Baw Baw Shire CEEP Project CEEP 1040

Street Lighting Energy Efficiency Program

FINAL PROJECT REVIEW REPORT

4th September 2015

This activity received funding from the Australian Government.
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About Ironbark Sustainability

Ironbark Sustainability is a specialist local government consultancy that works with councils around Australia by assisting them to reduce energy and water usage through sustainable asset and data management and on-the-ground implementation.

Ironbark has been operating since 2005 and brings together decades of technical and financial analysis, maintenance and implementation experience in the areas of energy & water auditing, and public lighting technologies and management.

Ironbark provides public lighting support nationally including technology advice, technology approvals, business cases and project management. Ironbark delivers strategic and specific advice and support for the establishment of effective environmental management systems for government and business clients. We pride ourselves on supporting our clients to manage their operations more sustainably.
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Executive Summary

The Baw Baw Shire Council Street Lighting Energy Efficient Changeover Program is a community energy efficiency project on a giant scale that involved changing over 2,606 old and inefficient street lights to modern energy efficient LEDs. The total cost of the upgrade was $1,036,528 with $489,546 in grant funding received from the Australian Government.

Each light changed represents a 77% reduction in electricity costs. These are savings that have started to flow through to the council, ratepayers and broader community – a total of $5.06 million in energy and maintenance savings over the 20-year life of the new lights. The project has resulted in a reduction of energy use by over 830,000 kWh a year which will result in a reduction of greenhouse gas emissions by over 20,000 tonnes over the next 20 years.

Indeed, this project has been – by a significant margin – the largest energy reduction project in Baw Baw’s history.

In addition to offering lower costs, lower energy consumption and lower greenhouse gas emissions, the new lights provide better lighting outcomes for the community, including a greater uniformity of light across and along Baw Baw’s streets; better colour rendering and visibility; less depreciation of the light output over time; and lower glare.

Moreover, the flow-on benefits from the community promotion and education component of the project has been far and wide, particularly in terms of increased awareness of residential and commercial energy savings and links to other Council programs and networks.

The project has been a great success and been delivered on time and on budget. What’s more, given improvements in energy efficient technology and procurement processes that have reduced capital costs, the project is set to deliver higher cost reductions than expected.

The benefits are more than financial. As well as reducing costs to Council which will result in improved services to all residents into the future, the installation of the LEDs has resulted in safer lighting; stimulated the Australian Economy through the choice of Australian made and owned products and services; and delivered great value for money for Council and the Australian Government.

The views expressed herein are not necessarily the views of the Commonwealth of Australia, and the Commonwealth does not accept responsibility for any information or advice contained herein
Project Objectives

The project aimed to replace large numbers of inefficient street lights with more efficient lights and was managed with the following objectives in mind:

- Maximisation of energy savings within project budget
- Maximisation of greenhouse gas reduction
- Reduction in Council and ratepayers electricity costs
- Sharing the learning and promoting energy efficiency with the community

The project was also guided by the following requirements, each of which were met:

- A proper procurement process was implemented as per the requirements of the Local Government Act and through partnership with the Municipal Association of Victoria’s (MAV) Street Lighting bulk procurement project.
- Approved, safe and thoroughly assessed lighting technology was installed.
- Safe and efficient work practices were undertaken.
- The project considered above-standard lighting in areas of crime and public safety concern.
- Community information was disseminated including information on the benefits of the project to residents, business and community organisations in saving energy and reducing greenhouse emissions.
- Engagement of local industry (in particular the Distribution Network Service Provider Ausnet Services, lighting manufacturers and local installers).
Project Outcomes and Outputs

The following high-level outcomes of the project were met. More information on each of these is provided within this report:

1. Installation of the most energy efficient lights approved:
   a. 2,606 x 80 Watt Mercury Vapour (MV) lights were replaced by 18 Watt LEDs.

2. Financial and environmental savings:
   a. Over 1,000 tonnes of greenhouse emissions saved per year (higher than the planned 900 tonnes).
   b. 20,530 tonnes of greenhouse emissions saved during the life of the new assets (over 20 years – higher than the planned 19,800 tonnes).
   c. $5.06 million in energy and maintenance savings over 20 years (higher than the planned $4.17 million).

3. Community education and promotional project:
   a. A raft of promotional activities were undertaken including distribution of fact sheets, regular updates about progress and outcomes of the project in local papers, and a launch that showcased the collaborative energy efficiency project between local and Federal Governments and the Clean Energy Finance Corporation (CEFC).
   b. Local communication channels include the Baw Baw Sustainability Network, Gippsland Climate Change Network (GCCN), Warragul Police and Council’s Environmental Voice Group and Council webpage.

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1 The project plan had originally outlined 2,660 lights to be changed over. Due to data inaccuracies on behalf of the asset owners, Ausnet Services, 2,606 was the maximum number of lights that could be changed over. This is explained further in the report.
Project Energy Efficiency Activities

The project involved replacing 2,606 inefficient and polluting MV lamps in Category P (residential) streets throughout the Shire of Baw Baw.

This included the towns and suburbs of Athlone, Buln Buln, Darnum, Drouin, Erica, Fumina South, Hill End, Jindivick, Longwarry, Neerim, Neerim North, Neerim South, Nilma, Noojee, Rawson, Rokeby, Tanjil Bren, Thorpdale, Warragul, Willow Grove and Yarragon.

LED Technology

When Council originally developed the funding application for Community Energy Efficiency Program (CEEP) the only energy efficient technology approved by the owner of the assets (Ausnet Services) was compact fluorescent lights. The original project plan was based on installing 2x14W “T5” lights. These were the only approved energy efficient replacement options for 80-Watt MV streetlights and provided a clear improvement to MV lamps in terms of lumens per watt and light colour. However while these would have been an efficient and suitable alternative, Council’s preference was to install more modern LEDs. In June 2014 Ausnet Services approved an LED street light for use on their network.

The capital cost of the LED was higher than the “T5”, but the overall cost savings and environmental benefits are superior. So the decision was made – in conjunction with the Department of Industry – to purchase and install LEDs.

LED technology has developed rapidly over the last five years. From a position where the upfront costs were prohibitively expensive, costs have now reduced dramatically with the size and reliability of savings significantly improved. In their landmark 2012 report, Lighting the way: Perspectives on the global lighting market, McKinsey & Co predicted that the price of LEDs would reduce by around 14% per year between 2010 and 2015.

Indeed over the last four years costs have fallen even faster than expected and by 2020, LED streetlights are expected to reach cost parity with legacy technologies, making their benefits to costs immediately positive. Furthermore, with many countries rapidly urbanising and in need of improved street lighting infrastructure, this has created an enormous market opportunity. Between 2015 and 2025, LED street lighting investment is projected to cumulatively reach $57.8 billion² of global investment pipelines which has already resulted in improved technology and cost reductions.

The key reasons for the decrease in prices are technology advancement and increased competition. Firstly, LED lighting is considerably more efficient than traditional lighting technology, which means that consumers can significantly reduce energy use. This is expected to continue with key international bodies³ stating that while it can be difficult to predict the speed at which the technology will develop, LEDs are predicted to increase in efficiency over the coming decade.

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³ For example, the US Department of Energy.
Prices are also falling through market forces. All large lighting manufacturers are spending significant money and resources on research and development and marketing of their LEDs. As competition increases, prices are decreasing.

Baw Baw is also one of the 68 councils in Victoria that have joined together to reap the benefits of bulk procurement of LEDs across local government boundaries which has seen increased competition and large reduction in capital costs as 232,000 lights are in the process of being changed over to energy efficient alternatives.

Finally, LED is also considerably better from an on-going maintenance perspective. The life of LED luminaires (10-20 years) are substantially longer than MV (3-4 years)\(^4\).

**Implementation**

The lights were installed by Vemco, a contractor accredited to work on the Ausnet network. Installation was uncomplicated with the exception of minor disruptions (see below). From a technological point of view this is one of the most straightforward projects a council, funding organisation or distributor can implement. It is simply changing one type of light to another 2,606 times. It’s as easy as 1-2-3:

1. **Find this:**
   
   ![An old inefficient 80W MV](image)

   An old inefficient 80W MV

2. **Replace with this:**
   
   ![The efficient 18W LED alternative](image)

   The efficient 18W LED alternative

3. **Repeat 2,606 times:**
   
   ![A new lighting design](image)

   A new lighting design

\(^4\) Note that High-Intensity Discharge (HID) sources such as MV have readily replaceable lamps while the luminaires can last 20 years or longer. For LEDs, typically the entire luminaire is replaced (at 10 to 20 years).
Site and technology specific problems

Overall the installation was a success and the project was implemented very smoothly. There were however minor issues, which are to be expected in a project of this size and scale:

- There was one example of an “improper connection” during the installation in February 2015, which resulted in standard project management and risk practices being implemented. This involved a stoppage to works to determine the cause of the improper connection; internal audits by the installer, Vemco; and external audits and checks by the DNSP, Ausnet Services. Once this process was complete, the installation continued.

- Ausnet’s GIS data was inaccurate. Although their GIS data (which is the basis of their billing of Council) had specified that there were 2,660 standard MV80 lights that could be replaced during the project, Council found while undertaking the project the data “on the ground” demonstrated there were only 2,606 MV80 lights. Council has begun a process to seek reimbursement from Ausnet for being over-charged in the past.

- There were minor issues with a small number of lights (<0.05%) found to be faulty. These were returned to the manufacturer and replaced.

- No complaints from residents. Council was expecting some complaints from the residents as the lights are new and bright, whereas the replaced MV80 lights were operating below the standard levels due to their age. Majority of the community network members appreciate the changeover project.
Project Demonstration and Communications Activities

Communication Objectives and Strategies

The Baw Baw Street Lighting Project was communicated broadly and frequently. It was a major project for Council, as it represents the single greatest available reduction in Council’s greenhouse gas emissions.

There were various reasons for Baw Baw to communicate widely to the community and Council indeed used the opportunity to do so.

The key communication objectives were:

- Inform the wider community about the benefits of the project.
- Promote energy efficiency to residents and businesses by linking to residential and commercial programs.
- Demonstrate leadership around energy efficiency in the community (“practice what you preach”).
- Provide information on the project outcomes.

Communication strategies included:

- Media releases to local newspapers, articles in relevant journals.
- Photo opportunities for residents, council staff, councillors.
- Fact sheets to be available electronically with hard copies at Council facilities
- Information on the Baw Baw website.
- Distribution and information through the Warragul and Drouin Gazette and The Trader-
  Local Media.

Target Audience and Stakeholders

Before the project, Council mapped out key stakeholders and audiences, including internal project partners and stakeholders (involved in the delivery of the project). The following key stakeholders were engaged throughout the project:

- Ausnet Services
• MAV Procurement
• Gerard Lighting (manufacturers)
• Vemco (installers)
• Council staff
• Department of Industry

External community groups were also identified, including:

• Residents of Baw Baw and Council’s Environment Voice Group
• The Baw Baw Sustainability Network
• Gippsland Climate Change Network and Warragul Police.
• Local commercial and industrial businesses
• Police and community safety representatives (involved in mapping out areas of concern regarding safety and increased light levels)

Council maintains close engagement with local environmental groups about a range of Council and Community environmental initiatives. This project was a great opportunity to build on these close relationships and build the capacity of the broader community.

A project launch event was organised to coincide with the upgrade of the first streetlights and this attracted broad-scale media interest emphasising the community and environmental benefits of the project.

Council communicated updates to the project development via website, community newsletters, key contacts within existing groups and in local newspapers for further community engagement. Project demonstration was completed through a range of communications, media, channels and forum.

The development of case studies, project reports, attendance at forums with residents was delivered through media releases, fliers, articles and web content.

Below is a list of all media releases, media enquiries and media mentions that Council recorded since the 2013/14 financial year.

**Media Mentions**

The Gazette (Tuesday 25 March 2014)
• Shire seeks reduction in street lighting costs - p.30 (Positive)

Latrobe Valley Express (Monday 16 June 2014)
• Tenders and Contracts: Tender 21466CT Street lighting bulk changeover program - p.26 (N/A)

The Gazette (Tuesday 18 November 2014)
• Lighting the way - p.26 (Positive)
The Gazette (Tuesday 25 November 2014)
• New LED lights - p.9 (Negative)

Latrobe Valley Express (Monday 8 December 2014)
• Lighting upgrade for Baw Baw streets - p.3 (Moe and Narracan News) - p.3 (Positive)

The Gazette (Tuesday 14 April 2015)
• Loan provides for better lighting - p. 5 (Positive)

The Gazette (Tuesday 10 March 2015)
• Many hands made light work - p.21 (Positive)

The Gazette (Tuesday 17 March 2015)
• Million dollar light change - p.15 (Positive)

Traf News (April 2015)
• Glowing progress in street lighting changeover - p.2 (Positive)

Traf News (February 2015)
• Baw Baw switches to energy efficient lighting - p.5 (Positive)

The Trader (Thursday 23 July 2015)
• Light at the end of the tunnel - p.6 (Positive)

Media Enquiries

Week Ending Friday 13 March 2015
• Erin Ryan from the Star FM Newsroom requested an interview to discuss the bulk public street lighting changeover project.

Week Ending Friday 24 July 2015
• Erin Ryan from Star FM News requested an interview regarding the Sustainable Public Street Lighting Upgrade.

Media Releases

Thursday 20 November 2014
• Baw Baw Makes the Switch to Energy Efficient Street Lighting

Wednesday 11 March 2015

Monday 20 July 2015
The key messages throughout the project were kept clear and simple:

- Energy efficiency is the best way to save money and reduce greenhouse emissions.
- Council is leading the way in reducing emissions and electricity costs for ratepayers.
- This is Baw Baw’s single largest energy efficiency project in Council’s history.

Council provided monthly reports to community groups such as the Baw Baw sustainability network and Environment Voice who are Council’s environmental advisory group comprising of various community members. Council also gave presentations of the project to the Gippsland Climate Change Network (GCCN) and internally to council staff.
Outcomes and Benefits

The following project outcomes were exceeded:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Expected</th>
<th>Observed</th>
<th>Met?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy reduction</td>
<td>723,500 kWh</td>
<td>839,927 kWh</td>
<td>Exceeded</td>
</tr>
<tr>
<td>GHG emissions per year</td>
<td>900 tonnes</td>
<td>1,124</td>
<td>Exceeded</td>
</tr>
<tr>
<td>GHG emissions over life of assets</td>
<td>19,800</td>
<td>20,530</td>
<td>Exceeded</td>
</tr>
<tr>
<td>Financial savings over life of assets</td>
<td>$4.17 million</td>
<td>$5.06 million</td>
<td>Exceeded</td>
</tr>
</tbody>
</table>

Energy reduction, GHG emissions and financial savings were higher than expected because Council ended up installing LED lights which are more energy efficient than the originally planned “2 x 14W T5” compact fluorescent lights. This resulted in greater energy reduction, greater GHG savings and greater financial savings.
The following project outcome was not met:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Expected</th>
<th>Installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of lights changed</td>
<td>2,660</td>
<td>2,606</td>
</tr>
</tbody>
</table>

Overall, 2,606 lights were installed. 54 lights could not be installed due to inaccuracies in the data provided by Ausnet. The data originally established that there were 2,660 standard MV80 lights to be replaced. Baw Baw undertook a business case, project plan and detailed design all based on these numbers and then began installation based on these numbers.

As Council completed installation it became apparent that Ausnet's data was inaccurate. There are only 2,606 lights that could indeed be changed over. This is consistent with other CEEP street lighting projects in the Ausnet area (for example, South Gippsland Shire Council, Bass Coast Shire Council, Casey City Council) whereby these councils reduced the number of lights to be changed.

Both Council and AusNet organised extensive audits to finalise and reconcile the number of 80-Watt MV Lights including shared, decorative and standard luminaire under the program. Now it has been establish the total number of lights in the project is 2,606.

**Energy Efficiency Outcomes**

Determining the energy efficiency and cost savings for street lighting projects is straightforward. Street lighting is an “unmetered load” with energy usage managed by the Australian Energy Market Operator (AEMO). The lights are all “standard”, all the same model and wattage, and all un-metered. So the procedure for determining the energy consumption is specified in Parts A and B of the *National Electricity Market (NEM) Metrology Procedures*. This means that the electricity use of the old and new technology and the energy efficiency savings are known in advance and guaranteed.

**Methodology**

The methodology for the calculation of energy volumes for such unmetered supplies is set out in the *National Energy Market (NEM) Metrology Procedures*, which are managed by the AEMO. The methodology relies upon knowledge of the energy consumption of each type of approved load at an unmetered connection point. The values for assumed energy consumption are obtained from power consumption tests.

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5 We are aware that CEEP funding arrangements were not effected with these councils. Instead there were variations - in the example of South Gippsland decorative lights were changed over and for Casey the number of lights were reduced significantly (by a few thousand) but more advanced and expensive technology (LEDs instead of T5s) were installed with no change to the funding amount.
The outcomes of these tests are agreed upon by AEMO, responsible persons, Registered Participants and other relevant parties. The results are then presented and published in “load tables” managed by AEMO. The load tables must be updated whenever a new unmetered device comes into use. It is from these load tables that retailers and network service providers are able to calculate energy use from unmetered supplies. This is undertaken by maintaining an inventory of lights for each council so that costs can be appropriately allocated.

AEMO provides a list of unmetered loads for each state under its jurisdiction. These loads are then used by the electricity distribution business to calculate energy usage for each load type. Ausnet Services multiply the load by the sunset to sunrise hours in that region over the relevant time in order to calculate total kWh.

**Baseline energy usage**

Since 2009, Baw Baw has been working with Ironbark Sustainability on energy efficient street lighting planning and development, including the development of the CEEP funding proposal in 2012. Over the last 3 years this has also involved liaison with the Municipal Association of Victoria (MAV) to assist with changing street lights, in particular procurement of materials.

Baseline energy usage and efficiency outcomes have been calculated using the same methods and factors used by Ausnet Services and by Ironbark Sustainability. These were reality checked against power and maintenance bills.

Inputs are very straight-forward – the number of lights (from council electricity bills) multiplied by wattage of each light. To calculate baseline energy use the calculation is:

\[
\text{Number of Lights} \times \text{Wattage} \times 365 \text{ (days/year)} \times 11.94 \text{ (hours operational per day based on the regulations cited above)} / 1000 \text{ (to get to kWh)}.
\]

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of 80W MV Lights to be changed</td>
<td>2,060</td>
</tr>
<tr>
<td>Wattage of 80W MV</td>
<td>95.6</td>
</tr>
<tr>
<td>Operating hours of lights in Victoria</td>
<td>11.94</td>
</tr>
<tr>
<td>Baseline energy use per annum (kWh)</td>
<td>1,088,020</td>
</tr>
<tr>
<td>Baseline energy use per annum (MJ)</td>
<td>3,916,874</td>
</tr>
</tbody>
</table>

For full information and data please refer to Attachment A: Project Energy Efficiency Improvement Template.

Figures are based on real street light data – bills and number of lights. Council’s lighting stock primarily comprised of standard 80 Watt MV lights, which used around 43.7% of the energy than efficient LEDs Council has replaced them with.
Projected efficiency improvements

Energy savings from street lighting are very easy to predict because the exact number and type of lights and their operating conditions are well known and do not change. The new lights are 18 Watt LEDs and to calculate new energy use the calculation is:

\[
\text{Number of Lights} \times \text{Wattage} \times 365 \text{ (days/year)} \times 11.94 \text{ (hours operational per day based on the regulations cited above)} / 1000 \text{ (to get to kWh)}.
\]

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of new LEDs</td>
<td>2,606</td>
</tr>
<tr>
<td>Wattage of new LEDs</td>
<td>21.9</td>
</tr>
<tr>
<td>Operating hours of lights in Victoria</td>
<td>11.94</td>
</tr>
<tr>
<td>New energy use per annum (kWh)</td>
<td>248,722</td>
</tr>
<tr>
<td>New energy use per annum (MJ)</td>
<td>895,402</td>
</tr>
</tbody>
</table>

This project will save 839,298 kWh per year (3,021,471 MJ), which amounts to a saving of 77% relative to old inefficient lights that have been replaced.

Projected financial savings

This project is the largest energy reduction project in Baw Baw’s history. The technology used is also one that will retain its efficiency potential for an extraordinary time period of 20 years (this is because of the cost of replacing these assets is high so they are maintained rather than replaced frequently).

The savings for are significant. A total $5,058,977 million will be saved over the 20-year period through reduced energy and maintenance costs. These funds will be reinvested into the community and will improve economic output for councils and the country. This is higher than the $4,170,243 million savings predicted before the project started.

Community and Other Benefits

As the largest energy efficient project in Baw Baw’s history, the project attracted a high level of media attention, with the project demonstrating to the community the importance of energy efficient and reducing greenhouse emissions.

Baw Baw is one of the first councils in Australia to do so through a funding arrangement that included Council, the Federal Government and the Clean Energy Finance Corporation.

Figure 3: Community News from “Government News”

Baw Baw is the first council in the region (Gippsland) to complete a changeover to LED street lights. LED streetlights have begun transforming cities and municipalities across the globe and this will continue over the next decade. LED streetlights lead the way when combining factors such as lamp life, lamp life efficacy, reduced maintenance costs and the potential for smart lighting controls and
remote monitoring systems. It is a mature technology ready for mass deployment as demonstrated by the growing number of jurisdictions around the world that have upgraded to LEDs – a list that now includes Baw Baw Shire.

As well as requiring less maintenance – and the obvious energy efficiency benefits – there are other critical benefits of LED that have been realised, especially around safety, social and environmental factors. Safe lighting can be considered as lighting that maintains a consistent level of light throughout a space. Safe lighting provides light that is spread evenly onto roads and public spaces, and avoids patches of dark and light, which are common with old lighting technologies such as MV.

Safe lighting should also allow objects (both moving and stationary) to be easily identified by the human eye. This property of lighting is measured via the Colour Rendering Index (CRI) and relates to the colour of the light emitted. Broadly speaking, a whiter or “cooler” light improves facial recognition and helps motorists and pedestrians react quicker, thereby reducing the chances of accidents. In contrast, a more yellow or “warmer” light reduces the ability to accurately perceive objects.

This is also an important consideration where CCTV is deployed as a safety measure, again, to assist with facial recognition. This aspect of lighting is also linked to what is known as colour temperature (measured in degrees kelvin). Whiter or “cooler” lights are in the range 4,000-6,000°K (above 5,000°K start to appear bluish), whereas more yellow or “warmer” lights are generally below 3,000°K. There is also balance to be struck between energy efficiency (i.e. higher temperatures in the blue range (above 5,000°K are more efficient) and the ability of drivers to see pedestrians (too blue or too yellow (below 3,000°K) results in lighting where it is hard to see colour and contrast). International trends are towards a mid-range colour temperature of 4,000°K (neutral white).

In Image 1 we can again see “before” (HPS) and “after” (LED) images of an LED retrofit in Los Angeles. Results from the LED changeover in Los Angeles demonstrated a measurable reduction in street crime and vandalism after LED street lighting was introduced.7

LEDS also minimises glare, thereby increasing visual comfort for people with certain kinds of vision impairment. Reduced glare also assists Victorian police and other law enforcement agencies, because less glare is clearer for cameras that require clear contrast.

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The light output the old MV lights was maintained by a process of periodic visor cleaning and lamp replacements throughout their service life. While the design of street lights will factor-in dirt build up on visors and reduction in light output of the primary light source over time, the light output from the old MV would drop off very quickly, resulting in a big difference in light output at the start of its service life compared to the end of its service life.

This resulted in significant differences in light output between lights at the beginning and end of their service life, and from light to light in a given street. Baw Baw’s new LED lights maintain a more consistent light output over time, which minimises fluctuation in illumination from light to light, and street to street.

Along with the technical parameters outlined above, public perceptions of safety are also an important consideration, and are often directly linked to the lighting of public spaces. Even though improved lighting should not be viewed in isolation as the answer to all crime and accident-related issues, improved illumination can play a role in addressing public perceptions of a lack of security or safety.

LEDs can also reduce other environmental impacts. The old MV lights were manufactured using harmful substances like lead and mercury. These substances risk being introduced into the environment during a light’s service life, and must be carefully disposed of when a light is retired.7

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7 The Baw Baw street lighting project included stringent waste and recycling practices that were carried out by the installer, Vemco.
Budget

The Baw Baw Street Lighting project was completed on budget. The pre-project budget included lower capital costs because it was based on the more affordable “T5” fluorescent lights. However savings were made with lower installation and project management costs than expected. Having decided to procure and install the more expensive LED lights, Council also sought – and received – additional financing from the CEFC.

Due to mapping discrepancies outlined above, there were also 54 less lights on the ground from the original estimate of 2,660 which resulted in a minor reduction in costs.

Council also provided a significant amount of in-kind support for this project, including project management and communications support to the value of $28,000. The following table summarises the costs throughout the project.

**CEEP1040 - 2014/15 Financial Report**

**Operating Statement for the period ended 30 June 2015**

<table>
<thead>
<tr>
<th>Project Budget - EX GST</th>
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<tbody>
<tr>
<td>Australian Government - CEEP</td>
<td>$489,546</td>
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<tr>
<td>CEFC</td>
<td>$546,982</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$1,036,528</strong></td>
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<table>
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<th>Income</th>
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<td>CEEP Milestone 1</td>
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<td>Milestone 2 and 3</td>
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<td>Milestone 4</td>
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<td>Milestone 6</td>
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<td><strong>Total Income</strong></td>
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<table>
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<th>Expenses</th>
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<td>Milestone 1, 2 and 3</td>
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<td>Advertisement</td>
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<td>Network Modification Agreement</td>
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<td><strong>sub-total</strong></td>
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<tr>
<td>Milestone 4</td>
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<td>Consultancy</td>
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</table>

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8 Based on half a day a week’s work for 2 years at $100/hour.
9 Baw Baw Shire Council and AusNet Services have agreed on the final number of 2,606 lights, which means Ausnet’s GIS system, and future tax invoices will be raised based on this number. Council will submit all the relevant financial documents to DOI in the final milestone report M7 including an audited financial statement. Council then will raise final tax invoice of $35,000 ex GST upon submission of all documents under the funding agreement.
<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Promotion</td>
<td>$8,060</td>
</tr>
<tr>
<td>Contractor</td>
<td>$154,000</td>
</tr>
<tr>
<td>Contractor</td>
<td>$303,380</td>
</tr>
<tr>
<td>Contractor</td>
<td>$22,819</td>
</tr>
<tr>
<td>Contractor</td>
<td>$10,780</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>$499,879</strong></td>
</tr>
</tbody>
</table>

**Milestone 5**

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Promotion</td>
<td>$145</td>
</tr>
<tr>
<td>Contractor</td>
<td>$103,721</td>
</tr>
<tr>
<td>Contractor</td>
<td>$49,588</td>
</tr>
<tr>
<td>Contractor</td>
<td>$134,288</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>$287,741</strong></td>
</tr>
</tbody>
</table>

**Milestone 6**

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Contractor</td>
<td>$45,383</td>
</tr>
<tr>
<td>Contractor</td>
<td>$22,819</td>
</tr>
<tr>
<td>Contractor</td>
<td>$30,849</td>
</tr>
<tr>
<td>Contractor</td>
<td>$19,712</td>
</tr>
<tr>
<td>Contractor</td>
<td>$154,000</td>
</tr>
<tr>
<td>Consultancy</td>
<td>$4,390</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>$277,153</strong></td>
</tr>
</tbody>
</table>

**Total**

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Expense</strong></td>
<td><strong>$1,190,487</strong></td>
</tr>
<tr>
<td><strong>Total Income</strong></td>
<td><strong>$489,546</strong></td>
</tr>
<tr>
<td><strong>Council/CEFC Expense</strong></td>
<td><strong>$700,941</strong></td>
</tr>
</tbody>
</table>
Project Operation, Mechanism and Processes

Council managed the project internally along with accredited Ausnet installer and project manager Vemco. This was an effective and affordable way to manage the project. Vemco and Council held monthly meetings to track the progress and update the risks and issues registers, while Vemco also provided monthly data with updates on the number of lights installed and any minor issues (such as faulty parts). Dealing with the one hardware supplier (Gerard Lighting) also aided in ensuring a smooth ordering and delivery process.

Baw Baw – along with other Victorian councils – has been investing options for a street lighting “bulk change” for nearly a decade and it has only been in the last few years that these projects have become mainstream. While Baw Baw is one of the first councils in the Gippsland region to complete this project, general processes have become more streamlined given the increased number of projects throughout the state and the fact that the asset owners (Ausnet) have now been fully engaged and were familiar with how these projects are implemented. Nevertheless, there were still components that were complex mainly due to the project involving a large number of diverse stakeholders; the fact that Council did not own the assets they were seeking to change; multiple funding streams; and the relative size of the project for a regional council.

Procurement

Baw Baw prepared all of the documentation and design work for the program and tendered for the installer and project manager. Council selected Vemco from this public tender process and managed the contract with Vemco and other stakeholders.

In procuring the hardware, Council accessed the MAV Procurement bulk procurement panel for street lighting materials. As the largest peak body representing councils in Victoria, MAV and street lighting experts Ironbark Sustainability went out to tender on behalf of all Victorian councils in 2012 to set up a standing panel of approved energy efficient hardware that all councils could access.

The panel contains all currently approved energy efficient street lights and is refreshed on a quarterly basis as new lighting becomes approved. Purchasing lights from this standing panel minimized Council’s compliance and procurement risks and ensured that Council was meeting the requirements of the Local Government Act 1986.

Key Challenges and Learnings

While the project was managed and implemented smoothly, there were some issues and learnings for Baw Baw Shire Council that can be shared with other councils and also assist Council into the future.

The biggest challenge was dealing with inaccurate and inconsistent data from Ausnet. As mentioned previously Ausnet’s data (which forms the basis of electricity and maintenance costs to Council) proved to be inaccurate. It has been challenging to undertake a final audit and reconciliation of all lights because the information provided to Council by Ausnet was different to what was found “on
the ground”. Council is currently working with Ausnet who will consider modifying their GIS and other data based on the program.

Similarly, it was also difficult to identify “decorative” or non-standard lights and lights that were “cost-shared” with Vic Roads. Council now has a greater understanding of the lighting assets it pays for. However, in the future when undertaking a changeover of the remaining lights (higher wattage lights), more extensive audits will be carried out to identify types and locations of lights. Council will also try to engage with Vic Roads before undertaking any project on the cost-shared lights to seek a contribution.

Overall the project will significantly impact on the efficiency of broader public lighting. Council also owns many outdoor lighting assets in parks, car parks and sports facilities. These assets can readily be replaced and upgraded in a similar manner to the standard street lights. Additionally indoor lighting has a large greenhouse footprint in Council operations and with the increased technical knowledge and project management experience, Council will investigate changing over these lights. Council plans to assess and audit these other lighting installations and develop plans to actively refit these. The street light project can thus be readily used as a case study for many other energy efficiency projects.

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10 Note despite the data inaccuracies it would not be recommended to undertake a physical audit before undertaking a standard “bulk changeover”. Quite simply, it would be a waste of resources to send crews out to audit lights to confirm data only to duplicate the process a few months later with crews “on the ground” changing those lights. It is more cost effective for the crews to note data irregularities while installing the new lights.
Conclusion

The Baw Baw Shire Council Street Lighting Energy Efficient Changeover Program has resulted in the successful implementation of 2,606 modern and energy efficient LEDs.

This has been one of the most successful projects Baw Baw has undertaken and key staff throughout Council are thrilled with the outcome. More importantly, council and ratepayers are starting to witness the massive cost and energy savings that flows through with lights that require 77% less electricity and cost less to maintain. The flow-on benefits from the community promotion and education component the project has been far and wide, particularly in terms of increased awareness of residential and commercial energy savings and links to other Council programs and networks.

Baw Baw has built on and improved partnerships and relationships internally and with the broader community – residents, local business and the electricity provider. The benefits of this project will flow into the future for the entire Baw Baw community.
DECLARATION

The Authorised Officer of the organisation makes the following declarations:

☑ I declare that I am authorised to submit this Final Report (including any attachments) on behalf of  
Raw Baw Shire Council  ........................................ (Name of organisation)

☑ I declare that the information provided in this Final Report is true and accurate.

☑ I understand, and acknowledge that giving false or misleading information in this Final Report is an offence under the Criminal Code Act 1995.

☑ I understand that final payment will only be made in accordance with the Funding Agreement including on satisfactory completion of Milestones.

Authorised Officer Signature: ........................................ Date: 7/9/15

Name: ........................................

Position: Director Strategy & Organisation: Raw Baw Shire Council

Witness Signature: ........................................ Date: 7/9/15

Name: Andrea Bibby

Position: Support Officer (Health) Organisation: Raw Baw Shire Council

The use and disclosure of information provided in this Final Report is regulated by the relevant provisions and penalties of the Public Service Act 1999, the Privacy Act 1988, the Freedom of Information Act 1982, the Crimes Act 1914 and the general laws of the Commonwealth of Australia.

Information contained in the Final Report may be disclosed by the Department for purposes such as promoting the program and reporting on its operation and policy development. This information may also be used in answering questions in Parliament and its committees. In addition, the selected project information will be made publicly available. Public announcements may include the name of the grant recipient and of any project partners; title and description of the project and its outcomes; and amount of funding awarded.
## Attachment A: Project Energy Efficiency Improvement

<table>
<thead>
<tr>
<th>PROJECT TITLE</th>
<th>Baw Baw Energy Council Street Lighting Energy Efficient Street Lighting Program</th>
<th>PROJECT ID</th>
<th>CEEP1040</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUNDING RECIPIENT</td>
<td>Baw Baw Shire Council</td>
<td>DATE</td>
<td>13/7/2015</td>
</tr>
</tbody>
</table>

### Building, Facility or Site 1

<table>
<thead>
<tr>
<th>Name of Building, Facility or Site 1</th>
<th>Street Lights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (address)</td>
<td>Towns and suburbs of Athlone, Buln Buln, Darnum, Drouin, Erica, Fumina South, Hill End, Jindivick, Longwarry, Neerim, Neerim North, Neerim South, Nilma, Noojee, Rawson, Rokeby, Tanjil Bren, Thorpdale, Warragul, Willow Grove and Yarragon</td>
</tr>
<tr>
<td>Type of building, facility or site</td>
<td>Street lights</td>
</tr>
</tbody>
</table>

### Activity Type and Measure

Street lighting replacement

### Energy Efficiency Estimate Method

Figures are based on real street light data — bills and number of lights. As there is essentially one technology change (80W Mercury Vapour to 18W LED lights*) it is very simple to determine savings. Inputs are very straightforward – the number of lights (from council electricity bills) multiplied by wattage of each light.

The methodology for the calculation of energy volumes for unmetered supplies such as street lighting is set out in the National Energy Market (NEM) Metrology Procedures, which are managed by the Australian Energy Market Operator (AEMO). The methodology relies upon knowledge of the energy consumption of each type of approved load at an unmetered connection point. The values for assumed energy consumption are obtained from power consumption tests. The outcomes of these tests are agreed upon by AEMO, responsible persons, Registered Participants and other relevant parties. The results are then presented and published in load tables managed by AEMO. The load tables must be updated whenever a new unmetered device comes into use. It is from these load tables that retailers and network service providers are able to calculate energy use from unmetered supplies. This is undertaken by maintaining an inventory of bulbs for each council so that costs can be appropriately allocated.

There were:

- 2606 x 80W Mercury Vapour Lights

To calculate baseline energy use the calculation is:

\[
\text{Number of Lights} \times \text{Wattage} \times 365 \text{ (days/year)} \times 11.64 \text{ (hours operational per day based on the regulations cited above)} / 1000 \text{ (to get to kWh)}. \]

* Please note the difference between nominal and total wattage.
of a lamp. The **nominal** wattage includes only energy use of the lamp. The **total** wattage includes the energy consumed by the control gear, or ballast, of the luminaire. It is this **total wattage** that is more relevant. The 80W Mercury Vapours have a nominal wattage of 80W but total wattage of 95.8W. The 18W LEDs have a nominal wattage of 18W but a total wattage of 21.9W.

<table>
<thead>
<tr>
<th>Baseline Energy Usage</th>
<th>Baseline energy use is 3,916,874 MJ per annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>916,874 MJ per annum</td>
<td>Council’s lighting stock primarily comprised standard 80 Watt mercury Vapour lights (80W MV), which uses around 77% more energy than more efficient technologies that are currently available and approved:</td>
</tr>
<tr>
<td>KM of roads that are P category: 280 km</td>
<td>KMs of roads that are P category: 280 km</td>
</tr>
<tr>
<td>Number of P lights: 2,606</td>
<td>Number of P lights: 2,606</td>
</tr>
<tr>
<td>Energy consumption: 3,916,874 MJ</td>
<td>Energy consumption: 3,916,874 MJ</td>
</tr>
<tr>
<td>Energy consumption per KM of road per year: 13,989 MJ/KM/Year</td>
<td>Energy consumption per KM of road per day: 38.3 MJ/KM/Day</td>
</tr>
<tr>
<td></td>
<td>Note this project only refers to Pedestrian Category, or “P Category” roads. P Category roads are also known as minor roads. The objective of P Category lighting is to provide a lighted environment where due to the low vehicular traffic flow the visual requirements of pedestrians are dominant. To accomplish this, it is necessary to illuminate both the roadways and the surrounding verges to allow pedestrians to identify obstructions, and to aid motorists in recognising that pedestrians may be present. The lighting levels are far lower than for Major Road lighting (or “V Category” or “Vehicle Category”) and the design is based upon the amount of light falling on the road reserve (boundary to boundary). The above requirements are considered achieved if the lighting is designed and installed according to the requirements of the Australian/New Zealand Standard AS/NZS 1158 “Lighting for roads and public spaces” (Category P – sub-categories P1 – P5).</td>
</tr>
<tr>
<td>Energy Efficiency Improvement</td>
<td>Energy savings from street lighting are very easy to predict because the exact number and type of lights and their operating conditions are well known, and do not change as it is regulated by AEMO (see above).</td>
</tr>
<tr>
<td></td>
<td>The new lights are 18W LEDs.</td>
</tr>
<tr>
<td></td>
<td>To calculate new energy use the calculation is: Number of Lights x Wattage x 365 (days/year) x 11.64 (hours operational per day based on the regulations cited above) / 1000 (to get to kWh).</td>
</tr>
<tr>
<td></td>
<td>The new energy use is 895,402 MJ per year.</td>
</tr>
<tr>
<td></td>
<td>This project will save 3,021,472 MJ, which amounts to a saving of 77% relative to the existing lights that would be replaced.</td>
</tr>
<tr>
<td>Reporting Data (Measuring Energy Efficiency and Additional Data)</td>
<td>Council has a total of 280KM of P-Category specific to this project</td>
</tr>
<tr>
<td></td>
<td>Average hours of operation of lights per day: 11.94 hours</td>
</tr>
<tr>
<td></td>
<td>Percentage of the day lights are operational: 49.8%</td>
</tr>
</tbody>
</table>
Assumptions
- Energy price increases at 5% per year.
- OMR prices are as stipulated in AER Determinations and data from Ausnet services
- All savings and cost figures are GST Exclusive;
- Operating hours of lights are 11.94 hours per day in Vic

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost of Activity</strong></td>
<td>$1,190,487</td>
</tr>
<tr>
<td><strong>Estimated Cost Savings</strong></td>
<td>$5,058,977 over 20 years or an average of $252,949 per year.</td>
</tr>
</tbody>
</table>