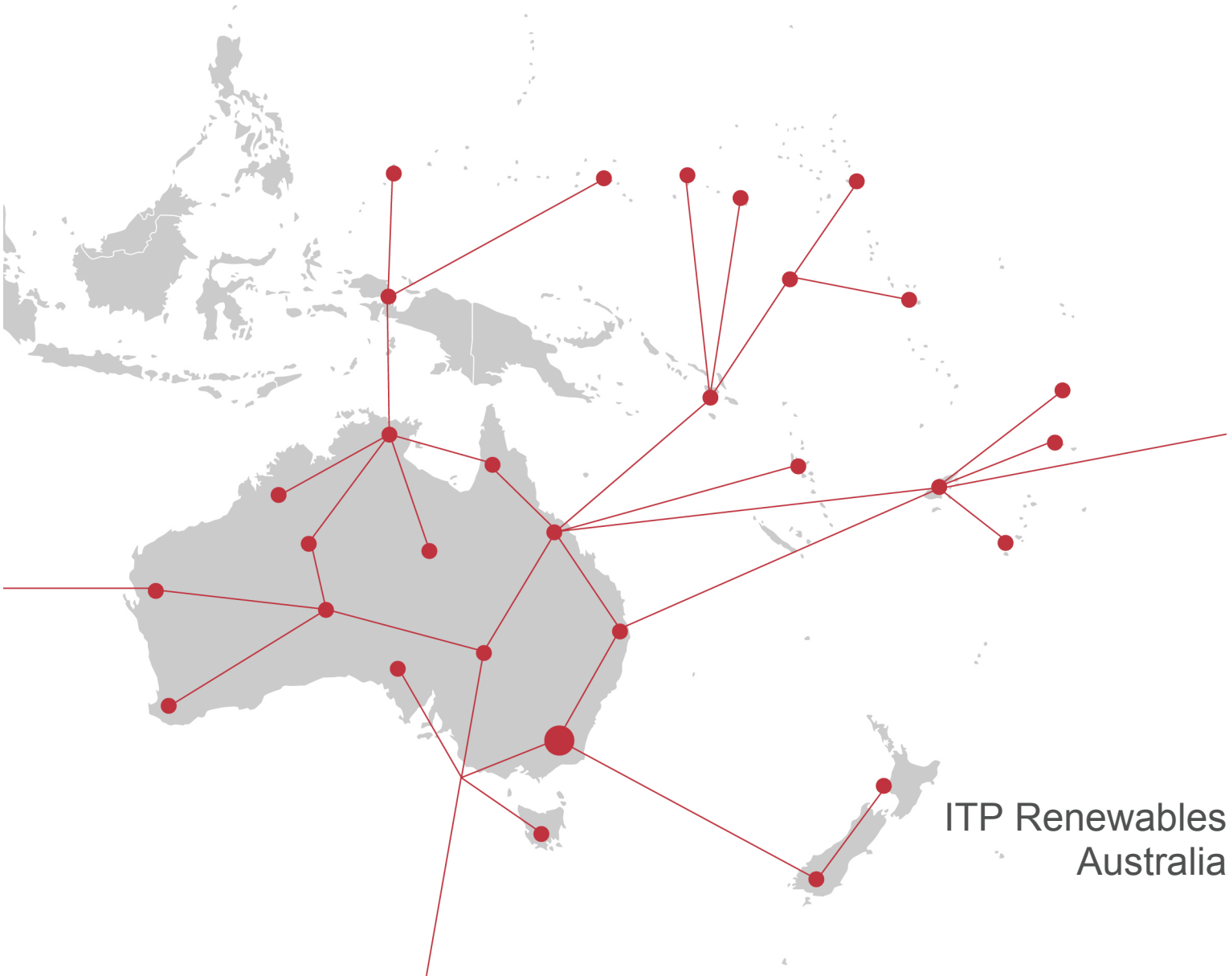
ACHIEVING 100% RENEWABLE ELECTRICITY IN NOOSA

For Zero Emissions Noosa

October 2018



ITP Renewables Australia

About ITP Renewables

Global leader, local expertise

ITP Renewables is a global leader in renewable energy consulting and project management, and has undertaken a wide range of projects, including grid-connected renewable power systems, providing advice for Australian and international government policy, feasibility studies for large grid and off-grid power systems, developing micro-finance models for community-owned power systems in developing countries and modelling large-scale power systems.

We are proud to be part of the international IT Power Group, one of the world's largest, most respected and long-standing specialist renewable energy engineering consultancies. We work with our clients at the local level to provide a unique combination of experienced renewable energy consulting, engineering and implementation.

The staff at ITP have backgrounds in renewable energy and energy efficiency, research, development and implementation, managing and reviewing government incentive programs, policy analysis and research, carbon markets, engineering design and project management. We work with our clients at the local level to provide a unique combination of experienced renewable energy consulting, engineering and implementation.

Specialised solar capability and services

We specialise in analysing, designing and implementing solar photovoltaics (PV) projects and programmes. For medium-scale to MW-scale ground mount systems, we provide design, owner's engineer and independent engineer services, project and construction management, engineering, procurement and construction (EPC) management, and due diligence assessment.

Energy storage services

We specialise in battery performance testing and analysing and implementing PV/battery projects and programmes. For 35 years we have been specifying battery energy storage to optimise the design of remote PV diesel hybrid mini-grids and PV/battery systems all around the world. Recently, with rapidly falling battery prices, we have extended this expertise to on-grid applications, now typically using lithium-ion battery technologies.

Mini and microgrid services

ITP has designed, managed, installed or commissioned microgrids (and minigrids) across the Pacific and in Australia over the past 13 years. We are industry-leading experts in the microgrid market, having been at the forefront of its development internationally and in Australia. Our end-to-end services encompass the full spectrum of a microgrid project, from feasibility studies through to construction and operation.

http://www.itpau.com.au

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Centre for Energy and Environmental Markets

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LIST OF ABBREVIATIONS

AEMO	Australian Energy Market Operator
APVI	Australian PV Institute
ATA	Alternative Technology Association
COREM	Community-Owned Renewable Energy Mullumbimby
CORENA	Citizens-Own Renewable Energy Network Australia
GW, GWh	gigawatt, gigawatt hour
ITP	ITP Renewables
kV	kilo volt
kW, kWh	kilowatt, kilowatt hour
LET	Local Energy Trading
LGA	Local Government Area
LGC	Large Generation Certificate
LRET	Large-scale Renewable Energy Target
MW, MWh	megawatt, megawatt hour
NEM	National Electricity Market
NEMO	National Electricity Market Optimiser
NSW	New South Wales
PPA	Power Purchase Agreement
PV	photovoltaics
Qld	Queensland
RE	renewable energy
RET	Renewable Energy Target
SRES	Small-scale Renewable Energy Scheme
STC	Small-scale Technology Certificate
SWH	solar water heater
UNSW	University of New South Wales
ZEN	Zero Emissions Noosa
ZS	zone substation

What's a Watt?

Throughout this report we talk about kW and kWh, MW and MWh and even GW and GWh – so what does it all mean?

A watt-hour is the amount of electricity used by an appliance that uses 1 watt for 1 hour. So for example, a compact fluorescent light might have a power rating of 10 watts, so using it for 1 hour would use 10 watt-hours of electricity.

On your electricity bill, your electricity use will be measured in kWh (or kilowatt hours). A kWh is one thousand watt-hours. This would be the same as using the 10W light for 100 hours, or using an electric kettle (generally around 2kW) for only half an hour.

A MW (megawatt) is one thousand kWs, and a GW (gigawatt) is one million kWs. Similarly, a MWh is one thousand kWhs and a GWh is one million kWhs.

EXECUTIVE SUMMARY

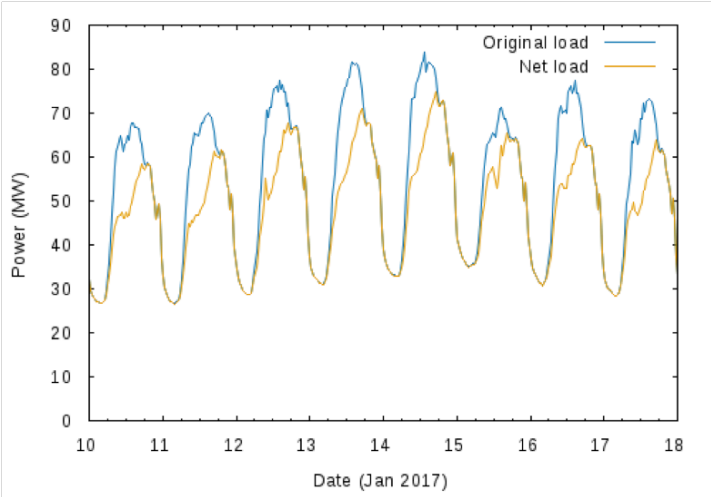
This report was commissioned by the not-for-profit group Zero Emissions Noosa Inc. (ZEN), with funding from the Noosa Biosphere Reserve Foundation. ZEN will draw upon the findings and recommendations of this report to develop strategies and programs for implementation. This report firstly reviews the electricity use and existing renewable energy generation in Noosa. It then models some possible mixes of electricity generation and energy efficiency required to achieve ZEN's 100% renewable energy target by 2026. It describes a range of available options that may be suitable for driving increased uptake of renewable energy, then recommends specific actions that can be taken in Noosa, with a special focus on those driven by the community. It concludes with a discussion and a list of recommended actions.

Electricity use

In Noosa Shire approximately 312,500 MWh of electricity was drawn from the Queensland grid in 2016/17, with about another 41,300 MWh from distributed PV. The highest demand peaks occur in summer. About 56% of the electricity is used by households, with the remainder used by business and industry.

Existing renewable energy

As at May 2018 there was about 29 MW PV installed in Noosa Shire, of which about 8,050 systems were most likely residential, and about 145 were most likely commercial. Thus, about 35% of suitable dwellings have PV (with an average residential system size of about 3.25kW), and about 4.7% of businesses have PV (average ~20 kW). This figure shows the total Noosa load profile in a typical summer week, where the orange line shows the electricity drawn from the Queensland grid, and the blue lines show what the load would have been if it hadn't been for the existing PV systems.



Modelling Renewable Energy Scenarios

Two scenarios were developed for 2026.

Scenario 1 Base Case: represents a fairly modest uptake of additional 'behind the meter' renewable energy and energy efficiency options based on the continuation of BAU levels of uptake. EV use increases to 10%. The net result is that a greater amount of large-scale PV (119 MW), or large-scale wind (85 MW), is needed to reach 100% renewable electricity.

Scenario 2 Stretch: represents a realistic but ambitious level of uptake of renewable energy and energy efficiency, and 20% uptake of EVs. In this case only 67 MW of large-scale PV, or 48 MW large-scale wind, is required to reach the 100% target.

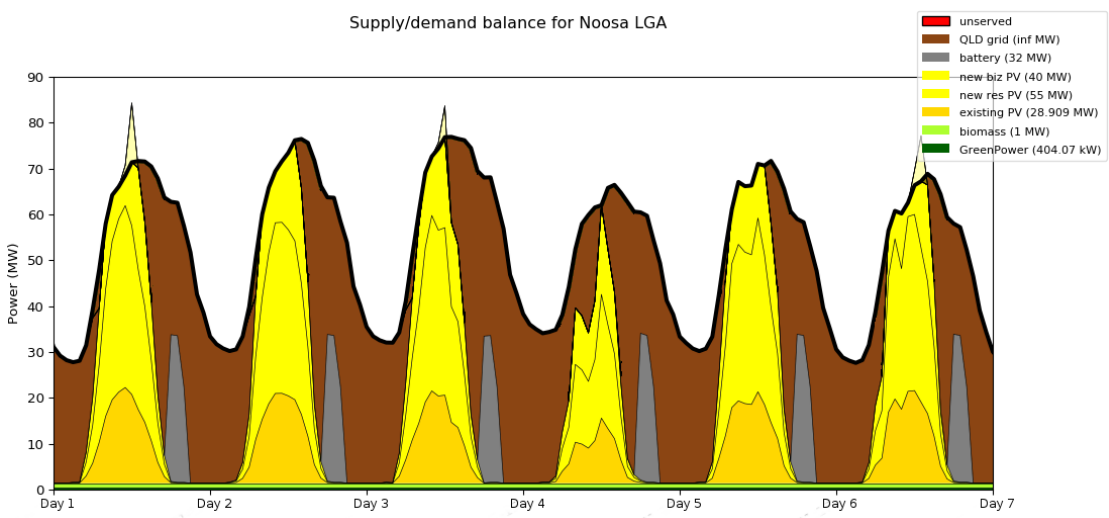
The table below shows the final capacity of each type of generator in 2026.

Capacity of each type of generator in 2026

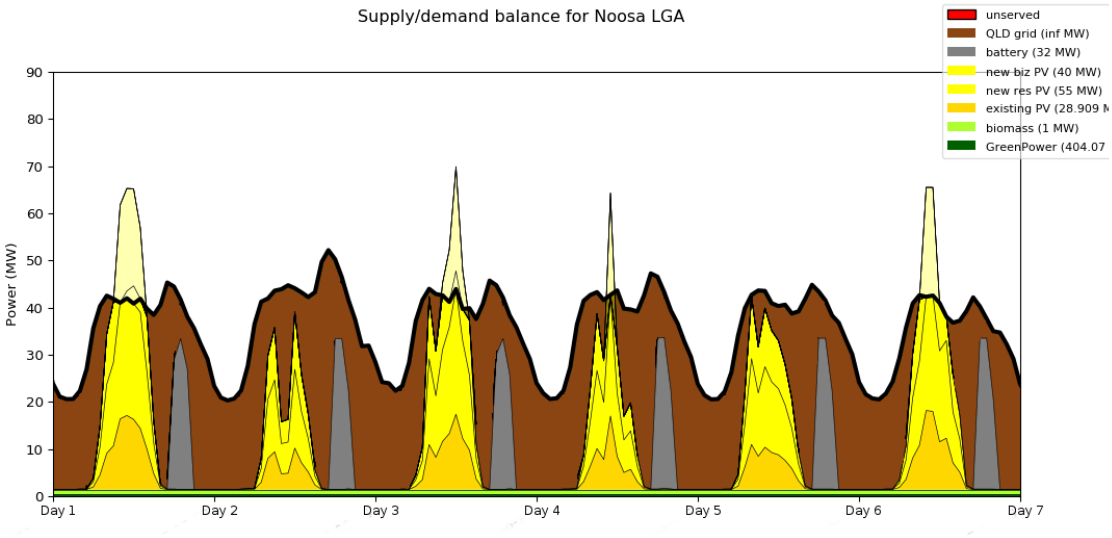
	Base case (MW)	Stretch (MW)
Existing PV	28.9	28.9
New residential PV	22	55
New commercial PV	28	40
New ground-mount PV/wind	119/85	67/48
Bioenergy	0	1

The following charts show the electricity generation from the mix of renewable energy technologies for the Stretch Scenario. The week of the summer demand peak and the week of the winter demand peak are shown. Each of the colours represents a different technology (or category of technology such as residential or commercial PV). The slightly thicker black line shows the level of demand, and where generated electricity is exported, a paler version of the technology's colour is used. In the charts below, 40% of households installed 5kW, 8kWh useable capacity batteries, which discharge in the evening, shown in grey. The brown areas represent electricity imported from the Queensland grid each night. The large-scale ground mount PV and wind farms have not been included in the charts because there is not enough space to build them in Noosa, they may also face public opposition because of visual impacts, and there are much better wind resources elsewhere.

Although the load is higher in summer, this is matched by higher PV generation. However because almost all the renewable electricity comes from solar PV, a significant amount of electricity is still drawn from the Queensland grid over night. At this level of PV uptake, even without large-scale PV, there is reverse power flow back up through the zone substations into the Queensland grid. The use of batteries reduces this effect, as would shifting night time loads such as water heating to the middle of the day to be used as a solar sponge.



Mix of RE Technologies, Noosa LGA, 2026 – Stretch Scenario, Indicative Summer Peak



Mix of RE Technologies, Noosa LGA, 2026 – Stretch Scenario, Indicative Winter Peak

Available Options

There are many different options to enable uptake of renewable energy. The emphasis of this report is on identifying new business opportunities that the community can develop. This means they should be both commercially available and readily deployable. As a result, solar PV and solar water heaters were assumed to be the predominant technologies (as they are now), although there may of course be some uptake of small-scale wind and small-scale hydro. Solar PV also has very short payback times (around 4 years for residential, and 3 to 5 years for commercial-scale, see Tables A and B), and has no moving parts and so is very reliable and requires very little maintenance. Large-scale PV and wind projects are currently being built in Australia and are reporting generation costs at less than $80/MWh, making them viable in their own right.

Table A Likely Financial Outcomes for a 5 kW Household Solar PV System

	Value
Installed cost	$5,500
Annual generation	6,850 kWh
Retail tariff	27c/kWh
Export tariff	9.5c/kWh
Amount of export	40%
Annual income	$1,370
Simple Payback Time	4 years
Simple Rate of Return	25% pa

Table B Likely Financial Outcomes for a 30 kW Commercial Solar PV System

	Value	
Installed cost	$30,000	
Annual generation	41,000 kWh	
Retail tariff	17.5c/kWh (with demand charges)	17.5c/kWh (with demand charges)
Export tariff	8c/kWh	
Amount of export	20%	
Annual income	$6,400	$10,500
Simple Payback Time	4.7 years	2.9 years
Simple Rate of Return	21% pa	35% pa

This report includes a brief description of the following options, and a more detailed description of specific programs recommended for Noosa is then provided below.

- Bulk buys
- Solar $aver programs
- Social Housing programs
- Solar Power Purchase Agreements and Solar Leasing arrangements
- Ways to overcome the split incentive barrier for landlords & tenants
- Community-owned Renewable Energy Projects – both donation based and investment based
- Local Energy Trading

Information & Education

Noosa Shire Council is well placed to be a reliable source of information to the community for both energy efficiency and renewable energy, and Zero Emissions Noosa can do this via its www.repowernoosa.com website. As well as reducing energy use, energy efficiency can help integrate renewables into household and business load profiles, and demand side management can be used to shift and reduce evening loads – thereby increasing the level of local energy self-sufficiency.

There are a number of reasons that energy efficiency is not taken up as much as it could be: lack of interest; lack of time to investigate the options; lack of good information; although the payback is high, the total amount of money saved can be quite low, and so not worth the effort; the split incentive problem (where a landlord would have to pay for the energy efficiency but the tenants get the benefit); for larger items such as SWHs the upfront cost may be too high; etc. Thus, the provision of information is necessary but not sufficient to maximise uptake.

Energy efficiency options for the future include:

Information

- Full-page newspaper spreads that provide simple tips for ways to reduce energy use, along with links to useful sources of information
- Online Energy Info Hub: A Noosa-specific website of the most relevant information

- A Community Energy Information Hub, where people can get authoritative impartial advice

Community Engagement

- ATA's Sustainable House Day: where people can open up their sustainably designed homes to the general public.
- Energy Assessors that can carry out home energy audits, and give talks at events and to local community organisations.
- A pledge, competition or community workshop for ideas to drive energy efficiency
- Noosa Energy Saving Challenge: a competition run by ZEN or Noosa Council to see who can reduce their energy use the most
- Repower Programs: where an entire street undertakes energy education, energy efficiency and renewable energy actions in order to maximise cooperative benefits.

Solar water heaters and heat pumps

- Bulk buys
- Pamphlet at point of sale on how to operate a SWH
- Information on how to choose a SWH of the correct size, type
- Training of SWH installers on what customers really want

Renewable energy options for the future, in addition to the above, include:

- Financial assessment tools such as the APVI's SunSPot and the ATA's Sunulator: which are free online tools for estimating the potential for electricity generation from PV on building roofs.
- Information booklets such as the 'Guide for Installing Solar PV for Households' and the 'Guide for Installing Solar PV for Business', both produced by the Clean Energy Council, and the 'Home Solar Battery Guide'.

Projects Proposed for Noosa

Following consultation with Zero Emissions Noosa, the broader community, Noosa Council and Tourism Noosa, the following proposals are made for Noosa. It is unlikely that ZEN currently has sufficient resources to implement these proposals, and so their success is dependent on ZEN obtaining dedicated funding.

1. Residential: Solar Bulk Buy, Solar $avers and Landlord/tenant agreements
2. Commercial-scale: Multi-site Feasibility Studies, and Solar Lease Arrangements, Environmental Upgrade Agreements, embedded networks.
3. Government buildings: Solar for Schools
4. Large-scale PV: Different legal structures for community ownership
5. Community Ownership: RePower Shoalhaven's CORE model

Residential

Household PV systems should be available for around $1,000/kW in Noosa. They should pay themselves off in about 4 years.

Solar Bulk Buy

This is a tried and tested approach used to 'bulk supply' solar systems, and more recently batteries and solar water heaters, at a reduced price. Although the margins for installers are lower, this is compensated by there being more installations. Their other advantages include the provision of reliable information from a trusted source such as a council or local community group, the use of quality local installers, and the inclusion of public benefits such as direct financial contributions or a solar system to

particular community groups. Both a higher end PV system and a cheaper option should be made available, and there may be a need for optional microinverters or power optimisers, which are more expensive but help a PV system to maintain it's output despite shading. Batteries and solar water heaters could also be considered. All options should have good warranties. The community should be consulted on what sort of community benefit they would like, and local community organisations' networks should be used to spread the word.

Solar $avers

With the Queensland government conducting its Sunny Savers trials, there is no reason that Noosa Council couldn't initiate their own Solar $avers program. Any of the three purchase options currently being trialled under Sunny Savers could be used, or possibly one of the local installers' current finance offerings.

Landlord/tenant agreements

A significant problem for the uptake of solar PV on tenanted premises (both residential and commercial) is the split incentive barrier. This is where the building owner has little incentive to install solar because the tenant will receive the benefits (assuming they pay their own electricity bills). Information on the various ways to overcome this problem are expected to be included in the 'Landlord Toolkit' that ZEN is having developed as part of the Repower Noosa project funded from Council's Economic Development Fund. We have also provided a simple Memorandum of Understanding that can be used to establish an agreement between the tenant and the landlord.

Commercial-scale

Commercial PV systems should be able to be installed at the same cost, or less, than residential systems. Because the commercial load profile is well matched to solar output, more of the electricity is used on-site and so avoids the purchase of electricity from the grid at the full retail rate. One complication for this is that larger customers may be on demand charges, which PV may not reduce, however even in this case the returns are still favourable. Another complication is that some community organisations may use little electricity during the day, in which case a much smaller system would be advisable.

Multi-Site Feasibility Studies

All commercial/industrial sites have significant daytime loads and large amounts of roof space. However, they may have limited time and lack the expertise to explore the possibility of solar and to assess proposals. A two-stage approach could be used to assist these businesses. The aim is to help the businesses to decide whether to install, and to ensure that they end up with a high quality system at a good price. The costs of each of these stages could be paid through a grant or by participating businesses.

The first stage would involve a 'Multi-Site Feasibility Study' that would assess the viability of solar for these businesses *en masse*. This would result in a separate assessment for each business that would detail: the recommended system size, the installed cost, the estimated annual generation and simple payback time, and a brief description of any relevant issues such as shading or roofing restrictions. Sites could also be given the option of a more detailed assessment including load monitoring, and/or an energy audit, which could be provided at an additional cost or incorporated into the Ecobiz program. The second stage would be to help interested businesses to install an appropriate solar PV system, which involves using a third party to call for tenders for installers and an assessment of those tenders, and then quality assurance on the completed installations.

Solar PPAs and Lease Arrangements

Solar PPAs and Solar Leases may be suitable for businesses in Noosa, and could even be offered by Noosa Council to its commercial and community tenants. However, before putting too much effort into these options it would be wise to survey business interest.

Environmental Upgrade Agreements

EUAs can be used to overcome the split incentive problem for commercial premises, but legislative changes will be required for them to be implemented in Queensland.

Embedded networks

Embedded electricity networks may be suitable for industrial estates, apartment blocks, retirement villages or caravan parks in Noosa, and can be used to reduce electricity costs and improve the financial returns from solar. However, developing an embedded network is not a trivial task, and so would need to be assessed on a case-by-case basis. Initially, we recommend that some sort of survey/audit is used to identify areas that do have an embedded network, as well as others that may be interested in having one.

Solar for Schools

Schools and the wider education sector represent a good opportunity to install solar systems. They can be installed with an online descriptive live data interface, and be combined with relevant curricula material that allows school children to understand how and when electricity is being produced and used. Most of the Noosa government schools should be included in the Queensland government's Advancing Clean Energy Schools program which is expected to commence in the latter half of 2018. Of course, It may be possible for the government schools who are not included in the ACES program to acquire solar systems themselves. Brisbane Catholic Education Queensland is undertaking two pilot programs with schools within the diocese, with the intent being to roll the program out to all schools in the diocese once the pilots have been evaluated, refined and the benefits proven. Zero Emissions Noosa is also developing a brief for a campaign to focus on the wider educational sector.

Large-scale

There are very few opportunities for large-scale renewable energy generation within Noosa Shire, and so any significant large-scale development will need to be outside Noosa. There are a number of solar and wind farms currently being built in Queensland, including the SolarQ proposal, which is relatively nearby. We have described three different approaches to community ownership of large-scale renewable energy projects, and the most promising approach for Noosa appears to be the approach taken at Sapphire Wind Farm, where shares will be made available for community ownership of a portion of the wind farm.

Community ownership

Community-Owned Renewable Energy (CORE) projects can be either donation-based or investment-based. With donation-based projects, the community provides funds as loans that are then repaid from savings in electricity bills. The repayments go into a revolving fund that can then be used to finance more projects, and so on. Investment-based projects can have a number of different legal structures (as discussed in the main report), and here ITP recommends that RePower Shoalhaven's CORE model be used (or the Farming the Sun approach). Each involves a proprietary company limited by shares being established for each solar system (or group of solar systems). Once a specific project has been identified, businesses, community organisations and public schools can use their own networks to make the project known to the public.

Discussion and Recommendations

To increase the uptake of renewable energy in Noosa it is important to create an environment where local people and businesses wish to invest. Although the vast majority of renewable generation will be from solar PV, energy efficiency and demand side management are very important.

The installation of 1 MW of solar PV (for example through two hundred 5kW systems through a solar bulk buy, or ten 100 kW systems through the Multi-site Feasibility Study approach) would create about 20 jobyears of direct employment in Noosa. A single large-scale ground-mounted PV system would create slightly less employment. 1 MW of solar PV would also generate about 1.37 GWh of renewable electricity each year, which would avoid about $85,000 leaving Noosa each year (as the generation component of peoples' electricity bills.

The following lists the major recommendations from this project. They are not listed in order of importance, but in the order in which they appear in this report.

Recommendations

1. Energy Info Hubs

The Repower Noosa website will host information using a 'funnel' approach to direct enquirers to information most relevant to their circumstances, and video testimonials relevant to installing solar PV. This could also link to online tools such as the Solar Potential Tool and the Sunulator. Noosa Council may also wish to establish a shop front drop-in centre, from which Energy assessors could operate.

2. Solar bulk buy

A solar bulk buy could be coordinated according to the process outlined above. It should have both a standard and higher-end option, use local installers, provide a community benefit, and could include batteries and SWHs.

3. Solar $avers

Noosa Council could pursue its own Solar $avers program – drawing on the experience of the various Victorian councils who have run this type of program, as well as the Sunny Savers program being run by the Queensland government.

4. Solar for Rentals

Information regarding the various options to overcome the 'split incentive barrier' are expected to be included in the 'Landlord Toolkit' that ZEN is having developed as part of the Repower Noosa project funded from Council's Economic Development Fund.

5. Solar Access Rights

Noosa Council could develop a firm policy on how to address the issue of overshadowing of what could be a significant financial investment in solar PV or SWHs

6. Multi-Site Feasibility Study

ZEN or Council could coordinate a Multi-Site Feasibility Study to help businesses obtain solar. The first stage would involve a high level assessment of the viability of solar at each business. The second stage would involve a call for tenders for installers and an assessment of those tenders, then quality assurance of the completed installations.

7. Solar PPAs and Leases

As a first step, businesses and Council could be surveyed to assess their interest in these options. If there is sufficient interest, this list could simply be made available to solar installers, or a Multi-Site Feasibility Study approach could be taken.

8. Environmental Upgrade Agreements

Noosa Council either undertake an investigation into whether EUAs may require legislative changes in Queensland, or lobby the state government to do this themselves

9. Embedded Networks

A survey/audit could be used to identify areas that have embedded networks, as well as their potential interest in installing solar. The outcomes of the survey/audit could be used to attract businesses who specialise in establishing and operating solar embedded networks.

10. Solar for Schools

ZEN could assist government schools with the Queensland government's Advancing Clean Energy Schools program to acquire solar systems. This support should be extended to any government schools who are not included in the ACES program, as well as any non-government schools and the wider educational sector.

11. Community organisations

Noosa council should complete the audits to be undertaken in conjunction with the Queensland government's EcoBiz program, and then implement the recommendations.

12. Large-scale solar

ZEN could explore the different approaches to community ownership of large-scale renewable energy projects, especially the approach taken at Sapphire Wind Farm.

13. Community-Owned Renewable Energy

ZEN could facilitate the development of community-owned renewable energy projects where appropriate. For all but the large-scale solar projects, this would most likely use either the RePower Shoalhaven model or the Farming the Sun model, and ideally be with the assistance of these organisations.

During the preparation of this report, and partly in response to it, Zero Emissions Noosa has developed briefs for a number of campaigns that are either underway or in the planning process. These campaigns localise the use of the tools recommended here and include Noosa Education Campaign, Solar for Low Income and Renter Households, Cooran Earth Rights Partnership, Local Large-scale RE Generation, Major Consumers, Tourism Noosa Campaign, Repower Noosa Business, Noosa Community Buildings, Academic ZEN, and Repower Noosa industry cluster. More details can be found here https://www.repowernoosa.com/programs, and in Appendix C.

TABLE OF CONTENTS

1. INTRODUCTION

1.1. Background

Over the last five to ten years the cost of renewable energy (RE) technologies, in particular solar photovoltaics (PV), has declined significantly. Solar PV is a modular technology, meaning it can be deployed at any scale, from smaller household systems commonly up to 15 kW, through systems suitable for a local business, to large-scale ground-mounted systems that range from 100 kW to tens or even hundreds of MWs.

The suitability of PV for smaller systems has opened up opportunities for individuals and communities to generate their own electricity. More recently, the price of batteries has declined significantly, and there has been progress in the development of energy management systems, which allows PV, batteries and other technologies such as solar water heaters to be integrated into effective distributed energy systems.

Other renewable energy technologies such as wind, hydro, bioenergy, tidal and wave power have also seen advances, with wind and hydro available as smaller-scale options suitable for household and community distributed energy.

These technologies have a number of benefits beyond financial savings. They create local employment, which can occur directly when they are installed, as well as indirectly because less money leaves the community in the form of electricity bills – meaning that more money remains to circulate through the local economy, which creates additional employment.

They can also provide local resilience, where the integration of batteries can provide support to the electricity network during times of peak demand, and maintain power supplies in the event of loss of the network. This is not only more convenient but can be critical in times of emergency response.

1.2. This Report

Zero Emissions Noosa, Inc (ZEN) is a not-for-profit group formed in 2016 with an identified goal of net zero community carbon emissions by 2026. That goal is to be achieved by working in collaboration with individuals, families, community groups, business and educational institutions. Zero Emissions Noosa has received funding from the Noosa Biosphere Reserve Foundation for the project Roadmap to Achieving 100% Renewable Electricity for Noosa Shire. The aim of this project is to identify the most efficient and cheapest mix of renewable energy and energy efficiency measures needed to eliminate all carbon dioxide emissions arising from electricity consumption in the Noosa Shire by 2026. ZEN will draw upon the findings and recommendations of this report to develop strategies and programs for implementation through such collaboration. In the context of this report, the term Renewable Electricity refers to electricity that is generated from renewable sources.

This Report aims to form the foundation of ZEN's endeavours for renewable electricity and is divided into the following Sections:

Section 2 (Current Electricity Grid, Use & Solar) characterises the existing electricity grid and the total amount of electricity used in Noosa Shire as well as the current renewable energy generation in the region.

Section 3 (Modelling Renewable Energy Technology Options) describes the modelling undertaken to characterise the possible mixes of electricity generation and energy efficiency required to achieve ZEN's 100% renewable energy target by 2026.

Section 4 (Available Options) then discusses the range of business models and other approaches which may be relevant for increasing renewable energy in Noosa. These range from ways to drive uptake at the household level through to larger-scale options.

Section 5 (What Can Noosa do?) then recommends specific actions that the local community and Noosa Council can undertake. After discussing how the provision of information can be used to drive uptake of both energy efficiency and renewable energy, it proposes specific options that can be used to enable uptake of residential-scale renewable energy, then commercial-scale, then large-scale and some opportunities for community ownership.

Section 6 (Discussion & Recommendations) then concludes the report by summarising the main outcomes and actions suggested for Noosa.

2. CURRENT ELECTRICITY GRID, USE & SOLAR

Electricity is provided to the Noosa Local Government Area (LGA) via transmission lines through zone substations and then through the distribution network. It is also provided by solar PV systems located on the distribution network. Figure 1 shows the Energex map of the Noosa area with the Zone Substations (ZSs) and the 132kV down to 33kV lines. Figure 2 shows a Google Maps view of the Noosa area with the locations of the lines down to 415V.

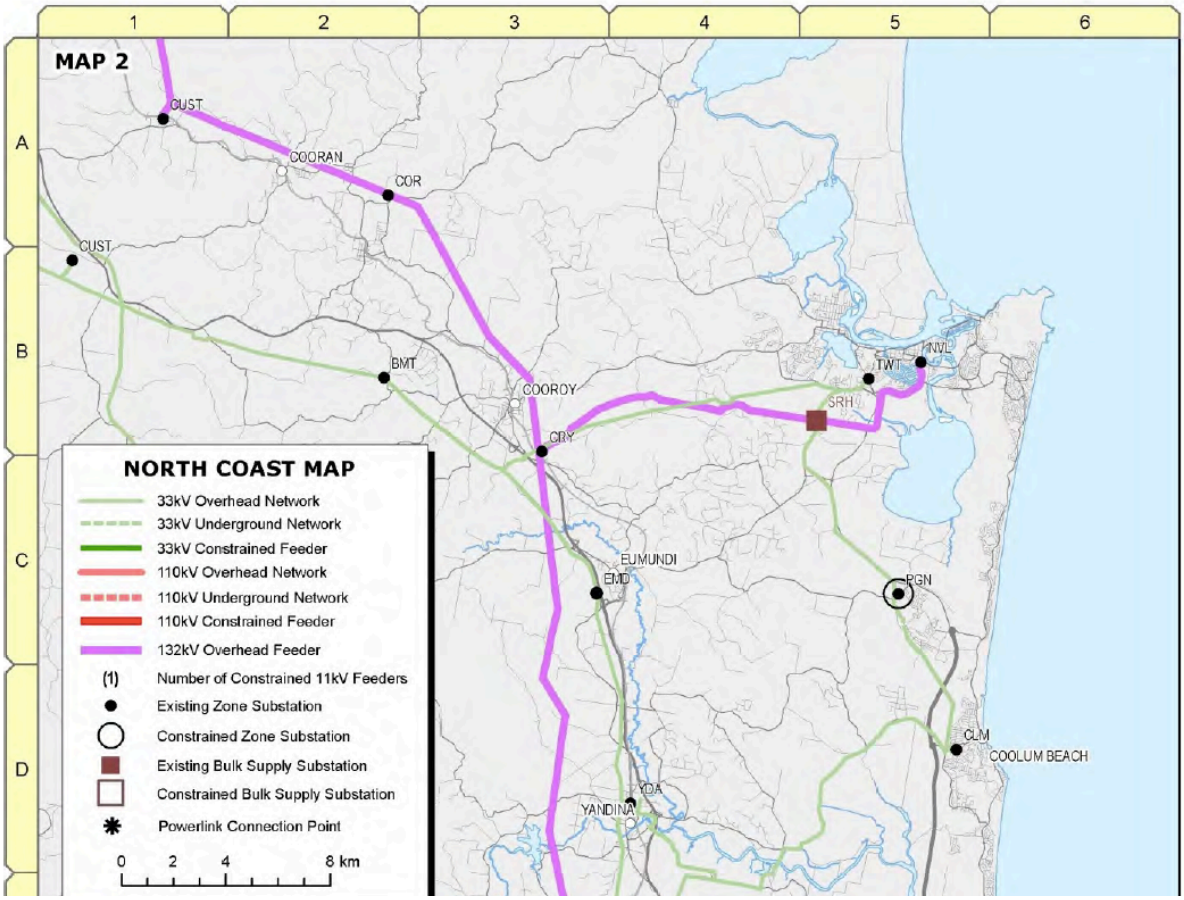


Figure 1. Energex map of the Noosa area

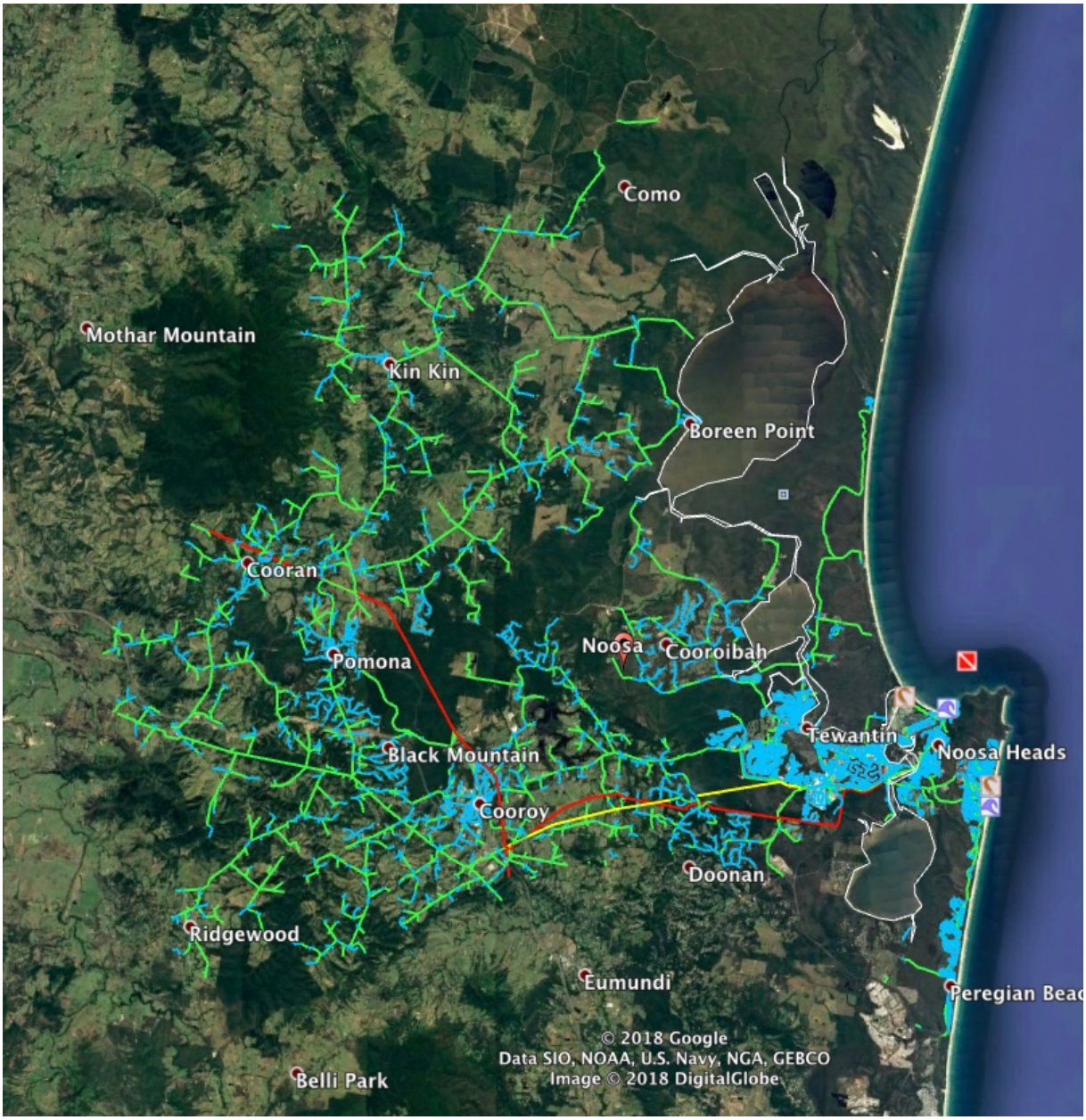


Figure 2. Types of Electricity Lines in Noosa area

Red = 132kV, Yellow = 33kV, Green = 11kV, Blue = sub 11kV

2.1. Electricity Use

The current electricity use in Noosa LGA according to Energex is 312,463 MWh, consisting of 173,091 MWh from the residential sector, 136,722 MWh from business, and 2,650 from streetlighting. The aggregated annual demand profile is shown in Figure 3. It can be seen that the highest peaks generally occur in summer, although there is a solid level of demand in winter.

Households make up about 56% of electricity use in Noosa,[1] with the remainder used by business and industry. There were 26,776 households in Noosa LGA in 2016,[2] and so each house, on average used about 15.71 kWh/day), which is very slightly higher than the South-East Queensland average of 15.37 kWh/day.

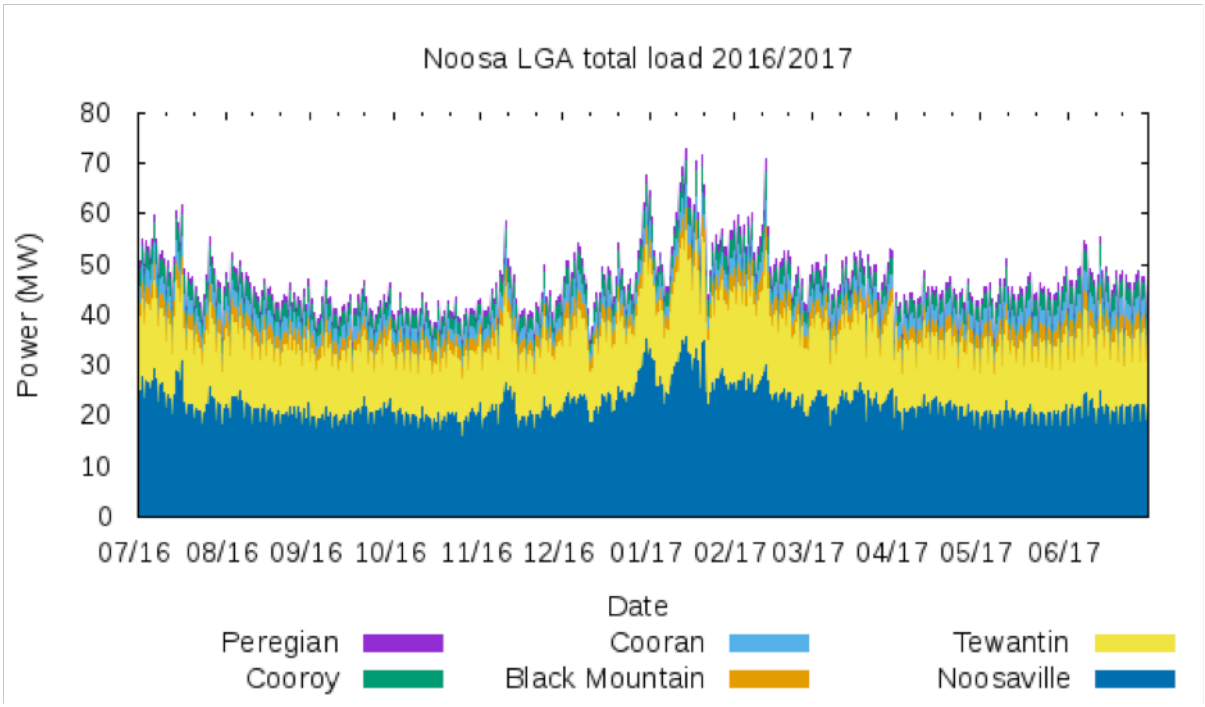


Figure 3. Noosa LGA Annual Demand Profile for 2016/2017

2.2. Existing Distributed Generation

Solar PV is by far the most prevalent form of distributed generation in Noosa LGA. According to the Clean Energy Regulator database there are no registered small wind or microhydro systems in Noosa. Solar PV reduces the amount of grid electricity used (by reducing the amount of electricity that is transmitted through the ZSs above). Therefore, to obtain the actual underlying electricity demand for the modelling, each half hourly period of electricity use was increased by the estimated amount of PV generation.

According to the Australian PV Institute Solar Map[3], as at May 2018, there was 28,909 kW PV installed in Noosa LGA. This consisted of 8,031 systems[4] (26,064 kW) that were less than 10 kW in size (generally assumed to be residential systems), and 145 (2,845 kW) in the 10 kW to 100 kW size range (generally assumed to be commercial systems). Although there are about

[1] From https://www.energex.com.au/about-us/our-commitment/to-our-customers/connecting-with-you/data-to-share

[2] 2016 Census, ABS.

[3] http://pv-map.apvi.org.au/historical#10/-26.3156/152.9681

[4] To calculate the number of systems we have used the postcode to LGA conversion method discussed in Section 3.1.2.

26,766 dwellings in Noosa LGA, only about 23,263 of these are considered to have suitable roof space for PV and solar water heaters (SWHs).[5] Thus, with 8,031 PV systems in the sub 10 kW size range, about 35% of suitable dwellings had PV, and the average residential system size was about 3.25 kW. With an estimated 3,057 businesses in Noosa LGA, about 4.7% of them had solar PV, with an average size of about 20 kW. See Table I.

Table I Solar PV Systems in Noosa LGA (May 2018)

	Residential (up to 10kW)	Commercial (10-100kW)	Total
PV Systems	8,031	145	8,176
PV Capacity	26,064 kW	2,845 kW	28,909 kW
Percentage with PV	35%	4.7%	
Average size	3.25 kW	20 kW	

Electricity generation by distributed PV was calculated by taking the average hourly generation of typical rooftop PV systems within Noosa LGA.[6] This was then scaled according to the number and size of PV systems to produce an estimate of the hourly generation over a year. The same approach was used for future installations of behind the meter PV (household and businesses) for each Scenario. The generation from in front of the meter (ground-mounted large-scale PV) was modeled using Australian Energy Market Operator (AEMO) PV traces for the area, which generates PV output data for a modeled single axis tracking ground mount PV system.

Thus, these PV systems generated an estimated 41,300 MWh of electricity in 2016/17, and so the real underlying electricity used in Noosa LGA was about 353,964 MWh (and so PV generation was about 11.7% of this underlying demand). To illustrate the impact of PV on the daily load as seen by the substations, Figure 4 and Figure 5 show an average week in summer and winter respectively showing the load as seen by the substations (Net load, orange) and what the load would have been if it hadn't been for the existing PV systems (Load, blue). The highest peaks in summer are most likely due to a combination of higher visitor numbers and air conditioning load, and are slightly reduced by solar. The small spikes visible in the winter evenings are when the off-peak load is activated.[7] Although there is also likely to be some small-scale wind turbines and micro-hydro, they were not included in the baseline adjustment because they would have a negligible effect.

The current Renewable Power Percentage under the Federal Large-scale Renewable Energy Target for Australia is 16.06%. Thus, when the electricity generated by local solar PV is included, it can be said that Noosa LGA has a higher percentage, with just over 26% of the electricity

[5] Derived from the 2011 Census, and the APVI Solar Map.

[6] PV data was sourced from publicly available PV performance database, PVOutput.org.

[7] Off-peak load is generally for water heating and is activated remotely.

currently used being renewable. However, very little of that 16.06% is currently generated in Queensland, with only 1.42% of the grid electricity used in Queensland in 2015/16 being renewable. Thus, it can also be argued that only around 12-13% of the actual electricity used in Noosa is currently renewable.

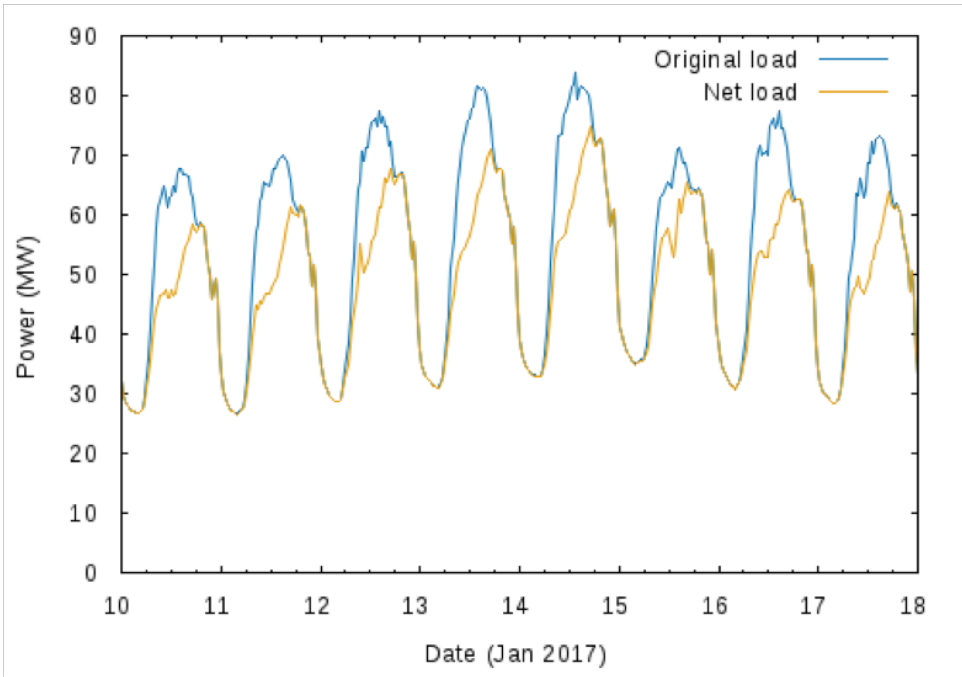


Figure 4. Representative Week for Noosa LGA Demand Profile, Showing Net Load (after PV) and Original Load (before PV), Summer

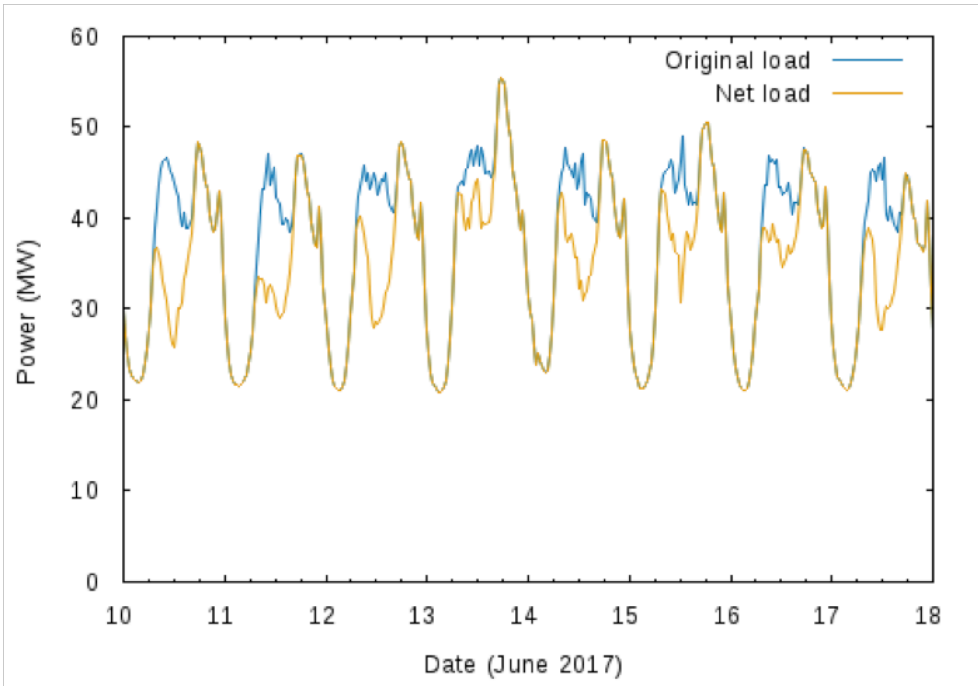


Figure 5. Representative Week for Noosa LGA Demand Profile, Showing Net Load (after PV) and Original Load (before PV), Winter

3. MODELLING RENEWABLE ENERGY TECHNOLOGY OPTIONS

Together with ITP Renewables, Zero Emissions Noosa has developed two scenarios for 2026.[8] These scenarios are firstly summarised, then are described below in more detail. They are also shown in Table II. Note that scenarios are not predictions: they are simply used to illustrate the impact of different levels of electricity demand and electricity generation options.

Scenario 1 Base Case: This is intended to result in a greater amount of large-scale PV being needed to reach 100% renewable electricity – largely because it has a relatively modest uptake of 'behind the meter' renewable energy and energy efficiency options, which are based on the continuation of BAU levels of uptake. Household PV increases from 26.1MW to 48.1 MW, while commercial PV increases from 2.7 MW to 30.7 MW. Solar water heaters/heat pumps increase from being on 17.1% of houses to being on 26.4%. This scenario assumes no additional bioenergy, wind or hydro. The population increases by 8.44%, 10% of vehicles are assumed to be EVs and there is only a 5% reduction in average per capita electricity use because of energy efficiency. As a result, 119 MW of large-scale ground-mounted PV is required to achieve the 100% renewable target. A quarter of households and businesses that install PV are assumed to have batteries, but the main impact of this is to help smooth the load profile by reducing evening peaks.

Scenario 2 Stretch: Is intended to result in a smaller amount of large-scale PV being required to reach 100% renewable electricity. It represents a realistic but ambitious level of uptake of renewable energy and energy efficiency in the general community. Total residential and commercial PV increase to 80.5 MW and 43.1 MW respectively, and SWHs/heat pumps are on 50% of houses, however only 1 MW of bioenergy is installed. Population growth is the same (8.44%) and energy efficiency reduces average per capita electricity use by 17%. However, in keeping with the community's increased interest in behind-the-meter PV and energy efficiency, there is also increased interest in EVs (20% of vehicles), which offsets the effects of lower population growth and increased energy efficiency. In this case, 67 MW of large-scale PV is required. Of households and businesses that install PV, 40% take up batteries, which smoothes the load profile more than in Scenario 1.

[8] The rationale behind these scenarios can be found at https://www.repowernoosa.com/roadmap-project-blog/2018/07/16/modelling-scenarios

Table II Summary of Scenarios for 2026

	2016	Base case		Stretch	
Population growth	53,638	58,164	+8.44%	58,164	+8.44%
SWHs/heat pumps	4,020	6,500	-1.3%	13,795	-5.2%
General energy efficiency			-5%		-17%
Electric Vehicles	0	3,630	2.5%	7,250	5.1%
Distributed PV	29 MW	79 MW	-31%	116 MW	-48.5%
Bioenergy	0 MW	0 MW	0%	1 MW	-2.5%
GreenPower	0.35%	0.5%	-0.5%	1%	-1%
OVERALL TOTAL			-26.9%		-60.7%

a: Where units are not indicated, the values are for total numbers

b: The percentage values are changes as a percentage of Noosa LGA's 2016/17 underlying electricity use

3.1. Modelling 2026 Electricity Use

The modelling was performed for the year 2026 using NEMO (National Electricity Market Optimiser), an open source electricity sector model (https://nemo.ozlabs.org). It was used to model the hour-by-hour dispatch of a range of electricity generation technologies according to the scenarios described below. Only technologies that are commercially available in Australia are used.

This firstly involved projecting electricity use from 2016/17 allowing for population growth, uptake of SWHs, and the uptake of energy efficiency options in general. Different levels of uptake of distributed smaller-scale PV, large-scale PV, wind, bioenergy and GreenPower purchase were then programmed into the model according to the following scenarios. It was assumed that electricity could be drawn from the National Electricity Market (NEM) when required (most likely overnight), then exported to the NEM when in excess (most likely during the day).

3.1.1. Population Growth

Based on information provided by Noosa Council, Zero Emissions Noosa has estimated that the Noosa population will grow by 8.44% between 2016 and 2026. This population increase is based on the projected increase in the permanent population,[9] and for the purposes of modelling it assumes that electricity usage by visitors and the non-residential sector grows at the same rate. We assume that the number of dwellings suitable for PV and SWHs also increases by 8.44%, resulting in 25,225 houses.

[9] See https://www.noosa.qld.gov.au/documents/40217326/41514433/1.Noosa-LGIP-Part-15_v2_Draft-02.03.2018.pdf

3.1.2. Smaller-scale Technology Uptake

The following discusses the various options that can affect electricity use. They can be divided into those that (i) decrease electricity use (energy efficiency, including solar water heaters and air-sourced heat pumps, behaviour change), (ii) increase electricity use (electric vehicles), (iii) generate renewable electricity (PV, wind turbines, bioenergy), and (iv) GreenPower.

Decreasing Electricity Use

Decreasing electricity use through energy efficiency measures (also known as negawatts) is generally by far the cheapest way to reduce the amount of electricity drawn from the grid, and therefore greenhouse gas emissions. Load management is similar, but includes simply shifting loads from one time to another, without necessarily decreasing electricity use.

They can provide value by (i) reducing the annual need for electricity, which makes meeting renewable energy targets easier, (ii) reducing demand at peak times, which reduces the amount of local renewable energy and network capacity needed at any one time, and (iii) reducing demand at times of low local renewable energy generation, which would reduce the amount of electricity that needs to be imported into Noosa LGA (for example, where large amounts of solar PV is used to meet electricity demand, overnight loads, such as off peak water heaters, should be moved to day time boosting).

Solar water heaters and air-sourced heat pumps

Information is available on the number of SWHs and air-sourced heat pumps by postcode from the Clean Energy Regulator. Noosa LGA includes the postcodes 4563, 4565, 4566, 4567, 4568, 4569, 4571, and 4573. Of these, postcodes 4563 and 4573 include a proportion outside Noosa LGA. The Australian Bureau of Statistics provides Australian Statistical Geographic Standard Correspondences that are a mathematical method used to assign data from one geographic region to another.[10] We have used these to assign the SWH uptake from these postcodes to Noosa LGA. Thus, about 13% of suitable dwellings have SWHs, and about 4% of dwellings use air-sourced heat pumps for heating water, making a total of 17%. For Scenario 1 we assume that the uptake occurs at the same rate as the last two years (4.3% per year for SWHs and 6.8% per year for heat pumps). For Scenario 2 we assume 10% per year for SWHs and 20% per year for heat pumps.

The amount by which SWHs reduce electricity use can vary greatly (eg. from 20% to 90%)[11] depending on the orientation of the system, the amount of shading, the efficiency of the system, the design of the system (eg. flat plate or evacuated tube), the climate, the hot water demand, the boosting type and the time of day that hot water is used. Some of these issues do not affect heat pumps, for example, they are unaffected by orientation or shading and their efficiency is generally unaffected by hot water demand. SWHs and air-sourced heat pumps are often assumed to, on

[10] These can be obtained from http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1270.0.55.006July%202011?OpenDocument

[11] Gill, N., Osman, P., Head, L., Voyer, M., Harada, T., Waitt, G. and Gibson, C., 2015, 'Looking beyond installation: Why households struggle to make the most of solar hot water systems', *Energy Policy*, 87, p83-94.

average, reduce the electricity used for the average hot water system by 70%[12] and a study of residential water heaters in Brisbane reported an average reduction from 7.95kWh/day to 2.74kWh/day (66%).[13] Thus, for the modelling conducted here, we have assumed that the average SWH or heat pump reduces electricity use by 5.2 kWh/day on average through the year. We apply this reduction between 10pm and 7am.[14] The SWHs and heat pumps currently installed in Noosa LGA avoid the use of about 7,550 MWh of electricity per year (meaning that, without them, electricity use would be about 2.1% higher).

SWHs and heat pumps offset the use of off-peak electricity, which costs less than standard electricity, which means they have a longer payback time than PV systems. We don't distinguish between SWHs and heat pumps because we have no data on the likely future split in uptake and it is likely they will have similar impacts on electricity use. Table III shows the estimated uptake of residential SWHs and heat pumps taking into consideration the projected population growth.

Table III Uptake of SWHs and Air-sourced Heat Pumps in Noosa LGA (2026)

	% of Dwellings	SWH & Heat pumps		MWh decrease [a]	% decrease cf baseline [b]
		Additional	Total		
Base case	26%	2,485	6,500	4,720	1.3%
Stretch	55%	9,775	13,795	18,575	5.2%

a: Decrease due to additional units

b: As a percentage of Noosa LGA's 2016/17 underlying electricity use

Other energy efficiency options

There is a wide variety of energy efficiency options available for households as well as businesses. Behaviour change (such as turning off lights, wearing warmer (or cooler) clothing, adjusting thermostats etc) is also a very significant contributor to energy efficiency outcomes.[15] The uptake of these options has been modelled as a general reduction in load between 7am and 10pm.

In order to create each Scenario we assume that these other energy efficiency options reduce Noosa LGA's electricity use in 2026 by the amounts shown in Table IV. Then, when combined with the impact of population growth and residential SWHs/heat pumps, the final

[12] http://www.energyrating.gov.au/products/water-heaters/solar-water-heaters

[13] Vieira A.S., Beal, C.D. and Stewart, R.A. (2014) 'Residential water heaters in Brisbane, Australia: thinking beyond technology selection to enhance energy efficiency and level of service', *Energy & Buildings*, 82, 222-236.

[14] SWHs and heat pumps would be much more effective in reducing electricity use during summer than in winter, and not all electric water heaters operate only between 10pm and 7am, however given the other estimates used here (such as uptake of these technologies), these assumptions are reasonable.

[15] Strictly speaking, behaviour change is an energy conservation measure, not an energy efficiency measure.

outcome are changes of 2.1% to -13.8% with respect to the underlying 2016/17 levels. Note that SWHs/heat pumps are assumed to decrease electricity use only between 10pm and 7am, and general energy efficiency is assumed to decrease electricity use only between 7am and 10pm.

Table IV Combined Impact of Population Growth, SWHs/heat pumps and General Energy Efficiency [a]

	Base Case	Stretch
Population growth	8.44%	8.44%
SWHs/heat pumps	-1.3%	-5.2%
General energy efficiency	-5%	-17%
Subtotal	2.1%	-13.8%

a: As a percentage of Noosa LGA's 2016/17 underlying electricity use

Increasing electricity use

Electric Vehicles

Although any new appliances and other technologies can increase electricity use, the main potential influence in Noosa LGA is electric vehicles (EVs). According to the 2016 Census, there are on average 1.8 vehicles per occupied dwelling in Noosa LGA, and with 20,142 such dwellings, there are about 36,250 cars. According to the ABS, the average passenger vehicle in Australia travels about 13,700 km/year.[16] According to Ergon Energy, the average EV requires about 18kWh to travel 100km.[17] Zero Emissions Noosa are interested in encouraging increased uptake of EVs, and assume 10% and 20% of total passenger vehicles for the Base case and Stretch scenarios respectively. Given the approximate nature and wide range of these values, we have not increased them to allow for population growth. Using these values, the assumptions and outcomes for each Scenario have been calculated and are shown in Table V.

Table V Uptake of Electric Passenger Vehicles in the Noosa LGA (2026)

	% Uptake	Number of EVs	MWh increase	% increase cf baseline [a]
Base case	10%	3,630	8,940	2.5%
Stretch	20%	7,250	17,880	5.1%

a: As a percentage of Noosa LGA's 2016/17 underlying electricity use

[16] http://www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0

[17] https://www.ergon.com.au/network/smarter-energy/electric-vehicles/charging-your-electric-vehicle

Renewable electricity

Distributed Solar PV

As discussed above, as at May 2018, there is currently about 28,909 kW PV installed in Noosa LGA: consisting of 8,031 systems (26,064 kW) that are less than 10 kW in size, and 145 (2,845 kW) in the 10 kW to 100 kW size range. About 35% of suitable dwellings have PV, as do 4.7% of businesses.

The assumptions and outcomes for each Scenario are shown in Table VI.[18] Scenario 1 results in 49% of suitable households and 50% of businesses having PV. Scenario 2 results in 69% and 71% respectively. In reality there will of course be a range in system sizes, with some installations being less or more than the assumed average.

Table VI Uptake of Distributed Solar PV in Noosa LGA (2026)

	Uptake	Solar PV		GWh generation [a]	% cf baseline [b]
		Additional	**Total**		
Base case **Residential** **Commercial** **Total**	5%/year 5 kW [c] 30%/year 20 kW	22 MW 28 MW 50 MW	48 MW 31 MW 79 MW	69 GWh 44 GWh 113 GWh	19% 12% 32%
Stretch **Residential** **Commercial** **Total**	9%/year 5 kW 35%/year 20 kW	47 MW 40 MW 87 MW	73 MW 43 MW 116 MW	116 GWh 57 GWh 177 GWh	33% 17% 50%

a: Generation due to total PV systems

b: As a percentage of Noosa LGA's 2016/17 underlying electricity use

c: This means that the number of PV systems increases by 5% per year and the average size is 5kW.

Bioenergy

Very little bioenergy is assumed to be installed in Noosa LGA by 2026 – only 1MW in Scenario 2. Its electricity generation was estimated by dispatching the full capacity of the biomass plant in each hour of the year. The assumptions and outcomes for each Scenario are shown in Table VII.

[18] As discussed above, according to the CER database there are currently no small wind or microhydro systems in Noosa, and although some may be built, they would not have a visible effect on the modelling outcomes.

Table VII Uptake of Bioenergy in Noosa LGA (2026)

	Capacity	MWh generation	% cf baseline [a]
Base case	0 MW	0 MWh	0%
Stretch	1 MW	8,760 MWh	2.5%

a: As a percentage of Noosa LGA's 2016/17 underlying electricity use

GreenPower

GreenPower is accredited and independently audited electricity that is certified to come from renewable energy generation. It is additional to any mandated renewable energy targets, and so is bought by electricity customers so they can make their own contribution to increasing the amount of renewable electricity and so reducing greenhouse gas emissions. It generally costs about an extra 5c/kWh, and so for a household using say 11kWh/day (~4 MWh/year), would add about $50 to their quarterly electricity bill. Currently only about 0.35% of Queensland electricity sales are through GreenPower. The assumed purchases of GreenPower for each Scenario are shown in Table VI.

Table VIII Assumed Purchase of GreenPower in Noosa Shire (2026)

	GreenPower as a % of Total Use
Base case	0.5%
Stretch	1%

a: As a percentage of Noosa LGA's 2016/17 underlying electricity use

Large-scale PV

As discussed above, the modelling started with 2016/17 electricity use, then allowed for population growth, uptake of SWHs, energy efficiency and EVs – which all affect the final amount of electricity that needs to be supplied. Different levels of uptake of distributed PV, bioenergy and GreenPower purchase were programmed into the model, which then calculated the amount of large-scale ground-mounted PV required to meet the remaining demand over the year. The amounts of wind power and hydro were assumed to be negligible.

Their combined impact of all the above options (excluding large-scale PV) is shown in Table IX. It can be seen that by 2026, the scenarios have total electricity use ranging from an increase of 4.6% to a decrease of 8.7% compared to 2016/17. The combined effect of distributed PV, wind, bioenergy and GreenPower purchase results in significant amounts of large-scale ground-

mounted PV needed to meet demand over the year: 119 MW (Base case) and 67 MW (Stretch), producing the amounts of electricity shown in Table X. As discussed in Section 5.2.3, wind farms outside Noosa could also be used to meet the 100% target, in this case requiring 85 MW and 48 MW for the Base case and Stretch scenarios respectively.

Table IX Impacts on 2016/17 Electricity Demand (by 2026)

	Base case	Stretch
Population growth	+8.44%	+8.44%
SWHs/heat pumps	-1.3%	-5.2%
General energy efficiency	-5%	-17%
Sub total	2.1%	-13.8%
Electric Vehicles	2.5%	5.1%
Total Impact on Electricity Use	4.6%	-8.7%
Distributed PV	-31%	-48.5%
Bioenergy	0%	-2.5%
Total Impact of Dist. Generation	-26.4%	-59.7%
GreenPower	-0.5%	-1%
OVERALL TOTAL	-26.9%	-60.7%

a: As a percentage of Noosa LGA's 2016/17 underlying electricity use

Table X Amount of Large-scale PV and Electricity Generated, Noosa LGA (2026)

	Large-scale PV (MW)	Large-scale Wind (MW)	Electricity Generated (GWh)
Base case	119 MW	85	260 GWh
Stretch	67 MW	48	146 GWh

3.1.3. Final Renewable Energy Mix

Table XI shows the final capacity of each type of generator in 2026. It can be seen that the total PV capacity is close to 180MW for both Scenarios, despite electricity demand increasing by 8.4% in the Base case Scenario and decreasing by the same amount in the Stretch Scenario. This is because a greater proportion of the generation in the Base Case is from single axis tracking ground-mount PV, which generates more electricity per MW of capacity.

Table XI Capacity of each type of generator in 2026

	Base case (MW)	Stretch (MW)
Existing PV	28.9	28.9
New residential PV	22	55
New commercial PV	28	40
New ground-mount PV/wind	119/85	67/48
Bioenergy	0	1

The following charts (Figure 6 to Figure 9) show the electricity generation from the mix of renewable energy technologies in each Scenario in Noosa LGA in 2026. For each Scenario, a summer peak week and a winter peak week are shown. Each of the colours represents a different technology (or category of technology such as residential or commercial PV). The slightly thicker black line shows the level of demand, and where generated electricity is exported, a paler version of the technology's colour is used. The brown areas represent electricity imported from the Queensland grid. Note that the large-scale ground mount PV and wind have not been included in the charts because there is not enough space to build them in Noosa, they may also face public opposition because of visual impacts, there are much better wind resources elsewhere.

In the Stretch scenario it can be seen that excess solar PV electricity may flow back up through the ZSs – which causes reverse power flow. Prior to reaching this level of solar penetration it is very likely that local feeders would experience reverse power flow and the associated voltage rise. This can generally be accommodated by Energex, but does come at some expense.

We have modelled the impact of some of the households (25% in the Base Case Scenario and 40% in the Stretch Scenario) with PV also installing batteries with a 5kW, 10kWh capacity (8kWh useable)[19]. These are used to capture excess PV electricity, which is then discharged from 6pm. The battery generation is shown in grey, and makes a much more significant contribution in the Stretch Scenario. The use of batteries in this way reduces the reverse power flow of PV electricity. Of course, load shifting through demand management, such as moving off peak water heating to the middle of the day, would also be very effective.

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[19] Assumes 80% useable capacity.

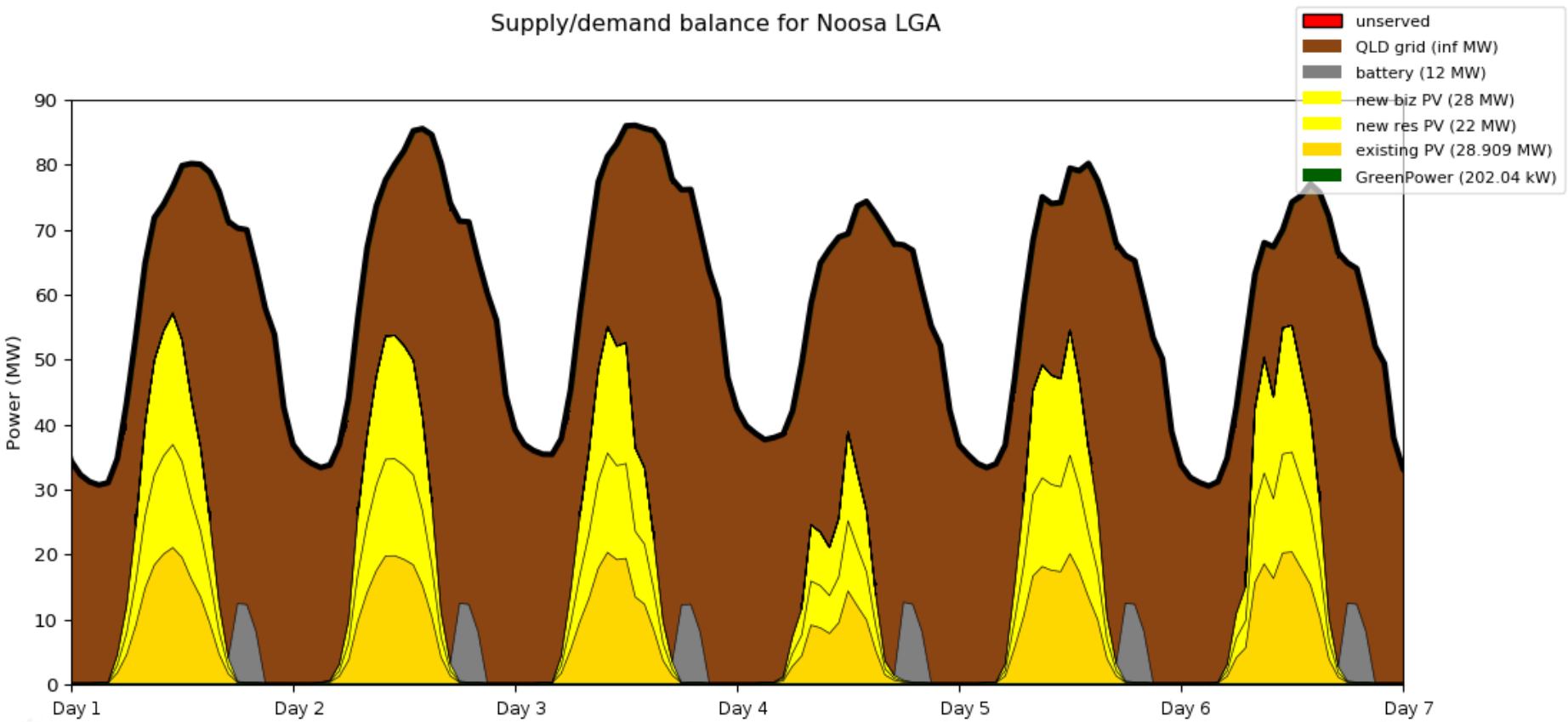

Figure 6 Mix of RE Technologies, Noosa LGA, 2026 – Base Case Scenario, Indicative Summer Peak

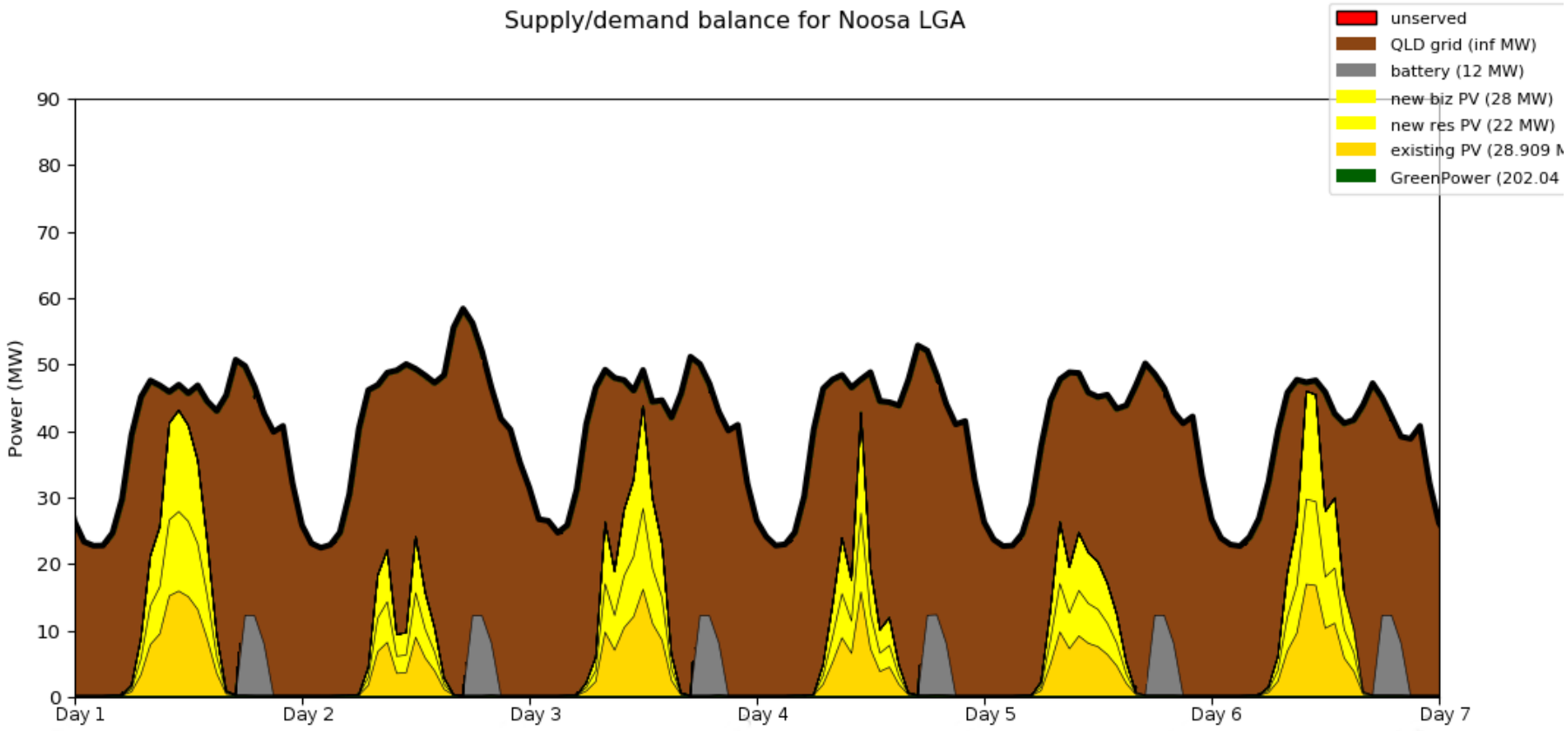

Figure 7 Mix of RE Technologies, Noosa LGA, 2026 – Base Case Scenario, Indicative Winter Peak

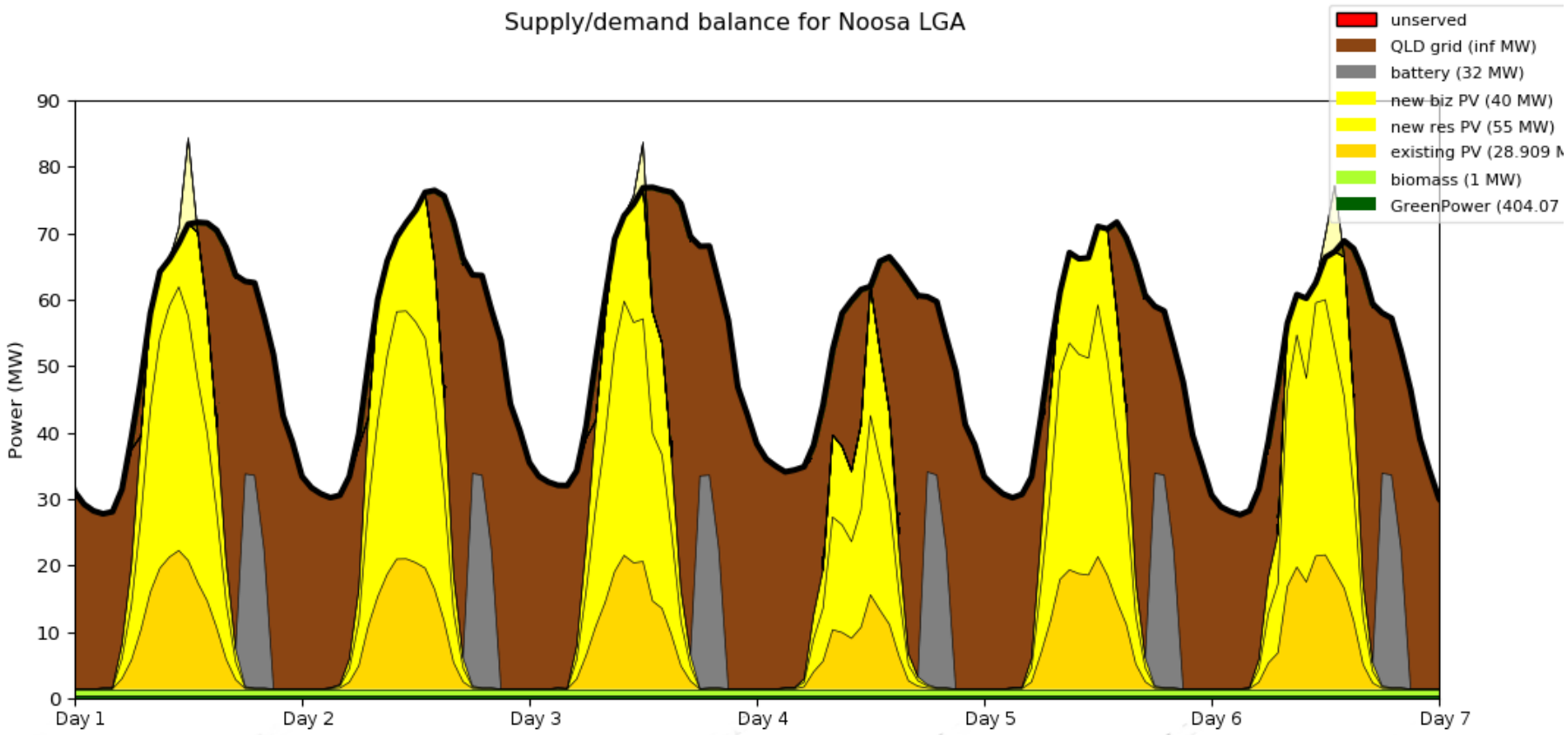

Figure 8 Mix of RE Technologies, Noosa LGA, 2026 – Stretch Scenario, Indicative Summer Peak

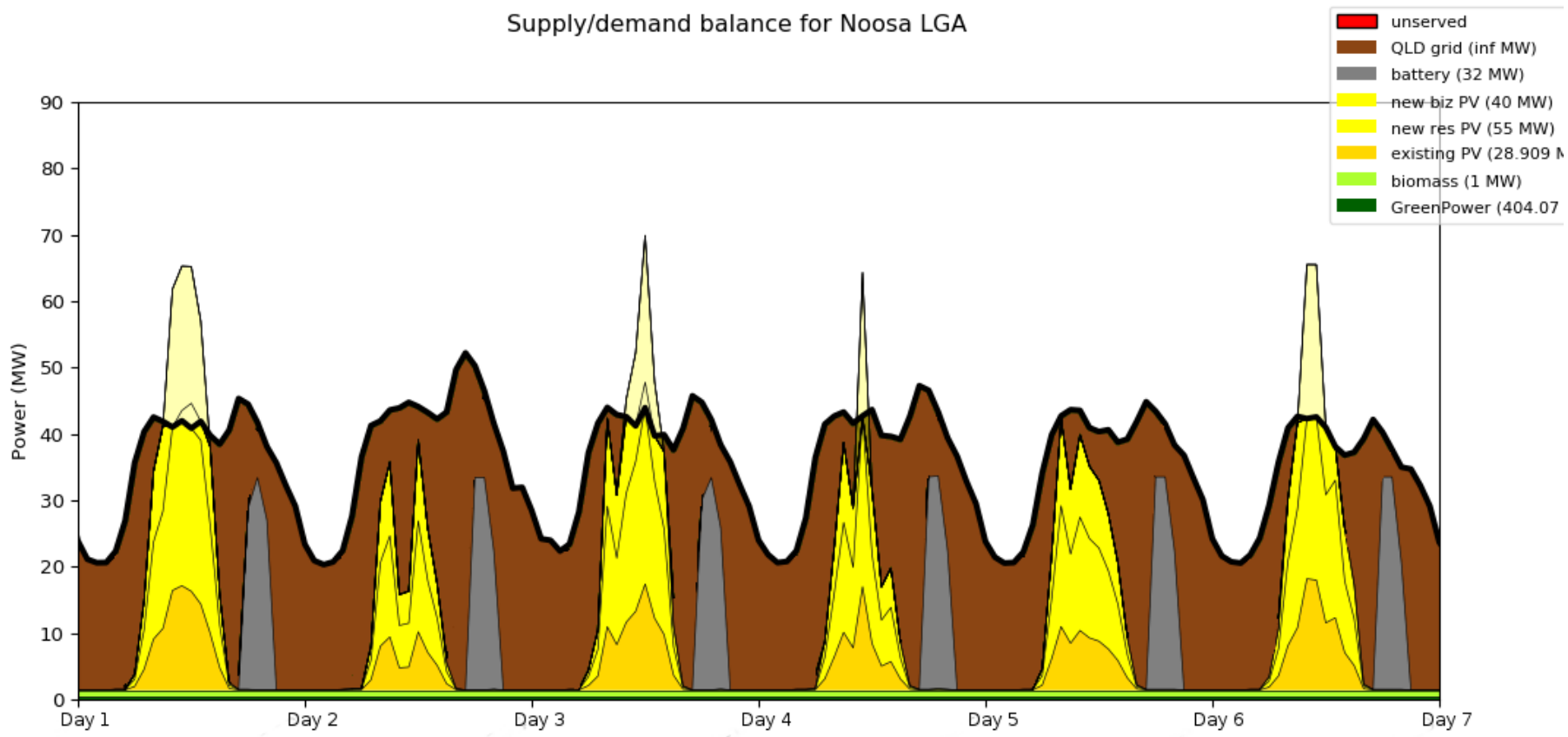

Figure 9 Mix of RE Technologies, Noosa LGA, 2026 – Stretch Scenario, Indicative Winter Peak

4. AVAILABLE OPTIONS

This section describes the different approaches or 'business models' that can be used to drive uptake of renewable energy technologies. Note that all these options are rapidly changing, so this focuses on what is available as at mid-2018. It is based on material from the report 'Background Technical Study: Bright Futures Renewable Energy Project' for East Gippsland Shire Council, but has been updated based on feedback from Zero Emissions Noosa and a series of community consultations in Noosa.

The emphasis here is on identifying new opportunities that the community can develop. This means the technologies should be both commercially available and readily deployable within Noosa. To reach 100% renewable energy it is likely that large-scale projects will need to be built outside Noosa. These are longer-term projects and as discussed above are better built after 2020 when they are more likely to be additional. Thus, although larger-scale systems are discussed here, the emphasis is on smaller scale (100kW or less) systems that can be built within Noosa Shire.

As highlighted in the modelling results above, solar PV is likely to continue to be the predominant technology deployed within Noosa. It has very short payback times (around 5 years for residential, and 3 to 5 years for commercial-scale), can be deployed at any scale, and has no moving parts and so is very reliable and requires very little maintenance. Solar water heaters and other energy efficiency technologies will of course also continue to be taken up, and possibly bioenergy and some small-scale wind – and many of the business models and programs discussed in this report could be applied to these technologies also.

Large-scale ground mount PV and wind farms have not been included as realistic options here because there is not enough space to build them in Noosa, they may also face public opposition because of visual impacts, and there are much better wind resources elsewhere.[20] Although pumped hydro has significant potential as a source of storage, it is not an electricity generation technology, and there are also limited resources in Noosa LGA.[21]

Although the focus here is on renewable energy, it is always a good idea to incorporate the uptake of energy efficiency. This will reduce the amount of renewable energy generators required to meet the 100% target, and can be used to reduce the amount of electricity required when solar PV isn't generating (and so reduce the import from the wider electricity grid). Demand side management is an overarching term that includes energy efficiency, but also includes, for example, shifting loads from the evening to the middle of the day when solar is generating. This both reduces the daytime export and reduces the evening peaks (which in turn reduces the size, and cost, of the networks required to meet these peaks).

[20] https://www.cleanenergycouncil.org.au/news/2016/March/wind-resource-map.html

[21] http://re100.eng.anu.edu.au/research/re/site/qld.php

Section 5 draws on these options to propose specific examples of actions that Zero Emissions Noosa and the local community can undertake.

4.1. Direct ownership

The most common 'business model' for the uptake of small to medium-scale renewable energy is direct ownership, where the host site (be it a household or a business) purchases the renewable energy system outright. Such systems are often assessed on the basis of simple payback of 5 years or less (an estimate of the time it takes an investment to repay its capital cost through savings and income).[22] Note that this approach does not take to account other benefits of direct ownership. These include: protection from changes in consumption and standby charges, possible adverse legislative or policy change intended to discourage further investment, and the insurance value of having certain access to low cost electricity meeting most or all of a household's requirement.

The calculation of the total benefit of direct ownership can be enhanced by various financial arrangements. Installers regularly offer some sort of finance package, and most banks seem happy to lend on agreeable terms for energy and efficiency projects.

Two common approaches to assist households in particular, as well as businesses, to install solar are solar/battery bulk buys and what are often called Solar $aver programs.

4.1.1. Bulk buys

'Bulk buys' are an approach used to reduce the upfront cost of solar PV systems. They can also be used for solar water heaters, but this is rare. They were first used widely back in 2010, and required 50 or more households to 'sign up' with an expression of interest. When sufficient 'sign ups' had been received, the components for 50 systems would be purchased in bulk at a discount and installed. Nowadays they are more flexible and generally don't wait until a certain number of systems have been ordered. Recent examples are listed in Table XII below, and in summary:

a) They generally involve a community group responsible for coordination and public outreach, but can also involve the local council. They may also be coordinated by a private business or social enterprise.

b) Local installers are used, and are vetted with respect to the quality of their installations and whether they are likely to be around to honour warranty claims.

c) A limited number of types of systems are available, both in terms of technology options and sizes, and they generally include additional costs in specific circumstances such as: the building being more than a single storey, the roof being tiled, and where a framing is required to angle the panels.

[22] This assumes the PV system has been well installed in the optimal orientation.

d) They can also result in public benefits of some sort, such as direct financial contributions to particular community groups, or a free system for a community building for every X number of total installations.

e) Prices are not necessarily much cheaper than normal, but there is an implied guarantee regarding the quality of both the systems and the installers. More recently they have included batteries and options such as Reposit.

f) Some are run only in the organisation's local area (eg. Darebin, MASH, SHASA), and some are run by organisations that work in a number of areas (eg. Farming the Sun).

A detailed recommendation for a bulk buy is provided in Section 5.2.1.

Table XII Examples of Solar Bulk Buys

Bulk Buy	Comment
Bogie Bulk Buy	This is organized by the Yarra Energy Foundation and operates in Strathbogie Shire. After registering their interest, people interested in a solar system will receive a tailored quote based on indicative prices on the website. A free solar system will be installed on a local community group for every 50kW installed. More information is available here http://www.bogiebulkbuy.com.au
Darebin	This is organised by Darebin council and is operating from 2017 to 2021. People interested in participating can register their interest and a range of system sizes is available, from 2 kW to 10 kW. More information can be found here - http://www.darebin.vic.gov.au/Darebin-Living/Caring-for-the-environment/EnergyClimate.
MASH	MASH stands for More Australian Solar Homes, and was run by the not-for-profit Hub Foundation (Castlemaine, Central Victoria), but is now run by the Central Victorian Greenhouse Alliance. They have partnered with Macedon Ranges Shire Council, Mount Alexander Shire Council and City of Greater Bendigo Council. To date they have installed over 850 solar PV systems and donated six free solar systems to community groups and schools. http://mash.org.au
Hepburn Solar Bulk Buy	This is also being coordinated by the Central Victorian Greenhouse Alliance and is targeting 200 solar homes, and aims to donate $20,000 in free solar. It is essentiall the same as the MASH offering. http://mash.org.au/hepburn-solar/
SHASA	SHASA stands for Southcoast Health and Sustainability Alliance, and is made up of Eurobodalla community members. Eurobodalla Shire Council's involvement in the first bulk buy was limited to providing advice and public exposure. They used local installers where possible, but sometimes had to bring in external installers. They are now up to their 3rd bulk buy and have decided to partner with Micro Energy Systems Australia (MESA) http://www.shasa.com.au
Farming the Sun	Farming the Sun is running bulk buys in the Northern Rivers and New England regions of NSW. They are also running a bulk buy for solar water heaters in New England. http://farmingthesun.net/bulk-buys/northern-rivers/

4.1.2. Solar $aver Programs

The first Solar $aver program was developed by Darebin City Council, which has been very proactive in encouraging uptake of solar PV. As well as the solar bulk buy described above, in 2014 and 2016 they rolled out the Solar $avers program, and have another planned for 2018. They allow pensioners; not-for-profit organisations; and renters in social housing, in receipt of a Centrelink benefit or in housing poverty, the chance to get a solar system. In the 2019 round, eligible residents will first receive a no-obligation quote on a 2 kW to 5 kW solar PV system. DCC will pay for the system up front and the household will then pay off the system interest-free over 10 years through special quarterly rate payments. The payments are less than the savings on their electricity bills. In the first two rounds households could also receive free advice on energy efficiency from Positive Charge (a social enterprise of not-for-profit community organisation Moreland Energy Foundation). Positive Charge also provided project management, household advice, solar assessment and brokers specifications and contracts on behalf of the solar PV supplier and Council. Nearly 500 solar PV systems have been installed through the Solar $avers program to date. More information on this model is available on the Embark website.[23]

A scaled-up version of Solar $avers is now being coordinated by the Victorian Greenhouse Alliances. It follows a six stage process:

1. They check that solar is right for the household.
2. They arrange a quote for a solar.
3. The household then approves the quote.
4. They organise for the solar system to be installed.
5. They support the household to understand and get the most out of their new solar system.
6. The household gradually pays for their solar system over ten years.

Instead of using repayments through rate increases they are using low interest loans through Bank Australia. A condition of this program is that all households must be at least $100 better of each year.[24]

The Queensland government is currently running the Sunny Savers trials, which are a form of Solar $avers that target social housing – see Section 4.2. Recommendations for the Solar $avers type of approach in Noosa are discussed in Section 5.2.1.

[23] http://www.embark.com.au/display/public/content/Darebin+Solar+Savers+model+description

[24] http://solarsavers.org.au

4.2. Targeted Social Housing Programs

These types of programs are similar to the Darebin model except that they target government-owned housing. They aim to reduce electricity costs for tenants and essentially revolve around a state government body organising to have solar installed on public housing, which is then either partially or fully paid off over time by the tenants.

The Queensland government is currently conducting the Sunny Savers trials in Cairns, Rockhampton and Logan through their Housing Service Centres. The trials are being conducted in partnership between the Department of Housing and Public Works and the Department of Natural Resources, Mines and Energy. Where householders can't pay upfront for their solar PV system themselves, three different purchase options are available. One uses a solar Power Purchase Agreement (PPA) approach where the system is installed free of charge, and the tenant agrees to purchase some or all of the electricity it generates at a per kWh rate that is less than grid electricity. After between 7 and 15 years the householder either owns or can buy out the system. Under the second option the householder can take out a solar loan to cover the cost, with repayments over 2-5 years, after which time they own the system. The third option uses a solar lease, where the householder pays a regular lease charge, then owns or can buy out the system after 5-10 years.[25]

4.3. Solar Power Purchase Agreements and Solar Leasing

Solar PPAs offered by solar installers are very popular in the United States, and may be becoming more popular in Australia. They involve the installer owning and operating a PV system on a house or business – which is then obliged to pay for any electricity it consumes directly from the PV system, but at a rate lower than grid electricity. The customer remains with whatever retailer they choose to be with, who meets the remainder of their electricity needs. Some solar PPAs come with the option of owning the system after a certain time, in which case the tariff payments are higher. Despite a number of companies offering this sort of product to the residential sector, they have not proven very popular in Australia, with most households preferring to own their own system. The latest efforts to target the residential solar PPA market have tended to be organised by property developers, who offer solar PPAs *en masse* to new home buyers,[26] and governments, such as in the Sunny Savers trials in Section 4.2. Another recent offering by ShineHub combines solar PPAs with a bulk buy of solar PV and batteries.[27] It will target all states except for the Northern Territory and Tasmania, and offers PV between 3 and 10kW, and batteries between 5.8 and 22.8 kWh. Households will enter into a 20 year contract to buy the solar at a 'low fixed rate' that ShineHub says will deliver instant bill savings of between 14% (in Victoria) up to 50% (in South Australia), and the option to buy the system out at any point along the way.

[25] More information is available here https://www.qld.gov.au/housing/buying-owning-home/compare-solar-purchase-options

[26] https://onestepoffthegrid.com.au/wa-residential-solar-ppa-absolute-game-changer/

[27] https://onestepoffthegrid.com.au/low-income-homes-offered-no-cost-solar-batteries/

Solar PPAs have been a bit more successful in the commercial sector, being offered by companies such as Energy Lease, Energy Matters, Infinite Energy and ReNu Energy.

These companies (and others) also offer solar leasing options, with the difference being that payments to the installer/leasing company are for a fixed amount, rather than being based on a per kWh rate. The lease periods are also generally much shorter than solar PPA periods (eg. 7 to 15 years vs 10 to 20 years).

4.4. Overcoming the split incentive barrier

A significant problem for the uptake on tenanted premises (both residential and commercial) is the 'split incentive barrier'. With regards to solar PV systems, this is where the building owner has little incentive to install solar because the tenant will receive the benefits (assuming they pay their own electricity bills).

Apart from the options outlined above where the housing is government-owned, there are a number of options either currently available, or being explored, to overcome this barrier. Note that although none of them necessarily involve a real estate agent, all will require some level of cooperation between the landlord and the tenant.

Simple agreement: In this case the landlord pays for and installs the PV system, then enters into an agreement with the tenant where the benefit to the tenant is either estimated or calculated. To calculate the total value the amount of exported electricity (kWh) is subtracted from the total generation to calculate the amount of on-site use. The exported and on-site electricity are multiplied by their respective tariffs to obtain to total value. The tenant then pays the landlord all or a proportion of this value, either through increased rent or direct payment.

Electricity retailer facilitated: In this case the retailer acts as a broker between the tenant and the landlord. Again the landlord pays for the system. The retailer has access to the information required to determine the value provided by the system, and can then apportion this value to the tenant and landlord.

Third party automation: Here a private business installs hardware that measures the exported and on-site electricity and the associated value, then uses bespoke software to arrange payment from the tenant to the landlord.[28] This could be seen as a type of solar PPA and examples include SunTenants[29] and Blue Star Energy[30], which differ in the nature of the costs faced by the landlord and the tenants, and how the landlord is paid (e.g. directly or through increased rent). A recent variation on this is where Stoddart Group, together with Powershop and Reposit are providing 'SunYield', a plan where PV systems are installed on new investment

[28] One example is Matter, which at the time of writing cost $1,507 upfront per site, then an ongoing fee of $14/month, http://go.matter.solar/going-solar/. Another example is SunTenants, but this is yet to be officially launched - https://www.suntenants.com.

[29] https://www.suntenants.com

[30] https://www.bluestarenergy.com.au/solar-pv/solar-landlords-tenants/

properties, where the tenants receive a single power bill that includes electricity from the solar PV system, and landlords receive income from the PV electricity sales.[31]

Environmental Upgrade Agreements: An EUA is a process whereby a building owner can access funding for construction works (generally for renewable energy or improvements to energy efficiency), the local council then collects repayments through its rates system and passes these on to the lender. Because the loan is repaid through the council rates system it is prioritised over other debts if there is a default. This increased security means the lender can offer a reduced interest rate. An EUA also means that the business that occupies the building can move on as the loan (and the improvements) stay with the building. In this case the building owner would need to charge higher rents to cover the increases to its rates.

Solar Garden: A solar garden is an option where individuals can purchase a 'share' of a solar PV system on someone else's roof. There are broadly two different types of solar gardens. One type is essentially an investment-based approach where an individual can invest in a project as discussed in Section 4.5.2. The other is where the electricity must be used on an instantaneous basis, and so the solar system is seen to be supplying the electricity to the individual involved in the solar garden directly to their home via the grid (for example through Local Energy Trading as discussed in Section 4.6).

4.5. Community-Owned Renewable Energy projects

Community-Owned Renewable Energy (CORE) projects can be either donation-based or investment-based. Both kinds could be implemented in Noosa.

4.5.1. Donation-based projects

Donation-based projects, such as those developed by Community-Owned Renewable Energy Mullumbimby (COREM)[32] and Citizens Own Renewable Energy Network Australia (CORENA)[33] rely on donations, and other forms of income such as fundraising events, to raise funds for PV systems – generally for community groups. The funds are provided as loans that are then repaid from savings in electricity bills. The repayments go into a revolving fund that can then be used to finance more projects, and so on. This approach relies on the host site helping to drive the fundraising efforts using their local networks, and organisations such as COREM and CORENA running the request for tender process, selecting the installer and helping with any post installation issues. They may also provide excess funds available from other fundraising efforts. It may be possible for a community group in Noosa to access funds from groups such as these, but the process would need to be driven by a local group. CORENA currently has funds available to help with donation-based projects.

[31] https://onestepoffthegrid.com.au/rental-solar-scheme-targets-15000-queensland-investment-homes/

[32] http://www.corem.org.au/projects-2/

[33] https://corenafund.org.au

4.5.2. Investment-based projects

Investment projects are far more complex and challenging than donation-based projects. This is because the organisation responsible for the project invests money on behalf of others and so has legal obligations regarding the use and return of that money. The following briefly describes the available legal structures and provides examples operating in Australia.[34]

The available legal structures can be divided into those most suitable for systems less than 100 kW and those most suitable for larger systems. The former are simpler to establish and operate, and are limited to 20 investors per year (the 20/12 Rule)[35]. In Australia, a hybrid approach is often used: with a 'parent' organisation using one type of structure, and a different type of legal structure for each renewable energy system (or group of systems). RePower Shoalhaven and ClearSky Solar use this approach.

Less than 100 kW:

- incorporated association (RePower Shoalhaven)
- private company limited by shares (Farming the Sun; RePower Shoalhaven)
- unlisted public company limited by guarantee (ClearSky Solar)
- trust and trustee company (ClearSky Solar)

More that 100 kW:

- unlisted public company limited by shares (SRPC, Sapphire)
- co-operatives (Hepburn Wind)
- listed public company.

There are currently no listed public companies that have been established for CORE projects, most likely because of the high cost in establishing and operating them.

Farming the Sun has developed two separate 99 kW solar systems: one on Goonellabah Sports & Aquatic Centre and one floating at the East Lismore Sewage Treatment Plant. Each involved the establishment of a proprietary (private) company limited by shares (each with a maximum of 20 shareholders). Each raised $180,000 that was provided as unsecured loans to Lismore City Council at 5.5% over 7 years. Savings on electricity costs enable the Council to repay both the interest and capital of the loan. Returns to investors are paid annually, and target a fully franked dividend of around 3.7% per annum. This approach may also be suitable for Noosa, and it is possible that Farming the Sun would be happy to provide assistance.

[34] The legal structure is different to the governance structure, where the latter relates to the set of processes by which an organisation makes decisions. Although the choice of legal structure does affect some aspects of how decisions are made, there is enough flexibility within Australian law to allow tailoring of the governance of an organisation within the chose legal structure.

[35] http://www.austlii.edu.au/au/legis/cth/consol_act/ca2001172/s708.html

RePower Shoalhaven is an incorporated association where members can invest money in discrete renewable energy projects. Solar PV systems are installed behind the meter on host premises, which buy the electricity at reduced rates. For each solar system, or group of systems, a private company limited by shares is created which owns the system(s), and is limited to 20 investors per year. Once the system is paid off, it then becomes the property of the host site. Member investors are paid a return on their investment, with the capital also being returned. To date, 7 tranches of projects have been developed.[36] This approach should be suitable for Noosa, and it is possible RePower Shoalhaven would be happy to provide assistance. The main difference to the Farming the Sun approach is that with Farming the Sun, the private company doesn't own the PV system but just loans the money to the host site (which owns the system from day 1).

ClearSky Solar Investments is a public company limited by guarantee. It is operated as a not-for-profit social enterprise. It helps to establish trusts as platforms for specific renewable energy projects. Investors can buy units in one of the trusts, with a maximum of 20 investors per project in a single year (the 20/12 Rule). This money is then passed to the for-profit installation company Smart Commercial Solar, who is contracted to own and operate the system. Smart Commercial Solar pays the trust an annual amount that consists of one seventh of the initial capital plus a revenue stream based on a value per kWh generated. This is then passed to investors after fees have been deducted. After seven years the host site owns the PV system. If this approach is to be used for Noosa, because of its complexity, it would most likely be best if ClearSky Solar was invited to manage a local project. ClearSky also have their dedicated installer, and so local installers could not be used.

Sydney Renewable Power Company (SRPC) is an unlisted public company limited by shares. A total of 519 shares were sold at $2,750 each, raising $1,427,250. It has funded Australia's largest CBD solar array at the International Convention Centre in Sydney. Each year it expects to pay dividends and aims to also return capital to investors. This approach is not recommended for sub 100kW projects within Noosa because it: "faces all of the expensive disclosure requirements that come with that structure. It relies on volunteers to run the company under a public company governance framework. … Ongoing ASIC requirements are expensive and time-consuming and involve half- yearly reviews".[37]

Sapphire Wind Farm is an interesting and recent development where a community investment vehicle is being established to own part of the wind farm to be located between Inverell and Glen Innes in northern NSW. This investment vehicle will most likely be an unlisted public company limited by shares. In this case the investment vehicle will acquire the rights to a portion of the earnings from the wind farm but will have no decision-making power or control over the operation of the wind farm. The wind farm is being built by CWP Renewables, who contracted

[36] https://www.repower.net.au/projects.html

[37] 'Funding Basics Guidebook for Community Energy Projects' by Frontier Impact Group, https://www.frontierimpact.com.au/toolkit

Taryn Lane (Akin Consulting) and Adam Blakester (Starfish Initiatives, who established Farming the Sun above), to investigate the community investment.[38]

Hepburn Wind is the trading name of Hepburn Community Wind Park Co-operative Ltd. It was established in 2007 by the Hepburn Renewable Energy Association (an incorporated association now known as SHARE). Is it the owner and operator of Australia's first community-owned wind farm, which consists of two turbines totalling 4.1 MW, located at Leonards Hill.

Once a cooperative is formed, members are allotted shares and a Board of Directors is elected. The board sets policies and establishes the business plan and the management deals with the day-to-day business. Renewable energy cooperatives would be classified as infrastructure cooperatives and so are required to undertake asset maintenance and renewal forward planning over the entire life of the infrastructure. Such cooperatives would normally be classified as a trading cooperative because they sell electricity to a third party. As such, they would be for-profit where income that isn't distributed to the member shareholders would be taxable. This approach should be suitable for Noosa for larger-scale projects, although note that such a structure has significant ASIC reporting requirements.

Some Queensland-specific information on community-owned renewable energy projects can be found at the Energetic Communities Association website,[39] and some more general information in the Community Power Agency's 'How To Guide',[40] and the Victorian Government's 'Guide to Community-Owned Renewable Energy for Victorians'[41], and a very detailed guide on a range of different business models can be found in the Frontier Impact Toolkit.[42] Specific proposals for CORE projects in Noosa are discussed in Section 5.3.5.

4.6. Local Energy Trading

Local Energy Trading (LET)[43] is basically where electricity produced by small generators (such as solar PV systems) can be sold directly to particular customers elsewhere on the grid. Although the name implies they are near each other, in fact there is also no upper limit to the distances between consumers and generators trading electricity – as long as they are on the same network. This is also called wheeling, where generation at one site is deemed to pass through the distribution system to a remotely located energy user. The most significant issue is negotiating the grid network charges that are applied to the transported electricity.

[38] More information is available at the following link, especially in the FAQ pdf - http://www.sapphirewindfarm.com.au/community-investment/

[39] http://www.energeticcommunities.org.au

[40] http://cpagency.org.au/wp-content/uploads/2014/06/CPAgency_HowtoGuide2014-web.pdf

[41] http://www.business.vic.gov.au/__data/assets/pdf_file/0007/1407751/Community-Energy-Projects-Guidelines-Booklet.pdf

[42] https://www.frontierimpact.com.au/toolkit

[43] Also sometimes called Virtual Net Metering.

Most organisations emerging in the LET field use blockchain technology (the technology that underpins Bitcoin). Local examples include Power Ledger (based in Perth)[44] and LO3 Energy (based in Byron Bay)[45], and now SonnenFlat. It is also the subject of 'desktop' trials, such as by AGL in Melbourne. Blockchain technology uses software that tracks multiple transactions between peers in a very secure manner without a third-party facilitator (hence the term peer-to-peer trading). It can be used to track the amount of renewable electricity generated by different people/businesses, as well as manage the sale of that electricity, possibly to multiple buyers. This minimises involvement by third-parties, which should reduce costs, and so maximise the returns to owners of distributed generation systems.

One exception to the use of blockchain technology is the Australian start-up Nexergy,[46] which uses simple reconciliation of transactions, where electricity is either sold into, or bought from, a general pool (rather than directly between peers). It also occurs in real time (the generation and use of the exported electricity occur at the same time) and from the customers' point of view, is essentially the same as the blockchain approach.

For both these versions of LET, the electricity flows can be measured using technology such as smart meters, while the financial flows around electricity trading, and the financial accounting (ie. reconciliation of who owes who and how much) are handled by information technologies and innovative accounting systems.

LET options for Noosa can be broadly divided into two types: i) uses an embedded network, and ii) uses Energex's network.

4.6.1. Embedded networks

An embedded network is an electricity network attached by a single connection point to the main grid. The embedded network itself is not owned by Energex, but instead by a 3rd party. Examples include a greenfield urban development or within an industrial estate, apartment block, retirement village or caravan park. In such cases, a 3rd party could operate as a retailer, selling electricity to internal customers. This can already happen simply using sub-meters, however it gets more complicated if solar PV (or some other generator) is generating electricity within that network. In this case, LET can be used to distribute the financial costs and benefits within that embedded network.

A significant advantage of embedded networks is that when excess PV electricity is exported and used by a neighbour, no per kWh network charges will apply, which means that the owner of the PV system can get more for their export and at the same time the user can buy electricity for less that the normal retail rate. Another advantage is that with only a single point of connection to the grid, there is only one daily connection charge, rather than one for each customer.

[44] https://powerledger.io, for example at White Gum Valley in Fremantle, WA.

[45] http://lo3energy.com, for example in Brooklyn, New York.

[46] http://nexergy.co

The PV arrangement is generally divided into two types. One where a single larger PV system exports electricity to a number of customers (eg. an apartment block or businesses within a larger building), and one where each dwelling could have its own PV system that exports to other dwellings on the embedded network (eg. retirement villages).

Pseudo-embedded networks

A third option has recently emerged that is currently being applied to apartments blocks. It is provided by Allume Energy and is where a single large PV system is separately wired 'behind-the-meter' to all the dwellings, and so doesn't use the embedded network at all.[47] PV is distributed to all residents in proportion to their instantaneous load.

Allume Energy has 2 possible business models at present:

1) The strata pays upfront for the PV system as well as the distribution equipment (wiring and metering). There is then a $5 per month per customer administration charge and the PV electricity is free.

2) Allume lease the roof from the strata (for $0), and pay for the PV and metering installation and sell generation to residents via a solar PPA set at less than the going retail rate for electricity.

This is approach can be used where the buildings are on Energex's network (rather than on an embedded network) and the per kWh network charges can still be avoided, however each customer still has to pay a single daily connection charge.

4.6.2. Using Energex's network

Under current network arrangements, when a distributed generation system such as a PV system exports electricity to the grid, the owner of the PV system is paid only the costs avoided by the retailer – which are essentially the avoided wholesale electricity costs. This is because when that electricity is on-sold, the retailer must pay the full network costs. These costs will also apply when LET is used, although the third party operator of the LET system may charge less than a retailer.

Of course, it can be argued that the network payments should only cover the amount of the network used, which would be much lower than normal since the exporting PV system may be very close to the importing customer. In this way, LET can be used to reconcile payments between a generator and a customer where network charges are reduced in much the same way as they would be on an embedded network. Unfortunately this has not occurred to date in Australia.

[47] https://allumeenergy.com.au

5. WHAT CAN NOOSA DO?

Like Section 4, this section is also based on material from the report 'Background Technical Study: Bright Futures Renewable Energy Project' for East Gippsland Shire Council. However, it has been updated to reflect the latest options, and most importantly, has been altered to take into account the feedback from the community consultation process in Noosa.

This Section identifies priority projects for Noosa drawn from Section 4, based on ITP's expertise and feedback from consultation with the community. The proposed projects have been categorised into residential, commercial-scale, large-scale and community-owned. Because the provision of information and education is important across the board, we first briefly identify some key sources of information.

There are many sources of funding from Commonwealth, State and local governments, as well as a variety of benevolent organisations. This can result in ongoing, although intermittent, sources of funding, which justifies a review every few months, especially where you have particular projects in mind. Indeed, as part of a Noosa Council Economic Development grant, Zero Emissions Noosa has commissioned the Repower Noosa project, a part of which will develop a sustainable business model for Repower Noosa so that it can continue to operate into the future, including by identifying funding sources.

5.1. Information & Education

Noosa Shire Council is well placed to be seen as a reliable source of information regarding renewable energy and energy efficiency. Council already has some information on its website that relates to its own operations, and some information on sustainable construction and some energy savings tips. The following outlines some further options that could be taken, either by Council or by Zero Emissions Noosa via its www.repowernoosa.com website.

5.1.1. Energy Efficiency

As identified in Section 3.1.2, increased uptake of energy efficiency and reduced energy waste can significantly reduce costs faced by customers and can help integrate renewables into customers' load profiles. Energy efficiency and demand side management can also be used to shift and reduce evening loads – thereby increasing the level of local energy self-sufficiency.

(i) Sources of Information

There is no shortage of actions that can be taken to reduce electricity use through energy efficiency, and potentially through demand-side management. The range of actions that can be taken is well documented on a range of websites and other reports – for example, see Table XIII.

Table XIII Some Sources of Information on Energy Efficiency Actions

Type of information	Source
Household general	http://yourenergysavings.gov.au/guides/reduce-your-energy-bills?page=3
Energy Efficient Homes	https://www.qld.gov.au/families/government/sustainable/pages/homes
Household fridges & freezers	http://www.fridgebuyback.com.au/fridge-energy-saving-tips/ & https://www.ergon.com.au/retail/residential/home-energy-tips/appliances/fridges-and-freezers
Household A/C, pool pumps and water heaters	https://www.energex.com.au/home/control-your-energy/positive-payback-program/positive-payback-for-households
Reduce Your Electricity Bill	https://www.qld.gov.au/housing/buying-owning-home/reduce-electricity-bill and https://www.dews.qld.gov.au/__data/assets/pdf_file/0009/1277181/energy-efficiency.pdf
Energy efficienct appliance rebate	https://www.qld.gov.au/community/cost-of-living-support/about-energy-efficient-rebate
Air conditioners	http://www.currentforce.com.au/CompareAirConditioners.aspx
House design	http://www.yourhome.gov.au
Building Star Energy Ratings	http://www.hpw.qld.gov.au/construction/Sustainability/SustainableHousingLaws/EnergyEquivalenceRating/Pages/default.aspx
Renew Economy	Online free articles on renewable energy and energy efficiency, http://reneweconomy.com.au
ATA Renew Magazine	Magazine for Alternative Technology Association members, http://renew.org.au
A Green House Around the Corner	Interesting stories about the energy efficiency journey! http://www.agreenhouse.net.au
Business general	http://www.environment.nsw.gov.au/business/energy-efficiency.htm and http://www.sustainability.vic.gov.au/services-and-advice/business/energy-and-materials-efficiency-for-business and https://www.solaraccreditation.com.au/dam/cec-solar-accreditation-shared/guides/Guide-to-improving-electricity-use-in-your-business.pdf
Business – A/C, power factor correction	https://www.energex.com.au/home/control-your-energy/positive-payback-program/positive-payback-for-business/eligible-areas
Business Energy Savers Program	https://www.business.qld.gov.au/running-business/energy-business/energy-saving/business-energy-savers

Information on the available options can be made available to the community through a variety of sources:

a. Full-page newspaper spreads. These can provide simple tips for ways to reduce energy use, along with links to useful sources of information.

b. Online Energy Info Hub: A Noosa-specific website, where the most relevant information is collated. This would pull together, vet, and provide access to reliable information and tools that are most relevant to Noosa Shire. It could include, for example, detailed reports; easy to read, well presented information on energy efficiency and renewable energy for households and businesses (e.g. http://www.yourhome.gov.au/); one or more public discussion forums on different topics; a brief description of the various groups in Noosa Shire and links to their websites; and summaries of current projects and campaigns. The Repower Noosa website is planning to host this information using a 'funnel' approach to direct enquirers to information most relevant to their circumstances, and is also planning video testimonials relevant to the barriers and benefits of installing solar PV.

c. A Community Energy Information Hub: This would be a council-run shopfront where people could drop in for authoritative impartial advice. It could cover general information as well as targeted advice suitable for builders, architects, electricians, council officers etc. Although volunteers could staff such a centre, there would also be a need for trained staff. Its purpose is to provide information on renewable energy technologies, help raise energy awareness in the community, enable better communications through a 'hub' and could even act as a base for energy coaches (see below) to operate from and where people can request energy audits.

Energy efficiency actions typically have a simple payback time of one to three years, often less than one, and yet it can be quite difficult to get households and businesses to take them up!

There is a range of reasons for this: lack of interest; lack of time to investigate the options; lack of good information (not only on the options that exist, but even on energy efficiency's effectiveness); although the payback is high, the total amount of money saved can be quite low, and so not worth the effort; the split incentive problem (where a landlord would have to pay for the energy efficiency but the tenants get the benefit); for larger items such as SWHs the upfront cost may be too high; etc.

It is because of this that passive provision of information is often not enough to maximise the uptake of energy efficiency. The following summarises activities that could be used to help convert simple information into the adoption of energy efficiency options in Noosa Shire.

(ii) ATA's Sustainable House Day

The Sustainable House Day is run by the Alternative Technology Association (ATA) and is where people can open up their sustainably designed homes to the general public – ones that are not only environmentally friendly, but cheaper to run and more comfortable to live in. It gives

visitors a chance to inspect houses that have been designed, built or renovated with sustainability in mind as well as the opportunity to talk to owners and receive unbiased advice. https://sustainablehouseday.com

(iii) Energy assessors

Energy assessors can be used to carry out home energy audits, and give talks at events and to local community organisations. Although they can generally be sourced from volunteers, they will need some form of formal training. Their information could be based on the sources in Table XIII. Ecobiz also offer a free energy assessment and action plan service for businesses (http://cciqecobiz.com.au).

(iv) Community Engagement

There are many ways to actively engage with the community:

a. Having people sign up for a pledge or simply that they support some sort of renewable energy or emission reduction target.

b. A competition or community workshop for ideas to drive energy efficiency. With the uptake of energy efficiency being such an intractable problem, it may be that the best solutions will come from the community and businesses themselves.

c. Noosa Energy Saving Challenge: This could be a competition run by ZEN that includes a high quality fact sheet that could form the basis of the full-page newspaper spread outlined above.[48]

d. Repower Programs: This is where a street, group or business undertakes energy education, energy efficiency and renewable energy actions in order to maximise cooperative benefits. It can include 'weatherisation programs' that aim to improve the building envelope, especially in low-income homes. A particularly powerful aspect of activities such as Sustainability Street is peer group support. Once households see what other households are doing, and benefiting from, they are much more likely to do these things themselves.[49]

(v) Solar water heaters and heat pumps

About 17% of households in Noosa Shire currently have solar water heaters or heat pumps, and the scenarios described above result in significantly higher uptake, and so here we cover SWHs in a little more depth than other energy efficiency options.

Where a significant amount of electricity is provided by solar PV, a large amount of electricity will be drawn from the grid overnight. Water heating generally uses off-peak electricity (overnight),

[48] An example of a fact sheet can be found here http://www.byron.nsw.gov.au/publications/fact-sheets

[49] A good example can be found here http://www.repowerbyron.org

and so SWHs can be very effective in reducing the amount drawn from the grid.[50] However, as discussed above, the effectiveness of SWHs can vary greatly. The amount by which they reduce the electricity used to heat water can vary between 20% and 90%. It is generally not possible for a householder to assess the performance of their solar water heater from their energy bills and other readily available information. A recent study regarding the installation and use of SWHs in Australia found that:[11]

a. Households generally lack the information to buy the right type and size of SWH to suit their needs, as well as where to place it.[51] This can act as a barrier to uptake.

b. Households generally don't know how to either use their SWH or adjust their habits to maximise its ability to reduce electricity use. As a result they are unsure how much money they have saved, if any.

c. SWH installers generally provide limited, if any, advice on how to use the SWH.

d. There is a clear need for independent unbiased advice for both purchase and operation, and community groups/events and word of mouth from friends are considered the most reliable sources.

e. Households can be classified as either active or passive users of their SWHs, and information should be sculpted to these different groups.

Thus, there is a need for options to encourage uptake, such as the 'Farming the Sun' solar water heater bulk buy in the Northern Tablelands,[52] but also a need for complementary measures such as:

- A pamphlet on how to operate a SWH that is provided along with all installations[53]
- Information, both online and as a pamphlet, on how to choose a SWH of the correct size, type etc
- Possibly some form of training of SWH installers on what customers really want. This could include a low-flow showerhead (that has a payback time of less than 6 months).
- Noosa Council could also investigate their powers to mandate SWHs in the planning scheme. As there may be limited opportunity for new houses in Noosa, a requirement for a SWH could also apply to renovations over a certain size.

Heat pump systems can offer a more flexible option to SWHs and their performance is usually comparable, if not better, for efficient systems. Heat pumps can overcome issues of shading, roof

[50] PV diverters can also be useful in this regard. Instead of excess PV electricity being exported to the grid, it is diverted to a storage hot water tank.

[51] The report found a wide variety of problems with installation, including solar panels shaded by trees, solar panels facing in the wrong direction, lack of proper insulation, tanks or panels that were undersized, water pipes that were sub-optimally routed or positioned, and panels supported on vulnerable structures.

[52] http://farmingthesun.net/bulk-buys/solar-hot-water-package/

[53] This can include simple advice such as the benefit of showering early in the day (so the sun has time to reheat the water before the overnight boost).

orientation and roof strength that often create major issues for solar thermal water heaters. They can be quite noisy however and so need to be located away from neighbours.

5.1.2. Renewable Energy

A. Financial assessment tools

There are various tools that households and businesses can use to assess the financial outcomes of solar PV systems. For example:

(i) SunSPoT

The Australian PV Institute (APVI) has developed the SunSPoT,[54] which is a free online tool for estimating the potential for electricity generation from PV on particular building roofs. The tool accounts for solar radiation and weather at the site; PV system area, tilt, orientation; and shading from nearby buildings and vegetation. Host sites potentially interested in installing PV can do their own preliminary assessment on the optimal size and financial return. Currently it only applies to capital cities (eg. Sydney City, Melbourne City, etc) as well as some suburbs in Sydney. To have it apply to Noosa would involve an upfront cost of around $12,000 plus about $3,000 per year for maintenance.

(ii) Sunulator

The Alternative Technology Association's Sunulator is free and is similar to the Solar Potential Tool above, but also allows the user to take account of their own energy use and tariffs – which is useful if the PV system is likely to have significant amounts of export. In this case it would provide a more sophisticated and accurate estimate of the financial outcomes. It can also model a battery storage option. However, it does not incorporate local solar radiation and shading, and is more complex and so more difficult to operate and so may not be suitable for many people.[55]

B. Information guides

There are also various information booklets available on solar and batteries for both households and business. For example:

(i) Guide for Installing Solar PV for Households

This is produced by the Clean Energy Council and includes the following topics.[56]

- The different types of solar PV systems
- How much will it cost?
- Government incentive schemes

[54] It can be found here http://pv-map.apvi.org.au/sunspot

[55] It can be obtained here - http://www.ata.org.au/ata-research/sunulator.

[56] http://www.solaraccreditation.com.au/consumers/purchasing-your-solar-pv-system/solar-pv-guide-for-households.html

- Feed-in tariffs (the amount your electricity company pays you for excess power)
- Choosing the right size solar system
- Things to watch out for when signing a contract
- Installation and connection to the grid
- Maintaining your solar system
- What to do if something goes wrong

(ii) Guide for Installing Solar PV for Business

This is also produced by the Clean Energy Council and includes the following topics.[57]

- Is solar PV the right choice for my business?
- Grid-connected vs stand-alone systems
- How much will it cost?
- The business case for solar PV
- Building and planning permits
- Advice for businesses in leased premises
- Government assistance and financing options
- Choosing and installing your solar PV system
- What do if something goes wrong

(iii) Battery Energy Storage website

The Queensland government has provided a website that explains the ins and outs of battery energy storage. It includes sections on:[58]

1. How battery energy storage works
2. Types of battery energy storage
3. Battery safety and maintenance
4. Is battery energy storage right for you?
5. Choosing a battery to suit your needs

Another useful source of information can be found here.[59]

5.2. Proposed Projects for Noosa

The following proposes some specific projects that can be used to enable uptake of renewable energy in the residential and commercial sectors in Noosa, as well as options for large-scale systems. This section also outlines opportunities for community ownership (CORE). The proposed projects are summarised in

[57] http://www.solaraccreditation.com.au/consumers/purchasing-your-solar-pv-system/solar-pv-guide-for-businesses.html

[58] https://www.qld.gov.au/housing/buying-owning-home/battery-energy-storage

[59] http://www.resourcesandenergy.nsw.gov.au/energy-consumers/sustainable-energy/home-solar-battery-guide

Table XIV.

During the preparation of this report, and partly in response to it, Zero Emissions Noosa has developed briefs for a number of campaigns that are either underway or in the planning process. These include Solar for Schools, Repower Cooran, Tourism Noosa collaboration, Repower Noosa Business, Community Buildings, Academic ZEN, and Repower Noosa industry cluster. More details can be found here https://www.repowernoosa.com/programs, and in Appendix C. In addition, Noosa Council, as part of its commitment to zero emissions by 2026 for its own operations has a number of programs in place – see https://www.noosa.qld.gov.au/zen

Table XIV Summary of Proposed Projects

	Proposal	Benefit
Residential-scale	Solar Bulk Buy	Reduces prices, maintains revenue for installers, provides trusted source of information, makes decision process easier.
	Solar $avers	Assists with up-front costs of installation, provides trusted source of information, makes decision process easier.
	Solar for Rentals	Helps overcome the split incentive problem where the landlord would pay for the PV system but the tenant benefits.
	Solar Access Rights	Protects the solar access of houses, solar PV and SWHs
Commercial-scale	Multi-site Feasibility Study	Overcomes the 'lack of time' barrier, provides trusted source of information, makes decision and installation process easier.
	Solar PPAs and leases	Helps overcome the upfront cost barrier, as well as the landlord/tenant problem.
	Environmental Upgrade Agreements	Helps overcome the upfront cost barrier, as well as the landlord/tenant problem.
	Embedded networks	Can improve the financial returns of solar PV by resulting in a better price for exported electricity.
	Standardised process for community organisations	Facilitates community groups installing solar on government buildings
	Solar for Schools	Overcomes the 'lack of time' barrier, provides trusted source of information, makes decision and installation process easier, and provides teaching materials.
Large-scale	Different legal structures for community ownership	Facilitates community ownership of portions of large-scale RE projects and so enables achievement of the 100% RE target for Noosa.
Community	RePower	Suitable for size of systems likely to be built, existing

Ownership	Shoalhaven's CORE model	successful model that can be replicated, assistance available.

5.2.1. Residential

Household-scale solar PV systems should provide a good investment return – see Table XV. Indicative electricity tariffs have been used and will of course vary between households. The export tariff of 8c/kWh is only as estimate and will vary between retailers, reaching as high as 20c/kWh as at July 2018. The amount of exported electricity depends on both the size of the PV system and the load profile of the household. The more electricity used during the day, the better the financial return. Although this is only a simple payback time calculation, and so does not take into account the fact that the money used to buy a PV system could have been invested elsewhere, this is counteracted by the fact that electricity prices are likely to increase over time (note that the recent increase in electricity prices means that retail tariffs have effectively doubled in the past 10 years). As Noosa is in the Energex region, grid-connection of solar systems are automatically approved for up to 5kW single phase and 15kW 3-phase (as at July 2018).

Table XV Likely Financial Outcomes for a 5 kW Household Solar PV System

	Value
Installed cost	$5,500
Annual generation	6,850 kWh
Retail tariff	27c/kWh
Export tariff	9.5c/kWh
Amount of export	40%
Annual income	$1,370
Simple Payback Time	4 years
Simple Rate of Return	25% pa

Solar bulk buys

ITP recommends that ZEN and/or Noosa Shire Council facilitate a solar PV bulk buy. As discussed above, the systems may not be much cheaper that could be accessed directly from installers, but there is an implied guarantee regarding the quality of both the systems and the installers, and they can result in community benefits of some sort. The bulk buy pricing and

associated information will also educate people so that they are less likely to fall prey to overpriced offers from external installers.

The main points to note are:

1. Running a solar bulk buy is not a trivial task. It requires a central organisation that takes full responsibility for running the bulk buy, is skilled in project management, and has a high level of knowledge of solar technologies. If no one at ZEN or Council can take this on, ITP recommends that organisations such as those listed in Table XII be contacted.
2. As many of the existing local installers should be used as possible. Any installers left out may undermine the bulk buy. A bulk buy should also be seen as an opportunity to up-skill local installers who may not yet quite make the grade. Increased competition will reduce prices, which should increase demand, which, combined with the other recommendations in this report, should create more than enough work for all the local installers. Instilling an ethos of high quality work and the use of high quality components will give the scheme high credibility and will lead to greater local confidence in solar and in the scheme, which will further build installation rates.
3. Both a higher end PV system and a standard option should be made available. There may be a need for optional microinverters or power optimisers,[60] which are more expensive but help a PV system to maintain its output despite shading. Use of good quality components installed by trusted local installers with suitable warranties of performance is a key element.
4. Batteries could also be considered, however it is very important that the community is well informed regarding their financial payback. In most situations, at current prices, batteries are unlikely to pay themselves off during their warranty period.
5. Solar water heaters should also be considered. Some of the solar PV installers in Noosa are also SWH installers, and so they could be involved in this offering. Farming the Sun has experience with SWH bulk buys. The use of high quality heat pump systems may be a more flexible and cost effective for the supply of hot water in many circumstances.[61]
6. The community should be consulted on what sort of community benefit they would like, be it a cash donation to certain charities or free solar systems for community organisations.

[60] Most inverters are what are known as 'string inverters', where the electricity from normally two strings of panels is all channelled through a single inverter. If one of the panels in a string is shaded then the output from the entire string is significantly reduced. Microinverters are smaller inverters that are placed on the back of each panel. In this case, if one panel is shaded, only the output from that panel is reduced. Power optimisers are similar in that they are connected to each PV panel and maximise the power output of that panel.

[61] http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/Agents-and-installers/Small-scale-systems-eligible-for-certificates/Register-of-solar-water-heaters

7. Maximum use should be made of all the local community organisations' networks to spread the word. This should extend beyond those with an environmental focus (eg. to sporting groups).

Solar $avers

As discussed in Section 4.2, the Queensland government is currently conducting the Sunny Savers trials in Cairns, Rockhampton and Logan. There is no reason that Noosa Council couldn't initiate their own Solar $avers program as many Victorian councils have done. Any of the three purchase options currently being trialled under Sunny Savers could be used. It may even be possible to use the local installers' current finance offerings. Involvement of ZEN and/or Council adds credibility to the offer. In fact, it may even be possible to offer a combined Solar $avers/bulk buy.

Solar for Rentals

Any of the four different types of approaches discussed in Section 4.4 could be used for rental properties. The 'simple agreement' approach is easy to make available as it does not necessarily involve a real estate agent, but will require cooperation between the landlord and the tenant. We have provided a simple spreadsheet that can be downloaded and used for this purpose. We have also provided a simple Memorandum of Understanding that can be adapted depending on the circumstances – see Appendix B.

Information of this and the various 'pay-for-use' options are expected to be included in the 'Landlord Toolkit' that ZEN is having developed as part of the Repower Noosa project funded from Council's Economic Development Fund. This information could also be made available through the various platforms discussed in Section 5.1. Another option for renters is of course to simply invest in a CORE project as discussed in Section 4.5.2, be it on a business, a community organisation or a local school.

Solar access rights

Solar access rights for buildings are important not only for solar PV, but also for energy efficiency technologies such as SWHs and even for natural lighting and for passive solar designed buildings. It is important to ensure that buildings and other structures do not infringe on the solar access provisions of a neighbouring property. The height of buildings, especially those located on a property's northern boundary, can be a critical factor in ensuring good solar access. Neighbourhood agreements, such as covenants, may be entered into between property owners to protect PV solar access.

The Noosa Planning Scheme Policy 10 refers to the need to take into account the solar access enjoyed by neighbours. Part 14 of The Noosa Plan also refers to the need to minimise reductions in solar access of neighbours, and specifically refers to the needs of solar panels. To

pre-empt complaints of shading of solar panels driven by new-builds or renovations, Noosa Council could develop a firm policy on how to address this issue. Overshadowing could reduce the financial returns from what could be a significant capital investment.

Cooran Earth Rights

Cooran Earth Rights is a community group with very strong local support, working to make Cooran a sustainable, thriving community. They oppose the renewal of exploration permits for coal and gas close to Cooran. Noosa Council has adopted a supportive policy on coal and gas exploration and mining. Cooran Earth Rights plan to declare the town coal and gas free in August 2018, and have formed a subgroup in collaboration with Zero Emissions Noosa to Repower Cooran to generate as much renewable energy as they consume.[62] See Appendix C for more information.

5.2.2. Commercial-scale

Commercial-scale solar PV systems should also provide a good investment return – see Table XV. Businesses generally have a better match between their load profile and PV generation than do households (both higher in the middle of the day), which results in less export to the grid compared to household systems. Businesses can be divided into those whose electricity tariffs included demand charges (larger businesses), and those that did not (most of the businesses operating in Noosa). Demand charges are applied to the customer's maximum monthly demand during specified time periods, and where they are included, the per kWh tariff rate is lower. Although a PV system may well reduce the demand charges, this is not certain without some additional internal load management system and/or batteries, and so in our calculations we have conservatively assumed it does not. This reduces the financial return but still results in very favourable payback times.

Table XVI Likely Financial Outcomes for a 30 kW Commercial Solar PV System

	Value	
Installed cost	$30,000	
Annual generation	41,000 kWh	
Retail tariff	17.5c/kWh (with demand charges)	30c/kWh (no demand charges)
Export tariff	8c/kWh	
Amount of export	20%	
Annual income	$6,400	$10,500

[62] https://www.repowernoosa.com/roadmap-project-blog/repower-cooran

Simple Payback Time	4.7 years	2.9 years
Simple Rate of Return	21% pa	35% pa

ITP has identified the following types of opportunities for commercial-scale systems.

1. Local businesses

Multi-Site Feasibility Study

Although detailed community consultation was not undertaken with businesses in Noosa (apart from one community information session that targeted businesses), based on our experience, many businesses are interested in solar but don't have the time to look into it because it is not part of their core business, and also lack the expertise to really know what the options are and what is best for their particular circumstances.

ITP recommends that a Multi-Site Feasibility Study (MSFS) based on a two-stage approach be used to assist these businesses. The aim is to help the businesses to decide whether to install solar, and, where they proceed, to ensure that they end up with a high quality system at a good price. The costs of each of these stages could be spread across participating businesses or they could be covered by Noosa Council's Economic Development Fund. Of course, even without support from the EDF, this would be money well spent given the high likelihood that solar would be a good business proposition.

The **first stage** would be to help these businesses assess the financial viability of solar PV. A consultant who does not have a direct interest in convincing a business to install solar, but that has a very high level of technical knowledge of solar, should be contracted to provide an assessment the viability of solar for these businesses *en masse*. This would result in a series of reports (a separate assessment for each business) that would detail:

1. The recommended system size(s)
2. A detailed estimate of the installed cost
3. The estimated annual generation and income
4. The estimated simple payback time
5. A brief description of any relevant issues such as shading or roofing restrictions (eg. any requirements for structural reinforcement), proposed alterations to operations in order to better align load with PV output, and any metering or switchboard limitations.

Sites should also be given the option of a more detailed assessment including load monitoring, and/or an energy audit, which could be provided at an additional cost. This would be important for businesses that have a demand charge included in their electricity tariffs because

their per kWh rate could be quite low and solar may not reduce their demand charges (for example if their peaks occur in the early morning or late evening).

The **second stage** would be to help interested businesses to install an appropriate solar PV system. Either the same consultant from stage 1, or a different consultant, would be contracted to project-manage a call for tenders for installers and an assessment of those tenders, and then to perform quality assurance on the completed installations. This could all be incorporated with the free service that Ecobiz offer (http://cciqecobiz.com.au).

Tourism Noosa may like to coordinate this approach for their members. It could also be combined with the use of the SunSPoT tool to write a report assessing Tourism Noosa's members' overall potential for rooftop solar.

Where the business doesn't own their building, one of the options identified in Section 4 could be used to overcome the landlord/tenant split incentive problem. As well as the 'simple agreement' and 'third party automation' approaches, other options include solar PPAs/leases, EUAs and solar gardens.

Solar PPAs and Solar Leases

Solar PPAs and Solar Leases may be suitable for businesses in Noosa, but before putting too much effort into these options it would be wise to survey business interest. They could be suitable for owner-occupiers or could even be used to overcome the landlord/tenant split incentive problem. Council could review its property portfolio and consider how to use solar PPAs and leases to facilitate the take up of solar by its commercial and community tenants. This would not only showcase Council progressive activities, but also show other landlords/tenants that it is possible. If there is sufficient interest, this list could simply be made available to solar installers, or a MSFS approach could be taken.

Environmental Upgrade Agreements

As discussed in Section 4.4, these can be used to overcome the split incentive problem for commercial premises. In both Victoria[63] and NSW[64] legislative changes were required for EUAs to be implemented. Thus, we recommend that Noosa Council either undertake an investigation into whether EUAs may require legislative changes in Queensland, or lobby the state government to do this themselves.

Embedded networks

As discussed in Section 4.6.1, industrial estates, apartment blocks, retirement villages or caravan parks may have embedded electricity networks. It is most likely that they do not, so if there is any interest in exploring the ability of embedded networks to enable the uptake of renewable energy, the first step would be to perform some sort of survey/audit to identify areas that do have embedded networks. Alternatively an invitation could be sent out to body corporates

[63] https://www.energy.vic.gov.au/energy-efficiency/environmental-upgrade-agreements

[64] http://www.environment.nsw.gov.au/business/upgrade-agreements.htm

(especially in the Noosaville industrial estate) to see if they have an embedded network, and if they do, then to see if they have any interest in installing solar.

Note that using an embedded network in this way is not a trivial task, and although any changes they undertake should have good financial returns, they could involve more complex metering and billing, and would need to be assessed on a case-by-case basis because each site is likely to have different circumstances and different opportunities. The outcomes of the survey/audit could be used to attract businesses that specialise in establishing and operating embedded networks.

Sundale Retirement Villages is in the process of building a retirement village in Tewantin that will be the first in Australia to have an embedded network. It will have a centralised PV system where the electricity will be shared amongst the residents, as well as electric cars and bicycles. Once this is built it will most likely act as a model case study proving that this can be done, and so lead to the development of more such projects.

2. Community organisations & Schools

Community Organisations

Many community organisations in Noosa occupy buildings owned by Noosa Council. They are generally under a licence or lease arrangement, but where multiple organisations may use a particular building, each may operate under an agreement which includes the cost of electricity.

A number of community organisations have funded the installation of solar and/or energy efficiency initiatives on Council-owned premises. They have funded these upgrades through their own capital and/or with the assistance of grants such as the Queensland Gambling Community Benefit Fund or Council's Community Grants program.

Noosa Council has recently accepted a University of Queensland Honours student placement for three months. The student will be working on a project to assist community groups occupying Council buildings to reduce their electricity consumption through the implementation of energy efficiency activities, installation of solar systems and behavioural change. In conjunction with the Queensland Government's EcoBiz program, a number of audits will be undertaken to identify potential opportunities for improvements. In conjunction with relevant stakeholders, appropriate implementation plans and funding opportunities will be considered.

<u>Community Ownership</u>

These sorts of solar systems are of course perfect candidates for community ownership – that is, ownership not just by the community group, but by individual community members of that group. Any of the options for CORE projects discussed in Section 4.5 could be used, although it is likely that either the RePower Shoalhaven or Farming the Sun models would be best.

Solar for Schools

Schools and the wider education sector represent a good opportunity to install solar systems. From the My School website[65], there are 19 primary and secondary school campuses in the Noosa LGA with over 9,000 enrolled students. There are an additional 20 campuses covering tertiary, pre-school, childcare and language institutions. The Solar Schools website[66] shows the installed solar PV together with real-time solar PV generation and grid consumption for all government schools. This allows school children to understand how and when electricity is being produced. This can be combined with relevant curricula material from pre-school through high school and serve as a valuable means of increasing familiarity, knowledge and acceptance of the technologies, which can be carried into later life. Solar Schools provides such a P-12 teacher's toolkit[67] that is aligned with the Australian Curriculum.

The Queensland government has recently announced the Advancing Clean Energy Schools (ACES), which is a three-year program to reduce state school energy costs across Queensland state schools through solar and energy efficiency measures. It is understood that most of the Noosa government schools are currently included in the program.

Following completion of a tender process, the first phase of the program is expected to commence in the latter half of 2018 with up to 30 schools in each of the seven Department of Education regions. A school's involvement in the program is dependent on a number of factors such as current levels of energy use and student enrolment numbers. Those schools involved in the program do not need to apply, as the Department will liaise directly with schools to confirm scheduling details, taking account of the school's operational priorities. Scheduling will be informed by a range of factors, including: the current levels of energy use; site conditions; school operational priorities; and the economic assessment of opportunities for energy savings, to support the capital investment in solar and other energy efficiency measures.

Under the ACES program, schools may receive solar systems and energy efficiency measures, such as LED lighting and timers on hot water systems to reduce energy costs. Following school site assessments, these measures will be tailored for each location where savings realised can support the capital investment required. Details of what will be required at each school will not be known until site assessments are completed.

Savings realised through the program will be retained by the Department of Education to support full implementation of the program and to address other educational priorities. The department has suggested that consideration could be given to delaying a decision on investing in solar until the school requirements have been assessed through the ACES program.

It may be possible for the government schools who are not included in the ACES program to acquire solar systems themselves based on the approach taken through 'Solar my School', which is a free council program currently being run in the Eastern Suburbs of Sydney. It is currently being run jointly by Waverley, Randwick and Woollahra councils, and helps schools install solar

[65] www.myschool.edu.au

[66] www.solarschools.net

[67] https://www.solarschools.net/teachers-toolkit

PV through a free solar assessment, advice on funding, assistance selecting a quality PV system, teaching materials and promotion of what the school is doing.

Brisbane Catholic Education Queensland has engaged Schneider to undertake two pilot programs with schools within the diocese. The pilot will evaluate the school's current energy consumption patterns, provide real time monitoring from their meter, provide efficiency upgrade recommendations, and scope recommended solar PV installation sizes. As part of the program Schneider will also be creating standard evaluation criteria for schools to use and develop a recommended contractor list. The intent is to roll the program out to all schools in the diocese once the pilots have been evaluated, refined and the benefits proven. St Teresa's College has nominated to be included in the second pilot and will also work with Brisbane Catholic Education and their energy retailer to ensure that all avenues are considered and addressed.

Zero Emissions Noosa is also developing a brief for a campaign to focus on the wider education sector. Refer to the appendices of this report.

Community Ownership

School solar systems are also excellent candidates for CORE projects because they can draw on members of the school community. Such projects provide ongoing financial benefits to the community owners long after their children have left that school.

5.2.3. Large-scale

Because of limits to the availability and cost of land there are very few opportunities for large-scale renewable energy generation within Noosa Shire. Here we take large-scale to be greater than 100kW, and so there would certainly be some opportunities in the Noosaville industrial estate, but nowhere near the amount required to reach the 100% renewable energy target.

Therefore, any significant large-scale development will need to be outside Noosa LGA. This then raises the issue of how Noosa can claim the renewable electricity towards its 100% RE target. As discussed in Section 3, we argued that renewable electricity could be said to contribute to Noosa's 100% RE target if it came about solely because of the actions of people from Noosa. Although it isn't necessary for the system to be owned, or the electricity to be purchased, by people from Noosa, this would create a clearer link to achievement of the target.

There are a number of solar and wind farms currently being built in Queensland, including the SolarQ proposal, which is relatively nearby.[68] Three different approaches to community ownership of large-scale renewable energy projects were discussed in Section 4.5.2: through an unlisted public company limited by shares (SRPC and Sapphire), and through a cooperative structure (Hepburn Wind).

The most promising approach for Noosa appears to be the approach taken at Sapphire Wind Farm, where shares available for community ownership of a portion of the wind farm are expected to become available in Oct 2018. Taryn Lane (Akin Consulting) and Adam Blakester (Starfish

[68] https://www.solarq.com.au

Initiatives) could be contacted to see if their approach could be applied to one or more large-scale developments in Queensland. Note that as above, for this to count towards Noosa's 100% target, an additional amount of capacity would need to be built – otherwise it is just a financial investment that would have happened anyway.

5.2.4. Community Ownership

For all the above project types (apart from the large-scale ground-mounted PV arrays), ITP recommends that either RePower Shoalhaven's CORE model or the Farming the Sun approach be used. Each involves a proprietary company limited by shares being established for each solar system (or group of solar systems). The main difference between the two is that under the Farming the Sun model the private company doesn't own the PV system but just loans the money to the host site.

In the first instance, RePower Shoalhaven or Farming the Sun should be contacted to see if they are happy to provide assistance, and what sort of assistance they could provide. The best option is likely to be that one of these groups coordinate the establishment of the first 'CORE company' with on-the-ground assistance from ZEN. Once a local community group has developed more internal capacity, it could then set up the next CORE company, and so on.

The same general approach would be used for all the CORE opportunities discussed above. Once a specific project has been identified and a financial analysis completed (ie. installed cost, expected annual income, return on investment), it would be advertised as a CORE project to people who are likely to want to invest. Businesses, community organisations and public schools can use their own networks to make the project known to the public.

6. DISCUSSION AND RECOMMENDATIONS

Increasing the uptake of renewable energy in Noosa Shire in a way that maximises local benefits is certainly not a trivial task. A key aim is to create an environment where local people and businesses wish to invest in renewable energy, energy efficiency and enabling technologies. ZEN and Noosa Council have a key role to play, primarily as facilitators, but Council can also lead the way through installing solar PV on their own buildings – which they are currently in the process of doing.

Based on the availability of renewable energy resources, the vast majority of renewable generation will be from solar PV, which can be located throughout the distribution network. Energy efficiency and demand side management are very important because they can reduce electricity use, reduce demand at peak times, and reduce demand at times of low local renewable energy generation. Vice versa, they can shift demand to times of solar PV generation, maximising the use of local renewable resources.

The direct employment[69] in PV installation businesses can be measured in job years/MW PV installed. In Australia we estimate this to be about 20 jobyears/MW, which means that to install 1 MW PV would employ 20 people for 1 year.[70] In Noosa this could be achieved through the installation of two hundred 5kW systems (for example through a solar bulk buy) or ten 100 kW systems (for example facilitated through the Multi-Site Feasibility Study approach).

In addition, every 1 MW of solar PV installed in Noosa Shire would generate about 1.37 GWh of renewable electricity each year, and would avoid about $85,000 leaving Noosa Shire each year when people pay their bills – for electricity to be generated outside the area.

By its very nature, renewable energy lends itself to smaller-scale projects that can be distributed throughout, and owned by, the community. This means it is important that there is community buy-in to the process. There are also significant benefits for business to invest in renewable energy, particularly in larger premises that have high energy costs, and opportunities for business to support community-owned projects.

The following lists the major recommendations from this report. They are not listed in order of importance, but in the order in which they appear in this report.

During the preparation of this report, and partly in response to it, Zero Emissions Noosa has developed briefs for a number of campaigns that are either underway or in the planning process. These campaigns localise the use of the tools recommended here and include Noosa Education

[69] Direct employment refers to those working directly for PV companies supplying, selling, installing or maintaining PV systems. There is also indirect employment, including legal and financial support services, general transport, government regulators, etc.

[70] Based on IRENA, 2016, 'Renewable Energy and Jobs, Annual Review 2016', International Renewable Energy Agency.

Campaign, Solar for Low Income and Renter Households, Cooran Earth Rights Partnership, Local Large-scale RE Generation, Major Consumers, Tourism Noosa Campaign, Repower Noosa Business, Noosa Community Buildings, Academic ZEN, and Repower Noosa industry cluster. More details can be found here https://www.repowernoosa.com/programs, and in Appendix C.

6.1. Recommendations

6.1.1. Energy Info Hubs

The Repower Noosa website is now planning to host information using a 'funnel' approach to direct enquirers to information most relevant to their circumstances, and is also planning video testimonials relevant to the barriers and benefits of installing solar PV. This could also link to online tools such as the Solar Potential Tool and the Sunulator. Noosa Council may also wish to establish a shop front drop-in centre. Energy assessors could be established to conduct home energy audits, and they could operate from the drop-in centre.

6.1.2. Solar bulk buy

A solar bulk buy could be coordinated according to the process outlined above. It should have both a standard and higher-end option, use local installers, provide a community benefit, and could include batteries and SWHs.

6.1.3. Solar $avers

Noosa Council could pursue its own Solar $avers program – drawing on the experience of the various Victorian councils who have run this type of program, as well as the Sunny Savers program being run by the Queensland government.

6.1.4. Solar for Rentals

Information regarding the various options to overcome the 'split incentive barrier' are expected to be included in the 'Landlord Toolkit' that ZEN is having developed as part of the Repower Noosa project funded from Council's Economic Development Fund.

6.1.5. Solar Access Rights

Noosa Council could develop a firm policy on how to address the issue of overshadowing of what could be a significant financial investment in solar PV or SWHs.

6.1.6. Multi-Site Feasibility Study

ZEN or Council could coordinate a Multi-Site Feasibility Study to help businesses obtain solar. The first stage would involve a high level assessment of the viability of solar at each business. The second stage would involve a call for tenders for installers and an assessment of those tenders, then quality assurance of the completed installations.

6.1.7. Solar PPAs & Solar Leases

As a first step, businesses and Council could be surveyed to assess their interest in these options. If there is sufficient interest, this list could simply be made available to solar installers, or a MSFS approach could be taken.

6.1.8. Environmental Upgrade Agreements

Noosa Council either undertake an investigation into whether EUAs may require legislative changes in Queensland, or lobby the state government to do this themselves.

6.1.9. Embedded Networks

A survey/audit could be used to identify areas that have embedded networks, as well as their potential interest in installing solar. The outcomes of the survey/audit could be used to attract businesses who specialise in establishing and operating solar embedded networks.

6.1.10. Community organisations

Noosa council should complete the audits to be undertaken in conjunction with the Queensland government's EcoBiz program, and then implement the recommendations.

6.1.11. Solar for Schools

ZEN could assist government schools with the Queensland government's Advancing Clean Energy Schools program to acquire solar systems. This support should be extended to any government schools who are not included in the ACES program, as well as any non-government schools and the wider educational sector.

6.1.12. Large-scale solar

ZEN could explore the different approaches to community ownership of large-scale renewable energy projects, especially the approach taken at Sapphire Wind Farm.

6.1.13. Community-Owned Renewable Energy

ZEN could facilitate the development of community-owned renewable energy projects where appropriate. For all but the large-scale solar projects, this would most likely use either the RePower Shoalhaven model or the Farming the Sun model, and ideally be with the assistance of these organisations.

7. APPENDIX A: WHAT COUNTS TOWARDS NOOSA'S RENEWABLE ELECTRICITY

During the consultations Zero Emissions Noosa stated the following principles:

1. Maximise Noosa's reduction in usage

2. Try to generate locally as much as we consume

3. Any shortfall is met by large-scale renewable electricity, in or outside the Noosa LGA.

Zero Emissions Noosa recognises the Australian environment of changing energy policy and uncertainty, particularly in the resolve to adhere to our Paris commitments.

Whilst the issues discussed in this appendix are important, Zero Emissions Noosa believes our community must take charge independent of State or Federal energy policies in adhering to the principles stated above.

Generating community support for increasing the uptake of renewables is not simply a matter of identifying the technologies to be used and then selecting appropriate business models to roll it all out. There are a number of 'high-level' issues that first need to be taken into consideration and discussed. These should be raised at the community consultation sessions because they may affect the technology choices and the types of business models that people wish to use.

1. Will the renewable energy be additional to the Federal Renewable Energy Target?
2. Will the Renewable Energy Target reduce the amount of renewable generation required to reach 100%?
3. Which renewable energy generation can be claimed towards the 100% RE target?
4. Should the renewable energy systems be owned by the community within Noosa Shire?

1. Will the renewable energy be additional to the Renewable Energy Target?

The Renewable Energy Target (RET) is made up of the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES). It is expected to result in about 23.5% of Australia's electricity coming from renewable sources by 2020. The Queensland 50% Renewable Energy Target is separate to the RET, and is discussed below.

The **LRET** is to have 33,000 GWh of renewable electricity generated in 2020, maintained until 2030. Renewable energy systems with a rated peak capacity of 100 kW upwards create a Large Generation Certificate (LGC) for every MWh of electricity they produce. In brief, if the solar PV

systems built in Noosa Shire are greater than 100 kW, they can be used to meet the LRET. For wind power the size limit is 10 kW, and for hydro is 6.4 kW. This would just mean that other renewable energy systems, that otherwise would have been built to meet the target, no longer need to be built. Thus, these systems built in Noosa would not increase the total amount of renewable energy generated in Australia (unless the LGCs are instead extinguished and not used to meet the target, as occurs for GreenPower and the ACT government's reverse auctions).

This is all complicated by the fact that the target does not increase beyond 2020. This means that, after this date, there should already be enough renewable energy generation built to meet the 33,000 GWh target. This in turn means there will be no more demand for LGCs, which means their value should approach zero. In this case, any new large-scale plant would have to be built without using LGCs (and so would need to be cheap enough to not need LGCs), in which case they would be additional to the LRET target.

The **SRES** applies to renewable energy systems that are no greater than 100 kW (10 kW for wind and 6.4 kW for hydro), and also uses certificates that each correspond to 1 MWh of renewable electricity, that are called Small-scale Technology Certificates (STCs). The SRES is different to the LRET in that the STCs aren't used to meet a target, but instead, no matter how many are created, they must all be bought by electricity retailers in Australia. This means that, if renewable energy systems built in Noosa Shire are less than 100 kW, they will be additional to any legislated target and so will increase the total amount of renewable energy generated in Australia.

The Queensland 50% target is different to both the LRET and the SRES in that it does not involve the use of certificates. As such it is not affected by the above additionality issues. Instead it involves a range of activities, including the use of reverse auctions to drive uptake of renewable energy, that aim to create the environment in which the target can be met.

2. Will the RET reduce the amount of renewable energy required to reach 100%?

Although the RET will mean that by 2020, about 23.5% of the electricity used Australia-wide would be from renewables, this doesn't mean that only another 76.5% of renewable electricity needs to produced to reach the 100% target. Say if 100 units of electricity are used, and say 20 units (20%) come from renewables (because of the LRET) and 80 units (80%) from fossil fuel sources. If another 60 units are used from renewable sources (making 80 units), of the remaining 20 units, only 20% of that will be from the LRET, with the remainder being from fossil fuels. This means there is some level of diminishing returns, with the first 20% being very easy (need to do nothing). If another 10 units of electricity are from renewables (not under the LRET)[71] this would increase the total to 28%.[72] Then say another 50 units would increase the total to 60%, and 90

[71] Note that if the 10 units of renewable electricity is produced under the LRET then it is arguable that if Noosa Shire claims that as 'it's own', then the amount of renewable electricity in the broader market is slightly less than 20% and so the amount of fossil fuel electricity is greater than 80%.

[72] This is because 20% of the remaining 90 units is renewable, which is 18 units, plus the 10 units, makes 28 units, or 28%.

units would increase the total to only 92%. So, to reach 100 units of renewable electricity there is a need for 100%, not just 80%.

3. Which renewable energy generation can be claimed towards the 100% RE target?

The modelling in Section 3 estimated the amount of renewable electricity from different sources that would be required to achieve say 100% RE. But are we talking about electricity generated from PV systems owned by the people of Noosa or are we talking about the electricity used? Which is it that is most meaningful when claiming 100% RE?

It basically comes down to whether the renewable electricity is additional i.e. If you hadn't done it, no one else have done it. It's safe to assume that a residential or business behind-the-meter PV system that is less than 100kW will be additional. If that household or business hadn't had it installed, then no one else would have, and as discussed above, it will be additional to the RET. In this case, the system is owned by someone in Noosa and the electricity will be used within Noosa.

PV systems greater than 100kW are more complex. As discussed above, if they use LGCs, they won't be additional. This is the case even if it is built on a large privately-owned roof space - because even though no one else would have had it built there, the same amount of capacity would have been built somewhere else to meet the target.

So let's assume that a large system (greater than 100kW) is built without the use of LGCs (for example it could be built some time after 2020). In this case, if the system is built on a company's roof, it is most likely additional. If it is a ground-mount system, it could be said to be additional and to contribute to Noosa's 100% RE target if it came about solely because of the actions of people from Noosa. Note that it isn't necessary for the system to be owned, or the electricity to be purchased, by people from Noosa. It would still reduce the amount of fossil-fuel electricity being generated and used. Although RE systems built outside Noosa Shire would not contribute to the region's energy independence and resilience to blackouts and brownouts, if they were built somewhere with a higher emissions intensity than Queensland (such as Victoria) they would reduce greenhouse emissions by a greater amount.

4. Should the renewable energy systems be owned by the Noosa Shire community?

This doesn't relate to the additionality of renewable energy but instead to the resulting social and economic benefits. Currently, a large amount of money leaves Noosa Shire every year through electricity bills. Just paying for the electricity to be generated outside the Shire costs over $30 million per year.[73] Where renewable energy systems are owned by individuals and organisations within the Shire, the money saved because of the electricity they generate circulates through the local economy, creating local employment.[74]

[73] We have not included the costs for transmission and distribution of the electricity because transmission makes up a fairly small proportion of the cost and local distribution costs will still need to be paid one way or another.

[74] Although the renewable energy systems need to be paid for, about a quarter of the system cost goes to local installers, and most PV systems pay themselves off after 4 or 5 years, so after that, all the avoided electricity costs represents money that stays in the area.

8. APPENDIX B: SAMPLE MOU FOR LANDLORD/ TENANT AGREEMENTS

This MOU governs the agreement between ….. [the landlord] and ….. [the tenant] regarding the solar photovoltaic (PV) system at ……. [address]

[the landlord] has financed and installed a ….kW PV system at [address]. The PV system has been connected to the electricity grid.

[the landlord] owns the PV system and is responsible for all maintenance.

The PV system will reduce [the tenant's] electricity costs, and [the tenant] agrees to pay [the landlord] 80% of these savings according to the calculation process outlined below.

Calculation Process

These payments will be made directly to [the landlord]. They will be calculated for each quarterly electricity bill according to the following formula (which may be automated using the online spreadsheet).

Onsite use = total generation for that quarter (from inverter) – exported electricity (from electricity bill)

Value of onsite use = Onsite use x retail tariff

Value of export = Value according to electricity bill

Total value = Value of onsite use + Value of export

<u>Total value to landlord</u> = 80% x Total value

9. APPENDIX C: LOCAL NOOSA CAMPAIGNS

During the preparation of this report, and partly in response to it, Zero Emissions Noosa has developed briefs for a number of campaigns that are either underway or in the planning process. These campaigns localise the use of the tools recommended here and include Noosa Education Campaign, Solar for Low Income and Renter Households, Cooran Earth Rights Partnership, Local Large-scale RE Generation, Major Consumers, Tourism Noosa Campaign, Repower Noosa Business, Noosa Community Buildings, Academic ZEN, and Repower Noosa industry cluster. More details can be found at https://www.repowernoosa.com/programs.

NOOSA EDUCATION CAMPAIGN

The Noosa Context

Schools and the wider education sector represent a good opportunity to install solar systems. From the My School website (www.myschool.edu.au) there are 19 primary and secondary school campuses in the Noosa LGA with over 9,000 enrolled students. There are an addition 20 campuses covering tertiary, pre-school, childcare and language institutions. The Solar Schools website (www.solarschools.net) shows the installed solar PV together with real-time solar PV generation and grid consumption for all government schools. This allows school children to understand how and when electricity is being produced. This can be combined with relevant curricula material from pre-school through high school and serve as a valuable means of increasing familiarity, knowledge and acceptance of the technologies, which can be carried into later life. Solar Schools provides such a P-12 teacher's toolkit (https://www.solarschools.net/teachers-toolkit) that is aligned with the Australian Curriculum.

What we know about electricity consumption for this sector

This is not known at this stage.

Current barriers

Independent schools are widely spread in their interest and adoption of solar. Many don't have at present while others may have a token installation. Some are seeing the benefits at a higher level (Catholic Education) whereas the less structured independents are reliant on their own understanding to drive installations.

Opportunities for electricity reduction

The Queensland government has recently announced the Advancing Clean Energy Schools (ACES) which is a three-year program to reduce state school energy costs across Queensland

state schools through solar and energy efficiency measures. It is understood that most of the Noosa government schools are currently included in the program.

Following completion of a tender process, the initial first phase of the program is expected to commence in the latter half of 2018 with up to 30 schools in each of the seven Department of Education regions.

Under the ACES program, schools may receive solar systems and energy efficiency measures, such as LED lighting and timers on hot water systems to reduce energy costs. Following school site assessments, these measures will be tailored for each location where savings realised can support the capital investment required. Details of what will be required at each school will not be known until site assessments are completed.

Brisbane Catholic Education Queensland has engaged Schneider to undertake two pilot programs with schools within the diocese. The pilot will evaluate the school's current energy consumption patterns, provide real time monitoring from their meter, provide efficiency upgrade recommendations and scope recommended solar PV installation sizes. As part of the program Schneider will also be creating standard evaluation criteria for schools to use and develop a recommended contractor list.

The intent is to roll the program out to all schools in the diocese once the pilots have been evaluated, refined and the benefits proven.

St Teresa's College has nominated to be included in the second pilot and will also work with Brisbane Catholic Education and their energy retailer to ensure that all avenues are considered and addressed.

Planned initiatives over the next 12 months

Currently in planning stage

SOLAR FOR LOW INCOME AND RENTER HOUSEHOLDS

The Noosa context

The solar divide is a term used to describe the gap between "solar haves" and "solar have nots". The latter group have been less able to participate in the exponential take up of roof top solar across Australia, due to either low income in a residential household, the split incentive barrier between landlord and tenant, or being an apartment dweller, all of which have been well documented[75]

The 2016 ABS Census revealed that many Noosa households are highly likely to be in this category. Low income and rental households are over represented in housing stress data. When

[75] https://reneweconomy.com.au/whos-missing-out-on-australias-rooftop-solar-boom-36261/
https://onestepoffthegrid.com.au/busting-solar-ceiling-fight-millions-australians-locked-rooftop-solar/

suburban figures are extrapolated, Tewantin experience is even worse than the overall Noosa data.

What we know about electricity consumption for this sector

Residential roof-top solar in Noosa is running at about 35%. However it is likely that apartments, low income and rental households are under-represented in these figures. It is also likely that the latter two categories have higher electricity costs due to older and less efficient appliances in the dwelling.

Current barriers

At this stage, we are assuming that the barriers for Noosa residents are the same as for other communities across Australia. Those are problems due to strata title restrictions, low income precluding take up by mortgagee households, and lack of incentive for landlords to install solar when tenants get the benefit. We need to test the validity of these assumptions.

Opportunities for electricity reduction

The two key opportunity areas to reduce electricity costs are for improved energy efficiency and installation of roof top solar, together with developments in apartment[76] opportunities.

Planned initiatives over the next 12 months

Depending on resource availability, we will undertake the following:

1. Strengthen alliance with Queensland Council of Social Services.
2. Promote Queensland Government interest free loans and grants for solar and batteries[77].
3. Advocate for legislative change to enable Environmental Upgrade Agreements such as operate in Victoria and NSW.
4. Advocate to the Noosa Council to introduce Solar Savers[78] or Environmental Upgrade Agreements once legislation enables this.
5. Update the Zero Emissions Noosa website to provide information on energy efficiency practices and incentives.
6. Seek funding to undertake a survey of Noosa households to establish current proportions of household expenditure for electricity.
7. Seek funding to explore partnerships with initiatives such as Sun Tenants[79] to deliver pilot projects.

[76] https://onestepoffthegrid.com.au/melbourne-shared-solar-storage-project-wins-980000-state-grant/?utm_source=RE+Daily+Newsletter&utm_campaign=517353d920-EMAIL_CAMPAIGN_2018_08_27_11_55&utm_medium=email&utm_term=0_46a1943223-517353d920-40436341

[77] https://www.qld.gov.au/community/cost-of-living-support/solar-battery-rebate

[78] http://solarsavers.org.au/

8. Observe the progress of the Department of Housing to find commercial partners to assist in delivering the next phase of the solar on public housing in Logan where up to 3000 detached homes in selected suburbs in the City of Logan will be eligible. If this is successful, a similar arrangement may be able to be made here in Noosa with private rental and social housing.

COORAN EARTH RIGHTS PARTNERSHIP

The Noosa context

Cooran is a Noosa hinterland community which has declared its community to be coal and gas free. ZEN and Cooran Earth Rights have jointly set a goal for Cooran to be a zero net user of coal and gas generated electricity. This would mean that Cooran would generate at least the same amount of electricity as it consumes, using solar PV and/or other renewable alternatives

What we know about electricity consumption for this sector

- Cooran uses 3.9 Million Kwh of electricity drawn from the grid
- The Average Household in Cooran emits 4.1 T of Carbon dioxide from electricity usage due to burning coal
- 40% of Cooran Households are low energy users 40% are medium to high users and 20% are high energy users
- 45% of suitable houses have solar
- 22% of houses have Solar Hot Water - either rooftop or heat pump
- Electricity usage is lower than the average for Noosa

Current barriers

- There is some confusion on what type of system and what size solar system to choose
- There is a lack of trust with Solar companies and installers
- There are a few well respected electricians and ex solar installers living in Cooran
- We have limited information on how many rentals are in Cooran
- There is an extreme range of diversity across the socioeconomic spectrum in Cooran
- Homes in Cooran have significant tree vegetation that may shade solar performance
- Awareness and affordability are seen as obstacles to faster Efficiency and renewable) uptake

[79] https://www.suntenants.com/

- Older residents and single parents face additional obstacles in uptake of efficiency and renewables
- There is limited understanding on how individuals use energy in their homes
- There is limited understanding of power bills , tariffs, costs on power bills
- Cooran do not celebrate what is working or how they are performing in renewable uptake

Opportunities for electricity reduction

- Cooran state school has some solar and are on the Govlist for Efficiency program (Tracy, Dahlia)
- There is interest in encouraging the 31 Businesses in Cooran to take up the free ecoBiz assessment
- Community hall has solar and is interested in ecoBiz and possible case study for other businesses in Cooran
- There is interest in a Community funded power initiative (a community green Levy used to install solar systems for the Community)

Planned initiatives over the next 12 months

In planning stage.

LOCAL LARGE-SCALE RENEWABLE ELECTRICITY GENERATION

The Noosa context

While this report notes significant limitations within the Noosa Shire for initiatives such as a solar farm, it also notes the need to identify sources of renewable electricity generation to meet the deficits identified under the Base and Stretch cases.

As this is necessarily a long-term project, a Working Group has commenced investigations into the options available for Noosa.

MAJOR CONSUMERS

The Noosa context

The Major Consumers campaign aims to identify the largest users of electricity in the Noosa Council area and speed their adoption of efficiency, on-site generation, and use of clean electricity produced elsewhere.

What we know about electricity consumption for this sector

The penetration of solar PV among commercial users lags way behind that of residential users, for a variety of reasons. Commercial electricity users draw about 40% of Noosa's total electricity. Presumably the ten or so largest consumers draw a big proportion of that 40%. This creates the opportunity to target a small number of decision makers with influence over a large fraction of our total consumption.

Roughly: Noosa consumes 350GWh/year total. Commercial users draw 40% = 140GWh/year. Apply the 80/20 rule and guess that the 20 largest consumers take 80% of that, and we conclude that the 20 largest commercial users draw 112GWh/year. If we could replace all that, we would achieve more than ⅓ of ZEN's total goal.

Current barriers

Many (such as Bunnings and Noosa Civic) operate within corporate entities which have policies to reduce waste and establish on-site production, but they seem to be moving slowly. It is possible that local efforts could move the Noosa branches of such nation-wide operations closer to the top of the queue.

Opportunities for electricity reduction

The fundamental economics are right, but complications interfere. The biggest electricity users pay as little as 9c per kWh, along with a complicated array of other charges. Many of the deals they strike with electricity providers are confidential. Nevertheless, the all-in cost of rooftop solar is down around 5c or 6c per kWh, so there's plenty of room for big users to save serious money if they can be motivated to do so. Most of the savings will come, probably, from reducing their Flat Volume Charge, ToU Volume Charge, Demand Charge, and Capacity Charge. For most businesses, these charges add up to more than the per-kWh charges they pay.

Many major consumers are operated by groups which have corporate energy policies. These may be real, or they may be just for show. We need to prod these corporates into actual action or call them out as frauds.

Planned initiatives over the next 12 months

Currently in planning stage.

NOOSA TOURISM CAMPAIGN

The Noosa context

Tourism is a major element of the Noosa economy. The Noosa region welcomed more than 2 million overnight and day-trip visitors who spent $909 million in the year to June 2017 with growth in all elements: • Overnight spend: +3.3% to $822.3 million • Overnight visitors: +1% to 1.03 million • Nights: +11% to 4.9 million

The Tourism Noosa Strategy 2017-2022 noted: “Almost one billion extra people will be travelling in 2022, and as a result, responsible tourism is likely to become increasingly important and necessary”.

What we know about electricity consumption for this sector

Tourism is a large contributor to carbon emissions for Noosa (yet to be quantified) but even at best practice of 93Gj per guest night, with over 4 M tourists’ nights in 2016 the emissions will be in the order of 80,000 T carbon dioxide, this could be as much as 1/3 of the entire Noosa shire emissions from the use of electricity.

We also know that general waste is a large source of carbon emissions for the Noosa Council, (as much as 40%) therefore food waste organics are identified for attention in this project due to the large number of restaurants and food outlets.

Current barriers to improved energy efficiency and renewable electricity

Anecdotally it is believed that there is room for considerable improvement in the energy efficiency of Noosa accommodation. In addition, the uptake of renewable energy in the tourism industry is also quite low. There are opportunities for significant savings in costs through the introduction of more energy efficient equipment and installation of rooftop solar.

It is likely that barriers to EE and RE will include:

- Lack of time to investigate opportunities
- Lack of knowledge regarding choosing trusted solar installer
- Mixed ownership patterns in accommodation
- Strata management conservatism
- Lack of access to informative and relevant case studies

ZEN has currently commissioned The Social Deck to undertake research on these issues.

Opportunities for electricity reduction

The Tourism Noosa Strategic Plan 2017-2022 has identified as one of its four top priorities to “Elevate Sustainability” and “Become globally recognised for Noosa’s commitment to sustainable tourism by working with global sustainability programs” with a key performance indicator of “Year-on-year improvements of set sustainable tourism indicators aligned with the Global Sustainable Tourism Council criteria”.

Planned Initiatives over the next 12 months

o The Volunteer team working on this project have an impressive skill set and believe that sound research and quantifiable data is the first important step in this project.

o Research is required to quantify and baseline the best approach.

o Along with this it's important that the ZEN Tourism Team initiate an extensive communications platform and begin to engage with the tourism Industry and tourists to document issues, barriers and expectations from the Industry and our community.

o Research is required to align our approach with the Government strategies and other local initiatives and the Tourism Industry strategic goals.

o Review Tourism data from Tourism Noosa

REPOWER NOOSA BUSINESS

The Noosa context

Energex figures show that less than 5% of Noosa business users have solar PV. This figure is way less than residential at about 35%. However, business consumes almost 45% of Noosa's electricity. This campaign group will work in conjunction with the Repower Noosa program and the Solar Installers Cluster, initially focussing on the Noosaville Industrial Estate, to assist businesses to reduce their energy costs by:

1. becoming more energy efficient; and
2. demonstrating how other businesses have reduced their energy costs by installing solar PV

Our initial research indicates that there are nearly 600 properties in the Noosaville industrial estate, with approximately 350 businesses operating there. The extent of landlord/lessee and owner/operator arrangements is not yet known.

What we know about electricity consumption for this sector

- That take up of solar PV by businesses in the Noosa Shire has been very low.
- There are a lot of large roof spaces that are not being utilized to generate solar PV
- That we need a better understanding of the barriers that have prevented business from installing solar PV
- There is no silver bullet one size fits all solution. Solutions need to be tailored to meet the needs of the individual business.
- Embedded networks are not in place to assist those businesses for which solar PV installation is not possible e.g. because they have insufficient roof space for their own business or the Return on Investment is not sufficient for an individual business
- Solar PV & solar water heaters are the predominant technologies to be used.
- Solar PV has a relatively short payback period i.e. 3-5 years for commercial premises.
- Demand side management can be used to reduce peak evening loads.

- Financial assessment tools such as the APVI's SunSPot and the ATA's Sunulator: which are online tools for estimating the potential for electricity generation from PV on building roofs.

What we don't know

- Average electricity use for SME businesses in the Noosa Shire
- Current electricity use per business and variations for type of business e.g. how much more does it cost for food producers with cool stores?
- If businesses are generally aware how they can improve their energy efficiency
- If businesses are generally aware how they can reduce their energy costs
- Should this program just focus on the energy cost savings and covering energy use and not worry about exporting to the grid?

Current barriers

The Social Deck is currently undertaking research for Zero Emissions Noosa (ZEN Inc.) to establish the barriers and benefits to installing solar. The findings will inform future strategies to increase the take up of rooftop solar. However it is known that in the landlord/lessee situation, the building owner has little incentive to install solar because the tenant will receive the benefits (assuming they pay their own electricity bills).

Information on the various ways to overcome this problem are expected to be included in the 'Landlord Toolkit' being developed as part of the Repower Noosa project.

Opportunities for electricity reduction

We believe there is considerable scope for increasing the take up of rooftop solar by Noosa businesses. However, it is imperative to work in collaboration with businesses and their associations to achieve this.

Planned initiatives over the next 12 months

1. Identify 6 businesses with solar to visit & talk to about:

    i. What were their barriers to getting solar?

    ii. What changed their thinking?

    iii. Are they owners or lessees?

    iv. How much power did they use per day or month before getting solar? Power usage now per day or month?

    v. Who do they know who may be interested in having solar? How do we best approach them?

vi. What “hooks” work with businesses apart from cost savings?

2. Develop case studies of businesses with solar.

3. Have a regular column in Noosa News featuring local solar success stories to raise awareness of the benefits of:

- energy efficiency &
- solar PV Link & leverage with Zero Emissions Noosa Inc. Solar Industry Group and other Zero Emissions Noosa (ZEN) Inc. working groups where possible for e.g. case studies & Noosa News features

4. Partner with a business association e.g. Noosaville Business Association

5. Develop a campaign & resources to target businesses with the benefits of solar.

6. Seek funds to do this from e.g. Regional Development Australia (RDA); Clean Energy Corporation.

NOOSA COMMUNITY BUILDINGS

The Noosa context

Noosa Council administers 89 community tenure arrangements across the Noosa Shire area for Council owned or controlled land to various not-for-profit community organisations.

What we know about electricity consumption for this sector

Some buildings already have rooftop solar but there is no consolidated database. Some sporting organisations may have high electricity costs due to night time practice.

Current barriers

It is likely that readiness to undertake energy efficiency audits and installation of rooftop solar will be highly dependent on the knowledge of committees of management.

Opportunities for electricity reduction

Funding is available which could be incorporated into this project, ecoBiz includes a free audit so less expenses there, council grants will be applicable to some, otherwise Energex and Powershop have some initiatives.

Planned initiatives over the next 12 months

Noosa Council Carbon Reduction Officer has scoped a project for a university intern which is currently under way.

Expressions of Interest have been called for from community groups who manage and maintain buildings.

Scoped project is 10 case studies for a best practice outcome (what worked well, what needs improvement?).

ACADEMIC ZERO EMISSIONS NOOSA

Academic Zero Emissions Noosa aims to lead research projects that support Zero Emissions Noosa's goals.

Currently Academic Zero Emissions Noosa consists of researchers from CQUniversity and the University of New South Wales (UNSW). Academic Zero Emissions Noosa are keen to partner with other universities across Australia.

Academic Zero Emissions Noosa have submitted a paper to the journal called *Sustainability Science*. The paper entitled *Zero Emissions Noosa: A community initiative in Australia* is currently under peer review.

An e-bike commuter pilot study is currently underway in the Noosa Shire. The project is assessing the potential for electric bikes (e-bikes) to reduce car travel in the Noosa Shire and to assess the health and wellbeing impacts related to e-bike usage. The interdisciplinary research team for this project is from CQUniversity and the project is sponsored by GIANT bicycles Australia.

REPOWER NOOSA/SOLAR INSTALLERS CLUSTER

The Noosa context

To meet the ZEN target of zero community carbon emissions by 2026, well over $100M of investment will be required, and it is desirable that a significant proportion of that investment can be captured locally. Benefits include 20 job years for each MW installed and up to $80M savings to local businesses to 2026 from decreased electricity costs.

ZEN is working with a group of local solar industry businesses to develop opportunities for growing solar installations in Noosa Shire. It is believed that benefits can be derived by solar businesses working in partnership with ZEN to overcome barriers for consumers to install solar.

ZEN has received an Economic Development grant from Noosa Council and this seed funding will be used to:

- Formalise the solar installers cluster
- Conduct a barriers and benefits research and analysis to understand the key motivators for Noosa businesses to install solar
- Develop a communications, engagement and brand strategy for Repower Noosa
- Develop and implement a social marketing strategy to address barriers and benefits

- Develop a series of case studies of local businesses that have installed solar
- Build an online platform to connect potential customers with local installers
- Develop a sustainable business model for Repower Noosa so that it can continue to operate into the future.

What we know about electricity consumption for this sector

Not applicable to this campaign

Current barriers

Key governance issues need to be agreed between solar installation businesses and Zero Emissions Noosa Inc. It is essential to ensure that quality control is built into the process to build trust with consumers and protect reputation for all parties.

Opportunities for electricity reduction

In addition to the economic benefits to solar installers, this project has the potential to generate significant power cost reductions for local businesses which currently spend approximately $23.4M on electricity each year. Furthermore, businesses that switch to solar are more likely to consider utilising other energy efficiency measures creating opportunity to expand the cluster and associated economic benefits to a wider range of businesses.

Planned initiatives over the next 12 months

It is intended to complete the deliverables listed above.

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