

RESOURCE EFFICIENCY:

WHAT IS IT AND WHAT DOES IT MEAN FOR BUSINESSES?

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Section 1 – Resource efficiency overview

Average annual \$ savings ¹	
ENERGY	MATERIALS
\$56,000	\$156,000

1.1 What is resource efficiency?

Resource efficiency is about deriving the most value from material and energy inputs by efficiently converting them into finished products or services, while minimising environmental impacts. Material resources refer to everything a business purchases to produce its products or services, including raw materials, stock, stationary, produce and chemicals.

In many cases, energy and materials can be managed to achieve a greater output from the resources used. Achieving greater productivity from resources will reduce costs and the environmental impact associated with the extraction, use and disposal of materials and fuels. Increasing resource efficiency will contribute to improving productivity, reducing costs and increasing the competitiveness of Victoria's businesses.

1.2 Why does resource efficiency matter?

Research by the Ai Group shows that for more than 90% of businesses, energy costs represents at least 5% of a business' costs² which means there are good cost saving opportunity through energy efficiency.

By comparison ABS data³ suggests that material and water costs for businesses range from 10% to more than 50% (an average more than 30%) of a business' revenue. Findings from more than 40 material assessments conducted as part of Sustainability Victoria's *Smarter Resources, Smarter Business (SRSB)* program (2012-2015) showed that for manufacturers material costs are 30 to 80% of the cost of producing a product, for many businesses this is far greater than labour costs.

This means that there are greater potential savings available to businesses through materials efficiency than energy efficiency or even labour reductions.

Although material efficiencies can be achieved through purchasing, it's in reducing wastage at all stages in the production of a product or delivery of a service that the big savings can be made. The *SRSB* resource assessments found average annual materials savings for businesses through material efficiency actions was \$156,000. By comparison average savings for energy efficiency actions was \$56,000.

An earlier study by Sustainability Victoria (2004/5) involving 12 companies identified more than \$23 million in lost value from non-productive resource flows. This comes about because businesses pay

¹ Findings from 136 resource assessments conducted as part of SRSB program, 2012-2015

² *Energy Shock: Pressure Mounts for Efficiency Action*, Ai Group, July 2012

³ ABS Data Series 8155.0 – Australian Industries and ABS Data series 4660.0 – Energy Water and Environment Management

multiple times for their material resources. Not only do they pay to purchase them, and pay to dispose of materials that end up as waste, they also pay for labour, energy and fuel costs associated with storing and handling the wastes. As well, many businesses forgo potential earnings from selling their waste because they fail to assess the value of their wastes or ignore the potential to reuse valuable material waste in production processes. This is called the 'real cost of waste'.

1.3 What are the benefits to business?

Resource efficiency can result in savings to an organisation by reducing the amount of materials or energy that needs to be purchased, or reducing waste disposal costs. The savings come from direct actions such as capital investment in efficiencies e.g. purchase of more efficient machinery or appliances, or indirectly as a result of more efficient processes - see table 1 which outlines some of the direct cost savings that can result from resource efficiency.

Savings relate to the efficiency of resource use. This means that even though resource costs may not go down, a business may be able to produce more from the same or fewer resources i.e. they produce or deliver more or better products or services, per unit of input, resulting in increased revenue.

Table 1: Direct cost savings

Cost saving/benefit	How this can be measured
Reduced cost of materials due to design improvements and efficiencies.	Supplier invoices.
Reduce cost of material due to re-use of waste	Supplier invoices and disposal fees
Reduce amount of lost value from resource flow	Break down of total material costs to separately identify the cost of materials incorporated into finished goods and services compared with the cost of materials disposed of as waste (using subaccounts), allowing separate analysis of the waste component. This permits business to calculate 'true cost of waste' and ratio of purchase to disposal cost.
Reduced energy consumption costs (e.g., electricity, gas, petrol, and diesel).	Periodic invoices issued by energy or fuel providers.
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.
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.

Cost saving/benefit	How this can be measured
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.
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. using medium-grade rather than high-grade copy paper, or using a new process which may require only 90% dry air rather than 99% dry air).	Supplier invoices.
Cost savings resulting from reduced spills.	Supplier invoices of product.
Increased revenue from turning a waste into a resource.	Identify the sales value of waste products and reduced costs of waste disposal.

1.4 Indirect costs savings

In addition, there may be indirect benefits arising from resource efficiency, which are more difficult to measure. These may include:

- Increased productivity due to reductions in down time, rework, and maintenance requirements
- Increased brand awareness, enhanced reputation, or competitive advantage, due to consumer preferences for more sustainable products
- Increased employee satisfaction and retention. Studies have shown people prefer to work for more sustainable organisations
- Improvements in occupational health and safety

1.5 Business Snapshots

The following snapshots from Sustainability Victoria's resource efficiency case studies provide examples of how different businesses have improved their resource efficiency, resulting in resource efficiency gains and significant cost savings.

- After implementing one recommendation from a materials assessment, rubber and rubber bonded products manufacturer Mackay Consolidated Industries saved \$64,000 per year by retooling a bonding machine for an investment of just \$3,500.
- Clothing manufacturer Nobody Denim reduced its materials, energy, water and chemicals use saving \$32,000 per year, through measures identified in a resource assessment.
- Innovative feeding regime changes have reduced Werribee fish farm Mainstream Aquaculture's key material use by 27%, saving \$100,000 in the first year.
- New die and process changes saved Pemara Printing \$26,000 in polypropylene, polyethylene and paper; \$3,000 in ink and varnish; and \$40,000 reduction in waste to landfill in the first 18 months. The purchase of a new winding machine is on track to save a further \$87,000 per year.
- PVC manufacturer Welvic Australia reduced oven energy use by 70% saving \$4,500 per annum for an investment of just \$3,800. Other measures are expected to save a further \$80,000 per year in materials and waste reductions.
- Licola Wilderness Village saved \$30,000 per year and enhanced its reputation through various energy efficiency actions including installing a VSD, lighting upgrades and sensors, metering, and the purchase of more efficient cooking appliances.

See these and other case studies [here](#).

Section 2 – Identifying and implementing resource efficiency

2.1 Understanding resource inputs and outputs

There are various inputs into and outputs from an organisation, depending on the industry or sector. These inputs and outputs can be significant areas of expenditure and waste, depending on how efficiently products are produced or services are provided.

The following table presents typical inputs and outputs to an organisation. Depending on the industry or sector, there may also be specific material inputs and waste types generated. Refer to Table 3 (on page 10) for sector specific examples.

Table 2: Typical resource inputs and outputs

Resource inputs	Outputs and waste materials
Raw materials (e.g. metals, plastics, glass) Energy (i.e. electricity, gas and fuel) Complete products Product components Produce Administration/office supplies Chemicals Packaging Facilities (floor space and location) Transport vehicles	Products (on specification) Off-specification products Discounted stock Waste: Damaged and discontinued stock Off cuts Packaging waste <ul style="list-style-type: none"> • Plastic wrap • Plastic containers • Polystyrene • Cardboard boxes Contaminated materials (e.g. out-of-date, incorrect storage) Cleaning products Administration/office based waste: <ul style="list-style-type: none"> • Office paper and cardboard • Ink cartridges • Food waste • Furniture • Bags (paper and plastics) • Aluminium cans • Glass and plastic containers • Paper towels Liquid paper containers Electronic waste Grounds and garden waste (organics) On-site construction / renovation / demolition waste

Identifying the inputs and outputs required to produce a product or deliver a service will help to understand where the greatest impacts occur and therefore the greatest opportunities for reducing costs.

The most effective way to reduce the quantity of resources used to produce a product or deliver a service, and to reduce or avoid wastage, is to address this at the design stage. There are a number of design strategies practiced by ‘smart’ businesses around the world that involve designing products and services that require fewer resources to produce, and that are easier to re-use or recycle at the end of their life. Although not every business has the opportunity to directly influence design of their final product or service, there are opportunities to work with supply chains to influence design, e.g. through purchasing decisions.

2.2 Resource efficiency assessments

Resource efficiency assessments provide a structured approach to measuring, documenting and implementing business improvements through a process of determining resource usage and identifying areas for cost savings.

Fig 1 Opportunities, leading to benefits through implementation of cost effective solutions



Waste, energy and material assessments have an important role to play in overall cost management activities. They can help an organisation to reduce energy costs, recognise activities that can assist to streamline processes, and find new and less expensive ways to manufacture products or provide services.

Measuring your inputs and outputs can assist you to compare your performance to a similar organisation's operations or monitor and improve your own performance over time.

2.3 Understanding where you can make improvements

When considering how much of something an organisation uses, an easy way to monitor this is to track how much is purchased. Supplier invoices, inventories and stock takes are a very useful source of information.

Visual assessments can help confirm how a resource is being used by observing the amount and type of waste in skips, especially expensive materials and finished or partly finished product. Observing patterns of usage is also very helpful, for example, recording how many computers or machines are left on at the end of the day, or whether lights are on in storerooms when no one is in there.

Physical waste audits can estimate how much waste is produced by counting the number of bins emptied each day, or how much waste is collected by your waste contractor.

Counting bins, although a good way of gaining a general understanding of waste quantities, is not completely accurate, as the bins may not be full when they are emptied. A more accurate measure is to measure the weight of the waste, or to conduct a physical audit.

Determining all inputs and outputs within a particular process or facility can be used to determine how efficient your organisation is and therefore identify areas for improvement.

2.4 Energy Assessments

An energy assessment provides the opportunity to understand where energy savings can be achieved within a particular process, facility or building.

The assessment itself obviously does not save money but will provide an objective assessment of where energy is being used and where there are opportunities to reduce energy use or use it more efficiently. The implementation of those opportunities will then reduce energy bills and/or provide productivity improvements.

The outcomes of an assessment should be aligned with on-going management plans and operational activities such as expansions and capital investment. The advantages of undertaking an energy assessment includes enabling an organisation to quantify current energy use and prioritise options for minimising or managing energy use based on energy efficiency improvements.

The scope of an energy assessment may include:

- investigating the usage of all types of energy consumed and energy using equipment within a building, facility or process;
- identifying the energy usage of all major heating and cooling applications and its percentage against total energy use;
- identifying cost-effective measures to improve the efficiency of energy use;
- estimating the potential energy savings, indicative budget costs and payback periods for each recommended action; and
- reviewing energy management strategies, including monitoring systems and evaluation process.

Australia has formal standards for energy assessments. This is covered by AS/NZS 3598:2014 Part 1,2 and 3

AS/NZS 3598.1:2014 Part 1 Commercial Buildings

AS/NZS 3598 2:2014 Part 2 Industrial and Related Activities

AS/NZS 3598.3:2014 Part 3 Transport and Related Activities

- **Type 1: Basic Energy Audit** Type 1 audits provide a quantitative overview that is typically suitable for smaller sites with lower energy expenditure, or as a scoping audit for larger sites. Type 1 defines the minimum level of detail for an audit to comply with the standard. Type 1 audits provide a quantitative overview of energy performance and identify no-cost and low cost opportunities with a payback periods of up to 2 years. The accuracy of costs and benefits would generally only be sufficient for low cost improvements or a method for prioritising opportunities for a more detailed assessment. Type 1 audits provide indicative or typical savings calculated using rules of thumb or industry benchmark, with indicative costs used to provide simple payback. Costs and energy savings are therefore a broad estimate level.
- **Type 2: Detailed energy audit** Type 2 defines a detailed level of audit involving a comprehensive review and analysis of equipment, systems and operational characteristics of the whole site to enable quantified energy savings and recommendations. Type 2 audits are required to include a financial analysis of recommended energy performance improvement actions based on agreed financial criteria to rank opportunities. The accuracy of costs and savings should generally be sufficient for operational expenditures or medium- scale capital investments and should be commensurate with organisation's approval processes. Type 2 audits calculates the energy savings by reconciling against end use breakdown, considering daily energy consumption profiles.

- Type 3: Process subsystem audit. Type 3 audits are detailed audits of specific subsystems, with additional data gathering and measurement to provide a higher level of accuracy. Audits of this type are typically focused on a process or subsystem level, such as for a process heating, compressed air or pumping systems, rather than the whole site. Type 3 audits involve onsite measurement to monitor energy data over a period long enough to capture the various operating conditions and relevant variables to a higher accuracy than possible under a type 2 audit. Audits of this type usually involves representatives from the organisation in the development of cost estimates to provide the level of accuracy required by the company's capital expenditure process.
Type 3 audits calculate energy savings by reconciling against the detailed energy use breakdown, considering the additional measurement taken during the audit.

2.5 Waste Assessments

Waste assessments allow a business to understand the outputs from particular processes and activities, and how this could be minimised through internal efficiencies and better waste management or re-use and recycling practices.

Waste is often ignored or treated as an unavoidable cost. Understanding what type and how much “waste” is being created will present opportunities for more cost-effective management. For example, the cost of sending waste to landfill is in many cases more expensive than sending it to recycling so if all recyclables are kept out of waste bins and separated there can be a reduction in landfill pickups and costs. It may even be possible to sell recyclable waste materials.

The outcomes of a waste assessment can also be used to inform a materials efficiency assessment as this is how a business can quantify total process wastage.

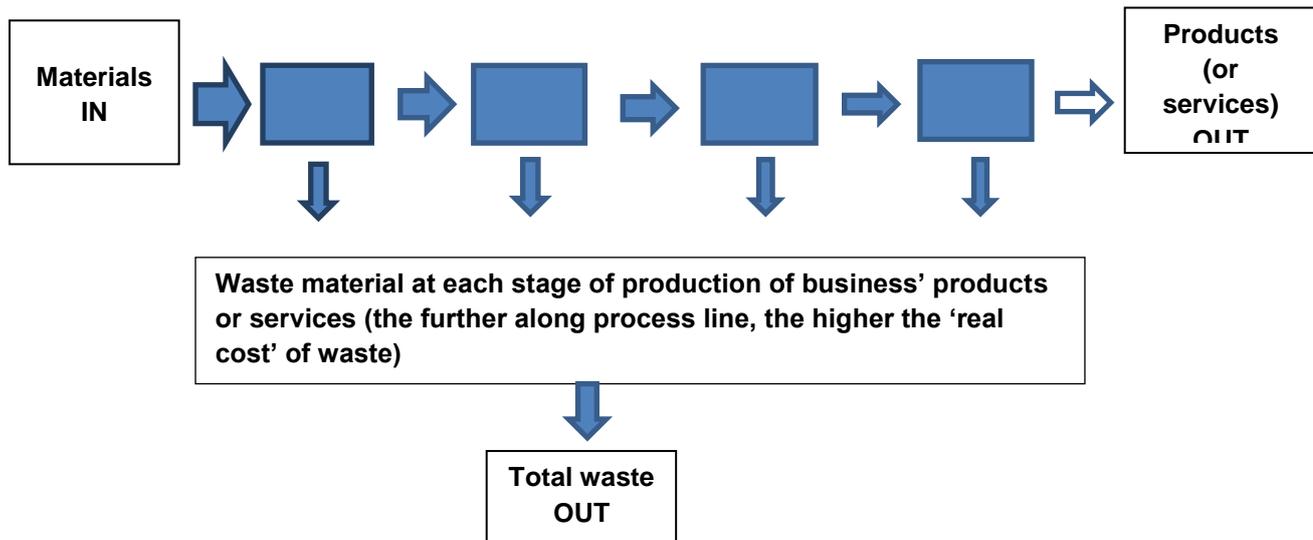
- A waste assessment will enable an organisation to:
- Better determine the type and amount of waste being generated;
- Measure the effectiveness of existing waste management systems;
- Potentially reduce the numbers of waste bins and waste collections through source separation and recycling;
- Identify opportunities for improving waste management systems and strategies; and
- Collect baseline data for measuring the effectiveness of waste minimisation strategies.

2.6 Materials Assessments

Materials assessments consider all material inputs into a particular process or activity and how these interact with the production of finished goods or delivery of a service – see Fig 2. They map the flows of materials into and through a business and can be measured in quantities or monetary value or both. The aim is to identify spoilage, waste and unproductive activity. The result is more efficient use of purchased materials, more up time of plant and equipment, more productive labour and less waste to landfill and significant savings to businesses.

Given that material costs are usually the largest business cost next to labour, and sometimes the largest cost, getting more from what you buy makes good business sense.

Fig 2. Overview of materials flow into and through a business



Materials efficiency is about reducing costs and:

- measuring flows of materials through the production process;
- knowing how much material is used and how much waste or spoilage is generated per unit of product;
- knowing the 'what, where and why' of waste/material within your production system/value chain;
- understanding the ratio of the purchased price of wasted material to the disposal cost;
- knowing how much this waste costs your business to produce and manage that is the 'true cost of waste';
- identifying how to improve efficiency and reduce waste;
- developing and implementing systems to improve and monitor resource efficiency;
- ensuring that the maximum amount of product (and value) is obtained from the materials used in production; and

Table 3 below provides some typical examples of the types of material inputs and outputs for a selection of business sectors.

Organisations that better understand how materials affect costs and productivity are able to identify:

- the inputs that cause production losses and reject product and the frequency and costs;
- opportunities to modify product supply specifications and/or work with suppliers to reduce material losses and costs;
- best practices to reduce waste and improve materials efficiency; and
- environmental benefits and responsibility that may be used to better promote products and services.

It is a common experience with companies undertaking materials efficiency assessments that by taking a fresh and comprehensive look at how their products are made or their services delivered, innovative thinking also emerges around product design, supply specification and service delivery.

Table 3 Typical sector specific inputs and outputs

Manufacturing and Food Processing Industries	
Material inputs and resources Raw materials / feed stocks Chemical additives Plant, equipment and appliances	Outputs and waste materials By-products of manufacturing processes including: Scraps, trimmings and off cuts Spoilage Lubricants, solvents, resins, thinners, thickening agents and chemicals Cleaning products Scrap plant equipment and parts Rags, gloves, hair/beard nets, ear plugs Sludge Sewerage effluent
Transport, Warehousing and Retail Industries	
Material inputs and resources Stock shelving Plant, equipment and appliances Transportation fuel	Outputs and waste materials Retail shop fit-out waste Grease, used oil and air filters Tyres Batteries Vehicle parts and scrap metal
Healthcare and Social Assistance and Accommodation and Food Services Industries	
Material inputs and resources Medical stock Food stock Furniture Stock shelving Equipment, appliances, devices	Outputs and waste materials Medical Clinical and anatomical waste body tissue and fluids disposable protective wear disposable equipment pharmaceuticals disinfectants sharps Cytotoxic waste: Pharmaceutical Waste Liquid Waste Food Industry Food scraps (organics) Utensils and ceramics Foil Grease trap waste Used oils Linen

2.7 Understanding what to assess

Understanding where major resources are used, especially the operations that are energy and/or materials intensive, how much is spent on materials and energy inputs and waste disposal will make it easier to identify where the greatest opportunities for efficiencies and costs savings lie costs and will help determine what type of assessment to undertake.

Undertaking an in-house process mapping exercise is a great starting point and will help a business determine if an assessment is needed, what type of assessment, energy or materials or both, and what processes/operations to assess. Sustainability Victoria has produced an easy to use [process mapping tool](#).

- Resource assessments provide the information and evidence required to make decisions on resource efficiency:
- analysing energy used by an organisation or by a particular process will assist an organisation to understand where savings can be made through energy efficiency opportunities
- material assessments will enable an organisation to identify opportunities to reduce their input costs
- waste assessments will assist an organisation to determine what savings can be made from waste reduction and better management of wastes.

