chemicals used, no hazardous wastes generated, and limited environmental compliance requirements.

Figure 7. Materials flow in the manufacturing business unit



To the extent it is undertaken, environmental management is the shared responsibility of the quality manager and the chief engineer. There is no separate environmental management system.

5.2 Environmental impacts associated with operations

Cormack undertook an environmental review and assessment to identify the significant environmental aspects and impacts of it's processes[12]. The major impacts identified relate to:

- the use of energy in the manufacturing and assembly functions; in the refrigeration units used to chill water for cooling moulds; in the compressors, in regrinding otherwise wasted materials; for factory lighting;
- use of raw material for plastics production (polyethylene, polypropylene and polystyrene – non-biodegradable; dyes), and whilst efforts are made to reuse potential wastes (through regrinding or recycling), some ultimately goes to landfill;
- use of packaging materials (some of which relates to supplier packaging which is discarded); and
- use of fuel (for example, in delivery trucks (third party responsibility), forklifts, and for heating).

[11] Re-grinding refers to the re-use of moulding waste in place of raw materials. In most cases, waste from moulding machines can be ground up on site and re-deposited in the machine in place of raw material. Special re-grinding machines are employed next to all moulding machines.

[12] Details of the environmental review and assessment are available in Cormack Manufacturing Pty Limited Environmental Management Accounting, Case Study

5.3 How the environmental impacts are accounted for within the pre-existing management accounting system

The management accounting system is segregated into the:

- Manufacturing Business Unit (MBU)
- Sales and Administration Business Unit (SAU).

Both business units are then combined in the consolidated accounts (CA). For recording and reporting purposes the MBU (on which this case study is based) is a cost centre only. The costs in the MBU are absorbed into the CA Cost of Goods Sold (COGS) account on a standard cost per machine hour basis every month. Table 7 presents a brief description of the costs recorded in the MBU.

Table 7: Cost centres of the Manufacturing Business Unit (MBU) and allocation of costs

MBU cost centre	Description of allocated costs
Product cost centres	
> Pumps > Child resistant assembly > Sports closures > Twist closures > General	The only costs allocated to the product cost centres are labour and overhead costs (eg depreciation, light & power, engineering) relating to manufacturing. Labour costs are allocated to these cost centres when they are incurred using timesheet records. Overhead costs are allocated to these cost centres by predetermined journals. The journals have been determined at some prior date, based on management estimations of where the overhead costs are incurred. The costs are subsequently recharged or absorbed out of the cost centres into the CA COGS using a standard cost per machine hour of production. Waste costs are not separately accounted for and captured in overhead allocations.
Administration cost : > Finance admin > Manufacturing engineering > Manufacturing tooling > Admin manufacturing > Packaging warehouse	Factory administration expenses. These costs are allocated directly to the cost centre where they are incurred. They are also then recharged into the CA based on standard cost per machine hour of production.
CA consolidated	**Description of allocated costs**
	All direct product costs (materials, packaging, labels etc) are coded directly to the CA (and therefore do not hit the MBU product cost centres). Therefore, it is not currently possible to determine the profitability of particular product lines. The COGS is a one-line account (in the consolidated accounts) which incorporates all direct product costs and recharged MBU labour and overhead costs. There is no allocation by type of cost (eg materials, labour etc) or by product type (ie there are no product profit centres). All other non-manufacturing overheads (labour, communications, travel etc) are allocated directly to the CA.

The management accounting, while functional, is imprecise. The allocations of some overheads between cost centres is based on assumed cost allocations, and there is no breakdown information on the cost of goods sold. Consequently, the detailed accounts are limited to reference use.

Senior management tends to use only the summary management accounts. These are produced every month from data in the detailed management accounts. Additional quantitative and qualitative information is included, covering, for example, debtors recoverability, inventory, sales, and KPIs such as

debtor days. The summary accounts only show limited detailed information on costs. Costs are accumulated into categories for example "Salaries & Wages", "Facilities Costs", "Repairs and Maintenance" and "Cost of Goods Sold".

Although other reports are used in conjunction with the management accounts, no additional cost information is readily available. There is limited data on product costs to make strategic decisions on price (driven by the market), product mix and volumes. The current structure provides no information on environmental costs, and middle management in particular has no information on the environmental aspects and impacts of the business activities. This has obvious implications for the subsequent control of environmental costs.

5.4 Suggested changes to the management accounting system

It was decided to implement changes to the management accounts in two stages. Initially, it was decided to implement the new account codes that could be accommodated within the existing accounting system. Information was collected for each of these new account codes during a trial period.

More complex changes, requiring some restructuring of the management accounts to implement the remaining account codes, are to be made at a later date in Stage 2. These new account codes were not subject to trialing.

Table 8 lists the environmental costs and revenues relevant to the new account codes created in Stage 1, how these costs are currently treated within the accounting system, and the new accounting treatments proposed. This is shown diagrammatically in figure 8.

Each current and proposed cost treatment is classified in accordance with the system of cost classification provided by the US EPA (1995), previously referred to earlier in this report (see Section 2.2.2). In the case study, Tier 1 and Tier 2 costs are those recorded in the general ledger and within the control of the business. Many of these, for example costs relating to waste, were readily recognisable. Others are hidden and dispersed throughout the accounts; these costs, while not on the face of it environmental costs, become relevant due to their association with environmental aspects. Examples include the depreciation of specific machinery, indirect labour and maintenance.

Tiers 3 & 4 costs (contingent and intangible) were considered subjectively, but not quantified. Tier 5 costs (externalities) were not included. This reflects the current limitations of accounting systems in only recording financial costs that have been incurred.

Table 8: Cormack's environmental costs and their current and revised accounting treatment

Relevant costs	Current accounting treatment	Revised treatment: stage 1
Tier 1		
'Materials' 'Packaging'	Packaging and materials costs are hidden within COGS in the CA	New account codes for "Materials" and "Packaging" to be created within COGS in the CA
'Light and Power'	One account for each product cost centre is maintained in the MBU for all energy costs (lighting, machinery, office equipment etc). The allocation of costs between the product cost centres is fairly arbitrary, based on assumed management estimations of energy usage.	To be separated out into new account codes "Lighting" and "Moulding energy" for each product cost centre within the MBU. This will improve understanding of how the costs are generated. The remainder will remain in the "Energy overhead" account. The allocation basis between product cost centres will be updated and based on actual readings taken during the trial, replacing the previous management estimation basis.

Table 8: Cormack's environmental costs and their current and revised accounting treatment (continued)

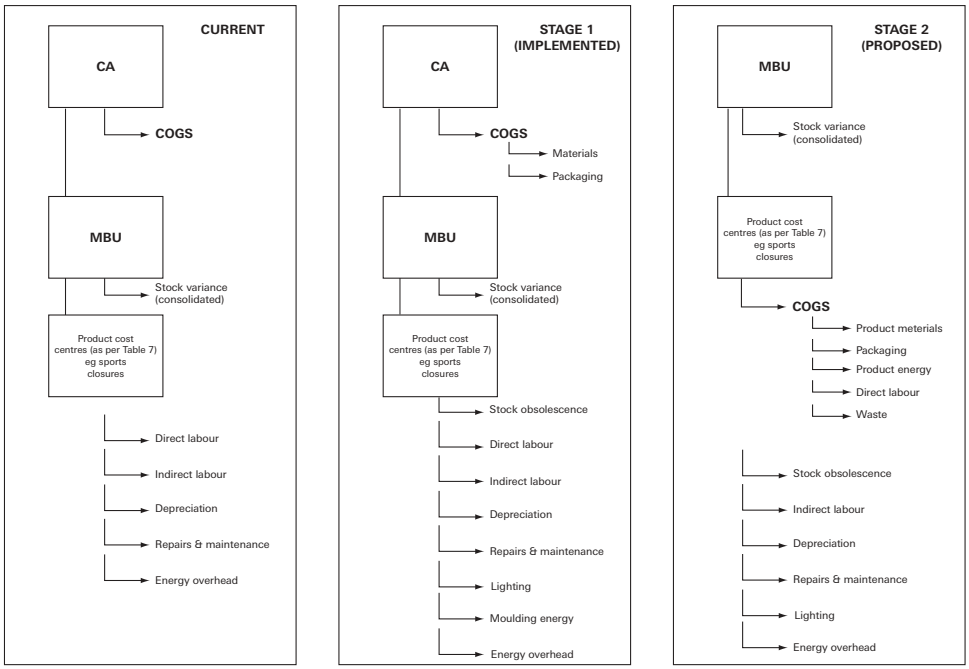
Relevant costs	Current accounting treatment	Revised treatment: stage 1
'Stock variance'	All stock losses are accumulated in the MBU at a consolidated level. These include obsolete stock, spills, wastage on the production lines and misappropriation. There is no allocation between product cost centres and no identification of particular components of the cost – for example, how much relates to waste.	"Obsolete stock" costs to be separated into a new MBU account code with costs allocated across the product cost centres. The remainder will stay within Stock variance account for the time being.
Tier 2		
'Direct labour' 'Depreciation' 'External repairs and maintenance'	Separate account codes in the MBU already. Costs are allocated directly to product cost centres to which they relate.	No change requested. Current accounts and the bases of allocation appear reasonable.
'Waste'	No cost data recorded. The materials cost of waste is hidden within the Stock variance account in the MBU, as noted above. Energy and labour costs of waste are hidden in the energy and salaries accounts respectively in the MBU.	The weight of plastic waste produced (by product category) by the moulding and assembly operations is to be set-up as a KPI in summary management accounts. Although not separating the costs of waste at this stage, this KPI at least provides management with a measure for monitoring and controlling waste, and identifying where and why it is generated. Waste costs (including raw materials, labour, energy etc) will be separated out in the future.
'Compliance'	Minimal environmental compliance costs.	No change requested.
Tiers 3, 4 and 5	Not being captured by the accounting system.	Quantitative and qualitative data to be included in the summary management accounts and brought into decision-making.

Implementing changes to Cormack's environmental costs – Proposed stage 2

Cormack has taken the decision to further restructure its detailed management accounts from 1 July 2002. In stage 2, the "Product materials" and "Product energy" account codes will be created. Direct materials costs (materials and packaging) will in future be recorded in the MBU, in separate accounts within a new MBU COGS (figure 8). The "Waste" account code will also be created in stage 2.

The existing product cost centres (by product type) will remain, but each will now show the full costs of production. The result will be clear and comprehensive cost profiles by product type within the existing management accounting framework. Although the costs shown will be at a generic product level, this will provide a useful starting point for understanding product costing.

Figure 8. The management accounting framework and treatment of environmental costs



5.5 Trialing the changes

During the trial, data was collected to enable costs to be allocated to the new (Stage 1) account codes. Detailed trialing of materials, labour and energy consumption was undertaken on a representative sample of moulding machines, to enable the management accountant to identify what the costs were and where they were being incurred. In the case of packaging and stock variances costs, analysis of the financial data was considered to be sufficient to understand them and no physical monitoring was required.

Table 9 shows how the results of the trial have been used to better allocate costs within the management accounts, for the period 1 July 2001 to 30 June 2002 for each of the selected account codes.

Table 9: Results of the trial applying previous and revised management accounting systems

Account codes	Previous (%MP)	Revised (%MP)
Materials	Not known	485%
Stock variance	130%	110%
Obsolete stock	Not known. Included in stock variance account	20%
Packaging	Not known	48%
Moulding machine energy	Not known. Included in energy overhead account	36%
Lighting	Not known.	
Included in energy overhead account	7%	
Energy overhead	55%	12%
Waste	Not known	KPI in summary management accounts
Compliance (Tiers 2 & 3)	Not known	Considered as part of a risk assessment

All figures expressed as % of manufacturing profit (%MP)

As a result of being able to identify the costing information provided above, management decided to implement a number of strategies to reduce certain costs. The various initiatives are discussed below.

Initiative 1: Comparison of the relative costs of using the hot runner versus cold runner process

Hot runner and cold runner processes refer to the mechanisms in a plastic injection moulding machine for injecting the liquid plastic into the mould. In a hot runner mechanism, the plastic is molten in the flow channels between the moulds. In a cold runner mechanism, plastic freezes in the flow channels each time a batch of (six) products is moulded. This 'runner' waste must be separated, and in most cases can be reground and reused as raw material. Moulding machines can be converted to one mechanism or the other but at significant expense. Most of Cormack's products can be made using either a hot runner or a cold runner mechanism. Details of the relative costs would influence what processes are used.

The two methods generate different quantities of waste, and require different amounts of energy and labour. Table 10 shows the estimated cost and environmental cost of moulding the same product using hot and cold runner moulds respectively. The costs have been grossed up to the annual production volume. The machines used in the trial were comparable (energy efficiency, depreciation, maintenance, labour etc) except for the hot and cold runner mechanisms.

Table 10: Comparison of the costs of using the hot and cold runner moulding process for a given product, based on machine production for one year

	Hot runner		Cold runner	
	Estimated cost ($)	**Environmental waste cost element ($)**	**Estimated cost ($)**	**Environmental waste cost element ($)**
Materials (FG)	95,868	—	95,868	—
Energy (FG)	2,899	—	3,049	—
Materials (waste)	13,221	13,221	11,508	11,508
Labour (waste)	2,216	2,216	6,216	6,216
Energy (waste)	150	150	132	132
Total	**114,354**	**15,587**	**116,773**	**17,856**
		13.6%		15.3%

Note: FG indicates the monetary value of the material that is included in the finished goods. Waste indicates the monetary value of material that is diverted into a waste stream

The different mechanisms of the two processes resulted in varying costs. The additional waste generated by the cold runner process during production resulted in a higher labour waste cost for sorting and processing the waste. For the hot runner, the large amount of unrecyclable waste generated during colour changes and purges, not necessary for a cold runner mechanism, resulted in a higher materials waste costs. This analysis showed that:

- the environmental costs of waste are far higher and more significant, at 13.6% and 15.3%, than management expected; and
- the hot runner method is slightly cheaper than the cold runner method, and has lower environmental costs. However quantification of the environmental impact of each method for the same period shows that other considerations may need to be taken into account in making any decision.

Table 11: Comparison of the environmental impacts of using the hot and cold runner moulding process for a given product, based on machine production for one year.

	Hot runner	Cold runner
Waste sent to landfill	1,844kg	1,605kg
CO_2 emissions from production	47 tonnes	49 tonnes

A decision to use exclusively hot runners or cold runners has not yet been taken. The financial costs are comparable, but there are differences in the associated environmental impacts. Cormack is currently considering several ways to minimise the waste generation of each process.

Initiative 2: Implementing more informed product costing incorporating environmental costs

Product costing and margin analysis drives product pricing, production mix and volume decision-making. However, a review of the current management accounting system identified that there is limited product cost information for decision-making. Standard costs have been determined, but are based on management estimations.

A specific product was selected during the trial to help understand:

- how environmental costs, particularly waste costs, are treated at a product level; and
- the appropriateness of the current standard costing system.

The product selected was unique at Cormack in that it was a simple, one-component product produced by one specific machine. This made collation and analysis of the data simple. The machine was also known to generate substantial waste.

Table 12: Standard direct costs and revised standard direct costs of production for a given product

	Current standard cost ($)*	Revised standard cost ($)*
Materials (FG)	387,000	387,000
Labour (FG)	95,300	60,000
Moulding energy (FG)	14,700	7,000
Materials (waste)	0	10,200
Labour (waste)	0	5,800
Moulding Energy (waste)	0	100
Total	497,000	470,100
Profit margin (including an allocation of other overheads**)	22.55%	23.79%

* based on annual production for FY02

** the other elements of standard cost relating to fixed overhead were not reviewed

The analysis showed that:

- existing standard costing for this product is imprecise;
- the revised margin was 1.3% higher than the standard used in decision-making; Environmental costs account for 0.5% of the profit margin on this product; and
- this year alone the waste associated with the manufacture of this product cost the business $16,100, before disposal costs. This was previously unknown.

The inclusion of environmental costs impacts the perceived profit margin being earned on products and the margin used for decision-making may be inaccurate. Failure to account for environmental costs at the product level raises issues of cross-subsidisation. For example, the materials waste costs are currently being hidden in the stock variance account. Stock variance costs are included in the standard cost of products as an element of an overhead allocation. The stock variance element of the standard cost allocated to this product is unlikely to equal $10,200 – it will probably be less as this product's production is known to generate significant waste. In other words, another product is being allocated a portion of this product's material waste costs.

Cross-subsidisation means that products with few environmental costs subsidise those with poor environmental performance and high environmental costs. The end result is that management may unknowingly make production decisions to produce more expensive products with higher environmental costs.

Initiative 3: Cost versus benefit of the re-grinding process

Almost all production waste is re-ground at source for re-use as raw material. No cost information is known about the re-grinding process, but it is assumed to be the most cost-effective means of waste disposal and materials use. From the cost and revenue data generated during the trial it was possible to analyse this "environmental" process to verify the economic and environmental credentials.

Table 13: Costs associated with the regrinding process

Costs and benefits per year	$
Depreciation cost	(1,950)
Energy cost	(131)
Labour cost	(3,087)
Recycling revenue foregone	(3,175)
Raw materials saved	47,628
Net benefit per year:	39,285

In this case, the economic and environmental benefits of re-grinding moulding waste were obvious to management, although unproven. This example is a useful demonstration of how to consider the merits of other environmental processes.

Initiative 4: Improved order forecasting to reduce obsolescence

As a result of now being able to identify that obsolescence (which impacts waste) was costing the business 20% of manufacturing process costs, management decided to review its order forecasting procedures. The new measures will improve the accuracy of forecasting sales, enabling better workflow scheduling and raw materials management. It is anticipated that this may reduce the current obsolescence costs by 40% (saving 8% of manufacturing profit per year), and hence also reduce the quantities of waste produced.

Cormack is also paying a significant sum (48% of manufacturing profit) for third party storage. Their own warehouses are insufficient to accommodate all their raw materials and finished goods stock. Preliminary management estimates anticipate a 15% reduction in stock levels and hence a saving of 7% of manufacturing profit by allowing more stocks to be moved back into their own warehouses.

Initiative 5: Improved stock control

Management reviewed the content of the remaining stock variance account. Analysis revealed the primary cause of the variance was losses of materials (as waste) during production which were not being reconciled to the stock holdings.

All waste from the production lines is now being weighed and recorded, and the data used for improved stock control and waste management by separating the materials waste costs from the stock variance account in the management accounts. From initial estimates it appears this will account for 91% of the remaining stock variance account (100% of manufacturing profit out of 110% of manufacturing profit).

The final element of the stock variance of 10%MP is attributable to spills or misappropriation. Identifying and monitoring costs will enable management to improve control over these losses.

Initiative 6: Reducing packaging costs

Identification and analysis of the packaging expense estimated that packaging to customers was costing the business over 50% of manufacturing profit per year. As a result, management initiated a trial in conjunction with a key customer to test the cost effectiveness of returnable packaging on a specific product line. Using the data from this successful trial, and with agreement from the customer, the initiative is to be extended to three other product lines based on the following cost/benefit assessment:

Table 14: Costs associated with packaging

Costs and benefits	$
One-off set-up costs for using returnable cartons:	
• purchase of new cutting equipment	
• design and print costs	
• additional cost of purchasing returnable cartons (compared to non-returnable cartons)	
Initial net outlay	(7,500)
Cost impacts to the business from using returnable cartons as compared to using disposable cartons (based on existing order quantities and lead times):	
• fewer cartons required (reduced purchase costs)	
• increased cartage (higher collection charges)	
• increased liner cost (more liners required for smaller cartons)	
• labour differences are negligible	
Net benefit per annum	4,790
Net benefit over expected life (4 years) of returnable cartons:	11,660
Intangible benefits:	
• industry reputation	
• customer relationship	
• meeting obligations under the Packaging Covenant and avoiding future regulation	
• reduced packaging waste in the supply chain	
Net intangible benefit	Unquantifiable

Cormack is now looking to extend the initiative to other customers and reduce its packaging expense further. If successful, costs for returnable cartons in the above cost/benefit assessment may come down further with increased economies of scale.

Initiative 7: Potential energy savings for alternative air compressors

The energy consumed by air compressors was suspected to be a significant part of the total energy cost of moulding. At the time of the trial, management was in the process of purchasing a new air

compressor to cope with increased capacity, but little information was available on energy consumption. An energy-efficient alternative had not been seriously considered as it was perceived to be too costly.

Simple analysis of information generated during the trial showed that investment in the new style energy-efficient air compressors would repay the additional cost over conventional air compressors (the preferred choice) within 5 years. Over the estimated life of 15 years, this would result in an energy saving of $50,000 equivalent to 773 tonnes of CO_2.

Table 15: energy savings for alternative compressors

Cost $	Conventional $[13]	Variable cycle $[14]	Differential (cost)/benefit
Capital outlay new compressor	(35,000)	(52,500)	(17,500)
Estimated energy cost per year	(14,500)	(10,000)	4,500
Total (cost)/benefit in year 1	(49,500)	(62,500)	(13,000)
Net (cost)/benefit after 15 years	(252,500)	(202,500)	50,000

Initiative 8: Improving the efficiency of lighting

Identification of the lighting cost has provided management with the information they need to assess a number of energy-saving strategies:

Painting the interior factory walls white

Two of the factories currently have dark red brick interior walls. The third, a newer factory, has white walls. All are of similar size and shape. Comparison of the respective lighting costs during the trial showed how painting the factory would pay for itself within 9 years, as follows:

Table 16: Costs savings from painting factory walls

Costs and benefits	$
Estimated cost to paint the two unpainted factories	(12,000)
Reduced energy consumption per year	$1,400
Payback period	8.6 years

Investment in energy-efficient lighting

A lighting consultant is to be engaged to investigate the economic feasibility of investing in energy-efficient lighting, now that cost data for the existing lighting is known.

Initiative 9: Managing the energy overhead

The original energy overhead cost has now been substantially allocated to lighting and moulding. The remainder relates to assembly operations, ancillary machinery and equipment usage around the offices and factory. This will be managed as follows:

- Cormack has signalled its intention to apply the environmental management accounting techniques learned to the assembly operations. This will identify the energy costs of this process, which may then also be separately accounted for, and subsequently managed for efficiency;
- Cormack is considering a full co-generation feasibility assessment for the factories to see if waste heat from the moulding process can be recycled to power ancillary machinery, reducing the overhead energy cost. Cormack believe there may be a case for investment having now identified the heating costs (fuel, maintenance) and the energy costs of the moulding machines; and

[13] From data generated during the trial.

[14] Estimated based on manufacturer specifications.

- For more general office and surrounds energy overheads, Cormack has initiated a process of ongoing review to identify general energy efficiency measures. They intend to approach the Sustainable Energy Development Authority (SEDA) to discuss the possibility of joining its business energy-smart program.

Initiative 10: Disaster prevention

Cormack has assessed that an environmental accident would be a significant risk for the organisation due to the potential associated costs. The main impact would be the loss of raw materials (small beads of polypropylene, polystyrene and polyethylene) offsite. Cormack is in the process of installing filters in the stormwater drain and a containment mesh around the southern perimeter of the site which receives the surface run-off.

Table 17: Disaster prevention – some costs and benefits

Costs and benefits	$
Estimated (maximum) cost of implementing safety measures	(10,000)
Minimise risk and exposure to:	Not quantified*
– a potentially significant penalty from regulators	
– the costs of remediation (collection of raw materials from the river and stormwater drains)	
– possible loss of operating licence or, at least, increased scrutiny by regulators	
– possible loss of key customers due to poor environmental performance	
– damage to reputation with customers, regulators and in industry	
– bad feeling generated in local community	

* risks may be quantified by sophisticated risk assessment techniques (outside the scope of the study).

The link between the above assessment and the accounting system is tenuous. Tier 4 costs and potential benefits are not captured by an accounting system based on actual costs and revenues incurred. The application of environmental management accounting principles has ensured that these factors are considered, at least qualitatively.

Initiative 11: Future changes to the management accounting to account for waste costs

Management intends to introduce a new "Waste" code into the MBU cost centre to record the combined materials, energy and labour costs of waste by product cost centre. The waste code could be split further into waste materials, energy and labour respectively, but this was not considered cost-effective at this stage.

A standard cost of waste per 1,000 units of product will be estimated for each product type (by further trials). For simplicity in accounting, waste costs will be limited to direct costs (materials, energy and direct labour). They should also incorporate elements of overheads such as maintenance, depreciation and indirect labour. At this stage of development of Cormack's environmental management accounting, this is considered too complex and unnecessary for current management purposes. These overhead allocations will be considered in the future, once the proposed changes have been successfully implemented.

Applying this standard cost will separate the following hidden costs from the overhead accounts: stock variance (materials), overhead energy (energy), and salaries (labour).

For the first time, management will be able to integrate waste data into the management accounts and monitor where waste is being generated. This information will be valuable for controlling waste and for identifying future cost-effective initiatives to reduce or eliminate waste during production. The rules applying to the standard costs of waste are the same as for standard costing, and will be applied in the monthly management accounting. Management will determine the frequency of review based on operational developments and changes. Standard costs will be tested by obtaining actual readings in future trials.

Identifying and separating the environmental costs for the business unit has already improved capital and operational decision-making and allowed management to identify a number of 'eco-efficient' strategies, as shown by:

- The assessment of the re-grinding process (operational), justifying the investment in the re-grinding machines (capital);
- Improved order forecasting and more efficient stock holding (operational);
- The investment in a new energy efficient air-compressor (capital); and
- Savings in packaging waste and purchasing costs by investing in returnable cartons (capital).

5.6 Lessons learned

There were a number of lessons learned, including:

- The definition of environmental costs should be agreed upfront and applied consistently so as to reduce subsequent communication problems.
- Participation of management in the process is a critical success factor to identifying and resolving issues and making implementation a success. Regular consultation with relevant management and staff should take place throughout the implementation process, rather than just at the start.
- Make someone who understands the business operations responsible for the environmental management accounting implementation process. Consult widely within the organisation, or within the target area, and educate staff. At Cormack this boosted morale and encouraged commitment to the objectives.
- Success is not dependent on identifying and classifying all the environmental costs of the business straight away. Environmental management accounting may be implemented incrementally, beginning with limited scale and scope.
- Quantitatively or qualitatively, the aim is to ensure the relevant costs and benefits that will assist environmental and financial decision-making are brought out in management information.
- The simplest way to identify Tier 2 or "hidden" environmental costs is to first identify the significant environmental aspects and impacts that need to be managed, then work back through the accounting system. At Cormack, this facilitated the identification of the production waste, energy and stock obsolescence costs which were dispersed in different accounts.
- Tier 3 and 4 potential and future costs may be identified by considering environmental aspects and impacts during the environmental review. In this study, this highlighted to Cormack that the potential costs of an environmental accident were above their level of risk tolerance. In other cases, it may identify risks that could be managed to create a competitive advantage. Cormack also discovered that they were approaching a statutory production threshold and would be subject to regulation, and future costs, once the threshold had been exceeded.
- Direct (Tier 1) and hidden (Tier 2) costs may be more cost-effectively treated using a predetermined journal, where the allocation basis is then subject to regular review. There are no

rules as to how frequently these allocation journals should be reviewed or tested, but at a minimum they should be considered once a year during the budgeting process.

- Tier 3 & 4 costs and revenues identified in the environmental review should be reported at least qualitatively in the management accounts and incorporated into decision-making.
- Regular environmental reviews and assessments should be made to keep information on Tier 3 & 4 costs up to date. In the current climate of increased environmental awareness and regulation, these types of costs and the benefit opportunities are subject to rapid change. Given their intangible nature, there is a risk that they may otherwise go unnoticed.
- Some knowledge of significant environmental aspects and impacts will be required to complete an environmental management accounting review. Many organizations will have identified this as part of an EMS such as ISO14001.
- Environmental management accounting is a useful technique to address environmental performance. By generating cost and revenue data on waste, energy and packaging, and the significant environmental aspects of the business, Cormack was immediately able to find cost-effective ways of minimising its most adverse environmental impacts.
- Use the environmental review to identify business units, processes or products of the highest priority. This is how the target areas were identified in this study and where the greatest benefits were achieved. Agree to these target areas up-front.
- A thorough understanding of the standard costing basis and how standard costs are derived will be required to support the environmental assessment.
- The focus of our trial also changed and evolved as we learnt more about the business and the environmental costs. Initially, for example, we intended to assess both the moulding and assembly processes, before realising the work involved in analysing the moulding process alone. We then further narrowed the focus to the hot runner cold runner process, which was identified as being particularly representative of the moulding process as a whole.
- Identify representative products or processes which may be used for extrapolation, gaining the maximum benefit from your limited resources
- Where possible, integrate the environmental cost accounting into the existing structure of the management accounts and use data collection systems already in place. Waste generation data, for example, was already being collected at Cormack. By adding two extra steps to the existing system, the data is now being integrated into the management accounting and will be used to identify waste costs by product type.

6 GH Michell & Sons Pty Ltd

6.1 Background

GH Michell & Sons (Australia) Pty Ltd, hereafter referred to as Michell, is Australia's largest processor of wool and leather. This case study concentrates on a particular process at Michell's to do with wool processing. Michell processes between 30 to 35 million kilograms of wool each year. Its head office is in Adelaide, South Australia. It has a number of processing plants throughout Australia, and makes sales throughout Australia and overseas.

6.2 Environmental impacts associated with operations

The case study concentrates on the process referred to as wool carbonising which is used to process wool that is of a lower quality but nevertheless has a number of end uses, including use in garments (crudely put, the carbonising process is used for the 'dirty' wool which will typically not find its way to 'top end' markets – such as those relating to fine wool suits). This process tends to be more complicated than that associated with the processing of high quality 'clean' wools (referred to in the industry as 'tops'). The wools used in the carbonising process typically include a relatively large amount of dirt, vegetable matter (for example, burrs) and water-soluble salts. To remove this matter, there are various inputs into the carbonising process, including wool, water, detergent, acid, sodium bicarbonate, hydrogen peroxide, energy, labour and machinery use.

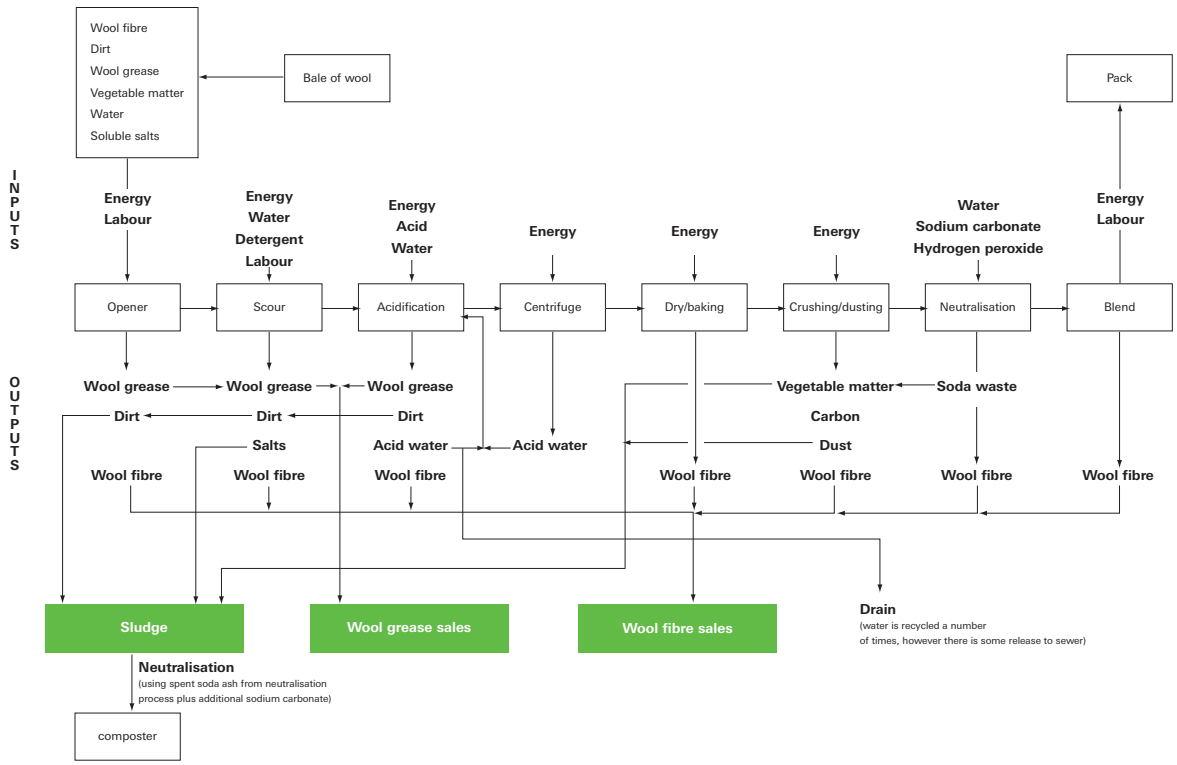
Throughout the carbonising process wool travels through many machines before finally being packed as a blended wool product. It is a highly capital intensive process. The process starts with wool initially going into an 'opener' which effectively separates the wool fibres which have been firmly packed for transportation purposes. Following this it goes into a scourer (there are four scourers in a row). Energy, water and detergent (and labour) are added throughout the scouring process. Following scouring an 'acidification' process is implemented wherein energy, acid and water is used. The acidification process acidifies the burrs and vegetable matter that are initially attached to the wool, thereby turning them to ash which is removed from the process (and used as an input to other products). A centrifuge is then employed to remove the water (requiring energy inputs – this water is recycled) before a dry baking process (energy inputs) is employed. A crushing/dusting process then follows (energy inputs) and then a 'neutralisation' process is implemented in which water, sodium carbonate and hydrogen peroxide is added. A blending process is then undertaken before the wool is packed. The process obviously has a number of environmental implications. A diagrammatic representation of the process is provided in Figure 9.

Apart from generating processed wool, the carbonising process generates a number of by-products which, whilst once treated as wastes, are now used in further processes. The process generates wool grease which currently sells for approximately $2 per kilogram and which is used by organisations, external to Michell to produce a variety of products[15]. The carbonising process also generates a deal of 'sludge' (which is generated because of the various foreign matter attached to the wool when it commences getting processed – because of the addition of water throughout the processing activity, the resulting sludge has a 45% water content). Whilst this once went to landfill this now goes through further processing (in which it is neutralised) before it becomes suitable as input to a composting process. This composting process is undertaken by a party not related to Michell. Michell pays the composter $15 per tonne to take the neutralised sludge.

During the processing there is also a relatively small amount of wool fibres which are separated from the balance of the wool. Some of the fibre is recycled into the production process, but a limited amount of fibre remains separated from production. These fibres are typically referred to as 'broken ends', or fibres that are damaged through the carbonising process. They are typically quite short in length, which restricts their usefulness. These fibres are collected and sold as a lower grade product, for use in various processes, such as the production of insulation.

15 Approximately a decade ago, wool grease was incinerated. The fact that the wool grease is now sold and used by other organisations, rather than being incinerated, has positive environmental implications.

Figure 9. A diagrammatic representation of the carbonising process



Whilst the entire carbonising process does use a deal of water, the water is actually used within a loop in which it is recycled a number of times. The water that is used in the second and third stage (scouring and acidification) goes into a treatment loop where settling tanks are used with one separating further wool grease, and one separating dirt which is used in a subsequent composting process. Some fresh water is added to the process and the water is then returned to the carbonising process (some still goes to the drain when the solution gets too dirty). Wool grease is extracted at various stages of the process[16].

For the purposes of the Michell project 'externalities' caused by Michell's operations were ignored. The project concentrates on a limited number of resource inflows that are known to have environmental implications. Environmental costs were defined quite narrowly as costs that are incurred by the organisation (thereby excluding 'societal costs'), and which are deemed to have environmental implications. The case study concentrated on:

- electricity costs (which have various environmental implications, including those related to the generation of greenhouse gas emissions);
- water costs (use and subsequent release of waste-water has obvious environmental implications);
- use of detergents (which necessitate removal at a waste-water treatment facility prior to release to waterways); and
- transport costs (which also have implications in relation to the generation of greenhouse gases).

The view taken was that if these costs are brought to the attention of management, and if they are able to find ways to reduce these costs, then prima facie, they will generate positive environmental (and

16 What is of interest is that wool processing necessarily generates wool grease – there is no way around this. Michell does not allocate any costs to the wool grease itself based on the argument that even if wool grease was not saleable, it would still be extracted as a necessity in processing wool. The costs of the extraction, together with the other processing costs, are treated as a cost of processing the wool. Indeed, wool grease was extracted when it had no market. The incremental costs associated with packaging the grease in a manner suitable for sale are accounted for and allocated to the wool grease. The wool grease does raise an interesting issue – at what point would/should the company start identifying costs associated with wool grease? This is not an issue that is resolved within this case study but nevertheless is an interesting one worthy of further thought. Michell's approach does appear reasonable. As with wool grease, no costs are separately attributed to the relatively small amount of wool fibres which are separated from the balance of the wool during the processing. Incremental costs pertaining to packaging and selling the fibres are separately recorded.

financial) effects. Of course, it is also likely that consideration of other costs and/or other process would also have positive effects – but to make the project manageable they set defined boundaries.

6.3 How the environmental impacts are accounted for within the management accounting system

It is commonly known that wool processing does not generate high margins, with the final profit contribution representing a very small percentage of the various acquisition and processing costs. Hence cost changes or realignments can have the potential to make certain lines of wool appear unprofitable. This potentially emphasises the sensitivity of various cost allocations.

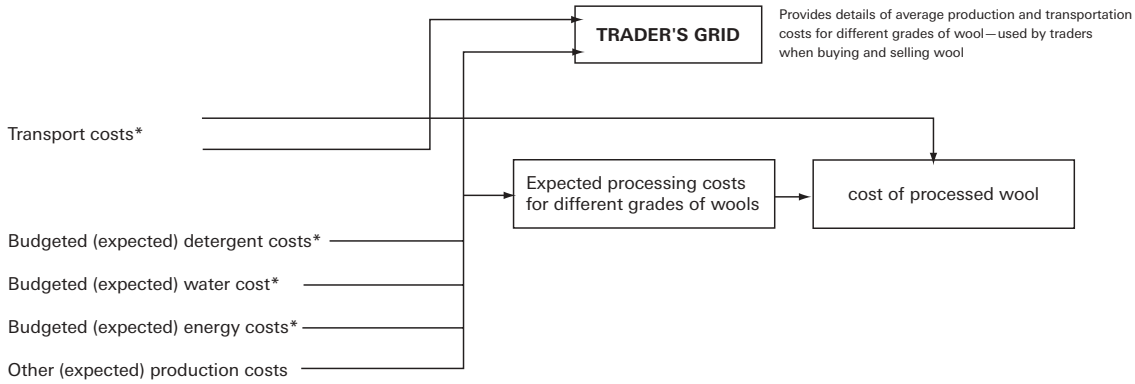
As noted above, inputted wool can be of many types with different microns, different vegetable matter content, and so on. There is an established industry system of classification for the various wool types, and the classification directly impacts the prices the Michell wool traders pay for the wool. Traders make decisions on the basis of perceived margins, which obviously, rely upon an assignment of projected processing costs. Traders are provided with details of estimated processing costs associated with particular classes of wool (the details are entered into a document referred to as the 'Traders' Grid'). This project concentrated on whether these estimated processing costs are perhaps in need of some refinement. Adjusting perceived margins (as a result of adjusting estimated processing costs) could affect what types of wools are acquired by the traders (and hence, subsequently processed by the company). This is the core issue of this case study.

In Michell, electricity, water and detergent costs are accumulated in an account that specifically relates to the carbonising process. These costs are then allocated to the different classes of wool as they are being processed. Hence, Michell does not accumulate such costs in an overhead account as is often the case elsewhere. However, there are still issues to resolve in terms of how the costs are subsequently allocated to the various classes of wool being processed. If different classes of wool use approximately the same resources to process then a fairly arbitrary basis of allocation can be used with little need for further refinement. For example, allocation on the basis of kilograms of wool entering processing could be appropriate. Indeed, this was the basis of assigning detergent, water and electricity costs to the various classes of wool. Implicitly, this assumes that all types of wool, regardless of the associated foreign matter included therein, require the same amount of detergent, water and electricity to process. Of course, this sounds unrealistic, but whether the costs associated with refining the costing data would provide benefits (the usual costs versus benefits test used by economists and accountants) in terms of influencing purchasing and processing decisions is not something that was initially clear.

In relation to transportation costs our investigation showed that these costs are also added to the cost of the processed wool. However, these costs per truck delivery (averaging $2,000 per truck – Michell does not own the delivery trucks) are simply allocated on the basis of bales such that all wool types receive the same allocation for transportation costs.

Figure 10 below provides a simple diagrammatic representation of how costs associated with energy, water, detergent and transportation costs are allocated to processed wool costs.

Figure 10. Existing process for allocating costs to wools processed in the carbonising plant



* costs are allocated on a 'per bale' or kilogram of input basis with all wool grades being allocated equivalent costs. The costs are predetermined on the basis of expectations about the costs to be incurred and on the basis of expected production levels (that is, by way of a standard cost). These expected processing costs are communicated to traders who use the information in determining prices to pay for wool (traders also consider future sales prices when making a decision to buy wool – many of which are 'locked-in' via forward sales contracts). Any differences between expected processing and transportation costs and actual processing and transportation costs (cost variances) are transferred to the production costs of wool on a periodic basis. Standard costs are revised regularly, although the basis of allocation is static.

A major accounting issue – was the existing basis of allocation appropriate?

At the present time many costs are assigned to the products on a kilogram of input basis which does tend to ignore the fact that particular wool types require more processing and hence more energy, water, detergent, and acid than others (for example, a kilogram of inputted product will generate a different amounts of 'final' wool depending upon amount of vegetable matter and so forth). Preliminary estimates indicated that if the focus is on actual water, detergents, and energy requirements, then costs are different depending upon the input type (class of wool) and these cost differences, if made part of the costing to be considered by the traders, could impact traders' decisions. Further, it appeared that wool grease recovery is more effective and cost efficient from the higher quality wool inputs, further impacting relative differences in product returns.

As noted earlier, 'transport costs in' are added to the cost of the processed wool. However, allocating the delivery costs on the basis of bales being delivered ignores the fact that some bales are 75% useable wool by volume, some is only 50 % by volume, and so forth (again, this information is reflected in the wool grades as initially acquired by the traders). If transport costs (which also have environmental implications) are allocated in terms of the expected yield of the unprocessed wool (rather than simply on bales of input), then this will further affect traders' acquisition decisions (again, one must always keep in mind the low margins on wool). What is being emphasised here, is that many costs (including energy, water, detergent, transport) are being allocated effectively on a basis which bears little relationship to what wool is ultimately being recovered from each bale – if these costs are recalculated to reflect recovery rates then projected margins will probably change, with consequent implications for trading decisions.

6.4 Suggested change to the management accounting system

The perceived limitations in the existing management accounting system relate to how certain costs are allocated to classes of wool. It is argued that the costs would be more correctly estimated if a revised

measure based on proportion of final product (wool) per bale was considered. The calculations would be based on sample runs that are used with particular lines of wool types, and average costs per wool type would be determined. A process of material tracking (which in many respects is a necessary precursor to any form of activity based costing) will be used[17].

The implications of the existing system of cost allocations are, basically, that 'dirty' wool inputs are being subsidised by 'clean' wool inputs with the possibility that some wools which are really generating low (perhaps negative?) returns are being acquired when they ought not to be (unless of course the traders could acquire the wool at reduced costs which compensate for the additional processing costs). That is, no allowance is being made for the different yields of the wools being processed and the fact that the 'dirtier' wool needs more processing. Changes in acquisition decisions will have implications for energy, water, detergent, and transportation use. If the case study partners are satisfied that the revised costs are likely to make a material difference, then this will directly influence the wool traders' decisions.

Revising costs to take into account the improved estimates of the actual (physical) use of resources could also mean that product prices could be reduced for the 'cleaner' wools, yet the same margin could be maintained. This could lead to increased sales as well as potentially having wider social benefits. However, it should be appreciated that in various commodity markets, including the wool market, supply and demand typically determines prices such that traders and processors are often price takers, rather than 'price makers'. Indeed, market conditions might be such that prices achieved at different times for processed wools might be less than the costs incurred – although clearly, this would hopefully be a short term phenomenon. Prices for processed wools can move in different directions to the costs incurred to acquire wools for processing[18]. Hence, it is not necessarily the case that changes in internal costings in a commodity market such as wool will necessarily lead to a change in the prices of processed products. For example, a reduction in processing costs will not necessarily lead to a reduction in the sales price of the wool.

To undertake the process of material tracking requires a significant amount of time. The process necessarily involves the participation of people who are experts within the processing activity. A diagrammatic depiction of the materials flows was produced[19]. This is based on Figure 9, provided earlier[20]. Subsequent to this, a diagrammatic depiction of the accounting process pertaining to the processing activity was also prepared. This is simplistically summarised in Figure 10. The two diagrams were compared and a review was undertaken to see if they really appeared to be describing the same underlying process. Clearly, the way the accounting system allocated the costs, on the assumption that each bale used the same amount of resources to process, was not terribly realistic. At issue was: Does the current accounting system make sense when compared to the underlying process to which it relates? This is a VERY central point to this whole exercise. Is the difference between the accounting system and the actual use of resources significant enough to warrant a revision of the accounting system? Would more 'realistic' costs alter any of the production decisions being made by the organisation?

In doing the analysis it became apparent that greater amounts of water, detergent and electricity went into processing 'dirtier' lines of wool, yet costs were being allocated on a per bale or per kilogram of input basis. Whilst the difference in allocated costs (being the difference in the amount allocated on the basis of weight, versus the allocation on the basis of yield) was only small in some cases, given the low

---

17 These processing runs when monitored provide average resource consumption data and would form the basis of subsequent costing revisions. These runs would have to be measured periodically to determine that the physical flows remained relatively unchanged. Within Michell these runs do happen to be constantly checked as to their use of resources, but in the past this has tended to be in relation to environmental and production efficiency decisions, rather than for product costing purposes. This is probably reflective of many organisations, where production people tend not to 'talk' to the accountants, and vice versa.

18 As a case in point, in 2002 there was a general increase in the costs associated with acquiring wools of various classes from wool growers. At this same time, the prices achieved for processed wools was falling, particularly in overseas markets.

19 As already noted, the staff at Michell were already aware of these flows. The flows are regularly monitored.

20 We have elected not to provide detailed information about the actual water, energy, and detergent usage for different grades of wool because of the competitive nature of this information.

margins on wool, this was appearing to be a significant finding[21]. Further cost adjustments to take account of revised transport cost allocations made the differences more significant.

Subsequent discussions also revealed that there were other costs that could be reassigned to the wools on a basis which reflected the expected yields of the wools being introduced into the processing. There are costs associated with storing and insuring potentially hazardous chemicals (for example, acids and detergents). Arguably, the wool-types which use more chemicals (the 'dirtier' wools) should bear more of these costs. Currently they do not. Allocating the storage costs on the basis of expected yields further changed the costing mix between the cleaner and dirtier (higher and lower yield) wools. Also, the releases to waste-water systems could be reduced if cleaner grades of wool were acquired, thereby relaxing load constraints, and associated risks, associated with discharges. Whilst similar arguments could be made for labour and purchase order costs, at this stage these costs (which were not directly deemed to be 'environmental costs') were not factored into the calculations.

As a further issue, it appeared that wool-grease recovery (and wool grease is a saleable product, as mentioned previously) was more efficient from the higher quality grades of wool. Working this out with any precision would be a costly exercise and was beyond the scope of this project. Nevertheless, this was another factor which, if accounted for, would potentially make the costs of processing higher grade (higher yield) wools relatively lower.

In summary, the data collected during the case study trial showed that the differences in the costs considered were significant enough to warrant a revision of the accounting system. In the absence of undertaking a materials flow analysis, in conjunction with a review of the existing accounting system, this would not have been apparent. This emphasised the value in undertaking a materials flow analysis.

6.5 Trialing the changes

With the above information in mind it was decided to recalculate costing data on a basis that takes into account the differences in the yield qualities of wool that enters the carbonising process. It was considered that allocating costs on the basis of expected yields more appropriately matches the actual use of resources than the existing method of allocation based on kilograms or bales of wool placed into the processing activity[22]. As already indicated, wools are classified into various classes that take account of such things as the amount of foreign matter included in the wool. Again, it was believed that assigning electricity, water and detergent costs on the basis of expected yield would provide a more realistic perspective of the actual resource usage (meaning that higher yield wools had less foreign matter and thereby required less processing). It was also decided that it would be more appropriate to allocate 'transport costs in' on the basis of expected yield.

The results of the above exercises changed the calculated average production costs of the various wool types. There is a view that these calculations can then be transferred to the information provided to wool-buyers who can then use the information when deciding what wool-types to acquire. The implication is that unless there are downward movements in prices for some wool types, then the organisation might subsequently elect to only buy cleaner wool with subsequent implications for the resources to be used in the processing activities.

What should be appreciated is that all the information for the revised costing data was already available within the organisation. For environmental control reasons, staff were already aware of the process flows – what was needed was to align, in some respects, the accounting system with the physical system. The costing revisions are not controversial from an accounting perspective. For example, no

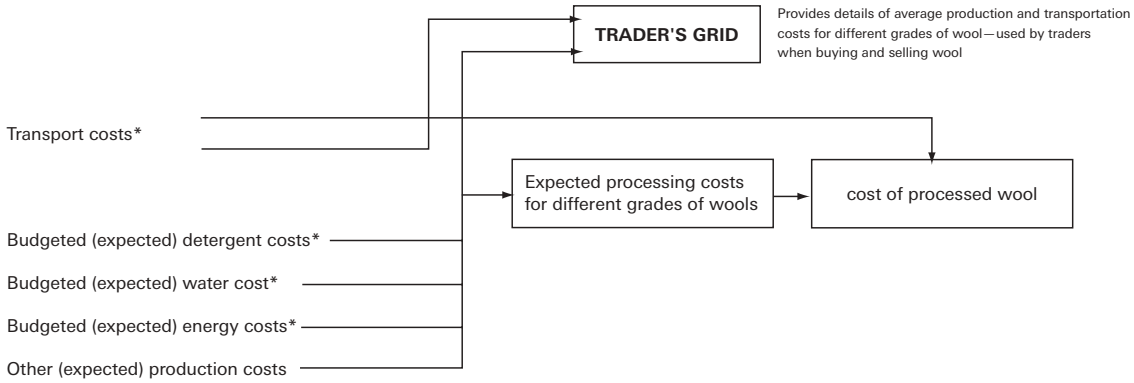
[21] The difference between allocated costs based on the 'old' approach as opposed to the 'new' approach (based on yield) was typically les than 10 per cent across the various wool types.

[22] As a very simple example of how the allocation of costs on the basis of yields can be done, assume that a bale of a certain grade of wool is expected to yield 90 percent wool, whilst a bale of another grade of wool is expected to yield 70 per cent (due to a relatively higher amount of foreign matter in the bale). Assume that these bales are the only ones being processed and that the total energy cost is $100. If we take the sum of the inverse of the yields (1/0.9 + 1/0.7), this equals 1.42857 + 1.11111, or 2.53968. The amount to be allocated to the higher yielding wool would be $100 x 1.11111/2.53968 which equals $43.75, and the amount allocated to the lower yielding wool would be $100 x 1.42857/2.53968, which equals $56.25. This can be contrasted with a system which would allocated equal amounts ($50.00) to each bale. There would also be other mathematical approaches to allocating costs on the basis of expected yields.

notional costs are calculated for externalities caused, such as the emission of ozone depleting substances, releases to water, and so on. The required data was already being captured by the existing systems – it just was not be used for accounting purposes.

The revised accounting system is diagrammatically illustrated in Figure 11 below:

Figure 11. Revised accounting system for allocating costs to process wool



* costs are allocated to classes of wool on the basis of expected yields for the wool. They are predetermined on the basis of expectations about the costs to be incurred and on the basis of expected production levels (that is, by way of a standard cost with each grade of wool having its own standard). These expected processing costs are communicated to traders who use the information in determining prices to pay for wool. Any differences between expected processing and transportation costs and actual processing and transportation costs (cost variances) are transferred to the production costs of wool on a periodic basis.

6.6 Other opportunities and threats

During the trialing, a number of other issues, opportunities and threats were considered. These are briefly discussed below.

Creating compost from the wastes of the processing activity

Michell is currently paying $15 per tonne to have dirt/sludge from wool processing removed from its Adelaide site. Sixty tonnes of this type of 'waste' is generated each day (a daily cost of $900 to have it removed, which obviously does not include the resource costs that contribute to the sludge, which is 45% water). The sludge is removed for the purposes of creating compost, the majority of which will be used by vineyards in the Adelaide area. The ultimate use of this compost will have positive environmental effects as evidence shows that vineyards that use the compost save significant amounts on both chemicals and water – real environmental benefits which are not captured within the accounts of Michell, but by others (for example, by the vineyards). That is, there are positive externalities which given current accounting systems (within Michell and elsewhere) are not brought to account. This is an interesting issue, but one that is not further pursued here other than to highlight that just as conventional accounting systems ignore negative externalities generated by an entity, they also tend to ignore positive externalities.

Because of the process used within the carbonising activity, the sludge that initially comes from the process needs to be neutralised. Whilst the entity would neutralise the sludge in any case (thereby making it suitable to the external entity that produces the compost), the costs associated with neutralising the sludge and then paying the external entity $15 per tonne (to remove the sludge) are less that the costs that would be associated with having the un-neutralised sludge removed. Of course, there are also positive reputational effects (which of course are difficult to measure in financial terms) associated with reducing waste releases and of being associated with the composting process[23].

[23] There are many potential benefits associated with appearing to do the 'right thing' for the environment. For example, it is often assumed that organisations with good social and environmental performance profiles are likely to attract the better employees. Whilst this is interesting, we do not pursue the identification of such benefits in this case study – but nevertheless, these 'other benefits' are something that organisations should consider when contemplating particular social and environmental initiatives, such as the implementation of an environmental management accounting system.

Another issue that arose in relation to the composting is whether management of the process could be enhanced by placing a 'cost' on the 'sludge' that was being generated. Obviously, as with all waste, there is an associated cost. The sludge is made up of raw material that was transported into the entity within the wool bales. The transportation of the various wastes included within the wool obviously contributed to the transportation costs. The sludge also comprises certain chemicals, water and so forth, all of which are acquired at cost[24]. Removing the sludge as part of the carbonising process also requires energy. However, these costs are treated as part of the cost of the wool processing and as such are measured and monitored. The sludge itself is not actually costed. What is occurring is that various wastes are being removed and these wastes together constitute the 'sludge'.

It is considered that this 'sludge' is not something that can be avoided as a result of processing wool – all wool has vegetable matter, salts, and so forth that has to be removed[25]. What is relevant are the incremental costs associated with further processing the sludge. These costs, pertaining to the neutralisation process have been determined and it has been shown that the neutralising costs, plus the costs paid to the external composting organisation are less than the costs that would be incurred by the company if they were to try and dispose of the unneutralised sludge to places, such as to landfill.

Consideration was given to creating the compost in-house, but at this stage the payback period associated with setting up the required infrastructure is deemed to be too long. The payback period analysis took into account the costs of designing and constructing the necessary infrastructure to create the compost. It also took into account (via discounted cash flow analysis) the expected revenues associated with selling the compost, and the costs associated with processing the sludge and thereafter selling the compost. Because of the confidential and competitive nature of the potential composting process, costing data associated with the composting process was not provided. If the price for compost increases then it has been indicated that this project is something that might be revisited in future periods.

European Eco-Labelling Scheme:
Of direct relevance to Michell and other Australian manufacturers exporting produce to Europe is the recently formulated Eco-Labelling Scheme operating in Europe. Details of the European eco-label can be found at http://europa.eu.int/comm/environment/ecolabel/. According to the European eco-label website, the eco-label is supported by the European Commission and by all the Member States of the European Union and the European Economic Area. To signify that the standards of the eco-label have been achieved, a logo, the European flower, appears on the products covered by the scheme. The eco-label website discusses the objectives of the process. The eco-labelling scheme is voluntary and organisations that do not meet the standard are not prohibited from trading within Europe – although it will become increasingly difficult to attain market acceptance. Foreign producers, such as Michell, are permitted to apply for the logo if they meet the criteria and want to market their products in the EU/EEA. They can still attempt to sell their products within the EU/EEA markets without the 'flower'.

There are specific requirements for the textiles industry, as there are for producers within other industries. The eco-label requirements state that to receive the EU Eco-label, textile producers must meet various ecological and performance criteria, including limits pertaining to specific toxic residues in fibres; reductions in air pollution generated throughout the production process; and reductions in water pollutants generated by the production process. Of some relevance to Michell are the restrictions pertaining to the use of chlorines and particular chemicals that often are included within detergents[26].

Hence, whilst this Environmental Management Accounting Project is focussed towards finding cost effective ways to reduce the use of particular materials, external 'shocks' might be imposed which

[24] As already noted, the water is recycled a number of times, such that final waste-water has been through the process a number of times. Whilst some water remains in the sludge, other water is released to sewer as waste. The total use of water is closely monitored.

[25] This can perhaps be contrasted with a situation where raw materials, that are all potentially useable, are wasted as a process of producing a particular product. For example, where only 90 per cent of a metal panel is used to make a particular product. The 10 per cent that is not used (perhaps an off-cut) is no different to the balance of the material that is used. An increase in the efficiency of the production approach could lead to a reduction in this waste. However, in processing particular wools, increases in efficiency will not lead to a reduction in the amounts of dirts, vegetable matter and other wastes that are produced as these need to be removed from the wool. Buying different grades of wool is the main way of reducing the amount of foreign matter acquired with the wool. Because of the capital intensive nature of the processes, it is not feasible to consider removing the foreign matter at the point of acquisition of the wool.

[26] One product which Michell sells is Superwash wool (anti-shrink wool). The process used to make Superwash wool relies upon the use of chlorine.

require us to cease using particular materials if you want to maintain a presence in particular markets. Management needs to be vigilant and be able to anticipate such changes. Whilst this project has not considered opportunity costs (which can be basically defined as losses in net-earnings that result from a particular decision), management seeking to maintain a position in markets that restrict or ban the inflow of goods that use particular processes or inputs must consider the lost revenues (and related expenses) that would result from either withdrawing from the market, or that would result from staying in the market as a result of modifying production processes.

Management needs to stay ahead of initiatives such as the Eco-Label. This may actually involve more costly (but more environmentally-sensitive) processes being put in place prior to any restrictions being imposed. However, 'staying ahead' provides obvious advantages when best practice requirements, such as those required pursuant to Eco-labelling, are introduced. Such initiatives as the Eco-Label will continue to provide both threats and opportunities for Australian businesses. Organisations that do not stay ahead of such developments are subjected to greater business risks and this should have direct implications for how an organisation is valued in the market place. Public knowledge about actual or potential losses of market position will have direct implications for the value of an organisation's equity (shares).

Failure to keep abreast of current developments overseas can have implications for the valuation of the organisation's assets. For example, equipment that relies upon processes that do not comply with particular requirements could conceivably have to be written down as a result of reassessments of associated cash flows. Reduced demand can also act to reduce the value of existing inventories. The valuation of goodwill associated with the business (purchased goodwill is an intangible asset that appears as a non-current asset in an entity's statement of financial position) would also conceivably be negatively impacted by the inability of an organisation to trade within particular markets. Other intangible assets, such as brand-names could also be adversely affected. This discussion emphasises that social and environmental developments, such as the introduction of an eco-labelling scheme, can have implications for the accounting valuations associated with a reporting entity. Organisations wishing to maintain asset values need to keep abreast of changing environmental expectations and requirements.

6.7 Lessons learned

A key lesson learned in the process is that it cannot be assumed that accounting systems necessarily reflect the actual use or flow of resources. Accountants often make simplifying assumptions that in turn can have the result of obscuring the fact that some products use more resources than others. This might only come to light when a materials flow analysis is undertaken and then used as a basis for comparison with how the accountant costs the same process. As costs of resources change across time, the potential impact of any simplifying accounting assumptions may become even more significant.

Another lesson to be learned is that unless a comparison of the accounting system and the physical flow of material is specifically placed on the agenda, then it is an issue that perhaps is unlikely to attract attention. Those people who study the physical flow of resources within an organisation, and those people who account for those flows are typically different parties, and it is not to be assumed that these parties necessarily communicate at regular intervals.

A further lesson to be learned was that organisations might already have the available information to enable a revision of the accounting system (for example, in relation to resource usage with such information perhaps being collected as part of an existing environmental management system) – hence an exercise such as the one described in this case study does not necessarily involve a great deal of investigation or cost.

7 Methodist Ladies College (Perth)

7.1 Background

Methodist Ladies College, Perth (MLC) occupies approximately 7 hectares on the foreshore of the Swan River, in the Perth suburb of Claremont. The School enrols 1,000 students from Kindergarten to Year 12 including 100 boarders, and has over 240 employees. Its facilities include:

- Classrooms and boarding houses;
- Café, commercial kitchens and dining hall;
- Outdoor swimming pool;
- Playing fields, playgrounds, gardens and river foreshore;
- Air conditioned auditorium;
- Laundry;
- Health centre;
- Science centre including 11 laboratories; and
- Resource and information technology centre.

7.2 Environmental impacts associated with operations

Following a review of MLC's operations, the key environmental impacts associated with MLC's operations were identified as pertaining to:

- Energy usage;
- Paper usage;
- Water usage; and
- Waste management.

Such impacts would be common to many service-based organisations. As with the other case studies, this case study did not take into account environmental impacts and costs that are external to MLC (that is, it does not attempt to account for externalities).

7.3 How the environmental impacts are accounted for within the management accounting system

Expenses are shown within the income and expenditure statement and are separated into a number of main headings with most costs, after tuition costs, being apportioned to an 'administration and general overheads' category. Other cost categories include:

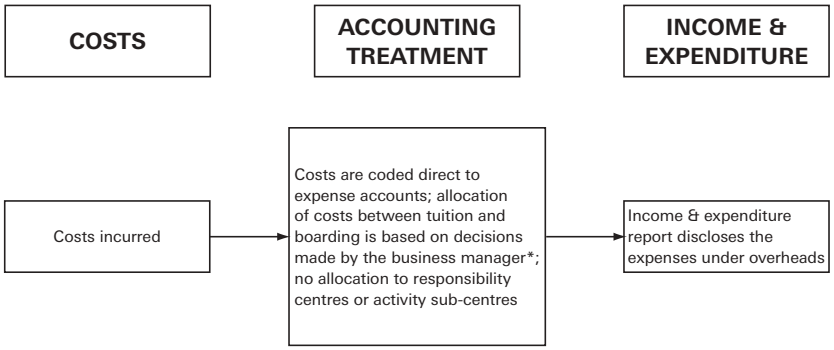
- buildings and equipment;
- gardens and grounds, boarding;
- catering;
- caretaking and cleaning;
- information technology; and
- the health centre.

The only expenses apportioned to these 'other categories' are salaries and wages, and sundry expenses (such as gardening expenses which are directly charged to garden and grounds, and catering expenses which are directly charged to catering). Energy, paper costs, and waste are not allocated to these categories, but are part of 'administrative and general overheads' account. Waste management expenses are reported under 'caretaking and cleaning' overheads.

Each of the above cost categories are further allocated between 'tuition' and 'boarding'. However, at the present time there is no further classification or analysis and no form of responsibility accounting for these costs.

The following figure, Figure 12, illustrates how the costs associated with the designated environmental impacts (pertaining to paper use, water use, energy use and waste management) are treated and flow through MLC's accounting system:

Figure 12. MLC's treatment of costs deemed to have environmental impacts



* The business manager's decision is based upon perception, rather than direct research

7.4 Suggested changes to the management accounting system

It was considered that there was an opportunity to improve the quality of management information by restructuring the classification system in the income and expenditure report and introducing further classifications. These new classifications would relate to Responsibility Centres and would only be for costs, given that individual areas of the school do not have the purpose of generating additional income. Costs would be traced to the individual managers most responsible for making decisions on those costs, although there would still be uncontrolled costs that the manager could not affect. There would also still be a certain amount of residual overheads allocated to the 'administration and general' classification.

It was considered that the most suitable method of classification for MLC would be by subject area and activity (such as catering or boarding). Responsibility Centres would be established as follows:

- Each core subject (English, Maths, Science, Society and Environment);
- Languages Other Than English;
- Music and Theatre Arts;
- Information Technology ("IT");
- Media and Business Education;
- Home Economics and Art;
- Physical Education;
- Administration;
- Catering;
- Building Maintenance;
- Boarding (including Health Centre and Laundry);
- Auditorium;

- Grounds and Gardens (including Swimming Pool);
- Primary School; and
- Other (student ancillary services).

Activity based costing (ABC) was used to assign costs. ABC would be particularly beneficial to MLC as the school has a high level of costs allocated to the 'administration and general' overheads classification ('administration and general' overheads represents 27.1% of total expenditure). ABC could be used to apportion all of the costs within the 'administration and general' overheads classification. However, for this case study the focus was on the apportionment of costs associated with the key environmental impacts. For each category of environmental impact, a cost driver, or basis for allocation, has been identified see Table 18.

Table 18: The cost driver and basis for allocation for each category of environmental impact

Category of environmental impact	Cost driver or basis of allocation
Light and power	Square metres of floor space occupied as a percentage of total school floor space
Photocopying	The number of photocopies made per the logged copy count per department as a percentage of total copies made
Water	The Water Corporation, Western Australia ("Water Corp") Domestic Water Usage Percentages adjusted for MLC's suggested change to toilet and washing machine percentages and to exclude outside watering usage (which uses bore water)
Waste	Direct allocation when the type of waste service (such as tipping fees, document shredding, grease trap removal) could be linked to one or more Responsibility Centres. For example, tipping fees and skip bins are charged to grounds and maintenance, wheelie bins and grease trap cleaning is charged to catering, and shredding is charged to administration. The balance of waste costs is allocated on the basis of square metres of floor space occupied as a percentage of total school floor space, and this is because it is incurred by the school as a whole. It is allocated on the basis of floor space because it is common to all sectors of the school except gardens and grounds, and building and maintenance, which have already had their waste identified

It should be noted that there are limitations to some of the suggested cost drivers used as the basis of allocation. For example, the obvious limitations associated with allocating light and power to a Responsibility Centre on a square metres of floor basis. If there is a reduction in power usage by that Centre, there will not be a corresponding reduction in costs allocated to the Centre because of the basis for the allocation. However, it would encourage Responsibility Centres to share spaces (for example, where rooms would otherwise be empty) and this might ultimately save on costs associated with building new facilities to house students and staff. An energy audit would provide MLC with the data to be able to allocate light and power on a basis that more closely reflects actual usage.

Another limitation in what has been suggested is that the waste costs relate only to disposal costs and do not include the costs of the bought in materials, for example, the cost of the paper that was acquired but is wasted.

7.5 Trialing the changes

The identified Responsibility Centres and cost drivers were adopted for the trial. Although this basis of allocation does not directly affect profitability, by allocating the costs to Responsibility Centres, the managers of those areas are assumed to have an increased awareness of costs and an increased

motivation to control, and even decrease, those costs. The following table, Table 19, shows the costs as reported in the Income and Expenditure Statement before the incorporation of the environmental management accounting suggestions:

Table 19: Costs prior to implementing environmental management accounting suggestions

Extract from Income and Expenditure Statement for Year Ended 31 December 2001

	Tuition $	Boarding $	Total $
Administration and General Overheads			
Light & Power	100,705	15,916	116,621
Photocopying	106,292	2,215	108,507
Rates - Council/Water	31,376	3,381	34,757
Caretaking & Cleaning			
Waste	16,041	7,918	23,959
Total	**254,414**	**29,430**	**283,844**

The following figure, Figure 13, illustrates the accounting treatment and reporting of the costs if they were allocated to Responsibility Centres and sub-centres.

Figure 13. Revised cost allocations

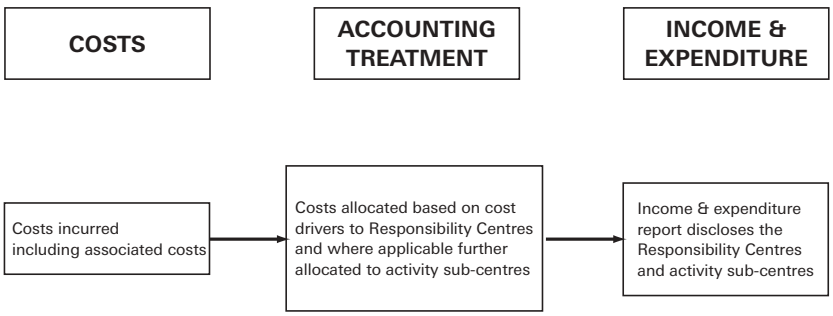


Table 20, shows the costs after reclassification.

After allocation, administration's environmental costs are reduced to $27,105 which is considered to better reflect the actual costs attributable to the function of administration. Those responsible for the other Responsibility Centres will now be better informed on the costs associated with each Centre. These costs can then be further allocated to activity sub-centres to assist with better managing costs associated with activities.

After completing the initial analysis and reclassifications it became apparent that there were a number of other opportunities for cost savings that could be generated from the introduction of the environmental management accounting system. Whilst these have not yet been implemented, the opportunities related to paper usage, energy usage, and water usage. They are now discussed:

Photo-copying

MLC classifies the cost of plain paper to the 'photocopying' expense and all other paper stationery such as letterhead, invoices, pads and envelopes to the 'printing and stationery' expense. Plain paper represents the majority of paper usage at MLC and is used for photocopying and printing, including newsletters and student printing.

Table 20: Reclassification of Extract from Income & Expenditure Statement after applying EMA

Responsibility Centre	Light & power $	Photo copying $	Waste $	Water $	Resource centre reallocated $	Total $
Administration	1,360	24,206	1,383	156	0	27,105
Auditorium	6,388	60	383	735	0	7,566
Boarding	26,459	270	1,587	19,598	0	47,914
Building Maintenance	0	0	4,240	0	0	4,240
Catering	6,018	103	8,140	3,741	0	18,002
English	5,081	9,672	305	585	624	16,267
Grounds & Gardens	0	0	4,240	1,220	0	5,460
Home Economics & Art	5,716	3,760	343	658	375	10,852
IT, Media, Accounting	2,700	3,193	162	311	4,028	10,394
LOTE	2,462	5,500	148	283	352	8,745
Maths	5,043	13,484	302	580	809	20,218
Music & Theatre Arts	1,710	5,735	103	197	524	8,269
Other	4,593	3,254	275	528	0	8,650
Physical Education	4,482	4,805	269	1,034	470	11,060
Primary School	13,187	1,808	194	1,517	2,992	19,698
Science	14,815	21,280	888	1,704	729	39,416
Society & Environment	7,195	10,928	432	828	605	19,988
Resource Centre	9,412	449	565	1,082	(11,508)	0
Total Allocated	**116,621**	**108,507**	**23,959**	**34,757**	**0**	**283,844**

The 'photocopying' expense includes:

- Photocopier expenses (includes consumables and the copy charge levied by the company that supplies the photocopiers) $37,115;
- Rental of photocopiers $49,240; and
- Photocopying paper $22,152.

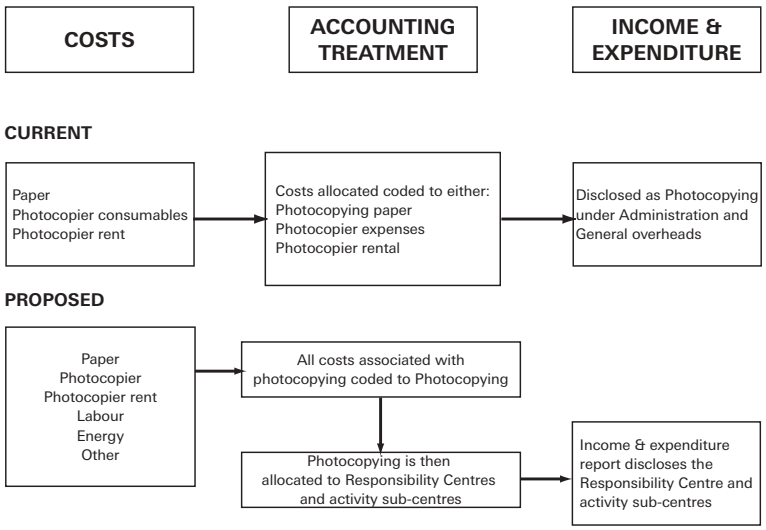
It does not include associated costs such as labour, energy and paper storage. For the actual cost of photocopying to be managed, the full cost should be recognised and then allocated to Responsibility Centres, and where appropriate, further allocated to photocopying activity sub-centres. To facilitate this, each photocopying activity to be costed would need to be identified and records maintained to show photocopier usage by activity to form the basis for allocating the full cost of photocopying.

Additional records would need to be maintained to capture and allocate relevant costs including:

- Labour time by activity - achieved by monitoring time spent by personnel on photocopying related activities as a percentage of their total time (note: photocopying related activities could include time spent ordering and handling the paper). This basis would then be used to allocate labour costs to photocopying;
- Energy usage of photocopiers - this information would be obtained from an energy audit and then used as a basis for allocating energy costs to photocopying; and
- Photocopier usage by activity - the current system of recording photocopies by department would need to be extended to also record the activity for which the copy was made. This information would then be used as the basis for allocating total photocopying costs to sub-centres.

The following figure, Figure 14, illustrates MLC's current treatment of photocopying costs and the treatment after applying the EMA suggestion.

Figure 14. Current and proposed approaches to accounting for photocopying costs



Newsletter

Throughout the school year newsletters are produced fortnightly for distribution to the school's families. Each newsletter averages ten pages printed on five sheets of paper and the first page is printed on letterhead paper. Eight times per year the newsletters are mailed to the parents, the other times they are distributed via the students. Over a year, approximately 200,000 pages are required for the newsletters. MLC has commenced a trial to encourage parents to receive newsletters via e-mail and the school website. However, without appropriate costing the potential savings of this strategy are unclear. Without the costings, alternative vehicles for distribution (for example, e-mail) may not be sufficiently promoted and improvements in both financial and environmental performance might not be achieved.

Estimated costs associated with printing and distribution of newsletters are now calculated as follows:

Table 21: Costs for printing and distribution of newsletters

Cost Components	Usage[27]	Cost per Unit	Total Cost ($)
Photocopying	200,000 copies	4 cents each[28]	8,000
Postage	8,000 posted	40 cents each	3,200
Envelopes and labels[29]	8,000 used	$130 per 1,000	1,040
Labour	100 hours	$20 per hour	2,000
Letterhead page	20,000 pages	$80 per 1,000	1,600
Total cost for the year			**15,840**
Savings on emailing newsletters @ 2/3 of total cost[30]			10,613

Students' Printing

Paper usage could potentially be reduced through the establishment of a user credit system for printing for each student. Under this type of system, a student must logon to a computer or photocopier by the use of a student identification number. Each time the student prints, a credit is deducted from the

27 Based on usage figures supplied by MLC.

28 Based on the photocopying expense divided by the number of copies made for the year, the cost per copy is 4 cents. This cost would increase once all associated costs are included in the photocopying expense.

29 These costs have been treated by MLC as Printing and Stationery.

30 The saving has been calculated as two thirds of the total cost based on the experience of the neighbouring school that distributes its newsletter by email. Savings do not take into account additional time potentially required to administer this dual system.

student's account. Once the account has no credits, it is necessary to buy back credits in order to print. The purpose of the credit system is to discourage students from unnecessarily and wastefully printing. MLC's Business Manager estimates paper usage by students for printing and photocopying to be approximately 400,000 sheets per year. At 4 cents per copy, this equates to a cost of $16,000 per annum. Energy costs would be in addition to this. Currently, MLC does not identify and allocate the costs associated with this paper usage activity. Making the students responsible for the costs will conceivably reduce the usage of paper, as well as providing a means of recouping costs being incurred by the organisation. An IT specialist will be involved to ascertain the feasibility of this suggestion.

Water Usage

Based on domestic water usage percentages issued by the Water Corp the cost of water for each usage can be estimated for MLC and used as a basis for allocating the cost of water usage to Responsibility Centres. This information also enables each Responsibility Centre to look at opportunities to reduce costs.

The following table, Table 22, shows the percentages based on data issued by the Water Corp and MLC's adjusted percentages to reflect the school's use of bore water for outside watering:

Table 22: MLC's use of water

Water Corp Domestic Water Usage		MLC	
	%	Adjusted (%)	Cost Apportionment ($)
Outside watering	43%	0%	0
Shower	17%	30%	10,427
Washing machine	14%	19%	6,604
Toilet	11%	25%	8,689
Taps	8%	14%	4,866
Other	5%	8.5%	2,954
Swimming pool	2%	3.5%	1,217
Total			**$34,757**

The data in the above table highlighted costs and related opportunities that might be missed in the absence of the information. Estimated annual savings from installing dual flush toilets and flow restrictor valves to showers and taps have been quantified from the above table:

- Single flush toilets use 11 litres of water per flush; dual flush toilets use 6 litres per full flush and 3 litres per half flush. Currently, approximately one-third of the school's toilets are dual flush;
- Conventional showerheads allow an average flow of 25 litres per minute; flow restrictor valves reduce this to one third, an average 8.3 litres per minute;
- Standard taps run at 15 to 20 litres per minute, flow restrictor valves reduce this to one third, 5 to 6.7 litres per minute, alternatively fitting aerators halves the flow.

Based on this, water usage savings from installing dual flush toilets and flow restrictor valves are estimated to be a 46% reduction for toilets and 66% for showers and taps. This equates to annual cost savings of $14,243 (41%) being $3,997 from toilet usage, $6,986 from shower usage and $3,260 from tap usage. These estimated annual cost savings could then be included to identify the full cost/benefit of installing dual flush toilets and flow restrictor valves.

Other savings arising from reduced water usage such as energy costs for heated water have not been included in these calculations. An energy audit would provide the information required to identify and allocate the energy costs for heated water.

It should be acknowledged that there were some costs which were not considered in relation to water usage. For example, there are environmental and financial risks associated with MLC's usage of bore water. These risks relate to MLC being located within an area of potential saltwater interface problems due to the school's close proximity to the Swan River; and MLC's reliance on a 'free' resource, which may change given the water shortage issue in Western Australia.

Waste Management

MLC does not maintain sufficient records to enable identification and allocation of costs associated with waste. Costs associated with waste that have not been considered by MLC include:

- Waste management: labour, containers, handling equipment and training;
- Waste disposed: cost of products disposed.

These costs should also be included with waste costs and allocated to the Responsibility Centres. In this way management would be aware of the total cost associated with waste. Development of the additional records required for identifying, allocating and managing the associated costs of waste, would include:

- Labour time by activity: this would be achieved by monitoring time spent by personnel on waste management related activities as a percentage of their total time. This basis would then be used to allocate labour costs to waste;
- Containers and handling equipment: for items that are expensed, the expense would be allocated to waste, and for capitalised items the depreciation would be allocated to waste;
- Training: where associated with handling and management of waste, the cost would be allocated to waste; and
- Cost of products disposed: to include this cost in waste, a waste audit would need to be conducted to identify MLC's waste profile, which would then be costed and allocated to waste.

Using the classification scheme provided by the United Nations Division for Sustainable Development (described earlier in this document) most of the analysis undertaken above has been 'past oriented ' – that is, it has analysed costs that have already been incurred. At MLC, 'future oriented' environmental management accounting analysis was also undertaken, and this is described below.

Air-Conditioning

In the past two years, the school has undertaken three major air-conditioning capital works projects and additional air-conditioning projects are under consideration. The capital expenditure decisions were based purely on initial tender costs when consideration should have been given to total costs associated with the projects. The capital works expenditure relating to air-conditioning was based upon agreed tender costs for air-conditioning installation of $488,449. If a broader approach to cost analysis had been adopted as part of the decision making process then there would have been additional and ongoing costs taken into consideration.

The following table, Table 23, highlights the agreed tender cost, the additional costs associated with the installation of the air-conditioning, and the estimated ongoing costs to be incurred over the life of each project. Estimated disposal costs have not been included, as they were not known.

Table 23: Revised costs of air-conditioning

Costs Estimated Life (years)	Auditorium 15 $	Resource Centre 12 $	Primary School 12 $	Total $
Capital Expenditure				
Agreed Tender Costs[31]	**238,170**	**83,120**	**167,159**	**488,449**
Additional direct costs[32]	32,369	13,185	14,096	59,650
Additional indirect costs[33]	33,536	64,130	58,778	156,444
Total Capital Expenditure	**304,075**	**160,435**	**240,033**	**704,543**
Expenses over expected life[34]				
Estimated energy costs	32,000	26,000	39,000	97,000
Estimated service & maintenance costs	75,000	36,000	120,000	231,000
Other estimated costs	2,000	2,000	5,000	9,000
Total Expenses	**109,000**	**64,000**	**164,000**	**337,000**
Total LCC	**413,075**	**224,435**	**404,033**	**1,041,543**
Impact on Income & Expenditure Statement				
Depreciation–Tender costs (10%)	23,817	8,312	16,716	48,845
Depreciation–Additional direct & indirect costs (10%)	6,591	7,732	7,287	21,610
Estimated energy cost per annum	2,000	2,000	5,000	9,000
Estimated service, maintenance & other costs per annum	5,133	3,167	10,417	18,717
Annual Impact on Income & Expenditure Statement[35]	**37,541**	**21,211**	**39,420**	**98,172**

The above analysis shows the total costs associated with the three air-conditioning projects, before disposal are taken into account, are more than double the tendered costs upon which the capital budget for air-conditioning was agreed. The capital expenditure decision was made without consideration of the ongoing expenses that will be incurred over the life of each project or the additional capital expenditure required as a consequence of proceeding with the projects.

Classrooms

Currently, there is a proposal to build additional classrooms. The average occupancy of a classroom is less than 80% with each teacher having his/her own classroom. The capital expenditure associated with further construction is extensive and must be considered in conjunction with the additional costs associated with further classrooms, such as energy, cleaning and maintenance. To provide the additional classroom space, minimise capital outlay and ongoing operational costs, MLC should consider maximising the occupancy of existing classrooms through the use of timetabling (similar to universities), staggered recess and lunch times, and earlier start times or later finish times for different year groups. This would potentially increase occupancy from 80 per cent to 100 per cent. A 20 per cent increase in occupancy would equate to 12 additional classrooms at no extra capital cost. The only increase in operating costs would be energy for lighting, heating and cooling. These costs are not currently identified and allocated by MLC's accounting system. An energy audit would provide MLC with information on energy used for lighting, heating and cooling classrooms. In deciding whether to proceed with building additional classrooms, a costing exercise should be undertaken and compared with costs associated with maximising the use of existing classrooms.

31 Actual costs incurred by MLC.

32 Additional direct costs included minor variations agreed to after the tender, air-conditioning consultants and design engineers fees.

33 Additional indirect costs included upgrading the electrical supply to meet the additional load required for the air-conditioning and $10,447 for extra insulation required in the primary school to optimise the efficiency of the air-conditioning system.

34 Estimates provided by MLC based on information provided by their air-conditioning contractors.

35 The 'Annual Impact on Income and Expenditure Statement' will differ in the first year and after the tenth year because there should be no service and maintenance costs in the first 12 months of operation as they are covered by warranty; and capital expenditure will be fully depreciated after 10 years (MLC applies a 10% depreciation rate to air conditioning plant).

Swimming Pool

Although MLC has a pool, it does not meet all of the school community's requirements and, therefore, the students often swim at a local pool facility. The pool is maintained throughout the year and there are costs associated with its upkeep. The ongoing costs along with the limited remaining life of the pool would make it appropriate for the school to undertake a cost/benefit analysis of maintaining the pool as compared to not having the pool and utilising the local pool facility for all swimming events. Alternatively, alongside MLC is a boys' school that has an outdoor pool that is thermally heated. It may be possible for MLC to share the use of the neighbouring pool.

The cost/benefit analysis would compare total costs associated with the different options available to MLC. The analysis would determine the most cost effective course of action to satisfy the school's requirements whilst also highlighting environmental impact costs associated with each option, including:

Maintaining the status quo: Maintaining the pool over its expected life, providing for the pool's replacement and utilising the local pool facility.

- Energy to run the pool pump for the existing and replacement pool;
- Water usage of existing and replacement pool;
- Chemicals to maintain the existing and replacement pool;
- Bus hire and other transport costs;
- Annual cost of using local pool;
- Estimated remaining life of existing pool and expected life of replacement pool;
- Capital expenditure required for replacement pool; and
- Estimated annual operational and maintenance costs of existing and replacement pool.

Upgrading the pool: Maintaining the pool over its remaining life, providing for replacement of the pool, undertaking the necessary changes to meet the school community's requirements and removing any need for the local pool facility.

- Energy to run the pool pump for the existing and replacement pool;
- Water usage of existing and replacement pool;
- Chemicals to maintain the existing and replacement pool;
- Capital expenditure required to meet school community requirements;
- Additional operational costs to be incurred from meeting school community requirements, such as energy costs for heating;
- Estimated remaining life of existing pool and expected life of replacement pool;
- Capital expenditure required for replacement pool; and
- Estimated annual operational and maintenance costs of existing and replacement pool.

Removing the pool: Filling in the pool and either sharing the neighbouring school's pool facility or utilising the local pool facility.

- Bus hire and other transport costs;
- Annual cost of using local pool or neighbouring school pool; and
- Capital expenditure removing the pool.

7.6 Lessons learned

In undertaking this case study a number of points became apparent. As is so often the case, many expenses with associated environmental implications were effectively hidden in overheads. This had the implication that there appeared to be a general lack of responsibility for minimising the costs. It was clear that any initiatives aimed at controlling environmental costs must, in the early stages, include a careful review of overhead accounts and the basis of their subsequent allocation to processes, or other cost centres.

It also became apparent that capital investment decisions can have the potential to be wrong if they are based on considerations which do not include running costs, inclusive of energy. What can appear cheaper at the outset may subsequently prove to have higher financial and environmental costs.

Throughout this exercise the participants sought to find reasonable bases for allocating costs, such as water and energy costs. What became apparent is that there is a possibility that work has already been done in this area by other organisations and this can make the introduction of environmental management accounting easier. For example, this case study used average water usage information provided by Water Corporation, Western Australia.

References

Bennet, M., James, P., *The Green Bottom Line: Environmental Accounting for Management – Current Practice and Future Trends*, Greenleaf Publishing, Sheffield, 1998.

Bennett. M., James, P., Lane, G., Tuppen, C., *Environmental Accounting in Industry: A Practical Review*, British Telecom, London, March 1996.

Burritt, R., Hahn, T., Schaltegger, S., "Towards a Comprehensive Framework for Environmental Management Accounting – Links Between Business Actors and Environmental Management Accounting Tools", *Australian Accounting Review*, Vol. 12, No. 2, 2002, pp. 39 –50.

Chartered Institute of Management Accountants, *Environmental Cost Accounting: An Introduction and Practical Guide*, CIMA London, 2002.

Ditz, D., Ranganathan, J., Banks, R., "Green Ledgers: An Overview", in Bennet, M., James, P. (eds), *The Green Bottom Line: Environmental Accounting for Management – Current Practice and Future Trends*, Greenleaf Publishing, Sheffield, 1998.

Ditz, D., Ranganathan, J., Banks, R., *Green Ledgers: Case Studies in Corporate Environmental Accounting*, World Resources Institute, May 1995.

Electrical Association (UK), *Electricity and the Environment 2002*, Electricity Association, London, 2002.

Glad, E., "Zero-Waste Accounting", *Chartered Accountants Journal of New Zealand*, Vol. 75, No. 7, August 1995, pp. 26 – 30.

Gray, R., Bebbington, J. Collison, D., Kouhy, R., Lyon, B., Reid, C., Russell, A., Stevenson, L., *The Valuation of Assets and Liabilities: Environmental Law and the Impact of the Environmental Agenda for Business*, The Institute of Chartered Accountants of Scotland, Edinburgh, 1998.

International Federation of Accountants (IFAC), *Environmental Management in Organisations: The Role of Management Accounting*, IFAC, New York, March 1998.

Osborn, R., *How Environmental Management Accounting Supports the 'Good Government, Better Living' Vision of the Eurobodalla Shire Council, New South Wales*, Green Measures, Canberra, July 2001.

Parker, L.D., "Green Strategy Costing: Early Days", *Australian Accounting Review*, Vol. 10, No. 1, 2000.

United Nations Division for Sustainable Development, *Environmental Management Accounting: Procedures and Principles*, United Nations, New York, 2001.

United States Environmental Protection Agency, *An Introduction to Environmental Accounting as a Business Management Tool: Key Concepts and Terms*, EPA, Washington, June 1995.

United States Environmental Protection Agency, *Environmental Accounting Case Studies: Full Cost Accounting for Decision Making at Ontario Hydro*, EPA, Washington, June 1996.

United States Environmental Protection Agency, *The Lean and Green Supply Chain: A Practical Guide for Materials Managers and Supply Chain Managers to Reduce Costs and Improve Environmental Performance*, EPA, Washington, January 2000.

Waste Audit & Consultancy Services (Aust) Pty Ltd, Extract from *Waste Audit Report*, prepared for Resources NSW, January 2002.

Appendix 1:
Brief details about the consultants in this project

(PROVIDED BY THE CONSULTANTS)

Professor Craig Deegan FCA

Craig Deegan is Professor of Social and Environmental Accounting at RMIT University in Melbourne. He is the author of leading Australian texts in the area of financial accounting and accounting theory, and has numerous national and international publications in the area of social and environmental accounting. Craig is Chairperson of the ICAA's Triple Bottom Line Special Interest Group. For many years he has worked closely with corporations, governments, and industry bodies on various social and environmental accounting projects and initiatives.

KPMG

KPMG is one of the world's leading business advisory firms with more than 100,000 people worldwide. Our Global Sustainability Services practice comprises more than 350 environmental, social, ethical and economic specialists in 27 countries, including Australia. This extensive and multi-skilled resource provides our clients with a spectrum of advisory and assurance services, ranging from sustainability strategy advice to practical assistance to assess, manage, and audit environmental, social and economic issues.

BDO Consultants (WA) Pty Ltd

BDO Consultants (WA) Pty Ltd is the Perth consulting division of BDO Chartered Accountants & Advisers. BDO Chartered Accountants and Advisers are an Australian-owned affiliation of firms, with offices throughout Australia. We have 80 partners and over 600 staff members who provide a comprehensive range of business advice and accounting services. Internationally, BDO is the world's fifth largest multinational accounting and consulting organisation. BDO specialises in providing environmental accounting services including environmental management accounting, triple bottom line reporting, energy audits and eco-audit procedures.

PricewaterhouseCoopers

PricewaterhouseCoopers (www.pwcglobal.com) is the world's leading professional services organisation. Drawing on the knowledge and skills of 150,000 people in 150 countries, we help our clients solve complex business problems and measurably enhance their ability to build value, manage risk and improve performance. Our global team is supported by a group of 1,000 specialists across 30 countries in our Sustainable Business Solutions team who provide advice across financial, environmental, social, human resources, and stakeholder dialogue issues. Our core team for this project are qualified environmental, financial and engineering specialists and bring strong experience in working with a range of stakeholders in the area of environmental accounting, disclosures, assurance and risk management.

Disclaimer

The Commonwealth of Australia through the Department of the Environment and Heritage and the State of Victoria through EPA Victoria provided funding for the Environmental Management Accounting Project under which this Report was produced. The Institute of Chartered Accountants in Australia (ICAA) was primarily responsible for producing the Report, and the following consultants have produced the detailed case studies that are discussed in Part A of the Report and summarized in Part B of the Report:

Consultant	**Case Study Subject**
1. BDO Consultants (WA) Pty Ltd	Methodist Ladies College Perth
2. KPMG	AMP
3. PricewaterhouseCoopers	Cormack Manufacturing Pty Limited
4. Craig Deegan	GH Michell & Sons Pty Ltd

Accordingly, the views expressed do not necessarily represent the views or reflect the policies of the Commonwealth, EPA Victoria or the State of Victoria.

None of the Commonwealth of Australia, EPA Victoria and the State of Victoria accept responsibility for the accuracy or completeness of the contents of this publication, and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this publication.

The Consultants have not participated in the writing of this Report, but each has confirmed that the references in this Report to its case study are not inconsistent with the full case study. In preparing their case studies, the Consultants relied on, and did not audit or verify, information provided to them by the case study subjects. The scope of the work performed by the Consultants in relation to the case studies and the content of their case studies may not be suitable for application to businesses other than the respective case study subjects. It is the responsibility of each recipient of this Report to determine the suitability of the Report for its purposes and if any recipient chooses to rely on the Report, they do so entirely at their own risk. The Consultants do not accept responsibility for the accuracy or completeness of the contents of the Report, and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of the Report. The full texts of the case studies provided by the Consultants can be found on the websites of Environment Australia, EPA Victoria, and the ICAA. Each case study is made available subject to the Consultant/case study subject disclaimer appearing at the beginning of each case study.

The Report and the case studies represent the opinions of the authors and not necessarily those of the ICAA or its members.

The Report and the case studies are for general information only. They are not intended as professional advice – for that you should consult a Chartered Accountant or other suitably qualified professional.

The ICAA expressly disclaims all liability for any loss or damage arising from reliance upon any information in the Report and/or the case studies.