Australian Government

Department of Resources, Energy and Tourism

ENERGY EFFICIENCY OPPORTUNITIES

ASSESSMENT HANDBOOK

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Energy Efficiency Opportunities

Energy Efficiency Opportunities Assessment Handbook

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This handbook is published by the Department of Resources, Energy and Tourism and was prepared by the Energy Efficiency Opportunities Section, Energy and Environment Division. The handbook may be downloaded from www.energyefficiencyopportunities.gov.au. For printed copies, tel: 1300 799 186 or email: energyefficiencyopportunities@ret.gov.au.

Acknowledgements

The Department of Resources, Energy and Tourism would like to thank all of the companies that provided input to development of the program – particularly those involved in the assessment trials and previous Australian Government partnership programs.

Revisions to the handbook

The handbook will be revised over time to incorporate the experiences of and suggestions from participating companies. For further information on the handbook or to provide feedback, please phone 1300 799 186 or email: energyefficiencyopportunities@ret.gov.au.

(V5Jul11)

Important notice – please read

This handbook does not replace or modify any of the requirements in the *Energy Efficiency Opportunities Act 2006* or the Energy Efficiency Opportunities Regulations 2006 and Energy Efficiency Opportunities Industry Guidelines.

The Department of Resources, Energy and Tourism has published this handbook purely for the assistance of the reader. The information in this document is considered to be as true, accurate and complete as possible at the time of publication. However, changes in circumstances after publication may impact on the accuracy and completeness of the information. Accordingly, readers should independently verify the handbook's accuracy, currency, completeness and relevance for their own individual purposes and should obtain appropriate professional advice before making any business decision based on the handbook.

To the full extent permitted by law, the Commonwealth of Australia will not be liable for any damage, loss or expense arising from the use of or reliance on this handbook.

As stated in the handbook, some hypothetical companies or activities are used as examples. They are for illustrative purposes only and are entirely fictitious. Any resemblance to past or present organisations or individuals is coincidental and unintended.

Contents

Appendices

Figures

Tables

Company case studies

Abbreviations

CEO	chief executive officer
DRET	Department of Resources, Energy & Tourism
ESMG	Energy Savings Measurement Guide
GJ	gigajoule
km	kilometre
KR	key requirement
kWh	kilowatt hour
L	litre
m	metre
MW	megawatt
NFEE	National Framework on Energy Efficiency
OH&S	occupational health and safety
PJ	petajoule
SWOT	strengths, weaknesses, opportunities and threats
yr	year

Executive summary

Introduction

Energy efficiency is good for business. It can reduce costs, improve your bottom line, boost productivity, reduce greenhouse gas emissions and contribute to your company's reputation as a socially responsible organisation.

This handbook draws on the practical experiences of companies and consultants that have undertaken effective energy assessments. It is a resource for use by companies participating in the Energy Efficiency Opportunities program to help them plan and implement assessments in a way that will optimise business outcomes while meeting the legislative requirements of the Energy Efficiency Opportunities program. Case studies are used throughout the handbook to provide real examples of how particular issues are being addressed by companies across a range of industry sectors. Additional case studies will be placed on the Energy Efficiency Opportunities website as they become available (see www.energyefficiencyopportunities.gov.au).

This handbook is written from the perspective of undertaking an assessment at a site. Findings might be used at that site or the outcomes transferred to similar sites, technologies or processes. The handbook is also useful for those undertaking representative assessments at a business division or activity level such as facilities management or transport.

Companies participating in Energy Efficiency Opportunities should use this handbook as a guide only and refer directly to the legislation and guidelines to ensure that they are meeting legislative requirements.

The seven-stage assessment process

Energy Efficiency Opportunities requires companies to undertake assessments of energy efficiency opportunities and includes activities such as registration and development of an assessment and reporting schedule. This handbook is designed to assist companies with the actual assessments. It provides a process that companies may follow to help them meet the requirements of the Assessment Framework and gather the information required for corporate reporting requirements as outlined in the Energy Efficiency Opportunities Regulations 2006 and the *Energy Efficiency Opportunities Industry Guidelines*.

The assessment process outlined in the handbook is divided into seven stages presented as a series of options that can be adapted by companies to build on and use existing business processes. There is some overlap between the stages.

The assessment should support other business policies, objectives and processes wherever possible. A successful assessment links the way that energy is used to other core business drivers and benefits throughout the process.

Stage 1 – Project plan

Planning is essential to ensure the assessment meets the requirements of the program in a way that supports other business priorities. A project plan outlines the actions required, who is involved, when actions are undertaken, and the financial and technical resources that are needed for the project. This stage also involves a critical review of the company's strengths, weaknesses, opportunities and threats that need to be considered when developing and implementing the plan.

Outcome
An internally approved project plan including assessment objectives and a description of the ways in which the key requirements of the Energy Efficiency Opportunities Assessment Framework will be met.

Stage 2 – Communication plan

Communication is an essential part of an assessment and is used at every stage in the process. While closely linked to the project plan, the communication plan involves an analysis of stakeholders (internal and external) and their role and importance for the assessment and implementation of energy efficiency projects. It outlines the individuals, groups or organisations that need to be involved in the assessment and how they will be effectively involved.

Outcome
An internally approved communication plan and demonstration of senior level support.

Stage 3 – Understanding energy use

Understanding energy use is a critical stage in the assessment process and one of the most challenging. During this stage, energy use information is collected and analysed. It is likely to include information on the business itself (e.g. policies, priorities and plans) as well as data on energy. This information provides important background for the activities undertaken in the next stage, and provides support for reporting.

Outcome
Background energy and business data compilation and preliminary analysis.

Stage 4 – Identifying potential opportunities

The information gathered in the previous stage provides a good basis for understanding the use of energy in the business and identifying potential opportunities for energy efficiency. It is important that a broad range of people from the company as well as external expertise or stakeholders are involved in identifying potential opportunities. Site visits, data analysis, workshops and meetings can be used to:

- discuss energy and the way it relates to the production system;
- review existing energy and production data; and
- brainstorm potential opportunities.

Further exploration of opportunities is undertaken and approaches for more detailed investigation are developed.

Outcome
List of ideas to improve energy efficiency and how these will be investigated further.

Stage 5 – Detailed investigation

During Stage 5, a plan is developed and approved, and investigation commenced on potential opportunities to determine whether implementation is feasible. Detailed investigation might involve:

- additional energy tracking or data analysis;
- workshops or meetings that bring together relevant expertise;
- trial or piloting activities;
- advice from expert consultants or internal staff; and
- estimates from equipment suppliers or service providers.

The resources required for investigation depend on the size and scope of each opportunity and internal investment protocols, including the level of detail required to make decisions and obtain funding for project implementation.

Outcome
Defined costs/benefits and business case for each opportunity.

Stage 6 – Business decisions and implementation

Business decisions and implementation may commence after initial scoping of opportunities if they fall within the discretionary powers of an individual manager or operator. Other decisions for further investigation or implementation that require significant capital expenditure may need to be approved at division, corporate or board level.

Outcome
Decisions and agreed actions on projects.

Stage 7 – Tracking and communication

Energy use, identified opportunities, business decisions and energy savings are documented for tracking and communication purposes, because decisions made at the operational level ultimately need to be reported at senior management and board levels. Outcomes of the assessment also need to be communicated to those involved in the assessment. A summary of opportunities and business decisions must be reported publicly and appropriate records kept for verification.

Outcome
Ongoing effective project management and communication of assessment outcomes.

Introduction

Purpose

This handbook is intended to help companies to design and conduct an 'energy efficiency opportunities assessment' – a core requirement of the Australian Government's Energy Efficiency Opportunities program.

The handbook draws on the practical experiences of companies including those involved in:

- trials undertaken to develop the Australian Government's Energy Efficiency Opportunities program throughout 2005 and 2006 and;
- the Australian Government's voluntary Energy Efficiency Best Practice Program (1998 – 2003).

It also takes into account research carried out through the Commercial and Industrial Working Group of the National Framework on Energy Efficiency (NFEE) in 2005 and 2006.

The handbook draws on lessons learned by companies and consultants involved in these programs to develop a logical stage-by-stage process that others may follow to help them meet the requirements of Energy Efficiency Opportunities.

While the handbook is specifically designed to assist companies participating in Energy Efficiency Opportunities, it may also assist companies involved in other energy programs or those simply interested in improving their energy efficiency. The ultimate goal is to achieve improved energy efficiency within companies to add value to the business.

The handbook is written from the perspective of undertaking an assessment at a site. Findings might be used at that site or the outcomes transferred to similar sites, technologies or processes. The process is also useful for those undertaking assessments at a business division or activity level, such as facilities management or transport.

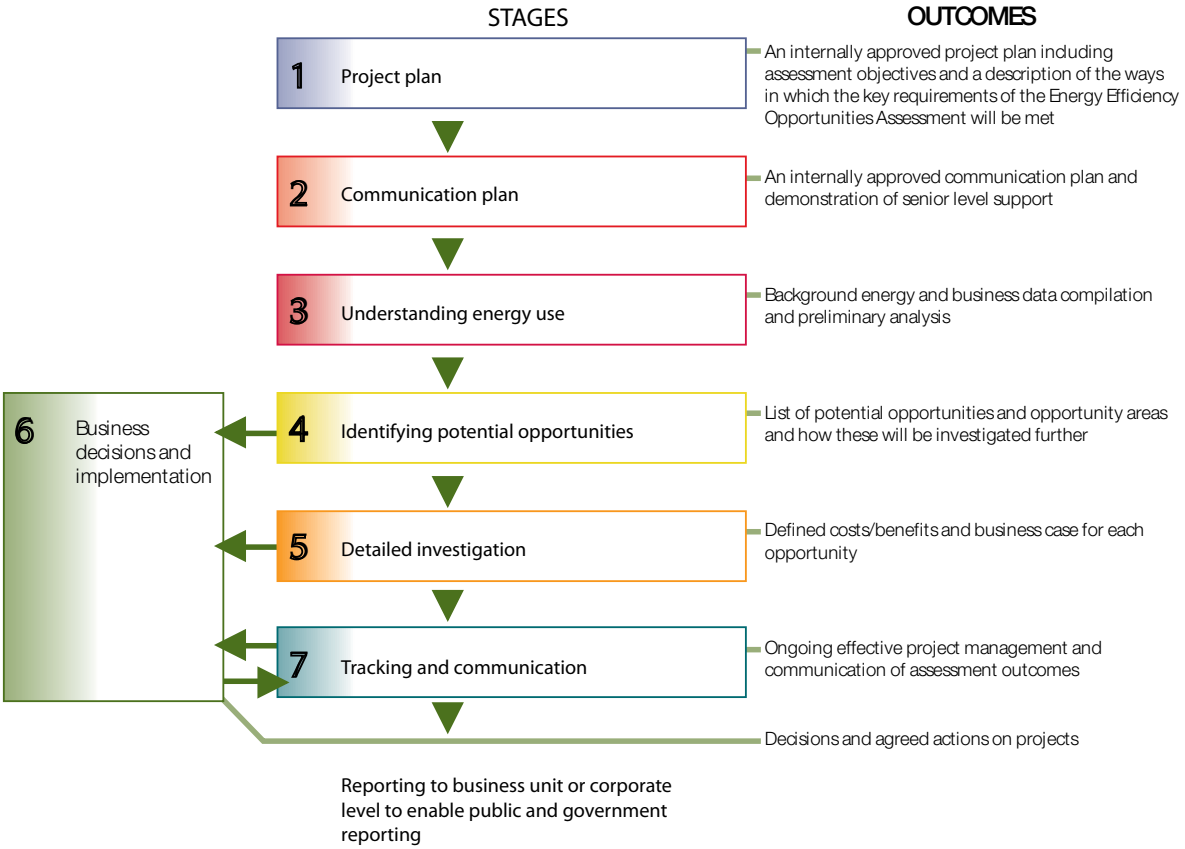
It is intended that additional case studies will be developed and made available on www.energyefficiencyopportunities.gov.au.

How to use this handbook

Every site is unique and may approach the assessment differently. This handbook is intended as a guide and reference, to give you ideas and to prompt you to think about important issues as you progress.

The handbook outlines the assessment in seven stages as outlined in Figure 1.

Figure 1: Overview of the assessment



At each stage information is provided on:

- **purpose**;
- underpinning **principles**;
- engaging **people** who need to be involved;
- **outcomes** that will be achieved;
- **processes** that could be followed;
- company **examples;** and
- relationship to **key requirements** of the Energy Efficiency Opportunities Assessment Framework.

Worksheets are provided at the end of each stage.

Where further information is available on a particular topic or case study, reference numbers are given. Full references are provided in Appendix F and at www.energyefficiencyopportunities.gov.au. Active weblinks are also made available at that webpage to facilitate easy access to additional information.

If you are reading an electronic version of this document you can click on '➲ **read more'** to go directly to the active weblinks at www.energyefficiencyopportunities.gov.au or, where marked, to one of the appendices of this handbook.

Company case studies provided throughout the document are listed as follows:

✪ Company case study

Purple boxes are used in Stage 3, 'Understanding Energy Use', where a hypothetical case study of Magma Minerals is used to demonstrate the benefits of specific data and analysis techniques.

Principles underpinning the handbook

A number of principles were followed in preparing the handbook.

Energy efficiency is given different levels of priority in different organisations. The handbook takes this into account by providing options and strategies that can be followed at each stage.

People have different learning styles (e.g. some like to use checklists and worksheets, while others are interested in reading more of the background and theory before taking action). The handbook acknowledges this by providing several styles and levels of information, including:

- a description of the process with examples in the body of each section;
- worksheets at the end of each chapter; and
- more detailed information, case studies, exercises and checklists on the Energy Efficiency Opportunities website.

The handbook has been designed so that it can be used in different ways and at different stages in the assessment process. This means that users may not have to read the whole book, although people who are very new to the process may benefit from doing so. The handbook's layout and cross-referencing allow access to information at any part of the process.

The handbook is a 'living document' that can be used to gather the learning and case examples from participating companies over time. Updates and additional case examples and guidance will be made available on the Energy Efficiency Opportunities website.

The handbook acknowledges that energy efficiency is often addressed as a purely technical initiative involving engineers and other technically oriented personnel. To effectively overcome the barriers to energy management that exist within organisations, however, ongoing success requires attention to policy and procedures as well as people and communication issues.

The handbook is designed to be used by anyone involved in an assessment process. In some cases this will be the person who has been given primary responsibility for coordinating or managing the assessment (the project leader). In other cases it will be a team of people, or a consultant employed to facilitate the assessment. Findings might be used on site or outcomes transferred to similar sites, technologies or processes. The seven stage process is also useful for those conducting assessments for a business division or activity, such as facilities management or transport.

Other government energy efficiency programs

If you would like more information on how you might integrate the requirements of other energy efficiency programs with your assessment, visit the Energy Efficiency Opportunities website for additional Guidance material.

Benefits of an effective assessment

Conducting an effective assessment of energy efficiency opportunities can provide many benefits to companies. These include:

- reduced expenditure on energy, permits (in the future), capital, maintenance and occupational health and safety (OH&S) costs;
- improved productivity, product quality and staff engagement;
- increased profits;
- closer alignment of energy procurement with actual energy needs;
- improved awareness of CO_2 emmissions from energy use and cost effective opportunities to reduce those CO_2 emmissions;
- improved corporate reputation; and
- access to external funds for energy efficiency and greenhouse projects.

Understanding your energy use and where it is both used and wasted gives you another lens through which to look at optimising the whole production process or activity. You can maximise the benefits from an assessment by considering energy use across your whole system rather than looking at components in isolation.

Box 1: Midland Brick – business benefits identified through an energy efficiency assessment trial

✪ **Midland Brick** (a Boral company) found that its energy efficiency opportunities assessment, conducted as part of a trial for the former Department of Industry, Tourism and Resources, identified additional business benefits.

'Although we are a large energy user and we manage our energy use on a day to day basis we have got great value out of spending time with our attention focused on energy efficiency. The energy efficiency perspective hasn't only been about ancillary energy savings. We have been able to identify projects with significant production benefits as well. As an example, we are currently investigating options such as doors on our kilns, installing improved energy monitoring equipment and re-using waste heat.

'We have some way to go in further identifying potential savings, but already we know that the business benefits are significant. To capitalise on the opportunities we have made a decision to employ additional resources.'

Greg Smith, General Manager Operations

Midland Brick, Perth

Table 1: Potential business benefits and company case studies

Benefit	Explanation	Company case study
Cost reduction	Direct energy savings are the obvious benefit of energy efficiency improvement, but there are many others. These may include: • improved plant utilisation; • deferred or avoided need to upgrade plant; • reduced water use; • reduced potential permit costs; • reduced waste charges; and • reduced material inputs or handling costs.	✪ **Murray Goulburn Co-operative** – identified energy efficiency opportunities which could generate savings of up to $400,000 on its energy bills each year. ➲ **Read more**[1] ✪ **Australia Post** – saved $500,000 as part of a Greener Motoring program conducted through the Australian Fleet Managers Association. Savings came from initiatives such as choosing more fuel-efficient vehicles, or moving from single trailers to double trailers. ➲ **Read more**[2]
Avoided or deferred capital expenditure	Energy efficiency can reduce capital expenditure on plant by improving the efficiency of existing equipment or by reducing capacity requirements.	✪ **Hardy Wine Company** – identified efficiency improvements to its refrigeration system that could allow it to obtain more cooling from the current system without adding another compressor. ➲ **Read more**[3]
Productivity improvement	Often energy waste is a sign of other problems, so energy efficiency improvements can reduce maintenance costs, increase plant output, or improve product quality. It can also improve working conditions for staff, for example by reducing heat from processes, improving daylight or reducing noise.	✪ **Alcoa** – installation of process control software at the Pinjarra refinery in WA has provided Alcoa with significant improvements in efficiency of the bauxite digestion process. ➲ **Read more**[4] ✪ **Pacific Brand Apparel** – installation of more efficient ultrasonic humidifiers in a knitting mill generated significant energy savings and also reduced production waste. Yarn breaks if humidity is inadequate and the new system allowed for better control of humidity. ➲ **Read more**[5]
Energy contracts and pricing	Energy efficiency can significantly reduce costs if opportunities are examined with a good understanding of energy contracts and the way that energy is billed. For example, contracts may include penalties for reducing energy demand, or annual pricing linked to periods of peak demand.	✪ **Orlando Wyndham Group** – shifted refrigeration out of peak load times at one winery, resulting in significant cost savings by restructuring the load to the cheaper off-peak tariff with no impact on wine quality. ➲ **Read more**[6]

Table 1: Potential business benefits and company case studies (continued)

Benefit	Explanation	Company case study
Occupational health and safety	Looking at the way that energy is used can highlight occupational health and safety risks in the workplace related to issues such as temperature and steam.	✪ **Bakers Delight** – better insulation of bread ovens improved staff working conditions by reducing temperatures within the bakeries. ➲ **Read more**[7] ✪ **Murray Goulburn Co-operative** – by focusing on the steam system in its dairy processing plant, the Energy Management Team saw an opportunity to raise awareness of safety aspects of steam use as well as efficiency. ➲ **Read more**[1]
Employee involvement and motivation	Involving staff in programs to identify energy efficiency opportunities can make them feel more involved in decision making and contribute to improved levels of job satisfaction.	➲ **Amcor** – as a result of an assessment at Botany paper, staff reported that they had learned more about how the site worked and had greater opportunities to improve operations and procedures. For many, this improved job satisfaction. ➲ **Read more**[8]
Improved profit margin	Profits are usually a small proportion of total turnover or input costs, so the cost reductions from energy efficiency may look small relative to turnover. Since they are often a significant proportion of profit margin, however, the results can be visible to shareholders.	✪ **Coles Supermarkets** – while energy costs are normally a small percentage of total operating costs they make up a significant proportion of the tight profit margins of many supermarkets. This provided one of the motivating factors behind the 'Greening of Coles' initiative. ➲ **Read more**[9]
Improved product quality	Energy efficiency improvements can also lead to improved product quality.	✪ **Barrett Burston Malting** – one of the smaller kilns at the Geelong malting plant was more difficult to control in warmer weather, resulting in excessive gas consumption. Improvements to burner control are expected to save up to $100,000 in gas consumption per year, improve malt quality and produce higher product yields. ➲ **Read more**[10]
Achievement of greenhouse gas reduction objectives	Where energy efficiency improvements avoid use of fossil fuels or electricity generated from fossil fuels, they may contribute directly to a firm's greenhouse reduction performance. Improved knowledge of fossil fuel related carbon liabilities and cost effective options to reduce carbon costs	✪ **Coca-Cola Amatil** – improvements to lighting efficiency at its beverage bottling plants are expected to reduce greenhouse emissions by 2000 tonnes per year. ➲ **Read more**[11] ✪ **Bunker Freight Lines** – decreased greenhouse emissions from 34,641 to 34,009 tonnes between 1998 and 1999 by improving the fuel efficiency of its fleet. ➲ **Read more**[12]

Acknowledgements

The Department of Resources, Energy and Tourism would like to thank all of the companies that provided input to development of the program – particularly those involved in the assessment trials and previous partnership programs.

Feedback

The handbook will be revised over time to incorporate the experiences of and suggestions from participating companies.

Contact for further information or feedback:

Phone: 1300 799 186

Email: energyefficiencyopportunities@ret.gov.au

How this handbook supports the Energy Efficiency Opportunities program

The assessment handbook is one of a number of important documents for companies participating in Energy Efficiency Opportunities. Others include:

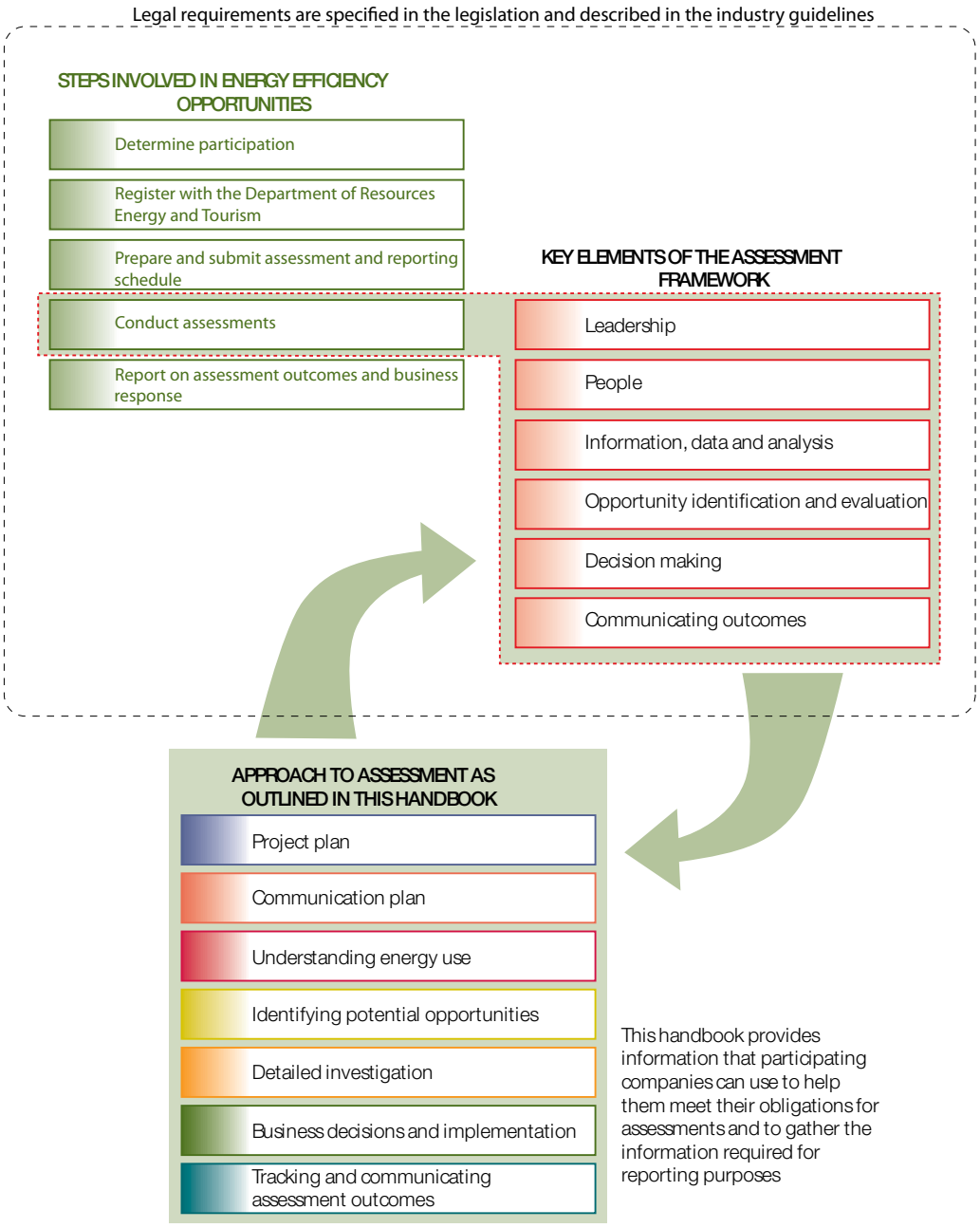
- the **legislation** – consists of the *Energy Efficiency Opportunities Act 2006* and associated Regulations. Participation in Energy Efficiency Opportunities is mandatory for corporations that use more than 0.5 petajoules (PJ) of energy per year, with specific requirements contained in the legislation.
- **industry guidelines** – the *Energy Efficiency Opportunities Industry Guidelines* are designed to provide businesses and their advisers with a plain English guide to assist them in meeting the requirements of the program, including the requirement for a rigorous and comprehensive assessment.
- **supporting information** of which this handbook is a part – together with case studies and information sheets that will be published progressively to assist participants with specific areas of the program.

To ensure that assessments are rigorous and comprehensive, participants must meet the key requirements of the Assessment Framework as outlined in the Energy Efficiency Opportunities legislation and guidelines.

Figure 2 summarises the relationship between the key program steps, the Assessment Framework and this handbook.

The Assessment Framework should be used as a checklist when planning your assessment and at key times of review to ensure that you meet legislative requirements.

Figure 2: Relationship between the legislation, industry guidelines and assessment handbook requirements.



The assessment stages in the handbook are designed to help you conduct an assessment that meets the requirements of Energy Efficiency Opportunities and optimises business outcomes. A summary of the relationship between the Assessment Framework and the assessment described in this handbook is provided in Table 2. You can also refer to Appendix B which shows some of the ways that companies involved in the Energy Efficiency Opportunities trials have been working towards meeting the requirements of the Assessment Framework.

Table 2: Relationship between the Assessment Framework and the assessment stages described in the handbook

The seven-stage process	Relevant key element in the Assessment Framework
Stage 1	
Preparation of a **project plan** that outlines: • actions required; • when they will be undertaken; • who will be involved; and • the financial and technical resources that will be needed for the project. Stage 1 also involves a critical review of strengths, weaknesses, opportunities and threats that need to be considered when developing and implementing the plan.	At this point it is important to review the corporate *Assessment Plan* to confirm your site is required to do an assessment, what activities it has committed your site to do to meet the Assessment Framework, and when the assessment needs to be completed. You also need to understand the Energy Efficiency Opportunities program as a whole. This includes: • the energy use rule that defines the types and sources of energy that must be assessed; • the need to assess all energy use on site (excluding 0.01 PJ for sites that use more than 0.5 PJ, or up to 0.1PJ or 2% of site energy use if approval has been provided by DRET); • the Assessment Framework and key requirements that need to be met, and evidence kept; and • reporting obligations within your corporation, to the Department of Resources, Energy and Tourism and to the public. The project plan also establishes or confirms the objectives of the assessment and how they link to business objectives, and allocates sufficient resources (both financial and human) to ensure that the assessment can be carried out successfully. These are requirements under the **leadership** element of the Assessment Framework.

Table 2: Relationship between the Assessment Framework and the assessment stages described in the handbook (continued)

The seven-stage process	Relevant key element in the Assessment Framework
Stage 2	
Preparation of a **communication plan** outlining the individuals, groups or organisations that need to be involved in the evaluation and how they will be effectively involved. Communication is an essential part of the assessment and is used at every stage.	At the commencement of the assessment, a demonstration of corporate and operational support is critical (the **leadership** element), through the setting and communication of assessment and/or EEO objectives by senior and operational management. Throughout the assessment, relevant people must be involved through communication activities (the **people** element). On completion of the assessment, the outcomes need to be communicated across your organisation including to senior management, the board and staff who have been involved in the assessment (**communicating outcomes** element). The data and outcomes will also be used for public and government reporting. This stage involves planning to ensure that people and communication requirements are effectively met.
Stage 3	
Collection and analysis of information that will help in **understanding your energy use**. This is likely to include information on the business itself such as policies, systems and plans as well as data on energy. This information will provide important background for the activities undertaken in the next stage.	This stage aims to meet the key requirements associated with the **information, data and analysis** element. The information collected at this stage is also essential for government and public reporting (**communicating outcomes** element). Additional guidance on representative assessments, including energy-mass balances and measuring energy savings will also assist. See www.energyefficiencyopportunities.gov.au
Stage 4	
Identifying potential opportunities for energy efficiency by the project team in collaboration with a broad range of people from the company as well as external experts if required.	This stage is primarily concerned with the **opportunity identification and evaluation** element, but must also involve a broad cross section of people (**people** element). It is informed by information collected during the previous stage, but may also involve further analysis of data (**information, data and analysis** element). Each of these key elements work together across this and the next stage as opportunities are broadly identified in the first instance and then progressively evaluated in more detail. In some cases, sufficient information will be available to justify immediate implementation of the opportunity without the need for further investigation (**decision making** element).

Table 2: Relationship between the Assessment Framework and the assessment stages described in the handbook (continued)*

The seven-stage process	Relevant key element in the Assessment Framework
Stage 5	
Detailed investigation of the potential opportunities that may involve: • collection of additional data; • sub metering and the establishment of tracking systems; as well as • evaluation of technical and financial feasibility.	Detailed investigation is a requirement under the element **opportunity identification and evaluation**. This stage (like **Stage 4**) is likely to involve a range of people internal and external to the organisation (people element), and more detailed collection and analysis of data (**information, data and analysis** element).
Stage 6	
If the investigation finds that an opportunity is feasible and meets the four-year payback requirement, a **business decision** will need to be made on implementation. **Implementation** may commence after the initial scoping of opportunities if a project falls within the discretionary powers of an individual manager or operator. Other opportunities that require significant capital expenditure may need to be approved by senior or operational management in the organisation.	This stage mostly corresponds with the **decision-making** element. Implementation of energy efficiency projects is not a key requirement, however, to meet the reporting requirements. It is important to consistently track the status of opportunities – whether implemented or otherwise, and reasons for their status.
Stage 7	
Opportunities need to be documented for **tracking and communication**. Energy use, savings identified, whole-of-business costs and benefits of the opportunities identified and business decisions made at the site level need to be reported to senior management and boards. Outcomes also need to be communicated to those involved in the assessment process. A summary of opportunities and business decisions must be reported publicly and appropriate records must be kept for verification.	This stage corresponds with the **communicating outcomes** element.

* Since this handbook was first developed, additional guidance material has been produced to assist companies to undertake representative assessments, energy-mass balances, and estimate, measure and track energy savings from opportunities. This information can be found at www.energyefficiencyopportunities.gov.au.

The assessment

Stage 1. Project plan

Purpose

A project plan is a valuable tool. It:

- helps you to design an assessment which is appropriate for your organisation and is able to support business development. You can only do this if you think carefully before you start about your business's objectives and priorities, risks, production and management systems, culture and people. **A successful assessment links the way that energy is used to other core business drivers and benefits throughout the process.**
- helps you to communicate to all stakeholders involved in the assessment – it provides key information about the assessment, how people will be involved and how the assessment will help them to achieve their business objectives.
- is a mechanism for allocating resources and negotiating corporate support for the assessment process.
- is a mechanism for ensuring that you will meet your legal obligations. It should include a description of how your assessment meets the key requirements of the Assessment Framework (see Appendix A) and should outline how you will meet your reporting requirements.

Principles

- Nominated individuals must be given formal accountability for ensuring the success of the assessment. These people need to be motivated and have appropriate authority, influence and access to adequate resources.
- The assessment needs to be designed so that it works with your business drivers and organisational culture. This means understanding the business context and designing an approach that works.
- Existing business systems and processes should be used and adapted wherever possible. The assessment will not succeed in the long term if it is simply seen as a 'bolt-on' activity rather than an integral part of the business.
- A successful assessment taps into expertise at the site and the wider corporation at all levels and in all areas, including technical and operational staff, and incorporates relevant external expertise as required.
- Creating a good project plan means being realistic in estimating the support and resources you need in order to complete the project successfully and on time.

Engaging people

In most cases the person responsible for development of the project plan will be the nominated project manager for the assessment. He or she may choose to involve and consult with other key people or form a project team to help develop the plan and conduct the assessment.

Outcomes

1. An established project team.
2. A project plan completed and approved by relevant people in your organisation.
3. Confidence that you understand the requirements of the project and have the authority and resources to proceed.

Process

1. Project manager/project champion role

It is important that the role of the project manager is defined as clearly as possible from the start of the assessment. Key questions to consider are:

- Who do they report to?
- What expectations have been communicated by management?
- What level of support is being provided by management?
- How much time, human and financial resources are being made available?
- How does management see this project linking to existing business priorities?

As well as project management skills, successful project managers are normally motivated individuals with appropriate expertise, authority and influence (see Box 2).

Box 2: Midland Brick – energy champion operating at site level

✪ At **Midland Brick** the site level coordinator of the assessment is a project engineer with a background and strong interest in energy efficiency. He has worked on new projects in the past which have involved a range of people in new tasks. He brought these networking and communication skills to the trial energy efficiency opportunities assessment and succeeded in maintaining momentum for a comprehensive assessment process.

Energy champions may also work across multiple sites. An example of a corporate-level energy champion is provided in Box 3.

Box 3: Xstrata Coal – energy champion operating across sites

✪ **Xstrata Coal** NSW has a dedicated Project Manager to act as a link between corporate management and on-site staff to ensure energy efficiency initiatives are actively being supported and implemented.

The project manager is required to build strong relationships with employees at all levels throughout the business. He assists site personnel design an assessment approach to match their organisation. Having previously worked on safety, maintenance and procurement, the Project Manager has the experience required to understand the important links between technical performance and business needs, when designing an energy efficiency opportunity assessment.

2. Energy Efficiency Opportunities requirements

It is critical that the project manager has a strong understanding of the specific legislative requirements that need to be met at both corporate and site level in terms of the:

- timing of the assessment;
- way in which the assessment is carried out; and
- accuracy of information that is ultimately reported to government and the public.

The project plan needs to complement and support your organisation's assessment plan that outlines the timing of assessments and reporting.

An important starting point is to meet with the corporate-level coordinator of Energy Efficiency Opportunities. He or she may have expectations that assessments are provided in a way that ensures reporting requirements are able to be met efficiently and accurately.

In relation to the assessment itself, the project manager needs to become familiar with the Assessment Framework (Chapter 5 in the Industry Guidelines, starting page 38) that details:

- key requirements that must be met through the assessment; and
- the types of evidence that will need to be kept in order to demonstrate compliance with the program.

Other key information that helps you plan for the assessment includes:

- the energy use rule that defines the types and sources of energy that must be assessed – this includes both stationary and non-stationary energy (page 21 of the Industry Guidelines for detail);
- the need to assess all energy use on site (excluding 0.01 PJ for sites that use more than 0.5 PJ or up to 0.1PJ or 2% of site energy use if approval has been provided by DRET in the assessment plan) (refer to section 4 of the Industry Guidelines) and
- the need to evaluate all identified projects to a level of accuracy of ±30% (as described in the Assessment Framework).

3. Energy Efficiency Opportunities assessment planning diagnostic

The Energy Efficiency Opportunities assessment planning diagnostic (see Appendix C) can be a useful planning tool to help consider the types of management systems and processes that need to be in place to support the assessment process and energy efficiency over a five-year period.

In addition to the processes required for the initial identification and investigation of opportunities, think about the management systems and processes required to achieve:

- the ongoing identification of opportunities; and
- efficient tracking and reporting of opportunities on an annual basis.

The diagnostic can help site staff to evaluate existing energy management practices and how these align with the key elements of the Energy Efficiency Opportunities Assessment Framework. The diagnostic is completed by a range of staff from across the organisation, with each person scoring how well she or he believes the company is currently achieving certain requirements. The results are then discussed to identify any weaknesses and actions that the organisation could take to undertake a successful assessment and to support ongoing attention to energy efficiency.

4. Purpose and objectives

As well as meeting the requirements of the Energy Efficiency Opportunities program, you need to establish the purpose and objectives for your assessment and show how they link into current business objectives.

To maximise business benefits from the assessment, it is important to consider how the assessment can be used for business improvement and development – rather than just as a ‘compliance’ activity. By focusing only on compliance, it is likely that business benefits may be missed.

In establishing objectives for your assessment, you need to draw on and align with corporate, business and site-level objectives, policies, strategic plans, key performance indicators and mission statements to help you highlight how a successful assessment will support the achievement of other corporate commitments. You should check whether specific objectives for the assessment have already been set at a corporate level.

It is important to link objectives established for the assessment to existing business priorities. Some of the objectives that could be drawn on or developed to demonstrate leadership commitment to the assessment of energy use improvement include:

- strategic plans or mission or vision statements to grow the business in a sustainable yet profitable manner;
- specific energy, environmental or sustainability objectives;

- specific objectives that meet key business risks such as energy security, increasing costs, corporate reputation and procurement;
- specific targets to reduce greenhouse emissions or energy use;
- corporate targets to reduce costs; and
- specific objectives to maximise the benefits from the assessment and contribute to meeting key corporate objectives.

You should also consider whether your organisation is involved in other government programs and how the work done for one might satisfy or complement other requirements.

At this early stage of the project it can be very useful to write up your understanding of the purpose and objectives of the assessment and use this as the basis for a discussion with management or a corporate assessment coordinator. This level of clarity also helps in communicating with staff about the project – particularly those whom you might invite to be part of an assessment project team.

5. Establish a project team

There are a number of advantages in establishing a project team to plan and conduct the assessment. A project team:

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

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

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

You may not need to establish a totally new team. You may:

- build on an existing energy management team; or
- modify the terms of reference of another group such as a health, safety or environment committee, or business improvement team.

Project team members could include:

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

Early establishment of a team means that it can become directly involved in planning the assessment. It can also be involved in other early assessment activities (see following points).

6. Site familiarisation tour

A visit to meet key people and view facilities first hand should be organised for anyone not familiar with the site. Encourage questions about:

- the manufacturing processes and technologies;
- distribution and logistics; and
- any quality, safety, maintenance or other operational issues.

It is likely that opportunities will begin to emerge – even at this early stage in the process.

7. Potential benefits

Document potential benefits to your company of conducting the assessment. This is useful in gaining the support of senior management and other staff members (see Table 1 for examples).

8. SWOT (strengths, weaknesses, opportunities and threats) analysis

Look at the business systems, resources, personnel and culture of your business or site, consider any potential strengths, weaknesses, opportunities or threats to the assessment process and develop strategies to overcome them (see Table 3 for examples).

The introduction of any new process, such as quality systems or occupational health and safety procedures, involves organisational change. By considering organisational change issues up front as part of the planning process you can often develop strategies to overcome barriers and problems or prevent them happening in the first place.

Similarly, identify any potential synergies with other company activities (e.g. facility upgrades, cost reduction targets) and potential allies in the organisation. Look at opportunities to use, learn from or build on existing business systems or processes, such as:

- project evaluation criteria;
- meeting schedules (e.g. regular maintenance meetings);
- data collection systems;
- an environmental management system;
- operational improvement programs/systems; and
- responsibilities and accountabilities in job descriptions.

Table 3: An example SWOT analysis for companies undertaking an assessment

Possible strengths	Strategy
Energy management systems are already in place.	Use Energy Efficiency Opportunities to reinforce and communicate existing activities, build status internally and help improve on the weaker areas in the company's systems. Use Energy Efficiency Opportunities to visibly reward good performance and reputation.
Energy use is already measured and opportunities identified for key energy processes.	Use Energy Efficiency Opportunities to look at areas that are not traditionally covered, such as those that support key energy-using processes.
The company was successful in gaining public recognition for performance in other sustainability areas.	Build on these achievements to motivate staff.
The company has a new corporate push for sustainability.	Link Energy Efficiency Opportunities requirements to corporate sustainability goals and use the assessment to achieve sustainability outcomes beyond energy efficiency improvement.
Excellent systems are in place for other aspects of business performance.	Use Energy Efficiency Opportunities to create pressure to adapt and extend existing good practices to energy use.
Possible weaknesses	**Strategy**
Major restructuring is planned for the site or organisation.	Ensure that responsibilities for the assessment have been allocated and that Energy Efficiency Opportunities requirements are embodied in the restructure.
Production performance has been poor.	Use the assessment to identify opportunities to improve performance.
The site has safety issues.	Involve safety staff in the assessment.
Senior management does not provide support.	Link assessment to management goals and objectives.
Lack of sub metering and in-house expertise mean it is difficult to work out where opportunities may lie.	Acknowledge this and develop an implementation strategy, internal training, plan to use external resources, etc.

Table 3: An example SWOT analysis for companies undertaking an assessment (continued)

Possible opportunities	Strategy
Plans to upgrade plant or equipment and/or expand/build a new site.	Involve designers, suppliers, engineers or other key people in the assessment process so that the upgrade builds in energy efficiency considerations and opportunities.
The company has or is developing an environment management system.	Develop links with the assessment (e.g. using it to assist in identifying environmental aspects and impacts).
There are problems with quality control, heat, noise, high maintenance costs, etc.	Estimate the value of improvements and focus the team on integrating this improvement with energy saving.
Possible threats	**Strategy**
Management (or another group within the firm) is aware of a significant opportunity for business improvement but lacks acceptance from key players within the firm.	Use Energy Efficiency Opportunities to raise the status of the issue, or capture resources to enhance business outcomes.
The firm has previously claimed publicly that its performance on energy is excellent, but the assessment exposes weaknesses.	Reframe the assessment as building on existing achievements rather than exposing weaknesses. Highlight that acting sooner rather than later positions the firm better.
Insufficient resources.	Look for in-kind resources and others that would benefit from improved efficiency (e.g. operations manager, maintenance, environmental management system), investigate government grants, outsourcing and internal resources (e.g. using energy performance contractors), develop a strategy for getting additional resources from management.

Table 3: An example SWOT analysis for companies undertaking an assessment (continued)

Possible threats	Strategy
The firm already has many cost-effective activities in the context of low energy prices or being a big energy intensive user. The 'low hanging fruit' have already been picked so the cost of doing an assessment and reporting is perceived to be greater than the benefits.	Energy Efficiency Opportunities reporting enables you to report what you are already doing as well as what Energy Efficiency Opportunities has delivered, so gives recognition for previous effort. Use Energy Efficiency Opportunities to learn what others are doing and what is delivering results. Use Energy Efficiency Opportunities to take a fresh look and build on what is working or not working and could be improved in your business. Consider new approaches to identifying opportunities such as improving energy management practices, and encouraging greater shop floor participation and input, encouraging innovative/blue sky thinking. If you usually focus on big energy-using processes, consider taking a closer look at other less intensive but still significant energy-using processes.
Potential opposition may come from staff due to low staff morale or cynicism.	Get staff involved, seek their ideas, highlight benefits to them and their role in the company. Make sure you respond to their suggestions and provide feedback to show you are serious. Staff members often respond strongly to quite small changes in the workplace – show that they can contribute significantly to greenhouse gas reduction (compare to the much smaller impacts of energy efficiency at home). Making a contribution to sustainability issues may motivate them more than increasing company profit.
Possible unfavorable comparisons with other firms and competitors.	Get moving, act quietly and implement some strategically useful measures so that you can point to success and business benefits – and surprise everyone.

9. Additional expertise

In addition to those already on your project team, you might need to use additional expertise from elsewhere in the company or from external sources (e.g. some corporations have global technical support teams). Use the results of your SWOT analysis (weaknesses) to identify gaps in your expertise that you might need to fill externally.

Skills and attributes available from external people include:

- **researchers and academics** tend to look at fundamental principles more than day-to-day issues and although this may sometimes mean that their relevance is not immediately obvious, they can help to re-think assumptions;
- **consultants** can be another good source of expertise – to make the most effective use of consultants, work out in advance how and when they can be used, and discuss important issues up-front with them;
- **equipment suppliers** understand the capacity and important elements of equipment and are familiar with developments in their field that may have potential application; they may also be able to make modifications to equipment specifications to enable implementation of specific energy efficiency opportunities;
- **modelling experts** can work with you to develop and apply systems thinking and analysis to a facility, helping you to focus on areas where there are problems and opportunities;
- **external specialists** can bring deep knowledge of the physical and chemical principles being applied, knowledge of energy efficient technologies, processes and analytical techniques, and different approaches being used in other industries to carry out similar tasks; they can also question assumptions and 'traditional practices';
- **independent facilitators** can play an important role in drawing out views, keeping people focused on the process, dealing with concerns, and ensuring outcomes within agreed timeframes.

The Department has established a directory of consultants that lists a range of expertise you might call on to support your assessment. You can access this Services Directory through the Energy Efficiency Opportunities website www.energyefficiencyopportunities.gov.au.

Box 4: Orica – internal expertise (external to site)

✪ **Orica** was able to draw on an internal ammonia expert for its energy efficiency opportunities workshop. This person worked for a company that Orica partially owns and had international experience as well as a good knowledge of the site. He was able to contribute background information on international energy efficiency benchmarks as a stimulus to the identification of opportunities.

Box 5: Bakers Delight – expertise of equipment supplier

✪ The involvement of an oven manufacturer in **Bakers Delight** Big Energy Project resulted in the design of a new electric oven with a 74% lower energy cost.

➲ **Read more**[7]

10. How to assess energy use across a site

Considering the sequence by which you assess energy use across the site is important. It might be appropriate for smaller sites to carry out the assessment across the whole site, while for larger or more complex sites it might be more effective to segment the site into more manageable components.

Segmenting the site could be done by:

- focusing on the larger, more energy intensive systems or processes on the site in the first instance;
- focusing on areas that may have not been examined previously;
- looking at energy systems that cut across a number of work areas (e.g. steam, refrigeration or compressed air);
- focusing on areas likely to provide quick wins;
- focusing investigation on the way in which areas of the site are internally managed and organised; and/or
- focusing on an area scheduled for major upgrade or modification.

It is important to ensure that in segmenting the site for the assessment you do not miss opportunities that cross organisational or cultural boundaries, such as rearranging operating systems, physical infrastructure or organisational arrangements. Costs and savings may have to be paid to different cost centres, or one change might involve reorganisation elsewhere (e.g. replacing a boiler with heat recovery systems and local sources of heat has implications for space allocation, maintenance contracts and costs and gas contracts). Some of the biggest opportunities can come from such measures.

Box 6: Midland Brick – demonstrating early benefits

✪ The **Midland Brick** (Boral) site in Perth has a number of brick kilns of varying age and capacity. In planning the assessment it was decided that the initial activity should be focused on the kilns which were most likely to provide opportunities. This helped obtain significant savings that were then used to promote the benefits of the assessment process. The findings will also be used as the assessment process is rolled out to the other kilns on site and to other brickworks in the Boral group.

11. The approach

Identify the process that you will follow throughout the assessment, including key tasks and timelines. Input from business improvement or change management specialists can be particularly useful in helping ensure that you design an approach that optimises business outcomes from the assessment and establish systems that facilitate ongoing improvement in the longer term. The stages outlined in this handbook are also an important resource that you might draw on.

Box 7: Xstrata Coal – designing an effective process to meet multiple requirements

- ✪ Using a comprehensive planning process, **Xstrata Coal** was able to design a single process that would meet the requirements of the Energy Efficiency Opportunities program and Energy Savings Action Plan created under what was then the NSW Department of Energy, Utilities and Sustainability (DEUS) .
- ➲ **Read more**[13]

12. Mapping your approach

It is important to review your plan at critical points in the assessment to ensure that you keep track of the activities that you are undertaking and that you are addressing the key requirements of the Assessment Framework as you go. A template is provided in Worksheet 5 on p. 30.

13. Measuring progress against objectives

The objectives you set for the assessment may need to be supported by more specific criteria for success. Key questions to ask include ‘How will we know we have succeeded?’ and ‘How will we measure and monitor progress?’. If possible, integrate the objectives of the assessment into existing policies and procedures.

14. Resources

Identify how much time you personally need to allocate to the project and the time commitment required from other staff members and consultants. Identify the financial resources you need. Your total resource requirements may include:

- staff time;
- external assistance;
- sub metering for data tracking at sites;
- expertise for analysis of data and modelling of systems; and
- reporting (internal and external).

Although resources may have already been allocated for the assessment, it is important to review the resources you require for your 'ideal plan'. If you need further resources then the planning work you have done will help to justify your position should you put such a proposal to management.

Prepare your project plan including purpose and objectives, tasks, project team responsibilities, timelines, human resources, budget and how achievements will be measured.

15. Management sign-off

Discuss the plan with management and obtain formal approval for your assessment. Check that the plan is consistent with the assessment and reporting schedule and other corporate commitments.

Relationship to the Assessment Framework

Implementation of the project plan will assist you to meet the following key requirements (KR) of the Assessment Framework:

- ☑ KR 1.1 (objectives)
- ☑ KR 1.2 (resources)
- ☑ KR 2.3 (roles and accountabilities) and
- ☑ KR 3.1 (business contextual information)

Reminder: Ensure hard copies of all documents or evidence that demonstrates compliance against the key requirements of the Assessment Framework are kept for a period of at least seven years, for verification purposes.

Project plan worksheets

Worksheet 1. Your role

Define your role in the assessment. Key questions to consider are:

- Who will you report to?
- What expectations have been communicated by management?
- What level of support will be provided by management?
- How much time, human and financial resources will be made available?
- How does management see this project linking to existing business priorities?

Worksheet 2. Objectives for your assessment

Worksheet 3. Potential project team members and their roles

Skills or expertise required	Who can provide it?	Their role on the team
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

Worksheet 4. Strengths, weakness, opportunities and threats at your site/ company that should be considered in designing an assessment

Strengths	Weaknesses
Opportunities	Threats

Worksheet 5. Map your project plans against the key requirements of the Assessment Framework

A possible template is provided below using the key element of Leadership as an example.

Key requirement	Action	Evidence	Future action
1. Leadership			
1.1 Energy assessment or energy use improvement objectives are established and communicated by senior and operational management to all personnel who are responsible for or have an influence on energy use and the energy assessment.			
1.2 Resources (people, time and money) are made available to meet energy assessment or energy use improvement objectives.			

Worksheet 6. Plan for the assessment

See example below – ideally you would use your own project management software or management system

Action	Who	When	Cost	Measure

The assessment

Stage 2. Communication plan

Purpose

- The communication plan helps to communicate with, and engage, a broad group of stakeholders about the assessment process. Stakeholders include people within the company as well as external organisations who could influence or be influenced by the assessment.
- An energy efficiency opportunities assessment can be viewed as a change process. It is about considering how to engage people in something they may not have been focused on previously. Communication is therefore critical to help them understand what is being done, why it is being done, how they can contribute and how they might benefit from the process.
- The effectiveness of an assessment and of ongoing attention to energy management ultimately depends on the level of support, enthusiasm and interest of key people within your organisation.

Principles

1. People need to understand 'what's in it for them'. This will vary according to the experience of your target audience and their areas of activity.
2. Involvement of relevant people is a requirement of the Energy Efficiency Opportunities program so that different perspectives are gained and input to the assessment is broad.

Engaging people

The communication plan is concerned with engaging people throughout the assessment process. It is typically prepared by the person responsible for developing the project plan, but others with communications expertise within the organisation could also develop the plan. Other people who may be appropriate to develop the communication plan are:

- communications specialists who may have been involved in any recent restructure or change process; and
- human resources staff, or people involved in training.

Outcomes

1. Clear communication objectives from senior and operational management that support the assessment process and energy efficiency improvement.
2. A plan is in place for effective communication with, and engagement of, internal and external stakeholders.
3. Support from key staff for the assessment process.
4. Site personnel are informed about the assessment process and how they can become involved.

Process

1. Communicating management support for the assessment

One of the most important aspects of your communication plan is to ensure that senior management (at both corporate and site level) clearly communicates support for the assessment. This gives the assessment legitimacy within the organisation and makes it easier to ensure that the people who need to be involved in the assessment are available to contribute effectively.

Communication of management support can happen in a number of ways depending upon the culture and processes within your organisation. One approach might be to develop and disseminate a statement to staff (e.g. through meetings, at the start of an energy efficiency workshop or in a newsletter). This statement could include:

- the purpose and importance of the assessment;
- energy or greenhouse objectives and targets;
- a request for the active and enthusiastic support of site personnel; and
- an expectation that the assessment will lead to implemented projects that will reduce costs, reduce greenhouse gas emissions and achieve other business benefits.

Updated statements at relevant intervals demonstrate the ongoing commitment and interest of management.

It is also important to tap into existing management commitments that may align with the outcomes you are trying to achieve through the assessment. These include:

- policy statements linked to key business and sustainability objectives;
- specific energy-related key performance indicators; and
- existing resource allocations that show management is supportive of the assessment process.

Some of the ways that companies are demonstrating support for energy efficiency through their existing business systems and processes are illustrated in Box 8.

Box 8: Toyota, Investa Property Group and Bunker Freight Lines – leadership examples

Company	Action
✪ **Toyota**	**Toyota** Australia has set specific energy efficiency and greenhouse reduction targets and developed robust tracking and reporting systems for its manufacturing sites. The sustainability committee tracks energy efficiency performance and identifies new strategies at its bi-monthly meetings. At an operational level, monthly progress reports on energy use and production levels are compiled for managers. Toyota intends to use these existing targets and business systems in conjunction with the requirements of the Energy Efficiency Opportunities program to renew its drive to improve energy efficiency performance. ➲ **Read more** in Appendix B
✪ **Investa Property Group**	To promote awareness across **Investa**'s portfolio, each tenant receives a report on energy performance and targets every six weeks through the company's newsletter. Property supervisors, facility managers and other senior staff have targets for sustainability (including energy) to monitor performance. Staff bonuses are linked to the company's annual energy performance. ➲ **Read more** in Appendix B
✪ **Bunker Freight Lines**	**Bunker Freight Lines** has an environmental management system based on ISO 14001 that helps to ensure that energy efficiency and greenhouse reduction is integrated within relevant policies and programs. Fuel efficiency is monitored and discussed at weekly management meetings and action plans are updated. This discussion is informed by reporting of energy performance based on rigorous data tracking and analysis (e.g. daily tracking of fuel efficiency ensures that energy consumption can be positively influenced on a daily basis). ➲ **Read more** in Appendix B

2. Developing a comprehensive communication plan

Senior management support is an important starting point for your communication plan. From that base you can take into consideration:

- **why effective consultation and communication** is important for the project;
- **who** you will need to communicate with at each stage;
- **strategies** you can use with each group to win their support; and
- **how** you will communicate with them (i.e. which tools will you use).

Box 9: Xstrata Coal – communication

✪ 'The assessment process needs to encourage and support the involvement of staff at each site. This encourages greater commitment and buy-in to the process and allows energy champions to emerge.'

Tony Egan

Xstrata Coal

3. Gaining support from staff

Think about all of the different people that you need to influence in the process of planning and carrying out your energy efficiency assessment. This builds on the Stage 1 considerations of who to include either directly or indirectly in the assessment.

Undertake a **stakeholder analysis** (see the stakeholder analysis tool in Worksheet 7 on p. 40) by:

- listing all stakeholders who will influence or be influenced by the assessment;
- rating each stakeholder according to their influence – *can she/he sink the project or ensure that it swims?*
- rating each stakeholder according to his/her alignment – *is she/he likely to be supportive, or not?*

Understanding where people are at. The stakeholders identified through this process will have different levels of awareness and different attitudes to energy use efficiency. Think about potential barriers that you need to address for each stakeholder, particularly for those that are critical to success or that you believe may be antagonistic or negative towards the assessment process. Barriers could be either informational or structural, such as:

- limited human or capital resources;
- people may not think they can meet the payback threshold on new projects;
- there may be a reliance on external contractors or suppliers;
- the business may be locked into older facilities and equipment;
- there may be contractual constraints; or
- high cost capital equipment may have long replacement cycles.

Gaining support. Develop some ideas and strategies for gaining the support, participation and cooperation of different people in the organisation. Think about the issues from their perspective by asking:

- what are they concerned about?
- how are they rewarded? or
- how can you help them to achieve success?

Some ideas for winning over key staff are provided in Table 4.

Table 4: Communication strategies*

Who	Strategies to gain their support
Senior managers	Look at the 'bottom line' benefits – compare potential energy savings with profit (not turnover), other less variable cost savings opportunities, share value, spin-off benefits. Help fix a crisis or threat (e.g. energy supply security, power cuts, sudden energy contract price increases, compliance). Corporate reputation – generate good public relations targeting clients (existing or potential), government, peer chief executive officers (CEOs), etc. Strategic positioning – the need to prepare and respond effectively to carbon costs. Address the triple bottom line, corporate social responsibility, and new regulations trade. Link environmental responsibility to becoming an employer of choice. Use punchy presentations. Access them via someone the CEO trusts and respects.
Financial managers	Talk their language – internal rate of return, risk, money, compliance issues. Present robust data analysis on costs and savings. Convert environmental issues into business risk and opportunity. Compare investments in sustainable energy with other aspects of the business. Document the financial value of spin-off benefits.

* Based on work by Alan Pears, Sustainable Solutions Pty Ltd

Table 4: Communication strategies (continued)

Who	Strategies to gain their support
Technical staff	Identify and work through myths and assumptions. Develop alliances. Help them to communicate issues to management. Help them to achieve improvements they value. Help them to redefine the boundaries – scope for improvement, payback thresholds. Help them with maintenance, occupation health and safety (OH&S) or operational issues. Promote their achievements – they may not!
Production staff and operational management	Understand the pressures they face. Help find solutions to their problems.
Suppliers and subcontractors that operate equipment	Review contracts to reward involvement in energy efficiency improvement. Ask them how they think they can contribute.
Shop floor staff	Make their lives easier, not harder. Link to improved working conditions. Ask them for ideas and provide coordinated feedback that their input is valued. Empower them with information, use of networks, rewards, job diversity. Link those actions on energy efficiency to lower greenhouse gas emmissions contributing to action on climate change. Involve them in projects bigger than their normal job and the opportunity to contribute to greenhouse gas reduction. Take care with ‘guilt trips’. Trial new techniques with ‘early adopters’. Ensure people are trained. If new measures may adversely affect them, make sure changes are introduced in a professional manner by a person whose status is accepted.
Staff responsible for energy procurement	Use assessment to address issues relating to security of supply. Control energy costs. Reduce costs through demand side management as well as energy efficiency. Match actual energy use and opportunites to reduce energy use in the future more closely with energy use contracts.

4. How (communication tools)

Make a list of potential tools or media you could use to communicate with different groups at different stages in the process (see Table 5). These may include:

- meetings – one-on-one or in small groups;
- briefing notes;
- newsletters – electronic or hard copy;
- intranet;
- posters;
- seminars or workshops; and
- public reports.

Each tool has benefits in particular circumstances and for particular purposes. If you are looking for approval, support or 'buy-in' from someone, then face-to-face communication, such as at a meeting, may be the best option. If you are simply aiming to communicate information, then less personal approaches that are able to reach a wider group of people, such as email or newsletters, may be appropriate.

A strategy used by Amcor to engage operational workers in the assessment process is provided in Box 10.

Table 5: Communication tools

Purpose of communication	Target audience	Possible communication tools
Senior management support – authority, resources	Supervisor	One-on-one meeting, briefing note
	CEO	One-on-one meeting, briefing note, powerpoint
	Board	Board paper or inclusion in CEO's report
Project planning and management – your project team	People with skills, knowledge, influence	One-on-one meetings initially, then group meetings and/or teleconferences
Carrying out the energy efficiency opportunities assessment	People with skills and knowledge – internal staff	Phone calls and memos to invite participation Background paper for the energy efficiency workshop
	External consultants	Tender process or direct invitation by phone/ meeting etc. Background paper for the energy efficiency workshop
Gaining and maintaining organisational support – ideas, information, resources	All staff	Staff newsletter, posters, video, suggestion box, brochures Recognition Key performance indicators
Communicating outcomes	Board	Board paper or inclusion in CEO's report
	All staff	Staff newsletter, posters at meetings or workshops
	Government	Report to RET
	Public	Environment report Sustainability report Annual report Website

Box 10: Amcor (Smithfield) – involving and communicating with employees

✪ **Amcor's** 'Green Light' program at its Smithfield packaging plant took a communication-driven approach to reducing energy consumption rather than a technical one. The program started by looking at how the behaviour of employees influenced energy consumption through simple actions such as turning off machinery at the end of a shift. With the support of a staff environmental committee, Amcor then developed a communications campaign to encourage behavioural change.

Initiatives included development of an internal communications brand ('Green Light'), reminder cards fixed to machines reinforcing the need to reduce demand where possible, information cards provided to staff that outline energy use by the machines they used every day and potential ways to save energy, a video about energy management featuring Smithfield employees, regular on-site feedback and a suggestion box.

The behaviour change resulted in a 38% reduction in base-load energy consumption overnight and a 70% reduction over the weekends, and energy savings of $26,000 /yr.

➲ **Read more**[14]

5. Develop your draft communication plan

Put Parts 1 – 4 in this process together into a plan to guide you throughout the assessment and implementation process. A possible format is included in Worksheet 11 on p. 42.

Relationship to the Assessment Framework

Implementation of the communication plan will assist you to meet the following key requirement (KR) of the Assessment Framework:

☑ KR 1.1 (objectives)

Reminder: Ensure hard copies of all documents or evidence that demonstrates compliance against the key requirements of the Assessment Framework are kept for a period of at least seven years, for verification purposes.

Communication plan worksheets

Worksheet 7. Stakeholder analysis

Use the table below to make a list of all the stakeholders who may be affected by or may affect the assessment process, and rate them according to their influence and alignment.

Stakeholder	**Influence rating** **1 = low influence** **10 = high influence**	**Alignment rating** **-5 = not at all supportive** **0 = neutral** **5 = highly supportive**
Internal		
External		

Worksheet 8. The business risks and benefits of energy efficiency for your company

Risks	Benefits
e.g. Fines for non-compliance with the Energy Efficiency Opportunities program	e.g. Cost savings
e.g. Site / Corporate reputation	

Worksheet 9. Communication strategies

What communication strategies could you use to gain the support and cooperation of key stakeholders?

Stakeholder	Key messages	Communication tools

Worksheet 10. Statement from senior management to all staff

When will it be sent out? _____

How will it be disseminated? _____

What will it say (key points)? _____

_____

How often will updates be issued? _____

How will its impact be monitored (to improve effectiveness)? _____

_____

_____

_____

Worksheet 11. Develop your communication plan

A possible format is provided below.

Purpose	Target audience	Key message(s)	Communication tool	When	Responsibility

The assessment

Stage 3. Understanding energy use

Purpose

Establishing a shared understanding of energy use based on accurate energy and production data provides the basis for identifying potential opportunities.

The information collected at this stage is used to ensure that everyone has a broad understanding of energy use. More detailed investigation is undertaken after identification of energy efficiency opportunities (discussed in Section 3.4 Scoping opportunities). Data is also used to report total energy use and to track outcomes where actions are implemented.

Further technical guidance on the collection, analysis and accuracy estimation for energy data is provided in the *Energy Savings Measurement Guide* (ESMG).

Principles

1. Different people typically make different assumptions about the use and costs of energy use. To identify opportunities, it is critical to expose and question these assumptions and develop a shared understanding based on accurate data.

   It is important to consider the system within the organisation as a whole (i.e. the entire energy delivery process from energy feed to finished product). The aim is to optimise the system by evaluating work requirements and matching system supply to these requirements. This might involve eliminating or reconfiguring inefficient uses and practices, and taking out or supplementing existing equipment to better match work requirements and increase operating efficiency. Often an individual has only a partial view of energy issues*.

2. A useful way to collect and analyse energy use data is to start with high level information such as total energy use, and then collect more detailed information to explore when, how and why energy is used. Attention is paid to identification of the energy losses in each element of the system.

Engaging people

Stage 3 is normally undertaken by the project leader with input from a range of people with appropriate data analysis skills and expertise. This input may be obtained through formal and informal meetings and investigation as part of the information-gathering process.

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* For example a maintenance manager may see insulating steam pipes as a cost and an additional workload because the financial benefits may be captured by the boiler house and that may be a separate cost-centre. Often managers of utilities such as steam or refrigeration see it as their role to provide as much steam or refrigeration as the production team ask for without question. This can increase energy and plant costs unnecessarily.

Outcomes

1. The background information is available in a way that can help develop a shared understanding of the way energy is used at a site as the basis for exploring energy efficiency opportunities. For example, a background paper (or other format if more appropriate) summarises key information and identifies issues and questions raised by the data about energy use in the business.
2. Specific opportunities are identified.
3. Accurate site-level energy use data (to ±5%) is established for the site as a whole to meet Energy Efficiency Opportunities requirements.

   Accurate data is available to enable the organisation to establish energy and financial savings from opportunities with up to a four-year payback (as per Energy Efficiency Opportunities reporting requirements). In some cases, this information may already be available. In most cases additional data and information need to be gathered as you move through the process – particularly to ensure completeness and accuracy.

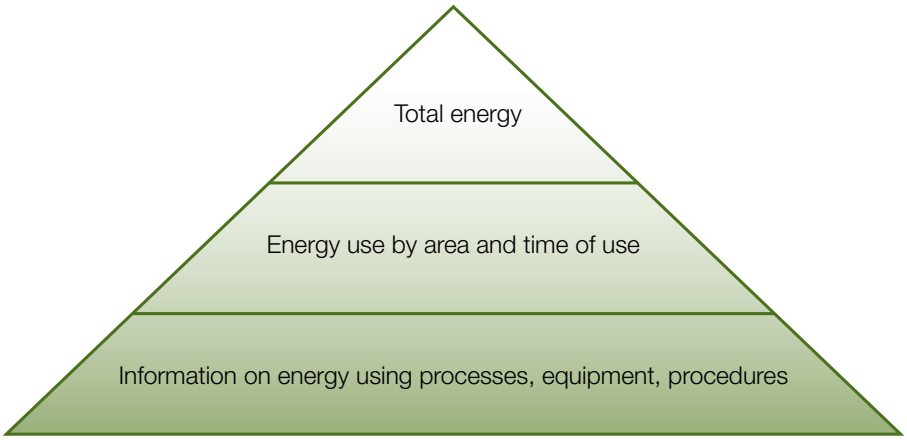
Process

1. Information hierarchy

Data gathering is generally a 'top-down' process that starts with high level information (such as total energy use) and then uncovers detail. This is illustrated in Figure 3.

Each new level of detail will inspire questions and help to provide answers, and ensure that people understand energy and its relationship to activities on the basis of accurate data rather than anecdotal assumptions that may be incorrect. It is possible to dissect information by area and by time to show how energy is used and where potential energy savings may be made.

Figure 3: The information hierarchy



2. Information and data needs analysis

Draw up a list of all the information and data you need to collect. Work out where the information is held within the organisation and how you can access it.

The information you need to collect includes:

- **background information** (e.g. business policies, systems, priorities and plans); and
- **energy data** (e.g. consumption and production data and energy flows).

More detail on each type of information is provided below.

3. Background information

Background information on the company helps in understanding issues such as reasons for energy use, anomalies, trends and patterns so that they can be taken into account when analysing energy use and evaluating energy efficiency opportunities. Background information could include:

- environmental, OH&S and energy management systems;
- key business priorities and plans (e.g. relocation, retrofit or expansion) and how these influence or impact on energy use and the energy assessment;
- key site processes and activities that use energy; and
- energy-related procurement issues including contract pricing or tariff structure, the incentives/disincentives for energy efficiency within existing contracts, and the level of data that can be provided by the energy suppliers.

A data checklist to assist you with this process is provided in Worksheet 12 on p. 70.

Delegate tasks to appropriate members of the project team, for example:

- corporate affairs – copies of company policies and procedures;
- financial analyst or energy procurement – energy accounts and trends in energy prices;
- production manager – details of energy using processes, company plans for expansion or plant upgrades; and
- procurement analyst or manager – copies of contracts and bills.

4. Collection and analysis of energy data

Collect detailed and accurate energy use data and information relating to relevant process parameters that may influence or be influenced by energy use. Many different methods can be used to compile and analyse energy data. Each level of information raises questions which may need to be investigated further. This process helps in challenging assumptions about the ways that energy is used.

Table 6 provides a summary of different types of data analysis that may help and relevant questions. More detail on many of them is provided later in this section. Some forms of analysis (marked in the table in green) can generally be undertaken to gather information prior to an energy efficiency workshop. These include:

- total energy use;
- graphs of energy demand over time;
- analysis of trends;
- plotting energy against production indicators;
- benchmarking against other sites or processes; and
- the first attempt at an energy-mass balance.

More specialised data analysis techniques, such as benchmarking against first principles (theoretical analysis), regression analysis and pinch analysis, may be undertaken as part of the detailed investigation stage.

These and other relevant techniques are presented in further detail in the ESMG. The energy-mass balance sectoral guides also provide guidance on a detailed approach to analysing energy and mass flows across a site. See www.energyefficiencyopportunities.gov.au.

Table 6: Different types of data analysis

Purpose	Where it may be useful	Key questions to ask
Total energy use (annual consumption, costs)		
Overall benchmarking Trends Reporting (required to ±5% for Energy Efficiency Opportunities reporting)	All sites and vehicles	How much is it costing? When compared with the theoretical ideal energy requirements, how much could we in theory save? Does the tariff structure of energy contracts encourage/discourage energy efficiency?
Graphs of energy demand over time (monthly, weekly, daily, hourly)		
Comparisons, trends, target anomalies	Where data is available	How does energy use compare with production or other activities? Are there unusual variations? Are we using energy when production is nil? What additional information do I need to understand what is going on? Are there any significant energy use peaks that attract peak tariffs? If so, are there opportunities to reduce these peaks?

Table 6: Different types of data analysis (continued)

Purpose	Where it may be useful	Key questions to ask
Analysis of trends (seasonal, changing conditions)		
Identify trends and correlate them to factors so their causes can be understood	Where energy consumption does vary and factors that may affect it can be identified	What effects do changes in ambient conditions and other factors have? What additional information (e.g. on possible factors influencing energy use) do I need to understand what is going on? Is additional analysis required to investigate factors influencing energy use?
Energy intensity indicators		
Key performance indicators, benchmarks Feedback to operators Tracking maintenance requirements Reporting (required for Energy Efficiency Opportunities)	From site or process level down to individual items of equipment as required Can be used in relation to procurement of equipment (based on lifecycle energy use of options)	Is this the right indicator? (e.g. energy use per dollar of turnover is very different from energy/unit of product, energy/unit of profit, energy/shift, etc.) Do I need multiple indicators, with each telling me something different but useful? How do I compare against benchmarks over time or similar processes? If an indicator has changed, why? Can I improve against key intensity indicators? Do current indicators enable improvements to be identified when some factors move adversely? Do the indicators account for changes in major factors affecting energy use, such as driver behaviour, output levels or ambient conditions?
Benchmarking		
Establish and use suitable energy indicators to compare performance to: • design specifications • other sites, processes, equipment, shifts, operators, etc. • past performance • 'ideal/theoretical' performance determined by calculations, modeling or simulation • a simulation of a different configuration or operating mode for an existing system	Wherever valid comparisons can be made – often more useful at an equipment, process or system level than at a site level. Benchmarking can also provide feedback for operators, designers, maintenance staff, etc.	Where there are differences, can I identify why they exist? How have the better performers done it? How can I apply this to my situation now, soon, or in the longer term? What is the theoretical minimum amount of energy required for this process?

Table 6: Different types of data analysis (continued)

Purpose	Where it may be useful	Key questions to ask
X-Y plots of energy use versus production (this is really a single variable version of regression analysis)		
To graphically illustrate the relationship between energy use and production rates	Any item of equipment, process or site where a measurable volume or quantity of product is processed and energy is used	How big is the 'fixed energy overhead'? What factors might be contributing to this? How far from the ideal is the gradient (i.e. marginal energy use per unit of output)? What factors might be contributing to this difference?
Energy-mass balance		
To systematically understand where and how energy is used, wasted and lost throughout a system To assist in development of effective models that help identify and measure energy losses and opportunities As a check to ensure completeness and accuracy of data across the whole process (and to help identify data gaps) To meet an explicit requirement of Energy Efficiency Opportunities	Any process where energy is used to carry out a task before, during and after an assessment. Development of the energy-mass balance is usually iterative, as often there is insufficient data to quantify all required parameters in the first iteration. Understanding of the process may also improve over time. The energy-mass balance could potentially be integrated into a broader environmental mass balance showing energy, material, water and waste flows. To quantify and measure the energy savings possible from an idea	Where is energy used and wasted? What material flows and transformations occur at each point in the process? How much energy is theoretically needed to carry out each stage – and how much is actually used or lost, when and where? Are there opportunities to avoid using energy, or to use energy lost from one part of the process somewhere else? Where are the biggest ares of energy use/ loss/potential efficiency gains? Is a balance achieved? Where do I need improved metering/data? Is there a significant gap in data or a significant imbalance between inflows and outflows? Can I sub meter or undertake additional analysis to fill data gaps to get an improved energy-mass balance?
Regression analysis		
Statistically quantify the factors that influence energy use most when there are multiple possible factors	Vehicles, multiple sites that are similar, but not exactly the same, plant or equipment whose performance may be affected by multiple factors Where a company is using a representative assessment methodology, in conjunction with other methods of analysis to confirm causality and verify regression results.	What factors might influence energy use? Do we have sufficient data to carry out regression analysis? How do we explain the results? Is our regression analysis valid? Are the key assumptions underlying the regression valid? For example, are the independent variables independent of each other? Have further statistical tests been undertaken to confirm the integrity of the regression?

Table 6: Different types of data analysis (continued)

Purpose	Where it may be useful	Key questions to ask
First principles (theoretical analysis)		
To calculate the energy use for systems that cannot be directly measured, or estimate energy use with alternative configurations or operating modes To estimate the theoretical ideal energy requirement for delivery of a service or task To set 'stretch' goals To break out of 'marginal improvement' thinking To facilitate brainstorming and creative solutions To 'deconstruct' the processes	Any transformation of energy or material, and any system	Can the energy use of the system be accurately modelled using relatively simple engineering calculations, or is more complex modelling required? Do the underlying principles change with different operating conditions (eg. phase changes as temperature rises or falls)? Are there several distinct operating regimes that might need to be modelled? What is the fundamental thing I am trying to do (e.g. remove moisture from a product; remove oxygen from a substance; shift material from A to B; keep a building productive; provide light for people to work; etc.)? Do I really need to do this? (e.g. if shifting product from A to B, can I relocate B so it is next to A, or reduce the amount of material I need to shift? If members of staff are uncomfortable, can natural light and temperature control be improved?)
Pinch analysis		
A design method based on graphical analysis that can be used to optimise the design of heat exchange networks in complex thermal systems, so as to achieve maximum heat recovery	Processes in which heat is exchanged between either single or multiple hot and cold streams, in order to facilitate heating and/or cooling. This method requires engineering expertise.	Where is the pinch? (minimum temperature difference between hot and cold streams, noting that for multiple hot or cold utilities there might be several utility pinches) Are hot utilities being used above the pinch, or cold utilities below the pinch (this could indicate opportunities)? Where is the optimal location for a heat exchanger within a network of hot and cold streams and between which streams should it be positioned? What is the appropriate balance between the efficiency provided by a small temperature difference, and the cost of the additional surface area required?
Other detailed analysis		
Other engineering, logistical or experimental analysis or diagnostic techniques such as vehicle trials, pilot studies, bench tests, thermographic imaging etc.	When the detailed energy flows cannot be directly determined from existing metering or sub-metering and require further investigation, when innovative solutions need to be tested on a limited basis, or to efficiently analyse complex plant.	What approaches can I use to analyse those energy flows that can't be directly metered? Are experiments or trials needed to verify theoretical predictions? Where is energy being used and/or dissipated in this process? What energy flows can I not determine using existing metering? What technology might need to be acquired to facilitate this analysis?

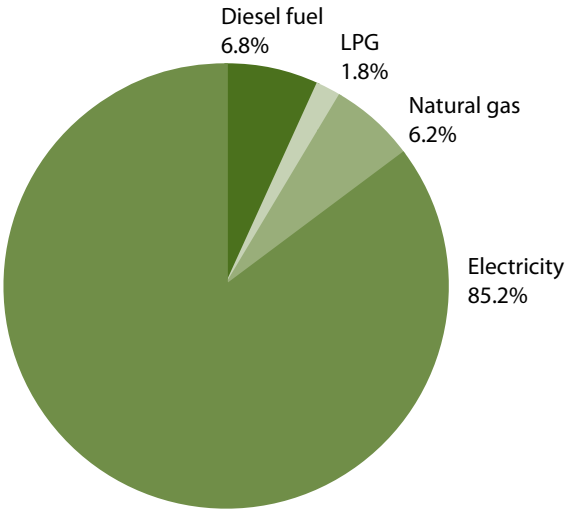
5. Total energy use

Find out how much energy is consumed at the site by looking at your accounts for gas, electricity and other fuels. Collect existing consumption and cost data for each energy source for a 24-month period. Consider the tariff structure. Draw up tables and graphs summarising energy data.

A hypothetical case study (Magma Minerals) is used throughout this section to illustrate the type of data that could be collected and how it might be analysed and presented. Magma Minerals extracts, processes and transports non-ferrous metals. It has operations in four States. This is an example of data collection and analysis for the Queensland site, which operates a quarry, mineral processing and a ship loading facility.

Total energy consumption, costs and greenhouse gas emissions for Magma Minerals are shown in Table 7, and the cost breakdown by energy source is shown in Figure 4. Some of the questions raised by data are listed in the box below.

Figure 4: Magma Minerals – elements of energy costs



Magma Minerals – questions raised by the data:

How do total energy costs compare with other costs of manufacturing/cost of sales/ profit?

Can some uses of high cost/greenhouse intensive energy be converted to other fuels (e.g. forklifts from diesel to natural gas, vehicles from diesel to LPG)?

Can the total energy use be converted to a key performance indicator for our industry/ company/product (e.g. GJ/tonne of mineral shipped)?

Where do we need more detail on where and when energy is used, to identify where losses occur and manage its use?

'Big picture' questions such as can the heat now supplied by natural gas be supplied by cogeneration to reduce total energy costs and greenhouse gas emissions? What other benefits would this bring?

Table 7: Magma Minerals – energy consumption, costs and emissions (total energy use for 2005 = 1.53 PJ)

Energy source	Cost	Proportion	Energy			Specific cost		Greenhouse		
	($)	(%)	Quantity	Quantity (GJ)	Proportion (%)	($/MWh)	($/GJ)	Index kg CO_2	tonnes CO_2/yr	Portion (%)
Electricity	28 187 402	85.2	296 398 MWh	1 067 031	69.8	95.1	26.42	1 058	313 589	90.8
Natural gas	2 037 613	6.2	370 475 GJ	370 475	24.3		5.50	68.80	25 489	7.4
LPG	585 554	1.8	900 852 L	23 422	1.5		25.00	1.60	1 441	0.4
Diesel fuel	2 241 837	6.8	1 765 226 L	67 691	4.4		32.99	2.70	4 766	1.4
Total	**33 052 406**	**100.0**		**1 528 619**				**1 113.10**	**345 285**	**100.0**

6. Breakdown by area of use

Find out how much energy is consumed in each part of the operation (e.g. by area, process, vehicle and plant). Collect consumption and cost data for each energy source for a 24-month period. What does this tell you? What questions does it raise?

If you have submeters installed in the factory, determine how much energy is used by each process. How much energy is lost between processes (e.g. from steam, compressed air or refrigeration pipes)?

Metering

The guiding principle for determining the level of data required is that the data should enable:

- meaningful analysis of energy use by major systems and items of equipment;
- calculation of energy efficiency indicators by activity when combined with other relevant data (e.g. production rates, transport task data); and
- accurate identification, evaluation and tracking of energy efficiency opportunities over time.

Participants should expect to spend up to 1.5% of the annual cost of the energy being monitored on metering and tracking. For example, if a piece of equipment uses $100 000 worth of energy each year, up to $1 500 /yr should be allocated for gathering detailed data (including capital cost for metering and ongoing costs such as calibration).

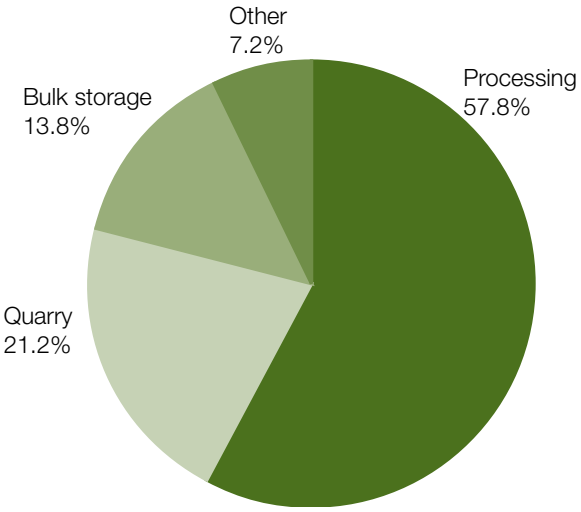
Additional guidance on metering approaches is provided in the ESMG, including approaches to minimise metering costs and improve accuracy over time.

The data for **Magma Minerals**' electricity is broken down by area of use in Table 8 and Figure 5 (the same would need to be done for gas consumption). Examples of the questions raised by the data are provided in the box opposite.

Table 8: Magma Minerals – electricity consumption by area of use

	Cost	Energy			Greenhouse	
	($)	(MWh)	(GJ)	Proportion electricity (%)	(tonnes CO_2/y)	Portion (%)
Quarry	5 975 729	62 836	226 211	21.2	66 481	21.2
Other	2 029 493	21 241	76 826	7.2	22 578	7.2
Bulk storage	3 880 862	40 903	147 250	13.8	43 275	13.8
Processing	16 292 319	171 318	616 744	57.8	181 254	57.8
Total	**28 178 403**	**296 298**	**1 067 031**	**100.0**	**313 588**	**100**

Figure 5: Magma Minerals – electricity consumption by area of use



Magma Minerals – questions raised by the data

Does the energy use in any area appear excessive or high compared with the area's function?

Is there a clear area or grouping of equipment in one of these areas that should also be metered?

Are some areas suited to specific key performance indicators (e.g. GJ/tonne of ore quarried, or GJ/tonne of ore processed)?

How has the consumption of each energy source changed from last year, and what are the causes, e.g. increased because of mine depth, less rain so less dewatering, varying quality of ore, change in excavators or trucks, change in procedures or operator training?

Where is energy being used – which areas, processes, vehicles, plant?

When is energy being used?

Hints:

Determining where energy is used helps to identify when it is being used.

Determining when energy is used helps to identify where it is being used.

Comparing where and when energy is used, with the actual requirements for energy services reveals energy efficiency opportunities.

7. Breakdown by time of use (monthly, daily, hourly)

Continuing the 'top-down' probing of energy use, calculate and chart energy use over time for each energy source.

Monthly

Look at energy consumption for a typical month. What does this tell you? What questions does it raise? When compared against other variables such as rate of production, ambient conditions etc., what are the correlations?

For electricity, this information is available from the retailer if a time interval billing meter ('smart meter') is installed.

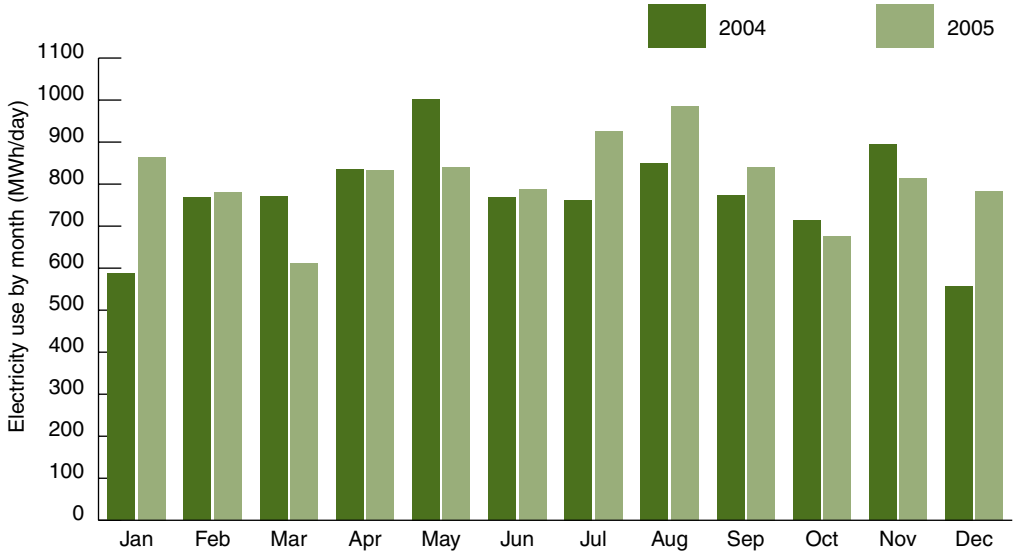
For natural gas, this data is available from the retailer if a time-interval billing meter ('in-line meter') is installed, or from in-house records if the gas supply contract requires you to manually read the gas meter each day.

For other energy sources, and for electricity and gas supplies without a time-interval meter, collect data for representative months (months providing a representative picture of data use will vary from site to site, e.g. a summer and a winter month; or high, usual and low production months). This load data can be obtained by:

- using manual records or electronic records from fuel dispensing systems;
- using temporary data loggers to monitor pulses from existing billing or private meters;
- using temporary metering or transducers on existing meters;
- installing a private meter;
- arranging installation of a time-interval meter with the energy retailer; or
- manually reading an existing (e.g. billing) meter at the same time each day for a month.

For Magma Minerals, the monthly electricity demand for 2004 and 2005 are shown in Figure 6. Examples of the types of questions raised by the data are provided in the box opposite.

Figure 6: Magma Minerals – electricity use by month (MWh/day)



Magma Minerals – questions raised by the data

Why is electricity use in January and December 2004 only about 20% lower than the average for the year, considering that most parts of the site are shut for two weeks in each of these two months?

What causes the variations from month to month? Are they explained by varying production volume, ambient conditions, the quality or degree of processing, customer requirements, or something else?

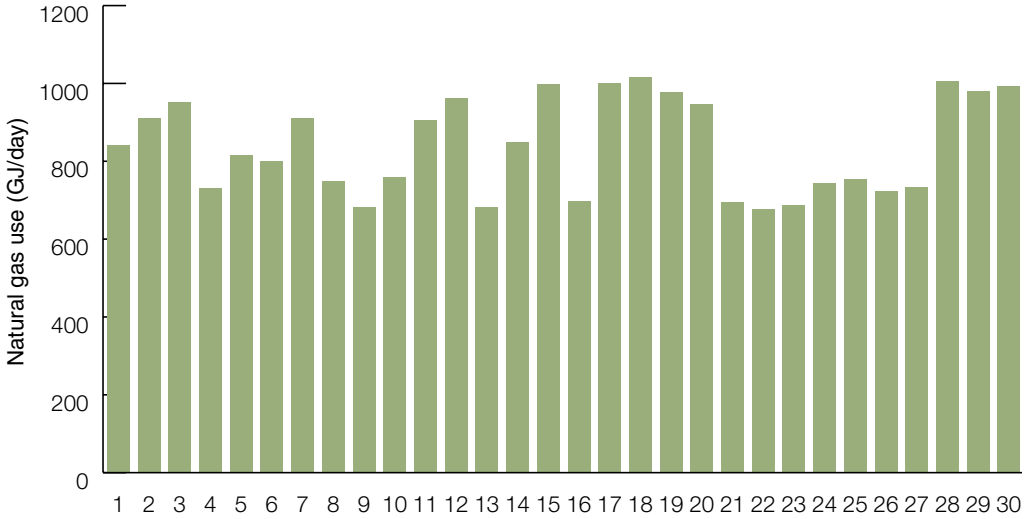
Answering these questions usually leads to the identification of possible savings opportunities. For example, if the variation in electricity use was due to a different way of operating (different shift supervisor or change in standard procedure), this reveals an opportunity to reduce energy use that does not require a capital investment or involve any lead time.

Daily consumption

Look at daily energy consumption for that month. What does this tell you? What questions does it raise?

An example of daily consumption for Magma Minerals during a one month period is shown in Figure 7. Examples of further questions raised by this data are provided in the box below.

Figure 7: Magma Minerals – natural gas use in ore processing, June 2006 (GJ/day)



Magma Minerals – questions raised by the daily data for one month

Is the weekly pattern of energy use reasonable considering the weekly production pattern? For example if the refinery operates just a maintenance shift on a Sunday, energy use should be much lower than on the other six days of the week.

What happened on the week beginning 21st June? Was there an interruption to production? If not, then energy efficiency was higher than usual, and the reasons will reveal an energy efficiency opportunity. For example, was there a different production supervisor, or were automatic controls adjusted differently?

If there was significantly lower production that week, then the gas use per unit of production may be higher than for the rest of the month. This may be a clue to 'base-load' or parasitic gas use; reducing this is another energy efficiency opportunity.

Was the weather colder on days of high gas use, indicating significant gas use due to heat loss from hot water piping, etc.?

Look at the variations in natural gas use throughout the month. How are these explained and what opportunities are revealed by the explanations?

In what periods are the highest tariffs? Could load shifting be achieved in periods of peak demand for a significant financial saving?

Hourly consumption

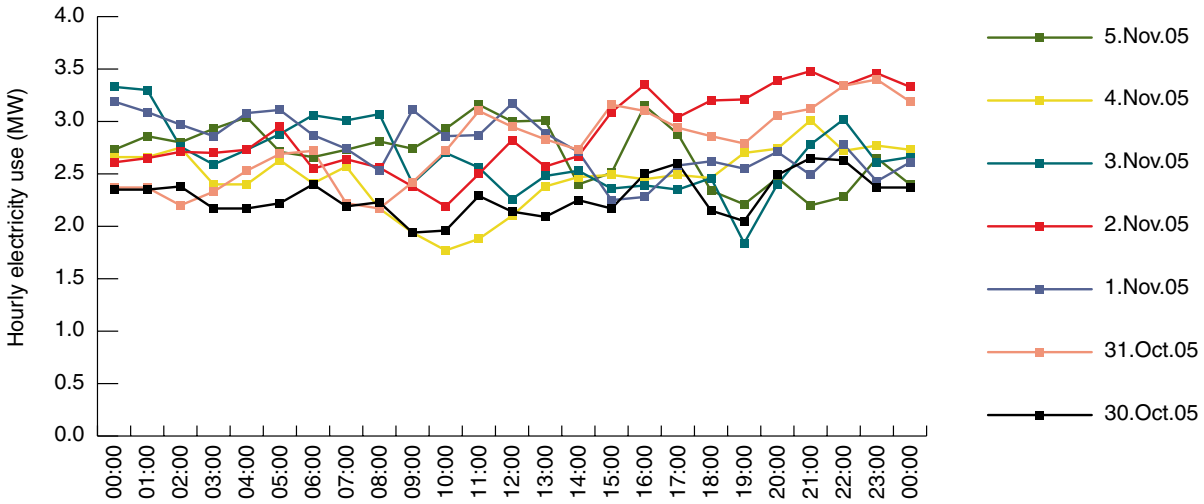
Look at hourly energy consumption for a week, for each major energy source and area. This data is available from energy retailers for most large sites. The data can often also be sourced from factory tracking systems (e.g. SCADA systems), or from specialist energy tracking providers.

What does this tell you? What questions does it raise? Repeat this for other sample weeks if energy use varies noticeably for different times of year or different operating modes.

An hourly breakdown of electricity used by **Magma Minerals** for quarrying in each day for a week is shown in Figure 8. Additional questions raised by the data are given in the box below.

Ask the questions raised by the data before looking for the reasons for the variations. Understanding the reasons for the variations and the components of electricity use usually leads to the identification of more saving opportunities.

Figure 8: Magma Minerals – hourly electricity use (MW)



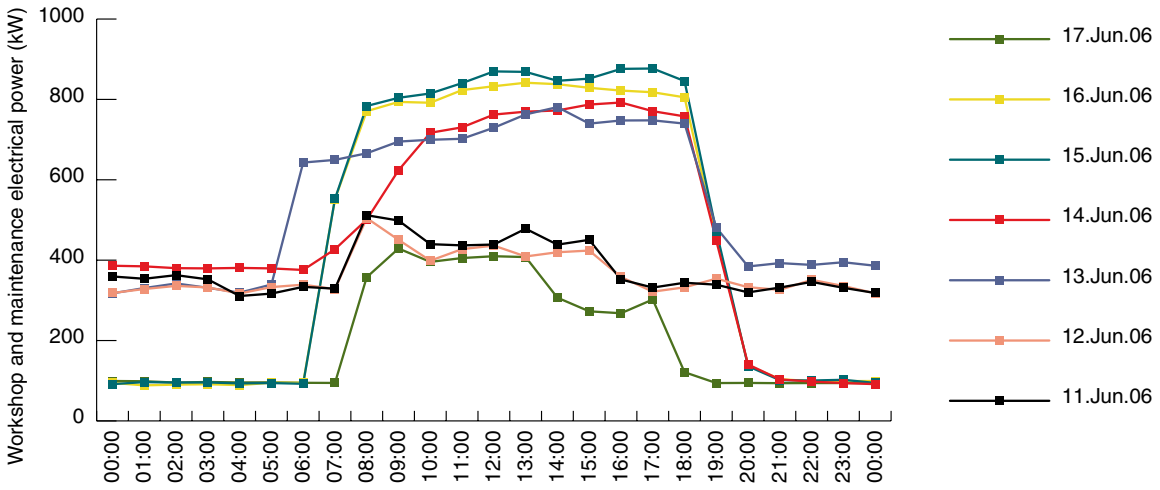
Magma Minerals – questions raised by the hourly data

Why does electrical demand vary from 1.75 MW to 3.5 MW in what is understood to be a continuous and unchanging process?

Why are the load profiles for the days in this week different from one another?

An additional chart of electrical power for the maintenance workshops, a five-day, single 12-hour shift operation, is provided in Figure 9. Further questions raised by the data are provided in the box below.

Figure 9: Magma Minerals – workshops and maintenance electrical power (kW)



Magma Minerals – questions raised by the data

What portion of the electricity use is represented by the base-load of 165 kW? (165 kW x 7000 non-working hours/year = 1155 MWh/yr = 30% of the workshops' total electricity use)

What is using power when the workshops are closed, and no maintenance is being carried out?

Why was the base-load 300 kW higher (400 kW compared with 100 kW) on four nights of the week?

Why does it take until 8:00 pm for load to drop to the base-load, when the workshops close at 5:30 pm?

What is happening on the weekends when the workshop is not open? (e.g. if only cleaning then energy use seems excessive.)

8. Link to production data

Look at energy consumption in relation to production data. Work out what the base-load energy is (i.e. if no product at all is produced).

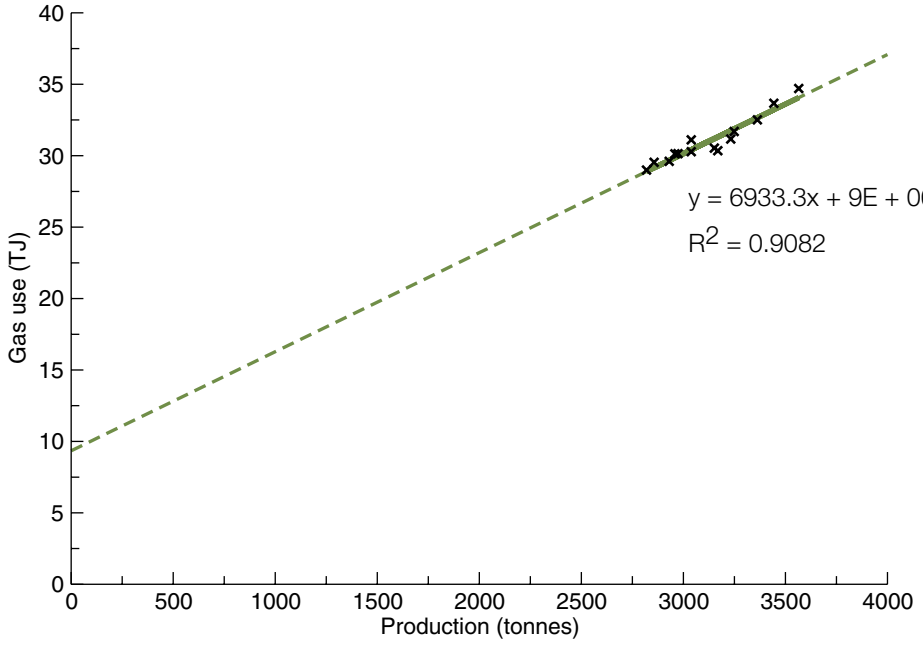
Many analysts plot energy per unit of production against production rate, rather than total energy use against production. A plot of energy per unit of production generally just shows that, as production increases, energy per unit declines – but this is not very meaningful. A plot of total energy versus production (**X-Y plot**) allows the 'fixed' energy overhead to be identified. The gradient of the graph shows the marginal energy consumption per unit, which can be compared to the theoretical energy requirement. An ideal process would use no energy when producing no useful output. The gradient of the line should be as near as possible to the theoretical chemical and/or physical requirements of the process.

Strategies that reduce 'fixed' energy overheads are usually quite different from those that reduce marginal energy consumption.

The production versus energy X-Y plot can be used for the whole facility (and therefore include all parasitic energy losses), and later for production versus energy use in specific processes/areas/vehicles.

A graph for **Magma Minerals** showing gas use against production (tonnes of ore processed) is provided in Figure 10. This chart shows that the 'fixed' energy use is 9 TJ/month, or 108 TJ/yr, which is 29% of the gas used on the site, or 33% of the gas used in the processing plant. Examples of the types of questions raised by the data are shown in the box on the next page.

Figure 10: Magma Minerals – gas consumption versus ore processed



Magma Minerals – questions raised by the X-Y plot

How does the base-load compare with other sites/fleets/processes/equipment/best practice?

What are the components of the base-load? Can these loads be better controlled so that they only operate when they are contributing to production?

How does the slope of the line compare with the theoretical limits of the process (calculated from first principles)?

How does the slope of the line compare with industry best practice and benchmarks?

What are the components of the slope of the line (in this case 6.933 GJ/tonne)? Can this figure (gas use per tonne of product) be reduced?

9. Energy-mass balance

The energy data can also be used to prepare an energy-mass balance to illustrate energy and material flows. An energy-mass balance quantifies the flow of energy through a site or process to determine the amounts of energy used by individual items of equipment and individual processes or subprocesses; energy losses from pipes, pumps, ducts and tanks; and the forms into which energy is converted.

The balance also quantifies the material flows through each processing stage; the physical and chemical changes that take place; the movement of materials against friction, gravity or other forces; and the correlation between energy use and material flows. An example of an energy-mass balance diagram is shown in Figures 11 and 12 (the full spreadsheet is provided in Appendix D). The energy-mass balance sectoral guides also provide further guidance on energy-mass balances for different sectors. See www.energyefficiencyoppotunities.gov.au

An energy-mass balance clearly shows where energy is used, transformed and lost, and how the materials flow in correlation to energy use. It illustrates this across the site, processes, systems, items of equipment and miscellaneous equipment such as pipes and ducts.

It is typically used to:

- systematically identify where energy is being lost from processes, distribution systems or conversion systems, converted into forms that cannot be used, or where energy may potentially be available for other uses;
- identify and measure opportunity areas for further investigation and areas where more detailed tracking and measurement is likely to be necessary or useful to underpin estimation of costs and benefits of opportunities;
- calculate performance indicators at process level;
- benchmark performance at process level;
- model whole-of-system changes and impacts;
- help identify and measure impacts on energy use that go beyond just equipment use, for example, people, air temperature and flows in a commercial building, or gradients and road surfaces in transport;
- determine the accuracy and completeness of data across the site.

Ideally the balance includes all of the individual processes that make up the whole energy-using process for a site or fleet. You must define to ±5% accuracy a minimum of 80% of the site's energy use and all processes that use more than 0.1 PJ. Note that the Energy Efficiency Opportunities program requires sites over 0.5 PJ to assess opportunities across all energy use except for minor activities totaling up to 0.01 PJ or 0.1 PJ capped at 2% of site energy use if this has been approved by DRET in the Assessment Plan. This guidance regarding application of energy-mass balances is intended to encourage program participants to apply them where they are of most value to them in identifying opportunities.

You should start by preparing a preliminary model of energy and material flows, but in putting this together you may find that you don't have enough metering and measuring capacity to do it. It will necessarily include some measurement, some calculations and estimations. Separate energy-mass balances can be prepared for individual systems within a site, and these can be integrated later.

Over time, you can improve the data quality and identify losses more accurately; clarify data gaps and document the reasons why such data is necessary; and then ensure a program is put in place so that appropriate data are available for future analysis. This might involve installation of permanent metering, short-term tracking of energy and material flows, temperatures and other relevant factors, and/or more detailed calculations.

You should document assumptions and uncertainties in data and review them to identify areas for improvement that would further improve capacity to identify energy efficiency opportunities. For example, where the energy losses from a pipe have been estimated, consider installation of tracking equipment that provides real data at sufficient detail to allow identification of factors such as failed insulation and leaks.

Even at this preliminary stage, however, you will start to identify potential losses in the system, for example from steam in the distribution system, or heat loss from components.

Compare operating profiles to energy and material flows and against relevant performance indicators. This provides opportunities to estimate potential savings from measures such as turning equipment off or varying operating parameters as demand for services varies. It also provides a tool for managing energy demand, comparisons of operator performance, and so on.

Some of the questions that you might ask as you use your energy-mass balance to identify opportunities include:

- what is the critical service being provided by the area/process (e.g. melting metal, driving a chemical conversion process)?
- what is the theoretical minimum energy required to provide the service – considering latent heat if melting, or theoretical energy for a chemical change?
- what is the actual amount of energy used to provide the service?
- what is the critical mechanism to provide the service?

- what is the current mechanism?
- what alternatives to providing the service could be considered (e.g. can heating be avoided or minimised, or sourced from elsewhere in the process)?
- how much of this service is actually required?

The energy-mass balance is shown in figures 11 and 12 (the full spreadsheet is provided in Appendix D) and highlights a number of issues:

- a significant proportion of metered gas for the boiler cannot be accounted for from measurements, while more electricity seems to be used than is metered – these anomalies should be explored;
- there is significant unaccounted heat gain to the chilled water system;
- efficiencies of the high temperature hot water generation (so called 'boiler) and heat transfer to syrup seem to offer potential for savings;
- it would be useful to separately meter a number of processes (e.g. cooling tower electricity, so that efficiencies can be measured and compared against ideal performance);
- there are significant heating and cooling applications that could be supplied by heat (and 'coolth') recovery from other parts of the production process, rather than relying entirely on the boiler and chiller and
- the mains water supply is a potential source of cooling.

For further guidance on how to complete an energy-mass balance, please refer to the energy-mass balance sectoral guidance available at www.energyefficiencyopportunities.gov.au.

Figure 11: Dreamt-Up Drink Co. energy-mass balance (heating and cooling systems, yearly energy and mass data)

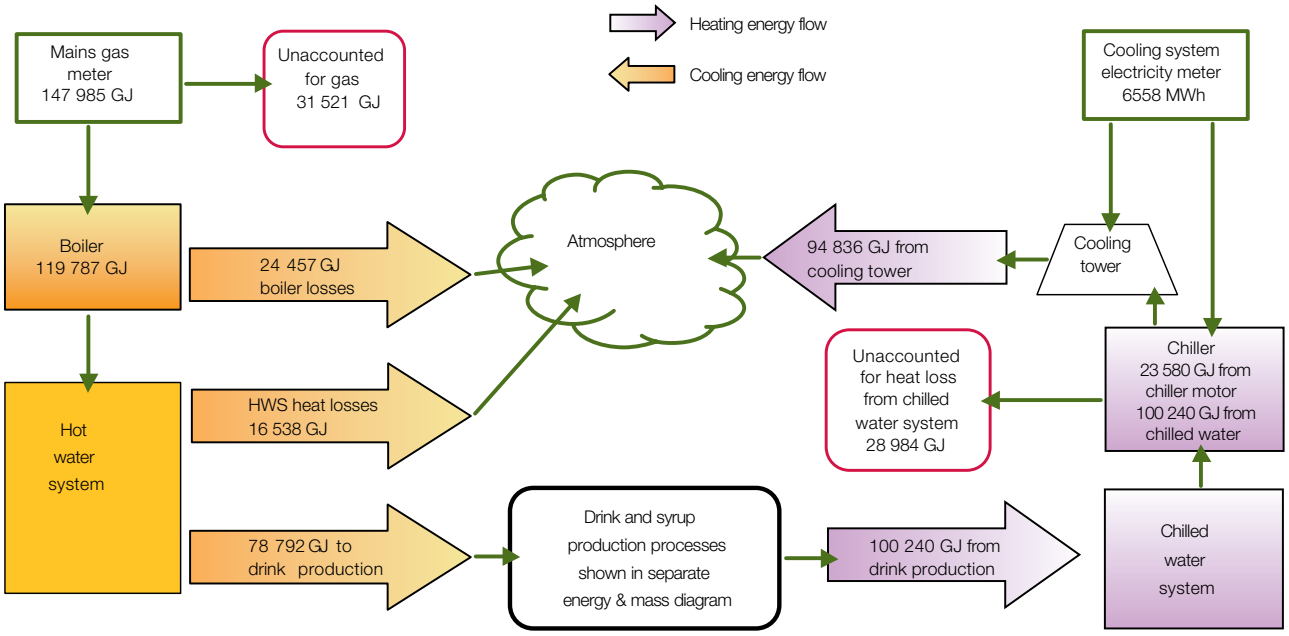
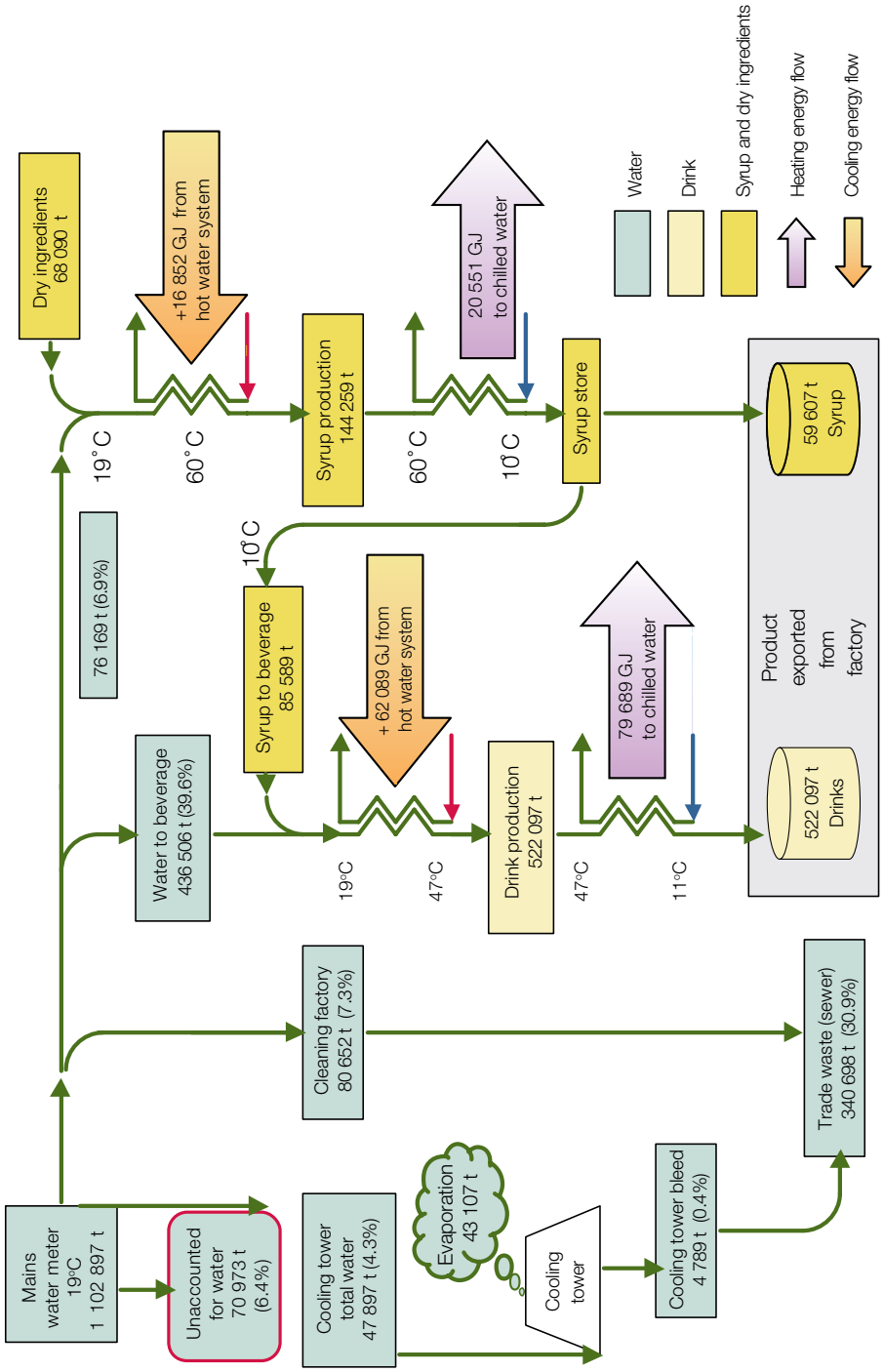


Figure 12: Dreamt-Up Drink Co. energy-mass balance (beverage and syrup production, yearly energy and mass data)



Box 11: Yalumba – energy-mass balance

✪ **Yalumba** developed an energy-mass balance model of the winemaking process to support its design of a new winery. The first stage was a simple energy flow diagram that showed that the biggest energy load was in reducing the temperature of grapes when they first come in after harvest.

A follow-up action was to develop a spreadsheet that combined energy and mass balance data with information from process mapping software that Yalumba had adapted from the dairy industry. This provides Yalumba with a tool to model what is going to happen when it makes changes to inputs – grapes, energy, water, loading equipment, etc. enabling it to improve product quality while optimising energy and water use.

10. Energy intensity indicators

Measuring energy efficiency is difficult, so we tend to use energy intensity indicators as a surrogate measure. Energy intensity is defined as unit energy per unit of output. Choose the output measures that are most meaningful for your organisation. They could be in physical units, for example:

- L/km of fuel;
- kWh per unit produced; or
- GJ/m^2 of floor area.

Output measures could also be in monetary units (e.g. energy expenditure per unit of sales or net income). Trends in monetary-based indicators tend to be less reliable as a measure of energy intensity because monetary units are affected by many other issues such as variations in energy costs and selling price.

11. Benchmarking

Comparing your energy use (at site level and particularly individual process level) against the original design specifications, and theoretical 'ideal' performance of industry 'best practice' can help you to benchmark your performance.

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

Benchmarking against *theoretical ideal performance* helps to identify where waste is occurring. This approach often facilitates radical changes that may lead to dramatic efficiency improvements through adoption of alternative approaches. This approach identifies 'stretch' targets and also encourages analysts to track down where all the energy has been lost.

Benchmarking is best done over time or between very similar processes or sites, otherwise time is spent explaining obvious differences (such as the difference between hotels in North Queensland and Tasmania).

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

12. Regression analysis

Where large numbers of sites or items of equipment operate under a range of conditions or with different types of equipment, regression analysis may be useful. This technique (included in spreadsheet software) allocates coefficients to each factor that may affect energy use, taking an iterative approach. It helps to identify which parameters are likely to be most significant in influencing energy use. The approach involves many assumptions, but can help to focus attention on critical issues. A typical regression result may look something like:

$$\text{Energy use} = 3.2 \times \text{temperature difference} + 4.2 \times \text{production volume} + 2.1 \times \text{volume of make-up air} + 287$$

In this simple example, the fixed value indicates the 'energy overhead', and if this is a significant proportion of total energy use, it should be analysed further. The most important variable is production volume, because its coefficient is largest. The other factors may all be important, so opportunities to address them should be explored. For example, the volume of make-up air could be reduced by tighter control of volume, pre-heating, dehumidification or other strategies.

Regression analysis also provides useful adaptive benchmarks (e.g. in the above example, for a given level of production and temperature conditions, a benchmark level of energy use can be calculated and compared with actual outcomes possibly indicating the significance of other factors, such as operator performance or deviation of input materials from specified standards).

Regression analysis may be useful in undertaking 'representative assessments' (these are explained further in Appendix 4 of the Industry Guidelines and in the Representative Assessment Guide available at www.energyefficiencyopportunities.gov.au).

Box 12: Coles – regression analysis

✪ **Coles** was involved in the Energy Efficiency Best Practice Program. Its initial analysis of energy consumed by 480 stores across Australia showed that annual energy consumption per square metre of trading area differed significantly between stores. This raised fundamental questions such as 'What are the variants that produce such differences? Is it the building, store design, operating hours, climate or other factors?

To answer these questions, Coles gathered information on 19 variables from 30 Victorian stores. The variables included store type, store age and size, type of bakery, weekly customer count, aisle lighting design, and length and volume of refrigeration and frozen food cabinets.

A multiple regression analysis of the data helped to identify the factors in store design and operations that contribute to the widely varying annual energy use between different stores. The two main influences on annual energy use were the volume of open food refrigeration cabinets (cooled and frozen), and the presence or otherwise of a store entry airlock.

➲ **Read more**[9]

13. Check accuracy of data

Minimise any inaccuracies or uncertainties, for example by having:

- automatic systems that alert the user to double check data outside the normal expected range;
- processes in place to cross-check the accuracy of source data (e.g. random checks of invoice amounts against site meters); or
- a system in place to double check that data has been transcribed correctly from source data (e.g. through random checks by someone not involved in the initial data collection).

Uncertainty

Uncertainty refers to understanding the error that may be involved in the figures entered into an inventory. The documented data collection process should ensure that assumptions associated with energy use are documented. For each assumption, an estimate of the error associated with it (e.g. ± X%) should be noted (this is known as estimation uncertainty).

14. Check completeness of data

Ensure that all energy sources within the chosen inventory boundary are accounted for, so that a comprehensive and meaningful inventory is compiled. Where anomalies or data gaps exist, measures should be put in place to identify and resolve them. In practice it may not be possible or feasible to collect data on everything, but any exclusion should be documented. Ways in which completeness could be assessed include:

- cross checking fuels and activities listed on the inventory with energy and material flows;
- checking invoices and accounts for energy; and
- comparing fuel uses across similar sites to identify anomalies.

15. Document the data collection process

Make sure that the process used to collect and analyse the data is documented, including any assumptions used in the collection process.

16. Background paper

A background paper is a useful way of summarising the key information gathered. It captures the data in a succinct, easy to read format, and provides a vehicle for understanding energy use in relation to the business. It can provide essential background information for participants in the next stage of the assessment process (see Section 3.4, Identifying opportunities).

The background paper should pose questions and highlight issues rather than provide definitive answers. Ideally it is open ended (i.e. provides sufficient information and analysis to stimulate discussion and ideas, but without making too many conclusions or recommendations). It should aim to highlight issues that link energy efficiency with business drivers.

The content of the background paper depends on the level of data currently available. It can be useful in highlighting data gaps and helping to plan additional activities to improve future data collection. A suggested contents list is provided in Table 9.

Table 9: Background paper outline

Section	Possible content
Introduction/purpose	An introduction to the Energy Efficiency Opportunities assessment – legislative requirement, purpose, potential business benefits, the assessment process. This section could also include a statement from the business about how the assessment can contribute to business goals and priorities.
The company and the site	An introduction to the company, including the main activities or processes undertaken, current business issues, environment policy, analysis of strengths, weaknesses, opportunities and threats, etc.
Energy use and analysis of data	Discussion of the nature of energy use in the company, including: • total energy use by type of energy; • demand by area of use and time of use; • analysis of trends; and • whole-of-system performance indicators such as energy use versus production. Identify questions raised by the data.
Industry best practice/ research and development	Other information that may inform the discussion about opportunities (e.g. relevant experience at other sites or in other companies, new technologies, research).
Opportunity areas	Suggestions of areas where energy waste or inefficiencies exist, with some brief discussion and any questions which need to be discussed at the workshop.
Data gaps	Identification of the need for energy measurement activities.

Some of the ways that companies are demonstrating support for energy efficiency through their existing business systems and processes are illustrated in Boxes 13 and 14.

Box 13: Bunker Freight Lines – data management and analysis

✪ At **Bunker Freight** the Fleet Manager receives fuel billing data on a daily, weekly and monthly basis for each truck. The data is analysed each day for trends and anomalies. The company also has 'real-time' data for every truck, including:

- engine;
- electronic braking system;
- idling time; and
- other performance areas related to energy efficiency.

All the data is analysed and immediate corrective action can be undertaken (e.g. by providing feedback to the drivers).

➲ **Read more** Appendix B

Box 14: Investa Property Group – use of sub metering

✪ **Investa**'s general practice is to submeter each discrete component of a building's services. These sources can include pumps, fans and chillers (heating, ventilation and air conditioning [HVAC] systems), lighting, car parks, lifts, escalators, power and fire services. Sub metering is regarded as an essential tool in effectively tracking energy use.

Each submeter is connected to a 'building management system' and provides real-time data on the energy consumption of each building Investa owns or manages. The data can be accessed and analysed at any time during the day, but is formally analysed fortnightly and monthly to track consumption and identify potential energy efficiency opportunity areas.

➲ **Read more** Appendix B

Relationship to the Assessment Framework

Implementation of the data and analysis activities as outlined in this stage will assist you to meet the following key requirements (KR) of the Assessment Framework:

- ☑ KR 1.2 (resources)
- ☑ KR 3.1 (business contextual information)
- ☑ KR 3.2 (data collection process)
- ☑ KR 3.2a (energy use and cost)
- ☑ KR 3.2b (energy consumption for each key process, system or activity)
- ☑ KR 3.2c (production data)
- ☑ KR 3.2d (operating profile)
- ☑ KR 3.2e (data on process parameters)
- ☑ KR 3.2f (energy and material flows)
- ☑ KR 3.2g (data accuracy and completeness)
- ☑ KR 3.2h (data gaps)
- ☑ KR 3.2i (assumptions)
- ☑ KR 3.3 (energy analysis process)
- ☑ KR 3.3a (energy use indicators)
- ☑ KR 3.3b (analysis of energy use and variables that influence it)
- ☑ KR 3.3c (comparison of performance)
- ☑ KR 3.3d (other detailed analysis or comparative techniques)
- ☑ KR 3.3e (analysis of energy and material flows)

Reminder: Ensure hard copies of all documents or evidence that demonstrates compliance against the key requirements of the Assessment Framework are kept for a period of at least seven years, for verification purposes.

Data collection worksheets

Worksheet 12. Collecting background information

Use the table below as a checklist.

Type of information	Where information is located	Notes
Occupational health and safety policies and procedures		
Environmental policies and procedures		
Energy management policies and procedures		
EPA and other license and compliance conditions		
Major hazard facility implications		
Existing energy efficiency or greenhouse emissions goals and strategies		
Existing business improvement strategies		
Previous energy management investigations, projects and audits and their outcomes		
Company plans (expansion, relocation, production changes, major projects, etc.) that may impact on future energy use in the short or long term		
Key people to contact about understanding energy-using processes, arranging access to facilities, understanding attitudes to energy, obtaining energy accounts and data		
Existing skill levels on site, staff training needs and skill gaps that may require additional expertise		

Worksheet 12. Collecting background information (continued)

Type of information	Where information is located	Notes
Detailed description of all energy-using processes (existing flow diagrams, equipment characteristics, energy models, documentation of processes, etc.) that may assist in the assessment		
The operating profile of the site or fleet including number of shifts, days per week, rostered days off, annual shutdowns (so equipment running hours can be calculated)		
For sites: layout, drawings, schematics and maintenance documents		
For fleets: composition of fleet (number of vehicles and listed by manufacturer, model and age), vehicle maintenance, performance tracking and selection and replacement policy		
Confidentiality requirements – find out what information is commercially sensitive. This will clarify whether confidentiality agreements will be needed with external participants and the limits that may be placed on public reporting.		
Industry- and process-specific issues – some changes may have an impact on other parts of the business and require action (e.g. the sales group may require specific product or service characteristics).		
Any specific issues or problems that energy efficiency improvements could help to address or may exacerbate (e.g. production bottlenecks, maintenance problems, insufficient capacity, noise, hot working environment)		

Worksheet 13. Total energy use

Draw up a table and graphs summarising energy data. Collect consumption and cost data for each energy source for a 24-month period.

Add a column for accuracy to be reported. Note that it is accuracy with regard to use that is important. For some fuels that are delivered in batches, such as diesel fuel, use may only be loosely related to delivered quantities, and the lack of fine detail will make it difficult to interpret the data in detail.

Source	Cost	Proportion of total	Energy amount		Specific cost		Greenhouse gases generated		
	($)	(%)	(kWh)	(GJ)	(cents/kWh)	($/GJ)	(index kg CO_2)	(tonnes CO_2/yr)	(%)
Electricity									
Gas									
Total									

Worksheet 14. Breakdown of use

Breakdown by area of use

Find out how much energy is consumed in each area. Collect consumption and cost data for each energy source for a 24-month period.

Breakdown by time of use (monthly)

Look at monthly energy consumption for a typical month.

Breakdown by time of use (daily)

Look at daily energy consumption for that month.

Breakdown by time of use (hourly)

Look at hourly energy consumption for a week of that month.

Breakdown by specific process and system element

If you have submeters installed on a site, determine how much energy was used by each process and how much was lost between processes (e.g. in steam distribution systems, or from compressed air leaks).

Worksheet 15. Link to production data

Look at energy consumption in relation to production data. Calculate the base-load for energy use (i.e. if no product is produced at all).

Worksheet 16. Energy-mass balance

Prepare an energy-mass balance that maps the total flows of energy and material through a site (aiming to define to ±5% accuracy a minimum of 80% of the site's energy use and all processes that use more than 0.1 PJ) including:

- the amounts of energy used by large individual items of equipment and processes;
- energy losses from pipes, pumps, ducts and tanks;
- the forms into which energy is converted;
- material flows through each processing stage;
- the physical and chemical changes that take place and the amounts of energy involved (in theory and practice);
- the movement of materials against friction, gravity or other forces; and
- the correlation between energy use and material flows.

Worksheet 17. Documentation of the process

Make sure that the process used to collect the data is documented, including any assumptions used in the collection process.

Worksheet 18. Summarising background data and information

Summarise relevant background information and data analysis in a document to be distributed to participants in the assessment process:

- assign someone to write it;
- ensure the draft is circulated for comment and discussion before it is finalised; and
- make the background paper available to participants in workshops and other processes in the assessment.

The assessment

Stage 4. Identifying potential opportunities

Purpose

The aim of this stage is to broadly explore options for cost-effective energy efficiency improvements and to establish plans for detailed investigation of potential opportunities. Further data needs are also identified as part of this process.

Principles

1. At the start of the opportunity exploration process it is important to keep an open mind and suspend judgement. This encourages new and potentially significant ideas to come forward.
2. An evidence-based approach using accurate data (such as that developed in Stage 3) is important to ensure that consideration of what is possible is based on valid data rather than historical or personal assumptions.
3. The exploration process should involve people who can bring new and different perspectives.
4. It is important to consider potential opportunities from the perspective of both specific items of plant and equipment and the system as a whole. This encourages identification of opportunities that acknowledge the interaction between energy use and the production process.
5. Energy efficiency opportunities should not be considered just for their potential to save energy. Using an 'energy efficiency lens' to review business and production processes can highlight opportunities that help address existing problems and provide a range of benefits beyond energy savings.

Engaging people

A wide cross-section of skilled and knowledgeable people need to be engaged in this process.

Outcomes

1. An effective process is undertaken so that a wide-ranging list of potential energy efficiency opportunities is identified. This process is broad and open-minded, incorporates a range of perspectives and encourages innovation.
2. Opportunities with a potential payback of four years or less are selected for implementation or further investigation.
3. Plans are developed for undertaking further investigation of each opportunity.
4. A database of potential energy efficiency projects is established to enable efficient tracking of progress when projects are implemented or evaluated further, and to support internal and external reporting requirements.
5. An update on the assessment process is provided to management and staff at the site.

Process

1. Approaches to identifying opportunities

When a business and its operations are reviewed through the lens of energy efficiency, a number of opportunities are found. Even companies that have focused on energy efficiency for a number of years might use the process to renew their energy efficiency program and identify further opportunities.

A rigorous and comprehensive assessment can be achieved through the interaction of:

- demonstrated leadership and support;
- good data and effective analysis;
- involving the right people; and
- having a process in place that brings the right people and effective analysis together to identify opportunities.

No single person has all the answers. In the past, there was typically an emphasis on an external energy expert reviewing an operation and providing a list of recommendations. External experts can provide extremely useful input, but their effectiveness is limited if they operate without the active involvement of site-based staff, and if they do not participate in some of the process, such as workshops and opportunity identification and evaluation.

At this stage in the process you may have already begun to identify opportunities through:

- comprehensive analysis of valid data by applying techniques as outlined in the previous chapter (e.g. reviewing electricity bills may highlight an increase in off-peak consumption that can be tracked through to equipment not being turned off or faults in timers); and
- site visits with a focus on exploring opportunities through physical inspection and informed discussions with operators and other staff in their work environment. Site visits can pick up a number of opportunities directly (e.g. missing lagging on steam pipes, obvious leaks, or lights and equipment left on) and also raise questions to be explored later.

Site visits might be combined with the workshop since a workshop provides an opportunity to incorporate fresh perspectives and ideas for improvement to workshop participants that are external to the site as well as site staff that only work in a particular area. This also ensures those involved with the workshop are familiar with site operations.

This section describes an approach that you can use to build on initial activities to ensure that you develop a comprehensive list of opportunities. It describes:

- a half to two-day **opportunities workshop** with a cross-functional and cross-hierarchical team that includes representation from management to the shop floor;

- further general **investigation of the opportunities and opportunity areas** identified in the workshop with the aim of getting a better understanding of their potential and the degree of further investigation required; and
- a **follow-up meeting** to develop plans for either implementation or further investigation of specific projects.

Companies may have other approaches that they can use, but it is important to have a process that provides an opportunity to step back from day-to-day work and to encourage a broader perspective on how energy is used and where new opportunities might be found.

The goal of your assessment should be to identify a broad range of opportunities that present both short- and longer-term potential. In the short-term you might focus on more straightforward projects that can be implemented immediately to demonstrate the practical focus and benefits of the assessment. This can help build management support at your site and within the organisation more generally. For more complex opportunities that require significant capital for implementation or further investigation, it is important that you plan for the level of investigation required and consider the best timing for implementation in relation to budget cycles, shutdowns and other factors that may influence the implementation of a project.

2. Opportunities workshop logistics

Workshop recruitment

Decide on the best way of recruiting the people you would like to have at the workshop. Options include:

- participants being nominated by management and simply being advised of the details;
- a preferred list drawn up by the project team and invitations sent out by letter or email;
- preliminary discussions between the project team and potential invitees to identify those with relevant knowledge, skills and open attitudes;
- expressions of interest invited from staff through newsletters, email or meetings (see Box 15); or
- a combination of the above.

Be sure that you review key requirement 2.2 of the Assessment Framework (involving a broad cross section of people in opportunity identification) and the Planning and Communication sections of this handbook on the people who might be involved in an assessment.

At this point, you also need to consider inviting and/or contracting external expertise such as consultants, suppliers and experts within your company who are, for example, external to the site.

Box 15: Coca-Cola Amatil

✪ In order to encourage strong representation across the site at an opportunities workshop, pre-workshop presentations were provided to production teams. These presentations described the assessment process and presented some of the data that had been gathered up to that time and the potential opportunity areas that were being highlighted through the analysis. Personnel were encouraged to attend the opportunities workshop so that their specific knowledge and experience would contribute towards identifying opportunities.

➲ **Read more** in Appendix B

Facilitator

Ideally the workshop should be facilitated by a person skilled in running group processes, and preferably with experience in designing and running creative and dynamic workshops. Qualities of a good facilitator include:

- avoiding making any negative judgment or inference about any participant's contribution;
- being able to ask questions and encourage participants to ask questions that expand and challenge current thinking without showing disrespect to participants;
- being a good listener;
- encouraging participation from everyone;
- rewarding or praising all inputs and the quantity and creativity of ideas; and
- managing time effectively but flexibly.

Background paper/background information

Circulate any background papers in advance to the people to be involved in the workshop and encourage them to review them beforehand. It is important, however, not to assume that everyone will have read pre-workshop materials in detail and to repeat critical information at the workshop.

3. Opportunities workshop outline

Work with the facilitator to develop a workshop agenda that engages and stimulates participants, and enables the group to identify a wide range of opportunities. A sample agenda is provided in Table 10, and key sections of the workshop are discussed in more detail following Table 10.

Table 10: Sample agenda for an opportunities workshop

Activity	Outcomes	Time
Introduction	Introduce the workshop. Agree on its purpose. Set evidence for its success. Determine ground rules.	9.00 – 9.30
Company objectives	Presentation by senior corporate or operational management on company drivers, assessment objectives and potential benefits.	9.30 – 9.45
Energy risks and opportunities	Understanding the potential risks and opportunities to the business in relation to energy use.	9.45 – 10.00
Energy Efficiency Opportunities planning diagnostic	Characteristics of an effective energy assessment: • Where are we now? • What more do we need to do to improve our approaches to managing energy use?	10.00 – 11.00
Morning tea		11.00 – 11.15
Background	Understanding energy use based on initial data and analysis.	11.15 – 11.45
Opportunity exploration: • lateral thinking exercise • brainstorming opportunities	Developing a list of potential energy efficiency opportunities. Warm-up. Applying lateral thinking methods to the task of identifying potential opportunities.	11.45 – 12.30
Lunch		12.30 – 1.15
Opportunity exploration (cont.)		1.15 – 3.00
Afternoon tea		3.00 – 3.15
Actions Next steps Responsibility allocation (site, management, consultants)	Group specific opportunities or opportunity areas and allocate responsibility for each opportunity. Discuss the preliminary investigation report to be prepared for all opportunities.	3.15 – 4.30
Conclusion	Summarise the outcomes of the workshop. Evaluate success of the workshop.	4.30 – 4.45

Introduction and company objectives

Start with introductions and an overview of the workshop ensuring that participants are clear about its purpose and the way they will work together throughout the workshop. This can be followed by an introduction from a senior corporate or site manager on:

- why the assessment is important to the business;
- targets for energy savings; and
- business drivers such as cost reductions, energy supply issues, risk mitigation, greenhouse emission reductions or worker safety.

The manager should present the assessment as an important way of achieving business goals and objectives. This could be combined with a presentation on 'big picture' sustainability issues such as climate change and water availability that impact on the business and on participating individuals.

This introduction is critical in providing participants with an appreciation that their actions can make a difference to the company and beyond, and that the company is committed to this program.

Energy risks and opportunities

If not already covered in the senior manager's presentation, the environmental manager, energy manager or consultant should present the business case for energy efficiency. This could include company, government and community perspectives of the risks and opportunities associated with energy use at the site.

Energy Efficiency Opportunities assessment planning diagnostic

The Energy Efficiency Opportunities assessment planning diagnostic (see Appendix C) could be used in the workshop in the following ways:

- have participants fill it out ahead of time, so that the results can be collated and a summary of scores discussed at the workshop – the focus is on negotiating a consensus score for each issue and clarifying the reasons for differences; or
- ask participants to fill out the form during the workshop itself, followed by discussion.

It is useful to encourage discussion about existing management systems and activities that support effective assessments. Participants may highlight areas for improvement that would support the way in which the assessment is undertaken and projects are monitored. Suggestions should be captured and incorporated into the action planning session held at the end of the workshop.

Background

It is essential that the data and analysis completed prior to the workshop is made available to participants, particularly if a background paper has not been developed and circulated. This information provides important context for the workshop and begins to highlight areas in which potential opportunities might be found. It may also challenge current understanding of energy use at the site using an evidence-based rather than assumption-based approach.

It may also be useful to ask participants who are external to the site about the potential opportunity areas that they are aware of. This session aims to set the scene for the brainstorming that follows.

Opportunity exploration

Brainstorming is suggested to encourage exploration of energy efficiency opportunities from a variety of perspectives. The following is a suggested approach.

Start with a short lateral-thinking exercise on another topic. This gives participants the freedom to offer different and even ridiculous ideas; to mentally 'limber up' without the normal constraints of the logic of the manufacturing process.

Ask a series of questions that encourage participants to explore opportunities from a 'whole business opportunity' perspective.

Sample questions include:

- are there specific production bottlenecks?
- is there equipment that is difficult or costly to maintain or control?
- can staff comfort be improved by reducing waste heat or cooling?
- are there other business benefits (e.g. water savings, productivity, product quality, 'licence to operate')?
- what information is needed to identify opportunities or improve the management of energy? How can that information be provided?
- are there organisational solutions or barriers (e.g. change contracts, price signals, organisational systems)?
- what equipment is due for replacement or upgrade? Soon or in the foreseeable future? Is equipment redundant?
- are there things we can do now? schedule into future plans? and/or conduct more research on or pilot test, in order to learn more?

Establish an overview of the operation from a combined energy and production perspective.

Write up on a whiteboard or present on a slide a simple graphical flow chart of energy inputs, flow, outputs and waste on site. This is important to ensure that participants have a perspective of the system as a whole and the interaction between energy use and production (refer to the energy-mass balance diagram on pp. 62 and 63 for an idea about how you might represent this graphically).

It may be useful to ask participants to present their interpretations of how things seem to work. A key aim here is to help participants look at their site and processes from different perspectives.

Discussion of the key indicators that might reflect energy efficiency performance can also be useful.

A series of questions can then be explored based on the shared understanding established within the group.

Start at the energy inputs and at each point in the process ask whether the step should be eliminated, substituted, re-engineered or joined with another.

To encourage participation in brainstorming, participants might be provided with large post-it notes and a dark felt pen. As ideas are generated the post-it notes can be stuck to a wall for other participants to see. A benefit of the post-it note approach is that they can be easily grouped and re-grouped by common themes.

An electronic whiteboard can also be used. The benefit of this approach is that copies can be easily made and shared with all participants.

Additional questions that may be used to quickly review opportunities and encourage further exploration include asking which of the opportunities:

- are the easiest, most difficult, most interesting; or
- present the greatest opportunity to make a difference, have potential to reduce waste, could lead to elimination of part of the process, could lead to significant redesign of the process, or could deliver on other core business objectives, such as improved productivity, product quality, avoided capital investment.

As the workshop progresses, opportunities may arise to investigate further why energy is used at any stage. This can be achieved by asking:

- what is the energy used to do in this process (e.g. heat, cool, pump)? and
- can this be done a different way?

Assigning opportunities and opportunity areas

Group and assign responsibility to further explore each of the opportunities and/or opportunity areas. Depending on the site, the number could be either large or small and the complexity and type of opportunities may vary considerably.

Where there are many opportunities it may be useful to group them into different technologies or business processes. For example, there may be a series of projects focused around steam (e.g. leaks and lagging), compressed air or a particular production process.

It may also be useful to group opportunities into those that look like they are easy to implement in the short term, and would help demonstrate you are getting early benefits out of the assessment process; and those that might require significant further investigation and/or require major capital to implement. Some categories that you might use include:

- projects with a short-term focus that can demonstrate the benefits of the assessment and build internal support for future assessment activities. These typically have paybacks of less than six months and are easy to implement (e.g. process control changes);
- projects with a medium-term focus that may require some investigation and capital but still have quite appealing paybacks of six months to two years; and
- projects with a longer-term focus that are likely to require detailed investigation and research, major capital investment and have paybacks between two and four years.

Ensure that there is a person or group of people responsible for each of the identified opportunities and that they have the time and resources to further explore each opportunity.

Discuss how those assigned responsibility for opportunities need to conduct preliminary investigations following the workshop. For example, those responsible might use an existing company template or you might develop one based on the example provided in Worksheet 22 on p. 91. Ensure that those responsible for gathering further information understand and agree to the information that needs to be provided.

In this early stage of investigation you should use the best possible data and information that is easily available.

It is critical that business benefits and costs in addition to energy savings are identified, as these may influence the broader business case and hence any decision to further investigate or implement a project. These may include impacts on:

- production, including shutdowns for implementation (and long-term effects);
- product quality and value;
- capital utilisation, including avoided capital investment;
- occupational health and safety; and
- labour, public relations and waste disposal costs.

It is important that information is gathered in a consistent manner to support comparisons between projects at subsequent meetings.

It is likely that there will be data and tracking gaps. An important aspect of the investigation at this stage is to consider actions that could improve the quality of information to be gathered so that more informed decisions can be made in future.

As those responsible start to collect, analyse and explore the data and information available, it is likely that they will collect information that will assist in further building the energy and material flows for the site. It is important that they provide this information to the person managing data and analysis for the assessment as a whole.

Workshop conclusion

Briefly review the workshop to consider the meeting processes that worked best and those that did not, and how any outstanding issues can be progressed.

A short review and capturing of comments is helpful for other sites when they are considering the way they approach assessments and to encourage continual improvement of the opportunities assessment process.

4. Follow-up investigations

This follow-up work is typically undertaken by key staff (particularly those involved in the workshop), and external expertise if required, to broadly explore each of the opportunities in more detail.

A template for the report is provided in Worksheet 22 on p. 91. The emphasis is on getting more information and data to support or reject the project. It is important not to get too bogged down in detailed investigation at this point.

Depending on the number and complexity of opportunities being explored, additional meetings may be needed to develop the preliminary investigation reports. Additional staff resources may also be required.

5. Further action on opportunities

Follow up meeting

A follow-up meeting is typically held three to six weeks after the energy efficiency workshop to review preliminary investigation reports.

Preparation

It is useful for each of the preliminary investigation reports to be reviewed. Simple analysis, tables and graphs that support discussion about where and when further investigation might be undertaken can be prepared.

Discussion

Each of the projects developed to the level of preliminary investigation reports are discussed and explored.

The follow-up meeting can also enable the group to discuss the barriers and opportunities (e.g. data limitations, resource constraints, difficulty accessing appropriate expertise) it has met in developing the reports, and to consider the challenges it might face for the next phase of the assessment and how those challenges might be overcome.

Prepare opportunities spreadsheet or database

Prepare a spreadsheet or database of projects in a way that is consistent with internal and external reporting requirements. This list (database) can be reviewed periodically and it is important that it is set up in a way that is aligned with the reporting needs of the organisation as well as the public reporting of Energy Efficiency Opportunities.

The spreadsheet or database could include the following categories:

- name of opportunity;
- status – recommended to include categories for 'under investigation', 'to be implemented', 'implementation commenced', 'implemented' and 'not to be implemented';
- estimate of payback for the project based on total costs and benefits (not just energy-related costs and benefits) – categories recommended to include 'less than two years', 'two to four years' and 'more than four years';
- estimated energy savings (GJ and $) and other costs and benefits;
- name of the person sponsoring the opportunity;
- accuracy range of the savings estimate; and
- notes that include next steps of project or reason for not implementing project.

Opportunities that are not being pursued should be listed to demonstrate the completeness of the assessment process. In addition, it might also be useful to note that if a certain variable changes then the opportunity might be picked up again (e.g. if the project is not being pursued because it has a long payback period, then it might be re-evaluated later if energy prices increase to an appropriate level or technology costs decline).

Recommendations for immediate implementation

For those opportunities that do not require any further investigation, develop recommendations to present to management (see Stage 6 'Decisions and implementation').

Recommendations for further investigation of opportunity areas or specific projects

This area is covered in Stage 5.

6. Communicate progress on the assessment and intended next steps to management and staff

Once a database has been established and action plans developed for either project implementation or further investigation, it is important to let management and staff know how the assessment is progressing.

This might include a description of the process that has been followed, opportunities identified that are likely to be implemented in the short term, and plans for further investigation.

If some of the actions that you have listed include raising awareness of energy efficiency on site, you might promote these activities at this stage through meetings, the site newsletter, notice-boards or other media.

Relationship to the Assessment Framework

Implementation of the activities outlined in this stage will assist you to meet the following key requirements (KR) of the Assessment Framework:

- ☑ KR 1.2 (resources)
- ☑ KR 2.2 (people for opportunity identification, evaluation and business case)
- ☑ KR 3.2 (data collection process)
- ☑ KR 4.1 (process to identify opportunities)
- ☑ KR 4.2 (identifying opportunities with a four-year payback or better)
- ☑ KR 4.4 (recommendations)
- ☑ KR 6.3 (communication to staff)

Reminder: Ensure hard copies of all documents or evidence that demonstrates compliance against the key requirements of the Assessment Framework are kept for a period of at least seven years, for verification purposes.

Identifying opportunities worksheets

Worksheet 19. Planning the energy efficiency workshop

To do list	Notes
Set a date for the workshop	
Decide start and finish times	
Book the venue	
Organise a facilitator	
Organise catering	
Book audiovisual equipment	
Organise record keeping	

Worksheet 19. Planning the energy efficiency workshop (continued)

To do list	Notes
Prepare the budget	
Prepare the agenda	
Send invitations to the participants	
Send background paper to participants	
Send confirmation, venue details and times to participants	

Worksheet 20. Workshop recruitment

Type of person	Name/organisation
People from various levels of the site or business unit who have a direct or indirect influence on energy use (e.g. site managers, operators, subcontractors, tenants, finance, marketing, production)	
People from within the corporation but external to the site who can integrate business objectives and assist with making a business case for identified opportunities (e.g. chief financial officer; procurement officer; business case analysts; senior corporate management; public relations, strategic planning, operational excellence people)	
Internal and external people with energy, technology and process expertise (e.g. suppliers of current and alternative equipment and technologies, systems modelling experts, engineers)	
People external to the site who can provide alternative perspectives, question assumptions and practices, and encourage innovation	

Worksheet 21. Developing the workshop agenda

Agenda item	Person presenting or facilitating	Start time	Finish time
1.			
2.			
3.			
4.			
5.			
6.			
7.			

Worksheet 22. Preliminary investigation report

Prepare a brief report on each opportunity or opportunity area. A sample pro-forma is provided below. The emphasis is on obtaining a little more information to support or reject the project. It is important not to become too bogged down in detailed investigation at this point.

Project title			
Manager/proponent		Date	
Production area			
Description of improvement			
Estimated investment			$
Expected energy benefits (estimates)	Annual quantity and value	Demand (if applicable)	Annual saving
Electricity			$ /yr
Gas			$ /yr
Other energy (specify)			$ /yr
Other benefits (e.g. water, consumables)			$ /yr
Total annual benefit			$ /yr
Estimated return on investment			% /yr
Estimated accuracy of data (± %)			
Initial assessment of:			
Difficulty	(easy/medium/hard)		
Resources required (e.g. management, engineering, labour)	(low/medium/high)		
Risk	(low/medium/high)		

Worksheet 22. Preliminary investigation report (continued)

Other considerations or issues (e.g. production benefits, maintenance or equipment replacement avoided or reduced)		
Data required to evaluate opportunity further (e.g. energy use, metering, product specification, prices)		
Next steps		
Milestone description	Who	By when

Worksheet 23. Proposed next steps for each opportunity

Opportunity	Next steps	Person responsible
1.		
2.		
3.		
4.		
5.		
6.		

The assessment

Stage 5. Detailed investigation

Purpose

The purpose of this stage is to investigate opportunities in sufficient detail to enable a business case to be prepared for identified opportunities.

Principles

1. The approach adopted for further investigation depends on the nature of the opportunity in question.
2. Principles and approaches presented in previous steps may be reapplied (e.g. people involved and the approach to tracking and data analysis, workshops etc.).
3. When considering which opportunity areas and specific opportunities to explore in detail and when to explain them, it is particularly important to consider where synergies with existing business needs are, or where the opportunity might lead to significant additional benefits such as production improvements. This 'whole-of-business' perspective encourages recognition of the full benefits of energy efficiency opportunities, but also provides a way for businesses to acknowledge non-energy-related costs associated with some energy efficiency opportunities.
4. This stage should use existing business systems and processes for the development of the business case for each project.

Engaging people

A range of people is involved in the investigation of specific opportunities and the development of business cases. This is another opportunity to engage those who use energy with other fields of expertise, and personnel with fresh perspectives.

Outcomes

1. A plan is developed and implemented for the investigation of identified projects.
2. Opportunities are documented and analysed to a level sufficient for informed whole-of-business evaluation of costs and benefits up to a four-year payback at an accuracy level of at least ± 30%.
3. Business cases are developed for projects to enable decision makers to make business decisions about the opportunities.

Process

1. Undertaking detailed investigations

At the end of the previous stage, preliminary investigation of opportunities was undertaken by people involved in the opportunities workshop and/or the project team. This included some detail on the way in which each project might be investigated further.

Table 11 provides a summary of possible approaches to detailed investigation. As in any investigation, approaches vary depending on:

- the nature of the project;
- experience within the organisation with similar projects; and
- access to internal and external resources such as research and development or corporate innovation projects.

Table 11: Project types and investigation options

Description of project type	Options for detailed investigation	Data and analysis considerations
Projects that require significant further investigation and customised solutions due to: • limited understanding of specific nature of the opportunity; • limited understanding of the costs and benefits associated with the opportunity; • a lack of apparent off-the-shelf solutions.	Undertake research to identify solutions (may be within the company or external). Identify experts and obtain advice. Undertake trials to verify your understanding of processes or to test new techniques. Run an innovation workshop process to further explore the opportunity area (e.g. the Big Energy Project process). ➲ **Read more**[16]	Addressing fundamental data or knowledge gaps may enhance further understanding of potential opportunities. Specialised data analysis might be undertaken (e.g. pinch analysis to identify and understand heat use). Energy modelling to determine the key variables that influence energy use in the area and hence the specific opportunity to be evaluated.

Table 11: Project types and investigation options (continued)

Description of project type	Options for detailed investigation	Data and analysis considerations
Projects that are well understood and serviced in the marketplace due to: • good understanding of the specific nature of the opportunity; • some understanding of the costs and benefits; • off-the-shelf products/ services are available.	Consider whether work will be carried out internally or externally. Obtain detailed internal quotes or quotes from suppliers.	It is important to understand your requirements in order to obtain accurate quotes. For example, to modify a compressed air system consider your compressed air requirements across the production process and consider questions such as: • where can compressed air be replaced with a more energy efficient system or process? • what are the current losses in the system that if minimised would reduce the required load? • is the system managed for maximum efficiency? What information and control systems are needed for operators to achieve this?
Projects that are low or no cost to implement.	Consider the approvals that are required and the impacts that procedural or other changes might have on core business activities and relationships. Consider the way change is implemented within your workplace. Where people are involved in the change it is important to choose an approach that is most effective.	It is important to gather accurate baseline data so that savings from the projects can be accurately quantified.

A particular approach that may be useful when a sub-system or area is difficult to define is an 'innovation workshop'. This approach (called the Big Energy Project) was developed during the Australian Government's former Energy Efficiency Best Practice program and led to the exploration and definition of significant energy efficiency projects.

The approach involves bringing key company staff and external technology and data analysis specialists together to develop a whole-of-system understanding of the issue in question, as the basis for jointly identifying new and innovative solutions.

➲ **Read more**[16]

Box 16: Barrett Burston Malting

✪ One of Australia's biggest malt producers, **Barratt Burston Malting** (BBM), involved external specialists in a two-day innovation workshop to identify energy efficiency opportunities in 2000. When BBM was developing a new plant, it saw the opportunity to focus on that as a project in itself. A range of spin-off opportunities also emerged out of the process. The specialists had expertise in gas technology/heat pumps, drying (in this case, timber drying), microwave technology, food processing and energy management. A CSIRO representative with expertise in energy modelling of industrial processes also participated. An energy-mass balance was used to highlight particular opportunity areas.

➲ **Read more**[10]

2. Developing and implementing an investigation plan

At this point in the assessment process it is important to bring together all projects to consider the timing and approach for assessing the projects in detail. Resourcing requirements influence decisions, and you may need to present management with a proposal that outlines when and how projects might be investigated.

In developing your proposal, consider:

- timing investigations of relevant opportunities to correspond with other major site activities (e.g. there may be upcoming design activities related to an equipment upgrade, refurbishment or new plant construction that will enable a range of opportunities to be explored in an efficient manner);
- scheduling the order in which projects are investigated to ensure that both short-term, high return projects and longer-term projects that may require complex investigation are progressed;
- demonstrating the benefits of the assessment to date in terms of the savings that will result from projects already implemented and the potential savings that could be achieved through investigation of the remaining projects;
- detailing the expertise required to provide the in-depth knowledge and understanding for the investigation, particularly in relation to establishing potential costs and benefits;
- conducting additional tracking, metering and analysis that would assist in understanding energy use and the opportunities in more detail and developing robust business cases. Tracking and metering may be permanent or temporary, depending on requirements. They will support you in completing your energy and material flows, potentially highlighting additional opportunities as you do so. They will also help you to meet the requirement that opportunities are documented and analysed to a level sufficient for informed whole-of-business evaluation of costs and benefits up to a four-year payback at an accuracy level of at least ± 30%; and
- exploring whether projects should be explored at site level, or whether your organisation has other processes for particular types of opportunities (e.g. there may be business unit or corporate level research and development resources, laboratories or existing trials that your site can use).

A best practice guide to assist companies estimate, measure, evaluate and track energy savings has been published by the Department and may be downloaded from www.energyefficiencyopportunities.gov.au.

3. Developing the business case

It is important to develop a whole-of-business evaluation for each project. Consult with people in the corporate part of the organisation (e.g. chief financial officer, marketing, design, procurement) to obtain their help in refining the business case, developing recommendations and selling projects internally.

The business case should consider all relevant and measurable business costs and benefits and not just direct energy-related costs and benefits. Some of the likely costs and benefits that might be considered for each identified opportunity include impacts on:

- production, including shutdowns for implementation and long-term effects;
- product quality and value;
- capital utilisation, including avoided capital investment;
- occupational, health and safety;
- labour, public relations and waste disposal costs; and
- potential carbon costs.

The business case is developed to be consistent with your organisation's evaluation methodologies and processes for capital expenditure approvals. Many companies use internal rate of return and/or net present value as investment criteria.

To meet the requirements of Energy Efficiency Opportunities you also need to evaluate projects to a level sufficient for informed whole-of-business evaluation of costs and benefits up to a four-year payback at an accuracy level of at least ± 30%.

$$\text{Simple payback period (years)} = \frac{\text{Initial capital cost}}{\text{Net annual saving including all business costs and benefits}}$$

Ensure that your assumptions are clear, including the level of accuracy to which estimates have been made.

You may also be able to access external finance for energy efficiency projects. Examples include:

- the NSW Energy Savings Fund www.environment.nsw.gov.au;
- the NSW Greenhouse Abatement Certificate (NGAC) scheme www.greenhousegas.nsw.gov.au.

If relevant, you may need to include a detailed action plan with the business case. This could detail:

- resource requirements;
- key expertise required; and
- expected timeframes for implementation.

Relationship to the Assessment Framework

Implementation of the activities outlined in this stage will assist you to meet the following key requirements (KR) of the Assessment Framework:

- ☑ KR 2.1 (data analysis skills and expertise)
- ☑ KR 2.2 (people for opportunity identification, evaluation and business case)
- ☑ KR 2.3 (roles and accountabilities)
- ☑ KR 3.2 (data collection process)
- ☑ KR 3.3 (energy analysis process)
- ☑ KR 4.3 (detailed investigation & whole-of-business evaluation)
- ☑ KR 4.4 (recommendations)
- ☑ KR 5.1e (data improvement recommendations)

Reminder: Ensure hard copies of all documents or evidence that demonstrates compliance against the key requirements of the Assessment Framework are kept for a period of at least seven years, for verification purposes.

Detailed investigation worksheets

Worksheet 24: Plan for detailed investigation

A possible format is provided below.

Opportunity	Investigation approach	Potential cost/benefit and level of accuracy of assumptions	Who will approve	When will detailed investigation commence
1.				
2.				
3.				
4.				
5.				
6.				

Worksheet 25. Whole-of-business cost - benefit analysis for each opportunity

A possible template is provided below.

Costs (-ve)	**Yr 1**	**Yr 2**	**Yr 3**	**Yr 4**	**Total**
Capital cost of measure					
Staff training					
Lost production during installation					
Benefits (+ve)	**Yr 1**	**Yr 2**	**Yr 3**	**Yr 4**	**Total**
Energy savings					
Water savings					
Production increase					
Difference between costs and benefits					
Payback period					
Level of accuracy					

The assessment

Stage 6. Business decisions and implementation

Purpose

The purpose of this stage is to ensure that relevant decision makers determine future action for each of the opportunities identified.

Principles

1. It is critical that communication with decision makers is carried out in a way that is meaningful and useful to them. In this stage it is important to ensure that the business case for each opportunity is communicated to management in a form that succinctly outlines the costs and benefits and allows them to make an informed business decision.
2. The level of information varies according to the size and scope of each project. It is important that you understand your business' own internal investment policy and criteria.
3. This stage should use existing business policies and processes.

Engaging people

Keeping decision makers informed of or directly involved in the assessment is likely to support improved understanding of the opportunities in question and may enhance the likelihood that a project will be resourced and implemented.

Outcomes

1. Personnel responsible for resource allocation make informed decisions on the opportunities that have been identified.
2. Clear lines of accountability, appropriate resources and timeframes are established for opportunities that are to be implemented.
3. Reasons for not pursuing opportunities are documented for use in reporting and verification.

Process

1. Understanding how decisions are made in your organisation

You need to present the business case and recommendations for each opportunity.

Each business has its own internal operating procedures for decision making. Some issues you need to consider include:

- the level of information that is required to enable a decision to be made;
- who is able to make the decision (delegation levels); and
- when decisions are typically made within the business cycle (e.g. budget cycles).

Members of your project team, such as finance specialists or site management, are important sources of information regarding the level at which decisions need to be made for different projects and the best process and information required in presenting them.

2. Presentation and report to management following your assessment

Although decisions about specific opportunities may be made at different times, the requirement to present the overall outcomes of the assessment to relevant levels of management may also provide an opportunity to obtain or confirm decisions on key opportunities.

The presentation and report to management following an assessment is discussed in Stage 7 'Tracking and communicating outcomes'.

3. Project plans

Update and develop action plans in more detail for the opportunities selected for implementation including:

- the priority of each opportunity;
- the tasks involved in implementation;
- the costs and resources involved;
- accountabilities;
- timetable for implementation; and
- engagement with stakeholders.

Allocate tasks to the person(s) specifically accountable for the implementation of each opportunity and provide regular feedback to people influenced by its implementation, including senior management.

Relationship to the Assessment Framework

Implementation of the activities outlined in this stage will assist you to meet the following key requirements (KR) of the Assessment Framework:

- ☑ KR 1.2 (resources)
- ☑ KR 2.3 (roles and accountabilities)
- ☑ KR 5.1 (information to management)
- ☑ KR 5.2 (business response)
- ☑ KR 5.3 (plans for implementation, investigation and tracking opportunities)

Business decisions and implementation worksheet

Worksheet 26. Project plans for approved projects

A possible template is provided below. Most companies will have their own templates and approaches to project management. Considerations include:

- the priority of each opportunity;
- the tasks involved in implementation;
- the costs and resources involved;
- accountabilities;
- timetable for implementation; and
- engagement with stakeholders.

Project title				
Project owner				
Priority (high, medium, low)				
Action	**Budget**	**Person responsible**	**Completion date**	**Status (✓ for completed)**
1.				
2.				
3.				
4.				
5.				
6.				

The assessment

Stage 7. Tracking and communicating assessment outcomes

Purpose

The aim of this stage is to ensure that opportunities are tracked and communicated to relevant internal and external stakeholders on completion of the assessment and through annual updates.

Principles

1. Tracking and reporting on energy efficiency projects is important in demonstrating success, encouraging continuous improvement and to meet internal and external reporting requirements.
2. Tracking energy efficiency and the progression of projects through existing business processes maximises its relevance and benefits to the business.
3. The outcomes of the assessment are communicated beyond decision makers to ensure that members of staff involved in the assessment remain engaged and committed to the process.

Engaging people

Communication requirements vary according to the specific target audiences including site staff, management, the government and the general public. Information communicated at a site level can typically be aggregated at business unit and corporate level to meet government, public and some internal corporate reporting including an aggregate report to the board.

Outcomes

1. Ongoing tracking, measurement and evaluation of opportunities while they are under investigation, being implemented or following implementation.
2. Improved staff awareness of energy efficiency, including benefits and future opportunities.
3. An assessment report and annual updates to site, division and corporate management in a manner that allows for government and public reporting from the organisation as a whole.
4. Evidence gathered and maintained for verification purposes.

Process

1. Tracking the progress of opportunities identified through your assessment

Stage 3 'Identifying opportunities' included discussion of the type of spreadsheet or database that can help you to monitor the energy efficiency projects arising from your assessment. Establishing a spreadsheet or database and tracking projects regularly will make it easier for you to communicate the outcomes of your assessment in an accurate and consistent manner to a variety of stakeholders.

Consider the way in which you will keep up to date on the status of projects. For example, you may have regular monthly meetings of your project team at which the people responsible for investigating or implementing projects provide updates on the projects for which they are responsible. Regular email updates may be another way of doing this.

An important aspect of tracking projects is to capture the savings and other benefits that result from your assessment. Having a list of projects also makes it easier to regularly review the assumptions that have been made on costs and benefits of implementation. For example, if energy prices increase, then you are well positioned to review projects against the increased energy price.

A best practice guide to assist companies estimate, measure, evaluate and track energy savings has been published by the Department and may be downloaded from www.energyefficiencyopportunities.gov.au.

2. Site communication

It is important that you ensure that the outcomes of your assessment are communicated back through the site – particularly to those who have been directly involved in the assessment. In developing your communication plan you will have defined a range of communication channels such as emails, notice boards, meetings and newsletters. Site-level communication is typically done on a regular basis from the start of the assessment, with updates on progress following the assessment. Some of the points at which you might communicate your progress include:

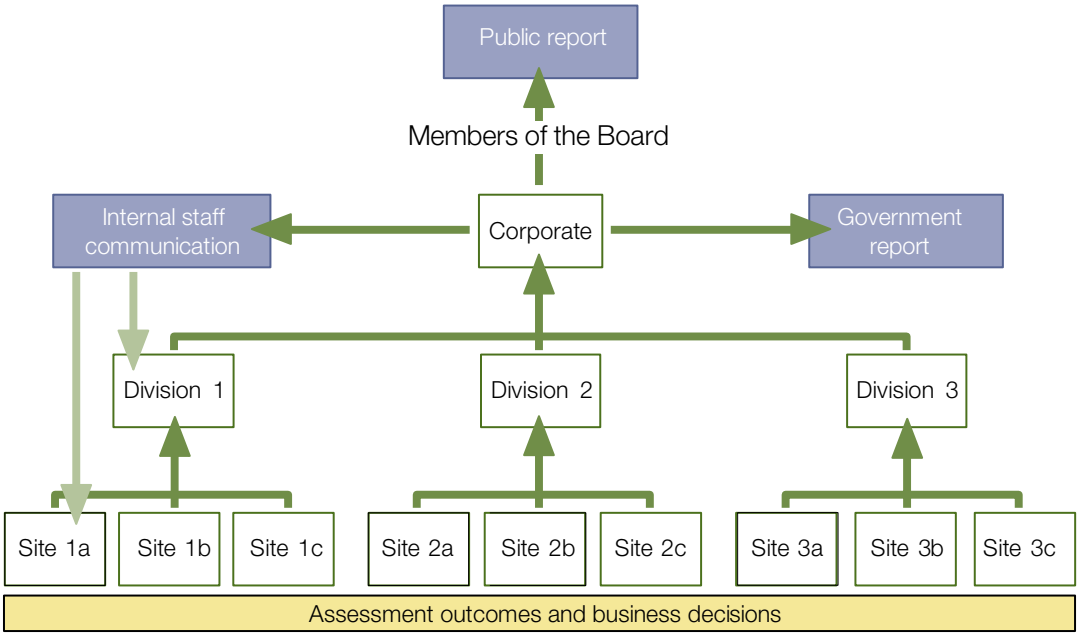
- commencement;
- after your workshop;
- as projects are implemented and savings quantified; and
- at regular periods following the assessment in conjunction with external reporting requirements.

It is important to link assessment outcomes to the objectives set by senior and operational management at the commencement of the assessment.

3. Business unit, corporate and external communication

The Energy Efficiency Opportunities program has specific requirements regarding data and information that must be reported internally, to the government and to the public. Except for single site corporations (or divisions), this information is aggregated and reported at a business unit and/or corporate level. Large organisations typically have a corporate coordinator for the Energy Efficiency Opportunities program. It is important for you to liaise with your coordinator to clarify the data and information required for these reports and when these are required.

Figure 13: Summary of the three key communication channels that need to be reported through the corporation



At site level, it is important to provide a report to site management (and divisional and corporate management if appropriate) that can be used for:

- management decisions on whether to further investigate or implement projects;
- future internal reporting to senior management and the board;
- public reports that must be signed off by the board;
- government reporting; and
- the communication of the assessment outcomes to all staff in the organisation in the context of the objectives set for the assessment by senior and operational management.

The key information required for public reporting is shown in Table 12. Of significance at the site level is the need to apply the same definitions and report the information in a consistent manner to allow for effective aggregation at the corporate level.

Table 12: Outcomes of and business response to assessments (see p. 111 for description of categories). Table taken from the Industry Guidelines.

Table 2: Outcomes of and business response to assessments

Status of opportunities		Number of opportunities	Estimated energy savings per annum by payback period (GJ)		Total estimated energy savings per annum (GJ)	Accuracy range* (%)
			0 – <2 years	2 – ≤ 4 years		
Outcome of assessment	Identified					
Business response	Under investigation					
	To be implemented					
	Implementation commenced					
	Implemented					
	Not to be implemented					
Other categories (information that may be provided voluntarily)						
Energy efficiency opportunities prior to commencement of the program	Previously identified, not yet implemented (pre-assessment cycle)					
	Energy efficiency savings implemented (2000 to beginning of the assessment cycle)					

* The accuracy ranges for projected or actual costs, benefits and energy savings.

Description of status categories

Required categories

- **Identified** – all opportunities up to a four year payback identified during the course of the assessment. The value of opportunities identified by conducting representative assessments is the estimate of the opportunities as if they were implemented across the entire population represented;
- **Under investigation** – this includes projects where a payback has been calculated (within 30%) and a decision has been made to investigate opportunities further, but no commitment has been made to implement. Also includes projects for which a payback period cannot be calculated with at least 30% accuracy but that are still being pursued (conducting further evaluation or research). For this latter group of projects, only the number of projects is required; estimates of the associated energy savings may be voluntarily included;
- **To be implemented** – a decision has been made to implement opportunities, but implementation has not begun at the time of the report;
- **Implementation commenced** – a decision has been made to implement, and opportunities are being implemented at the time of the report;
- **Implemented** – opportunities implemented since the commencement of the Energy Efficiency Opportunities assessment cycle (i.e. July 2006); and
- **Not to be implemented** – a decision has been made not to implement opportunities at the time of this report. A decision not to implement a project may be revisited by participants with changes reflected in subsequent reports.

Other categories (voluntary)

- Previously identified not yet implemented (pre-assessment cycle) – identified prior to the beginning of the assessment cycle and intended to be implemented (i.e. the project has all the necessary approvals normally used in the corporation).
- Energy efficiency savings implemented (2000 to beginning of the assessment cycle) – implemented in the period January 2000 to the beginning of the assessment cycle. Inclusion of this information, where readily available, will allow participants to demonstrate what they have already done to improve their energy efficiency.

Additional information that is required is summarised in Table 13. References in the Industry Guidelines and the Assessment Framework are also provided.

Table 13: Summary of additional information to be reported from a site

Data/information	Reference
Annual total energy use by energy type	Industry Guidelines pp. 30, 52 and 59
Energy use relative to units of production or service	Industry Guidelines pp. 30 and 59
Recommendations to improve data and evaluation accuracy (if required)	Assessment Framework key requirements 5.1 and 6.1
Total whole-of-business costs and benefits of the opportunities identified and business's responses	Assessment Framework key requirements 5.1 and 6.1
Recommendations for major investments	Assessment Framework key requirement 6.1
Examples of significant opportunities identified as part of the assessment (note: three per corporate group or 1 for each group member, business unit or key activity)	Industry Guidelines p. 52
An outline of how the assessment was conducted and over what period	Industry Guidelines p. 52

4. Presentation to management

A presentation (or presentations) may need to be made to management by staff responsible for:

- identifying and evaluating opportunities;
- highlighting key elements of the process; and
- explaining the associated costs and benefits.

This presentation provides an opportunity for management to clarify unresolved issues. Depending on your internal business processes, you may use this presentation to seek approval for further action or you may use it as an update if you have previously accessed decision makers for approval.

5. Evidence is collated and easily accessible for verification purposes

As a mandatory program it is important that a minimum standard is met both in the way in which assessments are conducted and the accuracy of the information that is reported. Use the guidance provided in the Energy Efficiency Opportunities Assessment Framework to gather and maintain the evidence you generate throughout your assessment. This ensures that if your assessment or reporting process is selected for verification, you are able to clearly and efficiently demonstrate that you have met the requirements of the program.

Relationship to the Assessment Framework

Implementation of the activities outlined in this stage will assist you to meet the following key requirements (KR) of the Assessment Framework:

- ☑ KR 5.1 (information to management)
- ☑ KR 5.3b (reviewing and monitoring)
- ☑ KR 6.3 (communication to staff)

Reminder: Ensure hard copies of all documents or evidence that demonstrates compliance against the key requirements of the Assessment Framework are kept for a period of at least seven years, for verification purposes.

Tracking and communication worksheet

Worksheet 27. Database or spreadsheet for project tracking

Tracking opportunities in an accurate and consistent manner is essential to ensure that reporting requirements can be met easily and to quantify the benefits of the assessment. Some suggested headings are listed below. It is important that you develop your spreadsheet or database in a way that meets your company's specific internal and external reporting requirements.

- site
- process area
- project champion
- project ID number
- description
- status (under investigation, to be implemented, implementation commenced, implemented, not to be implemented)
- identified before or after the assessment (B/A)
- type of energy (e.g. electricity, natural gas)
- potential/actual energy saving (gigajoules)
- costs ($)
- benefits ($)
- payback ($ – incorporating whole-of-business costs and benefits)
- level of accuracy of payback calculations (+/- %)
- next steps to progress the opportunity (written description)
- post implementation (actual savings and date of last review)
- other relevant information

Appendix A:
Assessment Framework

Key element 1

Leadership

INTENT

- Visible leadership and commitment from senior management provides clear direction and purpose to the assessment by:
  - setting and communicating energy performance objectives
  - ensuring that assessment objectives are aligned with business priorities.
- Senior management support, motivate and value the efforts of staff and other stakeholders involved in the identification and implementation of energy efficiency opportunities.

No.	Key requirements	Evidence/ supporting documentation
1.1	**Senior management and operational management establish and communicate energy assessment and energy performance objectives to all personnel who are responsible for, or have an influence on, energy use and the energy assessment.**	Evidence showing the existence and communication of energy assessment and energy performance objectives, e.g.: • policy documents containing energy objectives approved by senior management (e.g. specific energy policies, environment policies) • strategic plans signed off by senior management that contain either energy performance or energy assessment objectives • assessment objectives signed off by senior or operational management • meeting minutes, emails, memos and presentations showing communication of objectives, including details of the recipients and senders.

Guidance

To ensure that energy assessment and energy performance objectives can be monitored and used to track achievement, they should be measurable goals, rather than aspirational goals and should be aligned with business goals. These objectives should be communicated to all relevant personnel, including contractors.

No.	Key requirements	Evidence/ supporting documentation
1.2	**Resources (people, time and money) are made available to meet energy assessment and energy performance objectives.**	Evidence that identifies the appropriate personnel, e.g.: • an organisational chart (clearly identifying senior management and personnel responsible for energy use) Evidence showing allocation of people, time and money, e.g.: • an internal plan with a budget detailing people, time and costs; and • budgets showing allocations and expenditures.

Key element 2

People

INTENT

» Skilled and knowledgeable people, and people with direct and indirect influence on energy use, are involved in the assessment to effectively collect and analyse energy and process data, identify and evaluate energy efficiency opportunities, provide fresh perspectives and make the business case for identified energy efficiency opportunities.

» Responsibilities and accountabilities are suitably allocated and team diversity is encouraged.

No.	Key requirements	Evidence/ supporting documentation
2.1	**Personnel with appropriate skills and expertise are involved in the collection and analysis of energy and process data.**	Evidence showing the involvement of appropriately skilled personnel in the analysis of data, e.g. a schedule of participant roles, skills and experience.
2.2	**The energy efficiency opportunity identification, evaluation and business case development process involves a broad cross-section of people, including:** **a. people from various levels of the site or business unit who have a direct or indirect influence on energy use (e.g. site or fleet managers, operators, sub-contractors, tenants and people responsible for equipment procurement, maintenance, finance, marketing, production); and** **b. people from within the corporation (internal or external to the site) who can integrate energy productivity into business productivity objectives and assist with making a business case for identified opportunities (e.g. chief financial officer, business case analysts, business or process improvement managers and people responsible for procurement, corporate and operations management, public relations, strategic planning, operational excellence); and** **c. internal and external people with energy, technology and process expertise (e.g. suppliers of current and alternative equipment and technologies, systems modelling experts, engineers); and** **d. people external to the site who can provide alternative perspectives, question assumptions and practices, and encourage innovation (e.g. operators from other sites, corporate expert groups, internal or external engineering experts, academics, PhD students).**	Evidence showing the involvement of people in the opportunity identification and evaluation process, e.g.: • meeting minutes • emails • memos • presentations • an organisational map or list of those involved.

No.	Key requirements	Evidence/ supporting documentation
2.3	Clear roles, responsibilities and accountabilities are attributed to people involved in the assessment and the business response.	Evidence showing the allocation of roles and responsibilities for people involved in the assessment and the business response, e.g.: • planning documents with roles and responsibilities outlined • a copy of action plans, project plans and budget proposals.

Guidance

KE 2.3 should include identifying who, at which level, will be accountable and responsible for internal sign-off that an assessment is completed according to requirements.

Key element 3

Information, data and analysis

INTENT

- Sufficient data, in suitable forms, is used to quantify and understand energy use, identify and quantify energy saving opportunities, and track performance and outcomes (where actions are implemented).
- Energy data is analysed from different perspectives to understand relationships between activity and consumption, and identify energy efficiency opportunities.

No.	Key requirements	Evidence/ supporting documentation
3.1	**Business contextual information that influences energy use and returns on energy efficiency investments is analysed for its impact on current and future energy use during the assessment, including:** **a. the key business priorities and plans (e.g. relocation, expansion, site and equipment replacement, maintenance and shutdown schedules affecting investment timing and returns)** **b. the key site processes and activities that use energy** **c. other external factors affecting investment returns, if applicable (e.g. rising energy prices, interest rates).**	Evidence showing that key background information has been collected and analysed for its impact on energy use, e.g.: • a background paper • a series of reports or presentations summarising the analysis for consideration during the assessment.

Guidance

In looking at key business context, the company can determine where to allocate priority to areas of energy assessment by considering where the most energy is currently used, or expected to be used. It can also mean allocating a lower priority to areas that may be subject to shut down or replacement, or undertaking an assessment at the design stage for a new site, process or activity.

No.	Key requirements	Evidence/ supporting documentation
3.2	**Data collection processes are identified, documented and implemented to provide:** **a. energy consumption and cost data for each energy source. Data should be entered at the frequency that bills and other records are received (typically monthly) for a total of 24 months. The accuracy of data must be within ±5%. A less accurate level may be used only if it was approved as part of the assessment schedule** **b. energy consumption data for each of the key site processes, systems and activities** **c. production (or output or service) data for a total of 24 months. Data should be entered at the same frequency and timing as the energy consumption and cost data** **d. information about the impact of the operating profile of the site or fleet on energy use** **e. data on other process parameters that impact on energy use (e.g. ambient temperature, geology (mining) and production inputs** **f. information about the energy and material flows through the site or fleet and its processes, systems and equipment (e.g. using an energy-mass balance or similar technique appropriate to the type of activity** **g. information about measures being undertaken to ensure the accuracy and completeness of the energy data** **h. information about measures being undertaken to identify and resolve material data gaps and anomalies** **i information about assumptions used in the data collection process and their associated uncertainty.**	A documented data collection process, including assumptions and uncertainties. Evidence of the implementation of the data collection process, e.g.: • a data inventory that includes production, energy cost and energy consumption data based on billing data • an energy-mass balance or equivalent. • operating and production logs tracked against energy use. Evidence showing the measures undertaken to improve the accuracy and completeness of data, and to reduce data gaps and uncertainties, e.g.: • copies of action plans • project plans • budgets.

Guidance

Data collection processes should prioritise the major energy using systems and processes, and lead to a more detailed focus on systems and processes which are likely to yield opportunities. The data is collected on a range of levels, from a high level aggregation of the total energy use for each energy source, and the associated costs, to detailed analysis of how much energy is used by each process, system and activity, and extending to energy and material flows.

Information on any methodology or assumptions made during the collection of this data are to be recorded to ensure that any variations on accuracy of data, as well as any variations or data gaps can be clearly explained and supported. Keeping records also allows opportunities to be reviewed more easily as key parameters such as input prices and energy use change.

In 3.2(c), where a plant or service contract has not been in operation for 24 months, data should be collected for the longest period possible.

Data required to account for and analyse energy and material flows could include a combination of measurements and data from engineering tables. Data required may include, for example:

- For commercial buildings, energy inflows and outflows both purchased and ambient, where significant, including energy conversions and heat transfers such as thermal mass, solar gain and heat losses from boilers and pipes. Mass flows and related data such as air flows, humidities and temperatures affecting the heating, ventilation and air conditioning systems, hot water and steam flows, temperatures and pressures (where applicable), mass flows through pumps and condensers;
- For transport operations, data describing mass moved, such as unloaded vehicle mass, vehicle loading (by mass or volume as applicable), and other data and duty cycle characteristics that affect energy use when combined with mass (eg. distance travelled, velocities, gradients, braking and cornering frequency, drag coefficients). Some of this data may not be measured, but vehicle trials (such as in-service trials) can be used to investigate this data;
- In manufacturing and process industries, data relating to energy conversions, wastage and losses for sites, processes and systems, and items of equipment such as pipes and ducts (eg. temperatures, specific heats and conductivities of materials, surface areas, dimensions or distances); and
- Where applicable, data on mass flows (eg. fluid flows), mass movements and the mass and composition of materials where this affects or influences energy use (eg. flow rates, densities, temperature profiles, changes in elevation, velocity, viscosities); and

Data on the specific services and products that major energy using processes, systems and equipment deliver (eg. steam flow rates for boilers, illumination levels for lighting, freight mass, volume or distance travelled for freight). See also definitions of *energy and mass flow* and *energy-mass balance*.

No.	Key requirements	Evidence/ supporting documentation
3.3	**An energy analysis process to assist in the identification, quantification and evaluation of energy efficiency opportunities, using data from key requirement 3.2, is undertaken and documented, including:** **a. energy use performance indicators, established at the appropriate level, with consideration of variations over time and major factors that affect energy performance** **b. application of a range of analysis methods to explore relationships between energy use and variables (e.g. output or climatic factors) that may influence energy use, using data collected at appropriate times (e.g. review of graphs and charts, regression analysis)** **c. a comparison of performance to actual and theoretical energy use benchmarks, at the relevant level (process, technology, activity or site) to identify and quantify opportunities** ***Note: theoretical benchmarking may include engineering calculations or simulations based on thermodynamic and heat transfer analysis, fluid mechanics or combustion analysis.*** **d. if appropriate, other detailed analysis, comparative techniques or experimental approaches (e.g. engineering, vehicle trials, pilot studies, logistical approaches, or thermographic imaging)is used to fully understand energy consumption** **e. analysis of the energy and material flows through the site or fleet, and the processes, systems and equipment at the site or of the fleet, to systematically quantify if energy is being used, wasted or lost, compared with the amount of energy required by the specific products and services that the energy use delivers (e.g. energy-mass balance or similar).**	A documented energy analysis process. Evidence of the implementation of an energy analysis process, e.g.: • a background paper • a series of reports or presentations summarising the analysis for consideration during the assessment.

Guidance

EEO requires that companies analyse the energy and material flows through their site, and/or fleets, processes, systems and equipment. For many processes, the best way of looking at energy and material flows is through an energy-mass balance (EMB).

An energy balance is a mathematical statement of the conservation of energy, and a systematic accounting for energy flows and transformations in a system, including energy flows embodied in materials. Mass flows carry enthalpy, kinetic and potential energies. A detailed EMB identifies the flow of materials and energy through a process, showing where energy is being used, wasted and lost. Rigorous EMBs can be used to identify opportunities to save energy by highlighting points in the system where energy use or materials usage are greater than expected or required. Large imbalances in energy or material flows can indicate data deficiencies or anomalies in system performance, such as leaks. It is recommended that an EMB cover 80% of the energy use at a site to enable coverage of all key energy using processes / activities.

See also definitions of *energy and mass flow* and *energy-mass balance*.

Key element 4

Opportunity identification and evaluation

INTENT

» An effective process is undertaken to identify all potential cost-effective energy efficiency opportunities. The process is informed by accurate data and rigorous analysis undertaken in Key Element 3 and involves the relevant people identified in Key Element 2. This process is broad, open-minded and encourages innovation.

» Ideas are filtered to identify a documented list of potential opportunities that can then be analysed to a level sufficient for informed evaluation with a payback period of 4 years or less.

» A whole of business evaluation is undertaken to enable decision-makers to make informed business decisions about energy efficiency opportunities.

No.	Key requirements	Evidence/ supporting documentation
4.1	**A process to identify ideas is implemented and documented.** **The process should involve a review of the contextual information and data that is collected and analysed as part of Key Element 3 and include the appropriate people as stipulated in Key Element 2.** **The implemented process should result in a comprehensive list of ideas.**	Evidence showing the implementation of a process to identify opportunities, e.g.: • a comprehensive list of ideas to improve energy efficiency • a summary linking the process used to the personnel involved, the time period, and the level of the business at which it was carried out • meeting agendas or minutes involving the identification of opportunities, and a list of the people who attended • correspondence related to opportunity identification (e.g. emails) • external reports used to assist in the identification of opportunities (e.g. energy audit reports) • working papers or summaries of assumptions made implementing the process

No.	Key requirements	Evidence/ supporting documentation
4.2	**Ideas are examined to determine if they are feasible and have a potential payback of less than 4 years** **The examination process should result in the feasible ideas with a potential 4 year payback being categorised as either 'for implementation' or 'for further investigation'. These are potential opportunities.** **Reasons why ideas will not be further investigated are documented.**	Evidence showing the outcomes of a process, including: • a list of ideas for implementation or further investigation, including business criteria used to determine feasibility • documentation of reasons for not further investigating ideas (if relevant).
	Guidance Ideas that clearly have immediate business benefits can be categorised 'for implementation' at this stage as detailed investigation to reach an accuracy of ±30% is not required to justify their case. These projects should be monitored post-implementation. Ideas that will not be further investigated should be categorised as 'not to be implemented'.	
4.3	**Detailed investigation is undertaken (including sub-metering or real time metering) to quantify the energy use, and energy and financial costs and savings of potential opportunities to an accuracy of within ±30%.** **If ±30% cannot be achieved, providing an indication in 5.3 of how the accuracy level will be achieved, incvluding further investigation and sub-metering.** **A whole-of-business evaluation (informed by the detailed investigation) is undertaken to quantify costs and benefits of each potential opportunity in order to calculate a payback period, to identify a list of opportunities with a payback of 4 years or less.** *Note: Where an opportunity will require approval for significant capital expenditure, the costs and benefits should be evaluated to within ±10%, or to the level of accuracy required by the corporation's existing capital expenditure process.*	List of opportunities with energy costs and savings, financial costs and benefits documented, associated levels of accuracy and calculations for payback periods. Evidence of detailed investigation, showing the involvement of necessary people and the process used for determining accuracy, e.g.: • correspondence regarding investigations • documentation including sub-metered data, quotations for equipment, calculations undertaken, assumptions, and advice provided by experts. Evidence of further planned action to improve accuracy of potential opportunities in action plans, project plans and budget proposals (if relevant). Evidence of the use of appropriate evaluation methodologies for core business investment decision-making, e.g.: • documentation showing the calculations undertaken • procedures describing standard evaluation methodologies.

Guidance

A detailed evaluation of energy savings and financial costs and financial benefits must be undertaken to ±30% level of accuracy (regulation 1.6). This may involve further technical investigation of the ideas, as well as metering and monitoring energy use of processes or activities to determine the potential energy savings and a corresponding estimate of financial costs and benefits.

Opportunities that have immediate business benefits (low costs and immediate paybacks), or for which the cost of achieving accuracy is greater than the benefit, may be implemented or scheduled for implementation without being evaluated to within ±30%. If practicable, data on these opportunities should be monitored following implementation, to evaluate and report on savings. If a series of small opportunities has been identified, they can be grouped together to facilitate post-implementation performance monitoring and reporting.

Detailed investigation to reach an accuracy of ±30% is also not required for those ideas for which it can be shown that a payback period of 4 years or less is not possible, or those that prove to be infeasible for technical, safety or other genuine reasons. These should be documented and categorised as 'not to be implemented'.

The detailed investigation is used to inform a whole-of-business evaluation, to inform a full cost-benefit analysis to quantify benefits to business beyond the value of direct energy savings. These could include production efficiencies, reduced maintenance schedules, improvements to operational health and safety, staff comfort and engagement, improved reputational benefits, or changes in other factors that the company views as a business priority. This is used to calculate the payback period:

Payback period

$$\text{Payback period (in yrs)} = \frac{\text{Initial investment}}{\text{Net annual savings for the first four years after the initial investment}}$$

Payback includes both energy and non-energy costs and benefits. No discounting of future costs and benefits is done when calculating a simple payback period.

Note: Previously the detailed investigation and whole-of-business evaluation formed two separate key requirements.

Metering

The guiding principle for determining the level of data required is that the data should enable meaningful analysis of energy use of major systems and items of equipment, calculation of energy efficiency indicators by activity when combined with other relevant data (e.g. production rates, transport task data), and accurate identification, evaluation and tracking of energy efficiency opportunities over time. Participants should expect to spend up to 1.5% of the annual cost of the energy being monitored on metering and monitoring. For example, if a piece of equipment uses $100,000 of energy each year, up to $1,500 per annum should be allocated for gathering detailed data (including capital cost for metering and ongoing costs such as calibration).

Projecting energy savings

Estimation of potential energy savings can be done using different methods. For example:

- metered and documented savings from changes previously made at a similar site;
- engineering calculations or modelling of the savings may be carried out based on metered data;
- a trial or pilot may be implemented, metered and measured; or
- information may be provided by equipment suppliers and designers (this information should be validated).

No.	Key requirements	Evidence/ supporting documentation
4.4	**For all opportunities with a payback period of 4 years or less, recommendations, based on appropriate business criteria, are made to the decision-maker/s responsible for resource allocation and investment.** **Recommendations should include whether the opportunities should undergo further investigation, be implemented, or not be implemented.** **Reasons for not pursuing opportunities are documented.**	A list of opportunities and associated recommendations, including criteria used to make recommendations.

Guidance

Recommendations should include the business criteria and assumptions used to form the recommendation and categorise what is required for each opportunity. Recommendations should be made to the corporate or operational manager/s that have the level of delegation required to make a decision for the level of investment or resource allocation required to action the opportunity.

Any opportunities not for implementation should be comprehensively documented. Comprehensive documentation of the assumptions and analysis used to get to this decision will allow these opportunities to be reviewed and re-evaluated in future, when technical, environmental, business or financial changes may positively impact the outcome of the evaluation.

Key element 5

Decision making

INTENT

- Management responsible for resource allocation for opportunities identified by the assessments make informed decisions on the assessment based on investment quality information.
- Corporations develop clear lines of accountability, appropriate resources and timeframes for all energy efficiency opportunities that a corporation decides to implement or investigate further.
- Mechanisms for reviewing, monitoring and reporting on outcomes are established to learn from experience and enable public reporting.

No.	Key requirements	Evidence/ supporting documentation
5.1	**Management responsible for decisions about investment and resource allocation is presented with key background information and the relevant outcomes of the assessment. Information presented to management includes:** a. **total energy use and energy cost relative to variable operating costs and profit for the manager's area of responsibility** **b. energy savings identified for each opportunity** **c. the costs and benefits based on a whole of business evaluation, including a payback period for each opportunity** **d. the business recommendation for each opportunity** **e. recommendations to improve data and evaluation accuracy (if necessary).**	Evidence showing presentation of required information to management, e.g. • reports • presentations to management.
5.2	**Management responsible for decisions about investment and resource allocation decide the business response, including the opportunities that are to be implemented, to be further investigated (including improvements in data and evaluation accuracy), or not to be implemented.**	Evidence showing decisions by management, e.g. reports to management which also record the decisions.

Guidance

The decision maker should sign off on the completion of the assessment and ensure that all assessments are to be completed within the 5 year assessment cycle.

No.	Key requirements	Evidence/ supporting documentation
5.3	**The appropriate decision-maker allocates timelines, resources and accountabilities for the business response to the assessment, covering all energy efficiency opportunities that the corporation decides to implement or investigate further (including improvements in data and evaluation accuracy). This includes processes for reviewing and monitoring to learn from experience and support public reporting.**	Evidence of allocation of timelines, resources and accountabilities, e.g.: • A copy of action plans • strategies • project plans • budget proposals • monitoring and feedback mechanisms.

Key element 6

Communicating outcomes

INTENT

- Senior management and the members of the board are aware of the outcomes of the assessment in a strategic business context (including the corporation's risk management, corporate social responsibility and major investment decisions).
- The board reviews and notes the public report in the context of relevant business information.
- Recognition and awareness within the corporation of the benefits of improved energy efficiency and the outcomes achieved by the assessment, including recognition and awareness of people who contributed to its success.

No.	Key requirements	Evidence/ supporting documentation
6.1	**For each relevant business unit or key activity, the board and the senior officer responsible for signing the public report are presented with the public report and:** **a. total energy use and energy cost, relative to variable operating costs and profit, and other relevant business information (e.g. projected future energy use)** **b. total energy savings identified, and the business's response relative to the energy performance objectives set out in Key Element 1** **c. total whole of business costs and benefits of the opportunities identified, and the business's response** **d. recommendations for major investments** **e. all information that will be included in the public report when it is released.**	Evidence of presentation to the board.
6.2	**The board reviews and notes the information to be included in the public report.**	Evidence of board review and noting, e.g.: • meeting minutes • board agendas and reports • a statement by the signer of the public report.

No.	Key requirements	Evidence/ supporting documentation
6.3	**A clear message about the outcomes of the assessments, in the context of the objectives set by the organisation's leadership, is to be communicated by senior management and operational management to relevant staff in the organisation.**	Evidence of the communication of the outcomes of assessments and progress against objectives, including who has provided the information and to whom the information has been provided, e.g.: • correspondence to relevant staff of documents containing the relevant information (e.g. emails about the sustainability report or other reports that may contain the information) • presentations of outcomes, including meeting invitees, attendees and presenters.

Appendix B:
Case examples from Energy Efficiency Opportunities trial companies

Industry Case Examples

The following examples are provided to illustrate how trial corporations met the intent and key requirements of the Energy Efficiency Opportunities Assessment Framework.

The examples aim to demonstrate:

- what a key requirement or intent looks like in practice;
- that different approaches to assessments can be taken;
- that existing systems and processes can be utilised and built upon; and
- some of the early benefits coming out of energy efficiency opportunities assessments

It is important to remember when reading these examples that most companies were in the early stages of the assessment identification process. Future approaches will be recorded and published over time.

When planning for assessments, program participants should ensure they refer directly to the key requirements of the Assessment Framework which are published in the **Energy Efficiency Opportunities Industry Guidelines**. Businesses should not rely solely on the information contained in the following examples. The Industry Guidelines and other support material are available on our website at www.energyefficiencyopportunities.gov.au.

Key Element 1: Leadership

INTENT

- Visible leadership and commitment from senior management provides clear direction and purpose to the assessment by:
  - setting and communicating energy performance objectives; and
  - ensuring that assessment objectives are aligned with business priorities.
- Senior management support, motivate and value the efforts of staff and other stakeholders involved in the identification and implementation of energy efficiency opportunities.

BORAL

Midland Brick's parent company, Boral, has a comprehensive sustainability management and reporting process. Boral's Environmental Policy includes a commitment to sustainable development, best practice environmental management and 'continual improvement of our environmental performance including regular review and the setting of rigorous environmental objectives and quantified targets'. Environmental strategic plans are prepared annually for each of Boral's six divisions, and each site has an environmental action plan that forms part of their Environmental Management System (EMS).

This environmental management and reporting process drives the need to collect data for energy efficiency and greenhouse emissions. As data collection and reporting improves, each division and site is required to set specific targets. This is reflected in Midland Brick's strategic plans, which incorporate energy efficiency improvement targets of 1 percent for electricity and 2 percent for natural gas.

To support the development of projects to achieve these targets, a new position was proposed to manage Performance Enhancement Program (PEP) projects at Midland Brick. Projects include those identified through the energy efficiency assessment process. Direct responsibility for energy efficiency was assigned to business unit managers with support from PEP project personnel.

At the commencement of the energy efficiency assessment process, senior management at both corporate and site level participated in workshops and communicated a strong message of support for the assessment. This support was also demonstrated through the allocation of resources: both people (assignment of a project coordinator for the process, and meeting/investigation time of other personnel) and financial (e.g. external consultancy engaged to undertake a detailed analysis of proposed energy efficiency and productivity improvements to Kilns 7 & 8).

Read more about Boral's sustainability program at www.boral.com.au

BUNKER FREIGHT

Bunker Freight Lines (now part of Silk Logistics Group Holdings Pty Ltd) had weekly management meeting involving board members. Fuel efficiency was monitored and discussed at these meetings and action plans updated. The discussion was informed by reporting of energy performance based on rigorous data tracking and analysis. There was also regular discussion at these meetings about the trialing of new engines and other related efficiency issues such as tyres, trailer aerodynamics, engine and fuel types.

The company had targets for greenhouse gas emission reductions and fuel efficiency objectives which were considered in all aspects of the business, including vehicle purchases and operations. Fuel was a major cost to the company, and increasing energy costs meant that efficiency was a priority issue. Daily monitoring meant that energy consumption was positively influenced on a daily basis.

Bunker worked with its supply chain partners to reduce energy consumption. Vehicle, equipment and fuel suppliers were encouraged to achieve continuous improvement in energy efficiency. Customers were encouraged to consolidate their loads and to have B-double or Road Train loads where possible to reduce consumption. Drivers had a bonus system which was linked to performance including vehicle overall usage efficiency.

Bunker also had an environment management system based on ISO 14001 that helped to ensure that energy efficiency and greenhouse reduction is integrated within relevant policies and programs.

INVESTA PROPERTY GROUP

Investa Property Group is Australia's largest listed owner of commercial property. The company reports annually against energy use and greenhouse emission reduction targets in its Sustainability Report. These targets included a commitment to reduce the energy consumption of a building by 15% within 3 years of its inclusion in Investa's efficiency program, to achieve at least 3.5 Stars at more than 50% of the portfolio's buildings measured under the Australian Building Greenhouse rating scheme (ABGR) and to identify and implement projects with an internal rate of return greater than 15%.

To promote awareness across Investa's portfolio, each tenant received a report on energy performance and targets every two months with the company's newsletter. This report included targets and energy consumption for each site. Each month the action plan for each site was updated via monthly meetings of facilities managers, sustainability managers and energy service providers.

Property supervisors, facilities managers and other senior staff had performance targets for sustainability (including energy) incorporated into their personal objectives which tied into the company's incentive scheme.

Investa's leadership was recognised globally by its inclusion in the 2006 Dow Jones Sustainability World Index where it became the leading performer in the property sector in terms of sustainability performance.

TOYOTA

Toyota's parent company in Japan has set a clear vision for all its affiliates throughout the world to demonstrate leadership in its country of operation. This includes the setting of specific targets to reduce energy use. In response to this global vision, Toyota Australia had set specific energy efficiency and greenhouse reduction targets and developed robust monitoring and reporting systems for its manufacturing sites. Toyota Australia's latest five year Environmental Plan specifies a CO_2 reduction target of 13% per unit from 2001 levels by the end of the 2010-11 fiscal year.

To further support the achievement of environmental targets, an environmental steering committee with both board and site representation met every second month. The committee tracked energy efficiency performance, discussed the application of emerging energy efficient technologies, and identified strategies to promote the benefits of energy efficiency and other positive environmental actions.

At an operational level, monthly progress reports on energy use and production levels were compiled for managers. These reports assisted in tracking energy use at a site level, increasing awareness on the shopfloor and reporting to the sustainability committee.

Toyota utilised these existing targets and business systems in conjunction with the requirements of the Energy Efficiency Opportunities program to renew its drive to improve energy efficiency performance.

CASE EXAMPLES

Key Element 2: People

INTENT

- Skilled and knowledgeable people, and people with direct and indirect influence on energy use, are involved in the assessment to effectively collect and analyse energy and process data, identify and evaluate energy efficiency opportunities, provide fresh perspectives and make the business case for identified energy efficiency opportunities.
- Responsibilities and accountabilities are suitably allocated and team diversity is encouraged.

BORAL

Midland Brick (Boral) initiated the assessment process by bringing a group of site personnel together for a workshop to broadly identify opportunities. This group included a project manager (to coordinate project development and assessment activities), electrical engineer, business unit manager, kiln supervisor, data analyst, business improvement analyst and an external energy efficiency consultant. These people agreed to sponsor individual opportunities, and to meet regularly to discuss energy efficiency projects with a program coordinator in order to maintain focus and momentum.

It was intended that formal roles and responsibility for energy efficiency be assigned as the assessment proceeds. For example, the assessment process highlighted the potential benefits of focusing additional resources on energy efficiency, and it was proposed that a Performance Enhancement Program (PEP) Manager be employed to coordinate projects. Energy efficiency responsibilities were also incorporated into the roles of each business unit manager.

COCA-COLA AMATIL

At its Northmead bottling plant, Coca-Cola Amatil's (CCA's) National Environment Manager invited people with a wide range of skills, roles, and backgrounds to join an Energy Action Team. This approach was road tested by CCA to determine how best to garner opportunities arising from the Energy Efficiency Opportunities Program, with a plan to replicate the process across other areas of the business. The team included people from different operational areas and shifts at Northmead with roles in engineering, finance and production, a representative from another bottling plant owned by CCA, and people with national responsibilities in engineering and environment. An external energy data specialist and an external facilitator were also engaged and used at different stages during the process to maximise the chance of capturing potential savings.

For the team's first meeting, a full day workshop was used to establish an energy management program. A background briefing paper on energy consumption, performance indicators and possible efficiency opportunities was prepared by the external energy data specialist and distributed as prior reading.

The external facilitator ensured that team members had the opportunity to generate and prioritise potential opportunities (shortlist of 34) by providing an effective process and keeping the workshop to schedule. Team members volunteered to take responsibility for building on the background data, further extending the business case for key opportunities identified during the workshop session.

CCA determined that this process was a great way to collect ideas from across the workforce, by engaging staff and taking advantage of their knowledge and experiences within the organisation. The process provided an opportunity for open discussion and had a positive impact on the participants. It was then used in other sites within the CCA group.

Read more about CCA's environment program at www.ccamatil.com

Key Element 3: Information, data and analysis

INTENT

- Sufficient data, in suitable forms, is used to quantify and understand energy use, identify and quantify energy saving opportunities, and to track performance and outcomes (where actions are implemented).
- Energy data is analysed from different perspectives to understand relationships between activity and consumption, and to identify energy efficiency opportunities.

COCA-COLA AMATIL

Background company information which could influence or create energy efficiency opportunities was provided to an external data consultant through research and discussion with nominated site personnel. This background information, together with some preliminary analysis of energy data, was captured in a report and shared at a workshop-style meeting of national and site environmental, energy and engineering personnel. This report framed the Energy Efficiency Opportunities program in the context of the Company's broader environmental commitments, and site processes and programs, while providing graphical representation of average annual and monthly energy consumption data for the site. The requirements of the Energy Efficiency Opportunities program were discussed within this context during the initial workshop, where issues regarding internal financial requirements on investment were also discussed.

Many of the energy efficiency opportunities which were identified during the workshop involved heat transfer. Evaluating these potential opportunities required more information on the heating and cooling requirements of the processes on site, and quantification of existing and potential heating and cooling sources. The site Energy Action Team decided that compilation of an energy-mass balance and understanding the energy usage profile would be an important step in better exploring these opportunities.

CASE EXAMPLES

To produce the energy-mass balance, electricity and gas load profiles were compared with production data, with particular attention to the few periods each year when production was interrupted. This analysis revealed periods of apparently excessive energy use which did not contribute to product manufacture. 'XY plots', which graphed electricity and gas use in relation to production, showed that a significant proportion of both energy sources did not appear to contribute to production. This, combined with the load profile information, focused the team's efforts on 'base-load' or 'parasitic' energy consumption.

CCA Northmead had a number of procedures and programs in place for collecting and analysing data. In addition to key performance indicators targeting energy performance, Northmead monitors energy use online, and tracks efficiencies within specific elements or stages of the manufacturing process. This capability was used to better understand energy performance, and was correlated with data presented in the background assessment. Sound measurement and performance review processes will enable CCA to quickly identify and validate opportunities, both within the Northmead site and across similar operations within the Group.

BUNKER FREIGHT (PART OF SILK LOGISTICS GROUP HOLDINGS)

The Fleet Manager received fuel billing data on a daily, weekly and monthly basis for each truck. The data was analysed by the fleet manager each day for trends and anomalies and if necessary appropriate actions were taken in response. The data was reported in a monthly report to the board.

Bunker also had real time data for every truck. This data included the truck's overall performance including its engine, hard braking reports, idling time and other performance areas related to energy efficiency. All of the data was analysed and immediate corrective action undertaken by providing feedback to the maintenance workshops for action. The data was also analysed across common truck categories such as B-Doubles and singles, and compiled each month in a report to the board.

INVESTA PROPERTY GROUP

Investa's general practice is to sub-meter each discrete component of a building's services. These sources can include pumps, fans and chillers (HVAC systems), lighting, car parks, lifts, escalators, power and fire services. Sub-metering is regarded as an essential tool in effectively monitoring energy use.

Each sub-meter is connected to a centralised metering system and database and can be accessed in real time via the internet. The data can be accessed and analysed at any time during the day, but is formally analysed on a fortnightly and monthly basis to track consumption and to identify potential energy efficiency opportunity areas.

To confirm the accuracy of the system and data received, regular spot checks were carried out on each building and appropriate changes are made to the system.

Through this overall information, data and analysis approach, Investa has implemented projects which are expected to save over $1 million per annum recurrent savings across

the commercial office portfolio. All of these savings were delivered through operational adjustments and involved very little expense—for example by turning things off when not required. Control strategies and schedules for HVAC and lighting systems were adjusted to more closely reflect the occupancy of each building and the needs of tenants. The payback on the meters was under three years at each building and most of the initiatives undertaken to-date have had shorter than three year paybacks.

Key Element 4: Opportunity identification and evaluation

INTENT

- An effective process is undertaken to identify all potential cost-effective energy efficiency opportunities. The process is informed by accurate data and rigorous analysis undertaken in Key Element 3 and involves the relevant people identified in Key Element 2. This process is broad, open minded and encourages innovation.
- Ideas are filtered to identify a documented list of potential opportunities that can then be analysed to a level sufficient for informed evaluation with a payback period of 4 years or less.
- A whole of business evaluation is undertaken to enable decision makers to make informed business decisions about energy efficiency opportunities.

COCA-COLA AMATIL

Coca-Cola developed a progressive program to identify, investigate and evaluate potential energy efficiency opportunities, building on its experience and the requirements of the Energy Efficiency Opportunities program. An important first step was a meeting of people with site and national responsibilities for energy and environment, which included a briefing on the Energy Efficiency Opportunities requirements and mapping of any gaps in the current opportunity identification processes.

Although many energy efficiency opportunities had been identified and implemented before the Energy Efficiency Opportunities program, compliance with Energy Efficiency Opportunities led to involvement of staff with a broader range of roles and skills, a more comprehensive assembling and analysis of energy and production data, and a more structured approach. This in turn led to identification of additional energy efficiency opportunities.

The first formal opportunity identification activity was a workshop in which the Northmead Energy Action Team examined energy and production data and initial analysis, looked at word-of-mouth savings initiatives at other factories, and brainstormed further possible opportunities.

A list of 34 potential opportunities was generated and prioritised according to degree of difficulty/resource intensity, anticipated energy savings and cost. Team members

volunteered to take responsibility for researching in more detail the top 10 ranked opportunities. This included a commitment to gather preliminary data and complete a one-page summary assessment on the opportunity to highlight areas where further information would be required. These assessments were presented to the team when it convened three weeks after the initial workshop. At this meeting these assessments were reviewed, with the list further refined, indicating those projects for which a business case would be developed, or further review required to determine if a business case should be developed. Agreed actions and milestones were developed for each of these projects.

The next phase of work involved a thorough detailed evaluation of the top opportunities, and the development of business cases for projects for consideration by the business.

XSTRATA COAL

Xstrata Coal ran an opportunity identification and evaluation process that included the use of workshops and small investigation teams at eight of its New South Wales sites to engage staff in identifying a broad range of opportunities. In some cases, workshops were combined across sites that shared management teams and responsibility for energy management. The process was designed to meet the requirements of both the Energy Efficiency Opportunities program and the NSW Government's Energy Savings Action Plan. It was also developed to support the integration of energy efficiency into all aspects of the company's sites and systems to deliver sustainable energy management outcomes. The main aim was to ensure that sites accepted ownership of all energy efficiency activities.

The Xstrata Coal assessment process was successful because it:

- built on an existing process of open engagement at sites that is used to support culture change on health, safety and environment issues;
- was designed to have a consistent framework within which site-based activities were tailored to the needs of each site by local staff; and
- involved all relevant staff (including senior site personnel), enhanced site ownership of the process, leveraged site expertise and definitely improved outcomes.

The process comprised three individual workshops spaced over a two to three month period. The first workshop focused on opportunity scoping, beginning with a systematic review of the systems and processes used to manage energy at each site. Opportunities were then brainstormed by using site energy cost and consumption data as a catalyst, and by drawing on the expertise of staff and outside experts. After the site-specific discussion finished, opportunity lists from other sites were reviewed for potential synergies and any ideas which hadn't been fully explored.

After the list of opportunities had been finalised, it was discussed by the group, and any opportunities with obvious limitations were removed. A 'project owner' was identified to undertake follow-up research on each of the remaining opportunities. This research was conducted by carrying out more detailed data and analysis and by using, where necessary, equipment suppliers and external expertise to provide further insight into each opportunity being investigated. To make this process as efficient as possible, the project owner

was asked to complete a questionnaire which made it possible to test the performance of projects against energy efficiency, financial, safety, environmental, technical and management criteria.

A follow-up workshop with the site's energy management team was held to rank and prioritise the list of projects from the first workshop. Evaluation criteria were weighted by the group to ensure they reflected the specific needs and priorities of each site. The weightings were then applied to the information gathered from questionnaires to develop a ranked list of projects. Finally, action plans were developed for detailed assessments of projects with a level of information sufficient to enable a business decision to be taken.

Through this process across the eight sites, over 90 energy efficiency opportunities were identified. Some of these opportunities were quickly assessed, investigated and even implemented; others will be investigated and trialed over time; and some will be considered in future plant upgrades or new mine designs.

Key Element 5: Decision making

INTENT

- Management responsible for resource allocation for opportunities identified by the assessments make informed decisions on the assessment based on investment quality information.
- Corporations develop clear lines of accountability, appropriate resources and timeframes for all energy efficiency opportunities that a corporation decides to implement or investigate further.
- Mechanisms for reviewing, monitoring and reporting on outcomes are established to learn from experience and allow public reporting.

BORAL

At Midland Brick (Boral), the evaluation of energy efficiency opportunities is to be integrated within the company's existing operating and capital expenditure system—the Process Enhancement Project (PEP) system. This system ensures that the appropriate individuals will be involved in making the decision to proceed or defer the investigation of an identified opportunity. The site intends to appoint a Performance Enhancement Program Manager to ensure that an effective evaluation is undertaken of each project. In order for such a system to be successful a clear and accurate evaluation of energy efficiency's place within the capital expenditure approval system will be established and reflected in the targets set at site and business unit level.

CASE EXAMPLES

XSTRATA COAL

Xstrata Coal made decisions at each of the three workshops which formed the assessment process about whether to further investigate, implement or not implement opportunities throughout the course of its assessment process. The decisions were made by different people in the organisation (involving the relevant people at both site and corporate levels) and at different times, depending on the complexity of the opportunity and the level of authority to approve the resources required for implementation.

Some straightforward and low-cost opportunities were implemented shortly after the initial workshop by departmental managers and staff. Other opportunities were presented to site managers throughout the assessment process in order to compete for existing site discretionary funding. The participation of decision-makers in the original workshops made this process easier, as they had been involved in the evolution of opportunities into projects and action plans. Finally, large capital projects requiring future budget approvals were developed for inclusion in Xstrata Coal's next annual budget cycle.

The opportunities that required formal site and corporate approvals underwent detailed investigation to improve the evaluation accuracy and financial scrutiny according to Xstrata Coal's standard corporate evaluation methodologies, before final decisions could be made.

The progress of the assessments and their outcomes are regularly reported to the senior executives of Xstrata Coal on an overall basis by the project manager, and individually by the sites through the monthly and quarterly business reporting process. This reporting supports business decision making and promotes understanding across the business about the benefits of energy efficiency.

Key Element 6: Communicating outcomes

INTENT

- Senior management and the members of the board are aware of the outcomes of the assessment in a strategic business context (risk management, corporate social responsibility and major investment decisions).
- The board reviews and notes the public report in the context of relevant business information.
- Recognition and awareness within the corporation of the benefits of improved energy efficiency and the outcomes achieved by the assessment, including recognition and awareness of people who contributed to its success.

BORAL

Boral's existing internal and external sustainability reporting system will be modified to incorporate progress reporting on energy efficiency assessments.

The outcomes of the energy efficiency assessments will be summarised for each division, reviewed by senior management (including the Managing Director) and summaries provided

to the Board of Directors. The outcomes and case studies of successful projects will be communicated across the business, and a summary will be included in Boral's annual Sustainability Report which is published on the company's web site.

INVESTA PROPERTY GROUP

Investa makes clear decisions on energy efficiency opportunities at monthly meetings of facilities managers, sustainability managers and energy service providers at each site, and as part of the annual budget planning process.

Asset managers (responsible for leasing), portfolio managers (accountable to investors), facilities managers and property supervisors (jointly responsible for building services) all want to see the best results they can. As such, ideas are typically built up from the operational level and the business case develops as it passes along the line. Each business case needs to demonstrate consistency with the group's commercial objectives: to attract and retain tenants and reduce unnecessary running costs (which are what wasted energy is). Rarely will an initiative have to go to the Board for approval unless it's outside delegated authority limits.

Decisions made about the approval or rejection of energy efficiency opportunities and the reasons for the decision are communicated to the staff members responsible for the proposed projects. Direct feedback is also given by the facilities manager to the property supervisor.

Public accountability and reporting are very important for Investa. It has an ongoing focus on reporting performance against targets through its Sustainability Report, which is signed off by the board. Performance is also recorded on tenant scorecards and a range of survey responses.

Appendix C:
Energy Efficiency Opportunities assessment planning diagnostic

The assessment planning diagnostic is based on the Energy Efficiency Opportunities Assessment Framework. The diagnostic can be used in a number of ways, including as part of the project planning process, and/or as part of an opportunities workshop. The aim of the diagnostic tool is to give people within an organisation an understanding of their current situation and what they can do to achieve a successful assessment.

The diagnostic can help you achieve the following outcomes. Participants:

- have a greater awareness of the systems, processes and activities required to undertake an effective assessment;
- have the opportunity to discuss their perspectives on the systems, processes and activities that are currently in place at their site (and at the corporate level where relevant); and
- can discuss and agree on actions to be taken and nominate personnel to ensure that an effective assessment takes place.

The results from the diagnostic should feed into the Assessment Plan.

The diagnostic consists of questions that are succinct and designed to capture the essence of the key elements, the intents and the key requirements for the assessment (as outlined in the Assessment Framework).

Using the diagnostic

The diagnostic tool aims to evaluate the maturity of existing practices in energy assessment and management in order to:

- focus an organisation's improvement effort;
- enable people in an organisation to build relationships that allow them to work productively together and learn how energy is assessed and managed; and
- undertake successful assessments promptly by identifying weaknesses and proposing actions to address them.

The diagnostic is best used with a cross-functional team. Typically this includes:

- a senior corporate environmental or sustainability manager;
- business managers;
- operational excellence staff;
- business case analysts;
- procurement staff;
- supervisors;
- engineers;
- operators;
- maintenance staff; and
- subcontractors (where suitable).

This approach encourages communication across an organisation and allows a true representation of the organisation's focus on energy efficiency to be expressed.

When using the diagnostic as a group, it is useful to have participants respond to each question from their individual perspective prior to group discussion where different perspectives are shared.

Some guidance on how a two-hour session might be facilitated is provided on the following pages.

How a two-hour session might be run

1. Welcome/introductions
2. Purpose and process for using the diagnostic tool
3. Clarification of the organisation being discussed (e.g. whole organisation/ region/site)
4. For each key element question, the facilitator goes through the matrix with participants for a shared understanding
5. Each person scores each question according to the scoring scale
6. Differences in scores and the reasons are discussed by the participants
7. A scribe records the key outcomes of the discussion for good practices and weaknesses (names are not recorded)
8. A final score for each question is agreed by the participants – being careful (through the facilitator) not to compromise to an 'average' score. Sufficient time needs to be allocated to discuss scores (*outside* 1 plus or 1 minus) to sense whether the average is agreed or requires a re-rated score, and discuss other potential good practices and weaknesses
9. One or two improvements to address any weaknesses are discussed and agreed for each key element
10. The group then discusses what is being done or what could be done to undertake an effective assessment for each key element. The results may feed into the development of a corporation's assessment and reporting schedule.

After the two-hour session

The scribe reports the score, opportunities for improvement and good practices for each key element with the essence of the discussion leading to these outcomes also being reported.

A prioritised action plan is then developed.

Scoring scale for diagnostic tool

Score	Description
5	We're doing it so well that others should come and see it
4	We're doing it well in **all** areas
3	We're doing it well in all areas where energy use is high
2	We've done it for a while in some areas
1	We're starting to do it
0	We don't do this

Guide for scoring

Consider the question and '*What this typically looks like!'* for each item. What is your personal score for each question based on the scoring scale for the diagnostic tool?

Differences in personal scores are then discussed and, based on this knowledge, a 'group score' is decided for each item.

General discussion is held on how to maximise the benefit from the assessments and for energy management generally.

Question	What this typically looks like!	Score 0 – 5
1. Leadership		
Is leadership and commitment from senior management for improving energy efficiency visible?	Clearly stated energy use improvement objectives. Regular communication of objectives by management to relevant personnel – energy efficiency stays on the business radar.	
Are senior management supportive and motivated, giving value to the efforts of staff involved in the identification of energy efficiency opportunities?	Sufficient resources (people, time and money) made available to meet objectives.	
2. People		
Are skilled and knowledgeable people (those that influence energy use) used to identify and evaluate energy efficiency opportunities?	Opportunity identification and evaluation process: • includes people who directly or indirectly influence energy use; • includes a broad cross section of people from the site and business unit or corporation; • uses people with appropriate skills and expertise; and • uses people who can provide new and innovative ideas and question assumptions.	
Are responsibilities and accountabilities suitably allocated?	People have clear roles, responsibilities and accountabilities for identifying, investigation and evaluating energy efficiency opportunities.	

Guide for scoring (continued)

Question	What this typically looks like!	Score 0 – 5
3. Information, data and analysis		
Is quality data used to accurately: • quantify and understand energy use; • identify and quantify energy saving opportunities; and • track performance where actions are implemented?	A data collection process exists and includes: • business contextual information that influences energy use; • information on key site process and activities; • 24 months of energy consumption and cost data; • production data; • data on process parameters that impact on energy use; • energy mass balance; and • measures to ensure accuracy and completeness of data.	
Is energy data accurately and effectively analysed to: • understand relationships between activity and consumption; and • identify energy efficiency opportunities?	An energy analysis process exists and includes: • energy use performance indicators for each energy source and activity; • a range of methods of statistical data analysis techniques; • benchmarking performance against theoretical and actual energy use at process, technology and performance indicator level; • development of energy use performance indicators for each energy source and activity to an accuracy of 5%; and • application of a range of methods of statistical data analysis techniques including energy mass balance.	

Guide for scoring (continued)

Question	What this typically looks like!	Score 0 – 5
4. Opportunity identification and evaluation		
Is an effective process used to identify and investigate potential energy efficiency opportunities?	The process: • is broad, open-minded and encourages innovation; • uses skilled and knowledgeable people; • uses accurate data and analysis; • identifies opportunities that potentially have a four-year payback or better; • identifies and resolves data gaps; and • investigates opportunities to an accuracy of within 10% – 30%.	
4. Opportunity identification and evaluation		
Is a whole-of-business evaluation used to enable decision makers to make good business decisions about energy efficiency opportunities?	Accurate paybacks or equivalent are used to evaluate the whole-of-business costs and benefits for each opportunity identified. Recommendations to implement, investigate further or not implement opportunities with up to a four-year payback are developed.	
Are opportunities analysed to a level sufficient for informed evaluation?	Energy efficiency opportunities are analysed and evaluated to ± 30%.	
5. Decision making		
Is management responsible for resource allocation making informed decisions on the opportunities based on investment quality information?	Investment decision makers: • are given investment quality information on the evaluated opportunities; • are given appropriate contextual information on energy use and its associated costs relative to operating costs and profit; and • determine the business's response to the recommendations and support further investigation where required (including tracking).	

Guide for scoring (continued)

Question	What this typically looks like!	Score 0 – 5
5. Decision making		
Are clear lines of accountability, appropriate resources and timeframes being developed to support the business's response to opportunities?	Timelines, resources and accountabilities are allocated for the business's response.	
Are mechanisms for reviewing and tracking the business's response to opportunities in place to support learning in the organisation?	Review and feedback mechanisms are in place to inform the investment decision makers and other relevant staff of: • the effectiveness of implemented projects; and • the progress of opportunities under investigation.	
6. Communicating outcomes		
Do senior management and the members of the board review the business's response to opportunities?	The board is given: • quality information on the business response to energy efficiency opportunities identified; • business contextual information on energy use and its associated costs relative to operating costs and profit; • recommendations for major investments; and • information to be included in public reports.	
Has the organisation publicly reported on the opportunities identified and the business response?	The board reviews and notes the information to be included in public reports.	
Does senior management promote the benefits of energy efficiency within the organisation?	Results of energy assessments are communicated by senior management to staff with reference to initial energy use improvement objectives.	

Appendix D:
Energy-mass balance example

This is an example of an energy-mass balance for a fictitious manufacturer, Dreamt-Up Drink Co. It has been simplified by assuming that there are no heat recovery heat exchangers between heating and cooling streams, which of course would normally be installed to reduce gross heating and cooling requirements. For further guidance on how to complete an energy-mass balance, please refer to the energy-mass balance sectoral guides available at www.energyefficiencyopportunities.gov.au.

Line	Parameter	Total	Data source
	Mass balance		
1	Incoming water (L/yr)	1 102 897 551	water company invoices 2005
2	Discharge to sewer (L/yr)	390 698 537	water company invoices 2005
3	Nett water use in factory (L/yr)	712 199 014	calculation
4	**Completed products**		
5	Beverages produced and packaged, ready to drink (L/yr)	522 096 573	production records
6	Total syrup produced in factory (kg/L)	144 259 500	production records
7	Total syrup exported from factory (kg/L)	59 607 200	dispatch records
8	Expected syrup used in factory (kg/L)	84 652 398	calculation from above
9	Syrup added to drinks produced in factory (rate in kg/L)	0.164	recipe ratio
10	Syrup added (kg/yr)	85 589 602	recipe ratio and calculation
11	Water used in drinks produced in factory (L/yr)	436 506 971	subtraction of syrup from total
12	Syrup balance (litres missing for year)	937 204	line 10 minus line 8
13	Syrup balance (%)	0.6	line 12/line 6
14	Ingredients used to produce syrup (rate in kg/L)	0.47	recipe ratio
15	Ingredients used to produce syrup (kg/yr)	68 090 484	recipe ratio and calculation

Energy-mass balance example (continued)

Line	Parameter	Total	Data source
16	Ingredients purchased to produce syrup (kg/yr)	67 543 350	inwards goods records
17	Ingredients balance (negative indicates surplus) (kg/yr)	–547 134	line 16 minus line 15
18	(%)	–0.8	(line 17/line16) x 100
19	Water used in syrup production (kg/yr = L/yr)	76 169 016	line 6 minus line 15
20	Water used in beverage production (L/yr)	436 506 971	line 11
21	Total water used in production (L/yr)	512 675 987	line 19 plus line 20
22	Water used in factory for cleaning etc. (to sewer) (L/yr)	80 652 358	factory services water meter
23	Water used in cooling towers (total) (L/yr)	47 897 000	cooling tower water meter
24	Water used in cooling towers bleed (to sewer) (%)	10	assumed ratio
25	Water used in cooling towers bleed (to sewer) (L/yr)	4 789 700	line 24 x line 23
26	Water used in cooling towers (evaporated) (L/yr)	43 107 300	line 23 – line 25
27	Subtotal, water used accounted for (L/yr)	641 225 345	sum of lines 21 to 23
28	Water used elsewhere (not accounted for above) (L/yr)	70 973 669	line 3 – line 27
29	Calculated water to sewer (L/yr)	547 114 264	line 1 minus line 21 minus line 26
30	Actual water to sewer (L/yr)	340 698 537	water company invoices 2005
31	Calculated water to sewer, too high (low) by (L/yr)	206 415 727	line 29 – line 30
32	(%)	60.6	line 31/line 30

Energy-mass balance example (continued)

Line	Parameter	Total	Data source
33	**Energy balance: heating**		
34	Beverage production		
35	Water in beverage, inlet temperature (°C)	19.1	average of 12 readings during year
36	Water temperature required for mixing process (°C)	47.5	recipe and process control
37	Water temperature rise (°C)	28.4	line 38 – line 37
38	Specific heat of water (kJ/kg.°C)	4.18	physical constant
39	Quantity of water used in beverages (L/yr)	436 506 971	line 11
40	Energy added to warm water in beverages (kJ/yr)	51 818 615 541	line 37 x line 38 x line 39
41	(GJ/yr)	51 819	conversion 1 GJ = 1 million kJ
42	Syrup in beverage, inlet temperature (°C)	10.0	cool store set-point
43	Syrup temperature required for mixing process (°C)	47.5	recipe and process control
44	Syrup temperature rise (°C)	37.5	line 43 – line 42
45	Specific heat of syrup (kJ/kg.°C)	3.20	product data sheet
46	Quantity of syrup used in beverages (kg/yr)	85 589 602	line 10
47	Energy added to warm syrup in beverages (kJ/yr)	10 270 752 240	line 44 x line 45 x line 46
48	(GJ/yr)	10 271	conversion 1 GJ = 10^6 kJ
49	Total heating requirement for beverage production (GJ/yr)	62 090	line 41 + line 48

Energy-mass balance example (continued)

Line	Parameter	Total	Data source
33	**Energy balance: heating**		
34	Beverage production		
35	Water in beverage, inlet temperature (°C)	19.1	average of 12 readings during year
36	Water temperature required for mixing process (°C)	47.5	recipe and process control
37	Water temperature rise (°C)	28.4	line 38 – line 37
38	Specific heat of water (kJ/kg.°C)	4.18	physical constant
39	Quantity of water used in beverages (L/yr)	436 506 971	line 11
40	Energy added to warm water in beverages (kJ/yr)	51 818 615 541	line 37 x line 38 x line 39
41	(GJ/yr)	51 819	conversion 1 GJ = 1 million kJ
42	Syrup in beverage, inlet temperature (°C)	10.0	cool store set-point
43	Syrup temperature required for mixing process (°C)	47.5	recipe and process control
44	Syrup temperature rise (°C)	37.5	line 43 – line 42
45	Specific heat of syrup (kJ/kg.°C)	3.20	product data sheet
46	Quantity of syrup used in beverages (kg/yr)	85 589 602	line 10
47	Energy added to warm syrup in beverages (kJ/yr)	10 270 752 240	line 44 x line 45 x line 46
48	(GJ/yr)	10 271	conversion 1 GJ = 10^6 kJ
49	Total heating requirement for beverage production (GJ/yr)	62 090	line 41 + line 48

Energy-mass balance example (continued)

Line	Parameter	Total	Data source
50	Syrup production		
51	Water in syrup, inlet temperature (°C)	19.1	average of 12 readings during year
52	Water temperature required for mixing process (°C)	60.0	recipe and process control
53	Water temperature rise (°C)	40.9	line 52 – line 51
54	Specific heat of water kJ/kg.C	4.18	physical parameter
55	Quantity of water used in syrup (L/yr)	76 169 016	line 19
56	Energy added to warm water in syrup (kJ/yr)	13 022 007 313	line 53 x line 54 x line 55
57	(GJ/yr)	13 022	conversion 1 GJ = 10^6 kJ
58	Sugar, inlet temperature (°C)	18.0	estimated average warehouse temperature
59	Sugar temperature required for mixing process (°C)	60.0	recipe and process control
60	Sugar temperature rise (°C)	42.0	line 59 – line 58
61	Specific heat of sugar kJ/kg.C	3.07	physical characteristic
62	Ration of sugar to water in syrup (rate = 0.39 kg/L)		recipe
63	Quantity of sugar used in syrup (kJ/yr)	29 705 916	line 19 x line 62
64	Energy added to warm sugar in syrup (kJ/yr)	3 830 280 809	line 60 x line 61 x line 63
65	(GJ/yr)	3 830	conversion 1 GJ = 10^6 kJ
66	Heating energy required to change sugar from solid phase to solid dissolved in liquid (GJ/yr)	0	assumed to be zero
67	Total heating requirement for syrup production (GJ/yr)	16 852	line 57 + line 65 + line 66

Energy-mass balance example (continued)

Line	Parameter	Total	Data source
50	Syrup production		
51	Water in syrup, inlet temperature (°C)	19.1	average of 12 readings during year
52	Water temperature required for mixing process (°C)	60.0	recipe and process control
53	Water temperature rise (°C)	40.9	line 52 – line 51
54	Specific heat of water kJ/kg.C	4.18	physical parameter
55	Quantity of water used in syrup (L/yr)	76 169 016	line 19
56	Energy added to warm water in syrup (kJ/yr)	13 022 007 313	line 53 x line 54 x line 55
57	(GJ/yr)	13 022	conversion 1 GJ = 10^6 kJ
58	Sugar, inlet temperature (°C)	18.0	estimated average warehouse temperature
59	Sugar temperature required for mixing process (°C)	60.0	recipe and process control
60	Sugar temperature rise (°C)	42.0	line 59 – line 58
61	Specific heat of sugar kJ/kg.C	3.07	physical characteristic
62	Ration of sugar to water in syrup (rate = 0.39 kg/L)		recipe
63	Quantity of sugar used in syrup (kJ/yr)	29 705 916	line 19 x line 62
64	Energy added to warm sugar in syrup (kJ/yr)	3 830 280 809	line 60 x line 61 x line 63
65	(GJ/yr)	3 830	conversion 1 GJ = 10^6 kJ
66	Heating energy required to change sugar from solid phase to solid dissolved in liquid (GJ/yr)	0	assumed to be zero
67	Total heating requirement for syrup production (GJ/yr)	16 852	line 57 + line 65 + line 66

Energy-mass balance example (continued)

Line	Parameter	Total	Data source
68	Total beverage and syrup heating energy (GJ/yr)	78 941	line 49 + line 67
69	Boiler fuel to heat energy conversion efficiency (%)	79.0	annual boiler test result
70	Efficiency, heat energy transfer from hot water loop to product (syrup and beverage) (%)	85.8	measurement of water loop temperatures
71	Overall heating efficiency: gas to product (%)	67.8	(line 69 x line 70) / 100
72	Gas energy required into boiler (GJ/yr)	116 432	line 68/line 71 / 100
73	Energy lost from boiler (GJ/yr)	24 450	line 72 x (1 – line 69) / 100
74	Energy lost from heating water reticulation (GJ/yr)	16 533	line 72 x (1 – line 70) / 100
75	Actual natural gas consumption (GJ/yr)	147 985	from supplier invoices, 2005
76	Gas energy unaccounted for (–ve indicates surplus) (GJ/yr)	31 521	line 75 minus line 72
77	(%)	21.3	line 76/line 75
78	**Energy balance: cooling**		
79	Beverage temperature after syrup dissolver (°C)	47.5	
80	Beverage temperature after cooler, before bottling (°C)	10.6	
81	Temperature difference (°C)	–36.9	
82	Specific heat of beverage (kJ/kg °C)	3.83	weighted calculation of specific heats
83	Quantity of beverage to be cooled (L/yr)	522 096 573	line 5
84	Density of beverage produced (kg/L)	1.08	laboratory test

Appendix E:
Relationship between the assessment and the key requirements of the Assessment Framework

Key elements and key requirements of the Energy Efficiency Opportunities Assessment Framework					
Leadership	**People**	**Information, data and analysis**	**Opportunity identification and evaluation**	**Decision making**	**Communicating outcomes**
Project plan					
☑ KR 1.1 (objectives) ☑ KR 1.2 (resources)	☑ KR 2.3 (roles and accountabilities)	☑ KR 3.1 (business contextual information)			
Communication plan					
☑ KR 1.1 (objectives)					
Understanding energy use					
☑ KR 1.2 (resources)		☑ KR 3.1 (business contextual information) ☑ KR 3.2 (data collection process) ☑ KR 3.2a (energy use and cost) ☑ KR 3.2b (energy and consumption data) ☑ KR 3.2c (production data)			

Relationship between the assessment and the key requirements of the Assessment Framework (continued)

Key elements and key requirements of the Energy Efficiency Opportunities Assessment Framework					
Leadership	People	Information, data and analysis	Opportunity identification and evaluation	Decision making	Communicating outcomes
Understanding energy use					
		☑ KR 3.2d (operating profile) ☑ KR 3.2e (data on process parameters) ☑ KR 3.2f (energy and material flows) ☑ KR 3.2g (data accuracy and completeness) ☑ KR 3.2h (data gaps) ☑ KR 3.2i (assumptions) ☑ KR 3.3 (energy analysis process) ☑ KR 3.3a (energy indicators) ☑ KR 3.3b (analysis of energy use and nfluencing variables) ☑ KR 3.3c (comparison of performance) ☑ KR 3.3d (Other detailed analysis or comparitive techniques) ☑ KR 3.3e (analysis energy and material flows)			

Relationship between the assessment and the key requirements of the Assessment Framework (continued)

Key elements and key requirements of the Energy Efficiency Opportunities Assessment Framework					
Leadership	**People**	**Information, data and analysis**	**Opportunity identification and evaluation**	**Decision making**	**Communicating outcomes**
Identifying potential opportunities					
☑ KR 1.2 (resources)	☑ KR 2.2 (people for opportunity identification, evaluation and business case)	☑ KR 3.2 (data collection process)	☑ KR 4.1 (process to identify opportunities) ☑ KR 4.2 (identifying opportunities with a 4 year payback or better) ☑ KR 4.4 (recommendations)		☑ KR 6.3 (communication to staff)
Detailed investigation					
	☑ KR 2.1 (data analysis skills and expertise) ☑ KR 2.2 (people for opportunity identification, evaluation and business case) ☑ KR 2.3 (roles and accountabilities)	☑ KR 3.2 (data collection process) ☑ KR 3.3 (energy analysis process)	☑ KR 4.3 (detailed investigation & whole-of-business evaluation) ☑ KR 4.4 (recommendations)	☑ KR 5.1e (data improvement recommendations)	

Relationship between the assessment and the key requirements of the Assessment Framework (continued)

Key elements and key requirements of the Energy Efficiency Opportunities Assessment Framework					
Leadership	**People**	**Information, data and analysis**	**Opportunity identification and evaluation**	**Decision making**	**Communicating outcomes**
Business decisions and implementation					
☑ KR 1.2 (resources)	☑ KR 2.3 (roles and accountabilities)			☑ KR 5.1 (information to management) ☑ KR 5.2 Business response) ☑ KR 5.3 (plans for implementing, investigating and tracking opportunities)	
Tracking and communication					
				☑ KR 5.1 (information to management) ☑ KR 5.3b (reviewing and monitoring)	☑ KR 6.3 (communication to staff)

Appendix F: References

Web links for all references are available at www.energyefficiencyopportunities.gov.au

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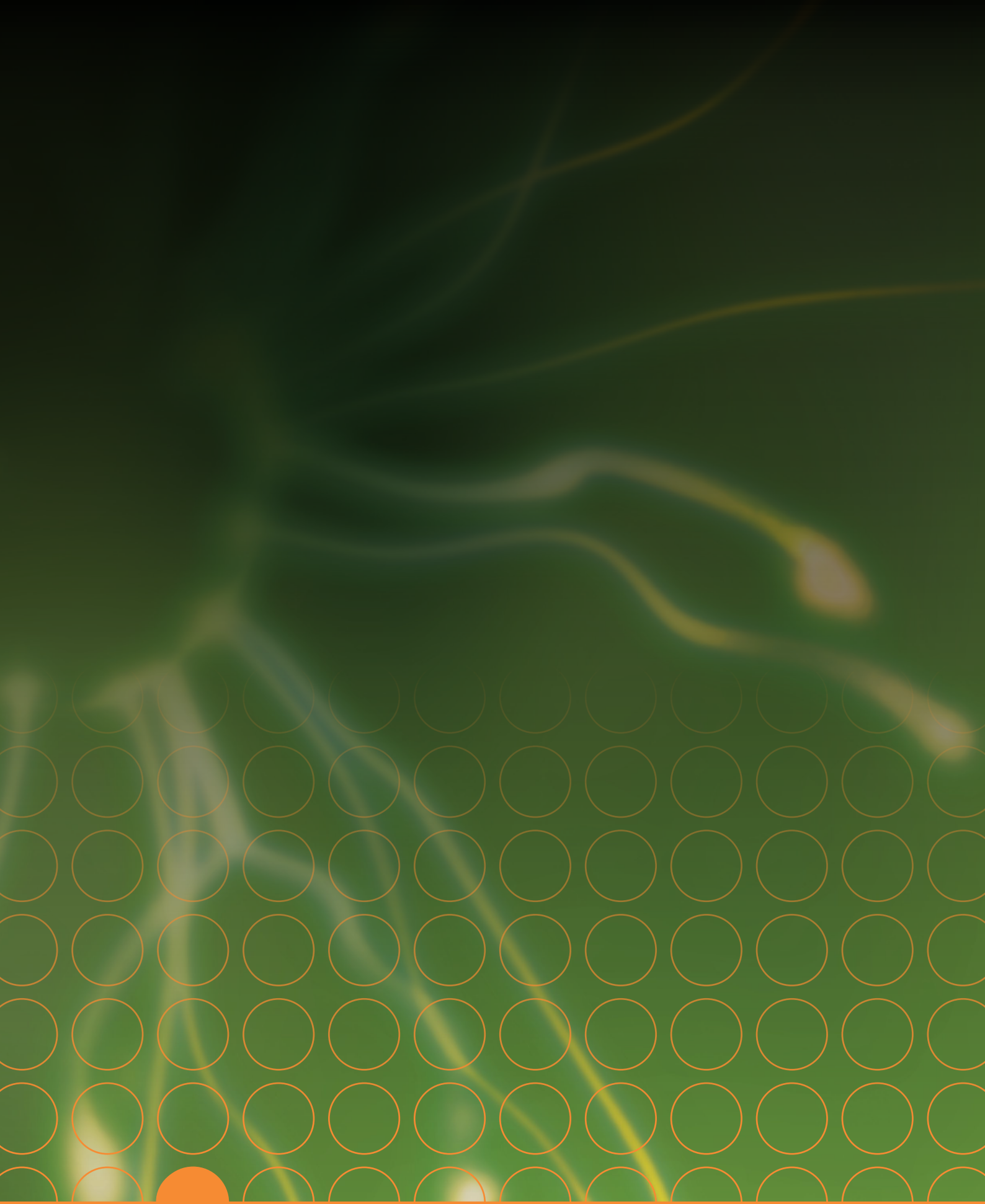

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