100% renewables

NSW GOVERNMENT | Planning, Industry & Environment

Narrandera Shire Council

Narrandera Shire Council

Climate Action Strategy (*Council Operations*)

24 November 2020

www.100percentrenewables.com.au

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Glossary of climate change & project abbreviations

Acronym	Definition
AC, DC	Alternating & direct current
ACCU	Australian Carbon Credit Unit
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AFOLU	Agriculture, Forestry and Other Land Use
APVI	Australian Photovoltaic Institute
ATA	Alternative Technology Association
B20, B50	Diesel blends with 20% and 50% biodiesel
BASIX	Building Sustainability Index
BAU	Business-as-usual
BCA	Building Code of Australia
BEEC	Building Energy Efficiency Certificate
BESS	Battery Energy Storage System
BMS	Building Management System
BEV	Battery electric vehicle
CDM	Clean Development Mechanism
C40	Network of the world's megacities committed to addressing climate change
CCF	Climate Change Fund
CER	Certified Emissions Reductions (offsets)
CFL	Compact fluorescent
CFD	Contract for Difference
COP	Coefficient of performance (refrigeration)
COP21	Conference of the Parties in Paris at which the Paris Agreement was reached
CO_2-e	Carbon Dioxide Equivalent
CPP	Cities Power Partnership
CPRS	Australia's Carbon Pollution Reduction Scheme
CSP	Community Strategic Plan
C4CE	Coalition for Community Energy
DOL	Direct On Line
DPIE	NSW Department of Planning, Industry and Environment
E3	Equipment Energy Efficiency program
EER	Energy efficiency ratio
EPA	Environmental Protection Authority
EPC	Energy Performance Contracting
EPC(M)	Engineer, Procure, Construct (Maintain)
ERF	Emissions Reduction Fund
ESB	Energy Security Board
ESC	Energy Saving Certificates
ESS	NSW Energy Savings Scheme
EUA	Environmental Upgrade Agreement
EV	Electric Vehicle

FiT	Feed-in-tariff
GFC	Global Financial Crisis
GHG	Greenhouse Gas
HVAC	Heating, ventilation, and air conditioning
ICE	Internal combustion engine
ICLEI	Local Governments for Sustainability
IPCC	Intergovernmental Panel on Climate Change
kWh, MWh, GWh	Units of energy – usually used for electricity
LED	Light Emitting Diode (lighting technology)
LGC	Large-scale Generation Certificate
MJ, GJ	Units of energy – usually used for gas
LGA	Local Government Areas
LPG	Liquefied Petroleum Gas
NABERS	National Australian Built Environment Rating System
NCC	National Construction Code
NDC	Nationally Determined Contributions by countries to meet Paris commitments
NEM	National Electricity Market
NCOS	National Carbon Offset Standard
NGA	National Greenhouse Accounts
NRMA	National Roads and Motorists' Association
NSW	New South Wales
O&M	Operation and maintenance
P2P	Peer to Peer trading of renewable energy
PHEV	Plug-in hybrid electric vehicle
PPA	Power Purchase Agreement
PV	Solar photovoltaic technology
REF	Revolving Energy Fund
RET	Australia's Renewable Energy Target
ROI	Return on Investment
S1	Scope 1 greenhouse gas emissions, from combustion of fuel at your facilities
S2	Scope 2 greenhouse gas emissions, caused by consuming electricity
S3	Scope 3 greenhouse gas emissions, indirect emissions upstream and downstream of your business
SDGs	Sustainable Development Goals
SRES	Small-scale Renewable Energy Scheme
SPS	Sewer Pumping Station
STC	Small-Scale Technology Certificates
STP	Sewerage Treatment Plant
VCS	Verified Carbon Standard
VFD, VSD	Variable Frequency Drive / Speed Drive
VGA	Virtual Generation Agreement
VPPs	Virtual Power Plants
W, kW, MW	Units of power – usually used for electricity
WTP	Water Treatment Plant

1 Executive Summary

100% Renewables was engaged by the NSW Department of Planning, Industry & Environment: Sustainable Councils and Communities Program to develop a Climate Action Strategy with Narrandera Shire Council that will help it to cost-effectively increase the amount of renewable energy at its facilities, lower energy demand, and reduce costs.

This Strategy is focused on energy-related emissions associated with Council's operations facilities, which can demonstrate to the community that emissions reduction is feasible and cost-effective, and position Council as a leader in the community's climate action. Council's broader climate response can extend beyond this to encompass landfill and other waste emissions resulting from community activities (that Council manages), as well as emissions in the community from stationary energy use, transport, agriculture and other land use.

1.1 Suggested climate action goals for Narrandera Shire Council

Based on an assessment of Council's energy utilisation and of opportunities for energy saving and emissions reduction, the following targets or goals could be pursued by Narrandera Shire Council.

1.1.1 Energy efficiency and renewable energy goals

The scope for grid energy savings from energy efficiency and behind-the-meter solar PV (with battery energy storage) at Council's facilities is up to 797 MWh per annum or 31% of current electricity consumption. Deterioration of solar performance over time, and projects that progressively upgrade Council's sites and services can see some of this potential be reduced.

A suitable target for grid energy reduction for Narrandera Shire Council could therefore be 25% of 2019 consumption, achievable within the next ten years, and with much of this achievable through cost effective actions within the next five years. Good examples of the opportunities available to Council include upgrading all streetlights to LED technology, shifting energy demand at large water pumping and treatment sites, and solar PV at the Narrandera sewerage treatment plant (STP).

Additional savings in energy consumption may be feasible through purchasing of low emissions vehicles, however these will be small in the next ten years.

In addition to grid electricity reduction, Council can elect to source its electricity supply from renewable energy sources, and many Councils in NSW have already done this. While typically this covers all large-market sites only, it may be feasible to source clean energy for all Council sites within the next ten years.

Potential targets for Narrandera Shire Council to consider are:

- 25% savings in grid electricity by 2030 through energy efficiency and onsite solar PV
- Up to 100% renewable energy for Council's electricity supply by 2030, with all large-market sites to be supplied with renewables as soon as practicable and where no added risk or costs are borne by Council

1.1.2 Greenhouse gas emissions reduction goal

The achievement of the above targets would translate into greenhouse gas emissions savings of 70-75% by 2030, with the balance of emissions relating to transport, and in particular to diesel used by large vehicles and plant.

It will likely be feasible to switch to electric vehicles for passenger cars and some LCVs by 2030, however there is greater uncertainty about timing of electric options for other vehicles at this time.

Given this, a suggested emissions target for Narrandera Shire Council is:

- Up to 75% savings in greenhouse gas emissions from Council's facilities by 2030

1.2 Budget implications

A number of potential energy efficiency and behind-the-meter solar PV opportunities have been costed at a high level for this strategy. This estimates costs of $1.2 million for short, medium and long term actions, with annual cost savings based on current rates of around $250,000. Overall this represents a payback of under five years.

There will be additional costs (and benefits) through sustainable transport and other procurements over time. It is envisaged that Council would enter into a renewable energy power purchase agreement where there is no added cost or risk to Council compared with their normal electricity procurement process. This would be assessed at each procurement cycle, typically every two to three years, and it may be done via a group of Councils through RAMJO for example.

1.3 Council's energy and carbon footprint

In 2019 Council's carbon footprint for its operations was dominated by electricity consumption followed by diesel fuel consumption, as tabulated and graphed below.

TABLE 1: NARRANDERA SHIRE COUNCIL – CARBON FOOTPRINT 2019, ENERGY ONLY

	Emission source	Activity data	Units	Scope 1 t CO2-e	Scope 2 t CO2-e	Scope 3 t CO2-e	Total	%
	Diesel for fleet	280	kL	762		39	801	25.3%
	Petrol for fleet	24	kL	56		3	59	1.9%
	Ethanol for fleet	0.005	kL	0		0	0	0.0%
	Electricity used in council assets	2,214,878	kWh		1,794	199	1,993	63.0%
	Electricity used by streetlighting	346,183	kWh			312	312	9.8%
	Electricity use from solar PV	57,629	kWh				0	0.0%
	TOTAL:			**819**	**1,794**	**553**	**3,165**	**100.0%**

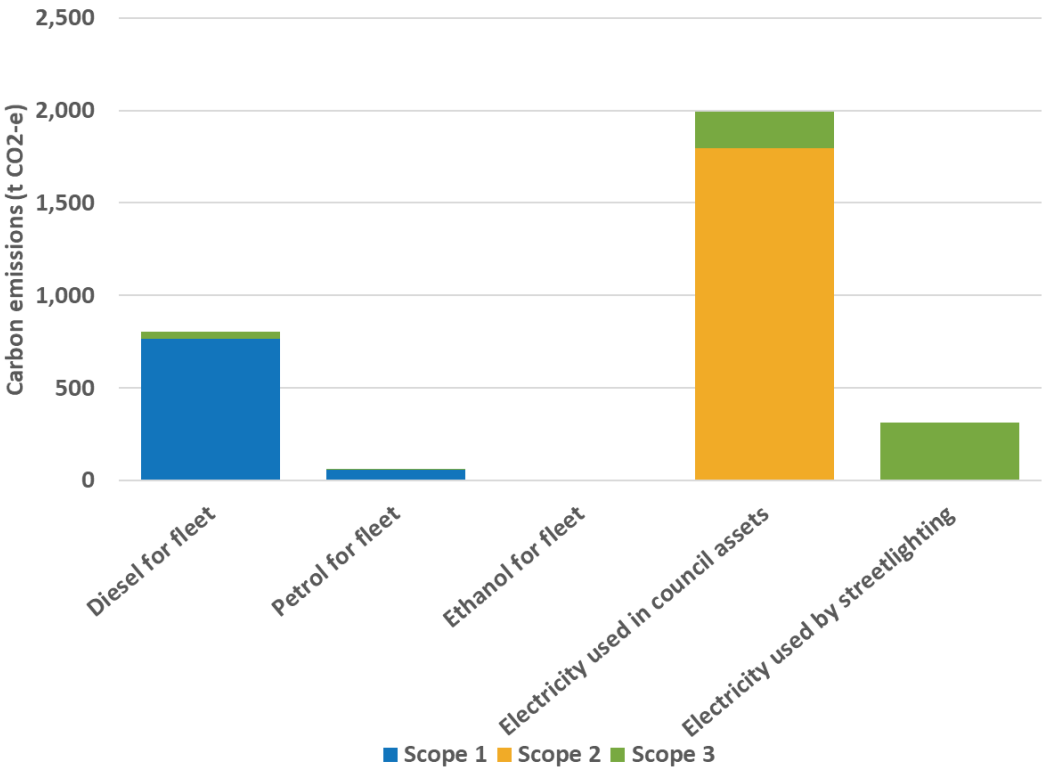

FIGURE 1: NARRANDERA SHIRE COUNCIL CARBON FOOTPRINT BY EMISSIONS SOURCE, ENERGY ONLY

Electricity use is dominated by a small number of large sites (including the main streetlighting account) and many individually small electricity using sites. The 'top 10' sites' use 79% of all Council's electricity.

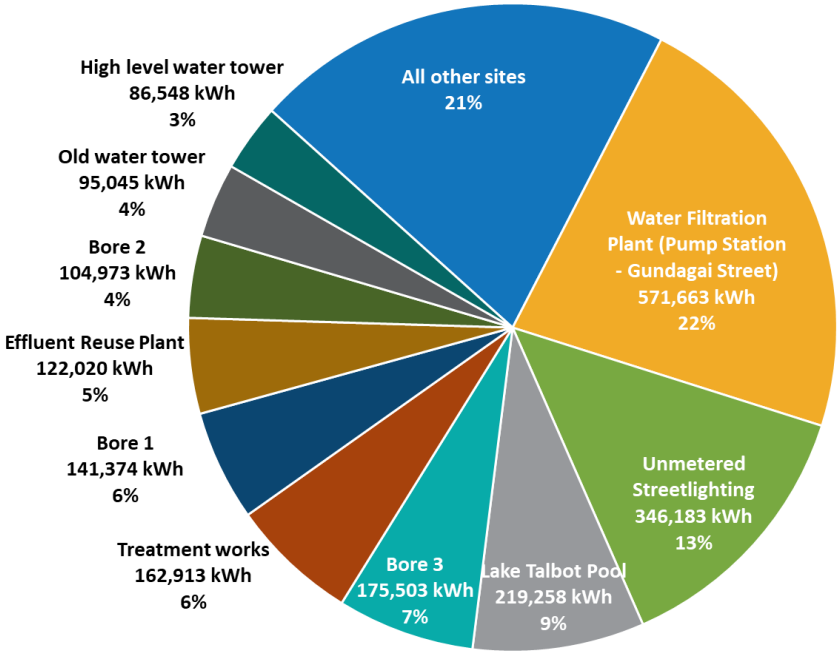

FIGURE 2: NARRANDERA SHIRE COUNCIL'S LARGE ELECTRICITY USING SITES

1.4 Efficiency, renewable energy & emissions reduction plans

A review of Narrandera Shire Council's current energy demand and carbon footprint, site visits and discussions with Narrandera Shire Council staff, suggest that there are six main areas of action by Narrandera Shire Council that, implemented together in a planned way, can significantly reduce energy demand, increase onsite renewables, and reduce emissions. These six areas are:

1. Grid decarbonisation
2. Buying clean energy (e.g. via a renewable energy power purchase agreement or PPA)
3. Behind-the-meter solar (i.e. onsite solar)
4. Energy efficiency
5. Sustainable transport
6. Sustainable procurement

Recommended action plans to achieve savings in Council's operations are tabulated below.

1.4.1 Short and medium-term action plan

TABLE 2: NARRANDERA SHIRE COUNCIL SHORT TO MEDIUM TERM PLAN FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Energy-saving option	Indicative cost
Energy efficiency	Metering and Accounts	Narrandera STP	Determine if the STP and Effluent Reuse Plant can be combined into a single NMI account to lower peak demand and supply charges.	Council confirming costs
Energy efficiency	VSD Control		Install a DO monitoring system to optimise the usage of existing VSD controls during aeration cycles.	$20,000
Behind the meter solar	Solar PV - Ground - STC		Install a 45.8 kW ground-mounted system in the field adjacent to the STP.	$59,540
Behind the meter solar	Solar PV - Ground - STC		ALTERNATIVE: Install an 80.6 kW ground-mounted system in the field adjacent to the STP if the STP and ERU meters can be combined	$104,780
Behind the meter solar	Solar PV - Ground - STC	Sewer Pump Station No. 1 Larmer Street	Install a 10.3 kW ground-mounted system in the field in front of the pump station.	$13,390
Energy efficiency	New Plant	Water Filtration Plant	Incorporate good practice energy efficient design into new works.	Not assessed
Energy efficiency	Power Factor Correction		Install a 135 kVAr PFC unit to reduce the demand charges.	$13,500
Energy efficiency	Scheduling		Implement load shifting of operations from peak to off-peak to reduce demand and energy charges.	Staff time
Energy efficiency	VSD Control		Investigate the costs and savings to install VSD control on the 2x 250 kW water pumps.	$200,000
Energy efficiency	Metering and Accounts	Old Water & High Water Towers	Determine if the Old Water and High Water can be combined into a single NMI account to lower peak demand and supply charges.	Council confirming costs

Behind the meter solar	Solar PV - Ground - STC	Red Hill Pressure Booster Station	Install a 4.74 kW ground-mounted system in front of the pump station.	$6,162
Energy efficiency	LED Lighting	Unmetered streetlighting	Install LED streetlights for local roads.	$359,000
Behind the meter solar	Solar PV - Roof - STC	Truck Washbay	Install a 10.1 kW roof mounted system.	$10,100
Behind the meter solar	Solar PV + BESS - Roof - STC	Sports Stadium	Install a 14.7 kW roof-mounted system with 15 kWh battery.	$28,200
Energy efficiency	Metering and Accounts	Council Chambers	Determine if the 3 NMIs supplying the Chambers main building, HR & Finance and the bell tower can be combined into a single NMI account.	Council confirming costs
Behind the meter solar	Solar PV - Roof - STC		Install an additional 9.7 kW roof-mounted system on the roof of the Chambers building (with micro-inverters).	$9,700
Behind the meter solar	Solar PV - Micro-inverter - Roof - STC		Install an additional 10.1kW roof-mounted system on the roof of the HR building, provided the meter for this and the Chambers building can be combined.	$12,120
Behind the meter solar	Solar PV - Roof - STC	Meals on Wheels (One stop shop)	Install a 14.7 kW roof-mounted system on the roof of the centre.	$14,700
Energy efficiency	Power Factor Correction	Bore Pumps	Install a 135 kVAr PFC unit to reduce the demand charges.	$13,500
Energy efficiency	Metering and Accounts	All sites	Install smart meters on all significant sites to capture usage to facilitate consumption analysis and potential for solar and batteries.	TBC if this is a capex or on-bill cost

Behind the meter solar	Solar PV + BESS - Roof - STC	Depot	Install additional 25.5 kW roof-mounted system with 25 kWh battery to increase solar energy usage onsite.	$48,000
Sustainable transportation	EV Charging		Install EV charging station to charge PHEV or BHEV vehicles.	$12,000
Behind the meter solar	Solar PV - Carport - STC	Lake Talbot Pool	Install a 49.8 kW carport solar system.	$139,440
Behind the meter solar	Solar PV - Carport - STC		Install a 74.7 kW carport solar system.	$209,160

1.4.2 Long term action plan

A suggested long-term action plan for Narrandera Shire Council is outlined below.

TABLE 3: NARRANDERA SHIRE COUNCIL LONG TERM PLAN FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Energy-saving option	Indicative cost
Energy efficiency	Voltage Optimisation	Narrandera STP	Install a voltage optimisation system to control incoming voltage.	$7,000
Behind the meter solar	Solar PV - Micro-inverter - Roof - STC	Old Water & High Water Towers	Install a 15.1 kW roof-mounted system on the roof of Old Water reservoir (after the current reservoir is replaced)	$18,120
Behind the meter solar	Solar PV - Micro-inverter - Roof - STC	Old Water & High Water Towers	Install a 29.8 kW roof-mounted system on the roof of Old Water reservoir (after the current reservoir is replaced AND if the meters for the two water towers can be combined.	$35,760
Behind the meter solar	Solar PV + BESS - Roof - STC	Truck Washbay	Install a 25.1 kW roof-mounted system with 25 kWh battery on the roof of washbay.	$47,600

Behind the meter solar	BESS	Library	Install an additional 30 kWh battery to the existing solar PV system to increase solar energy consumption.	$27,000
Behind the meter solar	Solar PV + BESS - Roof - STC	Parkside Cottage Museum	Install a 3.02 kW roof-mounted system with 3 kWh battery on the roof of the museum.	$5,720
Behind the meter solar	Solar PV + BESS - Roof - STC	Community Cultural Hall	Install a 3.02 kW roof-mounted system with 3 kWh battery on the roof of the east gallery.	$5,720
Behind the meter solar	Solar PV + BESS - Roof - STC	Sports Stadium	Install a 14.7 kW roof-mounted system with 15 kWh battery.	$28,200
Energy efficiency	VSD Control	Pine Hill Pump Station	Install VSD control on the pumps supplying the Pine Hill reservoirs.	$10,000
Energy efficiency	UV Treatment		Install LED for UV systems at the STP	Not estimated

1.4.3 Continuous improvement

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, a suggested continuous improvement plan for Narrandera Shire Council is outlined below

TABLE 4: NARRANDERA SHIRE COUNCIL CONTINUOUS IMPROVEMENT PLAN FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Energy-saving option	Cost or resources required
Sustainable Procurement	Sustainable Procurement	All sites	Review Council's procurement policy and practices and consider adopting the updated Local Government Sustainable Procurement Guidelines to inform policy, training and specifications for buying products and services, such as sporting field LED lighting and split system air conditioning unit replacement for example.	Not estimated

Sustainable transport	Sustainable transport		Review options available to Council to progressively improve the emissions of its fleet, and opportunities to transition towards electric vehicles – including hybrid vehicle costs for passenger cars and LCVs, development of EV infrastructure, a trial of an electric vehicle, Council's fleet strategy and review process including obtaining data from telematics, staying abreast of technology, policy and incentives, and low-NOx and Euro 6 opportunities for large fleet and plant.	Not estimated
Buying clean energy	Renewable Energy Power Purchasing		Incorporate renewables as a procurement option in Council's next supply agreement.	Not estimated
Energy efficiency	Energy efficiency awareness		Promote a higher awareness of good energy saving practise and reward staff accordingly.	Not estimated
Energy efficiency	Scheduling	Bore Pumps	Implement load shifting of 5-8 pm load to off-peak hours for Bore 1, and review periodically to optimise performance and respond to any network tariff changes	Not estimated
Energy efficiency	Scheduling		Implement load shifting of 5-8 pm load to off-peak hours for Bore 2, and review periodically to optimise performance and respond to any network tariff changes	Not estimated
Energy efficiency	Scheduling		Implement load shifting of 5-8 pm load to off-peak hours for Bore 3, and review periodically to optimise performance and respond to any network tariff changes	Not estimated

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Scope

Summary of the scope of work and approach

2 Approach and scope of work

100% Renewables was engaged by the NSW Department of Planning, Industry & Environment: Sustainable Councils and Communities Program to develop a Climate Action Strategy for Narrandera Shire Council that will help it to cost-effectively increase the amount of renewable energy at its facilities, and lower energy demand through efficiency measures. The scope of this project is outlined below, and is focused on Council's operations energy use and carbon emissions.

FIGURE 3: SEVEN-STEP PROCESS TO DEVELOP NARRANDERA SHIRE COUNCIL'S CLIMATE ACTION STRATEGY

- **Stage 1 – Inception**
  - Meet Council's key stakeholders and discuss the project plan
- **Stage 2 – Energy & carbon footprint**
  - Collect energy data from Council's energy management platform or billing
  - Analyse interval data where available
  - Develop energy & carbon footprint for Council operations
- **Stage 3 – Engagement**
  - Set up meetings / presentations with key stakeholders across Council
  - Set up and conduct site visits across key sites at Council
- **Stage 4 – Draft opportunities**
  - Develop draft opportunities in Excel for discussion with stakeholders
  - Circulate these opportunities to Council staff for input, discussion and prioritisation
- **Stage 5 – Business case development**
  - Model solar PV business cases, assess efficiency opportunities
  - Overview of sustainable transport and renewable energy power purchasing
- **Stage 6 – Action plans**
  - Develop short, medium and long term action plans for Council
- **Stage 7 – Climate Action Strategy Plan**
  - Draft Climate Action Strategy report
  - Conduct presentation of the plan to Council
  - Finalise Climate Action Strategy report

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Background and Context

Factors underpinning climate action at global and sectoral levels

3 Global context for climate action and targets

3.1 The need to reach 'net-zero' greenhouse gas emissions

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 2.8°C. To limit warming to 1.5°C, carbon emissions must decline sharply in the short-term and reach net-zero by mid-century.

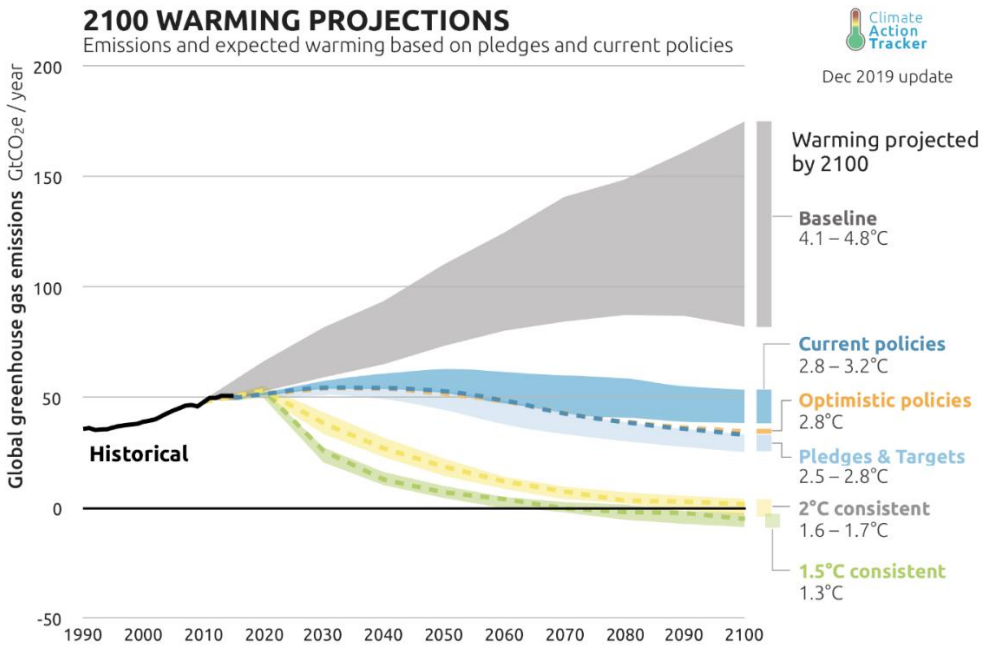


FIGURE 4: THE CLIMATE ACTION TRACKER'S WARMING PROJECTIONS FOR 2100, VARIOUS POLICY SCENARIOS

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 could mean:

1. Net-zero GHG emissions from stationary fuel combustion such as LP gas use, and
2. Net-zero GHG emissions from transport 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 5: GLOBAL CONTEXT FOR ACTION ON CLIMATE

[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

In addition, the World Economic Forum's Global Risks Report 2020[6] highlights adverse climate change-related outcomes as among the most likely to occur with the highest impacts to the global 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.

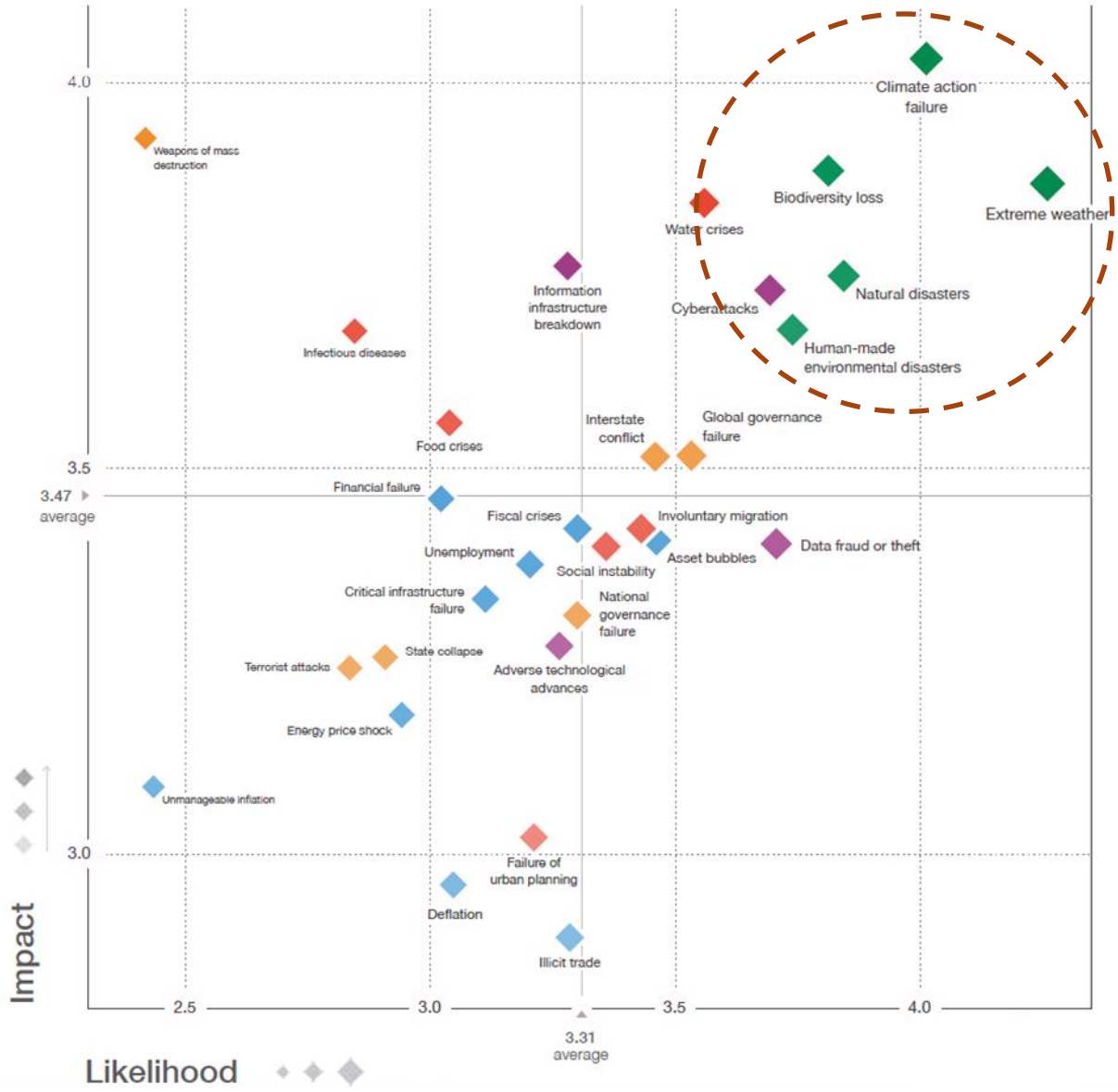


FIGURE 6: GLOBAL RISKS REPORT – LIKELIHOOD & IMPACT OF CLIMATE, OTHER RISKS TO GLOBAL ECONOMY

[6] http://reports.weforum.org/global-risks-report-2020/

4 National and State 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 7: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – NATIONAL LEVEL

According to the Clean Energy Regulator[7], the Renewable Energy target has been met and renewable energy generation will exceed the 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).

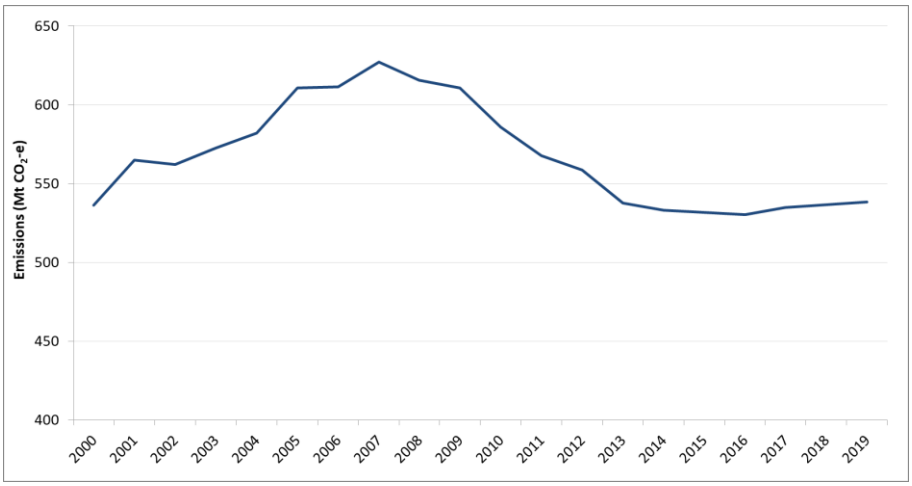


FIGURE 8: AUSTRALIA'S GHG EMISSIONS FROM ALL SOURCES

[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.

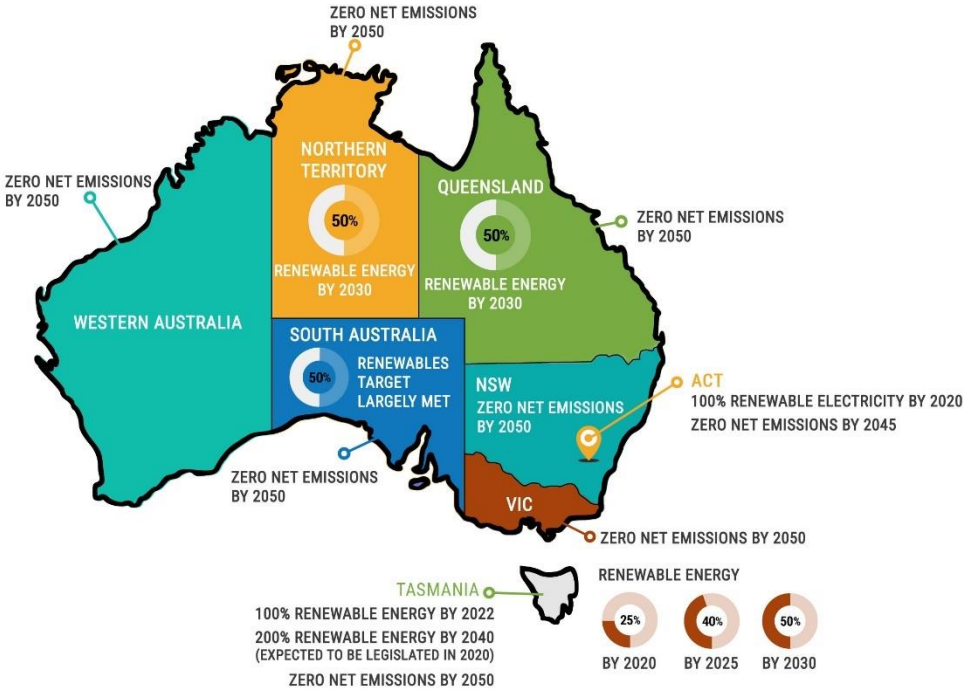


FIGURE 9: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – STATE & TERRITORY LEVEL

Supporting the NSW Government's commitment to reach net zero emissions by 2050, NSW Government recently released its **Net Zero Plan Stage 1: 2020–2030**[8]. This is a big milestone that sees the first of three 10-year plans released that will set a pathway to net zero emissions by 2050.

In addition the NSW Government has developed an **NSW Electricity Strategy**[9] which will help the State to deliver on its goal to attract renewable energy investment. In the first instance a 3,000 MW renewable energy zone (REZ) in Central West Orana will be developed, attracting significant private sector investment to developing new generation assets in this region.

A larger 8,000 MW renewable energy zone is to be developed in the New England region with up to seven additional REZs' to be developed in future.

The figures below show the approximate locations of the Central West Orana, New England and South-West REZs'.

[8] © State of New South Wales 2020. Published March 2020
[9] https://energy.nsw.gov.au/renewables/renewable-energy-zones

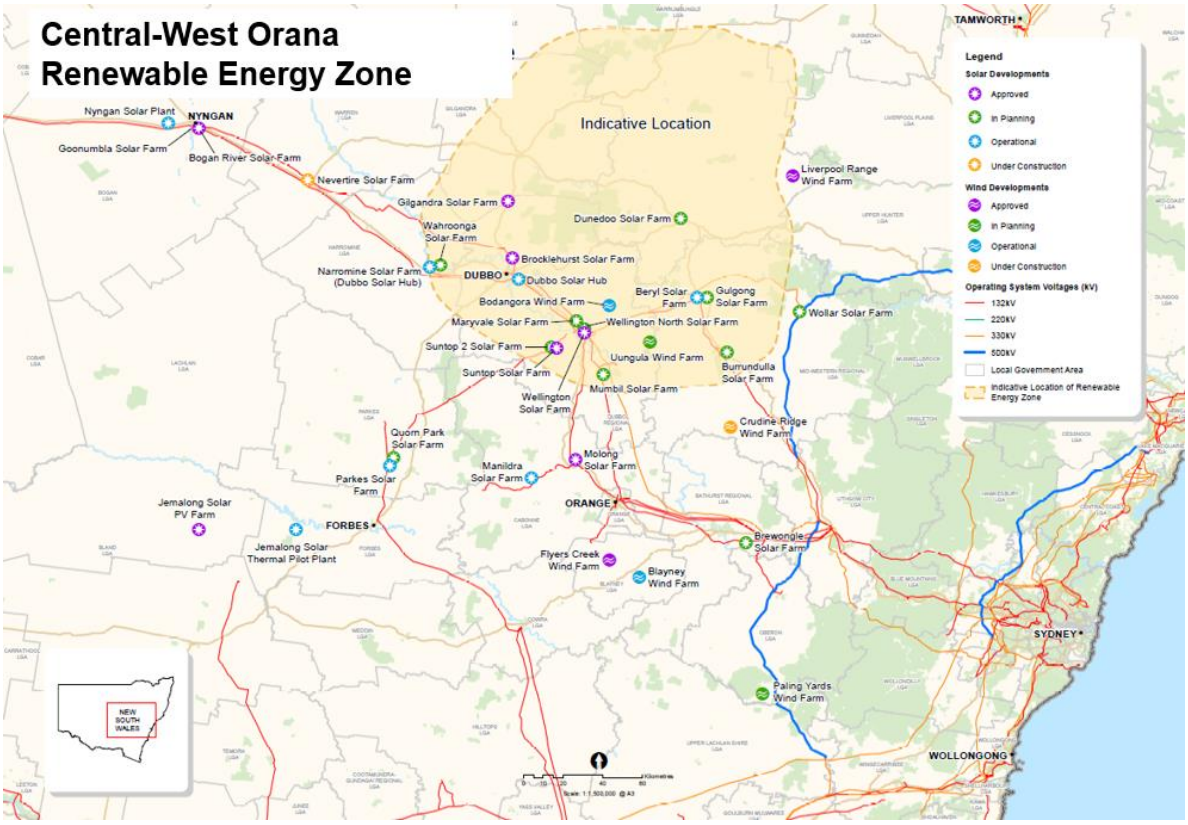


FIGURE 10: INDICATIVE CENTRAL-WEST ORANA NSW RENEWABLE ENERGY ZONE

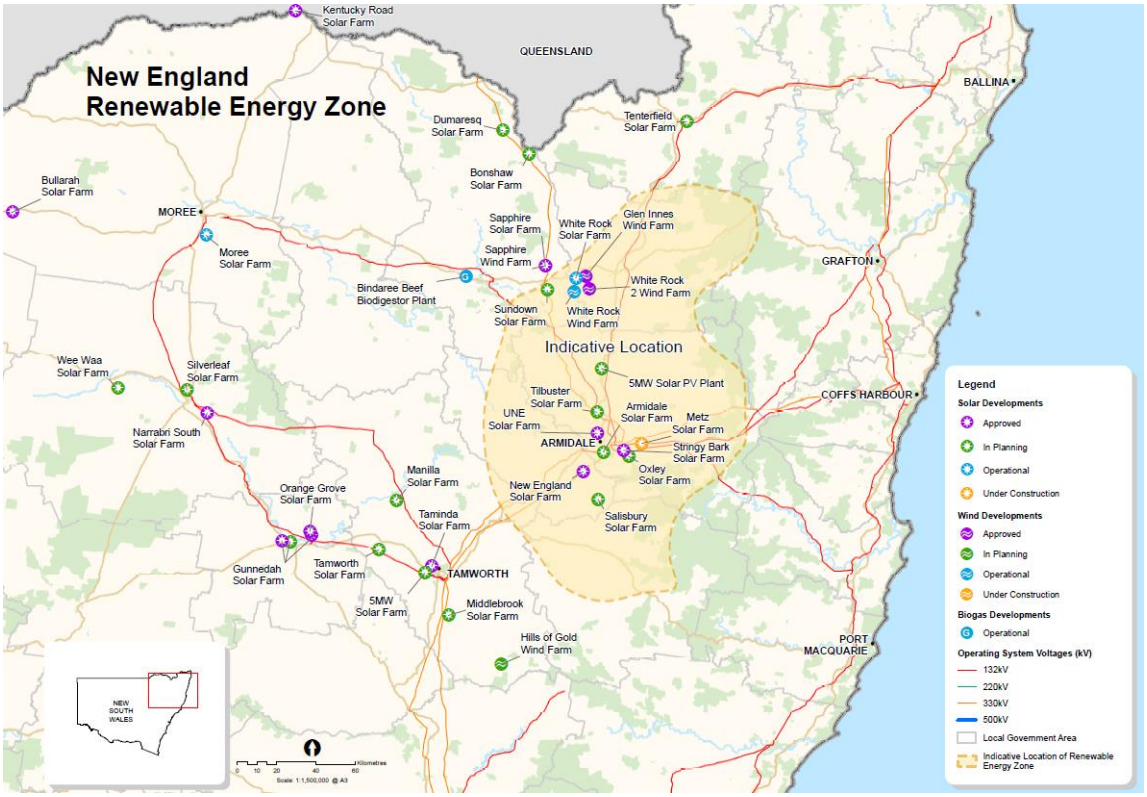


FIGURE 11: INDICATIVE NEW ENGLAND NSW RENEWABLE ENERGY ZONE

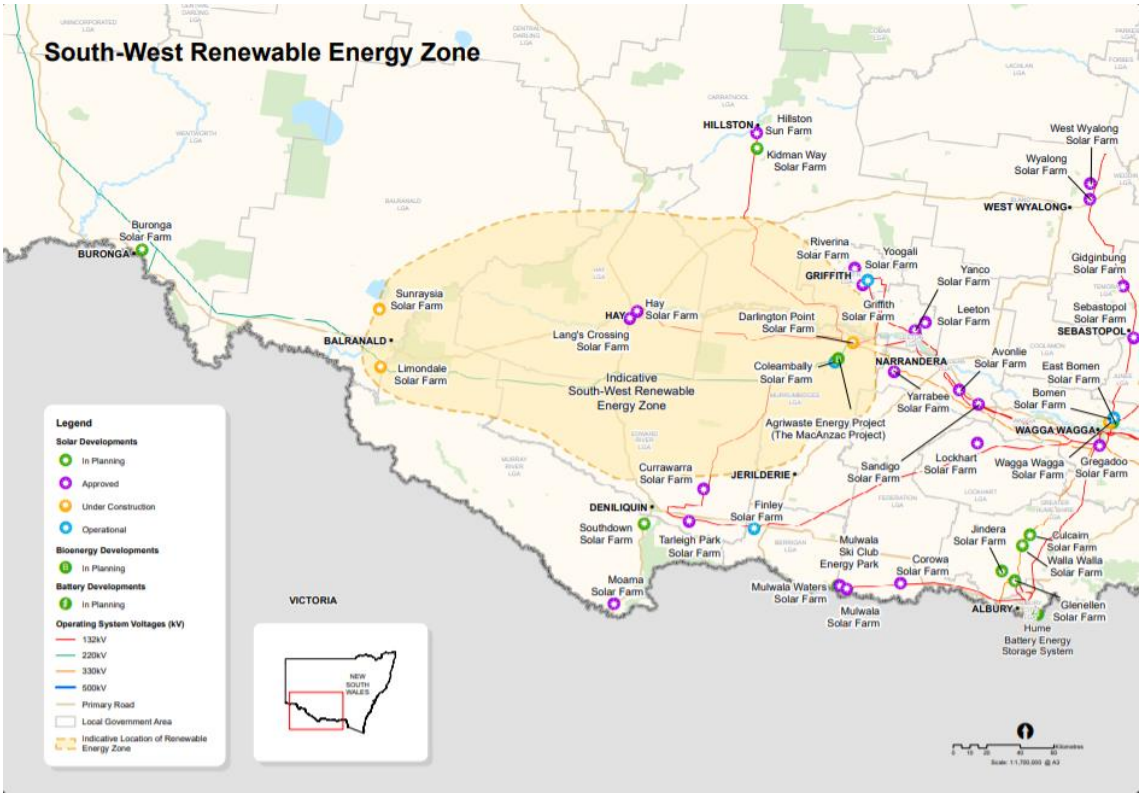


FIGURE 12: INDICATIVE SOUTH WEST RENEWABLE ENERGY ZONE

Some of the key highlights of the 2020-2030 Net Zero Plan include:

- A central focus of the Plan is about jobs that will be created and about the lowering of energy costs for consumers. Many renewable energy jobs will be created in regional NSW.
- The Plan commits to breaking down barriers that remain to people and business investing in commercially-available technologies, such as energy efficient appliances and buildings, rooftop solar, firmed grid-scale renewables, and electric vehicles.
- The Plan commits NSW to reducing State emissions by 35% by 2030 and to net zero by 2050 and articulates this is a shared responsibility among business, individuals and governments.
- There will be a broadening of the focus of abatement to encompass low-carbon products and services and providing consumers with more information to influence buying decisions.
- Clarity on some of the funding, targets and programs that will help drive this change, such as:
    - $450 million Emissions Intensity Reduction Program
    - $450 million commitment to New South Wales from the Climate Solutions Fund
    - $1.07 billion in added funding via NSW and Commonwealth across several measures
    - Development of three Renewable Energy Zones in the Central-West, New England and South-West of NSW to drive up to $23 billion in investment and create new jobs
    - Energy Security Safeguard to extend and expand the Energy Savings Scheme
    - Expanded Energy Efficiency Program
    - Expanded Electric and Hybrid Vehicle Plan with the Electric Vehicle Infrastructure and Model Availability Program to fast-track the EV market in NSW

- Primary Industries Productivity and Abatement Program to support primary producers and landowners to commercialise low emissions technologies
- Target of net-zero emissions from organic waste by 2030
- Development of a Green Investment Strategy, with Sydney as a world-leading carbon services hub by 2030
- Enhancement of the EnergySwitch service by allowing consumers to compare the emissions performance of energy retailers
- Advocate to expand NABERS to more building types, and improve both the National Construction Code and BASIX
- Establishment of a Clean Technology Program to develop and commercialise emissions-reducing technologies that have the potential to commercially out-compete existing emissions-intense goods, services and processes
- Establishment of a Hydrogen Program that will help the scale-up of hydrogen as an energy source and feedstock, and target 10% hydrogen in the gas network by 2030
- Aligning action by government under GREP with the broader state targets through clear targets for rooftop solar, EVs, electric buses, diesel-electric trains, NABERS for Government buildings, power purchasing and expansion of national parks

Several of these initiatives will be of interest and benefit to Narrandera Shire Council and its community.

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. Cities Power Partnership or CPP is an initiative of the Climate Council and it represents Australia's largest local government climate action network with >120 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. Making five action pledges to tackle climate change.
    b. Connection and sharing between participants.
    c. Access to a comprehensive online Knowledge Hub and Power Analytics tool to help track emissions, energy and cost savings.
    d. Councils can also access support from local and international experts.
2. 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 (at July 2020).

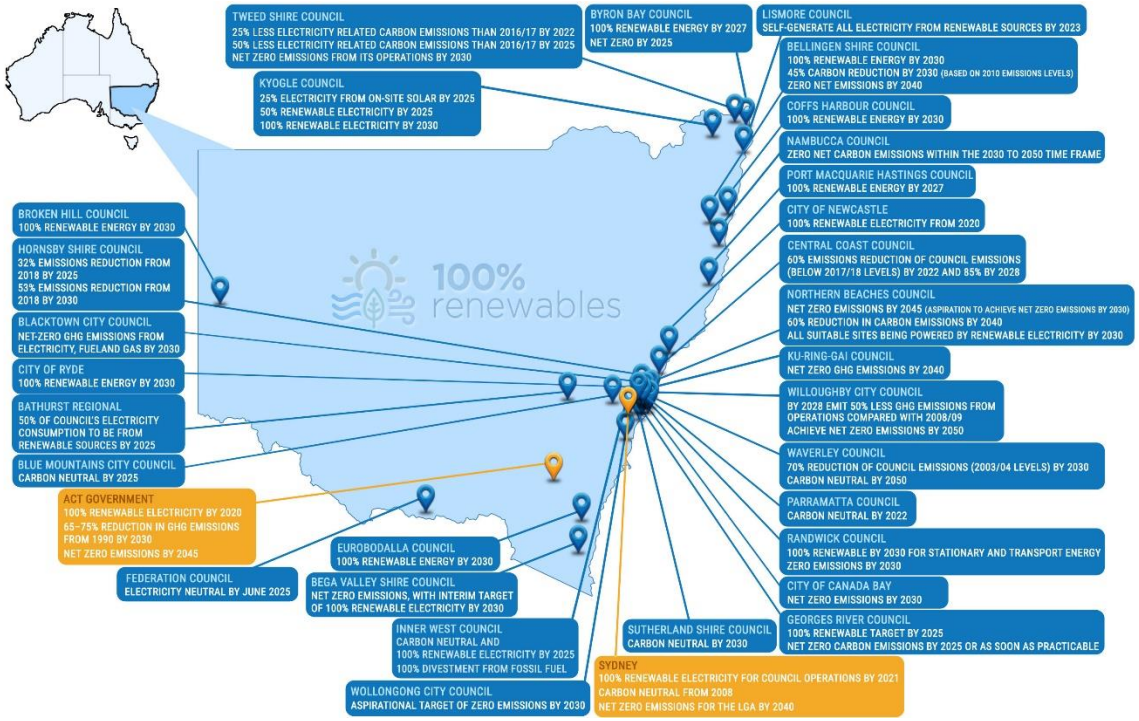


FIGURE 13: RENEWABLE ENERGY & CARBON TARGETS BY NSW COUNCILS & ACT

3. Many local councils across NSW have taken up opportunities as LED streetlighting has become available and approved for use, to upgrade their local and main road lights. Councils across NSW and across the three distribution networks have seen energy use and costs, as well as maintenance costs, fall dramatically as a result of these upgrades. Narrandera Shire Council is among those who will be upgrading their streetlights to LED in the near future.

5 Local trends – what is occurring in Narrandera Shire?

Narrandera Shire Local Government Area is in the upper middle of LGAs in terms of the uptake of solar hot water and solar PV systems. According to data sourced from the Australian Photovoltaic Institute (APVI), Narrandera Shire Council LGA has:

- 758 PV installations, a 25.6% penetration rate, at July 2020, with almost 5.5 MW of installed capacity. Refer to the APVI map with Narrandera Shire Council LGA details highlighted below.
- 67 installations over 10 kW and less than 100 kW, 690 installations of less than 10 kW, and 1 installation of over 100 kW.

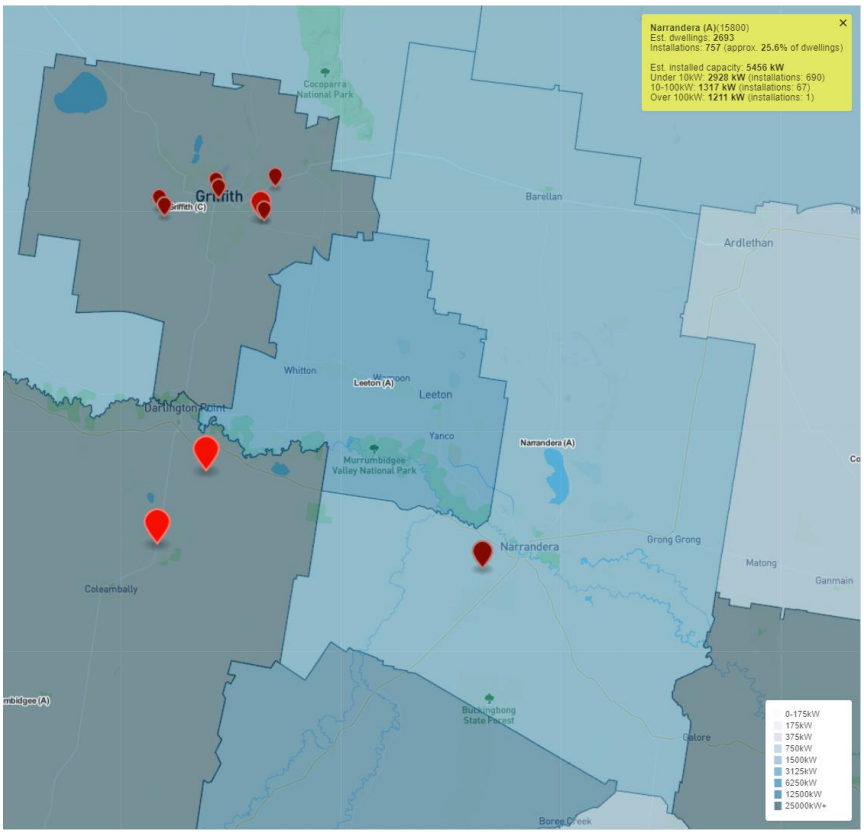


FIGURE 14: NARRANDERA SHIRE LGA SOLAR PV INSTALLATIONS, JULY 2020

Narrandera Shire Council has implemented a number of initiatives to reduce energy demand and cost. It is often the case that this is done as 'business-as-usual'. Examples, supplied by Council and observed from site visits, include:

- 20 kW solar PV installation at Narrandera Library
- 15 kW solar PV installation at Narrandera Shire Works Depot
- 15 kW solar PV installation at Narrandera Council Chambers
- VSD control of major motor drives in some of Council's sewer and water pumping systems
- LED lighting has been installed at most of Council's facilities such as offices, library, depot
- White Way and Festoon lighting in town has all been upgraded to LED technology
- Council has committed funding to upgrade all of its residential and main road lighting to LED technology

100% renewables

Baseline

Narrandera Shire Council's energy and carbon footprint

6 Council's 2019 energy use and carbon footprint

Council's energy use and carbon footprint were assessed based on energy consumption and emissions from landfill waste and wastewater, based on data supplied by Council covering the financial year 2018/19 and calendar year 2019. This reflects data availability for various emissions sources, and the inventory year is simply referred to as 2019.

In 2019 Council's carbon footprint for its operations was dominated by electricity consumption followed by diesel fuel consumption, as tabulated below. Waste from landfill, which Council operates but which reflects community greenhouse gas emissions, is also significant. Fugitive emissions estimates from wastewater pumping and treatment were not available.

TABLE 5: NARRANDERA SHIRE COUNCIL – CARBON FOOTPRINT 2019, ENERGY + LANDFILL WASTE

	Emission source	Activity data	Units	Scope 1 t CO2-e	Scope 2 t CO2-e	Scope 3 t CO2-e	Total	%
	Diesel for fleet	280	kL	762		39	801	16.8%
	Petrol for fleet	24	kL	56		3	59	1.2%
	Ethanol for fleet	0.005	kL	0		0	0	0.0%
	Electricity used in council assets	2,214,878	kWh		1,794	199	1,993	41.9%
	Electricity used by streetlighting	346,183	kWh			312	312	6.5%
	Electricity use from solar PV	57,629	kWh				0	0.0%
	Landfill waste	1,137	t	1,592			1,592	33.5%
	TOTAL:			**2,410**	**1,794**	**553**	**4,757**	**100.0%**

Outside of waste, Council's emissions are dominated by electricity as tabulated below.

TABLE 6: NARRANDERA SHIRE COUNCIL – CARBON FOOTPRINT 2019, ENERGY ONLY

	Emission source	Activity data	Units	Scope 1 t CO2-e	Scope 2 t CO2-e	Scope 3 t CO2-e	Total	%
	Diesel for fleet	280	kL	762		39	801	25.3%
	Petrol for fleet	24	kL	56		3	59	1.9%
	Ethanol for fleet	0.005	kL	0		0	0	0.0%
	Electricity used in council assets	2,214,878	kWh		1,794	199	1,993	63.0%
	Electricity used by streetlighting	346,183	kWh			312	312	9.8%
	Electricity use from solar PV	57,629	kWh				0	0.0%
	TOTAL:			**819**	**1,794**	**553**	**3,165**	**100.0%**

The above inventory summaries are repeated graphically below.

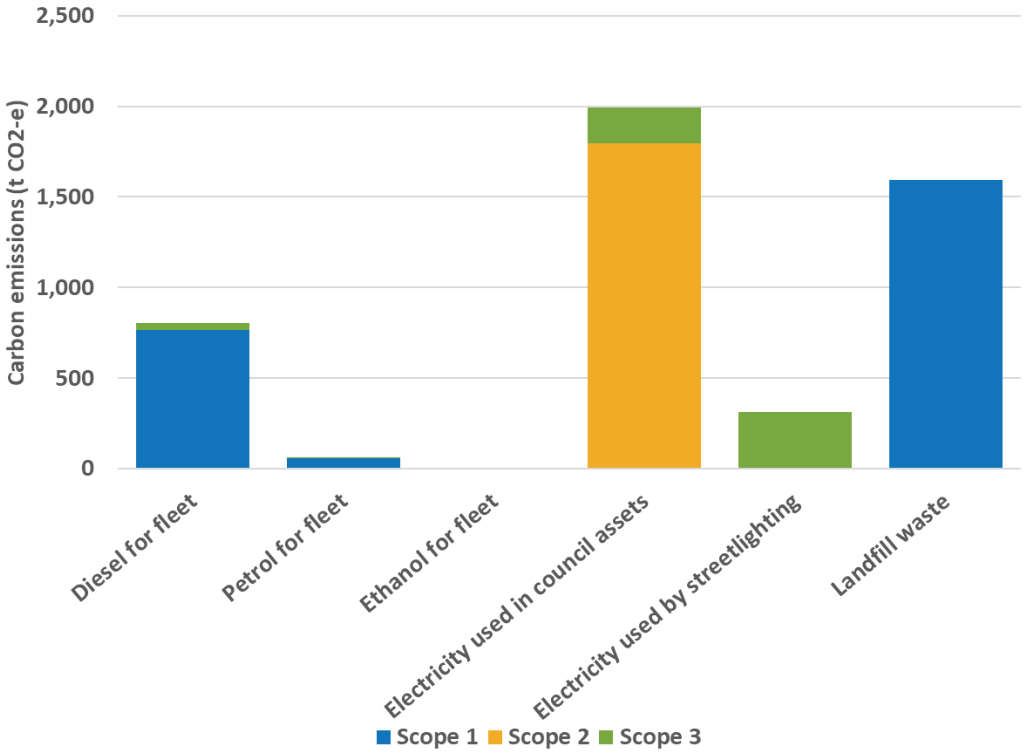


FIGURE 15: NARRANDERA SHIRE COUNCIL CARBON FOOTPRINT BY EMISSIONS SOURCE, ENERGY + WASTE

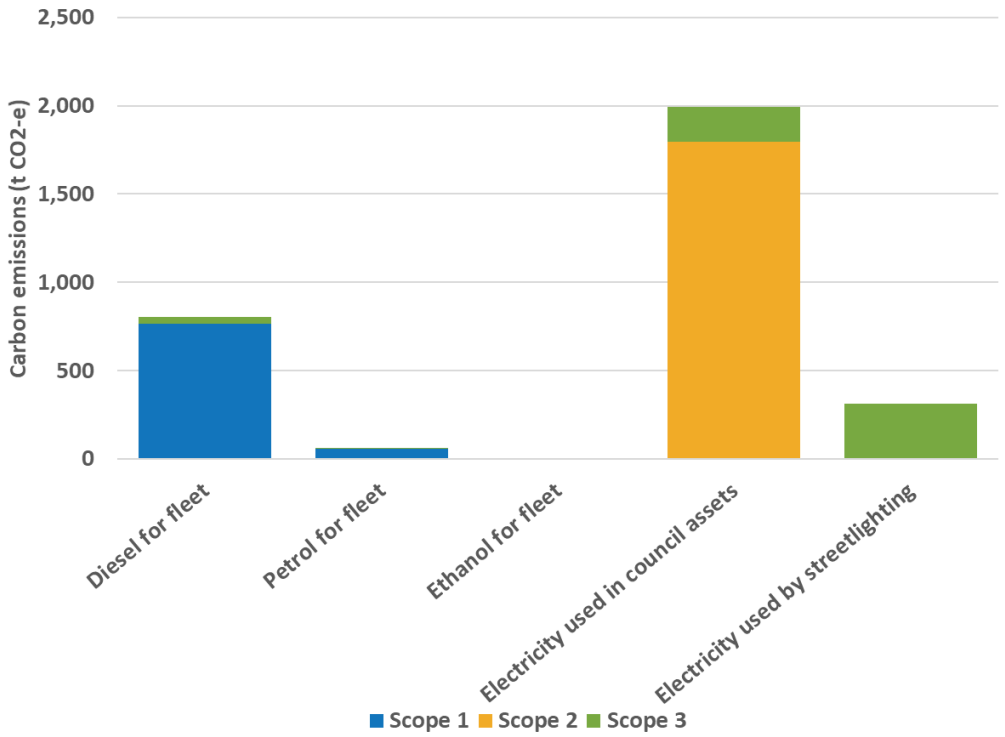


FIGURE 16: NARRANDERA SHIRE COUNCIL CARBON FOOTPRINT BY EMISSIONS SOURCE, ENERGY ONLY

6.1 Electricity consumption summary

As the main source of operational greenhouse gas emissions, electricity use was assessed further. The following three charts provide a summary of where and how electricity is used, including:

- Top 10 electricity using sites seen against the balance of consumption
- Electricity use by site type, and
- Estimated electricity end use by equipment type

Electricity use is dominated by a small number of large sites (including the main streetlighting account) and many individually small electricity using sites. The 'top 10' sites' use 79% of all Council's electricity.

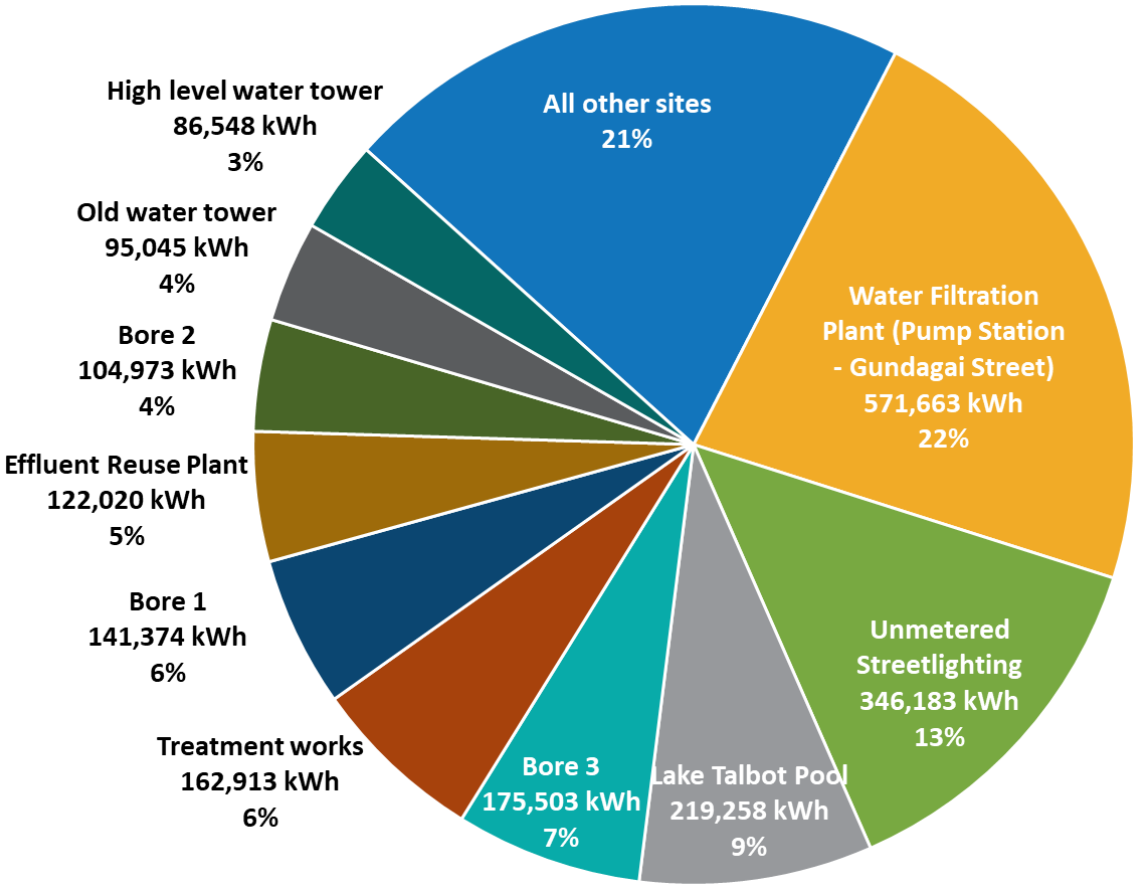


FIGURE 17: NARRANDERA SHIRE COUNCIL'S LARGE ELECTRICITY USING SITES

Viewed by site type it can be seen that water and sewer pumping assets consume 27% of Council's power, while water treatment plants use 22%, unmetered streetlighting uses 14% and sewage treatment plants use 11%. Council's swimming pools and buildings together consume 17% of power, and other sites are small users, aggregated into sports, parks, public lighting & amenities, depot, emergency services and other Council asset categories.

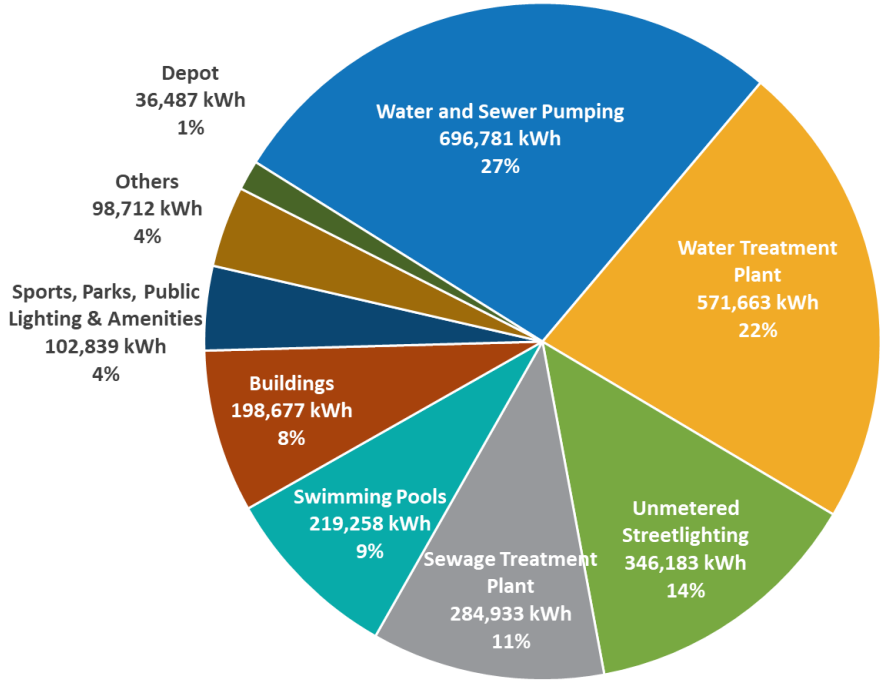


FIGURE 18: NARRANDERA SHIRE COUNCIL'S MAIN ELECTRICITY USING ASSET CATEGORIES

It is also possible to estimate the contribution by major equipment types to electricity use, based on experience with similar operations. The major equipment types include motor systems, lighting, air conditioning (HVAC) and power & appliances. The estimated contribution to Council's electricity consumption is illustrated below, highlighting motor systems and lighting as the major users, and likely the major focus areas for energy efficiency.

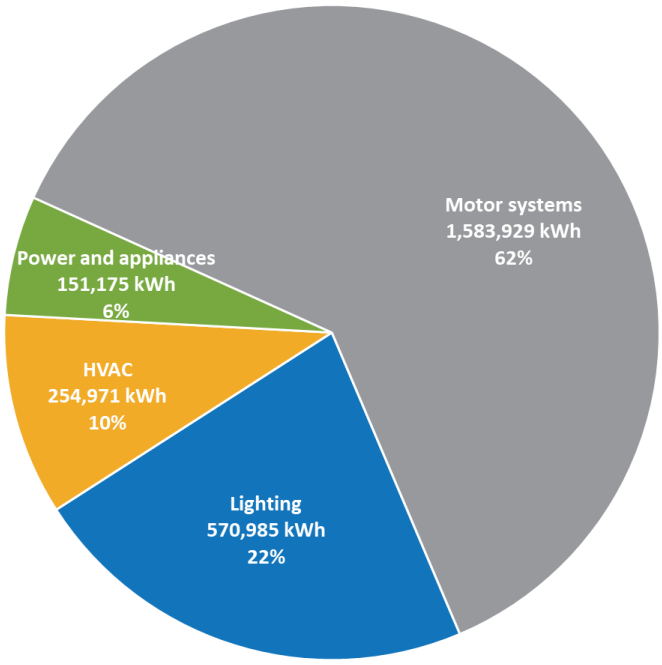


FIGURE 19: NARRANDERA SHIRE COUNCIL'S ELECTRICITY USE BY END USE EQUIPMENT

6.2 Landfill gas and wastewater emissions summary

6.2.1 Landfill gas emissions

Emissions from landfill are not the focus of this strategy. However, for completeness emissions are included in this work to provide a reference for Council as it considers its targets for carbon emissions in future, and action to reduce emissions by the Narrandera Shire community.

The 2019 landfill data was unavailable, hence, landfill data from 2017/18 was used. In 2017/18 emissions from landfill in Narrandera Shire were 1,591.8 t CO_2-e, from 1,137 tonnes of waste (see table below).

A total of 1,168 tonnes of waste was recycled in 2019.

TABLE 7: NARRANDERA SHIRE COUNCIL – CARBON FOOTPRINT 2019, LANDFILL GAS

	Emission source	Activity data	Units	Scope 1 t CO2-e	Scope 2 t CO2-e	Scope 3 t CO2-e	Total
	Landfill waste	1,137	t	1,592			1,592

6.2.2 Direct wastewater emissions

Council was not able to provide data for wastewater emissions in 2019. Emissions from wastewater should be included in future reporting of emissions by Council.

100% renewables

Climate Action Strategy

Narrandera Shire Council's emissions reduction opportunities

7 Narrandera Shire Council's emissions reduction options

7.1 Measures available to reduce Narrandera Shire Council's footprint

A review of Narrandera Shire Council's current operational energy demand and carbon footprint, site visits and discussions with Narrandera Shire Council staff, suggest that there are six main areas of action by Narrandera Shire Council that, implemented together in a planned way, can reduce energy demand, increase onsite renewables, and reduce emissions. These six areas are:

1. Grid decarbonisation
2. Buying clean energy (e.g. via a renewable energy power purchase agreement or PPA)
3. Behind-the-meter solar (i.e. onsite solar)
4. Energy efficiency
5. Sustainable transport
6. Sustainable procurement

These six measures are illustrated in the graphic below. Waste management was not included below as this was not the focus on this strategy. Following this, a summary of the scope, scale, cost-effectiveness and risks associated with each of these measures is presented that can enable the success of Council's abatement efforts. This is then followed by the presentation of action plans that will enable Narrandera Shire Council to achieve its goals.

Action plans are based on analysis of information and data, visits to numerous Narrandera Shire Council facilities with experienced staff, and discussions with key stakeholders.

FIGURE 20: SIX CATEGORIES OF EMISSIONS REDUCTION FOR NARRANDERA SHIRE COUNCIL

7.2 Grid decarbonisation

Description

In NSW there are five coal-fired power stations with combined 10,240 MW capacity that supply most of the State's electricity and make up the majority of NSW electricity sector emissions (Liddell, Vales Point B, Eraring, Bayswater, Mt Piper).

The state is largely self-reliant for power, with this supplemented by interstate links as and when required. Since 2010 three coal-fired power stations with 1,744 MW of capacity have closed in NSW (Wallerawang C, Redbank and Munmorah).

In recent years nearly 800 MW of large-scale solar and over 5,500 MW of wind energy generation has been built in NSW, together with nearly 2,350 MW of rooftop solar PV capacity, and in recent years rooftop solar installations have accelerated.

A total of 11,000 MW of capacity in two Renewable Energy Zones was recently announced for the State's Central West Orana and New England regions.

As more coal-fired power stations approach the end of their life – announced closures are in 2022, 2028, 2034, 2035 and 2043 respectively for the five active coal-fired power stations noted above – they are most likely to be replaced with renewable energy. This is most likely to be from large-scale wind and solar PV, together with Distributed Energy Resources (DER) and demand-side measures.

Assuming this, the future carbon intensity of the NSW grid could – simplistically – look something like the chart below (note that grid emissions factors are on a 3-year rolling average, leading to an apparent lag in emissions reduction compared with the above closure dates).

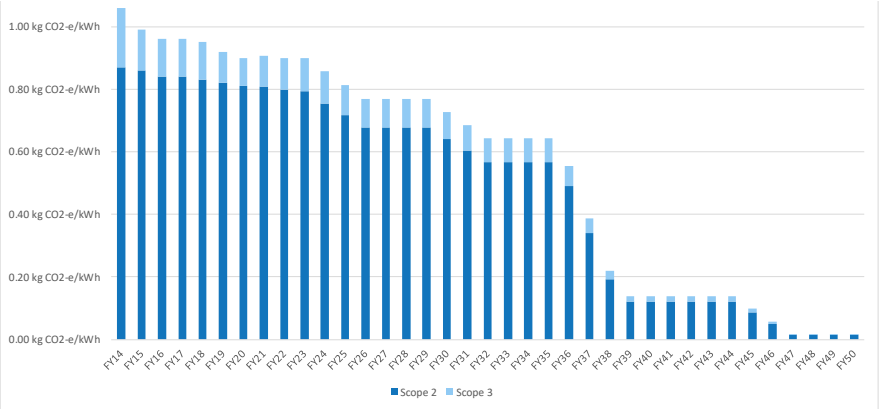


FIGURE 21: SIMPLISTIC FORECAST MODEL OF NSW GRID EMISSIONS INTENSITY

The actual grid emissions intensity will be influenced by a range of factors, and AEMO's Integrated System Plan 2020 [10] (ISP2020) models five scenarios with differing assumptions for key influencing factors including demand drivers, DER uptake, emissions, large-scale renewable build cost trajectories, investment and retirement considerations, gas market settings and coal price settings, together with assumptions regarding policy settings and transmission infrastructure development.

[10] AEMO: https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp

The resultant scenario outcomes for closure of large-scale generators in the NEM is illustrated below, highlighting the potential for the above scenario (broadly aligned with AEMO's Central scenario) to occur faster than the announced closure schedule.

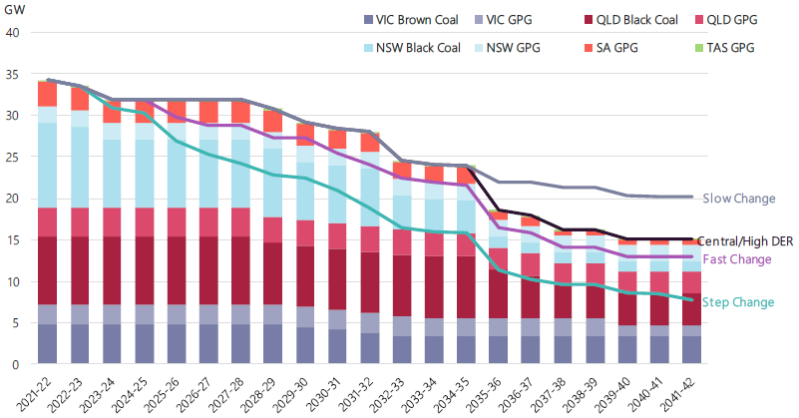


FIGURE 22: AEMO MODEL OF NEM COAL + GAS GENERATION CAPACITY & SCENARIOS[11]

It is also feasible that the NSW grid could 'green' even more rapidly than AEMO's most rapid change ('Step Change') scenario, and future modelling by AEMO will likely reflect updated forecasts.

Scope for abatement

The above potential scenarios for closure of coal-fired power in the NSW grid and associated reduction in carbon intensity will have a significant impact on GHG emissions in Narrandera Shire Council's operations. **A mostly renewable energy grid, allied to electrification of transport would see much of Council's 3,165 t CO_2-e from electricity and fuel be eliminated in time**.

Under most of AEMO's scenarios (excepting Step Change) the majority of this impact would not be seen until the late-2030s and in to the 2040s'. Hence, if Council wants to see its emissions decline at a faster rate, then abatement through energy efficiency, more onsite solar PV and battery storage, and switching to electric vehicles powered with renewables should be pursued.

Risks and mitigation

A slower change to the carbon intensity of grid electricity could see a slower rate of change in emissions intensity of grid electricity. Narrandera Shire Council has little influence over the rate of change in the grid carbon intensity, and the main risk mitigation strategy is to try and build capacity across Narrandera Shire Council to respond with local solutions to reduce emissions. Narrandera Shire Council could also have a role through its advocacy for change, potentially in collaboration with other Councils and representative organisations

Costs and benefits

There is no direct cost to Narrandera Shire Council associated with decarbonisation of the electricity grid, excepting impacts on energy pricing in future.

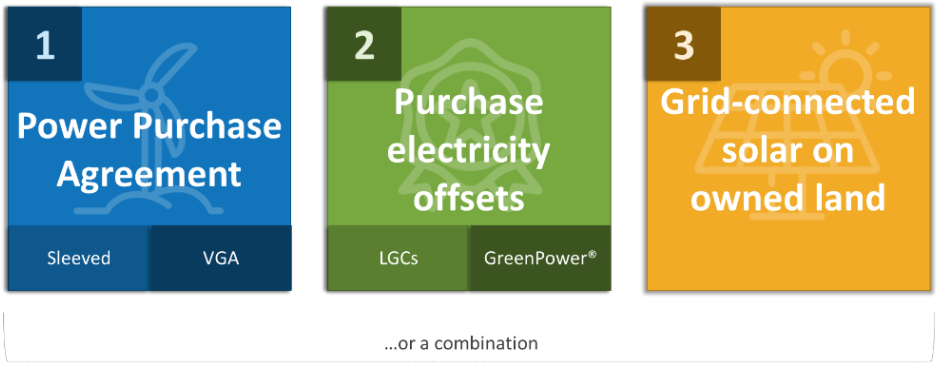
[11] AEMO, ibid

7.3 Buying clean energy

7.3.1 Renewable energy power purchase agreement

Description

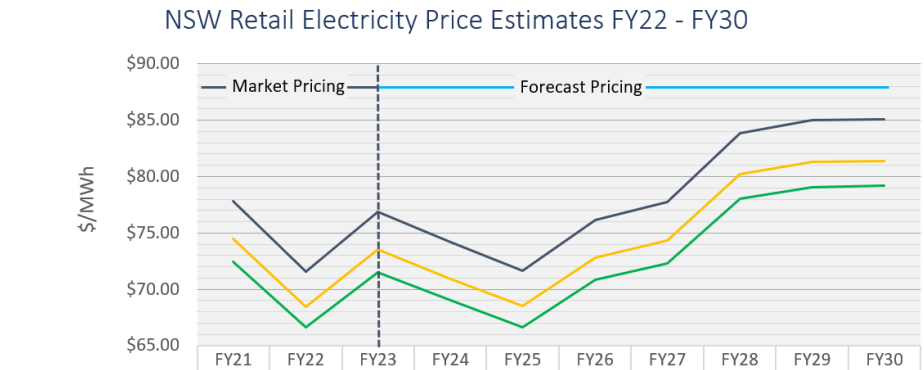
Electricity consumption accounts for 72.8% of Narrandera Shire Council's non-waste carbon footprint, and more than 79% of electricity is consumed by just 10 sites (including streetlighting). **The single biggest opportunity to reduce electricity emissions is to purchase renewable energy** and/or renewable energy offsets **via Council's electricity procurement process**. Unlike other abatement options, this does not require Narrandera Shire Council to physically implement change, only to stipulate that renewables be purchased to meet part or all of its electricity needs. This approach has been taken by several local governments in recent years and underpins most goals to reach carbon neutrality / net-zero emissions[12]. There are three main ways in which an organisation can source renewable energy, illustrated below.



The most favourable approach in the current market is to enter into a renewable energy power purchase agreement (PPA) with bundled electricity and Large-scale Generation Certificates (LGCs), and to consider the purchase of renewable energy offsets where a bundled PPA falls short of any targets Council may set in future. This can potentially be implemented for Narrandera Shire Council's next agreement, potentially just for large sites and streetlighting, or possibly encompassing all sites, and potentially in conjunction with other councils.

The cost for a PPA (typically 7 up to 10 years unlike regular electricity agreements that are for 2-3 years) will be compared with forecast electricity retail rates (wholesale rates plus retailer margin) to estimate cost savings. One current 10-year forecast for delivered retail electricity is shown below[13], and a process to develop a renewable energy PPA in future would create an updated forecast to inform comparison with offers from renewable energy retailers, enabling Council to make the most informed purchasing decision.

[12] Examples of NSW Councils' purchasing renewables as part of their electricity supply include: Southern Sydney Regional Organisation of Councils, City of Sydney, City of Newcastle and Hawkesbury City Council.
[13] Note that this forecast shows one forecast of **retail electricity** rates for a large energy user and does not include network charges / rates that would be added to a customers' bill.



	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Low Scenario	$72.43	$66.61	$71.50	$69.02	$66.66	$70.83	$72.33	$78.00	$79.07	$79.18
Medium Scenario	$74.46	$68.48	$73.50	$70.95	$68.53	$72.82	$74.36	$80.19	$81.29	$81.40
High Scenario	$77.84	$71.59	$76.84	$74.18	$71.65	$76.13	$77.74	$83.84	$84.99	$85.10

In the current market there are several types of PPA offers and going forward more will emerge. Two are outlined below that are representative of current market offers that local councils have adopted, and these along with other models would be assessed in greater detail as Council's contract renewal time approaches. These models include:

- Fixed price de-risked offer for 50% up to 100% renewable energy (for all or potentially just for large sites), and likely for up to 7-years covering both renewables and regular grid power and including LGCs in the pricing. In the current market this de-risked option is likely to be moderately more expensive than a regular-only agreement, and this would be re-assessed as part of a procurement process. Premium pricing could get smaller as the proportion of renewables approaches 100%.
- Virtual Generation Agreement (VGA): under this model around 75-80% of Council's load under the PPA may be load matched to renewable energy projects, and potentially at good prices compared with regular grid offers. Council's load profile would inform the proportions of wind vs solar, and the balance of load would be spot market exposed. This introduces some risk given the cap on spot prices is more than $14,000/MWh. Council could mitigate this risk by hedging against the spot market price, effectively capping risk at say $300/MWh. This hedge would increase the effective rate paid for electricity and could erode some or all cost savings. This model has underpinned some recent local council renewable energy PPAs, with net savings expected over their contract periods.

Scope for abatement

This opportunity for Narrandera Shire Council should be looked at in conjunction with grid decarbonisation since this will see all or most electricity sourced from renewables in any event in future. So, the opportunity is for Narrandera Shire Council to elect to buy renewables in the period between now and when decarbonisation occurs.

Based on Narrandera Shire Council's current energy mix, **purchasing 100% renewables would lead to abatement of 2,305 t CO_2-e, and 50% renewables would lead to abatement of 1,153 t CO_2-e per year** (the exact abatement would

change based on annual energy demand, on the selection of large-only sites or all sites, and on the proportion of renewables selected).

Risks and mitigation

Establishing a corporate PPA is complex, time-consuming and contains approaches and risks not previously considered by most consumers. These take time and resources to assess and manage, and this would be an integral part of Narrandera Shire Council's assessment, decision and procurement process.

A renewable energy PPA:

- is typically for a longer time period than a regular agreement,
- is associated with new-build solar, wind, hydro and battery projects,
- may be with recent or new entrants to the energy market, and
- occurs in an uncertain policy environment for renewable energy and climate change response

The key risk areas are illustrated below and would be assessed as part of a process to determine the best procurement solution for Narrandera Shire Council.

Costs and benefits

The costs or benefits of a renewable energy PPA are assessable via comparison of PPA offer pricing with forecast regular power pricing, and so is inherently subject to the quality of knowledge and assumptions underpinning forecasting.

In the current market (2020), PPA offers appear to be priced a little higher than regular offers where risk has been removed, and potentially lower than regular grid but with some risk exposure to the spot market. The market, pricing and contract models for renewable energy PPAs is still evolving, and the costs and benefits to Narrandera Shire Council should be assessed as part of Council's next procurement process.

7.3.1 Mid-scale renewable energy build by Narrandera Shire Council

Description

An option available to Narrandera Shire Council is to build its own mid-scale renewable energy plant on land it owns, or to participate in a regional mid-scale renewable energy project with other councils. Power generated would be exported to the grid, and Council could then purchase this electricity (and LGCs) via a licensed retailer or could simply take the grid spot price as income and retire or sell LGCs depending on its income and/or abatement goals.

This arrangement is like projects developed in recent years by Sunshine Coast Council (15 MW solar farm at Valdora meets all of Council's electricity needs) and City of Newcastle (5MW Summerhill landfill solar farm meets ~30% of Council's electricity needs). While several recent projects have been based on solar energy, bioenergy opportunities may also be feasible at a regional level.

A key aspect to note in these projects is that Council can't simply 'allocate' the renewable energy generated to its sites. If it wants to offset its regular power use with power from its own renewable energy plant, it must do so via a licensed retailer as an intermediary.

Like a PPA that is negotiated for supply from remote / non-Council projects, developing a mid-scale project is a complex undertaking, and requires assessment of a range of aspects, such as design, connection agreements, EPC and O&M contracts, ownership models, and the development of retail agreements to supply the power to Council. Community involvement in the ownership and/or purchasing of clean energy from the project could also be considered.

It is likely that this represents a medium to long term opportunity for Narrandera Shire Council, and this strategy does not assess the costs, benefits, options and risks associated with this approach.

The visits to the Narrandera Shire did not identify a particular site of Council's that could be suited to this approach at this time.

Scope for abatement

The scope for abatement of Council's emissions would depend on the scale and type of project, treatment of LGCs generated from the project's operation, and Narrandera Shire Council's offtake fraction of energy generated, for example.

The case for Council to develop a project such as this may have multiple aspects, such as meeting its own targets for renewables and abatement, its desire to see more renewable energy projects built in Narrandera Shire or in the RAMJO area, its desire to build projects that involve community ownership and/or establishment of a community energy retailer, or opportunities for grant funding that may make such a project economically viable compared with other options.

So, the scope for abatement of Council's emissions can range from a small fraction up to 100% of electricity emissions, and the scope for abatement in the wider community is potentially even larger.

Risks and mitigation

In addition to the renewable energy PPA risks highlighted above (which would also apply in the case of a mid-scale project), additional risks apply when looking at this opportunity. These include:

- Retailers may not want to be party to off-take, so ability to sleeve with Council's electricity agreement may be limited
- If the plant exceeds 5 MW in capacity then registration with AEMO will be required, with associated registration and recurrent fees
- At more than 5 MW (up to 30MW) and above 30MW in capacity a range of AEMO regulations will apply, leading to greater complexity in the operation of the asset and associated skills and knowledge required, as well as added risks to operation and income that would need to be modelled
- Greater skills and knowledge of wholesale markets would be required to manage revenue risk over time

These are examples and other risks may apply and would need to be identified, assessed and managed / mitigated as part of the project development.

Costs and benefits

In the current market – with declining wholesale prices, declining LGC prices, and lower offtake rates available for much larger renewable energy projects compared with mid-scale projects, the business case likely favours a PPA-only model to sourcing renewables for Council's facilities, from a financial perspective.

However continuing declining costs for mid-scale solar projects, emerging bioenergy opportunities such as via ARENA's bioenergy roadmap[14], and grant support to community-based renewables may make a mid-scale project viable for Narrandera Shire Council and/or the region.

[14] https://arena.gov.au/knowledge-innovation/bioenergy-roadmap/

7.4 Behind-the-meter solar

Description

Solar PV is a well-established technology, and more than 20% of Australian homes and an increasing number of businesses are installing solar panels to reduce their grid energy costs and greenhouse gas emissions. Uptake of battery energy storage (BESS) remains low but is expected to become more cost effective in future.

As noted above, Narrandera Shire Council has installed solar PV at the library, depot and Council chambers buildings.

Visits to Council's operations as well as discussions about planned new facilities and upgrades has highlighted opportunities for solar at several sites. At several sites more than one option can be considered. At some sites implementation of solar and storage may be a staged approach.

The following is a summary of the solar PV and BESS opportunities that have been identified at Council operated sites:

Site name	Behind-the-meter solar potential
Narrandera STP	A 45.8 kW ground-mounted system initially can be expanded to 80.6 kW in the event the STP and ERU meters can be combined.
Sewer Pump Station No. 1 Larmer Street	A 10.3 kW ground-mounted system can be installed in front of the pump station subject to review of land control. This can potentially be expanded with a battery in the long term.
Old Water & High Water Towers	A 15.1 kW roof-mounted system initially can be expanded to 29.8 kW if the two accounts can be merged. This is a long term option once the old water reservoir is rebuilt.
Red Hill Pressure Booster Station	A 4.74 kW ground-mounted system can be installed in front of the pump station. This can potentially be expanded with a battery in the long term.
Depot	An additional 25.5 kW system with 25 kWh battery can be installed on the roof to increase the onsite solar energy use.
Truck Washbay	A 10.1 kW roof-mounted system initially can be expanded to 25.1 kW and 25 kWh battery in the long term.
Library	An additional 30 kWh battery can be installed to increase the onsite solar energy usage during off-peak.
Sports Stadium	A 14.7 kW system with 15 kWh battery can be installed on the roof of the Sports Stadium.
Parkside Cottage Museum	A 3.02 kW system with 3 kWh battery can be installed on the roof of the museum.
Community Cultural Hall	A 3.02 kW system with 3 kWh battery can be installed on the roof of the east gallery.

Lake Talbot Pool	Both 49.8 kW and 74.7 kW solar carport systems are modelled and selection can be made based on demand during full operation.
Council Chambers	An additional 9.7 kW roof-mounted system on the Chambers roof (with micro-inverters or optimisers), with a 10.1 kW system on the roof of the HR building (provided the meters for these two accounts can be combined.
Meals on Wheels (One Stop Shop)	A 14.7 kW system can be installed on the east and west facing roofs of the One Stop Shop.

In addition, plans for the re-development of the town's water treatment plant should include an intent to develop a solar array (ground or roof mounted) to meet much of the daytime power demand of the site. Options to schedule future WTP operations to maximise solar self-consumption and Council's energy costs should be assessed.

Scope for abatement

The above opportunities can be summarised as:

- Council-operated sites have scope for ~206.48 kW – 296.28 kW of solar PV, with some scope for battery energy storage in the long term at sites with low or intermittent demand.
- This can generate from ~324.2 MWh to 459.2 MWh of electricity per year with most of this consumed on Council sites and some export to grid. Abatement at current grid carbon intensity would be 185.2 to 217.9 t CO_2-e per year for reduced onsite grid electricity use, plus emissions savings associated with export of excess solar energy to the grid for systems smaller than 100 kW.

Risks and mitigation

Risks associated with solar PV implementation are minimal provided systems are appropriately sized, designed, installed, connected and maintained on sound buildings and structures, as with any other asset.

The cost effectiveness of solar PV has long been demonstrated, and panel prices continue to fall. The commercial sector has embraced solar PV in recent years, and this is the main factor that has driven further acceleration in the implementation of rooftop solar.

Costs and benefits

The estimated costs and annual savings for each of the above systems is summarised in the tables below.

7.4.1 Onsite renewable energy

Site visits and data analysis were used to identify sites that are most likely to be suitable to install solar PV. A summary of the solar PV layouts at Narrandera Shire Council sites is provided in Appendix A.

TABLE 8: ESTIMATED COSTS AND SAVINGS FOR BEHIND-THE-METER SOLAR PV FOR COUNCIL-OPERATED SITES

Site	Modelled PV size	BESS (kWh)	Capital cost	Cost savings	Payback (years)	NPV	IRR	Solar yield (kWh)	% of solar export	% energy saving	Emissions reduction (t CO_2-e)[15]
Narrandera STP	*Short-term option 1:* **45.8 kW** Ground-mounted solar PV		$59,540	$12,860	5.0	$103,457	20%	75,190	28.9%	33%	43.29
	Short or Medium-term option 2: **80.6 kW** Ground-mounted solar PV[16]		$104,780	$18,437	6.0	$127,764	16%	131,306	52.8%	38%	50.17
Sewer Pump Station No. 1 Larmer Street	*Short-term option:* **10.3 kW** Ground-mounted solar PV		$13,390	$4,365	3.2	$44,079	31%	16,644	~30%	36%	9.44
	Long-term option 1: **15.1 kW**		$18,120	$5,044	3.8	$47,471	26%	20,837	~20%	18%	13.50

[15] Emissions reduction refers here only to reduced grid electricity use on site. Excess solar energy that is exported to the grid also reduces emissions that Council can claim for solar PV systems smaller than 100 kW.

[16] Note that export estimates are based on the STP meter only, and would be lower than this if the STP and ERU meters are joined, AND if the ERU plant continues to operate during the day. If the ERU plant switches to treated effluent water rather than potable water then this plant would run mainly at night ands the above business case would likely be accurate.

Site	Modelled PV size	BESS (kWh)	Capital cost	Cost savings	Payback (years)	NPV	IRR	Solar yield (kWh)	% of solar export	% energy saving	Emissions reduction (t CO_2-e)[15]
Old Water & High Water Towers	Roof-mounted solar PV										
	Long-term option 2: **29.8 kW** Roof-mounted solar PV		$35,760	$10,053	3.8	$94,984	26%	41,529	~20%	35%	26.91
Red Hill Pressure Booster Station	*Short-term option:* **4.74 kW** Ground-mounted solar PV		$6,162	$1,289	5.0	$10,355	19%	7,816	~50%	87%	3.17
Depot	*Medium-term option:* **Additional 25.5 kW** Roof-mounted solar PV	25	$48,000	$6,621	7.7	$25,456	10%	40,137	~50%	59%	16.26
Truck Washbay	*Short-term option:* **10.10 kW** Roof-mounted solar PV		$10,100	$3,299	3.2	$32,747	31%	14,823	~30%	28%	8.40
	Long-term option: **25.1 kW** Roof-mounted solar PV	25	$47,600	$6,744	7.4	$28,131	11%	37,087	~50%	51%	15.02
Library	*Long-term option:* **Add BESS in the existing solar PV system**	30	$27,000	$2,856	15.9	$3,817	6%	11,427	-	74%	9.26
Sports Stadium	*Short-term option:* **14.7 kW** Roof-mounted solar PV	15	$28,200	$3,604	8.4	$10,708	9%	22,255	~40%	60%	10.82

Site	Modelled PV size	BESS (kWh)	Capital cost	Cost savings	Payback (years)	NPV	IRR	Solar yield (kWh)	% of solar export	% energy saving	Emissions reduction (t CO_2-e)[15]
Parkside Cottage Museum	*Long-term option:* **3.02 kW** Roof-mounted solar PV	3	$5,720	$626	14.4	$797	6%	3,735	~30%	76%	2.12
Community Cultural Hall	*Long-term option:* **3.02 kW** Roof-mounted solar PV	3	$5,720	$814	7.5	$3,380	11%	4,092	~30%	62%	2.32
Lake Talbot Pool	*Medium-term option 1:* **49.8 kW** Carport solar PV		$139,440	$16,621	8.9	$75,911	10%	72,318	20%	26%	46.86
	Medium-term option 2: **74.7 kW** Carport solar PV		$209,160	$20,862	10.6	$59,725	8%	108,448	40%	30%	52.71
	Low priority option: **Kiosk** Roof-mounted solar PV	Not estimated: the capacity of the kiosk roofs is fairly small, and this may only be considered if a solar carport system cannot be progressed									
Council Chambers	*Short-term option 1:* **Additional 9.7 kW** Roof-mounted solar PV		$9,700	$2,533	4.1	$22,455	24%	14,454	30%	18%	8.20
	Short-term option 2: **Additional 10.1 kW** Roof-mounted solar PV		$12,120	$2,490	5.2	$19,455	19%	14,209	30%	17%	8.06
Meals on Wheels (One stop shop)	*Short-term option:* **14.7 kW** Roof-mounted solar PV		$14,700	$4,082	3.8	$37,738	26%	20,517	30%	39%	11.63
Minimum total	**206.48 kW**	101	$385,792	$64,613	6.0	$418,369		324,248	29%	32%	185.26

Site	Modelled PV size	BESS (kWh)	Capital cost	Cost savings	Payback (years)	NPV	IRR	Solar yield (kWh)	% of solar export	% energy saving	Emissions reduction (t CO_2-e)[15]
Maximum total	**296.28 kW**	101	$558,312	$82,842	6.7	$466,388		459,206	41%	37%	217.87

7.4.2 Assumptions used

The analysis of these opportunities was performed with the following inputs and parameters:

- Solar modelling software (Helioscope with Nearmap / Six maps) was used for all proposed installations.
- Council's energy billing data and site interval data (where available) was used to determine optimum solar array sizes and to estimate or calculate the level of self-consumption of solar and the amount likely to be exported in each case.
- Benchmark pricing for solar PV systems (flush roof-mount, tilted roof-mount and ground-mount systems) and inverters has been used. An additional of 20 cents is added in the pricing if the system was modelled with microinverters.
    - Flush and fixed roof-mount systems - $1/W STC scale and $1.5/W LGC scale
    - Ground-mount systems - $1.3/W STC scale and $1.8/W LGC scale
    - Floating solar systems - $3/W STC scale and $3.5/W LGC scale
    - Carport solar systems - $2.8/W STC scale and $3.3/W LGC scale
- Annual expenses include cleaning / maintenance. Cleaning costs of $15/MWh of solar energy generation have been used. These are applied to each solar PV opportunity with annual escalation at 2.5%.
- For all exported energy a feed-in rate of $0.08/kWh was assumed to be available, which will require Council to seek this in electricity agreements.

A single discount rate of 5% is applied for net present value (NPV) calculations.

7.5 Energy efficiency

Description

Energy efficiency remains the cheapest form of greenhouse gas abatement in many situations. This is reflected in Narrandera Shire Council's past and continuing efforts to manage energy efficiently as described above.

The following is a summary of the identified energy efficiency opportunities at Council sites:

- **Load scheduling:** WFP, Bore 1, Bore 2 and Bore 3 were assessed for load scheduling opportunities, showing that shifting operations away from peak hours will provide significant cost savings to council.
- **Power factor correction:** Bore 3 and WFP have poor power factor and installation of PFC units will provide a quick-win for Council.
- **Street Lighting:** Council has received a business case and proposed costs to upgrade its street lights to LED technology. This will apply to local as well as main roads (excluding lighting owned and managed by RMS).
- **WFP, STP and Pine Hill PS VSD controls:** The existing VSDs at the STP could be optimised to maximise energy savings during aeration cycles by operating in conjunction with dissolved oxygen (DO) monitoring. Water pumps could potentially benefit from installation of VSD controls, from the main WFP to smaller systems such as the Pine Hill reservoir pumps, and each opportunity would be assessed on a case-by-case basis.
- **Lighting: office / indoor** much of Council's facilities have been upgraded to LED lighting. This will be the preferred lighting technology going forward, and can be extended from higher use sites such as Chambers and the library, to lower use sites such as the Museum and Art Gallery in future.
- **Sports field lighting:** lighting of sporting fields with LED is widely available, but tends to be best implemented when building new lighting infrastructure or when replacing lighting at the end of its life. When replacing lights on existing poles a structural assessment may be necessary.
- **Design**: The Water Filtration Plant and Lake Talbot Pool are examples of large energy-using sites where re-design can ensure that energy efficiency measures such as VSD controls and other best practices are incorporated in to the design of these facilities. Provision for solar PV systems should also be considered when designing new facilities.
- **STP UV Treatment**: UV-LED technology has recently been trialled overseas, with claims of reduced energy costs by up to 90% compared to traditional bulbs. Council should keep abreast of developments in this technology and could look to upgrade if/when the technology is available.
- **Voltage Optimisation**: The STP's incoming voltage is 440V which could be over the required level. A detailed technical analysis would determine if voltage optimisation is feasible and the potential savings and return to Council.
- **Air Conditioning**: A strategy should be developed by Council to replace old AC units with more efficient AC inverter units. Consider selection of low-GWP refrigerants as well as energy-efficient operation.

Efficiency plans and budgeting will be informed by regular auditing of facilities and equipment, and by Operational Budget planning and Delivery Program

planning that considers projects that will continuously reduce Council's energy footprint.

Scope for abatement

The scope for energy efficiency across Council's sites is estimated to be around 338 MWh per year, equal to more than 13% of current electricity demand. Around 51% of this potential is associated with upgrading all streetlights to LED. At least 46% of the potential is associated with VSD control of motor systems for water and sewer services.

While energy savings potential is significant, the design and construction of new facilities may see increases in energy demand as well, even where these new facilities are energy efficient. Hence the net savings potential could be lower than these estimates.

Risks and mitigation

The risks associated with energy efficiency upgrades are generally low provided business cases, specification and contractor management processes are robust. Some of the main risks and mitigants will include:

- Designing effective measurement and verification at an affordable cost that provides useful feedback about the success of projects
- Persistence of energy savings – it is not uncommon, particularly for education initiatives and control settings to lapse in their performance and be changed back to poor practices or inefficient settings, and providing resources to sustain energy savings is also important
- Regular review processes for energy management is important. For example, design guidelines and procurement guidelines should stay at the level of development of new technologies, practices and services

Costs and benefits

The estimated costs and annual savings for each of the above systems is summarised in the tables below.

7.5.1 Energy efficiency initiatives

Site visits and data analysis were used to identify energy efficiency opportunities at Narrandera Shire Council.

TABLE 9: INDICATIVE COSTS AND SAVINGS FOR ENERGY EFFICIENCY FOR COUNCIL-OPERATED SITES

Site	Description of potential energy efficiency opportunity	Indicative cost	Cost savings	Payback (years)	NPV	IRR	Resource savings (kWh)	Emissions reduction (t CO_2-e)	% energy savings
Narrandera STP	*Short-term option:* Check if the STP and the ERU NMIs can be combined to lower peak demand and supply charges.	Council confirming costs							
	Long-term option: Install LED for UV systems.	Not estimated as this is a new technology and not in widespread use at this time							
	Medium-term option: Install DO monitoring system to allow the VSDs to vary in speed during aeration cycles.	$20,000	$3,908	5.0	$40,708	20%	19,549	15.84	12%
	Long-term option: Install voltage optimisation to control the incoming voltage.	Not estimated, likely >$25k	$1,629	>10			>8,145	6.60	5-10%
Water Filtration Plant	*Short-term option:* Incorporate good practice energy efficient design into new works.								Not estimated
	Short-term option: Install PFC unit to improve the power factor of the site.	$13,500	$13,738	1.0	-	-	59 kVA	0	0
	Short-term option:	$0	$27,132	0.0	-	-	Reduce Peak	0	0

Site	Description of potential energy efficiency opportunity	Indicative cost	Cost savings	Payback (years)	NPV	IRR	Resource savings (kWh)	Emissions reduction (t CO_2-e)	% energy savings
	Implement load scheduling to lower energy demand during peak hours (assuming no PFC unit installed).						Period kVA		
	Short-term option: Install VSD control on the 2 x 250 kW water pumps.	~$200,000	$24,521	7.9	$180,864	12%	135,769	109.97	24%
Old Water & High Water Towers	*Short-term option:* Check if the Old Water Tower and the High Water Tower NMIs can be combined.	Council confirming costs	-	-	-	-	-	-	-
Council Chambers	*Short-term option:* Check if the 3 NMIs in Council Chambers can be combined.	Council confirming costs							
Pine Hill Pump Station	*Short-term option:* Install VSD control on the pumps supplying the Pine Hill reservoirs.	~$10,000	$561	16.5	-$1,287	4%	2,244	1.82	24%
Unmetered streetlighting	*Short-term option:* Install LED streetlights for local roads.	$359,000	$69,230	5.1	$634,758	20%	173,092	140.20	50%
Library	*Continuous improvement option:* Develop a replacement plan for older AC units.	Not estimated, part of continuous improvement efforts to install energy efficient equipment to replace equipment that has reached the end of its economic and useful life							
Sports Ground	*Continuous improvement option:* Upgrade field lights to LED.								
Museum	*Continuous improvement option:* Upgrade to LED lighting.								

Site	Description of potential energy efficiency opportunity	Indicative cost	Cost savings	Payback (years)	NPV	IRR	Resource savings (kWh)	Emissions reduction (t CO_2-e)	% energy savings
Community Cultural Hall	*Continuous improvement option:* Upgrade to LED lighting.								
Lake Talbot Pool	*Short-term option:* Confirm good practice energy efficient designed into new works.	Not estimated, confirmation can be sought that options such as VSD control of recirculation pumps have been included in the re-development of the pool							
Bore Pumps	*Short-term option:* Install PFC unit to improve the power factor of Bore 3.	$13,500	$9,352	1.4	-	-	47 kVA	0	0
	Continuous improvement option: Implement load shifting of 5-8 pm load to off-peak hours for Bore 1.	$0	$1,441	0.0	-	-	Reduce Peak Period kVA	0	0
	Continuous improvement option: Implement load shifting of 5-8 pm load to off-peak hours for Bore 2.	$0	$1,245	0.0	-	-		0	0
	Continuous improvement option: Implement load shifting of 5-8 pm load to off-peak hours for Bore 3 (without PFC unit installed).	$0	$19,879	0.0	-	-		0	0
	Continuous improvement option: Implement load shifting of 5-8 pm load to off-peak hours for Bore 3 (with PFC unit installed).	$0	$15,913	0.0	-	-		0	0
All sites	*Short-term option:* Install smart meters on all significant sites to capture energy usage.	Not estimated. Council to determine if this is a capital expense or if new smart meter costs can be passed through via regular billing. Access to smart meter information for all sites will improve Council's energy management efforts in the future.							
	Continuous improvement option:	Not estimated. Typically behaviour change can have a modest impact, particularly in a regional council where a large proportion of energy use is by water and sewer system pumps & motors							

Site	Description of potential energy efficiency opportunity	Indicative cost	Cost savings	Payback (years)	NPV	IRR	Resource savings (kWh)	Emissions reduction (t CO_2-e)	% energy savings
	Promote a higher awareness of good energy saving practice and recognise staff accordingly.	that are required to operate. Staff influence on energy use may therefore be modest but this can promote good energy practices elsewhere.							
Maximum total		**$653,000**	**$168,670**	**4.4**	**$873,339**		**338,801 kWh**	**274.43**	**13%**

7.6 Sustainable transport

Description

Transport emissions are a mid-sized GHG source for Narrandera Shire Council, primarily from diesel used for Council's operational vehicles. Petrol, including E10 ethanol blended 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.

NSW Government's Net Zero Plan 2020-2030 is developing a range of measures that will start to shape the future of transport in the State. Current measures under development in relation to electric vehicles (EV), for example, include:

- EV infrastructure
- Transport Consumer Information
- EVs in Government fleet
- Financial support for purchasing EVs.
- Electric Buses

For communities such as Narrandera, some of the key aspects that these measures will need to consider in order for EV strategies to be locally applicable will include:

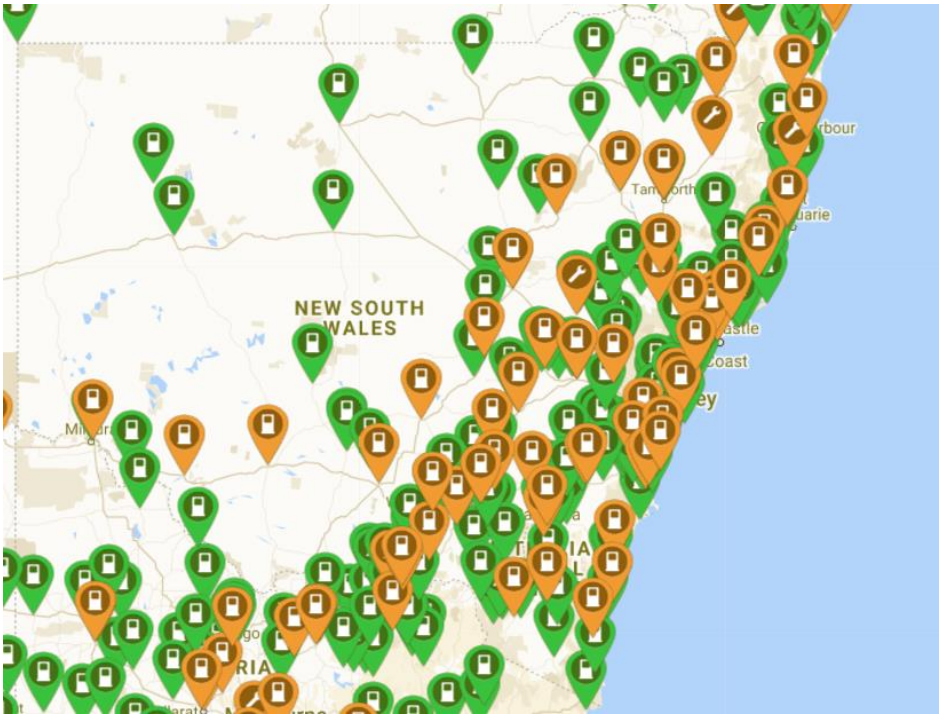
- Real data examining performance of hybrid and EVs in regional communities,
- Supply, warranty and servicing issues at a local regional level, and
- Coordination on EV charging infrastructure development, between State Government, councils / groups of councils through RAMJO, and private + motoring association providers

The focus of this section of Council's Climate Action Strategy is to provide an overview of the current status some of these key areas that will shape future transport, including current EV infrastructure, EV growth, and actions that Council can start to progress.

EV charging infrastructure

In July 2019 the Electric Vehicle Council reported that there were 1,930 DC and AC chargers in Australia[17]. Locations of DC and public chargers are readily accessible, see below[18], where green pins denote public chargers and orange pins denote fast, or rapid chargers. Increasing numbers of private chargers are also being installed, retrofitted to homes and businesses as well as designed into new buildings.

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



PLUGSHARE MAP OF PUBLIC (GREEN) AND FAST (ORANGE) EV CHARGERS IN NSW, OCTOBER 2020

In Narrandera Shire itself there is a dedicated fast charger installed in Narrandera Park (NRMA), and others at Hay, West Wyalong and Wagga Wagga. In many regions, public chargers are being installed at facilities such as hotels and motels, with local businesses seeking to provide charging for guests driving EVs.

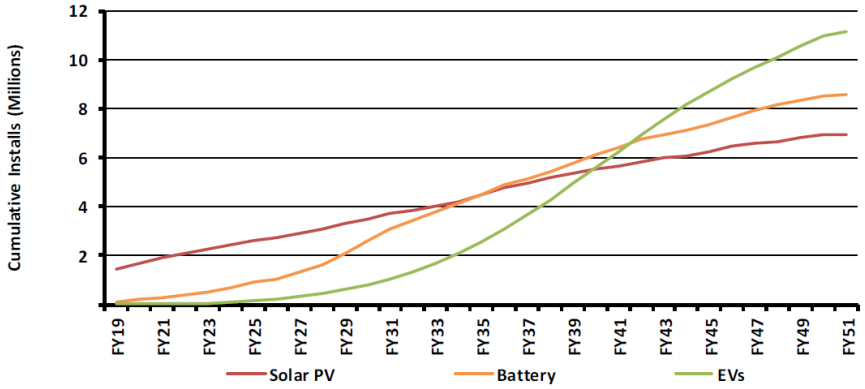
Current and continued growth in EV charging infrastructure will facilitate uptake of EVs, and Council should continue to develop and/or enable the implementation of chargers in the region.

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[19].

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.

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



AEMO PROJECTIONS OF EV UPTAKE – APRIL 2019

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. As indicated above the NSW Government's Net Zero Plan for the 2020-2030 period includes significant work to incentivise and encourage uptake of EVs well ahead of the above forecasts, so this is an area that may accelerate quicker than current forecasts.

Availability of electric passenger vehicles in Australia

According to the Electric Vehicle Council[20], in 2019 there were 22 EV models available in Australia (both BEV and PHEV), and this was forecast to 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

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

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.

Availability of low emissions Light Commercial Vehicles in Australia

Light Commercial Vehicles (LCVs), including 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. A short summary of the current status for several vehicles is provided below.

- Mitsubishi Triton[21]: 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[22]. 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[23]. Nissan also indicated that commercial vans were also candidates for electrification.
- Ford's next-generation Ranger and Everest models will include plug-in hybrid variants of both the dual-cab ute and off-road SUV, understood to be from 2022.

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

For Narrandera Shire Council utility vehicles are widely used and hybrid models such as those noted above may provide an opportunity to trial one or more in Council's fleet in coming years.

[21] https://www.caradvice.com.au/790317/mitsubishi-triton-to-get-hybrid-power-precede-nissan-navara-development/
[22] https://www.motoring.com.au/toyota-hilux-to-go-hybrid-121251/
[23] https://www.motoring.com.au/nissan-navara-e-power-hybrid-by-2025-119492

Recommended actions – electrification of vehicles

Suggested actions for Council to pursue in coming years in relation to electrification of its vehicle fleet include:

- Assess the costs and benefits of hybrid passenger cars within council's petrol and diesel fleet for new purchases or leases.
- In the medium-term switch to hybrid passenger vehicles and LCVs when these become commercially available and viable, and potentially one or more electric passenger vehicles.
- Consider the development of EV charging infrastructure on Council land and by supporting local businesses.
- Consider trialling or implementing telematics on fleet to get more detailed data that can help to inform future vehicle selection decisions.
- In future reviews of Council's transport / vehicle procurement strategy, integrate planning to assess / evaluate and progress Council's fleet towards electric technologies where and when feasible.
- Stay abreast of developments in EV incentives, policy and other support, and incorporate these in Council's planning process for its transport fleet.
- Over the longer term, 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.
- Continue transition from diesel to petrol vehicles where hybrids are not available (NOx, Euro 6).

Scope for abatement

The scope for emissions reduction for Narrandera Shire Council overall from transport measures is 861 t CO_2-e inclusive of both scope 1 and scope 3 emissions. The speed of emissions reduction will depend on the rate of adoption of EVs and hybrids, and on selection of renewable energy as the fuel source

Risks and mitigation

Narrandera Shire Council should assess the range of factors influencing the uptake of EVs for different types of vehicle user – owned or leased by Council, salary-sacrificed by staff, or driven by contractors. Factors will include:

- Whole of Life costing basis that consider purchase price, incentives, resale, and operating costs including electricity price
- Range and charging infrastructure
- Fitness for purpose
- Availability, serviceability, warranties
- The role of other technologies such as hydrogen, autonomous vehicles, etc in Council's long-term fleet strategy

Costs and benefits

The capital cost premium for EVs and hybrid models that are fit for purpose for Council requirements, as well as the future resale value will be assessed alongside fuel, registration, insurance and maintenance cost savings from time to time using a Whole of Life cost calculation. A cost-neutral approach would see low-emission vehicles have comparable total-cost-of-ownership to current fleet.

7.7 Sustainable procurement

Description

Sustainable procurement is an effective method of incrementally reducing Council's energy consumption and emissions, and improving sustainability over time. There are three main components to a suggested sustainable procurement approach:

1. Regularly reviewing and updating existing procurement policy framework to incorporate or update sustainable procurement aspects
2. Providing engagement and training to Council staff to educate and drive the use of a sustainable procurement framework in all aspects of Council's operations
3. Review current equipment and services specifications, and identify opportunities to incorporate the sustainable procurement framework into the procurement and use of equipment

Sustainable procurement framework

A policy relating to sustainable procurement can set out Council's overall intent to procure products and services with consideration of Council's sustainability goals, such as emissions reduction, energy efficiency and water conservation (among others). Alongside a policy, Council should develop its internal sustainable procurement guidance, drawing on an appropriate framework. One is summarised here:

NSW Local Government Guide

*"Sustainable procurement takes into consideration responsibility for the **economic**, **environmental**, **social** and **governance** impacts of any purchase – products or services. These four factors are referred to as the quadruple bottom line and relate to a total purchase cost, and not just the upfront dollar expense. Sustainable procurement, applied to NSW councils' spending, represents a significant opportunity to drive social and environmental change throughout a wide range of not only direct suppliers, but also the associated supply chains[24]".*

The 2017 Sustainable Procurement Guide for NSW local governments aims to help Councils develop and embed sustainable procurement practices in their organisation. The guide presents information on key concepts, certifications, standards and processes and is designed for all council staff involved in any purchasing. The Guide is applicable from major tenders through to one-off equipment purchases.

Council should examine the guide to identify key areas within its procurement processes where this can add value and lead to more informed and better procurement decisions.

Complementing a Guide such as this, Council has access to a wide range of information and data that can help it take decisions on equipment purchases. A prominent resource is the Equipment Energy Efficiency (E3) program.

[24] Sustainable Procurement Guide for Local Governments in NSW, 2017: https://www.lgnsw.org.au/files/imce-uploads/127/esstam-sustainable-procurement-guide-30.05.17.pdf

- The Equipment Energy Efficiency (E3) program [25], through which Australian jurisdictions (and New Zealand) collaborate to deliver nationally consistent mandated energy efficiency standards and energy labelling for equipment and appliances. Procurement policies and practices that routinely ensure that high star-rated appliances (motors, air conditioning units, kitchen appliances) are selected when replacing or buying new equipment will help Council's energy footprint decline over time.

Engagement & Training

Even with a policy and sustainable procurement framework in place, decisions to source services and products that deliver best practice sustainability outcomes will happen when people who are buying these services and products take these decisions.

Underpinning this needs to be engagement, education and training of staff across Council who procure services and products. This could encompass:

- Capital works staff involved in the design of new projects such as new water and sewer treatment plants, or new / renovated buildings, where energy and water efficiency and onsite renewables and battery storage could be specified,
- Roads and pavement repair / maintenance teams who specify the types of materials to be used, where there may be opportunities to use more sustainable materials,
- Fleet procurement staff who assess plant and vehicle needs and specify new purchases and leases that will impact fuel use for a number of years,
- Operational staff who may repair or replace equipment as it fails, such as appliances, air conditioners, lights, where there are opportunities to ensure that replacements are fit for purpose and energy efficient

Equipment and Services Specifications

Policy, procurement frameworks and education / training should ultimately lead to the specifications that Council develops for services and works / products being modified to include requirements for efficiency and renewables where applicable. In addition, the evaluation criteria and weighting of responses to tenders and quotes should be designed to properly evaluate and weight performance against specified sustainability requirements, such as level of efficiency, emissions reduction and whole-of-life cost.

Products and services where Council could potentially amend its specifications include:

- **Building lighting:** Council will see added savings over time as all lights are upgraded to LED, increasing if suitable controls are also specified as either additional components or built into LED lights.

[25] http://www.energyrating.gov.au/

- **HVAC:** Air conditioning at Council's sites is generally supplied by split system AC units. Replacement is generally not justified for energy-savings, 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,
    - Review any opportunities or incentives to select energy efficient AC units,
    - Research best practice energy efficient units that are available on the market and can be serviced locally,
    - Review energy efficient models in the current market (e.g. refer to www.energyrating.gov.au) and specify minimum efficiencies (COP / EER) in cooling and heating mode that align with good to best practice.
- **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. Efficient appliances and 'green IT' options are available and specifications can be developed that ensures all equipment such as these is energy efficient when purchased.
- **Water and sewer pumps** are upgraded or rebuilt from time to time, typically more frequently with sewer pumping systems. Upgrades offer the opportunities to assess system design, evaluate VSD opportunities and improve control systems. As these systems account for around 60% of Council's electricity use, all savings made in these systems will impact on Council's future energy demand.
- **Public park lighting:** LED lighting is gradually emerging as the default technology here. As parks are upgraded this will emerge as the preferred technology, integrated with controls where feasible/practical.
- **Sporting oval lighting:** some councils have started to select LED as the default technology for new sporting oval lighting, and more suppliers of both LED and traditional sporting oval lighting technologies are giving equal prominence to both solutions. Ovals have relatively few operating hours, so the technology cost and warranties need to more closely match those for existing technologies to make a compelling case for change to LED.
- **Building design policies:** The National Construction Code is a uniform set of technical provisions for the design, construction and performance of buildings throughout Australia. Energy efficiency performance requirements are set out in Section J of the BCA and these or an improvement to these could be stipulated by Council in designing new facilities. Section J recently underwent a review, with changes coming into effect mid-2019. The measures under NCC2019 are expected to deliver energy and carbon savings of at least 25% compared with the provisions of the 2016 NCC. Future reviews of Section J may see more stringent efficiency requirements.

Scope for abatement

The scope for abatement from sustainable procurement is sizeable, with incremental gains made via all purchased goods and services over the long term. Narrandera Shire Council also has the capacity to influence emissions reduction by its suppliers and contractors

Risks and mitigation

An assessment of risks and mitigation strategies would be part of any periodic review of procurement policies and processes for goods and services.

Costs and benefits

A robust sustainable procurement approach would see sustainable services and goods sourced on a whole-of-life cost basis, which will tend to favour efficiency and lower lifetime cost. Similarly, contractors and suppliers who are sustainable in their own operations are likely to have lower, not higher costs.

8 Narrandera Shire Council Action Plan

In order to achieve deep cuts in its energy use and associated GHG emissions, Narrandera Shire Council will need to commit time, resources and financial support to a multi-year program of work that will implement measures identified in this plan that reduce emissions. A key priority in this should be to invest in measures that also improve Council's bottom line.

These measures are identified below and tabulated into a short-medium term plan, and long-term and continuous improvement actions, based on priorities, costs and maturity of the technology recommended. The opportunities identified reflect the measures identified in the above section.

8.1 Short to medium term action plan

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, a suggested short to medium term action plan for Narrandera Shire Council is outlined below. Actions recommended could be implemented during the course of the current and next Delivery Plan cycle, for example.

TABLE 10: NARRANDERA SHIRE COUNCIL SHORT TO MEDIUM TERM PLAN FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Energy-saving option	Indicative cost
Energy efficiency	Metering and Accounts	Narrandera STP	Determine if the STP and Effluent Reuse Plant can be combined into a single NMI account to lower peak demand and supply charges.	Council confirming costs
Energy efficiency	VSD Control		Install a DO monitoring system to optimise the usage of existing VSD controls during aeration cycles.	$20,000
Behind the meter solar	Solar PV - Ground - STC		Install a 45.8 kW ground-mounted system in the field adjacent to the STP.	$59,540
Behind the meter solar	Solar PV - Ground - STC		ALTERNATIVE: Install an 80.6 kW ground-mounted system in the field adjacent to the STP if the STP and ERU meters can be combined	$104,780
Behind the meter solar	Solar PV - Ground - STC	Sewer Pump Station No. 1 Larmer Street	Install a 10.3 kW ground-mounted system in the field in front of the pump station.	$13,390
Energy efficiency	New Plant	Water Filtration Plant	Incorporate good practice energy efficient design into new works.	Not assessed
Energy efficiency	Power Factor Correction		Install a 135 kVAr PFC unit to reduce the demand charges.	$13,500
Energy efficiency	Scheduling		Implement load shifting of operations from peak to off-peak to reduce demand and energy charges.	Staff time

Energy efficiency	VSD Control		Investigate the costs and savings to install VSD control on the 2x 250 kW water pumps.	$200,000
Energy efficiency	Metering and Accounts	Old Water & High Water Towers	Determine if the Old Water and High Water can be combined into a single NMI account to lower peak demand and supply charges.	Council confirming costs
Behind the meter solar	Solar PV - Ground - STC	Red Hill Pressure Booster Station	Install a 4.74 kW ground-mounted system in front of the pump station.	$6,162
Energy efficiency	LED Lighting	Unmetered streetlighting	Install LED streetlights for local roads.	$359,000
Behind the meter solar	Solar PV - Roof - STC	Truck Washbay	Install a 10.1 kW roof mounted system.	$10,100
Behind the meter solar	Solar PV + BESS - Roof - STC	Sports Stadium	Install a 14.7 kW roof-mounted system with 15 kWh battery.	$28,200
Energy efficiency	Metering and Accounts	Council Chambers	Determine if the 3 NMIs supplying the Chambers main building, HR & Finance and the bell tower can be combined into a single NMI account.	Council confirming costs
Behind the meter solar	Solar PV - Roof - STC		Install an additional 9.7 kW roof-mounted system on the roof of the Chambers building (with micro-inverters).	$9,700
Behind the meter solar	Solar PV - Micro-inverter - Roof - STC		Install an additional 10.1kW roof-mounted system on the roof of the HR building, provided the meter for this and the Chambers building can be combined.	$12,120
Behind the meter solar	Solar PV - Roof - STC	Meals on Wheels (One stop shop)	Install a 14.7 kW roof-mounted system on the roof of the centre.	$14,700

Energy efficiency	Power Factor Correction	Bore Pumps	Install a 135 kVAr PFC unit to reduce the demand charges.	$13,500
Energy efficiency	Metering and Accounts	All sites	Install smart meters on all significant sites to capture usage to facilitate consumption analysis and potential for solar and batteries.	TBC if this is a capex or on-bill cost
Behind the meter solar	Solar PV + BESS - Roof - STC	Depot	Install additional 25.5 kW roof-mounted system with 25 kWh battery to increase solar energy usage onsite.	$48,000
Sustainable transportation	EV Charging		Install EV charging station to charge PHEV or BHEV vehicles.	$12,000
Behind the meter solar	Solar PV - Carport - STC	Lake Talbot Pool	Install a 49.8 kW carport solar system.	$139,440
Behind the meter solar	Solar PV - Carport - STC		Install a 74.7 kW carport solar system.	$209,160

8.2 Long term action plan

A suggested long-term action plan for Narrandera Shire Council is outlined below.

TABLE 11: NARRANDERA SHIRE COUNCIL LONG TERM PLAN FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Energy-saving option	Indicative cost
Energy efficiency	Voltage Optimisation	Narrandera STP	Install a voltage optimisation system to control incoming voltage.	$7,000
Behind the meter solar	Solar PV - Micro-inverter - Roof - STC	Old Water & High Water Towers	Install a 15.1 kW roof-mounted system on the roof of Old Water reservoir (after the current reservoir is replaced)	$18,120

Behind the meter solar	Solar PV - Micro-inverter - Roof - STC	Old Water & High Water Towers	Install a 29.8 kW roof-mounted system on the roof of Old Water reservoir (after the current reservoir is replaced AND if the meters for the two water towers can be combined.	$35,760
Behind the meter solar	Solar PV + BESS - Roof - STC	Truck Washbay	Install a 25.1 kW roof-mounted system with 25 kWh battery on the roof of washbay.	$47,600
Behind the meter solar	BESS	Library	Install an additional 30 kWh battery to the existing solar PV system to increase solar energy consumption.	$27,000
Behind the meter solar	Solar PV + BESS - Roof - STC	Parkside Cottage Museum	Install a 3.02 kW roof-mounted system with 3 kWh battery on the roof of the museum.	$5,720
Behind the meter solar	Solar PV + BESS - Roof - STC	Community Cultural Hall	Install a 3.02 kW roof-mounted system with 3 kWh battery on the roof of the east gallery.	$5,720
Behind the meter solar	Solar PV + BESS - Roof - STC	Sports Stadium	Install a 14.7 kW roof-mounted system with 15 kWh battery.	$28,200
Energy efficiency	VSD Control	Pine Hill Pump Station	Install VSD control on the pumps supplying the Pine Hill reservoirs.	$10,000
Energy efficiency	UV Treatment		Install LED for UV systems at the STP	Not estimated

8.3 Continuous improvement

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, a suggested continuous improvement plan for Narrandera Shire Council is outlined below

TABLE 12: NARRANDERA SHIRE COUNCIL CONTINUOUS IMPROVEMENT PLAN FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Energy-saving option	Cost or resources required
Sustainable Procurement	Sustainable Procurement	All sites	Review Council's procurement policy and practices and consider adopting the updated Local Government Sustainable Procurement Guidelines to inform policy, training and specifications for buying products and services, such as sporting field LED lighting and split system air conditioning unit replacement for example.	Not estimated
Sustainable transport	Sustainable transport		Review options available to Council to progressively improve the emissions of its fleet, and opportunities to transition towards electric vehicles – including hybrid vehicle costs for passenger cars and LCVs, development of EV infrastructure, a trial of an electric vehicle, Council's fleet strategy and review process including obtaining data from telematics, staying abreast of technology, policy and incentives, and low-NOx and Euro 6 opportunities for large fleet and plant.	Not estimated
Buying clean energy	Renewable Energy Power Purchasing		Incorporate renewables as a procurement option in Council's next supply agreement.	Not estimated
Energy efficiency	Energy efficiency awareness		Promote a higher awareness of good energy saving practise and reward staff accordingly.	Not estimated
Energy efficiency	Scheduling	Bore Pumps	Implement load shifting of 5-8 pm load to off-peak hours for Bore 1, and review periodically to optimise performance and respond to any network tariff changes	Not estimated
Energy efficiency	Scheduling		Implement load shifting of 5-8 pm load to off-peak hours for Bore 2, and review periodically to optimise performance and respond to any network tariff changes	Not estimated
Energy efficiency	Scheduling		Implement load shifting of 5-8 pm load to off-peak hours for Bore 3, and review periodically to optimise performance and respond to any network tariff changes	Not estimated

Appendix A: Solar PV potential locations

Narrandera STP – 45.8 kW – Ground-mounted solar PV

Narrandera STP – 80.6 kW – Ground-mounted solar PV

Sewer Pump Station No. 1 Larmer Street– 10.3 kW – Ground-mounted solar PV

Old Water & High Water Towers – 29.8 kW– Roof-mounted solar PV

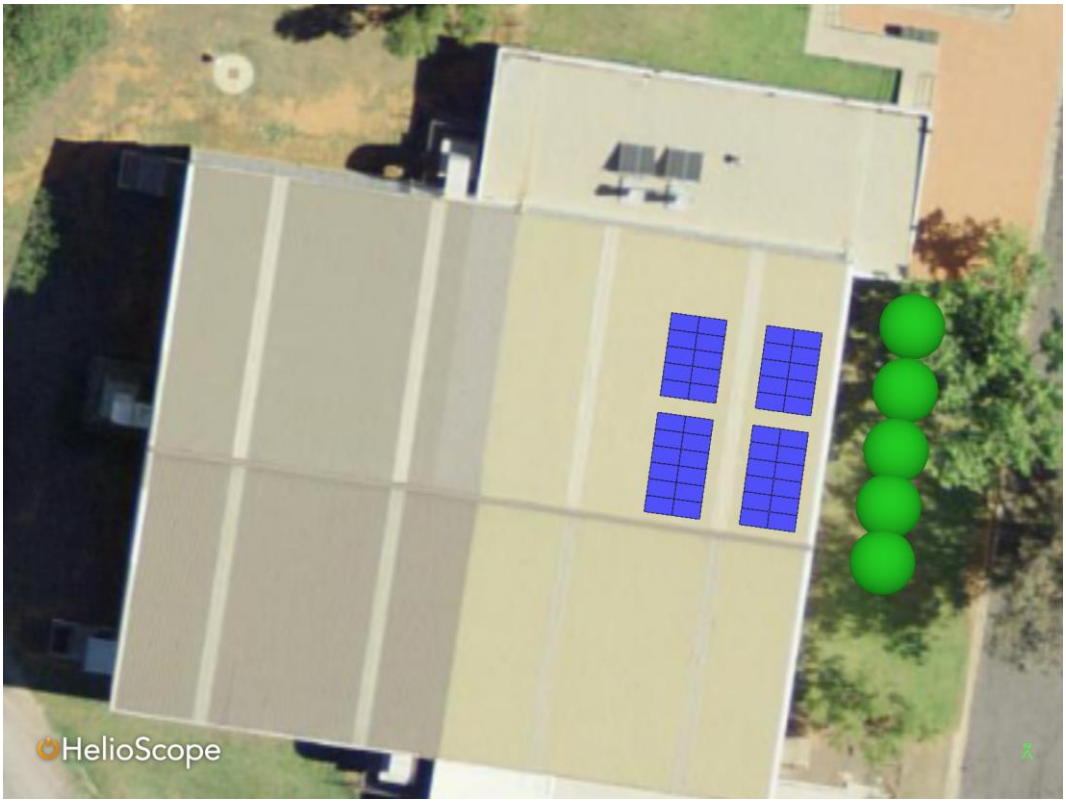
Red Hill Pressure Booster Station – 4.74 kW – Ground-mounted solar PV

Depot – 25.50 kW– Roof-mounted solar PV

Truck Washbay – 10.10 kW – Roof-mounted solar PV

Truck Washbay – 25.10 kW– Roof-mounted solar PV

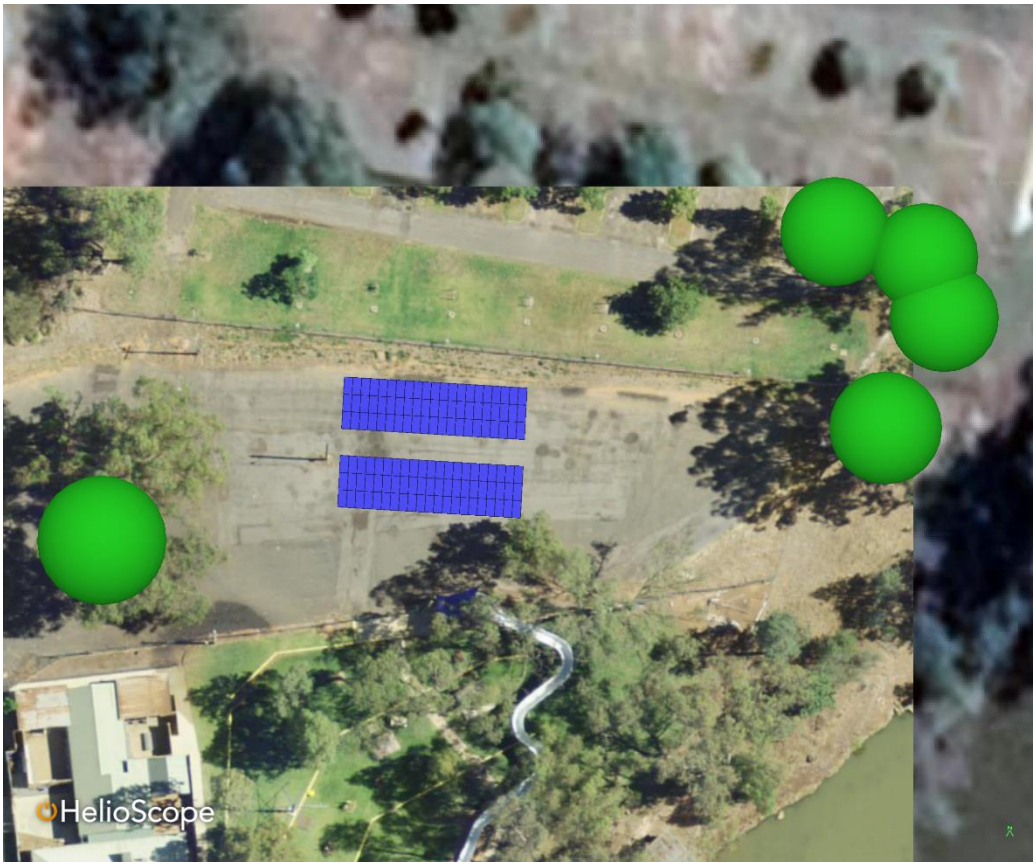
Sports Stadium– 14.70 kW– Roof-mounted solar PV



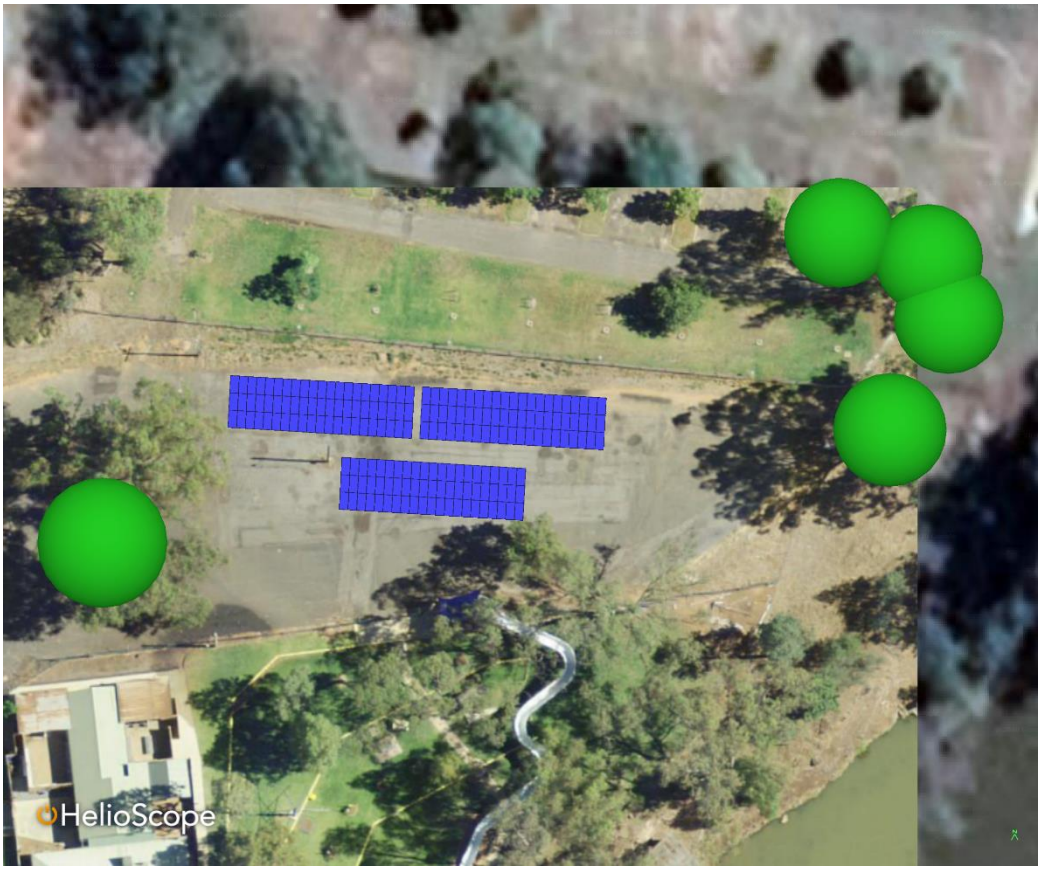
Parkside Cottage Museum – 3.02 kW – Roof-mounted solar PV

Art Gallery / Cultural Hall – 3.02 kW – Roof-mounted solar PV

Lake Talbot Pool – 49.80 kW – Carport solar PV

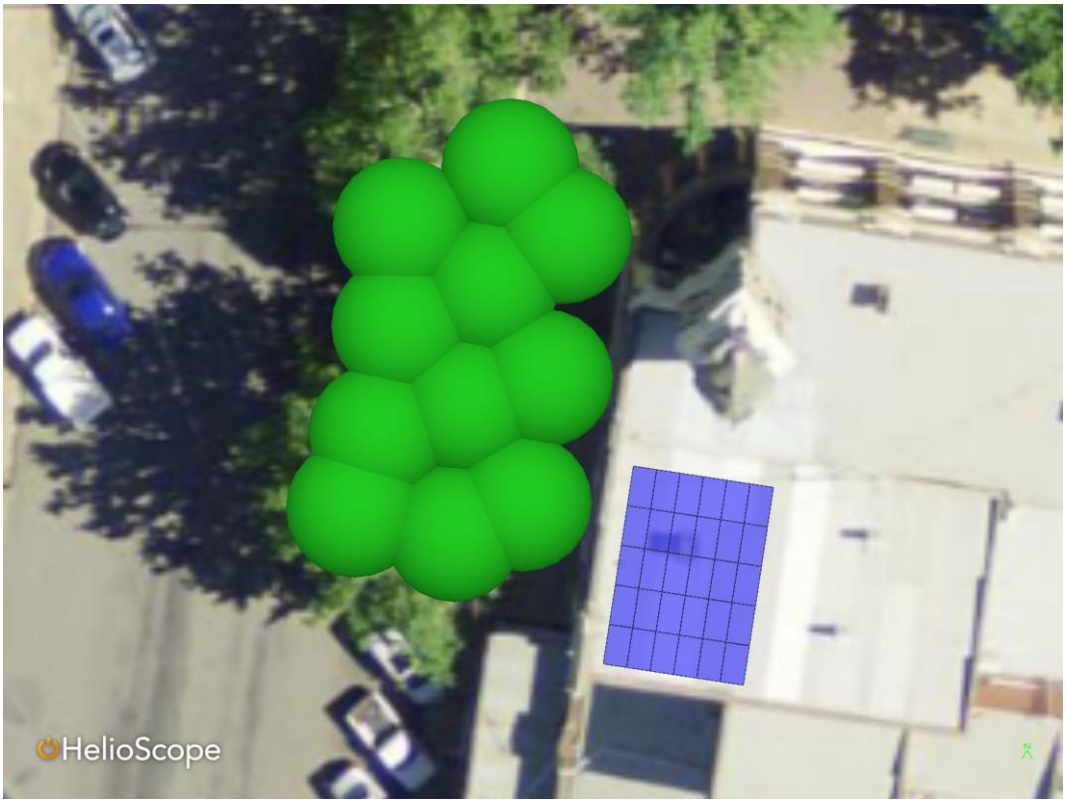


Lake Talbot Pool – 74.70 kW – Carport solar PV

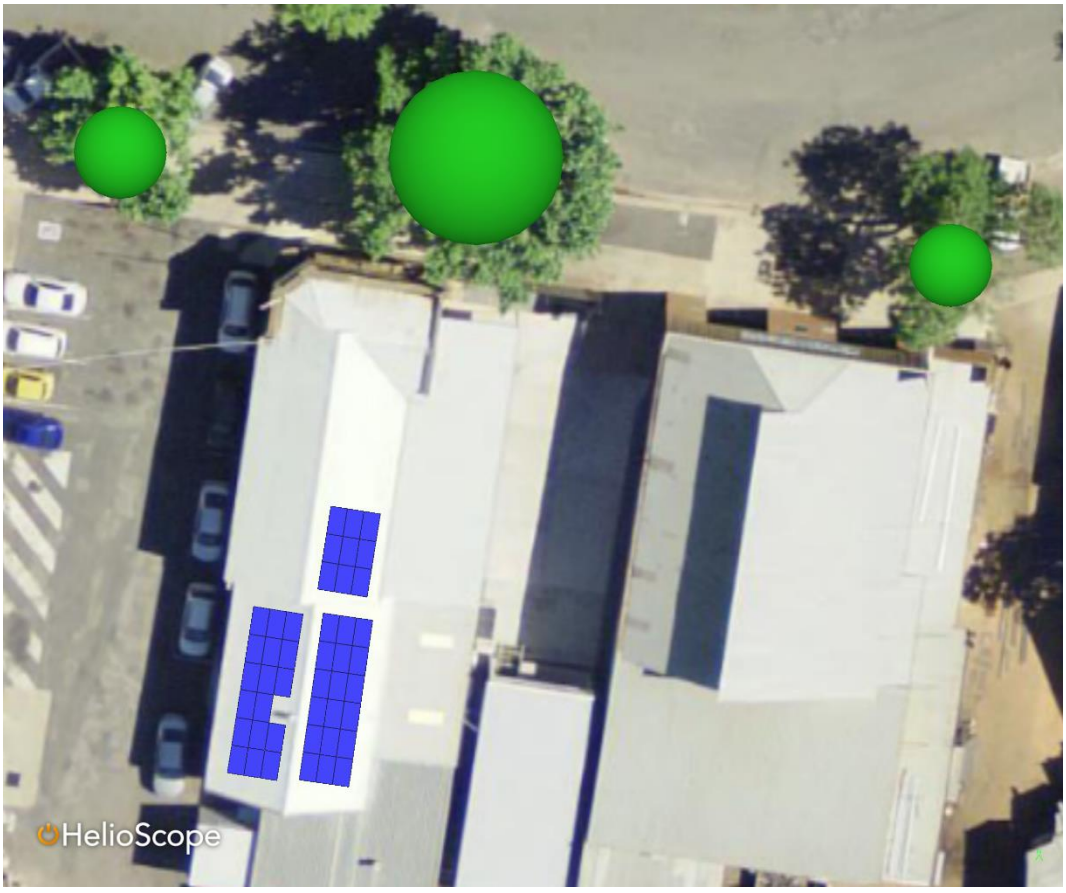


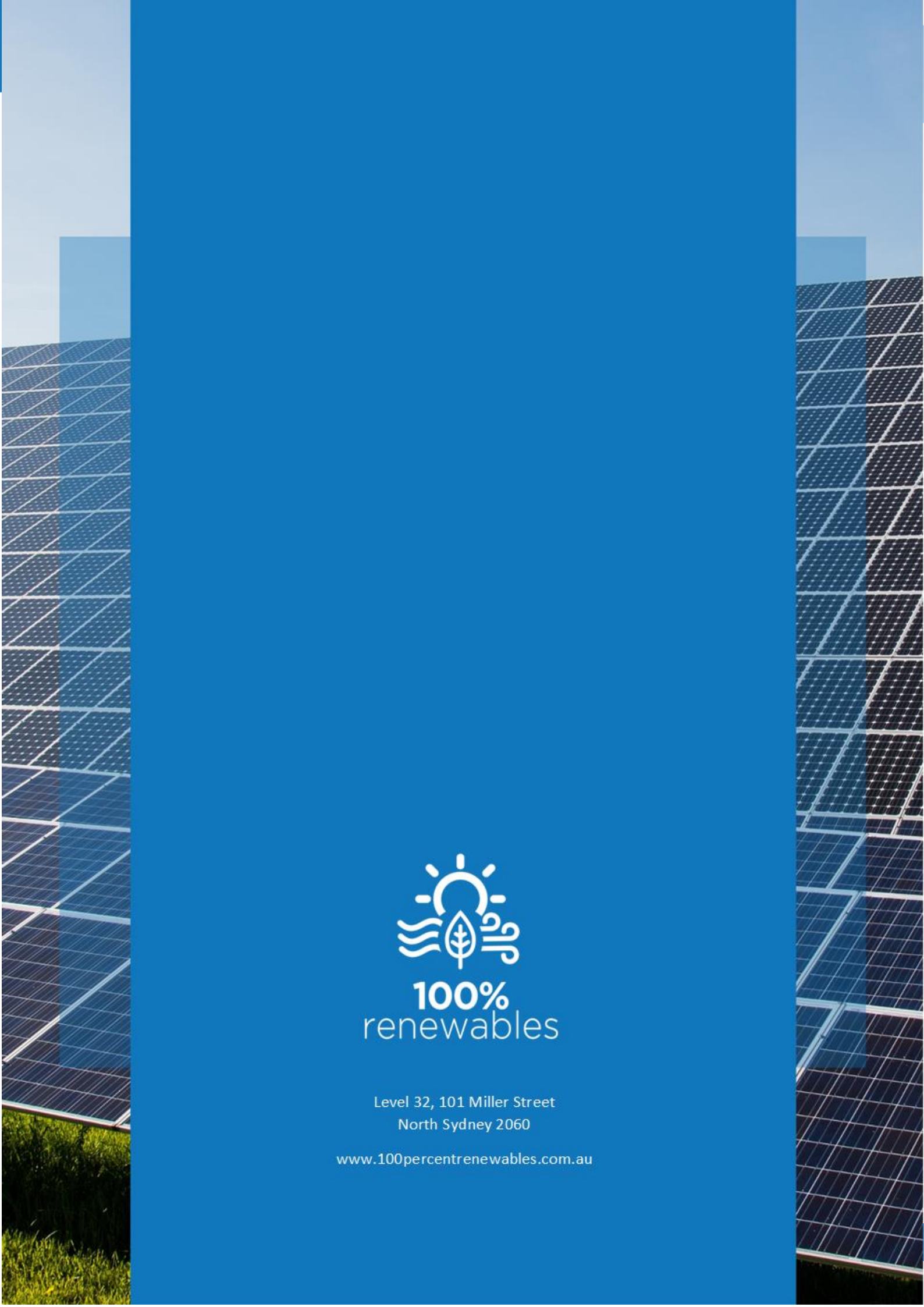
Council Chambers – 9.70 kW – Chambers roof-mounted solar PV

Council Chambers – 10.10 kW – HR roof-mounted solar PV



Meals on Wheels (One stop shop)– 14.70 kW – Roof-mounted solar PV





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