



Office of
Environment
& Heritage



100% Renewables

Sustainable Councils and Communities

LGA: Kyogle Council

Action Plan

Date: 17 May 2019

Adopted by Council: 11 June 2019

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Council Adoption

At its Ordinary Meeting of June 11, 2019 Council resolved (Resolution number CO/0619/10):

That Council:

1. *Receives and notes the Sustainable Councils Action Plan for Energy Efficiency and Renewable Energy report*
2. *Adopts the Kyogle Council Sustainable Councils Action Plan for Energy Efficiency and Renewable Energy*
3. *Adopts the following targets;*
 - (a) *That 25% of Council's electricity demand is met through on-site solar energy generation by 2025*
 - (b) *That 50% of Council's electricity demand is sourced from renewables by 2025*
 - (c) *That 100% of Council's electricity demand is sourced from renewables by 2030*
4. *Encourage and support the use of renewable energy by the community, particularly in new developments.*

1

Introduction

1 About the 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 Office of Environment and Heritage (OEH).

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.

OEH 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.

OEH 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

Kyogle Council signed a memorandum of understanding (MoU) with the NSW Office of Environment and Heritage (OEH) to participate in the SCC program on 23/11/2018.

2 Renewables and emissions targets – context and local government experience

One outcome of an action plan focused on renewable energy and energy efficiency should be consideration by Council of targets for renewables and/or carbon emissions.

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 Kyogle Council to consider:

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?

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

2.1.1 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 2030¹. 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 Celsius².
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 society³.

¹ Sourced from <https://www.un.org/sustainabledevelopment/development-agenda/>

² Sourced from <https://www.un.org/sustainabledevelopment/climatechange/>

³ Sourced from https://www.ipcc.ch/news_and_events/pr_181008_P48_spm.shtml

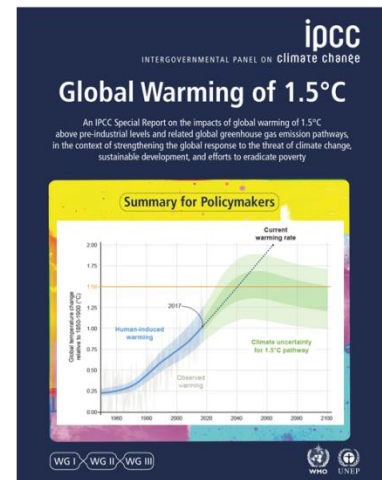


FIGURE 1: GLOBAL CONTEXT FOR ACTION ON CLIMATE

In addition, the World Economic Forum's Global Risks Report 2019⁴ highlights climate change-related outcomes as among the most likely to occur with the highest impacts to the global economy.

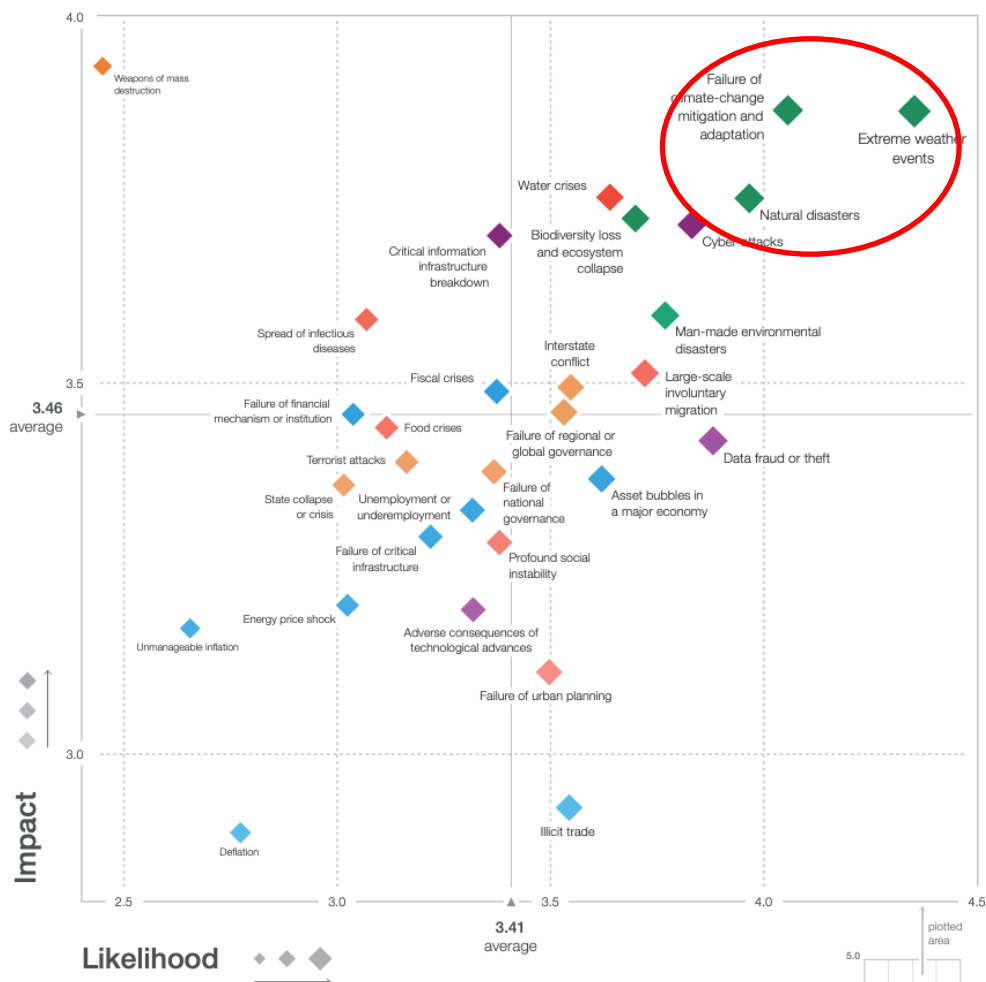


FIGURE 2: GLOBAL RISKS REPORT – LIKELIHOOD AND IMPACT OF CLIMATE AND OTHER RISKS TO THE GLOBAL ECONOMY

⁴ <https://www.weforum.org/reports/the-global-risks-report-2019>

2.1.2 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 3: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – NATIONAL LEVEL

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

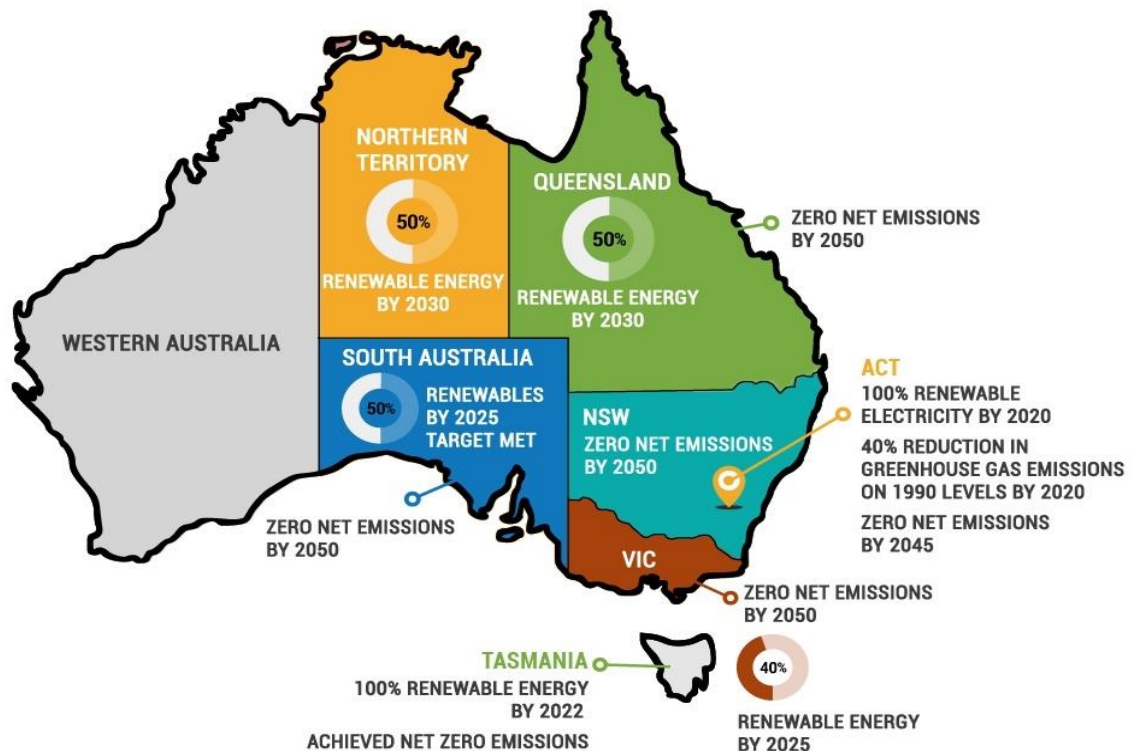


FIGURE 4: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – STATE & TERRITORY LEVEL

2.1.2.1 NSW State targets

The NSW Climate Change Policy Framework⁵ 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.

Through the Government's Climate Change Fund (CCF) 2018-2022 Strategic Plan a number of initiatives will be progressed in the next four year period with a total funding allocation of \$170 million. Implementation of programs is being led by the Division of Energy, Water and Portfolio Strategy (DEWPS) within the Department of Planning and Environment. The five major initiatives to be developed include:

1. supporting regional community energy projects and community energy hubs to give communities more control, avoid costly infrastructure upgrades and reduce rural energy costs.
2. supporting feasibility studies and commercialisation of emerging energy projects including pumped hydro generation and utility scale batteries, with potential co-funding from the Australian Renewable Energy Agency, to bring forward private sector investment to support the next generation of energy and storage projects in NSW.
3. providing small incentives to coordinate assets such as home and electric vehicle storage to beat energy peaks and provide household demand response to the grid, as highlighted by AEMO and the NSW Energy Security Taskforce as a key priority for system security.
4. supporting energy storage in state-owned sites, such as schools, to lower peak demand and potentially attract investment in local manufacturing.
5. increasing the energy savings for eligible recipients of the Low-Income Household Rebate by allowing them to opt out of the rebate and install a solar system on their roof. This would add solar capacity to the grid and more than double the energy savings for the households involved.

The NSW Renewable Energy Action plan has helped to drive the growth of renewables in the State through its three key goals:

- Goal 1 – Attract renewable energy investment
- Goal 2 – Build community support, including the establishment of the Renewable Energy Advocate
- Goal 3 – Attract and grow renewable energy expertise

2.1.2.2 Energy management support in NSW

The NSW Government runs a number of initiatives aimed at promoting and increasing the uptake of energy efficiency and sustainable practices. Initiatives that help local governments include:

- Sustainability Advantage program, which helps local governments commit to, plan, implement and be recognised for sustainability practices in their operations and supply chains
- Energy Savings Scheme – information and resources that help organisations get access to financial incentives by implementing verifiable energy savings initiatives, such as building retrofits, plant upgrades and lighting upgrades to LED
- In 2018 the government completed a panel of renewable energy Power Purchase Agreement (PPA) providers, which local governments can access to implement onsite

⁵ <http://www.environment.nsw.gov.au/topics/climate-change/policy-framework>

solar PV solutions. The advantage of an onsite PPA is that the solar PV can be installed and deliver cost savings from renewables at no upfront cost. However, cost savings are not as great compared to paying for a solar PV system using your own capital. This initiative is useful where access to capital is not available or is limited.

- Community renewable energy guides and resources e.g. <http://c4ce.net.au/>.
- A wide range of tools, guides, case studies, training courses and other materials is available to businesses through OEH, covering a wide range of sectors, technology types and energy forms
- Environmental Upgrade Agreements (EUA), which can help organisations and participating Councils overcome some traditional barriers to implementing and benefitting from environmental upgrades
- Clean Energy for Business – a program that ran in 2017 and helped businesses and local governments plan for a net-zero / 100% renewable energy future. Case studies from this program will help other organisations plan similar clean energy pathways.

2.1.3 NSW local government targets

While there are a large number of examples of what local governments around the world are doing, we focus here on Australia and on New South Wales in particular, as this seems broadly representative of what is occurring in many other countries or regions. Two approaches in particular are relevant.

1. Cities Power Partnership or CPP is an initiative of the Climate Council and it represents Australia's largest local government climate action network with more than 100 participating councils. While this doesn't involve setting specific targets per se, the commitment to key actions can either serve as a set of de facto targets or can provide a basis from which to set targets in future. Key aspects of the CPP include:
 - a. Local councils who join the partnership make five action pledges in either renewable energy, efficiency, transport or working in partnership to tackle climate change.
 - b. Connection and sharing between participants. Let's say your council wants to set a benchmark for new housing developments to put solar on the roof of every new home. The partnership will connect you to other councils who are already doing it, through the CPP's online portal and buddying system.
 - c. Councils get access to a comprehensive online Knowledge Hub and Power Analytics tool to help track emissions, energy and cost savings. Councils are teamed up with others working on similar projects to share knowledge.
 - d. Councils can also access support from local and international experts, events with other climate and energy leaders and help to get local climate and energy projects up and running.
 - e. In the Northern NSW region Tweed Shire, Byron Shire and Lismore City Councils are members of the CPP, along with 40 other NSW councils.
2. Adoption and publication of ambitious targets for renewable energy and/or carbon emissions for Council operations, and potentially adopting or setting targets for renewables or emissions reduction in the community.
 - a. The chart below shows the current status of target-setting by local councils in NSW (as at April 2019). A total of 17 councils and towns, plus the ACT have set ambitious goals for renewable energy and/or carbon emissions – typically 50-100% renewable energy or renewable electricity, and some net zero emissions targets are seen.

- b. Typically Councils set targets following a period of analysis of their data and information, and/or consultation with their stakeholders.
- c. For example Lismore City Council's intent to reach 100% renewables was informed by their 10-year strategic plan process from 2013, where the community expressed that they wanted their Council to be a model for sustainability.
- d. Other councils have developed plans and have adopted internal targets but have not publicly released these at this time.
- e. Based on surveys of local councils by 100% Renewables in 2018 the majority of local councils have energy and/or sustainability plans in place for their operations.
- f. Relatively few councils have similar plans and targets for their communities, though this is beginning to grow (noting that as part of previous local government-focused initiatives with ICLEI many councils did set aspirational community emissions reduction goals).

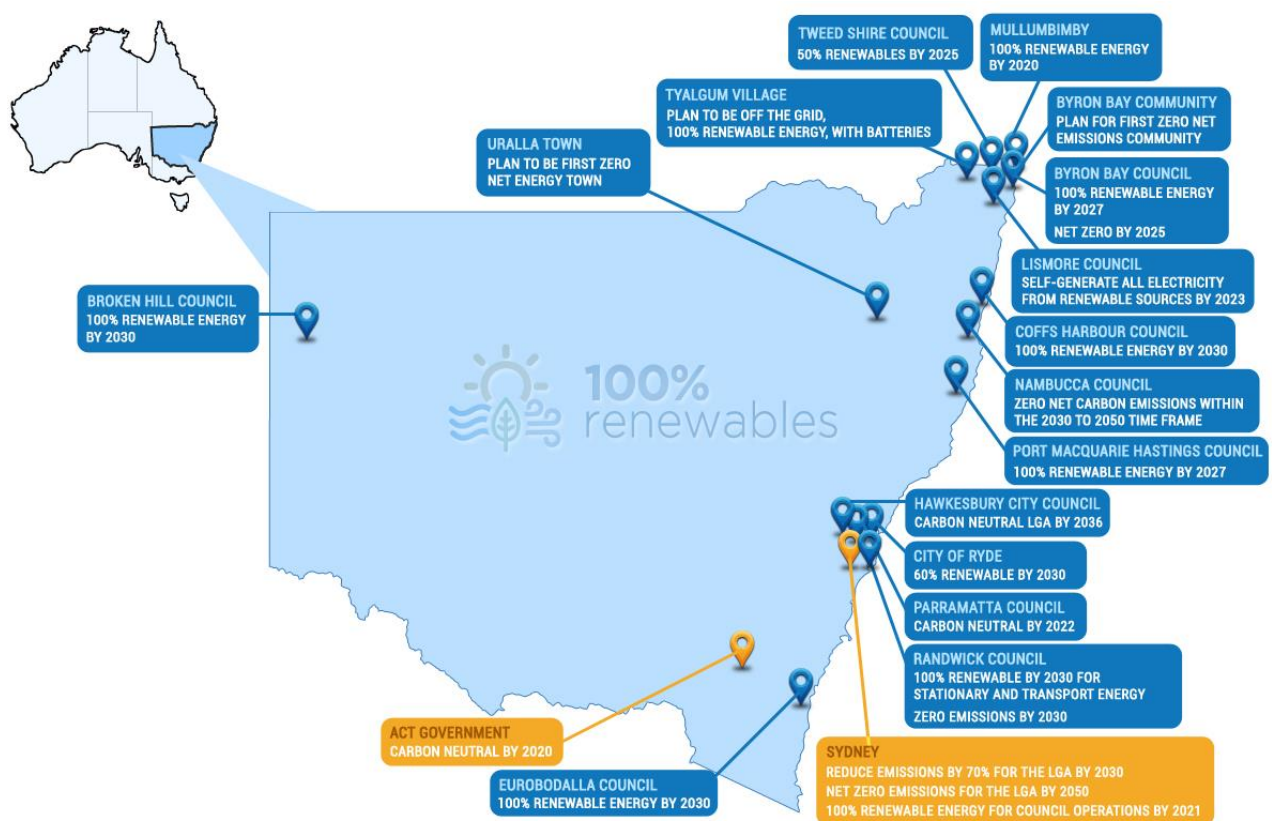


FIGURE 5: RENEWABLE ENERGY & CARBON TARGETS BY NSW COUNCILS AND COMMUNITIES

We have seen a trend towards staged and evidence-based target setting compared with aspirational targets that may set the goal first to reflect what is required to decarbonize and then develop the plan to fit this goal. We expect that this trend will continue.

We have also seen a small but increasing trend towards examining the scope for renewables and abatement in communities, both in terms of local action and how communities can participate more in the shift to renewable energy at scale. This is being informed by greater awareness of the need to act on climate, growing accessibility of information on community emissions, and the desire to ensure that communities and local business are part of and benefit from the technology changes that are occurring.

2.2 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 Kyogle Council this includes:

- Stationary energy including mainly electricity and small quantities of bottled gas (LPG),
- Transport energy including petrol and diesel for Council 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 Council's operations such as air travel, employee commute, consumables, catering and the like (Scope 3 emissions), and
- Carbon emissions associated with waste from Council and community / business that is managed and disposed of in the LGA. This typically includes legacy as well as ongoing waste management.

When considering what should be included in targets it is important to consider a number of factors:

- Energy that Council can influence or control. Typically stationary electricity is easy to include as solutions are available or near-commercial that can make this a fully renewable supply in a reasonably short timeframe – eg 5-10 years. However renewable energy fuels for transport are not yet widely available and/or commercially viable, but may be in the period 2030-2040.
- Emissions that Council can control or have confidence that they are declining. Waste management for example is a complex task, and the ability to set emissions reduction targets may rely on whether or not a waste management strategy is in place or planned. If not then it may be difficult to set a target that is realistic and achievable.
- Is an emissions source material or not? For example, LPG consumption may be trivial compared with other sources, so should time and effort be devoted to tracking and managing this source?
- Council's ability to account for all of the sources it may want to track so that it can report on its progress towards reaching goals. Often 90%+ of emissions can be readily accounted for with minimal effort or use of pre-existing systems (from simple spreadsheets to proprietary data collection and reporting systems), whereas the remaining ~10% of emissions can involve significant effort to both establish and then track emissions on an ongoing basis. The National Carbon Offset Standard program is seeking to make this simpler for smaller organisations to report and offset their carbon impact, however this will take time.
- Consideration of Council's overarching purpose in setting goals or targets, such as for internal cost cutting or internal management of emissions, or to provide guidance and leadership so that residents and businesses are motivated to act (typically a Council's emissions are ~1% of an LGA's emissions), or to partner with like-minded Councils to share information and knowledge that is mutually beneficial (or all of these).

There is no one preferred approach to selecting what should be included in targets.

In our experience many organisations have good data and renewables or abatement plans for electricity, good data but limited plans for reducing transport emissions, and mixed data and strategic plans including emissions reduction for waste. This tends to influence what is included in the scope of renewable energy and /or carbon emissions targets, often starting with a narrow scope of significant sources with an intent to expand the scope of targets.

Other organisations may have excellent data and plans across multiple energy and emissions sources, within their operations and their supply chains, and set the scope of targets accordingly.

2.3 What challenges are being faced by councils 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.

Both interim and ambitious long-term targets present challenges that other councils have encountered in our experience. Some of these 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. Some of the main strategies we have seen in councils include:
 - a. One or a few key staff and managers who want to see continued action on renewables and emissions reduction, and make it a priority on an ongoing basis. Without internal support at senior level as well as people to develop business cases and implement projects, most programs do not last or succeed.
 - b. Having clear financing strategies for renewables, efficiency and other emissions reduction measures, including good grant identification and application processes, awareness of incentives such as the Energy Saving Scheme and the Renewable Energy Target, environmental or waste levies, revolving energy funds or similar.
 - c. Alignment of renewable energy and emissions reduction plans with Council 4-year Delivery Plans, so that this is embedded in the organisation's priorities.
2. Understanding electricity markets and Councils' energy purchasing processes and limitations.
 - a. The ability to meet an ambitious renewable energy goal cost-effectively is heavily influenced by how electricity is sourced from the market.
 - b. Whereas in the past GreenPower® was available but at a cost premium, many organisations including councils are now able to source energy from renewable energy projects at similar or even lower cost than 'regular' power.
 - c. However the current and future electricity and renewable energy market, contract terms for renewable energy supply, types of contracts for renewable energy purchasing, and interest in collaboration or partnering for volume to achieve better pricing are all aspects of energy procurement that require understanding in a market that is still rapidly evolving.
 - d. Energy procurement will most likely deliver 60-80% of most councils' ambitious renewable energy goals, so without a plan to address this part an ambitious renewable energy goal will not be achieved ahead of the 'greening' of the grid.
3. Transport and waste are sources of large carbon emissions but solutions to achieve step-change in energy demand, renewable energy or carbon emissions can be limited, particularly if measures such as Euro vi vehicles, landfill gas flaring (typically supported by the Emissions Reduction Fund) or FOGO have already been implemented where applicable.

- a. In our experience the level of focus on carbon emissions and renewables for these sources is low or lags the focus that is applied to electricity and stationary gas. This often leads to the omission of these sources from targets.
 - b. While this may be reasonable, a commitment to bring these into future re-setting of targets would be prudent and lead to appropriate resources being applied to understanding opportunities and future trends.
 - c. An emerging aspect of this is the potential for electrification of vehicles to change electricity demand and thus increase the amount of renewable electricity that needs to be sourced to meet ambitious targets. Some councils are beginning to assess their future energy demand with an EV fleet and incorporate this into their long-term forecasts.
4. Underlying growth and the modest impact of onsite actions
- a. Several councils with ambitious targets find they have only achieved a small part of their goal after a few years, despite the fact they have progressed a number of onsite solar and energy efficiency projects.
 - b. Often building energy efficiency and onsite solar can deliver part of the solution but each project is individually small. This is beginning to change with LED technology for street lights, and cheaper solar panels making larger-scale systems cost-effective. These measures can have greater impact on energy demand and the level of onsite renewables.
 - c. While efficiency and renewables are being implemented, at the same time energy demand can be growing to meet new service levels – e.g. a new sewerage treatment plant may be energy efficient but if it replaces a trickle filter plant then energy demand will be far higher to deliver a better overall outcome in terms of treated water quality returned to the environment.

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 a council's assets over time helps to set targets that are realistic and achievable.

The overall effort towards ambitious goals is likely to include a small number of measures that have individually significant impact (renewable energy PPA, street lighting LED), plus a large number of small measures that have low impact but are good for the bottom line.

The emergence of electric vehicles will introduce new challenges for the identification of new opportunities and forecasting what changes will occur and when. This may not be a significant factor for the next 4-5 years but will almost certainly be a more important issue as we approach 2030.

3 Recommended targets for Kyogle Council

This plan has considered energy sources only, and so no consideration is given to setting targets for emissions from waste disposal or treatment in the LGA.

SCOPE OF TARGETS

Based on current information we suggest that any targets Council adopts be limited to renewable energy and carbon emissions associated with electricity in the first instance.

Solutions to reduce electricity consumption and install or procure renewable electricity are commercially available and either cost-effective today or becoming more cost-effective in the case of battery energy storage.

Energy use and emissions from transport are less able to be significantly impacted through efficiency and renewables at this time, with incremental and/or small changes more the norm through leasing and procurement, driver practices and the like.

Step-change solutions such as electric vehicles will become more widely available for passenger cars in the next decade, and zero-emissions solutions may become available for heavy vehicles and plant in future years.

Recommendation: consider setting targets for electricity only at this stage, with an intent to review the case for expanding targets to include transport energy at a later time, e.g. within 5 years.

ELECTRICITY CONSUMPTION

Council's grid electricity consumption, plus self-consumed solar energy generation, amounts to 1,309 MWh per year based on 2017/18 data. Kyogle Council currently meets an estimated 6.1% of this electricity demand with rooftop solar through 85 kW of installed solar PV capacity.

Implementation of all energy efficiency opportunities in this plan will reduce grid electricity demand by 222 MWh per year. Countering this, electricity demand for the planned works at Kyogle pool in coming years will increase demand, principally for operation of a 25m pool and also for the proposed gym and basketball buildings.

Overall there may be a net decrease in electricity consumption but it is likely to be less than 10% of Council's total grid electricity use. As such we do not advocate setting an electricity consumption target, but to focus on implementation of cost-effective projects, maximise efficiency in design for new or upgraded assets, and apply sustainable procurement principles when sourcing new equipment for all Council's sites.

Recommendation: consumption-based targets for electricity are not recommended at this time as overall scope for improvement is modest, with large savings in street lighting likely part-offset by growth in energy demand through asset / building upgrades.

ONSITE SOLAR

If Council implements all of the modelled solar PV opportunities in this plan, its fraction of electricity from renewables will increase to 20-22%. Additional opportunities to expand solar PV systems on the new Kyogle pool buildings and with battery storage will emerge within a few years and may lift the potential for onsite solar to 25% by say 2025.

Future opportunities will arise to consider floating solar on the Offsite Storage or Bonalbo Dam sites, and these could increase onsite solar to around one third of Council's electricity use within 10 years.

Recommendation: Council considers a target for onsite solar energy generation of 25% of Council's electricity demand by 2025.

OFFSITE RENEWABLES

If Kyogle Council wishes to aim for a large fraction of its electricity to come from renewables it must look to achieve this via its electricity procurement process. In the first instance this action plan recommends that Council obtain advice on a procurement approach for their large sites, including advice on correct tariffs, metering requirements for large contestable sites, forecast savings by going to market, and best timing in the next 12 months to do this. It is also recommended that Council obtain advice on the options for buying part of Council's electricity from renewables, with some power purchase agreement offers (PPAs) seeing rates comparable to 'standard' prices.

Experience to date for councils in NSW has included the aggregation of demand by close to 20 councils via Southern Sydney Regional Organisation of Councils (SSROC) and the procurement of cost-effective 20-30% renewable energy for these councils for 11 years from July 2019. Another region of councils (ROC) is currently going through the same process. In the current market these bulk purchases are integral to making the price for renewables competitive with 'regular' power prices. PPA offers for smaller businesses are emerging but without the same likelihood of cost savings at this time.

Most forecasts see a target of 100% renewables as being a very achievable goal by 2030 and this is reflected in many of the targets that have been set by councils in recent times. Within a shorter timeframe it is likely that collaboration with other parties such as other local councils is key to seeing cost-effective renewable energy agreements.

Recommendation: Council considers an overall target for electricity from renewables of 50% by 2025 or earlier, which could be 25% from a PPA and 25% from onsite solar for example. Council should also consider a target of 100% renewables by 2030 or earlier, consistent with other councils' goals and consistent with the rapid developments in renewable energy markets.

2

Council's energy and carbon footprint

4 Kyogle Council⁶

Kyogle Council is a local government area in the Northern Rivers region of New South Wales, Australia. The council services an area of 3,589 square kilometres and is located adjacent to the Summerland Way and the North Coast railway line, within a two hour drive from Brisbane and one hour from the Queensland Gold Coast and the northern NSW coast. More than 20% of Kyogle Council is protected including nearly 12% national parks.

As at 2015 there were 9,537 people residing in Kyogle Council according to the ABS (whereas reported population from the 2016 census is 8,939). From a total of 1,057 businesses, over 17% of workers are employed in the agriculture sector, which is the region's highest employing sector.

Kyogle Council a number of small towns, with more than 30% of people resident in the town of Kyogle itself. Other towns have resident populations of up to a few hundred, including the towns of Tabulam, Bonalbo, Old Bonalbo, Urbenville and Woodenbong.

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 54 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.

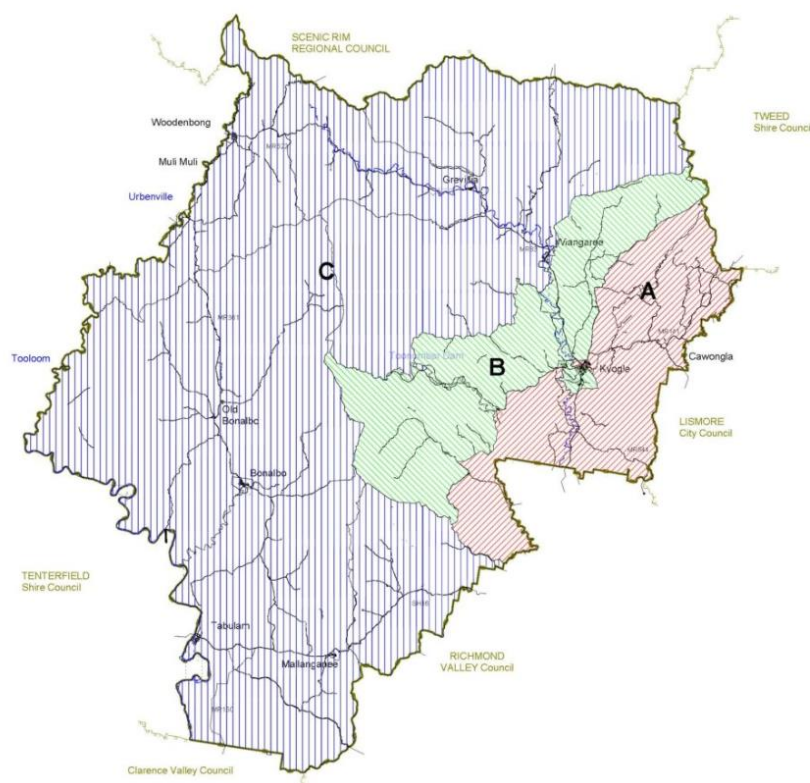


FIGURE 6: KYOGLE COUNCIL BOUNDARY MAP

⁶ Information sourced from https://en.wikipedia.org/wiki/Kyogle_Council#Towns_and_localities, http://stat.abs.gov.au/itt/r.jsp?RegionSummary®ion=14550&dataset=ABS_REGIONAL_LGA&geoconcept=REGION&datasetASGS=ABS_REGIONAL_ASGS&datasetLGA=ABS_REGIONAL_LGA®ionLGA=REGION®ionASGS=REGION, <https://www.kyogle.nsw.gov.au/> and <https://www.communityprofile.com.au/northernrivers>

4.1 Solar uptake in Kyogle Council

Some 30.5% of dwellings (APVI <http://pv-map.apvi.org.au/>) in the LGA have installed solar PV as at early 2019. This places Kyogle LGA in the top 11% of NSW councils in terms of the number of residents taking up solar panels. In addition to 1326 residential systems, there have been 40 installations of 10-100 kW in capacity, which tend to be commercial-scale systems. Local governments near Kyogle, including Tweed, Moree Plains and Narrabri, have reached solar uptake levels of 35% to 40% and lead the way for NSW councils.

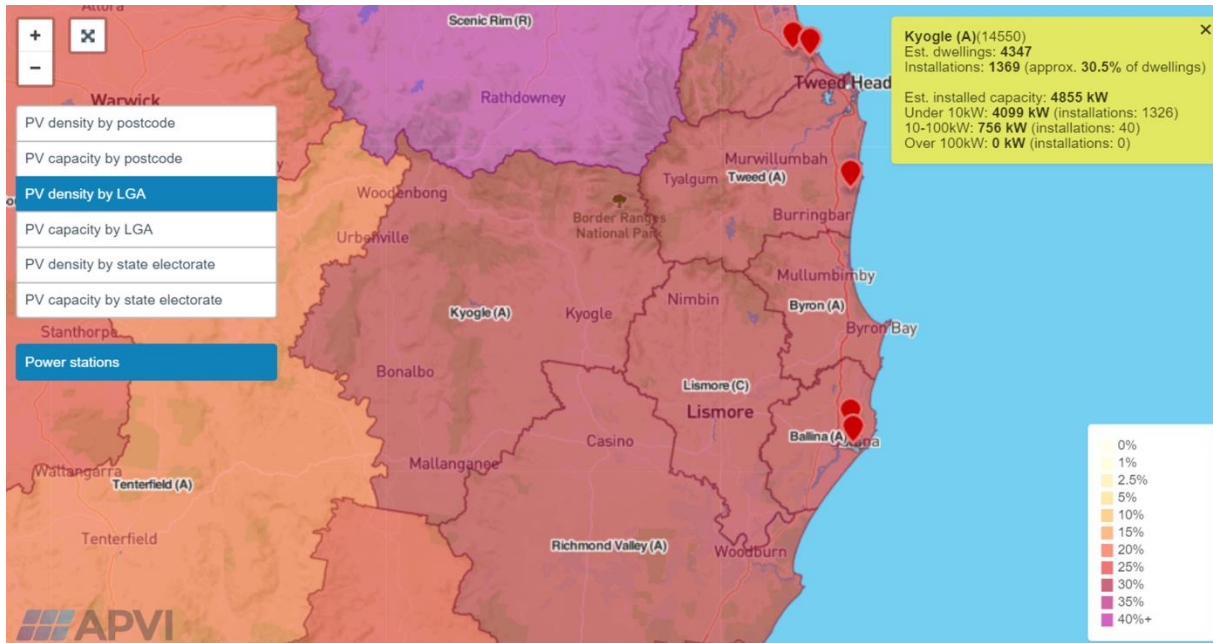


FIGURE 7: UPTAKE OF SOLAR PV IN KYOGLE AND SURROUNDING REGIONS

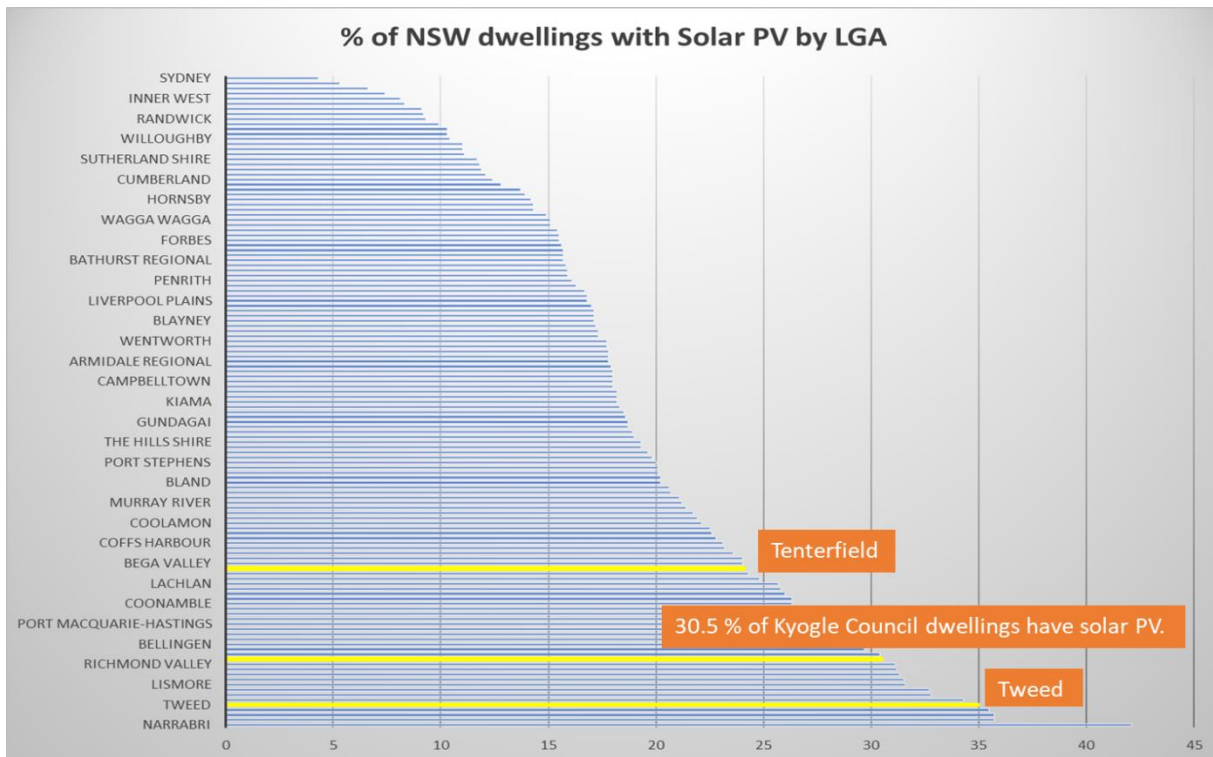


FIGURE 8: PERCENTAGE OF NSW DWELLING WITH SOLAR PV BY LGA

4.2 Sustainability actions by Kyogle Council

Council has been actively pursuing sustainable energy improvements over the past years, and energy demand today is less than it would have been without these actions.

Some of the main initiatives that have been implemented to date include:

- Street lighting: there are approximately 700 street lights in the Kyogle LGA, of which over 400 were upgraded to 42W compact fluorescent lamps in 2012. These replaced mercury vapour lamps at the time, leading to a saving of more than 50%. A further upgrade to LED technology is yet to occur.
- Solar PV systems have been installed at a number of sites in recent years and months, with a total capacity of 85 kWp now installed on Council's sites. Installed systems include:
 - Council Chambers: 10 kW system located on the carport roof in 2016
 - Kyogle Library: 5 kW system installed in 2016
 - Water treatment plant in Kyogle: 10 kW system located on the workshop roof in 2017
 - Kyogle senior citizens facility: 5 kW solar PV system plus solar hot water (not on list of Council energy use sites)
 - Kyogle swimming pool: 10 kW solar PV system located on the amenities block roof in 2016, plus solar hot water
 - Off stream storage facility: 20 kW system on the roof of the pumphouse in 2017 plus a small solar-powered aeration device in the storage dam
 - River / raw water pump station: 5 kW system mounted on the roof of the pumphouse, installed in 2017
 - Council depot in Kyogle: 10 kW system roof mounted behind the main workshop in 2014
 - Bonalbo swimming pool: 5 kW system mounted on the amenities block roof in 2016, plus solar hot water
 - Woodenbong swimming pool: 5 kW system mounted on the amenities block roof in 2016, plus solar hot water
- Some facilities' lighting has been upgraded to LED technology. This includes Council Chambers (LED tube retrofit 2016), the renovated Historical Museum building on Bloore Street, several lights in the water treatment building, new Art Gallery upstairs in the memorial Hall building, and all lighting at the Council depot.
- Variable speed drive control is installed at some facilities with large motor systems, including the filter pumps at the Kyogle swimming pool, 2 x 30 kW off stream storage pumps and 2 x 55 kW raw water river pumps.

4.2.1 Impact of past sustainability actions

We can develop reasonable estimates of the impact of Council's past actions with reference to the scale of actions themselves and energy consumption data.

TABLE 1: IMPACT ANALYSIS OF PAST SUSTAINABILITY ACTIONS

Initiative	Scope / potential impact	Likely energy saved
85 kW of solar PV capacity	This PV can generate approximately 110-120 MWh per year.	Data for 2017-18 supplied by Council indicates that over 25 MWh of solar PV is exported (21-23%). Hence net energy saved will be around 85-95 MWh per year.
Street lighting CFL upgrade in 2012	We assume that 413 mercury vapour lights were upgraded to CFL since this is the same quantity proposed by Essential Energy for an LED upgrade.	Data from 2011-12 compared with 2013-14 show a drop in energy use by street lighting of 154 MWh, consistent with a change from 80W up to 250W lamps with 42W compact fluorescent lamps across Council's street lights.
LED lighting in facilities	Approximately 250 lights have been changed to LED or selected as LED from design across Council's facilities.	For 2,000 run hours per year this quantity of LEDs will save roughly 12 MWh per year compared with traditional fluorescents, downlights and HIDs.
VSDs on pumps	Pumps consume most of the energy use for the raw water and OSS accounts, and probably 40% of the energy use for the Kyogle pool.	VSDs will typically save 10-30% of energy demand. Assuming a 20% saving compared with the non-VSD case for these sites energy savings of 37 MWh per year may have been achieved.

This analysis is high level but a reasonable estimate of the impact of Council's major energy efficiency and renewable energy actions in recent years. solar hot water systems will have made a small additional savings impact.

Taken together the above actions mean that Kyogle Council consumes around 300 MWh per year less than it would have if these actions had not been taken. If we take an average energy rate of \$0.25/kWh for street lighting and \$0.30/kWh for all other sites then Council is \$82,000 better off each year in electricity costs through these actions, plus additional savings in maintenance of street lights and building lighting.



FIGURE 9: ESTIMATED IMPACT OF PAST EFFICIENCY AND RENEWABLE ENERGY INITIATIVES BY KYOGLE COUNCIL

4.2.2 Analysis of Kyogle's historical energy consumption

The above estimate of energy savings that Council has made can be seen in historical energy trends in energy (electricity) consumption by Council's operations. Council maintains excellent records of past energy consumption that date back to 2007-08, as illustrated below.

A trendline shows the overall decrease in the council's energy consumption over the 11-year time period, in particular from 2011-12 when the first energy efficiency upgrade to street lights occurred.

Gains in energy efficiency are offset somewhat by improvements that Council has made to its services, such as the establishment of the offstream storage facility, improvements to water treatment facilities and trends towards air conditioning of office and community facilities.

The graph below also highlights energy cost trends, with steep rises in electricity prices evident through to 2013-14. Energy efficiency and renewable energy efforts have served to limit overall cost increases in this time.

Continued implementation of cost-effective energy efficiency and renewable energy initiatives will further insulate Council from ongoing uncertainty in electricity markets.

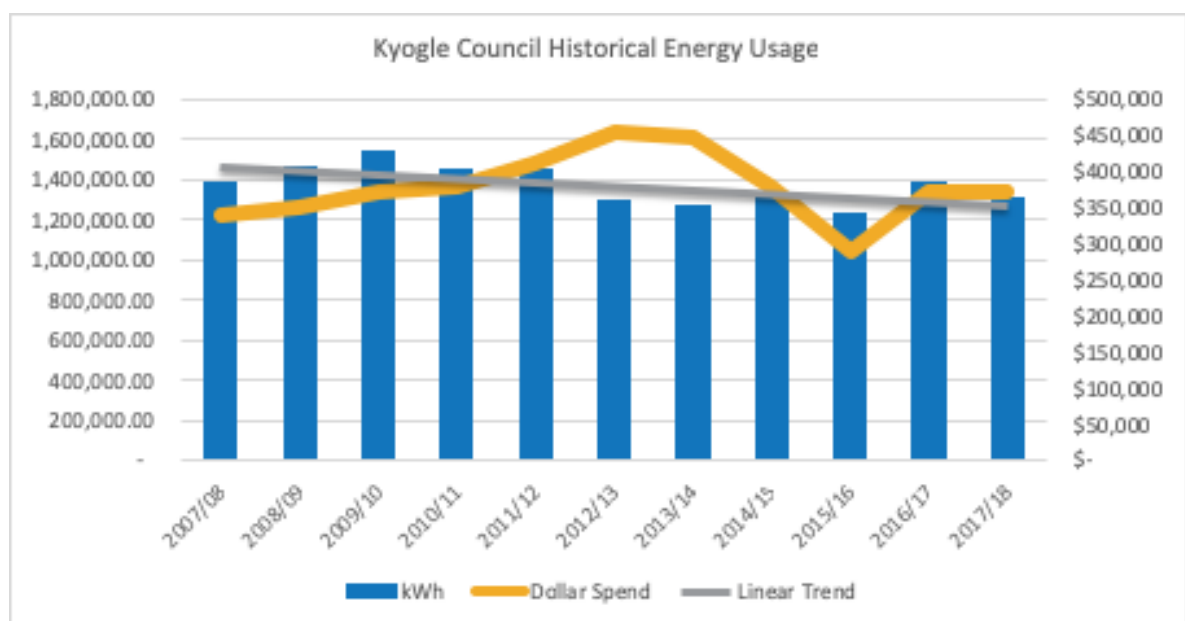


FIGURE 10: KYOGLE COUNCIL HISTORICAL ELECTRICITY CONSUMPTION AND COST

⁷ It should be noted that the some data were missing for certain time periods. In this case where consumption or invoicing quantities were unavailable estimations were applied to fill in the gaps.

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

Council's energy use and carbon footprint were assessed based on energy consumption only, and additional emissions from landfill gases, sewerage treatment emissions and other sources such as refrigerants are excluded. In 2017/18 Council's carbon footprint is dominated by diesel fuel consumption and electricity consumption.

TABLE 2: COUNCIL'S ENERGY USE AND CARBON FOOTPRINT

Emission Source	Activity Data	Units	Scope 1	Scope 2	Scope 3 ⁸	t CO ₂ -e	%
Diesel for fleet	552	kL	1,502		77	1,579	56.24%
Petrol for fleet	10	kL	23.13		1.23	24.36	0.87%
Electricity use Council assets	1,015,706	kWh		833	102	934	33.28%
Electricity use Streetlighting	293,396	kWh			270	270	9.61%
TOTAL (CO₂-e)			1,525	833	449	2,808	100%

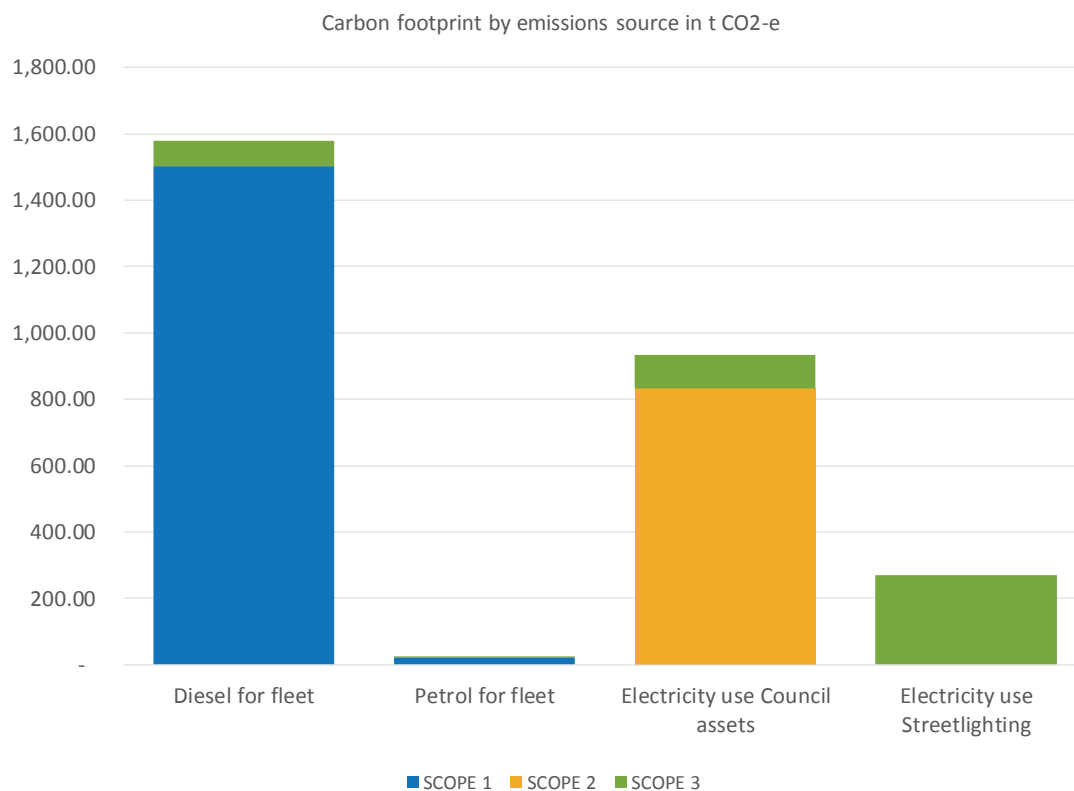


FIGURE 11: KYOGLE COUNCIL CARBON FOOTPRINT BY EMISSION SOURCE

⁸ 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.

While fuel – and diesel in particular – is significant in terms of both emissions and cost, options to achieve energy savings or GHG emissions reductions are limited at this time. Continued upgrading to the latest vehicle emissions standards (e.g. euro vi) as fleet is replaced will continue to incrementally tackle exhaust emissions, however electric or hydrogen heavy vehicles are some way from being commercial. Car fleet and light diesel fleet should see opportunities to switch to electric vehicle technology in coming years, and Council can have a role in demonstrating leadership on EVs as infrastructure is built and the range and reliability of EVs continues to improve.

The primary focus of this Action Plan however 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 1,309 MWh of grid electricity at a cost of \$367,000, and also self-consumed an estimated 79 MWh of solar PV (5.7% of total demand). Electricity was consumed at 55 facilities and unmetered supplies, ranging from swimming pools, office buildings, water and sewer treatment systems, community buildings, depots, parks & ovals, and street lights. 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.

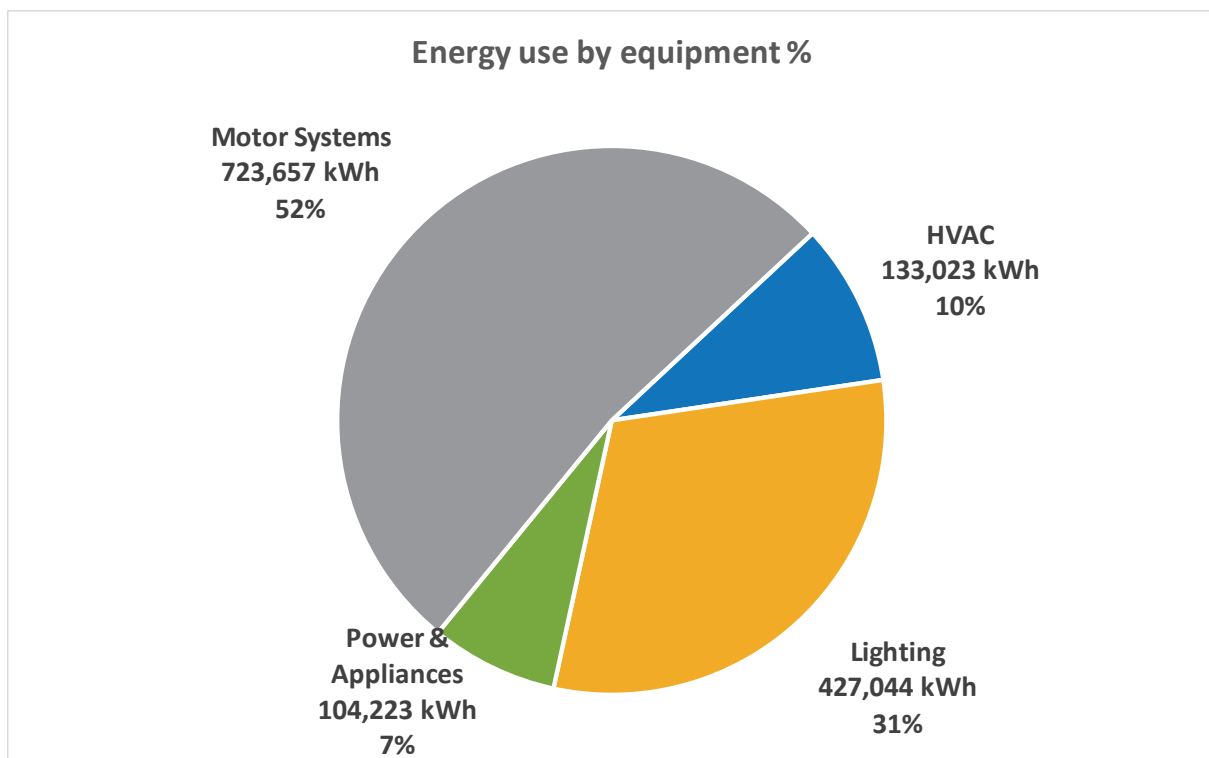
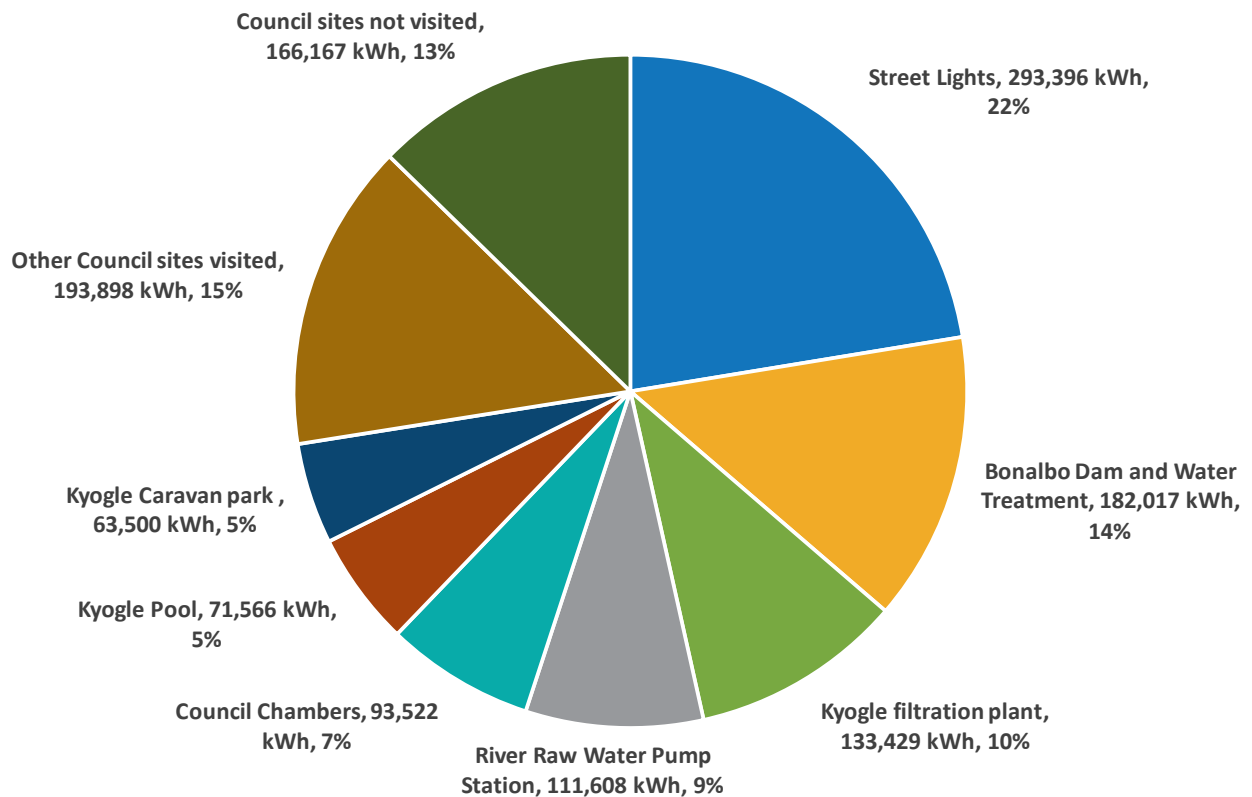


FIGURE 12: KYOGLE COUNCIL ENERGY USE BY EQUIPMENT

A 2-day visit to Kyogle 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 17 sites covering over 88% of Council's energy use as tabulated below.

TABLE 3: KYOGLE COUNCIL DETAILED ENERGY USE

Site	2017-18 kWh
Street Lights	293,396 kWh
Bonalbo Dam and Water Treatment	182,017 kWh
Kyogle filtration plant	133,429 kWh
River Raw Water Pump Station	111,608 kWh
Council Chambers	93,522 kWh
Kyogle Pool	71,566 kWh
Kyogle Caravan park	63,500 kWh
Woodenbong Pool	38,214 kWh
Kyogle Library	29,619 kWh
Woodenbong Treatment Works	28,651 kWh
Kyogle Tourist Information Centre	22,067 kWh
Bonalbo Pool	18,683 kWh
Kyogle Sewerage Treatment Works	15,243 kWh
Off Stream Storage	13,536 kWh
Kyogle Works Depot	12,062 kWh
Kyogle Memorial Hall	11,614 kWh
Bonalbo Caravan Park	4,209 kWh
Other Council sites	166,167 kWh


FIGURE 13: KYOGLE COUNCIL'S TOP 10 SITES FOR ENERGY CONSUMPTION

3

Renewable energy action plan

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 Kyogle 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 plans is to help Council with its planning, and reflects factors such as payback, ease of implementation and cost.

6.1 Short term action plan

TABLE 4: KYOGLE COUNCIL SHORT TERM PLAN

Site	End use equipment	Energy saving option
Large sites >100 MWh pa	Electricity purchasing	<p>Council is not on a competitively-sourced price for electricity. After discounts the Bonalbo Dam site pays \$0.272/kWh, Chambers pays \$0.326/kWh, Kyogle filtration plant pays \$0.312/kWh, raw water pump pays \$0.23/kWh and street lights charges are \$0.258/kWh. These 5 accounts make up 54% of Council's electricity use.</p> <p>Discounts apply to some accounts and not to others. The underlying tariff structures for each site are not clear, with charges bundled for most sites.</p> <p>Council should obtain advice on a procurement approach for their large sites, including advice on correct tariffs, metering requirements for large contestable sites, forecast savings by going to market, and best timing in the next 12 months to do this.</p> <p>In the current market it will be sensible to obtain advice on the options for buying part of Council's electricity from renewables, with some power purchase agreement offers (PPAs) seeing rates comparable to 'standard' prices.</p>
Small sites <100 MWh pa	Electricity purchasing	Small sites make up 46% of Council's electricity use and all are with Origin Energy. As with large sites Council should review its options for small sites to get cheaper electricity through a competitive procurement process.
Bonalbo Dam and Water Treatment	Solar PV	The site's demand is 182 MWh per year, second only to streetlighting. Some plant like dam aeration operates 24/7 and raw water and treatment pumps run on demand. Higher demand will be experienced during daytime, with likely average demand of 30-50 kW. As such a solar PV array of up to 50 kW can be considered to provide some of the daytime demand (est 70 MWh per year). Initial thoughts are a ground mounted array facing due

		north inside the site entrance to the right (left side of the roadway up to the treatment plant), as we understand the main meter is located here. While the roof of the treatment plant is also feasible, the size of array that can be located here is small (est 9 kW) and shading will lower yield.
Bonalbo & Woodenbong pools	Electricity use	Investigate why energy demand at Woodenbong is double that at Bonalbo given the 2 pools are nearly identical, with same sized pumps, lighting systems, solar PV and solar hot water. Rectify any operational differences that unnecessarily increase energy consumption (note we understand this has been investigated in early 2019 and that some changes will be made – it is recommended that monthly or quarterly energy demand be monitored over the next 12 months).
Bonalbo Dam and Water Treatment	Lighting	Treatment plant lights include 14 twin 36W linear fluorescent fittings which could be replaced with LED battens.
Kyogle Pool	Lighting	Lighting in the amenities block / kiosk includes 23 single 36W and 2 twin 36W linear fluorescent lamp fittings. We understand this block will remain as other parts of the facility are developed, and so upgrading to LED should be feasible. Savings are modest at ~2 MWh pa.
Kyogle Library	Lighting	Lighting includes 25 twin 36W linear fluorescent fittings, 4 twin 18W linear fluorescent fittings, 15 external mercury vapour or metal halide lights (dusk to dawn), and compact fluorescents both indoors and in outdoor bollards. Energy use for lighting is estimated at 13 MWh per year. This can be reduced by 8 MWh with an LED upgrade. Costs of around \$10,000 would be repaid in 4 years.
Kyogle Tourist Information Centre	Lighting	The TIC has 11 twin 36W recessed fluorescent light fittings that can be upgraded to LED, in the shop, café and bathrooms. Energy savings of ~3 MWh per year will result.
Kyogle Tourist Information Centre	HVAC	Advice on site was that the split AC unit serving the shop requires replacement. This should be done under the State Govt's Energy Saver program where a \$500 discount for a 4-star unit of 5 kW in capacity can be obtained. https://energysaver.nsw.gov.au/business/discounts-and-incentives/discounted-energy-efficient-air-conditioners .
Kyogle Tourist Information Centre	Solar PV	With several refrigerators and both the TIC and café operating daily there is a good case for solar PV to be installed on the roof of the site, flush mounted in a north-east direction. A 5 kW system is assessed for this site.
Kyogle Sewerage Treatment Works	Solar PV	Energy demand at the site is very low (trickle filter plant), with up to 5 kW solar likely to be an appropriate size. As the site is flood prone this would be installed on the roof of one of the 2 sheds on the west side of the site, with a north-west orientation.
Off Stream Storage	Solar PV	A 20 kW PV system is installed on this facility. The main demand is for the pumps that transfer water to the Kyogle filtration plant, which are VSD controlled.

		<p>Energy data show that export to grid for this system is over 40% of output, which indicates either an oversized system or a highly intermittent energy use pattern. The factors should be reviewed and confirmed – if oversized then perhaps part of the array could be deployed elsewhere in Council’s portfolio. If intermittency is the main factor then battery storage will help to maximise the value of solar but in the longer term.</p>
Off Stream Storage	Lighting	<p>15 twin 36W fluorescent lamp fittings are installed and were observed to be on during a site visit. Changing to LED or installing a movement sensor should be considered.</p>
Kyogle Works Depot	Lighting	<p>Consider installing dimming on the external lights so they drop to a low level at night (not off) and ramp up in response to movement. These lights have already been changed to LED, and further savings of 2-3 MWh will result.</p>
Kyogle Memorial Hall	Lighting	<p>Works are well progressed to implement the new art gallery upstairs in the Memorial Hall building. There is an opportunity to also change lights in the Hall and the small hall and kitchen underneath to LED. The Hall has approx. 10 twin 36W fittings, 2 twin 58W fittings with additional lights in the bathrooms. The downstairs hall / kitchen has a further 7 twin 36W fluorescent lamp fittings. Energy savings will be less than 3 MWh per year based on current demand.</p>
Kyogle Senior Citizens	Lighting	<p>This site was not on the list of council’s electricity accounts.</p> <p>Lighting includes ~32 twin 36W linear fluorescent fittings, both ceiling-recessed and surface mounted battens. A small number of single 36W fittings are also installed.</p>
Off Stream Storage	Micro-hydro	<p>These can all be upgraded to LED technology for energy savings of 60% compared with current use and cost.</p> <p>Two options were noted by Council staff – one at the inflow to the off stream storage dam and another on a weir close to the off stream dam.</p> <p>The basic way to roughly estimate the power available is via:</p> <ul style="list-style-type: none"> • Power (kW) = density (d) x flow rate (m) x gravitational constant ($g = 9.81 \text{ m/s}^2$) x net head pressure (h) x efficiency factor (%); i.e. • $P = dmgh \times e$ <p>So if we have a water (density = 1000) inflow of 52 L/sec ($0.052 \text{ m}^3/\text{sec}$) with net head of say 50 metres, and system efficiency after all losses is 75% (typical), then available power would be:</p>

		<p>$P = 1000 \times 0.052 \times 9.81 \times 50 \times 75\% = 19,130 \text{ W (19.13 kW)}$</p> <p>The amount of energy that can be generated is then a function of the hours when this flow is available. So if this flow occurs for say 4,000 hours a year then potentially 76.52 MWh of electricity can be generated annually. If exporting to the grid and receiving say 8¢/kWh then annual income of \$6,122 results.</p> <p>At this initial stage we suggest that basic system details be used for both sites to develop simple estimates of power and income, and that a decision then be taken whether this is a short-term priority or a longer term option.</p>
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6.2 Medium term action plan

TABLE 5: KYOGLE COUNCIL MEDIUM TERM PLAN

Site	End use equipment	Energy saving option
Street Lights	Lighting	<p>Upgrade all street lights to LED technology. The option to upgrade residential road lights has passed in the current cycle, and there will be LEDs available for all non-decorative lights at the next bulk upgrade in 2023. Energy savings potential is high, even though a prior upgrade to 42W CFLs was undertaken.</p> <p>Essential Energy's offer to upgrade local roads to LED will save 53.5 MWh with current LEDs, which is 63.5%. Applied to the larger energy used by the Council's 175 HID lights will yield additional savings of 131.5 MWh per year.</p> <p>That is an energy saving to Kyogle Council of 185 MWh per year. At this time the payback for upgrading local roads to LED is 4 to 6 years, though changes to SLUOS charging may affect this.</p>
Kyogle filtration plant	Pumps	<p>2 x 110 kW clearwater pumps have soft starter controls. VSD control would reduce energy demand and cost, and 2 units are in store at the Kyogle treatment works. If we assume these pumps consume 50% of the site's energy use and 30% energy savings are possible this is an energy reduction of 20 MWh per year.</p>
Kyogle filtration plant	Solar PV	<p>10 kW of solar was recently installed on the workshop roof and reduces site grid demand by around 10 MWh per year, with 3.6 MWh exported in 2017-18 (25% export). This suggests demand dominated by large intermittent pumps with low demand for daytime periods.</p> <p>Nonetheless overall demand, available roof space on the west side of the filtration plant and the potential for</p>

		<p>VSDs to be installed (could lead to longer operation of pumps at lower load?) means that added solar should be considered in future, with the load and roof space suggesting a further 20-40 kW should be considered in future.</p> <p>At say 24 kW energy use would be further reduced by >30 MWh per year. Analysis of load with VSDs operating is a preferred first step, along with assessment of what flexibility there is to operate more during daytime when solar yield is highest.</p>
River Raw Water Pump Station	Solar PV	With intermittent operation of the pumps (VSD controlled) the site may be a good candidate for battery storage in future so that high self-consumption of the site's 5 kW solar array is achieved.
Kyogle Pool	Re-develop	<p>Re-development of the site in stages will see a gym, basketball court, and a new 25m pool built over several years, with first stage works to include a heat pump for the LTS pool and the 335 m² GFA gym building. Specification of energy efficient design and technology should be required, and if possible solar PV (and battery?) should be incorporated into design or provision made for their later addition.</p> <p>An independent review of the design may also be sensible and help to ensure that energy efficient outcomes will result.</p>
Kyogle Pool	Solar PV	The current solar PV system (10 kW) exports 11% of its generation which occurs when the pool is closed in winter. Export when the pool is open is negligible, and may indicate scope for further solar PV (~10 kW) on the west side of the amenities block. Note that a heat pump for the LTS pool will boost summertime self-consumption.
Kyogle Caravan park	Solar PV	<p>The roofs of the amenities block and the 2-storey house may be suitable to have solar PV systems – we understand improvements will be made to the 2-storey building.</p> <p>With 63.5 MWh of electricity demand and 18 permanent sites there will be reasonable daytime demand, though early morning and late afternoon will tend to have higher demand. We suggest that 10-15 kW of solar PV be considered, with further assessment of the daytime load to confirm.</p>
Kyogle Library	Solar PV	A 5 kW solar PV system on the library reduces grid energy demand by around 7 MWh per year less 1 MWh export which is likely to mostly occur on the day the library is closed. Grid demand is still 29 MWh per year and will be reduced to around 21 MWh with an LED upgrade. This will see daytime demand still at around 10 kW, which likely makes an additional 10 kW solar system attractive. Two added arrays on the east and west sides below the existing arrays may be suitable locations.
Woodenbong Treatment Works	Solar PV	Energy demand at the site is low, with up to 10 kW solar likely to be an appropriate size. Possible locations include the roof of the building (<10kW) or ground mounted on the slope behind the building.

Kyogle Works Depot	Solar PV	<p>The current system has a high export of 35%, which reflects weekday-only operation of the site as well as efficiencies implemented including lower-power welding and LED lighting.</p> <p>Battery storage should be assessed in the medium term to maximise use of solar from this system. While there is ample room to expand the solar PV system the current level of export does not support this approach.</p>
Kyogle Memorial Hall	Solar PV	<p>With the installation of new air conditioning for the Hall as well as new lights and air conditioning for the new art gallery (which will run 24/7) there is an opportunity to meet some of this new load with solar PV on the north-facing roofs off Roxy Lane, with consideration of any heritage issues that apply.</p> <p>Sizing may be best determined after a period of operation of the new art gallery.</p>
Kyogle Historical Museum (?)	Solar PV	<p>This newly refurbished building (former depot site on Bloore Street) has an ideal north-facing roof that can host a solar array. Ideal sizing is unknown and would best wait for up to 12 months of operation including summer 2019/20 when both energy use and utilisation of the site should be reviewed. The site may be a good candidate for a solar + battery solution with likely intermittent but regular use.</p>
Kyogle Library	HVAC	<p>The main air conditioning unit is a Temperzone OSA390R unit with the condenser unit located on the Bloore Street side of the building. This unit has a 39 kW cooling capacity, a coefficient of performance of 2.69 at manufacture, and uses R22 refrigerant (banned excepting ~45 tpa for servicing systems until 2029). Long term plans to replace this can see sizeable % savings made with selection of an energy efficient PAC.</p>
Kyogle Senior Citizens	Solar PV	<p>This site was not on the list of council's electricity accounts.</p> <p>A 5 kW solar PV system and solar hot water are installed, and load is most likely intermittent (lights and AC) but with base demand for refrigeration and a freezer. More solar with battery storage will be a good long term option for this site, with space within the building perimeter to locate a battery.</p>

6.3 Long term action plan

TABLE 6: KYOGLE COUNCIL LONG TERM PLAN

Site	End use equipment	Energy saving option
Bonalbo Dam and Water Treatment	Solar PV	Both locations are possible long term options for floating solar arrays, though costs for this solution would need to be considerably lower than at present to justify it given that power would be exported to grid and therefore worth much less than if consumed on site.
Off Stream Storage		
Council Chambers	HVAC	With solar PV and LED lighting implemented, upgrading HVAC is the remaining significant energy saving measure for this site. The 4 x Mitsubishi City Multi units are fairly old though appear to be in reasonable condition. Energy savings potential of 20-30% will be possible when these are replaced, equating to less than 10 MWh per year. Hence this is not a high energy-saving priority and replacement will be justified when the current plant fails.
Off Stream Storage	Micro-hydro	Subject to initial assessment of the feasibility of this at the 2 locations at and close to the off stream storage these may be long term project options for Council.

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	<p>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.</p> <p>The opportunities for Council to improve the energy efficiency of air conditioning include:</p> <ul style="list-style-type: none"> - 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 installation 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) - Making caravan park residents aware of air conditioning upgrade incentives that may encourage them to replace old inefficient systems
Council facilities / buildings	Power & appliances	<p>Power and appliances represent a fairly modest % of Council's electricity use, ranging from commercial kitchens, to servers that run 24/7, office equipment such as computers, copiers and printers, to appliances like fridges, boiling water units, microwaves, dishwashers and televisions.</p> <p>The opportunities for Council to continue to improve the energy efficiency of office equipment and appliances include:</p> <ul style="list-style-type: none"> - Implement sustainable procurement practices based on the 2017 Sustainable Procurement Guide for NSW local governments - Making caravan park residents aware of appliance replacement program incentives that may encourage them to replace old inefficient fridges and TVs (https://www.nsw.gov.au/news-and-events/news/energy-rebates-for-households-and-businesses/)

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 (note Excel workbook is supplied):

- Export of solar energy generation is taken to be 20% with 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 \$1.50/watt installed
- Net present value and internal rate of return are calculated over a 25 year life, with maintenance and inverter replacement costs taken into account

TABLE 8: SUMMARY FINANCIAL ANALYSIS OF SOLAR PV OPPORTUNITIES

Site	Size	Capex	Self-consumed	Export	Savings Yr1	Payback	NPV (7% DCF)	IRR
Bonalbo Dam and Water Treatment (ground mount)	50.30 kW	\$75,450	67.42 MWh	16.86 MWh	\$19,500	4.11 Years	\$126,527.79	24%
Bonalbo Dam and Water Treatment (WTP roof)	9.05 kW	\$10,860	10.94 MWh	2.73 MWh	\$3,163	3.64 Years	\$21,856.76	27%
Kyogle Tourist Information Centre	5.03 kW	\$6,036	5.89 MWh	1.47 MWh	\$1,358	4.81 Years	\$7,518.14	20%
Kyogle Sewerage Treatment Works	5.03 kW	\$6,036	6.00 MWh	1.50 MWh	\$1,736	3.69 Years	\$11,918.06	27%
Kyogle filtration plant	23.80 kW	\$28,560	30.78 MWh	7.69 MWh	\$9,809	3.07 Years	\$74,273.97	32%
Kyogle Pool	10.10 kW	\$12,120	11.97 MWh	2.99 MWh	\$2,658	4.96 Years	\$14,223.96	19%
Kyogle Caravan park (residence)	5.03 kW	\$6,036	5.40 MWh	1.35 MWh	\$1,225	5.35 Years	\$6,129.71	18%
Kyogle Caravan park (amenities)	9.38 kW	\$11,256	11.48 MWh	2.87 MWh	\$2,606	4.68 Years	\$14,694.99	21%
Kyogle Library	10.10 kW	\$12,120	11.51 MWh	2.88 MWh	\$3,329	3.86 Years	\$22,291.97	25%
Woodenbong Treatment Works	10.10 kW	\$15,150	13.10 MWh	3.27 MWh	\$3,788	4.25 Years	\$24,064.74	23%
Kyogle Memorial Hall	15.10 kW	\$18,120	18.39 MWh	4.60 MWh	\$5,319	3.62 Years	\$36,908.42	27%
Kyogle Historical Museum	10.10 kW	\$12,120	12.25 MWh	3.06 MWh	\$3,542	3.63 Years	\$24,523.56	27%
TOTAL (excl Bonalbo WTP roof mount)	154 kW	\$203,004	194 MWh	48.6 MWh	\$54,870	3.70 Years	\$363.075	~25%

Images of modelled arrays are shown in Appendix A. Copies of all Helioscope modelling are provided as separate files to Kyogle 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 can 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

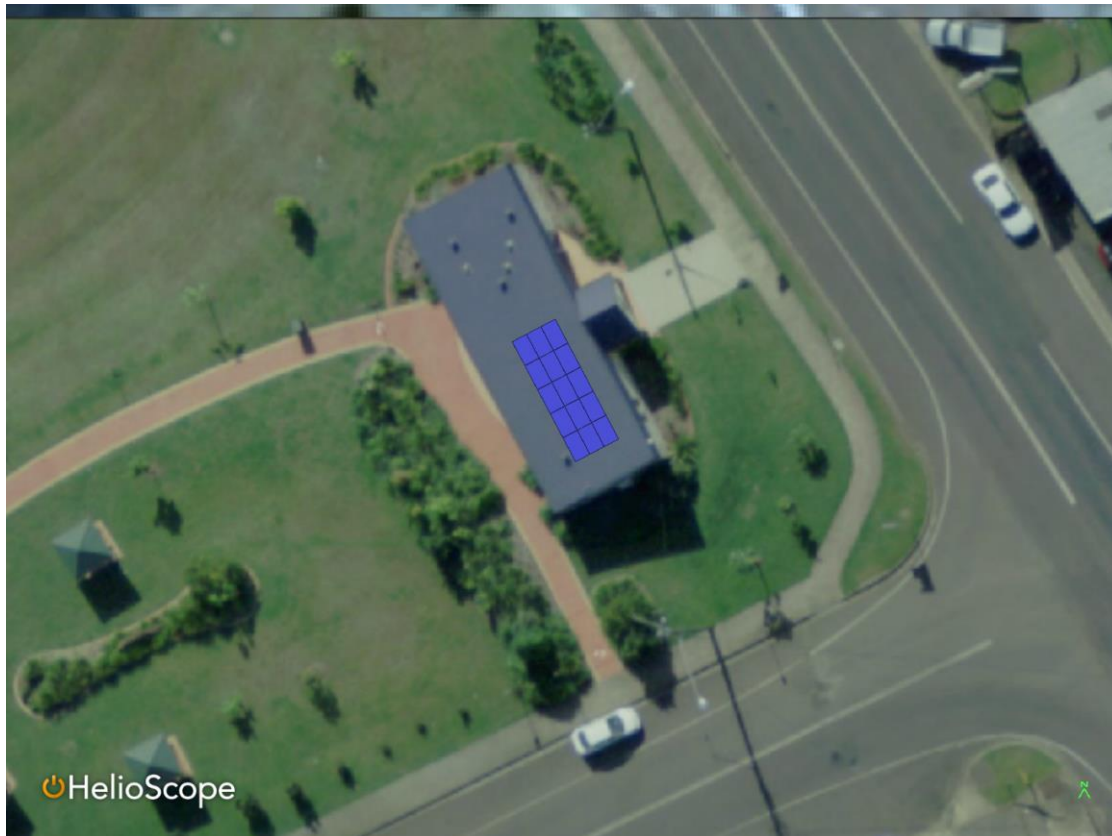
Site	Current technology and quantities (approx.)	Energy and cost savings with LED upgrade	Capital cost estimate	Simple payback estimate
Bonalbo Dam and Water Treatment	14 twin 36W linear fluorescent fittings	800 kWh per year and \$250 incl maintenance	\$1,250	5 years
Kyogle Pool	23 single 36W and 2 twin 36W linear fluorescent lamp fittings.	1,600 kWh per year and \$500 incl maintenance	\$2,000	4 years
Kyogle Library	25 twin 36W linear fluorescent fittings, 4 twin 18W linear fluorescent fittings, 15 external mercury vapour or metal halide lights (dusk to dawn), and compact fluorescents both indoors and in outdoor bollards.	7,000 kWh per year and \$2,000 incl maintenance	\$10,000	5 years
Kyogle Tourist Information	11 twin 36W recessed fluorescent light fittings.	1,500 kWh per year and \$450 incl maintenance	\$1,500	~3 years
Off Stream Storage	15 twin 36W fluorescent lamp fittings.	800 kWh per year and \$250 incl maintenance	\$1,350	> 5 years
Kyogle Works Depot	Consider installing dimming on the external lights so they drop to a low level at night (not off) and ramp up in response to movement.	2,000 kWh per year and \$400	\$2,000	5 years
Kyogle Memorial Hall	The Hall has approx. 10 twin 36W fittings, 2 twin 58W fittings with additional lights in the bathrooms. The downstairs hall / kitchen has a further 7 twin 36W fluorescent lamp fittings.	1,500 kWh per year and \$450 incl maintenance	\$1,800	4 years
Kyogle Senior Citizens	~32 twin 36W linear fluorescent fittings, both ceiling-recessed and surface mounted battens. A small number of single 36W fittings are also installed.	2,000 kWh per year and \$600 incl maintenance	\$3,000	5 years
TOTAL		17,200 kWh per year and \$4,900 incl maintenance	\$22,900	4.67 years

Appendix A: Solar PV modelled sites

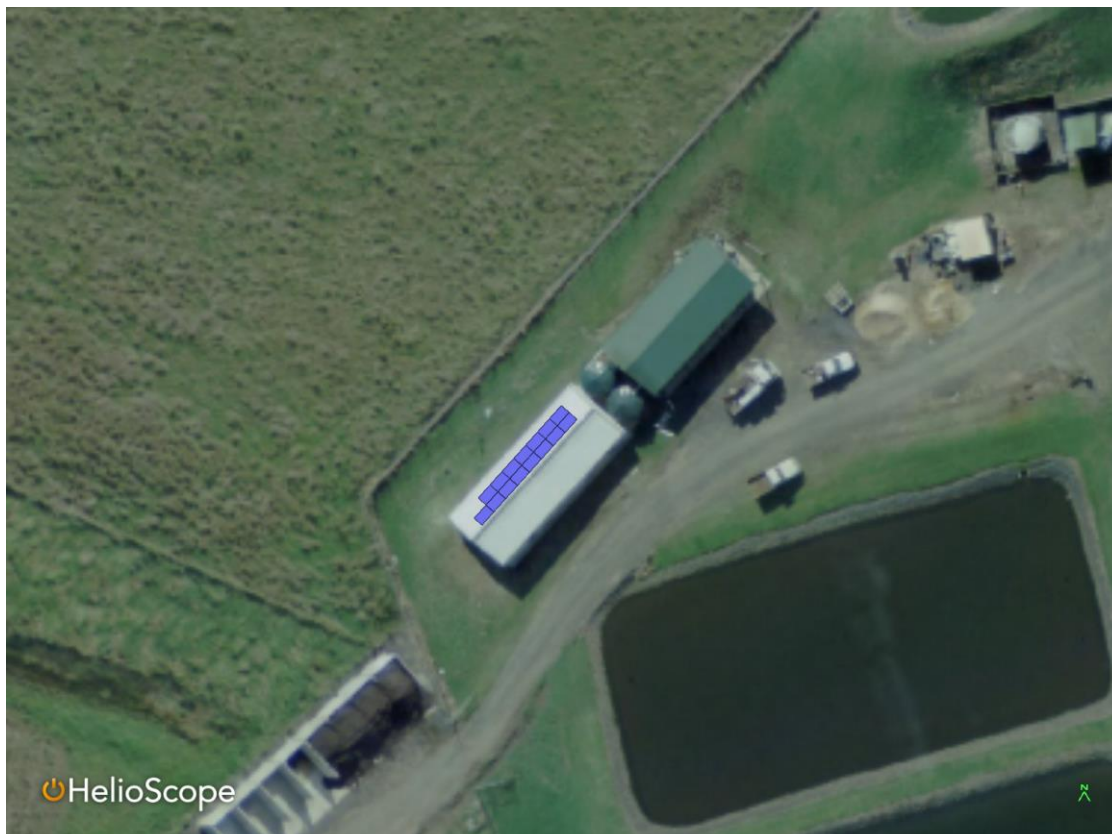
Bonalbo Dam and Water Treatment (ground and roof mount options)



Kyogle Tourist Information Centre



Kyogle Sewage Treatment Works



Kyogle Filtration Plant



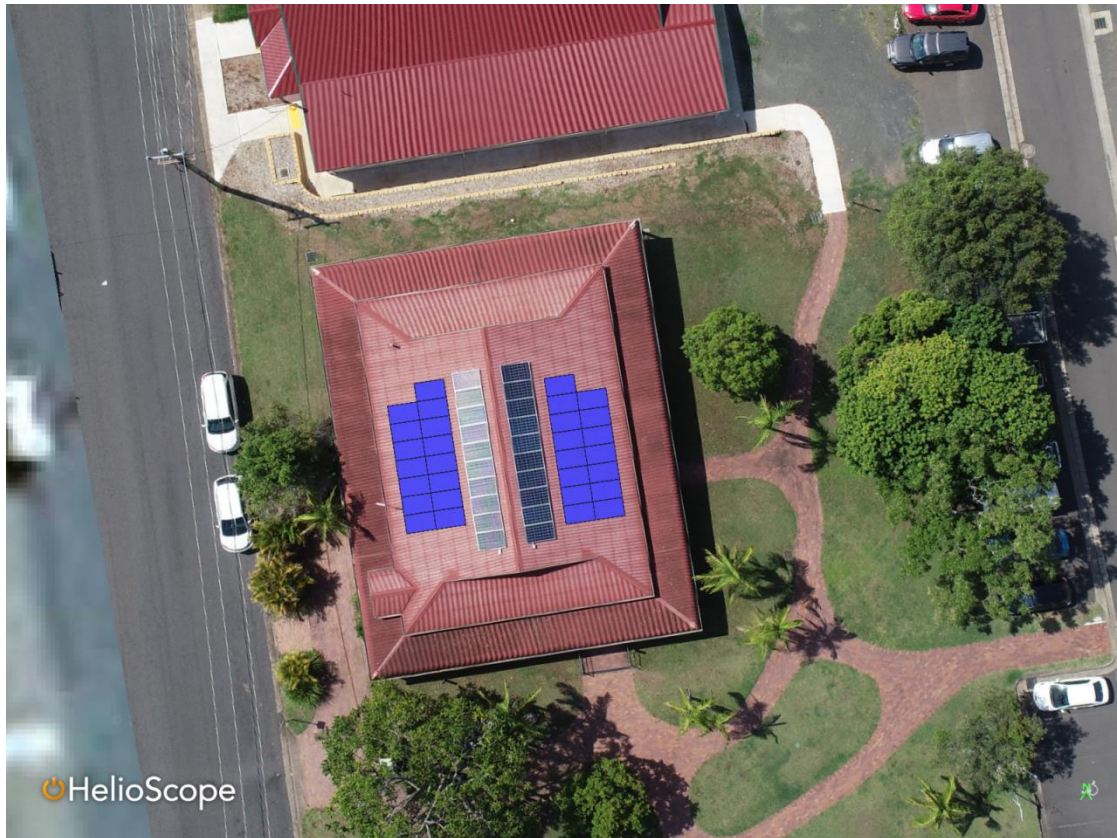
Kyogle Pool



Kyogle Caravan Park (residence and amenities block)



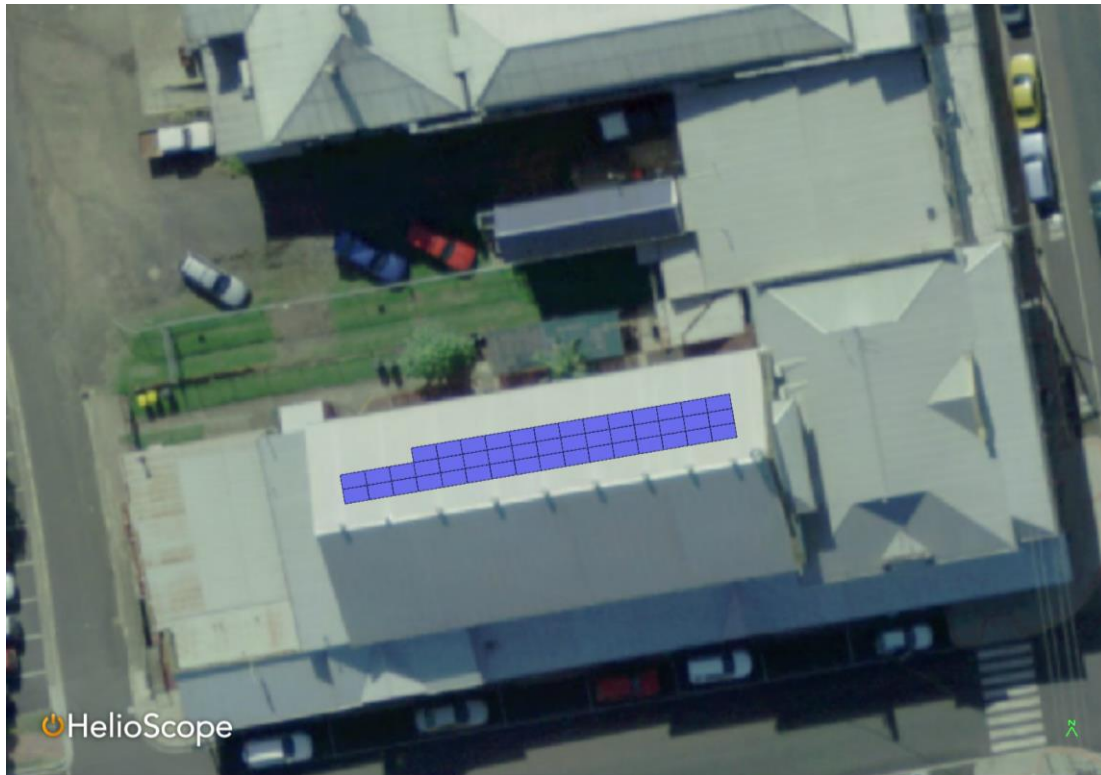
Kyogle Library



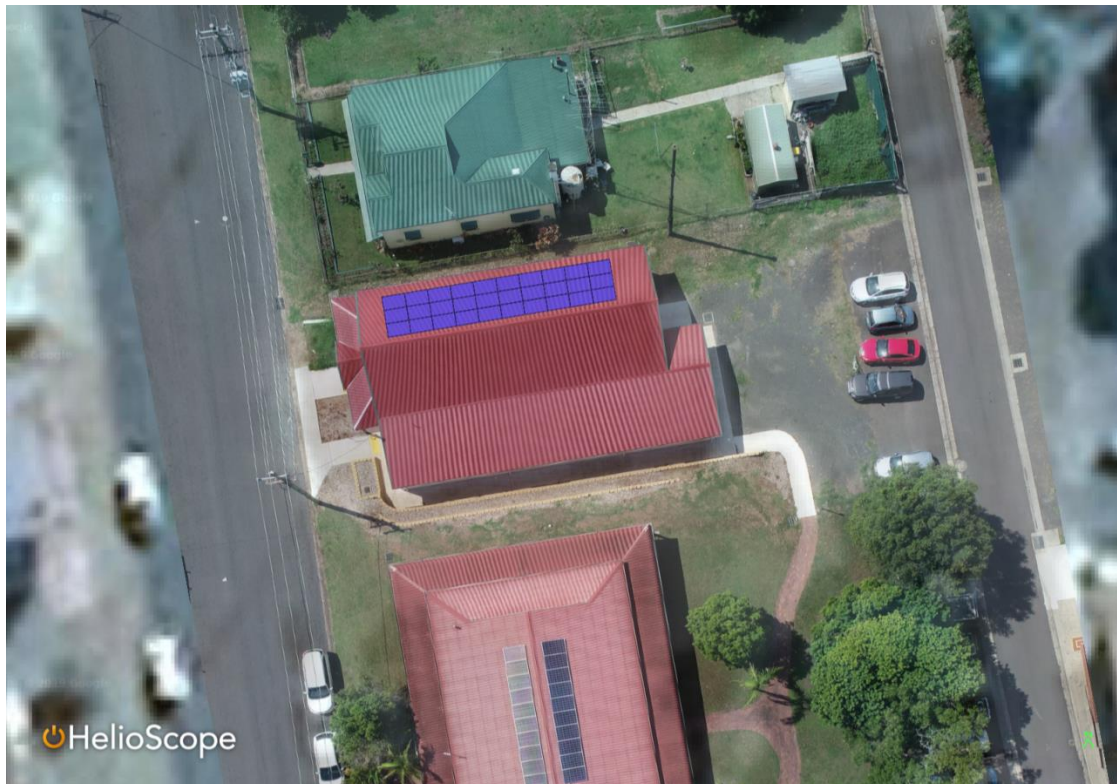
Woodenbong Treatment Works

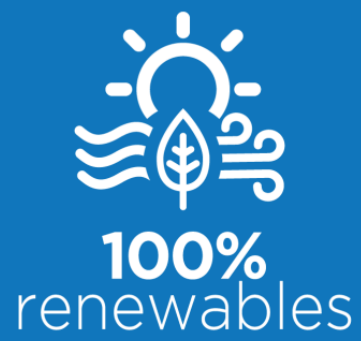


Kyogle Memorial Hall



Kyogle Historical Museum





Level 32, 101 Miller Street
North Sydney 2060

www.100percentrenewables.com.au