Strategies and Solutions for the Future of Roads: Key Findings

An Industry Research Project by the Sustainable Built Environment National Research Centre (SBEnrc) developed in collaboration with the CRC for Low Carbon Living.

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1. Introduction

1.1 Overview of Project

Road agencies face growing pressure to respond to issues related to climate change, resource shortages, and shifting transport mode preferences. A key part of this response will be to reduce the dependency on fossil fuel based energy (and the associated greenhouse gas emissions) of transport infrastructure and modes. In response to this the Core Partners of the Sustainable Built Environment National Research Centre (SBEnrc) called for a project to look at '*Strategies and solutions for the Future of Roads*', with the following parts:

1. Technologies and Processes for the Future of Roads: The first component responded to the understanding that a number of recent advances in technologies and processes need to be investigated for their sustainability and suitability for Australian road agencies. Building on the previous research findings the first stage of the project focused on three key areas selected by SBEnrc Core Members, namely:

   1. *The inclusion of onsite renewable energy generation technologies as part of road and transport infrastructure,*
   2. *The potential for automated motorways to reduce traffic fuel consumption (referred to as 'Smart Roads'), and*
   3. *The reduction of energy demand of route and signal lighting or main roads.*

   Given the rapid growth of innovation and commercialisation in these areas it is important to ensure a rigorous investigation is undertaken to inform appropriate consideration as part of current and future projects. The deliverables from this item included both a research report,[1] and an industry report,[2] with a summary of the key findings presented in Part 2.1.

2. Sustainability Reporting and the Future of Roads: The second component investigated sustainability assessment and reporting tools to identify opportunities to provide greater value to road and transport agencies. This area of the project delivered the following industry outcomes:

   - *Review of Sustainability Reporting Frameworks:* The research team has undertaken a review of existing sustainability assessment and reporting frameworks related to the road and transport sector to identify specific areas of value. The deliverable from this item was a research report,[3] with key findings presented in Part 3.1.

[1] Rode, I., Moriarty, M., Beattie, C., McIntosh, J., and Hargroves, K. (2014) 'Technologies and Processes to Reduce Carbon Intensity of Main Road Projects', a research report and annotated bibliography for the *Sustainable Built Environment National Research Centre (SBEnrc)* by the Curtin University Sustainability Policy Institute (CUSP).
[2] SBEnrc (2015)' An Investigation into Strategies and Solutions for the Future of Roads', an industry report to the *Sustainable Built Environment National Research Centre (SBEnrc)* by the Curtin University Sustainability Policy Institute (CUSP).
[3] Wilson, K., Farr, A., Whistler, L., and Matan. A (2014) 'A Literature Review of Sustainability Performance Assessment by Road Agencies', a research report to the *Sustainable Built Environment National Research Centre (SBEnrc)* by the Curtin University Sustainability Policy Institute and Queensland University of Technology.

- *Identify Tangible Benefits from use of Sustainability Reporting:* The research team has worked with partners to identify the value created by the use of aspects of sustainability assessment and reporting frameworks (namely the 'IS Tool') related to specific projects. The deliverable for this item is included in Part 3.1.

3. Low Carbon Tendering informed by Sustainability Performance and Reporting Tools: The third component focused on the role sustainability performance and rating tools can play in supporting low carbon tendering in the built environment. This item was undertaken in collaboration with the CRC for Low Carbon Living. This area of the project delivered the following industry outcomes:

   - *Current level of low carbon inclusions in procurement systems:* The research team undertook a desktop review of the level of low carbon inclusions included in associated procurement policies and supporting documents for road and transportation infrastructure in WA, NSW, and Qld. The review as undertaken in parallel with a review of low carbon inclusions in procurement documents by UrbanGrowth NSW in collaboration with the CRC for Low carbon living (Project RP2010). The deliverables from this item were a collaborative research report with the CRC for Low Carbon Living,[4] and a SBEnrc research report focused on road agencies,[5] with key findings presented in Part 4.1.
   - *ISCA 'Infrastructure Sustainability' Tool and Low Carbon Tendering*: Undertaken in collaboration with the CRC for Low Carbon Living, the process involved participation in the 'IS Rating Tool' training course and meetings with ISCA to identify ways the tool can inform low carbon aspects of project tendering, relevant to state government procurement of built environment infrastructure. This included identification of low carbon related items in the 'IS Rating Tool', identification of aspects of the tool to add value to low carbon tendering, client actions related to tool rating and low carbon outcomes, and areas of potential further research. The deliverable from this item was a research report,[6] with key findings presented in Part 4.1.
   - *Investigate the 'Low Carbon Readiness' of Supply Chains*: This item was undertaken in collaboration with the CRC for Low Carbon living and included the development of a supplier survey based on the low carbon items in the 'IS Rating Tool' that was trialled with UrbanGrowth NSW. The deliverables for this item was the design of a 'Low Carbon Readiness Survey', with a sample provided in Part 4.1.

[4] Hargroves, K. (2015) 'Low Carbon Inclusions in Commonwealth and NSW Government Built Environment Sector Procurement', a report to the CRC for Low Carbon Living in collaboration with the Sustainable Built Environment National Research Centre (SBEnrc).
[5] Hargroves, K., and Grant, G. (2016) 'Low Carbon Inclusions in Transport and Road Agencies Procurement Policies', a report to the *Sustainable Built Environment National Research Centre (SBEnrc)* by Curtin University Sustainability Policy Institute (CUSP), Curtin University.
[6] Hargroves, K (2014) 'ISCA Infrastructure Sustainability Rating Tool and Low Carbon Tendering', a report to the Sustainable Built Environment National Research Centre (SBEnrc) and the CRC for Low Carbon Living by the Curtin University Sustainability Policy Institute (CUSP).

2. Technologies and Processes for the Future of Roads

2.1 Key Findings

Harnessing road and transport infrastructure to generate electricity

A key area of focus for the future of roads that was selected by the SBEnrc Core Members was the potential for road infrastructure to contain renewable energy technologies to reduce demand for electricity from the grid, which is predominantly generated using fossil fuel. Much progress has been made to date to demonstrate feasibility of incorporating renewable energy into road infrastructure, as detailed in the associated research report[7] and summarised below (such as tidal and wave power associated with bridges, solar and wind power associated with road easements and structures, thermal power associated with pavements, etc.). Note that the use of solar panels as road surfaces is not covered as it is yet to be shown to be technologically or economically viable other than in walking or bicycle pathways.

Harnessing Solar Energy in Road Easements and Structures

There are a growing array of options for incorporating solar energy generation into roads and pavements as demonstrated in the following case studies, including:.

- *The Solar Highway Program (Oregon, USA)*: In 2008 a 1.75 MW solar array, containing just under 7,000 solar panels, was installed in the easement of Interstate 5 south of Wilsonville by the Oregon Department of Transport, shown in Figure 1. The primary value of the system is to provide electricity for the highway lighting, and it also generates renewable energy certificates.[8]

Figure 1: Oregon Solar Highway Project, 2008

Source: Solar Highway Program: From Concept to Reality, August 2011[9]

[7] Rode, I., Moriarty, M., Beattie, C., McIntosh, J., and Hargroves, K. (2014) 'Technologies and Processes to Reduce Carbon Intensity of Main Road Projects', a research report and annotated bibliography for the *Sustainable Built Environment National Research Centre (SBEnrc)* by the Curtin University Sustainability Policy Institute (CUSP).
[8] ODOT (2011) *Solar Highway Program: From Concept to Reality – A Guidebook for Departments of Transportation to Develop Solar Photovoltaic Systems in the Highway Right-of-Way [Easements]*, A Report for the Oregon Department of Transport by Good Company.
[9] Ibid.

The commercial feasibility of the project relied on a public-private partnership between ODOT and Portland General Electric (PGE), Oregon's largest electricity utility. Advantages for ODOT include not having to find the capital for the project or to be involved in managing the generation of electricity. Also, having a predictable, long term picture of energy expenditure is advantageous in forward planning and at rates which can often better those on offer from competing utility companies. PGE have the benefit of having a ready-made long term customer locked in providing an income stream that will assist in gaining finance for the asset as well as capitalising on the tax benefits and incentives available.

- *Photovoltaic Noise Barriers (PVNB):* Along with the use of easements an obvious place to consider the use of solar power is as part of the structure of noise reduction screening along roadways, such as along the A22 Autostrada at Brennero in Italy shown in Figure 2. According to World Highways in 2014 the energy generated from such structures can, '*help reduce the life-cycle cost of noise reduction devices by up to 30%.*'[10]

Figure 2: A photovoltaic noise barrier installed along the A22 Autostrada, Italy.

Source: World Highways.

- *Solar Thermal:* Given that roads in Australia absorb heat during the day this heat may be able to be harnessed to create electricity. It has been suggested that this may be done by either running pipes through the hot asphalt or cement to heat water or installing thermoelectric wiring within the asphalt surface. A paper published in 2006 suggested that not only can heat be extracted for energy generation using thermoelectric generation techniques, but this will also lead to a reduction in the temperature of road surfaces, increasing operational life of surfaces.[11]

[10] Bellucci, P. (2014) Photovoltaic finish to road noise pollution, World Roads, 2014
[11] Hasebe, M., Kamikawa, Y., Meiarashi, S., (2006) 'Thermoelectric Generators using Solar Thermal Energy in Heated Road Pavement', Thermoelectrics, 25th International Conference, 6-10 Aug. 2006.

Figure 3: The use of pipework to extract heat from road surfaces in the Netherlands.

Source: Ooms Avenhorn Holding

Harnessing Energy from Vehicle Movement

- *Wind Power*: As with solar power, road easements and structures may be suitable for the installation of wind power generation technologies. However a report by VicRoads published in 2013 presented findings of an investigation into the use of wind turbines to harness natural wind in road easements and found them to be unfeasible at this scale, in the order of 20kW. The report conclude that '*micro wind turbines not be considered as a method to generate renewable energy in Victoria unless it can be shown that a major saving in grid connection costs can be achieved*'.[12] Hence it may not be feasible to rely on natural wind for wind energy generation, however there is another source of wind associated with roads that can be harnessed – that of moving vehicles, as shown in Figure 4.

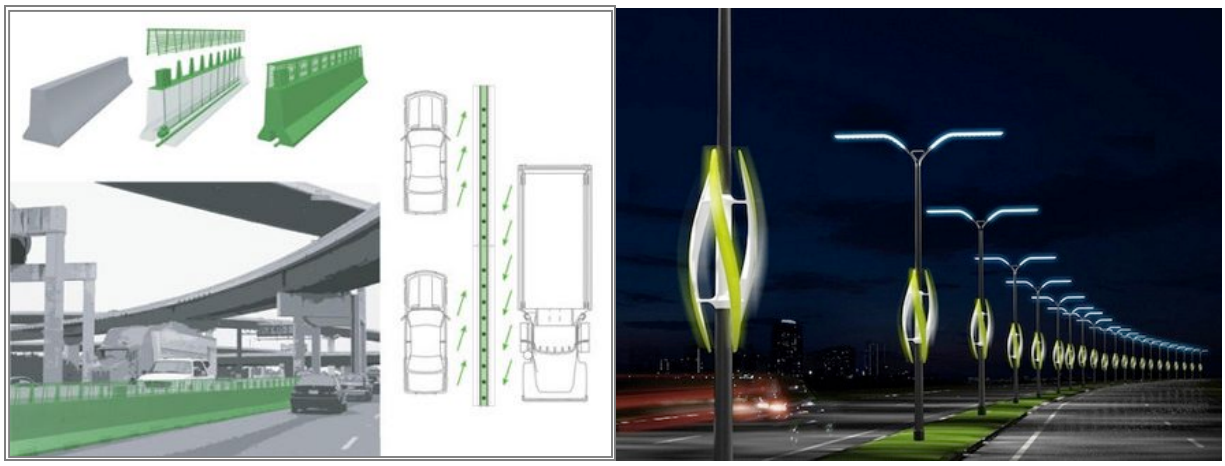

Figure 4: Examples of wind generation systems that harness air movement from passing traffic

[12] VicRoads (2013*) Renewable Energy Roadmap*, VicRoads, July 2013.

- *Piezoelectric Generators:* Along with the wind generated by vehicle movement energy may be able to be harnessed from the movement of vehicles and the pressure created in road surfaces, as shown in Figure 5.[13] This concept, referred to as the 'Piezoelectric Effect', was discovered by the Curie's in 1880, when they found that strain or deformation of a piezoelectric material causes charge separation across the device, producing an electric field which can generate an electric current. There is currently ongoing research on the principles behind the effect, and the practical application to harnessing vehicle energy is in its early stages.

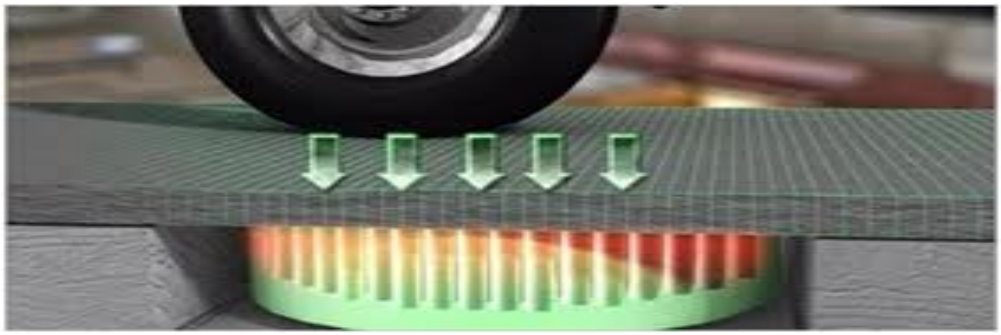

Figure 5: Piezoelectric device located under road surface

Source: Abbasi, A. (2013)

Deferring capital investment through Managed Motorways

Active Traffic Management Methods

According to the U.S. Department of Transportation there are a number of benefits of investing in active traffic management measures, including:[14]

- Increased throughput,
- Increased capacity,
- Decrease in primary incidents,
- Decrease in secondary incidents,
- Decrease in incident severity,
- More uniform speed,
- Decreased headways,
- More uniform driver behaviour,
- Increased trip reliability,
- Delay onset of freeway breakdown,

[13] Abbasi, A. (2013) 'Application of Piezoelectric Materials in Smart Roads and MEMS, PMPG Power Generation with Transverse Mode Thin Film PZT', *International Journal of Electrical and Computer Engineering* (IJECE), Vol. 3, No. 6, December 2013.
[14] Mirshahi, M., Obenberger, J., Fuhs, C., Howard, C., Krammes, R., Kuhn, B., Mayhew, R., Moore, M., Sahebjam, K., Stone, C., and Yung j. (2007) *Active Traffic Management: The Next Step in Congestion Management,* American Trade Initiatives, Commissioned by the U.S. Department of Transportation Federal Highway Administration

- Reduction in traffic noise,
- Reduction in emissions, and
- Reduction in fuel consumption.

Whilst the use of individual active traffic management mechanisms can yield significant benefits, these benefits compound when a combination of measures is used as part of a coordinated freeway management system. Such systems can deliver significantly reductions in accident and congestion related externalities (including reduced noise, carbon dioxide emissions, particulate matter emissions, and fuel use). Such benefit allow the road system infrastructure to utilise a greater proportion of its potential capacity which can lead to the prolonging of the need to invest in additional road infrastructure to meet increasing demand driven by population growth.[15] Along with informing traffic management devices the data collected on vehicle flows and timings is valuable in the design of new road infrastructure to minimise design related impacts on travel time and traffic throughput. Also this data can assist efforts to achieve greater efficiency of the wider road system by decongesting other parts of the road network as motorists seek to minimise their generalised cost of travel by shifting onto a less congested, more reliable managed freeway.

This report overviews a range of methods to achieve automated motorways to deliver sustainability benefits, such as reduced congestion related greenhouse gas emissions. Managed Motorways as a concept began in the United Kingdom in the early 2000's. Since then the active management of traffic on motorways has led to the development of a number of measures, which according to VicRoads include:[16]

- Lane Use Management,
- Variable Speed Limits,
- Traveller Information, and
- Freeway Ramp Metering.

These active traffic management measures can influence road user behaviour and improve traffic flow, increase road safety, reduce fuel consumption of vehicles, reduce time spent in congestion. Due to the interconnected nature of road systems such outcomes can influence the performance of other sections of the system, such as traffic re-routing due to ramp controls, that need to be accounted for. However despite the potential improvements to freeway performance VicRoads cautions that '*not every freeway needs to have every component of managed freeways*',[17] and hence it is important to ensure that the measures implemented are suitable for the freeway and the road system as a whole.

[15] J Gaffney, Vic Roads (2014, pers. comm., 05 December)
[16] VicRoads (2013) *Managed Freeways Handbook for lane use management, variable speed limits and traveller information,* VicRoads, Pg 2.
[17] VicRoads (2013) *Managed Freeways Guidelines*, VicRoads, Page 4.

Given that many of the measures involve providing information to the road user through electronic screens the success of managed motorways relies on effective asset management in order ensure that active traffic management measures are operated effectively. This can ensure that the measures are delivering the best level of service and that the anticipated return on investment is received.

Challenges and Issues Related to Managed Motorways

Whilst there are significant benefits for the Australian road and transport authorities from the investment in the infrastructure and technology to enable active traffic management of freeways, there are also a number of challenges that need to be considered for these benefits to be achieved.

Lack of National Guidelines for Managed Motorways: Australia currently does not have a set of national guidelines for managed freeways which presents a challenge to road and transport authorities intending to incorporate the use of active traffic management measures on freeways. The lack of a national guideline has led to disparate approaches to active traffic management measures amongst the state and territory road and transport authorities. Furthermore there is a lack of international consensus on the role of contemporary traffic theory and the appropriate metrics of success for active traffic management measures. For instance the U.K. measures performance of motorways by looking at the reliability of travel times and the reduction in the impact of incidents on traffic flow. In Victoria however, the performance of motorways is measured primarily based on lane throughput, safety factors, the number of accidents, and travel times. As part of the enhancement of the understanding of managed motorways in Australia, the 'National Smart Managed Motorways Program' has been established by the Australian Government Department of Infrastructure and Regional Development to '*deliver more efficient motorways through the application of smart infrastructure technologies to improve real-time management of major motorways*'.[18] As part of the program the government is investing in active traffic management measures in the absence of.

Lack of Central Integration of Active Traffic Management Measures: The central integration of the active traffic management measures enables a system wide approach to motorway management and allows greater effectiveness of managed motorways. A centralised system can allow:

- The provision of information to road users (such as information on conditions on the motorway and other motorway)s,
- Greater integration of traffic management devices such as ramp signalling and variable speed limits to maximise traffic throughput across the motorway system, and

[18] Australian Government (n.d) National Smart Managed Motorways Program, http://investment.infrastructure.gov.au/funding/managedmotorways.aspx

– Enhance management of flow during accidents, road works and other events through lane use management.

The central integration of the active traffic management measures, and the data collected from motorways, can deliver real benefits through the use of automated algorithm driven system responses in a live traffic environment, enabling greater utilisation of the motorway capacity while reducing trip time and delays to motorists – a win-win situation.

Upgrading lighting technologies and practices to save energy

LED lighting for streets and parks is now widely acknowledged as a viable energy saving option for the future of roads and is being utilised around the world. According to a strategy paper by the Australian, State and Territory and New Zealand governments, '*Street lighting is the single largest source of greenhouse gas emissions from local government, typically accounting for 30 to 60 per cent of their greenhouse gas emissions… The major lighting types are mercury vapour (12% of major road lighting national numbers – down from 25% in 2002/3) and high pressure sodium (86% of national numbers – up from 75% in 2002/3)'.*[19] There is a growing number of international case studies of significant value being created for governments that seek to rapidly retrofit street lighting to new technologies, such as a 2009 study from the United States that found that for a 10km stretch of double lane highway, with poles located 30 meters apart, using LED lighting over the conventional mercury lights would reduce as much as 75% of energy consumption with a payback period of 2.2 years, that is increased to 3.3 years if the LED's are powered by onsite solar energy.[20]

More recently the mayor of New York City, Mayor Bloomberg, announced that the city plans to replace all 250,000 high pressure sodium streetlights with LED's over a three year period.[21] Such projects are contributing to an expected rapid increase in the roll-out of LED's in streetlights globally, anticipated to rise from less than 3 million in 2012 to more than 17 million in 2020.[22] In 2008 the City of Los Angeles began a 4 year process to replace 141,089 streetlights with LEDs, becoming the largest retrofit of street lighting in the world, with staggering results in the amount of night light across the city, as shown in Figure 6. The program has a payback period of 7 years and following this the city estimates that it will benefit from some $10 million/year in savings in electricity and maintenance costs, while reducing greenhouse gas emissions by 47,583 tons/year.[23]

[19] Commonwealth of Australia (2011) Street lighting Strategy, prepared for the Equipment Energy Efficiency Program, a joint initiative of the Australian, State and Territory and New Zealand Governments.
[20] M.S. Wu, H.H. Huang, B.J. Huang, C.W. Tang and C.W. Cheng (2009) Economic feasibility of solar-powered led roadway lighting, *Renewable Energy*, Volume 34, Issue 8, Pages 1934–1938, January 13, 2009.
[21] Bloomberg, M (2013) 'All 250,000 NYC Street Lights Will Be Replaced with Energy-Efficient LEDs by 2017', Press Release, 24 october 2013.
[22] Martin, R. (2012) 'Shipments of LED-Based Street Lights Will Surpass 17 Million by 2020', Navigant Research, 16 October 2012.
[23] Office of the Mayor City of Los Angeles (2012) 'Mayor Villaraigosa announces completion of largest led street light replacement program', Press Release, 18 June 2012.

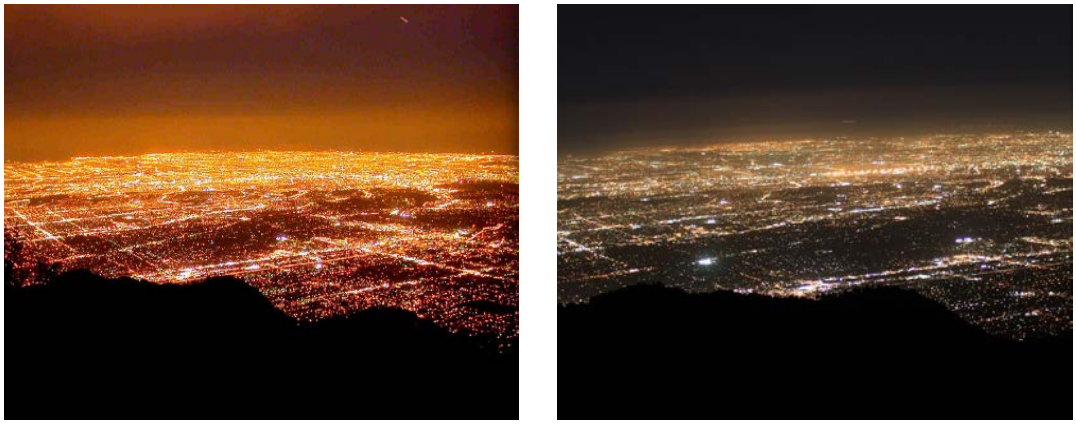

Figure 6: Los Angeles Basin View from Mount Wilson Before and After the Retrofit

In Australia, the City of Sydney has installed 2,600 LED street and park lights and is planning to replace a further 6,500 over the next three years, and the City anticipates saving $800,000 per year. A public survey revealed that over 90% of participants though the LED lighting was appealing and 75% thought that they improved visibility.[24] In Western Australia Main Roads WA has a rolling program, upgrading traffic signal lanterns with LED lamps, which started in 2012. Thus far 670 traffic signal controlled intersections have been upgraded to LED lamps with a further 50 planned for 2014. The overall cost savings from operation and maintenance is projected to be in the order of 71%. In addition, key environmental benefits will include a saving of 320 tonnes of GHG emissions annually and a reduction of materials sent to landfill due to the longer life of the lamps.

[24] City of Sydney (2014) LED lighting Project, City of Sydney.

3. Sustainability Reporting and the Future of Roads

3.1 Key Findings

A shift in environmental reporting by road and transport agencies

It is important to understand that a key part of the response to climate change from the infrastructure sector will be informed by and in large part structured by the tools that are used to report on sustainability and greenhouse gas emissions performance. The early decades of the 21st Century has seen a change in the focus of environmental reporting in roads agencies, from the practice of 'environmental management' which seeks to minimises ecological disturbance, to a second generation of reporting that expands this scope to include sustainable development associated considerations, including a focus on areas such as the energy intensity raw materials, both in their extraction and transportation, and the potential for alternative 'low-carbon' options. Such a shift in focus forms an important part of a road authorities approach to issues of growing concern such as increasing energy costs and increasing impacts from climate change, such as greater weather and natural disaster damage to road infrastructure. [25]

The shift in environmental reporting focus has been supported by the emergence of an array of sustainability assessment frameworks, all with varying purposes, reporting requirements, and outcomes. The research team has identified that much of the data that is required to fulfil the new generation of environmental reporting is already being collected across many, if not all road construction projects. However, it is clear that this data is not systematically reported on in a way that encourages use or transparency of such data. When considering the sustainability of a road project there are two key aspects, firstly the performance assessment of the projects and secondly the rating of the performance against an industry benchmark. As shown in Figure 7 either can be self-assessed or assessed as part of a third party tool, such as those as listed in Table 1. In short, 'Assessment tools' provide a framework to collect data on the actual performance of projects across a number of selected indicators, and 'Rating tools' consider this data to provide a rating that can be used to compare with industry benchmarks and/or internal targets.[26]

[25] Wilson, K. (2014) *A Literature Review of Sustainability Performance Assessment by Road Agencies for the Sustainable Built Environment National Research Centre*, a collaborative project between Curtin University and Queensland University of Technology.
[26] Ding, G. K. C. (2008) 'Sustainable construction – the role of environmental assessment tools', *Journal of environmental management (0301-4797), 86*(3), p.451.

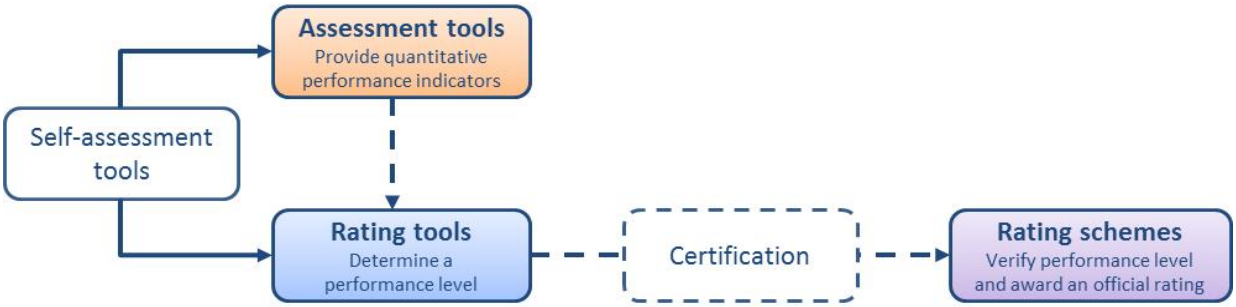

Figure 7: Self-assessment tools and rating schemes

Source: **Wilson, K (2014)[27]**

According to a review by the Engineering and Physical Sciences Research Council in the UK in 2004, there were over 600 tools evaluating social, environmental and economic dimensions. Given the growing concern regarding the impact of road and transport infrastructure projects on the environment, and visa versa, a number of national and international sustainability performance and rating tools have been developed that include a focus on roads and transportation infrastructure, as shown in Table 1.

Table 1: National and International Sustainability Rating Tools Specific to Roads and Transport Infrastructure

Australian Tools	International Tools
IS (Infrastructure Sustainability) Rating Tool, developed and administered by the Infrastructure Sustainability Council of Australia (ISCA).	'The Global Reporting Initiative' (GRI), economic, environmental, social, and governance performance, developed by an international non-profit group.
INVEST (Integrated VicRoads Environmental Sustainability Tool) rating tool, developed by VicRoads.	CEEQUAL, developed by the Institution of Civil Engineers and with an estimated £24.5 billion in assets being assessed since its launch in 2003.
Carbon Gauge® Calculator, developed by HAC and jointly funded by six road agencies across Australia and New Zealand.	Changer Greenhouse Gas Calculator, developed in Switzerland by the International Road Federation.
Bottom Line2 software, developed by the Dipolar Pty Limited and Integrated Sustainability Analysis – ISA, at the University of Sydney.	GreenLITES (Green Leadership in Transportation Environmental Sustainability), developed by the New York State Department of Transportation.
	Greenroads Rating System, developed by the Greenroads Foundation in the US.

Source: Wilson, K *et al* (2014)[28]

[27] Wilson, K. (2014) A Literature Review of Sustainability Performance Assessment by Road Agencies for the Sustainable Built Environment National Research Centre, a collaborative project between Curtin University and Queensland University of Technology.
[28] Wilson, K., Farr, A., Whistler, L., and Matan. A (2014) A Literature Review of Sustainability Performance Assessment by Road Agencies for the Sustainable Built Environment National Research Centre, a collaborative project between Curtin University and Queensland University of Technology.

On the international scale the most widely used sustainability reporting framework is the Global Reporting Initiative. The GRI can be used by Road and Transportation Agencies, with Main roads Western Australia saying that '*We continue to use the Global Reporting Initiative as we remain focussed on our commitment to achieve a fully integrated reporting framework that meets international standards of transparency and accountability.*'[29] A number of sector specific supplements are provided to assist efforts to tailor the generic sustainability reporting elements to the sector to ensure meaningful information is captured, however there is not currently a roads and transportation sector supplement (however a 'logistics and transportation' supplement is under development). Organisations may elect to undergo an independent third-party review of their performance against the GRI criteria to validate their data findings.

Introducing the IS Rating Tool

In Australia the recent release of the IS Rating Tool by the Infrastructure Sustainability Council of Australia (ICSA) has provided the built environment sector with an infrastructure focused rating tool that is quickly becoming a requirement of infrastructure project contracts.[30] The 'IS rating tool' is designed to be used to evaluate the sustainability of infrastructure across design, construction, and operational phases. The tool can be used for self-assessment as well as being able to be formally certified as 'Commended', 'Excellent', or 'Leading'. Considering specific themes within a range of social, economic and environmental sustainability categories across each project, the users of the rating tool nominate a performance level (1, 2, or 3) that they believe they have achieved for each credit and provide supporting evidence as outlined in the tool's technical manual. An assessment is carried out and based on predetermined weightings designed into the tool, the overall rating is calculated, and compared to a possible level of achievement. For example Figure 8 shows a sample rating across the various performance areas with a score of 6 attained for 'Management Systems' out of a possible 10.5.

There are a number of ways that the IS rating tool stands to impact on the climate change related aspects of road and transport infrastructure. In particular the tool provides an industry designed tool to standardise documentation related to sustainability project/asset performance (including greenhouse gas emissions) that can be requested as part of pre-qualification or tender documentation. For instance the tool provides a materials calculator that is designed to compare a 'reference design' with an 'actual design' to allow consideration of the impacts of various sustainability related inclusions and initiatives. The tool can calculate the greenhouse gas emissions of both design options and also provides an overall sustainability measure, called '*eco-points'*. This is an important tool for the industry as it allows direct quantified comparison between design options, along with the potential to demonstrate the value of an innovative design at the tendering stage.

[29] MRWA (2013) Annual Report 2013, Main Roads Western Australia.
[30] Hargroves, K (2014) *ISCA 'Infrastructure Sustainability' Rating Tool and Low Carbon Tendering: A Report to the Sustainable Built Environment National Research Centre and the CRC for Low Carbon Living*, Curtin University Sustainability Policy Institute, Curtin University.

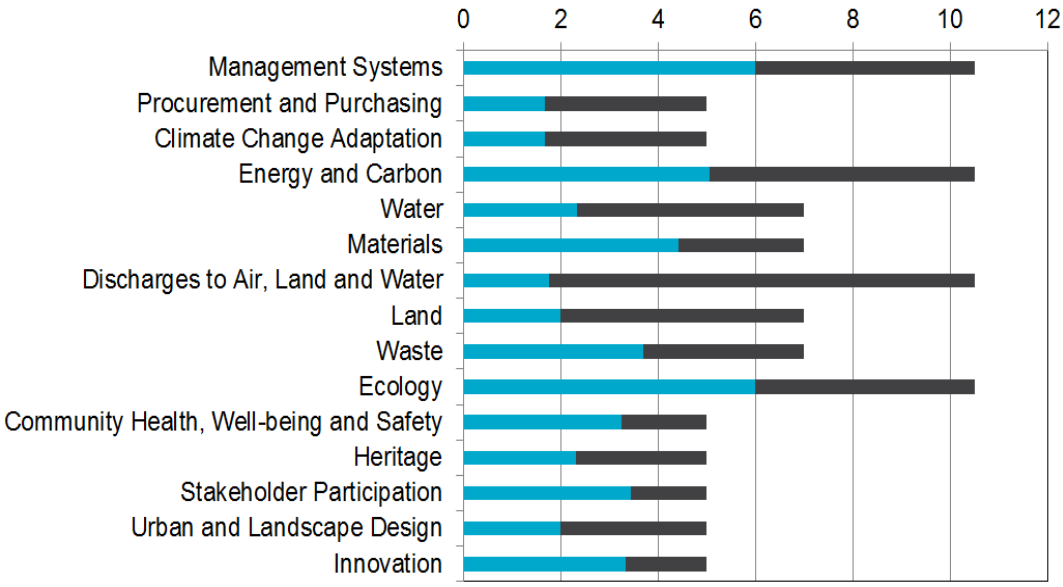

Figure 8: An example of IS rating tool outputs

Source: ISCA (2014)

An early trial of the tool was undertaken on the $45 million Eastern Busway project in Brisbane, Queensland, delivered as alliance between Department of Transport and Main Roads Queensland, Leighton Contractors, SKM and AECOM. The trial found that the tangible changes resulting from the ISCA trial and the inclusion of sustainability as a key performance area included a reduction in busway grades to save fuel, the lifting of bus stations to prevent flooding, the incorporation of water sensitive urban design, and significant reduction in lighting and operation costs due to improved design.

Updating Procurement Policies

The IS rating tool provides a robust framework that has been designed by industry and as such is a strong basis for incorporating sustainability considerations in to public procurement. For example the following short list of questions drawn from criteria from the tool could be considered for incorporation in to procurement polices:

- Does the contractor and/or supplier have a publically available procurement policy that demonstrates a commitment to consider environmental, social, and economic aspects? [Pro-1]
- Does the contractor include questions related to sustainability policies and their implementation in their supplier pre-qualification? [Pro-2]
- Does the contractor include sustainability requirements in their supplier evaluation criteria and contract documentation? [Pro-3]
- Does the contractor set sustainability related objectives and/or targets for suppliers, and if so is there a process for sustainability performance monitoring? [Pro-4]

When considering the sustainability performance of contractors or suppliers it is recommended that questions are raised based on the various 'IS Rating Tool' criteria as relevant to the area of procurement, such as:

- [Energy] Is there evidence that opportunities to reduce energy use and greenhouse gas emissions have been identified and implemented by the contractor or supplier? [Ene-2]
- [Materials] Is there evidence the contractor or supplier has an understanding of materials lifecycle impacts and has the ability to deliver reductions in such impacts? [Mat-1]
- [Water] Is there evidence that the contractor or supplier has an understanding of water use and methods to reduce water consumption? [Wat-1]
- [Biodiversity] Is there evidence that the contractor or supplier can maintain and enhance current biodiversity value? [Eco-3]
- [Heritage] Is there evidence that the contractor or supplier can identify community heritage values and minimise adverse impacts through a collaborative approach? [Her-1]

The above questions can be used in general procurement where as for the procurement of major projects it is recommended that pre-qualification, invitations to tender, and tender assessment processes include consideration of the overall 'IS Rating Tool'. This may include specific clauses or the nomination of a minimum rating score for project design, construction and operation phases.

4. Low Carbon Tendering Low Carbon Tendering informed by Sustainability Reporting Tools

4.1 Key Findings

Low Carbon Inclusions Summary

In investigation was carried out as to the level of low carbon inclusions included in associated procurement policies and supporting documents in Western Australia, New South Wales, and Queensland.[31] The investigation found that each state has a state wide procurement policy and main procurement document which includes to varying degrees, low carbon considerations. Both Western Australia and Queensland had specific guidelines regarding sustainable procurement, for WA 'Sustainable Procurement Practice Guideline' for QLD 'Procurement Guidance: Integrating Sustainability into the Procurement Process'. The NSW government defined sustainable procurement on their website and provide a suite of policies on social procurement, resource efficiency, environmental management system guidelines and examples of sustainable procurement.

The WA and QLD sustainable procurement documents both specify the triple bottom line as the three dimensions to be used in sustainable procurement; social, environmental and economic. The documents have been developed in line with British Standards with the 'Environmental Overview' of both documents being very similar along with the 'Economic Overview', however the social impacts vary with QLD adapting their social procurement dimensions from the 'Social Procurement in Australia Guide'. Both the WA and QLD documents have demand analysis, sustainability impact assessments and methods for contract assessment and review, although the specifics for these analysis and assessments differ.

Western Australia

State Government: In 2014 the State Supply Commission and Department of Finance (which have been merged since 2009) released a 'WA Sustainable Procurement Policy' specifying the stages of procurement where sustainability should be considered. This document is supported by the 'Sustainable Procurement Practice Guide' released in the same year. The document outlines how on a social, environmental and economic level sustainable procurement can be considered and possible positive outcomes, including low carbon living. This guide provides a quantitative assessment for the user and suggests further literature, a 'Sustainability Impact Scoring Chart' used to assess the sustainability of a procurement activity, and directs the reader to the 'Assessing a Supplier's Suitability Credentials' located on Australian Procurement and Constructions website.

[31] Hargroves, K., and Grant, G. (2016) 'Low Carbon Inclusions in Transport and Road Agencies Procurement Policies', a report to the *Sustainable Built Environment National Research Centre (SBEnrc)* by Curtin University Sustainability Policy Institute (CUSP), Curtin University.

Main Roads Western Australia (MRWA): In 2006 Main Roads Western Australia released a sustainability policy that outlined a set of associated principles and objectives. More recently the Western Australian Government has explored developing a 'Transport Portfolio Sustainability Policy Statement', within the transport portfolio including MRWA, Department of Transport, and the Public Transport Authority. While not to be publically released this work will help to shape MRWAs refreshed approach to Sustainability.

New South Wales

State Government: In 2005 the New South Wales government released the 'NSW Code of Practice for Procurement', which involved the introduction of sustainable procurement ideas and carbon reduction. The Procurement Policy Framework for NSW government agencies includes policy on pollution control, energy efficiency, waste minimisation and other low carbon related options. In 2014 the NSW government released a 'NSW Government Resource Efficiency Policy' which has a focus on energy, water, waste and clean air. Urban Growth NSW released a 'Sustainability Report' for 2013/2014 which points out the partnership with CRC for low carbon living to 'develop standard best practice sustainability clauses that we can include in procurement in the future'. The NSW Procurement Board has since released in July 2015 a 'Policy Framework for NSW Government Agencies' which again addresses the need for pollution control, waste minimisation recycling and disposal options.

Roads and Maritime Services (RMS): In 2012 Roads and Maritime Services (RMS) released an 'Environmental Policy Statement', outlining the management and accountability of environmental responsibility. The 'Roads and Maritime Strategy and Delivery Plan' was then released in 2013 and contained instruction on the use of the 'environmental impact statement' and further environmentally beneficial systems. In late 2014 RMS released a document 'Environmental Assessment and Decision Making', which outlined a program commitment to environmental performance in contractual arrangements. More recently Roads and Maritime Services have explored the development of an 'Environmental Sustainability Strategy' as well as a 'Technical Guide' to sustainability in infrastructure design and construction. These documents have expanded on the past documents single focus on environment, to a broader sustainable life cycle approach in multiple stages of services.

Queensland

State Government: In 2009 the Queensland's Governments Department of Housing and Public works released 'Procurement Guidance, integrating sustainability into the procurement process' which was later updated in 2014. This document provided graphs to quantify and classify the various positive or negative sustainable impacts of a procurement and supplier, addressing many issues regarding low carbon strategies. The 'Queensland's Procurement Policy' was released in 2013 and updated in 2014, which in its main principles includes the advancement of the governments economic, environmental and social objectives. The 'State

Procurement Plan 2014-2018' summarises results so far and a plan to sustain and innovate, although does not specify any action regarding carbon reduction.

Department of Transport and Main Roads (TMR): The TMR 'Environmental Management Policy and Strategy' from 2008-2013 has yet to be updated. Although carbon reduction is a part of the 'Queensland Cycle Strategy', intended to build safer areas for cycling to support 'protecting the environment and transitioning to a low carbon future.'

Using the 'IS Rating Tool' as a proxy for Low Carbon Readiness

Selecting Low Carbon Related Credits

The following is a list of credits that are related to 'low carbon tendering'. The table identifies those credits deemed to be 'directly' related to low carbon living and those that are 'in-directly related'.

Table 2: Summary of 'IS Rating Tool' credits related to Low Carbon Tendering

Code	Credit	Evidence requirements relevance to Low Carbon Tendering
Credits Directly Related to 'Low Carbon Readiness' (27.54 Total Points Possible)		
Energy and Carbon		
Ene-1 4.67	Energy and carbon monitoring and reduction	Evidence of the modelling and monitoring of actions to reduce energy use and greenhouse gas emissions (Scope 1, 2, and 3 emissions).
Ene-2 4.67	Energy and carbon reduction opportunities	Evidence that opportunities to reduce energy use and greenhouse gas emissions are identified and implemented.
Ene-3 1.17	Renewable energy	Evidence that renewable energy opportunities have been investigated and implemented.
Procurement and Purchasing		
Pro-1 1.25	Commitment to sustainable procurement	Evidence of a commitment to sustainable procurement that includes environmental, social and economic considerations.
Pro-2 1.25	Identification of suppliers	Evidence of supplier pre-qualification questionnaires including items related to the presence and implementation of a sustainability policy.
Pro-3 1.25	Supplier evaluation and contract award	Evidence of sustainability consideration in supplier evaluation criteria and contract documentation, including provision for auditing.
Pro-4 1.25	Managing supplier performance	Evidence of the sustainability performance monitoring of suppliers, with active management of non-compliance and rewards available.
Materials		
Mat-1 6.29	Materials lifecycle impact measurement and reduction	Evidence of the modelling and monitoring of materials lifecycle impacts across infrastructure lifecycle, and demonstrated reductions.

Mat-2 0.74	Environmentally labelled products and supply chains	Evidence of the use of major material products with environmental credentials nominated or approved by ISCA.
Innovation		
Inn-1 5.00	Innovation	Evidence of contribution to broader market transformation towards sustainable development, locally, nationally and internationally.
Credits In-Directly Related to 'Low Carbon Readiness' (15.5 Total Points Possible)		
Management Systems		
Man-1 1.07	Sustainability leadership and commitment	Evidence of a commitment to sustainability through a sustainability policy and inclusion in management plans and project contracts.
Man-2 0.43	Management system accreditation	Evidence of accreditation of asset management systems to ISO14001 standard for environmental management systems.
Man-3 0.86	Risk and opportunity management	Evidence of the assessment of environmental, social, and economic risks and opportunities in a risk register with annual reviews.
Man-4 1.07	Organisational structure, roles and responsibilities	Evidence of a member of the project senior management with central responsibility for managing sustainability, with position description.
Man-5 0.86	Inspection and auditing	Evidence of regular environmental and sustainability inspection of on-site performance and reported auditing of the management system.
Man-6 0.86	Reporting and review	Evidence of sustainability reporting that is reported to senior management and the public and involves community participation.
Man-8 3.21	Decision-making	Evidence of decision making guidelines that evaluate options by considering environmental, social, and economic aspects.
Climate Change Adaptation		
Cli-1 2.50	Climate change risk assessment	Evidence of the assessment of climate change risks, including direct, indirect and flow on risks with system and regional implications.
Cli-2 2.50	Adaptation options	Evidence of the assessment and implementation of climate change adaptation measures for extreme, high and medium risks.

* This is default 'As Built' rating point value including all credits.

The ability for companies to provide the evidence required by each of the credits in Table 2 stands to provide an indication of 'Low Carbon Readiness'. This will become an important measure as the focus on reducing energy demand and associated greenhouse gas emissions in the future intensifies. It can be used by industry to create a performance benchmark, along with providing a measure of industry readiness to provide low carbon offerings for government agencies and other major infrastructure procurers. For example considering the first credit in

Table 2, 'Energy and Carbon – ENE1: Energy and carbon monitoring and reduction' aims to reward monitoring and minimising of energy use and GHG emissions across the infrastructure lifecycle. This credit directly relates to low carbon tendering by requesting evidence of the modelling and monitoring of actions to reduce energy use and greenhouse gas emissions (Scope 1, 2, and 3 emissions), with points awarded in three tiers.

- *1.56 pts for provision of a report on initiatives undertaken to reduce energy use and GHG emissions, including a summary of actual and modelled GHG emissions across the infrastructure lifecycle,*
- *3.11 pts for the above evidence along with a report comparing actual and modelled GHG emissions to a reference footprint,*
- *4.67 pts for the above evidence along with a method for identifying significant sources of Scope 3 emissions.*

Performance in this credit, and other credits shown in Table 2, is a very strong indicator of low carbon readiness as if tenderers perform well against this credit, it is likely that they have process for modelling and monitoring energy use and greenhouse gas emissions, and using the outputs to inform the selection of actions to be taken.

Sample of Assessment of Credits Directly Related to 'Low Carbon Readiness'

An investigation was undertaken for each of the credits that are either directly or in-directly related to low carbon tendering to outline the aim of the credit, the evidence required, the points available, and highlights the support provided for low carbon tendering.[32] A sample for three such credits is provided below.

Ene-1 Energy and carbon monitoring and reduction (4.67)

Aim: To reward monitoring and minimising of energy use and GHG emissions across the infrastructure lifecycle.

Evidence: Asked to provide evidence of initiatives taken to reduce energy use and GHG emissions.

Awarding of Points: Points are awarded as follows,

- 1.56 pts for provision of a report on initiatives undertaken to reduce energy use and GHG emissions, including a summary of actual and modelled GHG emissions across the infrastructure lifecycle,
- 3.11 pts for the above evidence along with a report comparing actual and modelled GHG emissions to a reference footprint,

[32] Hargroves, K (2014) ISCA 'Infrastructure Sustainability' Rating Tool and Low Carbon Tendering: A Report to the Sustainable Built Environment National Research Centre and the CRC for Low Carbon Living, Curtin University Sustainability Policy Institute, Curtin University.

- 4.67 pts for the above evidence along with a method for identifying significant sources of Scope 3 emissions.

Support for Low Carbon Tendering: This credit directly relates to low carbon tendering by requesting evidence of the modelling and monitoring of actions to reduce energy use and greenhouse gas emissions (Scope 1, 2, and 3 emissions).

Indication of '*Low Carbon Readiness*': This is a very strong indicator of low carbon readiness as if tenderers perform well against this credit, it is likely that they have process for modelling and monitoring energy use and greenhouse gas emissions, and using the outputs to inform the selection of actions to be taken.

Key Points for Low Carbon Outcomes: The IS rating tool technical manual provides additional guidance as to the interpretation of this credit with the following of particular relevance to low carbon tendering:

- It is encouraged that monitoring and reporting be undertaken in line with the NGER Reporting Guidelines.
- It is recommended that reporting includes: total energy use and greenhouse gas emissions both during design and construction, and over the full life of the infrastructure; monthly energy use and greenhouse gas emissions; and annual operational energy use and greenhouse gas emissions over the forecast life of the asset.
- Carbon offsets can be used to achieve greenhouse gas emissions reductions but it must be demonstrated that they are only used when other options have been exhausted (such as design, efficiency improvements, sourcing renewable energy, and sourcing low-emissions energy.)

Ene-2 Energy and carbon reduction opportunities (4.67)

Aim: To reward identification and implementation of opportunities to reduce energy use and GHG emissions.

Evidence: Asked to provide evidence of design reports and as built drawings demonstrating carbon reductions.

Awarding of Points: Points are awarded as follows,

- 1.56 pts for provision of a report outlining how opportunities to reduce energy use and GHG emissions from Scope 1 and 2 and land clearing have been identified and implemented.
- 3.11 pts for the above evidence along with a report demonstrating how all feasible opportunities with a financial payback period of four years or less have been implemented,

- 4.67 pts for the above evidence along with an opportunity analysis that covers Scope 3 energy use and emissions, and evidence that at least one opportunity with a financial payback period of more than four years has been implemented, and demonstration that feasible opportunities to reduce peak demand on electricity grids have been considered and implemented.

Support for Low Carbon Tendering: This credit directly relates to low carbon tendering by requesting evidence that opportunities to reduce energy use and greenhouse gas emissions are identified and implemented.

Indication of '*Low Carbon Readiness*': This is a very strong indicator of low carbon readiness as if tenderers perform well against this credit, it is likely that they have process for analysing opportunities to reduce energy use and greenhouse gas emissions across the infrastructure lifecycle. Further that they have the ability to identify specific opportunities with both less than and greater than a four year payback period, including consideration of reductions to peak demand on electricity.

Key Points for Low Carbon Outcomes: The IS rating tool technical manual provides additional guidance as to the interpretation of this credit with the following of particular relevance to low carbon tendering:

- Land clearing or land use change impacts are to be included in opportunity analysis.
- The method to undertake the opportunity analysis is not specified however it must comply with ISO 50001 International Standard for Energy Management.
- The Federal Government Energy Efficiency Opportunities program is directly referenced as a supporting resource.
- Marginal abatement cost curves are recommended for achieving a 'fair comparison and prioritisation of opportunities to reduce greenhouse gas emissions.
- It is recommended that an energy and Carbon Management Plan be developed or embedded in existing management plans, to include: 'The process used to identify opportunities to reduce energy use and GHG emissions, a list of all the opportunities identified (with explanations), the process used to analyse and evaluate opportunities, commitments to implement particular opportunities during delivery and operation, and explanations of why other identified opportunities were not taken up.

Ene-3 Renewable energy (1.17)

Aim: To reward investigation of, and use of, renewable energy.

Evidence: Asked to provide evidence of design reports, management plans, and monitoring reports demonstrating the use of renewable energy.

Awarding of Points: Points are awarded as follows,

- 0.39 pts for provision of a report demonstrating that opportunities for the use of renewable energy has been fully investigated,
- 0.78 pts for the above evidence along with a report demonstrating that 20-40% of energy is from renewable sources for the infrastructure lifecycle.
- 1.17 pts for the above evidence along with a report demonstrating that greater than 40% of energy is from renewable sources for the infrastructure lifecycle.

Support for Low Carbon Tendering: This credit directly relates to low carbon tendering by requesting evidence that renewable energy opportunities have been investigated and implemented.

Indication of '*Low Carbon Readiness*': This is a very strong indicator of low carbon readiness as if tenderers perform well against this credit, it is likely that they have a process for investigating the potential use of renewable energy in the project and taking action to implement specific options.

Key Points for Low Carbon Outcomes: The IS rating tool technical manual provides additional guidance as to the interpretation of this credit with the following of particular relevance to low carbon tendering:

- Options for renewable energy are considered to have been fully investigated if it includes:
  1. Establishing criteria for deciding whether to invest in a renewable energy option,
  2. Identifying renewable energy options available to the project or asset,
  3. Assessing each option against the criteria to enable a decision on which options to implement,
  4. Justifying the options selected for implementation and the options not selected,
  5. Investigating at least three renewable energy technologies or fuel types.
- The purchase of standard grid electricity that is partially supplied from renewable sources does not qualify for this credit as it 'requires specific support for new renewable energy'.
- The use of carbon offsets for this credit is acceptable as long as it is demonstrated that the offsets are sourced from renewable energy projects.

Sample of Low Carbon Readiness Questionaries

Based on the credits identified in Table 2 a survey was designed to allow a mock assessment to be conducted to create a proxy of low carbon readiness. A sample of the survey related to the three criteria above is provided below:

1. Do you have a process to model the energy use and GHG emissions of a project over the infrastructure lifecycle [Ene-1] (L1)

□ 'Yes', □ 'No', □ 'I Don't Know', or □ 'Not Applicable'

If Yes,

a. Do you have a process to decide where to take action to reduce energy use and greenhouse gas emissions? (L1)
b. Do you have a process to monitor the actions taken? (L1)
c. Is the modelling and monitoring report audited internally? (L1)
d. Is the modelling and monitoring report subject to external audit? (L2)

2. Do you have a process to identify and implement opportunities to reduce energy use and GHG emissions? [Ene-2]

□ 'Yes', □ 'No', □ 'I Don't Know', or □ 'Not Applicable'

If Yes,

a. Does this include all NGER Scope 1 and 2 energy use and emissions? (L1)
b. Does this include all NGER Scope 3 energy use and emissions? (L3)
c. Does this include options to specifically reduce peak demand on energy grids? (L3)

3. Do you have a process to quantify the payback period of feasible options to reduce energy use and GHG emissions? [Ene-2]

□ 'Yes', □ 'No', □ 'I Don't Know', or □ 'Not Applicable'

If Yes,

a. Do you have experience in implementing those with a four year or less payback period? (L2 + above)
b. Do you have experience in implementing those with a more than four year payback period? (L3+)

4. Do you use 'energy and carbon management' plans or similar in projects? [Ene-2 notes]

□ 'Yes', □ 'No', □ 'I Don't Know', or □ 'Not Applicable'

If No, do you think it would be useful in your projects?

5. Do you have a process to fully investigate opportunities for the use of renewable energy in projects? [Ene-3] (L1)

□ ‘Yes’, □ ‘No’, □ ‘I Don’t Know’, or □ ‘Not Applicable’

If Yes,

a. Do you have the potential to provide between 20 and 40% of energy (including electricity and fuels) from renewable sources for the life of the infrastructure lifecycle? (L2)

b. Do you have the potential to provide greater than 40% of energy from renewable sources for the infrastructure lifecycle? (L3)

How the 'IS Rating Tool' can support Low Carbon Tendering

The following section outlines a number of ways that the IS Rating Tool can potentially support low carbon tendering. The development of the section was assisted by participation in the IS Foundation Training by ISCA, discussion with Rick Walters from the ISCA team, and feedback from the SBEnrc partners.

Provision of an indication of 'Tenderer Low Carbon Readiness'

As outlined above selected IS rating tool evidence requirements can be used to indicate low carbon readiness for tender comparison. This could be done on a tender by tender basis or through a survey of the supply chain to gain an overall sense of industry readiness (as is being undertaken as part in subsequent stages of this project). Tenders are beginning to set a minimum 'IS rating tool' overall score to be met in the project/asset and then specify the required scores for those credits related to low carbon performance, such as those identified in Table 1. This may include direction as to the appropriate scoping out of specific credits based on project/asset makeup. Some aggregation of credit scores might also be considered at a category level (or even combination of categories to provide a 'low carbon' sub-set score).

Tenderer Documentation and Low Carbon Readiness

Provides an industry supported tool to standardise documentation related to low carbon project/asset performance that can be requested as part of pre-qualification or tender documentation, such as:

- *Materials Calculator*: Potential to align quantity surveying / bill of materials reporting to the 'Materials Calculator' to simplify comparisons and estimate the low carbon performance (along with other sustainability related aspects). The calculator also allows both a 'reference design' and an 'actual design' where tenderers can differentiate low carbon additions to the design and quantify the impact on performance in both a tonnes CO_2e measure and a generic sustainability measure, '*eco-points'*. This is important as there is often a lack of time at the tender assessment stage to investigate innovative technologies or processes and undertake specific comparisons with standard designs to identify the low carbon contribution.
- *Risk and Opportunity Management*: Potential to align risk management documentation by tenderers to requirements of IS rating. Evidence for rating includes a list of possible low carbon related risks and opportunities and suggested ways to treat these risks/opportunities.
- *Sustainable Procurement*: Potential to align sustainable procurement documentation by tenderers to requirements of IS rating. Evidence for rating includes a procurement policy, supplier pre-qualification questionnaires, supplier contracts, supplier evaluation criteria and audit reports, documentation identifying sustainability related objectives and/or targets for suppliers, supplier sustainability performance monitoring reports showing objectives and targets and corrective actions taken to address non-compliances or poor performance, and

a supplier reward program (or similar) and examples of rewards given for sustainable procurement.

Informing pre-qualification of Tenderers

Inform pre-qualification assessment through the provision of appropriate forms of evidence documents aligned to the 'IS rating tool' related to low carbon performance, such as the presence of a sustainable procurement policy, ability to identify climate change projections, suitable skills amongst the project team (e.g., includes IS accredited professionals) etc. This sort of pre-qualification could be incorporated into current national road pre-qualification processes to streamline and standardise industry approaches and performance.

Client Actions Related to 'IS Rating Tool' rating and Low Carbon Outcomes

The following section presents a number of possible ways that clients can include items in requests for tenders that align with the IS rating tool. The items were identified by the research team and informed by participation in the IS Foundation Training by ISCA and discussion with Rick Walters from the ISCA team.

General Requirements

Specification of minimum rating score: Where the project/asset is anticipated to apply for an IS rating the client may request details on how credits will be achieved, potentially requesting details on particular ones that are of interest to the client or align with the client's objectives and requirements for sustainable procurement. This may be used to both assess the tender submission and also to influence the project development.

Scoping out of Credits: According to the IS rating tool, 'Credits can be scoped out if they are truly not applicable to the project or asset. They cannot be scoped out simply because they were outside the scope or very difficult to achieve. Note that for a certified rating, credits scoped out must be agreed with ISCA. Scoped out credits assume a weight of zero and therefore do not contribute to the overall score.' Hence as part of request for tender documentation the client can nominate credits that are assumed to be scoped out, assuming this has been agreed with ISCA. This will allow a level playing field for tenderers, especially when the request for tenders nominates a minimum IS rating tool score.

Energy and Carbon

Nomination of preferred energy saving options (Ene-1 and Ene-2): As part of this category projects are rewarded for monitoring and minimising of energy use and GHG emissions across the infrastructure lifecycle. Clients may nominate preferences for energy saving initiatives for specific projects to focus tenderers in areas of most interest to the client.

Nomination of preferred renewable energy options (Ene-3): As part of this category projects are rewarded for investigating, and using, renewable energy. Clients may provide a list of preferred renewable energy sources for specific projects to focus tenderers in areas of most interest to

the client. Further the client may nominate specific criteria to be used by tenderers to assist selection of renewable energy options, and may nominate preferred options for carbon offsetting, should this be proposed.

Procurement and Purchasing

Preferred aspects to include in sustainability procurement (Pro-1): As part of this category projects are rewarded for having a commitment to sustainable procurement. Clients may nominate specific low carbon related aspects that it would prefer be included in such documentation, such as a preference for a commitment to sourcing local materials.

Preferred questions to be included in pre-qualification questionnaire (Pro-2): As part of this category projects are rewarded for the identification of suitable suppliers and the incorporation of sustainability criteria in the engagement process. As part of the evidence requirement there is a request to provide a pre-qualification questionnaire that involves sustainability criteria. Clients may nominate specific low carbon related aspects that it would prefer be included in the questionnaire, such as the ability of the supplier to provide reduced transport and logistics fuel consumption.

Preferred criteria to be included in supplier evaluation (Pro-3): As part of this category there is a requirement to provide evidence of the consideration of sustainability in supplier evaluation and contract documentation. Clients may nominate specific low carbon related aspects that it would prefer be included in supplier sustainable evaluation criteria, and in supplier contracts, such as a preference for criteria around the ability of the supplier to provide a product or service that reduces the construction phase greenhouse gas emissions.

Nomination of objectives and/or targets for suppliers (Pro-4): As part of this category there is a requirement to provide evidence of the provision of sustainability related objectives and/or targets for suppliers. Clients may nominate specific low carbon related objectives and/or targets would prefer be included. Further, ISCA accepts such supplier objectives to be formalised only in the case of '*high impact procurement goods and services*', which the client may identify in tendering documentation, such as a preference for a supplier objective reducing greenhouse gas emissions associated with the delivery of the product or service.

Materials

Provision of Reference Design (Mat-1): As part of the category projects are rewarded for design and practice that reduce lifecycle environmental impacts of materials. Clients may set the reference design to be used by all tenderers as the assumed business as usual option. This can be done by populating the ISCA Materials Calculator for the reference (or base) design. If this is done the reference design can be verified by ISCA prior to the request for tender. This will streamline and reduce risk in the tender process and assist in comparisons of tenderers on low carbon grounds and also general sustainability.

Preferred 'Environmental Labels' or product certification (Mat-2): As part of this category projects are rewarded for procurement of major materials that have environmental labels or are from sustainable supply chains. The client may nominate a preference for a particular environmental label or product certification scheme that is suitable for low carbon outcomes. Note that if this is not one of the ISCA preferred ones listed in the technical manual it may be possible to gain approval from ISCA for a specific preference.

Innovation

Preferred areas of innovation: As part of this category projects are rewarded for pioneering initiatives in sustainable design, process, or advocacy. Clients may nominate a preference for areas of low carbon innovation such as innovation in the use of alternate cements.

Management Systems

Preferred inclusions in sustainability policies (Man-1): As part of this category projects are rewarded for a commitment to sustainability, and in particular to both mitigate and contribute to restorative actions across a range of negative environmental, social, and economic impacts. Clients may nominate a preference for low carbon commitments by tenderers, such as a preference for commitment related to contributing to the mitigation of climate change.

Preferred risks and opportunities to be explored (Man-3): As part of this category projects are rewarded for the assessment of sustainability risks and opportunities to inform project management. Clients may nominate a preference for low carbon related risks and opportunities to be explored by tenderers, such as consideration of threats from a greater frequency and intensity of natural disasters, or consideration of opportunities associated with providing local energy supply or co-generation opportunities with surrounding infrastructure.

Preferred responsibilities for sustainability-related roles (Man-4): As part of this category projects are rewarded for the allocation of responsibility for sustainability appropriately. Clients may nominate a preference for low carbon items to be included in position descriptions for sustainability related roles in project teams, such as a preference for inclusion in position description of duties related to identifying opportunities to showcase new products with low carbon performance.

Preferred inspection and auditing criteria (Man-5): As part of this category projects are rewarded for regular inspection of on-site performance and auditing of the management system. Clients may nominate a preference for low carbon criteria to be included in inspections and audits, such as a preference for investigation of performance of management system to achieve a reduction in plant and equipment fuel consumption onsite.

Preferred sustainability reporting topics (Man-6): As part of this category projects are rewarded for regular, comprehensive, and transparent sustainability reporting and review. Clients may nominate a preference for low carbon topics to be included in sustainability reports, which may include performance against specific goals or targets set by external bodies. This may include

a preference for inclusion of reporting on levels of greenhouse gas emissions from project operations.

Preferred decision making aspects (Man-8): As part of this category projects are rewarded for incorporating sustainability aspects into decision making. Clients may nominate a preference for low carbon aspects to be included in the decision making process and included in guidelines, such as a preference for inclusion of fuel efficiency of plant and equipment in procurement decision making processes.

Climate Change Adaptation

Nomination of climate change risks: As part of this category projects are rewarded for assessing climate change risks. Clients may nominate a preference for a particular climate change projection(s) to be used, along with a preferred list of potential risks and impacts to be included in the assessment. This may include a preference for the use of climate change projections that have been endorsed by a University in Australia, or a preference for the use of the new AS 5334-2013 standard as the basis of the consideration of climate change risks.

Nomination of climate change risks: As part of this category projects are rewarded for the assessment and implementation of climate change adaptation measures. Clients may nominate a preference for particular climate change adaptation measures to be assessed for implementation. This may include a preference for the assessment and implementation of climate change adaptation options that strengthen the resilience of existing infrastructure.