EREP Toolkit

Module 4 of 5:
Calculating payback periods

CONTENTS

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1. INTRODUCTION

This module is part of an Environment and Resource Efficiency Plans (EREP) Toolkit, which consists of five modules designed to help businesses meet their EREP obligations by increasing their resource efficiency. Figure 1 shows the structure of the Toolkit and the main contents of this module.

The purpose of this module is to:

1. help businesses to identify the financial benefits of resource efficiency actions
2. provide specific advice on payback calculations required of businesses subject to EPA Victoria's Environment and Resource Efficiency Plans (EREP) program
3. use case studies to demonstrate payback calculations in action
4. provide advice on how to quantify the cost-saving benefits of actions

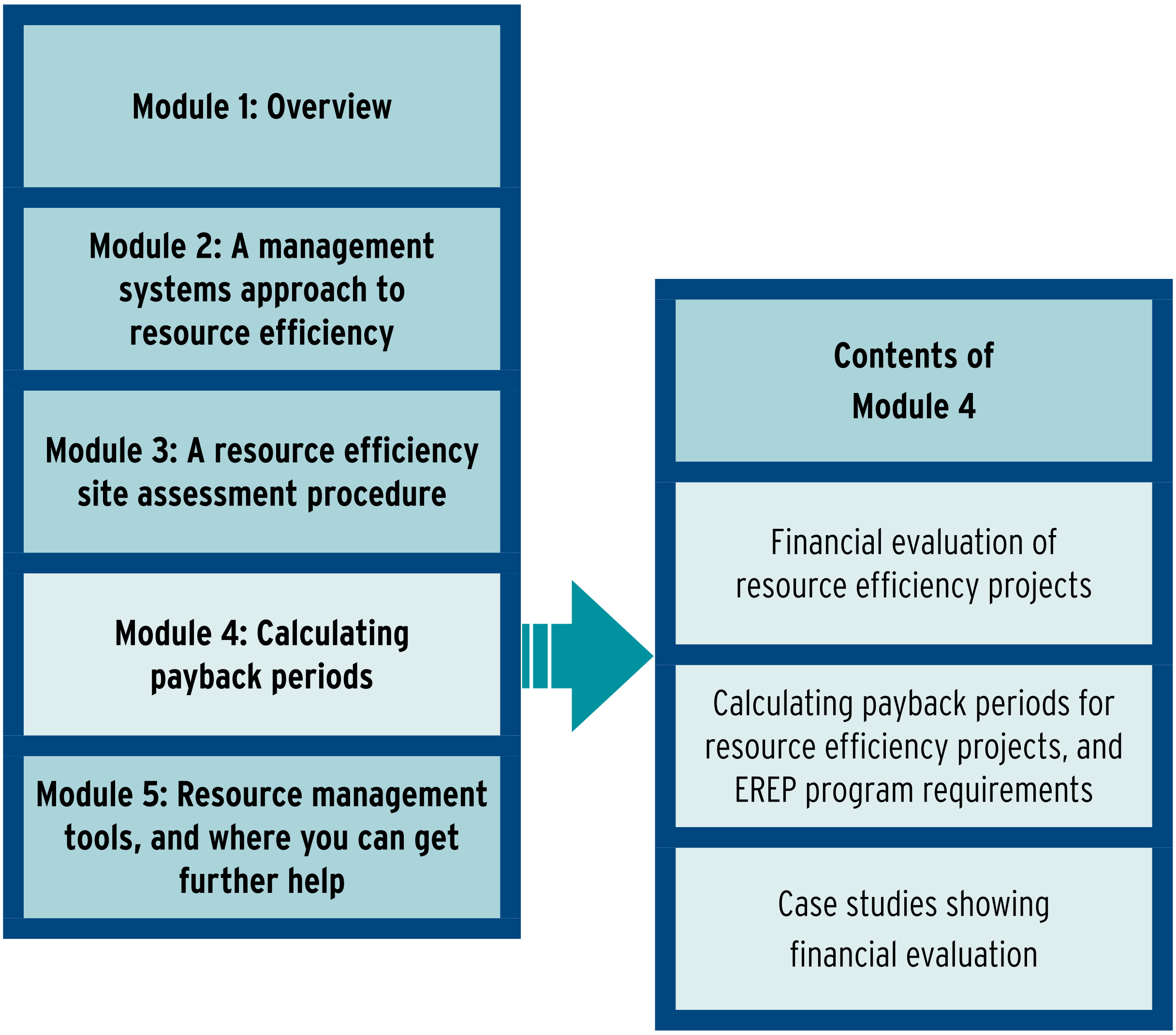

Figure 1: Key elements of the EREP Toolkit

2. FINANCIAL EVALUATION OF RESOURCE EFFICIENCY PROJECTS

The business case for resource efficiency is often overlooked or incomplete. Many opportunities are missed because their financial attractiveness is hidden by:

- not considering all the benefits (for example, reduced input cost or productivity improvements, which may be the dominant source of financial gains)
- not considering all the costs (such as operating costs) and basing decisions on capital cost alone
- ignoring the lower risk of investments in resource efficiency improvements, in comparison to overall business risks, which therefore can sometimes be expected to generate lower but more stable returns.

Financial evaluation is only one element of a comprehensive evaluation of a project. Other considerations may include occupational health and safety, quality, environmental, social, reputational and other non-financial outcomes. For instance, if an energy-efficient greenhouse reduction measure meets financial as well as safety criteria, this creates a stronger case for adoption.

2.1 Consider full benefits

Resource efficiency actions often have benefits other than the obvious reductions in direct costs. For example, converting from standard fluorescent tubes to triphosphor tubes would not only save on electricity use, but would also:

- increase lamp life, thereby reducing the cost of ordering, purchasing, storing and installing replacement lamps
- improve lamp light output, quality and reliability, potentially allowing the use of fewer fittings and/or improving productivity through better lighting levels.

Financial evaluation of the project should consider the impact of these additional benefits, as they all add to the financial savings that are attributable to it. Reasonable estimates may be feasible for the value of benefits that cannot be easily quantified.

Where an operating subsidy or grant is obtained from an external party, the financial evaluation should include this as part of the annual cost savings or benefits to be considered.

Appendix 1 lists typical costs and benefits that may arise from resource efficiency projects, and how such benefits might be quantified in an economic evaluation.

2.2 Consider full costs

Typically, the initial purchase cost is the prime consideration when investing in new equipment. The evaluation of a project should also consider such factors as the cost of installation and the lost production that may occur if a special shutdown is needed.

Where a grant is obtained from an external party to support the purchase and installation of a new equipment item or project, the amount of the grant should be deducted from the initial implementation cost of the project so that the financial evaluation is conducted using costs and benefits that relate to the company's contribution.

When comparing more than one improvement option, a choice made on the purchase and installation price alone can ignore ongoing operational costs and could result in the company paying too much every month for many years. This can be a particular problem where the capital budget and future operational budgets are treated separately, and the financial evaluation should be careful to include these separately chargeable factors.

Section 3.2 lists potential costs that may be considered during the financial feasibility evaluation.

3. Payback period

3.1 Environment and Resource Efficiency Plans (EREP) requirements

The EREP Regulations require businesses to calculate the payback period as a tool to evaluate potential resource efficiency and waste management actions as part of the EREP program.

All actions with a payback period of three years or less must be implemented by the business. Exceptions can be made where projects potentially conflict with other obligations, such as occupational health and safety or product quality requirements.

The financial payback measure listed in the *Environment Protection (Environment and Resource Efficiency Plans) Regulations 2007* is:

$$\text{Payback period (years)} = \frac{\text{Initial investment (\$)}}{\text{Net annual savings* (\$ per year)}}$$

Businesses involved in the EREP program must use this measure when calculating payback.

Sections 3.2 and 3.3 contain non-exhaustive lists of items that may be included in 'Initial investment' and 'Net annual savings' when making calculations.

3.2 Initial investment

The following items may be included when calculating the initial investment:

- cost of capital assets, such as plant and equipment (including installation costs)
- cost of alterations to existing capital assets
- site recoupment or repair costs
- initial consultancy fees (specific to the project).

As noted above, the value of any grant that may be received from an external party to support the project must be deducted from the 'Initial investment'.

3.3 Net annual savings

The following items should be considered when calculating net annual savings:

- energy savings; for example, from reduced gas, electricity or other fuels use
- water savings
- waste disposal/treatment savings
- carbon credits or the cost to offset carbon emissions.

Any operating grant or subsidy received from an external party must be included in the 'net annual savings'.

The flow-on impacts associated with energy, water and waste improvement actions should also be recognised, and the net annual savings may be affected (positively or negatively) by a number of associated impacts, which may change the costs in areas as outlined in the following table.

CATEGORY	POTENTIAL AREA OF CHANGE
Labour	• Staffing levels • Operating hours
Raw materials	• Different raw materials • Different quality specifications • Change in quantities required
Waste treatment/disposal	• Quantity or quality of trade waste, prescribed industrial waste, general waste
Production and/or productivity	• Process reliability/downtime • Staffing levels • Operating hours • Quantity of production • Product quality • Product sales value • Amount of internal rework • Amount of reject product for disposal
Production and/or productivity	• Downtime • Maintenance/repair labour • Replacement parts/equipment
Energy	• Quantity or type of energy used
Water	• Quantity or quality of water used

To expand on the general benefits and cost savings identified above, the table in Appendix 1 identifies specific benefits and cost savings that may arise in relation to the undertaking of a project and includes suggestions as to how each benefit or cost saving might be quantified.

Appendix 2 details a number of case studies that demonstrate the application of the payback period as required by the EREP program.

APPENDIX 1: HOW TO QUANTIFY SPECIFIC BENEFITS AND COST SAVINGS

COST SAVING/BENEFIT	HOW TO QUANTIFY THE COST SAVING/BENEFIT
Direct cost savings	
Reduced energy consumption costs (e.g., electricity, gas, petrol, diesel).	Periodic invoices issued by energy or fuel providers.
Reduced water consumption costs.	Periodic invoices issued by water authorities.
Reduced trade waste costs and parameter charges.	Periodic invoices issued by water authorities, or a trade waste agreement with a water authority.
Reduced waste disposal costs.	Waste disposal fee invoices.
Reduced labour costs resulting from reduced product rework, reduced handling of waste, or process improvement.	Wages paid in relation to a particular business process or production line.
Reduced costs relating to disposal of prescribed industrial waste ('PIW').	Waste disposal fee invoices.
Profit on sale of redundant equipment or fixed assets.	Sale contracts or invoices, and other accounting records.
Reduced cost of other various process inputs, such as processing chemicals.	Supplier invoices.
Reduced repair and maintenance costs (e.g., due to operating less equipment or more efficient equipment, resulting in fewer breakdowns and fewer spare part replacements).	Service provider invoices or maintenance employee wages.
Cost of raw materials	
Reduced cost of raw materials disposed of as waste.	Break down total raw material costs to separately identify the cost of raw materials incorporated into finished goods compared with the cost of raw materials disposed of as waste (using sub-accounts), allowing separate analysis of the waste component.
Reduced costs relating to defective goods manufactured.	Determine the unit cost of manufactured goods (using the business's existing product costing procedures) and monitor the volume of defective goods manufactured.
Cost savings resulting from the use of less specific, lower quality or lower cost inputs (e.g., a new process may require only 90% dry air rather than 99% dry air, or medium-grade rather than high-grade copy paper).	Supplier invoices.
Cost savings resulting from reduced spills.	Supplier invoices of product.

COST SAVING/BENEFIT	HOW TO QUANTIFY THE COST SAVING/BENEFIT
Indirect benefits and cost savings	
Increased revenue from turning a waste into a resource.	Identify the sales value of waste products and reduced costs of waste disposal.
Cost savings relating to reduced carbon emissions.	Cost savings may be counted in reduced energy costs, such as electricity and gas (however, emission reductions may not necessarily lead to energy cost savings).
Increased brand awareness or competitive advantage.	Projected increases in sales resulting from customer preferences for businesses with reduced environmental impact.
Reduced risk and/or liability.	Reduced insurance premiums should reflect the reduced risk profile of the business.
Increased employee motivation and retention (e.g., where employees prefer working for 'greener' organisations).	Reduced cost of employee turnover, including reduced training costs and reduced recruitment costs.
Increased productivity (e.g., reduced equipment down time, shorter production times, increased production of finished goods, fewer rejects, reduced staff hours).	Cost savings in relation to equipment down time may be quantified by determining the per-hour cost of having particular equipment out of use (e.g., reduced revenue, idle operator costs) and multiplying that cost by the reduced number of hours that the machine is out of use. Cost savings in relation to shorter production times may be quantified by determining the cost per hour of operating a particular machine (e.g., energy, operator wages) and multiplying that cost by the reduced number of hours that the machine is operational. Benefits relating to greater production or reduced staff hours may be quantified by reference to increased level of sales (resulting from increased production or greater yield) and reduced wages costs.
Increased occupational health and safety standards.	Reduced sick leave and WorkCover benefits paid as a result of decreased employee injuries.
Reduced costs resulting from actions undertaken by suppliers (e.g., waste reduction due to suppliers changing packaging to a recyclable material).	Reduced waste disposal costs or other relevant measures.
Increased government grants or subsidies in relation to the use of innovative technology or specialist training of staff.	Government grant or subsidy revenue received.
Increased research and development allowances.	Research and development benefits received (e.g., cash rebates received or reduced tax payable).

APPENDIX 2: CASE STUDIES USING THE PAYBACK PERIOD CALCULATION

A. Biscuit manufacturer's upgrade of lighting facilities

A biscuit manufacturer is considering an upgrade of its factory lighting.

The project will involve changing existing lamps to new generation tri-phosphors, which will reduce the number of lamps by 30 per cent. The project will also involve the installation of time-delay switches, occupancy sensors and devices that detect daylight to control lighting levels. These measures localise the control of the lights so they are not running unnecessarily.

For an investment of $27,000 to buy and install the new lighting system, the biscuit manufacturer will save $8,750 per annum in electricity.

Calculation of payback period – energy only

$$\text{Payback period (years)} = \frac{\text{Initial investment (\$)}}{\text{Net annual savings (\$ per year)}}$$

$$= \frac{\$27{,}000}{\$8750 \text{ per year}}$$

$$= 3.09 \text{ years}$$

Other benefits

On further consideration, the company realises that having 30 per cent fewer lights to operate, and with the lamps having a 100 per cent longer life before failure, there will be 65 per cent fewer lamp changes per year. The reduction in maintenance time and replacement lamps will increase the annual cost savings by $1500 per year.

It further expects that the better lighting quality delivered by the tri-phosphor lamps will reduce the product defect rate by 5 per cent, saving another $500 per year.

Calculation of payback period – comprehensive assessment

$$\text{Payback period} = \frac{\text{Initial investment (\$)}}{\text{Net annual savings (\$ per year)}}$$

$$= \frac{\$27{,}000}{\$10{,}750 \text{ per year}}$$

$$= 2.51 \text{ years}$$

A more complete and accurate assessment of the project shows that it comfortably lies within the EREP program's action implementation hurdle rate of a three-year payback.

B. Winery's redevelopment of wastewater treatment facilities

A winery is considering a redevelopment of its wastewater treatment facilities. The winery generates large amounts of wastewater from the manufacture and bottling of wine. The wastewater contains high levels of organic substances, making it unsuitable for discharge into the local sewerage system without prior treatment. Currently, the winery diverts wastewater into a series of lagoons and treats it using special anaerobic bacteria. Once treated and tested, the wastewater is then released into the sewer.

The winery is considering a new system of wastewater treatment that uses a similar system of lagoons but with aerobic bacteria rather than anaerobic bacteria. This new process requires the installation of special equipment to aerate the water and facilitate the process. The new process more effectively treats the wastewater; so much so that, once processed using the new system, the wastewater can be used to irrigate the winery's grape vines. The winery can also sell the treated wastewater to other farmers in the district for their irrigation purposes.

The local water authority is able to provide a grant of 20 per cent of the project cost to assist with water reduction projects of this nature.

Calculation of payback period

Initial investment

• Cost of plant and equipment	\$120,000
• Consultant fees	\$5,000
• Less grant received	(\$25,000)
Total initial investment	\$100,000

Net annual savings

• Reduced wastewater disposal costs	\$30,000 per year
• Reduced water purchasing costs	\$10,000 per year
• Sales of treated water	\$5,000 per year
• Less additional operating costs (repairs, electricity)	(\$2,000) per year
Net annual savings	\$43,000 per year

$$\text{Payback period} = \frac{\text{Initial investment (\$)}}{\text{Net annual savings (\$ per year)}}$$

$$= \frac{\$100{,}000}{\$43{,}000 \text{ per year}}$$

$$= 2.33 \text{ years}$$

C. Office building's upgrade of bathroom hand drying facilities

A multi-storey office building is considering the installation of warm air hand driers in all of its bathrooms to replace the use of paper towels. The office building has multiple bathrooms on each level of the building. The project involves replacing the paper towel facilities with warm air hand driers that have automatic shut-off sensors.

The hand driers will use electricity but the owner will not need to pay for paper towel purchases and waste paper disposal. Daily servicing of the bathrooms will take less time.

Calculation of payback period

Initial investment

• Purchase and installation of electric driers	$20,400

Net annual savings

• Reduced cost of paper towel	$16,000 per year
• Reduced cost of waste paper disposal	$300 per year
• Reduced bathroom servicing costs	$500 per year
• Less increased electricity costs	($1,100) per year
Net annual savings	$15,700 per year

$$\text{Payback period} = \frac{\$20{,}400}{\$15{,}700 \text{ per year}}$$

$$= 1.30 \text{ years}$$

D. Drycleaner's recovery and reuse of cleaning solvents contained in wastewater

A drycleaner is considering a project whereby dry-cleaning solvents contained in wastewater can be recovered and reused in the dry-cleaning process.

A particular dry-cleaning process generates wastewater that contains traces of the dry-cleaning solvent. By purchasing and using a new solvent extraction unit, which uses a distillation process, the drycleaner can extract most of the dry-cleaning solvent from the wastewater and can then reuse the solvent in the dry-cleaning process.

Due to the reduced toxicity of the wastewater, the wastewater disposal costs will significantly reduce.

The owner has decided to include the cost of equipment downtime during installation, and some additional staff training, in the project costs. He also considers that extra inspection and servicing fees should be included in the payback assessment for the project. He recognises that the project benefits will include reductions in solvent purchases and trade waste charges, and he expects that his business turnover will improve by 10 per cent because new customers will be attracted from the less 'green' drycleaning business in the next street.

Calculation of payback period

Initial investment

• Acquisition and installation of extraction unit	$62,000
• Initial staff training costs on use of extraction unit	$5,000
• Downtime during installation	$1,000
Total initial investment	$68,000

Net annual savings

• Reduced cost of dry-cleaning solvent purchase	$15,000 per year
• Reduced cost of wastewater disposal	$17,000 per year
• Increased business turnover	$27,800 per year
• Less additional inspection and servicing costs	($2,000) per year
Net annual savings	$57,800 per year

$$\text{Payback period} = \frac{\$68{,}000}{\$57{,}800 \text{ per year}}$$

$$= 1.18 \text{ years}$$

Failure to recognise the potential for increased business turnover would give the project a payback period of about 2.3 years, weakening the business case (though implementation is still required under the EREP three-year payback requirement).

E. Car trim manufacturer's process redevelopment.

A car trim manufacturer is considering a redevelopment of the process by which it manufactures rear parcel shelves for passenger vehicles. The manufacturing process currently uses a raw material that produces waste, such as off-cuts, which is sent to landfill. The current process also involves heating the raw material before use, which emits fumes that must be extracted and passed through carbon filters before discharge to the atmosphere.

The proposed project involves changing the manufacturing process to use a new and improved raw material to manufacture the parcel shelves. The project involves acquiring new machinery and incorporating it into the production line. By changing the manufacturing process, all trimming waste can be recycled into raw material and reused. No fumes are produced from the new process as no heating of the new product is required.

The new raw material is easier to use and results in increased productivity, as the number of shifts required to produce the same amount of product is reduced and the reject rate is expected to decrease substantially. The elimination of fumes will also result in a significant reduction in the company's WorkCover premium.

The project qualifies for a capital grant of 20 per cent under a government waste reduction program.

Calculation of payback period

Initial investment

• Equipment purchase and installation costs	$860,000
• Staff training costs	$30,000
• Plant downtime during installation	$100,000
• Less government grant	($172,000)
Total initial investment	$818,000

Net annual savings

• Reduced waste disposal	$22,000 per year
• Elimination of carbon filters	$26,000 per year
• Reduced heating energy bills	$20,000 per year
• Reduced WorkCover premium	$20,000 per year
• Increased productivity	$195,000 per year
• Less increased raw material costs	($10,000) per year
Net annual savings	$273,00 per year

$$\text{Payback period} = \frac{\$818{,}000}{\$273{,}000 \text{ per year}}$$

$$= 3.00 \text{ years}$$

In this case the project payback period would initially have exceeded three years, but the government grant has resulted in the project meeting EREP program criteria for implementation.