100% Renewables

Renewable Energy Action Plan

LGA: Glen Innes Severn Council

Final Report

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1

Introduction

1 Executive summary

100% Renewables was engaged by Glen Innes Severn Council to develop a Renewable Energy Action Plan (REAP) to enable Council to identify and prioritise opportunities that will help it to cost-effectively increase the amount of renewable energy at its facilities and lower energy demand.

The project included four steps as outlined below.

FIGURE 1: FOUR-STEP PROCESS TO DEVELOP GISC'S RENEWABLE ENERGY ACTION PLAN

Drivers for the development of the REAP are numerous and include:

- Globally, emissions are rising and will lead to unprecedented warming in coming decades, with consequences for all regions, including Glen Innes Severn. Acting in concert with other to reduce emissions provides the best opportunity to mitigate this risk.
- The REAP builds on past and continuing work by Council to improve energy efficiency and implement renewables, and puts a framework around future actions that can drive further action.
- The REAP complements action by the Glen Innes Severn community. Some 23.8% of dwellings in the Glen Innes Severn LGA have installed solar PV as of December 2019. This places the LGA in the mid to upper end of NSW councils in terms of the number of residents taking up solar panels. In addition to 984 residential systems, there have been 65 installations of 10-100 kW in capacity, which tend to be commercial-scale systems, plus two systems greater than 100 kW in scale. Total installed capacity is 5,337 kW not including the White Rock wind farm.
- Efficiency and renewables are cost-effective and deliver high returns for invested funds.
- Many local Councils around NSW and across Australia have taken leading positions to reduce their own emissions and act as leaders for their communities (see below).

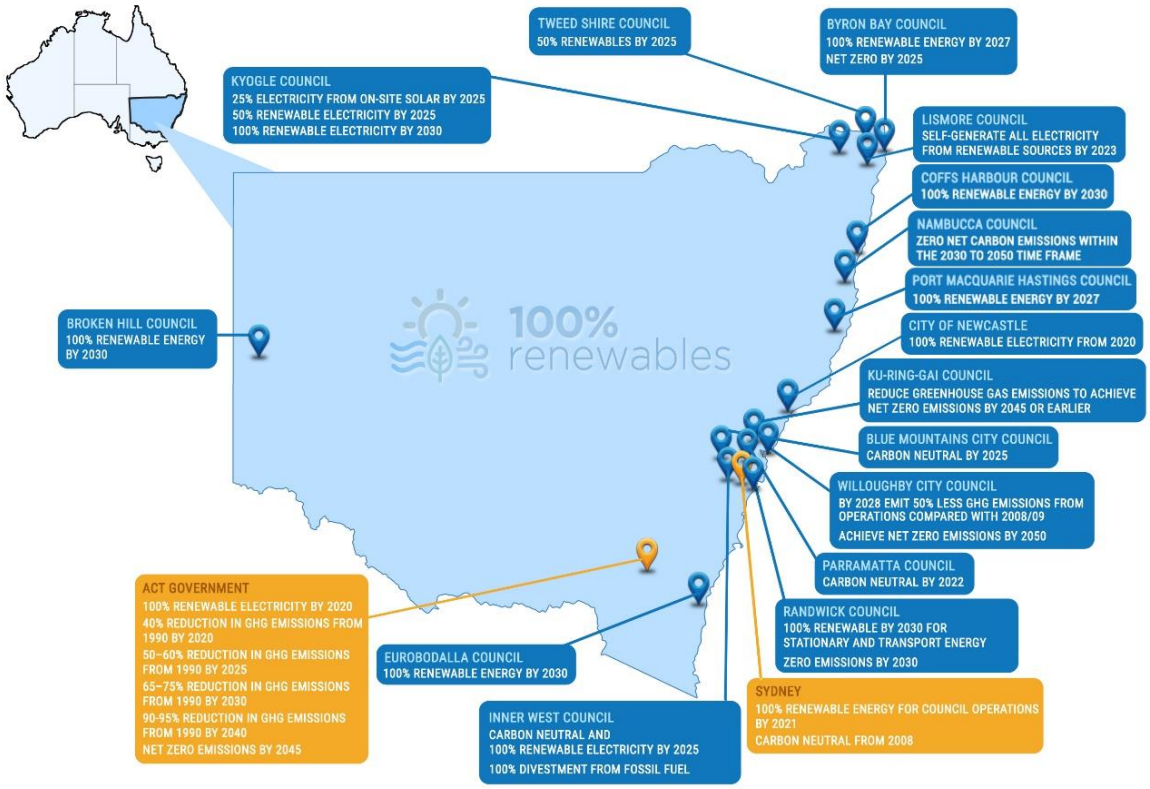


FIGURE 2: RENEWABLE ENERGY & CARBON TARGETS BY NSW COUNCILS & ACT

1.1 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 were excluded. In 2018/19 Council's carbon footprint was dominated by electricity consumption and diesel fuel consumption.

TABLE 1: COUNCIL'S ENERGY USE AND CARBON FOOTPRINT 2018/19

	Emission source	Activity data	Units	Total t CO_2-e	%
	Diesel for fleet	369	kL	1,055 t CO2-e	36%
	Petrol for fleet	35	kL	85 t CO2-e	3%
	Ethanol for fleet	2	kL	0.02 t CO2-e	0%
	LPG	56	kL	92.6 t CO2-e	3%
	Electricity used in council assets	1,547,141	kWh	1,423 t CO2-e	48%
	Electricity used by streetlighting	328,460	kWh	302 t CO2-e	10%
	TOTAL:			**2,958 t CO2-e**	**100%**

Electricity use is dominated by a small number of large sites and many small electricity using sites. Energy use data can also be organised based on high energy-using asset classes.

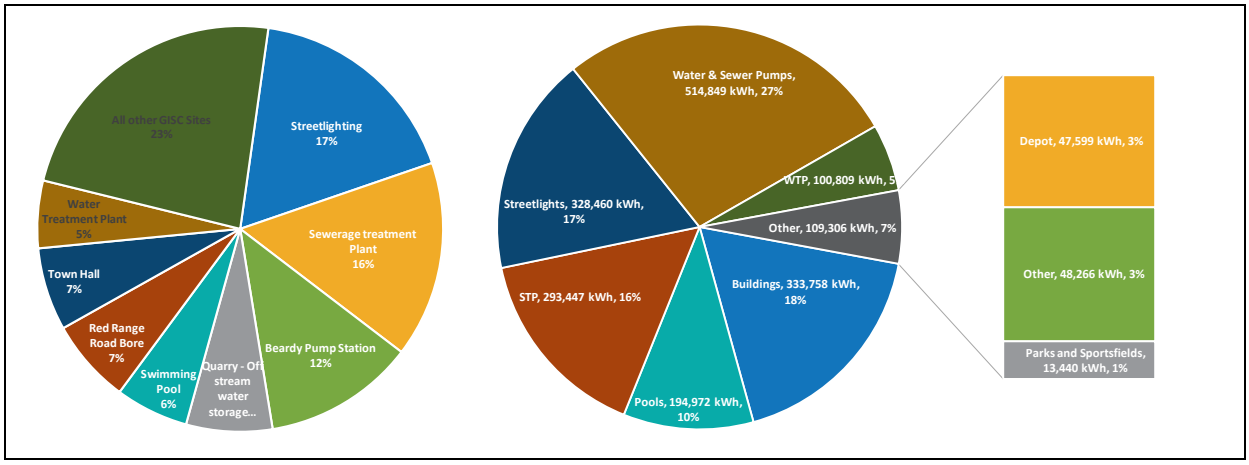


FIGURE 3: GLEN INNES SEVERN COUNCIL LARGE ELECTRICITY USING SITES & ASSET CLASSES

Diesel fuel use is mainly from two bulk fuel tanks that supply Council plant and large vehicles. The balance of diesel, as well as petrol, fuel smaller vehicles including passenger cars and utes.

LPG is supplied to 18 accounts across Council, however 86% of LPG is consumed at the Glen Innes pool and this is the only site where this is considered in this Plan.

1.2 Renewable Energy Action Plan for GISC

Focused on energy consumption, a renewable energy plan for Glen Innes Severn Council comprises of three main elements organised into short, medium and long term plans tabulated below:

1. Onsite energy efficiency and renewable energy
2. Renewable electricity purchasing, and
3. Sustainable transport energy

Assessment of energy efficiency and renewable energy opportunities was largely based on site visits to 16 of Councils largest energy-using sites, plus street lighting. These assets account for 94% of electricity use and 86% of gas use in Council. Opportunities to continuously incrementally improve energy efficiency via sustainable procurement and incremental improvements at smaller sites were also discussed. The current and emerging market for renewable energy power purchasing, as well as emerging trends and opportunities in vehicle electrification were assessed with reference to Council's energy use.

The outcome from this assessment of opportunities includes:

- 33 actions to improve efficiency and install renewable energy (and later on battery storage) across 16 sites plus streetlights.
- Continuous improvement actions across lighting, air conditioning and IT systems.
- Identified actions in the short, medium and long term that will help Council to engage with, develop and implement opportunities for renewable energy purchasing and sustainable transport.

1.2.1 Short term action plan

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, a suggested short-term action plan for Glen Innes Severn Council is outlined below.

TABLE 2: GLEN INNES SEVERN COUNCIL SHORT TERM PLAN (2019/20, 2020/21, 2021-22)

Site	Category	Energy saving option
Emmaville Mining Museum	Solar PV	Install 2 kW solar PV system on the main roof
Emmaville Mining Museum	Energy Efficiency	Replace all lights in the museum with LED technology
Emmaville Pool	Energy Efficiency	Investigate the scope for energy savings from VSD control of the main pool pump
Glen Innes new sports stadium	Design	Work with Council's architect to maximise energy efficiency and incorporate solar PV and potentially battery storage (Council should also seek any grant assistance that could make this feasible – for e.g. if the stadium would also serve as an evacuation centre then support to energy storage may be available)
Glen Innes Pool	Tariff and Electricity Contract	Based on the size of energy consumption, review the costs of being on a large site contract and time-of-use network tariff, compared with the single rate offered at this time. Interval data may be needed to enable this to be assessed accurately given the likely high level of offpeak power use. Note that at this time rates for both options may be similar.
Glen Innes Pool	Energy Efficiency	Investigate the scope for energy savings from VSD control of the pools pumps
Glen Innes Pool	Fuel Switching & Solar PV	Investigate the case for replacing solar matting and gas boilers with heat pumps and roof-mounted solar PV. Include an assessment of just switching from gas boilers to heat pumps and leaving solar matting in place, with ground mount solar on the northern end of the complex.
Glen Innes Depot	Energy Efficiency	Replace all lights in the depot with LED technology
Glen Innes Town Hall	Energy Efficiency	Replace all lights in the Town Hall and adjacent offices with LED technology
Glen Innes Town Hall	Solar PV	Install 20 kW solar PV on the stage roof at the rear of the Town Hall building
Glen Innes Visitor Information Centre	Energy Efficiency	Upgrade all lights to LED in the VIC and bus station and control outside lights on a PE cell
Glen Innes Visitor Information Centre	Solar PV	Install a 5 kW solar array on the roof of the VIC (north slope at the main entrance or potentially on the west side
Glen Innes Water Treatment Plant	Solar PV	Install 20 kW solar array at the WTP (subject to roof condition assessment)
Glen Innes - New bore (quarry)	Solar PV	Install a ground mount solar array to meet the new bore's daytime energy demand. Sizing

		will be confirmed based on design flow, pump demand and run times.
Glen Innes – Red Range Bore	Tariff and Electricity Contract	Based on the size of energy consumption, review the costs of being on a large site contract and time-of-use network tariff, compared with the single rate offered at this time. Interval data may be needed to enable this to be assessed accurately given the likely high level of offpeak power use. Note that at this time rates for both options may be similar.
Streetlighting	Energy Efficiency	Upgrade all non-LED streetlights to LED technology in line with the proposal received from Essential Energy.
Transport	Planning	Review short, medium and long term strategies to reduce emissions from transport. Continue to support the development of EV charging infrastructure on Council land and by supporting local businesses. Assess the costs and benefits of hybrid passenger cars within council's petrol fleet for new leases.
Electricity	Purchasing	Become more informed about renewable energy purchasing via PPAs – e.g. via Council's energy advisor/s, by joining groups such as the Business Renewables Centre – Australia (BRC-A – free) and by engaging with other Councils in your region and with some who have signed PPAs. Consider forming or joining a buyers' group that is interested in investigating and pursuing renewable energy PPAs and engaging with retailers and market experts to progress this opportunity over time.

1.2.2 Medium term action plan

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, a suggested medium-term action plan for Glen Innes Severn Council is outlined below

TABLE 3: GLEN INNES SEVERN COUNCIL MEDIUM TERM PLAN (2022/23, 2023/24, 2024/25)

Site	End use equipment	Energy saving option
Glen Innes Depot	Solar PV	Install 12 kW solar for the main building (modelling was performed with this on the roof facing Coronation Ave)
Glen Innes Offstream Storage	Solar PV	Install a further 50 kW solar PV subject to confirmation with Essential Energy of any limitations there may be on this expansion
Deepwater Water Treatment	Solar PV	Install ground mount solar PV system to serve the WTP – a 3 kW system was modelled but options from 3 kW to 5 kW should be investigated

Glen Innes Sewerage Treatment Plant	Power Factor	Install ~50 kVAr of PC equipment to correct power to 1.
Glen Innes Sewerage Treatment Plant	Solar PV	Install 50 kW of ground-mount solar PV at the STP in addition to the 12 kW system already installed.
Transport	Electric Fleet	Implementation of sustainable transport measures, potentially including increased switch to hybrid passenger vehicles and utes, and potentially one or more electric passenger vehicles. Review sustainable transport plans as this area is evolving rapidly.
Electricity	Purchasing	Progress (if feasible financially) with the procurement of a proportion of Council's electricity from renewables, alone or in a buyers' group (e.g. with other local councils).

1.2.3 Long term action plan

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, a suggested long-term action plan for Glen Innes Severn Council is outlined below

TABLE 4: GLEN INNES SEVERN COUNCIL LONG TERM PLAN (AFTER 2024/25)

Site	End use equipment	Energy saving option
Emmaville Mining Museum	Solar PV + Battery	Install a further 2 kW solar PV system on the main roof plus 5 kWh battery
Emmaville pool	Solar PV + Heat Pump	Subject to additional pool heating being considered in future (e.g. to extend open season), evaluate PV and heat pump options.
Glen Innes RFS (not Council asset)	Solar PV + Battery	The RFS buildings may have capacity for more solar and storage in future that could largely meet the energy needs of the facility – subject to any constraints placed by Essential Energy.
Glen Innes Saleyards	Energy Efficiency	Replace all lights in the saleyards with LED technology (potential future project or replace on fail).
Glen Innes Depot	Solar PV + Battery	Install a further 13 kW solar and a battery to meet most of the main building energy demand.
Glen Innes Depot	Battery for existing solar PV system	Install a battery on to the small account solar PV system to reduce export to grid.
Glen Innes Town Hall	Solar PV + Battery	Install an additional 20 kW of solar PV on the north facing roof of Town Hall, plus a 30 kWh battery to meet more of the site's energy demand.
Glen Innes Visitor Information Centre	Solar PV + Battery	Install an added 5 kW solar PV on the west roof of the VIC plus a 10 kWh battery to service the VIC account.

Glen Innes Water Treatment Plant	Solar PV + Battery	Install a further 30 kW solar array and a 70 kWh battery at the WTP - location to be determined.
Glen Innes Offstream Storage	Solar PV	Install a further 50 kW solar PV plus 100 kWh battery to meet more of the offstream storage energy demand.
Glen Innes - Beardy River Pumping Station	Energy Efficiency & Solar PV	In the longer term review the optimum location of the river pumps, and evaluate efficiency, VSD and ground mount solar PV opportunities with any re-location – e.g. to Shannon Vale Road
Deepwater Water Treatment	Solar PV + Battery	Expand solar with a battery to meet most of the WTP's energy demand
Transport	Electric Fleet	Progressively migrate fleet to lower and zero emissions where it is technically and financially viable, including passenger vehicles, utes, commercial vans / buses and other operational plant.
Electricity	Purchasing	Progressively increase the amount of renewable energy purchased as part of Council's energy procurement processes.

1.2.4 Continuous improvement measures

In addition to discrete energy saving projects, Council can make further energy use savings and cost savings through its normal procurement processes, by adopting sustainable procurement guidelines for local governments. Recommended actions are outlined below.

TABLE 5: 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 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)
Council facilities / buildings	Power & appliances	Power and appliances represent a fairly modest % of Council's electricity use, including servers that run 24/7, office equipment such as computers, copiers and printers, and appliances like fridges, boiling water units, microwaves, dishwashers and televisions. The opportunities for Council to continue to improve the energy efficiency of office equipment and appliances include: - Implement sustainable procurement practices based on the 2017 Sustainable Procurement Guide for NSW local governments - Making procurement and facilities management / maintenance staff aware of appliance replacement program incentives that may encourage them to replace old inefficient fridges and TVs (https://energysaver.nsw.gov.au/business/discounts-and-incentives)

1.3 Financial analysis summary and potential targets

Costed short and medium-term energy efficiency and renewable energy projects can reduce Council's energy and emissions and be good for Council's bottom line.

- Solar PV projects can reduce Council's electricity use by 322 MWh per year (plus 122 MWh exported to the grid). This will cost an estimated $372,565 and save Council $87,286 annually. These investments would pay for themselves in 4.27 years.
- Energy efficiency projects (including LED streetlights) can reduce Council's electricity use by 91 MWh per year and gas by 1,288 GJ per year. This will cost an estimated $384,659 and save Council $119,576 annually. These investments would pay for themselves in 3.22 years.
- Short and medium-term efficiency and solar projects would also:
    - Reduce grid electricity use by 22%
    - Reduce gas use by 86%
    - Reduce GISC's energy-related greenhouse gas emissions by 15%

The implementation of more solar PV allied to battery storage is a long-term opportunity, which Council should review and cost in 2-3 years' time. This has the potential to progressively reduce grid electricity to a cumulative 30%, and to reduce GHG emissions by GISC operations by more than 20%. Together with expected grid decarbonisation Council could expect to see its emissions reduce by nearly 30% by 2030.

In order to make deeper cuts in its grid electricity consumption and its energy-related GHG emissions, Council will also need to progress towards renewable energy power purchasing (PPAs) and to begin to decarbonise its fleet, beginning with passenger vehicles and utes over the next decade.

With numerous PPAs already in place, including by local governments, this is an opportunity that can be progressed as part of Council's next and subsequent electricity procurement cycles. This could seek to source 50% up to 100% of Council's electricity from renewables.

Decarbonising Council's road plant and heavy fleet is more challenging, and it will be difficult to make deep cuts to diesel emissions by 2030.

Taking all the opportunities available to Glen Innes Severn Council together, the following are suggested targets for Council to consider:

- By 2025, reduce grid electricity consumption by 25% through energy efficiency and onsite renewable energy
- By 2025 source at least 50% of Council's grid-delivered electricity from renewables, and up to 100% where cost-effective and incurring no added risk to Council
- By 2030 source 100% of Council's grid-delivered electricity from renewables where cost-effective and incurring no added risk to Council
- By 2025, reduce energy-related greenhouse gas emissions by 40%, inclusive of actions by Council and decarbonisation of the electricity grid
- By 2030, reduce energy-related greenhouse gas emissions by 70%, inclusive of actions by Council and decarbonisation of the electricity grid

2 Introduction and Scope of Work

100% Renewables was engaged by Glen Innes Severn Council to develop a Renewable Energy Action Plan (REAP) to enable Council to identify and prioritise opportunities that will help it to cost-effectively increase the amount of renewable energy at its facilities and lower energy demand.

The scope of this project is outlined below, which shows a 4-step process to review data, identify project options, develop cost-benefit analyses, and prepare Council's REAP.

FIGURE 4: FOUR-STEP PROCESS TO DEVELOP GISC'S RENEWABLE ENERGY ACTION PLAN

- **Step 1 – Review Council's energy use and emission sources and establish basic inventory**
  - Historical electricity use, interval data where available, sample energy bills from 2018/19 FY, data for other energy sources, e.g. transport
  - List of Council sites and relevant information (e.g. activity)
  - List and details of major planned capital works with an impact on energy demand
  - Future development plans or known projects that will affect energy demand
- **Step 2 – Identify and assess potential efficiency options, and opportunities to increase use of renewable energy, via consultation and site inspections**
  Consult with management and staff to clarify or establish Council's preferences regarding focus, potential targets, timeframes and resources
  - Two-day site visit period in Glen Innes Severn LGA
  - Preparation of initial list of potential opportunities for review and prioritisation
- **Step 3 – Assess the costs and benefits of potential opportunities and draft the renewable energy plan**
  - Business case analysis for energy efficiency and solar PV opportunities and future solar and battery storage opportunities, including new capital projects
  - Advice on mid-scale and/or renewable energy power purchasing, transport, etc.
  - Review and include a summary of grant, incentive initiatives
- **Step 4 – Finalise the renewable energy plan** including Council's overall strategy and costed short-term quick win opportunities, plus recommended medium and longer-term measures, following feedback and further discussion with Council.

3 Global context for climate action and targets

3.1 Rising carbon emissions and the Paris Agreement

Due to all historical and current carbon emissions global temperatures have increased by ~1°C from pre-industrial levels. The main driver of long-term warming is the total cumulative emissions of greenhouse gases over time. As shown by the *Climate Action Tracker*[1] below, without additional efforts, human-caused carbon dioxide (equivalent) emissions may increase to over 100 billion tonnes annually by 2100, which is double current global emissions. The resulting increase in global temperatures would be up to 4.8°C (as per the IPCC Climate Change 2014 Synthesis Report[2]).

With current policies around the world, global temperatures are projected to rise by about 3.2°C. To prevent dangerous climate change by limiting global warming, close to 200 of the world's governments signed the landmark Paris Agreement. This Agreement underpins science-based targets to limit global temperature increase to well below 2°C by 2050. With current pledges, and if all countries achieved their Paris Agreement targets, it would limit warming to 2.9°C. To limit warming to 1.5°C, carbon emissions must decline sharply in the short-term and reach net-zero by mid-century.

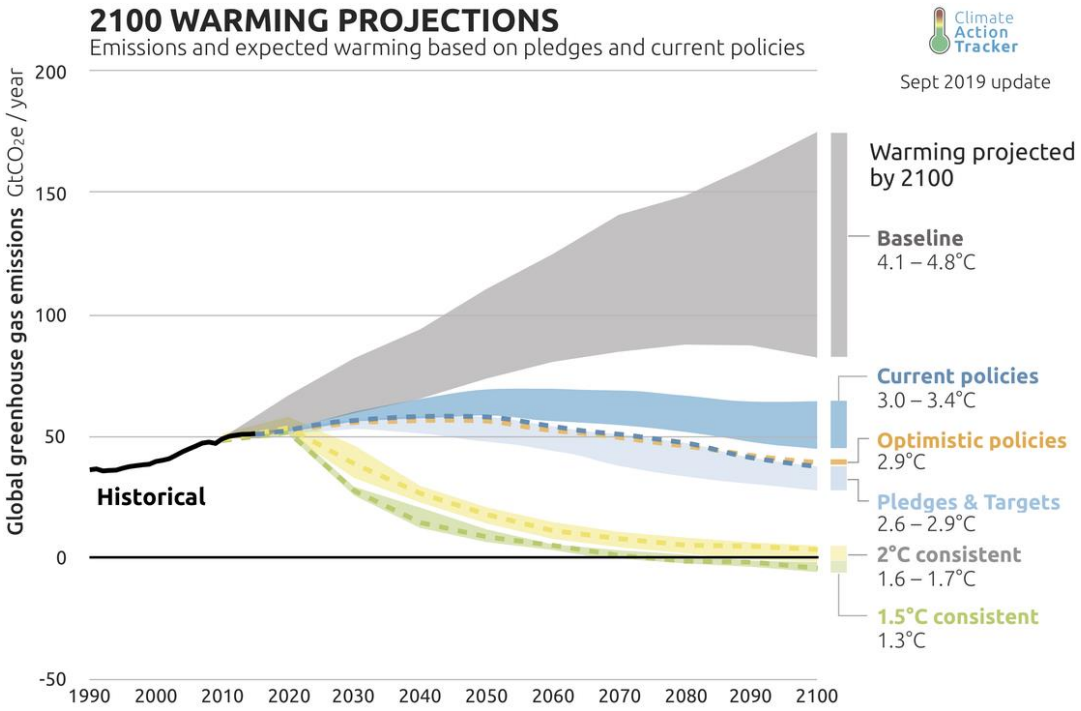


FIGURE 5: THE CLIMATE ACTION TRACKER'S WARMING PROJECTIONS FOR 2100, VARIOUS POLICY SCENARIOS

A net-zero target means that by the target date, there must be no greenhouse gas emissions on a net basis. For a local government's operations for example, this would mean:

1. Net-zero GHG emissions from stationary fuel combustion such as LP gas use, and
2. Net-zero GHG emissions from transport act fuel combustion, and
3. Net-zero GHG emissions from electricity consumption, and
4. Net-zero GHG emissions from the treatment of waste generated by Council

[1] https://climateactiontracker.org/global/temperatures/
[2] IPCC Climate Change 2014 Synthesis Report

3.2 International drivers for climate action

Internationally, there are three primary drivers for urgent action on climate, additional to the second commitment period of the Kyoto Protocol from 2013 to 2020. These are:

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[3]. 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, countries adopted the Paris Agreement at the COP21 in Paris on 12 December 2015, referred to above. 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, and given the grave risks, to strive for 1.5°C Celsius[4].

3. **Special IPCC report on 1.5°C warming (SR15)**

   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[5].

FIGURE 6: GLOBAL CONTEXT FOR ACTION ON CLIMATE

In addition, the World Economic Forum's Global Risks Report 2019[6] highlights adverse climate change-related outcomes as among the most likely to occur with the highest impacts to the global

[3] Sourced from https://www.un.org/sustainabledevelopment/development-agenda/
[4] Sourced from https://www.un.org/sustainabledevelopment/climatechange/
[5] Sourced from https://www.ipcc.ch/news_and_events/pr_181008_P48_spm.shtml
[6] https://www.weforum.org/reports/the-global-risks-report-2019

economy. The chart below from the WEF's report shows several key climate risks clustered in the top right corner; that is, these risks are assessed to be among the most likely to eventuate, with the greatest economic impact among all the global risks that were assessed.

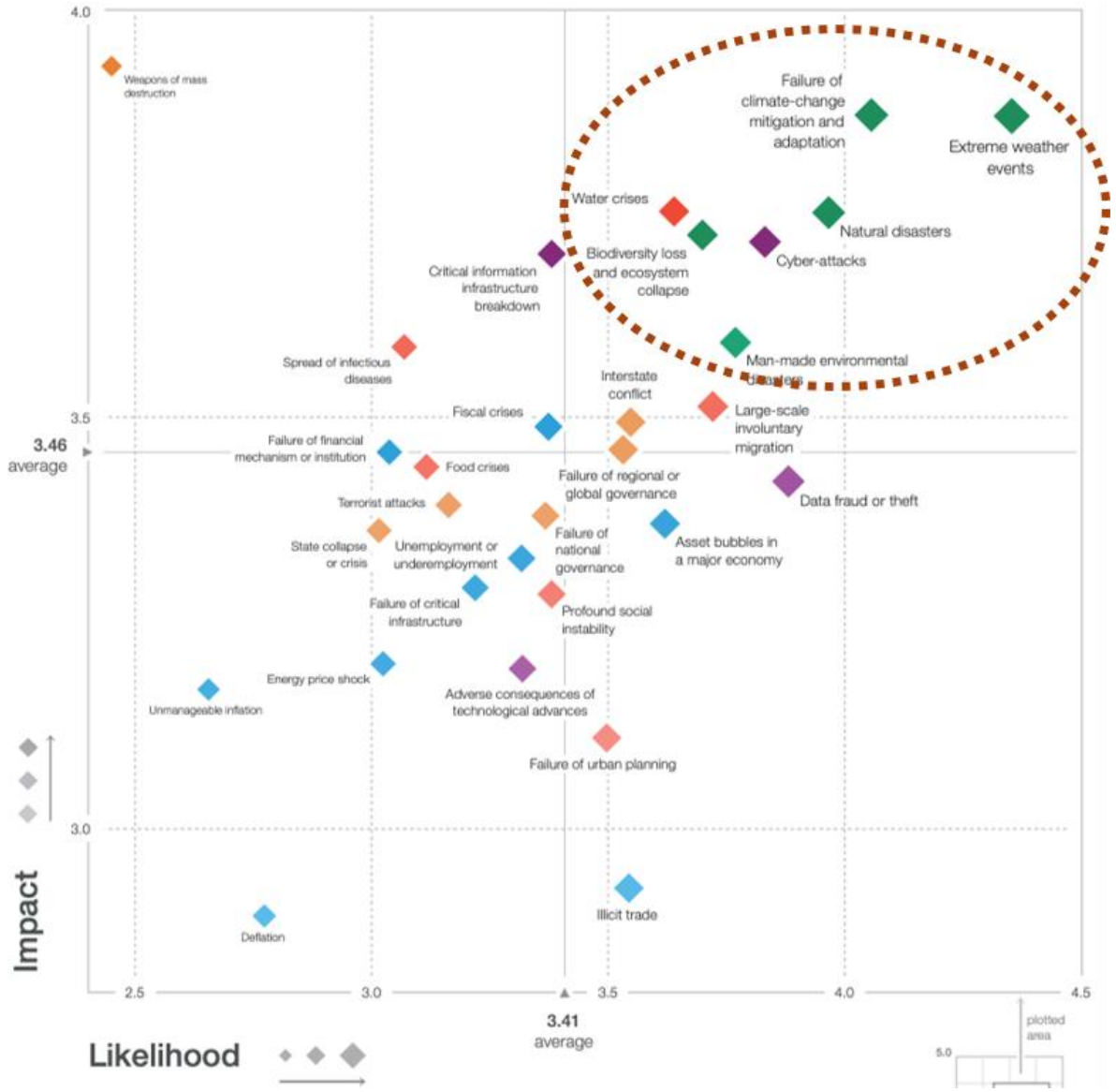


FIGURE 7: GLOBAL RISKS REPORT – LIKELIHOOD & IMPACT OF CLIMATE, OTHER RISKS TO GLOBAL ECONOMY

4 National, States and Local Government action

4.1 National targets

At a national level, Australia's response to the Paris Agreement has been to set a goal for greenhouse gas (GHG) emissions of 5% below 2000 levels by 2020 and GHG emissions of 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 from renewable energy sources by 2020.

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.

The RET is the main successful policy underpinning Australia's climate mitigation efforts. Other key initiatives include the Climate Solutions Fund, formerly the Emissions Reduction Fund, which sources abatement from eligible activities in the economy via periodic auction processes. Despite these initiatives, Australia's GHG emissions have been rising steadily in recent years following a period of emissions reduction at the time of the Global Financial Crisis (GFC) and during the period of Australia's Carbon Pollution Reduction Scheme (CPRS).

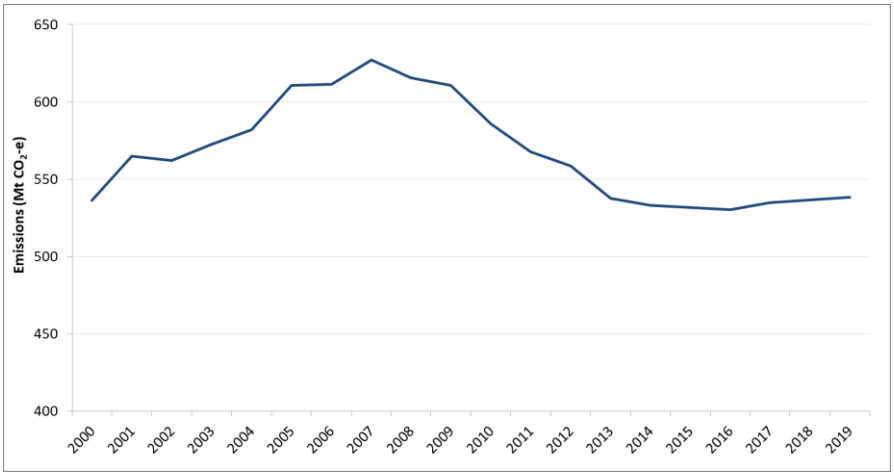


FIGURE 9: AUSTRALIA'S GHG EMISSIONS FROM ALL SOURCES

[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.

4.2 NSW State targets

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

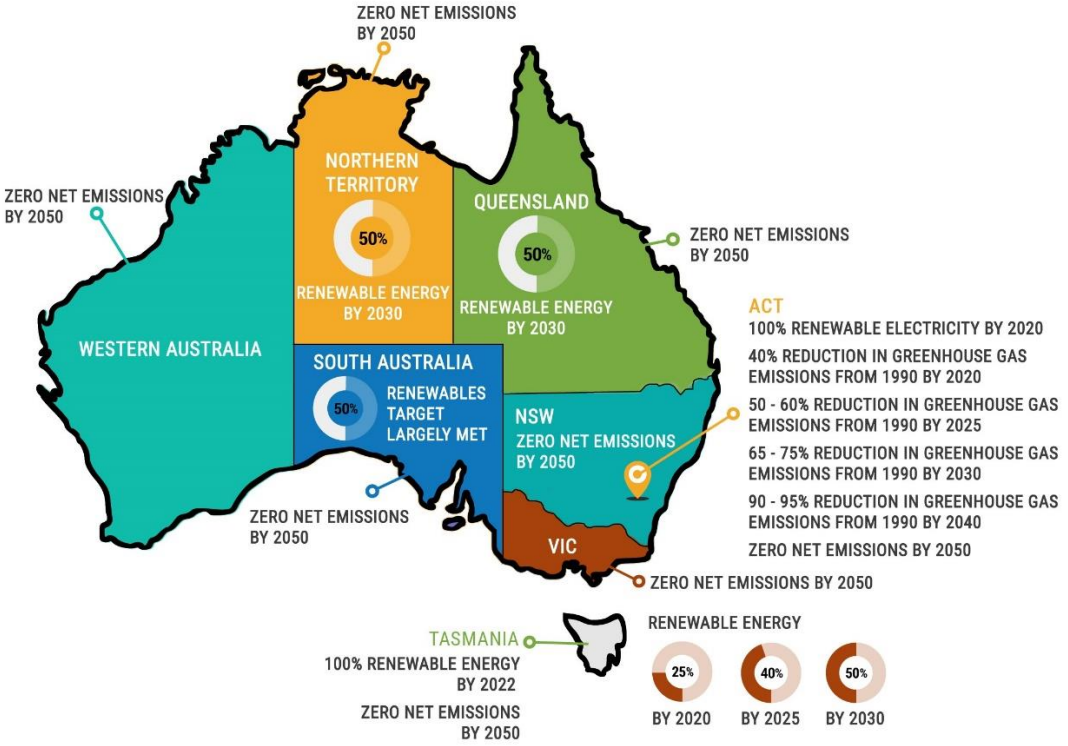


FIGURE 10: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – STATE & TERRITORY LEVEL

The NSW Climate Change Policy Framework[8] outlines the State's target of reaching net-zero emissions by 2050. This 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 several initiatives are currently being progressed with a total funding allocation of $170 million. The five major initiatives being 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.

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

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

The recently released NSW Electricity Strategy will help the State to deliver on these goals, with a 3,000 MW renewable energy zone in the Central West and several demand management measures announced as part of the strategy.

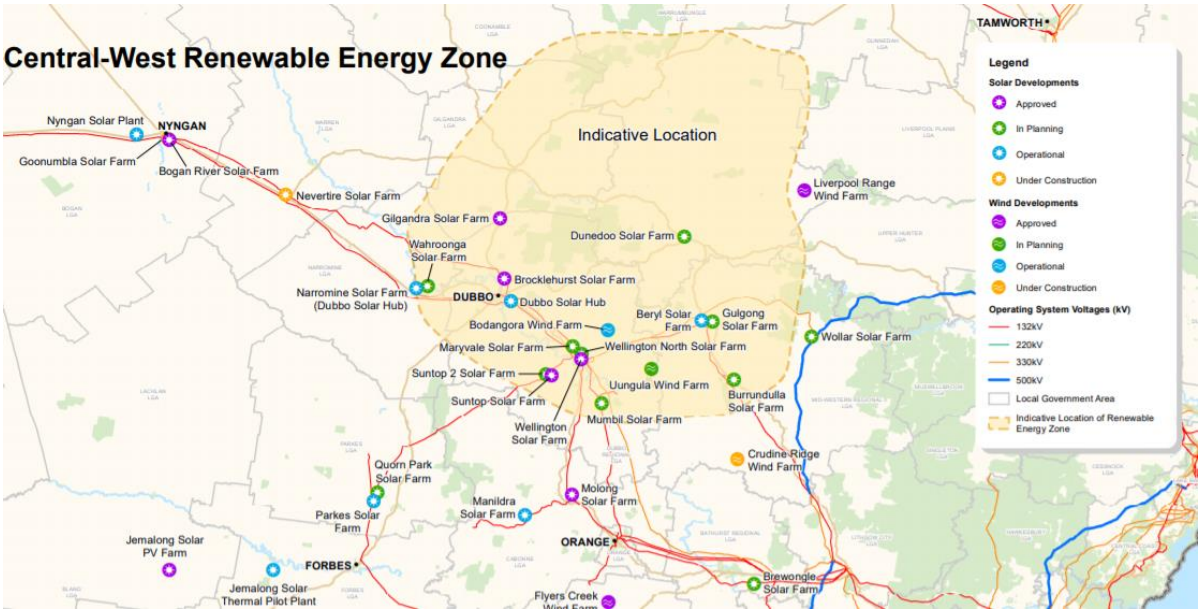


FIGURE 11: INDICATIVE CENTRAL-WEST NSW RENEWABLE ENERGY ZONE

4.3 NSW local governments response to climate change

Much of the leadership on renewable energy and climate in Australia comes from local government. Prominent examples of how local governments are demonstrating leadership are highlighted below.

1. Glen Innes Severn was part of the Northern Lights Project, where seven councils in the Northern Inland region installed LED streetlights, coordinated by Regional Development Australia Northern Inland and funded by the Australian Government. The work was completed in 2015 and replaced a total of 4,566 old high energy local road lights with new LED technology. This initiative preceded a much larger rollout of LED streetlights currently underway.
2. Cities Power Partnership or CPP is an initiative of the Climate Council and it represents Australia's largest local government climate action network with >100 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.

3. Adoption and publication of ambitious targets for renewable energy and/or carbon emissions for Council operations and setting targets for renewables or emissions reduction in the community. The chart below shows the status of target-setting by local councils in NSW (as at October 2019).

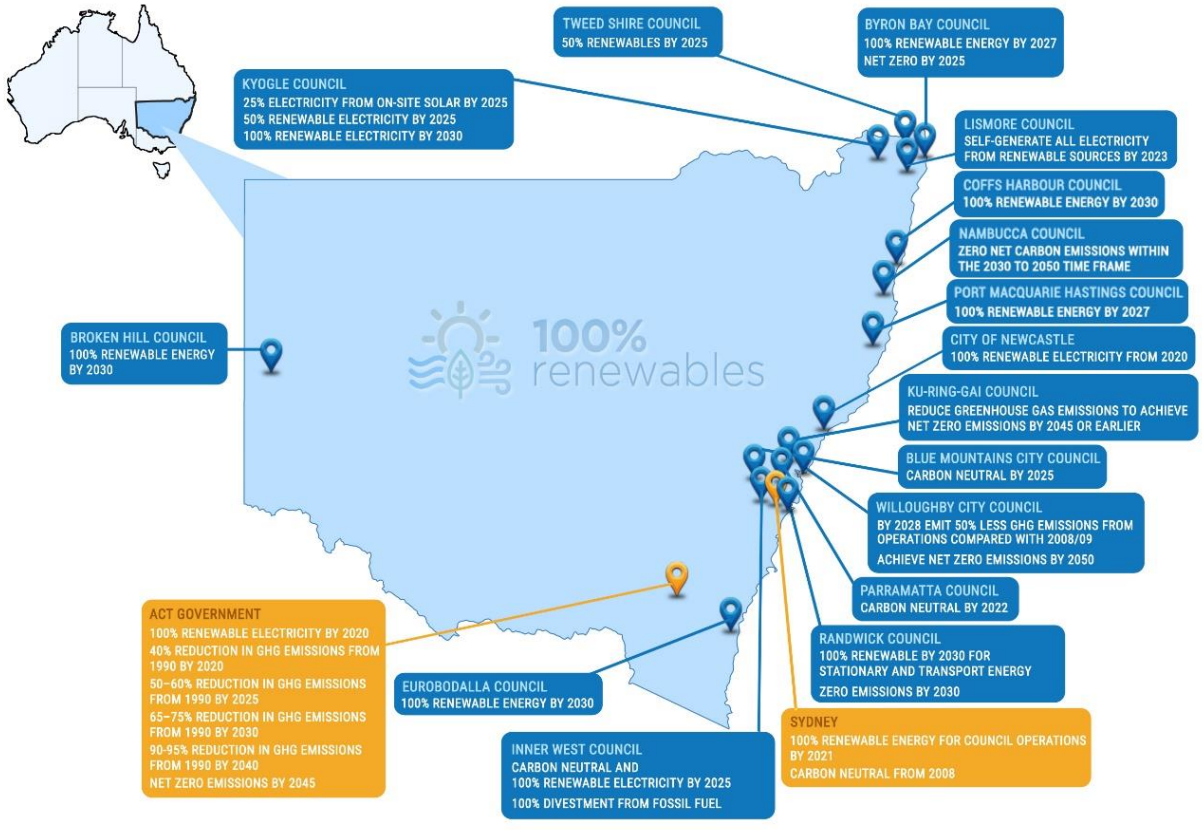


FIGURE 12: RENEWABLE ENERGY & CARBON TARGETS BY NSW COUNCILS & ACT

4.3.1 Current Solar uptake in Glen Innes Severn LGA

Continued falling prices for solar PV, rising electricity prices and the continued availability of financial incentives through the Renewable Energy Target (RET) has made renewable energy technologies

much more affordable for many residents and businesses. The uptake of solar PV has accelerated rapidly in recent years, with around 20% of all NSW households now having solar panels on their roofs.

Some 23.8% of dwellings (APVI http://pv-map.apvi.org.au/) in the Glen Innes Severn LGA have installed solar PV as of December 2019. This places the LGA in the mid to upper end of NSW councils in terms of the number of residents taking up solar panels. In addition to 984 residential systems, there have been 65 installations of 10-100 kW in capacity, which tend to be commercial-scale systems, plus two systems greater than 100 kW in scale. Total installed capacity is 5,337 kW not including the White Rock wind farm.

Local governments surrounding Glen Innes Severn have comparable levels of solar PV uptake, ranging from 20.3% to 30.1% uptake by local communities. The graphic below displays the current (end 2019) solar PV uptake status of the Glen Innes Severn LGA.

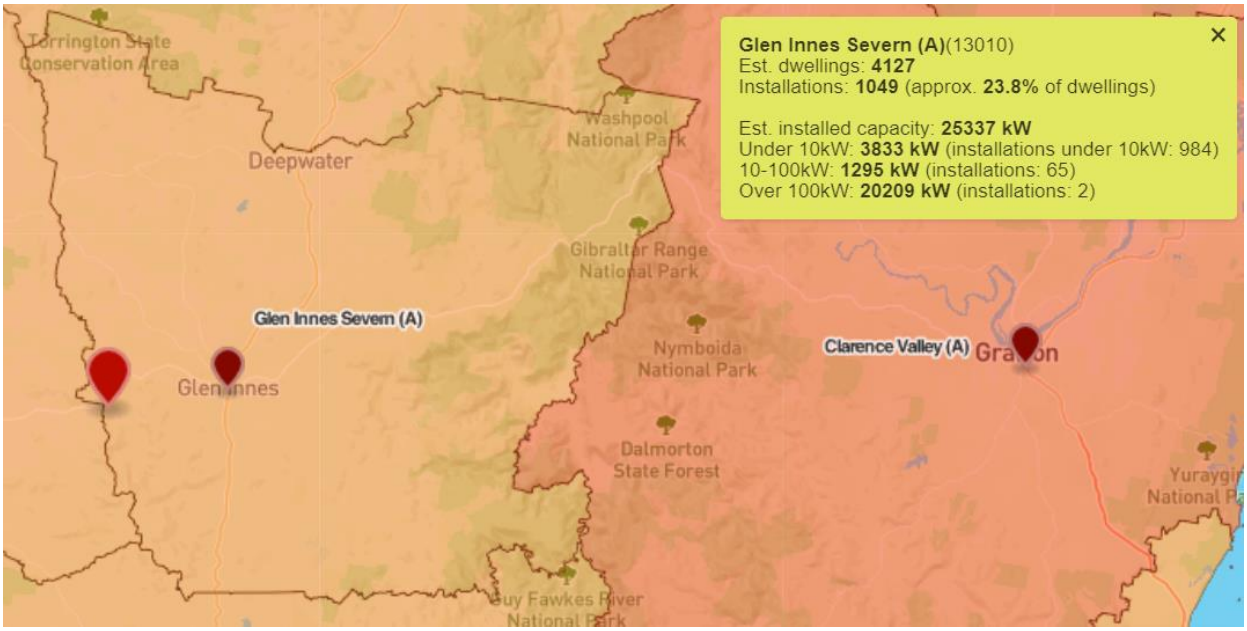


FIGURE 13: SOLAR PV UPTAKE BY GLEN INNES SEVERN (APVI 2019)

4.4 Considerations for possible Glen Innes Severn Council targets

Typically, both renewable energy and carbon emissions are considered in the context of climate targets. For Glen Innes Severn Council this could include:

- Stationary energy including electricity and bottled gas (LPG),
- Transport energy including petrol and diesel for Council vehicles (operational and personal where sourced via Council's leasing arrangements),
- 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/or community / business that is managed and disposed of in the LGA. This typically includes legacy as well as ongoing waste management.

If Council decides to consider the adoption of targets for renewables and/or carbon emissions, it is recommended that the following factors be considered:

- 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 – e.g. 5-10 years. However renewable energy fuels for all transport are not yet widely available and/or commercially viable but may be progressively over the period 2020-2040.
- 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 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 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 Climate Active program (formerly the National Carbon Offset Standard or NCOS) is making it simpler for smaller organisations to report and offset their carbon impact.
- Consideration of Council's overarching purpose in setting goals or targets, such as to align with global requirements, 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.

4.4.1 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 comparable cost to '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 and significant action.
    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 streetlights, 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. Similarly new water bores may be necessary to sustain viable water supplies to towns but add to a council's energy demand.

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.

2

Council's energy and carbon footprint

5 Glen Innes Severn Council[9]

Glen Innes Severn Council is a local government area in the New England region of New South Wales. The council services an area of 5,487 square kilometres and is located adjacent to the New England Highway, within a three hour drive from Coffs Harbour. More than 20% of Glen Innes Severn Council is protected including national parks, nature reserves, Indigenous protected areas.

As at 2018 there were 8,908 people residing in Glen Innes Severn Council according to the ABS. From a total of 1,079 businesses, over 14% of workers are employed in the management and commerce sector, which is the region's highest employing sector.

The town of Glen Innes is home to 6,155 residents – 69% of the LGA's total population. The balance of the population is in small towns including Deepwater, Emmaville, Glencoe and Red Range, and rural farms.

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.

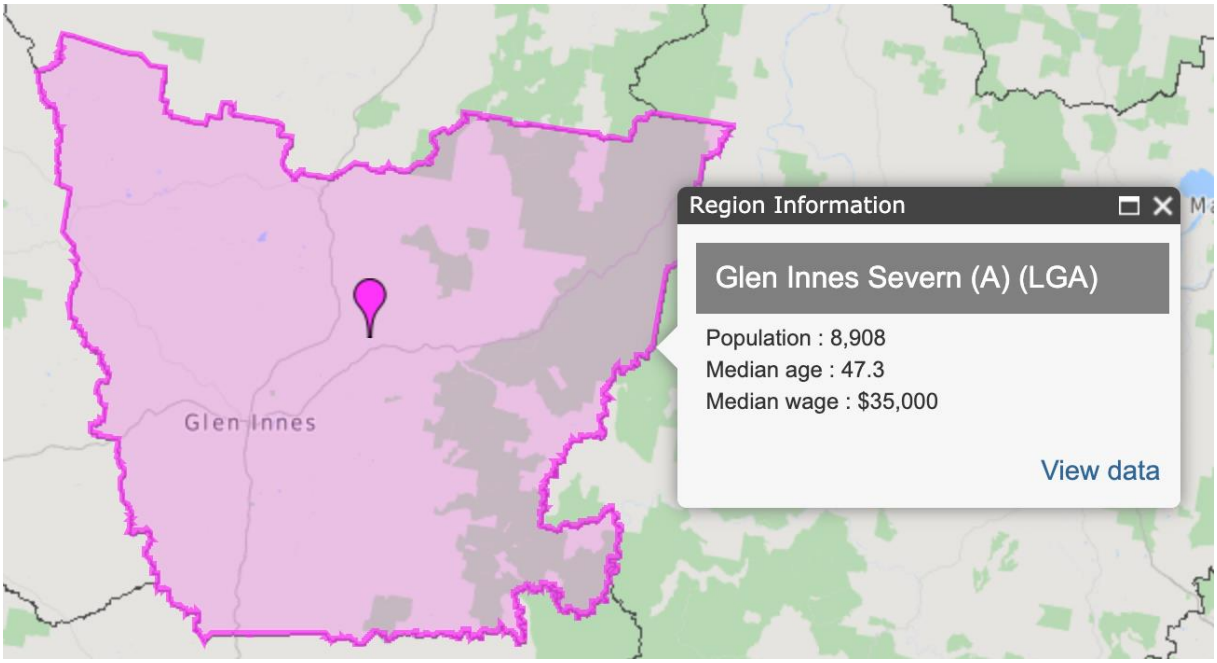


FIGURE 14: GLEN INNES SEVERN COUNCIL BOUNDARY MAP[10]

[9] Information sourced from https://www.gisc.nsw.gov.au/ and https://itt.abs.gov.au/itt/r.jsp?RegionSummary&region=13010&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

[10] Figure sourced from https://itt.abs.gov.au/itt/r.jsp?databyregion#/

5.1 Sustainability actions by Glen Innes Severn Council

Council has been actively pursuing sustainable energy improvements over the past several 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: Glen Innes Severn was part of the Northern Lights Project, where seven councils in the Northern Inland region installed LED streetlights, coordinated by Regional Development Australia Northern Inland and funded by the Australian Government. The work was completed in 2015 and replaced a total of 4,566 old high energy local road lights with new LED technology. Program savings were 1,096 MWh per year spread across the seven councils.
- Solar PV systems have been installed at a number of sites in recent years and months, with a total capacity of 198 kWp now installed on Council's sites. Installed systems include:
    - Sewerage treatment plant: 12 kW system
    - Church St offices: 12 kW system
    - Depot / workshop: 12 kW system
    - MRF (landfill): 12 kW system
    - Library and Learning Centre: 40 kW System
    - Fire Control Centre: 20 kW system
    - Eerindii Ponds (offstream storage): 90 kW system
- Council has fitted power factor correction equipment at the Beardy Weir pump station lifting power factor from 0.72 to 0.98 (1.0 is ideal).
- Council has also slowed the flow rate and reduced the elevation of water to the Glen Innes Severn water treatment facility from 110 meters to 70 meters lift, reducing energy demand and also enabling use of the 90 kW solar installation saving in the order of $100K per year.

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

For this project 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 were excluded. In 2018/19 Council's carbon footprint was dominated by electricity consumption and diesel fuel consumption.

TABLE 6: COUNCIL'S ENERGY USE AND CARBON FOOTPRINT 2018/19

	Emission source	Activity data	Units	Total t CO_2-e	%
	Diesel for fleet	369	kL	1,055 t CO2-e	36%
	Petrol for fleet	35	kL	85 t CO2-e	3%
	Ethanol for fleet	2	kL	0.02 t CO2-e	0%
	LPG	56	kL	92.6 t CO2-e	3%
	Electricity used in council assets	1,547,141	kWh	1,423 t CO2-e	48%
	Electricity used by streetlighting	328,460	kWh	302 t CO2-e	10%
	TOTAL:			**2,958 t CO2-e**	**100%**

Data were provided by Council from a handful of sources and the estimates developed as follows:

- Diesel data were supplied from Star Card and bulk diesel for tank workshop & GI aggregates,
- Petrol data were supplied from Star Card data and ethanol was extracted from this,
- Electricity for large sites including streetlighting, offstream storage, sewer treatment, workshops and the Beardy pump station were supplied by Council as a spreadsheet,
- Data for small sites were supplied by Council in an excel format. Several sites did not have a full year of data so this was extrapolated to 365-days equivalent

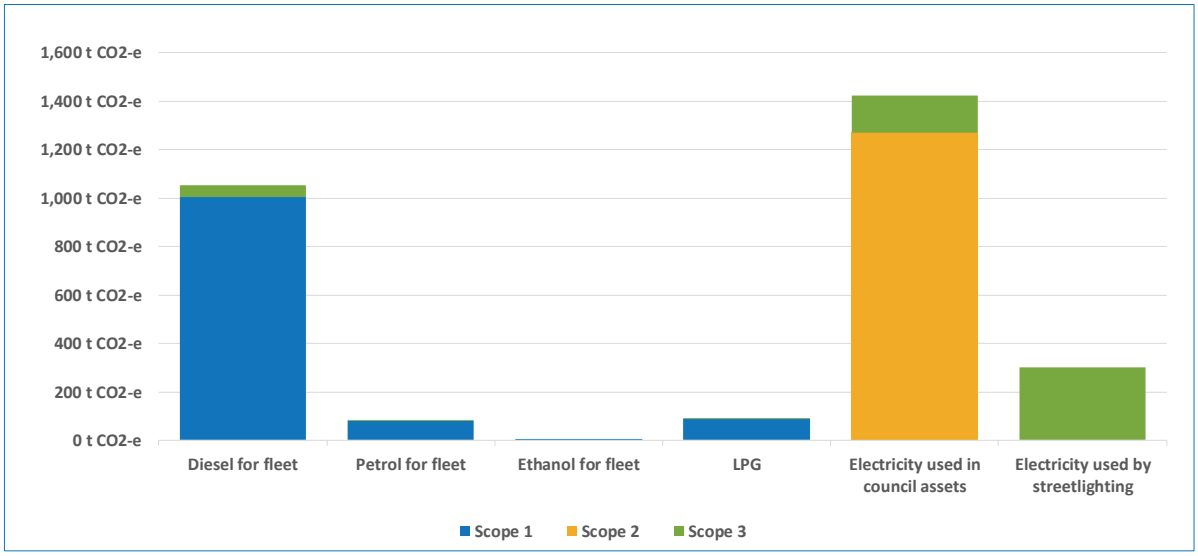


FIGURE 15: GLEN INNES SEVERN COUNCIL CARBON FOOTPRINT BY EMISSION SOURCE

Electricity use is dominated by a small number of large sites / accounts (including streetlighting) and many individually small electricity using sites.

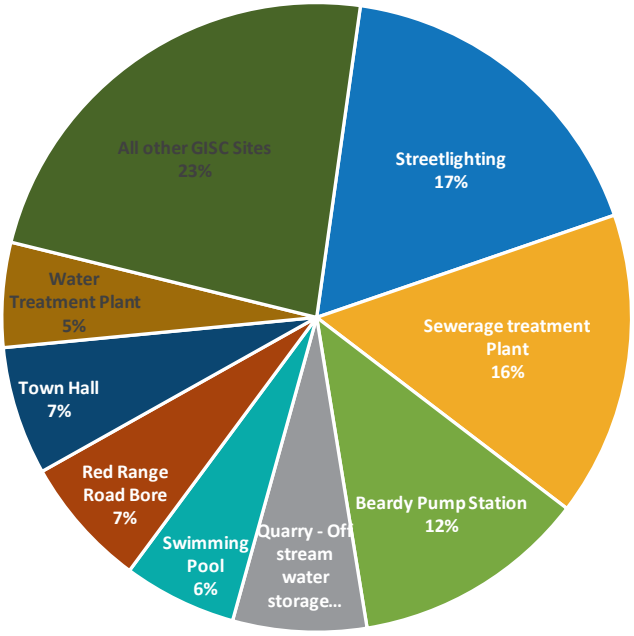


FIGURE 16: GLEN INNES SEVERN COUNCIL LARGE ELECTRICITY USING SITES

We can also look at electricity by end use - both in terms of the types of facilities / assets being served, and in terms of the equipment used at each site. An estimate of electricity end use at Council's sites is shown below.

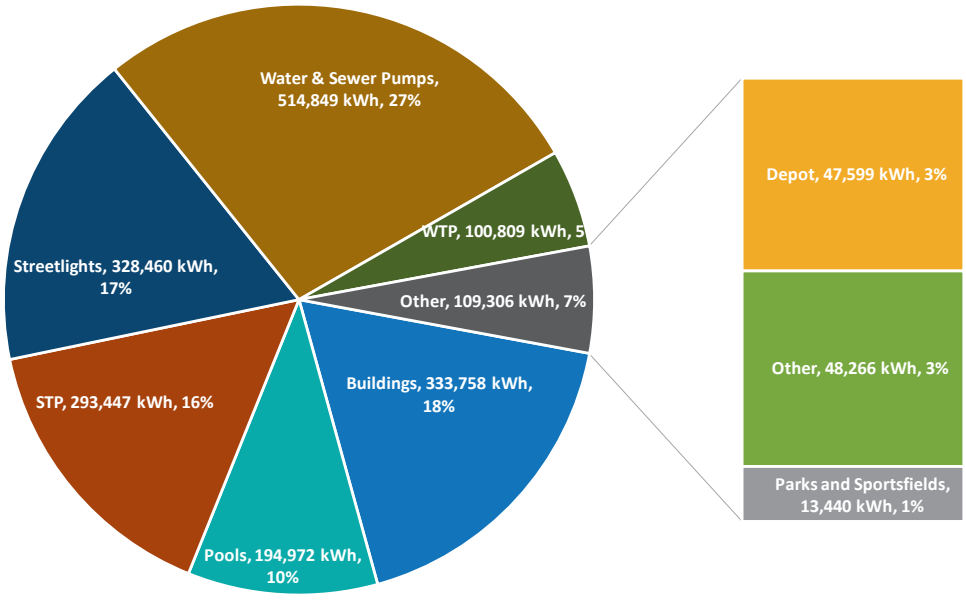


FIGURE 17: GLEN INNES SEVERN COUNCIL ELECTRICITY USE BY SITE CATEGORY

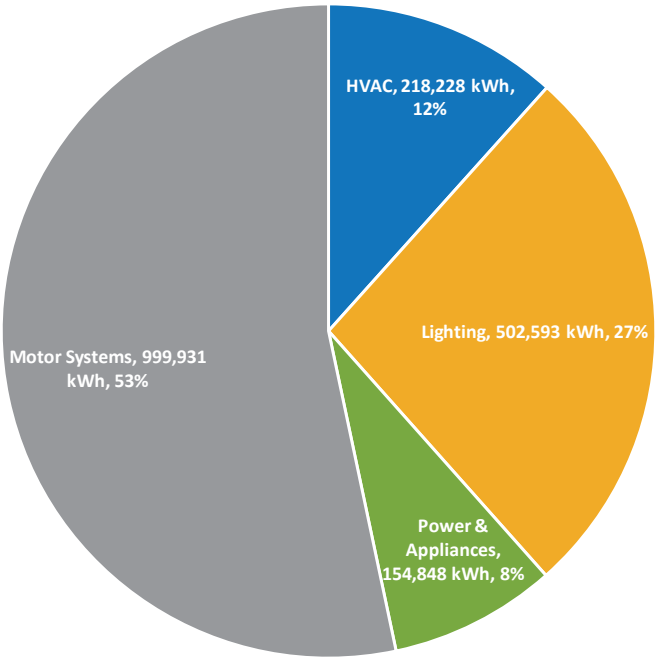


FIGURE 18: GLEN INNES SEVERN COUNCIL ELECTRICITY USE BY EQUIPMENT

Diesel fuel use is mainly from two bulk fuel tanks that supply Council plant and large vehicles. The balance of diesel as well as petrol fuel smaller vehicles including passenger cars and utes.

LPG is supplied to 18 accounts across Council, however 86% of LPG is consumed at the Glen Innes pool and this is the only site where this is considered in this Plan.

3

Renewable energy action plan

7 Renewable Energy Action Plan for GISC

Focused on energy consumption, a renewable energy plan for Glen Innes Severn Council comprises of three main elements:

4. Onsite energy efficiency and renewable energy
5. Renewable electricity purchasing, and
6. Sustainable transport energy

In this section, a discussion and identification of the main opportunities to increase Council's renewable energy is developed for each of these three areas. Following this, suggested short, medium and long-term action plans are tabulated.

In the next section a summary of the financial analysis of onsite solar PV and energy efficiency initiatives is presented to help underpin Council's consideration of the plan and decisions on what actions to include within its future Operational Plans and Delivery Program. An Excel workbook accompanies the plan with more detailed analysis of the business cases for identified opportunities.

7.1 Onsite energy efficiency and renewable energy

To inform the development of an action plan for Council two days were spent visiting a number of sites with Council staff. The following 16 sites were visited:

- Emmaville Mining Museum
- Emmaville Pool
- Glen Innes Pool
- Glen Innes RFS Control Centre (viewed solar externally only)
- Glen Innes Saleyards
- Glen Innes Depot
- Glen Innes Town Hall
- Glen Innes Visitor Information Centre
- Glen Innes Water Treatment Plant
- Glen Innes Offstream Storage
- Glen Innes - Quarry site / New bore
- Glen Innes - Beardy River Pumping Station
- Glen Innes STP
- Deepwater Raw Water
- Deepwater Clear Water
- Glen Innes - Red Range Bore

These sites – plus streetlighting – cover 94% of electricity usage across Council. LPG at the Glen Innes pool accounts for 86% of all LPG consumed by Council. As such stationary energy coverage for the plan is high.

A full table of the identified opportunities is shown below, incorporating review and feedback by Council staff.

7.1.1 Identified short, medium and long-term opportunities, by site / asset

TABLE 7: IDENTIFIED OPPORTUNITIES FROM SITE VISITS IN GLEN INNES SEVERN COUNCIL

Site	Site description	Energy Saving Category	Opportunity	Description
Emmaville Mining Museum	The museum is a single storey building with added workshops and displays at the rear of the building. The museum is open 10am to 4pm daily except Thursdays and public holidays. Energy use is over 10,500 kWh per year. Lights are mainly fluorescents with a small number of LEDs installed. Lighting is the main energy use.	Lighting	Upgrade all lights to LED.	There are about 63 lights in total - 22 twin 36W, 11 single 36W, 4 twin 58W, 3 single 58W, 8 single 18W or 20W, plus some halogens and LEDs.
		Solar PV	Install a 2 kW solar PV system on the main roof	If lighting energy use is reduced, then a 2 kW system will meet most daytime energy demand; 20% export is assumed.
		Battery + Solar PV	Install a further 2 kW solar PV system on the main roof plus 5 kWh battery	If lighting energy use is reduced, then a 4 kW total system and a small battery will meet most of the museum's energy demand. This is a longer term option.
Emmaville Pool	The pool operates from October to March each year. The roof of the amenities / kiosk building is covered in solar hot water matting for pool heating. The main energy using equipment is the 7.5 kW main pool filter (DOL control) and solar pumps. The splash pool pump runs with VSD control.	Motor Systems	Install VSD control for the main pool filter pump	This would require an investigation of current pump settings and flow rates, and if a smaller pump could be installed. Typical savings for VSD control can be from 5% to 40%, and for pools a fixed optimum speed is often set.
		Solar PV	Replace matting with a small heat pump and solar PV	This opportunity should only be considered at end of life of the matting system (long term) AND if Council considers implementing gas or electric heating to supplement solar (if not then stay with matting). A heat pump would have an expected life of 15 to 25 years, similar to an air conditioning system.

Site	Site description	Energy Saving Category	Opportunity	Description
Glen Innes New Stadium	A new indoor sports stadium is planned to be built on the northern side of the Glen Innes swimming pool. Opportunities noted here will be considered in the design of the facility by the selected architect.	Energy	Design of energy systems	This is an opportunity to minimise energy demand through design, including: - energy efficient technology (LEDs, controls, air conditioning, appliances, electric cooking / catering), - heat pumps to supply hot water - solar PV and battery storage
Glen Innes Pool	The pool operates from October to March each year. All useable roof surfaces have solar matting for pool heating. A Perspex frame around the southern end of the pool has provided a wind break and reduced pool heating requirements. Gas boilers supplement solar heating, with 2 boilers for the 25m pool (26 deg C) and one for the 7m pool (29 deg C). Two network tariffs are noted on GISC data, BLNN1AU and BLNE0AU. It is noted that the Essential Energy tariff BLNE0AU is "Ineligible Export" which may rule out grid exports from a future solar PV system. BLNN1AU is a general supply non-ToU tariff.	Heat Pumps + Solar PV	Replace matting and boilers with heat pumps and 28 kW solar PV on the pool's roofs	Matting and boilers are not old (~8 years) so there is no short-term need to replace them. However gas is expensive ($66/GJ) and heat pumps have developed and can run effectively in lower temperatures. Solar panels allied to heat pumps may provide a lower cost solution to energy and lower GHG emissions in future. Despite seasonal use, solar self-consumption would be high as there is continuing pump demand in winter and solar yield is lowest at that time. Given the high cost of LPG Council should investigate this project in the short to medium term.
		Motor Systems	Install VSD control for the main and 7m pool filter pumps.	This would require an investigation of current pump settings and flow rates, and if smaller pumps could be installed. Typical savings for VSD control can be from 5% to 40%, and for pools a fixed optimum speed is often set.

Site	Site description	Energy Saving Category	Opportunity	Description
Glen Innes Pool		Solar PV	Install 40 kW ground mount solar PV (alternative to roof mounted PV and heat pump, or potentially together with heat pumps replacing the gas boilers).	Install ground mount solar PV behind the grandstand or on the land adjacent to the pool. This could require the removal of a couple of trees depending on placement, but would not call for any changes to the current pool heating system. The ground area is larger than the area of the roofs, hence a larger solar PV system could be installed.
		Tariff / Contract	Change tariff and switch to Council's large sites contract	The network tariff applied to the site is BLNN1AU which applies a single rate to all energy used. A time-of-use or ToU demand tariff may be a better fit for the size of the consumption. Being >100 MWh per year there may be added benefits by adding the site to Council's large sites contract when this is next renewed. The difference in costs annually between these options should be analysed prior to any decisions being taken.
Glen Innes RFS Control Centre	The RFS has 20 kW of solar PV and the facility is modern. Site inspection was not carried out.	Battery + Solar PV	Increase solar PV capacity and install a battery (would be done by RFS, not a Council asset).	There is some added roof on the main (new) building and potentially on the truck garage building. A further 20-50 kW could be implemented with storage depending on cost and space. The site may be export limited which would affect the cost-effectiveness of this project.

Site	Site description	Energy Saving Category	Opportunity	Description
Glen Innes Saleyards	Energy demand appears to be mainly for external lighting plus lights / AC / appliances for one building. Energy use is intermittent and dominated by lighting use at night when livestock are at the site.	Lighting	Upgrade all lights to LED.	Close to 30 non-LED lights including incandescent and HID are used. Indoor lights were not reviewed. Lighting is assumed to account for 70% of all electricity use. This is considered to be a long-term option, with LEDs installed as older lights fail.
Glen Innes Depot	The depot complex has a large-site account and a small site account. The small account has a solar PV system which appears to export as much as the site consumes from the grid, about 9 MWh pa. The larger account uses 37 MWh per year, mainly lighting, and has no solar.	Lighting	Upgrade all lights to LED (if some buildings are unused a first step may be to disconnect rather than replace).	Observed lights included metal halides and linear fluorescents, a full count was not carried out. Based on other depots lighting is likely to account for ~30-40% of electricity use and this should be confirmed.
		Solar PV	Install 12 kW solar for the main account.	Load profiles show this level would be suitable for the site (medium term), assumes some demand reduction due to LED lighting, and assumes that 80% of output is self-consumed. Location could be any of the site's roofs. Modelling is based on installation on the Coronation Ave building.
		Battery + Solar PV	Install a further 13 kW solar and a battery to meet most of the large account energy demand	There appears to be ample roof space for a larger solar array (subject to structural and connection assessment), and a total 25 kW array with a battery could enable most of the site's demand to be met in the medium to long term.

Site	Site description	Energy Saving Category	Opportunity	Description
		Battery	Install a battery on to the small account solar PV system to reduce export to grid.	Origin data suggests 9 MWh of solar is exported on the small depot account, which is almost the same as the site's grid usage. This suggests little daytime demand and most power usage for lights at night. This situation should be confirmed. If correct a battery to store and discharge the excess power would be recommended in future.
Glen Innes Town Hall	Town Hall has 5 separate accounts, of which only 2 are significant and assumed to be the office areas and the town hall itself. The coffee shop is assumed to be separately metered. Office areas are in use during business hours, while the Town Hall / stage is used more irregularly and often in the evening.	Lighting	Upgrade all lights to LED.	Lighting in office areas includes mostly recessed and surface mounted twin 36W fluorescents. Town Hall lighting includes CFLs as well as linear fluoros. Lighting is estimated to account for 30% of electricity use for the two main accounts.
		Solar PV	Install 20 kW solar PV on the stage roof and the north facing roof of Town Hall.	The stage roof at the rear of the building appears suited to a tilted array facing north. An array to service the office areas account is costed since this is a daytime use facility so self-consumption of solar will be high.
		Battery + Solar PV	Install solar PV on the stage roof and the north facing roof of Town Hall, plus a battery to meet more of the site's energy demand.	Subject to space and heritage considerations a solar array on the Town Hall roof with a battery may enable more of the office and town Hall power to be met with renewables.

Site	Site description	Energy Saving Category	Opportunity	Description
Glen Innes Visitor Information Centre	The VIC has three accounts which may include the main VIC, bus station amenities and the tenancy within the centre. The VIC is open daily.	Lighting	Upgrade all lights to LED in the VIC and bus station and control outside lights on a PE cell	The main lighting observed includes 20W halogens in VIC display cases, twin fluorescents 36W in the VIC and 18W single fluorescent surface mounted lights in the bus station amenities and the outside perimeter of the building. Together these lights may use 13-18 MWh per year depending on operating practices. All perimeter lights were seen to be ON during the daytime, and a PE cell should be installed to control these. Lighting in the tenancy space in the VIC is excluded.
		Solar PV	Install 5 kW solar PV on the north or west roof of the VIC to service the VIC account	Estimated PV capacity is based on the main electricity account with lighting savings deducted and daytime demand met with a small PV system. Export is taken to be 10% since the centre is open every day.
		Battery + Solar PV	Install an added 5 kW solar PV on the roof of the VIC plus a battery to service the VIC account	A larger system may be able to supply most of the main VIC account. More than one PV system with battery may be able to supply the other accounts at the site but are not included here. 20% export is assumed.

Site	Site description	Energy Saving Category	Opportunity	Description
Glen Innes Water Treatment Plant	Water is supplied via the Offstream storage (quarry) or direct from the Beardy Weir and Red Range bore. Operation is mostly in daytime. There are several accounts with the main account taken to be for the 'new' plant.	Solar PV	Install 20 kW solar array on the main roof of the WTP.	Suitable sites may include the main building roof, reservoir roofs, ground mount in front of the clearwater tanks, subject to assessment. At this time the roof of the WTP is considered the most likely location. The site's meter is located at the rear of the WTP building so this is a consideration also. An export level of 30% is assumed for the solar-only option as operation of the plant will be intermittent, whereas for a larger array with battery just 20% is assumed to be exported.
		Battery + Solar PV	Install a further 30 kW solar array and a battery at the WTP - location to be determined.	
Glen Innes Offstream Storage	A 90 kW solar array meets part of the site's demand, which consists of 4 x 55 kW VSD pumps. Pumps run for 4-5 hours daily to pump water to the WTP. The site is on Council's large sites contract and interval data indicate room for more solar PV.	Solar PV	Install a further 50 kW solar PV (subject to confirmation of any approvals required).	An added 50 kW array would be largely absorbed when the pumps are running, so export level may be ~30-40% (likely similar to current level of export which has not been reviewed).
		Battery + Solar PV	Expand to 100 kW solar plus a battery.	The addition of 50 kW further solar plus a battery would meet more of the site's energy demand.
Glen Innes - Quarry site / New bore	Council is currently drilling a new bore that will supply water to a third quarry pit being excavated. This will provide a new water source for the town. The bore is located near the Gwydir Highway and there is land immediately south and north of the bore that could be suitable to build a solar array to meet some of the bore's energy demand.	Solar PV	Install a ground mount solar array in the short term to meet the new bore's daytime energy demand.	The energy demand should be modelled and a solar array sized based on this. Council can consider whether a 24/7 operation will apply or whether daytime operation is feasible where supplied from solar. Solar plus battery storage could also be considered, but in the longer term.

Site	Site description	Energy Saving Category	Opportunity	Description
Glen Innes - Beardy River Pumping Station	Pumps are 315 kW and alternately used. Run hours per day are low. Power factor correction has been installed.	Motor Systems	VSD control of major pumps.	VSD control and possibly longer run hours at lower load may be a feasible option when pumps are being replaced, but not a short-term opportunity.
	Consider relocating pumps to Shannon Vale Road. Construct a new offtake storage on Council land with channel extending to weir area.	Motor systems and solar PV		Any future plan to relocate the main river pumping system will consider efficiency (power factor, pump efficiency, VSD) and renewable energy generation (ground mount solar).
Glen Innes STP	A 12 kW solar array is installed, 4 x surface aerators are VSD-controlled with DO sensors. The plant runs 10 cycles a day 7 days a week.	Solar PV	Expand solar with an added 50 kW	Load profiles indicate this would be around 60-70% self-consumed. Possible areas where this may be sited include areas in front of and behind the aeration tank, and the old buildings that are to be decommissioned.
		Power Factor	Install PFC to correct incoming power to unity.	Demand data shows PF is 0.9 on average at peak demand. Installation of ~50 kVAr of PFC equipment in 12.5 kVAr steps will correct power close to unity.
Deepwater Raw Water pump and water treatment plant	A small raw water pump station is located at the river, with land between this and the WTP.	Solar PV	Install ground mount solar PV	Install 1 x small ground mount array for the WTP account (consumption ~8,000 kWh per year). 60% self-consumption is assumed.
		Battery + Solar PV	Expand solar with a battery	Expand solar for the WTP account with a battery to meet most of site's energy demand.

Site	Site description	Energy Saving Category	Opportunity	Description
Glen Innes - Red Range Bore	Bores are drilled adjacent to the road with a very small shed and no land to site solar PV on. Pumps run on VSD control.	Tariff / Contract	Change tariff and to Council's large sites contract	The network tariff applied to the site is BLNN1AU which applies a single rate to all energy used. A time-of-use or ToU demand tariff may be a better fit for the size of the consumption. Being >100 MWh per year there may be added benefits by adding the site to Council's large sites contract when this is next renewed. The difference in costs annually between these options should be analysed prior to any decisions being taken.
Streetlighting	Main road lights are still older HID technology while local roads are LED following the Northern Lights project.	Lighting	Upgrade all lights to LED.	As part of Council's next scheduled bulk replacement of streetlights work with Essential Energy to implement LED technology as proposed by EE and approved by Council in late 2019.

7.2 Renewable electricity purchasing

Power Purchase Agreements (PPAs) for renewable energy have emerged in recent years as a feasible way for organisations to meet ambitious renewable energy and/or carbon reduction goals where these cannot be met through on-site actions alone. Unlike the traditional approach of buying GreenPower® at a premium to regular power prices, PPAs have been entered into at costs comparable to regular grid power, albeit on longer terms and limited to either large energy users or buying groups with combined large energy demand.

7.2.1 Bundled and LGC-only agreements

Power Purchase Agreements can be undertaken for power only (the 'black' portion), the green attributes of the power (the Large-scale Generation Certificates or 'LGCs'), or for both ('bundled'). A bundled agreement will achieve a lower price for the LGCs than an LGC-only agreement. Purchasing LGCs can be compared to purchasing carbon offsets, except that LGCs are currently more expensive than carbon offsets, and they would enable Glen Innes Severn Council to claim 100% renewable energy.

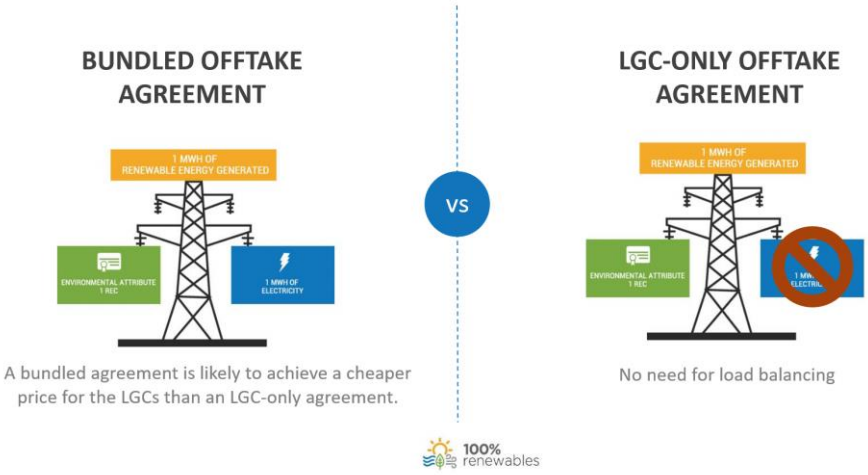


FIGURE 19: BUNDLED VERSUS LGC-ONLY PPAS

7.2.2 Solar and wind PPAs

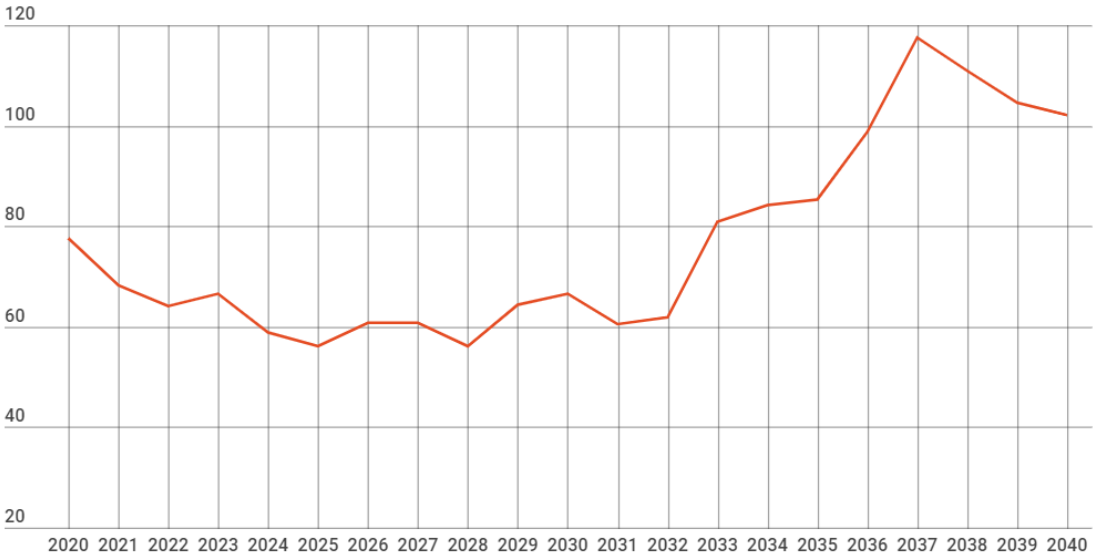
The majority of offsite corporate PPAs have been based on utility-scale solar and wind energy. In future we may see solar, wind, pumped hydro and battery storage be able to offer energy agreements based on renewables that are sculpted to an end user's energy demand profile, with lower exposure to wholesale markets. Increasingly customer-focused models are enabling energy users such as Glen Innes Council to receive large-site renewable energy supply offers that are comparable[11] to 'regular' retailer offers that are sourced from the mix of energy sources supplying the grid.

7.2.3 Wholesale electricity prices

Whether or not a PPA is a good deal is dependent on the difference between the price offered for a PPA (typically over 7-15 years but shorter terms are emerging) and the forecast wholesale electricity

[11] Comparable does not imply that renewable energy PPAs are cheaper, and changes in wholesale electricity prices (and long-term forecasts) can lead to PPA offers that are a little lower than, similar to or a little higher than 'regular' grid pricing.

price that would set prices for regular grid power contracts. As might be expected given the dynamic nature of the electricity market, a range of possible views on wholesale prices can be developed, and this is one of the core inputs required if Council seeks to go down this path. As an example, RepuTex[12] provides the following view of possible wholesale prices.



Source: RepuTex Energy, 2019

FIGURE 20: ONE POSSIBLE PATHWAY FOR WHOLESALE ELECTRICITY PRICES – REPUTEX ENERGY, 2019

7.2.4 PPA activity

There are many PPA models, but the most growth has come from retail PPAs, where a retailer facilitates the renewable energy buying. Most retail PPAs occur through tenders supported by energy procurement specialists.

Despite a high level of interest, not many renewable energy Power Purchase Agreements went ahead in 2019 compared with 2017 and 2018. This is mostly due to:

- 2019 Federal Election
- Project delays (e.g., grid connection issues)
- Policy and regulatory uncertainty (e.g., the impact of changing marginal loss factors on project revenues, absence of national energy and climate policy as the Renewable Energy Target ends)
- Uncertainty about future wholesale electricity prices and project revenues, especially for solar farms (high solar output in the middle of the day have pushed wholesale electricity prices to zero, which could lead to lower revenues for solar projects)

While there is a slowing of corporate PPA activities, Councils have been active in this market in recent years. Examples include:

- Several Councils, with support from Southern Sydney Regional Organisation of Councils (SSROC) entered into an agreement commencing on 1st July 2019 to source electricity via a 10-year PPA, under which solar energy is supplied from the Moree solar farm to meet 20% to 50% of their energy demand.

[12] https://www.reputex.com/research-insights/where-to-for-wholesale-electricity-prices-under-current-policy/

- City of Sydney Council has recently entered into an agreement to source 100% of their electricity from renewables. The deal will see 75% of the City's power sourced from wind generation (Sapphire Wind Farm near Glen Innes) and 25% from solar (projects in Bomen and Nowra in NSW), and is projected to save the City $0.5m over the next 10 years[13].
- We understand that Newcastle City Council has entered into a similar agreement to the one entered into by City of Sydney.
- The Victorian Greenhouse Alliances has also established a local government buyers group. The buyers group comprises 48 local councils which are seeking to sign a group PPA, subject to the terms falling within an agreed price range. The buyers group is preparing to issue a Request For Proposal for retailers to provide offers for a PPA to supply 246 GWh p.a. from 2020/21. The LGCs may be retired. This would be equivalent to 44 per cent of the constituent Councils' electricity requirements. Individually, the electricity consumption of each of these councils is too small to have much bargaining power. Joining together also enables the group to share the costs and access to higher quality expertise.
- City of Melbourne, along with a few other Victorian councils and corporates, entered into the Melbourne Renewable Energy Project recently, which will supply these organisations with cost-effective renewables over the long term.
- We understand that Centroc, representing councils in central NSW, recently sought to enter into a PPA for renewables for its members and other councils, however we understand that a renewable energy PPA was not entered into on this occasion.

7.2.5 Recommended actions

In the current market, lower wholesale electricity prices may mean that cost savings for renewable energy PPAs compared with 'regular' grid agreements may not be achievable. Recent experience with PPAs highlights both the need for expert advice and the advantage of volume when seeking to enter into such an agreement.

Actions that Council can look to progress include:

- Become more informed about renewable energy purchasing via PPAs – e.g. via Council's energy advisor/s, by joining groups such as the Business Renewables Centre – Australia (BRC-A – free) and by engaging with other Councils in your region and with some who have signed PPAs.
- Consider forming or joining a buyers' group that is interested in investigating and pursuing renewable energy PPAs and engaging with retailers and market experts to progress this opportunity over time.
- In the medium term, either alone or with a group of potential buyers, review and seek advice on the market for bundled renewable energy PPA models for electricity and LGCs that involve reduced risk and improved cost outcomes. This advice should include:
    - Renewable energy contracting / purchasing models available to councils
    - The current PPA market and market trends including case studies
    - Prevailing drivers of pricing of regular grid energy and renewable energy
    - The forward market: electricity futures and longer-term pricing
    - Preferred technology or mix of technologies (e.g. solar + wind, wind + battery, etc)
    - Barriers to negotiation of a successful renewable energy agreement
    - Strategic purchasing of renewable energy and managing risk
    - Operating a PPA or renewable energy purchasing contract

[13] https://news.cityofsydney.nsw.gov.au/articles/100-per-cent-renewable-energy-deal-struck-for-the-city

    - Financial modelling of potential outcomes/cost-benefit analysis based on Council's electricity load data
    - Consideration of Council's procurement timing for large and small sites, and potential based on this to achieve a PPA in the short term. In the event timing makes this not feasible in the short term what timing should Council consider for its next contract and what should be put in place to enable a PPA for renewables to be included in a subsequent tender
- Subject to the assessed opportunity and market conditions, seek to incorporate the purchase of renewable energy as part of a future electricity contract period where this is found to be financially viable and has no additional risk when compared to a regular retail contract.

7.3 Sustainable transport energy

Transport emissions are the second largest GHG source for Glen Innes Severn Council, primarily from diesel used for Council's operational vehicles. Petrol use for passenger cars is small by comparison.

Given the dominance of larger diesel-fuelled vehicles and plant the opportunities for Council to transition rapidly to low and zero-emissions fleet are currently limited. Nonetheless there are a number of tangible steps that Council can take to begin a shift of its vehicle fleet to lower emissions options. These include demand management through driving practices, selecting smaller and fuel efficient vehicles, and including hybrid cars as options for passenger cars and utes within its current fleet. Future opportunities such as hydrogen vehicles may play a role in a wider analysis of sustainable transport opportunities for Council.

In this plan the focus is on electrification of vehicles. The summary below sets out the current status of the EV market as it may apply to Council in the coming years.

7.3.1 EV charging infrastructure

In July 2019 the Electric Vehicle Council reported that there were 1,930 DC and AC chargers in Australia[14]. Locations of DC and public chargers is readily accessible, see below[15]. Increasing numbers of private chargers are also being installed, retrofitted to homes and businesses as well as designed into new buildings.

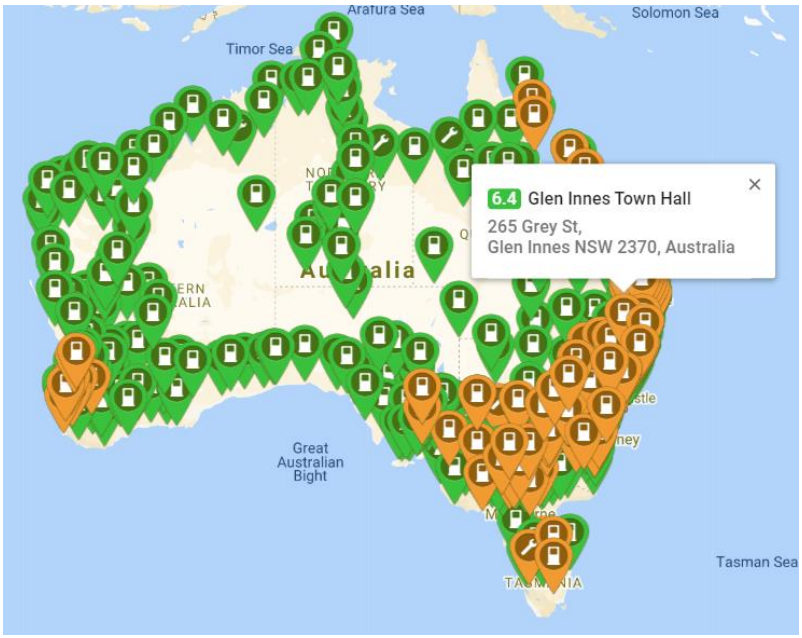


FIGURE 21: AUSTRALIA'S EV CHARGING NETWORK, JANUARY 2020 (PLUGSHARE)

In Glen Innes there are two public chargers installed by Council at the VIC and the showground, as well as a DC rapid charger installed by NRMA at Town Hall as part of their fast charge rollout program across NSW. The towns near Glen Innes are increasingly well served by EV charging infrastructure, including DC rapid chargers in Grafton, Coffs Harbour and Tamworth.

Current and continued growth in EV charging infrastructure will facilitate uptake of EVs, and Council should continue to develop and/or enable the implementation of chargers in the region. Of particular

[14] https://electricvehiclecouncil.com.au/wp-content/uploads/2019/09/State-of-EVs-in-Australia-2019.pdf, p19
[15] https://www.plugshare.com/

note is that many public chargers are being installed in hotels and motels, with local businesses seeking to provide charging for guests driving EVs.

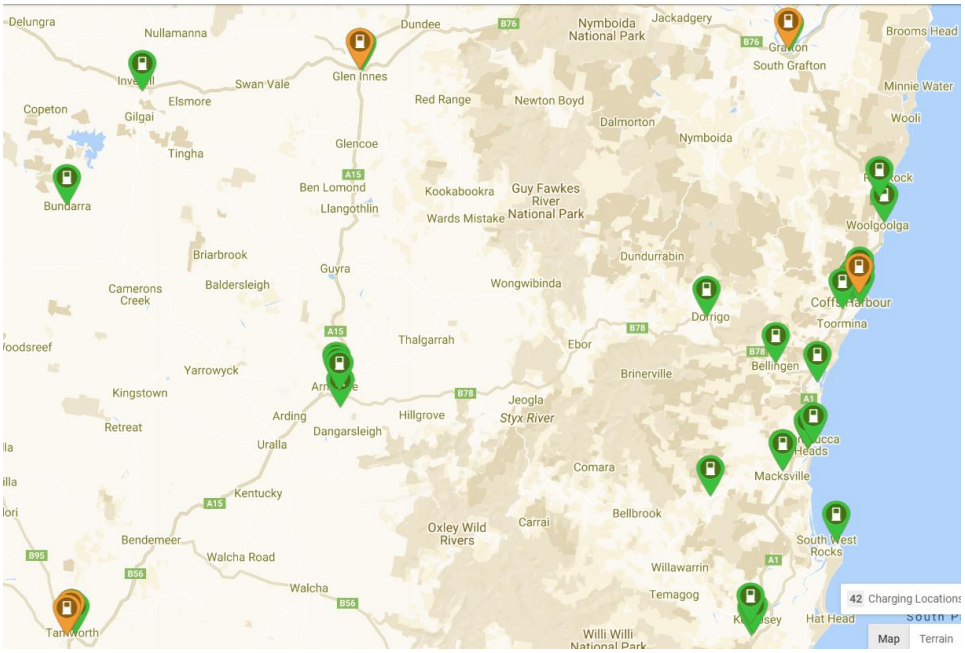


FIGURE 22: EV CHARGING NETWORK IN AND NEAR GLEN INNES, JANUARY 2020 (PLUGSHARE)

7.3.2 Projected growth in electric vehicles

AEMO's most recent forecast of uptake sees low uptake of EVs to 2030 (currently EVs make up <<1% of new car sales), with accelerated uptake after 2030 and reaching over 11 million cars by 2050[16]. Where fuelled with regular grid power in NSW EVs currently have higher operational emissions than hybrids, whereas where fuelled from renewables this is not the case. As the grid changes with planned retirements of coal fired power stations, this situation will change and emissions from EVs will become less than those from hybrids.

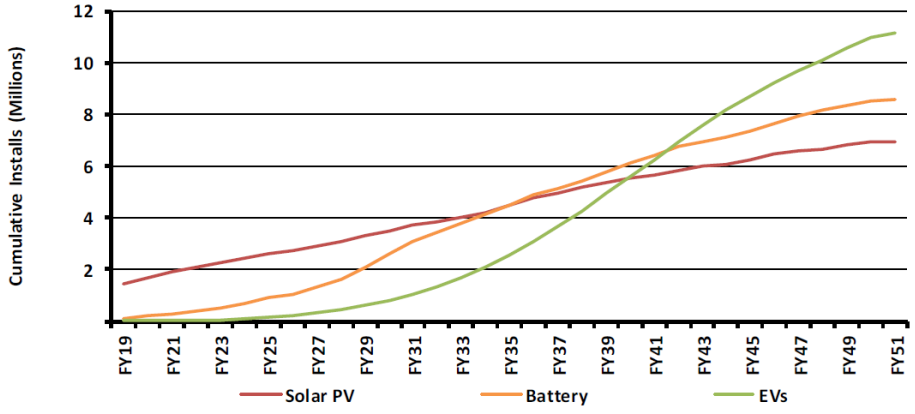


FIGURE 23: AEMO PROJECTIONS OF EV UPTAKE – APRIL 2019

[16] Energeia 2019: Distributed Energy Resources and Electric Vehicle Forecasts, prepared for AEMO, 13 June 2019

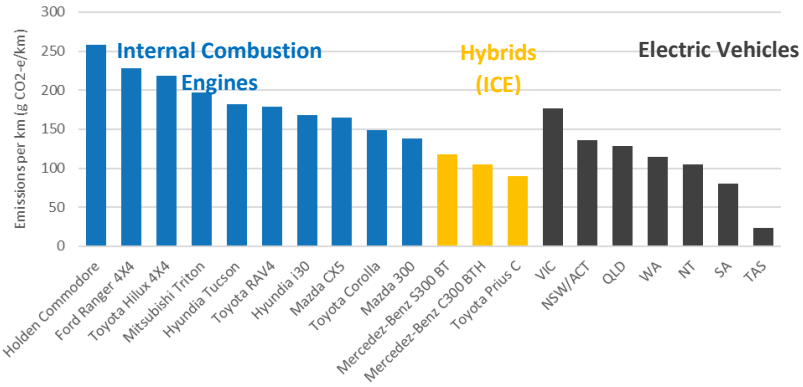


FIGURE 24: COMPARISON OF EMISSIONS PER KM FROM MOTOR VEHICLES IN AUSTRALIA[17]

Based on these forecasts it is likely that emissions reduction from sustainable transport measures nationally will be modest in the period to 2030, but significantly increased by 2050 as the grid greens and EV uptake increases. Forecasts are updated periodically, and Council should monitor these from time to time.

7.3.3 Availability of electric passenger vehicles in Australia

According to the Electric Vehicle Council[18], in 2019 there were 22 EV models available in Australia (both BEV and PHEV), and this will grow by a further 9 vehicles in 2020, with a shift towards battery electric vehicles (BEV).

In addition the EV Council reports the commitments by most major car manufacturers to develop EVs in coming years. For example:

- Ford: $11 billion in investment in EVs, 24 PHEV models and 16 BEV models by 2022
- General Motors: 20 BEVs by 2023
- Hyundai/Kia: $20 billion investment in 5 years in EVs, AVs and batteries, 14 BEVs, 12 PHEVs and 2 FCEVs by 2025
- Nissan: Alliance with Mitsubishi and Renault to invest $11.5 billion to develop new powertrains and electric technologies - 12 electric Renault-Nissan-Mitsubishi vehicles, 8 BEVs by 2022, $335 million in an EV and battery plant in Thailand, $10 billion investment in EVs
- Toyota: Aims to sell 4.5 million or more hybrids and PHEVS, and 1 million BEVs and FCEVs (approx. half of global sales) by 2025, 10 electric models available globally from 2020 across all vehicle segments, electrified versions of all models by 2025

Corporate and government fleets make up more than 50% of new EV sales, and many Councils are now developing long term transport strategies that explicitly include a shift in their fleet to low and ultimately zero emissions fleet. Most prominent at this time is the ACT Government, which is switching its passenger fleet to EVs for all new leases from 2020-21, and has trialled electric buses with a view to shifting these to all electric by 2040 as part of the ACT's carbon neutral commitment.

[17] http://www.arnhem.com.au/how-green-are-electric-vehicles/

[18] https://electricvehiclecouncil.com.au/wp-content/uploads/2019/09/State-of-EVs-in-Australia-2019.pdf, pp49-52

7.3.4 Availability of low emissions utility vehicles in Australia

Utility vehicles are common among Council fleets and often account for a sizeable proportion of total diesel fuel use. Over the medium term most of the major ute manufacturers have plans in place to provide electric and hybrid electric options in their ute range, often driven by customer demand in regional and agricultural areas. Other non-major brands currently provide electric ute models. A short summary of the current status for several vehicles is provided below.

- Mitsubishi Triton[19]: in September 2019 Mitsubishi advised that the next generation Mitsubishi Triton ute – due two to three years from now (~2022/23) – will have the option of hybrid power, with decisions still to be made whether this will be a PHEV or a paired electric battery with fuel engine.
- Toyota has committed to including electric options with all new vehicle models going forward, which will include utes[20]. Toyota is developing a hybrid version of its next-generation HiLux ute. It is expected this will be available from 2023. At this stage Toyota has not committed to an all-electric model. A diesel-electric powertrain is one of the options under consideration.
- Nissan is also planning for an electric vehicle future, with a hybrid diesel-electric Nissan Navara ute potentially available by the mid-2020s[21]. Nissan also indicated that commercial vans were also candidates for electrification.

While these are some of the more prominent models, a range of options are expected to be available to Australian ute buyers from 2020, including[22]:

- Tesla pick-up (all electric)
- Rivian R1T (funding of $700m input by Ford), targeting US sales by 2020 and Europe & China in 2021
- Fisker pick-up (all electric)
- Rich 6 and JMC Yuhu EVs (sold now in China)
- Great Wall Model P (likely to be available in Australia as full electric and FCEV, timing not available)
- Hyundai pick-up (likely available in Australia by 2022, hybrid and potentially all electric)
- ACE Yewt (local manufacture, small commercial ute will be sold within 5 years)
- Voltra eCruiser (BHP has a LandCruiser 70 series converted to electric by Voltra and operating at its Olympic Dam site in South Australia)
- Zero ZED70 (SA company Zero Automotive has converted Toyota's 79 Series LandCruiser to battery power.

Most of the current activity and plans points to electric and hybrid electric utes being a medium term proposition, and day-to-day performance carrying load, and charging infrastructure are key factors that will evolve in the next couple of years.

[19] https://www.caradvice.com.au/790317/mitsubishi-triton-to-get-hybrid-power-precede-nissan-navara-development/
[20] https://www.motoring.com.au/toyota-hilux-to-go-hybrid-121251/
[21] https://www.motoring.com.au/nissan-navara-e-power-hybrid-by-2025-119492
[22] https://www.carsales.com.au/editorial/details/top-12-electric-utes-coming-to-oz-121284/

7.3.5 Larger vehicle electrification

Council has a wide range of vehicle types in its fleet outside passenger vehicles and utes. Prominent local examples of fleet electrification that may be relevant to Council include:

- Electrification of garbage and recycling trucks: City of Casey in Victoria and City of Belmont in WA, have trials underway for electric garbage and electric recycling trucks respectively. These trials commenced in 2019. Both Councils' trucks are locally manufactured (Superior Pak and SEA Electric).
- SEA Electric manufactures a 15-seater battery-powered commuter bus, which may be suited for community use.

7.4 Short term action plan

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, a suggested short-term action plan for Glen Innes Severn Council is outlined below. A summary of the financial business case for actions is included following.

TABLE 8: GLEN INNES SEVERN COUNCIL SHORT TERM PLAN (2019/20, 2020/21, 2021-22)

Site	Category	Energy saving option
Emmaville Mining Museum	Solar PV	Install 2 kW solar PV system on the main roof
Emmaville Mining Museum	Energy Efficiency	Replace all lights in the museum with LED technology
Emmaville Pool	Energy Efficiency	Investigate the scope for energy savings from VSD control of the main pool pump
Glen Innes new sports stadium	Design	Work with Council's architect to maximise energy efficiency and incorporate solar PV and potentially battery storage (Council should also seek any grant assistance that could make this feasible – for e.g. if the stadium would also serve as an evacuation centre then support to energy storage may be available)
Glen Innes Pool	Tariff and Electricity Contract	Based on the size of energy consumption, review the costs of being on a large site contract and time-of-use network tariff, compared with the single rate offered at this time. Interval data may be needed to enable this to be assessed accurately given the likely high level of offpeak power use. Note that at this time rates for both options may be similar.
Glen Innes Pool	Energy Efficiency	Investigate the scope for energy savings from VSD control of the pools pumps
Glen Innes Pool	Fuel Switching & Solar PV	Investigate the case for replacing solar matting and gas boilers with heat pumps and roof-mounted solar PV. Include an assessment of just switching from gas boilers to heat pumps and leaving solar matting in place, with ground mount solar on the northern end of the complex.
Glen Innes Depot	Energy Efficiency	Replace all lights in the depot with LED technology
Glen Innes Town Hall	Energy Efficiency	Replace all lights in the Town Hall and adjacent offices with LED technology
Glen Innes Town Hall	Solar PV	Install 20 kW solar PV on the stage roof at the rear of the Town Hall building
Glen Innes Visitor Information Centre	Energy Efficiency	Upgrade all lights to LED in the VIC and bus station and control outside lights on a PE cell
Glen Innes Visitor Information Centre	Solar PV	Install a 5 kW solar array on the roof of the VIC (north slope at the main entrance or potentially on the west side
Glen Innes Water Treatment Plant	Solar PV	Install 20 kW solar array at the WTP (subject to roof condition assessment)
Glen Innes - New bore (quarry)	Solar PV	Install a ground mount solar array to meet the new bore's daytime energy demand. Sizing

		will be confirmed based on design flow, pump demand and run times.
Glen Innes – Red Range Bore	Tariff and Electricity Contract	Based on the size of energy consumption, review the costs of being on a large site contract and time-of-use network tariff, compared with the single rate offered at this time. Interval data may be needed to enable this to be assessed accurately given the likely high level of offpeak power use. Note that at this time rates for both options may be similar.
Streetlighting	Energy Efficiency	Upgrade all non-LED streetlights to LED technology in line with the proposal received from Essential Energy.
Transport	Planning	Review short, medium and long term strategies to reduce emissions from transport. Continue to support the development of EV charging infrastructure on Council land and by supporting local businesses. Assess the costs and benefits of hybrid passenger cars within council's petrol fleet for new leases.
Electricity	Purchasing	Become more informed about renewable energy purchasing via PPAs – e.g. via Council's energy advisor/s, by joining groups such as the Business Renewables Centre – Australia (BRC-A – free) and by engaging with other Councils in your region and with some who have signed PPAs. Consider forming or joining a buyers' group that is interested in investigating and pursuing renewable energy PPAs and engaging with retailers and market experts to progress this opportunity over time.

7.5 Medium term action plan

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, a suggested medium-term action plan for Glen Innes Severn Council is outlined below

TABLE 9: GLEN INNES SEVERN COUNCIL MEDIUM TERM PLAN (2022/23, 2023/24, 2024/25)

Site	End use equipment	Energy saving option
Glen Innes Depot	Solar PV	Install 12 kW solar for the main building (modelling was performed with this on the roof facing Coronation Ave)
Glen Innes Offstream Storage	Solar PV	Install a further 50 kW solar PV subject to confirmation with Essential Energy of any limitations there may be on this expansion
Deepwater Water Treatment	Solar PV	Install ground mount solar PV system to serve the WTP – a 3 kW system was modelled but options from 3 kW to 5 kW should be investigated

Glen Innes Sewerage Treatment Plant	Power Factor	Install ~50 kVAr of PC equipment to correct power to 1.
Glen Innes Sewerage Treatment Plant	Solar PV	Install 50 kW of ground-mount solar PV at the STP in addition to the 12 kW system already installed.
Transport	Electric Fleet	Implementation of sustainable transport measures, potentially including increased switch to hybrid passenger vehicles and utes, and potentially one or more electric passenger vehicles. Review sustainable transport plans as this area is evolving rapidly.
Electricity	Purchasing	Progress (if feasible financially) with the procurement of a proportion of Council's electricity from renewables, alone or in a buyers' group (e.g. with other local councils).

7.6 Long term action plan

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, a suggested long-term action plan for Glen Innes Severn Council is outlined below

TABLE 10: GLEN INNES SEVERN COUNCIL LONG TERM PLAN (AFTER 2024/25)

Site	End use equipment	Energy saving option
Emmaville Mining Museum	Solar PV + Battery	Install a further 2 kW solar PV system on the main roof plus 5 kWh battery
Emmaville pool	Solar PV + Heat Pump	Subject to additional pool heating being considered in future (e.g. to extend open season), evaluate PV and heat pump options.
Glen Innes RFS (not Council asset)	Solar PV + Battery	The RFS buildings may have capacity for more solar and storage in future that could largely meet the energy needs of the facility – subject to any constraints placed by Essential Energy.
Glen Innes Saleyards	Energy Efficiency	Replace all lights in the saleyards with LED technology (potential future project or replace on fail).
Glen Innes Depot	Solar PV + Battery	Install a further 13 kW solar and a battery to meet most of the main building energy demand.
Glen Innes Depot	Battery for existing solar PV system	Install a battery on to the small account solar PV system to reduce export to grid.
Glen Innes Town Hall	Solar PV + Battery	Install an additional 20 kW of solar PV on the north facing roof of Town Hall, plus a 30 kWh battery to meet more of the site's energy demand.
Glen Innes Visitor Information Centre	Solar PV + Battery	Install an added 5 kW solar PV on the west roof of the VIC plus a 10 kWh battery to

		service the VIC account.
Glen Innes Water Treatment Plant	Solar PV + Battery	Install a further 30 kW solar array and a 70 kWh battery at the WTP - location to be determined.
Glen Innes Offstream Storage	Solar PV	Install a further 50 kW solar PV plus 100 kWh battery to meet more of the offstream storage energy demand.
Glen Innes - Beardy River Pumping Station	Energy Efficiency & Solar PV	In the longer term review the optimum location of the river pumps, and evaluate efficiency, VSD and ground mount solar PV opportunities with any re-location – e.g. to Shannon Vale Road
Deepwater Water Treatment	Solar PV + Battery	Expand solar with a battery to meet most of the WTP's energy demand
Transport	Electric Fleet	Progressively migrate fleet to lower and zero emissions where it is technically and financially viable, including passenger vehicles, utes, commercial vans / buses and other operational plant.
Electricity	Purchasing	Progressively increase the amount of renewable energy purchased as part of Council's energy procurement processes.

7.7 Continuous improvement measures

In addition to discrete energy saving projects, Council can make further energy use savings and cost savings through its normal procurement processes, by adopting sustainable procurement guidelines for local governments. Recommended actions are outlined below.

TABLE 11: 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 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)
Council facilities / buildings	Power & appliances	Power and appliances represent a fairly modest % of Council's electricity use, including servers that run 24/7, office equipment such as computers, copiers and printers, and appliances like fridges, boiling water units, microwaves, dishwashers and televisions. The opportunities for Council to continue to improve the energy efficiency of office equipment and appliances include: - Implement sustainable procurement practices based on the 2017 Sustainable Procurement Guide for NSW local governments - Making procurement and facilities management / maintenance staff aware of appliance replacement program incentives that may encourage them to replace old inefficient fridges and TVs (https://energysaver.nsw.gov.au/business/discounts-and-incentives)

8 Financial analysis summary for selected opportunities

8.1.1 Solar PV initiatives

Short-term and medium-term 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. Images of modelled arrays are shown in Appendix A. Copies of all Helioscope modelling are provided as separate files to Glen Innes Severn Council.

TABLE 12: SUMMARY FINANCIAL ANALYSIS OF SOLAR PV OPPORTUNITIES – SHORT AND MEDIUM TERM

Site	Size	Capex	Self-consumed solar	Exported solar	Savings Yr1	Payback in Years	NPV over 25 years	IRR over 25 years	Emissions Reduction	% reduction in site energy use
Emmaville Mining Museum	2.01 kW	$2,613	2.85 MWh	0.71 MWh	$744	3.76	$6,868	26%	2.92 t CO_2-e	26.93%
Glen Innes Pool - Ground Mount	40.30 kW	$56,420	57.19 MWh	14.30 MWh	$14,940	4.04	$133,972	24%	58.62 t CO_2-e	39.33%
Glen Innes Pool - Roof Mount	28.50 kW	$34,200	39.78 MWh	9.94 MWh	$10,390	3.52	$98,185	28%	40.77 t CO_2-e	27.35%
Glen Innes Town Hall	20.10 kW	$28,140	28.72 MWh	7.18 MWh	$7,502	4.01	$67,477	25%	29.44 t CO_2-e	23.19%
Glen Innes Visitor Info Centre	5.03 kW	$6,036	7.60 MWh	0.84 MWh	$1,755	3.68	$16,311	27%	6.92 t CO_2-e	20.21%
Glen Innes Water Treatment Plant	20.10 kW	$28,140	22.12 MWh	9.48 MWh	$6,094	3.53	$81,118	28%	25.91 t CO_2-e	21.94%
Glen Innes - New bore (quarry)	50.60 kW	$70,840	85.73 MWh	4.51 MWh	$21,040	3.57	$200,676	28%	74.00 t CO_2-e	42.86%
Glen Innes Depot	12.10 kW	$14,520	8.22 MWh	12.32 MWh	$2,968	5.46	$21,228	18%	16.84 t CO_2-e	82.78%
Glen Innes Offstream	50.60 kW	$91,080	53.10 MWh	35.40 MWh	$15,641	6.35	$103,806	15%	72.57 t CO_2-e	41.23%
Deepwater Water Treatment	3.16 kW	$5,056	3.44 MWh	2.29 MWh	$1,012	5.44	$7,558	18%	4.69 t CO_2-e	33.10%
Glen Innes STP	49.80 kW	$69,720	53.15 MWh	35.43 MWh	$15,590	4.87	$124,473	20%	72.64 t CO_2-e	18.11%

8.1.2 Energy Efficiency & Management

For the lighting, motor systems, contract / tariff and power factor opportunities identified an initial analysis of costs and savings was performed based on site visits and data / information supplied by Council. 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. This is particularly important for street lighting upgrades, and an approved supplier must be appointed before work commences.

TABLE 13: SUMMARY FINANCIAL ANALYSIS OF ENERGY EFFICIENCY OPPORTUNITIES – SHORT AND MEDIUM TERM

Site	Project type	Description	Capex	Savings	Savings Yr1	Payback in Years
Emmaville Mining Museum	Lighting	Upgrade all lights to LED.	$6,300	4.92 MWh	$1,476	4.27 Years
Emmaville Pool	Motor Systems	Install VSD control for the main pool filter pump	$5,000	6.05 MWh	$1,452	3.44 Years
Glen Innes Pool	Tariff / Contract	Review tariff and change to Council's large sites contract if viable	$0	0.00 MWh	TBC	0.00 Years
Glen Innes Pool	Motor Systems	Install VSD control for the main and 7m pool filter pumps.	$15,000	20.97 MWh	$5,032	2.98 Years
Glen Innes Pool	Heat Pumps	Replace matting and boilers with heat pumps and solar PV	$150,000	-95.41 MWh 1,288 GJ	$62,356	2.41 Years
Glen Innes Depot	Lighting	Upgrade all lights to LED.	$20,444	11.04 MWh	$3,312	6.17 Years
Glen Innes Town Hall	Lighting	Upgrade all lights to LED.	$15,955	22.82 MWh	$6,845	2.33 Years
Glen Innes Visitor Info Centre	Lighting	Upgrade all lights to LED in the VIC and bus station and control outside lights on a PE cell	$8,600	10.74 MWh	$3,221	2.67 Years
Glen Innes - Red Range Bore	Tariff / Contract	Change tariff and to Council's large sites contract	$0	0.00 MWh	TBC	0.00 Years
Streetlighting	Lighting	Upgrade all lights to LED.	$155,860	110.00 MWh	$33,446	4.66 Years
Glen Innes STP	Power Factor	Install PFC to correct incoming power to unity.	$7,500	0.00 MWh	$2,436	3.08 Years

Appendix A: Solar PV modelled sites

Glen Innes Pool – Ground mount

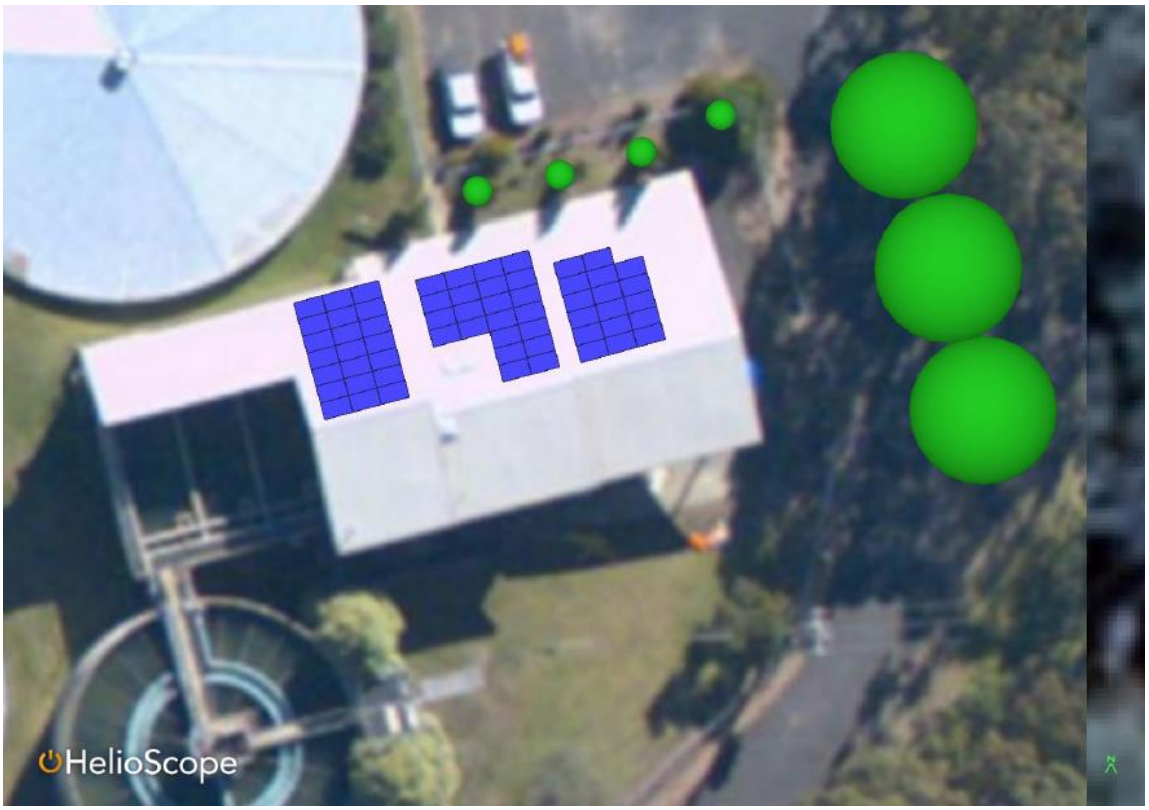
Glen Innes Pool – Roof mount

Emmaville Mining Museum

Glen Innes Depot

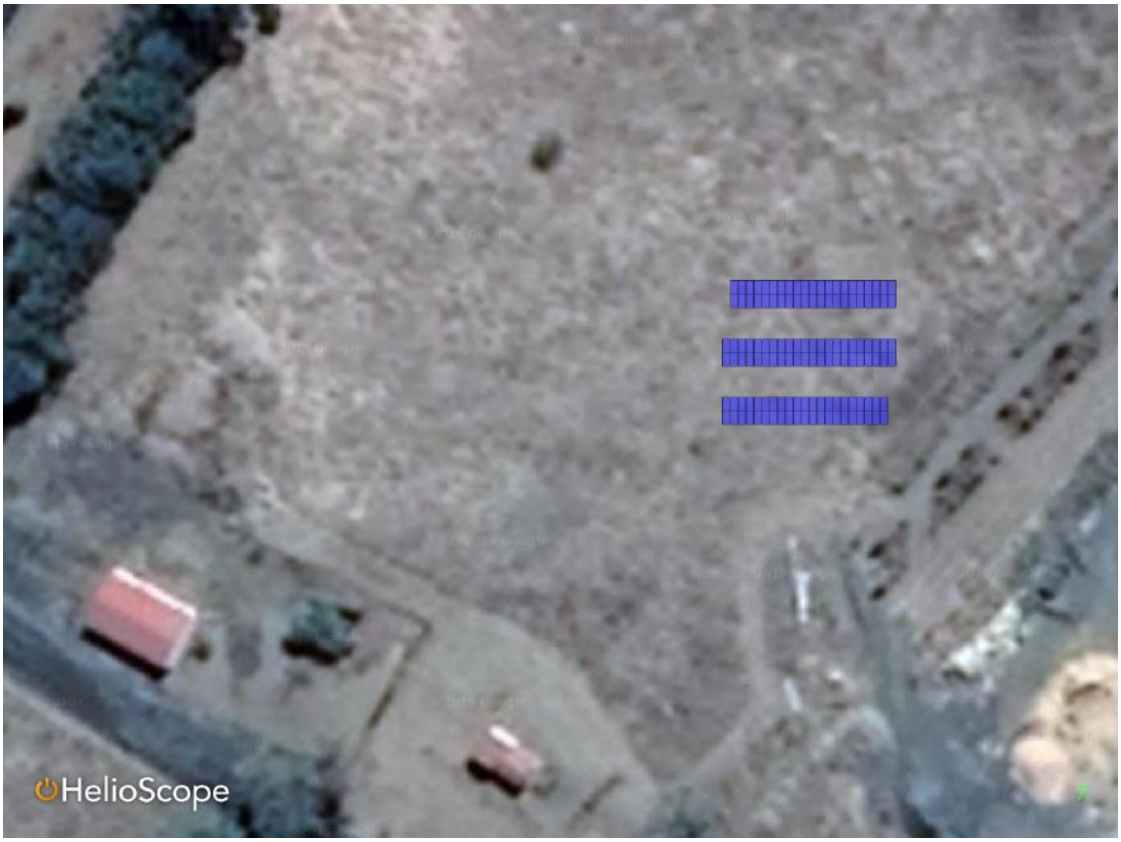
Glen Innes Town Hall

Glen Innes Water Treatment Plant



Glen Innes Offstream Storage

Glen Innes Quarry site – New Bore



Glen Innes Sewage Treatment Plant

Deepwater Water Treatment

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