

Environmental Review Report of The Open Polytechnic of New Zealand 2002

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This work may be cited as: Gehrke, T. and Harms, S. *Environmental Review Report of The Open Polytechnic of New Zealand 2002*. The Open Polytechnic of New Zealand, Working Paper, December 2002.

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This paper is also available on The Open Polytechnic of New Zealand website:
<http://www.openpolytechnic.ac.nz/>

Printed and published by The Open Polytechnic of New Zealand, Lower Hutt.

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ISSN — 1174-4103

ISBN — 0-909009-62-7

Working Paper No: 9-02

A list of Working Papers previously published by The Open Polytechnic is included with this document.

Preface

This report was first published in August 2002. Due to its research and work-in-progress character, the Working Papers Advisory Panel offered to publish the report in its Working Papers series. The current document is a revised version of the original report taking into account comments from the Working Papers Advisory Panel and two external reviewers. A major amendment has occurred under section 5.4.1, where the 2002 environmental action plan is now far more detailed and includes the baseline measures reflected in the report, together with recommendations for action. Also, as suggested by the external reviewer, an overall recommendation has been added to include the goal of sustainability in The Open Polytechnic of New Zealand's values.

Steffen Harms, Background Information

Steffen Harms, a postgraduate economics student at Hanover University, Germany, arrived at The Open Polytechnic on May 5 to spend 10 weeks with the Natural Resources Centre as an international graduate intern.

Steffen has a particular interest in environmental applications of economics, and his main project during his internship was to collect data to enable an update of the environmental review, undertaken at The Open Polytechnic 8 years previously. His prime objective was to record the current environmental position of The Open Polytechnic and to define a benchmark to highlight areas where improvement can be made, now and in the future. The aim of the review was to enable The Open Polytechnic to be better prepared for the future's challenges, especially in environmental terms. The benchmark provides a platform from which The Open Polytechnic can move towards the implementation of TNS framework and ISO 14001 certification, the international certification for an environmental management system. It will also allow The Open Polytechnic to compare its performance against that of other organisations.

Steffen helped to evaluate a range of environmental areas, and also touched on The Open Polytechnic's economic and social situation. His study covered the Waiwhetu campus with separate studies of the Print Shop and cafeteria. He noted that it was a huge project to undertake within such a short timeframe, but he was pleased with the progress that was made. Steffen said staff at The Open Polytechnic were extremely supportive in providing the information he needed.

While the project took most of Steffen's time, he provided some input into the online course, Economic Reasoning and also attended three TNS (The Natural Step) meetings with Tina Gehrke and took part at the AAPPA (Australasian Association of Higher Education Facilities Officers) conference on sustainability at Massey University in Wellington.

Workplace Learning and Development Group Manager Jo Blakeley said that 'Steffen's internship was of great value to the Polytechnic, not only for the work that he has done academically, but also for the contribution he made as a person to the Natural Resources Centre, which benefited greatly from his work, cheerful nature and easy-going personality.'

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Executive summary

The Open Polytechnic of New Zealand is the leading provider of distance education in New Zealand, with about 30,000 enrolled students and almost 500 employed staff.

The main objective of this environmental report is to benchmark the current position in order to devise quantitative and qualitative measures to reduce environmental impacts at The Open Polytechnic of New Zealand and to support the implementation of its environmental policy and The Natural Step framework.

In this report the environmental performance at The Open Polytechnic of New Zealand is investigated at the Waiwhetu Campus, with separate analyses provided for the Print Shop and the Cafeteria. Analysis of the Business Centres in Auckland, Wellington and Christchurch is outside the scope of this report.

Areas of environmental impact investigated are paper use, electricity and natural gas consumption, water use, waste generation, emissions, recycling activities and cleaning.

A major area of environmental impact at The Open Polytechnic of New Zealand is the use of paper. For example, the average monthly paper use at printers and copiers on campus amounts to 2.4 tonnes, or 437,750,00 sheets of paper. (This reflects administrative paper use only and excludes the printing of student promotional and course materials.)

Recommendations are made throughout the report with the aim of reducing adverse environmental impacts. In addition to actions geared specifically to each area of environmental performance, general aspects considered are

- the improvement of monitoring and reporting of the environmental impacts on campus
- education of staff, particularly about implementation of The Natural Step framework
- analysis of campus-wide opportunities to save energy
- introduction of a policy that considers the environmental performance of contractors to The Open Polytechnic of New Zealand.

The report shows that improved environmental management would benefit the financial, as well as the environmental, bottom line.

Acknowledgements

Thanks are due to the following people involved in compiling this report:

Internal staff (The Open Polytechnic of New Zealand)

Jo Blakeley	Head of School, Workplace Learning & Development
David Coplon	Administration Service Manager (resigned)
Richard Drummond	Instructional Designer, Learning Design Group
Louise Hazlett	Editor, Learning Design Group
Stephen Jensen	Manager, Print & Production
Paul Keats	Manager, Natural Resource Centre
Shaun Ransley	Property Manager
Sheryl Tunbridge	Information Services Support Manager

Subcontractors and external staff

Paul Borrie	Travel Agent/Paul Borrie Travel
Elaine Fouhly	National Institution of Water and Atmospheric Research (NIWA)
Chris Hughes	Electrical support, C & D Hughes Electrical
Deborah Orr	Manager of Cafeteria, EUREST Ltd

Reviewers of Working Paper version

Colin Higgins	Lecturer in Corporate Citizenship and Sustainable Development, Massey University
Dr Lin Roberts	The Natural Step Foundation New Zealand

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1. Introduction

Background

The aim of an environmental review is to determine an organisation's current relationship with its environment. It includes the ecological, economic, and social dimensions and considers legal, managerial and scientific boundaries.

This review updates the 1994 initial environmental review commissioned by The Open Polytechnic of New Zealand¹ and aims to provide a platform for The Open Polytechnic to move towards ISO 14001 certification and the implementation of The Natural Step (TNS)² framework. While a considerable amount of data was collected during the 1994 initial environmental review, The Open Polytechnic has since undergone a number of significant operational and structural changes, and a reassessment of the environmental impacts is timely.

The structure of this report is based on guidelines recommended by the Global Reporting Initiative (GRI) currently used by many international companies. The main focus for this report, however, is on *environmental performance*.

Objective

The main objective of this review is to benchmark the current position in order to implement quantitative and qualitative measures to reduce environmental impacts. This will be done in reference to the environmental policy and associated environmental objectives that are already integrated in the 2002 business plan. This report assumes the same key environmental impacts as covered in the 1994 environmental report.

¹ McManus, Nigel. *TOPNZ Environmental Performance Review*, Wellington: The Open Polytechnic of New Zealand, 1994.

² See TNS website for further information <<http://naturalstep.org/>>

Methodology

The data for this review was mainly acquired from informal interviews with key staff of selected departments, and gathered from documents such as invoices, delivery dockets and charts made available by suppliers. Several Excel files with data on resource consumption were made available by the Property Manager.

Recommendations are given at the end of each chapter for improving the environmental performance, and subsequently the economic performance, of The Open Polytechnic.

2. *Statement of Management*

The Open Polytechnic of New Zealand is committed to the implementation of environmentally sustainable business practices. The 2002 environmental review report has helped us to quantify our impacts on the environment, and we are now able to make informed decisions about priorities in order to reach our environmental goals and objectives.

The data collected for this report provides a benchmark against which our activities will be measured in future. Our performance against key targets will be stated in our Annual Report. Our aim is to not only reduce our environmental impacts, but also to improve the quality of our physical environment. This present report will help us to work towards becoming good environmental stewards.

The Open Polytechnic of New Zealand also realises that the quest for organisational sustainability must include financial, environmental and social considerations and we are proud of the initial steps we have taken by making this report available. We invite your feedback in order to improve future reports.

A handwritten signature in black ink, appearing to read 'Donovan Wearing'. The signature is fluid and cursive, with a long horizontal stroke at the end that tapers to a point.

Donovan Wearing

General Manager
Corporate Services

3. Profile and Structure of The Open Polytechnic of New Zealand

The Open Polytechnic of New Zealand is a Crown-owned tertiary institution that provides multifaceted open and distance learning. It was founded in 1946 as the Technical Correspondence School and was renamed The Open Polytechnic of New Zealand in 1990. In addition to individual servicing for students, it works with Industry Training Organisations, schools, other institutions and a wide range of public and private sector clients. The Open Polytechnic currently offers 130 programmes and 1,300 courses. Courses range from technical and vocational training to higher professional and continuing education courses.³ With 29,385⁴ students in 2001, The Open Polytechnic is one of the largest providers of tertiary education in the southern hemisphere and a recognised leader internationally in open learning.

The main campus of The Open Polytechnic is located in Lower Hutt, with business centres in Auckland, Wellington and Christchurch. All The Open Polytechnic facilities are located within New Zealand; however, students are based around the world. The student age range is distributed from under 20 up to over 50 years⁵, with overall, 13.8 per cent Māori students.

For the purpose of this report, the main campus in Lower Hutt is divided into three business sections:

- Core business operations, including Faculty Operations (tertiary education), Marketing, Course Design, Corporate Services
- The print shop which operates as an independent division of the institute
- The cafeteria, which is contracted out to EUREST Ltd.

The Open Polytechnic employs 479 staff in long-term contracts.⁶ Sixteen employees are located in the business centres, with six in Auckland, two in Wellington and eight in Christchurch. Four hundred and nine staff members are full-time employees; 70 work part-time.⁷

The organisational structure of The Open Polytechnic is reflected in Figure 1.

³ *The Open Polytechnic of New Zealand Annual Report*, Wellington: The Open Polytechnic of New Zealand, 2001, 2.

⁴ *Ibid*, 73

⁵ The student age ranges are as follows: under 20: 11%, 20–29: 31%, 30–39: 30%, over 40: 28%

⁶ 'Long term' is defined as a contract of twelve or more months.

⁷ Total part-time staff equate to 45.15 full-time jobs. The number of staff located on campus (including external contractors) is 536.

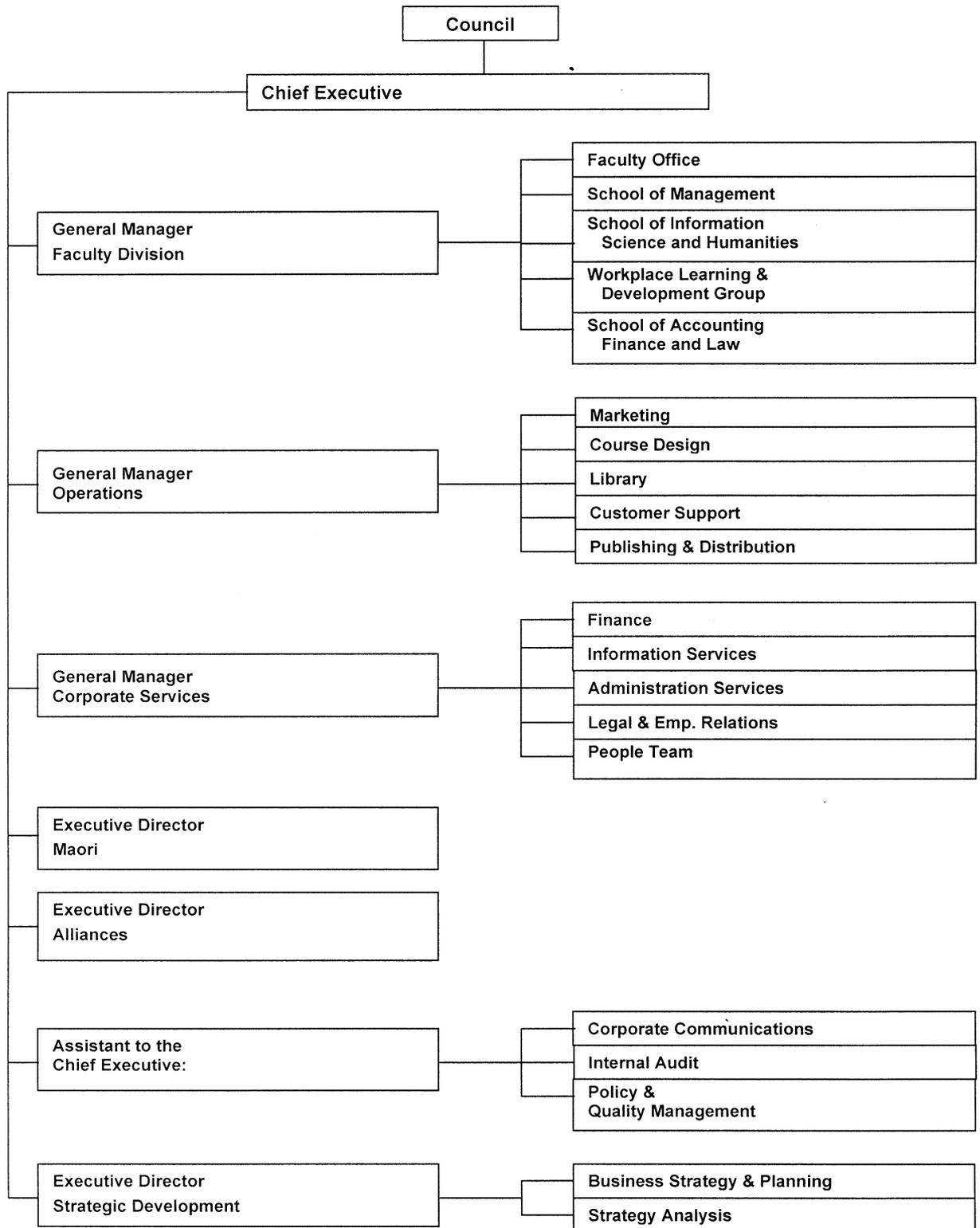


Figure 1: Organisational chart of The Open Polytechnic of New Zealand
 <<http://people/Documents/oc%20Organisa.doc>>

4. Vision

The following vision and mission statements are taken from *The Open Polytechnic of New Zealand Statement of Intent 2002–2004, (Including Statement of Objectives)*. Wellington: The Open Polytechnic of New Zealand, 2001⁸

Vision

First choice in open learning — supporting learners at any age stage.

Kia noho ko tātou ngā tino kaiako mō te marea, pakeke mai, tamariki mai, tauhou mai, tautōhito mai.

Mission/purpose

To support development of lifelong learners through open learning.

Kia whakahautia te kaupapa 'Kāore he mutunga o tēnei mea te ako'. Mā te huaki i te tatau ki te marea e taea ai.

The underlying Charter Goals are:

Honour the principles of the Treaty of Waitangi

Deliver educational products and services which are educationally coherent and meet market needs, are consistent with The Open Polytechnic's vision, mission and purpose, and meet The Open Polytechnic's quality standards;

Develop an organisation with capabilities and capacity to meet current and future requirements; and,

Manage resources consistent with long-term financial viability.

⁸ Source: The Open Polytechnic of New Zealand intranet: <<http://topic/TNS/strategic.cfm>, 11/07/02>

Values

The Open Polytechnic is guided by nine core values:

<i>Customer Focus:</i>	Being responsive to our customers — current and future
<i>Scholarship:</i>	Engaging in best practice teaching, learning and research
<i>People:</i>	Acknowledging that people make our organisation work
<i>Excellence:</i>	Doing the very best that can be done
<i>Commercial Orientation:</i>	Working to develop a strong and growing business
<i>Cooperation:</i>	Working together to achieve our goals
<i>'Can do' attitude:</i>	Being energetic, enthusiastic and innovative
<i>Diversity:</i>	Respecting the differences in people and groups
<i>Integrity:</i>	Being honest and doing what we say we do.

Five-year development strategy

To achieve its vision and mission, The Open Polytechnic has formulated six objectives for the 2002–2004 business cycle:

Objective 1: Core business

To design, develop, market and deliver open learning products and services that:

Enhance the development of The Open Polytechnic as a responsive, effective and efficient provider of learning products and services.

Contribute to the ongoing financial viability of The Open Polytechnic.

Objective 2: New business growth

To pursue new business growth opportunities consistent with our Charter goals that will:

Establish a significant business that is profitable on an ongoing basis and professionally reputable.

Use current capabilities to take advantage of incremental value-added business opportunities that are profitable.

Objective 3: Māori development

In addition to core business activities, to develop significant mutually beneficial opportunities with Māori in design, development and delivery of relevant and appropriate open learning products and services.

Objective 4: Customers

To meet the changing needs and expectations of our customers in a manner that is consistent with our Charter goals and organisational values.

Objective 5: Markets

To target markets that fit our portfolio and chosen customer profile in ways that maximise the contribution from the portfolio as a whole.

Objective 6: Capability and capacity

To ensure the appropriate management of our people, systems and physical infrastructure in a manner that will meet present and future business needs.

Environmental policy

We will manage the impact of our organisation on the physical and social environment through a programme of continuous improvement that also seeks to reduce cost and maximise economic benefits.

We will demonstrate our commitment to our kaitiakitanga role through our teaching, research and the management of our physical resources. We will use the following four principles from The Natural Step Framework to guide us:

- System Condition 1: Reduce our use of materials that come from mining and fossil fuels, especially materials that are naturally scarce in the Earth's crust.⁹
- System Condition 2: Reduce our use of synthetic substances that are toxic and/or don't biodegrade.
- System Condition 3: Promote environmental restoration and reduce use of materials from nature that are harvested unsustainably or used in ways that reduce natural productivity and biodiversity.
- System Condition 4: Increase environmental awareness and use resources efficiently and fairly so that all basic human needs can be met.

Source: <http://topic/TNS/TNS.cfm>

⁹ The above wording of System Condition 1 is taken directly from The Open Polytechnic of New Zealand environmental policy. It should be noted, however, that the addition '...especially materials that are naturally scarce in the Earth's crust.' should be removed from the policy, as it is without question that all mined materials and fossil fuels are scarce in the Earth's crust.

5. Performance

5.1 Scope

While the economic and social performance in this report refers to the whole organisation, the environmental performance is split into the different operating venues.

As mentioned before, The Open Polytechnic resides in four different locations:

- Waiwhetu Campus, the main campus in Lower Hutt,
- Business Centre Auckland,
- Business Centre Wellington, and
- Business Centre Christchurch.

This review focuses on the main campus in Lower Hutt. In addition to environmental impacts generated by staff on The Open Polytechnic's payroll, external contractors also impact. External contractors are:

Cafeteria operations	EUREST Ltd
Gardening (car park and atrium of faculty buildings)	Tim Green, Gardener Ltd
Gardening (lawn mowing and rest of campus)	Martin Landscaping
Maintenance of hot water boilers	Aquaheat Ltd
Electric maintenance	Chris Hughes

(**Note:** this list includes only contractors impacting on the on-site business operations: Other contractors who deliver or collect materials, for example, are included in this report where appropriate.)

The Waiwhetu campus houses ten buildings: A- to F- Block; K- Kanuka, H- and R- Block; B-Block is split into two buildings. (Please refer to the Appendix for a site map.) Kanuka is the largest building housing approximately 200 staff (over 40% of the campus total). As a result, resource consumption is highest in this building.

Regarding the supply of electricity, water and gas, the campus is divided into two sections. Kanuka and H-Block are supplied from Cleary Street, near the back entrance. As H-Block uses very small amounts of natural resources, data from the Cleary Street meters are considered as Kanuka use). All other buildings on campus are supplied from Wyndrum Avenue, near the main entrance (please refer to the Appendix for a site map).

The vehicle fleet of The Open Polytechnic comprises four cars and one forklift. Three vehicles are maintained on the Waiwhetu campus, and one at the Christchurch business centre.

For the benchmarking of all material flows at The Open Polytechnic, data sets used were:

- monthly comparison (where available and reasonable); comparison between years¹⁰;
- annual¹¹ comparison of data.
- where different methods were used, it is explained in the report.

For the comparison of different periods, weather fluctuations over the last two years must be considered. (This includes fluctuations in mean temperature as well as in precipitation.)

Staff numbers increased over the past years, which had a direct impact on resource use and the total number of electronic devices on campus. The number of air conditioning units (AC) also increased. A rise in resource usage does not therefore necessarily mean a decrease in efficiency rates.

Since the cafeteria and the print shop show substantial differences in structure and workflow compared with the rest of the campus, they are discussed under separate headings.

The scope of this report excludes the Waiwhetu stream, which is adjacent to the campus. Albeit small, it is New Zealand's most polluted stream owing to industrial waste deposits. A Waiwhetu Stream Working Group has been set up by the Hutt City Council and an action plan launched to restore the stream.

¹⁰ 'Comparison between years' is defined as a comparison of a 12-month period with the previous 12-month period.

¹¹ 'Annual' is defined as a comparison of one month in one year with the same month in the previous year(s).

It must also be pointed out that the limited consideration that this report gives to the social and economic dimension The Open Polytechnic of New Zealand's operation does not reflect local and international trends. Although the Global Reporting Initiative Guidelines (CRI), which give equal preference to economic social and environmental factors, were chosen for this report, it must be stressed that the report of the environmental performance of the organisation was the main aim of this document. Readers are, however, encouraged to comment on how economic and social aspects of the performance of The Open Polytechnic of New Zealand can be better measured and reported.

5.2 Economic performance¹²

The operating budget for The Open Polytechnic is derived from fees paid by students (tertiary fees), interest income, government grants, educational services income and a small proportion of income derived from other sources, such as consultancy and research contracts.

The governmental grants are calculated in 'equivalent full-time students' (EFTS). The ratio of an enrolment of an EFTS varies with the level and duration of the courses. Table 1 shows a breakdown of The Open Polytechnic's income of 2001.

Operating revenues	Amount (in \$000)
Governmental grants	28,434
Tertiary fees	12,169
Educational services income	3,222
Interest income	1,446
Other income	591
Total operating revenue	45,862

Table 1: Breakdown of income of The Open Polytechnic for the calendar year 2001

The operating expenses are dominated by salaries and other personnel expenses, and depreciation and amortisation. Combined, these make up more than two-thirds of the total expenses. The Open Polytechnic achieved a net surplus of over four million dollars in 2001.

¹² The data for this section is extracted from *The Open Polytechnic of New Zealand Annual Report*, Wellington: The Open Polytechnic of New Zealand, 2001.

Operating expenses	Amount (in \$000)
Salaries and other personnel expenses	26,733
Occupancy expenses	833
Data processing expenses	1,492
Depreciation and amortisation	3,285
Other expenses	12,378
Deduct: other expenses capitalised	(3,038)
Total expenses	41,733
Net surplus	4,129

Table 2: Breakdown of expenses of The Open Polytechnic for the calendar year 2001

5.3 Social performance

The following paragraphs summarise briefly The Open Polytechnic's commitment to research, and comment on contemporary social issues, and the high standards of staff development and welfare.

Staff involvement in professional bodies

Staff are members of various professional bodies, including national and international advisory boards, and the local District Health Board.¹³

Transfer of research

The Open Polytechnic emphasises strongly the transferability of research conducted by its academic staff. Conference presentations, professional papers and books have increased over the last few years. Examples of research transfer in 2001 include the organisation of the 8th consumer law conference with the University of Auckland's Research Centre for Business Law, and the launch of a new textbook edition on the law of marketing. Other transfers involve input into community health planning and into international copyright developments. (Further examples are quoted in *The Open Polytechnic of New Zealand Research Report 2001*.¹⁴)

¹³ For more details refer to *The Open Polytechnic of New Zealand Research Report 2001: Any way, Any Time, Any Place*, Wellington: The Open Polytechnic of New Zealand, 2001 26–27.

¹⁴ See the above report. 26–27.

Critic and conscience of society

Debates about the necessity for a tertiary institution to act as the critic and conscience of society are ongoing at The Open Polytechnic. Contracts, procedures and policies include links to this requirement wherever possible. Recently, staff have achieved international recognition in this area through their publications.¹⁵

Investors in People

The Open Polytechnic is currently working towards achievement of the Investors in People international standard.

The standard aims to align organisational goals with staff developmental requirements. 'Investing in people' refers to the improvement of people's performance through a planned approach to setting and communicating organisational goals, and developing people to meet those goals so that what people can do — and what they are motivated to do — matches what the organisation needs them to do. The standard provides the framework within which organisations can tackle key management issues, such as planning, communication, training and development.

Fostering interpersonal relationships

Internally, The Open Polytechnic provides opportunities for staff to interact socially on many levels. Examples are the Social Club, petanque tournaments, social function events, wine tastings, quiz nights, children's Christmas parties, raffles, laundry service and dragon boat racing events. The Social Club maintains a bar service for staff on two nights per week. Three billiard tables are located in the cafeteria and can be used by staff during their breaks.

Campus improvement project

An extensive campus redevelopment project began in October 2002 and is likely to continue for at least twelve months. The aim of the project is to achieve a working environment that

- values people by being comfortable, attractive, safe and healthy
- promotes efficient workflow
- is sufficiently flexible to meet current and future accommodation needs.

¹⁵ Ibid, 9.

5.4 Environmental performance

5.4.1 Environmental objectives

The Council governing The Open Polytechnic approved four environmental policy statements in 2001.

The environmental policy (see page 8), is based on the four system conditions determined by the TNS framework.

Figure 2 sets out the details of the 2002 action plan.

Unit objectives	Activities	Measures/targets
1. Reduce our use of materials that come from mining and fossil fuels, especially materials that are naturally scarce in the Earth's crust.	<p>Reduce use of the following natural resources: electricity natural gases fossil fuels</p> <p>Identify heavy metal components used by The Open Polytechnic and develop a plan to quantify and identify the point and manner of disposal, then manage and reduce their use, for example, inks, solvents, preservatives.</p> <p>Develop and implement a plan for whole life cycle management of computer hardware components.</p>	<p>10% reduction in per capital usage for each achieved by December 2002.</p> <p>List established by July 2002. Plan approved by December 2002.</p> <p>Plan approved and implemented by December 2002.</p>
2. Reduce our use of synthetic substances that are toxic and/or non-biodegradable.	<p>Establish a register of synthetic substances used by The Open Polytechnic, quantify usage and identify point and manner of disposal. Identify replacement options that meet both business needs and environmental goals.</p> <p>Set priorities for introducing preferred options to reduce use of potentially toxic substances, for example, solvents, cleaners, detergent, pesticides, formaldehyde, plastics, paints, chlorine bleach, printer cartridges.</p>	<p>Register established by December 2002.</p> <p>Priorities approved by December 2002.</p>

<p>3. Promote environmental restoration and reduce use of materials from nature that are harvested unsustainably or used in ways that reduce natural productivity and biodiversity.</p>	<p>Establish an Open Polytechnic purchasing policy that supports a move towards ensuring products used by The Open Polytechnic and its contractors have been sustainably produced.</p> <p>Develop and implement a long-term plan for promoting indigenous biodiversity on The Open Polytechnic property, working with Hutt City Council and other stakeholders to restore Waiwhetu Stream.</p> <p>Reduce paper usage Reduce waste to landfill through the use of recycling strategies, more efficient work practices, education and training strategies.</p> <p>Include the Environmental Policy requirements (that is, the TNS System conditions) in the Terms of Reference for the strategic review of The Open Polytechnic accommodation.</p>	<p>Policy approved and implemented by June 2002.</p> <p>Plan approved by December 2002.</p> <p>Reduction of 10% by 12-2002 Reduction of 10% by 12-2002</p>
<p>4. Increase environmental awareness and use resources efficiently and fairly so that all basic human needs can be met.</p>	<p>Prepare for triple bottom line (TBL) reporting on 2002 achievements.</p> <p>Develop and implement plans for: <i>Internal</i> — Raise awareness of environmental matters through staff training and communication. <i>External</i> — Students Raise awareness of environmental matters and publicising The Open Polytechnic strategies. <i>External</i> — Stakeholders Raise awareness of The Open Polytechnic commitment and strategies, including TBL (for example, through our profile.</p>	<p>Established TBL categories and identify benchmarks/targets for inclusion in report against 2002 achievements.</p> <p>Plans approved by Feb 2002 and implemented by December 2002.</p>

Figure 2: Objectives of the business plan 2002 of The Open Polytechnic with activities and targets to be achieved

5.4.2 Environmental performance analysis

The following sections discuss the environmental impacts generated by The Open Polytechnic.

Areas discussed are:

- The Waiwhetu campus
- The Print shop
- The cafeteria.

5.4.2.1 Waiwhetu campus

Paper

The production and recycling of paper affect the environment in many ways. The production of paper is resource intensive and the solvents and chemicals used have a major ecological impact. A similar scenario applies for the recycling and disposal of used paper. Monitoring of paper usage is important for an organisation that recognises the many direct and indirect effects associated with paper purchase and disposal.

The following section is divided into paper *input* such as purchase and distribution to different on-campus areas and *output*, such as disposal and recycling activities. (Impacts generated by the print shop are discussed separately under section 5.4.3).

Input

Paper is extensively used by The Open Polytechnic. It provides the basis for student course materials and promotional brochures and represents the largest single environmental impact. Use is measured in sheets (5 g per sheet), reams (500 sheets; 2.5 kg plus 30 g wrapping), boxes (5 reams) and pallets (50–65 boxes). This translates to 12.5 kg of paper per box and between 625 and 812.5 kg of paper per pallet.

Paper is used by faculty mainly for printing and copying. In February 2002 administrative usage amounted to 237 boxes, just under three tonnes of paper. Average usage since July 2001 has been 189.5 boxes per month, or 2.4 tonnes.¹⁶ Overall usage varies according to the semester cycles. Reporting periods (examination and course and student performance reports) are peak times for paper usage.

Currently paper is a 'free good' for users in the administrative area. The only cost centre bearing the actual purchase price of the paper before distribution to Faculty is the Administration Service area. They are charged internally by the print shop, which is responsible for the purchase of all paper.

The current ordering system is arbitrary, with administration staff in Faculty ordering paper through email, which is then delivered to printers and copiers by the Administration Services team. There is no further tracking of usage, and it is not possible to assign quantitative paper usage to sections or staff. In addition, it is also possible for staff members to avoid the ordering system by picking up boxes of paper directly from the store room, thus not accounting for usage at all. However, according to the Administration Service Manager and the Property Manager, the amount of paper taken in this way is not significant. Nonetheless, there is a clear gap in monitoring that needs to be addressed to enable proper quantification of paper usage around the campus.

In addition, historic data for paper usage is incomplete up to the middle of 2001, when a new Property Manager was employed. Consequently a meaningful comparison between the present and the past cannot be made. Also, the amount of paper used varies with the semester cycle, reporting times and other Open Polytechnic requirements. Therefore a monthly comparison can only be attempted once all parameters are clearly defined. The Appendix sets out current paper use graphically.

Not included in this analysis are the figures for paper usage through stationery. The Property Manager has initiated a survey of data, however, that will be completed at a later stage.

Also, in order to conduct a meaningful financial analyses of the monetary savings that may be achieved through the reduction of paper use campus-wide, it will be necessary to isolate the total cost of paper usage in relation to other costs incurred at The Open Polytechnic of New Zealand.

¹⁶ Approximately 17 trees are required to produce one tonne of paper.

Recommendation¹⁷

Develop an effective tool to monitor paper usage in different parts of The Open Polytechnic and an online monitoring system of printing. (The Information Service Support is currently assessing software on usability — a system similar to the current Internet daily cache analysis could be introduced.) If monitoring of printing jobs per workstation is not feasible, measuring printing output per printer could be considered in order to better track usage.

Recommendation

Reinstall counters (PINs) on copy machines to help monitor copier usage by section.¹⁸

Recommendation

Introduce detailed monitoring of data of paper distribution by the Administration Service to derive monthly data as a minimum.

Recommendation

Introduce a 'per student-paper-usage' monitoring that counts the amount of printed materials dispatched to students.

Recommendation

Negotiate with Lexmark (the provider of the printers) to solve an ongoing problem of paper jamming in printers during double-sided printing. (This feature has been discontinued with most printers.) Paper also regularly jams during normal printing in some printers. This wastes two sheets of paper (per jam) on average and is an annoyance to staff.

Recommendation

Educate staff on efficient information and record systems that avoid/reduce paper waste.

Recommendation

Create a paper flowchart. At this stage it is not possible to generate exact numbers of paper input and output.

¹⁷ These recommendations provide pointers only. In order to construct an achievable action plan, the most suitable recommendations should be selected.

¹⁸ Personal identification numbers for each cost centre were allocated previously, in order to trace individual copies to cost centres. As the data was not further analysed, the feature was discontinued in 2002.

Output

Most of the paper and cardboard waste at The Open Polytechnic is recycled. There are five different inside containers, and one big container outside for recycling.

Inside containers

1. 24 green 'wheelie bins', for paper only, with a capacity of about 100 kg of paper each. (They are placed on all floors of the different buildings; however, there are none inside offices.)
2. 10 recycle bags for cardboard
3. 4 cardboard cages for cardboard
4. 10 wooden bins for both paper and cardboard (according to the Property Manager the ratio of paper in these is only 30–40%).
5. All confidential paper is stored in a fifth kind of container, six blue wheelie bins (at the same size and volume as the green bins), which are locked. An external contractor, Online Security Services Ltd, collects them. The estimated amount of shredded paper is 700 kg per month (equal to about seven blue bins per month).

Outside container

The weight of recycled paper and cardboard is estimated by the size and the capacity of the bins.

Administration Services are beginning to record the emptying of bins from the respective locations into the big outside container for better tracking of disposal. The recycling contractor, DOSS Ltd., collects the outside container twice a week. No exact weight of recycled paper collected is obtainable, however, DOSS Ltd advises that the collected paper (*excluding* cardboard) amounts to about 2.4 tonnes per month on average. In total, they collect 4.88 t of paper *and* cardboard per month.

In addition, a proportion of paper is disposed of in office rubbish. This is not analysed here, however, the Property Manager advises that the amount of paper in the rubbish bins is negligible.

Another aspect of paper usage is paper used in the staff ablution areas. The Open Polytechnic purchases 24 packages of paper towels each month (each package contains 150 towels/27mm x 245 mm) and every second month 24 packets of toilet paper (each packet contains 72 rolls of 2-ply paper). Both packets and packages weight 12 kg each. That adds up to 5.184 t of paper on average per year for the staff ablution areas.

Recommendation

Improve information on the quantity of paper sent for recycling. One way to achieve this would be to separate paper out from cardboard.

Recommendation

Evaluate the efficiency of the current recycling system, including evaluating the location and number of recycling bins. Provide paper-recycling receptacles in offices.

Recommendation

Educate staff during induction and training programmes on paper recycling issues.

Recommendation

Place rubbish bins outside offices, and recycling bins inside offices, in order to encourage 'right behaviour'.

Electricity

There are several methods of generating electricity, each impacting differently on the environment. The two major resources used to produce electricity in New Zealand are renewable resources, such as wind and water, and fossil fuels. The different environmental impacts of these two resources are obvious. In both cases, however, for organisations to become more sustainable, it is not only important to reduce the use of non-renewable energy, but also to obtain information about the environmental impact generated during electricity production.

The electricity at the Waiwhetu campus is provided by Meridian Energy Ltd, a company generating energy from mainly hydrological sources.¹⁹ Meridian provides an online usage analysis on their website (as shown in Figure 3 below) that summarises information obtained from two meters at The Open

¹⁹ A call on Meridian Energy confirmed that all commercially generated electricity in New Zealand is supplied into one general system and electricity received by end users cannot be assigned to a certain power company or source.

Polytechnic at the Wyndrum Avenue and Cleary Street entrances. The main electric devices are air-conditioning (A/C) units, computers (including servers and accessories), lights, electric heaters, water heating (small hot water boilers for the old buildings and two 120 litre boilers for Kanuka) and fans.²⁰

Overall electricity usage of Kanuka building, A/C units, cafeteria and the Print shop is approximately 80% of the total usage. The total number of A/C units around the campus is 38: 14 in F-Block, 9 in A-Block, 7 in B-Block and one each in K- and D- Block. In addition there are two AC units in the server rooms in B-, F- and K- Block. The size of the units varies between 2.5 and 8 kVA. They are placed in all rooms where heat problems occur.

There are 550 personal computers on campus; in addition 45 servers form the backbone of the Intranet.

Electricity on campus is supplied at two points: the Cleary Street meter reflects the usage of the Kanuka building, while the rest of the campus is supplied from Wyndrum Avenue. Since Kanuka was built in 1996²¹ the data of the previous review can only be compared with the old part of the campus (Wyndrum Avenue meter).

Based on the previous report, the monthly average energy consumption was 47,000 kWh for the years 1992 and 1993 for the Wyndrum Avenue meter. The Wyndrum data for the time between 1997 and 2001 shows an increase to 51,000 kWh. The data is not complete for the years 1997 to 1999 (Data availability: 1997: August to December; 1998: January to July; 1999: July to December) and might be patchy due to some months missing. However, the latest data shows an increase of 3,000 kWh from the year 2000 to 2001 to 52,500 kWh. Coinciding with the expansion of The Open Polytechnic, an increase of approximately 1% electricity usage per year (8.5% since 1993) is assumed.

²⁰ The Print shop and the cafeteria are generally excluded from this analysis, as they will be dealt with separately.

²¹ The Kanuka building was designed with several architectural features in order to use energy more efficiently. Features include an atrium in order to reduce the need for air-conditioning and several other features that aim at light and energy efficiency.

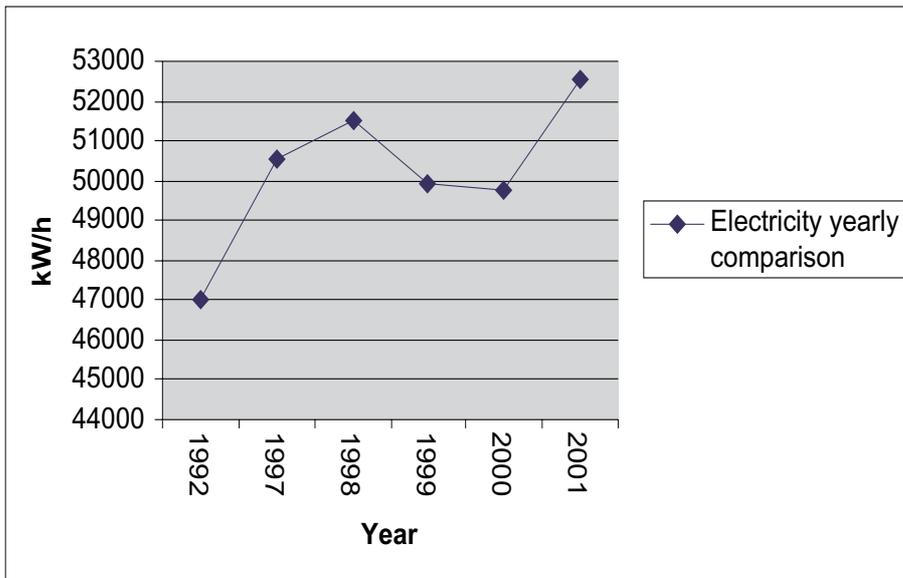


Figure 3: Year-by-year average electricity usage for years where data was available.

In summary, the average monthly electricity bill in 2001 was \$8,250. The Open Polytechnic's current contract with the electricity provider has expired and is being renegotiated. An increase in cost is expected and the budget for electricity has been raised from \$14,000 to \$113,000 for 2002. The planned reduction of electricity within the business plan of 10% would lead to a saving of approximately \$11,000.

Recommendation

Review the installation of A/C units and check if there are other solutions to heat problems (for example, better insulation, better ventilation, shading for offices on the sunny side, better vitrification/glazing, and so on)

Recommendation

Install more meters to provide more data per building. The print shop and the cafeteria are the highest electricity consumers next to Kanuka and the A/C units. More meters would greatly improve monitoring; the campus electrician quoted \$9,500 to equip each building. To install meters for the print shop and cafeteria only would cost approximately \$2,000.

Recommendation

Try to sign contracts with retailers who ensure sustainably generated energy. Currently electricity received cannot be assigned to a specific generator of power.

Recommendation

Reduce use and wattage of light bulbs. Most of the lamps on campus, particularly in Kanuka, are equipped with two bulbs each. Removing one made no recognisable difference in brightness. In Kanuka, 188 13 W fluorescent bulbs, in F Block 20 36 W fluorescent tubes, and in Totara, one whole lamp with two 36 w fluorescent tubes could be removed. The halogen spots around the campus are mainly equipped with 50 W bulbs; these could be replaced with 20 W ones. On the second floor of Kanuka at both ends are four 500 W floats, which burn most of the time instead of the more efficient fluorescent tubes. Several other lights on campus appear to be inefficient or for design purpose only. A bigger investment would be the replacement of old regular 100 W bulbs by 13 W energy saving fluorescents. However the amortisation of this move is doubtful since it would cost approximately \$100 per bulb.

Recommendation

Consult an expert in energy and lighting efficiency in order to advise on further possible changes and better energy use.

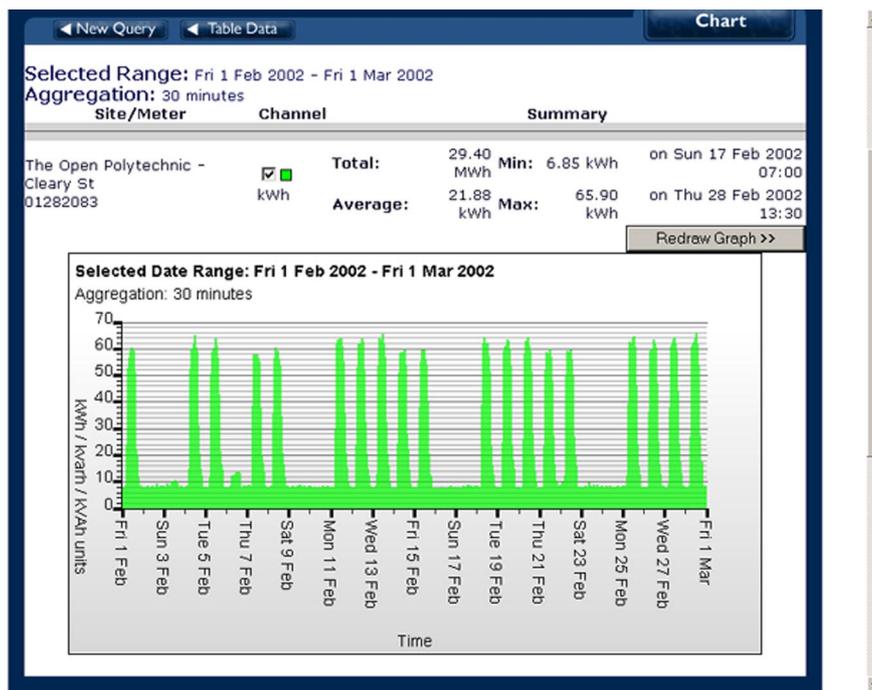


Figure 4: Sample screenshot of the online features for electricity usage analysis provided by Meridian Energy Ltd.²²

²² Graphs and data are available up to the last reading of the two campus meters. The data can be shown in minimum chunks of 30 minutes. There are two meters on campus, which are checked on a monthly basis.

Natural gas

Natural gas is considered to be a fossil fuel. Although gas is efficient in heating water and is less polluting than other fossil fuels, there are carbon monoxide (CO) and carbon dioxide (CO₂) emissions that occur when natural gas is burned. Natural gas is also a finite resource.

Wanganui Gas supplies the gas for The Open Polytechnic. The usage of Kanuka and H-Block can be read from the Cleary Street meter, and the rest of the campus from the Wyndrum Avenue meter. An installation of further meters is not feasible: the price of installation would not produce any return on investment. Also, gas is mainly used for heating and data can be generated directly at the three heating plants supplied by the gas.

The heating plants in Kanuka are technologically up to date. In addition they provide many features for timing and saving; for example, a controller recognises the outside and inside temperature in the morning and calculates the time it needs to reach the programmed temperature and then starts automatically in time to reach the targets. The old plants that are supplied from Wyndrum Avenue do not have such features; they only have a timer. Within the boiler room in Kanuka, there is no insulation on several pipes. Better insulation could save 2–3% of heating costs, or approximately \$900 per year.

Variations in the weather in the past years are especially relevant for heating. A yearly comparison shows a steep increase in gas usage at the Wyndrum Avenue meter in January 2002 (an increase of 278%) and February 2002 (an increase of 1179%). The summer of 2001 was comparatively warm, whereas the summer of 2002 was comparatively cold. (Refer to Appendix for a graph that depicts the median temperatures and the associated gas and electricity consumption.) That might explain some of the anomaly in gas usage, but not all. The big difference in gas use increase between Wyndrum Avenue and Cleary Street (79% and 149%) may be due to the better insulation in the newer building. Overall, the data reflects the expected seasonal fluctuations.

The average bill for natural gas in 2001 was \$35,000 and the budget for 2002 is set for \$36,000. If the proposed reduction of 10% is achieved in 2002 there will be savings of \$3,600.

Recommendation

Continue monitoring gas usage to detect anomalies.

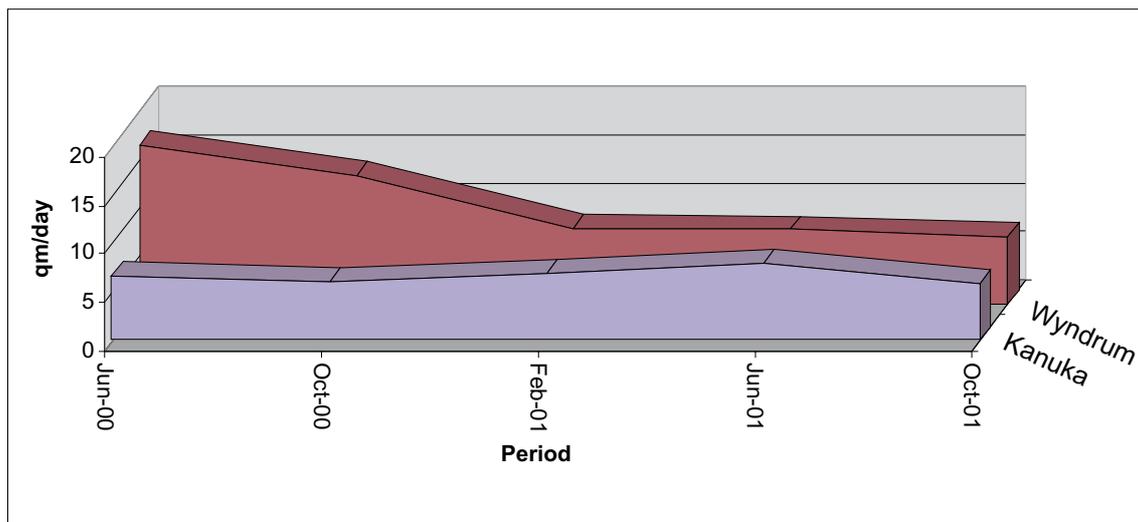
Recommendation

Clarify with the gas company whether the data provided is normalised according to the pressure prevailing in the system (if the pressure in the system varies, the amount of gas/m³ varies as well).

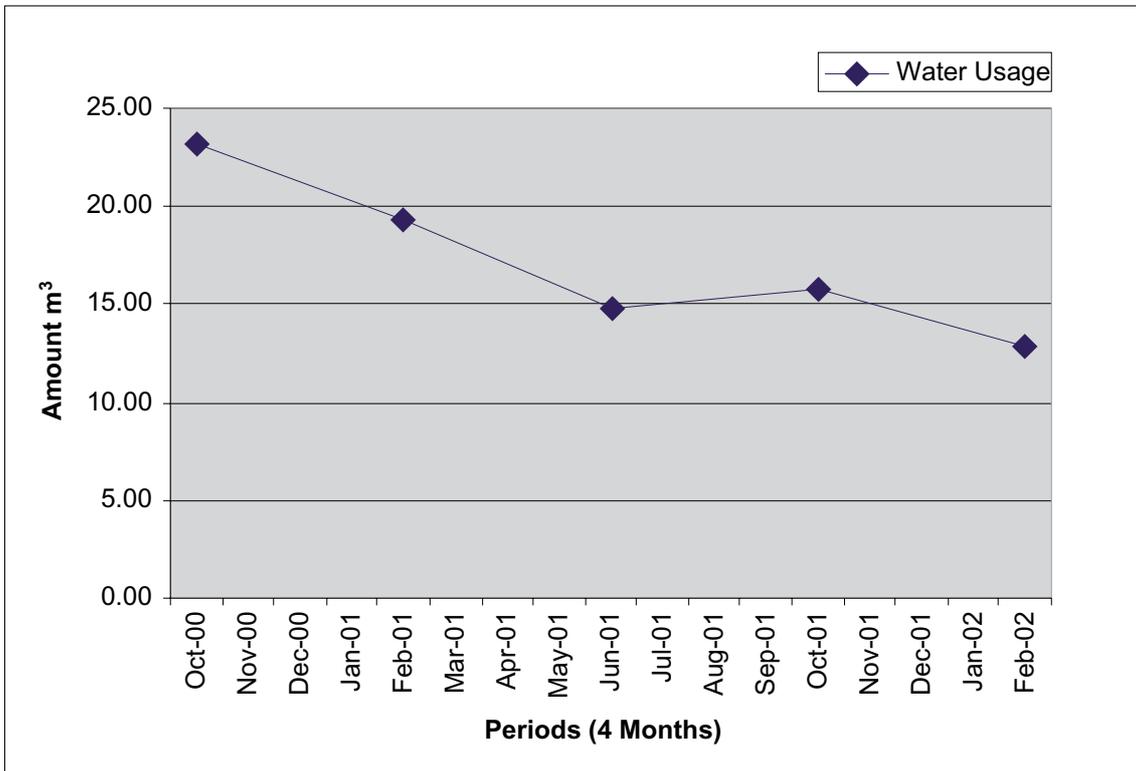
Water

Although water is readily available to most New Zealanders, it is considered a scarce resource on a global scale. People rely on fresh water from rivers, lakes and ground water. Most of the water on earth is not suitable for daily usage such as drinking, washing and cooking. Globally, it is important to reduce water consumption and avoid wasting water.

For The Open Polytechnic, water is supplied by the Hutt City Council. The main use is for watering plants, toilet flushing, tap water and showers. Data for water usage has been available since June 2000. Since the data is calculated from the amounts reflected on the invoices, only four-monthly usages can be analysed according to the billing period. Overall, water usage dropped significantly from the middle of the year 2000. The high usage in the June 2000 period was probably caused by a leak in the main pipe, which was eventually repaired in October 2000. Figure 5 below shows a reduction in water usage, measured by the Wyndrum Avenue meter, whereas the Cleary Street meter shows a slight increase. The overall decrease of usage may be explained by the high rainfall in the Hutt Valley region and associated reduction in watering of plants. There was no action taken by The Open Polytechnic to reduce water usage and no further explanations were offered during interviews.



(a) Average daily water usage at The Open Polytechnic



(b) Cumulative water usage at The Open Polytechnic

Figure 5: Water usage at The Open Polytechnic

Waste

New Zealand is one of the leading waste producers in all OECD countries and accounts for a high proportion of waste disposed to landfill. The Wellington region has the second highest per capita waste generation of the country. In 1998, for example, the region produced 1,257 kg of waste per capita.

The Open Polytechnic collects waste for the landfill in a 4 m³ and a 2 m³ container located outside the Administration Services building. The contractor (Waste Management Ltd) collects them twice a week. The containers are always filled to the top prior to collection. Consequently, the amount of rubbish can be estimated to be about 12 m³ per week, or about 625 m³ annually. For general rubbish disposal there are a couple of small rubbish bins in all offices. The cleaners (see p36) empty these every night and dispose of the rubbish into the big containers. At this stage there is no further monitoring done. Neither the amount of rubbish, nor the weight nor the number of bags is recorded at present.

Emissions

Carbon dioxide (CO₂) and carbon monoxide (CO) emissions are contributing to the greenhouse effect, also known as global warming. CO₂ has a direct impact on global temperature, while CO reacts with other gases, thus impacting indirectly on the greenhouse effect. The reduction of CO₂ emissions is part of the Kyoto protocol²³ that has been ratified by New Zealand. Because of this, a focus on an organisation's emissions is important.

Emissions from gas usage: No detailed data for the emissions generated by the plant on site could be obtained. It is known, however, that the old plant is within the government guideline, which stipulates that emission of carbon dioxide generated by a heating plant must be less than 9% per unit of expelled air. The figures for the new hot water boilers in Kanuka are estimated to be around 3–4%. Overall, CO₂ emissions from gas burners are negligible. More relevant data is the remaining ratio of oxygen (O₂) and the amount of CO in the extracted air. Recent measurements suggest 16 to 20 ppm of CO and a ratio of 4.6% to 5.2% of O₂ for the two Kanuka boilers. This suggests an efficiency of 85% to 88% according to the mechanic.

Emission from fuel usage: The Open Polytechnic maintains a vehicle fleet of four cars:

Ford	Econo-Van	(1994)	2000 cm ³
Mazda	626	(2001)	2000 cm ³
Mitsubishi	V 3000	(1996)	3000 cm ³
Mitsubishi	Lancer	(1998)	1800 cm ³

The cars are used for business travel around the country only. No staff have entitlements to a car written into their employment contract. Fuel usage during 2001 (the only data currently available) shows no recognisable pattern or trend. As the data shows only a 10-month period, its informational value is limited.

²³ For more information about the Kyoto protocol visit <<http://unfccc.int>> or <<http://www.mfe.govt.nz>>

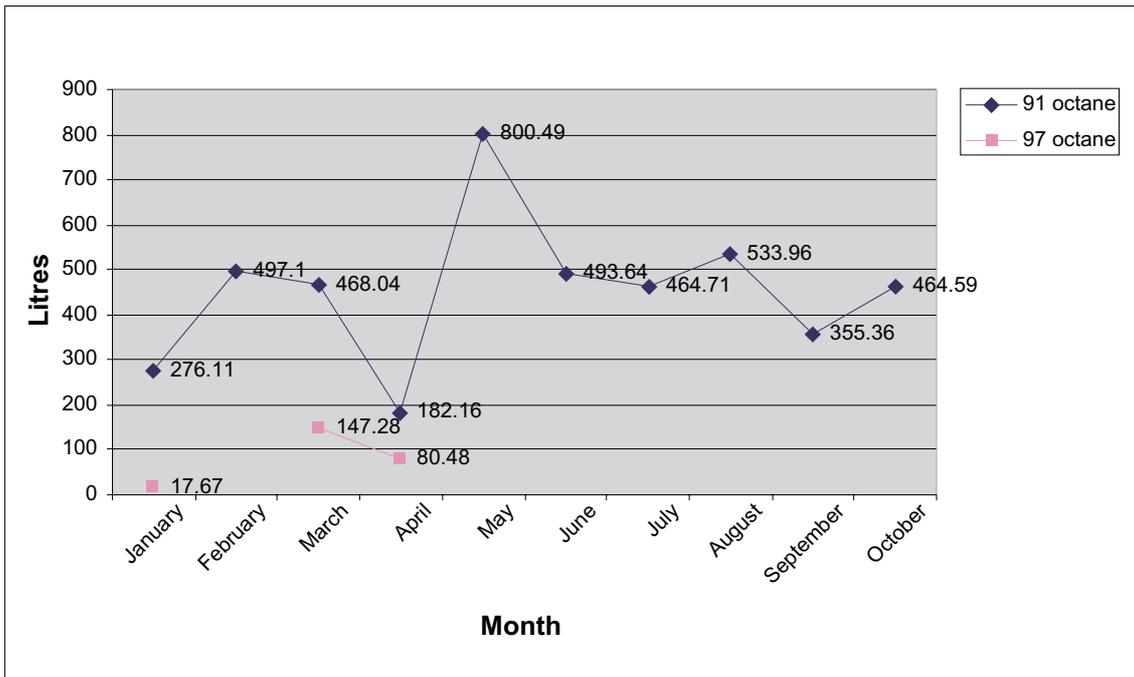


Figure 6: Fuel usage for the car fleet of The Open Polytechnic in 2001

To provide a full picture of the total emissions of an organisation, the daily commuting of employees between home and work is commonly included. Some staff who are currently travelling from the Kapiti Coast or Wellington are car-pooling. Staff commuting from the Wairarapa use public transport, particularly trains. The Open Polytechnic is a twelve-minute walk from a nearby railway station, which makes that form of transport attractive for many people. A lunchtime service was introduced twice a week in 2002, where staff can make use of a shuttle service to a nearby shopping centre.

For staff travelling by car, The Open Polytechnic provides parking around the buildings on the Waiwhetu campus. There are approximately 200 car parks on site. During business hours all spaces are taken, with some cars being parked on the street. It is estimated that staff travel a total of about 8000 km per day.²⁴ In addition, occasional student classes are held on site.

Emissions from business travel (by aircraft): The Open Polytechnic spent a total of \$1.08 m in 2001 on business travel other than fleet or private car. The expense of airfares amounted to \$501,158 (18% per cent more than in 2001). Airplanes greatly contribute to harmful emissions to the environment by burning kerosene. Taxi fares and car rental expenses added another \$135,691. These costs increased by 24%. The budget of 2002 extends the expenditure on airfares

²⁴ If future recommendations or actions will be based on these figures, the estimate should be confirmed via an audit on a particular key date.

by another 7%, and all travel expenses by 3.2%. However, this may be not so much an anticipated increase in air volume, but rather an anticipated increase in airfares of over 40% for domestic flights.

Recommendation

Identify key people who travel the most in order to educate them about impact and alternatives.

Recommendation

Assess the value of video and teleconferencing as one way to reduce air travel.

Recommendation

Monitor air miles to better ascertain the associated environmental impacts.

Recommendation

Encourage alternative transport, such as bicycle use, public transport and car-pooling through incentives.

Recommendation

Introduce more detailed monitoring of the fuel usage of the car fleet to detect possible patterns, peaks and anomalies.

Recommendation

Seriously consider planting trees to offset the CO₂ output of The Open Polytechnic.

Other

Recycling: Since a trial to recycle and separate rubbish in some areas failed, recycling is now restricted to paper and cardboard recycling. Old computers are being dismantled and parts recycled wherever possible, thus reducing the volume of waste to landfill. Most parts are collected and put together to assemble simple PCs, which are then distributed to the needy.

Cleaning: The cleaning around the campus is done by Spotless Ltd. There are eight cleaners working for three hours each evening. The cleaning contract includes the cleaning of sanitary facilities, sweeping and wiping or vacuuming the floors, emptying rubbish bins and dusting the offices. The emptying does not include waste separation or recycling, but that will form part of the next contract when it is negotiated. There are no guidelines relating to the use of cleaning materials by subcontractors around the campus.

Recommendation

Identify factors that contribute to the failure of the recycling project and educate staff accordingly.

Recommendation

Ensure environmental considerations are built into the next cleaning contract.

Landscaping

It is proposed to redevelop the landscape of The Open Polytechnic campus; currently, campus vegetation is mainly exotic. A redevelopment will focus on the following:

Enhancing biodiversity: Emphasis will be on expanding the recent successful native plantings, establishing a coherent landscape design through the whole campus, linking visually with the surrounding regenerating bush and enlarging wildlife corridors.

Reducing irrigation needs and promoting natural productivity: Rain water would be retained on-site by directing downpipes into gardens to reduce plant losses from drought. Impervious surfaces would be decreased throughout the campus, and rainwater permitted to flow off carpark areas into the piped drainage system that discharges into the Waiwhetu Stream.

Saving costs: Areas planted in native vegetation on campus have shown reduced maintenance costs, in contrast with other areas, where exotic plants show serious disease problems.

Growing Polytechnic business: It is important for the marketing of The Open Polytechnic as a 'green sustainably focused' organisation to have images that make students feel comfortable. Favourable first impressions play a role in students' choice of educational institution.²⁵

Improving staff job satisfaction: Landscape development makes the campus a more attractive place for staff to work. It is also a practical application of TNS, as it has an on-site educational role. Higher staff job satisfaction and retention give an economic gain through reducing the need for job training costs.

²⁵ 61% of new university students in the United States pick their place of study based on appearance. Carnegie Foundation, researcher Ernest Boyer, 'Landscape Architecture' May, 2001.

Networking with the wider community: Redeveloping the campus links the restoration work in the local community, revegetation of the hills, restoration of the Waiwhetu Stream, which is of special interest to the local Waiwhetu Marae, and gives scope for the inclusion of ethnobotanical plantings and recognition of Maori needs and a fairer society.²⁶

5.4.2.2 The Print shop

The print shop operates as a separate unit within The Open Polytechnic. All jobs completed in the print shop are internally charged to the ordering department. It is the biggest paper consumer on site. It is assumed that the paper that is not delivered to different cost centres is used in the print shop. Exact data on the amount of paper used in the print shop could not be extracted. The print shop is driven by financial efficiency: paper is purchased in periods of low-cost supply. 5600 reams of paper (or one container) are bought each time. On average, five containers of paper, or 700 tonnes, are purchased annually.

The purchase of paper follows three basic criteria:

1. The paper must be compatible with the printing machines (a trial pallet is provided by the supplier)
2. It must be available in sufficient amounts
3. The price has to be low.

Mostly non-recycled paper is purchased, as the low quality of recycled paper causes more paper jams than regular white paper. The print shop has made a commitment to monitor the improvement of recycled paper and will buy it when the quality fits their criteria.

The print shop also purchases other sizes and colours of paper. The quantities are, however, small. Details are not analysed here due to insufficient data.

While most of the printing is done in-house, contractors are used when more sophisticated printing machines are required, or the job can be performed more quickly, or less expensively, by a contractor. (The environmental implications of external contract work are not analysed in this report. It should also be noted that external contract activities add another 30% to the paper mass already discussed in this report.)

²⁶ This section is adapted from a presentation prepared by Bruce Treeby, senior lecturer at The Open Polytechnic of New Zealand

Course materials make up 90% of in-house printing. The remaining 10% of print jobs are stationery prints (business cards, letter heads, and so on) for the administrative area and promotional materials requested by the marketing department. The print shop also performs quick-copy jobs, when departments request larger quantities of copies than can be handled by the smaller copy and printing machines on campus.

The print shop uses different inks, solutions, developers, cleaners and other chemicals (see Appendix for full list). The offset printers require regular cleaning. The Printing Industries Federation runs occasional workshops on toxic solvents, chemicals and biodegradable substitutions for the common products used in printing, which are attended by the manager of the print shop. The Federation updates its members regularly on the newest research. However, to date no switch has been made to less harmful substances, owing to the poor performance of the environmentally more benign products.

A similar situation applies to the inks used in the print shop. The quality of water-based inks is at this stage not acceptable and the print shop still runs solvent-based inks. Ink residues are not recycled or separated. The bottles are disposed of in the general rubbish bins and the liquids are flushed down the drain. Other than separating out paper and cardboard, there is no recycling done in the print shop.

The biggest electricity users are two Fuji Xerox Docutech 6180 printing machines. The machines require 5.63 kWh when operating and 1 kWh while on standby. Overnight the printer units and control screens are turned off; the controller itself remains on standby power. The controller uses 0.67 kWh on standby. In addition to electricity, the two printers need about 16 litres of silicon oil per month and 6.34 kg (two cartridges) of toner per week. The toner efficiency is between 90–94%, which suggests 2.2 kg toner waste per month. This is collected by Xerox, and disposed of, rather than recycled. The cartridges (not to be confused with printer cartridges for office printers) are discarded and not recycled.

The printing machines emit heat noise and ozone. The lost energy through heat waste of the machines totals 26600 British thermal units per hour (Btus/h). When cooled by a fan, heat waste can be reduced to 17900 Btus/h.²⁵ The ozone emitted by the machines runs through a charcoal filter that is integrated into the machines. The noise is 70 db (A) when operating and 54 db (a) when on standby.

Owing to the workload of 1.5 million prints, or 900,000 sheets, per month, the machines break down once a week each, on average. A Xerox service engineer is on site three to four days per week, for maintenance and service. (Related environmental impacts of this activity are not further analysed.)

The print shop also orders in cardboard boxes from an external supplier, Charter Packaging Ltd., that are used to package course materials for dispatch. Over the last twelve months 52,234 of no. 1 boxes (small – 175 g), 14,150 of no. 2 boxes (medium – 305 g) and 1,950 of no. 3 boxes (large – 375 g) were delivered to the print shop. Collectively those 68,334 boxes amount to another 14,188 t of cardboard.

Recommendation

As toner is an extremely fine plastic powder that is not biodegradable, it is important to improve efficiency in use to minimise wastage. It should be recycled where possible. Obtain information from Xerox and the Council Hazardous Waste Centre relating to the disposal of the toner.

Recommendation

Investigate alternative disposal mechanisms for inks and solvents, rather than rubbish and drains.

Recommendation

Continue to keep up with the latest research on biodegradable solvents and water-based inks, and liaise with other Pathfinder companies to exchange ideas.

Recommendation

As the process of paper recycling also has detrimental impacts on the environment, it should be investigated whether it is ecologically more benign to recycle paper or to use paper made from fast-growing pine trees in New Zealand.

5.4.2.3 The Cafeteria

The cafeteria facilities are provided by The Open Polytechnic and are run by an external contractor. Resources such as water and electricity, used in the kitchen, are paid for by The Open Polytechnic. However, as there are no separate meters for the cafeteria, there is no data available on exact usage. As the kitchen operates several machines it is assumed that the use of natural resources is comparatively high. The main water user in the kitchen appears to be the dishwasher, which operates nonstop during the day. In addition, an electric

oven, five fridges, a soft drink vending-machine and two freezers operate. Electricity usage is further accelerated by many small electric appliances, such as microwaves, espresso machine, pie warmer, mixer, meat cutter and so on.

There is no system for waste separate or recycling in place in the cafeteria. After a failed attempt to introduce separate bins for food waste and recycle waste, the bins were removed. However, the contractors are in favour of introducing a separation or recycling system. This would have to be preceded by better instructions to staff.

The cafeteria generates on average three bags of waste a day.

Recommendation

Inform and educate staff about recycling and waste separation in the cafeteria and reintroduce recycling bins. Investigate composting systems for food wastes, for example, vermiculture.

Recommendation

Improve waste records in the cafeteria, particularly of recyclable components and organic waste.

6. Recommendations

It seems paramount for the organisation to make the goal of sustainability an overarching component of its operations and to instigate a process to investigate suitable indicators for reporting. In line with international developments, economic, social and environmental sustainability should be recognised by The Open Polytechnic of New Zealand. It is suggested that the goal of sustainability be integrated into its mission/purpose statement or the set of values. This suggestion also seems timely, as the mission and vision will be reviewed during 2003.

Most areas discussed in this report are also addressed by the 2002 Business Plan. In order to take a more structured approach, it is recommended that a TNS action plan, based on the recommendations made through this report, be implemented.

Continuation

In addition to the specific recommendations listed below, there are several general aspects that should be considered. A commitment to collect data on an ongoing basis and, for key staff, to take responsibility for action must be stated.

It is then important to assign responsibility for the ongoing collection and reporting of environmental data to an executive.

Responsibility must then be assigned for reporting and monitoring to the property manager, who manages all rubbish disposals and recycling, and receives all invoices for resources (gas, water, electricity) and so on.

Lastly, it is important to introduce higher-level goals that reflect a pro-active organisational commitment to sustainability and to set short-, medium- and long-term priorities within clear time frames. Examples of higher level goals include:

- A commitment to 'greening' the supply chain and communicating with supplier stakeholders about emerging organisational expectations and priorities
- The investigation of less intensive methods of producing study materials and generally seeking out ways to continue the core business of the organisation while minimising environmental impacts.

Education

Staff awareness and education is key to environmental improvements at The Open Polytechnic. The implementation of a TNS action plan should include the appointment of a project team. In addition, an external consultant should be employed to drive implementation.

Energy saving

A campus-wide analysis of opportunities to save electricity should be considered. In addition, money could be saved by cutting energy usage at peak times.

Purchase/procurement

In becoming a more environmentally responsible organisation, The Open Polytechnic should develop policies and procedures that lay out environmental performance requirements for subcontractors and suppliers.

Social

While this report mainly investigates the environmental impacts of the organisation, the development of the social dimension should be emphasised in future. In addition to the initiatives stated under 5.3, it is recommended that The Open Polytechnic develop a social policy.

Summary of recommendations

The following recommendations were identified as a result of the environmental analysis.

Paper usage

Recommendation

Develop an effective tool to monitor paper usage in different parts of The Open Polytechnic and an online monitoring system of printing. (The Information Service Support is currently assessing software on usability — a system similar to the current Internet daily cache analysis could be introduced.) If monitoring of printing jobs per

workstation is not feasible, measuring printing output per printer could be considered in order to better track usage.

Recommendation

Reinstall counters (PINs) on copy machines to help monitor copier usage by section.16

Recommendation

Introduce detailed monitoring of data of paper distribution by the Administration Service to derive monthly data as a minimum.

Recommendation

Introduce a 'per student-paper-usage' monitoring that counts the amount of printed materials dispatched to students.

Recommendation

Negotiate with Lexmark (the provider of the printers) to solve an ongoing problem of paper jamming in printers during double-sided printing. (This feature has been discontinued with most printers.) Paper also regularly jams during normal printing in some printers. This wastes two sheets of paper (per jam) on average and is an annoyance to staff.

Recommendation

Educate staff on efficient information and record systems that avoid/reduce paper waste.

Recommendation

Create a paper flowchart. At this stage it is not possible to generate exact numbers of paper input and output.

Recommendation

Improve information on the quantity of paper sent for recycling. One way to achieve this would be to separate paper out from cardboard.

Recommendation

Evaluate the efficiency of the current recycling system, including evaluating the location and number of recycling bins. Provide paper-recycling receptacles in offices.

Recommendation

Educate staff during induction and training programmes on paper recycling issues.

Recommendation

Place rubbish bins outside offices, and recycling bins inside offices, in order to encourage 'right behaviour'.

Electricity usage

Recommendation

Review the installation of A/C units and check if there are other solutions to heat problems (for example, better insulation, better ventilation, shading for offices on the sunny side, better vitrification/glazing, and so on)

Recommendation

Install more meters to provide more data per building. The print shop and the cafeteria are the highest electricity consumers next to Kanuka and the A/C units. More meters would greatly improve monitoring; the campus electrician quoted \$9,500 to equip each building. To install meters for the print shop and cafeteria only would cost approximately \$2,000.

Recommendation

Try to sign contracts with retailers who ensure sustainably generated energy. Currently the electricity received cannot be assigned to a specific generator of power.

Recommendation

Reduce use and wattage of light bulbs. Most of the lamps on campus, particularly in Kanuka, are equipped with two bulbs each. Removing one made no recognisable difference in brightness. In Kanuka, 188 13 W fluorescent bulbs, in F Block 20 36 W fluorescent tubes, and in Totara, one whole lamp with two 36 w fluorescent tubes could be removed. The halogen spots around the campus are mainly equipped with 50 W bulbs; these could be replaced with 20 W ones. On the second floor of Kanuka at both ends are four 500 W floats, which burn most of the time instead of the more efficient fluorescent tubes. Several other lights on campus appear to be inefficient or for design purpose only. A bigger investment would be the replacement of old regular 100 W bulbs by 13 W energy saving fluorescents. However the amortisation of this move is doubtful since it would cost approximately \$100 per bulb.

Recommendation

Consult an expert in energy and lighting efficiency in order to advise on further possible changes and better energy use.

Natural gas usage

Recommendation

Continue monitoring gas usage to detect anomalies.

Recommendation

Clarify with the gas company whether the data provided is normalised according to the pressure prevailing in the system (if the pressure in the system varies, the amount of gas/m³ varies as well).

Fuel usage

Recommendation

Identify key people who travel the most in order to educate them about impact and alternatives.

Recommendation

Assess the value of video and teleconferencing as one way to reduce air travel.

Recommendation

Monitor air miles to better ascertain the associated environmental impacts.

Recommendation

Encourage alternative transport, such as bicycle use, public transport and car-pooling through incentives.

Recommendation

Introduce more detailed monitoring of the fuel usage of the car fleet to detect possible patterns, peaks and anomalies.

Recommendation

Seriously consider planting trees to offset the CO₂ output of The Open Polytechnic.

Cleaning

Recommendation

Identify factors that contribute to the failure of the recycling project and educate staff accordingly.

Recommendation

Ensure environmental considerations are built into the next cleaning contract.

Print shop

Recommendation

As toner is an extremely fine plastic powder that is not biodegradable, it is important to improve efficiency in use to minimise wastage. It should be recycled where possible.

Obtain information from Xerox and the Council Hazardous Waste Centre relating to the disposal of the toner.

Recommendation

Investigate alternative disposal mechanisms for inks and solvents, rather than rubbish and drains.

Recommendation

Continue to keep up with the latest research on biodegradable solvents and water-based inks, and liaise with other Pathfinder companies to exchange ideas.

Recommendation

As the process of paper recycling also has detrimental impacts on the environment, it should be investigated whether it is ecologically more benign to recycle paper or to use paper made from fast-growing pine trees in New Zealand.

Cafeteria

Recommendation

Inform and educate staff about recycling and waste separation in the cafeteria and reintroduce recycling bins. Investigate composting systems for food wastes, for example, vermiculture.

Recommendation

Improve waste records in the cafeteria, particularly of recyclable components and organic waste.

7. Appendix

7.1 Proposed Institutional Environmental Action Plan of The Open Polytechnic of New Zealand for 2002/2003

DRAFT Proposed Institutional Environmental Action Plan of The Open Polytechnic of New Zealand for 2002/2003

Background: This plan matches the environmental policy of The Open Polytechnic of New Zealand (stated as goals that reflect the four system conditions of The Natural Step framework) with environmental targets (reflected in our 2002 business plan) and baseline measures and recommendations for environmental action (reflected in our 2002 environmental review report).

Note: Some columns were left incomplete to allow for further input from different work areas.¹

¹ Suggested next steps in the process:

1. Adoption of the plan by The Open Polytechnic Executive Team
2. Wider staff training in TNS issues
3. Divisional action plans

	<p>Fossil Fuels</p> <ol style="list-style-type: none"> 1. Air Travel 2. Travel by Open Polytechnic vehicle fleet 3. Staff travel in private cars <p>Heavy Metals: Identify heavy metal components used by The Open Polytechnic</p>	<p>Total monthly average: 450 litres.</p> <p>Total monthly average: Est. 16,000 litres.</p> <p>List of components established by July 2003.</p> <p>Plan to reduce use of heavy metals approved by December 2003.</p> <p>Plan approved and implemented by December 2002.</p>	<p>No data other than cost (variable, according to airfares).</p> <p>Print Shop: Inks — no data on volumes.</p>	<p>Fossil Fuels:</p> <p>Recommendation 4.1 Assess the value of video and teleconferencing.</p> <p>Recommendation 4.2 Monitor air miles.</p> <p>Recommendation 4.4 Introduce more detailed monitoring of the fuel usage of the car fleet.</p> <p>Recommendation 4.3 Encourage alternative transport, e.g. bicycles, public transport, car-pooling.</p> <p>Recommendation 4.5 Seriously consider planting trees to offset the CO₂ output.</p> <p>Encourage the effective and efficient use of fossil fuels among staff</p> <p>Other Recommendations ...</p> <p>Heavy Metals:</p> <ol style="list-style-type: none"> 1. Develop a plan to quantify and identify the point and manner of disposal, then manage and reduce their use, for example, inks, solvents, preservatives. <ul style="list-style-type: none"> • • • 2. Develop and implement a plan for whole life cycle management of computer hardware components. <ul style="list-style-type: none"> • • • 	
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<p>2. Reduce our use of synthetic substances that are toxic and/or non-biodegradable.</p>	<p>Reduce use of synthetic materials and ensure disposal is consistent with goals.</p>	<p>Register of volumes and materials established by June 2003. Priorities to reduce use of synthetic materials approved by December 2003.</p>	<p>Synthetics: Solvents Cleaners Detergent Pesticides Formaldehyde Plastics Paints Chlorine bleach Pesticides Printer components & casings Printer cartridges</p>	<p>Establish a register of synthetic substances used by The Open Polytechnic, quantify usage and identify point and manner of disposal. Identify replacement options that meet both business needs and environmental goals. Set priorities for introducing preferred options to reduce use of potentially toxic substances. Recommendation 5.1 Ensure environmental considerations are built into the next cleaning contract. Recommendation 6.1 Toner is an extremely fine plastic powder (not biodegradable) Need to minimise wastage. Recommendation 6.2 Investigate alternative disposal mechanisms for inks and solvents, rather than rubbish and drains. Recommendation 6.3 Continue to keep up with the latest research on biodegradable solvents and water-based inks. Train and educate the campus redevelopment project group in regards to TNS</p>	
<p>3. Promote environmental restoration and reduce use of materials from nature that are harvested unsustainably or used in ways that reduce natural productivity and biodiversity.</p>	<p>Reduce paper use and waste generation and actively support environmental restoration. Paper: 1. Reduce use</p>	<p>Quantify paper and waste streams by June 2003 Reduction of resource -use 10% by December 2003 Increase recycling by 20% by December 2003. Purchase Policy approved and implemented by December 2003.</p>	<p>A4 paper: Average monthly consumption 947.5 reams Other sizes: Unknown Cardboard: Unknown Other material incl news media: Unknown Paper towels: 288kg/month (Above figures do not include 30% of printing done off site.) All Paper: ca. 2.4t/month Cardboard: ca. 2.48t/month.</p>	<p>Establish an Open Polytechnic purchasing policy that supports a move towards ensuring products used by The Open Polytechnic and its contractors have been sustainably produced. Reduce paper usage Reduce waste to landfill through the use of recycling strategies, more efficient work practices, education and training strategies. Recommendation 1.1 Develop an effective tool to monitor paper usage in different parts of The Open Polytechnic and an online monitoring system of printing. Recommendation 1.2 Reinstall counters (PINs) on copy machines to help monitor copier usage by section. There is also a need to define the paper use on a per-person basis</p>	

	<p>2. Increase recycling</p> <p>3. Determine what is used</p>		<p>Administration:</p> <p>Recommendation 1.3 Introduce detailed monitoring of data of paper distribution by the Administration Service to derive monthly data as a minimum.</p> <p>Recommendation 1.4 Introduce a 'per student-paper-usage' monitoring that counts the amount of printed materials dispatched to students.</p> <p>Recommendation 1.5 Negotiate with Lexmark (the provider of the printers) to solve an ongoing problem of paper jamming in printers.</p> <p>Recommendation 1.6 Educate staff on efficient information and record systems that avoid/reduce paper waste.</p> <p>Recommendation 1.7 Create a paper flowchart. At this stage it is not possible to generate exact numbers of paper input and output.</p> <p>Recommendation 1.8 Improve information on the quantity of paper sent for recycling.</p> <p>Recommendation 1.9 Evaluate the efficiency of the current recycling system.</p> <p>Recommendation 1.10 Educate staff during induction and training programmes on paper recycling issues.</p> <p>Recommendation 6.4 As the process of paper recycling also has detrimental impacts on the environment, it should be investigated whether it is ecologically more benign to recycle paper or to use paper made from fast-growing pine trees in New Zealand.</p>	
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	<p>4. Biodiversity protection</p>	<p>Work towards a 'green campus'</p>		<p>Include the Environmental Policy requirements (that is, the TNS System conditions) in the Terms of Reference for the strategic review of The Open Polytechnic accommodation.</p> <p>Education: Raise awareness of impacts of excessive use of paper e.g. 1t. of paper consumes 17 trees (plus all the other env. impacts: soils, streams, etc)</p> <p>Community Involvement: Internal: Develop and implement a long-term plan for promoting indigenous biodiversity on The Open Polytechnic property, working with Hutt City Council and staff.</p> <p>External: Develop and implement a long-term plan for promoting indigenous biodiversity on The Open Polytechnic property, working with Hutt City Council and other stakeholders (Campus neighbours) to restore hillside behind Campus.</p> <p>Waste: Recommendation 7.1 Inform and educate staff about recycling and waste separation in the cafeteria and reintroduce recycling bins. Investigate composting systems for food wastes, for example, vermiculture.</p> <p>Recommendation 7.2 Improve waste records in the cafeteria, particularly of recyclable components and organic waste.</p>	
<p>4. Increase environmental awareness and use resources efficiently and fairly so that all basic human needs can be met.</p>	<p>Raise awareness of needs: internally (staff) and externally (neighbours and students)</p>	<p>Established TBL categories and identify benchmarks/targets for inclusion in report against 2002 achievements.</p> <p>Plans approved by Feb 2002 and implemented by December 2002.</p>	<p>Internal:</p> <ul style="list-style-type: none"> • • • <p>External:</p> <ul style="list-style-type: none"> • • • 	<p>Prepare for triple bottom line (TBL) reporting on 2002 achievements.</p> <p>Develop and implement plans for: <i>Internal</i> – Raise awareness of environmental matters through staff training and communication.</p> <p><i>External</i> – Students. Raise awareness of environmental matters and publicise The Open Polytechnic strategies.</p> <p><i>External</i> – Stakeholders. Raise awareness of The Open Polytechnic commitment and strategies, including TBL (for example, through our profile).</p>	

Summary of recommendations

The following recommendations were identified as a result of the environmental analysis

1. Paper usage

Recommendation 1.1 Develop an effective tool to monitor paper usage in different parts of The Open Polytechnic and an online monitoring system of printing. (The Information Service Support is currently assessing software on usability - a system similar to the current Internet daily cache analysis could be introduced. If monitoring of printing jobs per workstation is not feasible, measuring printing output per printer could be considered in order to better track usage.

Recommendation 1.2 Reinstall counters (PINs) on copy machines to help monitor copier usage by section.

Recommendation 1.3 Introduce detailed monitoring of data of paper distribution by the Administration Service to derive monthly data as a minimum.

Recommendation 1.4 Introduce a 'per student-paper-usage' monitoring that counts the amount of printed materials dispatched to students.

Recommendation 1.5 Negotiate with Lexmark (the provider of the printers) to solve an ongoing problem of paper jamming in printers during double-sided printing. (This feature has been discontinued with most printers.) Paper also regularly jams during normal printing in some printers. This wastes two sheets of paper (per jam) on average and is an annoyance to staff.

Recommendation 1.6 Educate staff on efficient information and record systems that avoid/reduce paper waste.

Recommendation 1.7 Create a paper flowchart. At this stage it is not possible to generate exact numbers of paper input and output.

Recommendation 1.8 Improve information on the quantity of paper sent for recycling. One way to achieve this would be to separate paper out from cardboard.

Recommendation 1.9 Evaluate the efficiency of the current recycling system, including evaluating the location and number of recycle bins. Provide paper-recycling receptacles in offices.

Recommendation 1.10 Educate staff during induction and training programmes on paper recycling issues.

2. Electricity usage

Recommendation 2.1 Review the installation of A/C units and check if there are other solutions to heat problems (for example, better insulation, better ventilation, shading for offices on the sunny side, better vitrification/glazing, and so on)

Recommendation 2.2 Install more meters to provide more data per building. The print shop and the cafeteria are the highest electricity consumers next to Kanuka and the A/C units. More meters would greatly improve monitoring; the campus electrician quoted \$9,500 to equip each building. To install meters for the print shop and cafeteria only would cost approximately \$2,000.

Recommendation 2.3 Aim to sign contracts with retailers who ensure sustainably generated energy. Currently the electricity received cannot be assigned to a specific generator of power.

Recommendation 2.4 Reduce use and wattage of light bulbs. Most of the lamps on campus, particularly in Kanuka, are equipped with two bulbs each. Removing one made no recognisable difference in brightness. In Kanuka, 188 13 W fluorescent bulbs, in F Block 20 36 W fluorescent tubes, and in Totara, one whole lamp with two 36 W fluorescent tubes could be removed. The halogen spots around the campus are mainly equipped with 50 W bulbs; 13 W energy saving fluorescents. However the amortisation of this move is doubtful since it would cost approximately \$100 per bulb.

These could be replaced with 20 W ones. On the second floor of Kanuka at both ends are four 500 W floats, which burn most of the time instead of the more efficient fluorescent tubes. Several other lights on campus appear to be inefficient or for design purpose only. A bigger investment would be the replacement of old regular 100 W bulbs by

Recommendation 2.5 Consult an expert in energy and lighting efficiency in order to advise on further possible changes and better energy use.

3. Natural gas usage

Recommendation 3.1 Continue monitoring gas usage to detect anomalies.

Recommendation 3.2 Clarify with the gas company whether the data provided is normalised according to the pressure prevailing in the system (if the pressure in the system varies, the amount of gas/m³ varies as well).

4. Fuel usage

Recommendation 4.1 Assess the value of video and teleconferencing as one way to reduce air travel.

Recommendation 4.2 Monitor air miles to better ascertain the associated environmental impacts.

Recommendation 4.3 Encourage alternative transport, such as bicycle use, public transport and car-pooling through incentives.

Recommendation 4.4 Introduce more detailed monitoring of the fuel usage of the car fleet to detect possible patterns, peaks and anomalies.

Recommendation 4.5 Seriously consider planting trees to offset the CO₂ output of The Open Polytechnic.

5. Cleaning

Recommendation 5.1 Ensure environmental considerations are built into the next cleaning contract.

6. Print Shop

Recommendation 6.1 As toner is an extremely fine plastic powder that is not biodegradable, it is important to improve efficiency in use to minimise wastage. It should be recycled where possible. Obtain information from Xerox and the Council Hazardous Waste Centre relating to the disposal of the toner.

Recommendation 6.2 Investigate alternative disposal mechanisms for inks and solvents, rather than rubbish and drains.

Recommendation 6.3 Continue to keep up with the latest research on biodegradable solvents and water-based inks, and liaise with other Pathfinder companies to exchange ideas.

Recommendation 6.4 As the process of paper recycling also has detrimental impacts on the environment, it should be investigated whether it is ecologically more benign to recycle paper or to use paper made from fast-growing pine trees in New Zealand.

7. Cafeteria

Recommendation 7.1 Inform and educate staff about recycling and waste separation in the cafeteria and reintroduce recycle bins. Investigate composting systems for food wastes, for example, vermiculture.

Recommendation 7.2 Improve waste records in the cafeteria, particularly of recyclable components and organic waste.

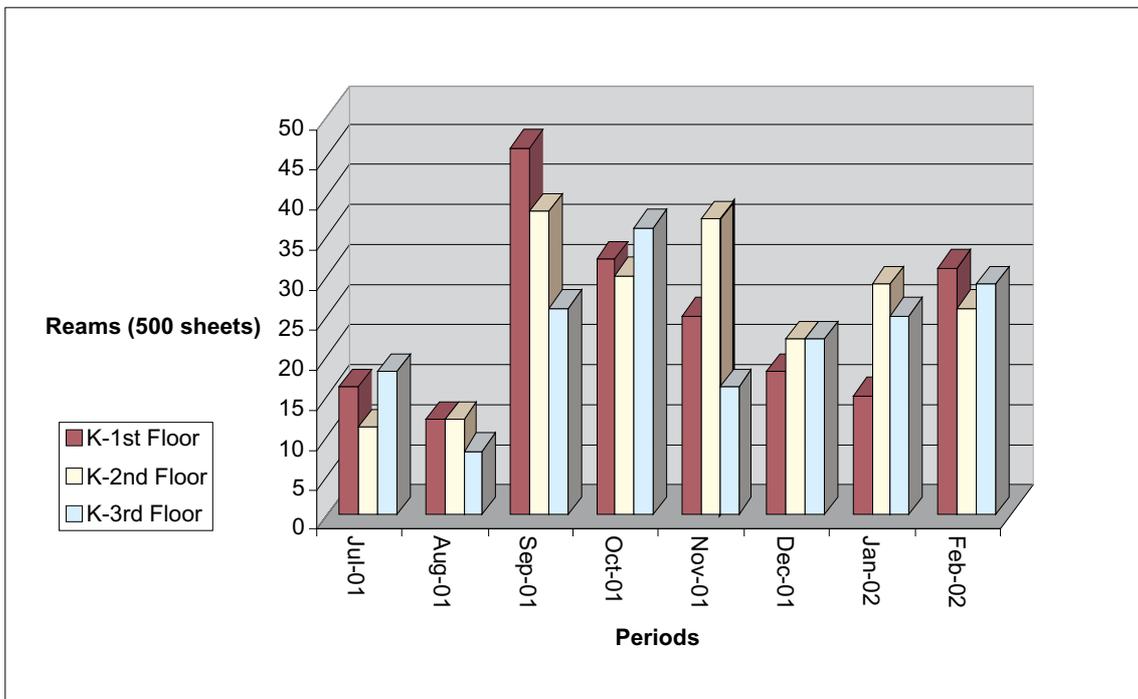
7.2 Tables and figures

Supplier	Product
Agfa-Gevaert	Ozazol Neg. Plate Developer (EN 232) 20 litre (0150000062)
Agfa-Gevaert	Ozazol Neg Plate Developer (EN 232) 5 litre
Agfa-Gevaert	Ozazol (N61) Plates 450 mm x 370 x .15 (KCQGB)
Agfa-Gevaert	Ozazol (N61) Plates 510 mm x 400 x .15 (KCQJF)
Agfa-Gevaert	RC 795 Gum Plate Machine
AM International	964 m Plate Gum (machine)
AM International	Agfa CL Film 406 x 508 mm
AM International	Supermaster Activator (G5260B) 5 ltr
AM International	Supermaster plates (SFP-TRLL) 450 x 370
AM International	Colour Wash Step 1
AM International	Colour Wash Step 2 (PS212)
Flint Ink	Alpine Plate Cleaner
Flint Ink	Aquawash
Flint Ink	Citrus Deglaze
Flint Ink	Citrus Soft Hand Cleaner (5440)
Flint Ink	Corporate Blue PMS 289 LASER INK
Flint Ink	Corporate Blue PMS 289 (10180 WSP 289)
Flint Ink	Corporate Green (Teal) PMS 321 LASER INK
Flint Ink	Corporate Green (Teal) PMS 321 Supertek E4727
Flint Ink	Desensitising Ink (new)
Flint Ink	Express Damper Wash
Flint Ink	Gloss Scuff Resistant Sealer W10203
Flint Ink	Metallic Gold PMS 875
Flint Ink	Metallic Silver
Flint Ink	New Decade Cyan
Flint Ink	New Decade Magenta
Flint Ink	New Decade Pantone Black (30180 SP10)
Flint Ink	New Decade Pantone Green
Flint Ink	New Decade Pantone Yellow (12180 SP1)
Flint Ink	New Decade Process Blue (12180 SP7)
Flint Ink	New Decade Red 032
Flint Ink	New Image Process Black
Flint Ink	Pantone Orange 021
Flint Ink	Pantone Purple
Flint Ink	Pantone Rhodamine Red
Flint Ink	Pantone Rubine Red
Flint Ink	Pantone Violet
Flint Ink	Pantone Warm Red
Flint Ink	Process Yellow
Flint Ink	Reflex Blue

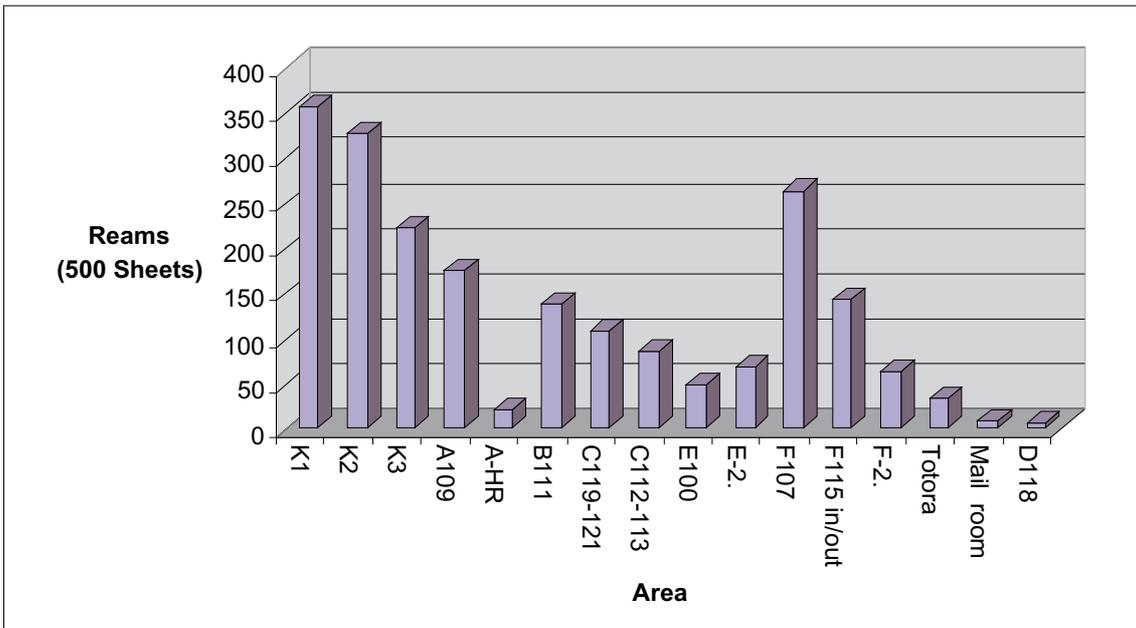
Table 3: List of inks and solvents used in the print shop with supplier and specifications

Business Travel Expenses in NZ\$						
	Budget 2002	Actual 2001	Budget 2001	Actual 2000	Alteration budget	Alteration actual
Airfares domestic	455,920	341,192	322,997	280,875	41.15%	21.47%
Airfares international	235,029	159,966	324,000	144,051	-27.46%	11.05%
Total airfares	690,949	501,158	646,997	424,926	6.79%	17.94%
Accommodation domestic	183,083	238,241	199,740	172,984	-8.34%	37.72%
Accommodation international	112,650	74,573	118,318	71,506	-4.79%	4.29%
Total accommodation	295,733	312,814	318,058	244,490	-7.02%	27.95%
Taxi fares	85,326	99,409	77,815	72,994	9.65%	36.19%
Rental vehicles	42,550	36,282	34,346	36,360	23.89%	-0.21%
Total car transport	127,876	135,691	112,161	109,354	14.01%	24.08%
Travel allowance and reimbursement	110,236	130,601	109,541	156,390	0.63%	-16.49%
Total business travel expenses	1,224,794	1,080,264	1,186,757	935,160	3.21%	15.52%

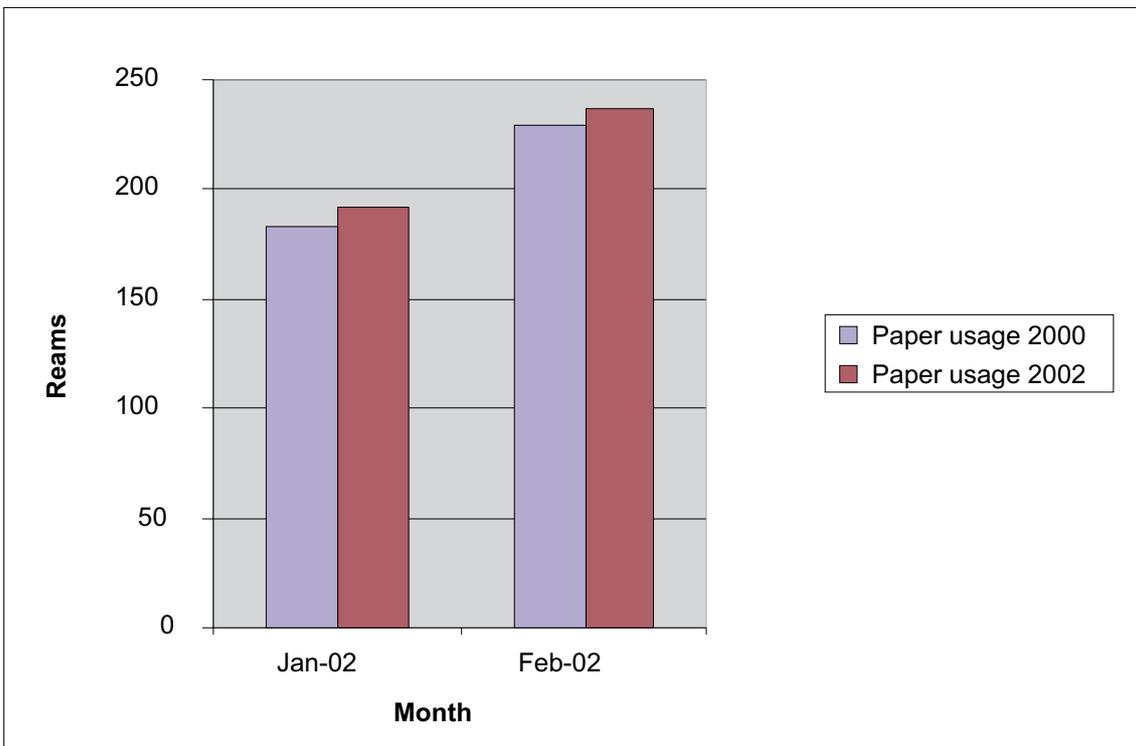
Table 4: List of travel costs for The Open Polytechnic for 2000–2002



(a) Paper usage by floor — Kanuka building

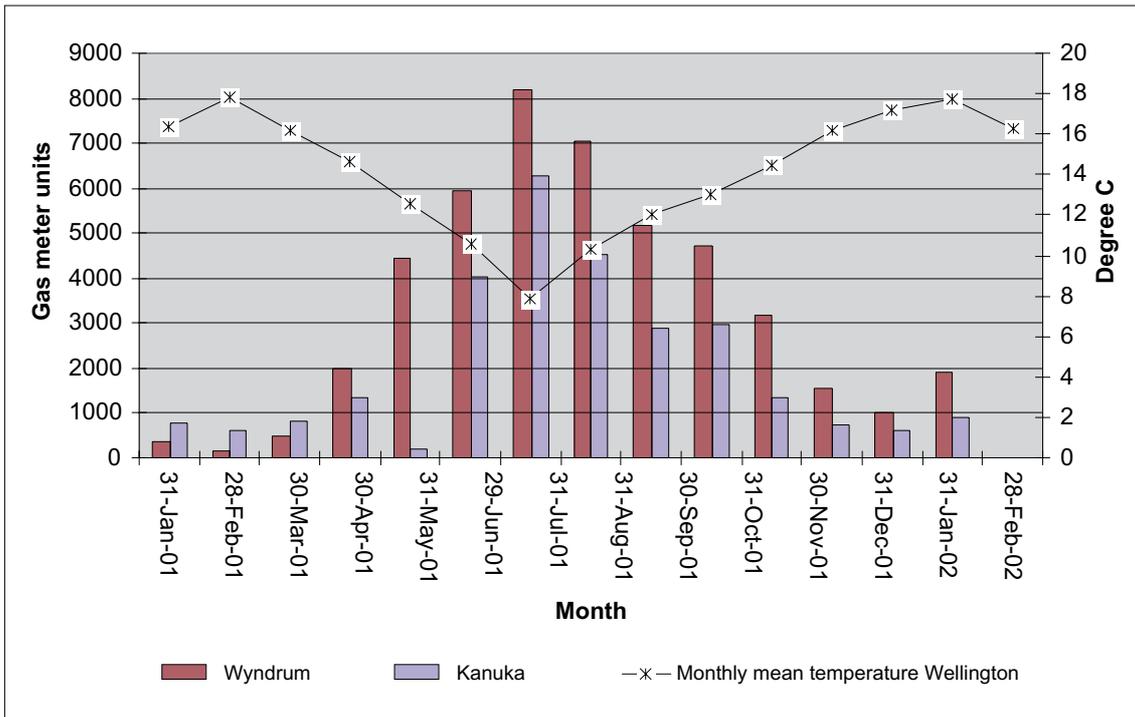


(b) Total paper usage by work area

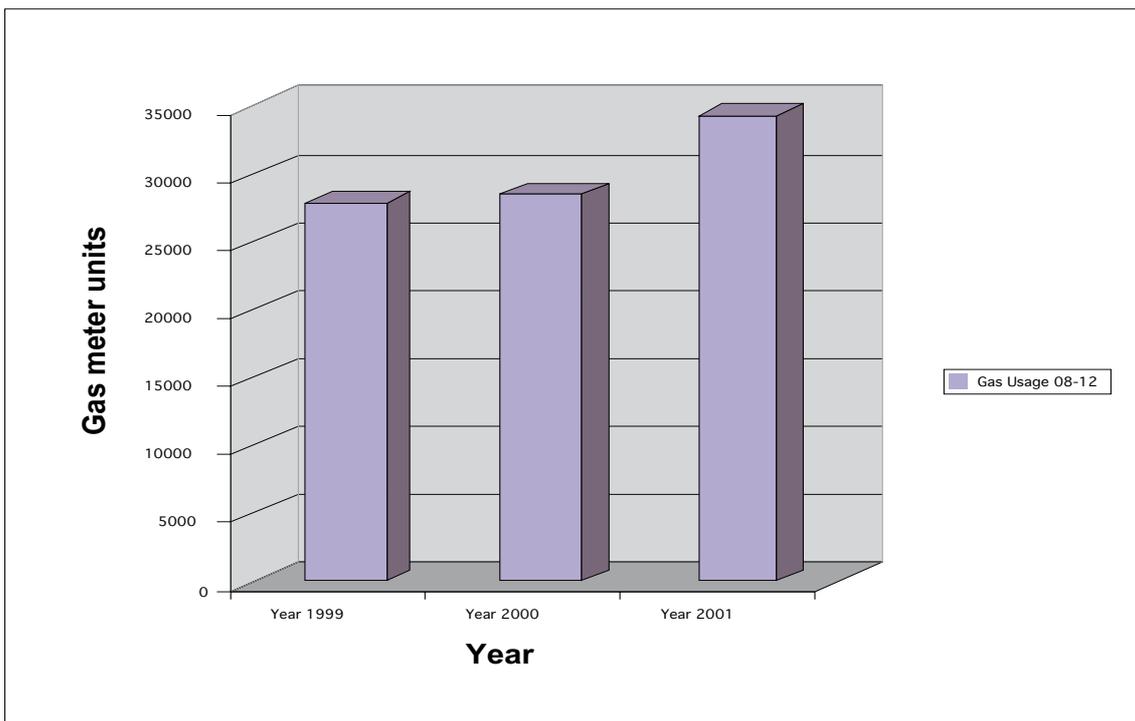


(c) Yearly comparison of paper usage

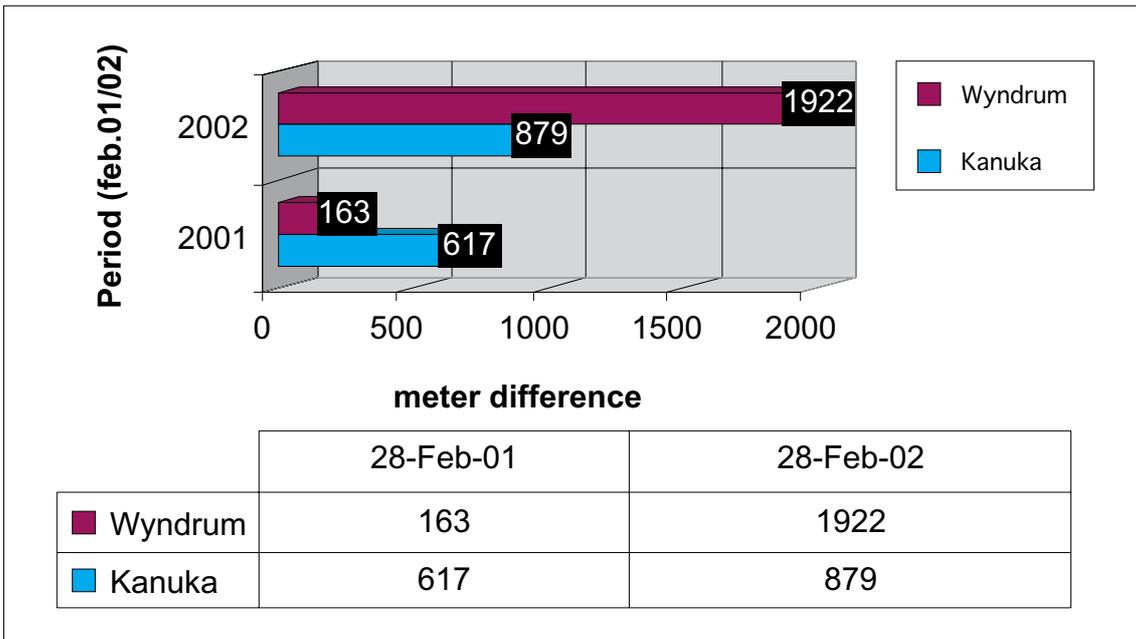
Figure 7: Paper usage at The Open Polytechnic



(a) Monthly gas usage relative to mean temperature in Wellington

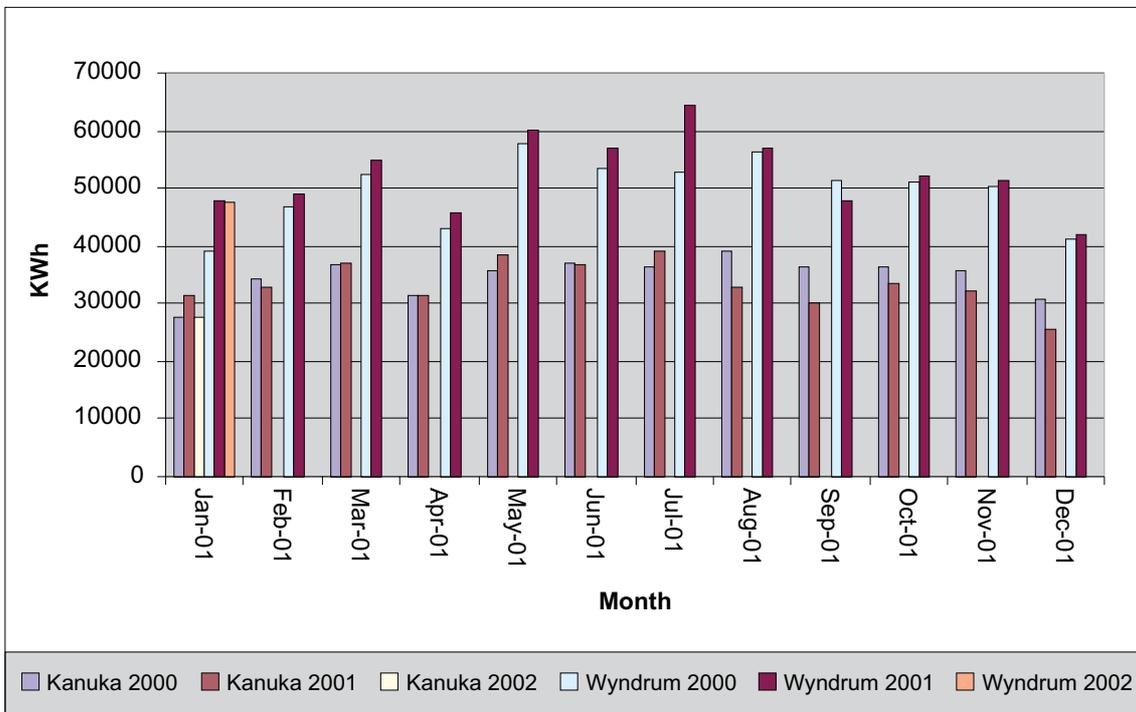


(b) Gas usage — September to December — three-year comparison

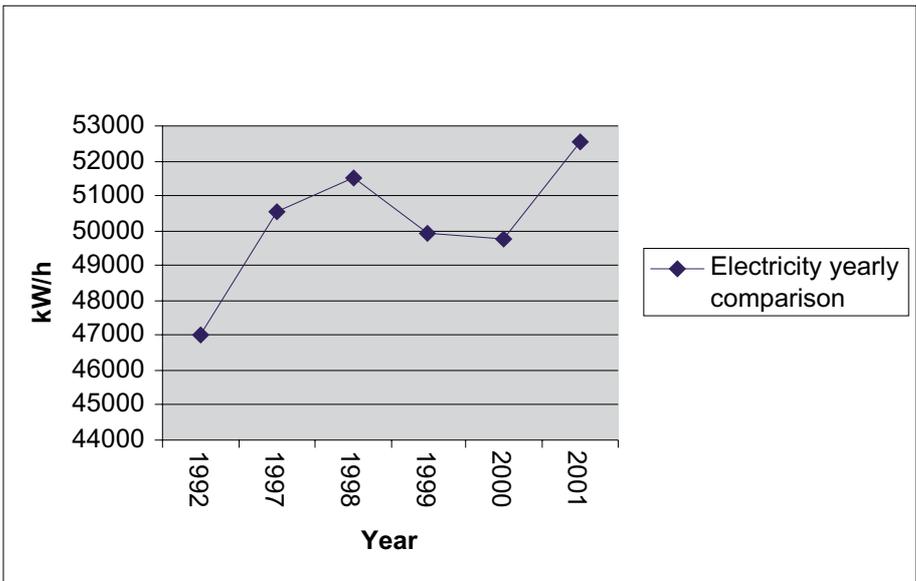


(c) Gas usage 02–01 vs. 02–02

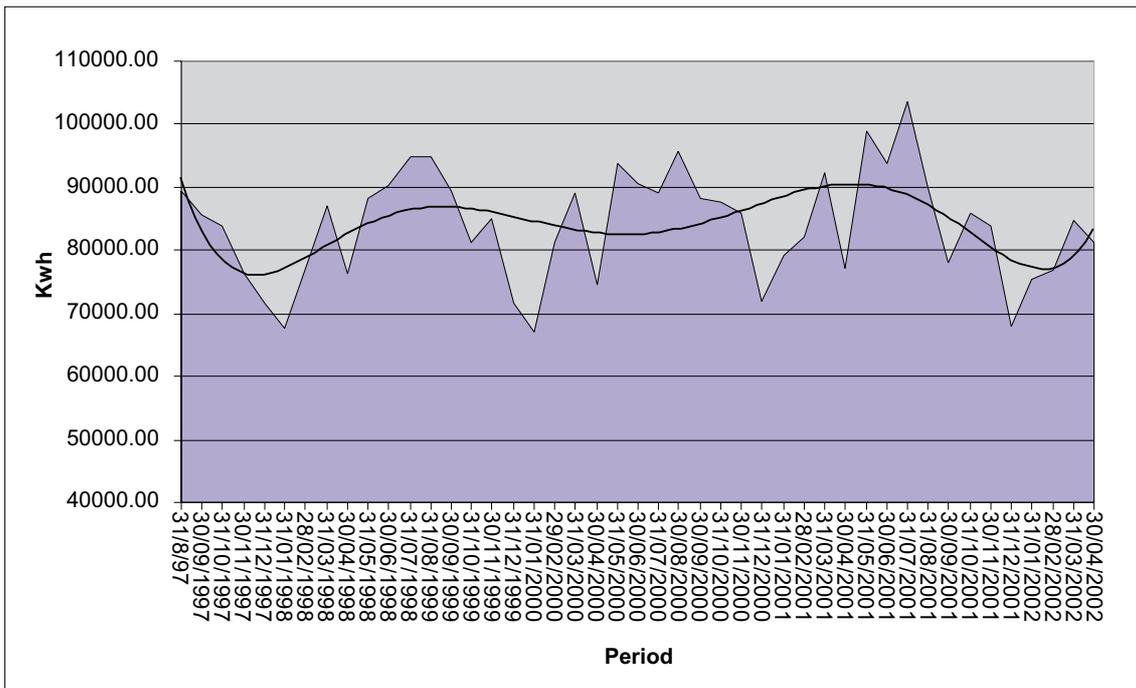
Figure 8: Gas usage at The Open Polytechnic



(a) Monthly electricity usage by meter



(b) Year-by-year average of electricity usage



(c) Total Open Polytechnic electricity usage and trendline

Figure 9: Electricity usage at The Open Polytechnic