Infrastructure Sustainability Council of Australia

Developing a Business Case for Sustainability Initiatives in Infrastructure

A 'How To' Guide

Version 1.0
November 2016

ISCA would like to thank all the volunteers in the ISCA Contractors Working Group for compiling this guide for use by the infrastructure Industry. The Contractor's Working Group membership at time of publication included Co-Chairs Glenn Hedges (EIC Activities) and Nicole Neal (McConnell Dowell), Rory Bracken (Fulton Hogan), Tim Clarke (Lendlease/ NorthConnex JV), Scott Fraser (John Holland), Samantha Hayes (CPB Contractors), Hollie Mapson (Laing O'Rourke), Mark Sabolch (Lendlease) and Rick Walters (UGL).

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Introduction

Purpose of this Guide

One of the primary barriers to the uptake of sustainability initiatives within the infrastructure sector is the perceived difficulty associated with developing a business case to demonstrate the benefits of such initiatives.

The purpose of this Guide is to assist infrastructure industry practitioners to develop a convincing business case for a sustainability initiative.

It has been developed to support practitioners in the preparation of a business case appropriate to the scale and type of a proposed initiative and its stakeholders. The aim is to assist in conveying both the tangible and intangible impacts of a proposed initiative in a language that will resonate with decision makers.

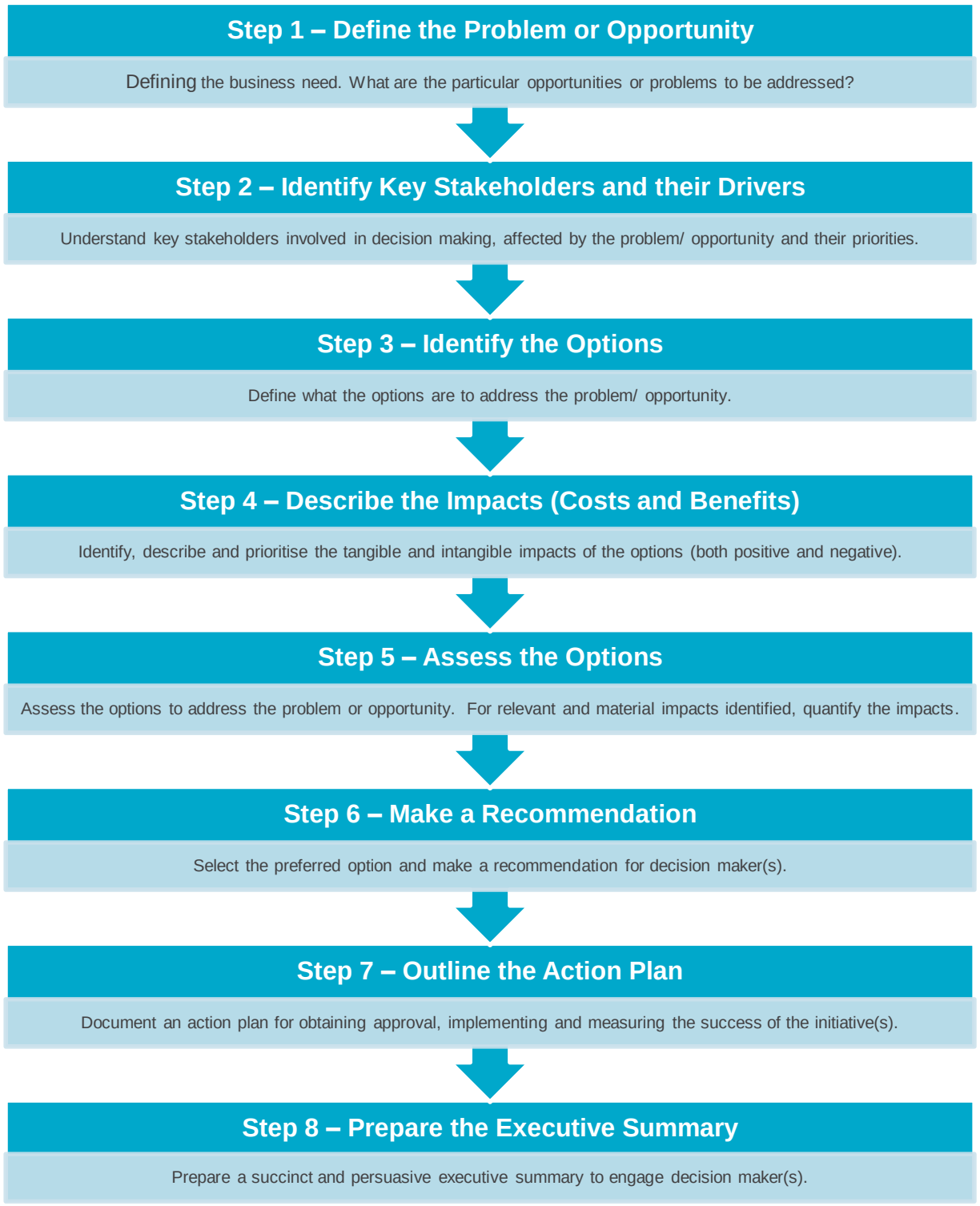
Who Should Use the Guide?

This Guide is designed to assist infrastructure industry practitioners involved in all stages of the infrastructure lifecycle – planning, design, procurement, construction, operation, maintenance and ownership. It is designed to cater for those with no prior experience in sustainability, though is intended be equally useful for sustainability professionals, engineers, environmental management and community engagement professionals.

The Guide is not intended to address specialist technical areas that may feed into a business case such as environmental economics or calculation of natural capital, for example. These technical specialities are developed through years of study and application, and as such a suitable expert should be consulted to provide this expertise where necessary.

Structure of the Guide

This Guide details eight key steps in developing a sustainability-focussed business case. These comprise:



To illustrate the steps of this Guide, two case studies are provided. Whilst Case Study 1 is the most prominent example, Case Study 2 is used in some instances to demonstrate analysis over a longer timescale.

Case Study 1: Energy Efficient Lighting Towers - Context and Introduction

An engineer is working on an infrastructure construction project which involves night works. The procurement team have sought their assistance in scoping and selecting a supplier to lease lighting towers for a period of 12 months. The construction team typically use diesel powered towers with metal halide lamps (herein referred to as 'standard towers') from a supplier they have used many times before.

The project has a target to achieve a 20% energy and greenhouse gas (GHG) emission reduction specific to the construction phase and is seeking opportunities to contribute to the achievement of this target.

The engineer has identified some suppliers offering new types of lighting tower utilising (a) LED technology and a smaller diesel generator and (b) LEDs using a solar/diesel hybrid. The suppliers claim these towers can significantly reduce fuel consumption and GHG emissions whilst providing the same lighting levels in comparison to standard towers. The engineer's review of product specifications and previous performance indicates that the claimed savings appear credible. The dry-hire rental prices for both options are more expensive than standard towers though these costs exclude the savings from reduced fuel use and associated labour to refuel and maintain the towers. The procurement team have also indicated that the Construction Manager (who will ultimately approve this package) will need convincing to deviate from their usual supplier arrangements.

This guide will work through the process for assessing the costs and benefits of each of the above options, as well as the standard option, to identify the preferred lighting tower technology for the project.

Case Study 2: Solar Power Array on a Fixed Building - Context and Introduction

This example focusses on an initiative where the client receives the value over a moderate time frame from a sustainability initiative rather than the contractor. The Case Study involves the design and installation of a series of solar panels installed on a client's fixed asset (roof of a depot being constructed by the contractor) which will meet some of the power demand from the depot during the day.

Step 1: Define the Problem or Opportunity

In the process of developing a business case for a sustainability initiative, there is a natural tendency to jump straight to analysing a potential initiative itself and justifying its costs and benefits. To develop a compelling business case however, it is *essential* to 'step back' and accurately define the problem or opportunity[1] that a proposed sustainability initiative is intended to address. Otherwise there is a significant risk of wasting time, effort and finances solving the wrong problem or at least not providing a suitable business case for decision makers.

The completion of this step should result in a clear statement of the problem or opportunity and a description of its causes and effects, scale and extent. There are two elements to good problem/ opportunity definition.

1. Identify the objectives and targets relevant to the proposed sustainability initiative

What organisational, client or broader societal objectives and targets may not be achieved due to the problem/ opportunity? What objectives and targets does the opportunity contribute to? When looking at opportunities, it may be useful to refer to the below framework, which outlines common business improvement objectives and value drivers:

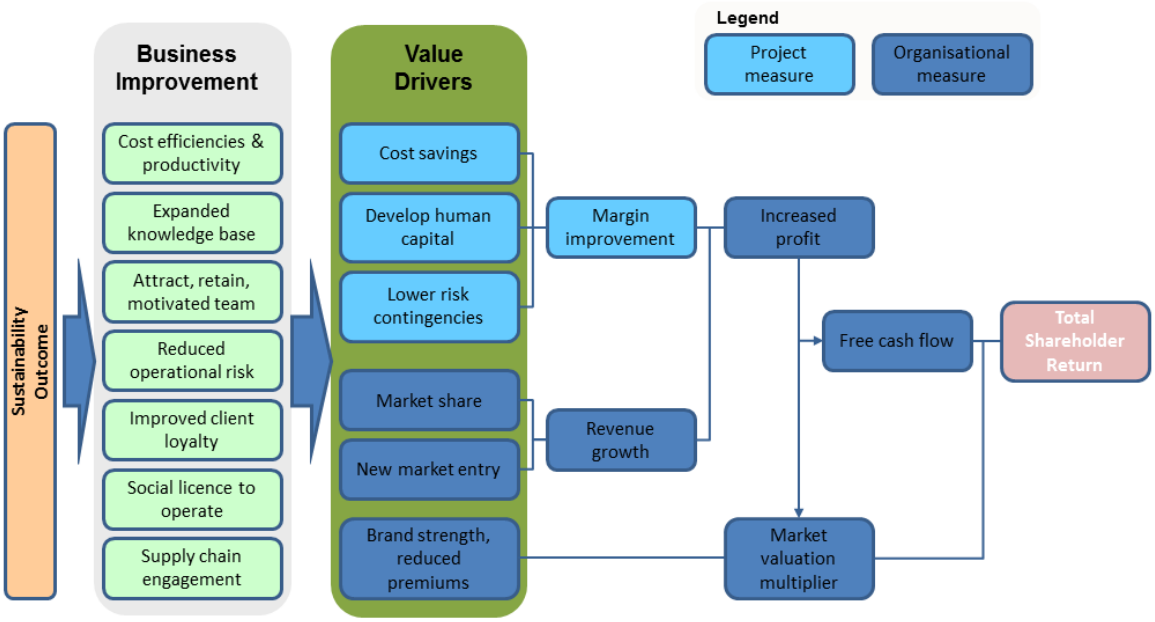


Figure 1: Value Flow Framework for Principal Contractors[2]

In the framework presented in Figure 1, a 'sustainability outcome' is a 'beyond compliance' or beyond 'business-as-usual' (BAU) outcome which exhibits environmental, social and/or economic benefits and has the potential to drive business improvements and create value.

Objectives and targets may relate to the infrastructure project/ asset itself or higher strategic goals. Refer to the project management plan, sustainability policy, client/government strategic plans, EIS and other related documents to identify key objectives and targets.

2. Identify and analyse the problem/ opportunity

Where possible, identification and analysis of the problem/ opportunity should be based on data and information obtained from surveys, modelling, interviews and studies from a range of sources appropriate to the materiality of the issue. Problem/ opportunity identification should not be confined

1 The term "problem" shouldn't be interpreted in purely a negative manner. The term "problem" can also mean challenge, constraint, or issue.

2 Adapted from Hedges (2014) with key influences from Berns et al (2009) and Stapledon (2012).

to existing situations or issues - emerging and potential future problems/ opportunities should also be considered.

Investigate, at least a high level, the explanations behind the problem/ opportunity and identify its fundamental root causes and symptoms. Effective action can only be taken once the underlying cause and effect of a problem or opportunity are understood. Seek to develop at least a high-level understanding of the scale, extent and cost of the problem/ opportunity.

Note that the problem/ opportunity definition will often be brief. While the details of stakeholder drivers and impacts will be assessed later, Step 1 is the opportunity to succinctly capture some of the key material elements to the business case.

Case Study 1: Energy Efficient Lighting Towers

(1) Identify the objectives and targets relevant to the proposed sustainability initiative.

Objectives: Improve energy efficiency and reduce Scope 1 and 2 emissions during the construction phase.

Targets: GHG reduction goal - achieve a 20% energy and greenhouse gas (GHG) emission reduction specific to the construction phase.

While the above objective is the most relevant in this instance, proposed initiatives may also be reviewed against broader project Key Result Areas (KRAs) including: Environmental performance, community impacts, cost savings, reliability and safety.

(2) Identify and analyse the problem or opportunity that the initiative seeks to address.

Analysis of the project energy base case shows that a number of initiatives across various plant and activity types will be required in order to achieve the significant 20% energy and GHG savings targeted. Lighting towers represent a small component of the overall energy profile, however they have been shortlisted as a focus area for energy reduction initiatives for the following reasons:

a. Scalability – lighting towers are commonly used on construction projects so there is potential for this new technology to be introduced to a large number of current and future projects.

b. Measurability – Lighting towers provide a consistent demand which makes performance improvements or comparisons easier to predict and measure than other activities with highly variable energy consumption.

A number of additional benefits may also be realised:

- Potential cost savings associated with reduced fuel consumption.
- Reputational and client relationship benefits stemming from efforts to move beyond minimum expectations and support industry transformation.
- Community benefits through reduced noise impacts.
- Contribution to sustainability messaging and a broader social licence to operate.
- Contribution to increased demand for energy efficient products within the supply chain, encouraging suppliers to further invest in more efficient solutions.

Step 2: Identify key stakeholders and their drivers

This section outlines the process of identifying key stakeholders relevant to the problem or opportunity. These stakeholders, who may be individuals or groups, are the key decision makers, influencers and authorities who are most impacted by the problem or opportunity, or will be most impacted by the sustainability initiative.

Why identify key stakeholders?

Early identification of stakeholders, who can influence, or potentially be impacted by, a proposed sustainability initiative, is essential to gain their support, address potential 'show stopping' issues, take on board previously unconsidered ideas or approaches, and ultimately develop a robust and compelling business case.

For more complex opportunities or problems, comprehensive stakeholder identification and engagement may be beneficial to ensure that all positive and negative impacts are understood, and where desirable, that key stakeholders participate in the decision making process. Involving stakeholders can also reinforce the objective nature of the assessment.

Who are the key stakeholders?

In identifying stakeholders (both internal and external to the business and project), look for people or groups who satisfy one or both of the following criteria:

1. Can potentially be impacted (positively or negatively) by the sustainability initiative.
2. Can influence the decision making process that this business case will be subject to.

These stakeholders could include internal project team stakeholders, internal organisational stakeholders, suppliers and service providers, end-users, and local community stakeholders (including residents and businesses). Also check with your key stakeholders for any of their stakeholders which they would have to manage relating to the problem/ opportunity.

What do stakeholders value?

When looking at the impacts of the problem or opportunity on each stakeholder, look at both the direct and indirect impacts and how these align with key stakeholder priorities and drivers.

It's important that the value drivers for stakeholders are understood, i.e. what really matters to them. Developing a business case in alignment with the priorities and broad objectives of key stakeholders is crucial in ensuring a business case has maximum impact.

When looking at what matters to stakeholders, consult their strategic vision, objectives and targets (where known), identify what motivates them and how they define or measure success.

Consideration should be given to the potentially differing value drivers of internal versus external stakeholders and the weighting given to each. Some value drivers may be the same, but there are likely to be others that are distinctly different, perhaps even opposing.

Prioritising stakeholders for engagement

Prioritisation of stakeholders should be undertaken to determine who to engage with and to what extent. It may be useful to plot key stakeholders on an influence/ importance matrix[3] which maps stakeholders according to their influence and importance in relation to the problem or opportunity under consideration (refer to Case Study for an example). The definitions for influence and importance are:

Influence: The power that stakeholders have over an initiative - to control which decisions are made, facilitate its implementation, or exert influence that affects the initiative negatively. This is the extent to which the stakeholder is able to persuade or coerce others into making decisions, and follow a certain course of action.

3 http://www.managingforimpact.org/tool/influence-and-importance-matrix

Importance: The priority given to satisfying stakeholders' needs and interests. This is likely to be most obvious when stakeholders interests in the initiative converge closely with project objectives.

Including stakeholders as part of the business case development process

When selecting the method(s) of engagement, the type of influence desired for any particular stakeholder needs to be considered. Types of influence are described in the IAP2 Public Participation spectrum[4] and include inform, consult, involve, collaborate and empower. The earlier the approach to stakeholders is made, the more likely they will feel well-informed and engaged. It may also be best to filter options before approaching stakeholders.

Case Study 1: Energy Efficient Lighting Towers – Stakeholder Analysis

Identifying key stakeholders: The key stakeholders are likely to be the Construction Manager (as the key decision maker), foremen, and supplier. A variety of other stakeholders may have an interest or be impacted by the decision, for example, the Commercial Manager, Community Manager, construction teams using the towers, the Environment Manager, and local residents.

Stakeholder priorities and values: The table below succinctly describes the perceived interests and impacts the problem/ opportunity has on each stakeholder.

Stakeholder influence and importance: An importance/ influence matrix was developed to help prioritise the importance of and influence each stakeholder could exhibit on the choice for each option. The resultant priorities for engaging stakeholders are provided in the table below.

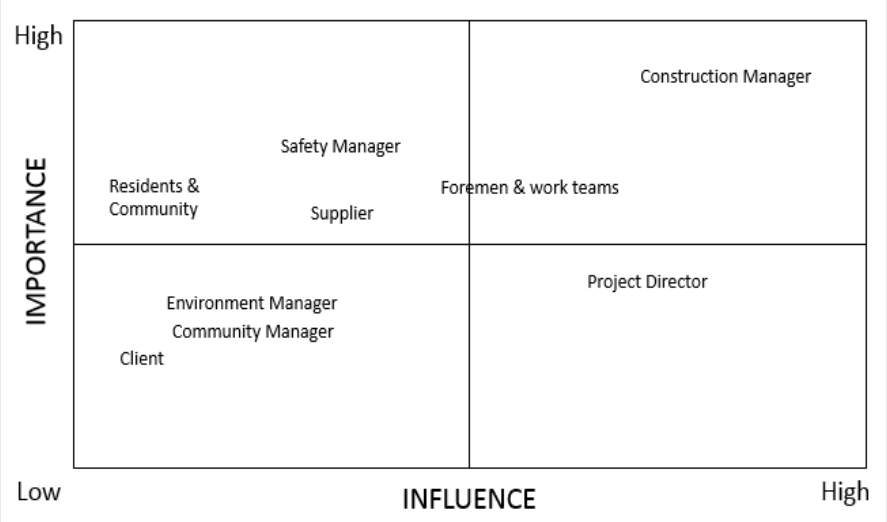
Stakeholder involvement in developing business case: An appropriate method for engaging each stakeholder in business case development is provided in the table below.

Stakeholder	Stakeholder Priorities and Values	Priority Rating	Method
Construction Manager	• Safe working environment, reliable light supply • Lowest cost	1	Involve
Foremen & work teams	• Safe working environment, reliable light supply • Easy to manoeuvre, mobilise, and use	2	Involve
Client	• Social licence with local community (no complaints) • Reputational benefit: corporate social responsibility commitments and legacy	6	Inform
Residents & community	• Noise minimisation • Reduced light pollution • Reduced air pollution	5	Inform
Project & Functional Managers	• Meeting policies, contractual requirements/ KRAs • Environmental benefits, minimise complaints • Cost reduction • Safe working environment	4	Consult
Suppliers	• Achieve a profit and regular cash flow • Confidence to invest in new products • Market share development (repeat business)	3	Collaborate

[4] https://www.iap2.org.au/Tenant/C0000004/00000001/files/IAP2_Public_Participation_Spectrum.pdf

Case Study 1: Energy Efficient Lighting Towers *continued…*

Influence/ Importance Matrix



Step 3: Identify the Options

Once the problem or opportunity has been clearly defined and the stakeholders and their influences and impacts have been identified, the next step is to identify the options (potential solutions) to address the problem/ opportunity. The completion of this step should result in the identification of a set of options that can readily be assessed.

Note the following considerations in options generation:

1. The range of options for assessment depends on the nature and 'size' of the problem/ opportunity**.** For simple opportunities/problems with low impact, a small number of options may be sufficient, otherwise more effort could be spent on the business case than on implementing the preferred option itself. In fact, for simple problems/ opportunities, it may be practical to simply consider just a single option and compare it to a base case option.
2. For complex opportunities/problems with high impact, it is important to consider a broad spectrum of options to ensure the most effective option is selected.
3. There should always be a base case option to refer to. This is the 'do nothing' or 'business as usual' (BAU) option which describes what would happen if the opportunity was not implemented or the problem was not solved.
4. It is recommended that, where possible, the option identification considers both capital investment and non-capital options, such as changes to procedures and practices, and hiring instead of buying / building products or services. These kinds of options may well have a lower lifecycle cost and more beneficial outcomes.
5. It is important to encourage consideration of innovative solutions, even if they are untested. It is also important to think outside of the scope of the construction contractor – which may mean considering partnerships with other stakeholders, such as organisations who will inherit asset maintenance responsibilities.
6. In some cases, the preferred initiative may seem to be clearly evident, or even pre-determined, and the business case is being prepared merely to obtain approval to proceed. Consideration of other options is still important even in these cases, because a decision maker is much more likely to be convinced by a business case that shows proper consideration of alternatives and that the preferred option is indeed superior.
7. There are many processes that can be used to generate ideas for options including ideation (brainstorming), design thinking and charrettes.
8. For complex opportunities/problems, an iterative process may be adopted to refine options by repeating Steps 3 to 5 as necessary. Feedback from stakeholders (Step 2) should be incorporated into this iterative process.

Remember to always challenge your own ideas. Review your ideas with a neutral lens to avoid a self-fulfilling prophecy. Getting a second opinion prior to taking the business case to a decision maker can be invaluable.

Case Study 1: Energy Efficient Lighting Towers – Option Identification

Three options have been identified to supply lighting towers for the project:

1. Standard Tower – The business as usual (BAU) option is to use standard light towers powered by diesel generators which are the industry standard for this application.
2. LED Tower – The first alternative option is to use LED lights powered by diesel generators. LED lights are more energy efficient than the standard towers.
3. LED Solar Tower – The second alternative option is to use LED lights powered by solar/diesel hybrid power. These towers may provide further energy benefits.

The dry-hire rental prices for both alternative options are more expensive than standard towers though these costs exclude the savings from reduced fuel use and associated labour to refuel and maintain the towers.

Step 4: Describe the Impacts (Costs and benefits)

Once the options have been identified, the tangible and intangible impacts (costs and benefits) of each of the options need to be explored thoroughly. At the end of this step, the impacts of each option should be established to enable the options to be assessed in Step 5.

Identifying and describing impacts can be a complex process but in simple terms, impacts will fall into one or more classes as shown in Figure 2.

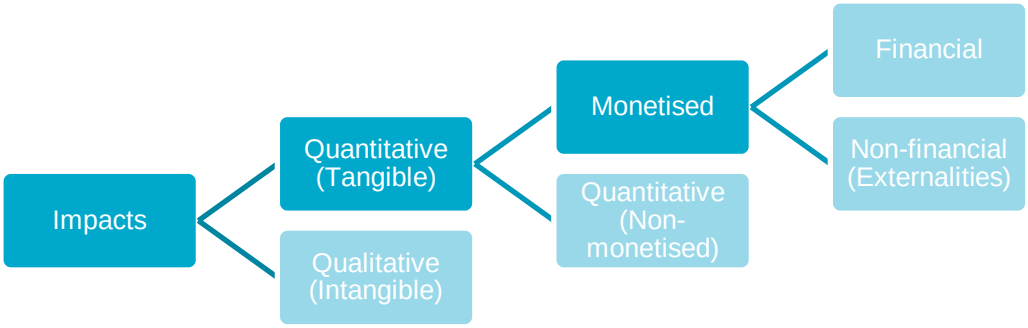


Figure 2: Classification of Impacts

Key points from this figure:

- All impacts can be described qualitatively e.g. a positive effect on community well-being.
- Some impacts can only be described qualitatively or it is not worth the effort to try to quantify them. These impacts are generally described as intangible, such as social licence or reputation.
- Some impacts can be quantified and generally described as tangible.
- Some of the quantifiable impacts cannot be monetised or it is not worth the effort to try to do so. These impacts are sometimes described as non-financial e.g. a reduction in greenhouse gas emissions of 1000 t CO_2-e per annum.
- Some of the quantifiable impacts can be monetised i.e. the impact expressed in the units of money e.g. reduced cost of using less fuel, or a loss of biodiversity valued at $500,000.
- Monetised impacts include internal financial or broader economic impacts which are usually easily monetised since this is the industry accepted approach to describing them. These impacts are sometimes described as financial.
- Monetising social and environmental impacts can be more difficult. These impacts are often termed ‘externalities’ since they lie outside of a traditional financial analysis. The light blue boxes represent the final impact description classes which can be used in the description of the impacts of each option. These classes are described further in sections below.

Quantitative impacts

Quantifying impacts is useful because it provides more detailed and comparable information to a decision maker. For example, consider two options which provide 1000t CO_2-e reduction and 1500t CO_2-e reduction respectively. The second option, on this impact measure at least, is 50% more effective. Compare this to two qualitative impacts being a loss of biodiversity and a significant loss of biodiversity for two options respectively. The latter information is more difficult for a decision maker to make sense of and use.

Quantify impacts by expressing the impact in terms of a suitable metric. This should preferably be a standardised and industry accepted unit. A range of non-financial business performance indicators can be used to measure social and environmental value. These types of metrics are used in:

- Voluntary corporate reporting (e.g. Annual Sustainability Reports) using metrics such as percentage of construction and demolition waste recycled or kilolitres of non-potable or potable water consumed.

- Reporting to Regulators using metrics such as tonnes of CO2-e emitted or kilowatt-hours of energy consumed.
- Internal project performance reporting to parent companies or benchmarking with other projects (e.g. Environmental Incident Frequency Rates).
- Internal decision making such as number of defects, number of complaints, actual versus planned construction time (expressed as a percentage change), or target and aspirational ISCA IS rating scores.

When compiling a business case it is imperative to understand which quantitative metrics are recognised and trusted by the key stakeholders (see Step 2), in addition to demonstrating how the options will influence those metrics.

Where metrics do not exist and need to be developed, attention should be paid to variances in the 'legitimacy' or robustness of the metrics selected. When selecting metrics, choose those which can be used to compare the benefits of multiple initiatives, can be readily linked to broader project, organisational or stakeholder objectives, and can be used for tracking performance of the options once implemented.

Monitised impacts

Financial impacts are, by definition, quantified in monetary units. They traditionally form the basis of a business case.

As noted in Figure 2, some quantitative, non-financial impacts can also be monetised. Being able to monetise an impact should lead to a greater awareness of the impact and also result more readily in appropriate decision making. Monetising an impact allows it to be included in a Cost-Benefit Analysis (CBA) readily (see Step 5), along with all financial impacts. It provides the decision maker with a real and relative sense of the magnitude of the impact. People cannot make rational decisions with incomplete information, and what is often missing is the value (measured and expressed in the same units as the rest of the analysis – money) of the environmental and social assets of the planet. For these reasons, it is desirable that impacts are monetised when they can be.

Monetising social and environmental impacts can be difficult. These impacts are often termed 'externalities' since they lie outside of a traditional financial analysis. Examples include noise, atmospheric and water pollution, climate change caused by greenhouse gas emissions, and severance (barrier effects). Significant progress has been made in recent years in the development of statistical and survey techniques to elicit people's valuations of environmental externalities (hedonic pricing, contingent valuation methods). However, these techniques are far from perfect and are resource intensive. While some argue that placing a monetary value on non-tangible impacts can be seen as subjective, the field of environmental economics is now well established and, with suitable care, it is possible to place a range of reasonable monetary values on a wide spectrum of environmental and social assets.

In simple cases and where particular externality costs are not critical (that is, small in relation to total impacts), default externality values may be used if available. Default values are standard unit costs that can be applied across the board to obtain an estimate of externality costs. Although only a rough guide, employing a default value for an externality is usually preferable to the alternative of giving it a zero value. Default values for typical transport impacts are provided in Australian Transport Assessment and Planning (2016)[5].

If some externalities are significant, then consider obtaining or undertaking modelling or survey work to identify externalities specific to the impacts of the options. Estimate the quantities of the externalities in physical terms and then value the externalities. When valuing an externality, the aim is to find out how much the affected people are willing to pay to avoid the externality, or how much they are willing to accept to put up with it. Techniques to do this include hedonic pricing, stated preference

[5] http://atap.gov.au/

surveys, and estimation of mitigation costs or damage and avoidance costs. More details on these techniques are provided in the references.

Qualitative impacts

As noted above, there are some impacts that can only be articulated qualitatively. Defining the intangible impacts of options is also of particular importance, otherwise decision makers will not receive a full picture.

Qualitative or intangible impacts may include:

- Reputation.
- Social outcomes.
- Environmental outcomes.
- Workforce engagement.
- Ethical and responsible practice drivers.

Clearly define and articulate the intangible impacts so that they are readily understood and their importance is made clear. Wherever possible, look to identify metrics which can quantify these impacts and move them to the 'tangible/quantitative' impact list.

Case Study 1: Energy Efficient Lighting Towers

Relative to Option 1 (the Standard Tower), the benefits and their associated metrics could include:

	Option 2: LED Tower	Option 3: Solar LED Tower
Qualitative (Intangible)	Reputational benefits	Reputational benefits Support for emerging solar technologies
Quantitative (Monetised)	Reduced refuelling cost ($) Reduced maintenance costs ($) Increased hire/purchase costs ($)	Reduced refuelling cost ($) Reduced maintenance costs ($) Increased hire/purchase costs ($)
Quantitative (non-monetised)	Noise reduction (dbA) % Reduction in community complaints Reduction in CO2-e emissions per lighting tower (tCO2-e)	Noise reduction (dbA) % Reduction in community complaints Reduction in CO2-e emissions per lighting tower (tCO2-e)

Describing the Impacts

Prepare a list of all impacts (costs and benefits) for each option. This should include investment costs (to develop an option), capital costs (to construct an option), operating costs (to operate an option), revenue gained (typically during the operating life of an option) and various benefits and 'dis-benefits' (i.e. negative impacts or costs to society and the environment). It may be useful to list the impacts for each option in three columns covering (a) a qualitative description, (b) a quantitative description and (c) a monetised description (not all descriptions will be necessary or available for each impact).

The assessment period should aim to cover the full lifecycle of the options. For capital projects, this should include the construction and operation periods (to the end of the design life) and end of life deconstruction and sale or disposal (where relevant). Where options have different design lives, it is preferable to use the longest design life and include a suitable renewal allowance for options with shorter lives.

Step 5: Assess the Options

In this step, the information on options and their impacts collated in Step 4 is assessed. This section outlines how to assess and narrow down options through a structured, objective, and evidence-based process for the purpose of identifying a preferred option.

Step 5 outlines a number of tools which can help with the assessment. Whilst the models outlined below suggest a number of tools to help with the analysis, this is by no means a complete list, as there are many more models available to use. As part of the analysis, you may use some or all of the methodologies. The actual tools used will depend on the problem at hand and the depth of analysis required.

Options should not be ruled out on the basis of personal preferences, perceived political difficulties or in any way that precludes genuine consideration of certain options. At this step, options should be judged solely on their merit and ruled out only on the basis that they do not address the problem/ opportunity in the most efficient way.

The assessment process consists of the following:

Screening (optional):

- Screening should be used where there is a long list of options that need to be shortlisted before undertaking a more detailed assessment.
- Requires less effort than going straight to detailed assessment with all options.

Detailed Assessment:

- Assesses how each option creates value and/ or how they deliver net benefits, i.e. benefits greater than costs.
- Identifies the option that generates the most value and/ or delivers the largest net benefit – this becomes the preferred option.

A number of tools are recommended for use in the assessment process, as listed below. Select in accordance with your organisation's preferences.

Options assessment stage	Recommended tools	Description	When Used
Screening	Screening checklist (see Appendix 1)	A checklist that aligns options against goals, objectives, policies and strategies for each initiative. If an option does not align then it can be ruled out and does not proceed to detailed assessment.	Less complex problems/ opportunities where there is a long list of options
	Multi-criteria assessment (MCA)	An approach that scores options under several different criteria (which may or may not be weighted and aggregated into a single score)	More complex problems/ opportunities where there is a long list of options
Detailed assessment	Cost-Benefit Analysis (CBA)	A financial analysis process for calculating the net costs and benefits of options expressed in monetary units. Results can be expressed in a variety of metrics including payback period, Net Present Value (NPV), and Return On Investment (ROI).	Most problems/ opportunities
	Complete Economic Analysis (CEA)	An economic analysis tool for calculating the net benefits (benefits less costs) of options and including wider environmental and social impacts (externalities), all expressed in monetary units.	More complex problems/ opportunities to extend CBA by bringing the externalities into the assessment

Options assessment stage	Recommended tools	Description	When Used
	Appraisal Summary Table (AST)	A format for summarising the results of an appraisal process, including financial and non-monetised benefits and costs.	Less complex problems/ opportunities to support CBA by bringing the non-monetised quantitative and qualitative aspects into the assessment
	Multi-criteria assessment (MCA)	As above.	More complex problems/ opportunities to support CBA by bringing the non-monetised quantitative and qualitative aspects into the assessment and scoring key impacts

Multi-Criteria Analysis (MCA)

MCA can be used to assess options where significant impacts cannot be monetised. This approach can be used to identify a single most preferred option, to rank options, to short-list a limited number of options for subsequent detailed assessment, or simply to distinguish acceptable from unacceptable possibilities[6]. In this process, it is often valuable to assess various options against the BAU or "do nothing" option (which are not necessarily the same thing). A useful range of MCA techniques can be found in the UK Department of Communities and Local Government's Multi-Criteria Analysis Manual for Making Government Policy (2009)[6].

In essence, MCA establishes preferences between options by reference to an explicit set of objectives that were identified in Steps 1 and 2. Each objective is assigned measurable criteria to assess the extent to which the objectives have been achieved. A standard feature of MCA is a performance matrix where one axis of the matrix describes the options and the other axis describes the performance of the options against each criterion. Refer to the Case Study for an example.

MCAs may be multi-score or single-score:

- A **multi-score MCA** uses a quantitative scale to 'score' options for each criteria. The multi-score MCA approach produces a score for each criteria for each option (the relative importance of each criteria against each other is not considered).
- A **single score MCA** is an extension of a multi-score MCA where weightings are introduced to represent the relative importance of each criteria. Weighted scores are then calculated, with the sum providing an overall weighted numeric score for each option. The Case Study provided below uses a single score MCA.

A single-score MCA applies numerical analysis to a performance matrix in two parts:

1. Scoring: the expected consequences of each option are assigned a numerical score on a strength of preference scale for each option for each criterion. More preferred options score higher on the scale, and less preferred options score lower. For example, a scale extending from 0 to 100 is common, where 0 represents a real or hypothetical least preferred option, and 100 is associated with a real or hypothetical most preferred option. All options considered in the MCA would then fall between 0 and 100. Other scoring systems such as -5 to 5 can be used, where a score of -5 is a materially negative impact, a score of 0 is a no impact option or neutral and a score of 5 represents a materially positive impact. The Case Study example below uses this scoring system.

2. Weighting: numerical weights are assigned to define the relative importance of each criterion.

[6] https://www.gov.uk/government/publications/multi-criteria-analysis-manual-for-making-government-policy

Case Study 1: Energy Efficient Lighting Towers – Multi Criteria Analysis

A weighted, single scored approach can be applied, using scales of -5 to +5 in comparison to the BAU option (which scores 0 for each criteria). The criteria and weightings assigned to each criteria were developed with the Construction Manager. The cost saving score could be based on a qualitative assessment for screening options or cost benefit analysis (refer Case Study described below).

Criteria	Weighting	Option 1 Standard Towers (BAU)	Option 2 LED Lighting Towers	Option 3 Solar LED Lighting Towers
Environmental performance	10%	0	2	5
Community impacts	10%	0	2	2
Cost Saving (CAPEX and OPEX)	50%	0	1	1
Reliability	15%	0	0	-1
Safety	15%	0	0	0
Overall Score		**= 0**	=(2x0.1) + (2x0.1) + (1x0.5) = **0.9**	=(5x0.1) + (2x0.1) + (1x0.5) + (-1x0.15) =**1.05**

Scoring Legend: Rating -5 to 5, where -5 = materially negative impact, 0 = comparable to BAU option, 5 = materially positive impact

Based on the above analysis Option 3, the Solar LED Lighting Towers, would be recommended as it achieves a cost saving, superior environmental performance, and reduced community impact in comparison to the standard lighting tower option.

The most common way to combine scores on criteria is to calculate a simple weighted average of scores, as shown in the above example.

The following websites provide free tools and worksheets for carrying out basic multi-criteria analysis:

- Natural Resources Leadership Institute: https://www.ncsu.edu/nrli/decision-making/MCDA.php
- Mindtools: https://www.mindtools.com/pages/article/newTED_03.htm

Cost Benefit Analysis (CBA)

CBA is a systematic approach to estimating the strengths and weaknesses of options to address a problem or opportunity or comparing the impacts (costs and benefits) of a specific decision. Impacts are expressed in monetary terms, and various metrics can be calculated from the costs and benefits to compare the options. These include Payback Period and Return On Investment (ROI). A CBA can also be adjusted for the time value of money to provide a Net Present Value (NPV). Other metrics include Benefit to Cost Ratio, or Internal Rate of Return (%) (IRR), which are not discussed further in this guide.

A CBA calculates the capital expenditure (CAPEX), operating expenditure (OPEX), and revenue of each option.

To undertake a CBA, the financial impacts identified in Step 4 are assessed in more detail to calculate the total costs and benefits relating to each impact. Refer to the Case Study example below. The common metrics for expressing the results of CBA are also further explained below.

Case Study 1: Energy Efficient Lighting Towers – Cost Benefit Analysis

The table below assesses and compares the costs for three lighting tower options. All costs exclude GST.

Cost item	Option 1 Standard Towers	Option 2 LED Towers	Option 3 Solar LED Towers
Hire cost for hire period (12 months, 10 units) ***(assumes equivalent lighting output per tower type)***	$1,400/month/unit x 12 months x 10 units = **$168,000**	$1,700/month/unit x 12 months x 10 units = **$204,000**	$2,000/month/unit x 12 months x 10 units **= $240,000**
Light Tower delivery and pickup costs ($150 delivery + $150 pickup per tower)	$300 x 10 units = **$3,000**	$300 x 10 units = **$3,000**	$300 x 10 units = **$3,000**
Fuel cost for hire period (12 months, assume run time 10hrs/day, 5 days/week, $1.30/L)	10hrs x 4L/hr x 5days/wk x 50 weeks x 10 units = **$130,000**	10hrs x 1.5L/hr x 5days/wk x 50 weeks x $1.30/L x 10 units = **$48,750**	10hrs x 0.5L/hr x 5days/wk x 50 weeks x $1.30/L x 10 units = **$16,250**
Labour to refuel for hire period (12 months, $30/hr, 15min to refuel each unit)	$30/hr x 0.25hr/unit x 10 units x 5 days/wk x 50 weeks = **$18,750**	$30/hr x 0.25hr/unit x 10 units x 2 days/wk x 50 weeks = **$7,500**	$30/hr x 0.25hr/unit x 10 units x 1 day/wk x 50 weeks = **$3,750**
Totals	**$319,750**	**$263,250**	**$263,000**

Option 3 exhibits the lowest forecast cost for the anticipated period of hire. A cost saving of $56,750is estimated compared to Option 1.

Payback Period

A payback period is the length of time required to recover the cost of investment by the receipt of profits or savings accrued from the investment. It is expressed in months or years as illustrated in the example.

Payback Period = Initial outlay of investment / profit or savings accrued per month or per annum

Case Study 2: Solar Power Array – Payback Period

This example analyses the merits of a large solar power array being installed on the roof of a fixed structure. The project requires an initial outlay of $45,000 and is projected to generate a net saving per year of $5,000 (the sum of projected electricity savings minus maintenance costs).

Capital cost for installing array	$45,000
Estimated net saving per year (the sum of projected electricity savings minus maintenance costs) = $5,000/year	$5,000/year
Payback Period = $45,000 / $5,000 per year	**9 years**

The payback calculation suggests that this investment would be favourable if the period of operation of the solar array exceeded 9 years.

Return On Investment

Return on Investment (ROI) is a simple financial measure that calculates the benefit of an investment decision as a percentage of profit against invested capital. This calculation is commonly used to measure the comparative benefits for the selection or justification in purchasing assets or using capital (e.g. purchasing a solar panel array for a depot building) rather than deciding the most cost efficient means to achieve a specific function like the lighting tower hire examples featured in this Guide. The calculation for ROI is:

$$\text{Return on Investment (\%)} = \frac{\text{Net Profit}}{\text{Cost of Investment}} \times 100$$

The higher the percentage, the better the return. A negative ROI indicates that there is no profit and the net benefit is less than the cost of the initiative. This method can also be used to compare the forecast returns of investment options to determine the best value for money. The time period of the investment is an important aspect to consider when assessing the merits of investment decisions utilising ROI.

Case Study 2: Solar Power Array – Return on Investment

This example extends on the case study by illustrating the ROI for the solar PV array.

Capital cost for installing solar power array	$45,000
Estimated net saving over 10 years (the sum of projected electricity savings minus maintenance costs) – investment = $5,000/year x 10 years - $45,000	$5,000
ROI = $5,000 / $45,000 x 100	**11%**

The ROI of installing a solar power array is 11% over 10 years, equivalent to 1.1% per year. The investment pays back the initial investment plus a profit of 11%.

Net Present Value (NPV)

NPV is a measurement of profitability and cash flow for an investment over time and is a useful tool to determine when or whether an option will result in a net value. It is calculated by aggregating the costs (negative cash flows) and benefits (positive cash flows) for each period of an investment (nominally on a yearly basis), then determining the value of those cash flows for each period. This adjustment for time is critical in NPV as it recognises that the value of one dollar in the future is less than one dollar at present. The formula for calculating NPV is:

$$\mathrm{NPV}(i, N) = \sum_{t=0}^{N} \frac{R_t}{(1+i)^t}$$

Where:
i = discount rate
N = total number of time periods
t = the time of the cash flow
R_t = the net cash flow (ie. cash inflow – cash outflow, at time *t*)

In construction projects, the NPV method can be useful for assessing the merits of designing and constructing an initiative where the operator/owner would receive a cash flow or equivalent reduction in costs in each period. If possible, it is also beneficial to link the upfront costs of an initiative to where it appears in the project's life cycle. It can also be beneficial to link to progress payments throughout a project, as cash flow can potentially be a barrier to adoption depending on the size, scale and timing of an initiative.

A variety of calculators are available online[7] and many common spreadsheet software include NPV formula. A positive NPV is projected to result in a profit, a negative NPV is projected to result in a loss, and a zero NPV means that the minimum Internal Rate of Return (IRR) nominated by the company involved has been achieved. An example of an NPV calculation is provided below.

7 http://www.financeformulas.net/Net_Present_Value.html

Case Study 2: Solar Power Array – Net Present Value

This example extends on the case study by illustrating the NPV for the solar PV array. The project requires an initial outlay of $45,000 and is projected to generate a net saving per year of $5,000 (the sum of projected electricity savings minus maintenance costs) over 10 years. The applicable discount rate is 10%.

Year	Cashflow	Accumulated Cashflow ($)
0	($45,000)	-45,000
1	= $5,000 / $(1 + 0.10)^1$ = $4,545	-40,455
2	= $5,000 / $(1 + 0.10)^2$ = $4,132	-36,322
3	= $5,000 / $(1 + 0.10)^3$ = $3,757	-32,566
4	= $5,000 / $(1 + 0.10)^4$ = $3,415	-29,151
5	= $5,000 / $(1 + 0.10)^5$ = $3,105	-26,046
6	= $5,000 / $(1 + 0.10)^6$ = $2,822	-23,224
7	= $5,000 / $(1 + 0.10)^7$ = $2,566	-20,658
8	= $5,000 / $(1 + 0.10)^8$ = $2,333	-18,325
9	= $5,000 / $(1 + 0.10)^9$ = $2,120	-16,205
10	= $5,000 / $(1 + 0.10)^{10}$ = $1,928	-14,277

Whilst this example excludes a multiple number of factors (such as energy price inflation, asset depreciation, and carbon offset savings), the Net Present Value of this initiative is -$14,277 and therefore it would not be a favourable investment. This is in contrast to the simple payback and ROI calculations which suggested that the initiative was favourable if it operated for 10 years. This example illustrates the importance of considering the time value of money and the usefulness of the NPV metric, particularly for initiatives having a long period of operation.

If two or more options were being assessed together or were competing for funds then the option with the higher NPV may be considered the better option as it is more profitable for a similar investment outlay.

Complete Economic Analysis

A Complete Economic Analysis[8] requires a complete evaluation of all of the costs and all the benefits accruing to all segments of society and the environment as a result of the initiative. This involves incorporating all the financial impacts as well as the relevant non-financial monetised impacts (i.e. the social and environmental externalities) into the CBA. The same sort of metrics apply as for CBA.

In the lighting towers Case Study, the monetisation of costs and benefits associated with tangible and intangible environmental and social impacts could look like this[9]:

8 Environmental and Economic Sustainability, Paul E. Hardisty, CRC Press, 2010

9 Note that for this exercise, the aim is to show the broad principles, rather than provide detail on how intangibles can be quantified.

Case Study 1: Energy Efficient Lighting Towers – Complete Economic Analysis (for Tower Option 2)

Cost/Benefit Type	Description	Workings / Assumptions	Annual Calculated Cost/Benefit
Social Costs	Nil	Nil	Nil
Social Benefits	The client (reputation benefit to client),	Similar to an advertisement in trade magazine $5k	$5,000
	Future clients (potential for future reputational benefit),	Opportunity of winning new work	$10,000
	Local community (each of the LED towers are quieter, so less noise),	Less need to respond to community complaints, say 2 events @ $2k each.	$4,000
	Workers (less noisy)	Less ear plugs ($20 box) and less noise testing ($1000)	$1,020
Environmental Costs	Nil	Nil	Nil
Environmental Benefits	Less GHG emissions	Diesel burn savings are 44.4 kL x 38.6 GJ/kL x 0.0705 tCO_2-e/GJ x $100/$tCO_2$-e	$12,083
	Less noise per tower	This translates to a social benefit, already outlined above, and benefit for local fauna (not monetised in this example)	Nil
	Less bulb replacement.	Metal halide bulbs are $150 each; installation labour $150. Replacement 1 every second year per tower. $300 per year per tower x 1 once in 2 years x 20 towers = $6000	$6,000

SUMMARY:

Sum of all Social and Environmental Costs per annum	Nil
Sum of all the Social and Environmental benefits of using the LED lighting towers per annum	$38,103
Sum of financial costs to hire 10 towers	$261,125
Net Costs of Option 2	$223,022
Net benefits compared to Option 1	$96,728

Appraisal Summary Table (AST)

The CBA and MCA approaches bring together the impacts expressed in dollars or scored terms respectively. There are almost always other impacts that are not readily monetised or quantified but are important for assessment and decision making. These non-monetised impacts should be listed, described in qualitative terms and, if possible, rated in terms of likely direction (e.g. +ve or –ve) and scale (e.g. small, medium or large).

An Appraisal Summary Table (AST) provides a mechanism for summarising both quantitative and qualitative results side-by-side. The AST is a decision-support tool that brings together the various strands of assessment into a summary format to better present the whole picture for decision makers.

The AST addresses the same question as CBA: is an initiative likely to produce a net benefit? Its key features are:

- It presents a summary of all monetised and non-monetised economic, social and environmental benefits and costs on a single page, in a user-friendly format.
- Monetised benefits and costs are presented in present value dollar units, with net present value and the benefit cost ratio from the CBA also recorded.
- A qualitative non-monetised rating system is used that describes impacts as being either positive or negative, and whether the scale of the impact is neutral, small, moderate or large. It also allows for inclusion of a level of confidence for the non-monetised rating
- Quantitative and qualitative descriptions of the associated impacts can also be recorded.
- The AST does not indicate the relative importance of the objectives and their associated impacts, leaving that to the decision-maker.
- The AST enables decision-makers to understand the economic, social and environmental components of the appraisal and to make a judgement about whether the combined monetised and non-monetised impacts suggest the option will produce a net benefit.

An example AST is provided in the Executive Summary Case Study in Step 8 below. Detailed guidance on designing an AST including examples is provided in Appendix D of the Australian Transport Assessment and Planning.

Step 6. Make A Recommendation

Following assessment of the options, a 'preferred' option should be selected and presented to decision makers for approval.

The preferred option should be selected based on the outcomes of the assessment in Step 5. In Step 5, options will have been evaluated against pre-determined criteria. The performance of each option against those criteria should be the primary determinant when selecting the 'preferred' option. While the quantitative assessment may suggest that a certain option is preferred, there may be qualitative impacts which when properly considered suggest a different option. Such considerations may include strong stakeholder preferences which have arisen through the engagement process or practical limitations to implementation, such as availability of supply.

Where such considerations impact on the 'preferred' option, ensure that the justification for varying from the initial assessment criteria is clearly stated in the recommendation.

When developing the recommendation for decision makers, include the following:

- The context and background for the recommendation.
- The key stakeholders engaged.
- The assessment method utilised.
- How the outcomes of the assessment influenced the recommendation.
- The proposed path of action.

Case Study 1: Energy Efficient Lighting Towers – Make a Recommendation

After comparing the three options, it was identified that Option 3 (Solar LED Towers) will result in savings of $56,750, and 98,750 Litres of Diesel, and net benefits of $95,423 compared to traditional lighting towers, as well as minimising disruption to local communities and advancing the industry uptake of energy efficient lighting towers. While the use of diesel powered LED lighting towers was also considered, the net benefits associated with the Solar LED option were forecast to be greater and as such it is recommended that the project hire solar LED lighting towers for use in all site applications during the construction phase.

Step 7. Outline the Action plan

The purpose of the Action Plan is to communicate the steps that will be taken should the recommendation be accepted and implemented.

The value of preparing an Action Plan is that the decision maker can see what is anticipated. It should describe the key elements needed for delivery.

The following are the key points to be addressed in the Action Plan:

- Clarification of the budget and resources required to implement the Proposal.
- Roles and responsibilities of people involved in implementation.
- Timeline with key milestones associated with implementation.
- Communication plan for key stakeholders that have been identified as being important to the delivery of the Proposal.
- Clear deliverables and outcomes, so that implementation progress can be monitored.

The Action Plan should provide enough detail to instil confidence in the decision makers that the proposed investment has been appropriately considered, and that the presented estimates are within an acceptable degree of accuracy.

Case Study 1: Energy Efficient Lighting Towers – Action Plan

Action (Implementation) Plan				
Roles & Responsibilities				
Engineer	Identify opportunities and develop business case			
Construction Manager	Review & approve business case			
Procurement Officer	Manage the procurement process			
Suppliers	Provide costs & specifications			
Plant Manager	Manage supply, operation & maintenance agreements			
Communication Strategy				
Project Leadership Team	• Initial Briefing note on business case • Updates at monthly project leadership meetings			
Foremen & Work Teams	• Initial toolbox talk on initiative • Training sessions for operators on operation & maintenance			
Client	• Briefing note on initiative & business case • Record in Project initiatives Register			
Residents & Community	• Letter drop to potentially affected residents • Light pollution			
Budget				
Delivery and pickup	$3,000			
Ongoing operation & maintenance	$21,510/month x 12 months = $258,125			
Key Delivery Milestones				
Identify options	Develop Business Case	Review & Approve Business Case	Procure	Deliver & Operate
21/1	28/2	15/3	5/4	1/5
Key Issues & Risks				
• OHS considerations associated with the change	• Procurement delays	• Potential effects on migratory species		
Measurement Criteria				
• Fuel consumption (Litres per lighting tower per week)				

Step 8. Prepare the Executive Summary

The Executive Summary is one of the most important parts of business case presentation. It should be the quick look-up, go-to outline for busy decision makers on the most salient aspects of the whole business case. Less is most definitely more in this step. A good Executive Summary should be:

- Concise – keep it short and sharp.
- Concentrated – present just the most relevant information, distilling the key points from the business case.
- Compelling – what is the business need, the recommendation being made and why? Frame the business case in a language that will be understood by the intended audience and decision makers.

The tangible, cost-focussed element/s of your business case should be outlined clearly and prominently. This may be the ROI calculations or NPV calculations, but use whatever type of figure or data that are most important to the stakeholders and ultimate decision maker/s. Present this alongside the salient qualitative information in an Appraisal Summary Table so that it can be understood as one overall picture.

In presenting the information in the Executive Summary it's important to remember to respect the intelligence of the decision makers – if information is presented well they are likely to make good decisions. The rest of the business case document or presentation can then contain the other relevant data and supporting information to verify and endorse that which is presented in the Executive Summary. An example of how an Executive Summary could be presented is provided below.

Case Study 1: Energy Efficient Lighting Towers - Executive Summary

The business case is described in the following Appraisal Summary Table:

Problem/ Opportunity	The project has a target to achieve a 20% energy and greenhouse gas (GHG) emission reduction target specific to the construction phase. Lighting towers used during night works have been identified as a significant contributor to project greenhouse gas emissions.			
Option(s) Identified	1. Standard Tower – The BAU option is to use standard light towers powered by diesel generators. 2. LED Tower – The first alternative option is to use LED lights powered by diesel generators. 3. LED Solar Tower – The second alternative option is to use LED lights powered by solar/diesel hybrid power. The cost benefit analysis identified that Option 3 was preferred as described below (compared to Option 1).			
Targets	**Impacts**	**Qualitative Description**	**Quantitative Measure**	**Assessment**
20% energy and greenhouse gas (GHG) emission reduction for construction	Energy and GHG emissions	Substantial reduction	Option 3 achieves a 4% reduction in energy and GHG emissions for the construction phase	Large +ve
Economic	Hire cost	Extra cost		-$72,000
	Fuel cost	Lower cost		+$113,750
	Refuelling labour	Lower cost		+$15,000
	Less bulb replacement	Lower maintenance cost	Standard metal halide bulbs $300 per year per tower x 1 once in 2 years x 20 towers	+$6,000
Social	Reputational benefits	Slight enhancement	Similar to an advertisement in trade magazine $5k	+$5,000
		Opportunity to win new work	Opportunity of winning new work	+$10,000
	Emerging solar technologies	Support		Moderate +ve
Environmental	GHG emissions	Less GHG emissions	121 t reduction	+$12,083
	Noise	Moderate reduction	10 dBA reduction	Moderate +ve
	Community complaints	Reduction	2 fewer	+$4,000
	Occupational noise	Less need for PPE	$20 saving in plugs $1,000 less noise testing	+$1,020
Cost Benefit Analysis results	Net financial saving of $62,750 plus net social and environmental externalities of $32,103 and other qualitative benefits.			

Conclusions & Recommendations

Based on the above analysis, it is clear that project commercial and environmental outcomes will be significantly improved if Solar LED Towers are implemented for the night works. Consequently, the sourcing and utilisation of Solar LED Towers in place of the current metal halide units is recommended.

Useful References

Australian Transport Assessment and Planning
http://atap.gov.au/

An update of the National Guidelines for Transport Systems Management, this is considered a best practice guide for planning, assessing and developing transport systems and related initiatives and includes an appraisal process which involves monetised benefits and costs as well as non-monetised benefits and costs.

The Business Case and Beyond

http://eex.gov.au/energy-management/the-business-case-and-beyond/

Website with further information and checklists, and focus on energy efficiency projects. The Energy Efficiency Exchange (eex.gov.au) is a joint initiative of the Australian, state and territory governments, administered by the Department of Industry and Science.

Writing a Business Case

http://prov.vic.gov.au/wp-content/uploads/2011/05/1010g4.pdf

Guideline prepared by the Victorian Public Record office of Victoria, 2010

Blogs on Persuading Decision Makers and Selling your Ideas to Decision Makers

http://www.ala.org/advocacy/advleg/advocacyuniversity/budget_crosshairs/story

http://www.1000ventures.com/business_guide/crosscuttings/persuading_selling_ideas.html

Cost Benefit Analysis

http://www.dpmc.gov.au/office-best-practice-regulation/cost-benefit-analysis

Website prepared by the Commonwealth Government, Department of Prime Minister and Cabinet.

Environmental Policy Analysis: A Guide to Non-Market Valuation

http://www.pc.gov.au/research/completed/non-market-valuation

Commonwealth Government's staff working paper, 2014, examines the validity and reliability of various non-market valuation methods.

APPENDIX 1: SUSTAINABILITY INITIATIVE SCREENING CHECKLIST

The table below is a simple check for assessing options to address a problem/ opportunity and can be used as a final screening. Impacts can relate to strategic objectives but can also include other important positive or negative impacts.

Using the Energy Efficient Lighting Towers Case Study as an example:

Reduced energy and GHG emissions should feature strongly in the checklist as these have been identified as a strategic objective in the Case Study example. A safer work environment due to enhanced brightness and/or quality of light is another impact that, while not an explicit strategic objective, can also be included.

Screening Checklist
Option 1 – Standard Light Towers (BAU)

Objectives	Impact Type	Qualitative Description	Quantitative Description	Rating
Improve energy efficiency and	Energy efficiency	No change	No change – uses 4L/hr	Neutral
Reduce Scope 1 and 2 emissions during the construction phase	GHG emissions	No change	No change	Neutral
Others	Safe working environment	No change	No change	Neutral

Option 2 – LED Towers

Objectives	Impact Type	Qualitative Description	Quantitative Description	Rating
Improve energy efficiency and	Energy efficiency	Good improvement	Uses 1.5L/hr	Moderate positive
Reduce Scope 1 and 2 emissions during the construction phase	GHG emissions	Significant reduction	86tCO_2-e reduction	Moderate positive
Others	Safe working environment	Some improvement	N/A	Slight positive

Option 3 – Solar LED Towers

Objectives	Impact Type	Qualitative Description	Quantitative Description	Rating
Improve energy efficiency and	Energy efficiency	Great improvement	Uses 0.5L/hr	Large positive
Reduce Scope 1 and 2 emissions during the construction phase	GHG emissions	Very significant reduction	121tCO_2-e reduction	Large positive
Others	Safe working environment	Some improvement	N/A	Slight positive

The screening check above shows that both options 2 and 3 pass the screening and should be considered for further analysis. Option 1 does not pass the screening as it does not deliver on the objective. It should only be considered further as a basis for comparison with the other options.

In reality, screening is best used where there is a long list of options but the above example is useful for illustrative purposes.

Screening Checklist Template (to be applied for each option being considered)

Objectives	Impact Type	Qualitative Description	Quantitative Description	Rating
List each objective (could be client, stakeholder, contractor etc driven) relevant to the option **Objectives listed here should be those established in Step 2 of the Business Case.**	**List the impact types under each objective.** These impacts may be single or multidimensional. For example, if the objective is to '**reduce energy and GHG emissions**', impact types could include carbon, fuel use/selection and air quality. Some impacts may appear more than once, against different objectives.	**For each impact type, describe the impact in qualitative terms.**	**For each impact type, specify the impact in quantitative terms.** This may include physical impacts (such as a reduction in tonnes of CO2 equivalents per annum) calculated over the life of the option. It may also include monetised benefits and costs.	**Rate the alignment to the objective (or impacts) of the option.** Alignment can be rated using a simple 'yes/no' or 'pass/fail' system or via a more detailed scale that assigns positive and negative ratings against each objective. A sample scale is set out in the table below.

Sample rating scale

Rating Level	Description
Large negative	Major negative impacts with serious, long-term and possibly irreversible effects leading to serious damage, degradation or deterioration of the physical, economic or social environment. Requires a major re-scope of concept, design, location and justification, or requires major commitment to extensive management strategies to mitigate the effect.
Moderate negative	Moderate negative impact. Impacts may be short, medium or long-term and impacts will most likely respond to management actions.
Slight negative	Minimal negative impact, probably short-term, able to be managed or mitigated, and will not cause substantial detrimental effects. May be confined to a small area.
Neutral	Neutral - no discernible or predicted positive or negative impact.
Slight positive	Minimal positive impact, possibly only lasting over the short-term. May be confined to a limited area.
Moderate positive	Moderate positive impact, possibly of short, medium or long-term duration. Positive outcome may be in terms of new opportunities and outcomes of enhancement or improvement.
Large positive	Major positive impacts resulting in substantial and long-term improvements or enhancements.