100% Renewables

Sustainable Councils and Communities

Upper Lachlan Shire Council

ULSC Energy Masterplan

Date: 25 September 2019

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Overview

Upper Lachlan Shire Council and the community have roles to play in ensuring the region contributes to efforts to mitigate climate change. Taking action to reduce energy use, increase renewable energy and reduce carbon emissions is aligned with Council's Community Strategic Plan and the Tablelands Regional Community Strategic Plan. Adoption of an Energy Masterplan will see cost-effective actions incorporated into Delivery Program and Operation Plans of Council going forward.

In particular the RCSP Environment strategy highlights Council's role as including:

OUR ENVIRONMENT: Strategy EN2

- Adopt environmental sustainability practices.
    - To internally consider and apply appropriate practices in each of the local government organisations and offices, such as water conservation, energy efficiency, recycling
    - To encourage the use of environmentally sustainable practices in suppliers' and Council services, for example water sensitive urban design (WSUD) in local designs, considering sustainability in tender assessments, and investigate improvements in Council operational practices such as pesticides used, fuel and energy consumption etc.

OUR ENVIRONMENT: Strategy EN5

- To investigate and implement approaches to reduce our carbon footprint
    - To develop initiatives that aim to reduce Council's carbon footprint through internal procurement processes.
    - To support residents, businesses and industry in reducing their carbon footprints in their homes, businesses, and lifestyle choices.
    - Develop or maintain walking and cycling paths and facilities to encourage active transport.
    - Support the development of renewable energy facilities where appropriate in the region.

This Energy Masterplan responds to these strategies by developing short, medium and long term action plans for Council operations to be more energy efficient and to install renewable energy systems. Implementation of the actions included in the Masterplan will reduce Council's costs and carbon footprint, and demonstrate Council's intent to be a leader in the community's efforts to respond to climate change. Council will also look to continue to work with the Sustainable Councils and Communities Program to ensure its focus is on both its operations and on helping the community reduce its carbon footprint and energy costs.

Future reviews of the Energy Masterplan will consider a range of additional inclusions, such as setting renewable energy and carbon reduction targets, sustainable transport, reducing emissions from waste, purchasing energy from renewables, as well as revising these plans for Council's facilities.

1

Introduction

1 Executive summary

100% Renewables was commissioned by the Department of Planning, Industry and Environment under the Sustainable Council and Communities Program to develop an Energy Masterplan for Upper Lachlan Shire Council. The Energy Masterplan aims to increase the proportion of Council's energy supplied from renewables and energy efficiency, through the development of a strategic plan that is aligned with Upper Lachlan's Community Strategic Plan and capable of being integrated into future Delivery Program and Operational Plans.

The Sustainable Councils and Communities (SCC) Program is funded by the NSW Climate Change Fund and works with up to 18 resource-constrained councils across NSW to increase renewable energy and improve the energy efficiency of council buildings and facilities as well as the community. It is designed to overcome a number of barriers reported by smaller local governments in NSW, including low ratepayer base, high operating costs and limited resources. These barriers result in resource-constrained-councils missing out on opportunities for financial savings and other co-benefits that can be achieved through improving the energy productivity of public facilities[1].

1.1 Summary of the opportunity for Upper Lachlan Shire Council

This Energy Masterplan has considered stationary energy sources only, and so no consideration is given in this plan to energy and emissions from transport, nor for waste disposal or treatment.

The estimated cost of energy efficiency (including streetlighting) and onsite solar PV projects (short, medium and long term) is around $1,360,000 including:

- $980,000 estimated for onsite solar PV and battery storage projects at today's prices)
    - 443 kW of solar PV + 430 kWh of battery storage
- $32,000 for building LED lighting upgrades
- $265,000 estimated for LED streetlights
- $82,500 estimated for implementing VSD controls

The expected cost savings to Council are $227,000 per year in the long term, including:

- An estimated $159,000 from solar PV and battery storage projects
- Nearly $7,000 per year for lighting projects
- Potentially $53,000 from street lighting upgrades, including both energy use savings and maintenance savings
- An estimated $7,700 from VSD controls

For all the projects the overall expected payback is around 6 years, whereas individually they are:

- An estimated 6.2-year payback for solar PV and battery storage projects
- An estimated 4.6-year payback for lighting projects
- An estimated 5-year payback for street lighting upgrades
- An estimate for 10-year payback for VSD controls

The financial return to Council from these measures is excellent and provides a strong case for investment. Implementation in stages is feasible and advised, with the most cost-effective projects first, followed by larger or less economic projects in the medium to long term (when batteries are

[1] See Appendix A for more details of the SCC Program

cheaper). This approach is reflected in the recommended short, medium- and long-term implementation priorities for Council.

1.2 Impact on consumption and emissions for Upper Lachlan Shire Council

Council's grid electricity consumption amounts to 1,619 MWh per year based on 2017/18 data. Upper Lachlan Shire Council currently does not meet any demand with solar PV.

Implementation of all energy efficiency opportunities in this masterplan will reduce grid electricity demand by 167 MWh per year, which would amount to 10% of Councils current demand. Furthermore, if Council implements all the modelled solar PV opportunities in this masterplan amounting to 443 kW of solar PV with 430 kWh of battery storage, renewable energy would comprise 38% of Councils total electricity requirement.

1.3 Quick wins

There are several opportunities identified in Section 5 of the Energy Masterplan that have varying levels of savings and timings associated with them. Of these opportunities, two short-term opportunities are highlighted as potential 'quick-wins' that Council could pursue in the very short term. These opportunities are highlighted below in Table 1.

TABLE 1: QUICK WIN OPPORTUNITIES FOR UPPER LACHLAN SHIRE COUNCIL

Site	End use equipment	Energy saving option	Capital cost	Expected savings pa
Crookwell WTP	Solar PV	Install a 50-kW solar PV array to meet daytime demand at the WTP. It is assumed that 80% of the solar energy generated is consumed on site, and that there is flexibility in the operation of the plant for greater % of daytime operation.	$69,720	$19,581
Crookwell Library	Lighting	Most indoor lights are twin 36W linear fluoroes and can be upgraded to LED technology.	$7,000	$2,000

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Council’s energy and carbon footprint

2 Upper Lachlan Shire Council[2]

Upper Lachlan Shire Council is a local government area in the Southern Tablelands region of New South Wales, Australia. The council services an area of 7,102 square kilometres and is located a two and half hour drive from Sydney and less than one hour from Canberra. More than 6% of Upper Lachlan Shire Council is protected including national parks and nature reserves.

As at 2018 there were 7,961 people residing in Upper Lachlan Shire Council according to the ABS. From a total of 1,152 businesses, over 25% of workers are employed in the agriculture sector, which is the region's highest employing sector.

Upper Lachlan Shire has several small towns, with more than 25% of people resident in the town of Crookwell itself. Other towns have resident populations of up to a few hundred, including the towns of Collector, Gunning, Bigga, Laggan, Grabben Gullen and Taralga.

Council provides water and wastewater services, community facilities, waste management, roads and vegetation management, sport and recreation, and planning and administration services from its facilities across Council. From an energy perspective Council has 104 metered electricity accounts and operates a fleet of diesel and petrol vehicles. Council also pays for street lighting services (energy and maintenance), though these assets are owned and managed by Essential Energy.

FIGURE 1: UPPER LACHLAN SHIRE COUNCIL BOUNDARY MAP

[2] Information sourced from https://en.wikipedia.org/wiki/Upper_Lachlan_Shire, https://itt.abs.gov.au/itt/r.jsp?RegionSummary&region=17640&dataset=ABS_REGIONAL_LGA2018&geoconcept=LGA_2018&maplayerid=LGA2018&measure=MEASURE&datasetASGS=ABS_REGIONAL_ASGS2016&datasetLGA=ABS_REGIONAL_LGA2018&regionLGA=LGA_2018&regionASGS=ASGS_2016, and https://www.upperlachlan.nsw.gov.au/

2.1 Solar uptake in Upper Lachlan Shire Council

Some 22% of dwellings (APVI http://pv-map.apvi.org.au/) in the LGA have installed solar PV as at early 2019. This places Upper Lachlan Shire LGA in the top 40% of NSW councils in terms of the number of residents taking up solar panels. In addition to 905 residential systems, there have been 56 installations of 10-100 kW in capacity and two systems greater than 100 kW, which tend to be commercial-scale systems. Local governments near Upper Lachlan Shire Council, including Yass Valley, Snowy Valleys and Hilltops, have reached similar solar uptake levels.

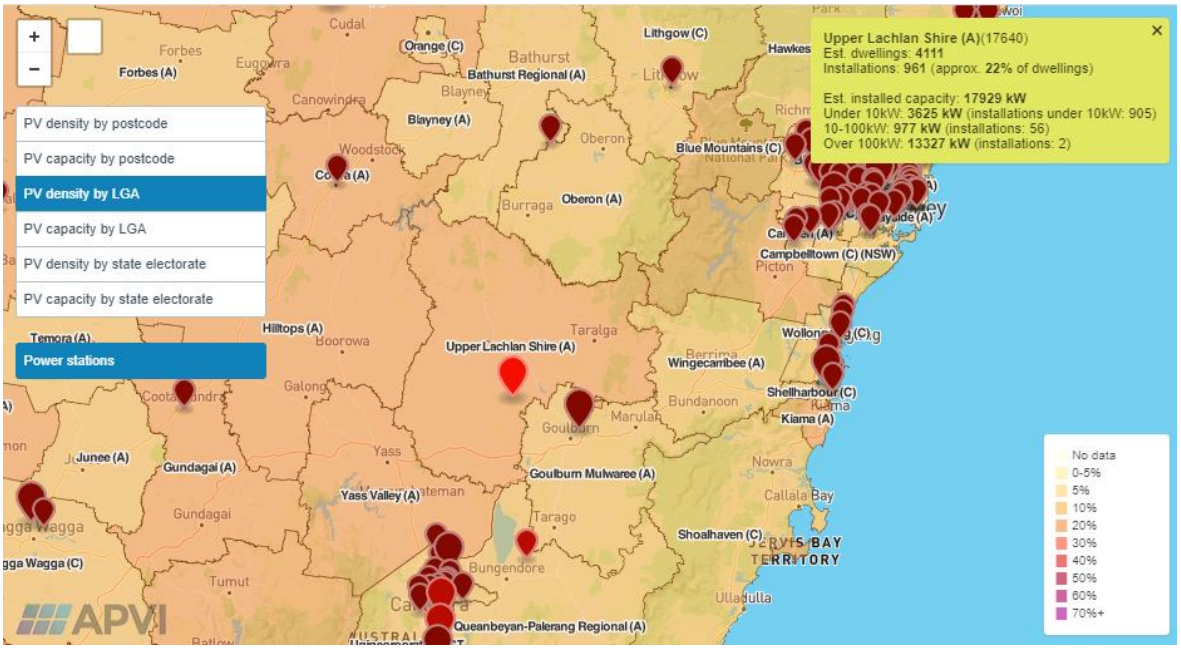


FIGURE 2: UPTAKE OF SOLAR PV IN UPPER LACHLAN SHIRE AND SURROUNDING REGIONS

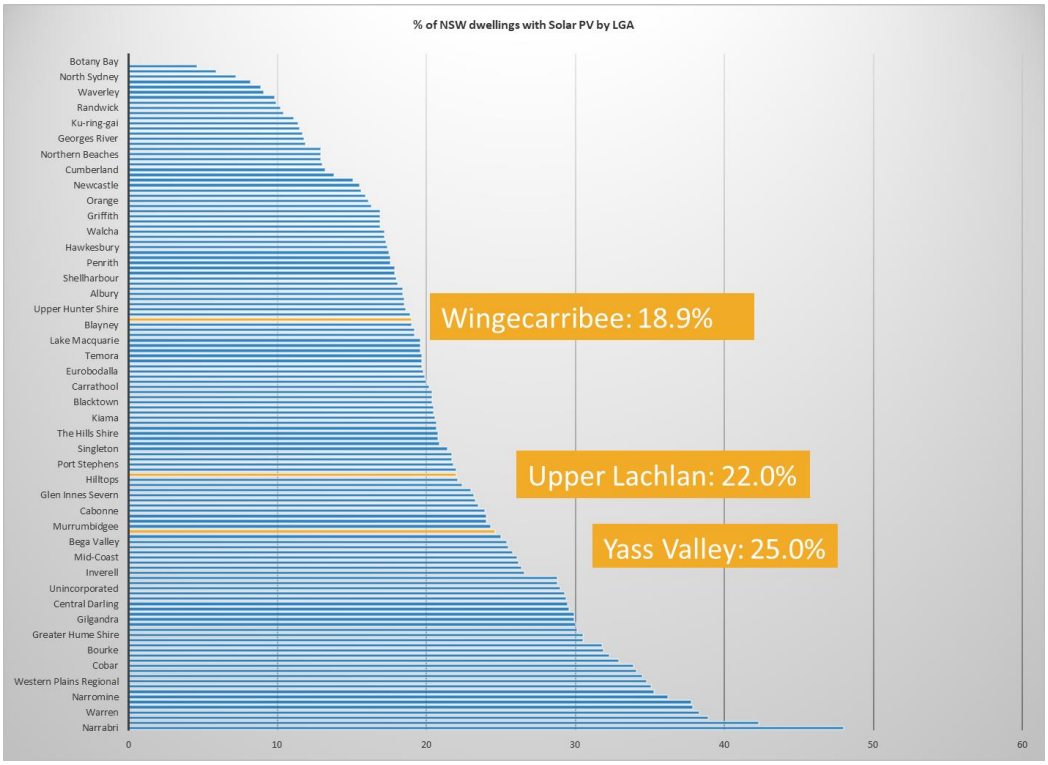


FIGURE 3: PERCENTAGE OF NSW DWELLING WITH SOLAR PV BY LGA

3 Council's 2017/18 energy use and carbon footprint

Council's energy use and carbon footprint were assessed based on electricity consumption only, and additional emissions from fleet, landfill gases, sewerage treatment emissions and other sources such as refrigerants are excluded.

TABLE 2: COUNCIL'S ENERGY USE AND CARBON FOOTPRINT

Emission Source	Activity Data	Units	Scope 1	Scope 2	Scope 3[3]	t CO_2-e	%
Electricity use Council assets	1,419,030	kWh		1,178	170	1,348	87.64%
Electricity use Streetlighting	200,081	kWh			190	190	12.36%
TOTAL (t CO_2-e)	**1,619,121**	**kWh**		**1,178**	**360**	**1,538**	**100%**

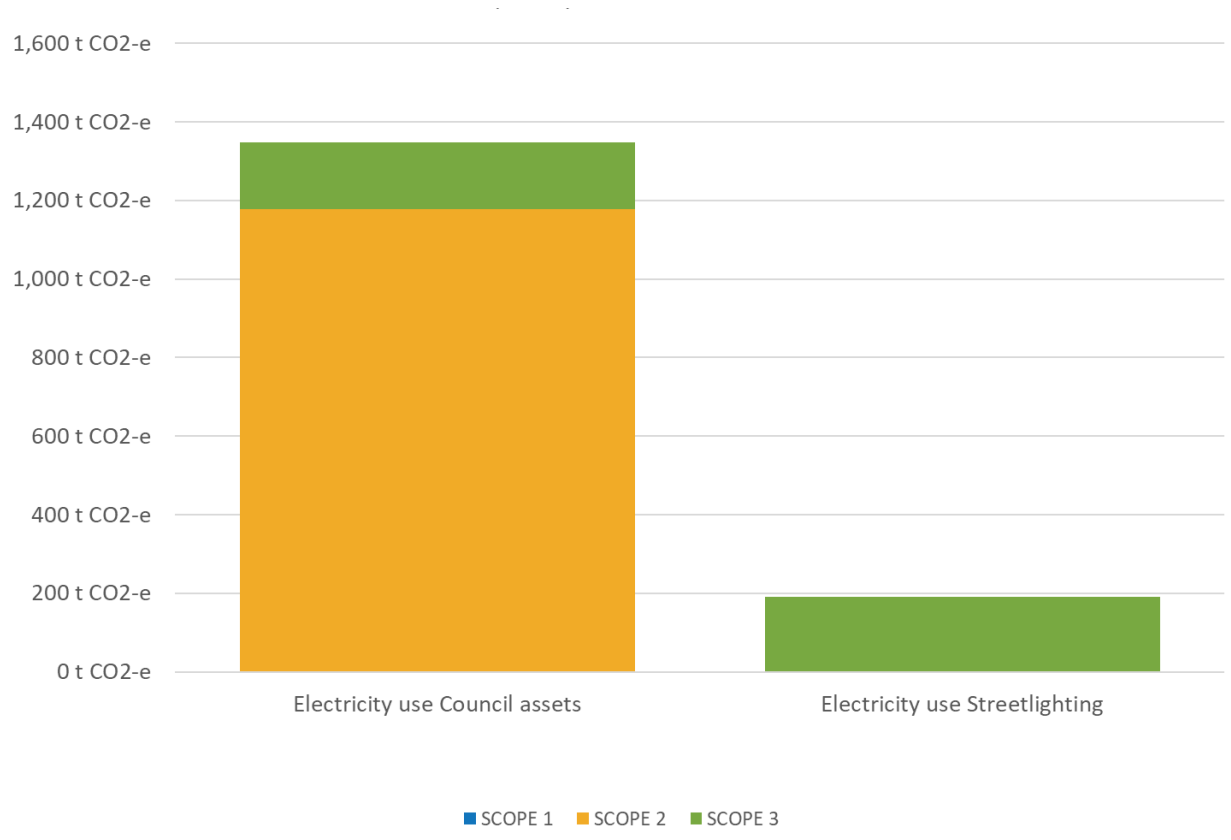


FIGURE 4: UPPER LACHLAN SHIRE COUNCIL CARBON FOOTPRINT BY EMISSION SOURCE

[3] Greenhouse gas emissions are arranged into three "Scopes" for reporting. "Scope 1" refers to direct emissions released from an activity – for example burning fuel in a car or truck or leakage of refrigerant gases from an air conditioning system. "Scope 2" refers to indirect emissions from energy used at a site – nearly all Scope 2 emissions are electricity consumed by the user. "Scope 3" encompasses all other "upstream" and "downstream" emissions released as a result of your activities. Good examples include emissions from the extraction and distribution of fuel to your vehicle before you burn it, or extraction of coal and gas for electricity generation and distribution to your premises. It also includes, for example, emissions from employee travel, business travel, consumables purchases by your business but not under your direct control. Included Scope 3 emissions here are limited to transmission and distribution of electricity.

The primary focus of this Energy Masterplan is electricity consumption, and energy and cost savings that Council can achieve through feasible and cost-effective projects in the short, medium and long term.

In 2017-18 Council consumed 1,619 MWh of grid electricity at a cost of $480,886. Electricity was consumed at 104 facilities and unmetered supplies, ranging from swimming pools, office buildings, water and sewer treatment systems, community buildings, depots, parks & ovals, and streetlights. Electricity end-use is split across four broad types of equipment, including lighting, general power and appliances, motor systems (for water and wastewater as well as swimming pools), and air conditioning (HVAC). An estimate of energy end-use was made for Council's assets as shown below, based on typical energy end-use splits for other regional councils.

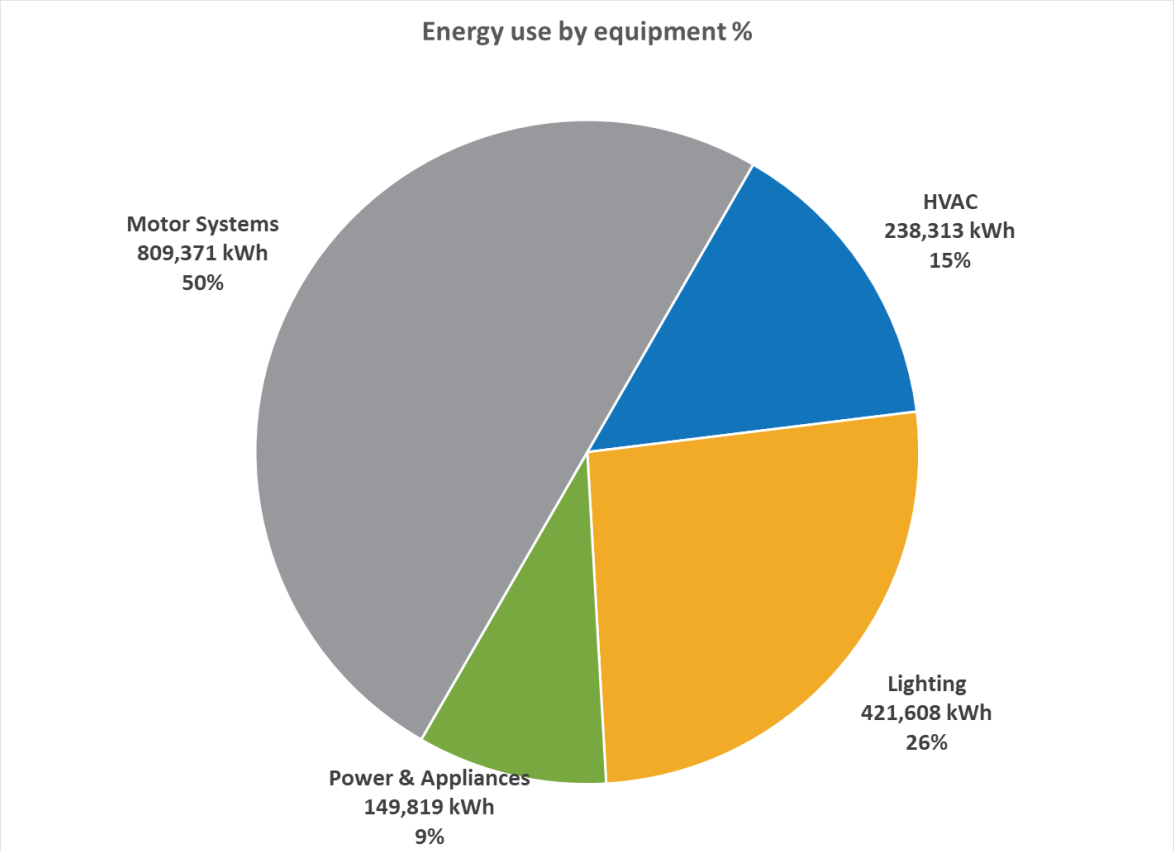


FIGURE 5: UPPER LACHLAN SHIRE COUNCIL ENERGY USE BY EQUIPMENT

A 2-day visit to Upper Lachlan Shire LGA was made to discuss and inspect a range of large and medium-sized energy using sites to identify and discuss potential energy saving opportunities to reduce Council's energy demand in these areas. The site visits and discussions included 21 sites covering over 88% of Council's energy use as tabulated below.

TABLE 3: UPPER LACHLAN SHIRE COUNCIL SITE-LEVEL ENERGY USE (VISITED SITES)

Site	2017-18 kWh
Streetlights	200,081 kWh
Crookwell Waterworks (part year old and new plant)	158,298 kWh
Crookwell Sewerage Treatment Works	133,718 kWh
Water Supply (part year old and new plant)	126,867 kWh
Gunning Water Treatment Plant	82,799 kWh
Taralga Sewerage Treatment Plant	82,062 kWh
Taralga Raw Water Pump Station	60,829 kWh
Council Depot	59,634 kWh
19A Robertson Street Crookwell - Env & Plan	59,374 kWh
Council Administration Office (HR Office)	55,992 kWh
Crookwell Sewerage Pumping Stn	55,669 kWh
Taralga Water Treatment Plant	50,042 kWh
Gunning Pumping Station	41,060 kWh
Council Chambers	40,192 kWh
Gunning Treatment Works End	30,721 kWh
Gunning Medical Centre	29,020 kWh
Library	27,951 kWh
Memorial Hall	25,898 kWh
Baths	25,160 kWh
Swimming Pool Barbour Park	21,276 kWh
Crookwell Visitors Centre	15,279 kWh
Rural Fire Control Centre	15,121 kWh
Other council sites not visited	222,068 kWh

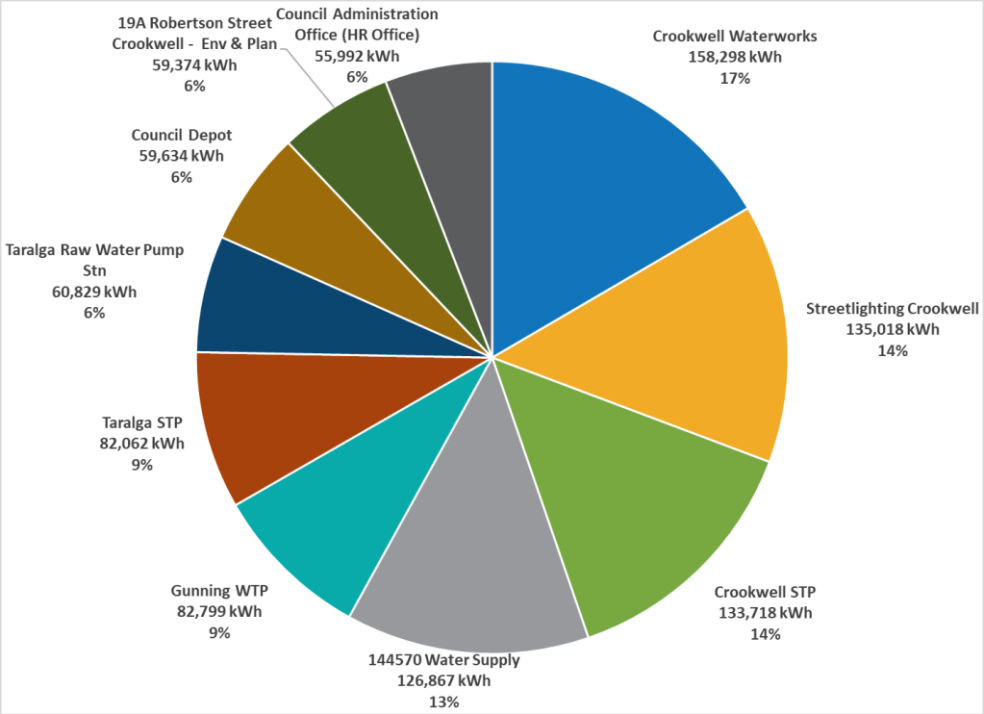


FIGURE 6: UPPER LACHLAN SHIRE COUNCIL'S TOP 10 SITES FOR ENERGY CONSUMPTION

3

Global and local context

4 Renewables and emissions targets – context and local government experience

One outcome of an Energy Masterplan focused on renewable energy and energy efficiency may be future setting by Upper Lachlan Shire Council of targets for renewables and/or carbon emissions. The context for setting targets is outlined below for Council to consider.

Global bodies, countries and states are setting targets that reflect global concerns about climate change. An increasing number of local councils around Australia are also setting ambitious targets and seeking to provide leadership and act as examples to their communities.

In considering such a step we highlight three important aspects for Upper Lachlan Shire Council:

1. What global, national and local government targets should Council be aware of?
2. What can or should be included within the scope of targets?
3. What challenges are being faced by councils that have set very ambitious goals?

4.1 What global, national and local government targets should council be aware of?

4.1.1 Global context for action

Internationally there are three primary drivers for urgent action on climate.

1. Sustainable Development Goals (SDGs)
    - In 2015, countries adopted the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals. Governments, businesses and civil society together with the United Nations are mobilising efforts to achieve the Sustainable Development Agenda by 2030[4]. The SDGs came into force on 1 January 2016 and call on action from all countries to end all poverty and promote prosperity while protecting the planet.
2. Paris Agreement
    - To address climate change, signatory countries adopted the Paris Agreement at the COP21 in Paris on 12 December 2015. The Agreement entered into force less than a year later. In the agreement, signatory countries agreed to work to limit global temperature rise to well below 2°C Celsius, and given the grave risks, to strive for 1.5°C Celsius[5].
3. Special IPCC report on 1.5°C warming
    - In October 2018 in Korea, governments approved the wording of a special report on limiting global warming to 1.5°C. The report indicates that achieving this would require rapid, far-reaching and unprecedented changes in all aspects of society. With clear benefits to people and natural ecosystems, limiting global warming to 1.5°C compared to 2°C could go hand in hand with ensuring a more sustainable and equitable society[6].

[4] Sourced from https://www.un.org/sustainabledevelopment/development-agenda/
[5] Sourced from https://www.un.org/sustainabledevelopment/climatechange/
[6] Sourced from https://www.ipcc.ch/news_and_events/pr_181008_P48_spm.shtml

FIGURE 7: GLOBAL CONTEXT FOR ACTION ON CLIMATE

4.1.2 National, States and Territories targets

At a national level, Australia's response to the Paris Agreement has been to set a goal for GHG emissions of 5% below 2000 levels by 2020 and GHG emissions that are 26% to 28% below 2005 levels by 2030. A major policy that currently underpins this is the Renewable Energy Target (RET). This commits Australia to source 20% of its electricity (33,000 GWh p.a., estimated to equate to a real 23% of electricity) from eligible renewable energy sources by 2020. The scheme runs to 2030. These two key targets are illustrated below.

FIGURE 8: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – NATIONAL LEVEL

According to the Clean Energy Regulator[7], *with the capacity of new build commencing generation in 2018 combined with the expected accreditations in 2019 and 2020, we expect (renewable energy) generation to step up from around 22,000 gigawatt hours in 2018 to around 30,000 gigawatt hours in 2019 and 40,000 gigawatt hours in 2020*. This exceeds the RET 20% target by some 7,000 GWh.

At a sub-national level, most states and territories have established aspirational emissions targets as well as some legislated targets for renewable energy.

[7] March 2018, Australian Government – Clean Energy Regulator. 2018 Annual Statement to the Parliament on the progress towards the 2020 Large-scale Renewable Energy Target.

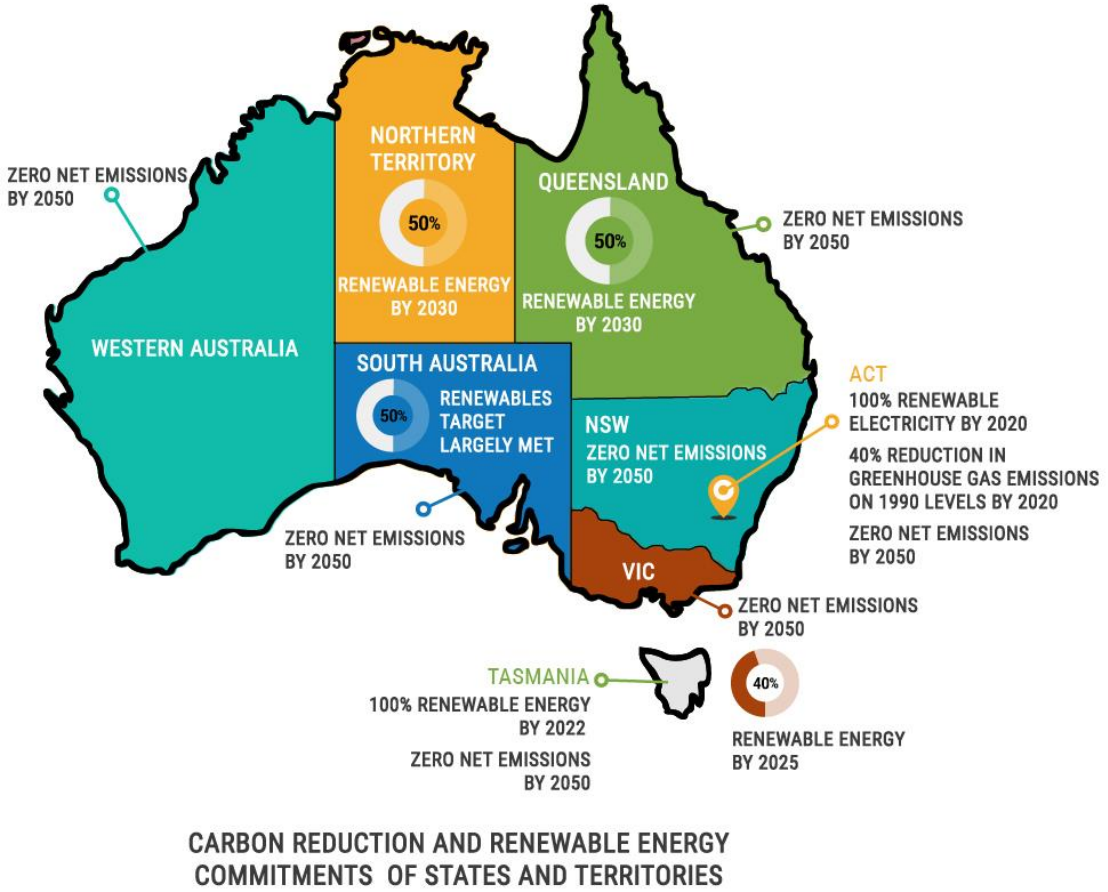


FIGURE 9: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – STATE & TERRITORY LEVEL

In NSW the Climate Change Policy Framework[8] outlines the State's target of reaching net-zero emissions by 2050. This is an aspirational objective and helps to set expectations about future GHG emissions pathways to help others to plan and act. The policy framework will be reviewed in 2020.

4.1.3 NSW local government targets

NSW local governments are leaders nationally in setting ambitious targets for renewable energy and emissions reduction within their operations, supported by long term action plans to help them achieve their goals, linked to their Community Strategi Plans as well as their Delivery Programs and Operational Plans.

Increasingly NSW local governments are also developing action plans to mitigate climate change through greater efficiency and renewable energy uptake in their communities, and the focus of transport and waste management strategies is also increasingly focused on climate change mitigation.

Targets set by NSW local councils up to September 2019 are illustrated below.

[8] http://www.environment.nsw.gov.au/topics/climate-change/policy-framework

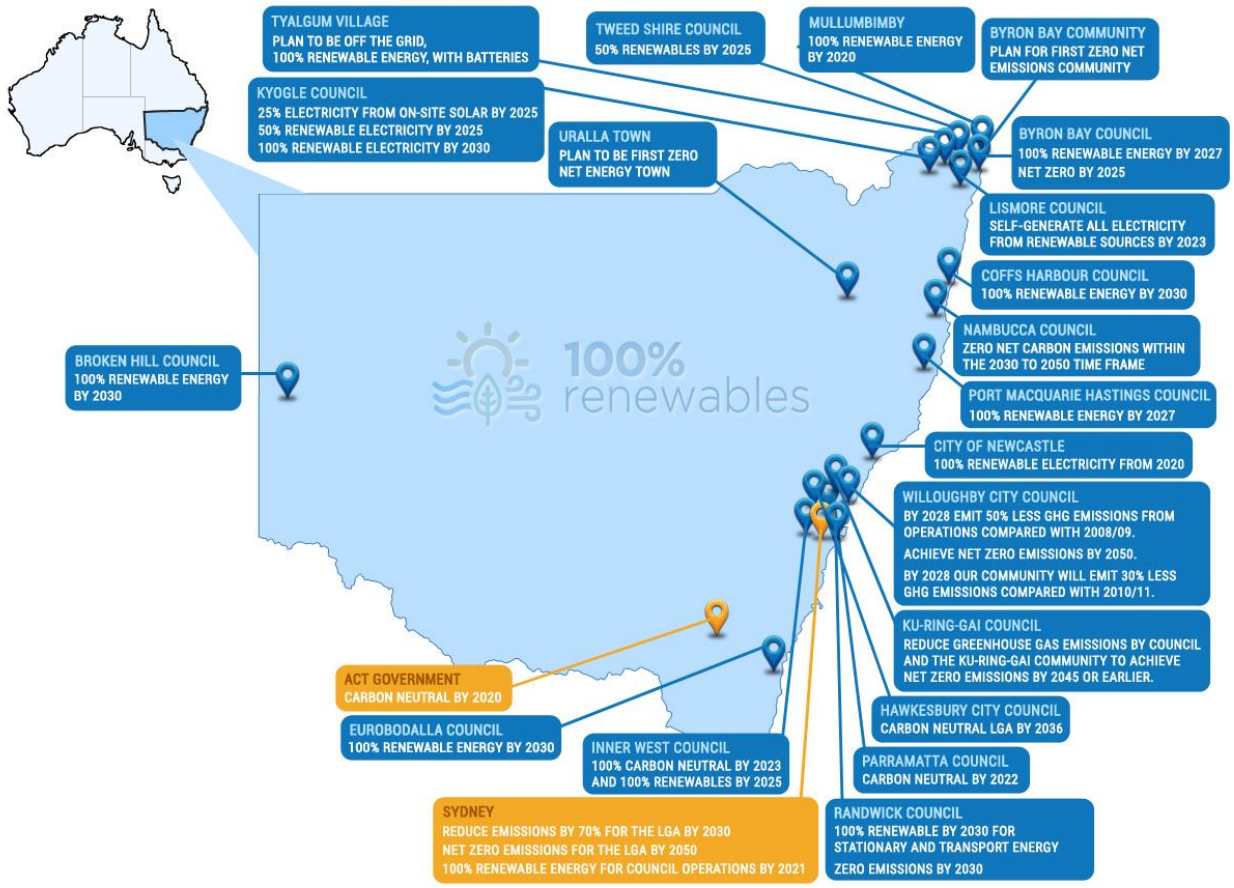


FIGURE 10: RENEWABLE ENERGY & CARBON TARGETS BY NSW COUNCILS AND COMMUNITIES

4.2 What can or should be included within the scope of targets?

Typically, both renewable energy and carbon emissions are considered in the context of climate targets. For Upper Lachlan Shire Council this can include:

- Stationary energy including electricity,
- Transport energy including petrol and diesel for operational vehicles,
- Carbon emissions directly associated with the burning of fuel and use of electricity (Scope 1 and Scope 2 emissions respectively per greenhouse gas accounting),
- Carbon emissions indirectly associated with fuel and electricity consumption – i.e. upstream extraction, production and transport processes for fuels and electricity (Scope 3 emissions),
- Carbon emissions associated with the running of operations such as air travel, employee commute, consumables, catering and the like (Scope 3 emissions), and
- Carbon emissions associated with waste from operations; for Councils this also includes waste from community / business that is managed and disposed of in the LGA. This may include legacy as well as ongoing waste management, depending on the accounting method.

When considering what should be included in targets it is important to consider factors such as:

- Energy that can be influenced or controlled (e.g. electricity use can be influenced with energy efficiency, rooftop solar and buying renewable energy, but transport energy use influence may be low until low and zero-emissions vehicles are more widely available).

- Emissions that can be controlled or influenced – in particular waste disposal and management.
- The materiality or significance of some emissions sources.
- Whether or not good data are available that Council can track and report on.

There is no one preferred approach to selecting what should be included in targets. In our experience the availability of good data tends to influence what is included in the scope of renewable energy and /or carbon emissions targets. Many plans start with a narrow scope of significant emissions sources with an intent to expand the scope of targets over time as better data and more detailed plans start to be developed.

4.3 What challenges are being faced by organisations that have set very ambitious goals?

Setting targets is often about striking a balance between what we know can be achieved with today's commercially available solutions and what will be available in coming years. This is why many targets for renewable energy for example are 100% by 2030, as it is expected that battery storage for solar, and renewable energy sourcing for energy supply will be readily available and cost-effective by that time. Interim targets tend to focus on onsite measures that are known to be cost-effective such as energy efficiency and solar panels; in some cases, large-scale bulk purchasing of renewables is also now cost effective.

Both interim and ambitious long-term targets present challenges that other organisations have encountered in our experience. These should be considered by Upper Lachlan Shire Council if looking to set emissions targets in future, and include:

1. Ongoing internal support, resources and funding – this is often the most common barrier and challenge; how to gain and sustain the support and funds internally to make efficiency and renewable energy initiatives happen. There are usually limited funds, competing priorities and resources are stretched.
2. Understanding electricity markets and organisations' energy purchasing processes and limitations. The ability to meet an ambitious renewable energy goal cost-effectively is heavily influenced by how electricity is sourced from the market. Energy procurement will most likely deliver 60-80% of most organisation's ambitious (i.e. 100%) renewable energy goal.
3. Transport and waste are sources of large carbon emissions but solutions to achieve step-change in energy demand, renewable energy or carbon emissions in the short to medium term can be limited. Understanding what timeframes will apply to the availability of cost-effective abatement from transport and waste is needed if achievable targets are to be set for these emissions sources.
4. Underlying growth and the modest impact of onsite actions: understanding that energy efficiency, onsite solar, purchasing renewables, waste management and sustainable transport are all important to act on if deep cuts in emissions are to be achieved.

The greater the level of organisational support and understanding of the nature, scale and timing of opportunities, as well as an understanding of the type and scale of changes that will occur to an organisation's assets over time helps to set targets that are realistic and achievable.

4

Energy Masterplan

5 Positioning of an Energy Masterplan

Council's activities are guided by its Community Strategic Plan (to 2023) and by the Tablelands Regional Community Strategic Plan (2016-2036). The Energy Masterplan will be one of several strategic plans that respond to these community plans and inform Council's Delivery Program (4-yearly) and annual Operational Plans.

The positioning of the Energy Masterplan within Council's other plans is illustrated below in Figure 11.

FIGURE 11: ALIGNMENT OF THE ENERGY MASTERPLAN FOR UPPER LACHLAN SHIRE COUNCIL

6 Identified short, medium and long-term opportunities

The site inspections, discussions with staff and data analysis were used to identify actions that can be implemented that will lead to energy and cost savings to Upper Lachlan Shire Council. A full table of the identified opportunities, with a description and recommended priority is shown below. Following this, business cases are outlined for selected opportunities such as solar PV and energy efficient lighting.

The rationale for arranging opportunities into short, medium- and long-term masterplans is to help Council with its planning, and reflects factors such as payback, ease of implementation and cost. The timing of the recommended short-term plan is to the end of the current Delivery Program cycle, with the medium-term plan aligned with the following Delivery Program period, and so on.

6.1 Short term plan (up to 2021/22)

TABLE 4: UPPER LACHLAN SHIRE COUNCIL SHORT TERM PLAN

Site	End use equipment	Energy saving option
Council		Council to continue partnering with SCC Program to improve energy efficiency and affordability in the Upper Lachlan community
Taralga STP	Solar PV	While load on the plant is 82 MWh per year this is intermittent with 10 cycles per day of diffused aeration operation where the largest demand will occur, followed by decant cycles when demand is low. As such it is likely that a 15-kW system will be best suited to ensure most of the solar energy is consumed on-site. A 20% export to the grid is assumed.
Crookwell RFS	Lighting	Most lights are twin 36W linear fluorescent, excepting external floodlights which are a mix of HID and LED. Training room lights should be changed to LED on failure as they are infrequently used. Office and workshop areas have approximately 100 twin fittings and these can be upgraded to LED battens and panels.
Crookwell RFS	Solar PV	After LED a small 5 kW solar array would likely be the most suitable size PV system for the site, with 80% self-consumption assumed.
Gunning WTP	Solar PV	A 30-kW system is assumed to be feasible with two-thirds self-consumption; this can be ground mounted near the raw water pump station or roof mounted at the main plant.
Gunning Medical Centre	Lighting	Most indoor lights are twin 36W linear fluoroes and can be upgraded to LED technology.
Gunning Medical Centre	Solar PV	We estimate that a system no larger than 10 kW would be suitable (subject to space - the low north-east and higher north-west roofs of the Court may also be suitable), with an assumed 80% self-consumption.
Gunning Office	Solar PV	The north-west roof of the office or chambers buildings are likely to be preferred (tree next to the chambers

- Admin & Chambers		building provides excessive shade). Confirmation would be required about whether the training room roof could be used (via Essential Energy as this building is on a different NMI). A 10-kW array is assumed to be suitable with 20% assumed exported mostly on weekends.
Crookwell WTP	Solar PV	Install a 50-kW solar PV array to meet daytime demand at the WTP. It is assumed that 80% of the solar energy generated is consumed on site, and that there is flexibility in the operation of the plant for greater % of daytime operation.
Crookwell Depot	Solar PV	The impact of LED lighting on the energy demand at the depot is to be confirmed. A 15-kW solar PV array is likely to be an appropriate size (30 kW could meet all demand after LED lighting implementation). Given weekday-only operation, export on weekends would be high, taken to be one third of generation.
Crookwell Library	Lighting	Most indoor lights are twin 36W linear fluoros and can be upgraded to LED technology.
Crookwell Library	Solar PV	The north-west facing roof of the memorial hall and library building looks ideal for solar subject to structural issues. The opening hours of the library make it a good candidate for solar PV after lights have been upgraded to LED. A 5-kW system is suggested, with the assumption that a sizeable % of the site's energy demand is for early morning heating in winter when solar yield is low. We assume 80% of the solar yield is consumed on site.
Crookwell Offices & Chambers	New Design	A planned new facility offers opportunity to demonstrate leadership, achieve significant energy savings and plan for future adoption of Electric vehicles. No analysis has been performed at this stage, however plans - if available - should be reviewed to highlight energy efficiency, renewable energy and sustainable transport aspects that could be considered.

6.2 Medium term plan (2022/23 to 2025/26)

TABLE 5: UPPER LACHLAN SHIRE COUNCIL MEDIUM TERM PLAN

Site	End use equipment	Energy saving option
Council		Review/evaluate the Energy Masterplan for the Delivery Program to 2025/26
Council		Council to continue partnering with SCC Program to improve energy efficiency and affordability in the Upper Lachlan community
Taralga WTP	Solar PV	The new shed will be 15 x 14m, with an area 15 x 9m to be north facing. Aside from access to the membrane plant the roof may be able to host solar panels. A 16.75 kW array would cover 75% of the roof, generate 22 MWh per year, equal to 43% of the site's electricity demand. This size assumes there is flexibility to ensure the plant normally runs during the daytime. A 10% export to grid is assumed.

Taralga WTP	Solar PV	The sloped land below the dam inside Council's fence may be an alternate location for a solar array. Losses would be higher as the array would be ~100m from the plant, and costs for cabling and a ground mount array would be higher. A 10% export to grid is assumed.
Taralga Raw Water pumps	Solar PV	Average energy demand if the pumps ran 8 hours a day would be 21 kW. A 30-kW array is suggested that can meet a portion of demand when this situation is feasible. One third export to grid is assumed.
Crookwell STP	Solar PV	Based on the site's operations and energy demand we estimate that 30 kW of solar PV can be considered, ground mount to the east side of the plant, with one third export assumed due to intermittent operation.
Gunning WTP	Lighting	Lighting is T5 and fairly new so it may not be warranted to replace these at this time. As lights begin to fail consideration should be given to replacing plant fluorescent lights with LED, which consumes 45% less energy.
Gunning WTP	VSD Control	Raw water pumps use soft start control and consume 17% of the plant's energy demand (assumed ~6 hrs per day operation of one 7.5 kW pump). VSD control is assumed to be able to reduce energy use by 30%.
Gunning WTP	VSD Control	Clear water pumps use soft start control and consume 33% of the plant's energy demand (assumed ~6 hrs per day operation of one 15 kW pump). VSD control is assumed to be able to reduce energy use by 30%.
Gunning Raw Water Pumps	Solar PV	Average energy demand if the pumps ran 8 hours a day would be 14 kW. A 20-kW array is suggested that can meet a portion of demand when this situation is feasible. One third export to grid is assumed.
Gunning STP	Solar PV	Energy demand is low at 31 MWh per year, with 9 or 10 aeration cycles daily for an hour. With aerators accounting for most of the site's demand solar PV will see reasonably high export levels. A 10-kW system (ground mount behind the main switch) is assumed to export one third of energy generation.
Gunning Office - training building	Lighting	Offices are now regularly used; training rooms may not be in use but provide access through to the amenities so may run most days. Upgrading to LED will save 60% of lighting energy use.
Gunning Office - training building	HVAC	Review bills for the next 2 or 3 quarters for the Training room account and review potential savings if a small split is installed to serve the office areas, with the larger ducted system only operated on days when training is run.
Gunning Office - training building	Solar PV	Subject to implementation of LED lighting and HVAC actions, review energy demand and scope a suitable solar PV size for the facility (e.g. 5 kW).
Crookwell Memorial Hall	Lighting	Most indoor lights are twin 36W linear fluoros and can be upgraded to LED technology.
Street Lighting	Lighting	LED lights for residential / local roads are approved in the Essential Energy network and several councils have implemented this with a payback of 4-5 years. There is an opportunity for ULSC to implement this initiative - ideally when the next bulk lamp upgrade occurs.
Street Lighting	Lighting	Main road LED lights are expected to be available in the short to medium term and there will be an opportunity in the next 1 or 2 bulk replacement cycles for ULSC to implement this initiative.

6.3 Long term masterplan (after 2025/26)

TABLE 6: UPPER LACHLAN SHIRE COUNCIL LONG TERM PLAN

Site	End use equipment	Energy saving option
Taralga WTP	Solar PV & Battery Storage	Total plant demand is 50 MWh which could be met with an expanded solar array with battery storage. A preliminary estimate of 35 kW of PV plus 40 kWh of storage is made, which would be reviewed at a later time based on plant demand and operation of a smaller array. A 20% export to grid is assumed.
Taralga STP	Solar PV & Battery Storage	If a large % of the plant's energy demand is to be met by solar a larger array and battery will be needed to address the intermittent operation of the plant (compared with the short-term Plan size). Expanding to a 50-kW array with a 50-kWh battery system would generate 80% of the site demand and likely meet 60% of demand with the balance exported.
Crookwell RFS	Solar PV & Battery Storage	After LED lighting a 10-kW solar array plus battery (20 kWh) would be the most suitable size PV system for the site, with 80% self-consumption assumed. This could be done after an initial 5 kW system is implemented and battery costs decrease.
Crookwell STP	Solar PV & Battery Storage	Expansion to a 60 kW PV system with a 75-kWh battery would meet a reasonable % of the site's energy demand, with one third export assumed due to intermittent operation.
Crookwell Sewer Pump Station #1	VSD Control	Investigate the benefit of installing VSD control on the SPS pumps. A 30% saving compared with current soft start / soft stop (SS/SS) control is assumed to be achievable.
Gunning WTP	Solar PV & Battery Storage	A 50-kW system with 50 kWh battery is assumed to be feasible with 80% self-consumption. Depending on whether a smaller roof or ground mount system is installed in the short term, this may be an expansion to 50 kW with battery.
Gunning Library	Solar PV & Battery Storage	Intermittent hours limit the potential for a solar-only approach. Energy use supports a 10 kW PV system with battery to meet most of the site's energy demand (slightly undersized if lights can be changed to LED). We assume a 20-kWh battery and 80% self-consumption.
Gunning Office - Admin & Chambers	Solar PV & Battery Storage	Subject to space and heritage considerations install 20 kW solar PV and a 40-kWh battery to meet a large % of the site's energy demand. Assumed at this stage that 80% of the solar energy is self-consumed. If a smaller system is implemented in the short term this may be an expansion up to 20 kW.
Crookwell WTP	Solar PV & Battery Storage	Install a 99-kW solar PV array and a battery system of 100 kWh, to meet daytime demand at the WTP. It is assumed that 80% of the solar energy generated is consumed on site, and that there is flexibility in the operation of the plant for greater % of daytime operation. If a smaller system is implemented in the short term this may be an expansion up to 99 kW.
Crookwell	Solar PV & Battery	The north-west facing roof of the memorial hall and library building looks ideal for solar subject to any structural

Library	Storage	issues. A 15 kW PV system with a battery (30 kWh) is assumed to be 80% self-consumed with a further 20% exported. If a smaller system is implemented in the short term this may be an expansion up to 15 kW.
Crookwell Memorial Hall	Solar PV & Battery Storage	The north-west facing roof of the memorial hall and library building looks ideal for solar subject to any structural issues. With very intermittent use of power the case for solar PV on its own is fairly weak with the chance most power is exported. A 15 kW PV system with a battery (30 kWh) is assumed to be 80% self-consumed with a further 20% exported.

6.4 Continuous improvement measures

TABLE 7: CONTINUOUS IMPROVEMENT MEASURES

Site	End use equipment	Energy saving option
Council facilities / buildings	Lighting	Other sites will also have a range of lighting, including older fluorescent lamps and halogen or CFL downlights. Council will see added savings over time as these are replaced with LED lights on fail – in general most other lights will have low utilisation and a bulk replacement is not justified.
Council facilities / buildings	HVAC	Air conditioning at Council's sites is generally supplied by split system AC units. Replacement is generally not justified for energy savings (even with part subsidies it is likely paybacks would be several years), and controls are generally user managed. The opportunities for Council to improve the energy efficiency of air conditioning include: - Review the design of planned new systems, - Access the NSW Government's Climate Change Fund (https://www.environment.nsw.gov.au/topics/climate-change/nsw-climate-change-fund) to access a $200 – $1000 discount off new and replacement air conditioner costs by installing high efficiency split, ducted or multi-split systems purchased through approved installers. - 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)
Council facilities / buildings	Power & appliances	Power and appliances represent a fairly modest % of Council's electricity use, small servers that run 24/7, office equipment such as computers, copiers and printers, to appliances like fridges, boiling water units, microwaves, dishwashers and televisions. To improve the energy efficiency of office equipment and appliances Council should implement sustainable procurement practices based on the 2017 Sustainable Procurement Guide for NSW local governments.

6.5 Business cases for selected opportunities

6.5.1 Solar PV initiatives

Solar PV opportunities identified above were modelled and an initial cost-benefit analysis performed based on current per-kWh rates (after discounts). The outcome from this analysis is presented below. In preparing this analysis the following assumptions are used:

- Export of solar energy generation is taken to have a feed-in rate of 8¢/kWh
- Capital cost of roof mounted systems is taken to be $1.20/watt installed, while ground mounted systems are assumed to cost $1.40/watt installed
- Net present value and internal rate of return are calculated over a 25-year life, with maintenance and inverter replacement costs considered

TABLE 8: SUMMARY FINANCIAL ANALYSIS OF SOLAR PV OPPORTUNITIES

Site	Type of installation	Solar capacity kW	Battery capacity kWh	Capital cost net $ ex GST	Savings	Payback in years	IRR %	Carbon Abatement p.a.	% of energy exported	% of site energy met by solar
Crookwell STP	Ground mount	30.2kW		$42,280	$9,216	3.40 Years	28.92%	42.59 t CO_2-e	33.3%	25.9%
Crookwell Library	Roof mounted - Flush	5.0kW		$6,036	$1,859	3.44 Years	28.66%	6.32 t CO_2-e	20.0%	22.0%
Gunning Office - Admin & Chambers	Roof mounted - Flush	3.7kW		$4,428	$1,288	3.65 Years	26.88%	4.63 t CO_2-e	20.0%	8.1%
Crookwell WTP	Ground mount	49.8kW		$69,720	$19,581	3.78 Years	25.92%	70.31 t CO_2-e	20.0%	43.3%
Crookwell RFS	Roof mounted - Flush	5.0kW		$6,036	$1,692	3.80 Years	25.78%	6.26 t CO_2-e	20.0%	40.4%
Taralga RWP	Ground mount	30.8kW		$36,960	$10,374	3.82 Years	25.40%	42.16 t CO_2-e	33.3%	56.3%
Taralga WTP	Roof mounted - Flush	16.1kW		$19,320	$5,230	3.91 Years	25.17%	17.52 t CO_2-e	10.0%	38.4%

Gunning Medical Centre	Roof mounted - Flush	7.7kW		$9,252	$2,451	4.00 Years	24.45%	8.40 t CO_2-e	20.0%	28.2%
Taralga STP	Roof mounted - Flush + Ground mount	15.5kW		$20,508	$5,388	4.05 Years	24.12%	19.61 t CO_2-e	20.0%	23.3%
Gunning STP	Ground mount	10.3kW		$14,420	$3,810	4.05 Years	23.97%	14.63 t CO_2-e	33.3%	38.7%
Crookwell Depot	Roof mounted - Flush	15.1kW		$18,120	$4,698	4.14 Years	23.33%	19.01 t CO_2-e	33.3%	25.9%
Gunning WTP	Ground mount	29.6kW		$41,440	$10,523	4.22 Years	22.85%	42.18 t CO_2-e	33.3%	41.4%
Gunning Office - Training building	Roof mounted - Flush	5.0kW		$6,036	$1,523	4.26 Years	22.80%	6.23 t CO_2-e	20.0%	15.1%
Gunning Office - Training building	Roof mounted - Flush	15.1kW		$18,120	$4,354	4.47 Years	21.63%	17.83 t CO_2-e	20.0%	43.3%
Taralga WTP	Ground mount	16.6kW		$23,240	$5,445	4.51 Years	21.62%	18.25 t CO_2-e	10.0%	40.0%
Gunning WTP	Roof mounted - Flush	29.5kW		$35,400	$8,430	4.51 Years	21.27%	33.79 t CO_2-e	33.3%	33.2%
Crookwell STP	Ground mount - West facing	60.0kW	75 kWh	$84,000	$16,189	5.65 Years	16.39%	74.82 t CO_2-e	33.3%	45.5%
Taralga STP	Ground mount	50.6kW	50 kWh	$108,340	$18,590	6.21 Years	15.11%	67.67 t CO_2-e	20.0%	80.5%
Crookwell WTP	Ground	98.8kW	100	$252,840	$38,801	6.95 Years	13.27%	139.32 t CO_2-	20.0%	85.9%

	mount - LGC scale		kWh					e		
Gunning WTP	Ground mount - LGC scale	50.6kW	50 kWh	$128,580	$19,719	6.95 Years	13.27%	70.46 t CO_2-e	20.0%	83.0%
Gunning Office - Admin & Chambers	Ground mount - LGC scale	11.1kW	15 kWh	$25,680	$19,719	7.09 Years	12.92%	13.87 t CO_2-e	20.0%	24.2%
Taralga WTP	Roof mounted - Flush with microinverters	32.7kW	40 kWh	$75,780	$3,860	7.20 Years	12.67%	40.65 t CO_2-e	20.0%	79.2%
Gunning Library	Ground mount	10.1kW	20 kWh	$27,120	$11,223	7.28 Years	12.59%	12.51 t CO_2-e	20.0%	85.7%
Crookwell Library	Roof mounted - Flush	15.1kW	30 kWh	$40,620	$3,938	7.75 Years	11.61%	18.91 t CO_2-e	20.0%	66.0%
Crookwell Memorial Hall	Roof mounted - Flush	15.1kW	30 kWh	$40,620	$5,566	7.90 Years	11.33%	18.90 t CO_2-e	20.0%	71.2%
Crookwell RFS	Roof mounted - Flush	10.1kW	20 kWh	$27,120	$5,470	8.59 Years	10.11%	12.51 t CO_2-e	20.0%	80.7%
Crookwell STP	Roof mounted - Flush	60.3kW	75 kWh	$140,670	$3,378	8.38 Years	9.99%	84.79 t CO_2-e	33.3%	51.6%

Images of modelled arrays are shown in Appendix B. Copies of all modelling are provided as separate files to Upper Lachlan Shire Council.

6.5.2 Lighting

Lighting systems at the following sites are identified to be suitable for upgrade to LED technology. Estimates of savings are indicative and we believe conservative. Council may be able to avail of incentives available to small businesses under the NSW Energy Saver Program to ensure that Energy Saving Certificate (ESC) discounts are applied, by engaging an approved supplier under this scheme.

TABLE 9: SUMMARY FINANCIAL ANALYSIS OF LIGHTING OPPORTUNITIES

Site	Current technology and quantities (approx.)	Energy and cost savings with LED upgrade	Capital cost estimate	Simple payback estimate
Crookwell RFS	Most lights are twin 36W linear fluorescent, excepting external floodlights which are a mix of HID and LED. Training room lights should be changed to LED on failure as they are infrequently used. Office and workshop areas have approximately 100 twin fittings with medium utilisation and these can be upgraded to LED battens and panels.	5,500 kWh savings in electricity $2,000 in energy and maintenance savings	$10,000	5.00 Years
Gunning WTP	Lighting is T5 and fairly new so it may not be warranted to replace these at this time. As lights begin to fail consideration should be given to replacing plant fluorescent lights with LED, which consumes 45% less energy.	2,000 kWh savings in electricity $1,000 in energy and maintenance savings	$8,000	8.00 Years
Gunning Medical Centre	Most indoor lights are twin 36W linear fluoroes and can be upgraded to LED technology.	3,000 kWh savings in electricity $1,000 in energy and maintenance savings	$3,000	3.00 Years
Gunning Office - training building	Offices are now regularly used; training rooms may not be in use but provide access through to the amenities so may run most days. Upgrading to LED will save 60% of lighting energy use.	1,500 kWh savings in electricity $500 in energy and maintenance savings	$2,000	4.00 Years
Crookwell Library	Most indoor lights are twin 36W linear fluoroes and can be upgraded to LED technology.	5,000 kWh savings in electricity $2,000 in energy and maintenance savings	$7,000	3.50 Years
Crookwell Memorial Hall	Most indoor lights are twin 36W linear fluoroes and can be upgraded to LED technology.	2,000 kWh savings in electricity $500 in energy and	$2,000	4.00 Years

		maintenance savings		
Street Lighting	LED lights for residential / local roads are approved in the Essential Energy network and several councils have implemented this with a payback of 4-5 years. There is an opportunity for ULSC to implement this initiative - ideally when the next bulk lamp upgrade occurs.	48,000 kWh savings in electricity $28,000 in energy and maintenance savings	$140,000	5.00 Years
Street Lighting	Main road LED lights are expected to be available in the short to medium term and there will be an opportunity in the next 1 or 2 bulk replacement cycles for ULSC to implement this initiative.	72,000 kWh savings in electricity $25,000 in energy and maintenance savings	$125,000	5.00 Years
TOTAL		**139,000 kWh per year and $60,000 incl maintenance**	**$297,000**	**4.95 years**

Appendix A: Sustainable Councils and Communities Program

The Sustainable Councils and Communities (SCC) Program aims to work with up to 18 resource constrained councils across NSW to improve the energy efficiency of council buildings and facilities. The program aims to help councils understand, prioritise and implement energy efficiency and renewable energy upgrades.

This program is funded by the NSW Climate Change Fund and delivered by the NSW Department of Planning, Industry and Environment (DPIE).

The Sustainable Councils and Communities Program aims to:

- Identify opportunities for councils to save energy, money and increase energy efficiency knowledge among council staff;
- Support councils in using energy data to develop business cases for efficiency or upgrade projects and become 'investment ready';
- Increase knowledge and capacity in LGAs through energy efficiency programs aimed at supporting households, businesses and communities.

This program is designed to overcome a number of barriers reported by smaller local governments in NSW. Due to internal resource constraints such as a low rate payer base, and high operational costs from large road networks and aging infrastructure, many councils are unable to devote internal capacity to manage and implement energy savings projects. These barriers result in resource-constrained missing out on opportunities for financial savings and other co-benefits that can be achieved through improving the energy productivity of public facilities.

DPIE also has a suite of programs focused on supporting households, businesses and communities across NSW. These programs include:

- The Appliance Replacement Offer
- Solar housing upgrades for social housing
- Energy efficiency for businesses and households
- Community engagement, capacity building and leadership.

DPIE will aim to connect communities to these programs and assist in driving energy efficiency and affordability for regions.

It is anticipated that councils participating in the Sustainable Councils and Communities Program will:

- Deliver scoped, verified, and prioritised opportunities to save energy and money
- Develop business cases for potential energy efficiency infrastructure improvements
- Identify funding pathways and opportunities
- Have connected and empowered communities with increased knowledge and understanding of government energy efficiency and affordability programs

Upper Lachlan Shire Council signed a memorandum of understanding (MoU) with the (former) NSW Office of Environment and Heritage (OEH) to participate in the SCC program in late 2018.

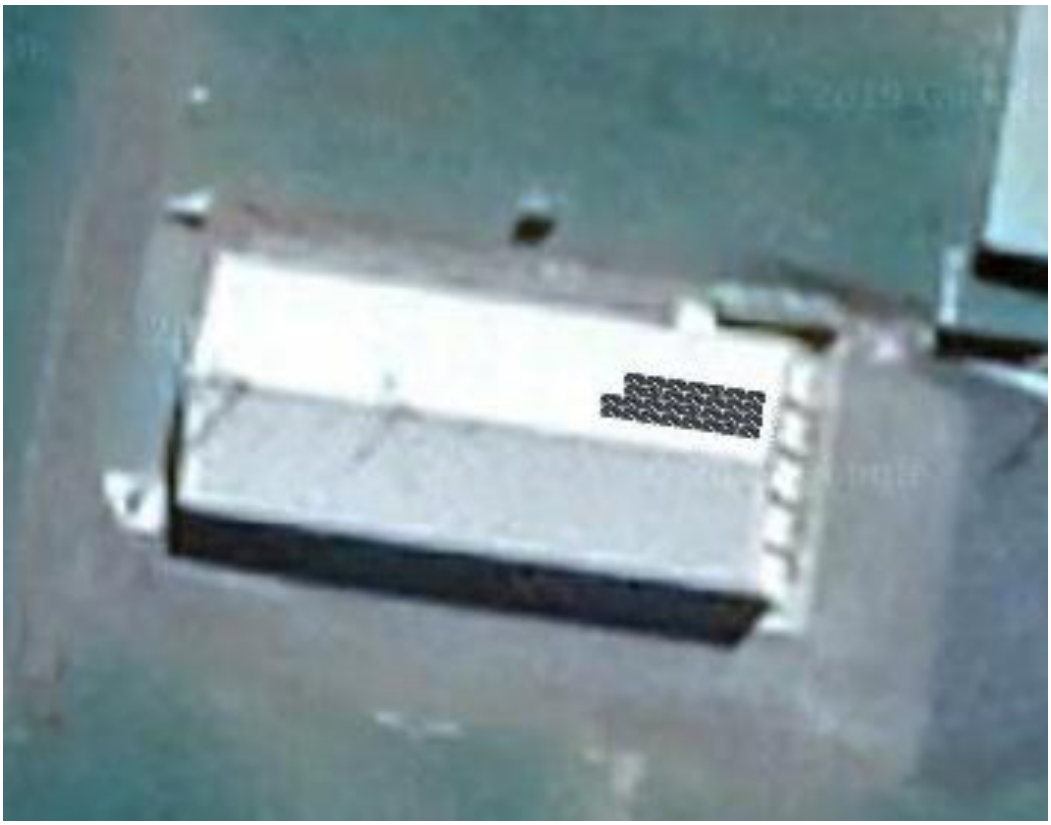
Appendix B: Solar PV modelled sites

Crookwell Depot 15.1 kW

Crookwell Library 5.03 kW & 15.1 kW

Crookwell Memorial Hall 15.1 kW

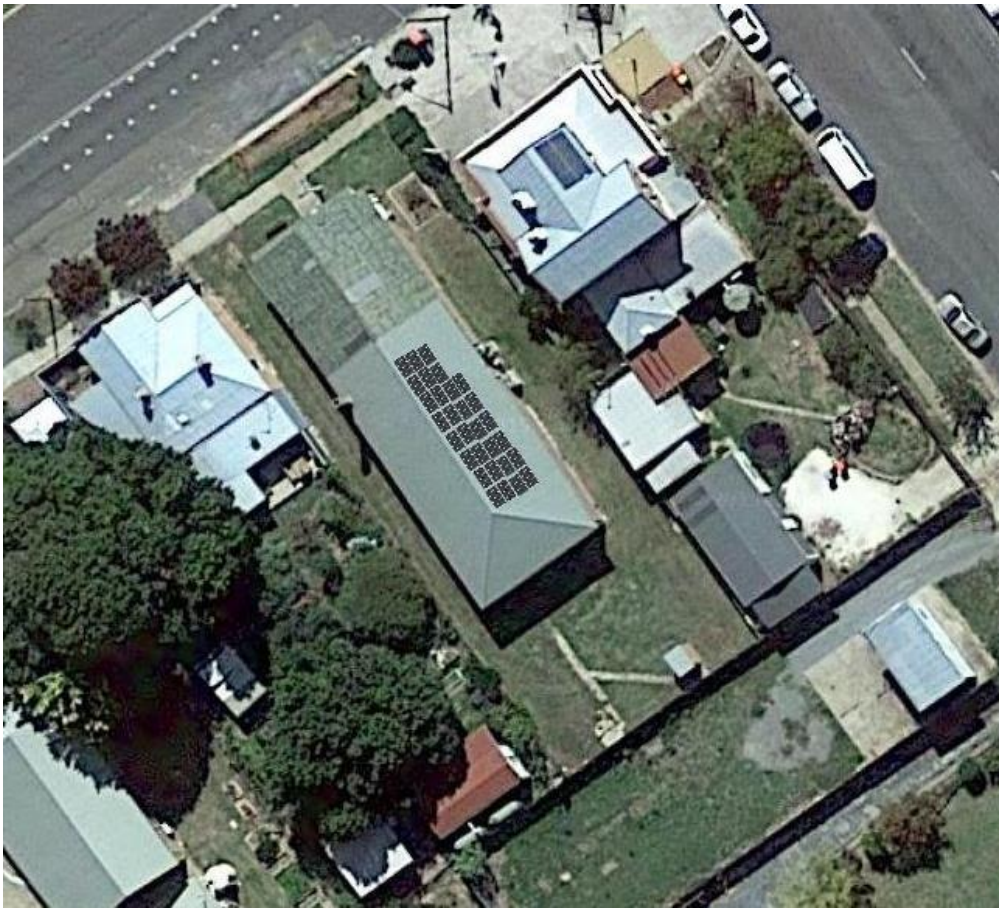
Crookwell RFS 5.03 kW & 10.1 kW



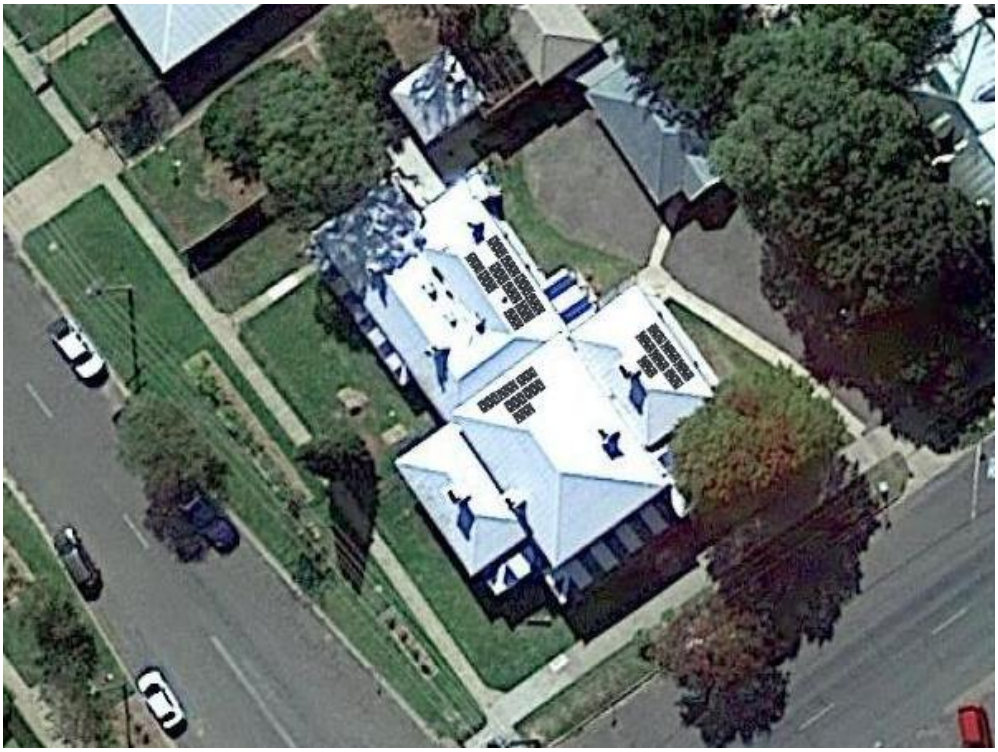
Crookwell STP 30.2 kW & 60.3 kW

Crookwell WTP 49.8 kW & 98.9 kW

Gunning Library 10.1 kW



Gunning Medical Centre 7.71 kW



Gunning Office – Admin & Chambers 3.69 kW & 11.1 kW

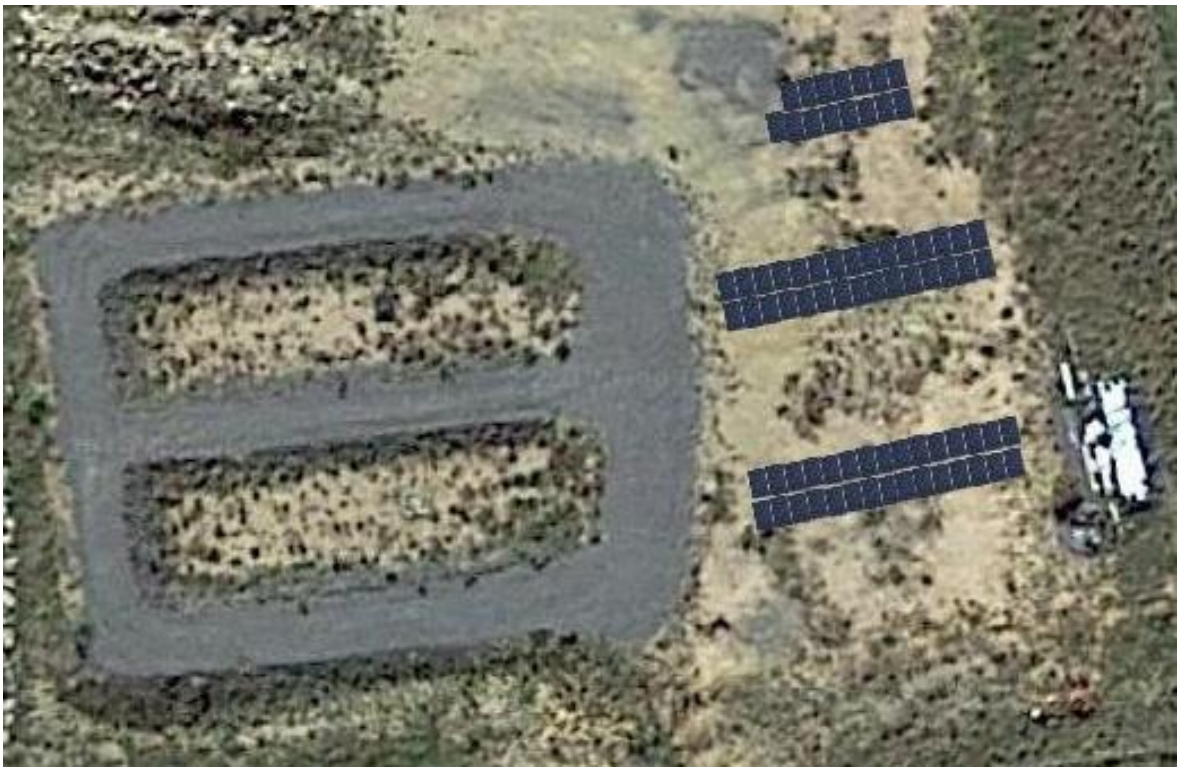
Gunning Office – Training building 5.03 kW & 15.1 kW[9]

[9] Note a 15.1 kW system is modelled solely to assess the roof PV capacity, in the event this can be used to supply the admin office and Chambers building. This model is excluded from business case analysis.

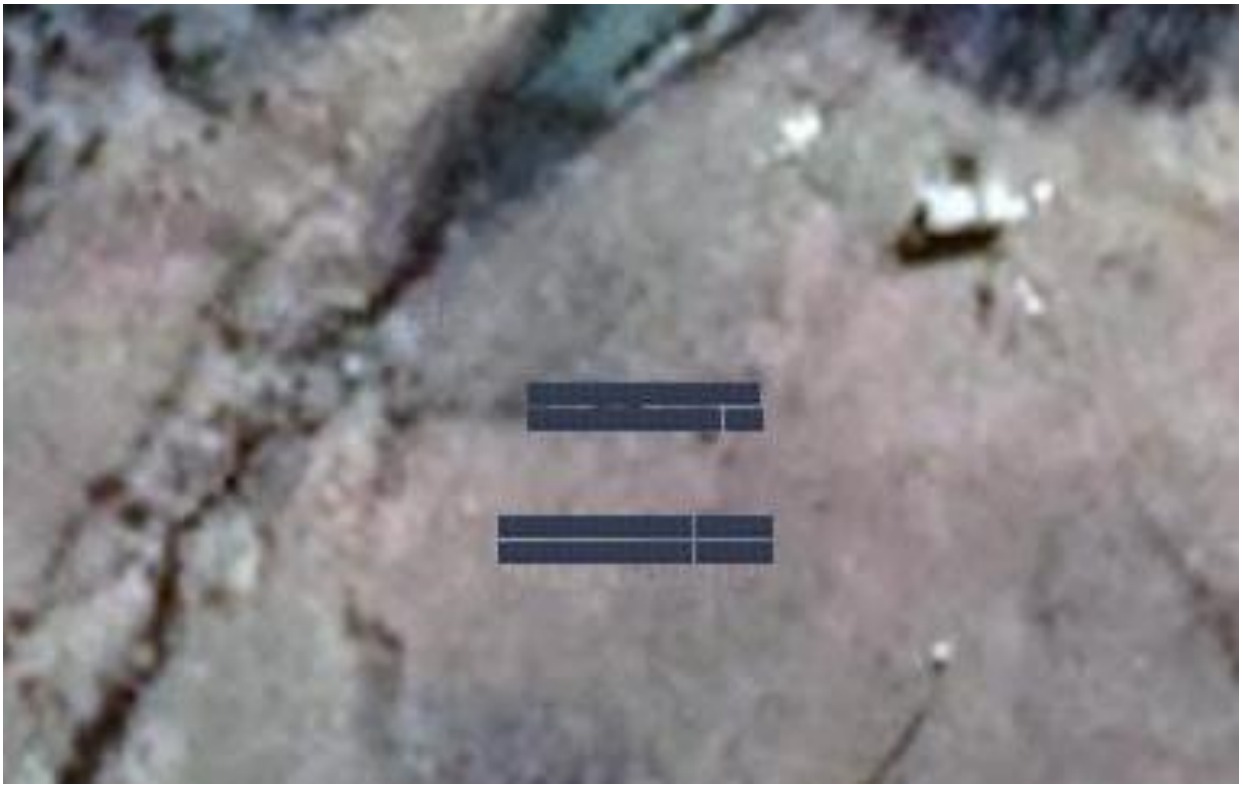
Gunning Raw Water Pumps 19.8 kW

Gunning STP 10.3 kW

Gunning WTP 29.6 kW (roof & ground options) & 50.6 kW



Taralga Raw Water Pumps 30.8 kW



Taralga STP 15.5 kW (roof & ground options) & 50.6 kW

Taralga WTP 16.10 kW (roof), 16.60 kW (ground) & 32.70 kW (combined)

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