100% renewables

NSW Planning, Industry & Environment

KEMPSEY Shire Council

NSW DPIE: Sustainable Councils and Communities

Kempsey Shire Council

Long-term Renewable Energy and Water Strategy

FINAL REPORT

Date: 28 September 2020

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Glossary

Acronym	Definition
AC, DC	Alternating current, direct current
AEMO	Australian Energy Market Operator
APVI	Australian Photovoltaic Institute
BASIX	Building Sustainability Index
BCA	Building Code of Australia
BESS	Battery Energy Storage System
BEV	Battery electric vehicle
CASA	Civil Aviation Safety Authority
CFL	Compact fluorescent
COP	Coefficient of performance (e.g. of refrigeration, heat pumps)
COP21	Conference of the Parties in Paris at which the Paris Agreement was reached
CO_2-e	Carbon Dioxide Equivalent
CPP	Cities Power Partnership
CSP	Community Strategic Plan
DOL	Direct On Line
DPIE	NSW Department of Planning, Industry and Environment
EER	Energy efficiency ratio (e.g. of an air conditioner)
EPC	Energy Performance Certificate
EV	Electric Vehicle
GFC	Global Financial Crisis
GHG	Greenhouse Gas
GPC	Global Protocol for Community-Scale Greenhouse Gas Emission Inventories
HVAC	Heating, ventilation, and air conditioning
IPCC	Intergovernmental Panel on Climate Change
kWh, MWh, GWh	Units of energy – usually used for electricity
KSC	Kempsey Shire Council
LED	Light Emitting Diode (lighting technology)
LGA	Local Government Areas
LPG	Liquefied Petroleum Gas
NABERS	National Australian Built Environment Rating System
NCC 2019	National Construction Code
NRMA	National Roads and Motorists' Association
NSW	New South Wales
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, S2, S3	Greenhouse gas emissions Scopes 1, 2 and 3
SDGs	Sustainable Development Goals
SPS	Sewer Pumping Station
STP	Sewerage Treatment Plant
VFD / VSD	Variable Frequency Drive / Variable Speed Drive
W, kW, MW	Units of power – usually used for electricity
WTP	Water Treatment Plant

1 Executive Summary

Kempsey Shire Council identified the need to develop a comprehensive long term strategy and action plan to cost-effectively increase the amount of renewable energy at its facilities, and lower demand through energy and water efficiency. Council engaged with NSW Department of Planning, Industry & Environment's Sustainable Councils and Communities (SCC) Program to help develop the strategy. Drivers for development of the Long-term Renewable Energy and Water Strategy include:

- Building on past and continuing work by Council to improve energy efficiency, implement renewables and improve water efficiency, and putting a framework around future actions.
- Cost-effectiveness of efficiency and renewable energy, which deliver high returns for invested funds.
- Kempsey Shire Council's desire to be a leader in sustainability for their community through the reduction of their own greenhouse gas emissions.

1.1 Recommended strategy and targets

1.1.1 Recommended strategy

This strategy and plan outlines an approach to renewable energy, energy and water efficiency that can be implemented progressively over several years, is based on cost effective and commercially available technologies and solutions, and can position Kempsey Shire Council as a leader in sustainability through its water conservation and emissions reduction actions.

Specifically, Council's strategy for renewables and efficiency should be to:

Short to medium term	• Focus on implementation of solar PV, water and energy efficiency opportunities at Council-operated sites in the short term and medium term where these are financially viable.
	• Take steps to be well informed about and begin the processes to:
	  ○ source electricity from renewables,
	  ○ move towards sourcing more low emissions and hybrid fleet and electric vehicle charging infrastructure, and
	  ○ continuously improve sustainable procurement practices.

Medium term	• Continue to implement solar and efficiency measures including progressing to larger solar systems with battery storage where financially viable. • Source some or all of Council's electricity from renewables (subject to price and risk being comparable to current electricity procurement). • Implement a trial of electric vehicles in Council's fleet as part of implementing a lower-emissions fleet strategy. • Implement and continue to improve sustainable procurement practices for equipment and services.
Longer term, subject to future revisions of Council's strategy)	• Aim to maximise on-site solar PV and battery storage where financially viable. • Continuously improve energy & water efficiency and sustainable procurement processes. • Progressively upgrade fleet to low emissions vehicles and plant. • Source Council's electricity from renewables including an investigation of mid-scale renewable energy generation on Council land.

This plan outlines how Kempsey Shire Council can work towards these objectives, through the identification and assessment of short, medium and long term opportunities.

In the immediate future Council should assess four specific measures that will be necessary to enable the identified potential savings to be unlocked. These are:

1. Invest in energy and water data management systems that will enable consumption and costs to be accurately captured and tracked over time to monitor and report on Council's resource use and progress towards any efficiency and renewable energy goals.
2. Assess the best ways to fund identified cost-effective opportunities, aligned with Council's Financial Sustainability Strategy, as well as staff resource requirements to approve and deliver opportunities in Operational Plans and Delivery Program cycles. A number of options can be assessed, including direct funding for financially viable projects through Council budgets, grant funding, an effective Revolving Energy Fund (REF), onsite solar Power Purchasing Agreements (PPAs) and others.
3. Consider the establishment and adoption of targets that can help to guide and inform Council's response over time, including consideration of the targets and objectives for water, renewable energy and emissions reduction suggested below.
4. Investigate priority short-term initiatives identified in this strategy for implementation, such as solar PV on the Civic Centre, investigating ways to reduce night energy demand at the Council's depot, and ensuring that energy efficiency and provision for solar PV are central to design of new water treatment plants.

1.2 Suggested energy and water goals for Kempsey Shire Council

The assessment of efficiency and renewable energy opportunities across Kempsey Shire Council operations has shown the following:

- Solar PV opportunities have the potential to reduce Council's electricity consumption by 15-20%
- Energy efficiency opportunities have similar potential, but will be partially offset with the construction of new facilities, particularly new water and wastewater treatment plants
- Significant water savings have already been achieved through leakage reduction, and further savings are possible
- There is proven potential for local councils in NSW to source electricity from renewables at prices comparable to 'regular' prices, depending on wholesale electricity market trends
- Savings in fuel for transport fleet in the short to medium term is limited, and large savings in energy and emissions are unlikely to be feasible until beyond 2030

Given the identified and assessed potential, the following targets should be considered for adoption by Kempsey Shire Council. Targets should be reviewed periodically to reflect new priorities and market changes, particularly for electricity supply.

1.2.1 Water goal

Be a leader in water conservation, with a focus on data management & tracking, reducing leaks within Council's water infrastructure (Operations), water efficiency particularly in water & sewer operations, and rainwater collection.

1.2.2 Energy efficiency and renewable energy goals

By 2030 aim to source 100% of Council's grid-delivered electricity from renewables where cost-effective and incurring no added risk to Council. This will require that Kempsey Shire Council source electricity from renewables in its supply agreements. An interim (e.g. 2025) target can be considered, focused on onsite solar, energy efficiency (particularly main road streetlighting) and potentially a renewable energy Power Purchase Agreement. Based on the assessed potential this interim target could be ~20% reduction in grid-sourced electricity, and up to 50% with a PPA (e.g. for large sites).

1.2.3 Greenhouse gas emissions reduction goal

Reduce energy-related greenhouse gas emissions by 70% by 2030, consistent with achieving 100% renewables for electricity. Review targets if/as electrification becomes feasible for Council's fleet.

1.3 Budget implications

The total estimated cost of all identified and costed short and medium term opportunities for Kempsey Shire Council is in the order of $2.7 to $3.7 million, with annual cost savings of $430,000 to $530,000. This is underpinned by the potentially large cost (~$1.7 million) to upgrade main road lighting to LED, and by the implementation of a number of solar PV systems of 100 kW or more. These cost estimates are for Council's operational sites only, and do not include third-party operated sites.

Funding a program of work such as this can be challenging, and a number of options can be considered by Council to deliver projects, aligned with Council's Financial Sustainability Strategy. A number of options to finance projects are described in this strategy, illustrated below. Funding of individual projects that are financially viable from Council's budget, allied to grants to implement efficiency and renewable energy projects, are the main approaches that will be pursued at this time.

FIGURE 1: FUNDING OPTIONS FOR LONG-TERM RENEWABLE ENERGY AND WATER STRATEGY

1.4 Council's energy and water use and carbon footprint

1.4.1 Energy consumption and carbon footprint

Council's carbon footprint of 30,082 t CO_2-e is dominated by waste emissions followed by electricity consumption, direct wastewater emissions, and diesel fuel consumption. As this strategy focuses on energy, an energy-only carbon footprint has also been calculated. The energy carbon footprint in 2019 was 8,482 t CO_2-e, with the biggest emission source being electricity use in council assets (60%), followed by diesel consumption in fleet (20%) and electricity for streetlighting (17%).

TABLE 1: COUNCIL'S ENERGY-RELATED CARBON FOOTPRINT 2019

	Emission source	Activity data	Units	Scope 1 t CO2-e	Scope 2 t CO2-e	Scope 3 t CO2-e	Total	%
	Diesel for fleet	603	kL	1,642		84	1,726	20.4%
	Petrol for fleet	80	kL	186		10	196	2.3%
	Ethanol for fleet	0	kL	0		0	0	0.0%
	Natural gas		GJ	0		0	0	0.0%
	Electricity used in council assets	5,379,208	kWh		4,465	646	5,110	60.3%
	Electricity used by streetlighting	1,525,437	kWh			1,449	1,449	17.1%
	Electricity use from solar PV	56,027	kWh				0	0.0%
	TOTAL:			**1,828**	**4,465**	**2,188**	**8,482**	**100.0%**

Electricity use is dominated by a small number of large sites (including streetlighting) and many individually small electricity using sites. The 'top 10' sites' use 71% of all Council's electricity.

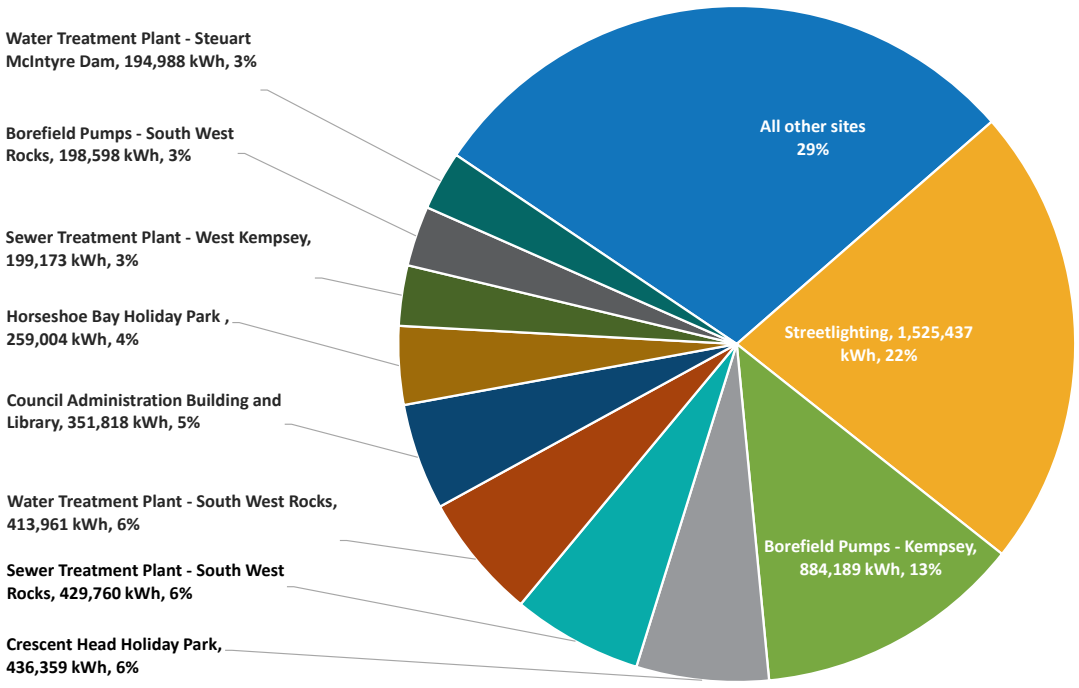


FIGURE 2: KEMPSEY SHIRE COUNCIL'S LARGE ELECTRICITY USING SITES

1.4.2 Water consumption

Water consumption data was supplied for nearly 140 Council sites, with consumption in 2019 of 222,567 kL. The estimated breakup of water consumption by site category is shown below.

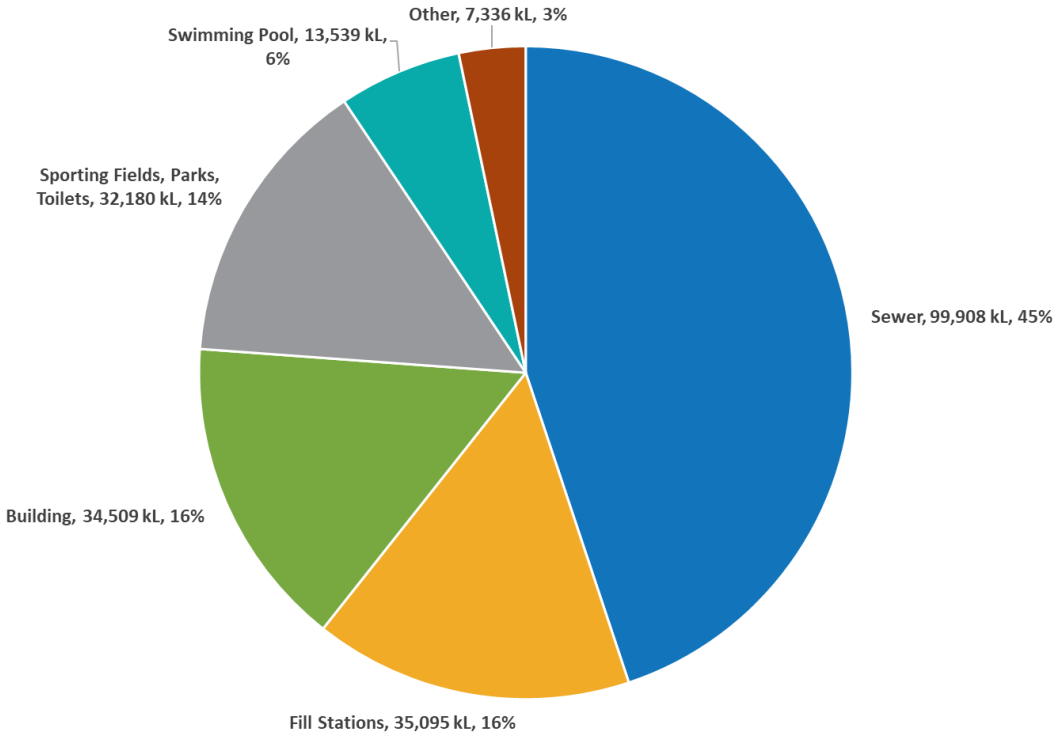


FIGURE 3: KEMPSEY SHIRE COUNCIL'S WATER USE BY SITE TYPE

Water is generally used for one or a handful of activities at each location, such as washdown, irrigation, for amenities (handwashing, drinking water, etc.) or pool water make-up. Washdown water for sewer wells is the single biggest end use of water. Potable water from fill stations (16%) and water use by lessees of Council-owned sites (est 14%) is largely outside of Council's direct control.

1.5 Efficiency, renewable energy & emissions reduction options

A review of Council's current energy & water demand and carbon footprint, site visits and discussions with Council staff, suggest that there are nine main areas of action that, implemented together in a planned way, can significantly reduce energy and water demand, increase onsite renewables, and reduce emissions. These nine areas, including resource reduction and enabling actions include:

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. Management & monitoring
7. Sustainable procurement
8. Water efficiency
9. Financing of initiatives

FIGURE 4: NINE CATEGORIES OF ENERGY AND WATER SAVING FOR KEMPSEY SHIRE COUNCIL

In the short to medium term (i.e. within the period of the current and the next Delivery Program cycle for Kempsey Shire Council), nearly 60 opportunities are identified for Council's consideration in helping to achieve significant resource, emissions and cost savings. These opportunities across each of the above areas are tabulated below.

These are opportunities to be considered taking into account the financial viability of individual measures, Council's capacity to fund projects, as well as consideration of staff time required compared with available resources.

1.5.1 Short-term opportunities

TABLE 2: KEMPSEY SHIRE COUNCIL SHORT-TERM OPPORTUNITIES FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Grid Decarbonisation	Electricity Supply	Whole-of-Council	Council will periodically update its emissions so that progress towards targets can be tracked and reported. This will capture the impact of grid decarbonisation and allow Council to adjust any of its forecasts to reflect changes.	Sustainability	Staff time
Grid Decarbonisation	Electricity Supply	Whole-of-Council	Council will proactively respond to and advocate to State or Commonwealth governments regarding clean energy policies that can provide investment certainty, lead to more renewable energy and regional jobs, and reduce energy costs to Council and the community.	Sustainability	Staff time
Buying clean energy	Electricity Procurement	Whole-of-Council	Develop an electricity procurement plan for KSC's next procurement cycle, to include a goal to source part or all of KSC's electricity from renewable energy sources subject to the market and contract models for renewables.	Procurement	Staff time and/or consulting advice
Financing of initiatives	Finance	Whole-of-Council	Investigate funding options for implementation of financially viable opportunities.	Sustainability / Finance	Staff time
Management & monitoring	Data Management	Whole-of-Council	Implement and manage an energy data management system that gives Council ready access to up-to-date and accurate information on Council's energy use, cost and GHG emissions	Sustainability	Data management system implementation + recurrent costs
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Review purchasing policies and frameworks for sustainability inclusions, and assess if / how sustainable purchasing decisions are made across Council.	Sustainability / Procurement	Staff time
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Develop and implement internal engagement and training to encourage the specification of sustainability in all Council buying decisions.	Sustainability / Procurement	Staff time

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Start to develop / update specifications and evaluation criteria for services and equipment / products that Council purchases to include Council's sustainability requirements.	Sustainability / Procurement	Staff time
Behind-the-meter solar	Solar PV	Dangar Street Depot (Thompson Street aka Kempsey Depot)	Continued maintenance on the 50 kW solar PV system to maintain design performance.	Facilities	Routine maintenance by installer
Energy efficiency	Lighting		Investigate whether cost-effective to upgrade all remaining lights to LED. High bays in the workshop have been upgraded to LEDs. Most lights are twin and single 36W battens, estimated 70 lights in total.	Facilities	$7,000
Energy efficiency	Baseload		Off-peak grid power use is 50,000 kWh per year for the main account, which will include minimal weekend daytime use as solar will meet most of this with surplus. Investigate why this power use is so high - e.g. external lights, wash bay pumps, etc.	Facilities	Staff time to audit night / weekend use and minor costs to implement operational or control changes
Behind-the-meter solar	Roof-mounted solar PV	Kempsey Civic Centre & Library	Install 99 kW solar PV on the roof (new) of Council's administration building (north and east roofs).	Facilities	$99,800
Energy efficiency	Lighting		Upgrade all Civic Centre lights to LED technology. Current lights consist of single and twin 36 W and quad 18 W fittings. Note that this upgrade is currently being undertaken.	Facilities	$22,050
Energy efficiency	Lighting		Upgrade all Library lighting to LED technology. This will reduce electricity use for lighting by 60%.	Facilities	$14,175
Energy efficiency	Metering and Accounts	West Kempsey STP & Treated Effluent Pumps	There are four electricity accounts at North Street, and the STP and treated effluent pumps meters have the same NMIs, indicating they may be the same supply. The other accounts may be separate sewage pump station (SPS) feeding in to the STP. These arrangements should be confirmed, particularly for the effluent pumps, as any future	Water and Sewer	Staff time

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
			solar PV at this site will be designed to meet demand by these pumps.		
Energy efficiency	Design	Steuart McIntyre Dam & WTP	Design energy efficient best practice into new WTP.	Water and Sewer	Staff time to specify EE/RE requirements
Energy efficiency	Lighting	South West Rocks and Central Kempsey Sports Complex	Sporting field and netball court lights have been upgraded to LED with grant assistance. Council should review bills to confirm energy savings.	Facilities	Staff time
Energy efficiency	Motor Systems	South West Rocks STP	VSD and dissolved oxygen (DO) control of Passveer channel drives.	Water and Sewer	$20,000
Energy efficiency	Motor Systems	South West Rocks STP	VSD control of 2 x effluent outflow pumps.	Water and Sewer	$20,000
Energy efficiency	Motor Systems	SPS #1 Simpson St SWR	As a minimum, implement soft start, or else VSD control of 2 x 30kW transfer pumps	Water and Sewer	$30,000
Energy efficiency	Motor Systems	Stuarts Point WTP	Optimise time of use operation to more off-peak and less daytime.	Water and Sewer	Staff time and potentially control changes
Energy efficiency	Design	Crescent Head WTP	Design energy efficient best practice into new WTP.	Water and Sewer	Staff time to specify EE/RE requirements
Behind-the-meter solar	Roof-mounted solar PV	Kempsey Waste Management Centre	Install solar on the roof of the main shed to meet demand for the wash bay and extruder drives, potentially add solar on the weighbridge offices – subject to appropriate structural and wind studies.	Facilities	$10,100
Sustainable Transport	Electric Vehicles	Kempsey Civic Centre & Library	Investigate the business case for different charger types and locations	Fleet Management	Staff time

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
				Working Group / Facilities	
Sustainable Transport	Electric Vehicles and hybrids	All of council	Investigate installing a telematic solution in the current fleet to get data about current driving behaviours and km driven, plus a report on potential business case for electric or hybrid vehicles.	Fleet Management Working Group / Facilities	Cost of telematics solution (to be determined)
Water efficiency	Water leakage	Whole-of-Council	Water consumption data to be stored in a readily accessible and searchable database (WaterOutlook), and a quarterly or half-yearly review of data to be performed to highlight anomalies in consumption data and investigated.	Water and Sewer	Staff time and routine maintenance
Water efficiency	Washdown water	Whole-of-Council	Review sewer well water use data, and check and set timers to be uniform across the network as part of routine maintenance. As part of this maintenance check for leaks.	Water and Sewer	Staff time and routine maintenance
Water efficiency	Washdown water	Whole-of-Council	Investigate water spray nozzles to determine if any lower flow fit-for-purpose devices are available or in use and can be applied to all wells over time as part of routine maintenance.	Water and Sewer	Staff time and routine maintenance, cost for any new nozzles

1.5.2 Medium-term opportunities

TABLE 3: KEMPSEY SHIRE COUNCIL MEDIUM-TERM OPPORTUNITIES FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Buying clean energy	Electricity Procurement	Whole-of-Council	Implement a 'market test' process to determine the current contract models, renewable energy availability and price for renewables as part of a PPA ahead of Council's next electricity supply agreement.	Procurement	Staff time and/or consulting advice
Buying clean energy	Electricity Procurement	Whole-of-Council	Target from the beginning of Council's next electricity supply agreement period to purchase 50% to 100% of KSC's electricity from renewable energy, subject to cost and risk assessment. Weigh up the costs and risks of a renewable energy PPA against a regular power agreement.	Procurement	Staff time and cost difference between 'regular' supply agreement and PPA
Sustainable transport	Electric Vehicles	Whole-of-Council	Install EV charging infrastructure / supply points to support Council Battery Electric Vehicle (BEV) / Plug-in Hybrid Electric Vehicle (PHEV) trial vehicles and/or public charging point.	Fleet Management Working Group / Facilities	~$12,000
Sustainable transport	Fleet	Whole-of-Council	In Council's next fleet plan, incorporate assessment and development of plans for EV charging at Council-owned and 3rd-party operated sites, transition to hybrid, Plug-in Hybrid EV, Battery EV for passenger cars and utility vehicles in the medium term.	Fleet Management Working Group	Staff time and/or consulting advice
Sustainable transport	Fleet	Whole-of-Council	Consider implementation of an EV trial for a passenger vehicle in Council's fleet.	Fleet Management Working Group	Cost premium between petrol / hybrid and EV
Energy efficiency	Design	Kempsey Library and planned Civic Centre & Library connection	Integrate ecological sustainable design (ESD) principles and maximise energy efficiency in the new design and in selecting lighting and power, air conditioning, and ICT equipment.	Facilities	Life-cycle cost assessment of options
Energy efficiency	HVAC		The HVAC unit at the rear (north, rear roof) of the library is very old. Investigate upgrading to an energy efficient system.	Facilities	Capex for a replacement HVAC unit

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Energy efficiency	Lighting	Commercial Services, Harold Walker Ave	Upgrade all Commercial Services lights to LED technology - current lights are single and twin 36W surface mounted battens.	Facilities	$1,833
Energy efficiency	Streetlighting	Streetlighting	Consider upgrading all main road streetlighting to LED technology. Currently P1 and P2 have been upgraded.	Facilities	$1,738,500
Energy efficiency	Motor Systems	Kempsey Bore Pumps	Run pumps at night where possible. During periods of high demand seek to avoid operation in peak charging period (5-8pm weekdays) when feasible to reduce peak demand charges.	Water and Sewer	Staff time and control setting adjustments if warranted
Energy efficiency	Compressed Air	Steuart McIntyre Dam & WTP	Review operating times for the 55 kW air compressor, confirm any changes to operation since installation of the 2 ultrasonic devices in the dam. Determine if it is feasible to monitor water quality and operate the compressor based on this.	Water and Sewer	Staff time and control setting adjustments if warranted
Energy efficiency	Motor Systems	Stuarts Point WTP	VSD control of 2 x 30kW transfer pumps.	Water and Sewer	$40,000
Energy efficiency	Baseload	Stuarts Point WTP	Reduce average base demand of ~4 kW by reviewing lights, compressed air leaks, etc (note a new air compressor may address this issue and is planned for implementation).	Water and Sewer	$5,000
Energy efficiency	Motor Systems	Crescent Head STP	VSD control of effluent outflow pumps.	Water and Sewer	$20,000
Energy efficiency	Voltage Optimisation	South West Rocks STP	Incoming voltage at old MSB was 249V, well above required level. This may hint at a VO opportunity (this can be investigated across several sites, costs are estimated for just this one).	Water and Sewer	$80,000
Behind-the-meter solar	Ground-mounted solar PV	Steuart McIntyre Dam & WTP	Install ground mount solar PV on the south side of the Steuart McIntyre dam to supply the new plant. Consider this option as part of the scope of the project up front.	Water and Sewer	$129,350

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Behind-the-meter solar	Roof-mounted solar PV	Steuart McIntyre Dam & WTP	Install solar PV on the roof of the existing treatment and pump house and the east side of the dam. Use both north and south faces due to shallow pitch, possibly with frames (note: there may be ground areas available for use in future that may provide better solar yield, with lower shading, so this can be considered as an alternative).	Water and Sewer	$40,300
Behind-the-meter solar	Roof-mounted solar PV	South West Rocks Bore Pumps	Investigate a 10kW solar array on the transfer pump house roof, flush on the North-East facing roof and tilted on the south facing roof, with a focus on shading and vegetation management issues.	Water and Sewer	$10,100
Behind-the-meter solar	Ground-mounted solar PV	South West Rocks STP	Install 99 kW of ground-mount solar next to the lab and MSB at the new plant, with consideration of vegetation clearance and ongoing management needs, as well as other practical site-specific considerations that may apply (roof mounted arrays are unlikely to be feasible).	Water and Sewer	$129,740
Behind-the-meter solar	Roof-mounted solar PV	South West Rocks Water Treatment Plant	Install solar array on the roof either facing east or mounted on frames facing north.	Water and Sewer	$30,200
Behind-the-meter solar	Roof-mounted solar PV	Hat Head STP	Install 14 kW solar PV on the roof over the chemical store.	Water and Sewer	$14,400
Behind-the-meter solar	Roof-mounted solar PV	Stuarts Point WTP	Install 10kW solar on the roof of the 2 WTP buildings, both east-west arrays.	Water and Sewer	$9,720
Behind-the-meter solar	Roof-mounted solar PV + BESS	Kempsey Waste Management Centre	Alternative to just installing solar (see under short term plan), solar with battery can be installed on the roof of the main shed to meet demand for the wash bay and extruder drives, potentially added solar on the weighbridge offices.	Facilities	$28,100

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Behind-the-meter solar	Ground-mounted or roof-mounted solar PV	Crescent Head WTP	Build a solar PV array with the planned new WTP at the rear of the current site - ground and/or roof-mounted. Consider this option as part of the scope of the project up front.	Water and Sewer	$65,780
Behind-the-meter solar	Ground-mounted solar PV	Crescent Head STP	Install 40 kW solar ground mounted array on grass area between main plant and UV / effluent outflow with consideration of vegetation clearance and ongoing management needs, as well as other practical site-specific considerations that may apply.	Water and Sewer	$52,390
Water efficiency	Washdown water	Whole-of-Council	At treatment works and saleyards the use of rainwater collection may provide an alternate source of washdown water, and investigations at relevant sites should seek to highlight potentially suitable locations where a reasonable return on investment can be achieved.	Water and Sewer	Cost for rainwater tanks
Water efficiency	Sports fields, parks and median strips irrigation	Whole-of-Council	Investigate the use of rainwater tanks at sites where this is feasible.	Parks	Cost for rainwater tanks
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Continue to deliver internal engagement and training to encourage the specification of sustainability in all Council buying decisions.	Sustainability / Procurement	Staff time
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Continue to develop / update specifications and evaluation criteria for services and equipment / products that Council purchases to include Council's sustainability requirements.	Sustainability / Procurement	Staff time

2 Approach and scope of work

Kempsey Shire Council identified the need to develop a comprehensive long term strategy and action plan that will help it to cost-effectively increase the amount of renewable energy at its facilities, as well as lower demand through greater energy and water efficiency. Council engaged with NSW Department of Planning, Industry & Environment's Sustainable Councils and Communities (SCC) Program to help develop the strategy. 100% Renewables was engaged by the SCC Program to develop the strategy in partnership with Kempsey Shire Council.

The scope of this project is outlined below, highlighting a 4-step process to review data, identify improvement options, develop cost-benefit analyses, and prepare KSC's Long-term Renewable Energy and Water Strategy.

FIGURE 5: FOUR-STEP PROCESS TO DEVELOP KSC'S LONG-TERM RENEWABLE ENERGY AND WATER STRATEGY

- **Step 1 – Review Council's energy and water use and establish baseline & carbon inventory**
  - Historical electricity & water use, transport data, data for landfill and wastewater
  - List of Council sites and relevant information (e.g. activity)
  - Information on new developments with an impact on energy demand
- **Step 2 – Identification of energy/water efficiencies, renewable energy options and management systems**
  - Three-day site visit period in Kempsey Shire LGA
  - Preparation of initial list of potential opportunities for review and prioritisation
- **Step 3 – Cost/benefit assessment of potential technical and management system opportunities**
  - Cost/benefit analysis for short and medium-term efficiency and solar PV opportunities
  - Review of transport efficiency/fuel switching options
  - Highlight long term efficiency, solar and battery storage opportunities
  - Mid-scale and/or renewable energy power purchasing, sustainable purchasing
- **Step 4 – Strategy plus costed short-term opportunities. Recommended medium and long term actions**
  - Draft and then finalised Strategy incorporating stakeholder feedback
  - Presentations to Council during the project as needs

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.

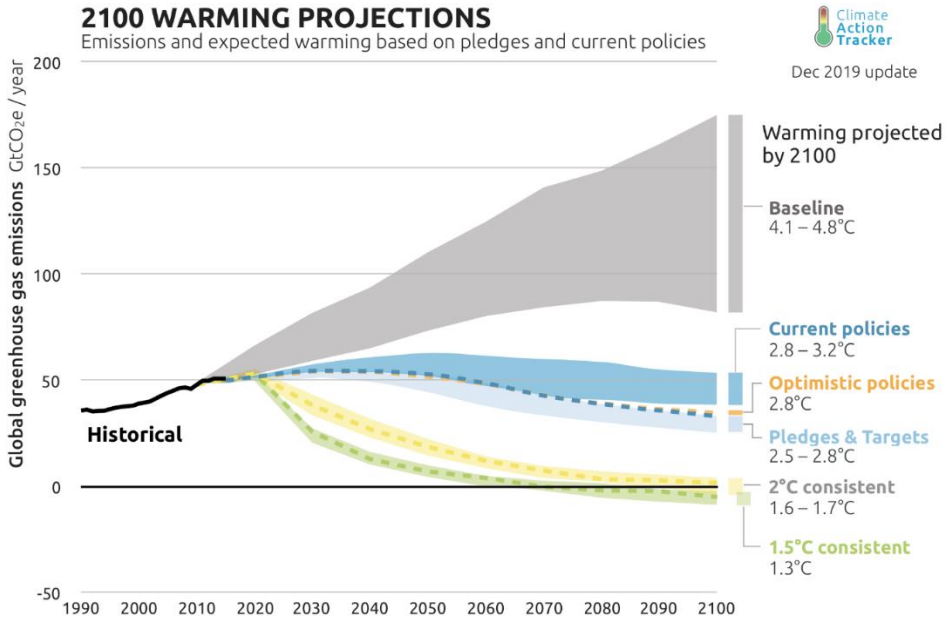


FIGURE 6: THE CLIMATE ACTION TRACKER'S WARMING PROJECTIONS FOR 2100, VARIOUS POLICY SCENARIOS

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

1. Net-zero GHG emissions from stationary fuel combustion such as LP gas use, and
2. Net-zero GHG emissions from transport 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

For some of these emission sources, carbon offsets may need to be bought to reach a carbon-neutral position.

[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].

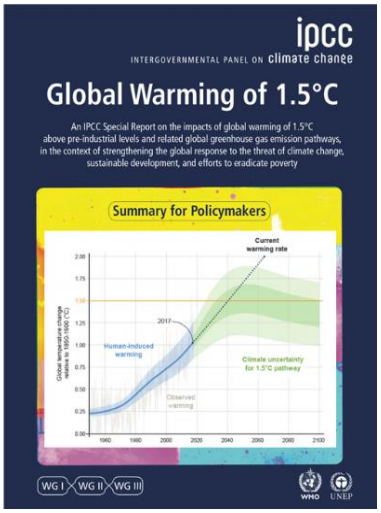


FIGURE 7: GLOBAL CONTEXT FOR ACTION ON CLIMATE

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.

[3] Sourced from https://www.un.org/sustainabledevelopment/development-agenda/
[4] Sourced from https://www.un.org/sustainabledevelopment/climatechange/
[5] Sourced from https://www.ipcc.ch/news_and_events/pr_181008_P48_spm.shtml
[6] http://reports.weforum.org/global-risks-report-2020/

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.

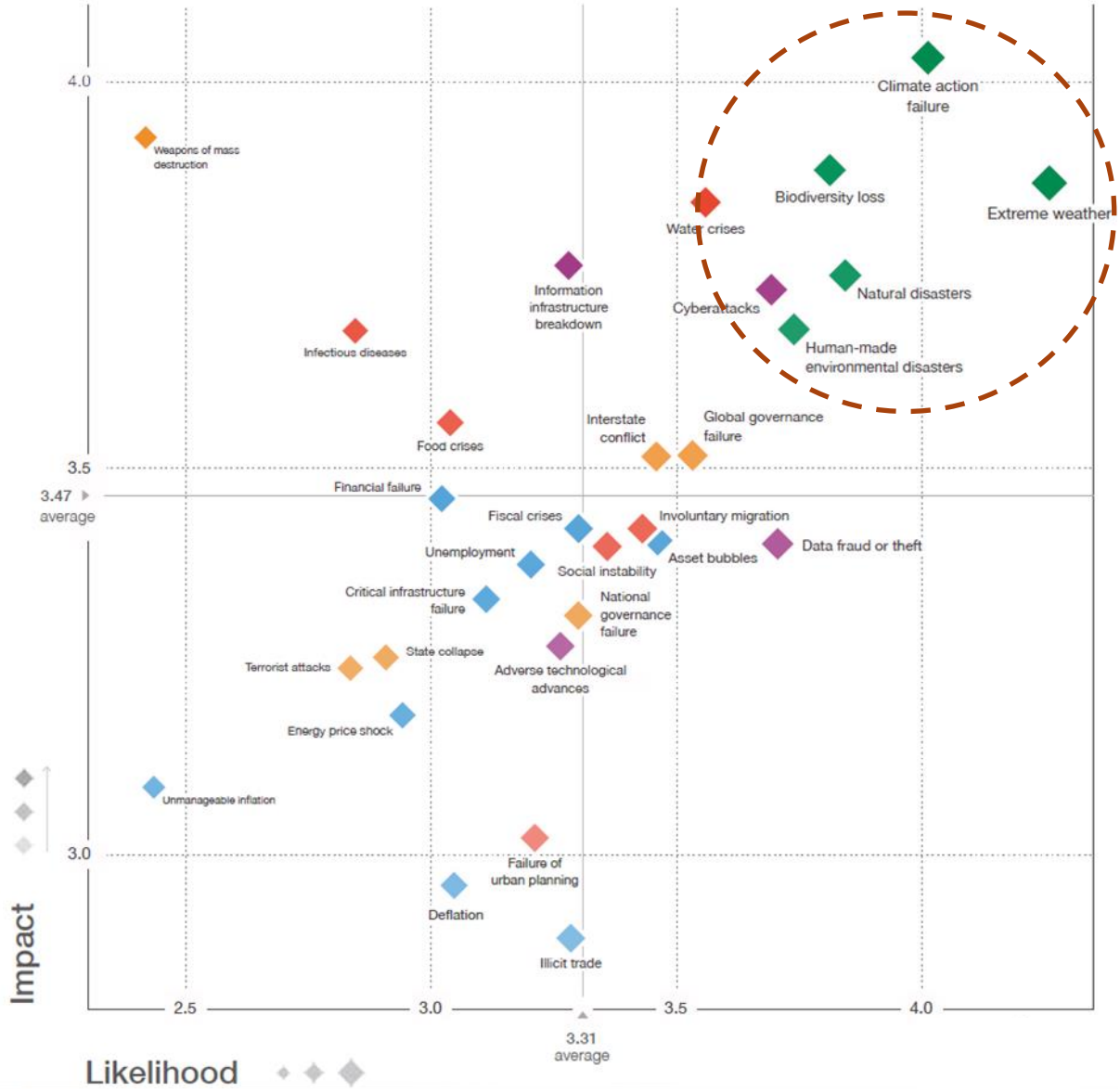


FIGURE 8: GLOBAL RISKS REPORT – LIKELIHOOD & IMPACT OF CLIMATE, OTHER RISKS TO GLOBAL ECONOMY

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), which committed Australia to source 20% of its electricity from renewable energy sources by 2020.

FIGURE 9: 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) in 2008 and during the period of Australia's Carbon Pricing Mechanism from 2012-2014.

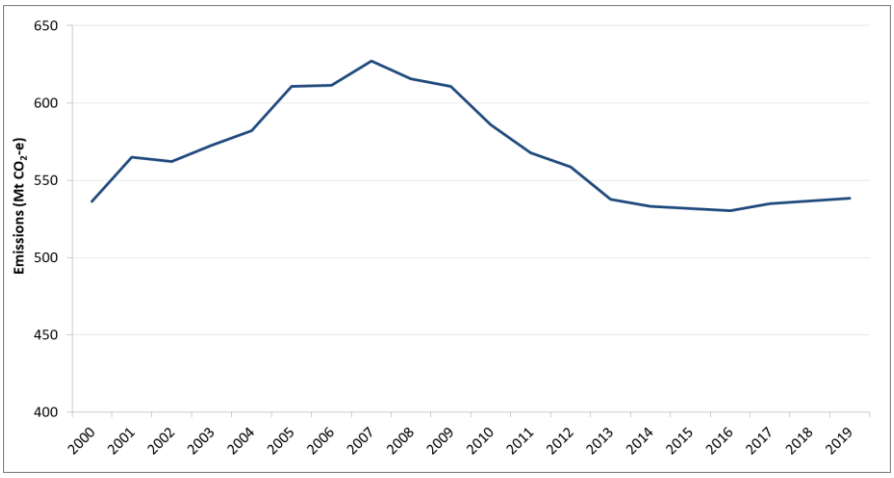


FIGURE 10: AUSTRALIA'S GHG EMISSIONS FROM ALL SOURCES

[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.

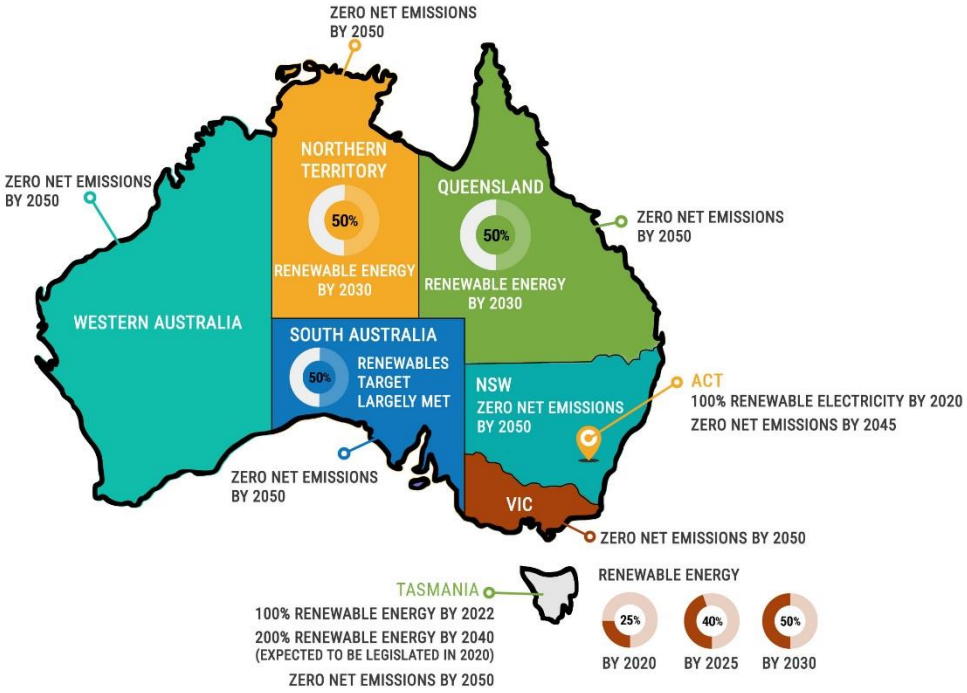


FIGURE 11: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – STATE & TERRITORY LEVEL

The **NSW Electricity Strategy** will help the State to deliver on its goal to attract renewable energy investment, with a 3,000 MW renewable energy zone in the Central West and several demand management measures announced as part of the strategy.

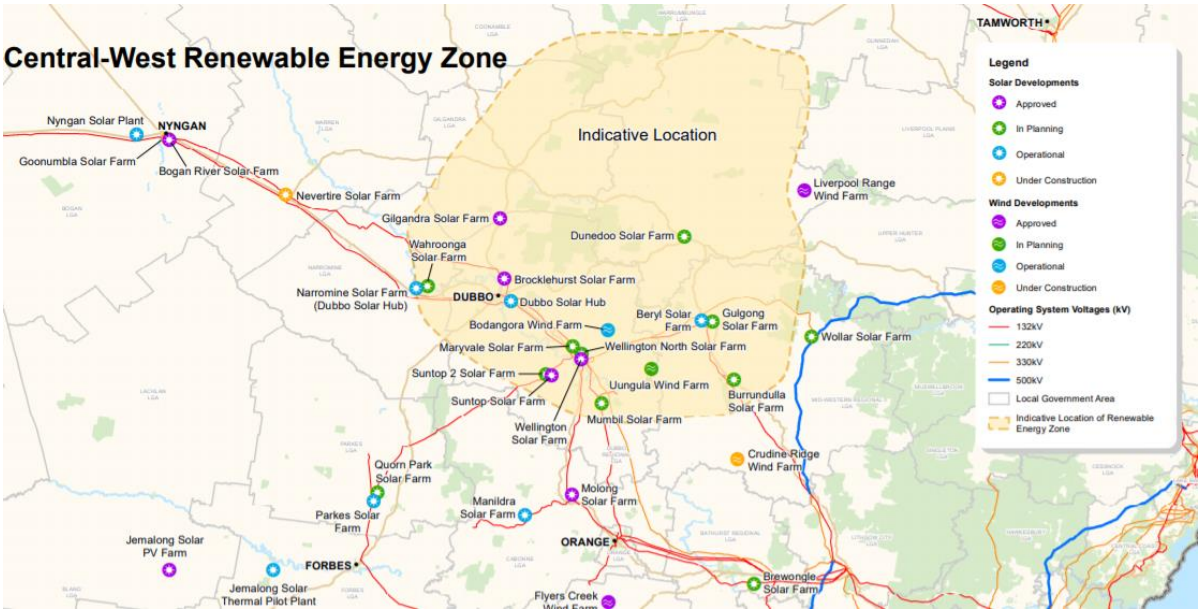


FIGURE 12: INDICATIVE CENTRAL-WEST NSW RENEWABLE ENERGY ZONE

Recently, the NSW Government released its **Net Zero Plan Stage 1: 2020–2030**[8], along with the release of two additional Renewable Energy Zones in regional NSW in the Riverina and New England. 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. Some of the key highlights of the 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.
- Commitment 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.
- Commitment by NSW to reducing State emissions by 35% by 2030 and to net zero by 2050, articulated as 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 the Government Resource Efficiency Policy (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 Kempsey Shire Council and its community.

[8] © State of New South Wales 2020. Published March 2020

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 (as at October 2019).

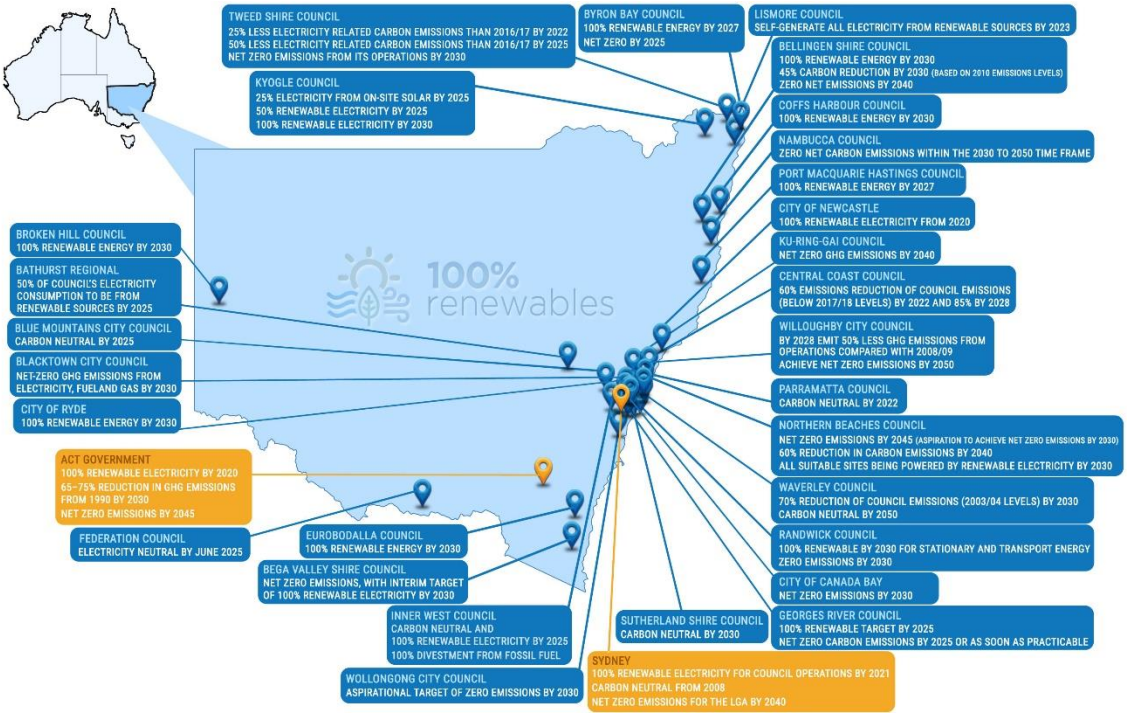


FIGURE 13: RENEWABLE ENERGY & CARBON TARGETS BY NSW COUNCILS & ACT

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. Kempsey Shire Council is among those to have upgraded most of their local road streetlights to LED in recent years.

5 Kempsey Shire Council – what has council been doing?

Kempsey 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:

- 50 kW solar PV installation at the Kempsey Shire Council Depot, implemented in 2013
- Upgrading of local road streetlights to LED technology
- Progressive upgrading of building lighting to LED on an as-fail basis and for new works
- Apricus solar hot water heating has been installed at some tourist parks and will continue to be rolled out at more locations
- Sporting field lighting at the South West Rocks and Central Kempsey sporting complexes were recently upgraded to LED technology
- The water treatment plant at South West Rocks is equipped with several energy efficient variable speed drives (VSDs) to control the treatment and pumping processes
- Identification and rectification of numerous leaks within Council's potable water network, in particular at the Kempsey Airport and in several sewer wells

6 Current solar uptake in Kempsey Shire

Kempsey 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), Kempsey Shire Council LGA has:

- 4,004 PV installations, a 30.2% penetration rate, at September 2020, with almost 17.7 MW of installed capacity. Refer to the APVI map with Kempsey Shire LGA details highlighted below.
- 1 installation of over 100 kW, 172 installations over 10 kW and less than 100 kW, and 3,832 installations of less than 10 kW.

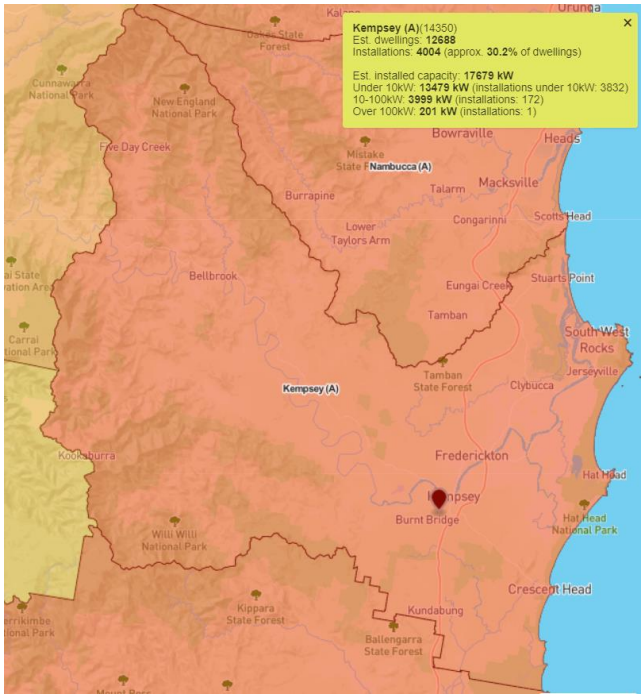


FIGURE 14: KEMPSEY SHIRE LGA SOLAR PV INSTALLATIONS, SEPTEMBER 2020

Baseline

Kempsey Shire Council's energy, water and carbon footprint

7 Background information on scope 1, scope 2 and scope 3 emissions

To help differentiate between different greenhouse gas emissions sources, emissions are classified into the following scopes according to the GHG Protocol – Corporate Standard:

- Scope 1 emissions are emissions directly generated at your operations, such as burning natural gas or driving company cars, or refrigerant gases in your air conditioning equipment.
- Scope 2 emissions are caused indirectly by consuming electricity. These emissions are generated outside your organisation (think coal-fired power station), but you are indirectly responsible for them.
- Scope 3 emissions are also indirect emissions and happen upstream and downstream of your business. Examples are waste, air travel, the consumption of goods and services, contractor emissions, or leased assets.

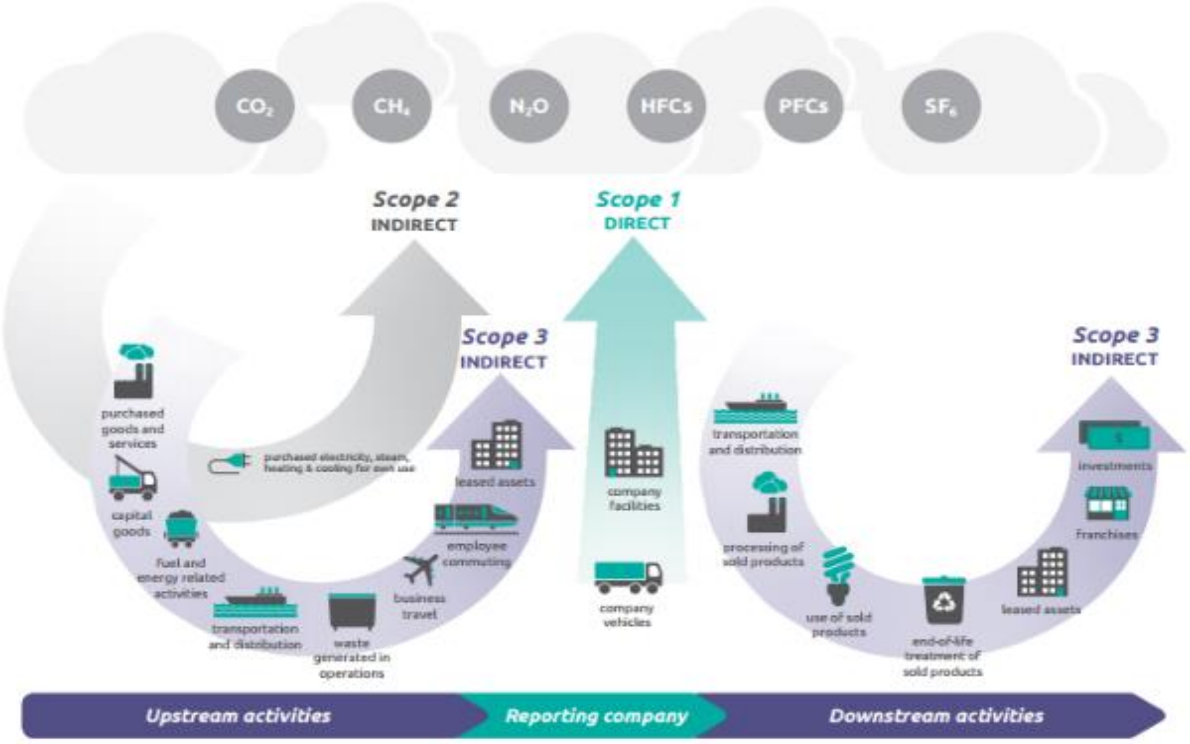


FIGURE 15: SCOPE 1, SCOPE 2 AND SCOPE 3 EMISSIONS

8 Council's 2019 energy use, water 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 was dominated by waste emissions followed by electricity consumption, direct wastewater emissions, and diesel fuel consumption, tabulated below.

When looking at Council's operational energy-related emissions only, electricity accounts for more than three quarters of emissions, followed by transport fuel. This is also tabulated below.

TABLE 4: KEMPSEY SHIRE COUNCIL – CARBON FOOTPRINT 2019, ENERGY + WASTE + WASTEWATER

	Emission source	Activity data	Units	Scope 1 t CO2-e	Scope 2 t CO2-e	Scope 3 t CO2-e	Total	%
	Diesel for fleet	603	kL	1,642		84	1,726	5.7%
	Petrol for fleet	80	kL	186		10	196	0.7%
	Ethanol for fleet	0	kL	0		0	0	0.0%
	Natural gas		GJ	0		0	0	0.0%
	Electricity used in council assets	5,379,208	kWh		4,465	646	5,110	17.0%
	Electricity used by streetlighting	1,525,437	kWh			1,449	1,449	4.8%
	Electricity use from solar PV	56,027	kWh				0	0.0%
	Water	222,567	kL				0	0.0%
	Waste water	2,311	t CO2-e	2,311			2,311	7.7%
	Municipal solid waste	9,165	t	12,831			12,831	42.7%
	Commercial & industrial waste	5,352	t	6,422			6,422	21.3%
	Construction & demolition waste	181	t	36			36	0.1%
	Garden and green waste (Landfill)	-	t	0			0	0.0%
	TOTAL:			**23,429**	**4,465**	**2,188**	**30,082**	**100.0%**

TABLE 5: KEMPSEY 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	603	kL	1,642		84	1,726	20.4%
	Petrol for fleet	80	kL	186		10	196	2.3%
	Ethanol for fleet	0	kL	0		0	0	0.0%
	Natural gas		GJ	0		0	0	0.0%
	Electricity used in council assets	5,379,208	kWh		4,465	646	5,110	60.3%
	Electricity used by streetlighting	1,525,437	kWh			1,449	1,449	17.1%
	Electricity use from solar PV	56,027	kWh				0	0.0%
	TOTAL:			**1,828**	**4,465**	**2,188**	**8,482**	**100.0%**

The above inventory summaries are repeated graphically below, to highlight the dominance of landfill gases in the full carbon footprint and electricity in the operational energy footprint.

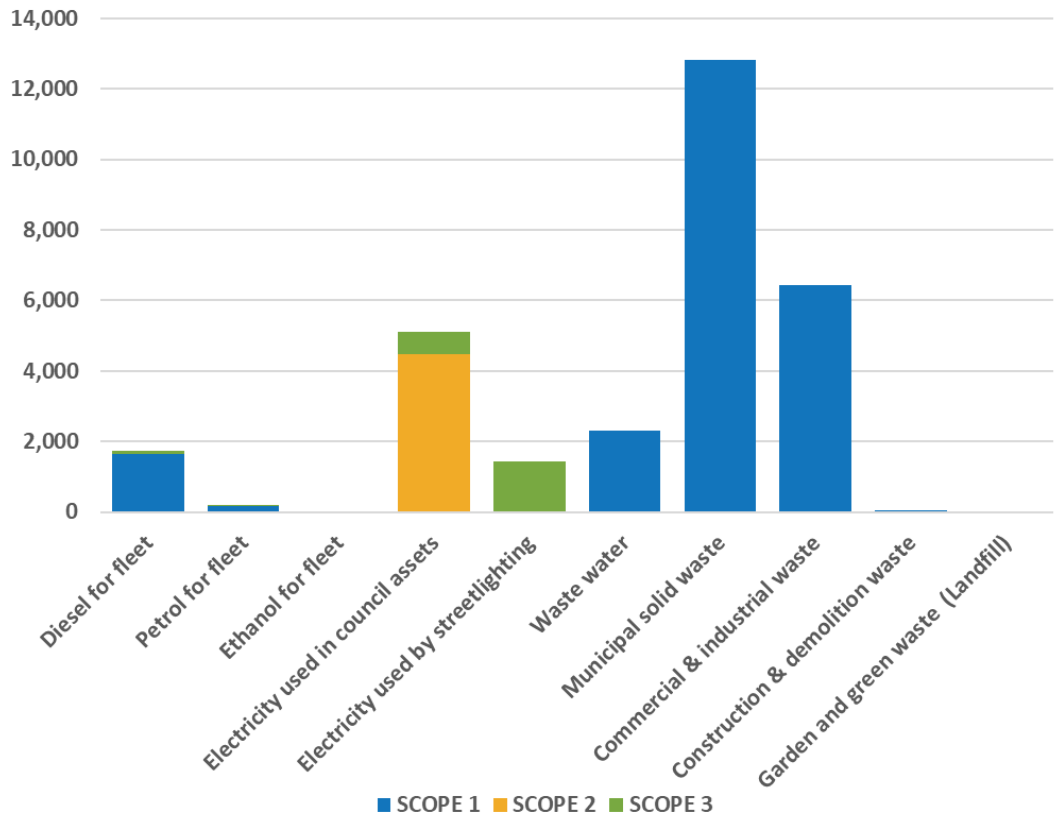


FIGURE 16: KEMPSEY SHIRE COUNCIL CARBON FOOTPRINT BY EMISSIONS SOURCE, ENERGY + WASTE

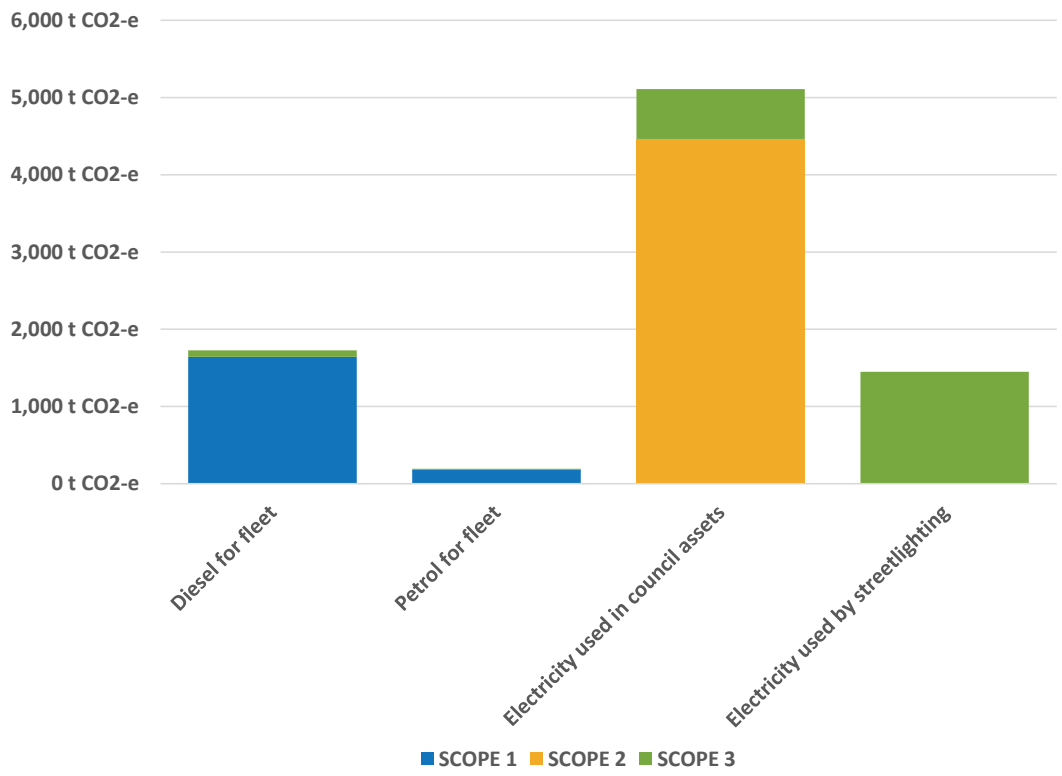


FIGURE 17: KEMPSEY SHIRE COUNCIL CARBON FOOTPRINT BY EMISSIONS SOURCE, ENERGY ONLY

8.1 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 accounts/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/accounts (including the main streetlighting account) and many individually small electricity using sites. The 'top 10' sites' use 71% of all Council's electricity.

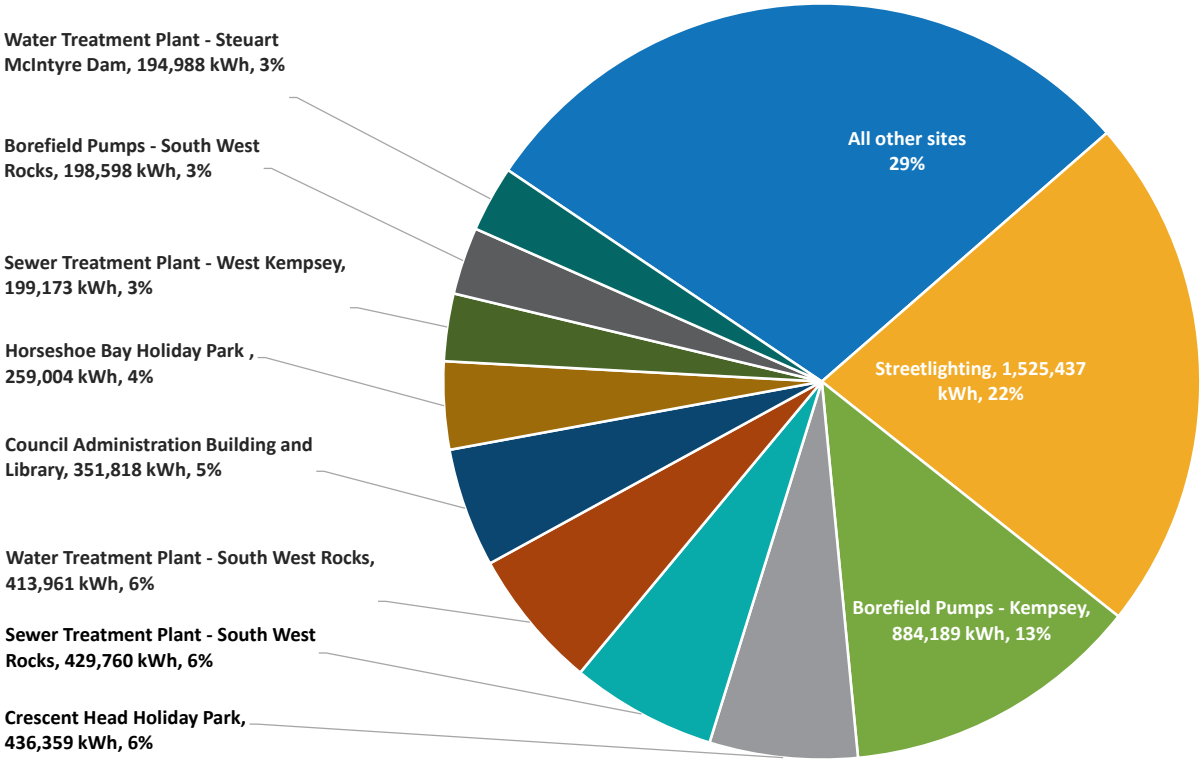


FIGURE 18: KEMPSEY SHIRE COUNCIL'S LARGE ELECTRICITY USING SITES

Viewed by site type, it can be seen that water and sewer assets consume 50% of Council's power, while streetlights (including the main account plus another small public lighting account) use 22% and tourist parks 14%. Council's main administration building and the Dangar Street depot together consume 7% of power, and other sites are small users, aggregated into parks & sporting fields and other Council asset categories.

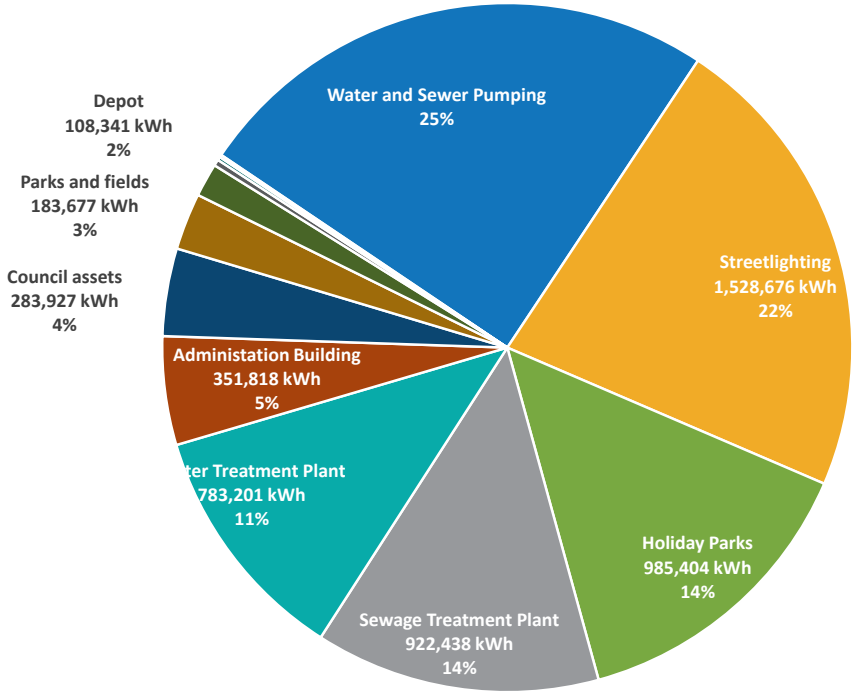


FIGURE 19: KEMPSEY SHIRE COUNCIL'S MAIN ELECTRICITY USING ASSET CATEGORIES

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 therefore the major focus areas for energy efficiency.

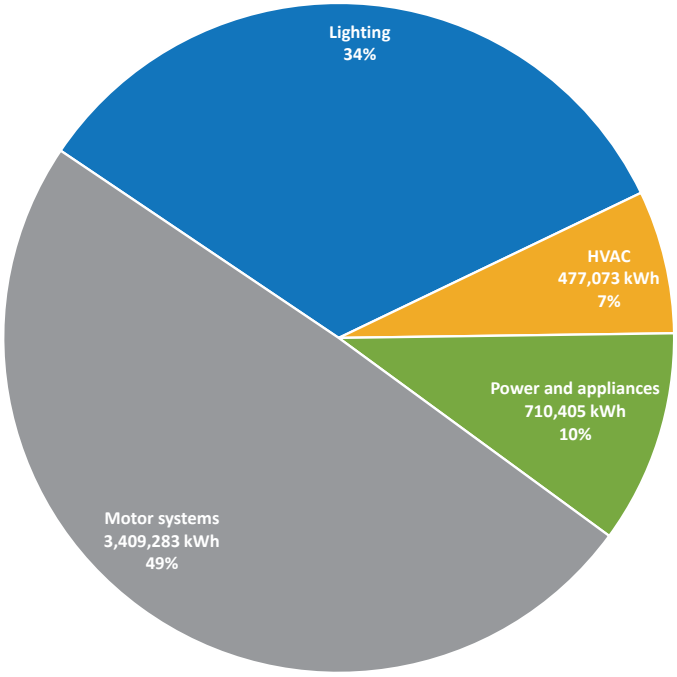


FIGURE 20: KEMPSEY SHIRE COUNCIL'S ELECTRICITY USE BY END USE EQUIPMENT

8.2 Water consumption summary

Water consumption data was supplied for nearly 140 Council sites[9], with consumption in 2019 of 222,567 kL. It should be noted that in 2019, the area experienced severe drought, which particularly affects fill station water use, and that in other years, water use might be less.

Water is used across a range of functions, including:

- Sewer systems, where water is used mainly for washdown of pump wells and treatment works,
- Fill stations: there are four designated fill points (2 in Kempsey, Crescent Head, Gladstone) used by water carters to service areas without a potable water supply. These points can also be used to refill reservoirs during high turbidity of river water, and for dust suppression in construction activities,
- Council buildings including offices, depots as well as RFS facilities (where water use can be highly variable depending on fire conditions from year to year), and Council-owned leased sites,
- Public outdoor facilities including toilet blocks, sporting fields, parks and median strips,
- Swimming pools where water is used for amenities as well as make-up for water evaporated from pools or lost as leakage

The estimated breakup of water consumption by end-use site or category is shown below.

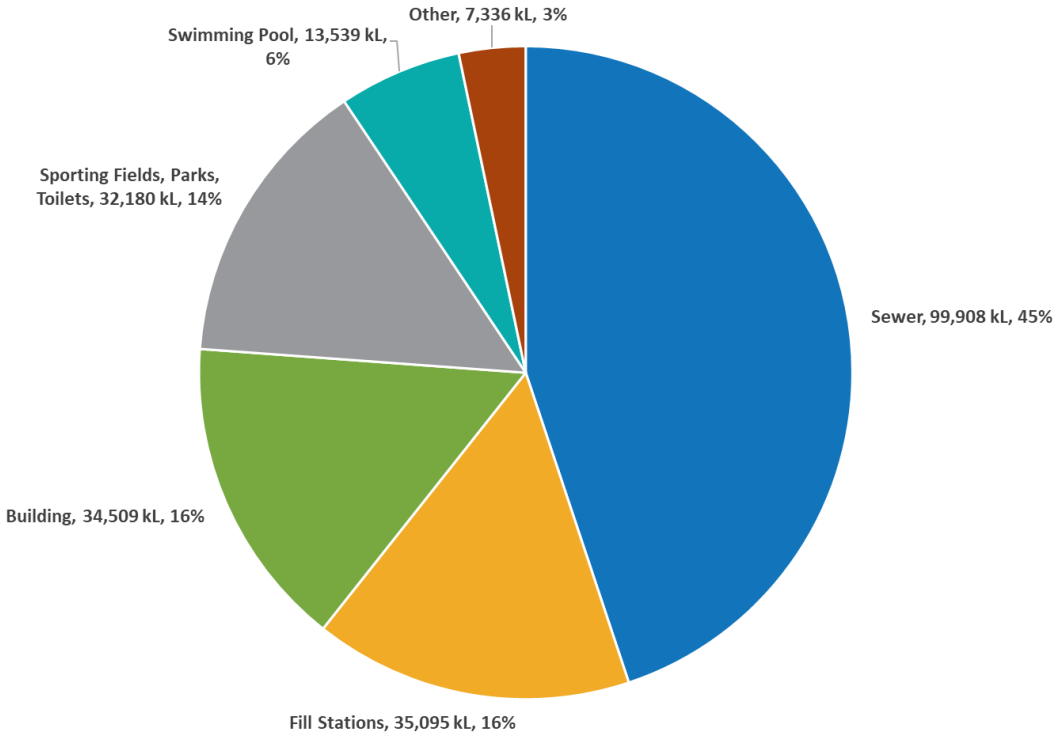


FIGURE 21: KEMPSEY SHIRE COUNCIL'S WATER USE BY SITE TYPE

[9] With more than 200 electricity accounts, there will be numerous water accounts that are not in the data supplied by Council. These may include, for example water bills received for some third-party operated sites including holiday parks and pools. Reviewing and deciding what sites and utilities to track and report on will be a key initial task of any new energy & water data management system.

Water is generally used for one or a handful of activities at each location, such as washdown, irrigation, for amenities (handwashing, drinking water, etc.) or pool water make-up. Fill station water supply and water used by lessees accounted for 30% of water use in 2019. Based on discussions with Council staff an estimate has been made of the breakdown of water use in each facility for the data provided. This is illustrated below.

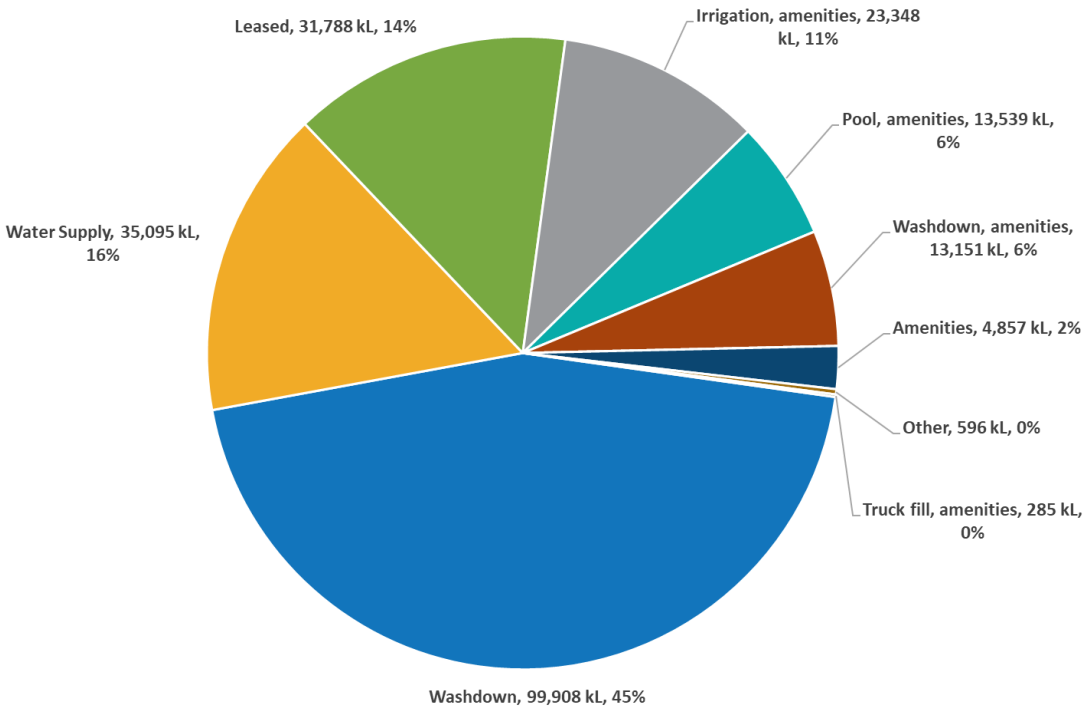


FIGURE 22: KEMPSEY SHIRE COUNCIL'S WATER USE BY END-USE ACTIVITY (ESTIMATED)

8.3 Landfill gas and wastewater emissions summary

8.3.1 Landfill gas emissions

Emissions from landfill are not the focus of this strategy, as Council's waste strategy will be updated in the near future. 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.

In 2018/19 emissions from landfill in Kempsey Shire were 19,290 t CO_2-e, from 14,698 tonnes of waste (see table below). This represents a reduction since 2016/17 of 3,502 t CO2-e (from 22,792 t CO2-e, 15%).

A total of 9,663 tonnes of waste was recycled in 2018/19, an increase from 7,834 tonnes in 2016/17 (23%), and weekly organics bins are available to all serviceable residents and businesses at low cost to divert food and garden organics from landfill for resource recovery.

TABLE 6: KEMPSEY 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	%
	Municipal solid waste	9,165	t	12,831			12,831	66.5%
	Commercial & industrial waste	5,352	t	6,422			6,422	33.3%
	Construction & demolition waste	181	t	36			36	0.2%
	Garden and green waste (Landfill)	-	t	0			0	0.0%
	TOTAL:			**19,290**	**0**	**0**	**19,290**	**100.0%**

Initial advice from Council's waste section regarding potential opportunities that can be explored in the waste strategy in terms of emissions reduction are;

- Reduce methane generation with more initiatives to reduce food, and compostable organics from landfill from both domestic and commercial waste streams via education, reduced pricing of the 140L commercial green bin promotions.
- Invest in research into other potential emissions reduction solutions for small landfills such as digestors. There is limited or no scope for flaring at Council's current landfill site.
- Reduce fuel use at the Waste Management Centre by developing (for example) a cost-effective passive solar leachate evaporation system using evacuated tubes and shallow heated trough.

8.3.2 Direct water and wastewater emissions

Direct emissions from wastewater processes are reported to the NSW Government, and data submitted for 2018/19 was supplied as input to this project. No further analysis of the data was performed, and only the fugitive sewage treatment emissions, which consist of methane and nitrous emissions were included.

TABLE 7: KEMPSEY SHIRE COUNCIL'S DIRECT WASTEWATER EMISSIONS

Wastewater emissions	Emissions
Sewerage Treatment Works 1 (STW 1)	1 t CO2-e
STW 2	0 t CO2-e
STW 3	73 t CO2-e
STW 4	9 t CO2-e
STW 5	713 t CO2-e
STW 6	1,373 t CO2-e
STW 7	15 t CO2-e
STW 8	127 t CO2-e
STW 9	0 t CO2-e
STW 10	0 t CO2-e
Total	**2,311 t CO2-e**

Abatement Strategy

Kempsey Shire Council's emissions, energy, and water reduction opportunities

9 Kempsey Shire Council's emissions, energy and water reduction options

9.1 Measures available to reduce Kempsey Shire Council's footprint

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

1. Grid decarbonisation
2. Buying clean energy (e.g. via a renewable energy power purchase agreement (PPA))
3. Behind-the-meter solar (i.e. onsite solar)
4. Energy efficiency
5. Sustainable transport
6. Management & monitoring
7. Sustainable procurement
8. Water efficiency
9. Financing of initiatives

These nine measures are illustrated in the graphic below[10]. 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 development of action plans outlining opportunities that will enable Kempsey Shire Council to achieve its sustainable energy and water targets. The identified opportunities are based on analysis of information and data, visits to numerous Kempsey Shire Council facilities with experienced staff, and discussions with key stakeholders.

FIGURE 23: NINE CATEGORIES OF ENERGY AND WATER SAVING FOR KEMPSEY SHIRE COUNCIL

[10] Waste management was not included below as this was not the focus on this strategy. Council's waste strategy will be updated in the near future.

9.2 Grid decarbonisation

Description

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

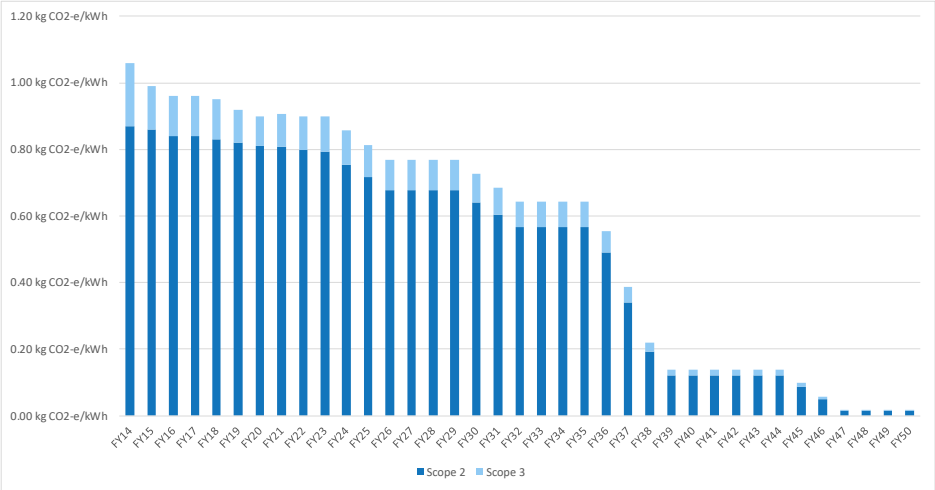
The state is largely self-reliant for power, with this supplemented by interstate links as and when required. Since 2010 three coal-fired power stations with 1,744 MW of capacity have closed in NSW (Wallerawang C, Redbank and Munmorah).

In recent years nearly 800 MW of large-scale solar and over 5,500 MW of wind energy generation capacity 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 3,000 MW Renewable Energy Zone was recently announced for the State's central west and more are planned, despite ongoing policy uncertainty at a Federal level, and constraints that have been placed on output from several renewable energy generators in response to transmission limitations in the state.

As more coal-fired power stations approach the end of their life – scheduled 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 wind and solar PV, firmed with pumped hydro and batteries.

Assuming this, the future carbon intensity of the NSW grid could 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).



Scope for abatement

The above potential change to the NSW grid carbon intensity would have a significant impact on GHG emissions for Kempsey Shire Council, with the potential for more than 8,000 t CO_2-e of abatement if electricity supply is nearly all renewable and vehicles have transitioned to electric over time. The majority of this impact would not be seen until the late-2030s and in to the 2040s'. In this scenario, significant abatement through energy efficiency and more onsite solar PV would be required under a rapid decarbonisation scenario.

A more rapid pathway to grid decarbonisation could see early retirements of coal-fired power stations, with some reports (e.g. AEMO[11]) modelling a step-change that could see, among other impacts, fossil-fuel stations retire early, say by 2030.

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. Kempsey 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 Kempsey Shire Council to respond with local solutions to reduce emissions. Kempsey Shire Council could also have a role through its advocacy for change, potentially in collaboration with other Councils and representative organisations.

Costs and benefits

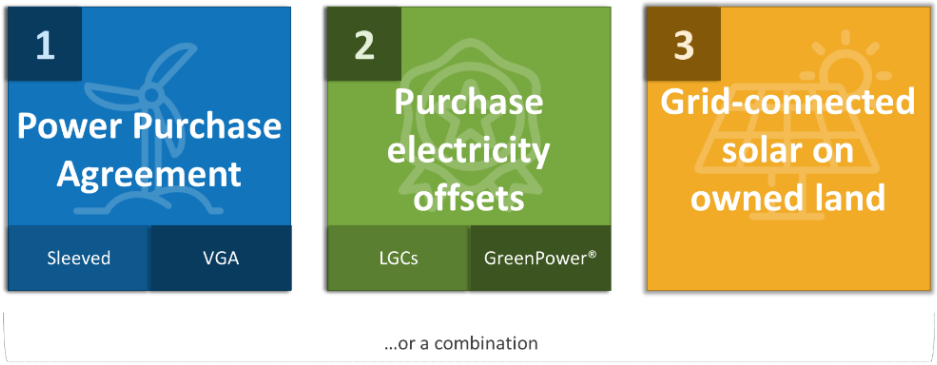
There is no direct cost to Kempsey Shire Council associated with decarbonisation of the electricity grid, excepting impacts on energy pricing in future years.

9.3 Buying clean energy

9.3.1 Renewable energy power purchase agreement

Description

Electricity consumption accounts for 77% of Kempsey Council's non-waste / wastewater carbon footprint, and more than 75% of electricity is consumed by just 15 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 Kempsey 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

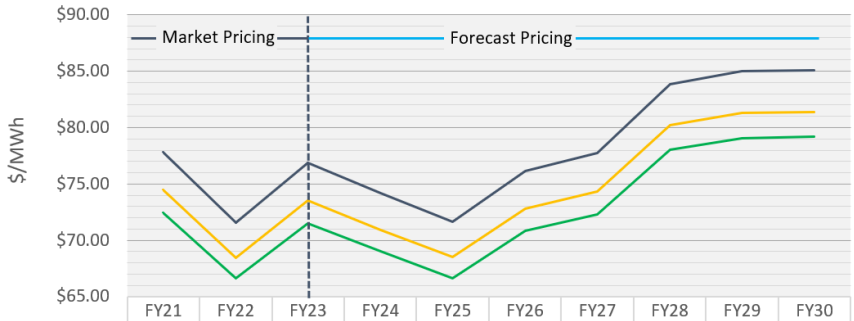
[11] AEMO, 2019, forecasting and planning scenarios, inputs, and assumptions August 2019

[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.

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 Kempsey Shire Council's next agreement from January 2023, with Council's large sites, streetlighting and small sites agreements all renewing at this time.

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.

NSW Retail Electricity Price Estimates FY22 - FY30



	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 may get smaller as the proportion of renewables approaches 100%.
- Virtual Generation Agreement (VGA): under this model around 75-80% of Council's load under a PPA would 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 would increase the effective rate paid

[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. These figures are comparable to the retail electricity rates that Council can see quoted in its current 3-year retail supply agreements.

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 Kempsey 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 Kempsey Shire Council to elect to buy renewables in the period between now and when decarbonisation occurs.

Based on Kempsey Shire Council's current energy mix, purchasing 100% renewables would lead to abatement of 6,559 t CO2-e, and 50% renewables would lead to abatement of 3,280 t CO2-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).

If all vehicles were also electrified and supplied with renewable energy, then additional abatement of 1,923 t CO2-e per year would result based on current grid intensity, though this will be much lower if vehicle electrification largely occurs through the 2030s and 2040s as expected.

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 Kempsey Shire Council's 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 Kempsey 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 or close to 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 Kempsey Shire Council should be assessed as part of Council's next procurement process.

9.3.1 Mid-scale renewable energy build by Kempsey Shire Council

Description

An option available to Kempsey Shire Council is to build its own mid-scale renewable energy plant on land it owns. 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). 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 Kempsey Shire Council, and this strategy does not assess the costs, benefits, options and risks associated with this approach. However, this project has highlighted two possible options that Council could examine in future, and these are highlighted below.

Option 1: New Central Kempsey Sewerage Treatment Plant

A new STP will be constructed in Central Kempsey, on a 110 Ha site, with a small fraction of this space to be used for the treatment works. One option for the use of the balance of the site includes the construction of a bioenergy generation plant that has inputs from the STP sludge as well as local bioenergy sources such as abattoirs, farm waste and the like. Three examples of projects emerging in this space include:

- An ARENA-funded project to help a Queensland refinery to repurpose sewage biosolids to produce renewable liquid fuels (ARENA Bioenergy Demo),
- A biohub planned for development in Bundaberg Queensland (Bundaberg Biohub), and
- A bioenergy hub proposed for an industrial area in Cowra, including the local Council STP, to include a solar and battery farm as well as bioenergy from sludge and farm waste (CLEAN Cowra).

A second option for the land at the new STP is to build a solar farm. Depending on the available land and design / technology selected, and proximity to the high voltage network, a solar farm of 5-40 MW may be feasible. An image of the 9 MW Kanowna solar farm in northern NSW is shown below, built on just 7 hectares[14].

Option 2: Kempsey Airport

The airport is located on a large land area. Many of the facilities at the site are leased, and there are future plans for parts of the site. One potential future consideration is the development of a solar farm on the site, subject to proximity to the electricity network (e.g. 11 kV or 33 kV) and ability to connect to the grid at this level, in addition to commercial business development considerations for the site.

In addition to other design and development aspects, a solar project here may have to satisfy CASA that there are no glare impacts for aircraft (noting that Adelaide and Darwin[15] airports have large solar PV arrays, as do many other airports).

The image below is of a modelled 2MW solar array ground mounted at the airport, which would generate an estimated 3,251 MWh of electricity per year, 47% of Kempsey Shire Council's total electricity demand. Note that the location for solar panels in this image is illustrative only, and any future consideration of a solar farm would consider all current activities and planned use of land across the site to determine an optimal location.

[14] Image sourced from https://reneweconomy.com.au/small-but-smart-kanowna-solar-farm-comes-on-line-in-northern-nsw-79905/

[15] https://www.darwinairport.com.au/news/darwin-airport-completes-4mw-large-scale-solar-power-facility

Other options

Other possible sites were considered for mid-scale solar. These include:

- South Kempsey Waste Management Centre – while the cap on the south-east corner has land space this is used for leachate spraying. There is also no close high voltage electricity network into which a solar farm could connect. These and other factors mean this site is not a good candidate for a solar farm at this time.
- The South Kempsey and West Kempsey sewerage treatment plants will be decommissioned in future, and one of the options to consider for future use of these lands is a solar farm.

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 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 Kempsey Shire, its desire to build projects that involve community ownership and/or establishment of a community energy retailer, and 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.

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:

Risks and mitigation

- Retailers may not want to be party to off-take, so the ability to sleeve the generation 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, which may increase
- 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 as part of project development
- 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.

However continuing declines in costs for mid-scale solar projects, continued developments to lower the cost / increase the value of bioenergy projects, and grant support to community-based renewables may make a mid-scale project viable for Kempsey Shire Council.

9.4 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.

Council has a single 50 kW solar array the at Kempsey Shire Depot in West Kempsey, installed in 2012/13. Data from the monitoring system for this installation shows that performance is good compared with expected output, and recent maintenance will see a good performance level maintained.

Visits to Council's operations as well as discussions about planned new facilities and upgrades has highlighted opportunities for solar at 20 sites. Most sites are operated by Council, but some are operated by third parties. Third party operated sites are under a commercial management agreement with all operational costs (such as electricity) being incurred by the third party contractor. Therefore, a return-on-investment business case for Council does not exist and these decisions would be taken by the operator, or considered in the future as part of new management agreements.

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
Kempsey Civic Centre & Library	A 100 kW system initially can be expanded later to up to 260 kW covering both facilities' roofs.
Dangar Street (or future new) Depot[16]	In the long term expansion with up to 150 kW solar could meet daytime charging for electric vehicles at this or a new depot.
West Kempsey STP & Treated Effluent Pumps	In the long term following the construction of the new Central Kempsey STP, a 50-100 kW ground mount array can be considered to supply the treated effluent pumps.
Steuart McIntyre Dam & WTP	Opportunities include a 40 kW roof system on the existing pump building (with vegetation management to the north) and a 100 kW ground mount array at the dam close to the planned new water treatment plant. Other options could include a floating solar array on the dam.
South West Rocks Water Treatment Plant	A 30 kW solar array on the roof either facing east or mounted on frames facing north would be largely absorbed by electricity demand at the plant.
South West Rocks Bore Pumps	A 10kW solar array on the transfer pump house, on the NE roof and tilted on the south roof can be considered, noting the surrounding vegetation (not KSC-managed).
South West Rocks STP	An option is a 100 kW array ground mounted next to the lab and main switch for the 'new' plant. The roofs of buildings at the site are unlikely to be suitable for solar.
Stuarts Point WTP	A small 10kW solar on the roof of the 2 WTP buildings, both east-west arrays can be considered.
Stuarts Point STP	For the planned new STP design a suitable solar array to meet daytime demand at the plant. A 50 kW array is assumed to be feasible but should be sized at design.
Central Kempsey STP	For the planned new STP design a suitable solar array to meet daytime demand at the plant. A 100 kW array is assumed to be feasible but should be sized at design.
Crescent Head WTP	For the planned new WTP design a suitable solar array to meet daytime demand at the plant. A 50 kW array is assumed to be feasible but should be sized at design.
Kempsey Waste Management Centre	A 10 kW array on the roof of the main shed or the weighbridge offices could meet demand for the wash bay and extruder drives and potentially lessen issues with

[16] It is noted that in the event depot services remain at this location, extensive roof improvements would be needed for this option to be viable. The depot may also be re-located in future; if this is the case then this option should be considered in planning – i.e. north-facing roofs suitable for solar, with provision for future installation of EV charge points and batteries.

	power supply that are experienced at the site. A BESS could be helpful to address intermittent demand.
Crescent Head STP	Install 40 kW solar ground mounted array on grass area between main plant and UV / effluent outflow.
Hat Head STP	Install 14 kW solar PV on the roof over the chemicals store plus the office building.

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

Site name	Behind-the-meter solar potential
Horseshoe Bay Holiday Park	Up to 15 kW solar PV may be feasible on the office / kiosk, and the amenities building to the west of the site. Shading from trees at the site may necessitate the use of micro-inverters.
Crescent Head Holiday Park	Several systems were identified and modelled here. Possible systems include: • 25 kW solar PV on residence and 2 amenities blocks closest to the entrance, with or without BESS • 45 kW solar and 100 kWh battery microgrid across 2 groups of cabins - near entrance / office, and towards Pebbly Beach
South West Rocks Swimming Pool	A 5-7 kW pole-mount array along the west side of the facility between the gate and underground filter could be a feasible solution subject to use of this part of the site by patrons.
Gladstone Swimming Pool	A 10 kW solar PV system on the inward west and east facing slopes of the entrance building can be considered.
Crescent Head Pool	Land and roofspace at the site is limited. A new toilet block roof faces south so will be unsuited to solar. The roof of the kiosk building could be considered but would need to be assessed for structural soundness.
Kempsey Pool	A 20 kW solar PV on the front roofs of the complex to meet base electricity demand at the site can be considered. Depending on whether solar matting on the grandstand and MSB building roofs is re-instated there may be scope for a larger solar PV array, say 50 kW.

In addition to these potential opportunities, carparks next to or within the Stuarts Point and Crescent Head tourist parks may be suitable to host solar carports, potentially with EV charging, that could help to meet future demand for electricity by electric vehicles visiting these parks. These carparks are not part of the tourist parks, so any future solar carport solutions would require deeper investigation to determine viability.

Scope for abatement

The above opportunities can be summarised as:

- Council-operated sites have scope for ~650-860 kW of solar PV, with some scope for BESS in the long term at sites with low / intermittent demand.
- This can generate from ~1,050 MWh to 1,400 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 670 to 850 t CO_2-e per year based on self-consumed solar, with additional abatement associated with export of surplus solar energy to the grid.
- An additional 90 to 160 kW of solar PV appears to be technically feasible at tourist parks and swimming pools. Several systems, particularly at tourist parks, could require battery storage to increase self-consumption of solar. Thus, financial support via grants may be needed to make these viable.
- Energy generation of ~140 MWh to 240 MWh per year would result, and with BESS much of this would be consumed at sites with some export. Abatement at current grid carbon intensity would be 90 to 160 t CO_2-e per year for solar consumed on site, with added abatement associated with export of surplus solar the the grid.

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.

As noted above, third party operated sites are under a commercial management agreement with all operational costs (such as electricity) being incurred by the third party contractor. Therefore, a return on investment business case for Council does not exist for these sites, and these decisions would be taken by the operator, or considered in the future as part of new management agreements.

9.4.1 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 potential solar PV layouts at Kempsey Shire Council sites is provided in Appendix B. The table below sets out the business case for solar PV opportunities at Council-operated sites. The expected business case for solar at third-party operated sites is included 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	Site GHG reduction (t CO_2-e)
Kempsey Civic Centre & Library	*Short term option:* **99.80 kW** Civic Centre solar PV		$99,800	$20,277	5.4	$153,748	17.9%	142,535	13%	35%	101
	Long term option 1: **Additional 50.30 kW** Library solar PV		$75,450	$9,561	8.6	$43,955	10.4%	77,049	38%	14%	38
	Long term option 2: **Additional 160.10 kW** Library+added Civic Centre solar PV	250	$465,150	$30,068	16.3	-$58,912	3.7%	232,414	31%	46%	130
Dangar Street Depot (or future depot site)	*Long term future expansion (on refurbished depot or new depot site):* **150.1 kW** Roof mounted solar PV	200	$405,150	$34,402	11.9	$65,182	6.6%	236,800	20%	175%	153
West Kempsey Sewerage Treatment & Treated Effluent Pumps	*Long term option 1:* **99.5 kW** Ground mounted solar PV – North facing		$129,350	$25,318	5.4	$195,220	17.8%	166,672	41%	49%	80
	Long term option 2: **99.5 kW**		$129,350	$23,617	5.9	$173,229	16.4%	149,288	36%	48%	78

Site	Modelled PV size	BESS (kWh)	Capital cost	Cost savings	Payback (years)	NPV	IRR	Solar yield (kWh)	% of solar export	% energy saving	Site GHG reduction (t CO_2-e)
	Ground mounted solar PV – East-West facing										
Steuart McIntyre Dam & WTP	*Medium term option 1:* **40.30 kW** Pump house solar PV		$40,300	$8,412	5.2	$65,535	18.7%	61,563	31%	22%	35
	Medium term option 2: **99.50 kW** Ground mounted solar PV for new WTP		$129,350	$24,825	4.4	$214,115	22.5%	170,874	20%		111
	Long term option: **Additional 98.50 kW** Floating solar PV		$295,515	$23,448	14.3	$430	5.0%	161,400	20%		105
South West Rocks Water Treatment Plant	*Medium term option:* **30.2 kW** Roof mounted solar PV		$30,200	$6,119	5.4	$46,751	18.0%	42,120	20%	8%	27
South West Rocks Bore Pumps	*Medium term option:* **10.1 kW** Roof mounted solar PV		$10,100	$2,671	4.1	$24,264	24.4%	15,040	20%	6%	10
South West Rocks STP	*Medium term option:* **99.8 kW** Ground mounted solar PV		$129,740	$27,881	5.0	$226,778	19.4%	164,833	12%	34%	117
Stuarts Point STP	*Medium term option:* **50.6 kW** Ground mounted solar PV for new STP		$65,780	$15,499	4.6	$134,120	21.6%	87,270	20%		57
Stuarts Point WTP	*Medium term option:* **9.7 kW** Roof mounted solar PV		$9,720	$3,283	3.1	$33,394	31.8%	14,114	16%	11%	10

Site	Modelled PV size	BESS (kWh)	Capital cost	Cost savings	Payback (years)	NPV	IRR	Solar yield (kWh)	% of solar export	% energy saving	Site GHG reduction (t CO_2-e)
Crescent Head WTP	*Medium term option:* **50.6 kW** Ground or roof mounted solar PV for new WTP		$65,780	$14,689	3.7 years	$138,690	26.8%	82,710	20%		54
	Long term option: **Additional 50 kW** Floating solar PV		$150,000	$15,540	10.37	$53,592	8.3%	~80,000	20%		~52
Kempsey Waste Management Centre	*Short term option:* **10.1 kW** Roof mounted solar PV		$10,100	$3,554	3.0	$36,865	33.6%	15,730	40%	68%	8
	Medium term option 2: **10.1 kW** Roof mounted solar PV	20	$28,100	$4,319	6.52	$31,768	14.7%	15,730	20%	91%	10
Crescent Head STP	*Medium term option:* **40.30 kW** Ground mounted solar PV		$52,390	$12,942	4.3	$115,304	22.8%	67,422	15%	31%	46
Hat Head STP	*Medium term option:* **14.4 kW** Roof mounted solar PV		$14,400	$4,391	3.5	$42,490	28.3%	22,080	10%	31%	16

9.4.2 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 calculate or estimate 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, including:
    - 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. This represents a premium to 10-year commonwealth government bond rates, which are at 0.89% for June 2020.

9.5 Energy efficiency

Description

Energy efficiency remains the cheapest form of greenhouse gas abatement in many situations. This is reflected in Kempsey Shire Council's past and continuing efforts to manage energy efficiently as described in Section 5.

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

- **Lighting: office / indoor lighting** is progressively being upgraded to LED technology. A prominent example of the potential is 2020 LED upgrades to Council's administration offices in Kempsey, along with the adjacent library. Lighting with medium to high utilisation can be cost-effectively upgraded to LED, while low use facilities can be upgraded to LED when lamps fail. Lighting controls can also be considered when retrofitting lights to LED.
- **Lighting: residential (P1 & P2) streetlights** have been upgraded to LED technology, and the upgrade of main road streetlights to LED also will deliver significant energy and maintenance savings to Council.
- **Lighting: sports field** lights in South West Rocks and Central Kempsey were upgraded to LED technology with a Government grant, and this can be replicated for other fields when lights are planned for replacement.
- **Design:** the development of new facilities (such as Central Kempsey STP, Stuarts Point STP, Crescent Head WTP, Kempsey WTP) and upgrades to existing facilities (e.g. Kempsey admin / library building) provide opportunities to ensure best practice design for energy efficient outcomes, including passive energy design, piping infrastructure driving low pumping energy outcomes, and efficient technologies and controls.
- **WTP, SPS and STP motor VSD controls**: numerous opportunities were identified where retrofit and future upgrade to motor systems can include VSD control to drive energy savings. Examples of potential opportunities include K6 sewer pump station, West Kempsey STP Effluent Pumps, bore field pumps across the region, South West Rocks STP passveer channel and effluent outflow pumps, SPS #1, Stuarts Point WTP transfer pumps, Crescent Head STP effluent outflow pumps, Hat Head WTP pumps, Hat Head STP aerators.
- **STP UV Treatment**: LED is an emerging technology for UV treatment of wastewater, and Council should stay abreast of developments and costs to review the case for upgrading to this technology in future.
- **Baseload & night energy demand**: at several sites' energy use may be higher than expected, and Council can make relatively simple energy savings through the adoption of practices and implementation of simple controls to minimise night energy use. This may require a review of night energy demand at sites over time to highlight current practices that can be changed. Typical examples of changes that can be made include LED and control of external lights (e.g. depot), turning off internal lights, turning off all computers and air conditioners (e.g. security or cleaners). The operation of bore pumps and clear water pumps to reservoirs should also be regularly reviewed to see if these can be optimised to lower energy costs.
- **Compressed air**: systems in use at Steuart McIntyre Dam can be reviewed and optimised. Operation can potentially be linked to operation of the ultrasonic devices in the dam and dam water quality. At Stuarts Point new

air compressors may enable more energy efficient operation / lower demand.

- **Voltage Optimisation**: incoming voltage at some STP and WTP sites was observed to be well over 240 V. Intra-site voltage drop was not reviewed, but there may be an opportunity to consider voltage optimisation to reduce energy demand. It is noted that widespread VSD control of motors, upgrade to LED lights and implementation of solar PV may reduce the viability of this measure.
- **Air Conditioning**: except for office buildings air conditioning is estimated to be a low proportion of energy demand. The main opportunities are to implement effective controls for existing plant, to specify energy efficient replacement plant, to design energy efficiency into new HVAC system, and to implement effective passive conditioning measures such as insulation and shading.

Efficiency plans 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.

In addition to Council-operated sites, there are further potential energy efficiency opportunities at third party operated sites. Third party operated sites are under a commercial management agreement with all operational costs (such as electricity) being incurred by the third party contractor. Therefore, a return on investment business case for Council does not exist and these decisions would be taken by the operator, or considered in the future as part of new management agreements. Opportunities include:

- **Lighting at Tourist Parks**: high use lights in amenities, kiosk/offices, external pathways and roads, and in laundry facilities can be upgraded to LED sensor lights.
- **Hot Water at Tourist Parks**: Council will continue to install solar hot water to preheat amenities water, supplemented with LPG or electric boost. This will replace older systems, some of which are diesel boiler systems.
- **Swimming Pool motor VSD controls**: all pool pump motors are fixed speed-controlled, in some cases reflecting older pools where achieving required water turnover requires pumps to run at full load. There may be opportunities to review the potential for VSD control at some pools where required water turnover rates are being achieved.
- **Swimming Pool heating**: the Kempsey pool has installed two energy efficient heat pumps, and energy efficient retrofits were made to the Crescent Head pool heat pump. Additional potential is modest and could include a third heat pump replacement at Kempsey, and installation of solar matting at South West Rocks and potentially Kempsey (re-instatement of matting).

Scope for abatement

The scope for energy efficiency across Council's sites is estimated to be around 1,340 MWh per year, equal to almost 20% of current electricity demand. More than 50% of this potential is associated with upgrading all streetlights to LED. At least 15% of the potential is associated with VSD control of motor systems, particularly for water and sewer services.

While energy savings potential is significant, design and construction of new facilities such as buildings and treatment plants may see increases in energy

demand as well, even where these new facilities are energy efficient. Hence the net savings potential is likely to be much less than 20% of current energy use.

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.

Third party operated sites are under a commercial management agreement with all operational costs (such as electricity) being incurred by the third party contractor. Therefore, a return on investment business case for Council does not exist and these decisions would be taken by the operator, or considered in the future as part of new management agreements.

9.5.1 Energy efficiency initiatives

Site visits and data analysis were used to identify energy efficiency opportunities at Kempsey Shire Council. The table below sets out the business case for energy efficiency opportunities at Council-operated sites. Opportunities for energy efficiency at third-party operated sites are included in Appendix A.

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

Site	Description	Capital cost	Cost savings	Payback (years)	NPV	IRR	Resource savings (kWh)	Emissions reduction (t CO_2-e)	% energy savings
Kempsey Civic Centre & Library	*Short term option:* Upgrade all Civic Centre lights to LED technology.	$22,050	$4,410	4.9	$42,124	20.7%	29,400	24	8%
	Short term option: Upgrade all Library lights to LED technology	$14,175	$2,835	4.9	$27,080	20.7%	18,900	15	5%
	Medium to long term option: Upgrade old Library HVAC unit to energy efficient unit	Not estimated	$2,363	Not estimated			15,750	13	5%
Commercial Services, Harold Walker Ave	*Short term option:* Upgrade all Commercial Services lights to LED technology	$1,833	$367	6.0	$2,352	16.2%	1,222	1	12%
Dangar Street Depot	*Short term option:* Upgrade all remaining lights to LED	$7,000	$3,400	2.6	$33,157	39.4%	14,784	12	14%
Streetlighting	*Medium term option:* Upgrade all main road streetlighting to LED technology	$1,738,500	$289,750	7.6	$3,980,250	12.5%	762,500	618	50%
South West Rocks STP	*Short term option:* VSD and dissolved oxygen (DO) control of Passveer channel drives	$20,000	$3,546	6.6	$25,508	15.1%	16,116	13	4%
	Short term option: VSD control of 2 x effluent outflow pumps	$20,000	$5,236	4.5	$47,210	22.5%	23,802	19	6%

Site	Description	Capital cost	Cost savings	Payback (years)	NPV	IRR	Resource savings (kWh)	Emissions reduction (t CO_2-e)	% energy savings
	Medium term option: Install voltage optimisation equipment to improve incoming voltage	~$80,000	$7,564	10.3	$113,392	8.4%	42,976	35	10%
K6B Sewer Pump Station, Thompson Street	*Long term option:* Upgrade 2 x 55kW auto-transformer starter motors with VSD / VFD drives	$75,000	$4,437	19.1	-$19,318	2.4%	11,092	9	24%
	Long term option: Upgrade 2 x 15 kW DOL-start overflow pump motors to VSD	Not estimated	$646	Not estimated			2,000	2	4%
SPS #1 Simpson St SWR	*Short term option:* Soft start or VSD control of 2 x 37 kW and 55 kW sewer pumps	$30,000	$1,356	19.5	-$8,240	2.2%	7,706	6	30%
West Kempsey Sewerage Treatment & Treated Effluent Pumps	*Long term option:* Upgrade 3 x 55kW soft starter (SS) pumps with VSD	$75,000	$11,203	8.0	$65,605	12.2%	44,814	36	23%
Kempsey Bore Pumps	*Medium term option:* Install VSD controls on the bore pumps	Not estimated	$42,441	Not estimated			265,257	215	30%
Stuarts Point WTP	*Short term option:* Optimise time of use operation to more off peak		$1,667						
	Medium term option: Reduce average base demand by ~4 kW	$5,000	$3,504	1.8	$38,976	57.6%	17,520	14	16%
	Medium term option: VSD control of 2 x 30kW transfer pumps	Not estimated	$5,500	Not estimated			16,667	14	15%

Site	Description	Capital cost	Cost savings	Payback (years)	NPV	IRR	Resource savings (kWh)	Emissions reduction (t CO_2-e)	% energy savings
Crescent Head STP	*Medium term option:* VSD control of effluent outflow pumps	$20,000	$2,000	9.5	$11,375	9.9%	10,000	8	6%
Hat Head WTP	*Long term option:* VSD control of 2 x 7.5 kW pumps to main tanks	$15,000	$1,000	13.9	$688	5.4%	5,000	4	8%
Hat Head STP	*Long term option:* VSD control of 2 x 7.5 kW aerators which are DOL-controlled	Not estimated	$2,808	Not estimated			10,800	9	17%

9.6 Sustainable transport

Description

Transport emissions are a large GHG source for Kempsey Shire Council, primarily from diesel used for Council's operational vehicles. Petrol and ethanol 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. Council currently has a single hybrid vehicle in its passenger fleet.

Kempsey Shire Council recently commissioned a Fleet Strategy, and this will underpin the next few years of fleet replacement as well as longer-term strategies. Key inclusions in this strategy may include:

- A commitment to implementing cost-effective sustainable fleet solutions that are aligned with the Energy & Water Strategy,
- A focus on optimising the fitness for purpose and the utilisation level for Council vehicles which can help to reduce fuel consumption,
- Implementing an evaluation process that focuses on environmental (emissions standards and labelling for e.g.) and whole-of-life / ownership costs as well as fitness for purpose

As Council is developing and implementing its fleet strategy, NSW Government 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 for example, include:

- EV infrastructure and model availability
- Transport Consumer Information
- EVs in Government fleet
- Electric Buses

For communities such as Kempsey Shire, 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 electric vehicles 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 JO/ROCs, and private + motoring association providers

The focus of this section of Council's Energy & Water Strategy is to provide an overview of the current status some of these key areas that will shape future transport, including current electric vehicle infrastructure, electric vehicle 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 is readily accessible, including the location of standard and rapid chargers in and near Kempsey, see below[18]. Increasing numbers of private chargers are also being installed, retrofitted to homes and businesses as well as designed into new buildings. Of particular note many chargers are being installed in hotels and motels, with local businesses seeking to provide charging for guests driving EVs.

In Kempsey itself there are no dedicated fast chargers installed, however there are four plug-in camp sites including one in South Kempsey Park, one in the showgrounds, and one in the Trial Bay Gaol Campground.

In April 2019, Council provided a letter of support to NRMA to access funding for Electric Car Charging Stations. As part of this process, Council assessed available sites within the Shire that would meet the location criteria set out by NRMA. Council has recently completed an Expression of Interest with NRMA for the placement of a Fast Vehicle Charging Station within the Kempsey CBD. Council will continue to explore locations and grant opportunities for the installation of these charging stations to attract motorists into the Shire and generate economic income to the local community.

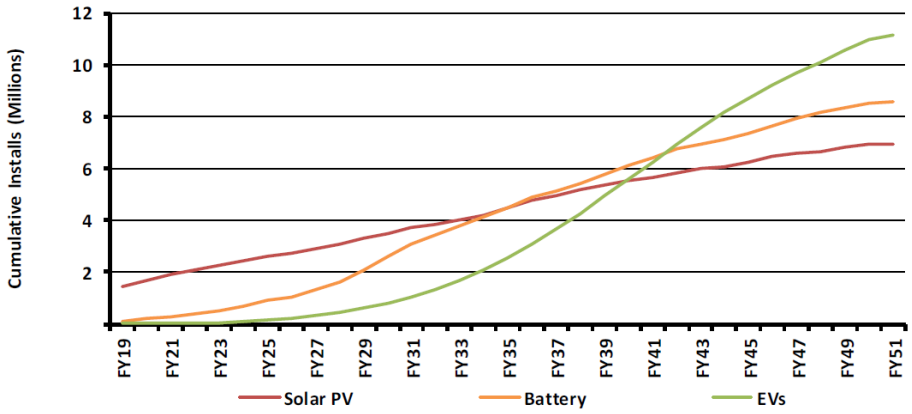
Projected growth in electric vehicles

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

[17] https://electricvehiclecouncil.com.au/wp-content/uploads/2019/09/State-of-EVs-in-Australia-2019.pdf, p19
[18] https://www.plugshare.com/
[19] Energeia 2019: Distributed Energy Resources and Electric Vehicle Forecasts, prepared for AEMO, 13 June 2019

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.



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 in Australia (both Battery EVs (BEV) and Plug in Hybrid EVs (PHEV)), and this will grow by a further 9 vehicles in 2020, with a shift towards battery electric vehicles.

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

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

available globally from 2020 across all vehicle segments, electrified versions of all models by 2025

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

Availability of low emissions utility vehicles in Australia

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

- Mitsubishi Triton[22]: 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[23]. 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[24]. Nissan also indicated that commercial vans were also candidates for electrification.

While these are some of the more prominent models, a range of options are expected to be available to Australian ute buyers from 2020, including[25]:

- Tesla Cybertruck (all electric pick-up)
- Rivian R1T (funding of $700m input by Ford), targeting US sales by 2020 and Europe & China in 2021
- Fisker pick-up (all electric)
- Rich 6 and JMC Yuhu EVs (sold now in China)

[21] https://www.newcastle.nsw.gov.au/Council/News/Latest-News/City-prepares-for-electric-vehicle-future
[22] https://www.caradvice.com.au/790317/mitsubishi-triton-to-get-hybrid-power-precede-nissan-navara-development/
[23] https://www.motoring.com.au/toyota-hilux-to-go-hybrid-121251/
[24] https://www.motoring.com.au/nissan-navara-e-power-hybrid-by-2025-119492
[25] https://www.carsales.com.au/editorial/details/top-12-electric-utes-coming-to-oz-121284/

- Great Wall Model P (likely to be available in Australia as full electric and FCEV, timing not available)
- Hyundai pick-up (likely available in Australia by 2022, hybrid and potentially all electric)
- ACE Yewt (local manufacture, small commercial ute will be sold within 5 years)
- Voltra eCruiser (BHP has a LandCruiser 70 series converted to electric by Voltra and operating at its Olympic Dam site in South Australia)
- Zero ZED70 (SA company Zero Automotive has converted Toyota's 79 Series LandCruiser to battery power).

Most of the current activity and plans points to electric and hybrid electric utes being a medium 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.

Recommended actions – electrification of vehicles

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

- 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.
- Assess the costs and benefits of hybrid passenger cars within council's petrol fleet for new leases (additional to the single hybrid vehicle currently leased).
- In future reviews of Council's transport / vehicle leasing 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.
- In the medium term increase the switch to hybrid passenger vehicles and utes, and potentially one or more electric passenger vehicles. Continue to review sustainable transport plans as this area is evolving rapidly.
- 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.

Scope for abatement

The scope for emissions reduction for Kempsey Shire Council overall from transport measures is 1,923 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

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

- Price, incentives (external and within Kempsey Shire Council), resale and electricity price
- Range and charging infrastructure
- Fitness for purpose
- Availability, serviceability, warranties – esp for regional areas
- The role of other technologies such as hydrogen, autonomous vehicles, etc in Kempsey Shire Council's long-term fleet strategy

Costs and benefits

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

9.7 Financing of initiatives

Description

It is common for energy efficiency, water efficiency and renewable energy projects to be funded direct from budget and through grants. There are a range of other options that could be considered in future, and potentially used where this is consistent with Council's adopted Financial Sustainability Strategy.

These additional options will include, for example, assessment of an effective Revolving Energy Fund (REF), and onsite solar Power Purchasing Agreements (PPAs).

Summary of options and hierarchy

A detailed guide to 11 financing options and an approach to determining what option/s work best for Council is provided as Appendix C to this report. We recommend that financial options be evaluated, organised in four groups as illustrated below.

CATEGORIES OF SUSTAINABLE ENERGY FINANCING

The 11 options are:

1. Free money
    a. Pre-existing and future incentives and grants
2. Internal financing
    a. Environmental levy/Special Rate Variation
    b. Self-financed through normal budgeting process
    c. Self-financed through Revolving Energy Fund (REF)
    d. Internal carbon price
3. Council borrows
    a. Loan financed
4. Third party
    a. Equipment lease
    b. On-bill financing
    c. Onsite Power Purchase Agreement (PPA)
    d. Energy Performance Contracts
    e. Community energy projects

Why is a financing plan necessary?

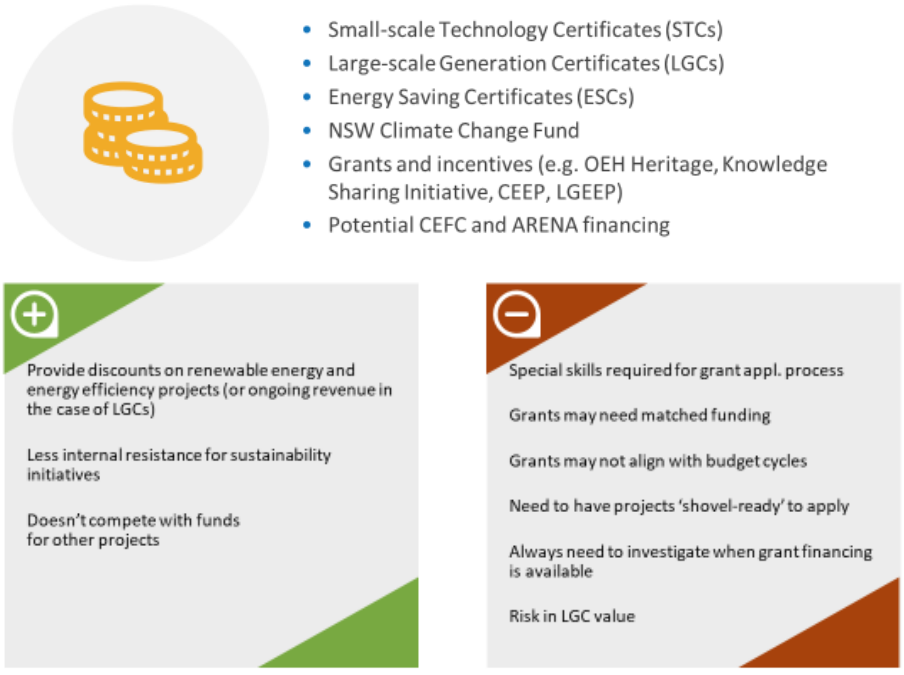
Most sustainability initiatives require some sort of financing. We recommend planning for funding sustainability initiatives be aligned with other key plans and functions in council, including:

- Strategic (e.g. Community Strategic Plan or CSP) and delivery/ operational plans
- Council's adopted Financial Sustainability Strategy
- Budgetary cycles (Operational Plans, Delivery Programs)
- Sustainability targets

It is important that each organisation determine the best way to finance sustainability projects given its circumstances and objectives. "Free" money is frequently preferred where available, however other approaches should be given due consideration and the best fit selected to meet the objectives of the Plan.

Attributes, pros and cons of various financing options

Each of the 11 financing options has its own attributes that can be looked at next to an organisation's objectives to establish if or how it can be useful. Each option also has its pros and cons which should be examined. All 11 options are outlined in Appendix C. Below is an illustration of this for incentives and grants ('free money').



TYPES, PROS AND CONS OF INCENTIVES & GRANTS

Recommended approach to develop a financing plan for Council

A summary of the attributes, pros and cons, together with Council's approved Long-term Renewable Energy and Water Strategy, provides a basis for the assessment of Council's preferred financing strategy.
For each project or group of projects (e.g. single or bundled on-site solar, street lighting upgrade, sourcing offsite renewables via a PPA, implementing single or multi-site lighting upgrades), an analysis of each financing option should be undertaken. This may ask:

- How does each option relate to Council's current situation?
- How does each option relate to each project or group of projects under consideration?
- What is the proposed timing of implementation and how can each financing option fit in with or be developed to meet this objective?
- What are the risks and opportunities of each option?

Based on this review each option can be scored and ranked against each project, thereby generating a draft pathway to finance the Strategy. This can be refined and presented to internal stakeholders such as senior management, to start the process of finalising Council's financing strategy.

Scope for abatement

The scope for abatement is indirect. Kempsey Shire Council has the potential to increase abatement depending on the number of initiatives they finance.

Risks and mitigation

Kempsey Shire Council should assess all financing options as discussed above and in Appendix C and ensure that all risks and mitigation strategies are assessed for each option. The financing guide can assist in this assessment with already identified risks for each financing option provided in the guide.

Costs and benefits

Each financing option should be assessed against its costs and benefits on a project by project basis. Some options are more appropriate than others for certain opportunities. For example solar PPAs will apply only to solar PV projects, enabling systems to be installed at zero upfront cost to Council and recurrent energy bill savings.

9.8 Sustainable procurement

Description

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

1. Updating existing policy framework to incorporate a sustainable procurement framework
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

The existing procurement policy should build on the current sustainability section and 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. Two are 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[26]".*

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.

[26] 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 [27], 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.

ISO 20400 – Sustainable Procurement Guide

Council can also consider the international standard ISO20400 for sustainable procurement.

Sustainable procurement is the process of making purchasing decisions that meet an organization's needs for goods and services in a way that benefits not only the organization but society as a whole, while minimizing its impact on the environment. ISO 20400 provides guidelines for integrating sustainability into an organization's procurement processes. Aimed at top managers and directors of the purchasing function, it covers the political and strategic aspects of the purchasing process, namely how to align procurement with an organization's goals and objectives and create a culture of sustainability. The standard defines the principles of sustainable procurement, including accountability, transparency, respect for human rights and ethical behaviour, and highlights key considerations such as risk management and priority setting. It also covers various stages of the procurement process, outlining the steps required to integrate social responsibility into the purchasing function[28].

There are four key clauses of the Standard that provide guidance to assist organisations to meet social and environmental responsibility.

1. Clause 4 Understanding the Fundamentals is a generalist clause which discusses what sustainable procurement involves and its strategic goals. It also outlines fundamental practices such as due diligence, risk management and priority setting.
2. Clause 5 Integrating Sustainability into the Organisation's Procurement Policy and Strategy provides guidance to top-tier management on bridging the gap between sustainable procurement strategy and organisational policy. This clause clarifies the importance of mandating sustainability objectives within the organisation at all levels and in particular, stresses the importance of accountability and sustainable supply chains.
3. Clause 6 Organising the Procurement Function towards Sustainability is most applicable for people engaged in procurement management and outlines the techniques to be employed to enable successful implementation, namely enabling people, engaging stakeholders, setting priorities and measuring performance.
4. Clause 7 Integrating Sustainability into the Procurement Process is directed towards individuals managing sourcing activities and

[27] http://www.energyrating.gov.au/
[28] https://www.iso.org/files/live/sites/isoorg/files/store/en/ISO%2020400_Sustainable_procur.pdf

contracts. It provides practical guidance regarding implementing sustainable procurement at each stage of the process including planning, supplier selection and contract management and review.

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 a program of 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:** many sites will have a range of lighting, including older fluorescent lamps and halogen or CFL downlights. Council will see added savings over time as these are replaced with LED lights on fail.
- **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,
    - Access the NSW Government's Climate Change Fund (https://www.environment.nsw.gov.au/topics/climate-change/nsw-climate-change-fund) to access a $200 – $1000 discount off new and replacement air conditioner installation

costs by installing high-efficiency split, ducted or multi-split systems purchased through approved installers.
    - 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, as well as low-GWP refrigerants.
- **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 pipework design, evaluate VSD opportunities and improve control systems. As these systems account for around 50% of Council's electricity use, all savings made in these systems will impact on Council's future energy demand. One suggested approach from a Council staff member is to add VSD controls to all pumps and motors within the Water & Sewer section that are greater than 7.5 kW in size. Council could also look to extend this by specifying VSD controls for all high-utilisation pumps (e.g. that are used for more than 3,000 hours each year).
- **Public park lighting:** LED lighting is 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, including KSC, have started to select LED as the default technology for new sporting oval lighting (e.g. Central Kempsey sporting complex, Phillip Drive sporting fields in South West Rocks), 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. It is published and maintained by the Australian Building Codes Board, on behalf of and in collaboration with the Australian Government and each State and Territory Government. 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. Changes include:
    - quantification of the mandatory Performance Requirements
    - introducing a NABERS Energy Commitment Agreement Verification Method
    - introducing a Green Star Verification Method
    - introducing commissioning requirements

- improved consideration of on-site renewables such as solar power
- improved thermal bridging requirements, and simpler Deemed-to-Satisfy Provisions

The measures under NCC2019 are expected to deliver energy and carbon savings of at least 25% compared with the provisions of the 2016 NCC.

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. Kempsey 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.

9.9 Water efficiency

Description

Water usage data highlights the major uses for water across KSC facilities, and this in turn helps to determine the strategies best suited to conserving water, which in turn lessens the inflow to wastewater treatment plants. In addition, discussions with KSC staff has highlighted where leakage of water has been identified or is likely to be occurring. The major water conservation strategies for KSC to consider are outlined below.

Water leakage

A review of the data for 2019 highlighted several accounts where leakage was identified and fixed, where there is known leakage, and where there is likely to be leakage that warrants investigation. These sites include:

- Kempsey aquatic centre and Gladstone pool, where leakage is known to be an issue though difficult to fix without major works at the sites,
- Kempsey Airport at Aldavilla had multiple metered accounts and water loss through one or more meters was very high. Prior to 2019 the leakage rate would have made this site the largest water user across Council. Leaks fixed in the second quarter of 2019 have led to a reduction in water use of 98%,
- Sewer pump stations at Lake Street Crescent Heat and off Angus McNeil Crescent in South Kempsey account for 10% of all Council's potable water use and are believed to be excessively high. These will be investigated and rectified where leaks are confirmed

The key task here is for water consumption data to be stored in a readily accessible and searchable database, and for a quarterly or half-yearly review of data to be performed to highlight anomalies in consumption data and investigated. Aligned with this, by 2024, all water abstraction, all water & wastewater treatment, and all potable water consumption will be metered, and this data will be captured in Council's online "WaterOutlook" cloud hosted service, used for state benchmarking.

Experience at Kempsey Airport and in the review conducted for this strategy highlight that this may be the least cost and most effective way to reduce water consumption.

Washdown water

50% of water usage in 2018/19 was for washdown, mostly in sewer wells, and also in sewerage treatment works and saleyards. In sewer wells water sprays work on timers to wash down the walls at regular intervals. At treatment works and saleyards hoses may be manually operated to wash plant areas and yards down on an as-needs basis. These activities are water intensive, and a number of strategies can be investigated to reduce consumption. These include:

- Review sewer well water use data, and check and set timers to be uniform across the network as part of routine maintenance. As part of this maintenance check for leaks,
- Investigate water spray nozzles to determine if any lower flow fit-for-purpose devices are available or in use and can be applied to all wells over time as part of routine maintenance,
- Wet weather inflows may effectively perform the same work as water sprays, so in future 'smart' controls could potentially be deployed that reduce or cut out potable water sprays during wet weather,

- At treatment works and saleyards the use of rainwater collection may provide an alternate source of washdown water, and investigations at relevant sites should seek to highlight potentially suitable locations where a reasonable return on investment can be achieved

Sports fields, parks and median strips irrigation

This accounts for an estimated 10% of water consumption across Council, with 40% of this water used at the Phillip Drive sporting fields in South West Rocks. Other large users include the Fredo sporting complex in Frederickton, South Kempsey Oval, and median strips in West Kempsey. Water consumption is heavily biased to summer months with much lower water use in winter. Potential strategies that can be investigated by KSC include:

- Use of rainwater tanks at sites where this is feasible,
- In future, linkage of 'smart' controls to irrigation systems so fields and parks are irrigated in line with moisture levels and/or based on rainfall

Water supply

- Council supplies water to areas not connected to mains via fill stations. The main lever available to encourage lower water usage is pricing for residential water carters as well as for construction – e.g. dust suppression.

Leased sites

- The majority of water used by leased sites has already been reduced with the fixing of water leakage at the airport.

Amenities

- Water is used at tourist parks, offices, halls, etc for toilets, tapware and the like. It is apparent that many sites' tapware and toilets have been retrofitted with low flow and dual flush controls, and this should be continued as part of routine facilities maintenance. Examples of efficient design for low water use were observed, such as the new amenities block at the Crescent Head tourist park, and similar design is expected for the new amenities block at the Crescent Head pool.

Scope for abatement

The scope for water savings appears to be significant, with up to 20% potentially saved through leakage management alone, and potentially significant savings in water use for washdown and sewer wells in particular.

Risks and mitigation

At all sites the key purpose for water use will need to be retained in any trials and changes made to reduce water use.

Costs and benefits

Costs and savings for sewer well leak inspection and simple changes to water controls should be performed as part of routine maintenance. Higher costs will be associated with implementation of rainwater tank systems, efficient tapware / flushing, and future smart controls aimed at reducing potable water use during rain events.

9.10 Management & monitoring

Description

Executive leadership and commitment to ambitious renewable energy and/or deep decarbonisation goals is required if Council's Long-term Renewable Energy and Water Strategy is to be successful. The implementation of management and governance systems for the strategy, and commitment and authority to act at relevant levels to reduce emissions, is also key for success to be achieved.

Priorities at leadership and management systems level could include:

- Appointment of a leadership group that brings together key stakeholders from cross-functional areas in Kempsey Shire Council
- Review and set targets for Kempsey Shire Council for renewable energy, carbon abatement, including scale, timing and any interim targets
- A reporting framework that integrates the plan, key performance indicators (KPIs), sustainability policies, and relevant strategic plans of Kempsey Shire Council
- Establish responsibilities and accountabilities related to the plan, included in position descriptions
- Assessment of resourcing considerations for the Energy & Water Strategy as part of Delivery Program planning and Operational Plans
- Planning, budgeting and funding plan actions through capital or operational budgets, grants, or other mechanisms
- Review metering and data management systems for the collection and reporting of energy and carbon sources relevant to Kempsey Shire Council's energy & carbon reduction goals
- Implement suitable measurement and verification systems – e.g. at the level of individual major projects such as onsite solar PV, and at whole-facility level for energy-intensive assets to enable outcomes to be accurately measured
- Develop communication, engagement and capacity-building plans that identify key staff, identify communication channels, report progress against Kempsey Shire Council's goals, identify and develop training, induction and awareness materials, and solicit input that increases awareness, recognition and buy-in

Focusing on a few of the key aspects of this:

Data management systems

Collection and management of energy data and water data across Council can be improved. The data collection to develop this Energy & Water Strategy included:

- Electricity data provided in spreadsheet form, with most data available for large sites in 2019, but significant amounts of missing data for smaller accounts, requiring extrapolation of provided data to a full-year equivalent. In addition, data for half of 2018 for large sites was missing.
- No bottled gas or stationary diesel (e.g. for standby generators) data were provided, though these will be small.
- Petrol and diesel data for fleet was provided as annual sum totals, and no details on purchases over a full year were able to be provided that

could allow for more detailed analysis of monthly usage and any potential gaps in data.

- Water consumption data is maintained in a spreadsheet and this was supplied as part of this work. The data required further analysis in order to derive quarter-by-quarter data that allows for comparison of periods and analysis of trends.

One of Council's main priorities should be to invest in a data management system for energy and potentially water that can ensure an accurate and comprehensive record of resource usage is maintained across all of Council's sites. In the first instance electricity data is the most important, with fuel and water following.

Resourcing considerations

Individual projects in the Long-term Renewable Energy and Water Strategy will require resources to be allocated to a range of tasks, which includes:

- Contract development and administration
- Project management of solar PV installations and energy efficiency upgrades
- Overall Long-term Renewable Energy and Water Strategy program management, including a management committee for the program
- Maintenance management process for solar PV projects, which will be new assets on many Council facilities
- Training of and engagement with Council staff in the operation and maintenance of PV systems, sustainable procurement, etc

The resourcing requirements should be taken into account when planning each year's program of work, and in planning for Council's next Delivery Program.

Project post-implementation monitoring

At the level of individual solar energy systems access to monitoring is strongly recommended such as is available for the depot 50 kW solar array. Without monitoring Council has no idea if a system is performing as expected and has no insight to problems that may have occurred (e.g. failed inverter, system isolated, physical damage).

Monitoring can be specified with individual projects and this can help to monitor performance in the post-implementation phase. A key criterion here may be the ability for the selected inverter technology to communicate with a supervisory monitoring system, on the assumption that Council will ultimately have a few different types of inverter.

Council should begin to investigate the availability and capabilities of supervisory monitoring systems, or whether it is practical to monitor performance via proprietary systems.

Program review processes

There should be a process to review Council's program so that new technologies, innovative ideas, changed market conditions and other factors can be considered and the plan changed based on the best available solutions in future. A two to three year period is suggested.

Many of the new technology ideas and innovations come to Council in an ad hoc fashion, such as directly from suppliers, from community groups, advice

from consultants, attendance at conferences or via social media. New ideas or solutions will come to numerous people across many functions.

Council should review what an appropriate process looks like for receiving, storing, evaluating and deciding on the merits of new clean energy ideas, and consider the resourcing requirements of this as part of the overall resourcing of the Long-term Renewable Energy and Water Strategy.

Scope for abatement

By itself this will not result in actual emissions reduction, but good leadership and effective management systems will be key factors in Kempsey Shire Council achieving their targets.

Risks and mitigation

A number of Councils in Australia have set ambitious renewable energy and carbon abatement goals, as set out in Section 4.3. With the recent rapid adoption of ambitious targets, and with growing awareness of the need for a rapid response to climate change, including by local communities, there is a potential risk of Kempsey Shire Council lagging behind its peers if it does not act in concert with other leading Councils. Potential targets for KSC can be seen in Section 1.2.

Reputation risk is associated with failing to achieve Kempsey Shire Council's goals, underlying the need for effective leadership and management systems to drive changes.

Costs and benefits

The main cost will be the allocation of staff time to establish, govern and implement Kempsey Shire Council's Long-term Renewable Energy and Water Strategy.

10 Summary of key short and medium term opportunities

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

Looking across all of the action areas, the tables below collate opportunities that could be progressed in the short, medium and long-term, based on priorities, costs and maturity of the technology recommended. Short and medium term opportunities represent measures that could be progressed, subject to capital, preferences of an incoming Council, and other limitations, in the next ~5 years – i.e. by the end of Council's next Delivery Program cycle.

10.1 Short-term opportunities

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, suggested short-term opportunities for consideration by Kempsey Shire Council are outlined below.

TABLE 10: KEMPSEY SHIRE COUNCIL SHORT-TERM OPPORTUNITIES FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Grid Decarbonisation	Electricity Supply	Whole-of-Council	Council will periodically update its emissions so that progress towards targets can be tracked and reported. This will capture the impact of grid decarbonisation and allow Council to adjust any of its forecasts to reflect changes.	Sustainability	Staff time
Grid Decarbonisation	Electricity Supply	Whole-of-Council	Council will proactively respond to and advocate to State or Commonwealth governments regarding clean energy policies that can provide investment certainty, lead to more renewable energy and regional jobs, and reduce energy costs to Council and the community.	Sustainability	Staff time
Buying clean energy	Electricity Procurement	Whole-of-Council	Develop an electricity procurement plan for KSC's next procurement cycle, to include a goal to source part or all of KSC's electricity from renewable energy sources subject to the market and contract models for renewables.	Procurement	Staff time and/or consulting advice
Financing of initiatives	Finance	Whole-of-Council	Investigate funding options for implementation of financially viable opportunities.	Sustainability / Finance	Staff time
Management & monitoring	Data Management	Whole-of-Council	Implement and manage an energy data management system that gives Council ready access to up-to-date and accurate information on Council's energy use, cost and GHG emissions	Sustainability	Data management system implementation + recurrent costs
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Review purchasing policies and frameworks for sustainability inclusions, and assess if / how sustainable purchasing decisions are made across Council.	Sustainability / Procurement	Staff time

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Develop and implement internal engagement and training to encourage the specification of sustainability in all Council buying decisions.	Sustainability / Procurement	Staff time
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Start to develop / update specifications and evaluation criteria for services and equipment / products that Council purchases to include Council's sustainability requirements.	Sustainability / Procurement	Staff time
Behind-the-meter solar	Solar PV	Dangar Street Depot (Thompson Street aka Kempsey Depot)	Continued maintenance on the 50 kW solar PV system to maintain design performance.	Facilities	Routine maintenance by installer
Energy efficiency	Lighting		Investigate whether cost-effective to upgrade all remaining lights to LED. High bays in the workshop have been upgraded to LEDs. Most lights are twin and single 36W battens, estimated 70 lights in total.	Facilities	$7,000
Energy efficiency	Baseload		Off-peak grid power use is 50,000 kWh per year for the main account, which will include minimal weekend daytime use as solar will meet most of this with surplus. Investigate why this power use is so high - e.g. external lights, wash bay pumps, etc.	Facilities	Staff time to audit night / weekend use and minor costs to implement operational or control changes
Behind-the-meter solar	Roof-mounted solar PV	Kempsey Civic Centre & Library	Install 99 kW solar PV on the roof (new) of Council's administration building (north and east roofs).	Facilities	$99,800
Energy efficiency	Lighting		Upgrade all Civic Centre lights to LED technology. Current lights consist of single and twin 36 W and quad 18 W fittings. Note that this upgrade is currently being undertaken.	Facilities	$22,050
Energy efficiency	Lighting		Upgrade all Library lighting to LED technology. This will reduce electricity use for lighting by 60%.	Facilities	$14,175
Energy efficiency	Metering and Accounts	West Kempsey STP & Treated	There are four electricity accounts at North Street, and the STP and treated effluent pumps meters have the same NMIs, indicating they may be the same supply. The other	Water and Sewer	Staff time

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
		Effluent Pumps	accounts may be separate sewage pump station (SPS) feeding in to the STP. These arrangements should be confirmed, particularly for the effluent pumps, as any future solar PV at this site will be designed to meet demand by these pumps.		
Energy efficiency	Design	Steuart McIntyre Dam & WTP	Design energy efficient best practice into new WTP.	Water and Sewer	Staff time to specify EE/RE requirements
Energy efficiency	Lighting	South West Rocks and Central Kempsey Sports Complex	Sporting field and netball court lights have been upgraded to LED with grant assistance. Council should review bills to confirm energy savings.	Facilities	Staff time
Energy efficiency	Motor Systems	South West Rocks STP	VSD and dissolved oxygen (DO) control of Passveer channel drives.	Water and Sewer	$20,000
Energy efficiency	Motor Systems	South West Rocks STP	VSD control of 2 x effluent outflow pumps.	Water and Sewer	$20,000
Energy efficiency	Motor Systems	SPS #1 Simpson St SWR	As a minimum, implement soft start, or else VSD control of 2 x 30kW transfer pumps	Water and Sewer	$30,000
Energy efficiency	Motor Systems	Stuarts Point WTP	Optimise time of use operation to more off-peak and less daytime.	Water and Sewer	Staff time and potentially control changes
Energy efficiency	Design	Crescent Head WTP	Design energy efficient best practice into new WTP.	Water and Sewer	Staff time to specify EE/RE requirements
Behind-the-meter solar	Roof-mounted solar PV	Kempsey Waste Management Centre	Install solar on the roof of the main shed to meet demand for the wash bay and extruder drives, potentially add solar on the weighbridge offices – subject to appropriate structural and wind studies.	Facilities	$10,100

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Sustainable Transport	Electric Vehicles	Kempsey Civic Centre & Library	Investigate the business case for different charger types and locations	Fleet Management Working Group / Facilities	Staff time
Sustainable Transport	Electric Vehicles and hybrids	All of council	Investigate installing a telematic solution in the current fleet to get data about current driving behaviours and km driven, plus a report on potential business case for electric or hybrid vehicles.	Fleet Management Working Group / Facilities	Cost of telematics solution (to be determined)
Water efficiency	Water leakage	Whole-of-Council	Water consumption data to be stored in a readily accessible and searchable database (WaterOutlook), and a quarterly or half-yearly review of data to be performed to highlight anomalies in consumption data and investigated.	Water and Sewer	Staff time and routine maintenance
Water efficiency	Washdown water	Whole-of-Council	Review sewer well water use data, and check and set timers to be uniform across the network as part of routine maintenance. As part of this maintenance check for leaks.	Water and Sewer	Staff time and routine maintenance
Water efficiency	Washdown water	Whole-of-Council	Investigate water spray nozzles to determine if any lower flow fit-for-purpose devices are available or in use and can be applied to all wells over time as part of routine maintenance.	Water and Sewer	Staff time and routine maintenance, cost for any new nozzles

10.2 Medium-term opportunities

Based on the assessment of onsite measures, the current electricity market and sustainable transport opportunities, suggested medium-term opportunities for Kempsey Shire Council are outlined below.

TABLE 11: KEMPSEY SHIRE COUNCIL MEDIUM-TERM OPPORTUNITIES FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Buying clean energy	Electricity Procurement	Whole-of-Council	Implement a 'market test' process to determine the current contract models, renewable energy availability and price for renewables as part of a PPA ahead of Council's next electricity supply agreement.	Procurement	Staff time and/or consulting advice
Buying clean energy	Electricity Procurement	Whole-of-Council	Target from the beginning of Council's next electricity supply agreement period to purchase 50% to 100% of KSC's electricity from renewable energy, subject to cost and risk assessment. Weigh up the costs and risks of a renewable energy PPA against a regular power agreement.	Procurement	Staff time and cost difference between 'regular' supply agreement and PPA
Sustainable transport	Electric Vehicles	Whole-of-Council	Install EV charging infrastructure / supply points to support Council Battery Electric Vehicle (BEV) / Plug-in Hybrid Electric Vehicle (PHEV) trial vehicles and/or public charging point.	Fleet Management Working Group / Facilities	~$12,000
Sustainable transport	Fleet	Whole-of-Council	In Council's next fleet plan, incorporate assessment and development of plans for EV charging at Council-owned and 3rd-party operated sites, transition to hybrid, Plug-in Hybrid EV, Battery EV for passenger cars and utility vehicles in the medium term.	Fleet Management Working Group	Staff time and/or consulting advice
Sustainable transport	Fleet	Whole-of-Council	Consider implementation of an EV trial for a passenger vehicle in Council's fleet.	Fleet Management Working Group	Cost premium between petrol / hybrid and EV
Energy efficiency	Design	Kempsey Library and planned Civic	Integrate ecological sustainable design (ESD) principles and maximise energy efficiency in the new design and in selecting lighting and power, air conditioning, and ICT equipment.	Facilities	Life-cycle cost assessment of options

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Energy efficiency	HVAC	Centre & Library connection	The HVAC unit at the rear (north, rear roof) of the library is very old. Investigate upgrading to an energy efficient system.	Facilities	Capex for a replacement HVAC unit
Energy efficiency	Lighting	Commercial Services, Harold Walker Ave	Upgrade all Commercial Services lights to LED technology - current lights are single and twin 36W surface mounted battens.	Facilities	$1,833
Energy efficiency	Streetlighting	Streetlighting	Consider upgrading all main road streetlighting to LED technology. Currently P1 and P2 have been upgraded.	Facilities	$1,738,500
Energy efficiency	Motor Systems	Kempsey Bore Pumps	Run pumps at night where possible. During periods of high demand seek to avoid operation in peak charging period (5-8pm weekdays) when feasible to reduce peak demand charges.	Water and Sewer	Staff time and control setting adjustments if warranted
Energy efficiency	Compressed Air	Steuart McIntyre Dam & WTP	Review operating times for the 55 kW air compressor, confirm any changes to operation since installation of the 2 ultrasonic devices in the dam. Determine if it is feasible to monitor water quality and operate the compressor based on this.	Water and Sewer	Staff time and control setting adjustments if warranted
Energy efficiency	Motor Systems	Stuarts Point WTP	VSD control of 2 x 30kW transfer pumps.	Water and Sewer	$40,000
Energy efficiency	Baseload	Stuarts Point WTP	Reduce average base demand of ~4 kW by reviewing lights, compressed air leaks, etc (note a new air compressor may address this issue and is planned for implementation).	Water and Sewer	$5,000
Energy efficiency	Motor Systems	Crescent Head STP	VSD control of effluent outflow pumps.	Water and Sewer	$20,000
Energy efficiency	Voltage Optimisation	South West Rocks STP	Incoming voltage at old MSB was 249V, well above required level. This may hint at a VO opportunity (this can be investigated across several sites; costs are estimated for just this one).	Water and Sewer	$80,000

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
Behind-the-meter solar	Ground-mounted solar PV	Steuart McIntyre Dam & WTP	Install ground mount solar PV on the south side of the Steuart McIntyre dam to supply the new plant. Consider this option as part of the scope of the project up front.	Water and Sewer	$129,350
Behind-the-meter solar	Roof-mounted solar PV	Steuart McIntyre Dam & WTP	Install solar PV on the roof of the existing treatment and pump house and the east side of the dam. Use both north and south faces due to shallow pitch, possibly with frames (note: there may be ground areas available for use in future that may provide better solar yield, with lower shading, so this can be considered as an alternative).	Water and Sewer	$40,300
Behind-the-meter solar	Roof-mounted solar PV	South West Rocks Bore Pumps	Investigate a 10kW solar array on the transfer pump house roof, flush on the North-East facing roof and tilted on the south facing roof, with a focus on shading and vegetation management issues.	Water and Sewer	$10,100
Behind-the-meter solar	Ground-mounted solar PV	South West Rocks STP	Install 99 kW of ground-mount solar next to the lab and MSB at the new plant, with consideration of vegetation clearance and ongoing management needs, as well as other practical site-specific considerations that may apply (roof mounted arrays are unlikely to be feasible).	Water and Sewer	$129,740
Behind-the-meter solar	Roof-mounted solar PV	South West Rocks Water Treatment Plant	Install solar array on the roof either facing east or mounted on frames facing north.	Water and Sewer	$30,200
Behind-the-meter solar	Roof-mounted solar PV	Hat Head STP	Install 14 kW solar PV on the roof over the chemical store	Water and Sewer	$14,400
Behind-the-meter solar	Roof-mounted solar PV	Stuarts Point WTP	Install 10kW solar on the roof of the 2 WTP buildings, both east-west arrays.	Water and Sewer	$9,720
Behind-the-meter solar	Roof-mounted	Kempsey Waste	Alternative to just installing solar (see under short term plan), solar with battery can be installed on the roof of the main	Facilities	$28,100

Category	Sub-category	Site	Abatement option	Responsibility	Cost estimates or resources
	solar PV + BESS	Management Centre	shed to meet demand for the wash bay and extruder drives, potentially added solar on the weighbridge offices.		
Behind-the-meter solar	Ground-mounted or roof-mounted solar PV	Crescent Head WTP	Build a solar PV array with the planned new WTP at the rear of the current site - ground and/or roof-mounted. Consider this option as part of the scope of the project up front.	Water and Sewer	$65,780
Behind-the-meter solar	Ground-mounted solar PV	Crescent Head STP	Install 40 kW solar ground mounted array on grass area between main plant and UV / effluent outflow with consideration of vegetation clearance and ongoing management needs, as well as other practical site-specific considerations that may apply.	Water and Sewer	$52,390
Water efficiency	Washdown water	Whole-of-Council	At treatment works and saleyards the use of rainwater collection may provide an alternate source of washdown water, and investigations at relevant sites should seek to highlight potentially suitable locations where a reasonable return on investment can be achieved.	Water and Sewer	Cost for rainwater tanks
Water efficiency	Sports fields, parks and median strips irrigation	Whole-of-Council	Investigate the use of rainwater tanks at sites where this is feasible.	Parks	Cost for rainwater tanks
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Continue to deliver internal engagement and training to encourage the specification of sustainability in all Council buying decisions.	Sustainability / Procurement	Staff time
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Continue to develop / update specifications and evaluation criteria for services and equipment / products that Council purchases to include Council's sustainability requirements.	Sustainability / Procurement	Staff time

10.3 Long-term opportunities

Long term opportunities across the abatement categories are tabulated below. At this time these are simply described, and no cost or resource estimates, and no responsibilities are identified. It is anticipated that Council could re-visit these opportunities as part of a future revision of the Energy & Water Strategy, but it is not anticipated that these will be implemented within the current or next Delivery Program cycle.

TABLE 12: KEMPSEY SHIRE COUNCIL LONG-TERM OPPORTUNITIES FOR COUNCIL OPERATED SITES

Category	Sub-category	Site	Abatement option
Buying clean energy	Electricity Procurement	Whole-of-Council	Develop a plan for successive electricity procurement cycles that integrates sourcing of renewables and periodic analysis of the market for renewables to inform procurement plans.
Buying clean energy	Mid-Scale Renewables	Whole-of-Council	Review the opportunity for council to build its own solar farm on the Kempsey Airport, Central Kempsey STP or other sites such as the South Kempsey STP (when decommissioned). In addition, investigate the potential for a bioenergy hub at the Central Kempsey STP that utilises sludge, abattoir waste and other inputs to develop biogas, potentially bioenergy generation and co-products. As part of these investigations, assess the potential for community ownership and community energy retailing of renewable energy.
Sustainable transport	Fleet	Whole-of-Council	Progress with the implementation of EV vehicles and EV infrastructure in Council's fleet.
Sustainable transport	Fleet	Whole-of-Council	Keep a watch on new developments in vehicle technologies, including fuels (e.g. Hydrogen) and heavy vehicles and plant.
Energy efficiency	Motor Systems	K6A Sewer Pump Station, Thompson Street	Upgrade 2 x 15 kW DOL-start overflow pump motors to VSD.
Energy efficiency	Motor Systems	K6B Sewer Pump Station, Thompson Street	Upgrade 2 x 55kW auto-transformer starter motors with VSD / VFD drives
Energy efficiency	Motor Systems	West Kempsey STP & Treated Effluent Pumps	Upgrade 3 x 55kW soft starter (SS) pumps with VSD, adjust operation to align with solar if a solar array is installed, and to run on off-peak rates at other times. This opportunity only eventuates if drives can be re-constituted elsewhere, or as critical spares once the site has been de-commissioned.

Category	Sub-category	Site	Abatement option
Energy efficiency	Motor Systems	Hat Head STP	VSD control of 2 x 7.5 kW aerators which are DOL-controlled.
Energy efficiency	Design	Central Kempsey STP	Design energy efficient best practice into new STP.
Energy efficiency	UV Treatment	Wastewater Treatment	LED lighting technology for wastewater UV treatment is an emerging technology, though is not in widespread use. Monitor progress in this technology in terms of fitness-for-purpose, cost and energy demand compared with trends in current UV treatment lighting. Review and if feasible and proven technology in water treatment, add into Preferred Supplier & Equipment Listing.
Energy efficiency	Motor Systems	Hat Head WTP	VSD control of 2 x 7.5 kW pumps to main tanks.
Behind-the-meter solar	Roof-mounted solar PV	Kempsey Civic Centre & Library	Maximise solar PV on rooftops by adding: • An additional 50 kW solar PV on the roof of the library which has a north facing slope (it is noted that the current roof has leakage issues and rectification of these along with structural assessment would be required before solar can be considered here) • Up to an additional 160 kW on Civic Centre and Library roofs (in addition to Library roof issues noted above, the structural integrity of the customer service centre roof would be required.
Behind-the-meter solar	Ground-mounted solar PV	Stuarts Point STP	Build a solar PV array with the planned new STP at Tea Tree Lane.
Behind-the-meter solar	Roof-mounted solar PV + BESS	Dangar Street Depot	The whole depot is under detailed investigation as to whether Council would refurbish assets at this location or alternatively relocate the depot operations to another site. Solar expansion could only be supported at Dangar Street if the roofing on current buildings is refurbished. If Council were to move to a new depot, then designing roofs and electrical infrastructure that could support future solar as well as battery storage and EV charging should be considered.
Behind-the-meter solar	Ground-mounted solar PV	West Kempsey STP & Treated Effluent Pumps	After the STP is decommissioned and replaced with the new Central Kempsey STP, investigate ground mount solar off North St and below the trickle filter tanks to supply the treated effluent pumps.
Behind-the-meter solar	Floating solar PV	Steuart McIntyre Dam & WTP	Investigate solar PV on the surface of the dam to supply the new water treatment plant and/or the pump house.

Category	Sub-category	Site	Abatement option
Behind-the-meter solar	Floating solar PV	Crescent Head WTP	Investigate the feasibility of a solar PV array with the planned new WTP on the water body at the current site (if ground or roof mount are not feasible).
Behind-the-meter solar	Ground-mounted solar PV	Central Kempsey STP	Implement ground or roof-mounted solar PV for the new Central Kempsey STP to meet STP daytime demand.
Water efficiency	Wash down water	Whole-of-Council	Wet weather inflows may effectively perform the same work as water sprays, so in future 'smart' controls could potentially be deployed that reduce or cut out potable water sprays during wet weather.
Water efficiency	Sports fields, parks and median strips irrigation	Whole-of-Council	In future, linkage of 'smart' controls to irrigation systems so fields and parks are irrigated in line with moisture levels and/or based on rainfall.
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Continue to deliver internal engagement and training to encourage the specification of sustainability in all Council buying decisions.
Sustainable Procurement	Services and Equipment Purchasing	Whole-of-Council	Continue to develop / update specifications and evaluation criteria for services and equipment / products that Council purchases to include Council's sustainability requirements.

Appendix A: Opportunities for third-party operated sites

Third party operated sites are under a commercial management agreement with all operational costs (such as electricity) being incurred by the third party contractor. Therefore, a return on investment business case for Council does not exist and these decisions would be taken by the operator, or considered in the future as part of new management agreements.

TABLE 13: ABATEMENT OPPORTUNITIES FOR 3RD PARTY OPERATED SITES

Category	Sub-category	Site	Abatement option
Energy efficiency	Lighting	Horseshoe Bay Holiday Park	Upgrade western amenities and park lighting to LED.
Energy efficiency	Hot Water		Replace diesel fuel and boilers with either solar-boosted LPG or solar-boosted heat pump systems.
Behind-the-meter solar	Roof-mounted solar PV + BESS		Solar PV and battery storage may be feasible on the office / kiosk and the amenities building in the west of the site.
Energy efficiency	Solar Matting	South West Rocks Swimming Pool	Solar matting would enable the pool temperature to be boosted across the open season, and in particular would enable temps close to 27 deg C to be attained in October and March/April with the help of the pool blankets. Would need to secure agreement from the golf course to install matting on one of their sheds (estimated at 200m^2) with water circulated back to the pump house.
Energy efficiency	Heat Pump		Heat pumps would increase energy demand but would allow the pool to regulate temperature and potentially stay open longer.
Energy efficiency	Lighting	Stuarts Point Holiday Park	Install LED lights in all amenities and fix PE control of roadway lights in the park. Note that some have already been upgraded.
Behind-the-meter solar	Roof-mounted solar PV	Crescent Head Holiday Park	Install ~30 kW solar PV on residence and 2 amenities blocks closest to the entrance, subject to condition assessment.
Energy efficiency	Lighting		Upgrade all remaining park lighting to LED. Please note that new cabins have LED as part of asset replacement program.
Energy efficiency	Motor Systems	Crescent Head Pool	VSD control of the main filter pump.
Behind-the-meter solar	Roof-mounted solar PV	Kempsey Pool	Install solar PV on the front roofs of the complex to meet base electricity demand at the site.
Behind-the-meter solar	Roof-mounted solar PV	Gladstone Pool	Install 10kW of solar PV on the inward west and east facing slopes of the entrance building.
Behind-the-	Roof-mounted		Install ~30 kW solar PV but with a battery in the event daytime demand is very low.

meter solar	solar PV + BESS	Crescent Head Holiday Park	
Behind-the-meter solar	Roof-mounted solar PV + BESS		Install solar and battery microgrid across 2 groups of cabins - near entrance / office, and towards Pebbly Beach (note that several cabins have been replaced that are not shown in the image used to model solar. Solar was considered as part of the asset upgrades but was not included, and solar & battery prices may have to decline much further before this would be revisited).

TABLE 14: INDICATIVE COSTS AND SAVINGS FOR BEHIND-THE-METER SOLAR PV FOR 3RD PARTY-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)
Horseshoe Bay Holiday Park	**15.1 kW (west amenities)** Roof mounted solar PV		$15,100	$3,733	4.0	$36,282	24.4%	24,330	10%	9%	18
	Additional 15.1 kW (kiosk) Roof mounted solar PV	30	$42,100	$3,172	13.9	$1,410	5.3%	20,670	10%	8%	15
Crescent Head Holiday Park	**29.8 kW (amenities block and cabins near to entrance)** Roof mounted solar PV		$29,800	$6,954	4.6	$59,025	21.3%	43,920	30%	7%	25
	29.8 kW (amenities block and cabins closest to entrance) with BESS Roof mounted solar PV	30	$56,800	$7,937	7.2	$52,659	13.1%	43,920	10%	9%	32
	Additional 46.6 kW (North east corner cabins) with BESS Roof mounted solar PV	100	$136,600	$12,667	10.80	$38,511	7.7%	67,990	5%	15%	52
Gladstone Swimming Pool	**10.1 kW** Roof mounted solar PV		$10,100	$3,118	3.4	$31,026	29.4%	13,800	40%	75%	7
Kempsey Pool	**20 kW** Roof mounted solar PV		$20,000	$5,101	4.22	$45,341	23.4%	30,090	20%		23

TABLE 15: INDICATIVE COSTS AND SAVINGS FOR ENERGY EFFICIENCY FOR 3RD PARTY-OPERATED SITES

Site	Description	Capital cost	Cost savings	Payback (years)	NPV	IRR	Resource savings (kWh)	% energy savings	Emissions reduction (t CO_2-e)
Horseshoe Bay Holiday Park	Upgrade amenities and park lighting to LED.	$20,000	$2,914	8.2	$12,033	10.9%	14,572	6%	12
South West Rocks Swimming Pool	Install solar matting to boost temperature across the opening season	$30,000	-$240	Not estimated			-1,000		-1
	Install heat pumps to regulate temperature and allow pool to potentially open longer	$40,000	-$6,000	Not estimated			-25,000		-20
Stuarts Point Holiday Park	Install LED lights in all amenities	$10,000	$2,432	5.0	$18,550	20.3%	9,356	6%	8
Crescent Head Holiday Park	Upgrade all remaining park lighting to LED	$10,000	$3,043	4.1	$25,523	25.1%	12,680	3%	10
Crescent Head Pool	VSD control of the main filter pump	$15,000	$2,880	6.3	$20,768	15.9%	12,000	8%	10

Appendix B: Solar PV potential locations

Council-owned sites

Kempsey Civic Centre & Library – 99.8 kW – Roof-mounted

Kempsey Civic Centre & Library – Additional 50.3 kW – Long term option 1 – Roof-mounted

Kempsey Civic Centre & Library – Additional 160.1 kW – long term option 2 – Roof-mounted

Dangar Street Depot – 150.1 kW – Roof-mounted – Future expansion

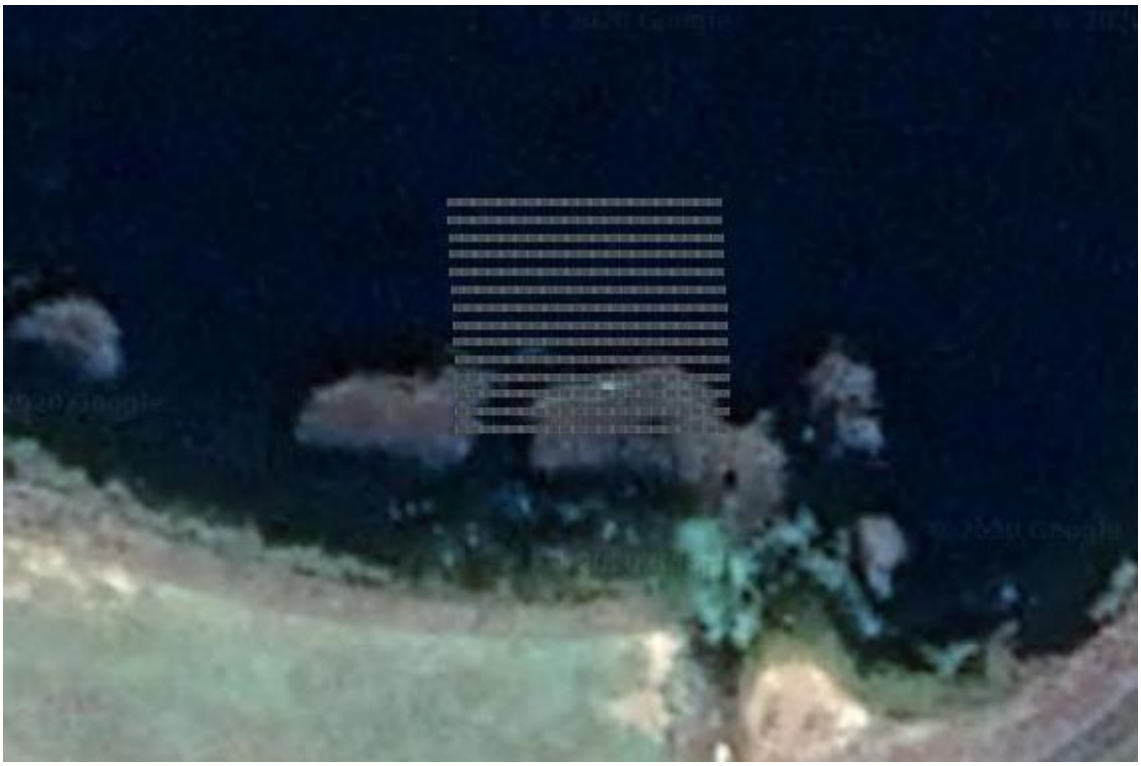
West Kempsey Sewerage Treatment & Treated Effluent Pumps– 99.5 kW – Option 1 – Ground-mounted – North facing

West Kempsey Sewerage Treatment & Treated Effluent Pumps– 99.5 kW – Option 2 – Ground-mounted – East-West facing

Steuart McIntyre Dam & WTP – 40.5 kW – Roof-mounted

Steuart McIntyre Dam & WTP – 99.5 kW – Additional medium-term option – Ground-mounted

Steuart McIntyre Dam & WTP – Additional 99.5 kW – Additional long term option – Floating solar PV



South West Rocks Water Treatment Plant – 30.2 kW – Roof-mounted

South West Rocks Bore Pumps – 10.1 kW – Roof-mounted

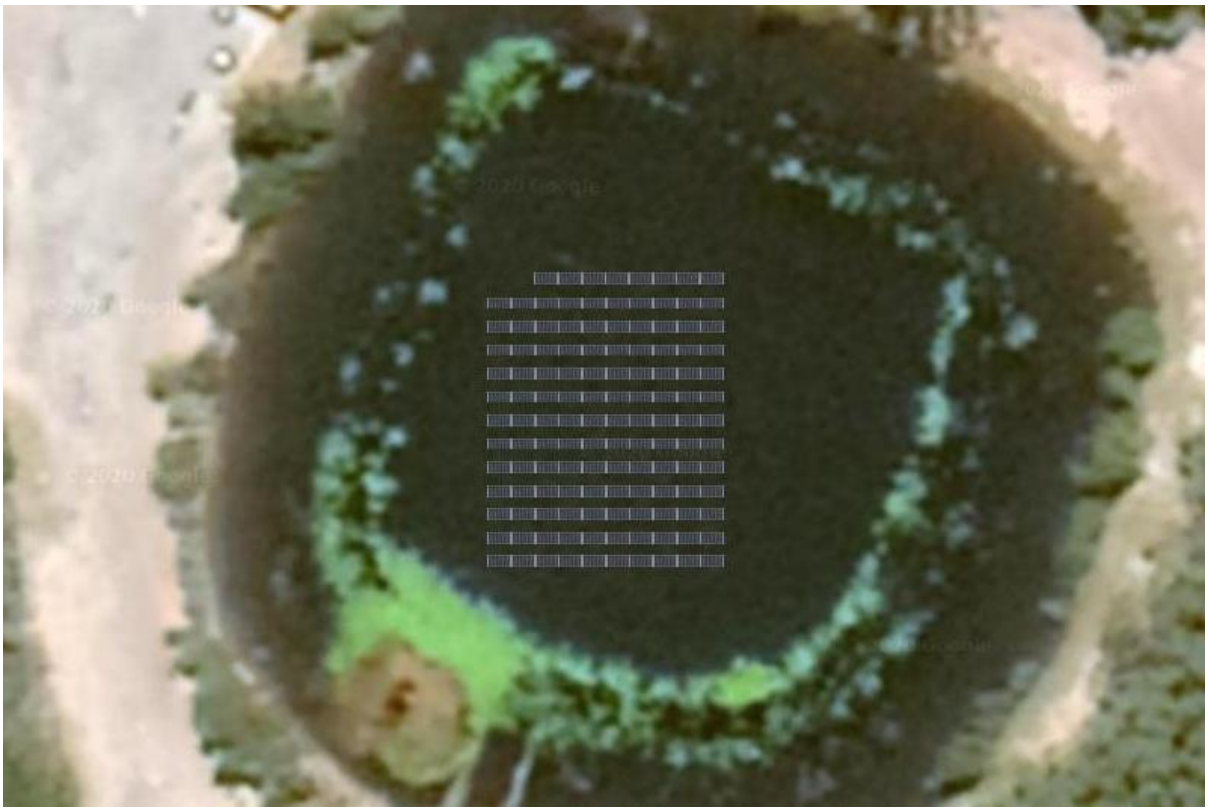
South West Rocks STP – 99.8 kW – Ground-mounted

Stuarts Point WTP – 9.72 kW – Roof-mounted

Stuarts Point STP – 50.6 kW – Ground-mounted

Crescent Head WTP – 50.6 kW – Ground-mounted

Crescent Head Water Treatment Plant – 50.6 kW – Floating Solar



Kempsey Waste Management Centre – 10.1 kW – Roof-mounted – Location 1

Kempsey Waste Management Centre – 10.1 kW – Roof-mounted – Location 2

Crescent Head STP – 39.5 kW – Ground-mounted – Location 1

Hat Head STP – Option 1 – Roof-mounted – 10.1 kW

Hat Head STP – Option 2 – Roof-mounted – 14.1 kW

Third-party operated sites

Horseshoe Bay Caravan Park – 15.1 kW – Roof-mounted – Location 1

Horseshoe Bay Caravan Park – 15.1 kW – Roof-mounted – Location 2

Crescent Head Tourist Park – 29.8 kW – Roof-mounted – Microgrid 1

Crescent Head Tourist Park – 46.6 kW – Roof-mounted – Microgrid 2

Gladstone Swimming Pool – 10.1 kW – Roof-mounted

Kempsey Pool – 20 kW – Roof-mounted

Appendix C: Financing Guide for renewables and efficiency

FINANCING

SUSTAINABILITY PROJECTS FOR LOCAL GOVERNMENTS

100% renewables

What we will cover

01 About 100% Renewables

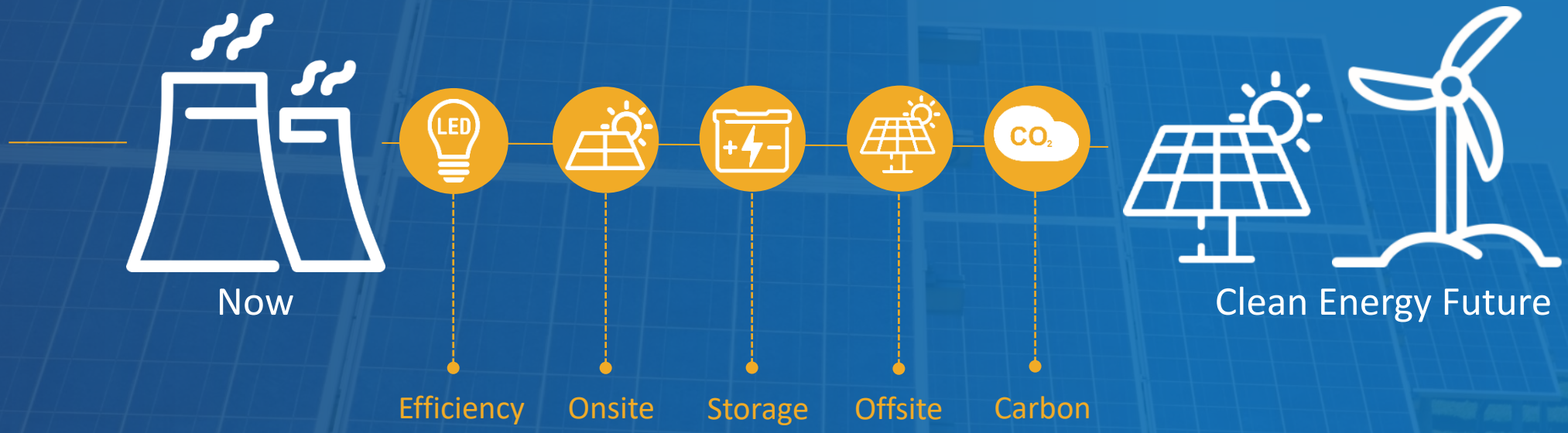
02 Why you need a financing strategy

03 Organisational alignment of your financing strategy

04 Financing options & pros and cons

05 Integrating your financing strategy

We help councils develop and implement their clean energy strategy



100% renewables

Overview

OPTIMAL FINANCING STRATEGY FOR LOCAL GOVERNMENTS, © 100% RENEWABLES

01

FREE MONEY

Grants and incentives

02

INTERNAL FINANCING

Money with low opportunity cost. From budget, REF, carbon price

03

COUNCIL BORROWS

Typically for capital-intensive projects. Low interest finance

04

THIRD PARTY

Higher financing costs. Lease, EPC, PPA, community energy

02
Why you need a financing strategy

Reasons you need a financing strategy

- Most sustainability initiatives require some sort financing
- Need to plan ahead to align with
  - Strategic (e.g. Community Strategic Plan or CSP) and delivery/ operational plans
  - Budgetary cycles
  - Sustainability targets
- Determine the best way to finance sustainability projects given your circumstances and objectives

03 Organisational alignment

Aligning a local government's financing strategy with strategic and operational plans

Community Strategic Plan (CSP)

Financing Strategy

Sustainability Strategy

Operational and Delivery Plans


04
What are your financing options?

Financing options

Free

Pre-existing and future incentives and grants

Internal funding

Environmental levy/ Special Rate Variation

Self-financed through budgeting process

Self-financed through REF

Internal carbon price

Council borrows

Loan financing

Third party

Equipment lease

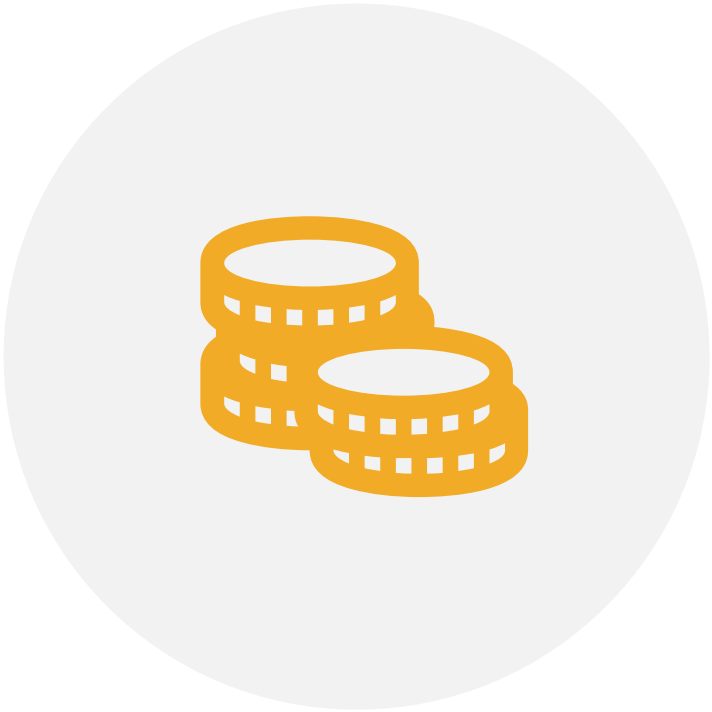
On-bill financing

Onsite PPAs

Energy Performance Contracts (EPC)

Community energy projects

1. Pre-existing and future incentives and grants



- Solar:
  - Small-scale Technology Certificates (STCs)
  - Large-scale Generation Certificates (LGCs)
- State-based white certificate schemes, e.g.,
  - NSW: ESCs
  - SA: REES
  - VIC: VEECs
  - ACT: EEIS
- State-based funding
- Grants and incentives
- Potential CEFC and ARENA financing

Impacts of establishing and maintaining financing from incentives and grants

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

Pre-existing and future incentives and grants

Provide discounts on renewable energy and energy efficiency projects (or ongoing revenue in the case of LGCs)

Less internal resistance for sustainability initiatives

Doesn’t compete with funds for other projects

Special skills required for grant appl. process

Grants may need matched funding

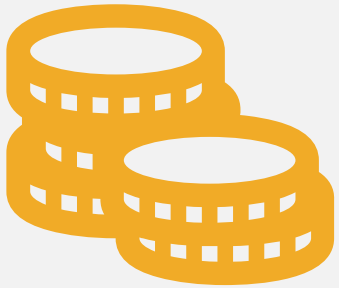
Grants may not align with budget cycles

Need to have projects ‘shovel-ready’ to apply

Always need to investigate when grant financing is available

Risk in LGC value

2. Environmental levy/Special Rate Variation



- Special rate paid by residents
- Generally used for protection of the natural environment, but can also be used for energy efficiency and solar PV projects

Impacts of establishing and maintaining financing from environmental levy/SRV

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

Environmental levy/Special Rate Variation

Continuous funds

Expectation that funds will be spent on environmental projects

Great financial return

Community has to be willing to accept expenditure on sustainability projects

Council has to account and report on how the money was spent

Case Study Environmental Levy – Sunshine Coast Council

Environment Levy

Print

Last updated: 09 Jun 2019

The Sunshine Coast's natural environment is one of our most important assets and is highly valued by council and our community.

Protecting, maintaining and enhancing our environment is a key priority for council. It is also an important element of the liveability of our community as well as the success of our economy.

Environment Levy overview

An important funding source contributing to the protection and enhancement of our biodiversity, waterways and wetlands and coastal areas.

Land acquisition program

Levy funds are invested into the acquisition of environmentally significant land to protect and enhance habitat areas.

Progress and achievements

Learn about Environment Levy achievements and expenditure through the annual report and our updates page.

From https://www.sunshinecoast.qld.gov.au/Environment/Environment-Levy

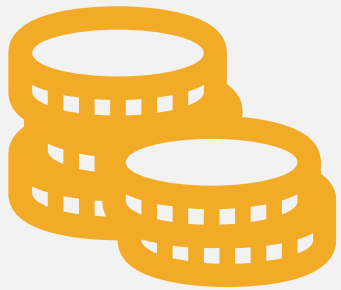
Case Study Environmental Levy – Sunshine Coast Council

2017/18 highlights

- $7,300,000 spent on purchasing nine new properties across the local government area, adding approximately 405 hectares to Council's reserve network
- $820,000 contributed to the protection and sustainable use of our coastal areas through on-ground ecological restoration works
- Approximately $310,000 invested into the delivery of riparian restoration projects to enhance waterway health across the Pumicestone, Maroochy, Mary and Mooloolah catchments
- $512,000 invested into the strategic management of invasive plants and animals guided by the Sunshine Coast Local Government Area Biosecurity Plan 2017
- $595,000 allocated to support 22 Environment Levy-partnership groups
- More than $230,000 invested into building our knowledge through a range of research management and monitoring projects.

From https://www.sunshinecoast.qld.gov.au/Environment/Environment-Levy

3. Self-funded through normal budgeting process



- Energy efficiency and renewable energy projects financed directly from capital budget
- Possible options:
  - General funds
  - Water and sewer funds (regional councils)
  - Streetlighting fund (for streetlighting upgrades)
  - Development contributions
- Projects may compete for funds with other activities
- Energy efficiency measures are likely to be funded through this option

Impacts of establishing and maintaining financing from budget

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

Self-funded through normal budgeting process – pros and cons

No contractual obligation

In most cases best financial return

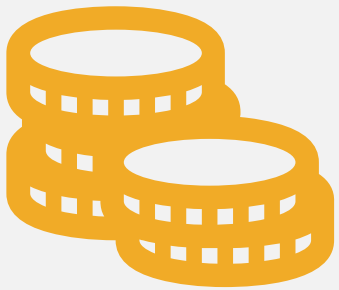
Owning the equipment

Financial and performance risk

Responsibility for maintenance

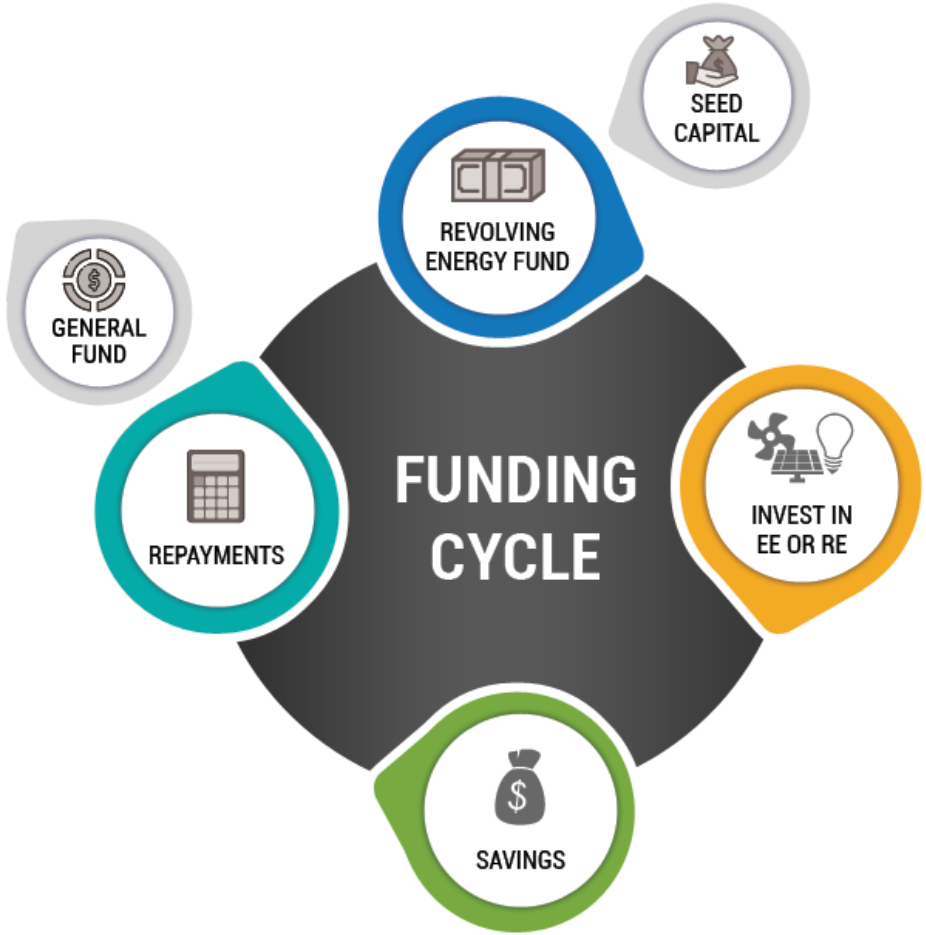
Less capital for core business activities

4. Self-funded through Revolving Energy Fund (REF)



- A REF is a sustainable financing mechanism
- Savings from sustainability projects are tracked and used to replenish the fund for the next round of investments
- Seed fund can come from capex or opex budget
- Essential that the portfolio performance and cash injections are forecast to see whether the fund will grow or deplete over time
- REFs can be very popular but need to be set up well in order to work

Self-funded through Revolving Energy Fund (REF)



Impacts of establishing and maintaining financing from a REF

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

Self-funded through Revolving Energy Fund (REF) – pros and cons

Monetary investment spent many times without reducing its value

Financing of sustainability projects becomes an organisational habit

Can make it easier to get sustainability projects over the line

Verification of savings can be challenging and expensive depending on the method used

Requires time to implement and convince stakeholders

Requires seed financing and availability of money in the fund to be functional

Council resolution may be required

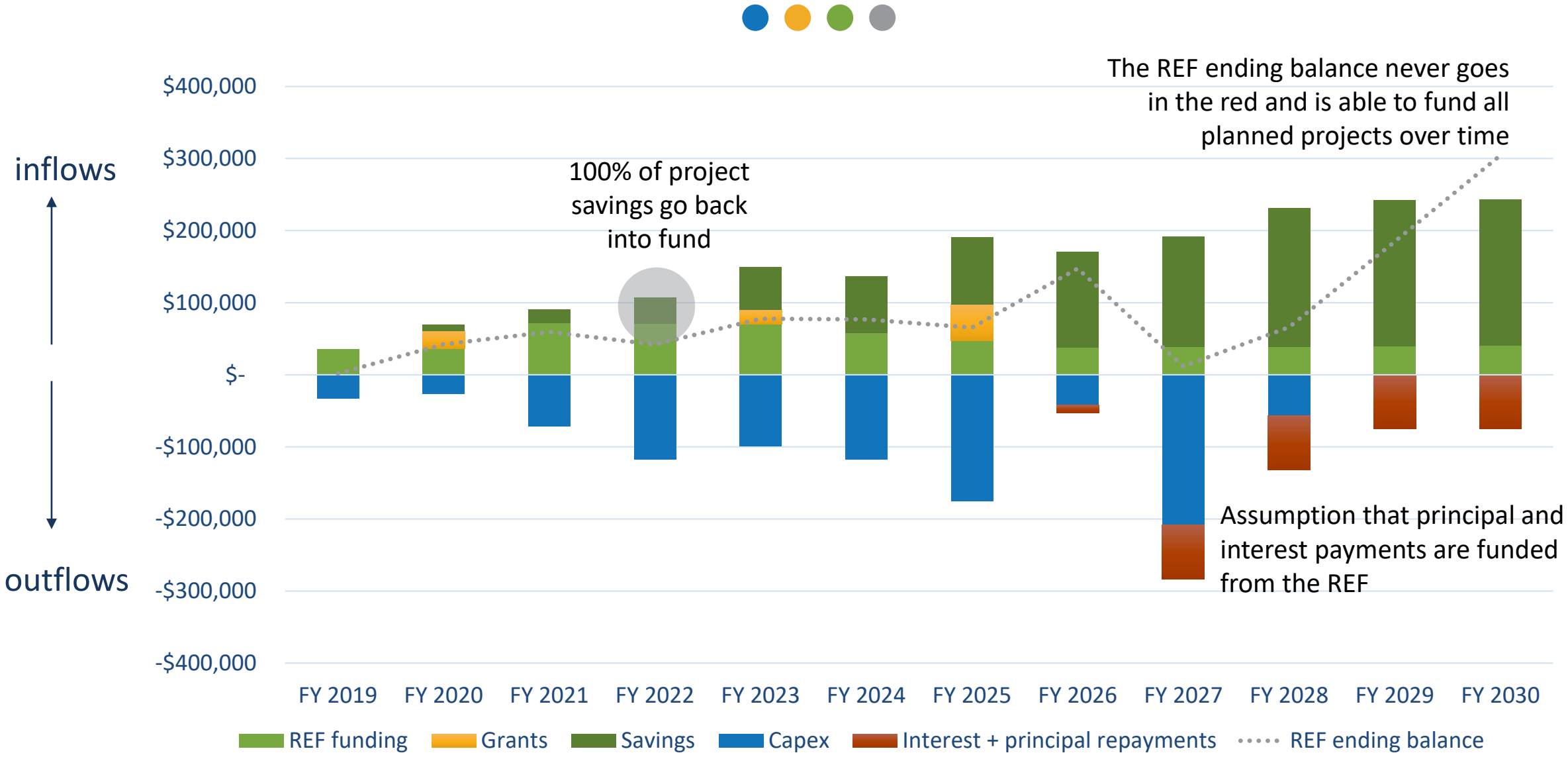
Case Study REF – Penrith City Council

- Penrith Council has a forward financing financial reserve
- Balance maintained through payback of cost savings from projects
- Initially used an actual savings approach, but found that this was too difficult to implement
- Switched to estimated savings
- 100% of realised savings reinvested into the REF for 3 years
- Council ensured asset managers were in charge of electricity bills to ensure incentive to reduce costs

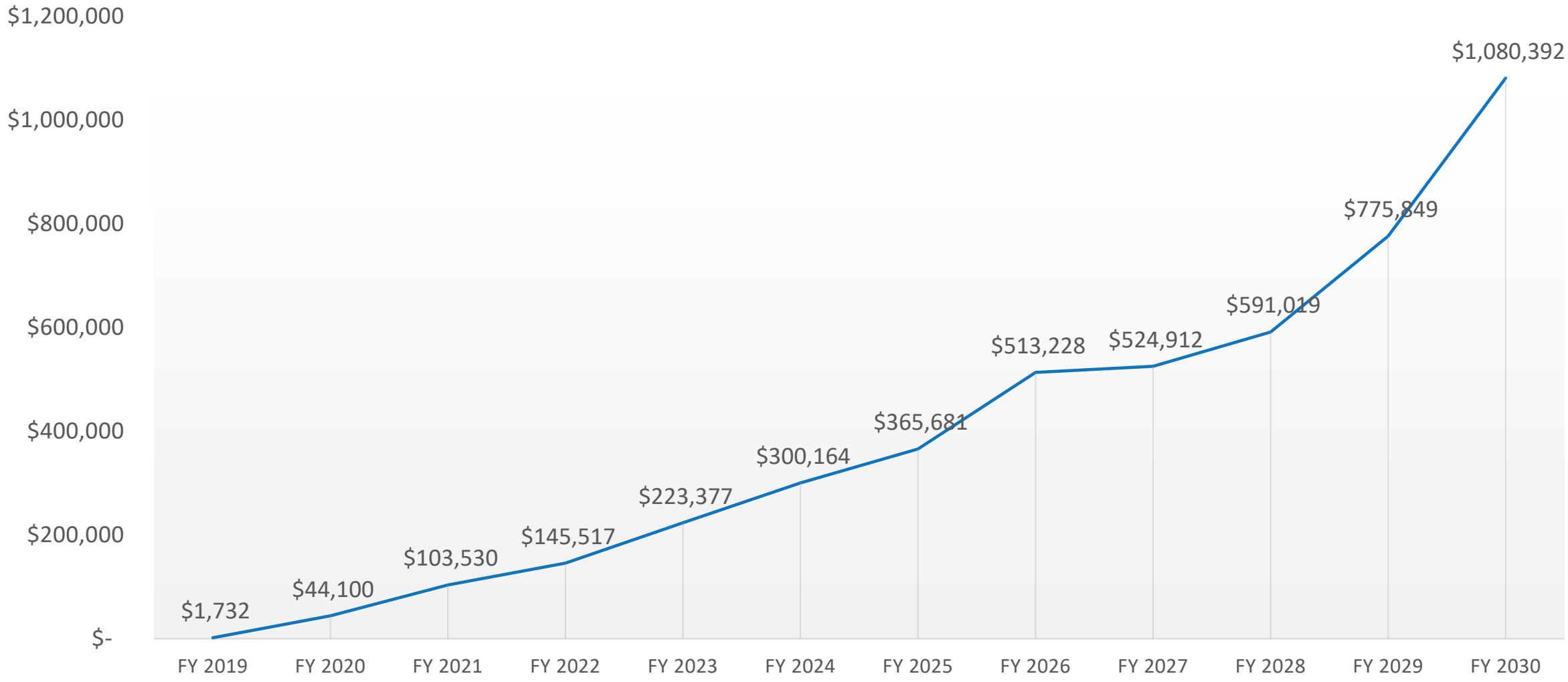
Modelling case study - REF and loan financing

- Regional council with commitment to reach zero net emissions developed a renewable energy plan
- The Plan was split into short, medium and long term actions
- Capex needed to implement identified efficiency and solar actions: $2.4m
- Yearly environmental levy ($40K - $50K) to be put in Revolving Energy Fund
- The council needed financial modelling:
  - How long would it take to implement all actions using the REF?
  - What is the cashflow if all actions loan funded & immediately implemented?
  - Impact if only 50% of savings go into REF?
  - Impact if savings go back into working fund after 10 years?

Modelling case study - REF and loan financing - budget



Modelling case study - REF and loan financing, cumulative cashflow



5. Internal carbon price

A value that organisations voluntarily set to internalise the economic cost of their GHG emissions

01	02	03
SHADOW PRICE	**INTERNAL TAXES, FEES, OR TRADING SYSTEMS**	**IMPLICIT PRICE**
Hypothetical or assumed cost for carbon emissions to better understand the potential impact of external carbon pricing	Formal financial incentive or program. Internal fee for various activities or expenditures.	Implicit cost per tonne of carbon emissions based on how much an organisation spends to reduce its emissions.
DIRECT		INDIRECT

Impacts of establishing and maintaining financing from internal carbon price

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

Internal carbon price– pros and cons

Easier to fund sustainability initiatives

Shift in organisational thinking to be less carbon intensive

Ability to establish a Science-Based Target

Difficult to implement

Difficult to generate buy-in from business units with high emissions

Case Study– Internal carbon price

- **Microsoft** – Carbon Fee
  - Assigned a carbon fee in 2012 across its business units
  - Funds used to pay for energy efficiency projects, renewable energy projects and launching new product lines
- **National Australia Bank** – Implicit price on carbon
  - Introduced in 2010 to fund its goal of becoming carbon neutral through offset purchases and energy efficiency projects
- **ENGIE** – Shadow price
  - Implemented a price on carbon for future investments to lower investment in high emissions energy generation

HOW TO SET AN INTERNAL CARBON PRICE

1
Calculate your carbon impact

2
Establish reduction targets

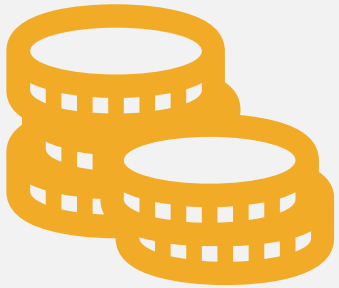
3
Get support and set carbon price

4
Integrate into strategy & planning

5
Monitor performance

100% renewables

6. Loan-funded



- Lender provides capital
- Pre-determined variable interest rate
- Repayments are made over time
- Typically used for expensive equipment

Impacts of establishing and maintaining financing from a loan

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

Loan-funded – pros and cons

No or reduced upfront cost

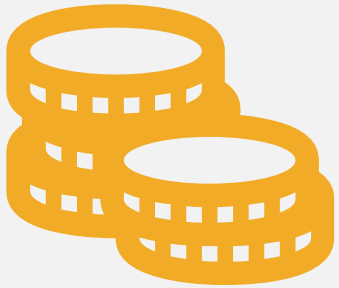
Capital available for other projects

Councils have access to cheap interest rates

Economic and technical risk if equipment becomes unusable and the loan is on the balance sheet

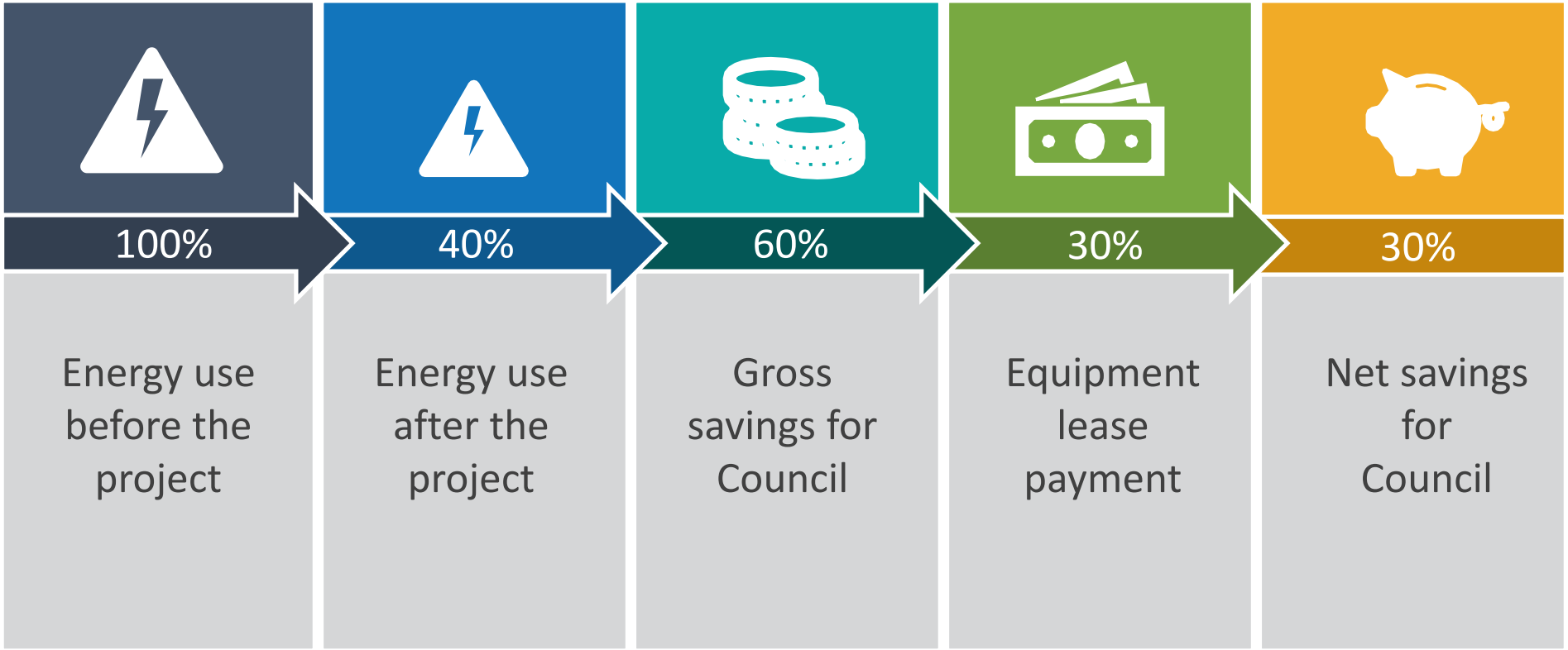
Financial returns are less compared with self-funded equipment

7. Equipment lease



- Supplier owns and installs equipment
- Monthly repayments for 5-10 years
- Options for end of the lease:
  - Remove
  - Rollover
  - Buyout

Equipment lease



Impacts of establishing and maintaining financing from an equipment lease

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

Equipment lease – pros and cons

Supplier responsible for maintenance

No or modest upfront cost

Cost of investment spread out

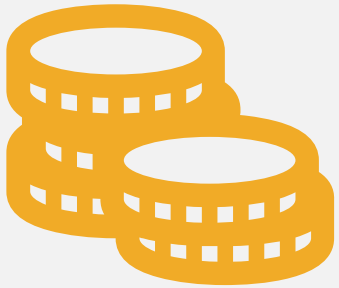
Access to new equipment after the lease has run out

Repayments with interest are incurred

Equipment is more expensive compared to upfront purchase

No ownership

8. On-bill financing



- Retailer or network provider (streetlighting) installs equipment
- Repaid through a repayment charge on the energy bill/streetlighting bill
- Once payments are made, ownership can be transferred

Impacts of establishing and maintaining financing from on-bill financing

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

On-bill financing – pros and cons

No or reduced upfront cost

Payment via utility/streetlighting bill reduces risk of default

Repayment liability on the balance sheet

May tie customer to the energy retailer

May be more expensive in the long run

9. Onsite Power Purchase Agreement (PPA) – behind-the-meter

- PPA provider designs, constructs, owns, operates and finances the renewable energy generation equipment
- PPA provider retains ownership and responsibility for maintenance
- Company agrees to purchase certain amount of electricity from provider
  - Purchase price of electricity lower than bundled price of electricity from the grid

Solar PPAs

PPA Provider

- Owns, finances and installs the solar PV
- Operates and maintains the system

Electricity Retailer

- Electricity retail agreement
- Continues to supply electricity from grid
- May purchase excess solar generation

Solar PV system

- Installed at no initial costs
- Can be transferred upon expiry

Excess electricity

Your organisation

- Buys solar energy from PPA provider cheaper than grid
- Buys less energy from retailer

Impacts of establishing and maintaining financing from an onsite PPA

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

Onsite Power Purchase Agreement (PPA) – pros and cons

Cheaper price for electricity

No upfront cost

Provider takes responsibility of maintenance and equipment replacement

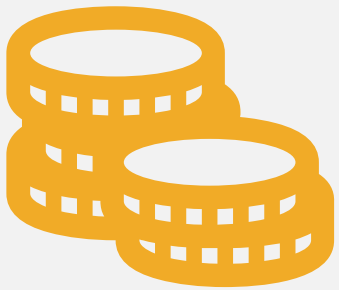
LGC risk is taken by the solar PPA provider (>100kW)

Not beneficial for small systems especially those under 100 kW

Ties customer to the PPA provider

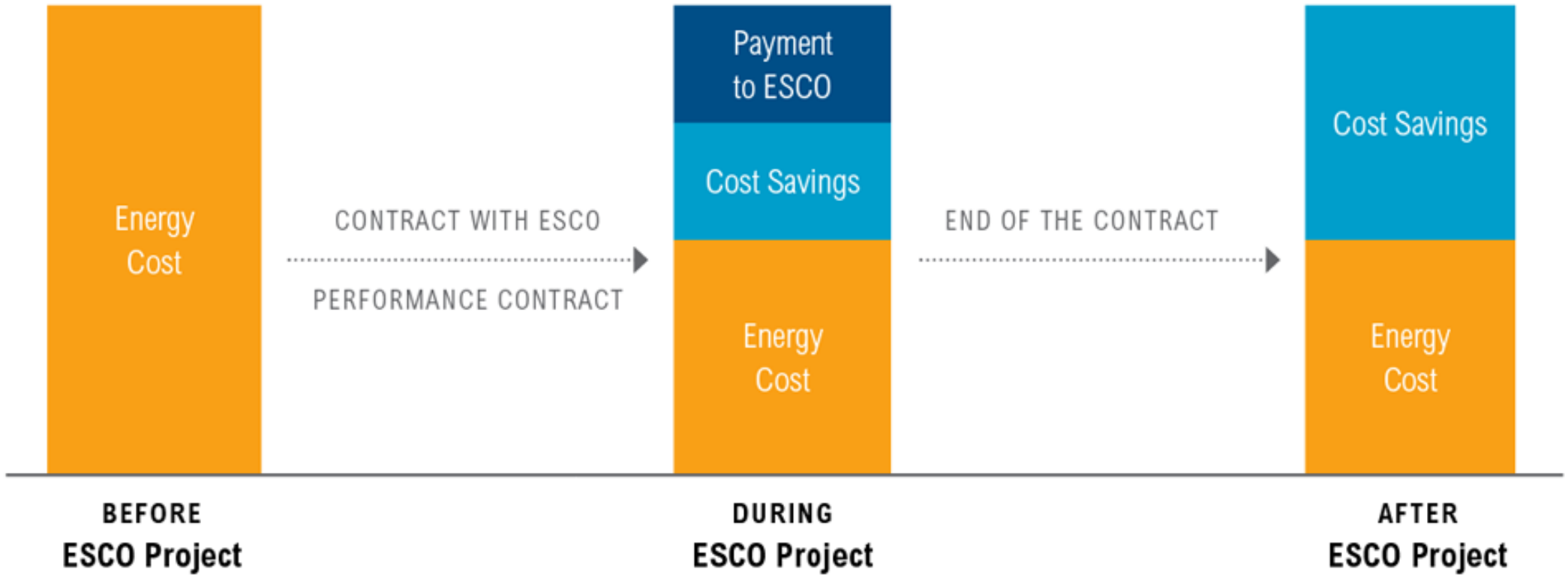
Higher cost in the long run for solar

10. Energy Performance Contracts (EPCs)



- An EPC is a contract between an energy service company (ESCO) and an organisation
- Under an EPC,
  - the ESCO is engaged to improve the energy efficiency of a facility
  - the ESCO examines a facility,
  - evaluates the level of energy savings that could be achieved,
  - then offers to implement the project and guarantee those savings over an agreed term
  - The guaranteed energy savings from the project pay for the capital investment required for the project

Energy Performance Contracts (EPCs)



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Impacts of establishing and maintaining financing from an EPC

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

Energy Performance Contracts (EPCs) – pros and cons

Upgrade aging and inefficient assets

Technical and financial risk borne by ESCO

Guaranteed savings reduces the risk of savings erosion over time

Require a large project above $500K to attract ESCOs

Not cost effective for addressing a single measure

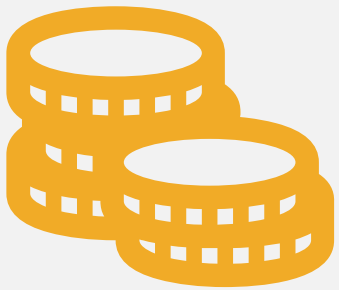
Establishing governance arrangements

Skills are being outsourced to another provider, no upskilling in the organisation

Energy Performance Contracts (EPCs) – City of Yarra Council Case Study

- The City of Yarra Council engaged Ecosave in a $3.3 million 10-year EPC
- 18 Council buildings involved
- Measurement and verification plan at all sites
- Measurement of baseline consumption of plant and equipment
- Proposed energy saving measures were installed
- After installation, actual consumption was measured over a 12 month period
- As a result, verifiable proof that the following outcomes were achieved:
  - Electricity savings: 160 MWh
  - Gas savings: 3,950 GJ
  - Carbon savings: 429.1 tonnes
  - Cost savings: $47,518

11. Community energy projects



- Community energy projects are usually either structured as a PPA or a community loan
- With a PPA,
  - renewable energy is developed and owned by the community,
  - The host buys the energy (example: Repower Shoalhaven)
- With a loan,
  - funds are raised from investors and lent to the host who builds and operates renewable energy projects.
  - The host repays the loan (example: Lismore City Council, Farming the Sun)
- Council could be host to a community energy project to develop solar projects in the local area

Impacts of establishing and maintaining financing from a community project

People resources to establish, upskilling

Setting up internal systems

Maintaining systems and skills

Community energy projects – pros and cons

Financial benefits returned to the community

Transfer of skills and knowledge of renewable energy to the local community

Raises the profile of Council

Shares the financial rewards with the community

Take a long time to set up

Financial benefits are not as great as compared to being funded from capital budget

Significant resources required to implement

Summary of financing options 1/2

	People resources to establish, upskilling	Setting up internal systems	Maintaining systems and skills
1. Existing/future incentives & grants			
2. Environmental levy/SRV			
3. Normal budgeting process			
4. Revolving Energy Fund			
5. Internal carbon price			
6. Loan-funded			

Legend:

Summary of financing options 2/2

	People resources to establish, upskilling	Setting up internal systems	Maintaining systems and skills
7. Equipment lease			
8. On-bill financing			
9. Onsite PPA			
10. Energy Performance Contracts			
11. Community energy projects			

Legend:

Remember: Financing options are not mutually exclusive


05
Integrating financing into your strategy

Method for integrating the financing with your sustainability strategy

Select financing options

- Pre-evaluate possible financing options and select shortlist
- How does each option relate to Council's current situation?
- Risks and opportunities of each option?
- Workshop with key stakeholders to determine best options
- Develop a draft pathway – determine when to finance what project
- Model scenarios based on different inputs

Finalise financing strategy

- Get feedback from leadership team
- Refine Council's preferred financing options and scenario modelling
- Develop a final pathway for implementation
- Get financing strategy adopted, if required

OPTIMAL FINANCING STRATEGY FOR LOCAL GOVERNMENTS, © 100% RENEWABLES

01

FREE MONEY

Grants and incentives

02

INTERNAL FINANCING

Money with low opportunity cost. From budget, REF, carbon price

03

COUNCIL BORROWS

Typically for capital-intensive projects. Low interest finance

04

THIRD PARTY

Higher financing costs. Lease, EPC, PPA, community energy

Need help with developing your Financing Strategy?

- How does each option relate to your current situation?
- What are the risks and opportunities of each option?
- What are the financial outcomes of the various funding options?

100% Renewables is specialised in helping our clients develop business cases and model financial outcomes over a specific timeframe.

If you need help with shortlisting financing options, preparing a workshop or presentation for your senior management, or with modelling different funding options, please talk to us.

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