Bega Valley Shire Council Clean Energy Plan

2019 – 2030

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Contents

List of acronyms used

ACT	Australian Capital Territory
BESS	Battery Energy Storage System
BVSC	Bega Valley Shire Council
DO	Dissolved Oxygen
ESC	Energy Saving Certificate
EPA	Environment Protection Authority
FOGO	Food Organics, Garden Organics
GHG	Greenhouse Gases
Ha	Hectare
HV, LV	High voltage, low voltage
HVAC	Heating, Ventilation and Air Conditioning
kW, MW	Kilowatt, megawatt
kWh, MWh	Kilowatt-hour, megawatt-hour
LED	Light Emitting Diode
LGC	Large-scale Generation Certificates
LPG	Liquefied Petroleum Gas
MSB	Main Switchboard
OEM	Original Equipment Manufacturer
PPA	Power Purchase Agreement
PRV	Pressure Reducing Valve
PV	Photovoltaic
RE	Renewable energy
REC	Renewable Energy Certificate
RFS	Rural Fire Service
SLUOS	Street Lighting Use Of System
SPS	Sewer Pump Station
STC	Small-scale Technology Certificate
STP	Sewage Treatment Plant
UV	Ultra Violet
VSD	Variable Speed Drive
WPS	Water Pumping Station
WWF	World Wildlife Fund

1. Background

1.1. Why a Clean Energy Plan?

Bega Valley Shire Council (BVSC) has developed a Clean Energy Plan, with support from the NSW Department of Planning, Industry and Environment (DPIE). This plan builds on BVSC's existing commitment to greenhouse gas emissions (GHG) reduction (which includes a 20% by 2020 renewable energy target) and provides a framework for further improvements in BVSC's operational energy efficiency and transition to renewable energy. This plan is a key tool for the implementation of mitigation actions to be proposed in the forthcoming BVSC Climate Resilience Strategy, which is currently under preparation.

The key objectives of the plan are to;

- Address all of BVSC 's stationary electricity and fuel uses
- Reduce vulnerability of BVSC's budget to future energy price uncertainties
- Increase energy resilience of BVSC's facilities
- Achieve operational cost savings
- Leverage external funding and drive innovation in clean energy infrastructure
- Provide feasible pathway options to achieve 100% renewable energy

1.2. Scope of the Clean Energy Plan

The BVSC Clean Energy Plan will focus on stationary electricity and fuel consumption associated with BVSC operations. The assessment of BVSC's overall GHG emissions including waste management and the identification of offsetting mechanisms to address BVSC's emission footprint will be incorporated in BVSC's forthcoming *Climate Resilience Strategy.*

This BVSC Clean Energy Plan;

- Describes BVSC operational energy consumption sectors and trends, and trends in the broader energy market.
- Aligns with BVSC operational plans, to contribute to BVSC's strategic direction and the aspirations of the Bega Valley community.
- Focuses on reducing BVSC's in-house GHG footprint through cost effective opportunities, such as energy efficiency, renewable energy and energy storage.
- Explores the options for an offset strategy to abate residual emissions after BVSC has exhausted all cost-effective opportunities.
- Recommends short, medium and long-term plans that focus on projects, policies and processes that BVSC should pursue in order to drive towards ambitious future GHG emission reduction goals within available budgets.

1.3. BVSC current energy use

BVSC has an annual revenue of $87 million, a stationary energy spend (electricity) of $1.68 million (2.0% of revenue) and a fuel spend of $1 million (1.2% of revenue). Forecast population growth is less than 1% per year for the next 20 years. Based on this moderate population growth, BVSC anticipates a small (approximately 5%) increase in population driven demand on any of its major facilities to 2030.

Table 1 summarises Council's current energy consumption, GHG emissions and annual expenditure on fuel and electricity.

Table 1: Summary of BVSC GHG emissions from 2017- 2018

Emission Source	Activity Data	Total t CO2-e	Expenditure 2017-18
Electricity use Council assets	6,622 MWh	5,430 t CO2-e	$1.679m
Electricity use Street lighting	1,324 MWh	1,085 t CO2-e	
Electricity (total)	7,945 MWh	6,515 t CO2-e	
Fuel for fleet	925 kL	2,455 t CO2-e	$0.995m
TOTAL		8,970 t CO2-e	

BVSC owns around 245 sperately metered sites across 12 asset categories, and pays for street lighting services supplied by Essential Energy. A significant portion of Council electricity emissions are due to street lighting, accounting for 17% of total electricity consumption, followed by Merimbula Sewage Treatment Plant and Sapphire Aquatic Centre accounting for 7% and 6% ,respectively (Figure 1). The largest 11 sites (including street lighting as a 'site') consume almost 60% of annual electricity use (Table 2).

Table 2: BVSC SITES CONSUMING MORE THAN 160 MWh OF ELECTRICITY PER ANNUM

Asset category	Significant electricity using site (>160 MWh pa)
Aquatic facilities	Sapphire aquatic centre
Buildings	BVSC administration building
Sewer management	Bega STP (Sewerage Treatment Plant) Bermagui STP Eden STP Merimbula STP Tura STP/SPS (Sewer Pum p Station)
Water management	Bega WPS (Water Pumping Station) Brogo WPS Kiah WPS
Street lighting	Street lights

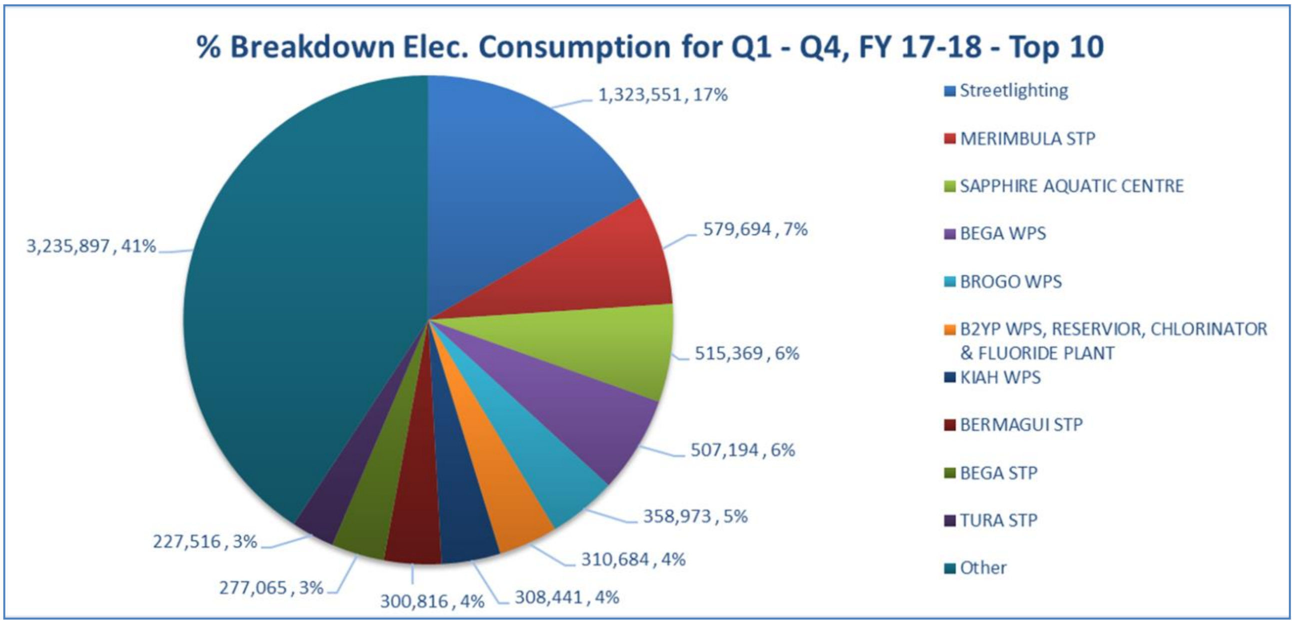

FIGURE 1 -2017-18 BVSC ELECTRICTY CONSUMPTION (kWh)

Council’s fleet data for 2017-18 showed a fuel consumption of 925 kL with carbon emissions of 2,455 t CO_2-e, (comprising 13% unleaded and 87% diesel). Council’s current fleet strategy is to maintain a modern and fuel efficient fleet within budget constraints, whilst keeping a watching brief on the rapidly evolving hybrid and electric vehicle sector.

1.4. BVSC current energy efficiency and renewable energy actions

BVSC has had a Climate Change Strategy in place since 2014. This period has seen a significant increase in the amount of energy efficiency and solar PV initiatives undertaken by BVSC, building on initiatives such as the Tathra community solar farm. The effect of BVSC’s efforts on electricity has been to stabilise consumption, while continuing to increase and improve services to the community. In addition to electricity BVSC is also implemented fleet management based initiatives to reduce emissions from its plant and heavy vehicle fleet, and from passenger vehicles.

Current and recent renewable energy and efficiency projects include the;

- Installation of 30kW solar array at Bemboka Water Treatment Plant
- Proposed installation of 70kW solar panels on new Council depot workshop roof
- Proposed installation of 30 kW solar panels at the Regional Learning Centre
- Proposed upgrade of LED lighting at the Regional Learning Centre
- Feasibility study for the development of a 300kW solar farm at the Bega STP
- Energy efficiency retrofits across buildings, aquatic centres, water and sewer management facilities, street lighting and community facilities

The current process that is employed by BVSC to progress energy management / efficiency initiatives includes:

- Development of an annual budget for energy efficiency and renewable energy work – this has typically been at around $70,000 per year funded through savings in electricity costs, which can be augmented with grant and loan funds, where applicable;
- The inclusion of energy efficiency (operational practices and technological improvements) and solar arrays as "business as usual" in all new capital and asset renewal projects;
- Assessment of cost and consumption data, high-consuming assets and roofs to identify priority projects;
- Assessment of opportunities including financial performance (Net Present Value/Internal Rate of Return), technological viability, complexity, stakeholder needs/engagement, community benefit/awareness and ultimately the ability to secure funding (internal or external),
- Implementation of projects that demonstrate a clear whole of life business case.

As a result of BVSC's efforts energy (electricity) consumption in 2015-16 was almost exactly the same as it was in 2009-10, and 1% lower than in the year 2012-13, the base year for the current Climate Change Strategy. In essence, with modest population growth of around 1% per annum, improvement of services and asset renewal, BVSC's efforts have succeeded in maintaining energy consumption at historical levels.

1.5. Business analysis

The current plan was further informed by an assessment of BVSC priorities that might influence future energy and GHG savings. This covered a range of important issues as summarised below:

- Growth in population is expected to be small, so future energy use under a do-nothing scenario may be expected to be similar to current levels, or rising slightly as assets age,
- The development of new water and sewer facilities and new recreation assets such as the proposed Bega Indoor Stadium will potentially impact BVSC's energy footprint. The inclusion of Solar Arrays, energy efficient technology (lighting etc.) as part of the design of these facilities will be the principal way of offsetting any increased energy use that may arise from the development or renewal of these major facilities.

Given this likely scenario for BVSC's operations there are no barriers to BVSC being able to set ambitious goals for energy savings and GHG abatement.

Key issues that influence the Clean Energy Plan were evaluated with the following key outcomes:

- There is good management and Council support for clean energy initiatives;
- Notwithstanding the good work on energy efficiency and renewable energy that has been done under the current Climate Change Strategy and associated targets (especially the current 20% renewables by 2020 target), there is a clear need to ramp up efforts to meet current and future targets, by focusing on the business case for new opportunities;
- Community expectation is reasonably high, and much of the work has been visible for the community to see (e.g. Tathra STP, solar PV on community buildings);
- Context is also important – particularly what other councils and State Governments are doing to develop energy and GHG abatement targets and strategies;

- In particular, senior-level engagement on key strategic decisions relating to potential ambitious targets is crucial – for example whether Council should consider a role in energy generation to meet future energy demand;
- Water and sewer: account for 67% of consumption with the potential for renewable energy installations following on the success of the community solar PV system on Tathra STP;
- Procurement: Given developments in renewable energy and energy efficiency in recent years and rising electricity prices, sustainable procurement remain an important element of BVSC's emissions reduction program.

2. Clean energy opportunities

The following section provides a brief summary of the various options available to BVSC to achieving significant reduction in energy consumption, expenditure on electricity purchase and GHG emissions.

2.1. Street lighting

The next "in-cycle" opportunity for BVSC to upgrade its street lighting to LED technology is likely to be 2021, with the recent 2017 upgrade understood to have been carried out using older lighting technologies.

For many local councils who have implemented approved LED street lighting on local roads in the Essential Energy network in recent years (e.g. Eurobodalla, Lismore, Port Macquarie, Coffs Harbour), and those councils who participated in the 5,000 LED trial in the northern inland / New England region (Glen Innes, Tenterfield, Gwydir, etc.) the payback has been estimated at around 4 to 5 years, well within the lifetime and planned replacement cycle for LEDs. The payback is based on both the significant energy savings (typically 50-60% depending on the technology being replaced) as well as large SLUOS (Street Lighting Use of System) cost savings charges, which include maintenance, lamp replacement and a capital component.

In order to prepare for the 2021 upgrade, BVSC will consider:

1. The likely timing of the Southern Lights project and confirm the implications for BVSC.
2. Whether it is feasible to undertake a whole of Shire upgrade (possibly excepting decorative fittings).
3. Changes to the SLUOS charges for older and LED technologies by Essential Energy for the 2019-2024 period. It is likely that new charges will be lower than those that have applied in recent years, leading to savings to BVSC.
4. Options to fund the likely capital cost, in the order of $1 million, which may include a grant, loan or reallocation of SULOS savings (see above).
5. Nomination of an Accredited Certificate Provider (ACP) before any works are completed in order to access Energy Saving Certificates (ESCs) that effectively reduce the cost of an LED upgrade by about 7%.

Overall this upgrade will represent the single largest action that BVSC will be able to implement to reduce its energy consumption (by ~8% of electricity demand) and is highly likely to be a cost-effective investment.

2.2. Solar PV behind-the-meter

Solar panels are a cost-effective way for an organisation to reduce its grid energy demand, reduce energy costs and in the case of BVSC demonstrate leadership in the community. BVSC to date has installed approximately 250kW of PV behind the meter. Behind the meter PV is where the energy generated by PV on a facility is consumed first by the facility on which it is installed, with surplus power exported to the electricity network.

- PV remains highly cost effective, and many councils are increasing their solar capacity through large arrays (greater than100 kW) that do not attract an upfront discount. For example:

- Clarence Valley Council has installed more than 800 kW of PV capacity, with arrays on all of its major buildings as well as on all major water treatment and wastewater treatment plants. A second round of PV systems is planned and budgeted, and should see its solar capacity more than double.

- In April 2019 Tweed Shire Council commissioned a 165 kW solar array on its Tweed Regional Aquatic Centre in Murwillumbah, one of numerous projects that will drive it towards its near-term target of 25% renewables. This system brings its installed capacity to 435 kW.
- Lismore City Council's leading community-owned solar projects of 99 kW each on the East Lismore STP (the first floating array in Australia) and the Goonellabah Sports and Aquatic Centre are well established, and it is now considering opportunities to expand these systems.
- Richmond Valley Council recently implemented a 99 kW ground-mounted PV array to meet much of the daytime demand of its major water treatment plant in Casino.
- Eurobodalla Shire Council's 2012-2017 emissions reduction plan highlights that more than 630 kW of PV is already installed with more planned.

The above are a small number of examples of councils seeing the clear cost benefits of more and larger-scale behind the meter PV systems on their facilities. Numerous local councils across NSW have developed ambitious targets and plans that are underpinned by the rollout of cost effective solar PV systems across council operational facilities.

As such the business case for rolling out solar panels across BVSC's facilities has only strengthened and there is a clear case for a continued and perhaps accelerated program to maximise this opportunity.

Appendix B provides a first-pass assessment of PV potential at major BVSC facilities. Not all of these sites will prove to be feasible; however other sites may be able to host PV that are not identified here.

FIGURE 2 – 30kW Solar Array – Bemboka Water Treatment Facility 2019

2.3. Energy efficiency of Council operations

Energy efficiency is often the most cost effective" renewable energy" resource. As with PV there is a continued strong business case for energy efficiency. BVSC has implemented much of the 'low hanging' fruit' of energy efficiency, in particular LED lighting in some key community buildings and its administration building, and a range of efficiency and renewable energy measures at most aquatic centres (VSDs, efficient heat pumps, solar hot water) via various grants.

From a retrofit perspective BVSC should continue to upgrade all high and medium use sites to LED technology, availing of incentives via Energy Saving Certificates. BVSC has already progressed this opportunity and the business case for accelerating a lighting upgrade program is considered to be high.

As large energy-using equipment is replaced there are opportunities to make step changes in energy efficiency, applying whole of life costing to selection processes. Chillers, water and sewer pumping systems, sporting field lighting, and major building upgrades fall into this category.

For smaller energy-using equipment adhering to good practices, sustainable procurement principles and availing of incentives can avoid incremental growth in demand that can occur. For example:

TABLE 3: Energy Efficiency Options

End use equipment	Energy saving option
Lighting	Small and low-use sites will have a range of lighting, including older fluorescent lamps and halogen or CFL downlights. BVSC will see savings over time as these are replaced with LED lights on fail. Where utilisation is low it is generally not justified to do a bulk upgrade, but policies that require LED as the default replacement – with sensor controls where appropriate – are recommended.
HVAC	Air conditioning at many BVSC sites is supplied by split system AC units. Replacement is generally not justified for energy savings, and controls are generally user-managed. The opportunities for BVSC to continue to improve the energy efficiency of air conditioning include: Review the design of planned new systems to ensure that energy efficiency is considered and that passive measures have been undertaken to minimise the requirement for air conditioning. Know what older units carry R22 refrigerant charge, as these may well be the units that will need replacement in coming years. Import of R22 is now banned, except for small quantities annually to 2029, since this gas was scheduled for phase-out under the 1987 Montreal Protocol. Access the NSW Government's Climate Change Fund (https://www.environment.nsw.gov.au/topics/climate-change/nsw-climate-change-fund) to receive $200 – $1000 discount off new and replacement air conditioner installation costs by installing high efficiency split, ducted or multi-split systems purchased through approved installers.
Power & appliances	Power and appliances represent a fairly modest proportion of BVSC's electricity use, and include office equipment such as computers, copiers and printers, as well as appliances like fridges, boiling water units, microwaves, dishwashers and televisions. However, the upfront costs of equipment and appliances are typically low compared to their operational costs. BVSC will take a whole of life approach to the selection of equipment and appliances.

BVSC will also consider whole of life costs in the design and construction of new capital, incorporate energy efficiency into tender and design specifications, and, where affordable, implement sustainable procurement practices based on the 2017 Sustainable Procurement Guide for NSW Local Governments (https://www.lgnsw.org.au/files/imce-uploads/127/esstam-sustainable-procurement-guide-30.05.17.pdf).

Water and sewer pumping systems do not tend to have significant energy efficiency opportunities except when assets are upgraded. At that time more efficient pumps, VSD controls and scheduling may result in efficiencies being achieved. Water and sewer network optimisation and management of infiltration to the water network can also deliver energy savings as a consequence.

As such the range of opportunities for added energy efficiency is incremental. Investigations indicate that the main opportunities include:

- Continued upgrade of lighting to LED across BVSC: this is well established in major buildings and can continue to occur at other sites including water and sewer facilities. For outdoor lighting systems (e.g. public walkways, parks / ovals and amenities blocks) solutions may require consideration of other factors such as vandal-resistance, and may require liaison with OEMs to find appropriate replacement or upgrade options. Sports ground lighting can be difficult to upgrade to LED due to capital costs, long term warranties by suppliers of halide lamps, low utilisation and trends towards user-pays where BVSC manages the assets but does not pay for the electricity. It is estimated that remaining lighting energy saving potential is around 100 MWh per year, which would save around $20,000 annually plus reduce maintenance. With mainly small sites and some special requirements for some lighting solutions it would be reasonable to expect a payback of around 6 years in total, suggesting $120,000 in costs to upgrade all of BVSC's facilities.

- Lighting controls: alongside LED technology upgrades BVSC can assess lighting control systems, either for lighting systems or integrated within individual lights. LED lighting can be specified to include control capabilities such as dimming and occupancy detection. These are particularly useful for low or intermittently used spaces such as STP offices, amenities blocks, car parks and civic / community buildings.

- The administration building has two chillers, one of which is from the original build. It is therefore old, is energy inefficient and will fall due for replacement in coming years. Upgrading with a reverse cycle system can be considered so that, in addition to cooling savings, electric heating demand can be reduced. These upgrade works should be incorporated into the broader facility upgrade design planned for 2019-20.

- The Merimbula STP operating regime may have opportunities for optimisation with the integration of DO control and management of blower operation. As the largest energy using sites are STPs there is always a case for reviewing operating processes such as aerators, pumps and UV systems and optimising these while meeting EPA licence requirements.

- At all sites energy system operating practices can be reviewed and optimised through awareness / education and control procedures, particularly to ensure that night and weekend energy demand is minimised.

Taken together it is estimated that further energy efficiency measures could deliver 5% energy savings or around 300 MWh per year and $60,000 per year. This would be achievable over the long term and require marginal and full costs of around $300,000.

For all energy efficiency upgrades an assessment of issues such as safety, licence requirements, fitness-for-purpose and standards is a routine part of the business case. The drivers for these initiatives are predominantly electricity rates and the market value of ESCs. The detailed business cases to be developed will take these parameters into account, and seek advice on future trends to assist with making the case as robust as possible.

2.4. Maximising solar PV behind the meter with battery storage

Current evidence suggests that pricing for small and medium sized battery storage has not trended down nearly as quickly as was forecast in the last couple of years, and it may take more time for this to occur as mass production and uptake of electric vehicles starts to occur.

Solar Quotes (https://www.solarquotes.com.au/battery-storage/comparison-table/) presents analysis on battery storage that is useful. A sample of their most recent market update is shown in Appendix B. The main point of note is the simple expression of cost as $ per kWh of warranted energy discharged from the battery. This can be compared easily with BVSC's current rates or the value of PV savings. Storage becomes financially possible when the cost of storage falls well below the value of savings, likely to be below 10¢/kWh.

In the context of BVSC's renewable energy plans the current cost of storage suggests that this is still not economically viable in most cases, and the strategy of waiting for technology costs to drop while considering one or more small-scale battery trials remains the recommended approach. New systems will be installed to ensure future addition of battery storage is technically feasible.

Battery energy storage systems (BESS), and potentially higher feed-in-tariffs in future (given rises in wholesale electricity prices), may allow BVSC to increase the amount of solar PV it can put on specific sites. Rather than sizing PV systems to around the peak daytime demand of sites, storage provides the opportunity to maximise the capacity of PV that can be installed, up to a level that meets the energy demand of a site, subject to space constraints.

A preliminary analysis was performed on BVSC's sites to estimate the offset that could be achieved with this strategy. Energy use data and site visits were used to estimate the maximum size PV system that is likely to be feasible for each site. Estimates of solar yield are based on an assumed 1,400 kWh per kWp per year. This energy will be consumed direct on site and stored in batteries for later use. The results of this Analysis are shown in Appendix C. The main added requirement will relate to location of battery storage, taking into account building code requirements if located indoor, and risks to equipment if located outdoor (heat, security, etc.). There is unlikely to be any material saving to BVSC from batteries until the costs of production fall substantially.

2.5. BVSC as a generator of renewable energy

A 100% renewable electricity target could be achieved in the next couple of years if BVSC was to become a generator of electricity. This could be done in conjunction with other users – e.g. other councils – to create scale. However for present purposes it is assumed that BVSC would simply seek to meet its own needs.

In recent years a small number of mid-scale solar PV projects have been developed by local governments, including:

- Sunshine Coast Council's 15 MW Valdora solar project (operating),
- City of Newcastle's 5 MW Summerhill solar project (under construction), and
- City of Fremantle's 5 MW South Fremantle landfill project (approved, construction 2019/20)

These projects may have benefitted from high Large-scale Generation Certificates (LGC) values and high wholesale electricity prices at the time of planning.

The business case for such projects appears to have diminished, with a number of NSW council feasibility assessments showing relatively low financial returns based on their current view of wholesale electricity prices going out over the next 10 years, grid connection costs, current low and very low forecast prices for LGCs, and the EPC costs of solar projects at this scale.

In addition, the business case for mid-scale build projects compared with medium to long term renewable energy power purchase agreements (PPA) from larger utility-scale projects is inferior when looking solely at energy costs for a council. Future declining costs for solar projects, local job opportunities and leadership credentials may factor into BVSC's decision making in relation to a council-owned solar farm to meet part of BVSC's energy demand. Further details on the business case for a BVSC-owned solar farm and case study information regarding the Sunshine Coast Council's Valdora Solar Farm are provided in Appendix C.

Essentially a 4- 5MW solar farm would be required to generate BVSC's electricity requirements, after all of the previously described measures were implemented. Current advice suggests a facility of this size would not be affordable at this time. However, developments in the financial viability of such projects need to be monitored and the business case for a Solar Farm be revisited as ongoing medium to long term action as part of this Plan.

2.5.1 Other local self-generation options

Technologies such as micro-hydro (e.g. at a dam outlet or replacing a PRV) may be able to produce small amounts of energy relative to Council's demand however there are no local opportunities that could produce enough electricity to meet BVSC's needs.

Energy from waste is permitted under EPA guidelines where done in conjunction with the production of a biochar product or through the production of biogas from animal waste. However, BVSC does not currently have a source of animal waste or a demand for biochar that would warrant investment in either of these options.

The south coast region has reasonable ocean energy resources, though it is likely that south-western and southern resources would be exploited in Australia before the lesser resources on the east coast. Wind energy resources are also good in some locations, though an assessment of BVSC-owned land for wind energy potential has not been performed.

2.6. BVSC as a purchaser of renewable energy

The main way in which large scale renewable energy has been sourced in recent years is via corporate power purchase agreements (PPAs), where renewable energy developers and retailers have engaged with end users to develop and/or sell all or a percentage of an organisation's electricity requirements from renewable energy.

The majority of offsite corporate PPAs have been based on utility-scale solar and wind energy. In future solar, wind, pumped hydro and battery storage systems are expected to offer energy agreements based on renewables that are matched to an end user's energy demand profile, with lower exposure to wholesale markets. Increasingly customer-focused models may enable small energy users such as BVSC to receive renewable energy supply offers that are comparable to 'regular' retailer offers that are sourced from the mix of energy sources supplying the grid.

At this time the approach recommended for councils in NSW, who cannot enter into derivatives-based agreements including Contracts for Difference (which underpin most large volume renewable energy PPAs that supply most or all or an organisation's electricity), is to:

- Consider purchasing a fraction of energy from renewables such as 20-30%, ideally with market-matching and review clauses that assure value for money over the term of an agreement,
- Plan to progressively increase purchases from renewables as the PPA market matures,
- Consider entering into a buying group to increase the volume of renewables being purchased, which is more attractive to retailers and thus can lead to lower pricing

The timing of any approach by BVSC to the market to source renewable energy as part of their normal electricity procurement will be best informed via consultation with BVSC's electricity market experts, and may be influenced by factors such as the end of existing agreements, maturity of the market for buying renewables, interest by and ability of other parties to partner with BVSC, new projects connecting to the grid, forecast electricity market trends, among others.

Councils in NSW, with support from Southern Sydney Regional Organisation of Councils (SSROC), have recently entered into an agreement to source 25% to 50% of their electricity via a 10-year PPA that will see solar supplied from the Moree solar farm. We understand that a second PPA involving multiple regional and urban NSW councils is currently under development.

BVSC will evaluate purchasing options, alongside self-generation options, at the time of its next energy contract renewal to determine the best value-for-money outcome, taking into account BVSC's preferences, risk management aspects and options / opportunities for collaboration with other end users. Appendix E details the steps that BVSC should take in exploring the feasibility of PPAs.

2.7. Fleet energy management

Fleet accounts for 8.4% of BVSC's greenhouse gas emissions, and fuel use has been stable for a number of years. Council's current practices include the selection of high efficiency / low emissions fleet on replacement / upgrade, and the availability of smaller passenger vehicles.

A full review of Council's options and opportunities for fleet carbon abatement has not been performed. The inclusion of all sources within Council's long term GHG objectives will enable such a review to be conducted that will examine:

- Future technology developments for fleet, including the potential for electric plant,
- Options for 'greening' passenger fleet including vehicle size, emissions / fuel economy,
- Availability of biofuels including ethanol and biodiesel,
- Prospects for electric vehicles, hydrogen vehicles or other low / zero-emissions fuels in the BVSC region,
- Carbon offsets for residual emissions in the context of a net-zero target by 2030

Low contribution to emissions, current practices and current opportunities for abatement suggest that abatement measures for this source are likely to occur in the long term, rather than short to medium term.

2.8. Do nothing

Without any specific action from BVSC, GHG emissions associated with its consumption of electricity will fall. This is a consequence of the 'greening' of the national electricity network. As the cost of renewables is now lower than that of fossil fuels, replacement generation being fed into the national electricity grid is increasingly being provided by renewables (primarily large-scale wind and solar). This trend will accelerate as ageing coal fired power stations reach the end of their useful lives. This means that the GHG intensity of each MWh of electricity consumed by BVSC will fall, leading to a reduction in GHG emissions associated with BVSC's electricity consumption.

Based on the projected uptake of renewables across the national electricity network to 2030, the estimated reduction in BVSC GHG emissions is expected to be 50-100%, compared to 2017-18. While this is a positive outcome in terms of GHG emissions, it is not expected to materially reduce BVSC's energy costs.

3. Clean Energy Implementation Plan

The Clean Energy Plan will be implemented through the following actions, which.

The implementation is broken into Short / Medium / Long term actions as follows;

2020	2021	2022	2023	2024	2025	2026	2027	2029	2030
Short term		**Medium term**			**Long term**				

3.1. Clean Energy Implementation Plan Funding

Council's 2019-20 budget has a Clean Energy and Energy Efficiency allocation of $70,000. It is proposed that this existing allocation become a permanent budget allocation, increasing in line with the Local Government Cost Index. Staff will endeavour to leverage these funds with available grant funding. For the purposes this plan it is suggested that an annual grant income of $35,000 is an appropriate and conservative estimate of likely grant income. Financial saving generated through energy efficiency measures will be reinvested into further clean energy initiatives outlined in this plan.

In addition to these direct contributions, energy efficiency and renewables will be integrated with new capital and asset renewal projects where there is a sound business case established on a whole of life cost basis. This will ensure that lifecycle costs of capital works are considered, and minimised, at the design stage. BVSC may consider additional loans, such as to fund the Southern Lights project, where major projects, requiring significant upfront investment, present a once in a lifetime opportunity to capture lifecycle savings.

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3.2. Short Term Clean Energy Plan

BVSC's short term clean energy plan will include the 2019-20 and 2020 - 21 financial years.

The following initiatives will be pursued in the short term.

Source	Initiative	Description	Expected cost	Expected energy saving pa	Expected cost saving pa	Payback
Electricity	Solar PV	Implementation of solar PV at: • Bega Depot and RFS, • Bega STP, • Merimbula STP and Depot • BVSC administration building augmentation • Regional Learning Centre • Sapphire Aquatic Centre	$,350,000	302,000 kWh	$45,000 pa	7.78 years
Electricity	Solar PV	• Explore emerging technologies including microgrid and virtual grid solutions	Nil – resource time only			
Electricity	Solar PV	• Undertake a feasibility assessment of Solar PV sites identified in Appendix A	20K			
Electricity	Solar PV and Energy Efficiency	• Embed EE and PV as business as usual in design and construction of new capital and asset renewal	Nil – resource time only			
Electricity	Street lighting	• Refine preliminary business case for Southern Lights LED • Begin budgeting for future LED upgrade	Nil – resource time only	Nil	Nil	NA
Electricity	Energy Efficiency	• Embed sustainable procurement practices in BVSC procurement process	Nil – resource time only			
Electricity	Energy Efficiency	• Implement one third of remaining EE potential, focused on building lighting and STP motor systems (E.ZG. optimising DO & aerator systems at Merimbula STP	$100,000	100,000 kWh	$20,000	5 years

Source	Initiative	Description	Expected cost	Expected energy saving pa	Expected cost saving pa	Payback
Fuel	Fleet energy efficiency options	• Investigate opportunities available to Council for ongoing fuel efficiency options	Nil – resource time only	Nil	Nil	NA
Electricity	PPAs	• Explore trial PPAs with community group(s)	Nil – resource time only			
Electricity	Generation of 100% of BVSC demand	• Investigate the options available to Council for achieving generation of 100% RE, including: ○ Self-generation on Council land ○ Partnering with other organisations to generate	Est $20-30,000 plus internal resource costs over 2+ years	Nil	Nil	NA

3.3. Medium term Clean Energy plan

BVSC's medium term clean energy plan will include the 2021- 22 to the 2023 -24 financial years. The following initiatives will be pursued in the medium term.

Source	Initiative	Description	Expected cost	Expected energy saving pa	Expected cost saving pa	Payback
Electricity	Contract	• Develop power purchase agreement, or alternative electricity contract, following completion of existing electricity contracts	Nil – resource time only			
Electricity	Solar PV	• Implementation at all remaining sites where a behind-the-meter PV solution is feasible	$345,000	300,000 kWh	$44,000 pa	7.64 years
Electricity	Street lighting	• Upgrade all street lighting to LED, funded by either grant or loan	$1,000,000	550,000 kWh	$257,413	3.88 years
Electricity	BESS	• Select and implement one or more trials of solar with storage based on agreed criteria	$30-32,000 for 2 x 4kW PV w/14 kWh storage	10-11,000 kWh pa	$3,120 at 30¢/kWh	10 years or less
Electricity	Energy Efficiency	• Implement one third of remaining EE potential, focused on building lighting and STP motor systems	$100,000	100,000 kWh	$20,000	5 years
Fuel	Fleet energy efficiency options	• Continue to implement opportunities for ongoing fuel efficiency options, including electric vehicles, and install charging stations at major Council sites	Not determined	Nil	Nil	NA
Electricity	Generation of 100% of BVSC demand	• Maintain a watching brief on opportunities and prevalent market conditions. Provide further report to Council if conditions change.	Nil – resource time			
Electricity	Purchase of 100% of BVSC demand					

3.4. Long Term Clean Energy Plan

BVSC's long term clean energy plan will include the period from 2024 – 25 through to 2030.

The following initiatives will be pursued in the long term.

<table>
<tr><th>Source</th><th>Initiative</th><th>Description</th><th>Expected cost</th><th>Expected energy saving</th><th>Expected cost saving</th><th>Payback</th></tr>
<tr><td>Electricity</td><td>BESS</td><td>• Widespread implementation of solar with BESS, including augmentation of existing sites' PV systems, subject to expected positive business case</td><td>TBC – as PV & storage costs reduce</td><td>1,100,000 kWh est</td><td>$250,000 at 2015/16 rates</td><td></td></tr>
<tr><td>Fuel</td><td>Fleet energy efficiency options</td><td>• Continue to implement opportunities for ongoing fuel efficiency options, including electric vehicles, and install charging stations at major Council sites</td><td>Not determined</td><td>Nil</td><td>Nil</td><td>NA</td></tr>
<tr><td>Electricity</td><td>Energy Efficiency</td><td>• Implement one third of remaining EE potential, focused on building lighting and STP motor systems</td><td>$100,000</td><td>100,000 kWh</td><td>$20,000</td><td>5 years</td></tr>
<tr><td>Electricity</td><td>Generation of 100% of BVSC demand</td><td rowspan="2">• Plans are to be revised and may be implemented based on continuing evaluation of opportunities, including carbon offset strategies. Further report to Council in the event of realised opportunity in this space.</td><td colspan="4" rowspan="2">Preference is for local Solar Farm with potential community partnership.

Transition energy source from Power Purchase Agreement to Solar Farm</td></tr>
<tr><td>Electricity</td><td>Purchase of 100% of BVSC demand</td></tr>
</table>

3.5. Risk assessment and monitoring plan (include project review and continuous improvement)

BVSC will develop an appropriate risk management framework alongside the further development of the strategies outlined in this plan.

Some of the key elements of this risk management framework will should include:

- Electricity price risk: wholesale electricity markets are quite volatile, and changes to the generation mix may continue for some years. Volatility in pricing makes decisions about if and when to generate or purchase large-scale renewable energy challenging, and sound market information should be solicited regularly so that BVSC's decisions are informed,
- Technology prices for solar, battery storage, electric vehicles, future opportunities to trade in renewable energy, waste treatment (composting, waste-to-energy) and other opportunities will continue to change – fall in most cases. The best time to invest will likely change as some technologies mature and become cheaper. BVSC should seek to stay abreast of technology price changes so that its Clean Energy Plan can be adjusted as needed going forward.
- New opportunities will likely emerge that can further assist BVSC to achieve its goals across electricity, fuel and waste, and a process of continuous review of new opportunities will help Council to maintain the currency of its Clean Energy Plan,
- Safety and risk assessments at a project level will be part of normal processes – as with solar PV opportunities such as battery storage will introduce new requirements in terms of implementation requirements and standards, and training / capacity building within BVSC,
- Skills development: battery storage, large-scale generation, large-scale renewables purchasing, development and management of new waste treatment processes, management of electric vehicles and the like will require BVSC to upskill resources so that the maximum benefit is realised from all Clean Energy Plan opportunities,
- Review and reporting: existing practices can be documented and adapted to accommodate the review of new initiatives.

3.6. Change management plan

Most initiatives have been progressed via facilities management / sustainability. For the ambitious goals of a Clean Energy Plan to be realised efficiency, renewables and carbon management need to be part of the way BVSC 'does business' – i.e. continuous improvement in these areas becomes business-as-usual.

The development of this project saw engagement across all sections of BVSC and at management levels up to General Manager. Building on this a Change Management Plan is recommended so that the needs of all key stakeholders (information, skills, communication, etc.) can be identified, developed and incorporated into the strategy.

Appendices

3.7. Appendix A - Summary of the estimated solar PV potential on major Council facilities

The following is a summary of the estimated solar PV potential from this high level analysis.

Table 4: High level solar PV estimate for BVSC – behind-the-meter, excluding storage						
Asset Name	**Consumption**	**Solar PV**	**Solar kWh**	**Capex**	**PV savings**	**Possible locations**
Bandara Childrens Services	16,516 kWh	5.00 kW	7,000 kWh	$6,250	$1,400	PV already installed, augmentation is possible
Bega Depot Amenities & Town Team Shed	24,367 kWh	5.00 kW	7,000 kWh	$6,250	$1,400	Could host a larger system, assess daytime demand
Bega Indoor Stadium	16,812 kWh	2.00 kW	2,800 kWh	$2,500	$560	Likely night use mainly, storage candidate
Bega Rfs	36,028 kWh	7.00 kW	9,800 kWh	$8,750	$1,960	New building
Bega Stp	273,948 kWh	50.00 kW	70,000 kWh	$87,500	$9,100	Land adjacent to STP, N-facing
Bega Valley Regional Learning Centre	43,918 kWh	10.00 kW	14,000 kWh	$12,500	$2,800	Not visited - Google map view only. Medium term opportunity
Bega Wps	326,055 kWh	20.00 kW	28,000 kWh	$35,000	$3,640	Reservoir roofs
Bermagui Stp	385,060 kWh	40.00 kW	56,000 kWh	$70,000	$7,280	Former landfill, hill face near bottom of site, green tank roofs
Bermagui Works Depot	10,322 kWh	5.00 kW	7,000 kWh	$6,250	$1,400	Mount on roof at western end away from mast, in between daylight panels
Bvsc Administration Building	194,943 kWh	20.00 kW	28,000 kWh	$25,000	$3,640	Flat roof in front of existing panels, old chambers roof
Candelo Pool	51,904 kWh	10.00 kW	14,000 kWh	$12,500	$1,400	Export for much of the year as 6-month operation. Mount on main building roof
Candelo Reservoir & Chlorinator	31,308 kWh	3.00 kW	4,200 kWh	$5,250	$840	Assumes a small system can be mounted on the reservoir - google view only

Candelo Stp @Candelo Showground	102,039 kWh	20.00 kW	28,000 kWh	$35,000	$5,600	Flat land opposite side of side road from plant, or on hillside above plant
Cobargo Stp	90,403 kWh	15.00 kW	21,000 kWh	$26,250	$4,200	Limited space, possibly small system on building roofs and small ground mount
Compactor @ Wallagoot Transfer Station	15,992 kWh	10.00 kW	14,000 kWh	$17,500	$2,800	Roof of transfer station appears useable - supply to STP subject to Essential Energy
Depot (Welding Shop)	46,299 kWh	10.00 kW	14,000 kWh	$12,500	$2,800	
Eden Stp	209,078 kWh	30.00 kW	42,000 kWh	$52,500	$5,460	N-facing hillside adjacent to MSB
Merimbula Depot	11,241 kWh	3.00 kW	4,200 kWh	$3,750	$840	Roof mounted on depot – could potentially host more
Merimbula Stp	604,895 kWh	90.00 kW	126,000 kWh	$157,500	$16,380	Land at back of depot, stormwater overflow, trickling filter tanks
Minyama Pde Multi Site	36,226 kWh	10.00 kW	14,000 kWh	$12,500	$2,800	Part of depot site, mast at one end gives shade issue – manage with micro-inverters
Sapphire Aquatic Centre	438,432 kWh	25.00 kW	35,000 kWh	$31,250	$4,550	Roof on S-W side of the building above admin and childcare
South Bega Wps	57,393 kWh	10.00 kW	14,000 kWh	$17,500	$2,800	Roof of reservoir may be a possible location
Tura Stp/Sps	217,057 kWh	30.00 kW	42,000 kWh	$52,500	$5,460	Hillsides inside front gate & front of sludge pond. Future dewatering building roof
Total	3,240,236 kWh	430.00 kW	602,000 kWh	$696,500	$89,110	

The overall potential represents 8.6% of Council's electricity use, and would bring its total solar PV offset to more than 12%. This is a level that is well aligned with what other Councils have identified, and in some cases achieved.

The costs and benefits of this initiative are estimated to be:

- Capital cost $696k
- Energy savings of 602 MWh per year or 8.6% of BVSC's electricity consumption
- Simple payback estimated to be 7.84 years

Risk assessment: investigation of feasibility and implementation requirements would be required for all systems. Council has already implemented a number of commercial-scale PV systems, so feasibility and risk assessment will follow established processes.

Sensitivity analysis: the drivers of the business case are predominantly electricity rates and the market value of STCs. The detailed business cases to be developed will take these parameters into account, and seek advice on future trends to assist with making the case as robust as possible.

Clean energy strategy development needs: feasibility assessments of all sites will examine structural issues, electrical connections, shading and solar modelling and other factors as required. Current and forecast energy rates as well as peak demand reduction potential will feed into cost benefit analysis. pre-feasibility studies

Based on this preliminary assessment a number of sites are identified to be high priority in terms of further assessment and implementation where viable. These include:

- Bega Depot and RFS precinct, encompassing 4 separate accounts,
- Bega STP, on land adjacent to the STP and subject to other potential uses for this site in future,)
- Merimbula STP and Depot
- Added PV on the BVSC administration building
- Sapphire Aquatic Centre, on the roof of the entrance area and childcare centre

Together these locations account for around 50% of the identified potential, and should be the focus of initial investigations.

Figure 3: possible solar PV locations at Merimbula STP

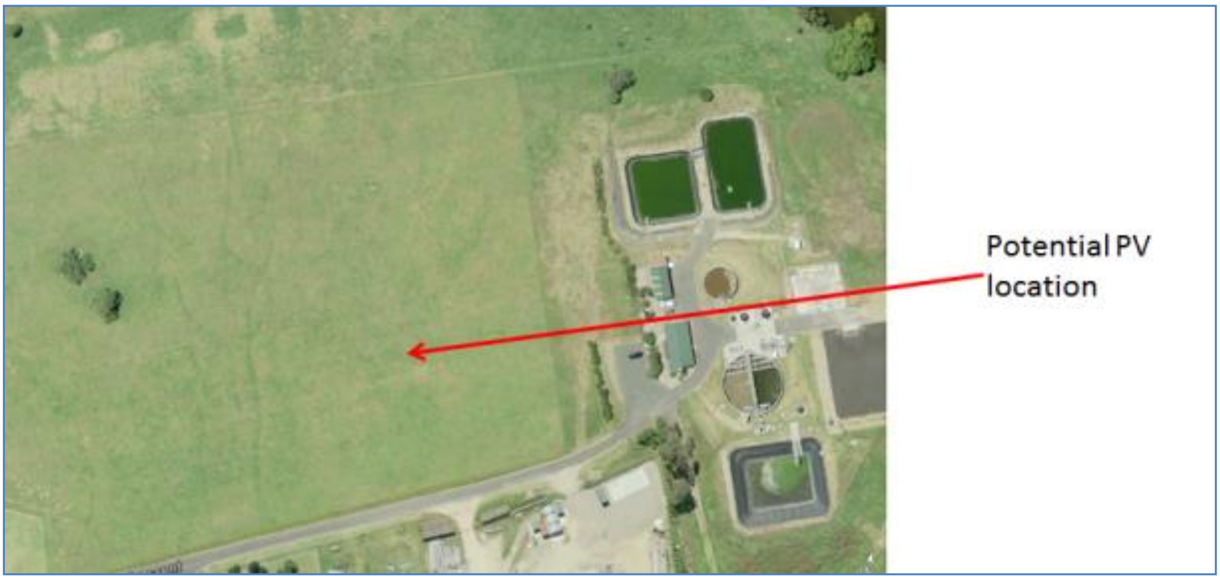


Figure 4: possible solar PV location at Bega STP

3.8. Appendix B - Analysis of battery storage costs

Table 5: Battery storage – sample of current options and costs (Solar Quotes)					
Product Name	**Battery Type**	**Price excl. installation**	**Usable Storage Capacity**	**Total warranted kWh (1 cycle per day)**	**Cost per Total warranted kWh (1 cycle per day)**
BYD B-Box RESBYD B-Box RESBYD B Box Pro 13.8	Lithium-ion (Lithium Iron Phosphate)	$7,500	10.24 kWh	31,700	$0.24 (+ inverter cost)
DCS PV 10.0DCS PV 10.0DCS PV 13.5	Lithium-Ion (Lithium Iron Phosphate)	$8,900	10.42kWh	38,033	$0.24 (+ inverter cost)
LG Chem Resu 10LG Chem Resu 10LG Chem RESU 6.5LG Chem RESU HV 10LG Chem RESU HV 7	Lithium-Ion (NMC)	$7,655	8.8kWh	24,300	$0.31 (+ inverter cost)
Redflow Zcell	Flow (Zinc-Bromide)	$12,600	10 kWh	36,500	$0.35 (+ inverter cost)
Sonnenbatterie Eco 9.43	Lithium-ion (Lithium Iron Phosphate)	$16,500	13.5kWh	49,275	$0.34
Tesla Powerwall 2	Lithium Ion (NMC)	12350	13.5 kWh	37,800	$0.32 (+ inverter cost)
Trinabess Powercube	Lithium Ion (Lithium Iron Phosphate)	9790	8.64kWh	22,450	$0.31 (+ inverter cost)
Opal Storage	Lithium Ion	$12,000	11.7 kWh	40,000	$0.30

The optimum battery capacity will be site-specific and will range from small batteries that are intended to manage peak demand (e.g. kWp:kWh ratio of say 1:1) up to large batteries that can store a full day's solar PV generation, for example to use at intermittently-used facilities (e.g. kWp:kWh ratio of 1:4). Detailed evaluation will not only take site-specific factors into account but will also consider the potential value of load shifting / arbitrage, network needs and incentives, and opportunities to export stored energy via a retailer or aggregator for example.

For the purpose of this preliminary work required storage capacity is taken for each site to have a kWp:kWh ratio of 1:3 – that is, up to ¾ of average daily solar yield can be stored for later use. This can be a useful and conservative starting point when thinking about budgeting for future solar & storage projects, with detailed assessment for each site then used to refine and optimise the storage required.

The results of this analysis are tabulated below.

Table 6: Analysis of Battery Storage Potential at Selected BVSC Facilities

Asset Name	Current Energy Consumption	Max Solar PV Capacity	BESS capacity in KWh at kWp:kWh of 1:3	Annual Solar Yield kWh (consumed and stored)	Possible locations
Bandara Childrens Services	16,516 kWh	5.00 kW	15 kWh	7,000 kWh	PV already installed, augmentation is possible
Bega Depot Amenities & Town Team Shed	24,367 kWh	17.41 kW	52 kWh	24,367 kWh	Cover all available roof spaces at the depot
Bega Indoor Stadium	16,812 kWh	12.01 kW	36 kWh	16,812 kWh	Cover all available roof space
Bega Rfs	36,028 kWh	25.73 kW	77 kWh	36,028 kWh	Cover all available roof spaces at the depot
Bega Stp	273,948 kWh	195.68 kW	587 kWh	273,948 kWh	Land adjacent to the STP is fairly flat and N-facing. This system would take up 2-3,000 m^2. Consideration of future use of land
Bega Valley Regional Learning Centre	43,918 kWh	31.37 kW	94 kWh	43,918 kWh	Cover all available roof space to supply this and the 3/3Market St meter
Bega Wps	326,055 kWh	20.00 kW	60 kWh	28,000 kWh	Unlikely to be other space available
Ben Boyd Chlorinator & Reservoir	10,935 kWh	7.81 kW	23 kWh	10,935 kWh	Assumes roof of building next to dam can be used. Google view only
Bermagui Community Centre - Hall/Library	39,684 kWh	5.00 kW	15 kWh	7,000 kWh	The existing PV + LED may meet all needs with BESS
Bermagui Stp	385,060 kWh	150.00 kW	450 kWh	210,000 kWh	The old landfill appears to be the only space that can accommodate this size system. Cap condition and penetration risk would be major factors

Bermagui Works Depot	10,322 kWh	7.37 kW	22 kWh	10,322 kWh	Fill as much of roof as possible taking shading issue into account
Bvsc Administration Building	194,943 kWh	20.00 kW	60 kWh	28,000 kWh	Likely to be the max added capacity
Candelo Pool	51,904 kWh	10.00 kW	30 kWh	14,000 kWh	Appears to be limited added space - hillside in front of pool may offer a solution but low security
Candelo Reservoir & Chlorinator	31,308 kWh	3.00 kW	9 kWh	4,200 kWh	Assumes 3kW is the max space
Candelo Stp @Candelo Showground	102,039 kWh	50.00 kW	150 kWh	70,000 kWh	Space appears adequate but split over a few possible locations
Central Waste Facility	14,365 kWh	10.26 kW	31 kWh	14,365 kWh	No maps or site seen
Cobargo Hall	5,678 kWh	4.06 kW	12 kWh	5,678 kWh	Rest of roof can be used to augment existing PV system
Cobargo Stp	90,403 kWh	15.00 kW	45 kWh	21,000 kWh	Limited space, possibly small system on building roofs and small ground mount
Compactor @ Wallagoot Transfer Station	15,992 kWh	10.00 kW	30 kWh	14,000 kWh	Roof of transfer station appears useable - supply to STP subject to essential energy
Depot (Welding Shop)	46,299 kWh	33.07 kW	99 kWh	46,299 kWh	Cover all available roof spaces at the depot
Eden Childcare Centre	11,557 kWh	5.00 kW	15 kWh	7,000 kWh	Looks like there is a small system, assumes the roof can take more - some trees may provide shade issue
Eden Stp	209,078 kWh	40.00 kW	120 kWh	56,000 kWh	N-facing hillside adjacent to MSB
Kiah Hall	9,009 kWh	6.44 kW	19 kWh	9,009 kWh	2 x buildings have N-facing roofs, can assess for PV suitability
Merimbula Depot	11,241 kWh	8.03 kW	24 kWh	11,241 kWh	May all fit on the roof
Merimbula Stp	604,895 kWh	300.00 kW	900 kWh	420,000 kWh	Would require the use of part of the stormwater system

					and the ground to the S-E of the site
Minyama Pde Multi Site	36,226 kWh	10.00 kW	30 kWh	14,000 kWh	Appears to be the max potential
Pambula Beach Reservoir	11,556 kWh	8.25 kW	25 kWh	11,556 kWh	Appears that roof is about 15m diameter
Sapphire Aquatic Centre	438,432 kWh	25.00 kW	75 kWh	35,000 kWh	Roof on S-W side of the building above admin and childcare
South Bega Wps	57,393 kWh	10.00 kW	30 kWh	14,000 kWh	If future WTP built on this site PV should be included
Tathra Stp	88,968 kWh	63.55 kW	191 kWh	88,968 kWh	Fill-in' Imagine sign with different-shaded panels. Could use the treated water pond also
Tura Reservoir	8,639 kWh	6.17 kW	19 kWh	8,639 kWh	Appears that roof is about 15m diameter
Tura Stp/Sps	217,057 kWh	30.00 kW	90 kWh	42,000 kWh	Limited space apart from identified areas for BTM
Wolumla Reservoir/Chlorinator	13,956 kWh	3.00 kW	9 kWh	4,200 kWh	Small roof
Yellow Pinch Chlorinator	50,187 kWh	35.85 kW	108 kWh	50,187 kWh	Assumes a floated system on the dam, level changes in drought may affect?
Yellow Pinch Dam Compressor	58,798 kWh	42.00 kW	126 kWh	58,798 kWh	Assumes a floated system on the dam, level changes in drought may affect?
Total	3,563,568 kWh	1,226 kW	3,678 kWh	1,716,470 kWh	

If all of this potential were realised the offset of grid electricity demand would equate to 25% of Council’s 2015-16 electricity use. However costs for solar PV would likely be around $2 million, with a further $3-4 million in battery storage costs at current prices. With cost savings of $350-400k per year this is not an economic proposition at this time. However storage costs are decreasing, and it is likely that from 2020 the case for PV + storage will be more attractive.

3.9. Appendix C - Solar Farm Criteria and Sunshine Coast Council Case Study

At this time it is assumed that Council would seek to develop a solar energy project, as the Sunshine Coast Council has done to meet its operational energy requirements.

In order to identify possible sites for future mid-scale solar PV opportunities Council was asked to identify parcels of land meeting certain criteria, including:

- Flat or near-flat land (e.g.<5% slope),
- Council-owned that currently has no other committed future use (could be STP land, old landfill, other owned land),
- Generally a north-facing aspect,
- Buffer to residents or highlighting nearby residential areas,
- Flood status (e.g. 100-year, 10-year, maximum flood level),
- Highlight if areas are subject to a vegetation management plan or similar constraint,
- Proximity to the electricity grid with LV/HV overlaid

For Council's energy use a solar PV plant of 3.2 MW to 5.1 MW could meet its needs depending on the level of grid energy reduction that can be achieved. For simplicity it is assumed that a 4 MW solar PV plant could be required. This would likely occupy fairly flat land of around 12 Ha.

The business case for such a project would require detailed assessment and comparison with other potential options including consideration of other technologies (e.g. wind), collaboration (e.g. achieving scale with other users including Councils) and purchasing options (refer below).

At this time it is most useful to develop an understanding of the business case developed to support Sunshine Coast Council's 15 MW solar farm being built at Valdora. The financial case shows that key drivers of the project include:

- Long term cost for energy to Council, compared with expected grid energy prices,
- Expected export revenue as the plant is a little over-sized for Council's needs only,
- Forecast prices for Large-scale generation certificates (LGCs) in the period to 2030,
- Residual value of the plant at the end of the analysis period,
- These benefits are offset against the capital and operating costs of the project. It is noted that Council is the owner-operator of the project so third-party margin is eliminated, however being built on a flood plain means that the capital cost is higher than would be seen on less flood-prone sites

Further detail on the development of the Valdora project provides useful information for other Councils who may be considering generating their own power to both safeguard against volatility in the energy market and meet their energy and climate-related targets.

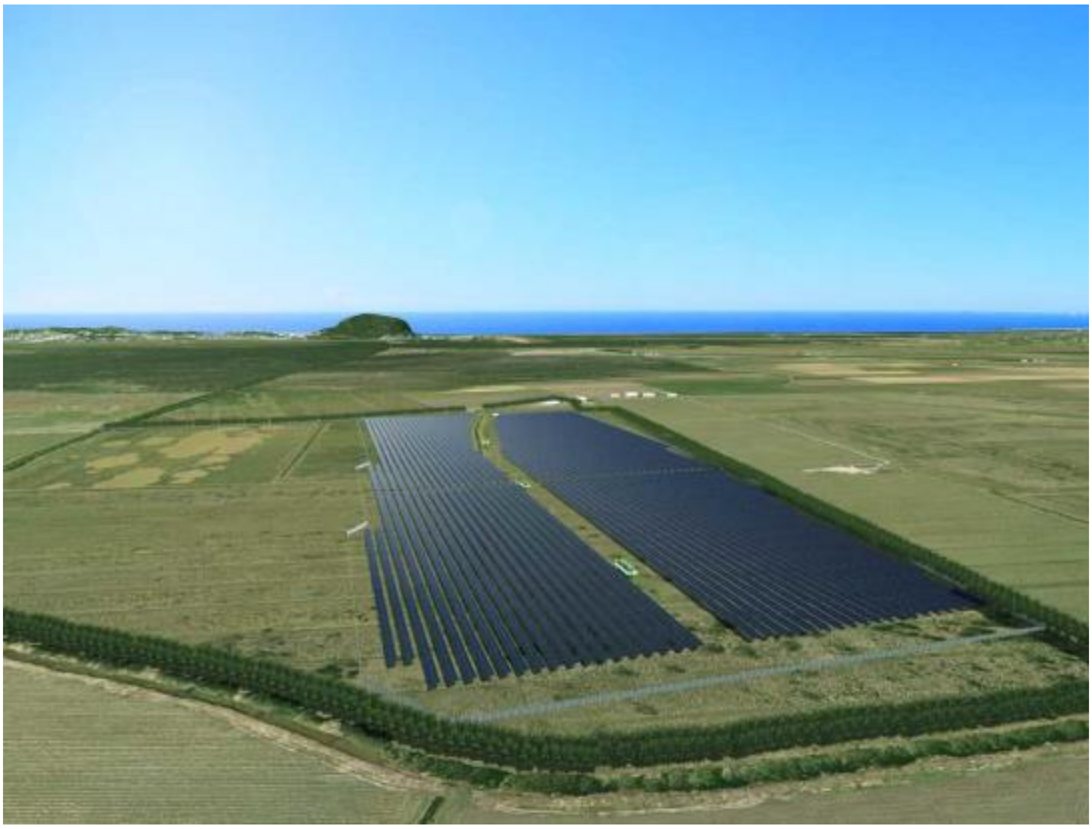


Figure 5: Artists impression of the 15 MW Valdora solar farm

Type of Cost	BAU NPV $millions	Project NPV $millions	Diff $millions
Energy Charges	$(78.7) m	$(35.4) m	$43.3 m
Carbon Charges	-	-	-
Network Charges	$(132.8) m	$(132.8) m	-
ENERGEX Service & Maintenance	$(98.5) m	$(98.5) m	-
Other Charges	$(9.4) m	$(9.4) m	-
Total electricity costs	**$(319.2) m**	**$(276.0) m**	**$43.3 m**
Total Project Spend	-	$(50.4) m	$(50.4) m
Operating cost	-	$(10.6) m	$(10.6) m
Large scale generation certificates	-	$22.6 m	$22.6 m
Electricity Export	-	$12.8 m	$12.8 m
Solar farm terminal value	-	$4.4 m	$4.4 m
Total costs	**$(319.2) m**	**$(297.1) m**	**$22.1 m**

3.10.Appendix D - Energy analysis of Council's operations

Grid electricity consumption and cost by BVSC's sites from 2013-14 to 2015-16 is tabulated below, together with consumption and cost for the 'top 15' sites in 2015-16.

Table 7: Summary of Bega Valley Shire Council grid electricity use 2012-13 to 2015-2016

Organisation Unit	2013-2014 (kWh)	2014-2015 (kWh)	2015-2016 (kWh)
Aquatics Facilities	944,882	727,604	729,692
Buildings	279,966	368,429	300,393
Children's Services	33,914	34,817	33,993
Community and Cultural Services	13,077	14,481	17,999
Depots	223,130	217,496	227,855
Halls and Cemeteries	4,390	51,354	44,076
Libraries and Galleries	122,034	151,073	162,757
Non BVSC accounts		16,103	
Parks and Amenities	40,050	63,815	71,090
Property Services	3,577	3,742	2,797
RFS	78,515	79,366	77,746
Sewer large sites	1,585,582	1,695,518	1,794,960
Sewer small sites	892,570	1,013,788	1,056,239
Sportsgrounds	27,072	31,262	35,827
Waste Infrastructure	11,879	23,967	26,413
Water large sites	1,317,320	1,138,014	1,094,874
Water small Sites	642,799	604,946	561,132
Total electricity for assets	6,220,757	6,235,775	6,237,843
Street lighting	833,847	854,743	868,348
Grand total kWh	7,054,604	7,090,518	7,106,191
Grand total cost $	$2,073,833	$2,044,843	$1,730,920

As the table suggests electricity use is dominated by water and sewer services. Summarising electricity consumption by three major asset types highlights this for 2015-16.

Table 8: 2015-16 electricity use and cost by major asset groups

Asset group	Consumption in 2015-16	Cost in 2015-16
Water & Sewer	4,507,205 kWh	$997,051
Property	1,730,638 kWh	$457,944
Street Lights	868,348 kWh	$275,925

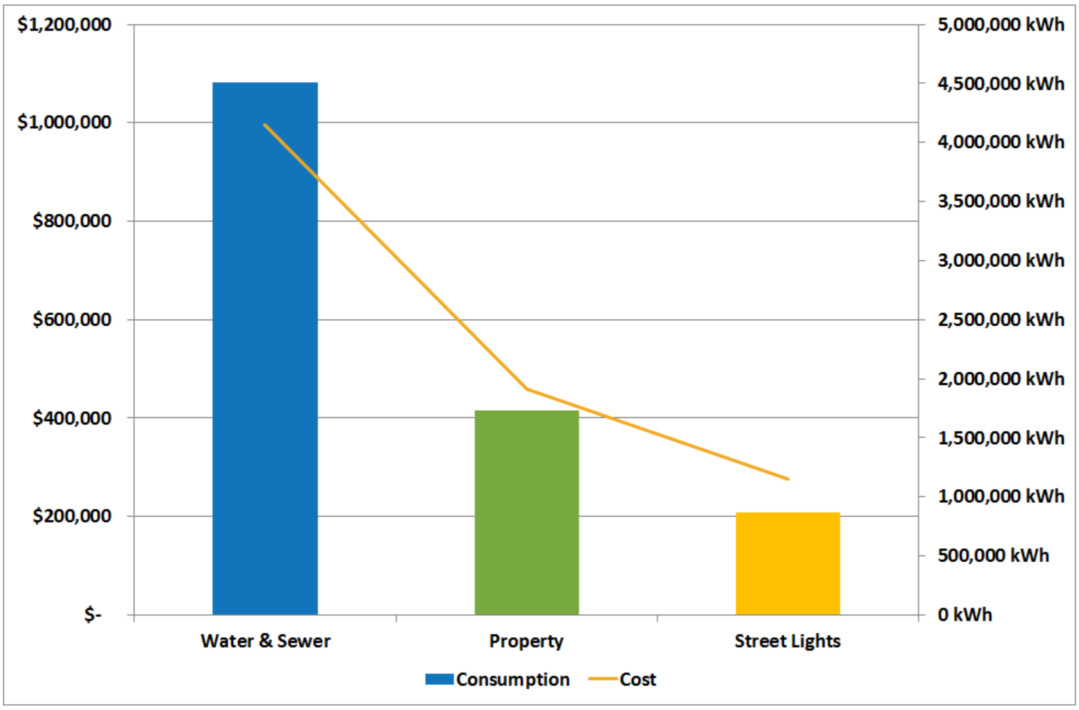


Figure 6: 2015-16 electricity use and cost by major asset groups

In addition, a handful of sites account for the majority of electricity consumption.

Table 9: Summary of 'top 15' sites electricity use 2016

Site	Consumption kWh	Cost ($)
Street lighting	889,575 kWh	$127,656
Merimbula Stp	604,895 kWh	$90,988
Sapphire Aquatic Centre	438,432 kWh	$68,583
Bermagui Stp	385,060 kWh	$58,440
Brogo Wps	333,238 kWh	$71,539
Bega Wps	326,055 kWh	$88,764
Bega Stp	273,948 kWh	$42,669
Kiah Wps	236,606 kWh	$48,016
Tura Stp/Sps	217,057 kWh	$35,165
Eden Stp	209,078 kWh	$34,301
Bvsc Administration Building	194,943 kWh	$43,590
Kiah Bore Pump	144,197 kWh	$26,070
Merimbula Sps 3 (Black Dolphin)	139,493 kWh	$36,028
Candelo Stp @Candelo Showground	102,039 kWh	$24,623
Wolumla Stp @ Showground	99,705 kWh	$24,159
Total top 15 sites	4,594,321 kWh	$820,591

Electricity rates

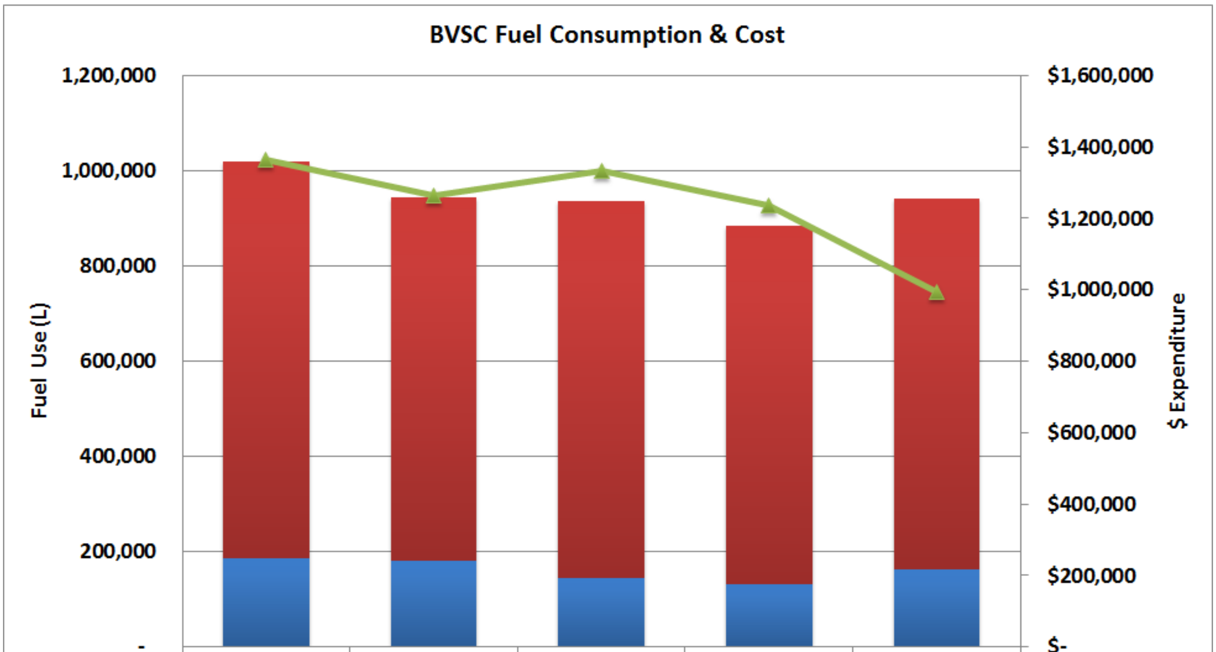
For Council as a whole the average rate paid for electricity in 2016 was $0.23 per kWh. For the large sites tabulated above the average rate in 2016 was $0.18 per kWh, with a range of $0.14-0.27 per kWh. Excluding large sites the average electricity rate is a little over $0.30 per kWh. The purpose in looking at rates is to highlight that savings can have different values at different sites, as well as different rate / tariff structures. This is relevant when assessing the business case for opportunities at individual sites.

Table 8: Summary of Electricity average rates for large sites 2016

Site	Average rate $/kWh
Street Lighting	$0.14
Merimbula STP	$0.15
Sapphire Aquatic Centre	$0.16
Bermagui STP	$0.15
Brogo WPS	$0.21
Bega WPS	$0.27
Bega STP	$0.16
Tura STP /SPS	$0.16
Kiah WPS	$0.20
Eden STP	$0.16
Bvsc Administration Building	$0.22
Kiah Bore Pump	$0.18
Merimbula SPSs 3 (Black Dolphin)	$0.26
Candelo STP @Candelo Showground	$0.24
Wolumla STP @ Showground	$0.24
Overall average rate for large sites	$0.18

Fuel consumption

Fleet represents a significant energy cost to Council with close to a $1m spend per year. Consumption levels did not change significantly in the period 2012-13 to 2015-16 as shown below.



	2011-2012	2012-2013	2013-2014	2014-15	2015-16
Diesel	831,628	763,604	789,441	753,094	780,861
Unleaded	187,088	181,760	146,070	131,105	161,688
Cost	$1,363,841	$1,263,899	$1,332,587	$1,234,749	$995,616

Figure 7: BVSC FUEL USE AND COST 2012-13 TO 2015-16

LPG consumption by Council is negligible and was excluded from the scope of the Clean Energy Strategy.

3.11.Appendix E - Recommended offsite renewable energy action plan for BVSC

The short-term recommendation is for BVSC to focus on developing a knowledge base and understanding of this opportunity. This may be a useful starting point to understand some of the drivers of renewable energy in the current electricity market, and the main factors that can make for good and bad outcomes for end users. Council can and should also seek advice from electricity market experts.

Beyond this there are other actions that can be taken in the short term, such as:

- Engage with other councils who have examined large-scale renewable energy sourcing, both from Council's region and more broadly across NSW, Queensland and Victoria,
- Attend webinars, seminars and conferences on mid-scale renewables and PPAs, including for example any events hosted or provided by the NSW Office of Environment and Heritage or the Cities for Climate Protection of which BVSC is a member, and the Business Renewables Centre Australia (BRC-A)

In the medium to longer term if Council is pursuing a 100% renewables goal, it will be necessary to take active steps to source renewables that meet most of its current demand for electricity.

Given the current market and trends, suggested recommendations at this time are:

1. In general, PPAs appear to offer lower risk and potential cost savings compared with mid-scale build options at this time. Ahead of any decision to source renewables and tender for same, seek advice on the market for emerging bundled PPA models for electricity (and LGCs if still applicable) that involve reduced risk and improved cost outcomes compared to regular energy offers.
    - For example, approach and/or obtain advice via the Business Renewables Centre Australia (BRC-A), and research major retailers' latest offers and monitor the announcements of new PPA agreements especially with respect to councils.
    - Both 'sleeved PPA' and the 'Virtual Generation Agreement' PPA options appear to offer solutions that will not require Council to enter into a contract for difference, and further assessment of these options may be warranted.
2. Seek to incorporate the purchase of renewable energy from the start of the selected electricity contract period using a shorter-term agreement where it is found to be financially viable and has no additional risk when compared to a regular retail contract.
    - Seek to incorporate a mechanism for managing market price risk over the agreement term. This could include: the ability to approach the market to reprice or price match grid power costs during the term; purchasing of hedging solutions; requesting pricing that is sculpted to follow the forecast market price trajectory; or potentially increasing the proportion of renewable energy over time when prices may be more favourable.
3. Ahead of any future tender, continue to engage with other organisations to seek interest to aggregate demand – e.g. forming a buying group or partnering with other councils in the

region or state to increase the size of the electricity (including renewable energy) load to be contracted and the willingness of retailers to negotiate and price effectively.

- Investigate support for a buying group with councils that have a similar contract expiry and renewable energy aspirations and targets.
- If there is interest, set an opt in cut-off date that allows sufficient time to go to market and achieve supply for the next contract period (this may require lead time for a new project to be built).

4. Periodically review build and operate models to test viability against other available options following market investigations.

3.12.Appendix F - Business case - street lighting

Category	**Energy efficiency**
Technology / initiative	LED street lights for P-category (local) and V-category (main) roads
Description	BVSC has received a fee proposal from Essential Energy to replace eligible street lights with approved LED fittings at the next bulk re-lamp, scheduled in 2017. A summary of the offer that was received is shown below, which includes four options for various approved LEDs. A total of 2,405 lamps are eligible to be upgraded to LED, with most of the remaining 400 lamps being main road lamps (Category V) that do not yet have eligible LED replacements (though trials are in progress). The upgrade is different from a routine bulk re-lamp as full luminaires need to be replaced. Therefore a capital contribution is sought from Council. This would be a one-off cost, with Essential Energy undertaking re-lamps in future bulk upgrades.
Location(s)	BVSC has 2,804 street lamps across local and main roads throughout the Shire.
Capacity for grid energy reduction and/or carbon abatement	Potential savings take Option 1 from the four options offered by Essential Energy since this leads to the greatest energy savings. The upgrade of 2,405 lamps to LED will reduce electricity consumption by 339 MWh per year, from a base of 526 MWh for P-category lamps. When expanded to all 2,804 lamps as main road LEDs are approved the total savings increase to 550 MWh per year.
Cost benefits	Savings are estimated on the basis of 2016/17 SLUOS prices and electricity costs as well as estimated ESC benefits. Electricity savings of 339 MWh per year $47,408 per year based on 2015/16 costs. Savings rise to $77,226 per year when remaining street lights are included in the analysis. Energy Saving Certificates are assumed to be available for 12 years at a net benefit to BVSC of $11/ESC. For currently eligible lamps this gives a preliminary ESC estimate of $47,381, rising to $77,181 when extended to all lamps. This is taken as a discount to the capital cost of the project. 2016/17 saw SLUOS prices rise by 24% on average compared with 2015/16. A further 17% rise is incorporated in 2017/18. For 2016/17 SLUOS costs are $207,216. When compared with costs for 2,405 LEDs plus non-LEDs SLUOS costs are $118,311. This is a saving of $88,905 which will rise to around $112,620 with all lamps upgraded. This gives an estimate of total savings, applied to the full BVSC street lighting inventory of $189,846 per year at 2016/17 prices. Costs for upgrading 2,405 lamps is $739,713. To upgrade all street lights it is estimated that costs of around $1,083,113 will be incurred, based on an estimated per-luminaire cost of $850. This is broadly in line with trial V-category lamps, and is likely to fall as bulk replacements commence. When ESCs are discounted from this cost the net expected capital cost is $1,005,932, say $1million.

<table>
<tr><td></td><td>This gives a simple payback of 5.3 years.
<table>
<tr><td>Capital cost</td><td>$1,083,113</td></tr>
<tr><td>Energy Saving</td><td>551,611 kWh</td></tr>
<tr><td>Energy Cost Saving</td><td>$77,226</td></tr>
<tr><td>SLUOS Saving</td><td>$112,620</td></tr>
<tr><td>ESC discount</td><td>$77,181</td></tr>
<tr><td>Net capital cost</td><td>$1,005,932</td></tr>
<tr><td>Net savings pa</td><td>$189,846</td></tr>
<tr><td>Simple Payback</td><td>5.30 Years</td></tr>
</table></td></tr>
<tr><td>Approaches to implementation</td><td>Council should begin to allocate budget to upgrade street lights to LED from appropriate funding sources in the next budget cycle. Implementation via Essential Energy should be approved to coincide with the next bulk lamp upgrade to minimise the net cost to Council. It is understood that this will be in 2021.
A second option is to seek to implement the LED upgrade for P-category assets ‘out-of-cycle’ with the normal bulk upgrade – i.e between now and 2021. This will entail forfeiting the bulk lamp discount included in the offer received from Essential Energy, so total implementation costs would rise by more than $130,000. This would add a year to the expected payback of the project.
Subject to the eligibility requirements of the NSW Climate Change Fund to be confirmed in coming months, Council may be able to seek support for the project that could mitigate some of these added costs, and bring some of these energy savings forward.</td></tr>
<tr><td>Risks / barriers</td><td>The analysis supplied by Essential Energy contains some aspects relating to SLUOS costs for the replacement options that will require clarification when a full business case is developed. All elements of the project’s costs and benefits should be re-visited closer to the implementation year so that current SLUOS, energy and ESC prices / rates are used. At this time reasonable estimates of future rates for these three aspects should be identified so that the business case is as accurate as possible.</td></tr>
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